



# **WETLAND BASELINE AND RISK ASSESSMENT FOR THE PROPOSED PART II EA AMENDMENT FOR THE MOTUOANE HENNEMAN EXPLORATION PROJECT**

**Virginia, Free State**

January 2024

**CLIENT**



**Prepared by:**

**The Biodiversity Company**


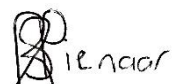
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Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

## Table of Contents

1	Introduction.....	6
1.1	Terms of Reference .....	6
2	Receiving Environment .....	6
2.1	Vegetation Types .....	9
2.1.1	Central Free State Grassland (Gh 6) .....	9
2.1.2	Vaal-Vet Sandy Grassland (Gh10).....	9
2.1.3	Highveld Alluvial Vegetation (AZa 5).....	9
2.2	Soils and Geology .....	10
2.3	Climate .....	10
2.4	South African Inventory of Inland Aquatic Ecosystems .....	10
2.5	National Freshwater Priority Areas .....	10
3	Key Legislative Requirements.....	12
3.1	National Water Act (NWA, 1998) .....	12
3.2	National Environmental Management Act (NEMA, 1998).....	12
4	Methodology.....	12
4.1	Identification and Mapping .....	12
4.2	Ecological Classification and Description .....	13
4.3	Functional Assessment .....	13
4.4	Present Ecological Status .....	14
4.5	Importance and Sensitivity .....	15
4.6	Buffer Requirements .....	15
4.7	Risk Assessment.....	15
4.8	Knowledge Gaps .....	15
5	Results and Discussion .....	16
5.1	Delineation and Description .....	16
5.2	Unit Setting.....	18
5.3	General Functional Description.....	20
5.4	Functional Assessment .....	20
5.5	Present Ecological Status .....	23
5.6	Importance and Sensitivity .....	23
5.7	Buffer Requirements .....	24
5.8	Regulatory Zone.....	24
6	Risk Assessment.....	25
6.1	Potential Impacts.....	25
7	Impact Assessment.....	29
8	Conclusion and Recommendation .....	29
8.1	Baseline Ecology.....	29

8.2	Risk Assessment.....	29
8.3	Impact Assessment.....	30
8.4	Specialist Statement .....	30
9	References.....	31

## Figures

Figure 2-1	The project locality map .....	7
Figure 2-2	Close up of the 30 km Seismic transects as well as the proposed boreholes. Left is the northern cluster and right the southern cluster .....	8
Figure 2-3	Summarised climate for the region (Mucina & Rutherford, 2006).....	10
Figure 2-4	SALIAE and NFEPA wetlands in close proximity to the PAOI.....	11
Figure 4-1	Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013).....	13
Figure 5-1	Photographical evidence of the different HGM units found within the PAOI. A) Drainage features., B) Floodplain wetland., C) Channelled valley bottom., D) Dams located within the channelled valley bottom	16
Figure 5-2	Delineation and location of the different HGM units identified within the PAOI .....	17
Figure 5-3	Amalgamated diagram of a typical channelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013) .....	18
Figure 5-4	Amalgamated diagram of atypical depression wetland, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013) .....	18
Figure 5-5	Amalgamated diagram of a typical floodplain system, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013) .....	19
Figure 5-6	Amalgamated diagram of a typical unchannelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013) .....	19
Figure 5-7	The watercourse classifications (DWA, 2005) .....	19
Figure 5-8	Average ecosystem services scores for the delineated wetlands .....	22
Figure 5-9	Overall present ecological state of delineated wetlands .....	23
Figure 6-1	The mitigation hierarchy as described by the DEA (2013) .....	25
Figure 6-2	The identified risk areas within the PAOI .....	26

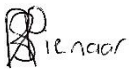
## Tables

Table 4-1	Classes for determining the likely extent to which a benefit is being supplied .....	13
Table 4-2	The Present Ecological Status categories (Macfarlane, et al., 2008) .....	14
Table 4-3	Description of Ecological Importance and Sensitivity categories .....	15
Table 4-4	Significance ratings matrix .....	15
Table 5-1	Average ecosystem service scores for delineated wetlands .....	21
Table 5-2	The zone of regulation for the project .....	24
Table 6-1	DWS Risk Impact Matrix for the proposed seismic routes (Andrew Husted Pr Sci Nat 400213/11) .....	27
Table 7-1	Impact assessment for the proposed project.....	29

## Declaration

I, Rian Pienaar declare that:

- I act as the independent specialist in this study;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this study, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



**Rian Pienaar**

**Freshwater Ecologist**

The Biodiversity Company

January 2024

# 1 Introduction

The Biodiversity Company was commissioned to conduct a wetland baseline and risk assessment for the proposed Motuoane Hennenman Exploration Project near Virginia in the Lejweleputswa District Municipality of the Free State province in South Africa.

Motuoane Energy (Pty) submitted an application for the exploration of hydrocarbons, in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended) to the Petroleum Agency South Africa (PASA) in 2016. The application was successful but only included 3 drilling wells and did not include the seismic aspect. As the applicant proposes to undertake an addition of ten (10) new exploration boreholes (13 drilling wells in total including the initial 3 which were approved) and ~30km of new seismic transects, an EA Amendment process has been initiated.

A 500 m area has been demarcated for the project to facilitate the identification of wetlands within the regulatory zone, this area is referred to as the project area of influence (PAOI).

One wetland site visit was conducted from the 18<sup>th</sup> to the 20<sup>th</sup> of October 2023 as well as 11 to 12 January 2024, which constitutes both a late dry season and a wet season survey. This report, after taking into consideration the findings and recommendation provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the proposed activity.

This assessment has been completed in accordance with the requirements of the published General Notice (GN) 509 by the Department of Water and Sanitation (DWS). This notice was published in the Government Gazette (no. 40229) under Section 39 of the National Water Act (Act no. 36 of 1998) in August 2016, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 509 process provides an allowance to apply for a WUL for Section 21(c) & (i) under a General Authorisation (GA), as opposed to a full Water Use Licence Application (WULA). A water use (or potential) qualifies for a GA under GN 509 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM). This assessment will implement the RAM and provide a specialist opinion on the appropriate water use authorisation.

## 1.1 Terms of Reference

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- The delineation, classification and assessment of water resources within the regulated area;
- Conduct risk assessments relevant to the proposed activity; and
- Recommendations relevant to associated impacts.

# 2 Receiving Environment

A 500 m buffer area was created around the seismic lines provided, and a 1 km buffer surrounding the drilling wells, resulting in the Project Area of Influence (PAOI) which represents the total area assessed. The area surrounding the project area consists mainly of grazed grassland with interspersed agricultural activities and secondary roads.

The 30 km seismic transects are located approximately 15 km south-east of Virginia of the Free State province (see Figure 2-1).

