ECOLOGICAL AND WETLAND IMPACT ASSESSMENT REPORT

As part of an Environmental Impact Assessment for the proposed Prospecting Right Application combined with a Waste license Application on Farm 596, Portion 7 of the Farm Adeisestad 409, Portion 1 of the Farm Kalkpunt 407 and the Remaining Extent of Portion 21 and Portion 29 of the Farm UAP 418. Registration Division: Gordonia, near Upington in the Northern Cape Province.

Prepared for:

Mopane Tree (Pty) Ltd.

May 2022

Prepared by:

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PROJECT SPECIFICS

Project Name:	Ecological and Wetland Impact Assessment Report as part of an Environmental Impact Assessment for the proposed Prospecting Right Application combined with a Waste license Application on Farm 596, Portion 7 of the Farm Adeisestad 409, Portion 1 of the Farm Kalkpunt 407 and the Remaining Extent of Portion 21 and Portion 29 of the Farm UAP 418. Registration Division: Gordonia, near Upington in the Northern Cape Province.
Report Title:	Ecological and Wetland Impact Assessment Report
Prepared By:	Milnex CC
Report Reference:	ECO130_Report_EIA506PR_Mopane Tree (Pty) Ltd
Date:	May 2022

QUALITY CONTROL:

	Report Author:	**Report Reviewer:**
Name:	Khume Mtshweni Ecologist	Mari van der Westhuizen Ecologist Pri.Sci.Nat. 400166/15

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SUMMARY

Receiving Environment:

The study site falls within the D73E Quaternary Catchment and forms part of the Lower Orange Water Management Area (WMA) (DWS, 2016). The Lower Orange WMA covers a total catchment area of 252 182 km^2. With its major rivers being the Ongers, Hartbees and Orange Letaba.

The study sites are situated within low shrubland, open bush and dense bush along the edges of major Drainage lines and Riparian areas. The Southern boundaries of the study sites are bordered by the Orange river Floodplain. Land use on the study sites was observed to be in the form of Cultivation of dense commercial fields and vines, and dirt roads providing access to the various farms. The study sites were also noted to present bare non-vegetated areas, where bare mining operations potentially occurred.

Ecological Assessment:

- According to the National Threatened Ecosystem database (2011), the threatened Lower Gariep Alluvial Vegetation ecosystem borders with the study sites to the south.
- According to the Northern Cape Critical biodiversity Areas and map (2016), all the study sites were observed to border a CBA1 area on their Southern boundaries, this area was observed to be the orange river's Riparian area. AoI-1 and AoI-3 were observed to overlap CBA2 and ESA areas while AoI-2 overlapped with a CBA2 area. While the study areas were observed to overlap CBA areas, significant portions of study sites were comprised of non-natural, cultivated areas
- According to the NBA2018 National Wetland Maps 5 Areas Database (Van Deventer *et al.*, 2018), four (4) wetland types were expected to occur within and around the study sites. AoI-1 was expected to present a wetland flat, AoI-2 was expected to present a Valley head seep, and AoI-3 was expected to present an Unchannelled Valley bottom (UVB) wetland while bordering the Orange River floodplain. A site visit confirmed the presence of two Unchannelled valley bottom wetlands (UVB1 and UVB2) at Aoi-1, one Unchannelled Valley bottom (UVB3) and a Floodplain wetland (FP) at AoI-3, along with its associated Riparian areas.
- *Vachellia erioloba, Boscia albitrunca*, *Aloidendron dichotomum* and *Aloe claviflora*, which are protected plant species of South Africa, were recorded on site.

- Exotic and Invasive Vegetation Species were recorded on site (**Table 9**).
- For Avifaunal species potentially occurring on site, and that enjoy conservation status in the IUCN Red List, kindly refer to section 4.2.1(**Table 10**) for a species list.
- Several species possibly occurring on site are protected under ToPS and NEMBA, although not observed during the site visit.
- The Endangered (IUCN, 2021) African Spurred tortoise (*Centrochelys sulcate*) was observed on site AoI-3, while a Rock monitor (*Varanus albigularis*) was observed as roadkill outside AoI-1. Based on the Frog Atlas of South Africa, the Near Threatened Giant Bullfrog (*Pyxicephalus adspersus*) is expected to occur on the study sites.

Wetland Assessment:

Classification	Scientific Buffer	PES	EIS	REC
UVB1	64m	C	B-High	B/C Improve
UVB2	64m	C	B-High	B/C Improve
UVB3	51m	D	C-Moderate	D Maintain
FP	75m	C	A-Very high	A Improve

Sensitivity and Impact Assessment:

NEMA Impact assessment	Most of the impacts associated with the prospecting activities range from High to Medium-Low prior to mitigation taking place. With mitigation fully implemented, the significance of most impacts can be reduced to Medium-High to Very-Low
DWS Risk assessment	All the impacts associated with the prospecting activities are ranked as Low to High, with most impacts presenting Medium ranking
Mitigation Measures	Refer to Section 6.5

Impact Statement:

The proposed Prospecting activities are only supported if all recommendations and mitigation measures provided in this report as well as general good practice, are strictly adhered to.

EIA REGULATIONS: SPECIALIST REPORT GUIDE

All specialist reports must be prepared in accordance with Appendix 6 of the EIA Regulations of 2014 (as amended in 2021).

NR.	CONTENT	REFERENCE
a	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix A
b	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page viii
c	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
cA	An indication of the quality and age of base data used for the specialist report;	Section 2
cB	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5,6,7
d	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1
e	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 6
g	An identification of any areas to be avoided, including buffers;	Section 5.4
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5.4
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
j	A description of the findings and potential implications of such findings on the impact of the proposed activity [including identified alternatives on the environment] or activities;	Section 4,5, 6, 7
k	Any mitigation measures for inclusion in the EMPr;	Section 6.5
l	Any conditions for inclusion in the environmental authorisation;	Section 6.5

m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6.5
n	A reasoned opinion— i. [as to] whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, in the case of a closure activity;	Section 8
o	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q	Any other information requested by the competent authority.	None

SPECIALIST DECLARATION

I, Khume Mtshweni, declare that:

- I acted as the independent specialist;
- I performed the work in an objective manner, even if the findings and conclusions are not favourable to the applicant;
- I do not have any financial interest in the undertaking of this project or projects, other than remuneration for the work performed in terms of the National Environmental Management Act 107 of 1998;
- There are no circumstances that may compromise my objectivity in performing such work;
- The contents of this report comply with the relevant legislative requirements, specifically Appendix 6 of the NEMA: EIA Regulations (2014, as amended in 2017);
- I have the relevant expertise required to conduct a specialist report of this nature in terms of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) and the National Water Act (NWA) (Act no. 36 of 1998);
- I understand that any false information published in this document is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act;
- I undertake to disclose and provide to the competent authority all material and information in my possession regarding this project as required in terms of National Environmental Management Act 107 of 1998; and
- Based on the information provided to me by the client and in addition to information obtained during this study, I have presented the results and conclusion regarding this project to the best of my professional ability.

Khume Mtshweni

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

ADU	Animal Demography Unit
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CR	Critically Endangered
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment

EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme / Plan
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information Systems
GPS	Global Positioning System
HGM	Hydro-Geomorphic
IBA	Important Bird and Biodiversity Areas
IAPS	Invasive Alien Plant Species
IHI	Index of Habitat Integrity
IUCN	International Union for Conservation of Nature
LC	Least Concern
MAP	Mean Annual Precipitation
MAT	Mean Annual Temperature
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEMPA	National Environmental Management: Protected Areas Act
NFEPA	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
SAMBF	South African Mining and Biodiversity Forum
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SWSA	Strategic Water Source Areas

TEMP	Temperature
ToPS	Threatened or Protected Species
VU	Vulnerable
WMA	Water Management Area

1 INTRODUCTION

1.1 Activity Description

Milnex CC Environmental Consultants (hereafter referred to as Milnex) was appointed by Mopane Tree (Pty) Ltd to conduct an Ecological and Wetland Impact Assessment Report as part of an Environmental Impact Assessment for the proposed Prospecting Right Application combined with a Waste license Application on Farm 596, Portion 7 of the Farm Adeisestad 409, Portion 1 of the Farm Kalkpunt 407 and the Remaining Extent of Portion 21 and Portion 29 of the Farm UAP 418. Registration Division: Gordonia, near Upington in the Northern Cape Province (**Figure 1**).

A desktop assessment, followed by field verification, was conducted to assess and determine the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC) of the area, and to determine the impacts and risks of the proposed prospecting operations and associated activities on the receiving environment.

It should be noted that the study sites will be assessed as three (3) components and referred to as Areas of Influence (AoIs). The Remaining Extent of Portion 21 and Portion 29 of the Farm UAP 418 (AoI-1) on the left. The Farm 596 and Portion 7 of the Farm Adeisestad 409 (AoI-2) in the middle, and Portion 1 of the Farm Kalkpunt 407 (AoI-3) on the right (**Figure 1**).

Table 1: Study area breakdown

Reference (Area of Influence)	Study site
AoI-1	The Remaining Extent of Portion 21 and Portion 29 of the Farm UAP 418
AoI-2	The Farm 596 and Portion 7 of the Farm Adeisestad 409
AoI-3	Portion 1 of the Farm Kalkpunt 407

1.2 Scope of Work

The Terms of Reference (ToR) for this study included the following:

- Desktop description of the baseline receiving environment (general surrounding as well as site specific environment);
- Identification and description of any sensitive receptors that occur in the study site, and the way these sensitive receptors may be affected by the activity;
- Site visit to verify desktop information;
- Provide a list of fauna and flora which occur or might occur, and to identify species of conservation concern (SCC);
- Conduct wetland delineation in accordance with Department of Human Settlements, Water and Sanitation guidelines and recommend suitable buffer zones (DWAF, 2008);
- Outline Present Ecological State (PES) of the wetland areas, and identify special (sensitive / listed / protected / endemic) species and habitats that are found / could potentially be found on the site;
- Assess Ecological Importance (EI) and Sensitivity (ES) of wetland areas;
- Conduct an Impact Assessment as specified by the Environmental Impact Assessment Regulations of 2014 (as amended in 2017);
- Conduct a Risk assessment in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21 (c) and (i) (GN 509 of 2016);
- Provide management recommendations to mitigate negative and enhance positive impacts.

1.3 Assumptions and Limitations

- The fieldwork component of the assessment comprised of one assessment only, during the late wet season in February. No temporal trends for the respective seasons have been assessed.

- The fieldwork was limited to areas deemed safe by the client. Therefore, the study area was not assessed to its entirety.

- Mainly physical structure, augering and presence of vegetation associated with watercourses were used to indicate wetland boundaries.

- The assessment was conducted on the portions of the study site as originally defined by the client, any changes in the project boundaries subsequent to this may negatively impact the robustness of this report.

- A detailed activity list for the proposed activity was provided and therefore the impact and risk assessments have been completed based on the Prospecting Work Programme (PWP) submitted for a prospecting right application with bulk sampling.

- Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage.

- Due to the scale of the remote imagery used (Google Earth Imagery), as well as the accuracy of the handheld GPS unit used to delineate wetland areas in the field, the delineated boundaries cannot be guaranteed beyond an accuracy of about 15m on the ground. Should greater accuracy of the riparian boundary mapping be required, the boundaries will need to be pegged in the field and mapped using conventional survey techniques.

- Buffer zone calculations does not consider climate change or future changes to watercourses resulting from increasing catchment transformation.

- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the current survey, and as such there is a high confidence in the information provided.

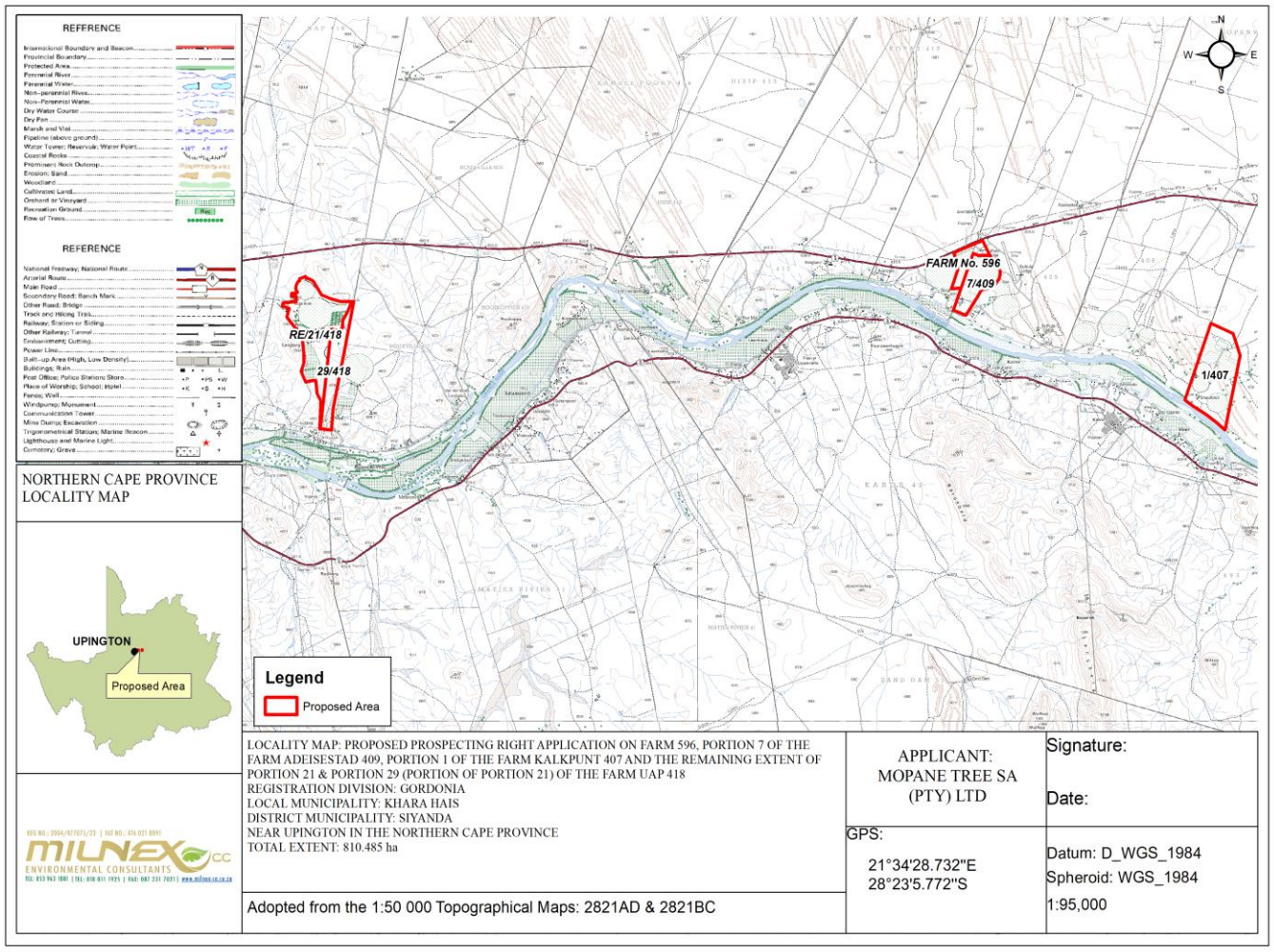


Figure 1: Locality map of the study sites located within the Northern Cape Province.

1.4 Legislative Requirements

The following legislative requirements apply to this study:

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); and
- The IUCN (World Conservation Union).
- Constitution of the Republic of South Africa (Act 108 of 1996)
- National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);

- National Environmental Management: Protected Areas Act (NEMPA) (Act No. 57 of 2003);
- National Water Act (NWA) (Act No. 36 of 1998);
  - Regulations and Guidelines on Water Use under the NWA,
  - South African Water Quality Guidelines under the NWA, and
  - GN 267 (Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals).
- Environmental Conservation Act (ECA), (Act No. 73 of 1989);
- Environmental Impact Assessment (EIA) regulations;
- Terrestrial Biodiversity, Plant and Animal Species protocols, gazetted 30 October 2020 (Government Notice number 1150);
- The RAMSAR Convention
- National Forests Act (Act No. 84 of 1998), specifically with reference to Protected Tree species;

2 METHODOLOGY

A detailed description of the methodology is provided in the subsections below. The desktop assessment was used as the point of departure. Subsequently, a site visit was undertaken on the 26th and 27th of May 2022 to confirm desktop findings and conduct a watercourse delineation and ecological assessment of the area.

2.1 Literature Review and Desktop Assessment

A desktop assessment was undertaken of all available data. This involved the investigation of aerial photography and GIS databases, including literature reviews pertaining to the study site to determine the theoretical importance and sensitivity of the terrestrial and aquatic ecosystems involved. The study site was mapped using Geographical Information Systems (GIS) (e.g. ArcGIS) to better understand the layout and structure of the surrounding environment.

The South African National Biodiversity Institute's (SANBI) online biodiversity tool was used to query a species list for the 2821AD and 2821BC quarter degree square grid cells (QDS). The Virtual Museum and Animal Demography Unit (ADU) was used to compile species lists based on the sightings and data gathering from the South African Biodiversity Institute. Species of conservation concern were reviewed, along with their potential for occurrence within the study site and surrounding areas. Therefore, all species identified under the above-mentioned references were not necessarily analysed in detail.

The following data sources and GIS information provided in **Table 2** was utilised.

Table 2: Information and data sources used to comprise the desktop assessment**.**

Data	Source	Date of Data Source
Latest and Historic Google Earth ™ imagery	Google Earth PRO™ On line	2021
Vegetation Map of South Africa, Lesotho and Swaziland	SANBI	2018
DEA National Landcover	SANBI	2015
Northern Cape Critical Biodiversity Areas	SANBI	2016
National Wetland Map5	SANBI	2018
National Freshwater Ecosystem Priority Area maps	Water Research Commission,	2011

and database	Implementation: Manual and Maps for FEPA area / SANBI	
Strategic Water Source Areas (SWSAs)	CSIR	2017
Important Bird Areas	SANBI	2015
National List of Threatened Ecosystem	SANBI	2011
NBA Terrestrial Formal Protected Areas	SANBI	2011

2.2 Field Survey

The field investigation was conducted to supplement and confirm the findings of the desktop analysis. A walkover field survey of the site verifying the presence or absence of faunal and floral species predicted to occur on the site was conducted. Verification of the wetlands identified, and their current status was also included. The field survey essentially consisted of the following:

a) Identification and location of keystone or indicator species that may be impacted;
b) The site was comprehensively assessed to determine fauna and faunal micro habitats present within the site;
c) Identify important habitats;
d) Identify areas of conservation and/or ecological importance;

2.3 Classification System for Wetlands and Other Aquatic Systems

The National Water Act (No. 36 of 1998) defines a watercourse, wetland and riparian habitat as follows:

- A watercourse means - (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.
- A wetland means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

- A riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

2.4 Delineation

2.4.1 Wetland Delineation

To delineate any wetland the following criteria are used as in line with Department of Water Affairs (DWA): Updated manual for identification and delineation of wetlands and riparian areas, Edition 2 September 2008. Also read with the guide is a draft updated report of the abovementioned guideline. The draft is used, as it provides a guideline for the delineation of wetland areas: Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. DWA (2008) Draft report.

