forestry, fisheries & the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

Freshwater Functional and Impact Assessment for the Vereeniging Water Treatment Works Project

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Freshwater Functional and Impact Assessment for the Vereeniging Water Treatment Works Project
Specialist Company Name	The Biodiversity Company
Specialist Name	Khume Mtshweni
Specialist Identity Number	9408065020089
Specialist Qualifications:	MSc Aquatic Health
Professional affiliation/registration:	SACNASP Pr Sci Nat 138592
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Postal address:	777 Peridot Str, Jukskei Park
Postal address	2188
Telephone	N/A
Cell phone	063 772 7501
E-mail	khume@thebiodiversitycompany.com

2. DECLARATION BY THE SPECIALIST

I, Khume Mtshwenii declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

The Biodiversity Company

Name of Company:

08 Jul 2025

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Khume Chamie Mtshweni_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

The Biodiversity Company

Name of Company

7th July 2025

Date

Click or tap here to enter text.

Signature of the Commissioner of Oaths

Click or tap to enter a date. 08/07/2025

Date

MARC CURLEWIS
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3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with *'the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Freshwater Functional and Impact Assessment for the Vereeniging Water Treatment Works Project
Specialist Company Name	The Biodiversity Company
Specialist Name	Celine Klinkert
Specialist Identity Number	9708200130085
Specialist Qualifications:	MSc Freshwater
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Postal address:	777 Peridot Street, Jukskei Park
Postal address	2188
Telephone	N/A
Cell phone	073 742 8832
E-mail	celine@thebiodiversitycompany.com

2. DECLARATION BY THE SPECIALIST

I, Celine Klinkert declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

The Biodiversity Company

Name of Company:

08 Jul 2025

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Celine Megan Klinkert_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

The Biodiversity Company

Name of Company

7th July 2025

Date

Click or tap here to enter text.

Signature of the Commissioner of Oaths

Click or tap to enter a date. 08/07/2025

Date

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Freshwater Functional and Impact Assessment for The Proposed Construction and Maintenance of the New System 1 at Rand Water Vereeniging Treatment Works, Installation of Approximately 7 Km Phase 2 Sludge Pipeline in Vereeniging, 1.5 Km Sludge Line in Panfontein and Associated Infrastructure within the Jurisdiction of Sedibeng District Municipality, Gauteng Province.

13/05/2025

Updated July 2025

Prepared by:

The Biodiversity Company

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www.thebiodiversitycompany.com

Report Name	**Freshwater Functional and Impact Assessment for The Proposed Construction and Maintenance of the New System 1 at Rand Water Vereeniging Treatment Works, Installation of Approximately 7 Km Phase 2 Sludge Pipeline in Vereeniging, 1.5 Km Sludge Line in Panfontein and Associated Infrastructure within the Jurisdiction of Sedibeng District Municipality, Gauteng Province.**	
Specialist Theme	Aquatic Theme	
Project Reference	New System 1 Vereeniging WTW; 7km Phase 2 Sludge Pipeline; 1.5km Sludge Line in Panfontein	
Report Version	13/05/2025	
Fieldwork	Khume Mtshweni	
Report Writer	Celine Klinkert	
Reviewer	Andrew Husted (SACNASP 400213/11)	
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, Amended. We have no conflicting interests in the undertaking of this activity and have no interest 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.	

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List of Abbreviations

Wastewater Treatment Works	WWTW
Project Area of Influence	PAOI
Hydrogeomorphic Unit	HGM Unit
Channelled Valley Bottom	CVB
Present Ecological State	PES
Ecological Importance and Sensitivity	ESI
Recommended Ecological Category	REC
Recommended Management Objectives	RMO

Executive Summary

The Biodiversity Company was commissioned to conduct a freshwater functional and impact assessment in support of the water use and environmental authorisation process for the proposed Construction and Maintenance of the New System 1 At Rand Water Vereeniging Treatment Works, Construction and Maintenance Of Approximately 7 Km Phase 2 Sludge Pipeline In Vereeniging, 1.5 Km Sludge Line In Panfontein And Associated Infrastructure Within The Jurisdiction Of Sedibeng District Municipality, Gauteng Province Project. The proposed project entails three separate developments occurring at three locations. The proposed project is located in Vereeniging, a suburb within Emfuleni Local Municipality, Sedibeng District Municipality, Gauteng Province. The Project Area will refer to the combined layout of the three developments. A 500 m radius has been demarcated for the project area to facilitate the identification of wetlands and other aquatic features; this area is referred to as the Project Area of Influence (PAOI).

A field survey for the area was undertaken on the 9th of April 2025, which is an early dry-season survey, to identify the presence of freshwater features (including wetlands) and to delineate their spatial extents. The seasonality is not considered to be a limiting factor to the assessment and the results of this assessment are conclusive.

The findings from the field survey showed two types of watercourse features were identified within the encompassing 500 m PAOI, categorized into ten hydrogeomorphic (HGM) units. These were classified as one perennial river system (HGM 1), namely the Vaal River, and nine seep wetlands (HGM 2 - 9). Additionally, canals were identified within the PAOI, which are not considered to be natural features and have been not been included within the functional wetland assessments.

A DWS risk and impact assessment was conducted for the proposed project. The overall post-mitigation risk status for the project presented within the “Moderate” consequence and significance category, due to the identification of several moderate risks, relating to the construction phase of the development. The remaining risks, including all of the operation risks were scored within the “Low” risk category.

Mitigation measures have been prescribed to minimize impacts on the identified watercourses that are likely to be impacted by the proposed development. The report concludes that, considering the assessment findings, no fatal flaws are evident for the proposed project at this stage. As the proposed pipeline route cannot be altered to fully avoid the identified wetland areas and associated buffers, it is therefore recommended that a rehabilitation and monitoring programme is implemented for the affected wetlands, to ensure suitable corrective measures are taken to conserve the condition of the wetlands and their associated buffer zones. In addition to the above, it is recommended that the pipeline is constructed on stilts, where feasible to do so, where the pipeline route intersects the wetland areas to reduce direct impacts to the watercourses. It is the opinion of the specialist that the project may be favourably considered for authorisation, on condition that all prescribed mitigation measures are implemented.

1 Introduction

1.1 Background

The Biodiversity Company was commissioned to conduct a freshwater functional and impact assessment in support of the water use and environmental authorisation process for the proposed Construction and Maintenance of the New System 1 At Rand Water Vereeniging Treatment Works, Construction and Maintenance Of Approximately 7 Km Phase 2 Sludge Pipeline In Vereeniging, 1.5 Km Sludge Line In Panfontein And Associated Infrastructure Within The Jurisdiction Of Sedibeng District Municipality, Gauteng Province Project. The proposed project entails three separate developments occurring at three locations. The proposed project is located in Vereeniging, a suburb within Emfuleni Local Municipality, Sedibeng District Municipality, Gauteng Province (Figure 1-1). The Project Area will refer to the combined layout of the three developments. A 500 m radius has been demarcated for the project area to facilitate the identification of wetlands and other aquatic features; this area is referred to as the Project Area of Influence (PAOI) (Figure 1-1).

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 a water use authorisation.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations (2014) (amended by GNR 326, 7 April 2017 and GNR. 517, 11 June 2021) 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 the specialist studies is to provide relevant input into the environmental assessment process and provide a report for the proposed activities associated with the project. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

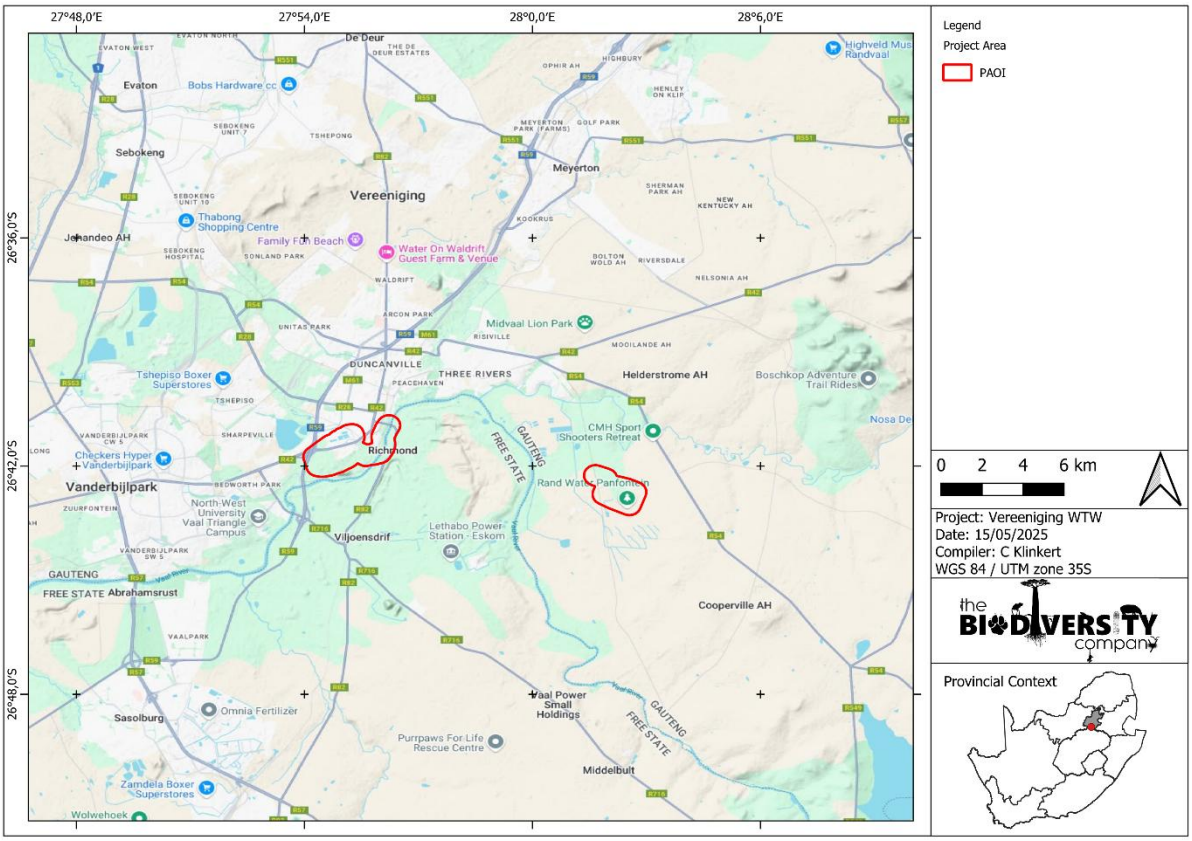

Figure 1-1 Location of the proposed project

1.2 Scope of Work

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

- A desktop assessment of available and related datasets to provide context of the freshwater biodiversity of the project area and to indicate potential wetland areas;
- The delineation, classification and assessment of wetlands within 500 m of the project area, where perceivable and significant risks are potential;
- An assessment of the related impacts through the use of the Risk Assessment (DWS, 2023);
- The provision of recommendations relevant to associated impacts; and
- Report compilation detailing the baseline findings.

1.3 Project Description and Technical Information

The purpose of this background information is to provide information to interested and/or affected parties (I&APs) about the Basic Assessment process, Water Use License Application and the Heritage Permit for the Construction & Maintenance of New System 1 at Rand Water Vereeniging Treatment Works, the Installation of approximately 7 Km Phase 2 Sludge Pipeline in Vereeniging, a 1.5 Km Sludge Line in Panfontein and Associated Infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng Province, South Africa.

The proposed project spans three locations but remains within the jurisdiction of the Servitude of Rand Water within the Sedibeng District Municipality, Gauteng Province, South Africa. The coordinates to the three sites are as follows (refer to the locality maps and the tables below).

The Vereeniging New System 1 at Rand Water Vereeniging Treatment Works will consist of the following infrastructure (but not limited to):

- Construction of a new 250 MLD flocculator and 225 MLD sedimentation tank.
- Installation of the de-sludge bridge.
- Construction of access roads.
- Installation of a raw water pipeline.
- Installation of a sludge pipeline.
- Demolition of System 1 tank (90 MLD) to allow for the installation of a new automated system capable of producing 1400 MLD.
- Construction of a Laboratory and
- The installation of a new Carbon Dioxide dosing Carbonisation Bay.

The Phase 2 Sludge Pipeline in Vereeniging will consist of the following infrastructure:

- Phase 2 of the sludge pipeline starts from the sludge pumping station inside Vereeniging Treatment Works and runs through mostly an established industrial area in the south of Vereeniging.
- The proposed sludge pipeline runs alongside as well as across some of these services, which also include Rand Water Bulk Water Pipelines to the Vaal River Crossing.
- The installation of approximately 7 km in length of 1000mm nominal internal diameter steel sludge pipe with an 8mm wall thickness to be laid from the Vereeniging Pumping Station to the Vaal River Crossing.

The Panfontein Sludge Pipeline will consist of the installation of an interconnection new sludge pipeline with approximately 1.5km in length and 800mm in diameter.