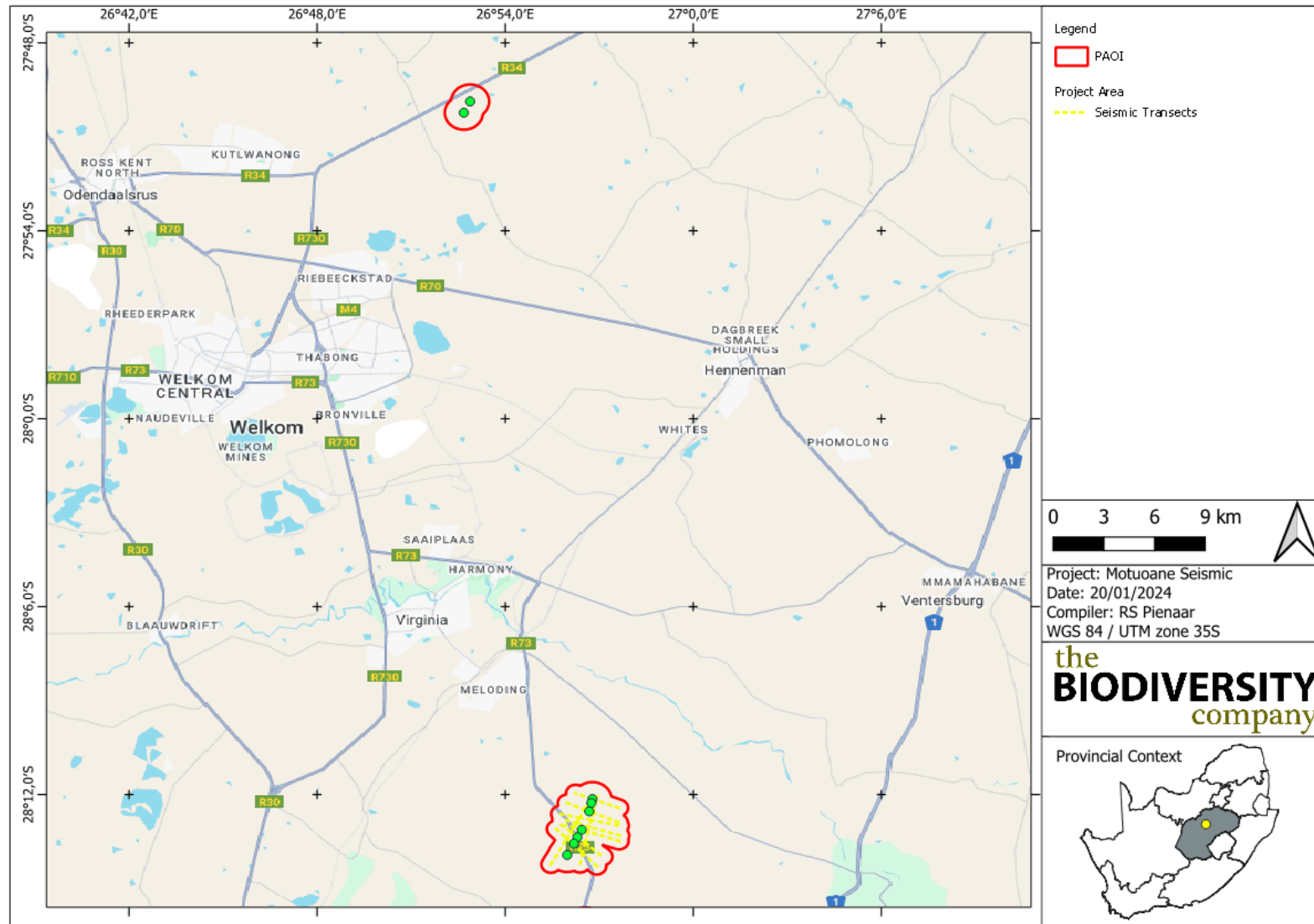


Figure 2-1 The project locality map



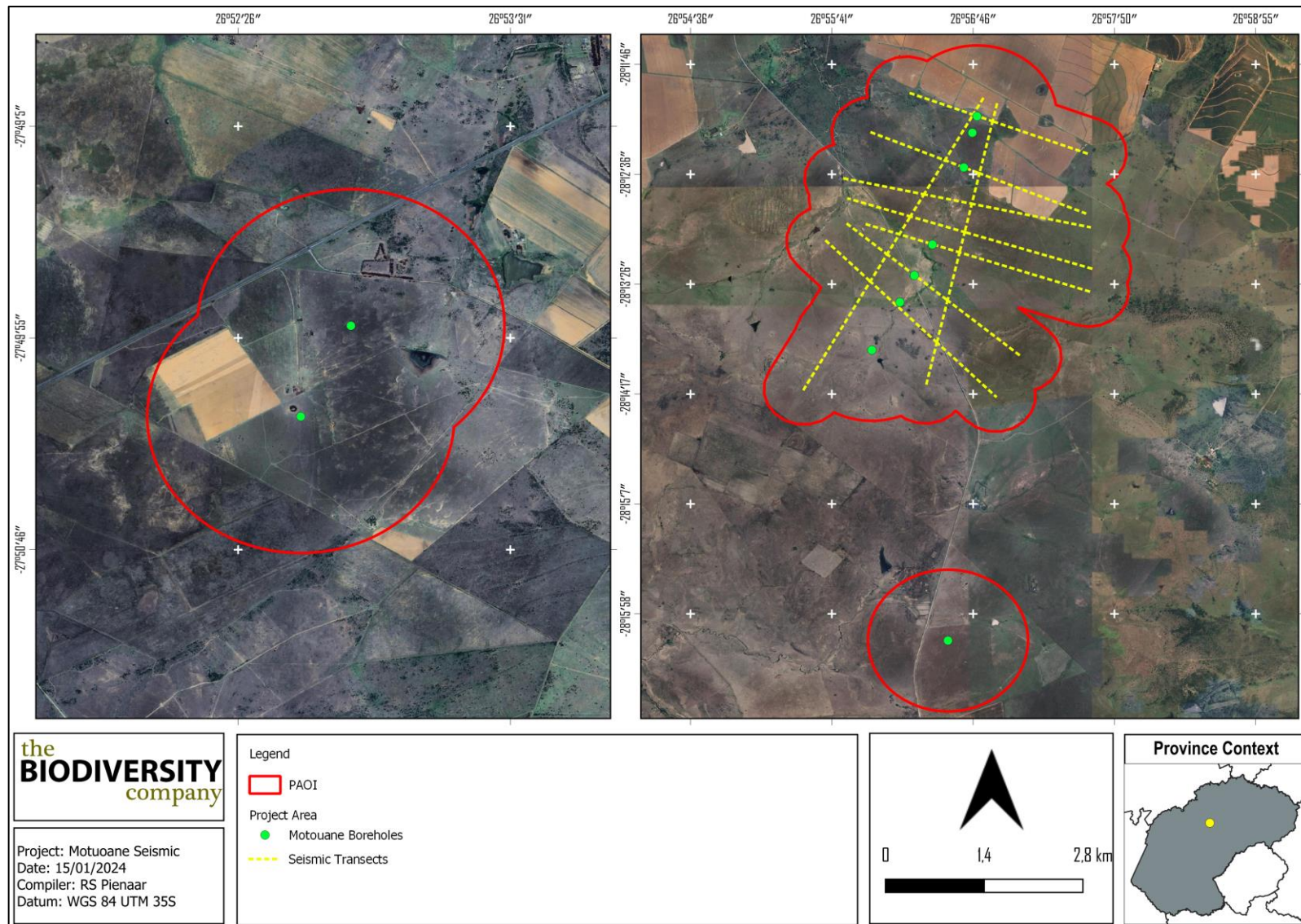


Figure 2-2 Close up of the 30 km Seismic transects as well as the proposed boreholes. Left is the northern cluster and right the southern cluster

## 2.1 Vegetation Types

According to Mucina and Rutherford (2006) the seismic transects fall within three different vegetation types namely the Central Free State grassland (Gh 6), the Vaal-Vet Sandy Grassland (Gh 10) and the Highveld Alluvial Vegetation (AZa 5) vegetation types.

### 2.1.1 Central Free State Grassland (Gh 6)

The Central Free State Grassland (Gh 6) vegetation type is distributed throughout the Free State province and impedes into parts of Gauteng. A broad stroke of this vegetation type stretches from Sasolburg to Dewetsdorp. Other major settlements located within this vegetation type include Ventersburg, Kroonstad, Winburg, Edenville, Lindley and Steynsrus. The altitude of this vegetation type ranges between 1 300 Metres Above Sea Level (MASL) and 1 640 (Mucina & Rutherford, 2006).

Short grasslands cover undulating plains in this vegetation type and is dominated by species like *Eragrostis curvula*, *Themeda triandra* and *E. chloromelas*. Clayey bottomlands are characterised by Dwarf karoo bushes which have established due to the level of disturbances. Low-lying areas that have been overgrazed and trampled are susceptible to Acacia karoo overgrowth (Mucina & Rutherford, 2006).

This vegetation type is vulnerable with a target percentage of 24%. Only small portions of this vegetation are conserved in conservation areas which include Rusfontein, Willem Pretorius and Koppies Dam Nature Reserve. Approximately 25% of the vegetation type has been transformed by cultivation or by dams. No serious alien flora has been observed within this vegetation type with only Dwarf karoo bushes dominating disturbed clayey areas (Mucina & Rutherford, 2006).

### 2.1.2 Vaal-Vet Sandy Grassland (Gh10)

The Vaal-Vet Sandy Grassland (Gh10) vegetation type. This vegetation type is distributed throughout North-West and Free State and stretches from south of Lichtenburg to Klerksdorp, Bothaville, Leeudoringstad as well as Brandfort. The latitude suited for this vegetation type is between 1 260 meters above sea level to 1 360 meters above sea level (Mucina & Rutherford, 2006).

This vegetation type features in areas dominated by plains with scattered and undulating hills. These areas mainly comprise of low-tussock grasslands with *Themeda triandra* being one of the most important features of this vegetation type. Overgrazing and erratic rainfall have however ensured that *Themeda triandra* is often replaced with *Elionurus muticus*, *Aristida congesta* and *Cymbopogon pospischilii* (Mucina & Rutherford, 2006).

The conservation status of this vegetation type is endangered with only 0.3% of it being protected within the Bloemhof Dam, Sandveld, Schoonspruit, Wolwespruit, Soetdoring and Faan Meintjes nature reserves (Mucina & Rutherford, 2006).

### 2.1.3 Highveld Alluvial Vegetation (AZa 5)

The highveld alluvial vegetation type is characterised by flat topography supporting riparian thickets dominated by *Acacia karoo*. This vegetation type can be found in the Free State, North West, Mpumalanga and Gauteng Province. It is embedded in the Grassland and Savanna biomes.