The following indicators stipulated in the National Delineation Guidelines were considered in the field. Not necessarily all these indicators were used at each site. Mention is made in the results which of these indicators were used:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation such as grey horizons, mottling streaks, hard pans, organic matter depositions, iron and manganese concretion resulting from prolonged saturation;
- The presence of water loving plants (hydrophytes);
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
- Topographical location of the wetland in relation to the landscape

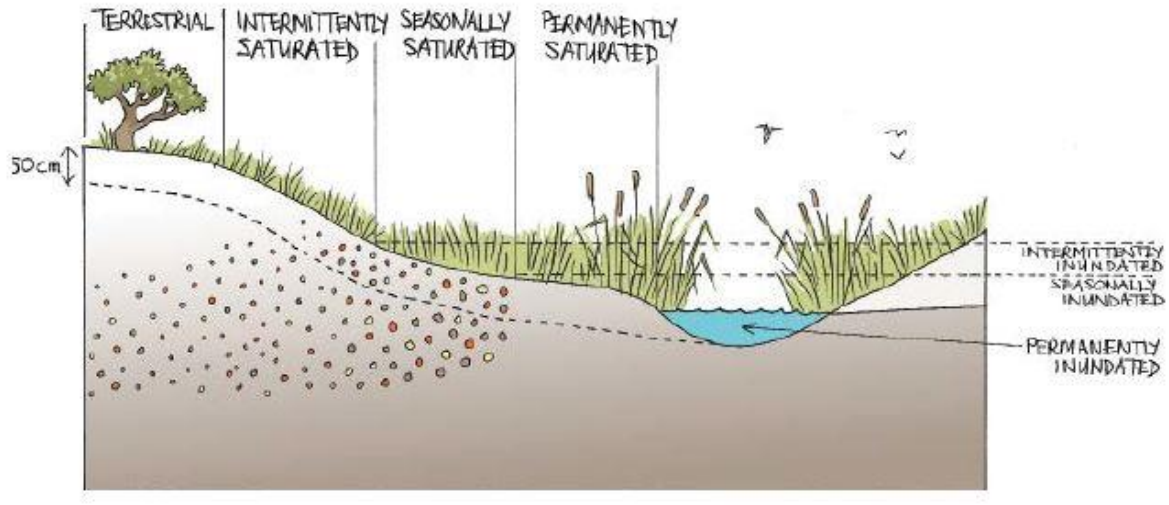


Figure 2: Typical cross-section of a wetland (Ollis *et al.,* 2013)

2.5 Present Ecological State (PES) Assessment

WET-Health (Macfarlane *et al*., 2020) provides an appropriate framework for undertaking an assessment to indicate the ecological integrity of each of the wetland systems being assessed. The outcome of the assessment also highlights specific impacts, therefore highlighting issues that should be addressed through mitigation and rehabilitation interventions.

The impact categories, scores, and associated present state categories are summarised in **Table 3**

Table 3: Rating table used to assess the impacts

Impact Category	Description	Impact Score Range	Present Ecological State Category
None	Unmodified, or approximates natural condition	0 – 0.9	A
Small	Largely natural with few modifications, but with some loss of natural habitats	1 – 1.9	B
Moderate	Moderately modified, but with some loss of natural habitats	2 – 3.9	C

Large	Largely modified. A large loss of natural habitat and basic ecosystem function has occurred	4 – 5.9	D
Serious	Seriously modified. The losses of natural habitat and ecosystem functions are extensive	6 – 7.9	E
Critical	Critically modified. Modification has reached a critical level and the system has been modified completely with almost complete loss of natural habitat	8 – 10.0	F

2.6 Ecological Importance and Sensitivity (EIS)

The EIS was determined using the methodology developed by Rountree *et al.*, (2013). It is a rapid scoring system to evaluate:

- Ecological Importance and Sensitivity
- Hydrological Functions; and
- Direct human benefits.

The highest score of the three derived scores (each with range 0 – 4) was then used to indicate the overall importance category of the wetland (**Table 4**).

Table 4: Description of the EIS Categories (Adapted from Macfarlane *et al.*, 2007)

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

3 ECOLOGICAL DESKTOP AND SENSITIVITY ASSESSMENT

This section contains data accessed as part of the desktop assessment. This data was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance.

3.1 Land Use and Land Cover

The study sites are situated within low shrubland, open bush and dense bush along the edges of major Drainage lines and Riparian areas. (**Figure 3**).

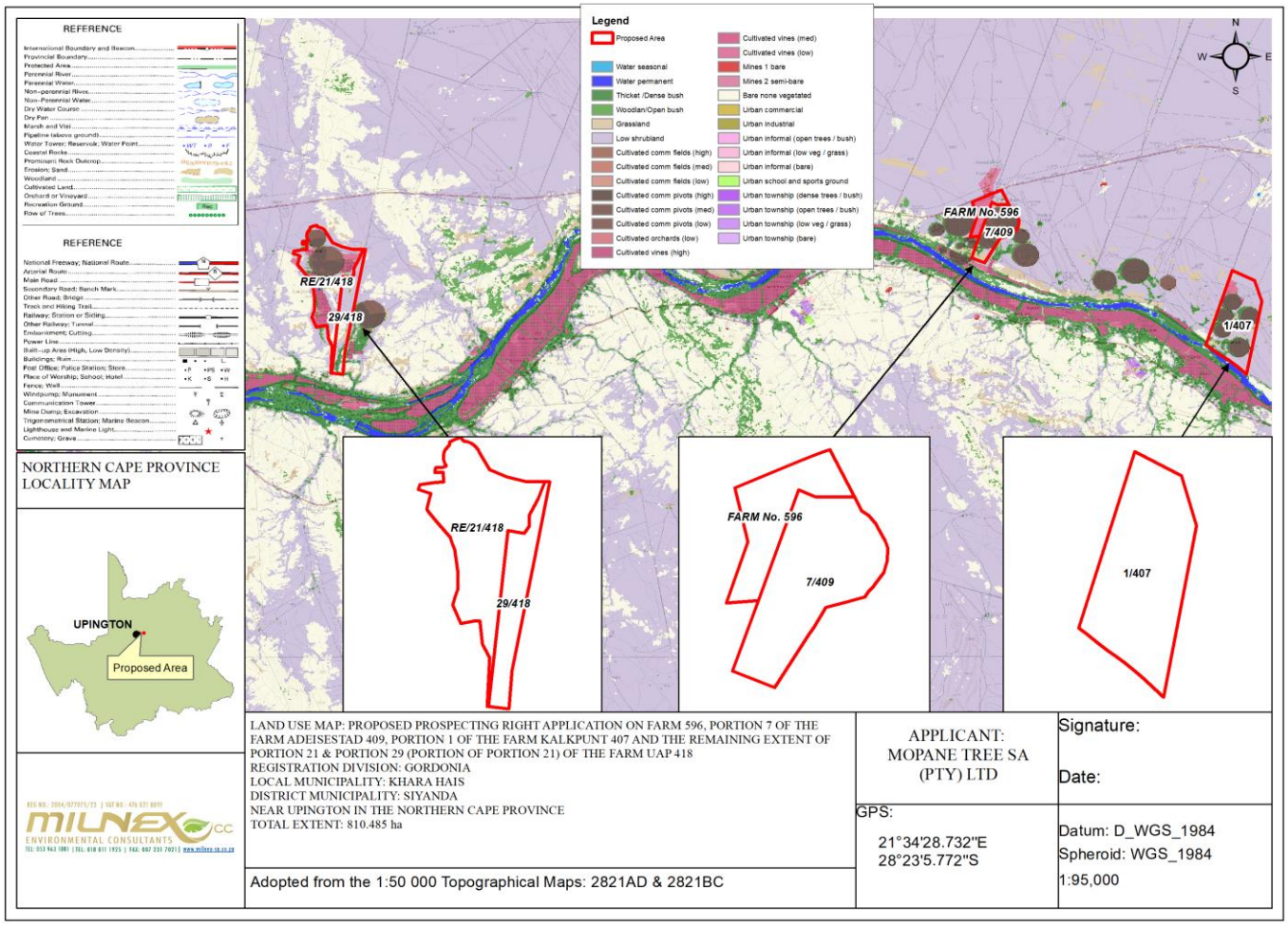


Figure 3: Current Land Use associated with the study sites and surrounding areas.

The Southern boundaries of the study sites are bordered by the Orange river Floodplain. Land use on the study sites was observed to be in the form of Cultivation of dense commercial fields and vines, and dirt roads providing access to the various farms. The study sites were also noted to present bare non-vegetated areas, where bare mining operations potentially occurred.

3.2 Regional Vegetation Assessment

The proposed sites for prospecting overlaps within the Nama-Karoo and Savanna Biomes (Mucina & Rutherford 2006). Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The study sites overlap with the Bushmanland and Kalahari Duneveld Bioregions (**Figure 4**). **Table 5** below provides an overview of the vegetation types associated with the study sites.

Table 5: Vegetation types and their conservation statuses

Area of Influence	Vegetation Type	Biome	Bioregion	Conservation Status
AoI-1	Kalahari Karroid Shrubland (NKb 5)	Nama-Karoo	Bushmanland	Least Threatened 21% Target Minimally Transformed Statutorily conserved
AoI-2	Gordonia Duneveld (SVkd 1)	Savanna	Kalahari Duneveld	Least Threatened 16% Target Minimally Transformed Statutorily conserved
AoI-3	Gordonia Duneveld (SVkd 1)	Savanna	Kalahari Duneveld	Least Threatened 16% Target Minimally Transformed Statutorily conserved

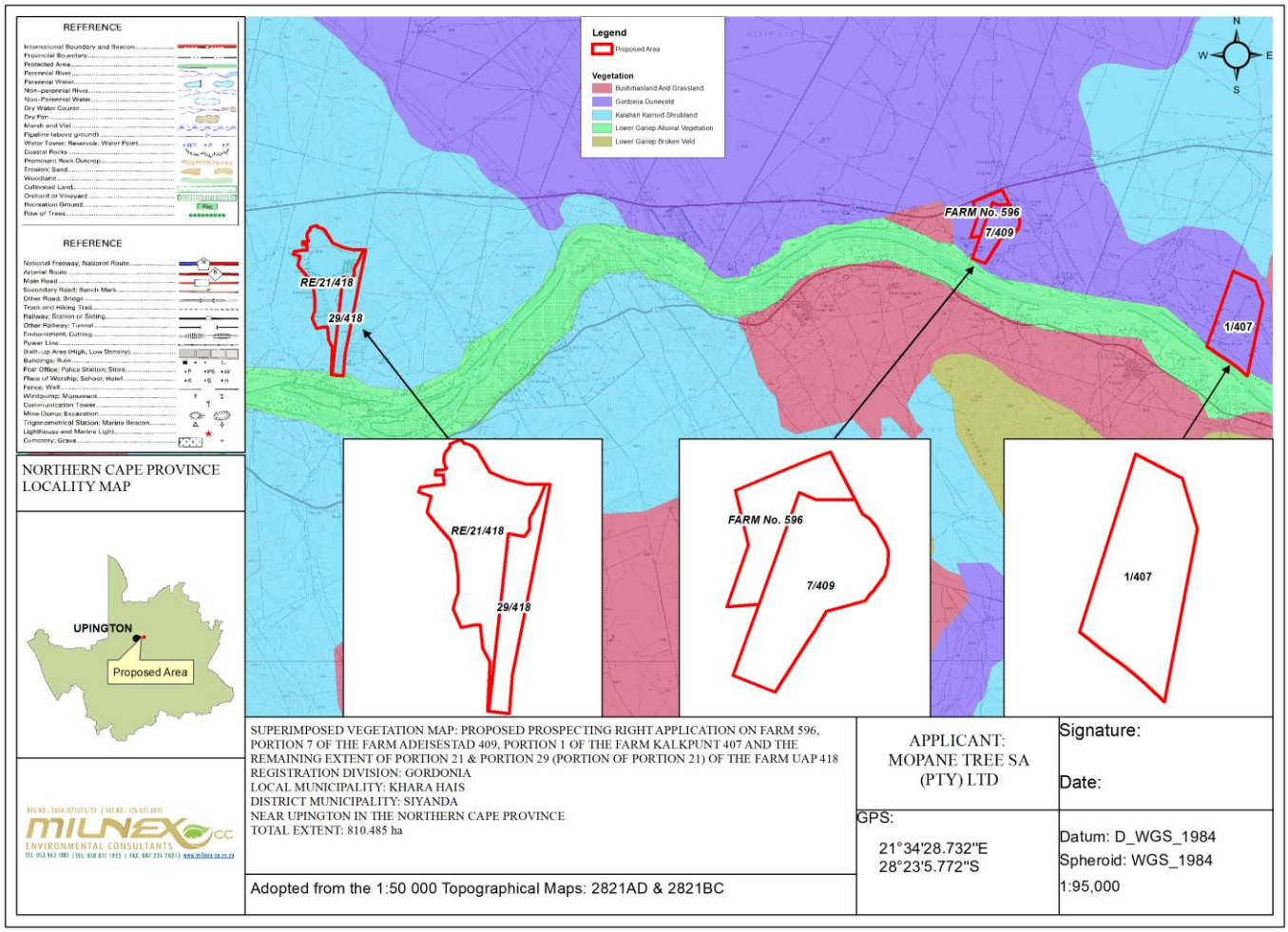


Figure 4: Vegetation Types associated with the study sites.

3.3 Protected Areas and Threatened Ecosystems

Formally protected areas are protected either by national or provincial legislation. Based on the SANBI (2010) Protected Areas Map (**Figure 5**) and the Northern Cape Critical Biodiversity Areas and map (2016), the study sites do not overlap with any formally Protected Area (**Figure 5**). Therefore, the location of the study sites is not expected to have an impact on any formally protected areas.

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver *et al*., 2012). Datasets have been developed by SANBI (2016) in order to outline threatened ecosystems, with the primary objective of limiting the rate of ecosystem

extinctions. Four established categories group these ecosystems namely: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Protected.

According to data sourced from South African National Biodiversity Institute (SANBI), the proposed sites are not located within any Endangered area. It was however observed that all three (3) study sites bordered the Endangered Lower Gariep Alluvial vegetation of the Orange river.

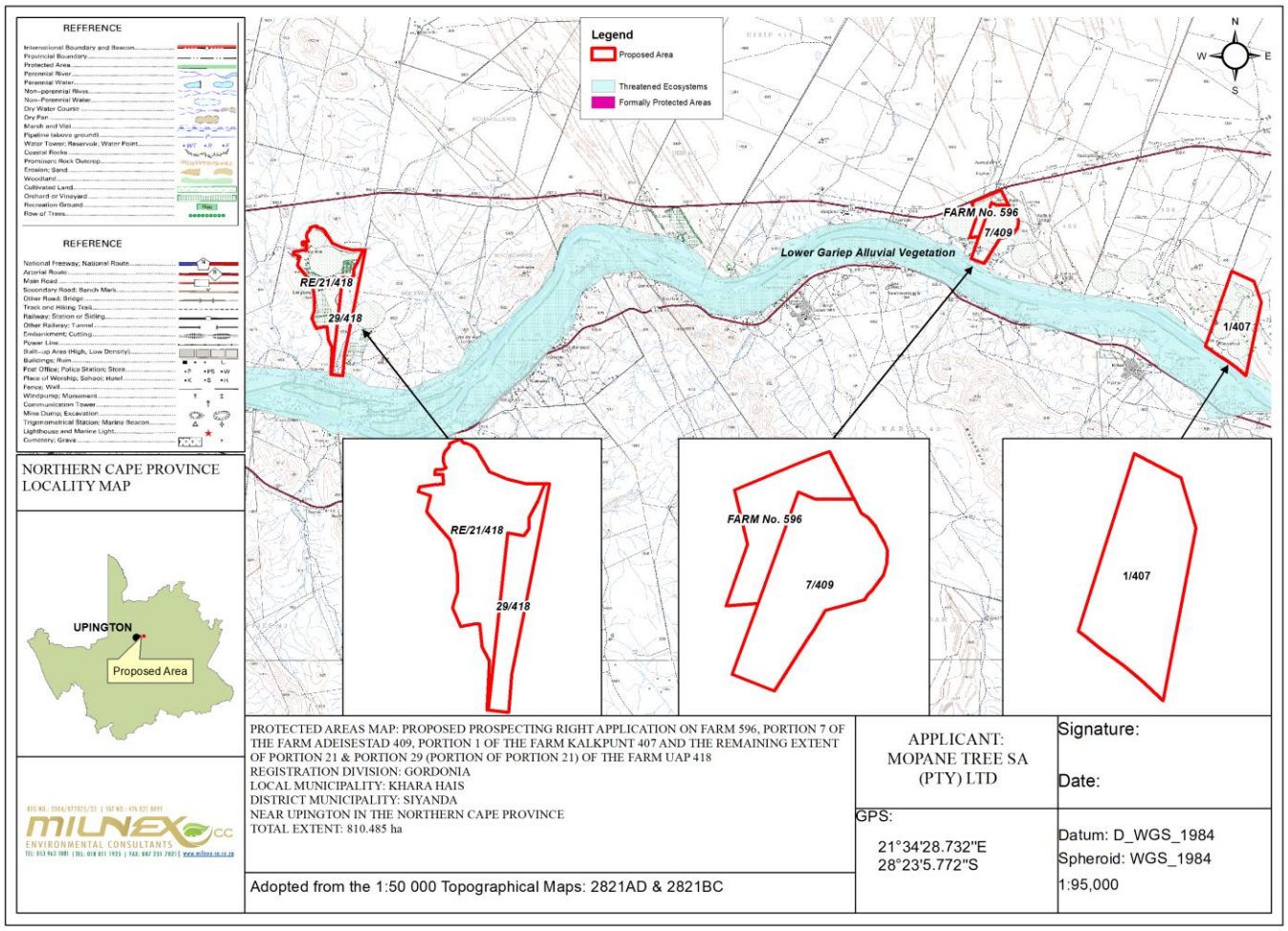


Figure 5: Threatened Ecosystems and Formally Protected Areas associated with the study sites and surroundings.