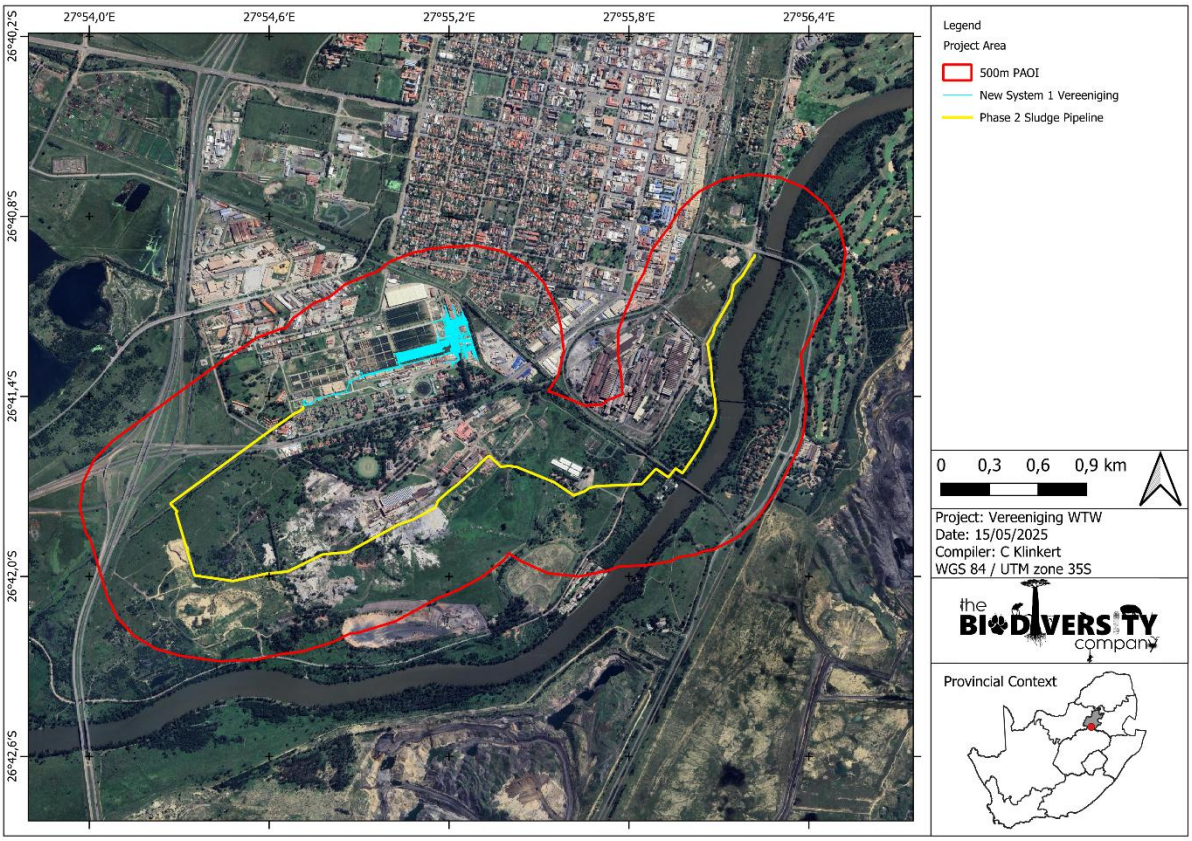

Figure 1-2 Proposed layout and project area of influence

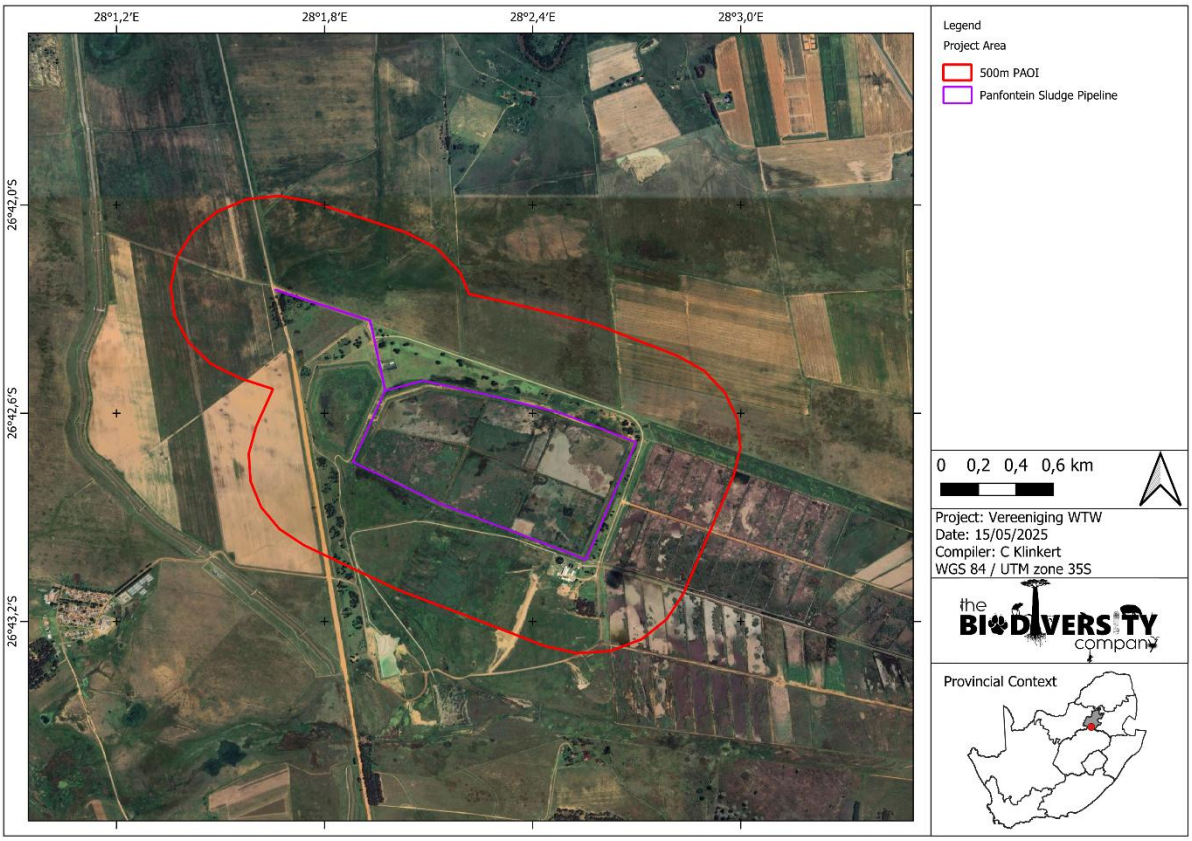

Figure 1-3 Proposed layout and project area of influence

1.4 Assumptions and Limitations

The following aspects were considered as limitations:

- It has been assumed that the spatial files provided to the specialist is accurate;
- Areas characterised by external wetland attributes were the focus for this assessment, where wetlands were thereafter confirmed by soil form indicators
- Areas within the 500 m PAOI were delineated and assessed via desktop where inaccessible. Only features presumed to be at potential risk from the proposed activities were assessed in terms of their ecological characteristics;
- Only natural features were considered for the ecological components of this assessment;
- Only Section 21(c) and 21(i) water uses are applicable to the use of the DWS Risk Assessment Matrix (2023); and
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by a maximum of five meters to either side.

1.5 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements

Region	Legislation / Guideline	Comment
National	National Environmental Management Act (Act No. 107 of 1998) (NEMA)	To provide for the effective protection and controlled utilisation of the environment and for matters incidental thereto.
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), Threatened or Protected Species Regulations	The protection of species and ecosystems that warrant protection.
	National Environmental Management: Waste Act (Act No. 59 of 2008)	The regulation of waste management to protect the environment.
	National Water Act (Act No. 36 of 1998) (NWA)	To provide for the regulation of water uses.
	NWA: Government Notice (GN) 4167 (previously GN 509 of 2016 and GN 3139 of 2023)	Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses and the provision to apply for a General Authorisation subject to usage and outcome of the Risk Assessment Matrix.
	NEMBA: Alien and Invasive Species Regulations (2014) (GNR R598, 1 August 2014) NEMBA: Alien and Invasive Species Lists (2020) (GN 1003, September 2020)	The regulation and management of alien invasive species.
	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)	To provide for control over the utilisation of the natural agricultural resources, including the vegetation and the combating of weeds and invader plants.
Provincial	Transvaal Nature Conservation Ordinance (Act No. 12 of 1998)	To consolidate and amend the laws relating to nature conservation and to provide matters incidental thereto.
	Gauteng Conservation Plan (2022)	The spatial designation of conservation areas and targets within the province.

1.6 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, not just the water itself, constitutes a water 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).

1.7 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.

1.8 Legislative Framework

In line with the protocol for the specialist assessment and minimum report content requirements for environmental impacts on freshwater biodiversity, as per Government Notice 320 published in terms of NEMA, dated 20 March 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" – the following has been assumed:

- An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of:
    - "very high sensitivity" for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment; or
    - "low sensitivity" for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement.

- Where the information gathered from the site sensitivity verification differs from the screening tool designation of “very high” aquatic biodiversity sensitivity, and it is found to be of a “low” sensitivity, an Aquatic Biodiversity Compliance Statement must be submitted; and

- Similarly, where the information gathered from the site sensitivity verification differs from the screening tool designation of “low” aquatic biodiversity sensitivity, and it is found to be of a “very high” sensitivity, an Aquatic Biodiversity Specialist Assessment must be submitted.

An Aquatic / Freshwater Biodiversity Specialist Assessment Report must contain the information as presented in Table 1-2 below.

Table 1-2 Aquatic Biodiversity Specialist Assessment information requirements as per the relevant protocol, including the location of the information within this report

Information to be Included (as per GN 320, 20 March 2020)	Report Section
The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of aquatic sciences	7.3
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae	Pg i
A signed statement of independence by the specialist(s)	7.3
The assessment must be undertaken on the preferred site and within the proposed development footprint	1.3
A baseline description of the aquatic biodiversity and ecosystems on the site, including: aquatic ecosystem types; presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns.	3.1.5
The threat status of the ecosystem and species as identified by the screening tool	-
An indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free-flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area)	3.1.5
A description of the ecological importance and sensitivity of the aquatic ecosystem including: (a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g., movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and (b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater)	3.2.3
The assessment must identify alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate	-
Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present? How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include: (a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); (b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub-catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);	4.1

(c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and (d) to what extent will the risks associated with water uses and related activities change.	
How will the proposed development impact on the functioning of the aquatic feature? This must include: (a) base flows (e.g., too little or too much water in terms of characteristics and requirements of the system); (b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g., seasonal to temporary or permanent; impact of over -abstraction or instream or off stream impoundment of a wetland or river); (c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchanneled valley-bottom wetland to a channelled valley -bottom wetland); (d) quality of water (e.g., due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); (e) fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and (f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g., waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.)	4.1
How will the proposed development impact on key ecosystems regulating and supporting services especially: (a) flood attenuation; (b) streamflow regulation; (c) sediment trapping; (d) phosphate assimilation; (e) nitrate assimilation; (f) toxicant assimilation; (g) erosion control; and (h) carbon storage?	4.1
How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	-
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	2
The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant	7.1
A description of the assumptions made, any uncertainties or gaps in knowledge or data	1.4
The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant	3.3
Additional environmental impacts expected from the proposed development	-
Any direct, indirect and cumulative impacts of the proposed development on site	3
The degree to which impacts and risks can be mitigated	4.2
The degree to which the impacts and risks can be reversed	4.2
The degree to which the impacts and risks can cause loss of irreplaceable resources	3
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies	3.3
Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr)	4.2
A motivation must be provided if there were development footprints identified as having a “low” aquatic biodiversity sensitivity and that were not considered appropriate	-
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	**5.2**
Any conditions to which this statement is subjected	**5.2**

2 Fieldwork

A field survey for the area was undertaken on the 9th of April 2025, which is an early dry-season survey, to identify the presence of freshwater features (including wetlands) and to delineate their spatial extents. The seasonality is not considered to be a limiting factor to the assessment and the results of this assessment are conclusive.

3 Results & Discussion

3.1 Desktop Dataset Assessment

3.1.1 Vegetation

The PAOI is situated in the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

a. Seasonal precipitation; and
b. The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees.

On a fine scale, the PAOI overlaps with the Soweto Highveld Grassland and the Central Free State Grassland vegetation types.

3.1.2 Climate

The dominant vegetation type within the PAOI (Soweto Highveld Grassland) was used to draw inferences on the climate of the area. The climate is categorised by summer rainfall, and cool-temperate winter temperatures. Frost frequently occurs in these areas, with large thermic diurnal differences (Figure 3-1; Mucina & Rutherford, 2006).

