WETLAND BASELINE AND RISK ASSESSMENT FOR THE PROPOSED HARMONY NOOITGEDCHT TAILINGS STORAGE FACILITY (TSF) AND PROPOSED PIPELINE PROJECT

Welkom, Free State Province, South Africa

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CLIENT

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1 Introduction

1.1 Background

The Biodiversity Company (TBC) was appointed to undertake a wetland baseline and risk assessment for the proposed Nooitgedacht Tailings Storage Facility (TSF) expansion and proposed slurry pipeline project, located in Welkom, Free State province. Harmony Gold Mining Company Limited (Harmony) own and operate a number of Gold Mines and Plants, and currently deposit tailings onto the Free State South (FSS) 2 TSF, St. Helena 4 TSF, St. Helena 123 TSF, Dam 23 TSF, Brand D TSF and Target 1&2 TSF. The current planned Life of Mine (LOM) of the Free State Operations exceed the available deposition capacity of these TSFs and Harmony is undertaking a feasibility assessment to construct the new Nooitgedacht TSF with associated slurry pipelines.

In order to assess the baseline ecological state of the area and to present a detailed description of the receiving environment, a desktop assessment as well as a field survey was conducted during April 2023. Both levels of assessment entailed the detection, identification, and description of any locally relevant water resources. Furthermore, the manner in which these sensitive features may be affected by the proposed development was also investigated. A 500 m radius around of the proposed activities, which is the suggested regulation area for the identification of water resources in terms of the proposed project, has been demarcated and is referred to hereafter as the Project Area of Influence (PAOI).

This assessment has been completed in accordance with the requirements of the published Government Notice (GN) 4167 by the Department of Water and Sanitation (DWS) (previously GN 509 of 2016 and GN 3139 of 2023). The said notice was published in the Government Gazette (no. 49833) under Section 39 of the National Water Act (Act no. 36 of 1998) in December 2023, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 4167 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 4167 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM), provided the identified risks are all considered a low risk and the applicant is listed under Appendix D1 or Appendix D2 of the same notice. This assessment will implement the RAM and provide a specialist opinion on the favourability for water use authorisation.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations (2014) (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020) in terms of NEMA, dated 20 March and 30 October 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation” (Reporting Criteria).

The purpose of conducting the specialist study is to provide relevant input into the overall Environmental Authorisation application process, with a focus on the proposed project activities and their associated impacts. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Registered Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making as to the ecological viability of the proposed project.

1.2 Design Description

A reserve reclamation study which looked at the reclamation and treatment of the 774Mt of tailings contained in reserve status in TSFs in the Free State through the sequentially reprocessing of tailings through Target Plant and Harmony One Plant, as Run of Mine Ore is depleted, will require deposition space in future. The Nooitgedacht TSF was identified as a deposition site for residue from the reclamation

of tailings during Project Saints in 2007. The properties, Goedgedacht 53, Nooitgedacht 50 and Jacobsdal 37 were subsequently purchased with the intention of constructing a new Tailings Storage Facility on this site. Harmony commenced with feasibility assessment for the Nooitgedacht Tailings Deposition Project that of the project is to secure future deposition capacity for Harmony Free State Operations for residue from both Run of Mine and Tailings Reclamation operations. The following are proposed for the project:

- Infrastructure will include the TSF and associated infrastructure including possible access roads and water management infrastructure including pipelines and a return water dam;
- The infrastructure will cover a total area of up to 895 hectares. Topsoil stockpile will be 3 m;
- Tailing deposition method to be used: cyclone deposition. TSF side slope gradient of 1:3;
- The height of the TSF is still being determined through the engineering designs however current design scope of the Nooitgedacht TSF is based on a height of 100m at 1426 mamsl; and
- The TSF barrier system will be determined in consultation with the authorities and will be in compliance with relevant norms and standards for determination of liner requirements.

The following pipelines are being proposed:

- One 10 km long slurry lines from Harmony One Plant to the St Helena Booster Pump Station;
- One 16 km long slurry line from Brand A TSF to the St Helena Booster Pump Station; and
- One 17 km slurry line from the St Helena Booster Pump Station to FSN 1 TSF.

The proposed pipelines traverse the following farm portions:

- Vlakplaats 125 Ptn 3, 4 and 5;
- Mijannie RE/66 Ptn 0;
- Toronto RE/115 Ptn 7 and 0;
- Rietpan 17 Ptn 0;
- Rietkuil 28 Ptn 0;
- Rheeders Dam 31 Ptn 0;
- Farm 41 Ptn 20;
- Ouders Gift 48 Ptn 0;
- Nooitgedacht 50 Ptn 0; and
- Goedgedacht.

The pipelines will be flanged steel pipelines of over 0.36 m in diameter and installed above-ground on pre-cast concrete plinths. A 3.5m wide access road, adjacent to the pipelines, will be cleared/graded to provide access for construction, maintenance and inspections.

1.2.1 Design Description Update

The Free State Reclamation (FSR) Project seeks to increase tailings reclamation at Harmony's Free State operations from 800ktpm to 2000ktpm, with residue deposited at the new 800Ha Nooitgedacht TSF. A low-pressure (LP) water supply system, comprising two above-ground concrete storage tanks, will support the operation by storing up to 40 megalitres of return water, treated effluent, borehole water, and plant overflow. The selected tank configuration offers a compact footprint, optimal pump suction conditions, and is designed in accordance with DWS and SANS guidelines.