This vegetation feature is dominated by riparian thicket, reed beds, flooded grassland and herb lands.

According to Mucina & Rutherford (2006), this vegetation type is classified as LT. The national target for conservation protection for both these vegetation types is 31%, with nearly 10% statutorily conserved in the Barberspan (a Ramsar site), Bloemhof Dam, Christiana, Faan Meintjes, Sandveld, Schoonspruit, Soetdoring and Wolwespruit Nature Reserves.

## 2.2 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the site is characterised by three different landtypes, these are Bd 20, Dc 8 and Dc12 land types. The Bd landtype consists of plinthic catena. Upland duplex and marginalitic soils are rare and eutrophic and/or mesotrophic red soils are not widespread.

The Dc land types is characterised with duplex, transitional young alluvial soil deposits with occasional red soils, some saturated profiles, shallow soils, and intrusive hard rocks.

## 2.3 Climate

The site is characterised by a summer rainfall with a Mean Annual Precipitation (MAP) of 560 mm which peaks in December and January. The Mean Annual Temperature has been calculated at approximately 15°C with a relatively high frost occurrence (Mucina & Rutherford, 2006) (see Figure 2-3).

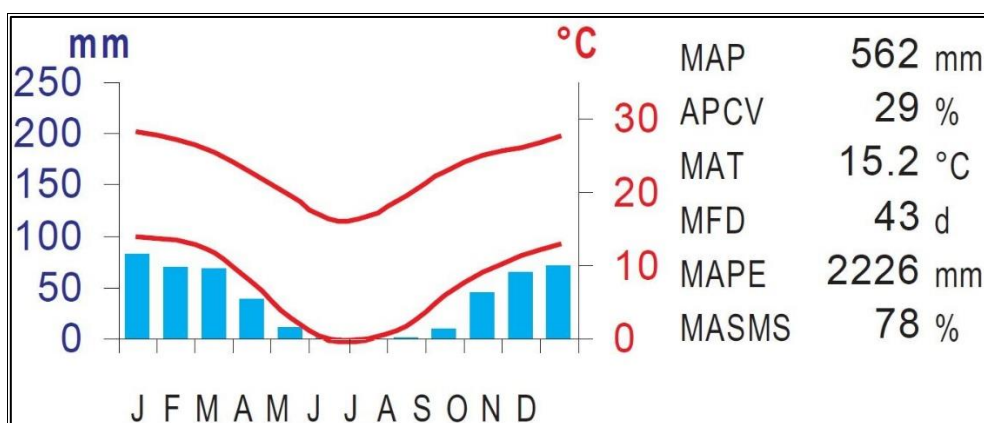


Figure 2-3 Summarised climate for the region (Mucina & Rutherford, 2006)

## 2.4 South African Inventory of Inland Aquatic Ecosystems

This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the National Biodiversity Assessment (NBA 2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE, 2018). Two depression wetlands are located in both the northern and southern clusters, towards the northern side of the project areas. Both these wetlands are far away from the proposed development and will most likely not be influenced by the proposed development.

## 2.5 National Freshwater Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach for the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the NWA. This directly applies to the NWA, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al.* 2011). The NFEPA's are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (Act No.10 of 2004) (NEM:BA), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al.*, 2011). According to Nel *et al.* (2011), multiple seep wetlands are located within the PAOI, as well as a near threatened river (Merriespruit), located in the western part of the PAOI (see Figure 2-4).



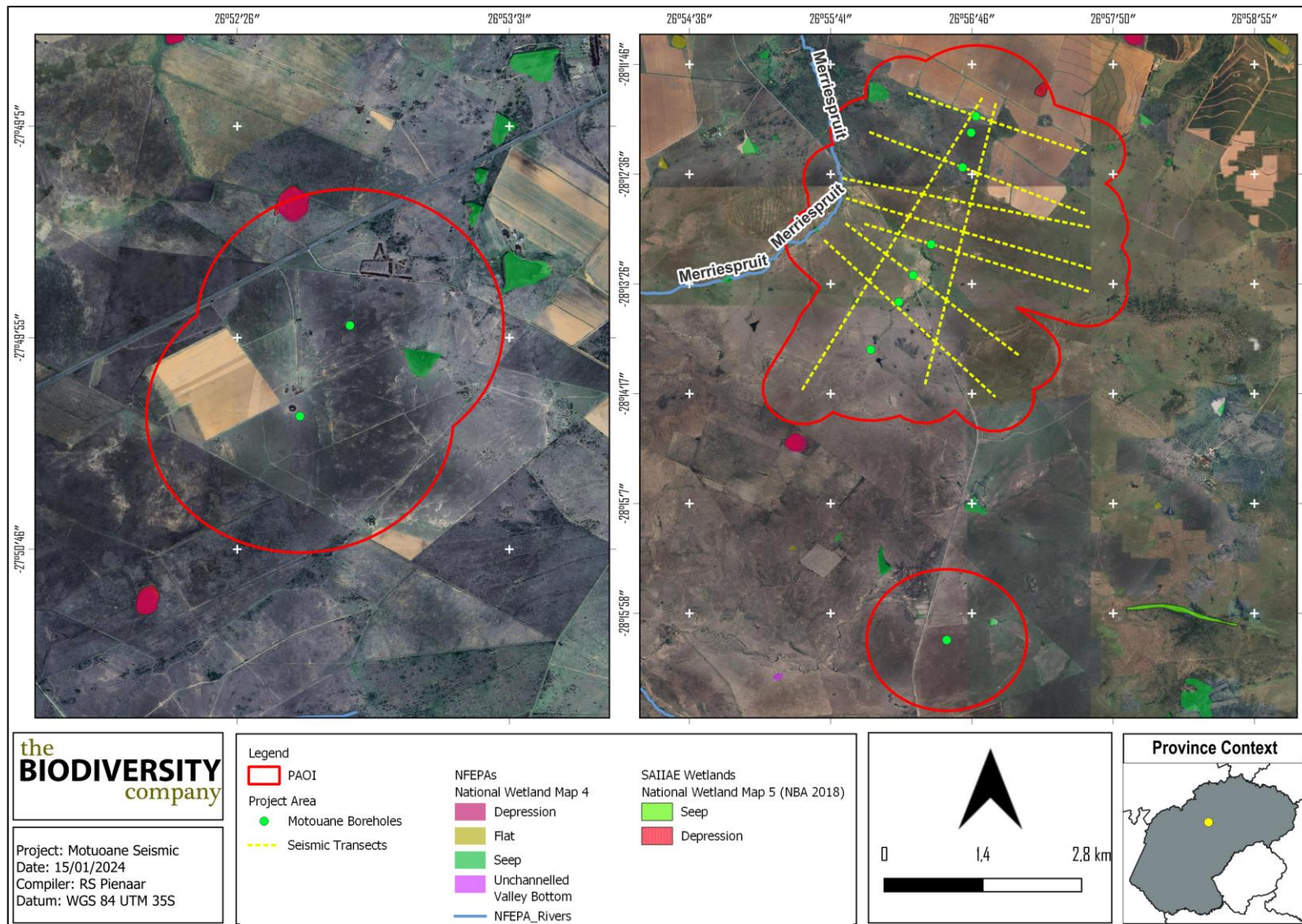


Figure 2-4 SAIIE and NFEPA wetlands in close proximity to the PAOI.

## 3 Key Legislative Requirements

### 3.1 National Water Act (NWA, 1998)

The DWS is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource;

A watercourse means;

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- 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.

The NWA recognises that the entire ecosystem and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

### 3.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

## 4 Methodology

The wetland assessment fieldwork was undertaken on the 18<sup>th</sup> to the 20<sup>th</sup> of October 2023 as well as the 11<sup>th</sup> and 12<sup>th</sup> of January 2024, which constituted a late dry season and a wet season survey, respectively.