3.4 Critical Biodiversity Areas

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of high biodiversity value that need to be conserved and maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services (MTPA, 2014). According to the National Environmental Management Act (NEMA) (Act no. 107 of 1998), certain activities have strict guidelines or are prohibited within CBAs and ESAs. Refer to the listed activities under the NEMA: Environmental Impact Assessment Regulations of 2014 (GNR 982) as promulgated in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) [as amended] for a comprehensive breakdown. The following terms are used to categorise the various land use types according to their biodiversity and environmental importance:

- Critical Biodiversity Area One (CBA1);
- Critical Biodiversity Area Two (CBA2);
- Ecological Support Area (ESA);
- Other Natural Areas (ONA); and
- Protected Area (PA).

Based on the desktop information (**Figure 6**), all the study sites were observed to border a CBA1 area on their Southern boundaries, this area was observed to be the Orange River's Riparian area. AoI-1 and AoI-3 were observed to overlap CBA2 and ESA areas while AoI-2 overlapped with a CBA2 area. While the study areas were observed to overlap CBA areas, Significant portions of study sites were comprised of non-natural, cultivated areas. According to a matrix of recommended land use zones and associated activities in relation to the CBA map categories. Prospecting is not permitted, and actively discouraged in CBA 1 areas. In CBA 2 and ESA areas, prospecting is restricted to compulsory, site specific conditions and controls. When these conditions are unavoidable, prospecting is usually not permitted.

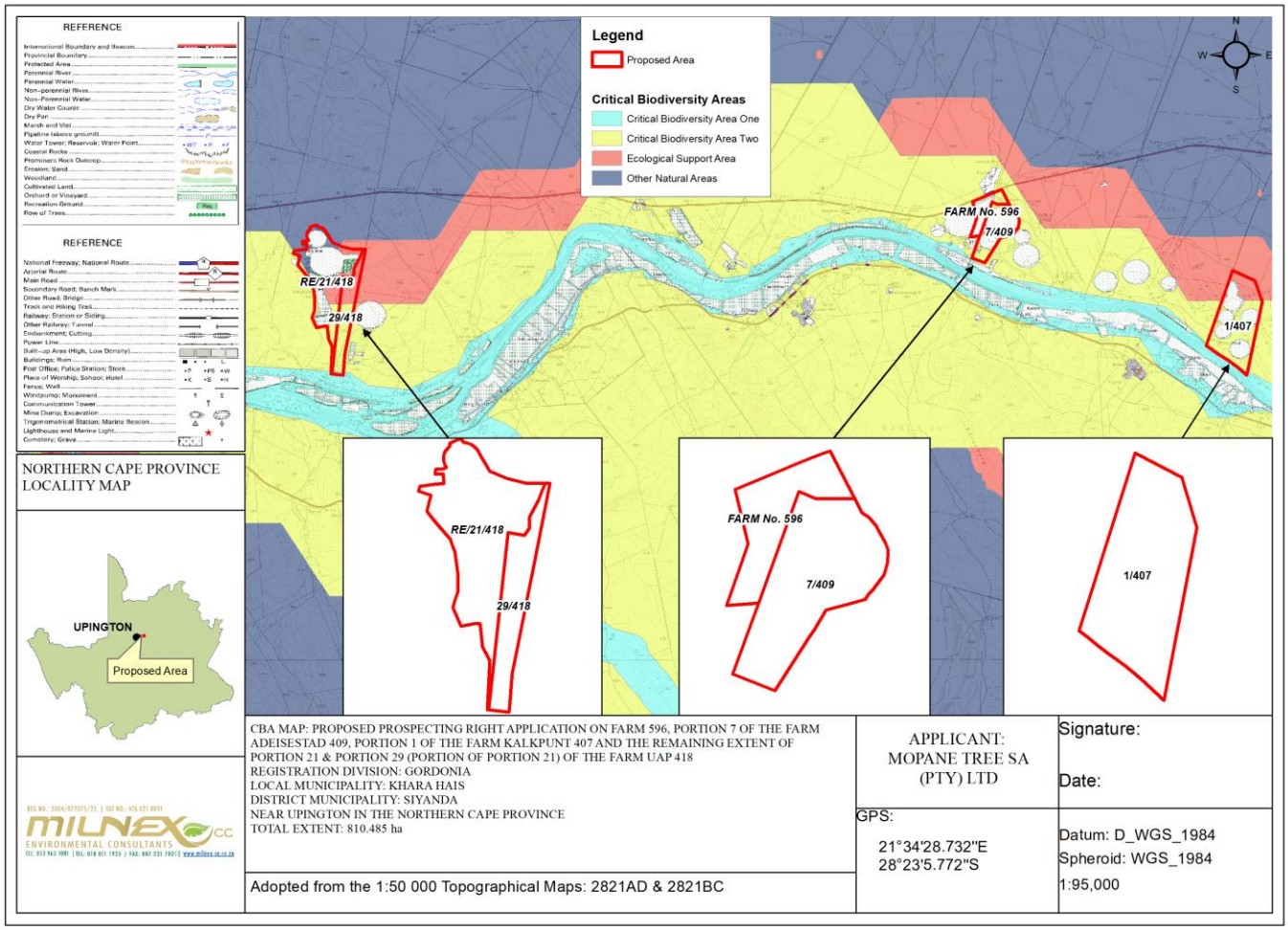


Figure 6: The Critical Biodiversity Areas associated with the study sites according to the Northern Cape Critical Biodiversity Areas and map (2016).

3.5 Biodiversity Priority Areas for Mining

According to the Mining of Biodiversity Guidelines, biodiversity priority areas sensitive to the impacts of mining are categorised into four categories (**Table 6**)

The purpose is to identify and categorise biodiversity priority areas sensitive to the impacts of mining, to support mainstreaming of biodiversity issues in decision making in the mining sector. According to the mine guide map (**Figure 7**), the proposed area falls within Category B, and therefore has highest biodiversity importance. The areas highlighted for highest biodiversity importance, correspond with the areas highlighted in **Figure 6** as CBA 1 and ESA areas. These areas are also flagged in the screening tool as areas of high aquatic biodiversity and importance. An assessment of the biodiversity content is

required, along with the application of the mitigation hierarchy to reduce impacts on the biodiversity in the specified area.

Table 6: Four categories of biodiversity priority areas

Category	Description
A	Legally protected
B	Highest biodiversity importance
C	High biodiversity importance
D	Moderate biodiversity importance

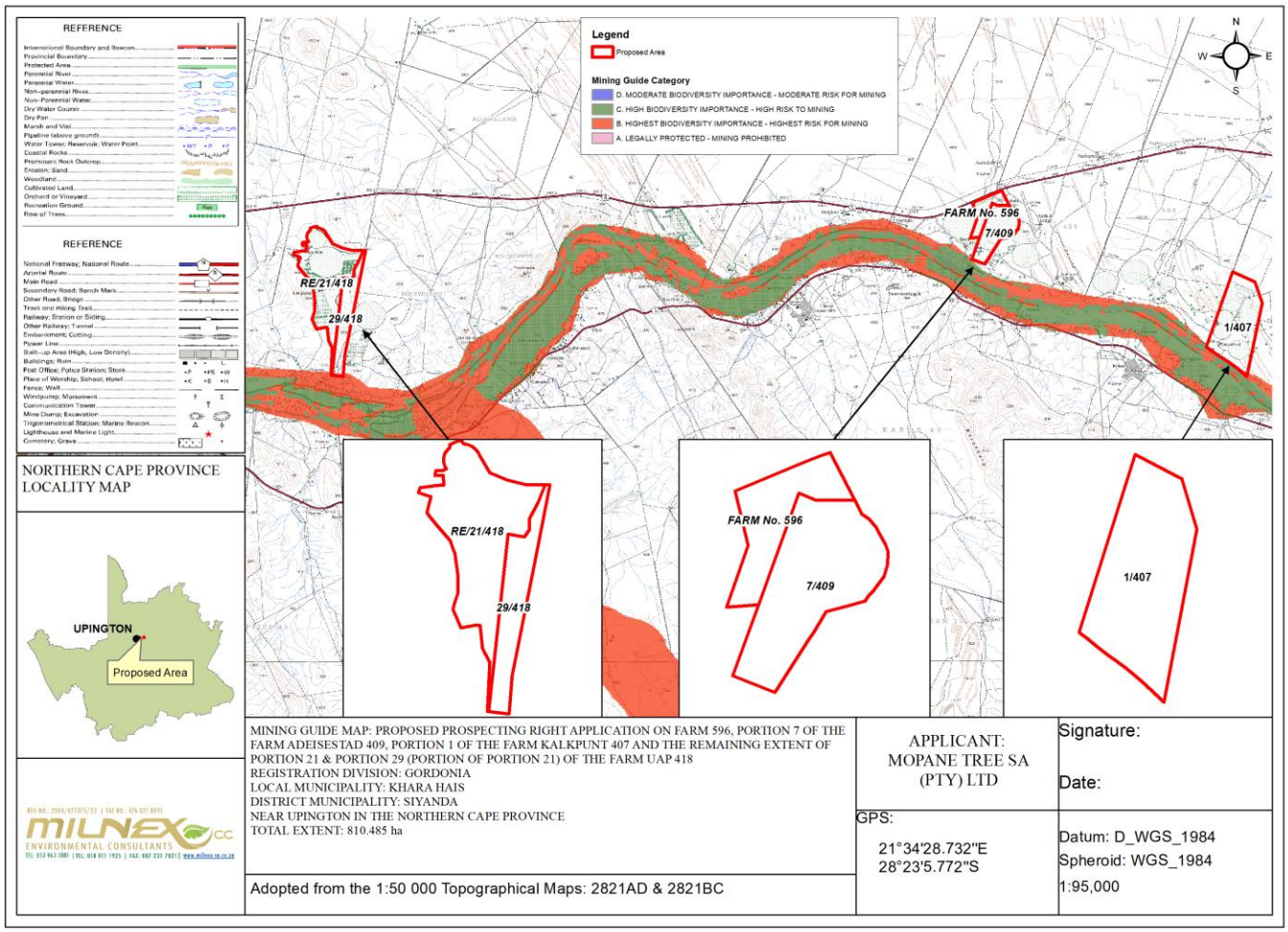


Figure 7: The study site according to the Mining and Biodiversity Guidelines (2013).

3.6 Ecoregion Characteristics

The study site falls within the Nama Karoo Ecoregion according to Kleynhans *et al.* (2005), A level 1 River Ecoregion classification System for South Africa, Lesotho and Swaziland. Ecological regions (Ecoregions) are regions within which there is relative similarity in the mosaic of ecosystems and ecosystem components (biotic and abiotic, aquatic and terrestrial) (Kleynhans *et al*., 2005). The topography of the Nama Karoo Ecoregion is represented by plains with a moderate to high relief and lowlands, hills and mountains with moderate to high relief are dominant. The vegetation is dominated by Nama karoo vegetation. The region is traversed by the perennial Riet and Orange rivers, drained by the seasonal Hartbees River. Attributes of the Nama Karoo Ecoregion are summarised in **Table 7** below.

Table 7: Attributes of the Nama Karoo (26) Ecoregion (Kleynhans *et al.,* 2005)

Ecoregion Characteristics	
Dominant primary terrain morphology	**Plains; Low Relief** Plains Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; **Open Hills, Lowlands; Mountains; Moderate to High Relief;** Closed Hills; Mountains; Moderate and High Relief
Dominant primary vegetation types	Eastern Mixed Nama Karoo; Upper Nama Karoo; **Bushmanland Nama Karoo;** Orange River Nama Karoo; Great Nama Karoo (very limited) Lowland Succulent Karoo (limited); Upland Succulent Karoo Escarpment Mountain Renosterveld
Altitude (m a.m.s.l)	300-1700, 1700-1900 (limited)
MAP (mm)	0 to 500
Coefficient of Variation (% of MAP)	30 to >40
Rainfall concentration index	50 to >65
Rainfall seasonality	Late to very late summer to Winter
Mean annual temp. (°C)	12 to 20
Winter temperature (July)	0 to 22
Summer temperature (Feb)	12 to >32
Median annual simulated runoff	<5 to 60

3.7 Surface Hydrology and Aquatic Classification

3.7.1 Quaternary Catchments and Associated Watercourses

The study site falls within the D73E Quaternary Catchment and forms part of the Lower Orange Water Management Area (WMA). The Lower Orange WMA covers a total catchment area of 252 182 km^2. With its major rivers being the Ongers, Hartbees and Orange Letaba.

3.7.2 NFEPA Wetlands

In terms of Section 1 of the National Water Act (No. 36 of 1998) (NWA), wetlands are legally defined as: "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*" (NWA, 1998).

Wetlands are defined by the presence of unique soils and vegetation that do not occur in terrestrial and purely aquatic environments (Ollis *et al.,* 2013). Wetland soils are referred to as hydric soils that develop under anaerobic conditions (condition where oxygen is virtually absent from the soil). Wetlands are also typically characterised by relatively large and dense stands of plants sticking out of shallow water or wet soil. Plants adapted to such waterlogged conditions are referred to as hydrophytes. Wetlands are distinct from true aquatic ecosystems like river ecosystems, which are characterised by fast flowing water within channels, and lake ecosystems, that are flooded to great depth; both of which are not primarily characterised by the occurrence of hydric soils and hydrophytes.

A wide variety of wetland types are present in South Africa, and can be classified into six broad types, namely floodplain wetlands, unchannelled valley bottom wetlands, channelled valley bottom wetlands, seeps, depressions and wetland flats (**Figure 8**). Owing to the large variations in climate and topography across South Africa, vegetation and habitat associated with these wetland types vary tremendously from subtropical reed beds and tall swamp forests to arid salt pans, which all support unique and varied animal life (Ollis *et al*., 2013).

3.7.3 Strategic Water Source Areas

Water source areas are those areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. Strategic water source areas are those that supply substantial downstream economies and urban centres. These water source areas are vital to the national economy (Nel et al., 2013).

The study area is not found in a strategic water source area.

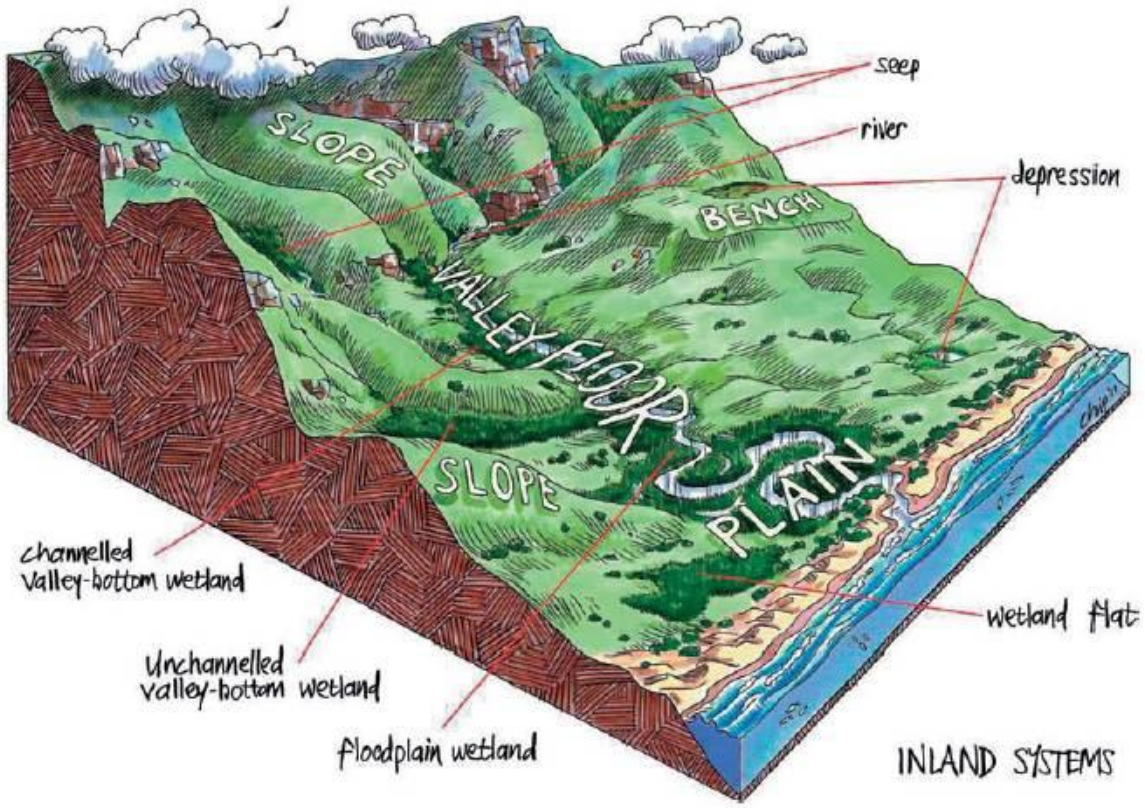


Figure 8: Hydro-geomorphic wetland types of South Africa (Ollis *et al.,* 2013).

4 FAUNA AND FLORA SPECIES ASSESSMENT

During the Desktop study, a list of potential flora and fauna species occurring in the study areas were compiled and included in this section of the document for the affected quarter degree grid cells, however, it does not mean that these do occur on-site.

4.1 Floral Assessment

Reliance was also made on desktop knowledge of the floral species occurring in the area (**Table 8**). A list of flora observed on site was compiled and their protection status indicated where relevant (**Table 9)**. If a species is a known Alien and Invasive Species, this was also indicated.