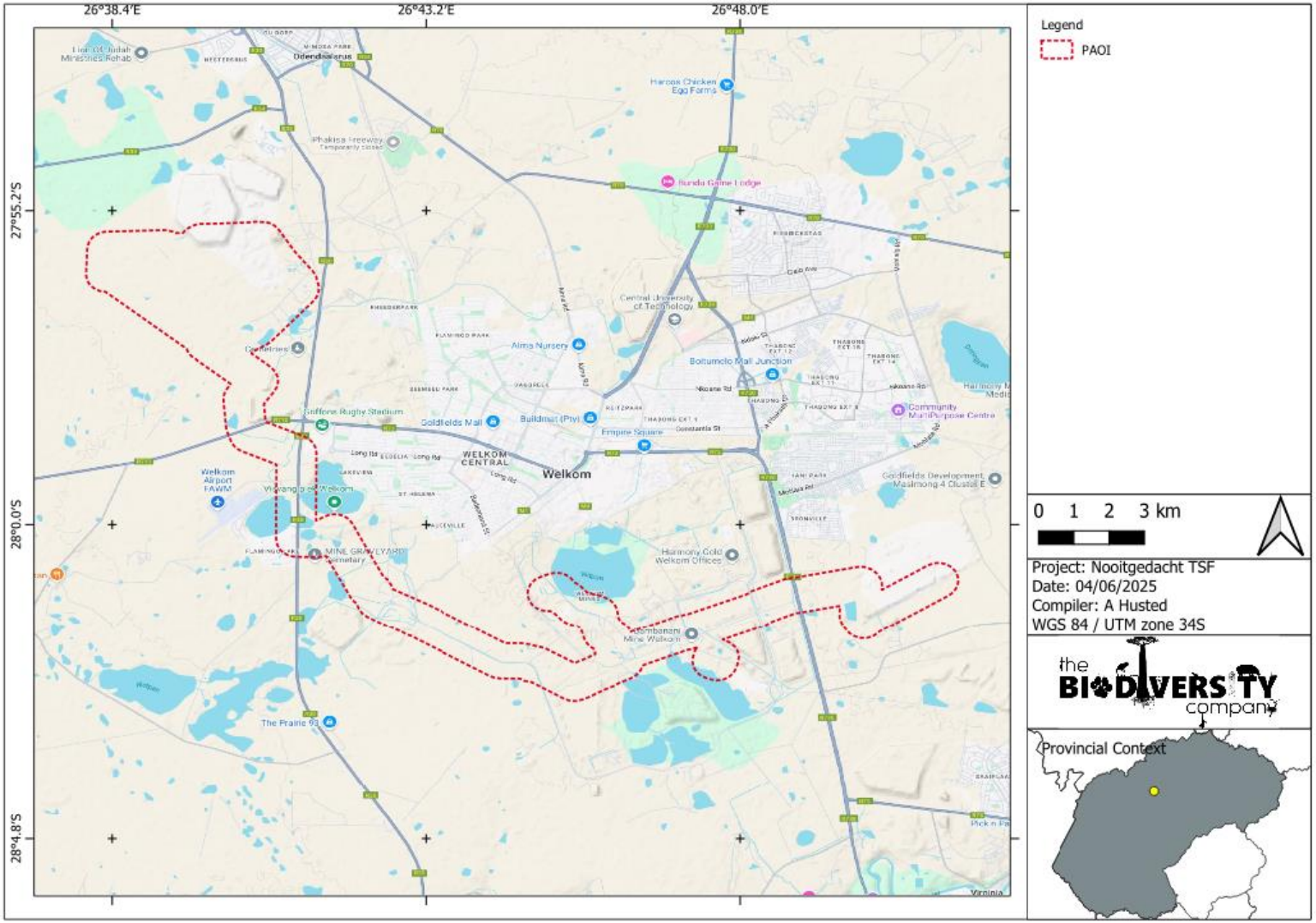


Figure 1-1 Map illustrating the regional context of the project area

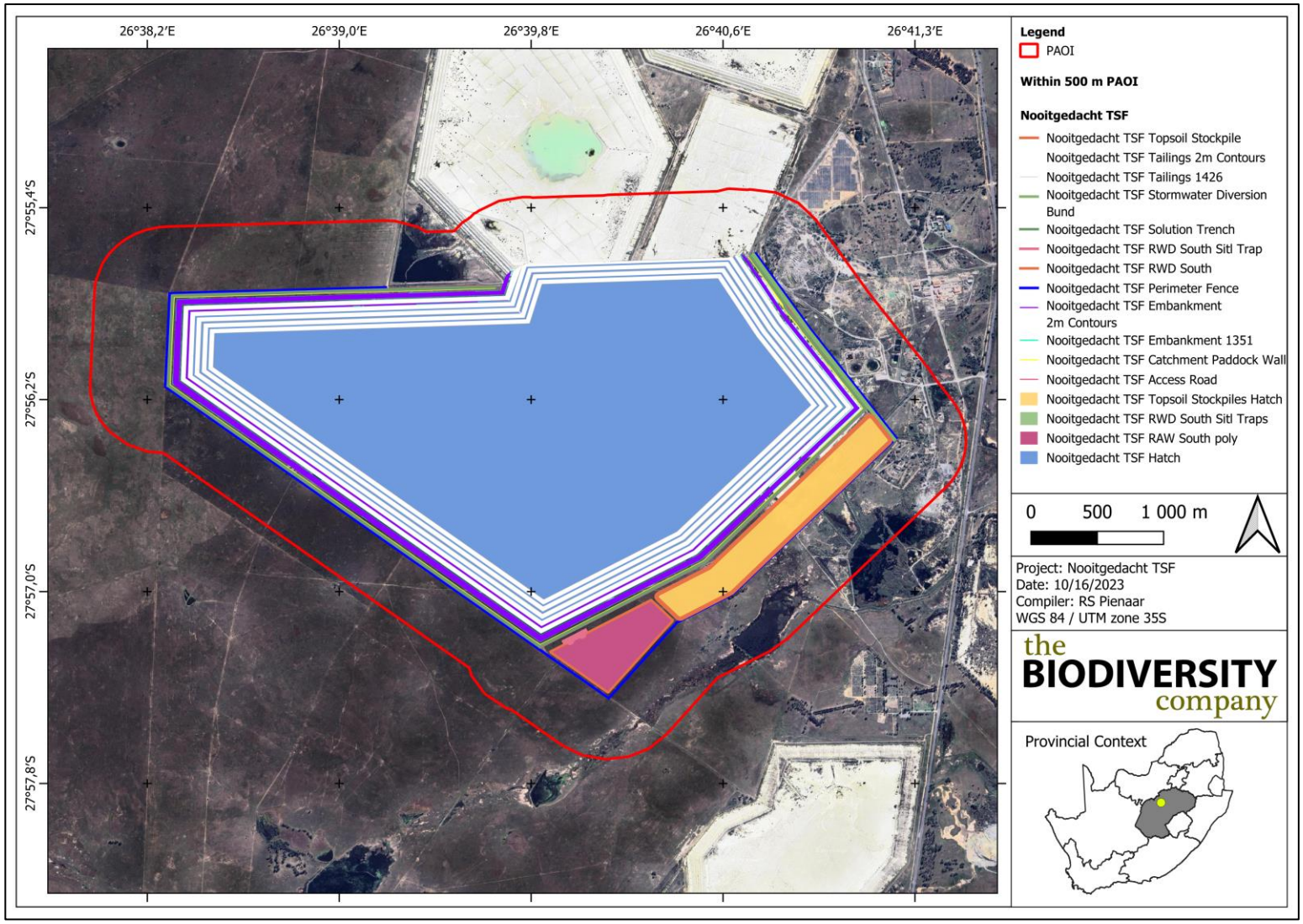


Figure 1-2 Map illustrating the proposed layout of the TSF

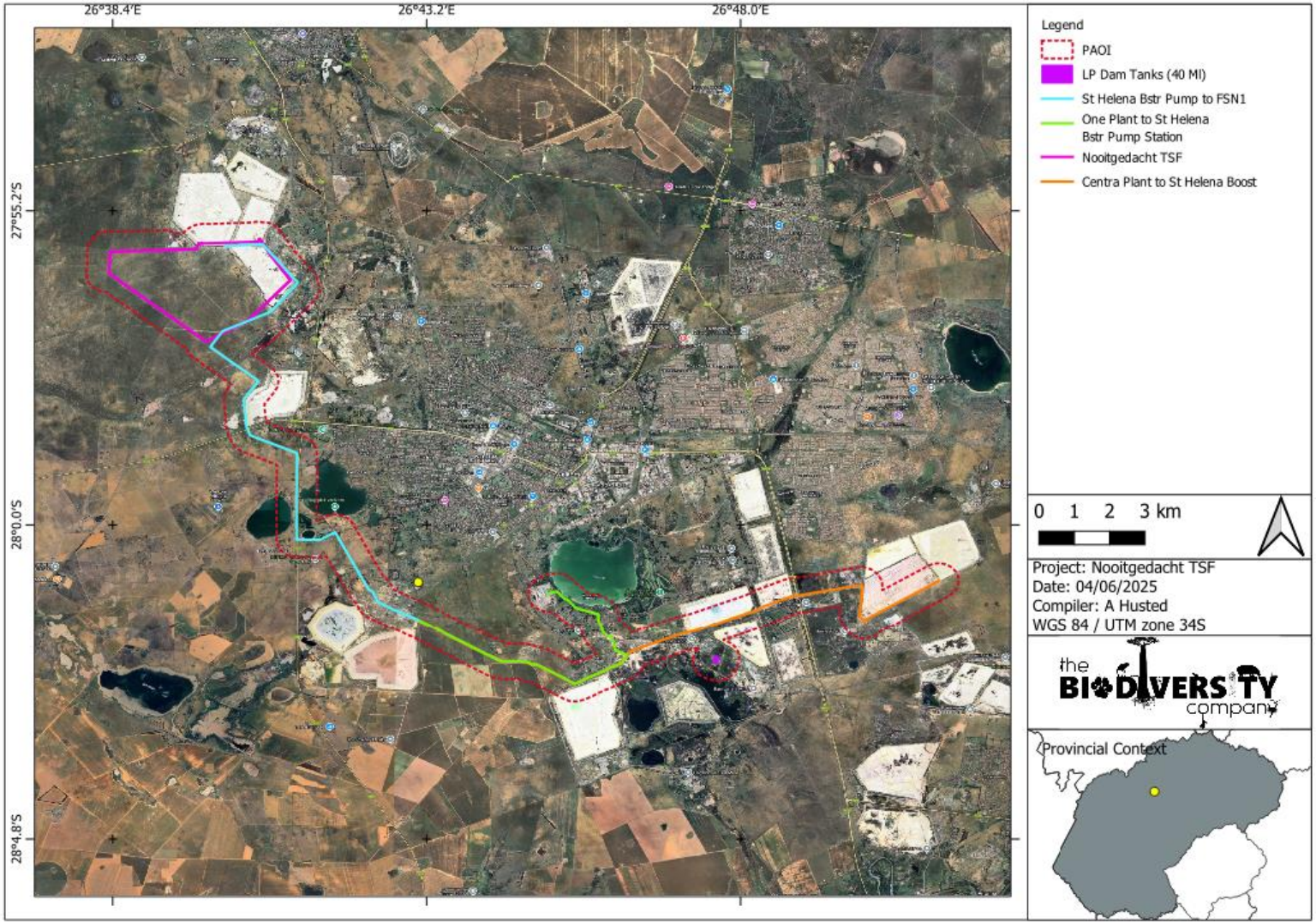
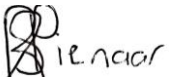


Figure 1-3 Map illustrating the proposed layout of the TSF

1.3 Specialist Details

Report Name	**Wetland Baseline and Risk Assessment for the Proposed Harmony Valley TSF and Pipeline Project**	
Submitted to	EIMS ENVIRONMENTAL IMPACT MANAGEMENT SERVICES	
Report Writer & Fieldwork	**Rian Pienaar**	
Report Update	**Namitha Singh**	
Reviewer	**Rowan Buhrmann**	
Report Update (June 2025)	**Andrew Husted (Pr. Sci. Nat.400213)**	
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.	

1.4 Terms of Reference

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

- The delineation, classification and assessment of wetlands within 500 m of the project area;
- Conduct risk assessments relevant to the proposed activity;
- Recommendations relevant to associated impacts; and
- Report compilation detailing the baseline findings.

1.5 Key Legislative Requirements

1.5.1 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, 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).

1.5.2 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.

2 Methods

Two wetland site visits were conducted from the 26th – 27th of January 2023 (Summer), and from the 11th to 13th of April 2023, which constitutes a wet- and late wet-season survey, respectively.

2.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2-1. 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.

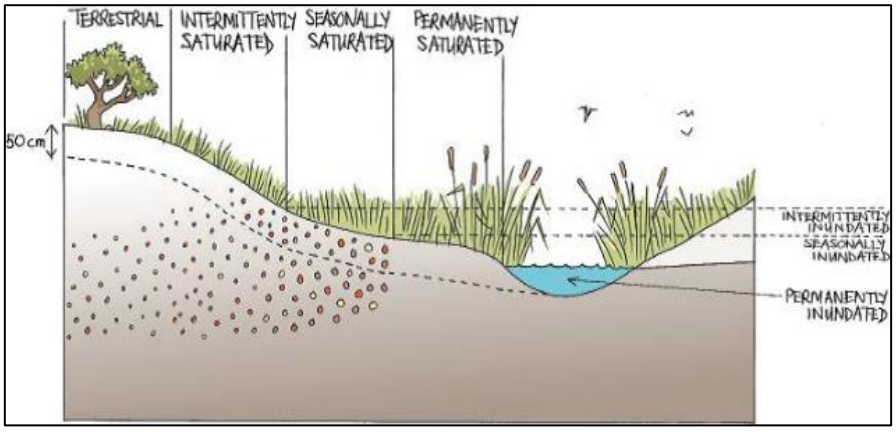


Figure 2-1 Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)

2.2 Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the project area. These delineations are then illustrated by means of maps accompanied by descriptions.

2.3 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).

2.4 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 serves 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 2-1).

Table 2-1 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

2.5 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 2-2.

Table 2-2 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

2.6 Importance and Sensitivity

The importance and sensitivity of water resources is determined to 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 2-3.

Table 2-3 Description of 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**

2.7 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) (Table 2-4) was determined based on the results obtained from the PES and EIS of the assessed wetlands, with the objective of recommending how a water resource should be managed. This is achieved by either maintaining or improving the ecological integrity of the wetland in order to ensure continued ecological functionality (DWA, 1999).

Table 2-4 Recommended Ecological Category and Recommended Management Objectives for water resources based on Present Ecological State and Ecological Importance and Sensitivity scores

		Ecological Importance and Sensitivity			
		Very High	*High*	*Moderate*	*Low*
PES	***A (Pristine)***	A Maintain	A Maintain	A Maintain	A Maintain
	B (Natural)	A Improve	A/B Improve	B Maintain	B Maintain
	C (Good)	A Improve	B/C Improve	C Maintain	C Maintain
	D (Fair)	C Improve	C/D Improve	D Maintain	D Maintain
	E/F (Poor)	D Improve	E/F Improve	E/F Maintain	E/F Maintain

2.8 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.

2.9 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 rated according to the classes presented in the table below.

Table 2-5 Significance ratings matrix

Rating	Class	Management Description
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	(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. Licence required.
61 – 100	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

2.10 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The focus area was based on the spatial files provided by the client and any alterations to the area and/or missing GIS information would have affected the area surveyed;
- Only the outline area of the proposed TSF site and infrastructure was provided to the specialist at the time of survey;
- Wetlands within the extended 500 m radius were delineated and assed via desktop wherever they were inaccessible on field;
- The update is for the low-pressure water supply system, comprising two above-ground concrete storage tanks which was completed remotely. No further site work was deemed necessary for this update;
- Several artificial features were noted within the PAOI and are attributed to the predominant mining land use in the area. Artificial features do not form of the assessment, however the main and observable features were delineated to provide context for the receiving environment; and
- The GPS used for the survey has a 5 m accuracy and therefore any spatial features may be offset by 5 m.

3 Results and Discussion

3.1 Desktop Baseline

3.1.1 Vegetation Type

The project area falls within the Western Free State Clay Grassland (Gh 9) and the Vaal-vet Sandy Grassland (Gh 10) vegetation type.

The following is noted pertaining to the Western Free State Clay Grassland (Mucina & Rutherford, 2006):

- This vegetation type is distributed throughout the Free State province and stretches from Bloemfontein in the south to Wesselsbron in the north and from Brandfort in the east to Hertzogville in the west;
- The altitude suited for this vegetation type is between 1 200 meters above sea level to 1 420 meters above sea level (Mucina & Rutherford, 2006);
- This vegetation type is restricted to flat bottoms supporting dry, species-poor grassland with a high abundance of salt pans (playas) within the grassland. The vegetation type is characterised by dwarf karoo shrublands surrounding the salt pans within disturbed areas; and
- The conservation status of this vegetation type is least threatened with a target percentage of 24. There is currently 0 % of the vegetation statutory conserved within conservation areas. Approximately twenty percent of the vegetation type has been transformed for wheat and maize cultivation (Mucina & Rutherford, 2006).

The following is noted pertaining to the Vaal-vet Sandy Grassland (Mucina & Rutherford, 2006):

- 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 altitude suited for this vegetation type is between 1 260 meters above sea level to 1 360 meters above sea level;
- 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*; and
- 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.

3.1.2 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised predominantly by the Dc 9 and Bd 20 land type. The Dc land type consists of prismacutanic and/or pedocutanic diagnostic horizons with the addition of one or more of the following; Vertic, melanic and red structured diagnostic horizons. Whereas the Bd land type consists of consists of plinthic catena. Upland duplex and margalitic soils are rare and eutrophic and/or mesotrophic red soils are not widespread.

The geology of the area dominated by the Western Free State Grassland is characterised by deposits of sandstone, shale, and mudstone (Volksrust Formation, Ecca Group) and is found in flat areas with

some undulating plains. No rivers or streams drain these plains thus all water drains into the salt pans. Dry, clayey, duplex soils are typically found within this geology (Mucina and Rutherford, 2006).

The geology of the area dominated by the Vaal-vet Sandy Grassland is characterised by aeolian and colluvial sand which overlies mudstone, sandstone and shale of the Karoo Supergroup. Older Ventersdorp Supergroup basement gneiss and andesite is located to the north (Mucina and Rutherford, 2006).