### 4.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 4-1. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.

- The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

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

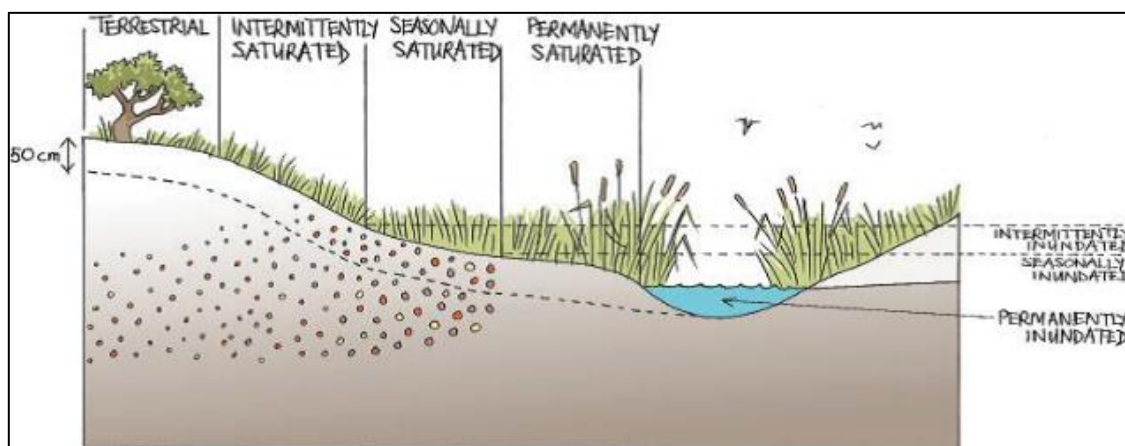


Figure 4-1 Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)

## 4.2 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis et al., 2013).

## 4.3 Functional Assessment

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

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze et al. 2008). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 4-1).

Table 4-1 Classes for determining the likely extent to which a benefit is being supplied

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

2.1 - 3.0	Moderately High
> 3.0	High

#### 4.4 Present Ecological Status

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 4-2.

*Table 4-2 The Present Ecological Status categories (Macfarlane, et al., 2008)*

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



## 4.5 Importance and Sensitivity

The importance and sensitivity of water resources is determined in order establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants is used to assign the Importance and Sensitivity (IS) category as listed in Table 4-3.

Table 4-3 Description of Ecological Importance and Sensitivity categories

IS 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

## 4.6 Buffer Requirements

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

## 4.7 Risk Assessment

The Department of Water and Sanitation (DWS) risk matrix assesses impacts in terms of consequence and likelihood. The significance of the impact is calculated according to Table 4-4.

Table 4-4 Significance ratings matrix

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	(M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
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.

## 4.8 Knowledge Gaps

The following aspects were considered as limitations:

- It has been assumed that the location of the drilling sites provided to the specialist are accurate;
- During the dry season survey, more reliance was afforded to the soil wetness and form indicators to assist with the delineation of wetland systems;
- During the wet season survey the project area received high volumes of rains and thus all soils on site was highly saturated thus more focus was placed on hydrophyte vegetation as well as topographical indicators when looking for wetlands; and
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side.

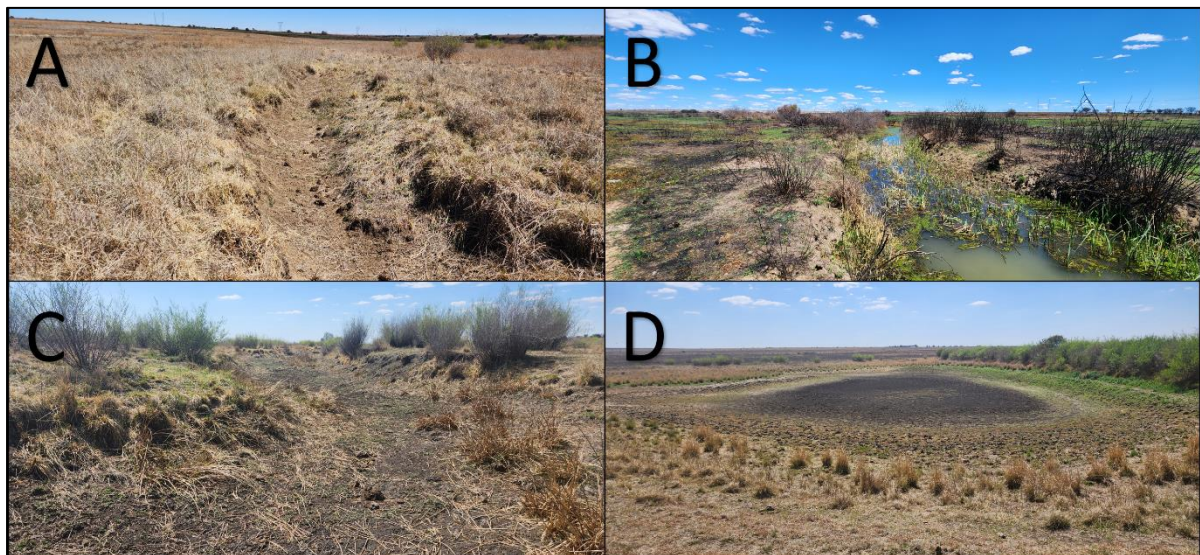


## 5 Results and Discussion

### 5.1 Delineation and Description

During the site visit, seven HGM units were identified within the project area of influence (PAOI) that relate to the proposed project (Figure 5-2). The wetland types were classified as a channelled valley bottom (HGM 1), multiple depressions (HGM 2 and HGM 6), a floodplain (HGM 3) and multiple unchannelled valley bottom wetlands (HGM 4, 5 and 7). Along with the natural wetlands multiple artificial wetlands (off channel dams) and multiple big drainage features were identified within the PAOI. These features are referred to as 'A' Section channels that convey surface runoff immediately after a storm event and are not associated with a baseflow (DWAF, 2005). These systems were not characterised as wetlands due to the lack of wetland vegetations and soils present inside the systems.

It is evident while looking at the location of the wetlands as well as the impacts of the proposed development that only HGM 1, 2 and 3 will be impacted on by the proposed development and thus the functional assessment will only focus on these wetlands.



*Figure 5-1      Photographical evidence of the different HGM units found within the PAOI. A) Drainage features., B) Floodplain wetland., C) Channelled valley bottom., D) Dams located within the channelled valley bottom*

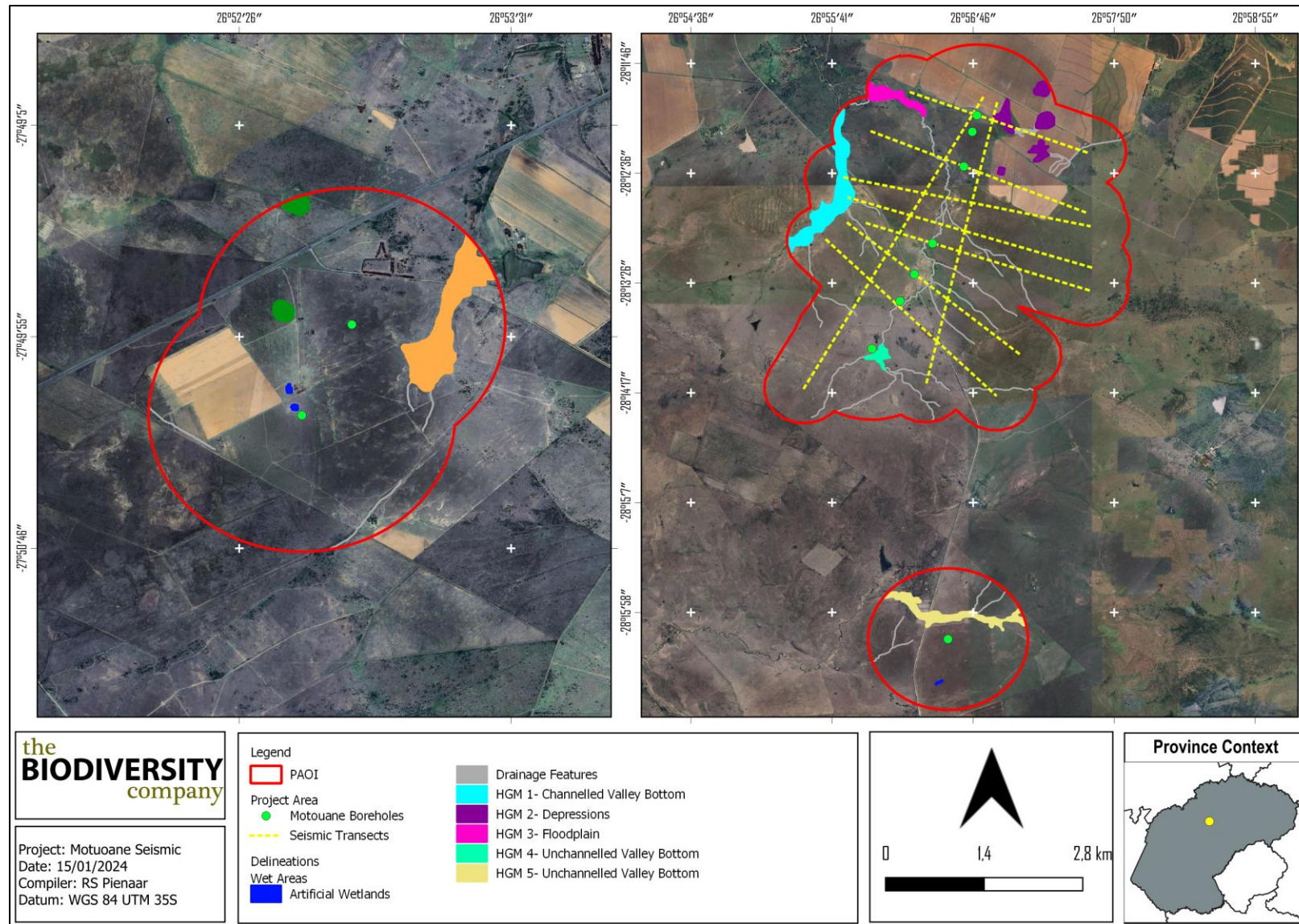


Figure 5-2 Delineation and location of the different HGM units identified within the PAOI



## 5.2 Unit Setting

Channelled valley bottom wetlands are typically found on valley floors with a clearly defined, finite stream channel and lacks floodplain features, referring specifically to meanders. Channelled valley bottom wetlands are known to undergo loss of sediment in cases where the wetlands' slope is steep and the deposition thereof in cases of low relief. Figure 5-3 presents a diagram of a typical channelled valley bottom, showing the dominant movement of water into, through and out of the system.