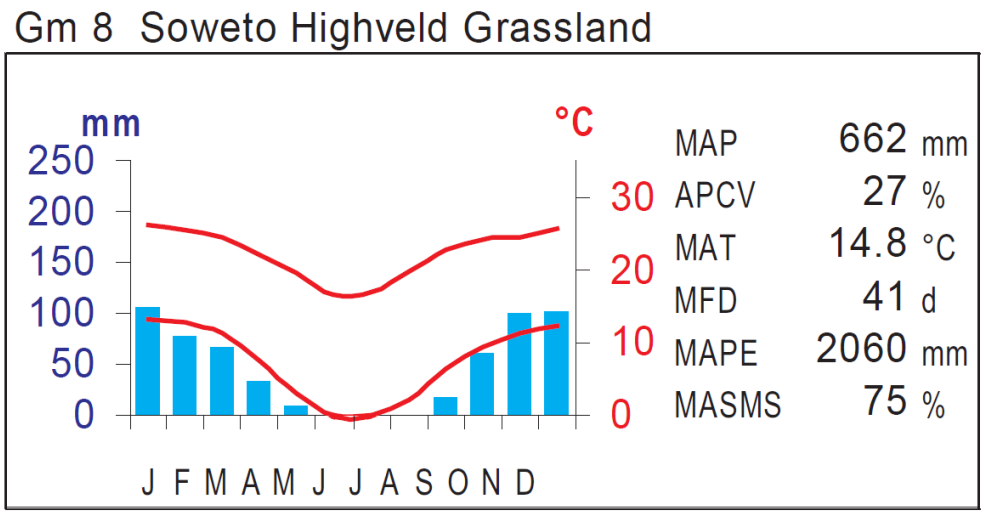

Figure 3-1 Climate for the project area based on the Soweto Highveld Grassland (Mucina & Rutherford, 2006)

3.1.3 Soils and Geology

According to Mucina and Rutherford (2006) the geology of the Soweto Highveld Grassland includes shale, sandstone or mudstone of the Madzaringwe Formation or the intrusive Karoo Suite dolerites which feature prominently in the area. In the south, the Volksrust Formation (Karoo Supergroup) is

found and in the west, the rocks of the older Transvaal, Ventersdorp and Witwatersrand Supergroups are most significant. Soils are deep, reddish on flat plains and are typically Ea, Ba and Bb land types.

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is located within the Bb 23, Ba 31 and Ca 1 land types.

3.1.4 Hydrological Characteristics

The PAOI falls within the Highveld Ecoregion, within the Vaal_Orange Water Management Area (WMA). At a finer scale, within the C22F and C21G quaternary catchment areas. Additionally, the topographical data for the area presents one non-perennial and one perennial river line which overlap with the PAOI. Moreover, three Inland Water Area features overlap with the PAOI, namely a sewage works, a large reservoir and a dam (Figure 3-2 and Figure 3-3)

The fine scale hydrological features are presented in the following section:

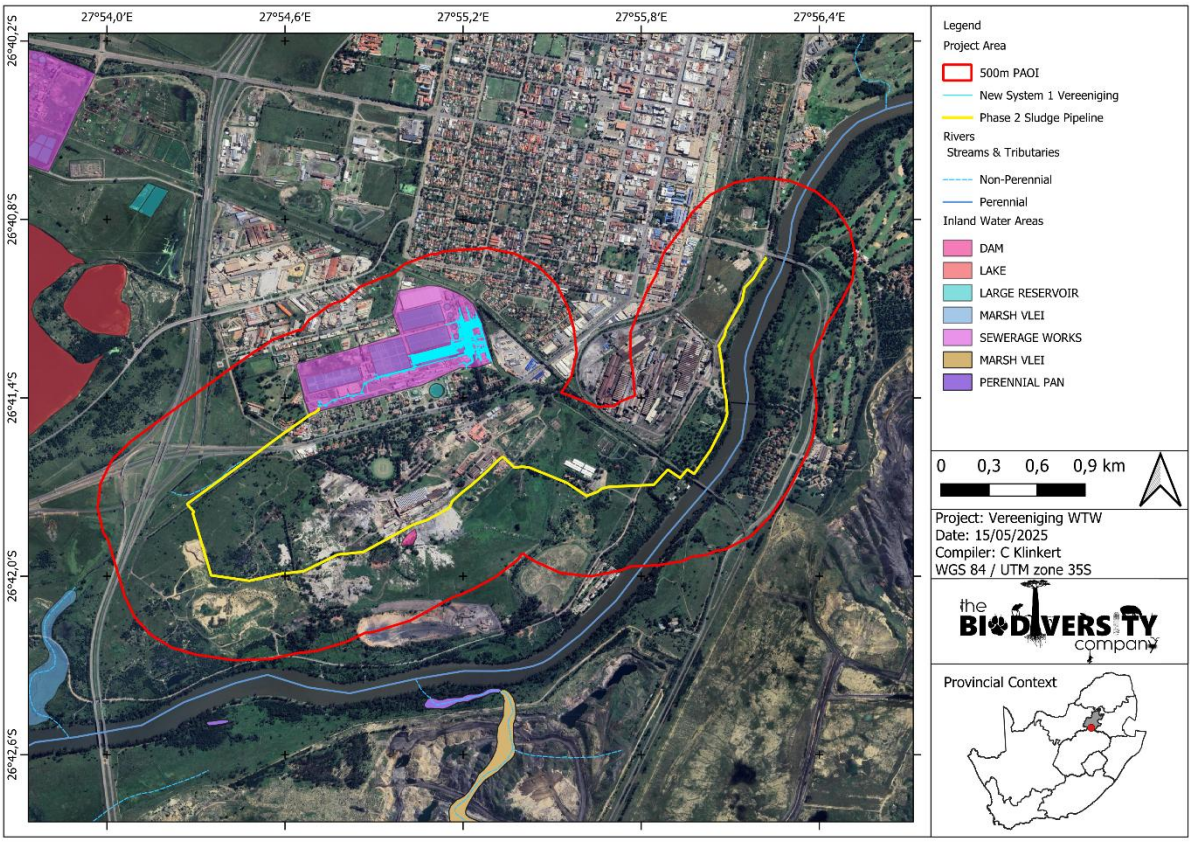

Figure 3-2 Topographical features and Inland Water Areas identified within the project area of influence

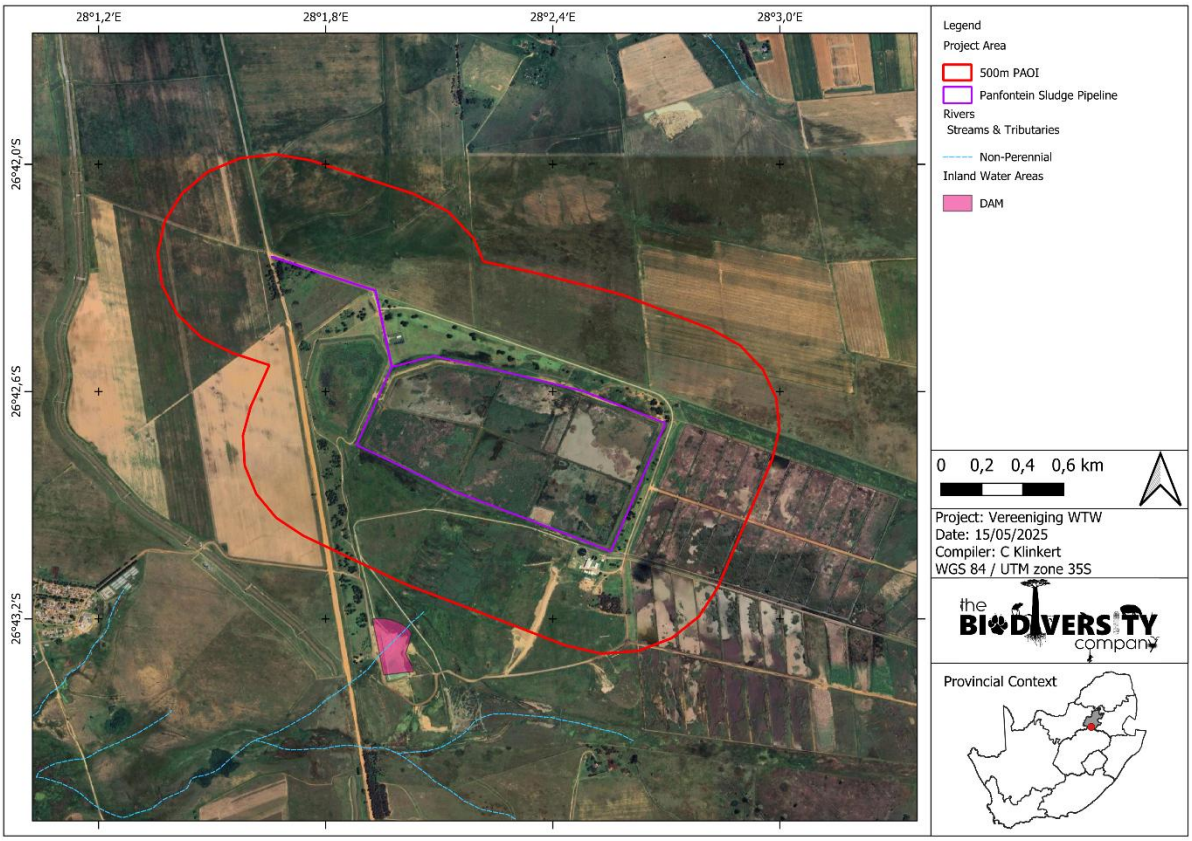

Figure 3-3 Continued topographical features and Inland Water Areas identified within the project area of influence

3.1.5 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features is summarised in Table 3-1. Only features that were identified to be relevant to the proposed project were further discussed.

Table 3-1 Summary of relevance of the proposed project to ecologically important landscape features

Desktop Information Considered	Relevant/Irrelevant	Section
South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	Relevant – PAOI overlaps with SAIIAE wetlands and river.	3.1.5.1
National Freshwater Priority Area	Relevant – PAOI overlaps with NFEPA wetlands and river.	3.1.5.2
Provincial Conservation Plan	Relevant – PAOI overlaps with CBA and ESA areas.	3.1.5.3
Strategic Water Source Areas	Irrelevant – PAOI does not overlap with a SWSA.	-

3.1.5.1 South African Inventory of Inland Aquatic Ecosystems

Wetlands and Rivers were identified using the South African Inland Inventory of Aquatic Ecosystems (SAIIAE; NBA, 2018) dataset. The identified watercourses along with their Classification, Condition, Ecosystem Threat Status (ETS) and Ecosystem Protection Level (EPL) are presented in the table below.

Table 3-2 Summary of identified SAIIAE watercourses and their characteristics

Wetland classification	Condition	Threat status (2018)	Protection level (2018)
Seep	D/E/F – Largely/ Seriously/ Critically Modified	Critically endangered	Not protected
Perennial river (Vaal)	D – Largely Modified	Critically endangered	Poorly protected

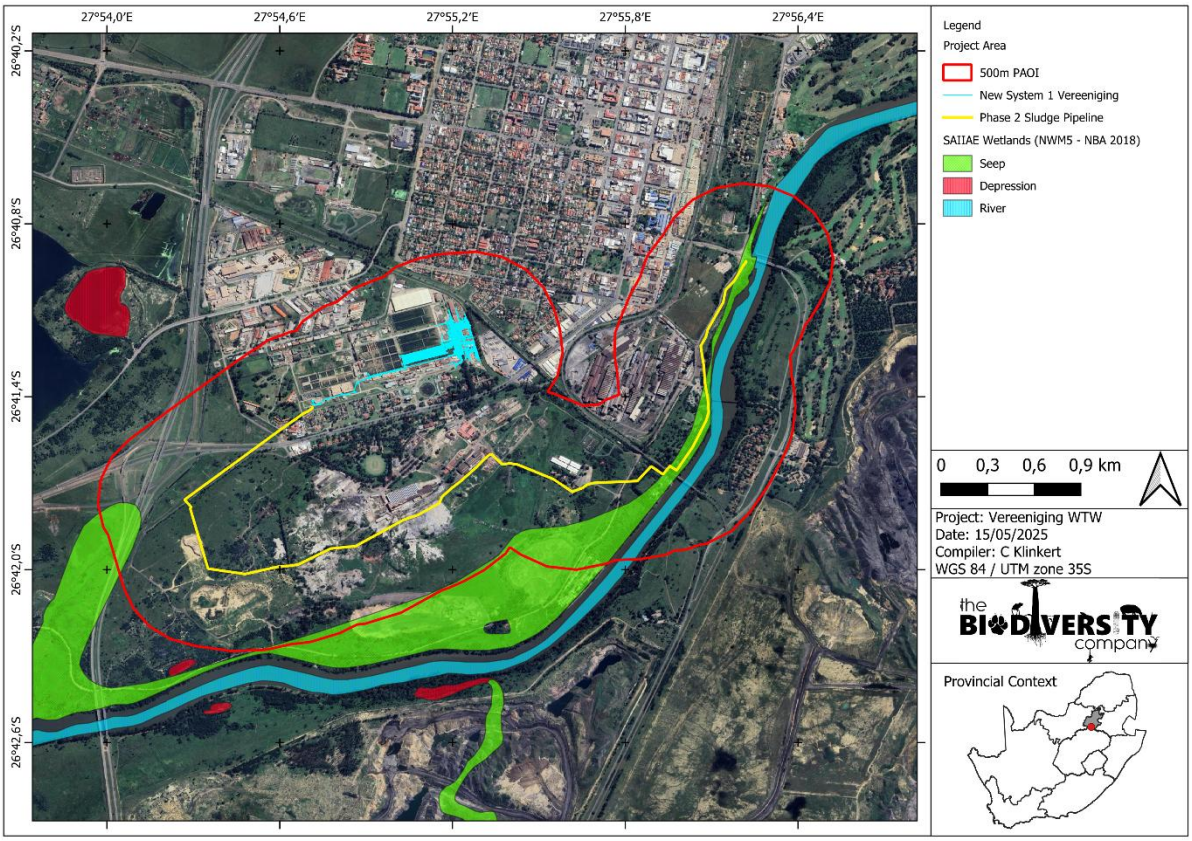

Figure 3-4 Watercourse features identified within the project area of influence according to the SAIIAE dataset

3.1.5.2 National Freshwater Ecosystem Priority Ecosystems

Three watercourse types have been identified within the PAOI, namely a valleyhead seep, a floodplain wetland and a river system (Vaal) (Figure 3-5). The river has been classified as a perennial river, and is within the D – Largely Modified condition category.