3.1.3 Climate

This region is characterised by a cool to warm temperature regime with a MAP ranging between 16 and 17°C with the average annual precipitation ranging between 451 mm – 530 mm (Figure 3-1; Mucina & Rutherford, 2006).

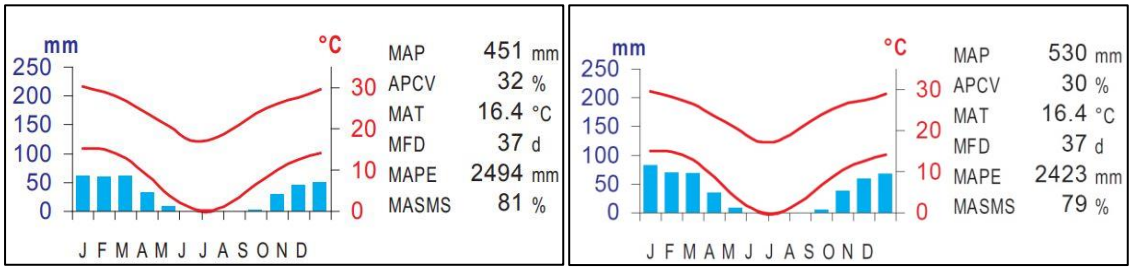


Figure 3-1 Climate for the Western Free State Clay Grassland (left) and Vaal-vet Sandy Grassland (right) (Mucina & Rutherford, 2006)

3.1.4 South African Inventory of Inland Aquatic Ecosystems

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) wetland dataset is a recent outcome of the National Biodiversity Assessment (NBA, 2018) and, was a collaborative project by the South African National Biodiversity Institute (SANBI) and the Council for Scientific and Industrial Research (CSIR). The SAIIAE dataset provides further insight into wetland occurrences and extents building on the information from the NFEPA, as well as other datasets.

Three wetland types were identified by means of this dataset which incorporate one seep wetland, an unchannelled valley bottom wetland and five depression wetlands within the project area of influence (Figure 3-2). The depression wetlands are considered to be ecosystems of “Least Concern” whereas the seep and unchannelled valley-bottom wetlands are considered to be “Critically Endangered” ecosystems.

3.1.5 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) wetland dataset is a collaborative project between multiple stakeholders such as CSIR, the WRC and SANBI. The objective of the project was to identify priority areas to conserve and protect as well as to promote sustainable water use, thereby assisting in meeting the biodiversity goals for freshwater habitats set out in all levels of government (Nel et al. 2011).

The NFEPA dataset represents four wetland types within the PAOI classified as several depressions, wetland flats, seeps and unchannelled valley bottom wetlands (Figure 3-2). Majority of these identified systems are classified to be artificial with conditions within the “Z2 / Z3 – <50% / <25% natural landcover remaining” condition category. The systems that were classified to be natural according to the dataset have conditions ranging between the “AB / C – natural-largely natural / moderately modified” categories. The priority status of the wetlands range between “priority” and “non-priority” which is indicated in the subset map in Figure 3-2.

3.1.6 Topographical Inland Water and River Lines

The topographical inland and river line data for the “2726” and “2826” quarter degree was used to identify potential wetland areas within the PAOI. This data set indicates multiple inland water areas classified as dams, large reservoirs, marsh vlei, non-perennial and perennial pans and, sewerage works (Figure 3-4). Furthermore, a single non-perennial river line can be found inside the project area of influence.

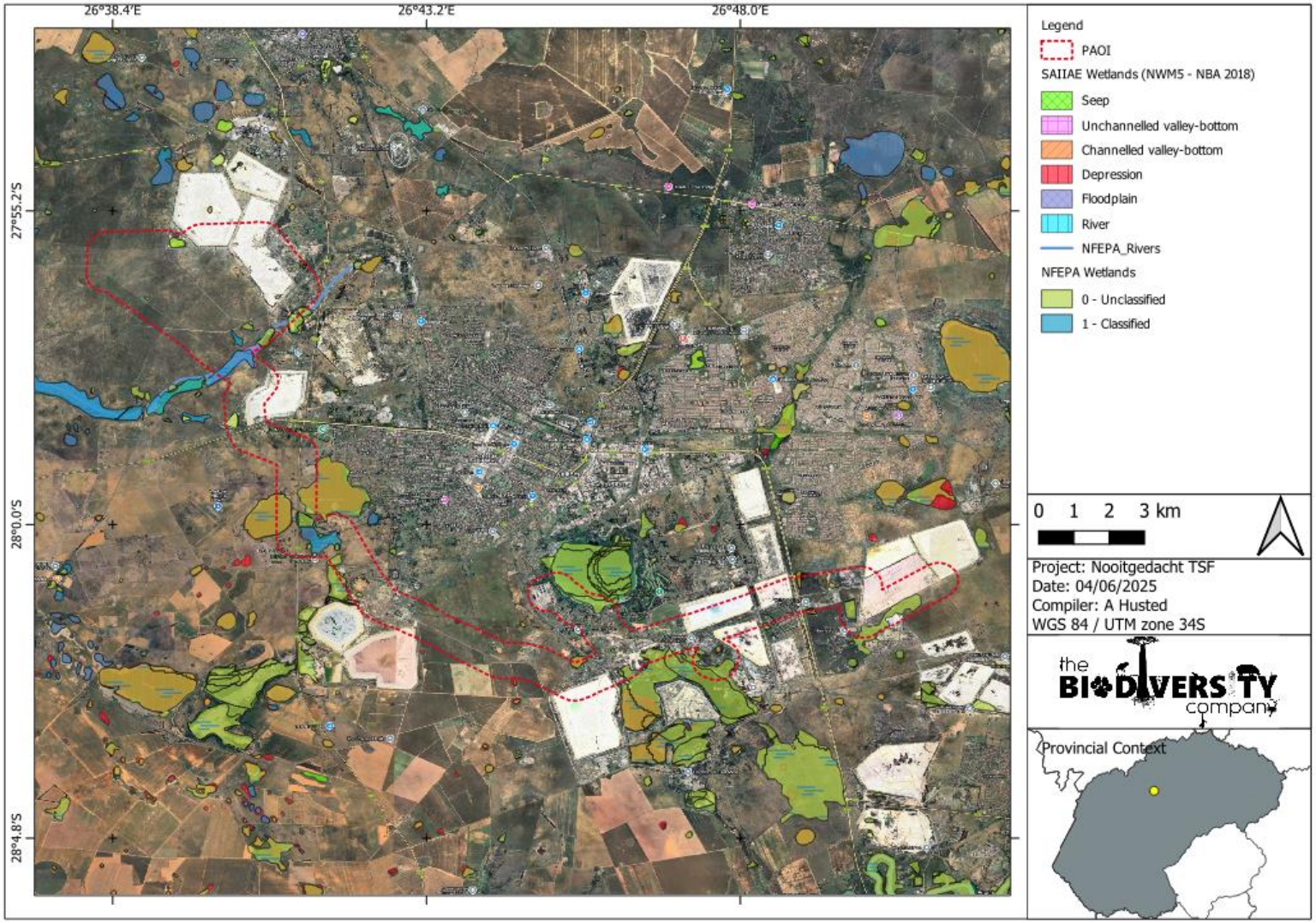


Figure 3-2 NFEPA and SAIIAE wetlands located within PAOI

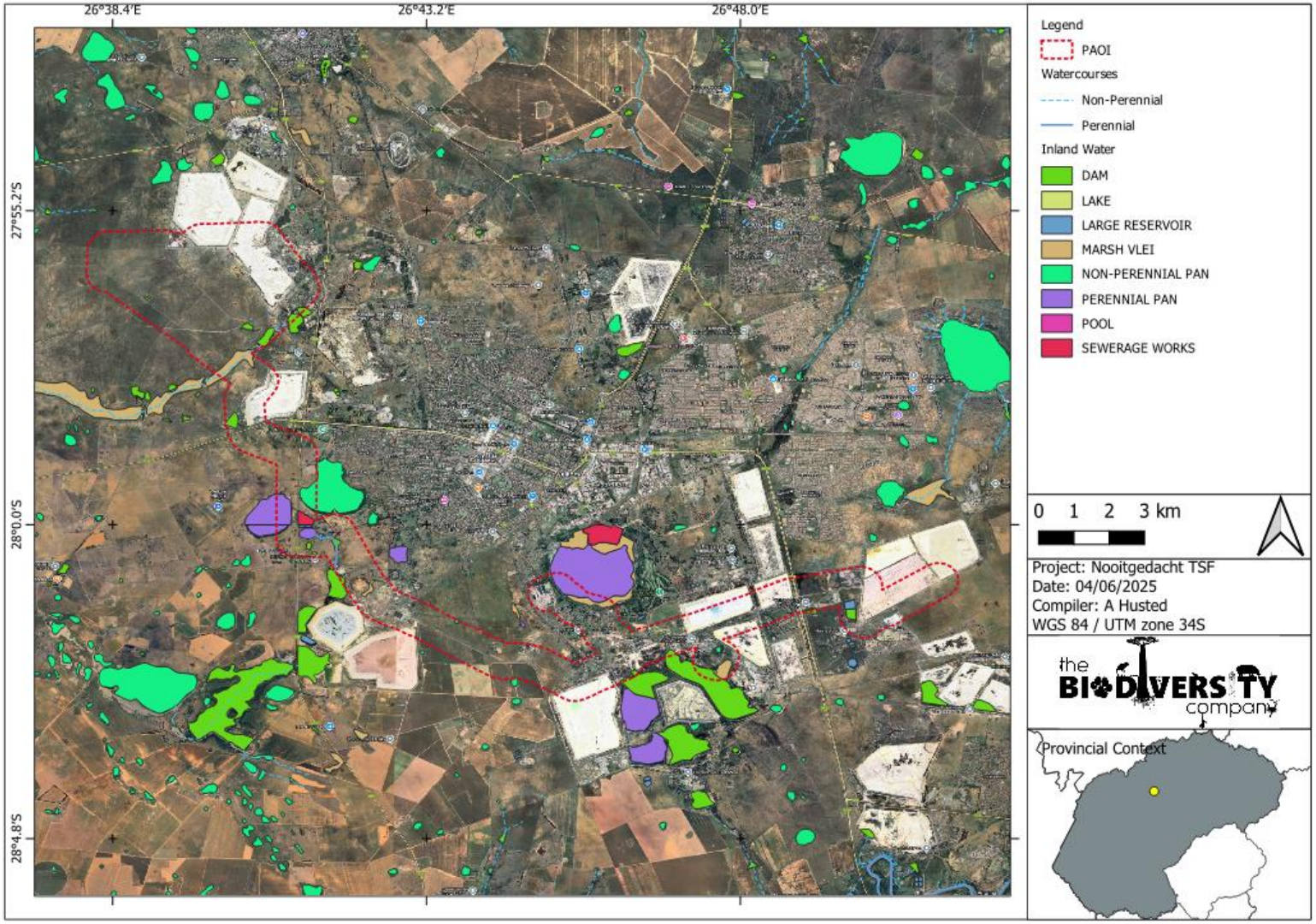


Figure 3-4 Topographical Inland water areas located within the PAOI

4 Field Assessment

4.1 Delineation and Description

During the site visit, nine HGM units were identified within the PAOI that relate to the proposed development (Figure 4-3). The wetland types were classified as four unchannelled valley bottoms (HGM 1, 2, 6 and 9), two channelled valley bottoms (HGM 3 and 8), and three depressions (HGM 4, 5 and 7). Multiple artificial wetlands, mostly seepage from the tailing's facilities were identified within the PAOI.

Drainage features (or lines) were also identified throughout 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). Many of these features were likely artificially created to regulate water runoff and overflows between the TSF's and natural watercourse systems.