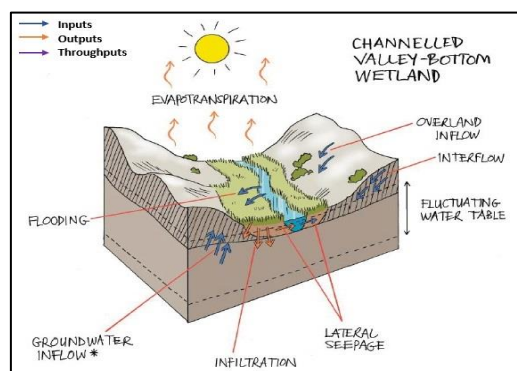


Figure 5-3 Amalgamated diagram of a typical channelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

Depression wetlands are located on the “slope” landscape unit. Depressions are inward draining basins with an enclosing topography which allows for water to accumulate within the system. Depressions, in some cases, are also fed by lateral sub-surface flows in cases where the dominant geology allows for these types of flows. Figure 5-4 presents a diagram of a typical depression wetland, showing the dominant movement of water into, through and out of the system.

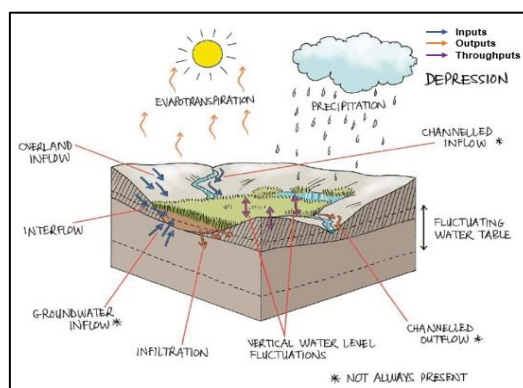


Figure 5-4 Amalgamated diagram of a typical depression wetland, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

Floodplain wetlands are located on valley floors and are characterised by a well-defined stream channel with typical floodplain features, including levees, scroll bars and oxbows. The water inputs of this wetland is mainly from overflows from the stream channel's banks during flooding events. Figure 5-5 presents a diagram of the delineated floodplain, showing the dominant movement of water into, through and out of the system.

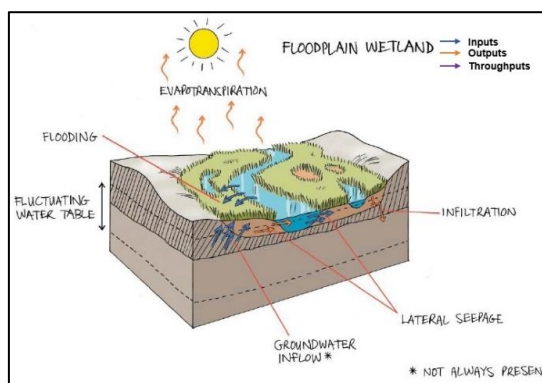


Figure 5-5 Amalgamated diagram of a typical floodplain system, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

Unchannelled valley bottom wetlands are typically found on valley floors where the landscape does not allow high energy flows. Figure 5-6 presents a diagram of a typical unchannelled valley bottom wetland, showing the dominant movement of water into, through and out of the system.

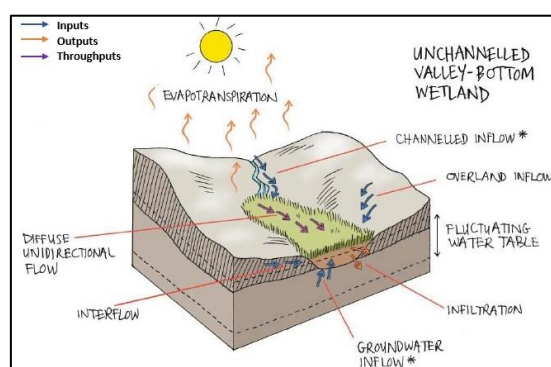


Figure 5-6 Amalgamated diagram of a typical unchannelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

The DWAF (2005) manual separates the classification of watercourses into three (3) separate types of channels or sections defined by their position relative to the zone of saturation in the riparian area. The classification system separates channels into:

- those that do not have baseflow ('A' Sections);
- those that sometimes have baseflow ('B' Sections) or non-perennial; or
- those that always have baseflow ('C' Sections) or perennial.

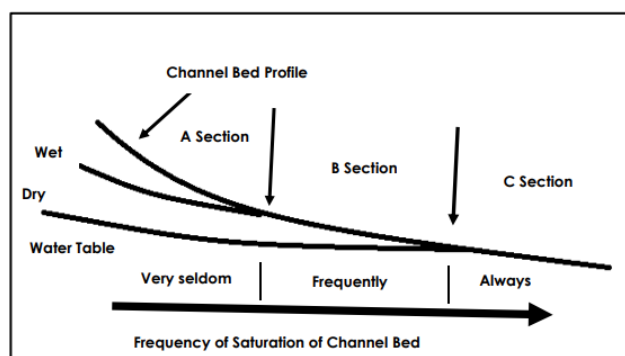


Figure 5-7 The watercourse classifications (DWAF, 2005)

### 5.3 General Functional Description

Channelled valley bottom wetlands tend to contribute less to sediment trapping and flood attenuation than other systems. Channelled valley bottom wetlands are well known to improve the assimilation of toxicants, nitrates and sulphates, especially in cases where sub-surface flows contribute to the system's water source (Kotze et al., 2009).

The generally impermeable nature of depressions and their inward draining features are the main reasons why the streamflow regulation ability of these systems is mediocre. Regardless of the nature of depressions in regard to trapping all sediments entering the system, sediment trapping is another Eco Service that is not deemed as one of the essential services provided by depressions, even though some systems might contribute to a lesser extent. The reason for this phenomenon is due to winds picking up sediments within pans during dry seasons which ultimately leads to the removal of these sediments and the deposition thereof elsewhere. The assimilation of nitrates, toxicants and sulphates are some of the higher rated Eco Services for depressions. This latter statement can be explained the precipitation as well as continues precipitation and dissolving of minerals and other contaminants during dry and wet seasons respectively, (Kotze et al., 2009).

Floodplains generally are formed during high flow events which subsequently cause water to overspill its banks. Due to the topographic setting of floodplains, flood attenuation for these systems are very high, especially during seasons where the soil within the wetland is not yet saturated and before the oxbows are filled. Seeing that floodplains usually are characterised by clayey soils which retain water for long periods and are susceptible to vast amounts of evapotranspiration, very little streamflow regulation is expected for floodplains. In hindsight, floodplains with course soil types are ideal in regulating streamflow. Floodplains are excellent in assimilating phosphates due to the decrease in velocity during the overspill of banks. During this process, lateral deposition of sediment is prone to happen. Phosphorus tends to bound strongly to mineral particles which ensures that the phosphorus is retained on the floodplain after the deposition of these particles. Denitrification does occur to a lesser extent due to little exposure of large amounts of water seeing that these water masses are dependent on floods. Additionally, sub-surface flows are rare for floodplains which decrease the possibility of denitrification even more so.

Unchanneled valley-bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley-bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes. The shallow depths of surface water within this system adds to the degradation of toxic contaminants by means of sunlight penetration.

It is however important to note that the descriptions of the above-mentioned functions are merely typical expectations. All wetland systems are unique therefore, the ecosystem services ratings for the wetlands on site may differ slightly to the general expectation given by the nature of the wetland type in relation to its topographic setting.

### 5.4 Functional Assessment

The ecosystem services provided by the wetland units identified on site were assessed and rated using the WET-EcoServices method (Kotze *et al.*, 2008). The average ecosystem service scores for the delineated systems are illustrated in Table 5-1 and Figure 5-8. The ecosystem services scores of the delineated wetlands ranges from intermediate to moderately high. Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation and, erosion control.