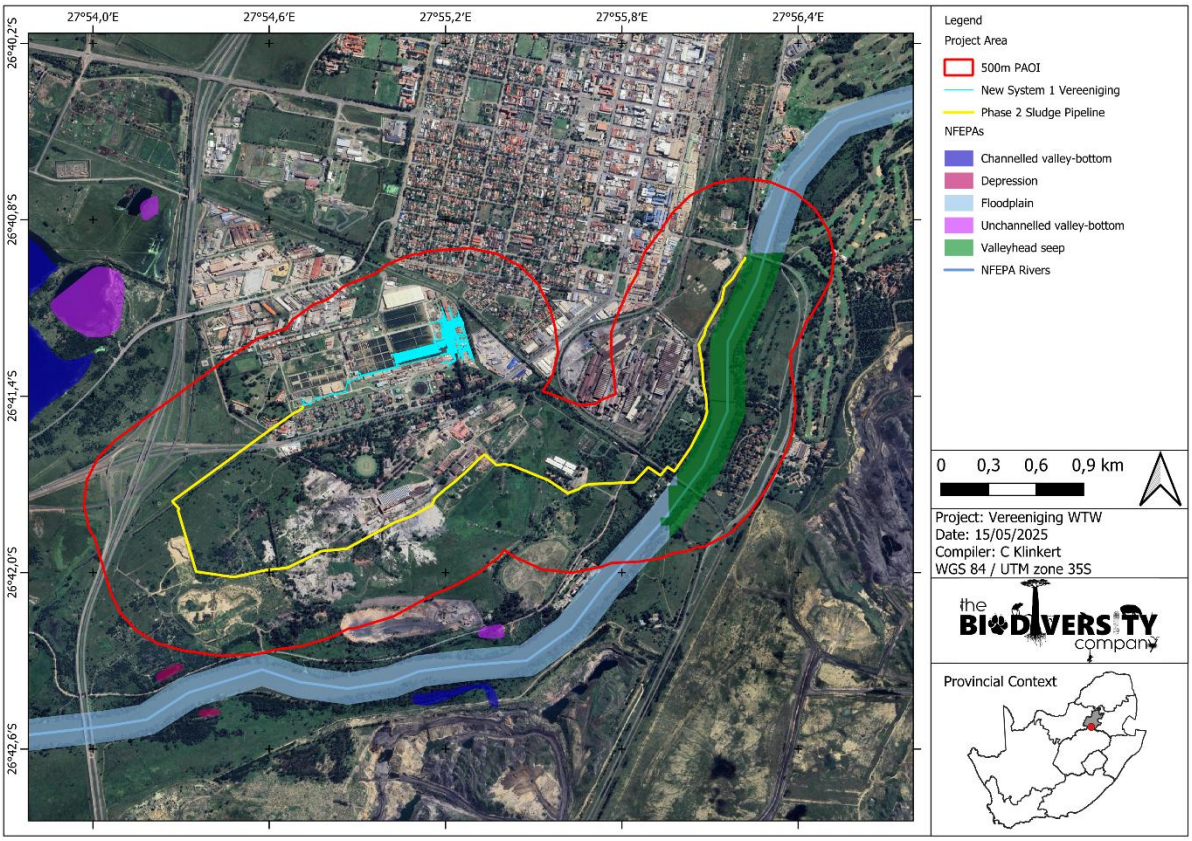

Figure 3-5 Wetland and River features identified within the project area of influence according to the National Freshwater Ecosystem Priority Ecosystems dataset

3.1.5.3 Provincial Biodiversity Sector Plan

The conservation plan for Gauteng Province is based on the Gauteng C-Plan V3.3, According to the Gauteng Biodiversity Sector Plan (GDARD, 2014) (Figure 3-6), the PAOI intersects with Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA). The Critical Biodiversity Areas are comprised of key areas that are required to meet national biodiversity pattern and process targets. Ecological Support Areas are areas required to prevent the degradation of Critical Biodiversity Areas and Protected Areas.

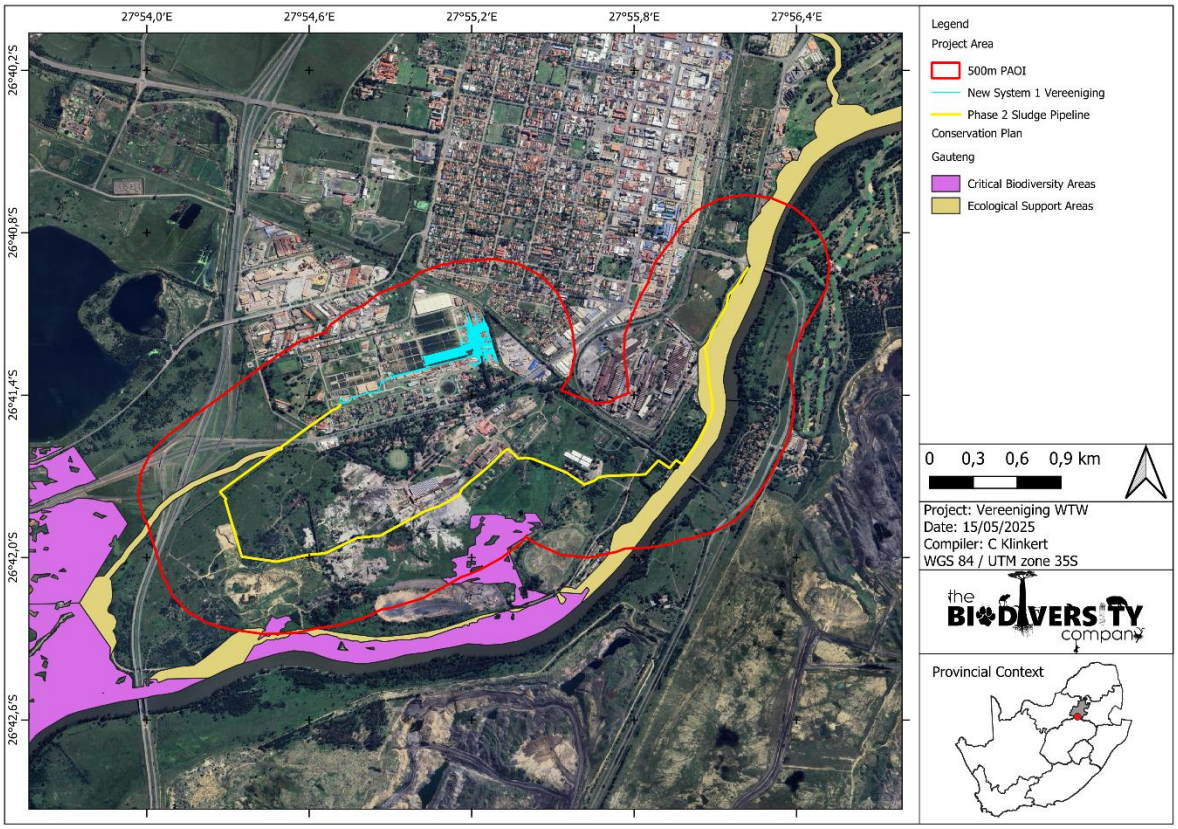

Figure 3-6 Gauteng Biodiversity Sector Plan overlayed with the project area of influence

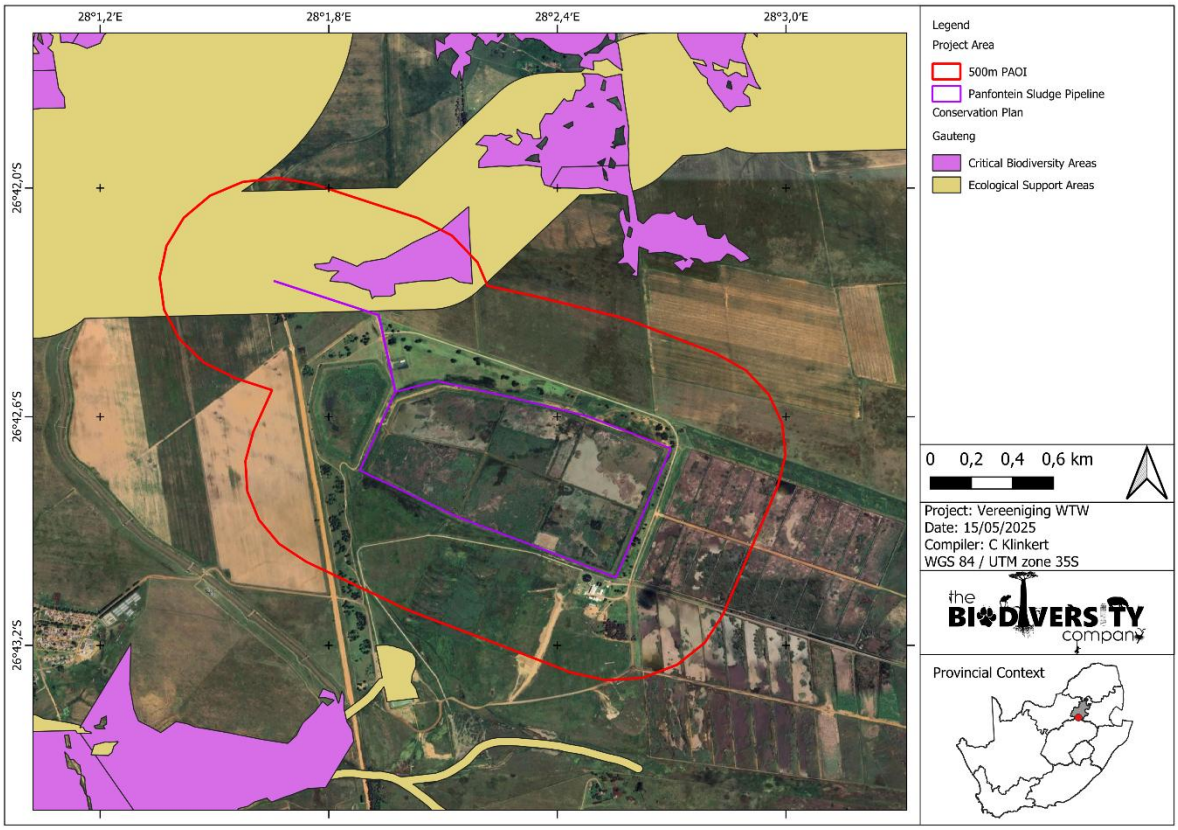

Figure 3-7 Continued Gauteng Biodiversity Sector Plan overlayed with the project area of influence

3.2 Wetland Ecology Survey

3.2.1 Delineation

Two types of watercourse features were identified within the encompassing 500 m PAOI, categorized into ten hydrogeomorphic (HGM) units. These were classified as one perennial river system (HGM 1), namely the Vaal River, and nine seep wetlands (HGM 2 - 9) (Figure 3-8 and Figure 3-9). Additionally, canals were identified within the PAOI, which are not considered to be natural features and have been not been included within the functional wetland assessments.