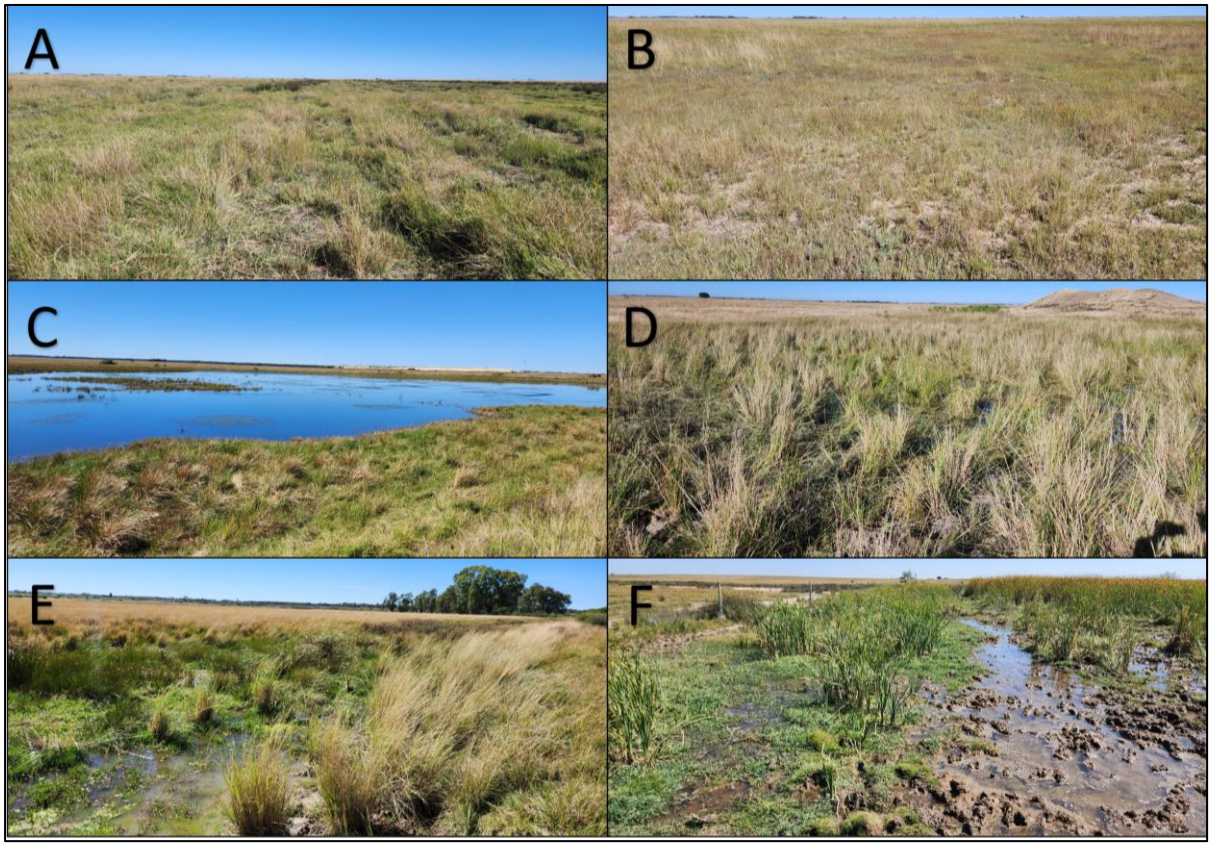


Figure 4-1 ***Photographical evidence of the different HGM units found within the PAOI in proximity to the proposed TSF. A) Unchannelled valley bottom., B) Depression wetland., C) Dam., D) Depression wetland., E & F) Channel valley bottom.***

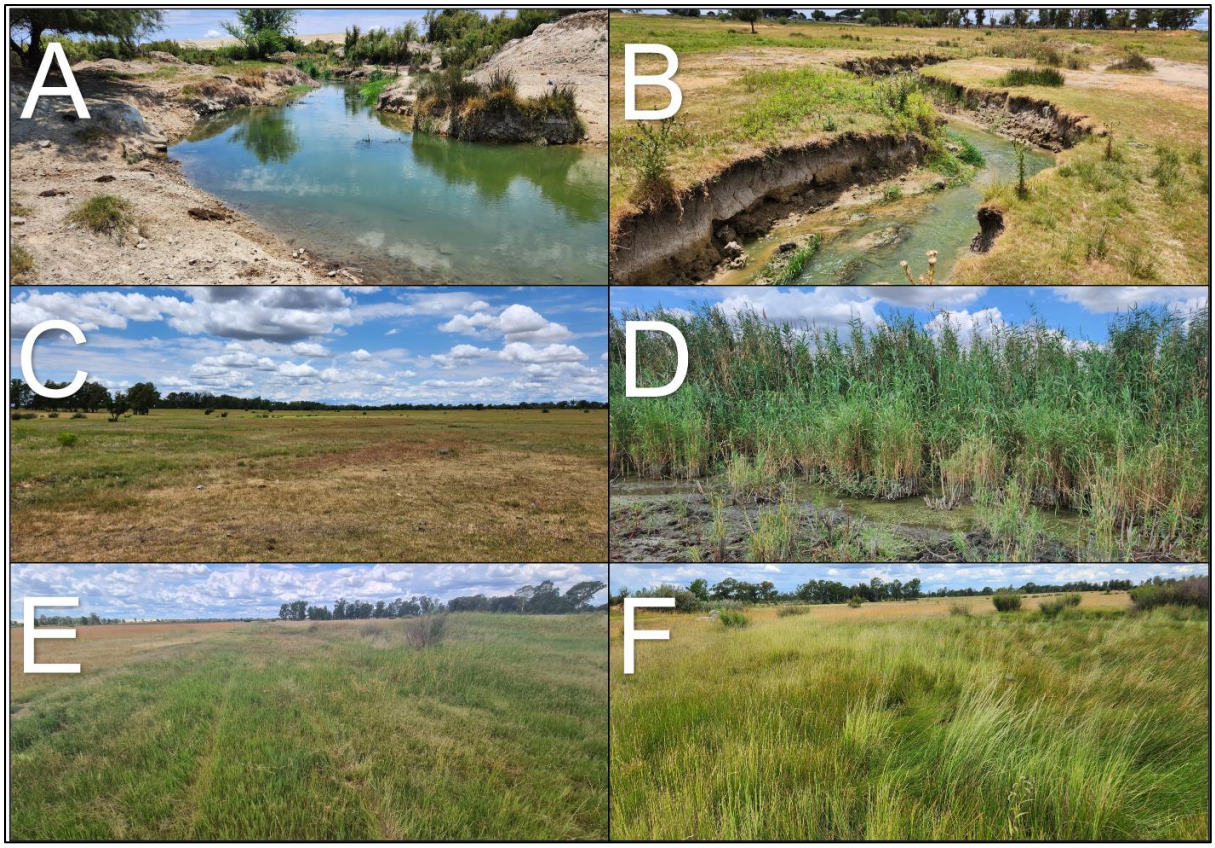


Figure 4-2 Photographical evidence of the different types of wetlands within the PAOI in proximity to the proposed pipelines. A & B) Channelled Valley Bottoms., C) Depression., D) Depression Pan., and E & F) Unchannelled valley bottoms.

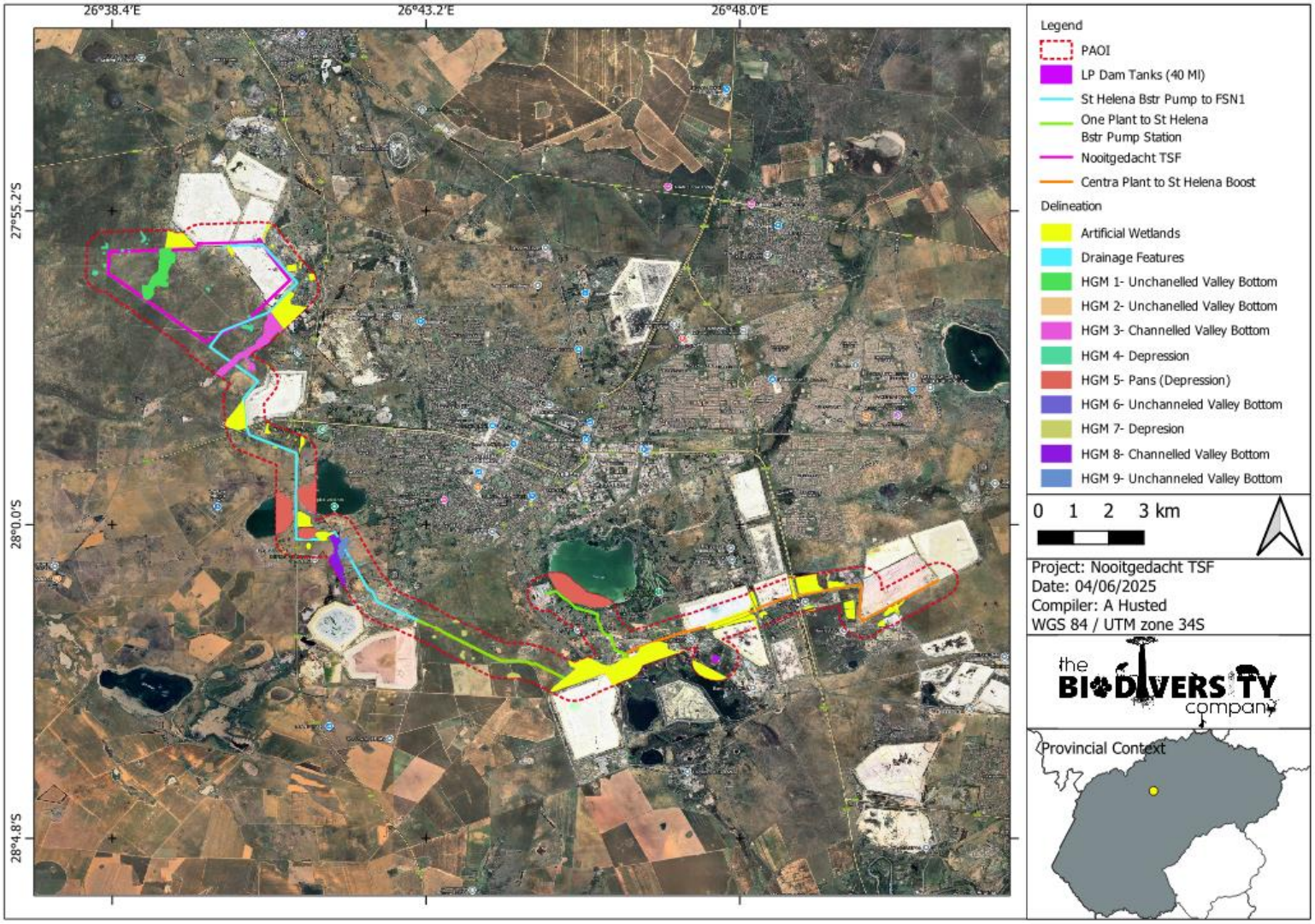


Figure 4-3 Delineation and location of the different HGM units identified within the PAOI

4.2 Unit Setting

Unchannelled valley bottom wetlands are typically found on valley floors where the landscape does not allow high energy flows and supports the diffuse flow of water. Figure 4-4 presents a diagram of a typical unchannelled valley bottom wetland, showing the dominant movement of water into, through and out of the system.

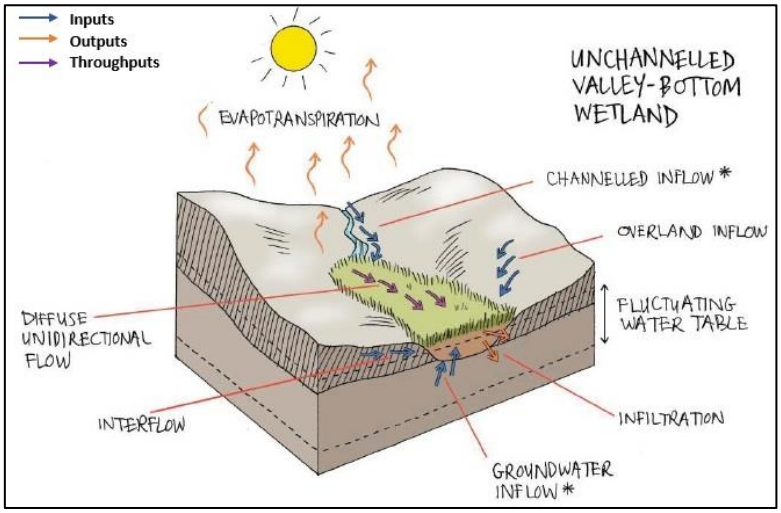


Figure 4-4 Amalgamated diagram of a typical unchannelled valley-bottom, highlighting the dominant water inputs, throughputs, and outputs, SANBI guidelines (Ollis et al. 2013)

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 4-4 presents a diagram of a typical channelled valley bottom, showing the dominant movement of water into, through and out of the system.