## Seismic Project

Table 5-1 Average ecosystem service scores for delineated wetlands

Moderately High	Intermediate	Not Applicable
HGM 1	HGM 2	HGM 4
HGM 3		HGM 5
		HGM 6
		HGM 7

HGM 1, and 3 scored “Moderately High” on the provision of ecosystem services due to the nature of the wetlands, being a channelled valley-bottom and a floodplain wetland respectively. Both the valley bottom wetland and the floodplain play a major role in streamflow regulation and flood attenuation which is important to ensure that downstream properties are not washed away. The hydrophytes within the wetlands will remove toxicants from runoff/seepage from the local communities and agricultural activities to produce cleaner water downstream. These systems also provide habitats for many bird species as well as some animals. The wetlands also provided resources for both humans and animals.

HGM 2 scored “Intermediate” ecosystem services scores. The wetland has been modified to such an extent that they have lost some of their function. The wetland has lost most hydrophyte vegetation with only a few hydrophyte species present in a narrow band within some reaches of the wetland. The wetland does still play an important role in the assimilation of phosphates and nitrates runoff from the agricultural activities, and will still purify the water flowing through them.



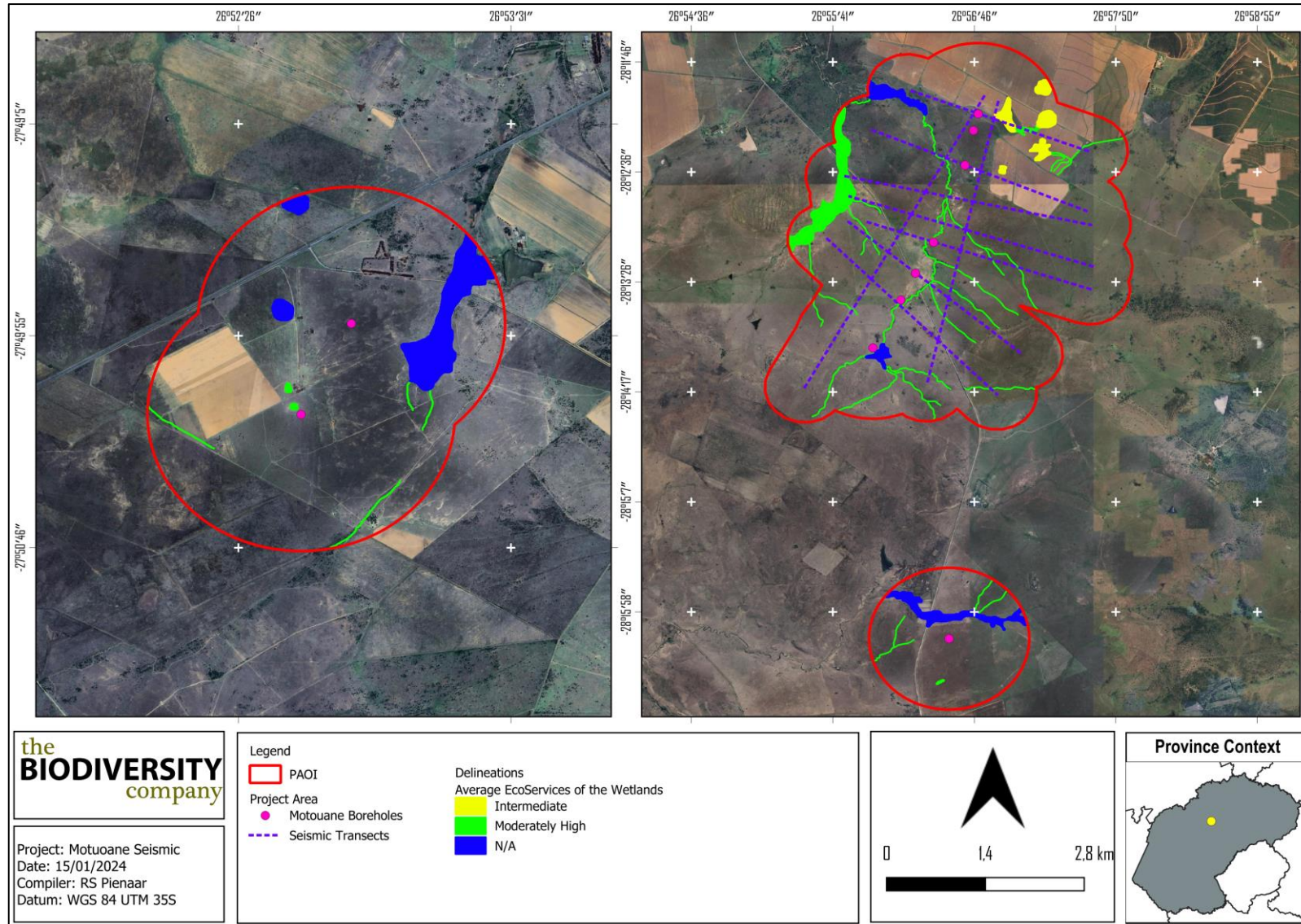


Figure 5-8 Average ecosystem services scores for the delineated wetlands

## 5.5 Present Ecological Status

The PES for the assessed HGM units is presented in Figure 5-9. The ecological state of the wetlands located within the project area of influence were rated as ranging between “D”- Largely Modified to “E”- Seriously Modified. These scores are due to the magnitude of anthropogenic impacts such as agricultural activities as well as the construction of roads inside the wetlands and wetland catchments.

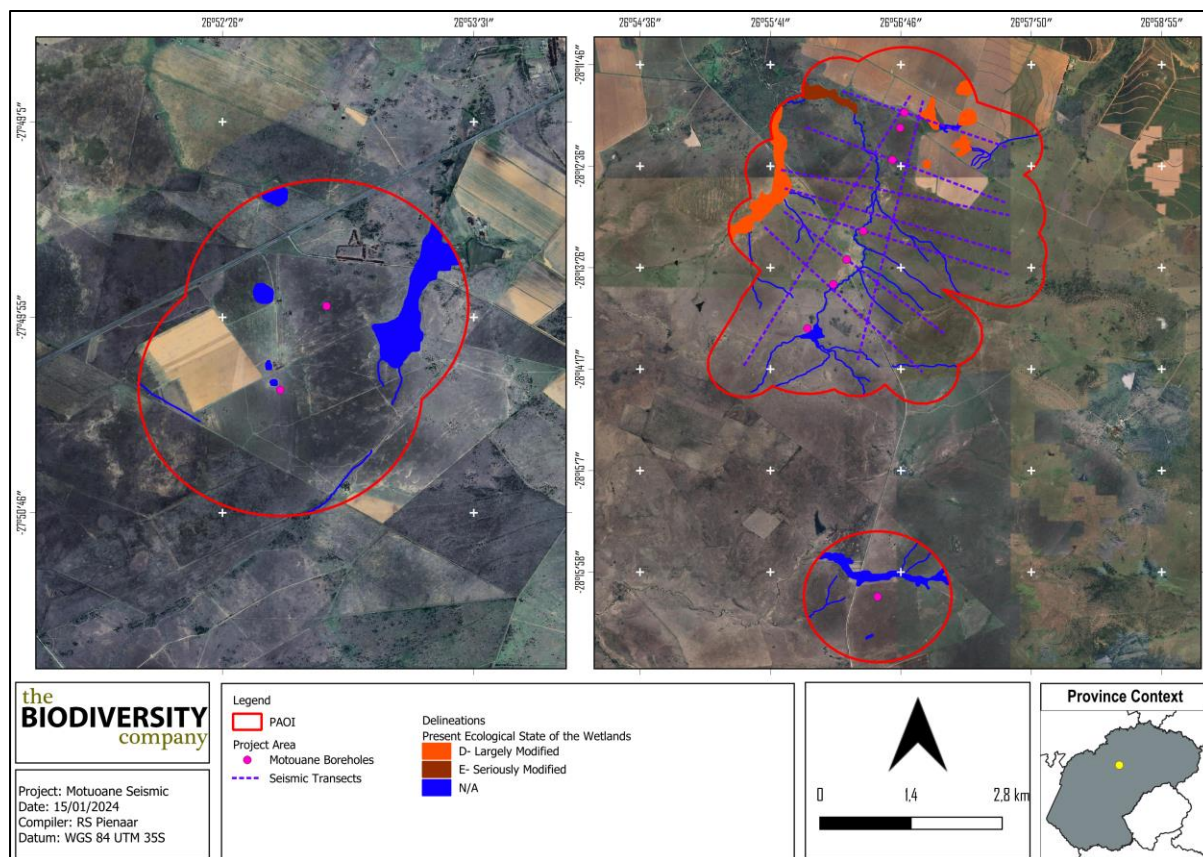


Figure 5-9 Overall present ecological state of delineated wetlands

## 5.6 Importance and Sensitivity

The results of the ecological IS assessment are shown in Table 5-. Various components pertaining to the protection status of a wetland are considered for the IS, including Strategic Water Source Areas (SWSA), the NFEPA wetland vegetation (wet veg) threat status and the protection status of the wetland. The IS for both the valley bottoms and the depression wetlands were calculated to be “Moderate”, which combines the low protection status of the wet veg and the and the high threat status of the wetlands themselves. The floodplain wetlands scored “High” sensitivities due to the low threat status of the wet veg and the low threat status of the wetlands themselves.