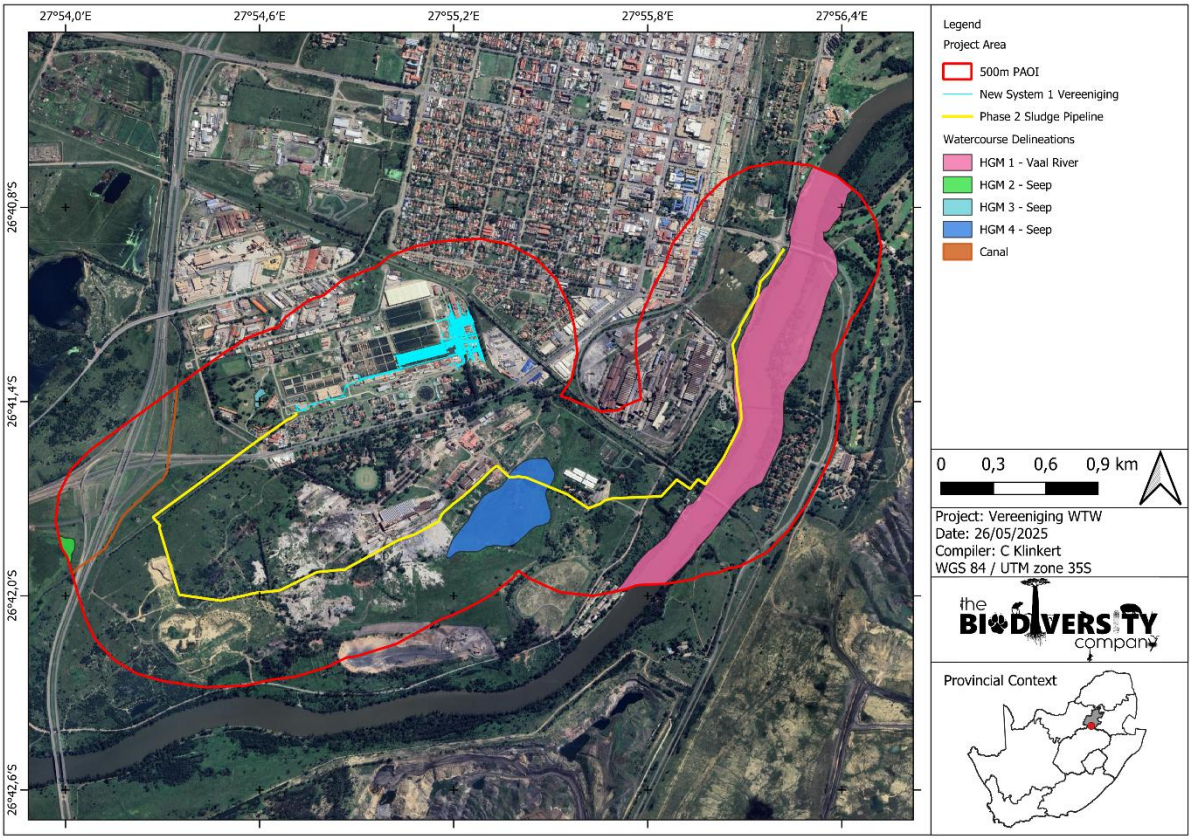

Figure 3-8 Delineations of the watercourse features within the project area of influence

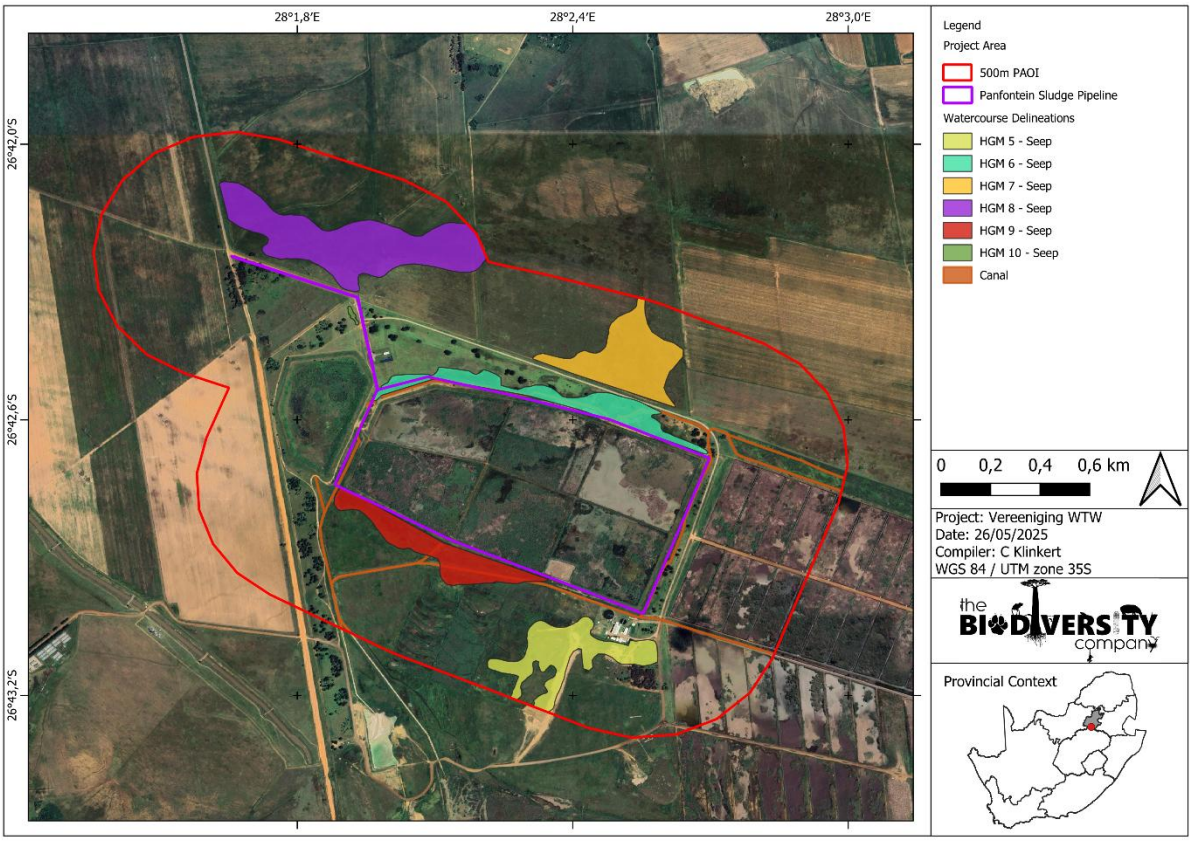

Figure 3-9 Continued delineations of the watercourse features within the project area of influence

Figure 3-10 Representative photographs of wetlands within the PAOI. A) Vaal River; B) & C) Seep wetlands; and D) Artificial canal

3.2.2 Classification and Description

The wetland classification as per SANBI guidelines (Ollis *et al.,* 2013) is presented in Table 3-3.

Table 3-3 Wetland classification as per SANBI guideline (Ollis et al., 2013)

Wetland Type	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
HGM 1	Inland	Vaal_Orange	Dry Highveld Grassland Group 4	Valley Floor	River	Lowland river	Active channel
HGM 2 - 9				Slope	Seep	Without chanelled outflow	N/A

Rivers are linear landforms with distinct beds and banks that carry concentrated, unidirectional water flow either permanently or periodically, encompassing both the active channel and riparian zone (Ollis et al., 2013). Hydrological inputs include concentrated surface flows from upstream channels and tributaries, diffuse surface or subsurface flows from seepage wetlands, interflow from valley side-slopes, and groundwater inflow via springs. Water moves through the system as concentrated flow, exiting primarily as downstream discharge, with additional losses through evapotranspiration and infiltration.

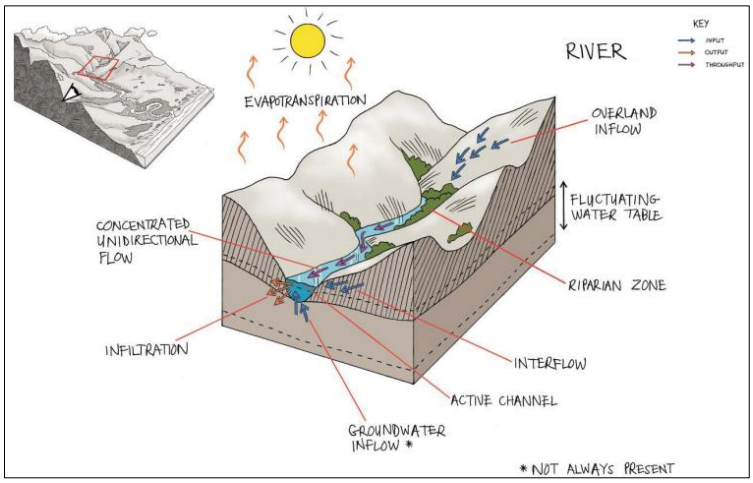

Figure 3-11 Amalgamated diagram of a typical channelled valley-bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al., 2013)

A typical hillslope seep is located within slopes, as mentioned in Figure 3-12. Isolated hillslope seeps are characterised by colluvial movement of material. These systems are fed by very diffuse sub-surface flows which seep out at very slow rates, ultimately ensuring that no direct surface water connects this wetland with other water courses within the valleys. Figure 3-12 illustrates a diagram of the hillslope seeps, showing the dominant movement of water into, through and out of the system.

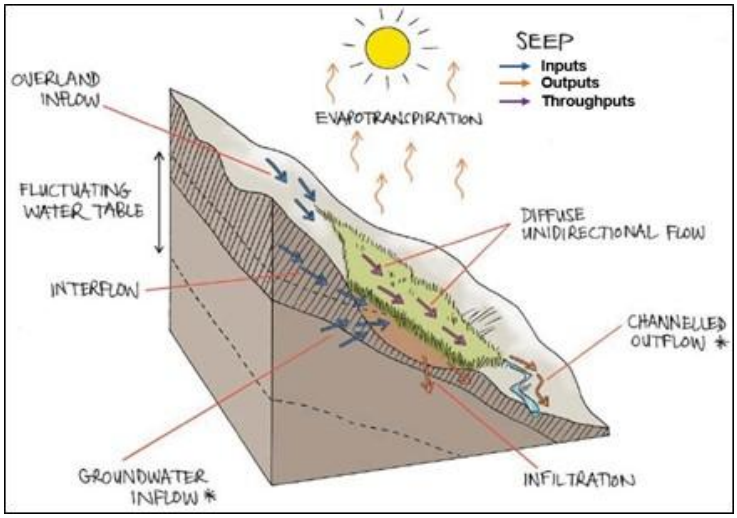

Figure 3-12 Amalgamated diagram of a typical hillslope seep, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

3.2.3 Functional Assessment

3.2.3.1 Ecosystem Services

The ecosystem services provided by the relevant wetland units on site were assessed and rated using the WET-EcoServices method (Kotze *et al.,* 2008). The results of the assessment are presented in Table 3-4. The ecosystem services scores of the delineated wetlands ranges from “Low” to “High”. Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation, erosion control, and provision of cultivated foods, and provision of water resources (Vaal River).

Table 3-4 Summary of the average ecosystem scores of the assessed wetland units

High	Intermediate	Moderately Low	Low
HGM 1	HGM 2	HGM 5	HGM 3
	HGM 4	HGM 6	HGM 10
	HGM 8	HGM 7	
		HGM 9	

3.2.4 Present Ecological State

The wetlands exhibited different degrees of modification resulting from natural physical changes as well as anthropogenically induced impacts at both the local and catchment level. Resultingly, the wetlands have scored an average Present Ecological State (PES) score within the “D – Largely Modified” and “E – Seriously Modified” classes.

Table 3-5 Average Present Ecological State scores for the assessed wetlands

Largely Modified	Seriously Modified
HGM 1	HGM 3
HGM 2	HGM 5
HGM 4	HGM 9
HGM 6	HGM 10
HGM 7	
HGM 8	

3.2.5 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) assessment was applied to the different wetland types, to assess the levels of sensitivity and ecological importance of the wetlands. Various components pertaining to the protection status of a wetland is considered for the EIS, including Strategic Water Source Areas (SWSA), the NFEPA wet veg protection status and the protection status of the wetland itself considering the NBA wetland dataset (Table 3-6). The EIS of the wetlands were determined to be High for the perennial river (HGM 1) and Moderate for the seep wetlands (HGM 2 -10).

Table 3-6 Aspects considered in the Ecological Importance and Sensitivity assessment

HGM Type	NFEPA Wet Veg			NBA Wetlands			SWSA (Y/N)	CBA / ESA (Y/N)	Overall EIS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level			
HGM 1 (River)	Dry Highveld Grassland Group 4	Critically Endangered	Not Protected	D – Largely Modified	Critically Endangered	Poorly Protected	N	Y (CBA)	High
HGM 2 – 10 (Seep)		Critically Endangered	Not Protected	D/E/F – Largely/Seriously/ Critically Modified	Critically Endangered	Not Protected	N	Y (CBA & ESA)	Moderate

3.2.6 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 the wetland feature within the site, had underwent transformation as a result of historical and current impacts. Nevertheless, despite the altered ecological integrity of the systems,

they are considered to provide important ecological services. The objective for the assessed wetlands is described in the table below (Table 3-7).