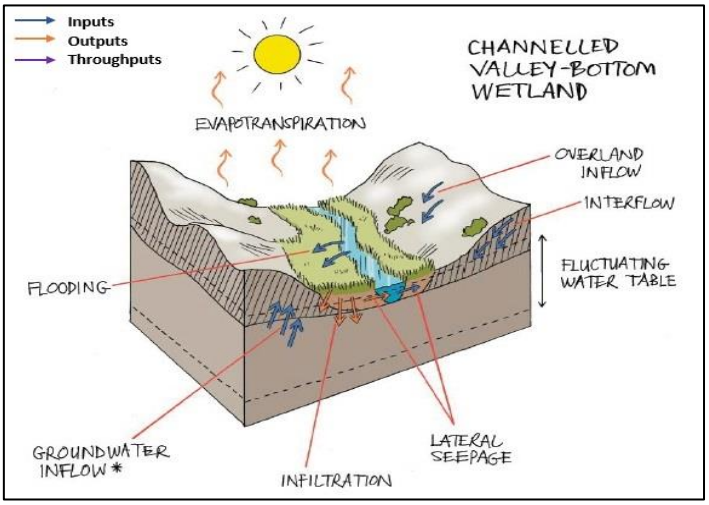


Figure 4-4 Amalgamated diagram of a typical channelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

Depression wetlands are located can be located on the plain and bench landscape units. 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 4-5 presents a diagram of a typical depression wetland, showing the dominant movement of water into, through and out of the system.

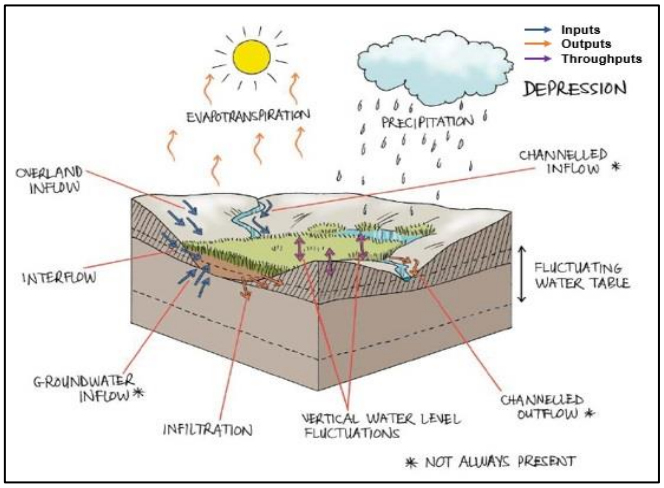


Figure 4-5 Amalgamated diagram of atypical depression wetland, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

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.

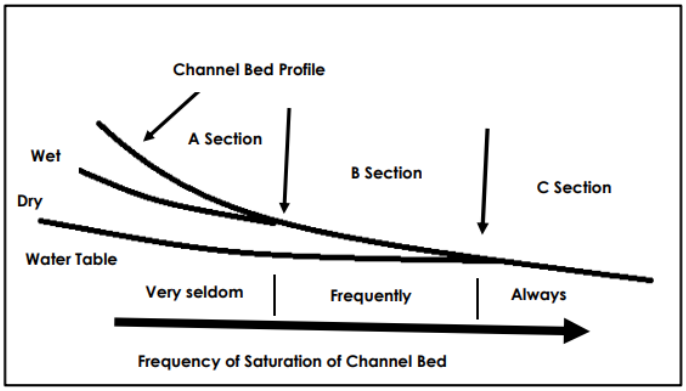


Figure 4-6 The watercourse classifications (DWAF, 2005)

4.3 General Functional Description

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.

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 reduced. Regardless of the nature of depressions with regard to trapping sediments entering the system, the provision of this service can be reversed during dry seasons when sediments are transported out of the systems through aeolian force. The assimilation of nitrates, toxicants and sulphates are some of the higher rated benefits for depressions. This latter statement can be explained by the process of precipitation and consequent dissolving of minerals and other contaminants during the wet seasons (Kotze *et al.,* 2009).

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 from the general expectation given by the nature of the wetland type in relation to its topographic setting.

4.4 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 4-1 and **Error! Reference source not found.**. The ecosystem services scores of the delineated wetlands range from "Moderately Low" to "High". Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation, and erosion control.

Table 4-1 Average ecosystem service scores for delineated wetlands

High	Moderately High	Intermediate	Moderately Low
HGM 5	HGM 3	HGM 1	HGM 2
-	HGM 4	HGM 8	-
-	HGM 6	HGM 9	-
-	HGM 7	-	-

HGM 1 scored "Intermediate" ecosystem services scores. The wetland has been modified to an extent that some function has been lost. The wetlands have only a few hydrophyte species present attributed to the level of modification but will still play an important role in flood attenuation and streamflow regulation and water purification.

HGM 2, scored "Moderately Low" on the provision of benefits due to its small size, isolated nature and the low cover of hydrophyte vegetation present inside the wetland. Hydrophytes help with the accumulation of toxicants as well as phosphates and nitrates from the environment as well as provides habitat and resources so the removal of them lower the ecosystem services dramatically.

HGM 3, and 4 scored "Moderately High" on the provision of ecosystem services. The valley bottom wetlands will play a major role in streamflow regulation and flood attenuation which is important in terms of runoff from the tailing's facilities. The wetlands are well vegetated with hydrophytes which increases the potential to remove toxicants from water entering these systems. The depression wetlands are particularly important for the provision habitat and resources for a variety of fauna. The depression will also act as a sink where toxicants, nitrates, and phosphates from the environment.

HGM 5 scored the highest ecosystem services form all the HGM units due to the wide variety of habitats the systems provide for important species. This system plays a very important role for water birds that

uses the pans for different lifecycle stages, the pans also play an important role in the assimilation of nitrates and phosphates as well as toxicants that flows from the residential areas into the pans. HGM 5 plays an important role in streamflow regulation as well as sediment trapping from the TSF. The HGM unit has high volumes of hydrophytes that plays an important role in sediment trapping and the assimilation of toxicants from the TSF and thus filters the water for cleaner water downstream.

HGM 6 and 7 have scored “Moderately High”. HGM 6 is a grouping of depression wetlands that have good coverage of hydrophytes with surface water present making them a valuable resource point for fauna and hence are important in maintaining biodiversity within a relatively disturbed environment. HGM 7 is a channelled valley bottom wetland flowing from the TSF in the south towards the pans. The HGM unit thus plays an important role in the assimilation of toxicant from the TSF cleaning the water before it reaches bigger water courses.

HGM 8 scored “Intermediate” due to the low cover of hydrophytes within the wetlands. HGM 8 flows from HGM 7 into the surrounding grassland, where the wetland is subjected to overgrazing. The HGM unit is also subjected to erosion that removes high volumes of hydrophytes from the systems, subsequently lowering the potential to provide ecosystem services on a substantial scale.

Attributed to private ownership of most of the land that the wetlands are located within and, the subsequent restricted access to the public, the potential to be used for tourism, recreation and the provisioning of cultural benefits was assumed to be limited.

4.5 Present Ecological Status

The PES for the assessed HGM units is presented in Table 4-2. The ecological state of the wetlands located within the project area of influence were rated as ranging between “D”- Largely Modified and “E”- Seriously Modified. These scores are due to the magnitude of anthropogenic impacts such as mining and agricultural activities as well as the construction of roads and pipelines inside the wetlands and wetland catchments. The wetlands that are less modified is located in the more natural grassland areas of the project area.

Table 4-2 Average Present Ecological State of the delineated wetlands

D – Largey Modified	E – Seriously Modified
HGM 1	HGM 2
HGM 3	HGM 6
HGM 4	HGM 9
HGM 5	-
HGM 7	-
HGM 8	-

Current impacts affecting the watercourses PES are indicated in Figure 4-7 and relate to the following:

- Historic wetland loss from catchment land uses such as mining and agriculture;
- Alteration to watercourses hydrology and geomorphology components;
- Induced erosion and sedimentation;
- Disturbance and fragmentation attributed to grazing and infrastructural developments;
- Impaired water quality associated mainly with contaminants from the mining industry and smaller scale pollution resulting from littering or dumping;
- Proliferation of Invasive Alien Plants attributed to high levels of disturbance; and

- Consequent reduced functionality and alteration of water resource quality.

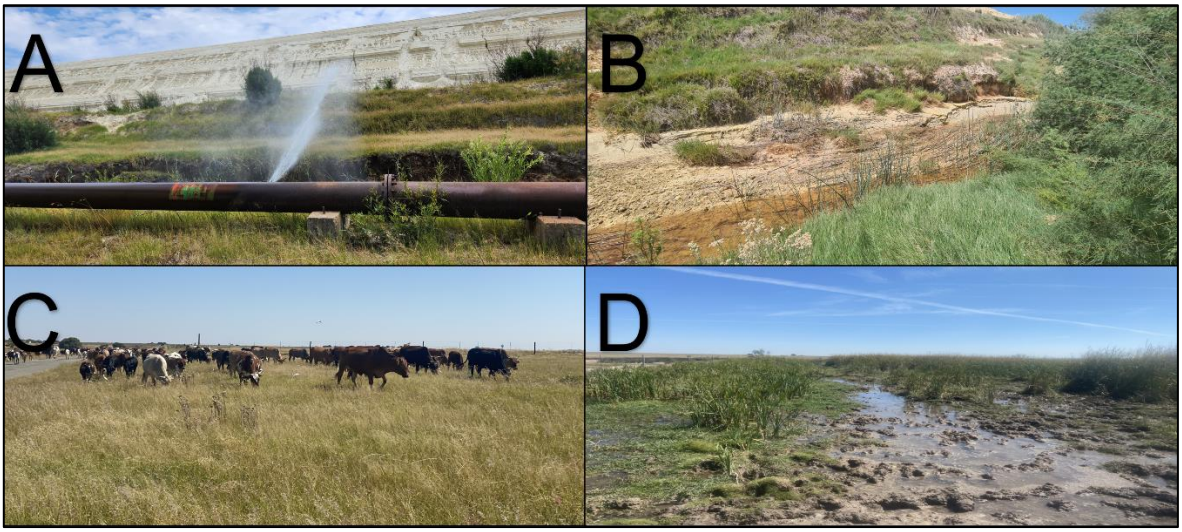


Figure 4-7 Some of the impacts identified on site. A) Burst pipe adding water into wetlands, B) Example of erosion and TSF materials within the wetlands, C) Grazing of cattle, D) Dirt Road through wetland.

4.6 Importance and Sensitivity

The results of the ecological IS assessment are shown in Table 4-. 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 seep wetlands were calculated to be “High”, which combines the low protection status of the wet veg and the and the high threat status of the wetlands themselves. The depression wetlands scored “Moderate” sensitivities due to the low threat status of the wet veg and the low threat status of the wetlands themselves.

Table 4-3 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		
Unchannelled Valley Bottom	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	E – Field Visit	Critically	Not Protected	N	**High**
Channelled Valley Bottom	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	D/E – Field Visit	Critically	Not Protected	N	**High**
Depression	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	D/E – Field Visit	Least Concerned	Not Protected	N	**Moderate**

4.7 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) for the wetland areas was determined from the results of the PES 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. Nevertheless, despite the altered ecological integrity of these systems, they are considered to provide some important ecological services. The appropriate REC and RMO estimated for the wetland areas is presented in Table 4-3 below.