4.1.1 Desktop Terrestrial Vegetation

According to Mucina & Rutherford (2006), the study area overlaps the Northern Upper Karoo (NKu3) and the Lower Gariep Broken Veld (NKb1) vegetation types. Plant species expected to occur within this vegetation type are listed in **Table 8.**

Table 8: Flora species expected to occur according to Mucina and Rutherford (2006)

Kalahari Karroid Shrubland (NKb 5) – AoI-1
Small Trees: *Senegalia mellifera* subsp. *detinens* (d), *Parkinsonia africana* (d), *Boscia foetida* subsp. *foetida*.
Tall Shrubs: *Rhigozum trichotomum.*
Epiphytic Semiparasitic Shrub: *Tapinanthus oleifolius*
Low Shrubs: *Hermannia spinosa (d), Limeum aethiopicum (d), Phaeoptilum spinosum (d), Aizoon schellenbergii, Aptosimum albomarginatum, A. lineare, A. marlothii, A. spinescens, Barleria rigida, Hermannia modesta, Indigofera heterotricha, Leucosphaera bainesii, Monechma genistifolium subsp. genistifolium, Phyllanthus maderaspatensis, Polygala seminuda, Ptycholobium biflorum subsp. biflorum, Sericocoma avolans, Solanum capense, Tephrosia dregeana.*
Herbs: *Dicoma capensis (d), Euphorbia inaequilatera (d), Amaranthus praetermissus, Barleria lichtensteiniana, Euphorbia glanduligera. Chascanum garipense, Cleome angustifolia* subsp*. diandra, Cucumis africanus, Geigeria ornativa, Hermannia abrotanoides, Indigastrum argyraeum, Indigofera alternans, I. auricoma, Kohautia cynanchica, Limeum argute-carinatum, Mollugo cerviana, Monsonia umbellata, Sesamum capense, Tribulus cristatus, T. pterophorus, T. terrestris.*
Succulent Herbs*: Gisekia africana, G. pharnacioides, Trianthema parvifolia*.
Graminiods: *Aristida adscensionis (d), Enneapogon desvauxii (d), E. scaber (d), Stipagrostis obtusa (d), Aristida congesta, Enneapogon cenchroides, Eragrostis annulata, E. homomalla, E. porosa, Schmidtia kalahariensis, Stipagrostis anomala, S. ciliata, S. hochstetteriana, S. uniplumis, Tragus berteronianus, T. racemosus.*
Gordonia Duneveld (SVkd 1) – AoI 2and AoI-3
Small Trees: *Senegalia mellifera* subsp. *detinens* (d)
Tall Shrubs*:* *Grewia flava* (d), *Rhigozum trichotomum* (d).
Low Shrubs*:* *Aptosimum albomarginatum, Monechma incanum, Requienia sphaerosperma.*

Succulent Shrubs: *Lycium bosciifolium, L. pumilum, Talinum caffrum.*

Graminoids: *Schmidtia kalahariensis* (d), *Brachiaria glomerata, Bulbostylis hispidula, Centropodia glauca, Eragrostis lehmanniana, Stipagrostis ciliate, S. obtuse, S. uniplumis*.

Herbs: *Hermbstaedtia fleckii (d), Acanthosicyos naudinianus, Hermannia tomentosa, Limeum arenicolum, L. argute-carinatum, Oxygonum dregeanum* subsp. *canescens* var. *canescens, Sericorema remotiflora, Sesamum triphyllum, Tribulus zeyheri.*

4.1.2 Plant species observed on site

Table 9: Dominant plant species observed on the study sites**.**

Plant species list		
AoI-1		
Scientific Name	**Common Name**	**Status**
[P]Aloe claviflora	Kraal aloe	IUCN 3.1 redlist
Aristida congesta	Spreading Three-awn	Least concern
Asparagus burchellii	Wild asparagus	Least concern, endemic
Asparagus suaveolens	Wild asparagus	Least concern
[P]Boscia albitrunca	Sheperd's tree	Protected tree (Nationally)
**Bidens pilosa*	Blackjack	Exotic
Cenchrus ciliaris	Foxtail Buffalo grass	Least concern
Cynodon dactylon	Couch Grass	Least concern
**Datura stramonium*	Downy Thorn Apple	Exotic, declared invader (1b)
Eragrostis annulata	Blousoetgras	Least concern
Eragrostis lehmanniana	Lehmann Lovegrass	Least concern
**Eucalyptus camaldulensis*	River red gum tree	Exotic, declared invader (1b)
Fingerhuthia africana	Thimble grass	Least concern
Lycium arenicola	Sand Honey-thorn	Least concern
Lycium hirsutum	River Honey-thorn	Least concern
Diospyros lycioides	Bushveld Bluebush	Least concern
**Opuntia ficus-indica*	Sweet prickly pear	Exotic, declared invader (1b)
Panicum coloratum	Small buffalo grass	Least concern
Parkinsonia africana	Green-hair tree	Least concern
Phragmites australis	Common reed	Potential invader
Pogonarthria squarrosa	Herringbone grass	Least concern
Rhigozum trichotomum	Three thorn	Least concern
Searsia lancea	Karree	Least concern
Senegalia mellifera	Black thorn	Least concern
Setaria verticillata	Hooked bristlegrass	Least concern
Stipagrostis ciliata	Bushman grass	Least concern
Stipagrostis obtusa	Small bushman grass	Least concern
Typha latifolia	Bulrush	Least concern
[P] Vachellia erioloba	Camel Thorn	Protected tree
Vachelia karoo	Sweet thorn tree	Least concern
Ziziphus mucronata	Buffalo-thorn	Least concern
Ziziphus zeyheriana	Dwarf Buffalo-thorn	Least concern
AoI-2		
**Agave americana*	American Agave	Exotic
[P]Aloe claviflora	Kraal aloe	IUCN 3.1 redlist
Aristida congesta	Spreading Three-awn	Least concern
Asparagus burchellii	Wild asparagus	Least concern, endemic
[P]Boscia foetida	Stink Sheperd's tree	Protected tree (Provincially)

Cenchrus ciliaris	Foxtail Buffalo grass	Least concern
Cynodon dactylon	Couch Grass	Least concern
**Datura stramonium*	Downy Thorn Apple	Exotic, declared invader (1b)
Eragrostis spp	Blousoetgras	Least concern
Fingerhuthia africana	Thimble grass	Least concern
Heteropogon contortus	Spear grass	Least concern
Lycium arenicola	Sand Honey-thorn	Least concern
Lycium hirsutum	River Honey-thorn	Least concern
Diospyros lycioides	Bushveld Bluebush	Least concern
Panicum coloratum	Small buffalo grass	Least concern
Parkinsonia africana	Green-hair tree	Least concern
Rhigozum trichotomum	Three thorn	Least concern
Searsia lancea	Karree	Least concern
Senegalia mellifera	Black thorn	Least concern
Setaria verticillata	Hooked bristlegrass	Least concern
Stipagrostis ciliata	Bushman grass	Least concern
Stipagrostis obtusa	Small bushman grass	Least concern
Vachelia karoo	Sweet thorn tree	Least concern
[P] ***Vachellia erioloba***	Camel Thorn	Protected tree
Ziziphus mucronata	Buffalo-thorn	Least concern
Ziziphus zeyheriana	Dwarf Buffalo-thorn	Least concern
AoI-3		
[P]***Aloe dichotoma***	Quiver tree	Protected tree (Nationally)
[P]***Aloe claviflora***	Kraal aloe	IUCN 3.1 redlist
Aristida congesta	Spreading Three-awn	Least concern
Asparagus burchellii	Wild asparagus	Least concern, endemic
Asparagus suaveolens	Wild asparagus	Least concern
[P]***Boscia albitrunca***	Sheperd's tree	Protected tree (Nationally)
[P]***Boscia foetida***	Stink Sheperd's tree	Protected tree (Provincially)
**Bidens pilosa*	Blackjack	Exotic
Cenchrus ciliaris	Foxtail Buffalo grass	Least concern
Cynodon dactylon	Couch Grass	Least concern
**Datura stramonium*	Downy Thorn Apple	Exotic, declared invader (1b)
Eragrostis annulata	Blousoetgras	Least concern
Eragrostis lehmanniana	Lehmann Lovegrass	Least concern
**Eucalyptus camaldulensis*	River red gum tree	Exotic, declared invader (1b)
Fingerhuthia africana	Thimble grass	Least concern
Heteropogon contortus	Spear grass	Least concern
Lycium arenicola	Sand Honey-thorn	Least concern
Lycium hirsutum	River Honey-thorn	Least concern
Diospyros lycioides	Bushveld Bluebush	Least concern
**Opuntia ficus-indica*	Sweet prickly pear	Exotic, declared invader (1b)
Panicum coloratum	Small buffalo grass	Least concern
Parkinsonia africana	Green-hair tree	Least concern

Phragmites australis	Common reed	Potential invader
Pogonarthria squarrosa	Herringbone grass	Least concern
**Ptycholobium biflorum*	-	Exotic
Rhigozum trichotomum	Three thorn	Least concern
Searsia lancea	Karree	Least concern
Senegalia mellifera	Black thorn	Least concern
Setaria verticillata	Hooked bristlegrass	Least concern
Stipagrostis ciliata	Bushman grass	Least concern
Stipagrostis obtusa	Small bushman grass	Least concern
Typha latifolia	Bulrush	Least concern
Vachellia karoo	Sweet thorn tree	Least concern
[P] ***Vachellia erioloba***	Camel Thorn	Protected tree
Ziziphus mucronata	Buffalo-thorn	Least concern
Ziziphus zeyheriana	Dwarf Buffalo-thorn	Least concern

[P] - **Protected Species**

* - Alien Species

4.2 Faunal Assessment

4.2.1 Avifauna

Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation (Harrison *et al*., 1997). Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. It is the survival of these species that become threatened as they cannot adapt to habitat changes. Habitat-specific species are sensitive to environmental change, with destruction of habitat being the leading cause of species decline worldwide (Barnes, 2000).

It is widely accepted that vegetation structure, rather than the actual plant species, influences bird species' distribution and abundance (Harrison *et al*., 1997). Therefore, the vegetation description used in the Bird Atlas does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. After generating a screening report for the respective study sites, it was observed that the Near threatened *Neotis ludwigii* (Ludwig's Bustard) was flagged to occur within the region (all the study sites).

Suitable breeding, nesting and feeding habitats influencing bird distribution and migration were observed on site in the form of Riparian areas and dense shrubland. Regardless of the fact that the study areas were disturbed and fragmented due to extensive commercial farming, these areas presented vegetation with greater physical structure and density, as compared to adjacent terrestrial vegetation. In thus, providing essential avifaunal habitats. Birds potentially occurring in the study area and birds which enjoy conservation status in the IUCN Red List are presented in **Table 10** below.

Table 10: List of Birds Possibly Occurring within the Study sites (Taylor *et al*., 2015)

Scientific Name	Common Name	Eskom Red Data List Category	Likely to Occur
Sagittarius serpentarius	Secretarybird	**EN**	High likelihood
Circus maurus	Black Harrier	**EN**	Possible
Oxyura maccoa	Maccoa Duck	**VU**	Possible
Gyps africanus	White-backed Vulture	**CR**	High likelihood
Torgos tracheliotos	Lappet-faced Vulture	**EN**	Possible
Gyps coprotheres	Cape Vulture	**EN**	High likelihood
Polemaetus bellicosus	Martial Eagle	**EN**	High likelihood
Aquila rapax	Tawny Eagle	**VU**	Possible
Calidris ferruginea	Curlew Sandpiper	**NT**	Possible
Phoeniconaias minor	Lesser Flamingo	**NT**	Not Likely
Glareola nordmanni	Black-winged pratincole	**NT**	Not Likely

Falco vespertinus	Red-footed Falcon	**NT**	Possible
Circus macrourus	Pallid Harrier	**NT**	Possible
Numenius arquata	Eurasian Curlew	**NT**	Not Likele
Ardeotis kori	Kori Bustard	**NT**	High likelihood
Neotis ludwigii	Ludwig's Bustard	**NT**	Possible
Bucorvus leadbeateri	Southern Ground-hornbill	**VU**	Possible

4.2.2 Mammals

Table 11 below lists the mammal species possibly occurring on the proposed study sites according to the Animal Demography Unit alongside the designated statuses of those species in the South African Red list of Mammals (Child *et al*., 2016) and the Threatened or Protected Species (ToPS) List (NEMBA, 10 of 2004). Several species possibly occurring on site are protected under NEMBA (See species in bold). It was noted that most of the big game observed on site were brought in by the landowners for game farming and hunting purposes. Therefore, not all observed mammals are likely to naturally occur in the area.

Highlighted Species were observed on site.

Table 11: List of Mammals Possibly Occurring on Site (ADU, 2019)

Area of Influence occurrence.	Scientific Name	Common Name	Red List Category	ToPS
	Aepyceros melampus	Impala	Least Concern	
	Alcelaphus buselaphus caama	Red Hartebeest	Least Concern (2008)	
	Damaliscus pygargus phillipsi	Blesbok	Least Concern (2016)	
	Connochaetes gnou	Black Wildebeest	Least Concern (ver 3.1, 2016)	

	Connochaetes taurinus	Blue Wildebeest	Least Concern (ver 3.1, 2016)	
	Kobus ellipsiprymnus	Waterbuck	Least Concern (ver 3.1, 2016)	
	Taurotragus oryx	Common Eland	Least Concern (ver 3.1, 2016)	
	Antidorcas marsupialis	Springbuck	Least Concern (ver 3.1, 2016)	
AoI-1 Aoi-2 AoI-3	*Raphicerus campestris*	Steenbok	Least Concern (2016)	
	Sylvicapra grimmia	Bush Duiker	Least Concern (2016)	
AoI-1	*Hippotragus niger niger*	Sable	Least Concern (ver 3.1, 2016)	
AoI-1	*Hippotragus equinus*	Roan	Least Concern (ver 3.1, 2016)	
	Tragelaphus scriptus	Bushbuck	Least Concern	
	Tragelaphus angasii	Nyala	Least Concern (ver 3.1, 2016)	
AoI-3	*Oryx gazella*	Gemsbok	Least Concern (ver 3.1, 2016)	
	Syncerus caffer	Cape Buffalo	Least Concern (Population decreasing)	
	Tragelaphus strepsiceros	Greater Kudu	Least Concern (2016)	
	Canis mesomelas	Black-backed Jackal	Least Concern (2016)	
	Otocyon megalotis	Bat-eared Fox	Least Concern (2016)	
	Crocuta crocuta	Spotted Hyena	Least Concern (ver 3.1, 2016)	
	Vulpes chama	**Cape Fox**	**Least Concern (2016)**	**Protected**
AoI-1 Aoi-2 AoI-3	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern (2016)	
	Atelerix frontalis	**Southern African Hedgehog**	**Near Threatened (2016)**	**Protected**
	Caracal caracal	Caracal	Least Concern (2016)	
	Felis nigripes	**Black-footed Cat**	**Vulnerable (2016)**	**Protected**
	Felis silvestris	Wildcat	Least Concern (2016)	
	Leptailurus serval	**Serval**	**Near Threatened (2016)**	**Protected**
	Panthera pardus	**Leopard**	**Vulnerable (2016)**	**Protected**

	Giraffa giraffa giraffa	South African Giraffe	Least Concern (2016)	
AoI-1 Aoi-2 AoI-3	*Cynictis penicillata*	Yellow Mongoose	Least Concern (2016)	
AoI-1 Aoi-2 AoI-3	*Herpestes sanguineus*	Slender Mongoose	Least Concern (2016)	
	Suricata suricatta	Meerkat	Least Concern (2016)	
	Mungos mungo	Banded Mongoose	Least Concern (2016)	
	Hyaena brunnea	**Brown Hyena**	**Near Threatened (2015)**	**Protected**
	Proteles cristata	Aardwolf	Least Concern (2016)	
	Lepus capensis	Cape Hare	Least Concern	
	Lepus saxatilis	Scrub Hare	Least Concern	
AoI-2	*Procavia capensis*	Rock Hyrax	Least Concern (2016)	
	Ictonyx striatus	Striped Polecat	Least Concern (2016)	
	Mellivora capensis	**Honey Badger**	**Least Concern (2016)**	**Protected**
	Poecilogale albinucha	African Striped Weasel	Near Threatened (2016)	
	Aonyx capensis	African Clawless Otter	Near Threatened (2016)	
	Orycteropus afer	Aardvark	Least Concern (2016)	
	Pedetes capensis	South African Spring Hare	Least Concern (2016)	
AoI-1 Aoi-2 AoI-3	*Xerus inauris*	South African Ground Squirrel	Least Concern	
	Phacochoerus africanus	Common Warthog	Least Concern (2016)	
	Hystrix africaeaustralis	Cape Porcupine	Least Concern (2016)	
	Civettictis civetta	African Civet	Least Concern (2016)	
	Genetta genetta	Common Genet	Least Concern (2016)	

4.2.3 Herpetofauna

The local occurrences of reptiles and amphibians (collectively known as Herpetofauna) are closely dependent on broadly defined habitat types, terrestrial, arboreal (tree-living), rupiculous (rock dwelling) and wetland-associated vegetation cover. The Endangered (IUCN, 2021) African Spurred tortoise (*Centrochelys sulcate*) was observed on site AoI-3, while a Rock monitor (*Varanus albigularis*) was

observed as roadkill outside AoI-1. Based on the Frog Atlas of South Africa, the Near Threatened Giant Bullfrog (*Pyxicephalus adspersus*) is expected to occur on the study sites.

5 WATERCOURSE AND RIPARIAN ASSESSMENT RESULTS

5.1 Wetland Habitat Description and System Characterisation

The wetland assessment was conducted on the 26th and 27th of May 2022, which was within the late wet, early dry season. A hand-held auger and a GPS phone were used to log all information in the field. The wetlands within the 500m regulated area were identified and delineated in accordance with the DWAF (2005) guidelines. Based on the development type, the risks radius of the development on the wetland systems were deemed to be within 100m. Therefore the field survey focused on the wetlands that were potentially most at risk.