Table 3-7 Recommended Ecological Category and Management Objectives for the assessed wetlands

Wetland Unit	REC	RMO
HGM 1	C/D	Improve
HGM 2, 4, 6, 7 & 8	D	Maintain
HGM 3, 5, 9 & 10	E/F	Maintain

3.3 Buffer Requirements

The “Buffer zone guidelines for wetlands, rivers and estuaries” (Macfarlane et al., 2014) was used to determine the appropriate watercourse buffer zones for the proposed activity. The buffer guideline of Macfarlane et al. (2014) enables the user to take into account the level of assessment as well as the proposed development and then generate a preliminary threat rating and buffer.

Using the buffer guidelines (Macfarlane, et al. 2014) the prescribed pre-mitigation buffer is 32 m for all wetlands identified within the 500 m regulated area (HGM 1 – 10). Following mitigation measures, the wetland buffers can be reduced to 25 m for HGM 1, and 15 m for the remaining seep wetlands (HGM 2 – 10) displayed in the table (Table 3-8) and figures below (Figure 3-13 and Figure 3-14).

Table 3-8 Post-mitigation buffer requirement

Wetland	Pre-mitigation Buffer (m)	Post-mitigation Buffer (m)
HGM 1	32 m	25 m
HGM 2 - 10	32 m	15 m

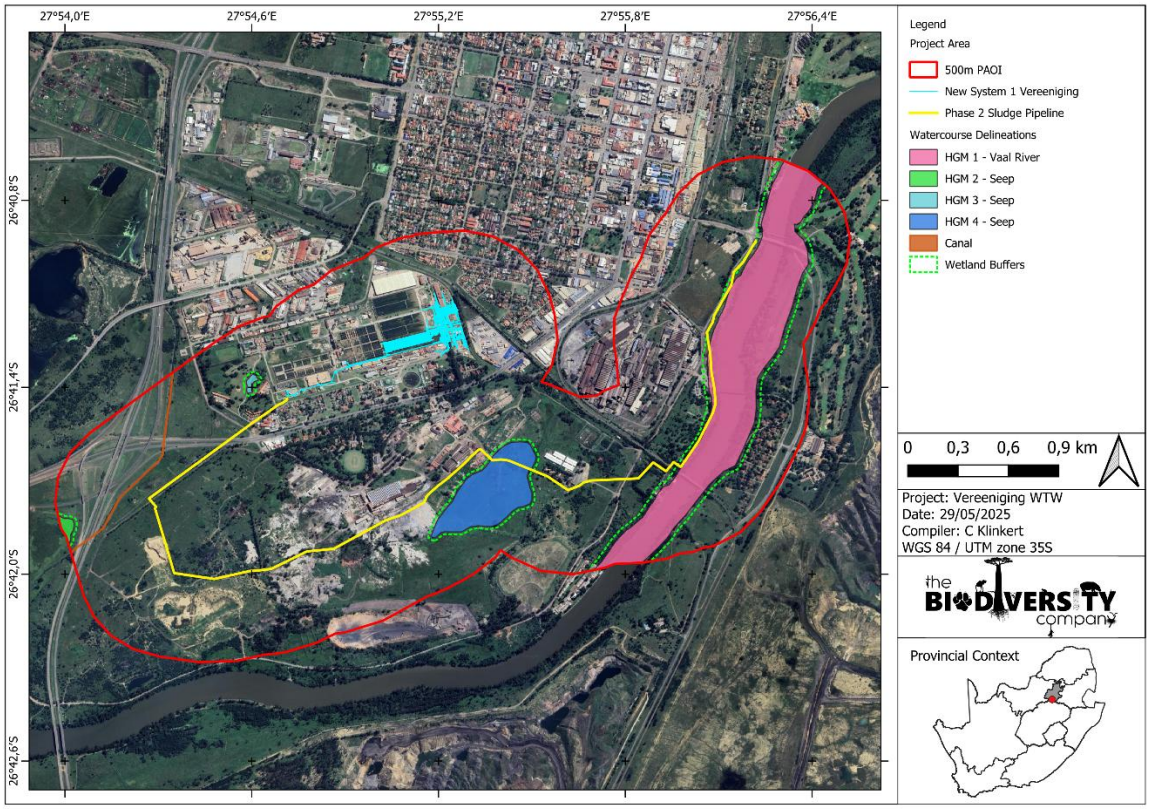

Figure 3-13 Wetland buffer zones for the identified watercourse features within the project area of influence

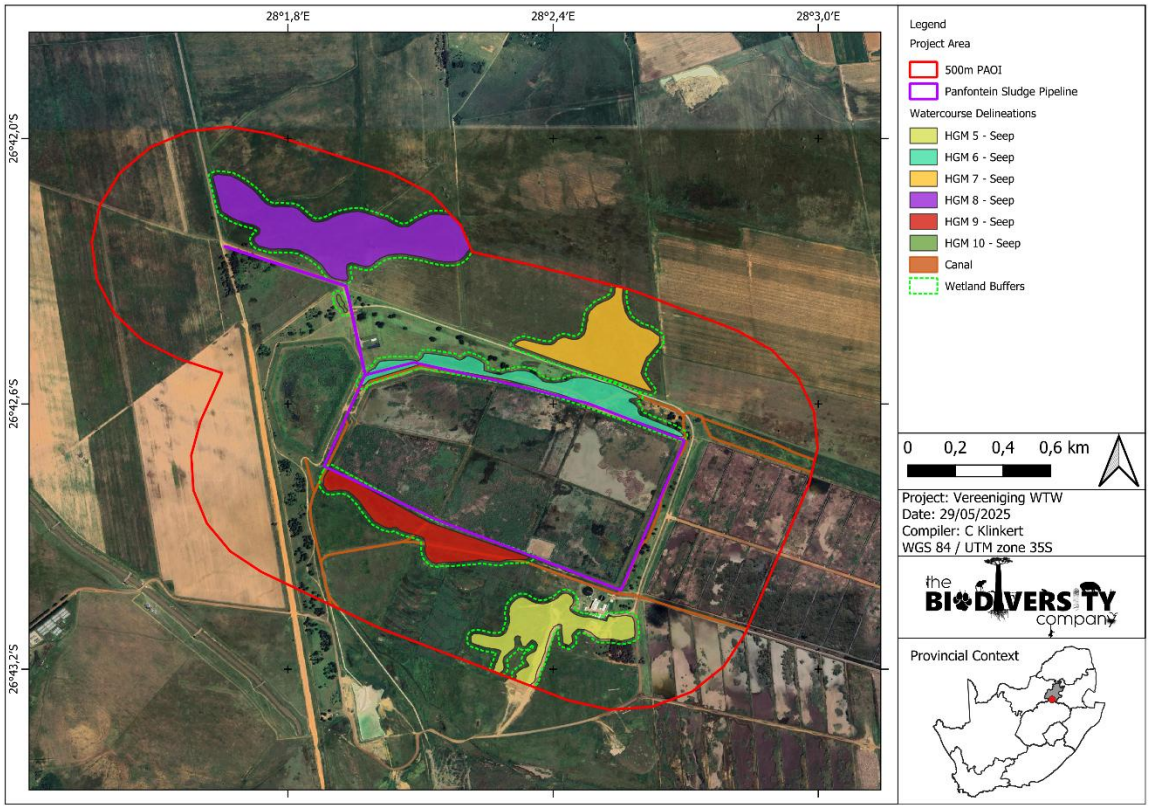

Figure 3-14 Continued wetland buffer zones for the identified watercourse features within the project area of influence

3.3.1 Regulation Zones

Table 3-9 presents the legislated zones of regulation that would be applicable to the wetland areas.

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 applicable 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.

Table 3-9 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.”

4 Risk and Impact Assessment

4.1 Risk Assessment

The risk assessment considered both direct and indirect impacts to the wetland systems identified within the 500 m regulated area of the proposed development. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the assessment (Figure 4-1). 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 phasing to avoid impacts. In this case, the road intersects several wetland features, therefore minimisation of impacts will be the preferred mitigatory response for the project.

A single risk assessment was compiled for the project. A decommissioning phase for the proposed development was not considered due to the longevity of the facility. It has been assumed the project will avoid the identified wetlands, and therefore only indirect risks are considered.

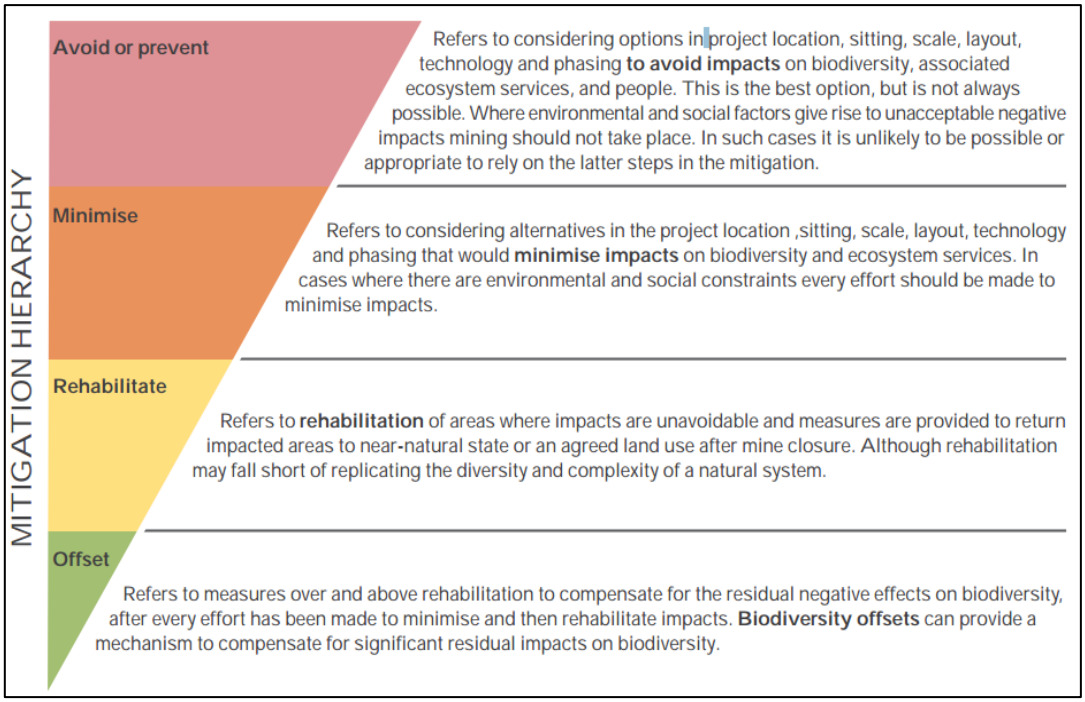

Figure 4-1 The mitigation hierarchy as described by the DEA (2013)

4.1.1 Potential Aniticipated Impacts

Table 4-1 illustrates the potential aspects expected to threaten the integrity of sensitive receptors during the activities associated with the proposed development. The post- mitigation significance ratings have been calculated considering various parameters, these results are presented in the subsequent tables.

Table 4-1 Aspects and impacts relevant to the proposed activity

Phase	Activity	Impact
Construction	Clearing of vegetation for project infrastructure	Direct and indirect loss of wetlands;
	Alteration of surface topography (excavations, reshaping and compacting)	Erosion of wetland and induced increase in sediment and turbidity of downstream river;
	Stormwater management (potential erosion and sedimentation)	Loss of natural vegetation;
	Alteration of hydrodynamic patterns due to excavations	Displacement of fauna and flora;
	Waste and ablution facilities	

	Storage of chemicals, mixes, and fuels with associated accident spills	Water quality impairment from stochastic spills and inputs from construction activities; Pollution from waste disposal; Altering overland flow characteristics; Deposition of dust; and Decrease in overall functionality.
	Indiscriminate dumping of waste products or construction materials	
	Soil stockpiling and building material stockpiles	
	Operation of vehicles, equipment, and machinery	
	Construction and upgrade of access roads	
	Final landscaping and reshaping	
Operational	Potential bursts or leaks of treated water	
	Conducting routine maintenance of servitude	

Anthropogenic activities drive habitat destruction causing displacement of aquatic and terrestrial fauna and flora. Land clearing for development infrastructure (all inclusive) destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines and their associated riparian area, or other locally important features such as off channel wetlands (where present).

It is anticipated that the project will pose “Low” post-mitigation risks, provided that the suggested mitigations are implemented.

A decommissioning phase for the proposed development was not considered as the development is anticipated to have an extensive longevity.