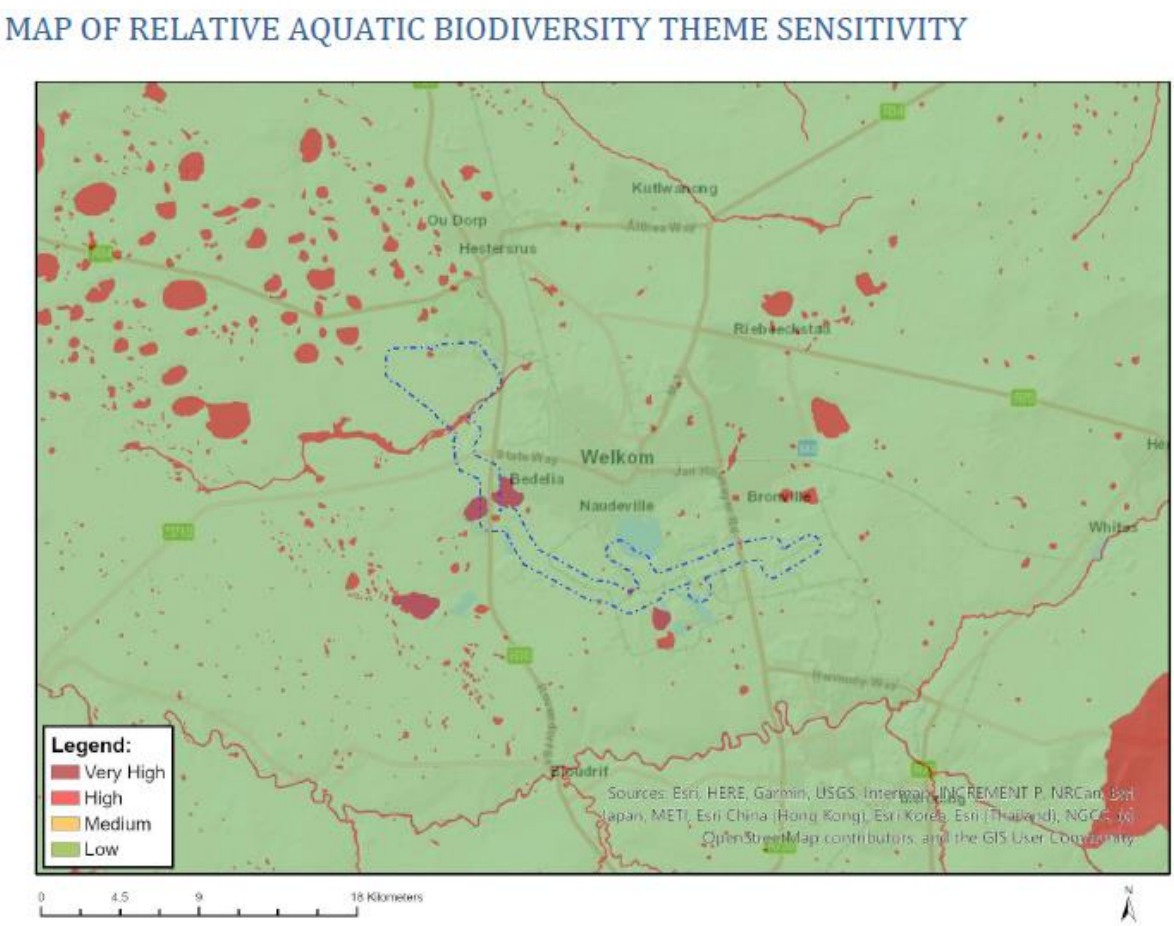
Table 4-3 Summary of the REC and RMO categories assigned to the relevant wetlands

Wetland Unit	REC - RMO
HGM 1	D - Maintain
HGM 2	E - Maintain
HGM 3	D - Maintain
HGM 4	D - Maintain
HGM 5	D - Maintain
HGM 6	E - Improve
HGM 7	D - Maintain
HGM 8	C/D - Improve
HGM 9	E - Improve

4.8 Sensitivity Verification

The following is deduced from the National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended):

- Aquatic Biodiversity Theme sensitivity as “Very High” for the PAOI (Figure 4-8), attributed to the presence of;
    - Rivers with a “Z” Condition; and
    - Seep, depression and valley-bottom wetlands (Dry Highveld Grassland Bioregion).



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	Wetlands_Depression
Very High	Wetlands_Seep
Very High	Wetlands_Unchannelled valley-bottom
Very High	Rivers

Figure 4-8 Aquatic Biodiversity Theme Sensitivity for the project area

4.8.1 Screening Tool Comparison

The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas as presented in Table 4-4 below. A summative explanation for each result is provided as relevant. The specialist-assigned sensitivity ratings are based largely on the ecological assessment processes followed in the previous section, and consideration is given to any observed or likely presence of sensitive fauna and flora.

Table 4-4 Summary of the screening tool vs specialist assigned sensitivities

Features	Screening Tool Theme	Environmental Screening	Specialist Sensitivity	Tool Validated or Disputed by Specialist - Reasoning

		Tool Sensitivity		
Wetlands	Aquatic Biodiversity Theme	Low / Very High	Moderate / High	Screening Tool Sensitivity disputed. Rational for the specialist assigned 'Moderate' / 'High' rating: The wetlands occur in a disturbed landscape and whilst being extensively impacted, some of these systems do have inter-connectivity, increasing the importance as a biodiversity corridor and a hydrological driver for wetland persistence. The features should therefore be conserved for the biodiversity potential and ecosystem services it does provide, especially in terms of the important bird species that are located within the area.
Drainage Features	Aquatic Biodiversity Theme	Low	Low	Screening Tool Sensitivity validated. Rational for specialist assigned "Low" rating: These features present as artificial channelled drainage areas. Most of these areas were well vegetated with a variety of grasses and the occasional and scarce presence of hydrophytes. Natural historical modifications to the hydrology of these features from the changing landscape processes do exist. The overall topographic setting of the features makes them important in maintaining the hydrological regime of the area and for providing an exit point of surface runoff from the landscape. Therefore, the features are not perceived to contribute significantly to freshwater biodiversity; however, attributed to their connectivity to downstream wetlands, the features should still be maintained.
46 and 15 m Buffer	Aquatic Biodiversity Theme	Low	Moderate	Screening Tool Sensitivity disputed. Rational for the specialist assigned 'Moderate' rating: Whilst the buffer areas do not necessarily represent freshwater features, their conservation is imperative to limiting impact to the wetlands as they form the periphery of the wetlands thereby having spatial connectivity to the wetlands. The sensitivity of the buffers is therefore determined by the landscape and the sensitivity of the features they encompass.
Remaining Area	Aquatic Biodiversity Theme	Low	Low	Screening Tool Sensitivity validated. Rational for the specialist assigned 'Low' rating: Much of the PAOI has been historically modified through agricultural and mining activity and in other areas the landscape displays homogeneity and is not perceived to contribute significantly to freshwater resources apart from providing hydrological inputs related to overland flow.

4.9 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 56 m and a post-mitigation wetland and watercourse buffer of 46 m is applicable in relation to the proposed TSF (Table 4-5). Furthermore, a 32 m pre-mitigation and 15 m post-mitigation buffer is applicable to the wetlands in relation to the proposed pipelines and LP water supply system. The buffer widths are attributed to pre-existing modifications to the wetlands and their immediate surrounding catchment and in consideration that pipelines are linear structures and are not anticipated to have a large impact radius.

Table 4-5 Recommended buffers for the proposed project

Aspect	Post-mitigation	Pre-mitigation
TSF	46 m	56 m
Pipeline	15 m	32 m
LP water supply system	15 m	32 m

The suggested buffers in this report do 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.

4.10 Regulatory Zone

In accordance with Government Notice (GN) 4167 of 2023 and GN 509 of 2016, as it relates to the NWA (1998), the regulated area of a watercourse for Section 21 (c) and 21 (i) of the NWA (1998) must be considered if the proposed development and associated infrastructure fall within the respective zones of regulation as defined in the Act.

Listed activities in terms of the NEMA (1998), (Act 107 of 1998) EIA Regulations as amended in April 2017 must be taken into consideration if any infrastructure is to be placed within the applicable zone of regulation.

Both types of authorisation are deemed necessary attributed to the presence of wetlands within the proposed TSF site.

Table 4-6 Legislated zones of regulation

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). GN 4167 as published in the Government Gazette 49833 of 2023. GN 509 as published in the Government Gazette 40229 of 2016.	In accordance with GN 4167 of 2023 and GN 509 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: • 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; • 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 • a 500 m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.
Environmental Authorisation in terms of the Listed activities of the National Environmental Management Act, 1998 (Act No. 107 of 1998). EIA Regulations (2014), as amended.	Activity 12 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) states that: The development of: (xii) Infrastructure or structures with a physical footprint of 100 square meters or more; Where such development occurs— Within a watercourse; In front of a development setback; or If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse. … (dd) where such development occurs within an urban area… Activity 19 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA regulations, 2014 (as amended) states that: “The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic meters from a watercourse.”

5 Risk Assessment

5.1 Potential Impacts

The impact assessment considered the anticipated direct and indirect impacts to the wetland systems as a result of the proposed tailings facility (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.

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.

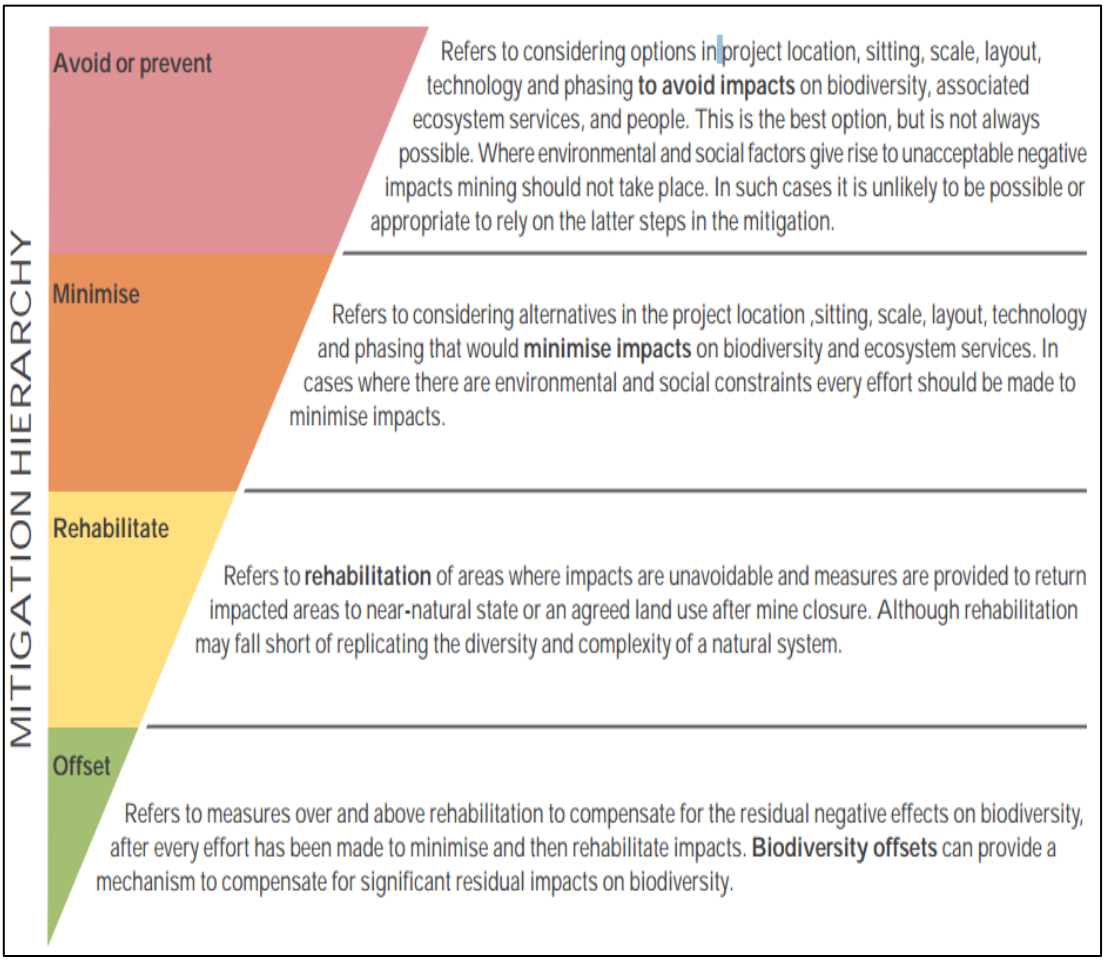


Figure 5-1 The mitigation hierarchy as described by the DEA (2013)

Various impacts are expected in relation to the proposed project and are presented in the table below.