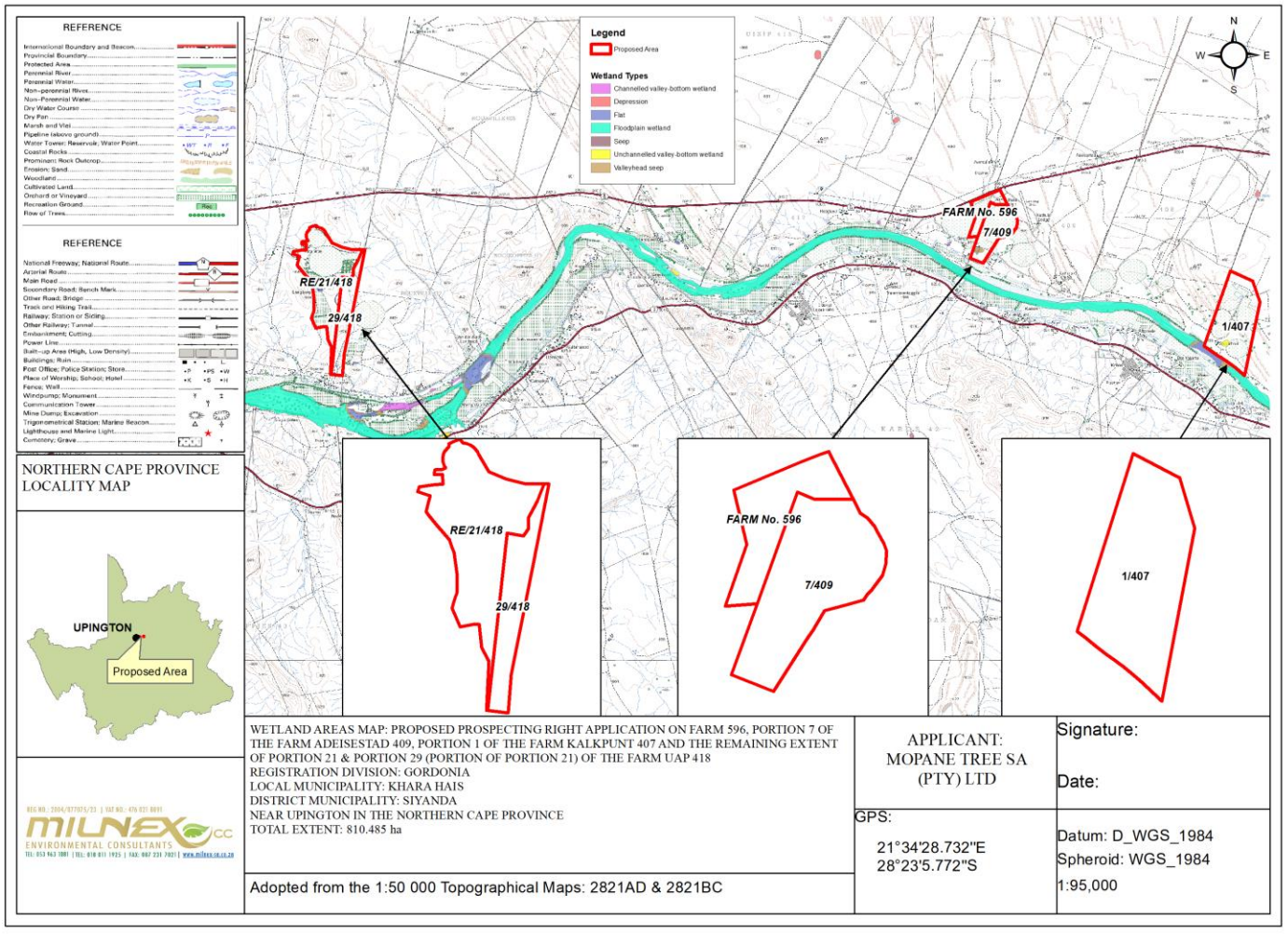


Figure 9: Wetland types expected to occur in the study area (NWM5 2018).

Based on the desktop assessment, four (4) wetland types were expected to occur within and around the study sites. AoI-1 was expected to present a wetland flat, AoI-2 was expected to present a Valley head seep, and AoI-3 was expected to present an Unchannelled Valley bottom (UVB) wetland while bordering the Orange River floodplain (**Figure 9**).

During the site visit, two Unchannelled valley bottom wetlands (UVB1 and UVB2) were assessed and delineated at AoI-1. These were second (**Figure 10**) and third (**Figure 11**) order streams which drain into a first order channel (Orange river). AoI-2 presented an Unchannelled Valley bottom (UVB3) (**Figure 12**) originating from centre pivots to the north and draining into the Orange river. Most of this system lies outside the proposed study site (AoI-2), but with 500m thereof. The Orange River was observed to lie 300m away from the southern boundary of AoI-2, and therefore inferred that any potential impacts arising from the study site would be buffered by the cultivated fields between the study site boundary and the Orange River. For that reason, the Orange rivers' floodplain and Riparian zone was not assessed.

Owing to the size of the watercourse considered at AoI-3, the Riparian area of the Orange River at the study site was noted to consist of a complex structure. Floodplains and cross channel spills (**Figure 15**) have created floodplain depression wetland systems (**Figure 14**). The extent of the Orange River Floodplain (Floodline) is expected to be wider than the Riparian area presented in this report. Therefore, the Riparian area was assessed as part of the floodplain (FP)

Figure 10: Unchannelled Valley Bottom wetland (UVB1) (AoI-1).

Figure 11: Unchannelled Valley Bottom wetland (UVB2) (AoI 1).

Figure 12: Unchannelled Valley Bottom wetland (UVB3) (AoI 2).

Figure 13: Orange River floodplain and Riparian area (FP) (AoI-3).

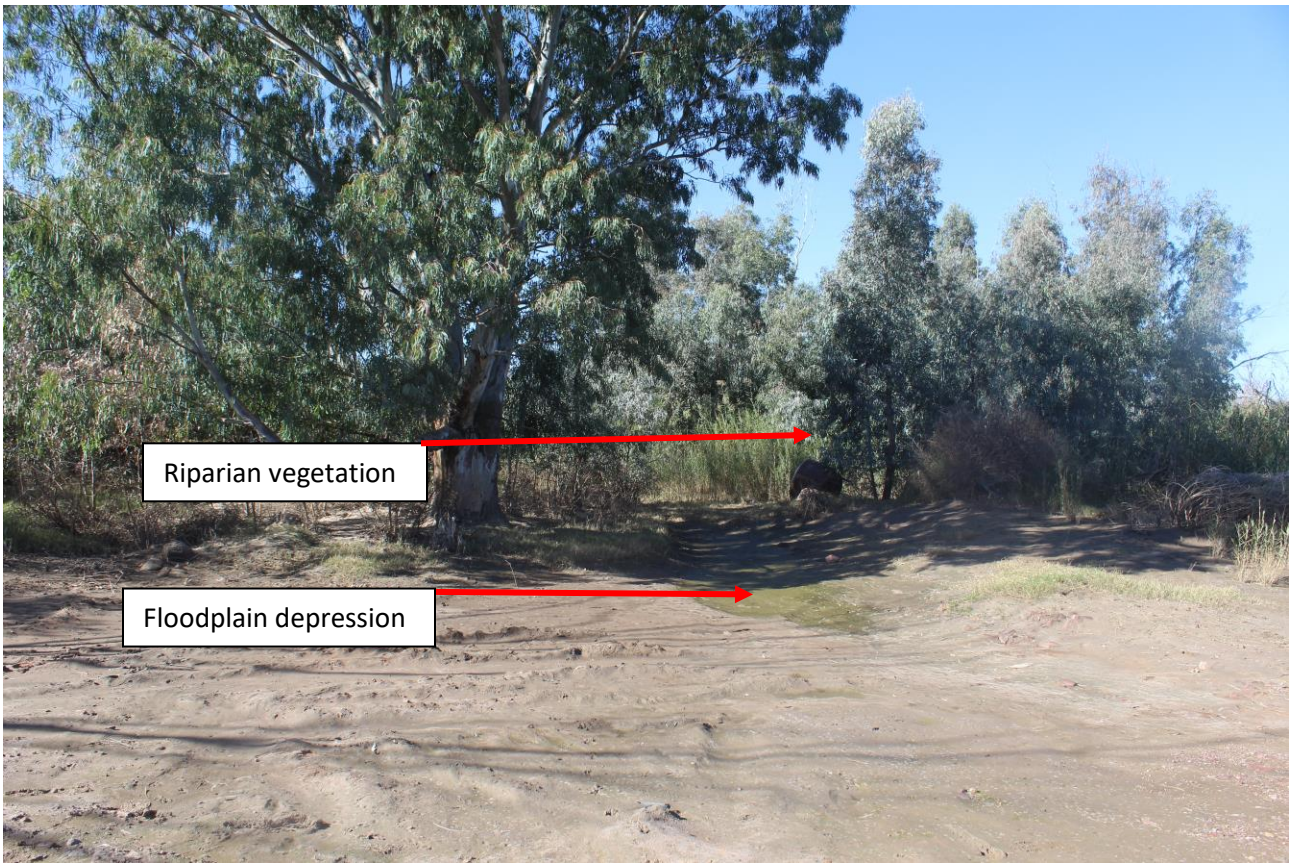


Figure 14: Orange River floodplain and Riparian area (FP)(AoI-3).

Figure 15: Orange River floodplain and Spill channels (AoI-3).

5.2 Wetland Habitat and System Characterisation

5.2.1 Assessment of the wetlands and Riparian areas

The study focused on features which were potentially most at risk as a result of the prospecting operations and associated activities. (**Table 12**). The potential impacts of activities such as farming, drought, clearance of natural vegetation, flood events and erosion within the greater catchment were taken into consideration during the assessment.

Two wetland types were identified to be most at risk, as a result of the proposed prospecting activities. These wetland types are Unchannelled Valley bottom (UVB1, UVB2 and UVB3) wetlands and a Floodplain (FP) wetland.

Table 12: Description of the assessed wetlands and Riparian areas on site.

Area of influence	AoI-1		AoI-2	AoI-3
Feature	UVB1	UVB2	UVB3	FP
Catchment Features and Current Impacts	The catchment area of this assessed unit is exorheic meaning there is outflow and surface water drains from the catchment towards the lowest part of the wetland. At the time of the field survey, surface water was observed in the assessed wetland (**Figure 10**). Major impacts in the catchment area, consists of commercial farming, and access roads along the wetland system.	The catchment area of this assessed unit is exorheic meaning there is outflow and surface water drains from the catchment towards the lowest part of the wetland. At the time of the field survey, surface water was observed in the assessed wetland (**Figure 11**). Major impacts in the catchment area, consists of earthworks, commercial farming, and access roads along the wetland system.	The catchment area of this assessed unit is exorheic meaning there is outflow and surface water drains from the catchment towards the lowest part of the wetland. At the time of the field survey, no surface water was observed in the assessed wetland (**Figure 12**). Major impacts in the catchment area, consists of commercial farming, and access roads along the wetland system.	FP is a first order river (Orange) that meanders from the slopes of the Drakensberg mountains in Lesotho Westwards towards the Atlantic Ocean. Its major tributaries are the Ongers, Hartbees and Orange Letaba Rivers. The river is surrounded by dense settlements and large-scale commercial farming. Major impacts in the system consists of recreational activities (jet skiing), illegal fishing, earthworks and water abstraction for commercial use, domestic use, and cultivation (**Figure 18).**
Unit Type	Unchannelled Valley Bottom wetland	Unchannelled Valley Bottom wetland	Unchannelled Valley Bottom wetland	Floodplain wetland (Orange river)
Downstream Features	Extensive agricultural activities within the study area.	Extensive agricultural activities within the study area and within the Orange river floodplain.	Extensive agricultural activities within the study area and within the Orange river floodplain.	Agricultural activities (extensive)
Vegetation Characteristics	The wetland vegetation was observed to be dominated by *Phragmites australis, Juncus spp, Prosopis grandulosa, Ziziphus mucronata* and	The wetland vegetation was observed to be dominated by *Eucalyptus camaldulensis, Phragmites australis, Typha latifolia, Juncus spp, Prosopis*	The wetland vegetation was observed to be dominated by *Prosopis grandulosa, Cynodon dactylon* and *Nidorella hottentotica* plant species	Riparian vegetation is dominated by *Eucalyptus camaldulensis, Phragmites australis, Ziziphus mucronata, Prosopis grandulosa, Celtis africana, Vachellia karoo,*

	Senegalia mellifera plant species.	*grandulosa, Ziziphus mucronata, Tapinanthus oleifolius* and *Senegalia mellifera* plant species.	within the wetland unit. The wetland edge was observed to be covered by *Vachellia karoo, Ziziphus mucronate, Eucalyptus camaldulensis, Senegalia mellifera* and *Celtis africana* plant species (**Figure 12**).	*Boscia foetida, Searsea lancea* and *Cynodon dactylon* plant species (**Figure 14** and **Figure 15**)
Algae Presence	Present	Present	None	None.
Aquatic Faunal Impacts	Major impacts would be on macroinvertebrate assemblage as a result of eutrophication from the use of agrochemicals. Habitat fragmentation could have potentially resulted from the earthworks activities observed within the vicinity of the assessed wetland	Major impacts would be on macroinvertebrate assemblage as a result of the movement of livestock through the wetland, and eutrophication from the use of agrochemicals.	Assessment unit was dry	Soil erosion, illegal fishing, stream channel enlargement and water pollution as a result of agrochemical use affects aquatic faunal assemblage and abundance. Fragmentation of aquatic faunal habitat (**Figure 18**) may result in the loss of aquatic species.
Depth Characteristics	Less than 1m deep	Less than 1m deep	Assessment unit was dry (**Figure 12**)	Not assessed
Flow Conditions	No flow was observed	Low stream flow	Assessment unit was dry	Not assessed
Water Clarity	Low turbidity	Moderate turbidity	Assessment unit was dry	High turbidity.
Water Odour	No odour.	No odour.	Assessment unit was dry	No odour.
Erosion Impacts	Earthworks activities (**Figure 16**) within the vicinity of the wetland unit may result in increased erosion potential.	Movement of livestock through assessment unit	Access roads traversing the wetland unit.	High erosion potential at the abstraction point due to the felling of Riparian vegetation. The adjacent areas present low erosion potential due to densely vegetated banks.

Soil characteristics	Redoximorphic features such as mottling could not be identified due to the inability to auger through the rock structures. Therefore, signs of wetness and vegetation were used as the main indicators	Redoximorphic features such as mottling and were observed on site.	Soil bleaching and Redoximorphic features such as mottling and were observed on site.	Redoximorphic features such as mottling were present on the outer edge of the wetland areas, along with alluvial deposits.

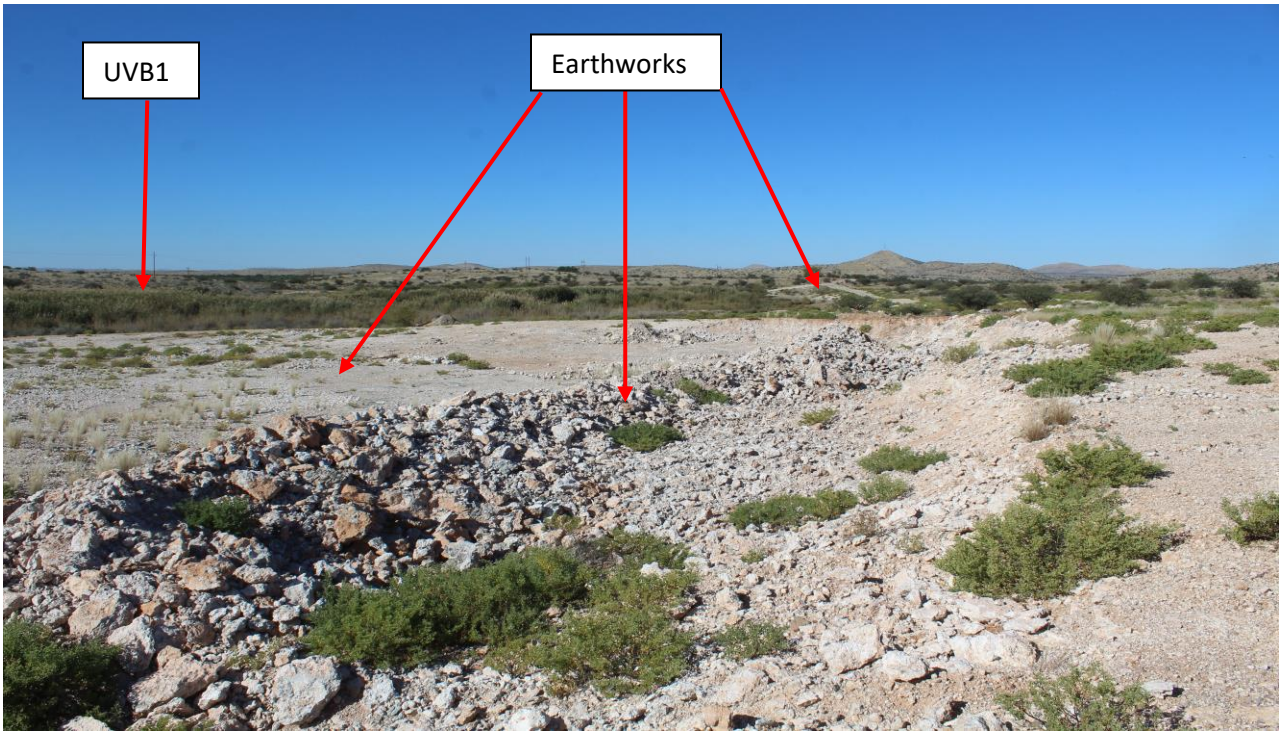


Figure 16: System features and current impacts at UVB1 (AoI-1).

Figure 17: System features and current impacts at AoI-2.