Table 4-2 Summative results of the Risk Assessment conducted for the proposed project

Phase	Activity	Impact	Significance (max = 100)	Risk Rating
CONSTRUCTION	<1> Clearing of vegetation for project infrastructure	<1a>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**24**	**L**
		<1b>Loss of natural vegetation	**38,4**	**M**
		<1c>Displacement of fauna and flora	**22,4**	**L**
		<1d>Decrease in overall functionality	**24**	**L**
	<2>Alteration of surface topography (excavations, reshaping and compacting)	<2a>Direct and indirect loss of wetlands	**38,4**	**M**
		<2b>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**24**	**L**
		<2c>Altering overland flow characteristics	**28,8**	**L**
		<2d>Decrease in overall functionality	**12**	**L**
	<3>Stormwater management (potential erosion and sedimentation)	<3a>Direct and indirect loss of wetlands	**16,8**	**L**
		<3b>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**25,6**	**L**
		<3c>Altering overland flow characteristics	**22,4**	**L**
	<4>Alteration of hydrodynamic patterns due to excavations	<4a>Direct and indirect loss of wetlands	**25,6**	**L**
		<4b>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**24**	**L**
		<4c>Altering overland flow characteristics	**28,8**	**L**
		<4d>Decrease in overall functionality	**12**	**L**
	<5>Waste and ablution facilities	<5a>Water quality impairment from stochastic spills and inputs from construction activities	**16,8**	**L**
		<5b>Pollution from waste disposal	**16,8**	**L**
	<6>Storage of chemicals, mixes, and fuels with associated accident spills	<6a>Water quality impairment from stochastic spills and inputs from construction activities	**16,8**	**L**
	<7>Indiscriminate dumping of waste products or construction materials	<7a>Pollution from waste disposal	**16,8**	**L**

	<8>Soil stockpiling and building material stockpiles	<8a>Direct and indirect loss of wetlands	**22,4**	**L**
		<8b>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**22,4**	**L**
		<8c>Deposition of dust	**16**	**L**
	<9>Operation of vehicles, equipment, and machinery	<9a>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**12**	**L**
		<9b>Deposition of dust	**12**	**L**
	<10>Construction and upgrade of access roads	<10a>Direct and indirect loss of wetlands	**28,8**	**L**
		<10b>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**25,6**	**L**
		<10c>Loss of natural vegetation	**24**	**L**
		<10d>Displacement of fauna and flora	**24**	**L**
		<10e>Altering overland flow characteristics	**28**	**L**
		<10f>Decrease in overall functionality	**22,4**	**L**
	<11>Final landscaping and reshaping	<11a>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**22,4**	**L**
		<11b>Displacement of fauna and flora	**16,8**	**L**
		<11c>Proliferation of alien invasive species due to surrounding disturbances	**25,6**	**L**
		<11d>Altering overland flow characteristics	**16,8**	**L**
		<11e>Deposition of dust	**12**	**L**
OPERATIONAL	<1>Potential bursts or leaks of water	<1a>Direct and indirect loss of wetlands	**28.8**	**L**
		<1b>Erosion of wetland and induced increase in sediment and turbidity of downstream river	**28.8**	**L**
		<1c>Altering overland flow characteristics	**24**	**L**
	<2>Conducting routine maintenance of servitude	<2a>Direct and indirect loss of wetlands	**9.6**	**L**
		<2b>Displacement of fauna and flora	**9.6**	**L**

4.2 Mitigation Measures

In light of the expected impacts from proposed activities the following mitigation measures have been proposed to lower the intensity of the impacts on the ecological integrity of the wetlands and any downslope wetland features.

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

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community of the river and wetland areas;
- Limit the construction area to the defined project areas and only impact those areas where it is unavoidable to do so otherwise;
- Implement non-impactful construction and installation methods to prevent direct impacts to the wetland systems where the proposed pipeline routes cannot fully avoid wetland areas. E.g.) pipeline on stilts; and
- Conduct regular maintenance and monitoring on the pipeline and associated infrastructure to reduce the risks of operational impacts

4.2.1.1 Development Specific Mitigation

The following development specific mitigation measures (based on the current information provided to the specialist) are provided:

- The development footprint area must be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- The footprint area must be aligned in existing pipeline reserves wherever possible. Disturbed areas should be sought as the preferred alignment area;
- The pipeline must be aligned as close to any existing pipeline routes as possible;
- Pipeline trenches and sandy bedding material may produce preferential flow paths for water across the project area perpendicular to the general direction of flow instead of angle. This risk can be reduced by installing clay plugs at intervals down the length of the trench to force water out of the trench and down the natural topographical gradient;
- Pipelines crossing wetland areas should preferably be buried underground at a sufficient depth below ground level such that the pipelines do not interfere with surface water movement or create obstructions, where flows can cause erosion;
- If pier support structures are needed for the pipeline to span a wetland or river, then piers should be placed outside of preferential flow paths with the least number of pier structures used as possible;
- Contamination of aquatic systems with unset cement or cement powder should be negated as it is detrimental to aquatic biota. Pre-cast structures should be made use of (where possible) to avoid the mixing of these materials on site, reducing the likelihood of cement in the river system;
- During the excavation of trenches, flows should be diverted around active work areas where required. Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion;
- Cut off valves should be placed at regular intervals to shut down the pipeline in case of leaks, bursts and repairs;
- The pipeline should be regularly inspected (quarterly) for any signs of failure, damage or leaks. Maintenance measures need to be implemented upon finding pipeline issues and failures.
- Adherence to the buffer areas. These should be visibly demarcated to avoid encroachment into these areas;
- Silt traps and sediment trapping berms must be in place around drainage lines around the construction site to prevent the movement of contaminated or sediment laden runoff from entering the wetlands;
- Erosion prevention and sediment control measures (wetland and instream) are imperative and need to be implemented throughout the entire project footprint area. Temporary erosion control methods may include silt fences, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching;

- All removed soil and material must not be stockpiled within the watercourse and buffers. Stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.

4.2.1.2 Impaired Water Quality

The following water quality specific mitigation measures are provided:

- All construction activities must be undertaken during the low flow (dry season) period as much as possible to limit surface flow transporting contaminants to the surrounding watercourse habitat;

- Construction areas, laydown yards, camps and storage areas should not extend beyond the demarcated development areas, and the riparian and watercourse areas must be marked as “restricted” in order to prevent the unnecessary impact too and loss of these systems;

- The overflow basin that intercepts high peak flows that cannot be handled by the installed equipment must be regularly inspected for signs of failure with immediate corrective actions taken to address areas of failure. This will limit pollution events in the receiving watercourse;

- The overflow basin is subject to sludge accumulation lowering the capacity of the structure. This sludge needs to be removed on a bi-annual basis or more frequently should increase frequency be required to create additional capacity;

- The pipeline and associated infrastructure should be regularly serviced to avoid damage or failure of the WTW plant during critical periods and subsequent increased pollution input events in the receiving watercourse;

- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;

- During construction contractors used for the project must have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;

- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;

- As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site;

- All chemicals and toxicants during construction must be stored in bunded areas;

- All machinery and equipment should be inspected regularly for faults and possible leaks; these should be serviced off-site;

- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation and watercourse);

- No dumping of construction material on-site may take place;

- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported;

- A suitable stormwater plan must be compiled for the facility and implemented during the construction phase. This plan must attempt to displace and divert stormwater from the project area and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced with energy dissipaters and flows discharged into the local watercourses. This plan must be ongoing and adaptive based on on-site conditions. All stormwater infrastructure must be monitored and maintained addressing areas on non-efficacy;

- It is preferred that during the operation phase, stormwater flows should pass through vegetated wetlands and channels with stepped and vegetated swales for flow attenuation and phytoremediation before entering the watercourse;

- During operation, the infrastructure must be routinely monitored for maintenance needs for the life of the project. It is advisable that monitoring occur weekly during the dry season and daily during the wet season to identify any system failure which could lead to contamination of the groundwater and surrounding water courses;

- During operation of the sludge pipelines, all infrastructure must be properly and regularly managed, maintained and operated throughout the life of the project;

- Any leaks and failures of the pipeline infrastructure must be fixed immediately and areas rehabilitated as needed;

- The existing plant and equipment must be brought up to full operational capacity;

- An independent freshwater professional should be appointed to monitor and audit the WTW plant and associated infrastructure on a regular basis to ensure the functioning and health of the identified watercourses are not impacted from the proposed development and all corrective mitigation and rehabilitation measures have been implemented.

4.2.1.3 Erosion and sedimentation of catchment and downstream watercourses

The alteration of surface topography and hydrology for the project infrastructure will inevitably be accompanied by an increase in erosion and sedimentation as rainwater erodes and washes exposed soils (active working and exposed areas) into the downslope watercourses. This is a key consideration for the project due to the high erodibility of the catchment soils, and current levels of exposed soils and instream sedimentation.

Mitigation:

- Loose soils are particularly prone to loss due to wind or water. It is therefore preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces;

- Practice good soil management across the construction footprint;

- Avoid the creation of concentrated flow paths wherever possible;

- Devise and implement a suitable stormwater management plan for the construction and operation phases;

- Signs of erosion must be addressed immediately to prevent further erosion of the area to prevent head cut erosion from forming;

- 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;

- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;

- Relandscape to gentler gradients and re-vegetate all cleared areas, which includes the areas adjacent to the proposed infrastructure, as soon as possible to limit erosion potential. Sandbags and geotextiles should be used to assist until vegetation has established in these reworked areas;

- Stem any head cut/ erosion gulley as it occurs by bulldozing, filling, re-contouring to gentler gradients and re-vegetating; and

- 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.

4.2.1.4 General Mitigation Measures

The following general mitigation measures are provided in addition to the aforementioned mitigation:

- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces;

- The wetland areas outside of the specific project site area must be avoided where possible;

- The project should be relocated to outside of the wetland buffer zones, which would significantly reduce potential impacts to the said systems;

- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;

- Laydown yards, camps and storage areas must be beyond the wetland areas. Where possible, the construction of the aqueduct must take place from the existing paths;

- Prevent uncontrolled access of vehicles through the watercourses that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;

- All chemicals and toxicants to be used for the construction must be stored outside the watercourse areas and their respective buffers and in a bunded area;

- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site in a designated area;

- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;

- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel within the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);

- 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;

- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the watercourse buffers. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;

- Mixing of concrete must under no circumstances take place within the drainage or wetland systems. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished;

- No dumping of construction material on-site may take place;

- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported; and

- Consideration should be given to implementing an alien invasive plant management plan post construction to control any current invaded areas and prevent the growth of alien invasive species on cleared areas.

5 Conclusion

The project is for the proposed Construction and Maintenance of the New System 1 At Rand Water Vereeniging Treatment Works, Installation of Approximately 7 Km Phase 2 Sludge Pipeline in Vereeniging, 1.5 Km Sludge Line in Panfontein and Associated Infrastructure within the Jurisdiction of Sedibeng District Municipality, Gauteng Province Project. A 500 m radius has been demarcated for the project to facilitate the identification of wetlands and other aquatic features.

A single field survey was conducted on the 9th of April 2025. Two types of watercourse features were identified within the encompassing 500 m PAOI, categorized into ten hydrogeomorphic (HGM) units. These were classified as one perennial river system (HGM 1), namely the Vaal River, and nine seep wetlands (HGM 2 - 10). Additionally, artificial canals were identified within the PAOI. The following is summarised for the functional wetland assessments ecology:

- The wetlands have an average PES score within the “D – Largely Modified” and “E – Seriously Modified” classes;
- The EIS of HGM 1 (river) determined to be High, while the seep wetlands (HGM 2 – 10) scored within the moderate category; and
- A post-mitigation buffer width of 25 m is recommended for HGM 1, and 15 m for the remaining seep wetlands.

5.1 Risk and Impact Statement

A risk assessment was conducted for the proposed project. The overall post-mitigation risk status for the project presented within the “Moderate” consequence and significance category, due to the identification of several moderate risks, relating to the construction phase of the development. The remaining risks, including all of the operation risks were scored within the “Low” risk category.

5.2 Specialist Opinion

Considering the assessment findings, no fatal flaws are evident for the proposed project at this stage, however moderate risks are anticipated to impact the wetland systems during the construction phase of the development. As the proposed pipeline route cannot be altered to fully avoid the identified wetland areas and associated buffers, it is therefore recommended that a rehabilitation and monitoring programme is implemented for the affected wetlands, to ensure suitable corrective measures are taken to conserve the condition of the wetlands and their associated buffer zones. In addition to the above, it is recommended that the pipeline is constructed on stilts, where feasible to do so, where the pipeline route intersects the wetland areas to reduce direct impacts to the watercourses. It is the opinion of the specialist that the project may be favourably considered for authorisation, on condition that all prescribed mitigation measures are implemented.

6 References

Awuah, A. 2018. NBA 2018 Rivers and NBA 2018 National Wetland Map 5. South African National Biodiversity Institute (SANBI), Newlands, Cape Town.

Department of Water Affairs and Forestry (DWAF). 2005a. A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas.

Department of Water and Sanitation (DWS). 2005b. River Ecoclassification: Manual for Ecostatus Determination. First Draft for Training Purposes. Department of Water Affairs and Forestry.