Table 5-3 The IS results for the delineated HGM units

HGM Type	NFEPA Wet Veg				NBA Wetlands		SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level		
Channelled Valley Bottom	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	D/E/F Largely Modified	Critically	Not Protected	N	Moderate



## Seismic Project

<b>Depression</b>	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	A/B Largely Natural	Least Concerned	Not Protected	N	<b>Moderate</b>
<b>Floodplain</b>	Dry Highveld Grassland Group 3	Critically Threatened	Not Protected	D/E/F Largely Modified	Critically	Not Protected	N	<b>High</b>
<b>Unchannelled Valley Bottom</b>	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	D/E/F Largely Modified	Critically	Not Protected	N	<b>Moderate</b>

## 5.7 Buffer Requirements

It is worth noting that the scientific buffer calculation (Macfarlane *et al.*, 2014) was used to determine the size of the buffer zones relevant to the proposed project. A pre-mitigation buffer of 32 m and a post-mitigation wetland and watercourse buffer of 15 m is recommended for the delineated systems. This is attributed to pre-existing modifications of the catchments around the wetlands and the nature of the project, which has the potential of minimally impacting on the wetland systems.

The suggested buffer in this report does not qualify as a relaxation to any other legislated buffers managed by the respective authorities (e.g., DEA and DWS). Therefore, the relevant authorisations are still a requirement prior to project commencement.

## 5.8 Regulatory Zone

The following regulatory zones are applicable and pertains to the project area being within 100 m from the Merriespruit and wetland systems (Table 5-2).

Table 5-2 The zone of regulation for the project

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). Department of Water and Sanitation (DWS)	<p>Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) in accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as:</p> <ul style="list-style-type: none"> <li>the outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;</li> <li>in the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or</li> <li>a 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.</li> </ul>

## 6 Risk Assessment

### 6.1 Potential Impacts

The impact assessment considered the anticipated direct and indirect impacts to the wetland systems as a result of the proposed seismic and borehole activities (Table 5-1). The mitigation hierarchy, as discussed by the Department of Environmental Affairs (2013), will be considered for this component of the assessment. In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology and project/activity phasing to avoid impacts.

Two levels of risk have been identified and considered for the overall risk assessment, these include Medium and Low risks. Due to the non-destructive characteristics of both the seismic prospecting and the boreholes, there are no High risks expected for the project. Medium risk refers to areas where the seismic transects goes over or into wetlands and their associated buffers. Low risks refer to areas where the seismic transects avoid both the wetlands and their associated buffers. The Medium risks were the priority for the risk assessment, focussing on the expected potential for these direct risks.

Due to the fact that direct impacts to the wetlands (and buffers) will not be avoided, the risk assessment will consider all direct and indirect risks posed to these systems as a result of the project. The figure below illustrates various aspects that are expected to impact upon the delineated wetlands during the respective project phases.

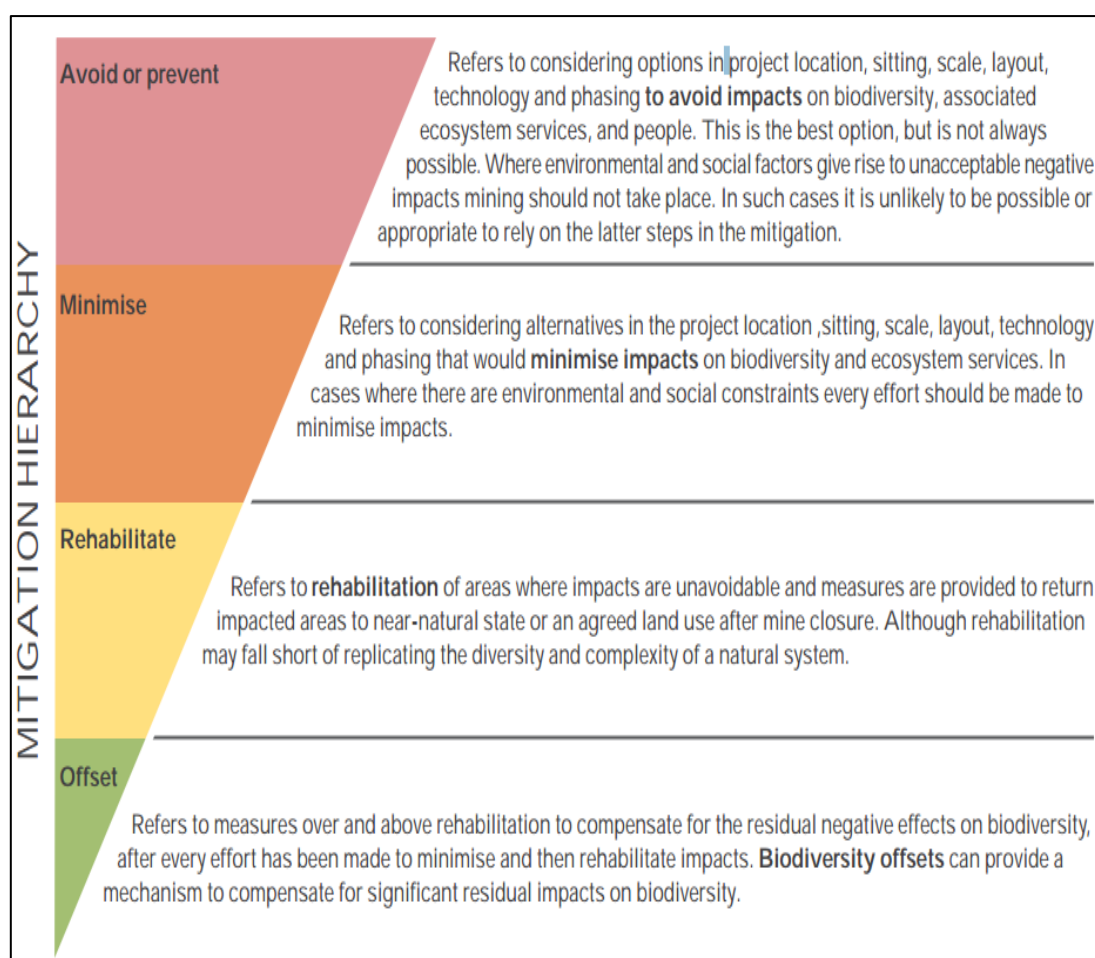


Figure 6-1 The mitigation hierarchy as described by the DEA (2013)