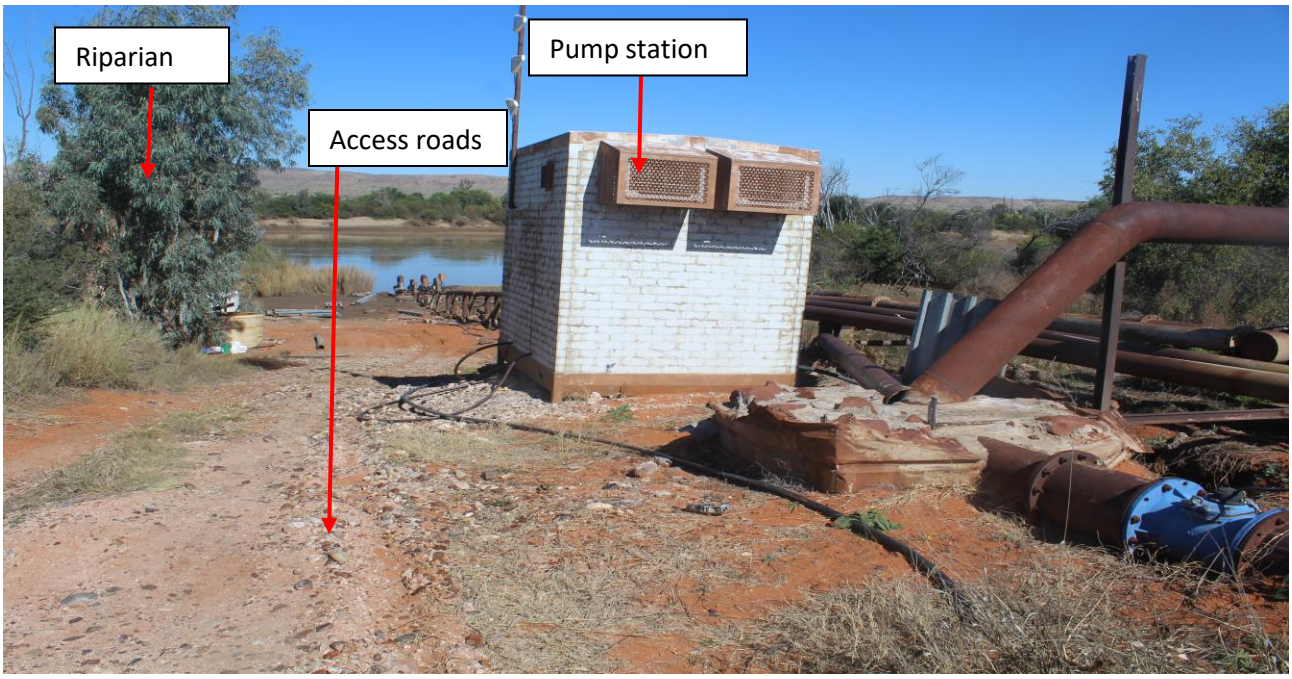


Figure 18: System features and current impacts at AoI-3.

5.2.2 WET-Health Assessment

Three modules, namely hydrology, geomorphology and vegetation, were assessed as a single unit for the HGM Units and subsequently an area weighted score was obtained for the HGM Units. The potential impacts of activities such as agriculture, drought, earthworks, altered hydrological functions and clearing of natural vegetation within the greater catchment were taken into consideration during the assessment. The Riparian areas were assessed as floodplains using the Wet-Health tool because riparian areas are a result of overspill and flood waters resulting in prolonged saturation of the banks, which further result in the proliferation of plants with different physical structure, as compared to those on adjacent terrestrial areas. The results are summarised in **Table 13** below.

Table 13: Summary of results of the WET-Health assessments conducted for the wetland areas.

Wetland	Hydrology Module		Geomorphology Module		Water Quality		Vegetation Module		Overall PES Score
	Impact Score	Trajectory of Change	Impact Score	Trajectory of Change	Impact Score	Trajectory of Change	Impact Score	Trajectory of Change	
UVB1	D	→	C	→	B	→	D	→	**C**
UVB2	D	→	C	→	B	→	D	→	**C**
UVB3	E	→	C	→	B	→	E	→	**D**
FP	C	→	B	→	A	→	C	→	**C**

The overall PES Category for the UVB1, UVB2 and FP is a C which means that the functionality of the wetlands is Moderately modified, with some loss of natural habitats. Moderate change in ecosystem processes and loss of natural habitat has occurred but the natural habitat remains intact. From these results, it is evident that the major changes and impacts have occurred as a result of the commercial agricultural activities within and around the wetland units. One module, being vegetation, was mostly impacted, and this may have been due to the encroachment of alien vegetation (*Prospois grandulosa, Phragmites australis, Juncus* spp and *Eucalyptus camaldulensis*) within the assessed wetlands. A decrease in the PES is likely to occur over the next few years if the prospecting activities occur within the exclusion zones, further road construction takes place, and if degradation occurs due to human activities.

The overall PES Category for the UVB3 is a D which means that the functionality of the wetland is largely modified, and that a great loss of natural habitat and basic ecosystem function has occurred. The hydrology and vegetation modules were mostly impacted, pushing the PES to a D. The system was observed to be dry and encroached by *Prosopis glandulosa.* A decrease in the PES is likely to occur over the next few years if the prospecting activities occur within the exclusion zones, further road construction takes place, and if degradation occurs due to human activities.

5.2.3 Ecosystem Services

Physical and hydrological features allow hydro-geomorphic units to perform specific ecosystems services. A Wet-EcoService evaluation was conducted for the wetland and riparian areas assessed on site to determine the services as described in the methodology. The degree of disturbance and modification of wetlands and riparian areas results in a decrease in the ability to which they can perform

these ecosystem services. The findings of the Wet-Ecoservice evaluation conducted is provided in **Figure 19** below.

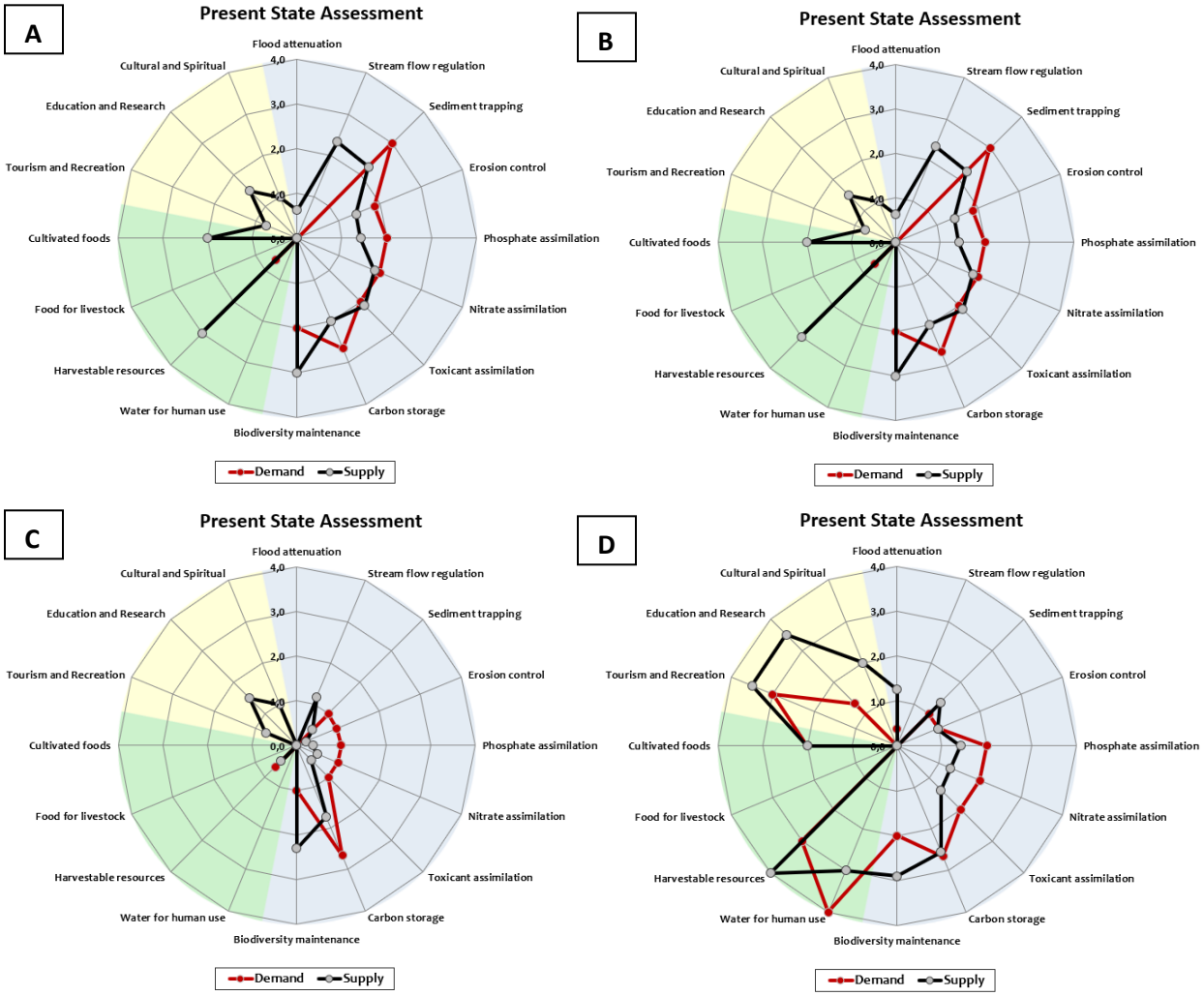


Figure 19: Results of the Ecosystem Services provided in graph format. **A**: UVB1, **B**: UVB2, **C**: UVB3 and **D**: FP.

5.2.4 Ecological Importance and Sensitivity

The EIS assessment was applied to all wetland features within the study area in order to ascertain the level of sensitivity and ecological importance of the features, as well as to assist in informing a suitable REC for each. The results of these assessments are summarised in the table below.

Table 14: EIS scores obtained for the wetlands (Kleynhans, 1999).

Wetland Importance and Sensitivity	UVB1		UVB2		UVB3		FP	
	Importance	**Confidence**	**Importance**	**Confidence**	**Importance**	**Confidence**	**Importance**	**Confidence**
Ecological Importance & Sensitivity	2.5	4.0	2.5	4.0	1.3	4.0	2.4	4.0
Hydro-Functional Importance	2.3	4.0	2.3	4.0	0.0	4.0	0.9	4.0
Direct Human Benefits	1.8	4.0	1.8	4.0	0.0	4.0	4.0	4.0
Overall Score	2.5		2.5		1.3		4.0	

The results indicated that wetlands UVB1 and UVB2 fell within EIS Category B – High, while UVB3 fell within Category C – Moderate. The floodplain wetland presented the highest EIS category of A-Very High. It is an indication that these systems are ecologically important and sensitive on a provincial and/or local scale. The importance of services supplied by these systems is Moderate to Very High relative to that supplied by other wetlands. Considering the services provided by the different wetland units, the biodiversity of UVB1 and UVB2 may be more sensitive to flow and habitat modifications as compared to UVB3 and the Floodplain wetland (FP).

The Recommended Ecological Category (REC) for the features of the wetland and Riparian areas was determined from the results of the functionality and EIS assessments. These assessments indicated that all wetland features within the site, had to an extent, underwent transformation as a result of historical and current impacts, disruption of the hydrological cycle and agricultural activities. Nevertheless, despite the altered ecological integrity of these systems, they are considered to provide important ecological services. The REC estimated appropriate for the wetland and Riparian areas features is presented in **Table 15** below.

Table 15: Summary of the REC categories assigned to all wetland features

Features	REC Category
UVB1	B/C Improve
UVB2	B/C Improve
UVB3	D Maintain
FP	A Improve

5.3 Delineation and Buffer Zone Determination

5.3.1 Wetland Delineation

The buffer zones (**Figure 20**) for the wetlands were based on mining operations and were calculated using the Site-Based Tool: Determination of buffer zone requirements for wetland ecosystems (Macfarlane *et al., 2010)*. The recommended/exclusion buffer zones were calculated as follows:

- UVB1: **64m**
- UVB2: **64m**
- UVB3: **51m**
- FP: **57m**

5.4 Summary of Results

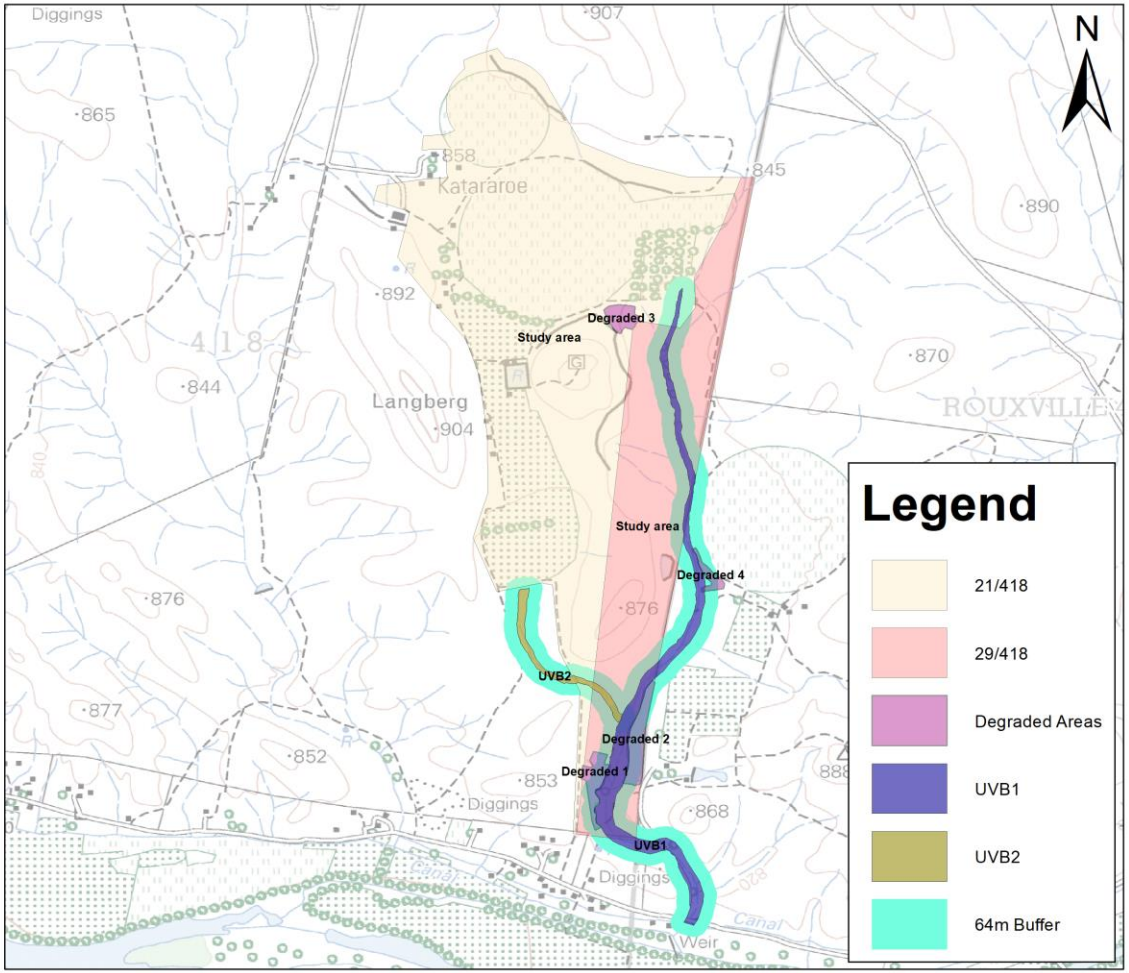
The results recorded for the watercourse potentially affected by the agricultural activities are summarised in **Table 16** below.

Table 16: Summary of the results

Classification	Scientific Buffer	PES	EIS	REC
UVB1	64m	C	B-High	B/C Improve
UVB2	64m	C	B-High	B/C Improve
UVB3	51m	D	C-Moderate	D Maintain
FP	75m	C	A-Very high	A Improve

A

AoI-1: WETLAND ASSESSMENT AND DELINEATION MAP



REFERENCE

REFERENCE

PROPERTY DESCRIPTION:
THE REMAINING EXTENT OF PORTION 21 AND PORTION 29 OF THE FARM UAP 418, REGISTRATION DIVISION: GORDONIA RD NORTHERN CAPE PROVINCE
TOTAL EXTENT: 286.3294 HA

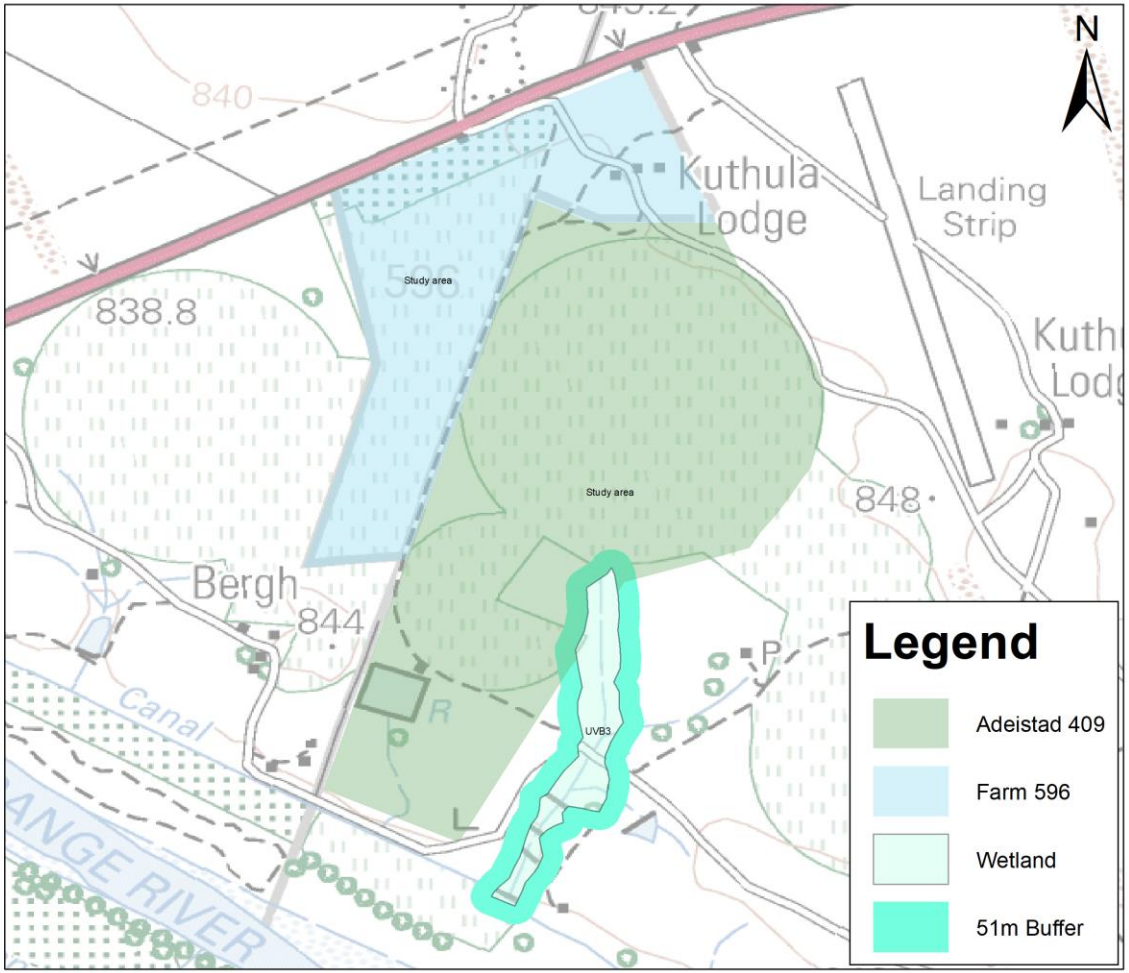
CLIENT:	MOPANE TREE SA (PTY) LTD
DATE: 10 JUNE 2022	DATUM: D_WGS_1984
DRAWN BY: E KRUGER EAP	SCALE: 1:10 000 0 0,175 0,35 0,7 Km