Table 5-1 Typical impacts expected for the construction and operational phase of the proposed TSF and pipeline

Phase	Activity	Expected Impacts
Proposed TSF		
Construction phase	Clearing of vegetation and site preparation to facilitate the development of the TSF Excavating and reshaping for the Banks of the TSF Soil stockpiling Storage of chemicals, mixes and fuel Operation of heavy machinery and equipment within and in proximity to wetlands Installation and assembly of subsurface drainage systems Backfilling of residual excavated areas Dewatering excavated areas in relation to water accumulation from rainfall and stormwater management Ablution facilities	Impeding hydro-dynamics. Siltation of water resources. Erosion of water resources. Loss of indigenous vegetation. Altering hydromorphic soils. Altering hydrological regime. Direct loss of wetland areas. Proliferation of alien vegetation. Decrease in functionality. Additional water quality impairment.
Operational phase	Operation of TSF relating to consistent stockpiling of tailings material Operation of drainage systems	Siltation of water resources. Erosion of water resources. Altering hydrological regime. Proliferation of alien vegetation. Wetland disturbance and decrease in functionality. Water quality impairment.
Decommissioning Phase	Dewatering of TSF compartments Excavating and reshaping TSF to pre-construction state Removal of TSF drainage systems Rehabilitation of reworked area	Siltation of water resources. Erosion of water resources. Altering hydrological regime. Proliferation of alien vegetation. Wetland disturbance and decrease in functionality. Water quality impairment.
Cumulative Impact	All phases of the TSF project	Local wetland loss within the site and deterioration of wetland integrity beyond the project footprint.
Proposed Pipeline		
Construction phase	Clearing of vegetation to facilitate the development of the pipeline and LP water supply system Excavating for plinth placement and LP water supply system Soil stockpiling Storage of chemicals, mixes and fuel Operation of heavy machinery and equipment within and in proximity to wetlands Installation and assembly of pipelines and LP water supply system Backfilling of excavated areas Dewatering excavated areas in relation to water accumulation from rainfall Ablution facilities Domestic and industrial waste	Impeding hydro-dynamics. Siltation of water resources. Erosion of water resources. Loss of indigenous vegetation. Altering hydromorphic soils. Altering hydrological regime. Direct loss of wetland areas. Decrease in functionality. Additional water quality impairment.

Operational phase	Routine maintenance of pipeline and LP water supply system	Impeding hydro-dynamics. Erosion and siltation of watercourse. Water quality impairment.
	Pipeline and LP water supply system faults and leaks	
Decommissioning Phase	Re-excavation of plinth areas and LP water supply system and backfilling of wetland soils	Wetland degradation and proliferation of alien and invasive species. Disruption of wetland soil profile, hydrological and sediment regime.
	Removing of the pipeline and LP water supply system infrastructure	
	Rehabilitation of reworked area	
Cumulative impacts	All phases of pipeline project and LP water supply system	Deterioration in wetland integrity beyond the pipeline servitude.

The risk assessment for the proposed TSF indicated that “Moderate” post-mitigation risks are expected during the construction and decommissioning phase, particularly in relation to wetland loss (for those systems located within the proposed TSF boundary) and altering the hydrological regime of the wetlands in proximity. It is anticipated that good implementation of the suggested mitigations will result in the risks relating to water quality impairments, erosion, sedimentation and wetland vegetation disturbance (including the proliferation of invasive alien plants) presenting in the “Low” post-mitigation category during the construction and decommissioning phases of the development. Majority of the operational phase risks were rated as “Moderate” in the post-mitigation scenario and is attributed to the nature of the TSF which will inevitably result in altering the hydrological regime of the adjacent wetlands and adversely impacting on the water quality, especially seeing as the TSF will be in existence for an extended period of time, consequently resulting in longevity for the expected impacts. The risks associated with sedimentation and siltation during the operational phase can be mitigated to a larger degree and has therefore been rated as “Low”.

The proposed LP water supply system, situated proximal to an artificial wetland system, poses a “Low” residual risk to the wetland due to its above-ground design, engineered containment measures, and compliance with applicable DWS and SANS standards, which collectively minimise the potential for leaks, seepage, or surface contamination

Table 5-2 DWS RAM for the proposed TSF development

Phase	Activity	Impact	Significance (max = 100)	Risk Rating
CONSTRUCTION	Clearing of vegetation and site preparation to facilitate the development of the TSF	Loss of wetland area	**57**	**M**
		Altering surface flow patterns	**36**	**M**

		Erosion of surrounding landscape and subsequently the watercourses	**24**	**L**
		Sedimentation and siltation of watercourses	**28,8**	**L**
		Proliferation of invasive alien plants	**24**	**L**
	Excavating and reshaping for the Banks of the TSF	Altering surface and subsurface flow patterns	**30**	**M**
		Erosion of surrounding landscape and subsequently the watercourses	**19,2**	**L**
		Sedimentation and siltation of watercourses	**24**	**L**
	Soil stockpiling	Altering surface and subsurface flow patterns	**18**	**L**
		Erosion of surrounding landscape and subsequently the watercourses	**14,4**	**L**
		Sedimentation and siltation of watercourses	**14,4**	**L**
	Storage of chemicals, mixes and fuel	Impaired water quality from spills and leaks	**10,8**	**L**
	Operation of heavy machinery and equipment within and in proximity to wetlands	Altering surface flow patterns through hardened surfaces	**24**	**L**
		Erosion of surrounding landscape and subsequently the watercourses	**19,2**	**L**
		Sedimentation and siltation of watercourses	**14,4**	**L**
		Wetland vegetation disturbance and proliferation of invasive alien plants	**14,4**	**L**
		Impaired water quality from spills and leaks	**10,8**	**L**
	Installation and assembly of subsurface drainage systems	Altering surface and subsurface flow patterns	**33**	**M**
	Backfilling of residual excavated areas	Altering surface and subsurface flow patterns	**24**	**L**
		Erosion of surrounding landscape and subsequently the watercourses	**19,2**	**L**
		Sedimentation and siltation of watercourses	**14,4**	**L**
	Dewatering excavated areas in relation to water accumulation from rainfall and stormwater management and releasing water into the environment	Temporary alteration of hydrology within watercourse	**19,2**	**L**
		Erosion of watercourses from concentrated flows	**19,2**	**L**
		Sedimentation and siltation of watercourses	**19,2**	**L**
	Domestic and industrial waste	Wetland degradation	**9,6**	**L**

		Impaired water quality	**10,8**	**L**
	Ablution facilities	Impaired water quality from spills and leaks	**16,2**	**L**
OPERATIONAL	Operation of TSF relating to consistent stockpiling of tailings material	Altering surface and subsurface flow patterns	**42**	**M**
		Sedimentation and siltation of watercourses	**28,8**	**L**
		Impaired water quality from residual tailings materials entering the system	**36**	**M**
	Operation of drainage systems	Altering surface and subsurface flow patterns	**42**	**M**
		Sedimentation and siltation of watercourses	**28,8**	**L**
		Impaired water quality from residual tailings materials entering the system	**36**	**M**
DECOMMISSIONING	Dewatering of TSF compartments	Altering surface and subsurface flow patterns	**33**	**M**
		Sedimentation and siltation of watercourses	**16,2**	**L**
		Impaired water quality from residual tailings materials entering the system	**16,2**	**L**
	Excavating and reshaping TSF to pre-construction state	Altering surface and subsurface flow patterns	**33**	**M**
		Erosion of surrounding landscape and subsequently the watercourses	**21,6**	**L**
		Sedimentation and siltation of watercourses	**21,6**	**L**
	Removal of TSF drainage systems	Altering surface and subsurface flow patterns	**33**	**M**
		Sedimentation and siltation of watercourses	**21,6**	**L**
		Impaired water quality from residual tailings materials entering the system	**21,6**	**L**
	Rehabilitation of reworked area	Altering surface and subsurface flow patterns	**33**	**M**
		Sedimentation and siltation of watercourses	**16,2**	**L**
		Impaired water quality from residual tailings materials entering the system	**27**	**L**
		Proliferation of invasive alien plants	**21,6**	**L**

The risk assessment for the proposed pipeline indicated that “Moderate” risks are expected for the proposed pipeline and water supply system and are more prevalent in the construction and

decommissioning phase of the proposed project. This attributed to the higher rates of activity and disturbance within and in proximity to the watercourses during these project phases. The operational phase risks for the development are expected to be “Low” as pipeline infrastructure is linear and once constructed, is not perceived to alter the wetlands characteristics extensively. In regard to the LP water supply system, due to its above-ground design, engineered containment measures, and compliance with applicable DWS and SANS standards, which collectively minimise the potential for leaks, seepage, or surface contamination “Low” residual risks are expected.

However, impacts relating to water quality impairments from leaking pipeline infrastructure were rated “Moderate” during the operational phase, seeing as the pipelines will transport hazardous materials. Additionally, the extent and magnitude of damage from a leaking pipe is dependent on the detection, level of fault in the line and response time to resolving the leak.

Table 5-3 DWS RAM for the proposed slurry pipelines

Phase	Activity	Impact	Significance (max = 100)	Risk Rating
CONSTRUCTION	Clearing of vegetation to facilitate the development of the pipeline and LP water supply system	Loss of wetland area	56	M
		Altering surface flow patterns	40	M
		Erosion of surrounding landscape and subsequently the watercourses	32	M
		Sedimentation and siltation of watercourses	40	M
		Proliferation of invasive alien plants	32	M
	Excavating for plinth and LP water supply system placement	Altering surface and subsurface flow patterns	30	M
		Erosion of surrounding landscape and subsequently the watercourses	24	L
		Sedimentation and siltation of watercourses	24	L
	Soil stockpiling	Altering surface and subsurface flow patterns	30	M
		Erosion of surrounding landscape and subsequently the watercourses	24	L
		Sedimentation and siltation of watercourses	24	L
	Storage of chemicals, mixes and fuel	Impaired water quality from spills and leaks	16	L
	Operation of heavy machinery and equipment within and in proximity to wetlands	Altering surface flow patterns through hardened surfaces	30	M
		Erosion of surrounding landscape and subsequently the watercourses	24	L
		Sedimentation and siltation of watercourses	24	L

		Wetland vegetation disturbance and proliferation of invasive alien plants	**24**	**L**
		Impaired water quality from spills and leaks	**24**	**L**
	Installation and assembly of pipelines and LP water supply system	Altering surface and subsurface flow patterns	**24**	**L**
	Backfilling of residual excavated areas	Altering surface and subsurface flow patterns	**30**	**M**
		Erosion of surrounding landscape and subsequently the watercourses	**30**	**M**
		Sedimentation and siltation of watercourses	**24**	**L**
	Dewatering excavated areas in relation to water accumulation from rainfall and stormwater management and releasing water into the environment	Temporary alteration of hydrology within watercourse	**32**	**M**
		Erosion of watercourses from concentrated flows	**32**	**M**
		Sedimentation and siltation of watercourses	**24**	**L**
	Domestic and industrial waste	Wetland degradation	**16**	**L**
		Impaired water quality	**16**	**L**
	Ablution facilities	Impaired water quality from spills and leaks	**24**	**L**
OPERATIONAL	Routine maintenance of pipeline and LP water supply system	Altering surface flow patterns with subsequent erosion	**27**	**L**
		Erosion and sedimentation	**18**	**L**
		Wetland vegetation disturbance	**18**	**L**
	Pipeline and LP water supply system faults and leaks	Altering surface and subsurface flow patterns	**27**	**L**
		Erosion and sedimentation	**18**	**L**
		Impaired water quality	**36**	**M**
DECOMMISSIONING	Re-excavation of plinth areas and LP water supply system and backfilling of wetland soils	Altering surface and subsurface flow patterns	**32**	**M**
		Erosion of surrounding landscape and subsequently the watercourses	**24**	**L**
		Sedimentation and siltation of watercourses	**32**	**M**
	Removing of the pipeline and LP water supply system infrastructure	Altering surface and subsurface flow patterns	**32**	**M**

		Sedimentation and siltation of watercourses	**24**	**L**
		Impaired water quality from residual tailings materials entering the system	**40**	**M**
	Rehabilitation of reworked area	Altering surface and subsurface flow patterns	**32**	**M**
		Sedimentation and siltation of watercourses	**24**	**L**
		Impaired water quality	**16**	**L**
		Proliferation of invasive alien plants	**40**	**M**

Even though mitigation will be implemented for the proposed project, wetland loss of approximately 63.17 ha and, other moderately rated impacts from the development of the TSF will still occur. It is the opinion of the specialist that the second and third step of the mitigation hierarchy, which refers to minimisation and rehabilitation, must be carried out to ensure the conservation of wetlands. In this regard, rehabilitation targets should also consider and attempt to compensate for the wetland loss that occurs as a result of the TSF development.