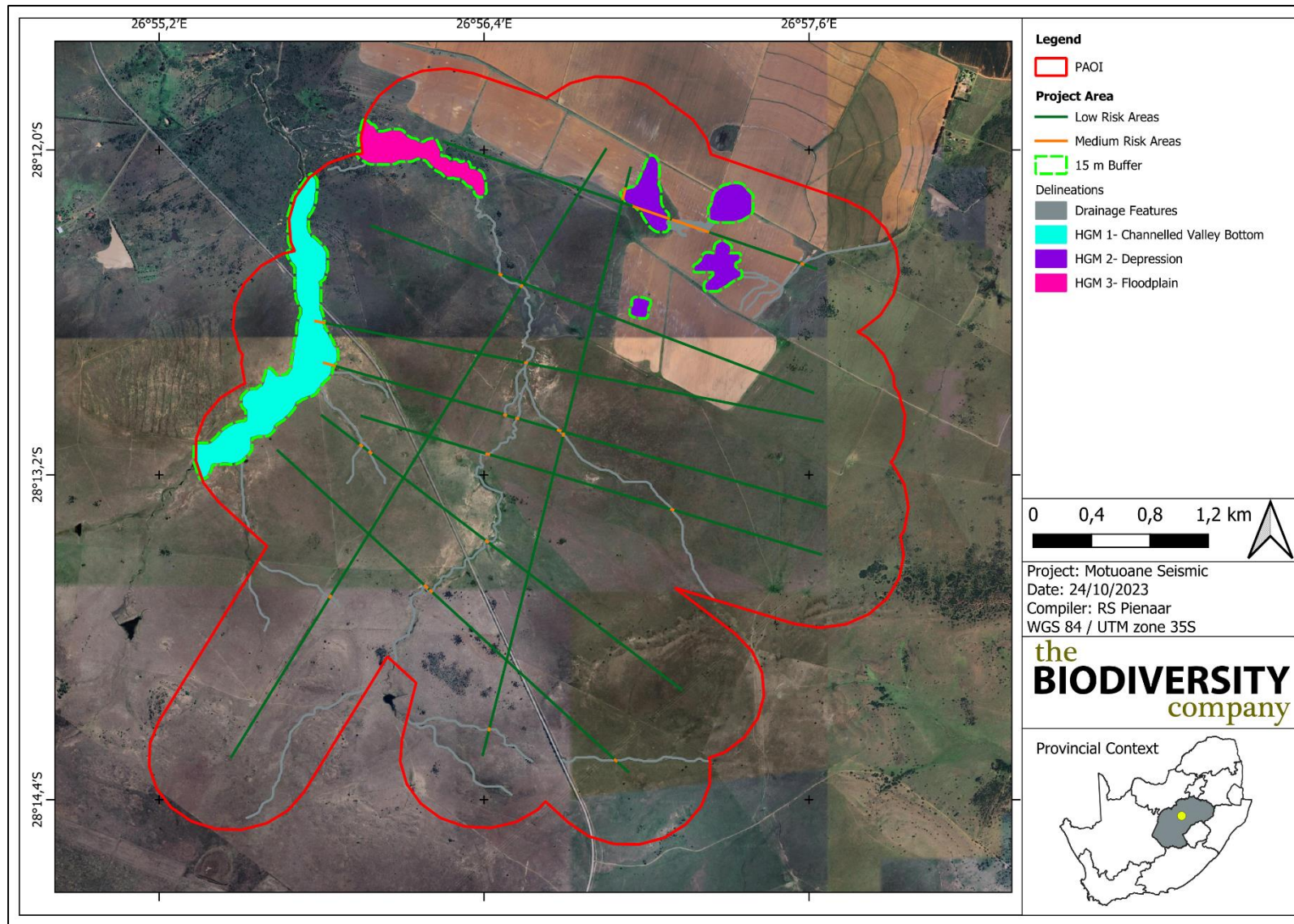


Figure 6-2 The identified risk areas within the PAOI

Table 6-1 DWS Risk Impact Matrix for the proposed exploration activities (Andrew Husted Pr Sci Nat 400213/11)

Activity	Aspect	Impact	Mitigation Scenario	Severity					Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures			
				Flow Regime	Water Quality	Habitat	Biota	Severity														
Construction																						
Site clearing to create road	Clearing of vegetation and creating roads as well as storage of equipment.	Direct loss, disturbance and degradation of wetlands.	Without	3	3	3	3	3	2	2	7	3	3	1	1	8	56	M	<ul style="list-style-type: none"><li>• Make use of existing roads to crossing the wetlands and drainage features. Make sure that all the other HGM units and their buffers are avoided as far as possible to limit the impacts on them.</li><li>• Adhere to the prescribed wetland buffers. Restrict all non-essential activities (e.g. cement mixing and equipment/ machinery storage) to outside of wetlands and their prescribed buffers.</li><li>• Wetland spatial data must be loaded onto a GPS and use it to mark out the positions where the proposed activities will take place, as well as the wetlands and associated buffers.</li><li>• Demarcate the avoidance areas with wooden poles.</li><li>• Try to scrape existing hard pack roads and instead use two track roads to reduce bare surfaces.</li><li>• Do not situate any of the construction material laydown areas within any wetland.</li><li>• No machinery should be allowed to be parked in any wetlands.</li><li>• Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed.</li><li>• The use of herbicides is not recommended in or near wetlands (opt for mechanical removal).</li><li>• Clearly demarcate construction footprint, and limit all activities to within this area.</li><li>• Minimize unnecessary clearing of vegetation.</li><li>• Landscape and re-vegetate all denuded areas as soon as possible.</li></ul>			
			With	1	1	2	1	1.25	1	2	4.25	3	1	5	1	10	43	L				
		Increased bare surfaces, runoff and potential for erosion	Without	3	3	3	3	3	2	2	7	3	3	1	1	8	56	M				
			With	2	2	2	2	2	2	2	6	3	1	1	1	6	36	L				
		Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation	Without	2	2	4	4	3	2	2	6	3	3	5	1	12	72	M				
			With	1	1	2	1	1.25	1	2	4.25	3	1	5	1	10	43	L				
		Operation																				
		Driving the seismic truck			Without	2	2	4	4	3	2	5	10	3	3	5	1	12		120	M	

Activity	Aspect	Impact	Mitigation Scenario	Severity					Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
				Flow Regime	Water Quality	Habitat	Biota	Severity											
		Direct loss, disturbance and degradation of wetlands.	With	1	1	1	1	1	2	1	4	3	1	5	1	10	40	L	<ul style="list-style-type: none"> <li>• Make use of existing roads to crossing the wetlands and drainage features. Make sure that all the other HGM units and their buffers are avoided as far as possible to limit the impacts on them.</li> <li>• Adhere to the prescribed wetland buffers. Restrict all non-essential activities (e.g. cement mixing and equipment/ machinery storage) to outside of wetlands and their prescribed buffers.</li> <li>• Create roads during winter to ensure that the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest during this time.</li> </ul>



## 7 Impact Assessment

The proposed project will result in the loss of watercourse habitats (HGM 1 and 2) where infrastructure traverses or is placed inside of the wetland. The clearing of vegetation will happen when the vehicles drive through the wetlands. This can also cause a disruption to the biotic community structure due to the fragmentation and deterioration of habitat. Thus, the loss, fragmentation and/or deterioration of wetland habitat will reduce the level of ecosystem service benefit provided by the affected systems. Vehicle movement in proximity of the watercourses would also create erosion hotspots which could contribute to the sedimentation of any receiving watercourses. Infrastructure in proximity to watercourses and located on an inappropriate slope could create preferential flow paths, causing increased surface run-off volumes and velocities causing erosion to the area.

The impacts associated with the proposed activities, was assessed in the impact matrix provided by EIMS and the results are given in Table 7-1.

Table 7-1 *Impact assessment for the proposed project*

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Confidence	Cumulative Impact	Irreplaceable loss	Final score
Direct loss, disturbance and degradation of wetlands.	Construction	-4.5	-1.25	High	1	1	-1.25
Increased bare surfaces, runoff and potential for erosion	Construction	-5.25	-1.25	High	1	1	-1.25
Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation	Construction	-4.5	-1.25	High	1	1	-1.25
Direct loss, disturbance and degradation of wetlands	Operation	-64.5	-1.25	High	1	1	-1.25

## 8 Conclusion and Recommendation

### 8.1 Baseline Ecology

During the site assessment, seven HGM units were identified and assessed within the project area of influence. These comprise of a channelled valley bottom (HGM 1), multiple depression wetlands (HGM 2 and 6), a floodplain wetland (HGM 3) as well as multiple unchannelled valley bottoms (HGM 4, 5 and 7). Due to the location of the wetlands, it was deemed that only HGM 1, 2 and 3 were at risk by the proposed activities and was thus the focus of the study. These systems scored an overall PES scores ranging between D- "Largely Modified" and E – "Seriously Modified", due to the modifications arising from anthropogenic influences and surrounding agricultural activities. The IS for both the valley bottom and depression wetlands were calculated to be "Moderate", which combines the low protection status of the wet vegetation and the high threat status of the wetlands themselves. The floodplain wetland scored "High" sensitivities due to the High threat status of the wet veg and the High threat status of the wetlands themselves. The average ecosystem service score was determined to range between "Intermediate" and "Moderately High". A post-mitigation buffer of 15 m was assigned to the systems.

### 8.2 Risk Assessment

A risk assessment was conducted in line with Section 21 (c) and (i) of the National Water Act, 1998, (Act 36 of 1998) to investigate the level of risk posed by proposed project. Moderate post mitigation risks are expected on HGM 1 and HGM 2 as well as the drainage feature crossings. But with the use of mitigations all risks will decrease to low. The most important mitigation will be to not create new

roads, or use roads running through the delineated water resources, but rather drive the seismic truck through the fields.

### 8.3 Impact Assessment

The impact assessment considered both direct and indirect impacts, to the water resources. It is evident that the proposed activities will encroach into the delineated wetland areas but will not have a large impact on the systems.

### 8.4 Specialist Statement

Considering the above-mentioned information, it is important that the mitigations measures indicated in the amended EMPr and this report are adhered to when conducting the exploration activities. No significant wetland loss is foreseen. It is the opinion of the specialist that the project may be favourably considered, on condition all prescribed mitigation measures and supporting recommendations are implemented. A **General Authorisation** will be required should any Section 21 Listed Activity be triggered by this project.

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