Adopted from the 1:50 000 Topographical Maps - 2821AD

LOCALITY MAP: NORTHERN CAPE PROVINCE

B

AoI-2: WETLAND ASSESSMENT AND DELINEATION MAP



C

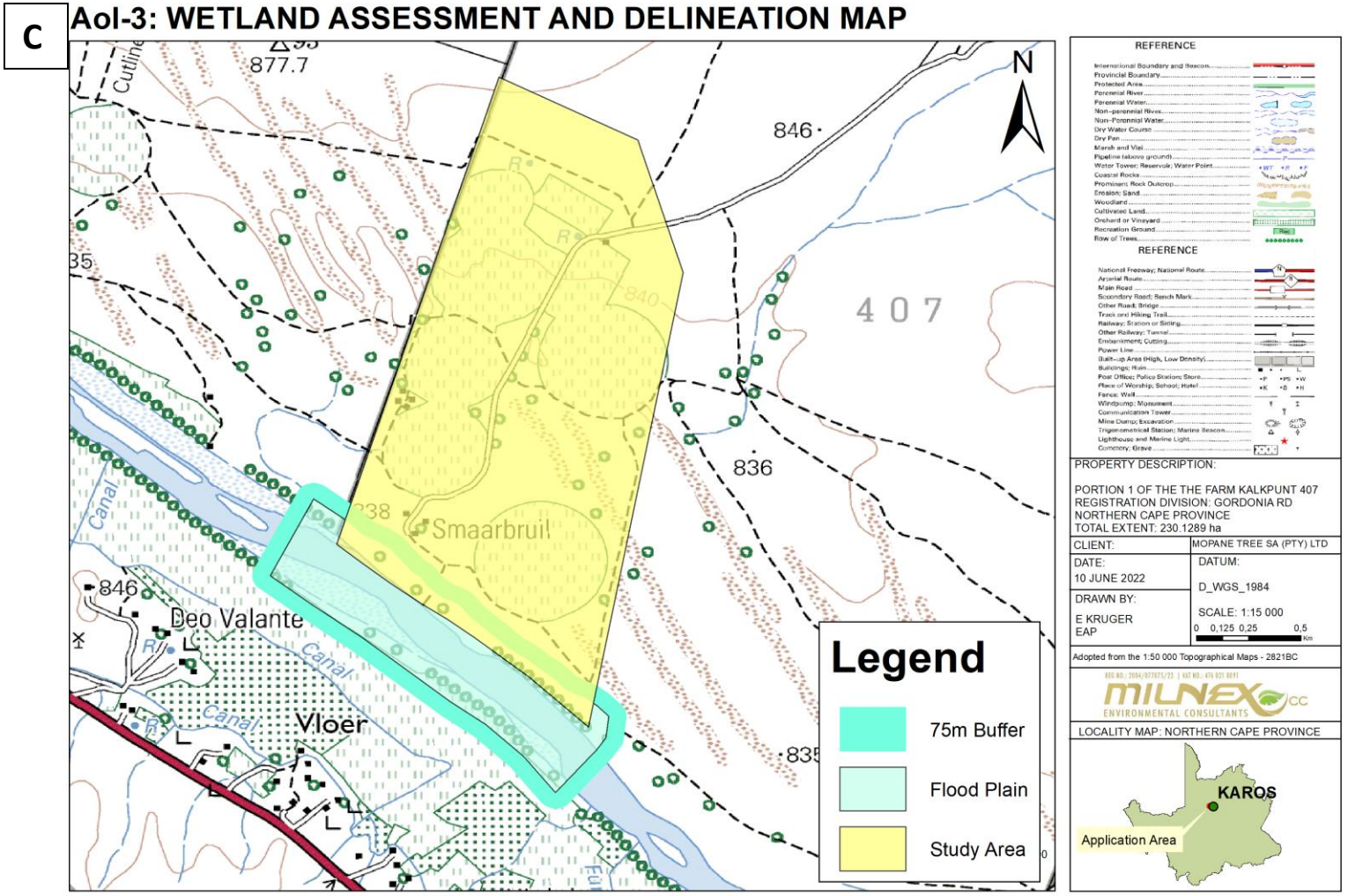


Figure 20: Watercourse Assessment and Delineation of the resources associated with the study sites **A**: AoI-1, **B**: AoI-2 and **C**: AoI-3**.**

6 NEMA IMPACT ASSESSMENT

All forms of development, albeit for agriculture, industrial, urban or residential purposes, will have an immediate effect on the natural environment. It is therefore of utmost importance to provide information on the environmental consequences these activities will have and to inform the decision-makers thereof.

6.1 Potential Impacts

The prospecting activities will potentially result in a disturbance of the wetland systems and vegetation habitats during the construction and operation phases. During rainfall events, the wetlands and riparian areas will receive an influx of sediment and other nutrients and possible toxic pollutants. See **Table 17** below for a list of expected impacts.

Table 17: Summary of potential impacts

Construction Phase	Operational Phase	Decommissioning Phase
Alteration of the flow regime of the watercourse	Alteration of the flow regime of the watercourse	Alteration of the flow regime of the watercourse
Loss and disturbance of watercourse habitat and fringe vegetation	Loss and disturbance of watercourse habitat and fringe vegetation	Loss of terrestrial habitat
Alteration of the amount of sediment entering the water resource and associated change in turbidity	Alteration of the amount of sediment entering the water resource and associated change in turbidity	Changing the physical structure within a water resource (habitat)
Alteration of water quality	Alteration of water quality	Introduction and spread of alien vegetation
Loss of terrestrial habitat	Loss of terrestrial habitat	
Loss of Aquatic Biota	Loss of Aquatic Biota	
Loss of Terrestrial Fauna	Loss of Terrestrial Fauna	
Loss of Terrestrial Flora	Loss of Terrestrial Flora	
Introduction and spread of alien vegetation	Introduction and spread of alien vegetation	

6.2 Ecological Impact Assessment Methodology

Impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined below (NEMA, 1998).

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.

- An environmental aspect is an 'element of an organizations activities, products and services which can interact with the environment'. The interaction of an aspect with the environment may result in an impact.

- Environmental risks/impacts are the consequences of these aspects on environmental resources or receptors of value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.

- Receptors can comprise, but are not limited to, people or human-made systems, such as residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.

- Resources include components of the biophysical environment.

- Frequency of activity refers to how often the proposed activity will take place.

- Frequency of impact refers to the frequency with which a stressor (aspect) will impact on the receptor.

- Severity refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

- Spatial extent refers to the geographical scale of the impact.

- Duration refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (**Table 18**). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary.

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment considers the recommended management measures required to mitigate the impacts.

The NEMA Regulations require that an impact assessment provide quantified scores indicating the expected impact, and the cumulative impact of a proposed activity. The following format was utilised during this assessment:

- *Direct impacts* - Impacts caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

- *Indirect impacts* - Indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
- *Cumulative impacts* result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Risks/Impacts were assessed for the following stages of the project cycle:

- Construction;
- Operational; and
- Decommissioning

Table 18: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS	
Frequency of Impact	**Rating**
Almost Never / Almost Impossible	1
Very Seldom / Highly Unlikely	2
Infrequent / Unlikely / Seldom	3
Often / Regularly / Likely / Possible	4
Daily / Highly Likely / Definitely	5
Frequency of Activity / Duration of Aspect	**Rating**
Annually or less / Low	1
6 Months / Temporary	2
Monthly / Infrequent	3
Weekly / Life of Operation / Regularly / Likely	4
Daily / Permanent / High	5
CONSEQUENCE DESCRIPTORS	
Severity of Impact	**Rating**
Insignificant / Non-harmful	1
Small / Potentially Harmful	2
Significant / Slightly Harmful	3
Great / Harmful	4
Disastrous / Extremely Harmful	5
Spatial Scope of Impact	**Rating**
Activity specific	1
Mine specific (within the site boundary)	2

Local area (within 5 km of the site boundary)	3
Regional	4
National	5
Duration of Impact	**Rating**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post Closure / Permanent	5

Table 19: Significance Rating Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (Frequency of Impact + Frequency of Activity)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 20: Positive / Negative Mitigation Ratings

Significance Rating	Value	Impact Management Recommendation
Very High	126 - 150	Critically consider the viability of proposed projects. Improve current management of existing projects significantly and immediately.
High	101 - 125	Comprehensively consider the viability of proposed projects. Improve current management of existing projects significant
Medium – High	76 - 100	Consider the viability of proposed projects. Improve current management of existing projects.
Medium – Low	51 - 75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy.
Low	26 - 50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy.
Very Low	1 - 25	Maintain current management and/or proposed project criteria and strive for continuous improvement.

6.3 Impact Assessment Table

Table 21: Construction Phase Impact Assessment

Potential Environmental Impact	Environmental Impact Before Mitigation						Environmental Impact After Mitigation					
	Frequency of Impact	Frequency of Activity	Severity	Spatial Scale	Duration	Significance	Frequency of Impact	Frequency of Activity	Severity	Spatial Scale	Duration	Significance
Alteration of the flow regime of the watercourse	5	4	3	4	4	99 Medium – High	3	4	2	3	3	56 Medium – Low
Changing the physical structure within a water resource (habitat)	4	4	4	3	4	88 Medium – High	2	4	2	2	3	42 Low
Alteration of the amount of sediment entering the water resource and associated change in turbidity	4	4	3	4	3	80 Medium – High	3	4	2	3	2	49 Low
Alteration of water quality	4	4	3	4	3	80 Medium – High	3	4	1	3	2	42 Low
Loss of terrestrial habitat	5	4	3	3	3	81 Medium – High	3	4	2	2	2	42 Low
Loss of Aquatic Biota	3	3	3	4	3	60 Medium – Low	2	3	1	2	1	20 Very Low
Loss of Terrestrial Fauna	4	3	2	3	3	56 Medium – Low	2	3	1	1	1	15 Very Low
Loss of Terrestrial Flora	4	4	3	2	3	64 Medium – Low	3	4	2	1	1	28 Low
Introduction and spread of alien vegetation	4	3	3	3	4	70 Medium – Low	3	3	2	2	2	36 Low

Table 22: Operational Phase Impact Assessment

Potential Environmental Impact	Environmental Impact Before Mitigation						Environmental Impact After Mitigation					
	Frequency of Impact	Frequency of Activity	Severity	Spatial Scale	Duration	Significance	Frequency of Impact	Frequency of Activity	Severity	Spatial Scale	Duration	Significance
Alteration of the flow regime of the watercourse	5	4	4	4	5	117 High	4	4	3	3	4	80 Medium – High
Changing the physical structure within a water resource (habitat)	5	4	4	4	5	117 High	4	4	3	3	3	72 Medium – Low
Alteration of the amount of sediment entering the water resource and associated change in turbidity	5	4	4	4	4	108 High	4	4	2	3	2	56 Medium – Low
Alteration of water quality	5	4	4	4	4	108 High	4	4	2	3	2	56 Medium – Low
Loss of terrestrial habitat	5	4	3	3	5	99 Medium – High	4	4	2	2	4	64 Medium – Low
Loss of Aquatic Biota	4	3	3	4	3	70 Medium – Low	3	3	2	2	4	48 Low
Loss of Terrestrial Fauna	4	3	3	3	4	70 Medium – Low	3	3	2	2	3	42 Low
Loss of Terrestrial Flora	5	4	3	3	5	99 Medium – High	4	4	2	2	3	56 Medium – Low
Introduction and spread of alien vegetation	4	3	3	3	5	77 Medium – High	2	3	2	1	3	30 Low

Table 23: Decommissioning Phase Impact Assessment

Potential Environmental Impact	Environmental Impact Before Mitigation						Environmental Impact After Mitigation					
	Frequency of Impact	Frequency of Activity	Severity	Spatial Scale	Duration	Significance	Frequency of Impact	Frequency of Activity	Severity	Spatial Scale	Duration	Significance
Alteration of the flow regime of the watercourse	4	4	3	3	3	72 Medium – Low	2	4	2	1	2	30 Low
Loss of terrestrial habitat	4	4	2	2	3	56 Medium – Low	3	4	2	1	2	35 Low
Changing the physical structure within a water resource (habitat)	4	4	3	3	3	72 Medium – Low	3	4	2	2	2	42 Low
Introduction and spread of alien vegetation	4	3	3	3	3	63 Medium – Low	3	3	2	1	2	30 Low

6.4 INDIRECT AND CUMULATIVE IMPACTS

- Downstream bed degradation due to sediment deficient flow from the prospecting area;
- Possible impact on the remaining catchment due to changes in run-off characteristics;
- Habitat changes due to channel and sediment-size changes;
- Loss of floristic and faunistic biodiversity; and
- Changes to in situ chemical parameters (temperature and dissolved oxygen) with possible change to water velocity and flow.

6.5 Mitigation Measures

Table 24: Proposed management measures relevant to the proposed prospecting operations

Impact	Source of Impact	Recommended Mitigation Measures
Alteration of the flow regime of the watercourse	**Construction:** • Infrastructure development within watercourses • Removal and disturbance of watercourse habitat and vegetation • Habitat fragmentation • Impoundments within the watercourse • Lack of adequate rehabilitation resulting in colonization by invasive plants **Operational:** • Excavation from the watercourses • Clearing of vegetation • Vehicles driving in and through watercourses **Decommissioning:** • Damage to vegetated areas • Ineffective rehabilitation measures • Vehicles driving in and through watercourses	• Any activities that take place within 500 meters of a wetland or watercourse or the 1:100 year flood lines will require authorisation in terms of the relevant regulations of NEMA, however as far as possible infrastructure should be placed outside the recommended buffer lines. • Demarcate the watercourse areas and buffer zones to limit disturbance, clearly mark these areas as no-go areas. • Where construction occurs in the demarcated watercourse and buffer areas, additional precautions should be implemented to minimise watercourse loss. • No stockpiling should take place within a watercourse or the calculated buffers. • All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds. • Erosion and sedimentation into channels must be minimised through the effective stabilisation and the re-vegetation of any disturbed stream banks. • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site clearing activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. • A sensitivity map has been developed for the study area, indicating the wetland systems, and their relevant buffer zones. It is recommended that this sensitivity map be considered during all phases of the development and with special mentioning of the planning of infrastructure, in order to aid in the conservation of and minimise impact on the wetland and aquatic habitat and resources within the study site.

		• Any areas where bank failure is observed, due to the prospecting impacts, should be immediately repaired. • As far as possible the existing road network (farm gravel roads) should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Construction and Operational phase activities should not take place within watercourses or buffer zones. • The duration of impacts on the wetlands should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • All rehabilitation activities should occur in the dry season. • Rehabilitation of disturbed areas as a result of construction must be implemented immediately upon completion of construction.
Changing the physical structure within a water resource (habitat)	**<u>Construction:</u>** • Infrastructure development within watercourses • Loss of vegetation • Flow alteration • Erosion **<u>Operational:</u>** • Excavation from the watercourses leading to degraded watercourses. • Removal of substrate within wetlands • Clearing of vegetation – vegetation loss • Loss of biodiversity • Alteration and/or loss of hydrological flow classes • Vehicles driving in and through watercourses **<u>Decommissioning:</u>** • Damage to vegetated areas • Ineffective rehabilitation measures • Vehicles driving in and through	• Other than approved and authorizsd structures, no other development or maintenance infrastructure is allowed within the delineated watercourses and their associated buffer zones. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. E.g, Check dams can be constructed to reduce erosion in a channel. • No stockpiling should take place within a watercourse or the calculated buffers. • All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds. • All maintenance within watercourses must be restricted to the dry season. • Maintenance activities should not impact on rehabilitated or naturally vegetated areas. • The duration of impacts on the wetland systems should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised.