5.2 Mitigation Measures

In light of the expected impacts from proposed activities, measures have been proposed to lower the intensity of the impacts on the ecological integrity of the wetland catchment and its downslope wetland features.

The focus of mitigation measures should be to reduce the significance of potential environmental impacts associated with the proposed development and thereby to:

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community of the wetland areas; and
- Limit the construction or working areas to the defined portions and only impact those areas where it is unavoidable to do so otherwise.

Table 5-4 Mitigation measures for the expected impacts of the proposed development

Impact	Measure
Direct loss, disturbance and degradation of wetlands	• Educate staff and relevant contractors on the location and importance of the identified wetlands through toolbox talks and by including them in site inductions as well as the making them aware of the overall site plan which should indicate sensitive areas, waste disposal areas and any other relevant project specifics. • Promptly control the spread of alien vegetation. • Landscape and re-vegetate all denuded areas as soon as possible. TSF: • Attempt by all means to limit the extent of HGM 1 that will be lost by the proposed activities. Make sure that all the other HGM units and their buffers are avoided completely. • Adhere to the prescribed wetland buffers. Restrict all non-essential activities (e.g. cement mixing and equipment wetland machinery storage) to outside of wetlands and their prescribed buffers. • Contain wastewater in a PCD. Contaminated water must not be discharged into watercourses. • Demarcate the 10 m construction corridor as well as the prescribed m buffer on the ground (e.g. pained wooden poles).

	• Try to reduce the disturbance footprint and the unnecessary clearing of vegetation on either side of the TSF facility when traversing wetlands. • Construct as far as possible during winter when flow volumes are lowest, prioritise this for crossing sites. This will reduce impacts to wetlands due to soil poaching and vegetation trampling under peak saturation levels. Additionally, the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest during this time. Pipelines: • Use existing pipeline servitudes as far as possible. • Adhere to the prescribed wetland buffers. Restrict all non-essential activities (e.g. cement mixing and equipment wetland machinery storage) to outside of wetlands and their prescribed buffers. • Try to reduce the disturbance footprint and the unnecessary clearing of vegetation on either side of the pipeline route as far as possible when traversing wetlands. • At crossing points restrict all construction activities to a 10 m corridor on either side of the pipeline route. Demarcate the 10 m construction corridor as well as the prescribed 15 m buffer on the ground (e.g. pained wooden poles). • Construct as far as possible during winter when flow volumes are lowest, prioritise this for crossing sites. This will reduce impacts to wetlands due to soil poaching and vegetation trampling under peak saturation levels. Additionally, the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest during this time.
Increased bare surfaces and potential for erosion	• Devise and implement a stormwater management plan. TSF • Keep the TSF activities to the proposed site and only access the tailings facility from the South to prevent greater loss to the wetlands northern parts. • Ensure that the TSF is lined and secured to prevent runoff through rain. • Mixing of concrete must under no circumstances take place in any wetland or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished. • Do not situate any of the construction material laydown areas within any wetland. • No machinery should be allowed to parked in any wetlands. • Ensure topsoil is spread back over trench area. • Flatten and lightly till (no deeper than 30 cm) excavated / cleared areas to encourage vegetation establishment as soon as possible. Pipeline: • Keep the excavation areas neat and tidy. Stockpiles should be located outside of the wetland areas, on the same side as the excavator tracks. Separate topsoil and sub-soil, and backfill in a first-out last-in manner. • Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. • Mixing of concrete must under no circumstances take place in any wetland or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished. • Do not situate any of the construction material laydown areas within any wetland. • No machinery should be allowed to parked in any wetlands. • Ensure topsoil is spread back over the excavated and filled areas. • Flatten and lightly till (no deeper than 30 cm) excavated / cleared areas to encourage vegetation establishment as soon as possible.
Sedimentation and siltation of watercourses	• Devise and implement a stormwater management plan. • Any water to be released into the environment from dewatering activities associated with temporary excavations during the construction must undergo filtration before it is released to minimise sediment laden water from entering the watercourses. TSF and Pipeline: • Install sandbags on downstream side of the footprint to trap sediment until the site has been constructed and vegetation has re-established. • Re-instate topsoil and lightly till disturbance footprint.

	• Exposed road surfaces awaiting grading, or other problematic areas must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion. Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching. • A combination of step like grassed berms or perforated bricks and silt traps must be placed in the preferential flow paths along the site and roads to prevent scouring of the road margins and subsequent sedimentation of the downslope water resources. • Avoid the creation of concentrated flow paths wherever possible; • Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. • Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil. • Where required, the rehabilitation of watercourse banks must take place following construction. Key areas where erosion has occurred should be rehabilitated through bank reprofiling to gentler gradients and the revegetation of the wetland periphery areas.
Proliferation of invasive alien plants	TSF and Pipeline: • Revegetate bare or denuded areas as soon as possible. • Once and if detected, control the spread of any existing colonies. • Avoid working in areas with alien vegetation as dispersal into unaffected areas may be aided through vehicular movement. • Should alien vegetation infestation be considered a contributing factor to ecosystem degradation on the site, the implementation of an alien invasive management plan should be considered.
Impaired water quality	TSF and Pipeline: • The use of herbicides is not recommended in or near wetlands to control alien vegetation (opt for mechanical removal). • Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. • Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and the wetlands. • Regularly maintain stormwater infrastructure, pipes, pumps and machinery to minimise the potential for leaks. Check for oil leaks, keep a tidy operation, install bins and promptly clean up any spills or litter. • Provide appropriate sanitation facilities during construction and service them regularly. • Conduct regular inspections along the pipeline route and fix leaks timeously. • Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems. The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly. • Stormwater and sediment control infrastructure must be regular maintained to ensure proper functionality and aim to release only clean water into the environment.
Alteration of hydrological regime	This impact cannot be fully mitigated due to the nature of the activity. The above-mentioned general mitigation relating to appropriate stormwater management, removal of alien vegetation and revegetation denuded areas will assist in alleviating some impact.

6 Conclusion and Recommendation

6.1 Baseline Ecology

During the site visit, nine HGM units were identified within the PAOI that relate to the proposed development. The wetland types were classified as four unchannelled valley bottoms (HGM 1, 2, 6 and 9), two channelled valley bottoms (HGM 3 and 8), and three depressions (HGM 4, 5 and 7). Multiple artificial wetlands, mostly seepage from the tailing's facilities were identified within the PAOI.

Drainage features (or lines) were also identified throughout 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). Many of these features were likely artificially created to regulate water runoff and overflows between the TSF's and natural watercourse systems.

A summary of the ecological characteristics of the wetlands are provided in the table below.

Table 6-1 Ecological characteristics and buffer requirements of the freshwater resources

HGM Unit / Feature	PES	EIS	Ecosystem Services	REC - RMO	Post-mitigation Buffer Requirement
1 – Unchannelled valley-bottom	D - Largely Modified	C – Moderate	Intermediate	D - Maintain	46 m – TSF 15 m - Pipeline
2 – Unchannelled valley-bottom	E - Seriously Modified	C – Moderate	Moderately Low	E - Maintain	
3 – Channelled valley-bottom	D - Largely Modified	C – Moderate	Moderately High	D - Maintain	
4 – Depression	D - Largely Modified	C – Moderate	Moderately High	D - Maintain	
5 – Depression	D - Largely Modified	C – Moderate	High	D - Maintain	
6 – Unchannelled valley-bottom	E - Seriously Modified	B – High	Moderately High	E - Improve	
7 – Depression	D - Largely Modified	C – Moderate	Moderately High	D - Maintain	
8 – Channelled valley-bottom	D - Largely Modified	B – High	Intermediate	C/D - Improve	
9 – Unchannelled valley-bottom	E - Seriously Modified	B – High	Intermediate	E - Improve	

6.2 Risk Assessment

A risk assessment was conducted to investigate the level of risk posed by proposed project. The post-mitigation risks for the TSF, proposed slurry pipelines and LP water supply system in all respective project phases presented within the "Moderate" and "Low" significance classes. The "Moderate" risks are associated with the nature of the development to alter the hydrological dynamics of the local area and subsequently the watercourses. Furthermore, in consideration that the development will result in the loss of ≈ 63 ha in wetland surface area and that water quality impairments are inevitable from such developments even with the implementation of mitigation measures. The "Moderate" risks associated with the proposed slurry pipelines relate to the activity occurring within the delineated wetlands for which impacts can only be mitigated against to a certain degree. During the operational phase for the

development, the risk significance will decrease, however some residual “Moderate” and “Low” risks will still be potential attributed to water quality and hydrological changes resulting from the activities.

The cumulative impact of the proposed project is deemed to be “Moderate” owing to the loss of some functional wetland and attributed to the high-risk nature of mining and tailings projects.

6.3 Specialist Statement

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. In the event wetland systems will be lost, a compensation strategy must be compiled for the project, and this should priories the on-site rehabilitation of proximal water resources.

In accordance with the GA in terms of section 39 of the NWA, for water uses as defined in section 21 (c) or section 21 (i) a GA does not apply *“to any water use in terms of section 21 (c) or (i) of the Act associated with the construction, installation or maintenance of any sewer pipelines, pipelines carrying hazardous materials and to raw water and waste water treatment works”.* Since this project will include the installation of pipelines to accommodate the flow of hazardous materials, **a water use license will be required.**

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8 Specialist Declarations

Declaration

I, Rian Pienaar, declare that:

- I act as the independent specialist in this application;
- 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 applicant;
- 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 application, 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

Ecologist

The Biodiversity Company

July 2024

Declaration

I, Namitha Singh, declare that:

- I act as the independent specialist in this application;
- 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 applicant;
- 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 application, 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.

Namitha Singh

Ecologist

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9 Specialist CV

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Profile Summary

Working experience throughout Southern Africa

Specialist experience with mining, construction and agriculture.

Specialist expertise include wetlands resources, aquatic ecology, parasitology and ecotoxicology.

Areas of Interest

Mining, Oil & Gas, Renewable Energy & Bulk Services Infrastructure Development, Farming, Land Contamination, Sustainability and Conservation.

Key Experience

- Environmental Impact Assessments (EIA)
- Environmental Management Programmes (EMP)
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Soil classification
- Agriculture potential assessments
- Land contamination assessments

Country Experience

South Africa

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Areas of Interest

Water Resource Management, Mining, Renewable Energy, Infrastructure Development, Agriculture, Land contamination, Sustainability and Conservation.

Key Experience

- Wetland Delineation and Functional Assessments
- Hydropedology Assessments
- Wetland Rehabilitation
- Coastal and Estuarine Assessments

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Nationality

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