	watercourses	• Rehabilitation must ensure that wetland structure and function are reinstated in such a way as to ensure the ongoing functionality of the systems at pre-prospecting levels. • All rehabilitation activities should occur in the dry season.
Alteration of the amount of sediment entering the water resource and associated change in turbidity	**Construction:** • Vegetation clearance causing sedimentation • Earthworks activities • Disturbance of soil surface and runoff characteristics • Erosion **Operational:** • Excavation from the watercourses leading to degraded river channels. • Removal of substrate within wetlands • Clearing of vegetation – vegetation loss • Loss of biodiversity • Alteration and/or loss of hydrological flow classes • Vehicles driving in and through watercourses **Decommissioning:** • Damage to vegetated areas • Ineffective rehabilitation measures • Vehicles driving in and through watercourses	• Buffer zones should be maintained, in order to minimise sedimentation of the downstream areas. • No stockpiling should take place within a watercourse or the calculated buffers. • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site clearing activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. • All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds. • Erosion and sedimentation into channels must be minimised through the effective stabilisation and the re-vegetation of any disturbed stream banks. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Erosion control measures, such as berms, must be implemented to manage runoff from roads to prevent erosion and pollution. • Rehabilitation of disturbed areas as a result of construction must be implemented immediately upon completion of construction. • Rehabilitation must ensure that riparian structure and function are reinstated in such a way as to ensure the ongoing functionality of the larger riparian systems at pre-prospecting levels. • All rehabilitation activities should occur in the dry season. • The duration of impacts on the riverine systems should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. • Maintain flood capacity, particularly in areas with

		significant flood hazards.
Alteration of water quality	**Construction:** • Runoff from road surfaces • Discharge of sewage • Discharge of solvents, chemicals and hydrocarbons **Operational:** • Maintenance of vehicles and machinery • Runoff from road surfaces • Discharge of sewage • Discharge of solvents, chemicals and hydrocarbons • Excavation from the watercourses and the release of nutrients and pollutants from disturbed soils • Removal of substrate within wetlands **Decommissioning:** • Damage to vegetated areas • Ineffective rehabilitation measures • Vehicles driving in and through watercourses	• Re-fuelling must take place on a sealed surface area to prevent hydrocarbon pollution. • All spills should be cleaned up immediately and disposed of. • Spill kits should be readily available and easily accessible throughout the site. • All chemicals must be stored safely on site, outside the buffer areas and surrounded by bunds. Chemical storage containers must be regularly inspected for early leak detection. • Littering must be prevented by effective site management and the provision of bins. • Provision of adequate sanitation facilities located outside of the delineated buffer zones. • An emergency spill procedure should be developed and implemented. • No stockpiling should take place within a watercourse. • All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds. • Stockpiles must be located away from channels, wetlands and drainage lines. • Erosion and sedimentation into channels must be minimised through the effective stabilisation and the re-vegetation of any disturbed riverbanks.
Loss of terrestrial habitat	**Construction:** • Clearing of vegetation – vegetation loss **Operational:** • Removal of substrate within watercourses • Clearing of vegetation during prospecting operations **Decommissioning:** • Damage to vegetated areas • Ineffective rehabilitation measures • Vehicles driving in and through watercourses	• Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon (including fencing off the defined project area) and preventing movement of workers into natural areas. • The duration of the prospecting should be minimised to as short term as possible, in order to reduce the period of disturbance on fauna and flora. • Areas of indigenous vegetation should under no circumstances be fragmented or disturbed for used as an area for dumping of waste. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local

		environment. • All staff and visitors to the site must undergo an induction process and must be made aware of the sensitive nature of the environment and floral species which occur there. • The area must be re-vegetated with plant and grass species which are endemic to the exact vegetation types. • Rehabilitation measures that are implemented must be continually monitored to ensure that proper succession has occurred and that there is no erosion occurring. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.
Loss of Aquatic Biota	**<u>Construction:</u>** • Runoff from road surfaces • Sedimentation • Discharge of solvents, chemicals and hydrocarbons **<u>Operational:</u>** • Maintenance of vehicles and machinery • Runoff from road surfaces • Discharge of solvents, chemicals and hydrocarbons • Excavation from the watercourses and the release of nutrients and pollutants from disturbed soils • Removal of substrate within wetlands • Sedimentation	• Biomonitoring of aquatic macro-invertebrates within the riverine systems is essential.
Loss of Terrestrial Fauna	**<u>Construction and Operational:</u>** • Vegetation loss and disturbance – clearing of vegetation • Excessive noise disturbances • Illegal hunting • Habitat fragmentation destruction • Vehicles driving through natural vegetated areas	• Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to

		a suitable location beyond the extent of the development footprint by a suitably qualified ECO trained in the handling and relocation of animals. • Fencing should be erected around the project area to prevent workers and members of the public from entering the surrounding environments. This fence should have small openings to allow wildlife to pass through. • Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation and decommissioning activities, these should be relocated to natural areas in the vicinity. Any sensitive fauna that are inadvertently killed during earthmoving operations should be preserved as museum voucher specimens. • No hunting, trapping or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area. • Trenches and deep excavations should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are exposed should contain soil ramps allowing fauna to escape the trench.
Loss of Terrestrial Flora	**<u>Construction and Operational:</u>** • Vegetation clearance • Vehicles driving through natural vegetated areas • Habitat fragmentation and destruction	• Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation as soon as possible. This will also reduce the likelihood of encroachment by alien invasive plant species. • Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority. This is especially applicable to the Protected *Vachellia erioloba, Boscia* albitrunca, *Aloidendron dichotomum* and *Aloe*

		claviflora which were present on the study sites.
Introduction and spread of alien vegetation	**<u>Construction:</u>** • Clearing of vegetation **<u>Operational:</u>** • Removal of substrate within watercourses • Clearing of vegetation during prospecting operations • Vehicles driving in and through watercourses **<u>Decommissioning:</u>** • Damage to vegetated areas • Ineffective rehabilitation measures • Vehicles driving in and through watercourses	• Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive drainage and wetlands areas during the eradication of alien and weed species.

7 DWS RISK ASSESSMENT

All forms of development, albeit for prospecting, mining, industrial, urban, agricultural or residential purposes, will have an effect on the natural environment. It is therefore of utmost importance to provide information on the environmental consequences these activities will have and to inform the decision-makers thereof.

7.1 DWS Risk Matrix (c & i Water Uses)

The Risk assessment followed the approach prescribed by the Department of Water and Sanitation (DWS) Notice 509 of 2016 (General Authorisation in terms of Section 39 of the National Water Act (36 of 1998) for water uses as defined in Section 21 (c) and (i).

The following Formula is used:

CONSEQUENCE = SEVERITY + SPATIAL SCALE + DURATION

LIKELIHOOD = FREQUENCY OF THE ACTIVITY + FREQUENCY OF THE IMPACT +LEGAL ISSUES + DETECTION

RISK = CONSEQUENCE x LIKELIHOOD

This risk assessment matrix assists in quantifying expected impacts and the scores are useful in evaluating how the proposed activities should be authorised. **Table 25** below provides a description of the classes to establish the appropriate channel of authorisation. Risk is determined after considering all listed mitigation measures.

Table 25: Risk scores, classes, and the appropriate authorization process (Extract from DWS, 2016)

Rating	Class	Management Description	Authorisation	Delegation
1 - 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands are excluded.	GA	Regional Head
56 - 169	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.	WUL	Regional Head
170 - 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.	WUL	Director General

Table 26: The DWS (2016) risk assessment matrix for the proposed prospecting operations.

Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota	Severity	Spatial Scale	Duration	Consequence	Frequency of Activity	Frequency of Impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence
Construction related activities	Alteration of the flow regime of the watercourse	• Infrastructure development within watercourses • Loss of vegetation • Flow alteration • Erosion • Vegetation clearance causing sedimentation • Earthworks activities • Disturbance of soil surface and runoff characteristics • Runoff from road surfaces • Discharge of sewage • Discharge of solvents, chemicals and	2	2	2	2	**2**	1	2	**5**	5	5	5	2	**17**	**85**	**M**	75
	Loss and disturbance of watercourse habitat and fringe vegetation		3	3	3	3	**3**	2	2	**7**	5	5	5	2	**17**	**119**	**M**	75
	Alteration of the amount of sediment entering the water resource and associated change in turbidity		2	2	2	2	**2**	1	2	**5**	5	5	5	2	**17**	**85**	**M**	75
	Alteration of water quality		2	2	2	2	**2**	2	2	**6**	5	5	5	3	**18**	**108**	**M**	75

	Loss of Aquatic Biota	hydrocarbons • Excessive noise disturbances • Illegal hunting • Habitat fragmentation destruction • Vehicles driving through natural vegetated areas	3	3	3	3	**3**	2	2	**7**	5	5	5	2	**17**	**119**	**M**	75
	Introduction and spread of alien vegetation		2	2	2	2	2	2	4	**8**	5	5	5	3	18	**144**	**M**	75
Operation related activities	Alteration of the flow regime of the watercourse	• Excavation from the watercourses leading to degraded river channels. • Removal of substrate within wetlands • Clearing of vegetation – vegetation loss • Loss of biodiversity • Alteration and/or loss of hydrological flow classes • Vehicles driving in and through	4	3	4	4	**3.75**	3	4	**10.75**	5	4	5		**17**	**182.75**	**H**	75
	Loss and disturbance of watercourse habitat and fringe vegetation		4	3	4	4	**3.75**	3	4	**10.75**	5	4	5	3	**17**	**182.75**	**H**	75
	Alteration of the amount of sediment entering the water resource and associated change in turbidity		3	2	2	2	**2.25**	2	4	**8.25**	5	4	5	3	**17**	**140.25**	**M**	75

	Alteration of water quality	watercourses • Maintenance of vehicles and machinery • Runoff from road surfaces • Discharge of sewage • Discharge of solvents, chemicals and hydrocarbons • Excavation from the watercourses and the release of nutrients and pollutants from disturbed soils • Removal of substrate within wetlands	2	2	2	2	**2**	3	4	**9**	5	4	5	3	**17**	**153**	**M**	75
	Loss of Aquatic Biota		2	2	3	3	**2.5**	3	3	**8.5**	3	4	5	3	15	**127.5**	**M**	75
	Introduction and spread of alien vegetation		3	2	4	4	**3.25**	2	4	**9.25**	5	5	5	2	17	**157.25**	**M**	75
Decommission related activities	Alteration of the flow regime of the watercourse	• Damage to vegetated areas • Ineffective rehabilitation measures • Vehicles driving in and through	2	2	2	2	**2**	1	2	**5**	5	5	5	2	**17**	**85**	**M**	75
	Changing the physical structure within a water resource (habitat)		2	2	2	2	**2**	1	2	**5**	4	3	5	3	15	**75**	**M**	75

	Introduction and spread of alien vegetation	watercourses	2	1	2	1	**1.5**	1	1	**3.5**	3	3	5	3	14	**49**	**L**	75

7.2 Control measures

Kindly refer to **Table 24** for the proposed Control measures relevant to the prospecting activities.

8 CONCLUSION

In Conclusion:

- According to the National Threatened Ecosystem database (2011), the threatened Lower Gariep Alluvial Vegetation ecosystem borders with the study sites to the south.
- According to the Northern Cape Critical biodiversity Areas and map (2016), all the study sites were observed to border a CBA1 area on their Southern boundaries, this area was observed to be the orange river's Riparian area. AoI-1 and AoI-3 were observed to overlap CBA2 and ESA areas while AoI-2 overlapped with a CBA2 area. While the study areas were observed to overlap CBA areas, significant portions of study sites were comprised of non-natural, cultivated areas
- According to the NBA2018 National Wetland Map 5 Areas Database (Van Deventer *et al.*, 2018), four (4) wetland types were expected to occur within and around the study sites. AoI-1 was expected to present a wetland flat, AoI-2 was expected to present a Valley head seep, and AoI-3 was expected to present an Unchannelled Valley bottom (UVB) wetland while bordering the Orange River floodplain. A site visit confirmed the presence of two Unchannelled valley bottom wetlands (UVB1 and UVB2) at Aoi-1, one Unchannelled Valley bottom (UVB3) and a Floodplain wetland (FP) at AoI-3, along with its associated Riparian areas.
- *Vachellia erioloba, Boscia albitrunca*, *Aloidendron dichotomum* and *Aloe claviflora*, which are Protected plant species of South Africa, were recorded on site.
- Exotic and Invasive Vegetation Species were recorded on site (**Table 9**).
- For Avifaunal species potentially occurring on site, and that enjoy conservation status in the IUCN Red List, kindly refer to Section 4.2.1(**Table 10**) for a species list.

- Several species possibly occurring on site are protected under Tops and NEMBA, although not observed during the site visit.
- The Endangered (IUCN, 2021) African Spurred tortoise (*Centrochelys sulcate*) was observed on site AoI-3, while a Rock monitor (*Varanus albigularis*) was observed as roadkill outside AoI-1. Based on the Frog Atlas of South Africa, the Near Threatened Giant Bullfrog (*Pyxicephalus adspersus*) is expected to occur on the study sites.

Three Unchannelled Valley Bottom wetlands and a Floodplain wetland was recorded and assessed on the study sites. The results are summarised in the table below:

Classification	Scientific Buffer	PES	EIS	REC
UVB1	64m	C	B-High	B/C Improve
UVB2	64m	C	B-High	B/C Improve
UVB3	51m	D	C-Moderate	D Maintain
FP	75m	C	A-Very high	A Improve

The allocation of buffers/exclusion zones was in accordance with the wetlands PES as well as EIS. The allocated buffers can be reviewed. Various potential impacts are associated with the proposed Prospecting activities and are discussed in the impact assessment scores derived according to the amended EIA Regulations (2017).

NEMA Impact assessment	Most of the impacts associated with the prospecting activities range from High to Medium-Low prior to mitigation taking place. With mitigation fully implemented, the significance of most impacts can be reduced to Medium-High to Very Low
DWS Risk assessment	All the impacts associated with the prospecting activities are ranked as Low to High, with most impacts presenting Medium

	ranking
Mitigation Measures	Refer to Section 6.5

It is imperative that an effective management plan is implemented to ensure that all mitigation measures discussed in the report are adhered to. It is also imperative for the operations to be conducted outside of the recommended exclusion buffers. Therefore, the proposed prospecting operations can be considered from an ecological conservation point of view, given that all mitigation measures are adhered to. During the construction, operational and decommissioning phases all recommendations made, and concerns raised in this document should be taken into consideration. A good closure and rehabilitation plan should be in place to rehabilitate the habitat for faunal and floral species and active alien and invasive vegetation removal and monitoring should take place in accordance with an Alien Invasive Vegetation Management Plan.

9 REFERENCES

Barnes, K.N. (ed.). (2000). *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg.

Child, M. F., Roxburgh, L., Do Linh San, E., Raimondo, D. & Davies-Mostert, H. T. (2016). The 2016 Mammal Red List of South Africa Lesotho and Swaziland. Endangered Wildlife Trust & South African National Biodiversity Institute (SANBI).

Edwards, R., Macfarlane, D., Robinson, K., Israel, A., de Groen, M. & Dunsmore, S. (2018). *Wetland Management Guidelines: Building Capacity and Supporting Effective Management of Wetlands within South African Municipalities.* Eco-Pulse Environmental Consulting Services. 300 pages.

Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. (2013). *Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector*. Pretoria.100 pages

Department of Water Affairs and Forestry. (2005). *Environmental Best Practice Specifications: Construction for Construction Sites, Infrastructure Upgrades and Maintenance Works*. Version 3

Department of Water Affairs. (2008). *Updated Manual for the Identification and Delineation of Wetlands and Riparian areas*.

Department of Water Affairs (2010). National Water Act, 1998 (Act No 36 of 1998) S21(c) & (i) Water Uses. Version: February 2010. Training Manual.

Driver, A., Sink, K.J., Nel, J.L., Holness, S., Van Niekerk, L., Daniels, F., Majiedt, P.A., Jonas, Z. & Maze, K., (2012). National Biodiversity Assessment 2011: *An assessment of South Africa's biodiversity and ecosystems. Synthesis Report*. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds.). (1997). *The Atlas of Southern African Birds*. Vol. 1 & 2. BirdLife South Africa, Johannesburg

IUCN (2021). The IUCN Red List of Threatened Species. Version 2021-1. www.iucnredlist.org Visited on 03 November 2021.

Kleynhans, C.J. (1999). *A procedure for the determination of the ecological reserve for the purpose of the national water balance model for South African Rivers*. Institute for Water Quality Studies Department of Water Affairs and Forestry, Pretoria.

Kleynhans C.J., MacKenzie J. & Louw M.D. (2007). *Module F: Riparian Vegetation Response Assessment Index in River Classification: Manual for EcoStatus Determination* (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 333/08

Kleynhans, C.J., Thirion, C. and Moolman, J. (2005). *A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland*. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa

Kotze D.C., (1999). *A system for supporting wetland management decisions*. Ph.D. thesis. School of Applied Environmental Sciences, University of Natal, Pietermaritzburg.

Macfarlane D.M., Ollis D.J & Kotze D.C. (2020). *WET-Health (Version 2.0): A refined suite of tools for assessing the present ecological state of wetland ecosystems. Technical guide* Water Research Commission, Pretoria. WRC Report TT820/20 May 2020

Macfarlane D.M., Teixeira-Leite A., Goodman P., Bate G & Colvin C. (2010). *Draft Report on the Development of a Method and Model for Buffer Zone Determination*. Water Research Commission project K5/1789. The Institute of Natural Resources and its Associates.

Mucina, L. & Rutherford, M.C. (2006). *The vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

National Environmental Management Act (ACT 107 OF 1998) Implementation Guidelines.

Ollis, D., Snaddon, K., Job. N. & Mbona. N. (2013). *Classification System for Wetland and Other Aquatic Ecosystems in South Africa. User Manual: Inland Systems*. Pretoria, South Africa: SANBI.

Rountree M.W., Malan H.L. and Weston B.C. (2013). *Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0).* WRC Report 1788/1/13. *Water Research Commission, Pretoria.*

South Africa. (1998). The National Environmental Management Act 107 of 1998.

South Africa. (1998). The National Forest Act 84 of 1998.

South Africa. (2004). National Environmental Management: Biodiversity Act no 10 of 2004.

South Africa. (2005). National Environmental Management: Biodiversity Act no 10 of 2004: Draft lists of threatened and protected species, 2005.

South Africa. (2016). National Environmental Management: Biodiversity Act no 10 of 2004. Alien and invasive species lists, 2016.

Taylor MR, Peacock F, Wanless RM (eds). 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa. Johannesburg, South Africa

Tourism, M., Parks Agency (MTPA). (2014). *Mpumalanga Biodiversity Sector Plan Handbook*.

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E. & Snaddon, K. (2018). *South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems*

(SAIIAE). Version 3, final released on 3 October 2019. Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.

Water Research Commission. (2017). Surface and Groundwater SWSA [Vector] 2017. Available from the Biodiversity GIS website, downloaded on 13 June 2022 .

10 APPENDIX A: SPECIALIST CURRICULUM VITAE AND QUALIFICATIONS

MILNEX CC ENVIRONMENTAL CONSULTANTS

Khume Chamie Mtshweni

Ecologist

Khume Chamie Mtshweni is Milnex's Junior ecologist and has 4 years' experience in surface water monitoring, ground water monitoring, aquatic biomonitoring. He also has experience in conducting noise surveys and weather station maintenance. Khume have skills in laboratory analysis (toxicity testing), field work (water, sediment, soil, aquatic invertebrates and fish sampling), analytics, report writing, aquatic and sediment toxicology.

QUALIFICATIONS

- MSc (Aquatic health)
- BSc Hons (Zoology)
- BSc (Environmental Sciences)

Khume has **SPECIALIST SKILLS** in the following areas:

- Environmental data analysis and interpretation
- Conducting laboratory experiments and exposures
    - Toxicity testing
    - Sediment analysis
- Surface water monitoring
- Ground water monitoring
- Aquatic biomonitoring

  - Sediment
  - Fish
  - Aquatic macroinvertebrates
- Terrestrial ecology
- Dust fallout monitoring
- Wetland Classification and Delineation

EMPLOYMENT HISTORY

Company	Golder Associates
Position	Aquatic ecology intern (Student)
Period	2017 – 2020

Company	Milnex cc
Position	Aquatic Ecologist
Period	March 2021 - current

LANGUAGES

English, Afrikaans, IsiNdebele, siSwati, Sepedi, Setswana, Sesotho, Zulu

11 CERTIFICATION

I, Khume Mtshweni, declare that, to the best of my knowledge, all the information contained herein is true.

Per: Khume Mtshweni

Milnex CC:

Date: 7 March 2022