Department of Water and Sanitation (DWS). 2016. General Authorisation in Terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for water uses as defined in Section 21(c) or section 21(i). Government Gazette Notice: 509 in Government Gazette 40229 of 26 August 2016.

Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.C., and Collins, N.B. 2009. A Technique for rapidly assessing ecosystem services supplied by wetlands, Mondi Wetland Project.

Lotter, M.C., Le Maitre, D. 2021. Fine-scale delineation of Strategic Water Source Areas for surface water in South Africa using Empirical Bayesian Kriging Regression Prediction: Technical report. Prepared for the South African National Biodiversity Institute (SANBI), Pretoria. 33p.

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2014. Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. Final Consolidated Report. WRC Report No TT 610/14, Water Research Commission, Pretoria.

Macfarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. and Goge, C. 2007. A technique for rapidly assessing wetland health: WET-Health. WRC Report TT 340/08.

Nel, J. L., Driver, A., Strydom, W. F., Maherry, A. M., Petersen, C. P., Hill, L., Roux, D. J., Nienaber, S., van Deventer, H., Swartz, E. R. & Smith-Adao, L. B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources, WRC Report No. TT 500/11. Water Research Commission, Pretoria.

Nel JL, Murray KM, Maherry AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

North West Department of Rural, Environment and Agricultural Development (READ). 2015. North West Biodiversity Sector Plan. North West Provincial Government, Mahikeng. December 2015.

Ollis DJ, Snaddon CD, Job NM, and Mbona N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

SANBI. 2017. Technical guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning. Driver, A., Holness, S. & Daniels, F. (Eds). 1st Edition. South African National Biodiversity Institute, Pretoria.

Van Deventer, H.; Smith-Adao, L.; Mbona, N.; Petersen, C.; Skowno, A.; Collins, N.B.; Grenfell, M.; Job, N.; Lötter, M.; Ollis, D.; Scherman, P.; Sieben, E.; Snaddon, K. 2018. South African Inventory of Inland Aquatic Ecosystems. South African National Biodiversity Institute, Pretoria. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.

7 Appendix Items

7.1 Appendix A – Methodology for Wetlands

7.1.1 Desktop Dataset Assessment

The desktop assessment was undertaken using Geographic Information System (GIS) to access, view and overlay the latest available related datasets with the project area. The information represented within the datasets was used to develop the relevant digital maps used to identify potentially environmentally sensitive areas. These datasets and their respective dates of publishing are provided below:

- Vegetation Types - Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018 & Mucina and Rutherford 2006);
- Soils and Geology - Land Types Database (Land Type Survey Staff, 1972 - 2006); and
- Topographical Inland Water Areas and River Lines (based on the 1994 1:500 000 topographic maps as per the Chief Directorate of the National Geo-spatial Information).

7.1.1.1 Vegetation Types - Vegetation Map of South Africa, Lesotho and Swaziland

The Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018) is the latest and updated version of the maps published in earlier time such as those presented by Mucina and Rutherford (2006) and those presented in the National Biodiversity Assessment (2011). The map provides spatial details on the representative vegetation of South Africa and is complemented in this report using information from Strelitzia (Mucina & Rutherford, 2006) to provide insight on the landscape features, biogeography, climate, geology, and soils of the project area.

7.1.1.2 Soils and Geology - Land Type Database

The Land Type Survey provides information on the soils, terrain, climate, and geology of areas within South Africa. The data includes the pedological classification of soils and is used in this report to provide insight on the common soil forms associated with aquatic or freshwater systems of a particular area.

7.1.1.3 Topographical River Lines and Inland Water Areas

Topographical Inland Water Areas and River Lines for South Africa are based on the topographic maps dated 1994 as per the National Geo-spatial Information. These datasets are used in this report to provide insight on potential wetland areas and serves to highlight the location and extent of drainage features, dams, wetlands, reservoirs and other relevant inland waterbodies.

7.1.1.4 Ecologically Important Landscape Features

The datasets listed below were incorporated to establish the relation between the project and ecologically important or sensitive freshwater entities. Emphasis was placed around the following spatial datasets:

- South African Inventory of Inland Aquatic Ecosystems (SAIIAE), NBA 2018 Rivers and Wetlands (Van Deventer *et al.,* 2019);
- National Freshwater Priority Areas, Rivers and Wetlands, 2011 (Nel *et al.,* 2011);
- Strategic Water Source Areas, 2021 (Lötter & Le Maitre, 2021); and
- Free State Conservation Plan (Collins*,* 2016).

7.1.1.4.1 The South African Inventory of Inland Aquatic Ecosystems

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the 2018 NBA, the SAIIAE is a collection of spatial data layers that represent the extent of river and inland wetland ecosystem types as well as the pressures on these systems. The same two headline indicators, and their associated categorisations, are applied as with the terrestrial ecosystem NBA, namely Ecosystem Threat Status and Ecosystem Protection Level. The Ecosystem Threat Status of river and wetland ecosystem types are based on the extent to which each ecosystem type had been altered from its natural condition.

7.1.1.4.2 National Freshwater Ecosystem Priority Areas, Rivers and Wetlands

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its inland aquatic systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs). The FEPAs are intended to be conservation support tools and it is envisioned that they will guide the effective implementation of measures to achieve the National Environment Management: Biodiversity Act's biodiversity conservation goals (Nel *et al.,* 2011).

7.1.1.4.3 Strategic Water Source Areas

SWSAs are defined as areas of land that supply a disproportionate quantity of mean annual surface water runoff in relation to their size, and therefore contribute considerably to the overall water supply of the country, as well as national aquatic and terrestrial biodiversity resources. These are considered key ecological infrastructure assets and the effective protection of SWSAs is vital for national security because a lack of water security will compromise national security and human wellbeing on all levels.

7.1.1.4.4 Free State Conservation Plan

The Free State Biodiversity Plan (Collins, 2016) is a strategic framework aimed at conserving biodiversity in the Free State Province of South Africa. Key outputs include the identification and mapping of Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESA.s), prioritization of conservation actions, management guidelines, integration with land-use planning, stakeholder engagement, monitoring and evaluation systems, and policy recommendations. The plan emphasizes sustainable land use, collaboration with stakeholders, and the incorporation of biodiversity data into development planning, serving as a comprehensive guide to preserving the region's biodiversity while balancing ecological, social, and economic needs (Collins, 2016).

The Free State Conservation Plan uses the following terms to categorise the various land use types according to their biodiversity and environmental importance:

- Critical Biodiversity Area (CBA);
- Ecological Support Area (ESA);
- Other;
- Protected; and
- Degraded.

CBAs are specific regions identified as being of high biodiversity importance. These areas are essential for conserving a viable representative sample of ecosystems and species. CBAs include habitats that are crucial for maintaining ecosystem processes and ensuring the persistence of species that are rare, threatened, or endemic. They are prioritized for conservation actions to ensure the long-term sustainability of biodiversity within the landscape (Collins, 2016).

The Free State Conservation Plan specifies two different CBA areas, Irreplaceable CBA's and CBA Optimal. Irreplaceable CBA's are areas required to meet biodiversity targets and where no other areas are available to achieve such targets. CBA Optimal are areas that have been selected based on its complementarity for meeting biodiversity targets (Collins, 2016).

ESAs are an area that plays an important role in supporting the ecological functioning of a protected area or Critical Biodiversity Area, or in delivering ecosystem services. In most cases ESA's are currently in at least fair ecological condition, and should remain in at least fair functioning condition. Two types of ESA's, ESA 1 and ESA 2. ESA 1 are sites with minimal degradation and ESA 2 are sites with degradation, i.e. they can be totally degraded, but not totally transformed (Collins, 2016).

Other areas are an area of natural habitat not required to meet biodiversity targets for ecosystem types, species or ecological processes, i.e. natural areas not selected as CBA or ESA (Collins, 2016).

Degraded areas are regarded as areas that are either degraded or transformed habitat that has not been selected as an ESA, i.e. all remaining areas (Collins, 2016).

7.1.2 Wetland Field Survey

7.1.2.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 7-1. 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.

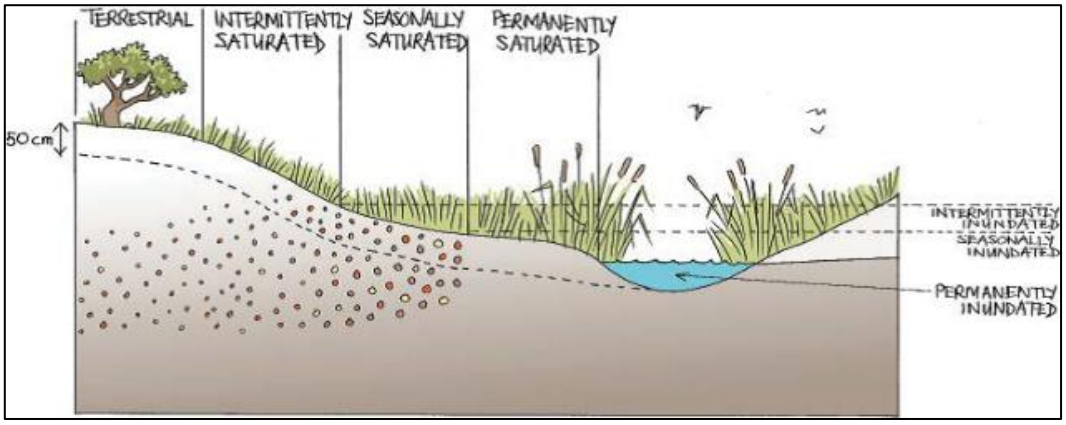

Figure 7-1 Cross section of a wetland, indicating how the soil wetness and vegetation indicators respond to changes in topography (Ollis et al. 2013)

7.1.2.2 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.

7.1.2.3 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).

7.1.3 Risk Screening

A risk screening procedure which considers the general topography of the proposed area in conjunction with the spatial proximity of the natural wetlands to the proposed areas of development was used to determine the 'Risk Status' of the delineated wetlands. Two broad categories are included in the screening process which classify wetlands to be 'At Risk' or 'Not at Risk'.

7.1.4 Functional and Ecological Assessment

7.1.4.1 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.,* 2009). 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 7-1).

Table 7-1 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

7.1.4.2 Present Ecological Status

The overall approach as described by Macfarlane *et al.,* 2009, 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 7-2.

Table 7-2 The Present Ecological Status categories (Macfarlane et al., 2007)

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

7.1.4.3 Ecological 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 as described by Rountree *et al.,* 2013, is used to assign the Ecological Importance and Sensitivity (EIS) category as listed in Table 7-3.

Table 7-3 Description of Ecological Importance and Sensitivity categories

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

7.1.4.4 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) (Table 7-4) 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 7-4 Recommended Ecological Category and Recommended Management Objectives for water resources based on Present Ecological State and Ecological Importance and Sensitivity scores

PES		Ecological Importance and Sensitivity			
		Very High	***High***	***Moderate***	***Low***
	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

7.1.5 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.

7.2 Appendix C – 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 Table 7-5.

Table 7-5 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.

7.3 Appendix E – Specialist Declaration of Independence Declaration

I, Khume Mtshweni, 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.

Khume Mtshweni

Ecologist

The Biodiversity Company

May 2025

I, Celine Klinkert, 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.

Celine Klinkert

Ecologist

The Biodiversity Company

May 2025

Rehabilitation and Monitoring Plan for the new System 1 at Rand Water Vereeniging Treatment Works, Installation of approximately 7 km Phase 2 Sludge Pipeline, 1.5 km Sludge Line in Panfontein and associated infrastructure

Emfuleni Local Municipality, Sedibeng District Municipality, Gauteng Province, South Africa

7/24/2025

Prepared by:

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Report Name	**Rehabilitation and Monitoring Plan for the new System 1 at Rand Water Vereeniging Treatment Works, Installation of approximately 7 km Phase 2 Sludge Pipeline, 1.5 km Sludge Line in Panfontein and associated infrastructure**
Specialist Theme	Rehabilitation & Monitoring Plan
Project Reference	Vereeniging WTW
Report Version	7/24/2025
Environmental Assessment Practitioner	SELAHLE CONSULTANCY & PROJECTS Reg No. 2014/201351/07
Report Writer	Andrew Husted (SACNASP 400213/11)
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, Amended. 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.

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1 Introduction

The Biodiversity Company was appointed to develop and compile a watercourse rehabilitation and monitoring plan for the new System 1 at Rand Water Vereeniging Treatment Works, Installation of approximately 7 km Phase 2 Sludge Pipeline, 1.5 km Sludge Line in Panfontein and associated infrastructure project. The project is within the Emfuleni Local Municipality, Sedibeng District Municipality, Gauteng Province (Figure 1-1).

A watercourse rehabilitation plan has been compiled to facilitate the rehabilitation of potentially impacted water resources associated with the development area and seeks to fulfil the requirements of The National Water Act 1998 (Act No. 36 of 1998) (NWA), and Section 28 of National Environmental Management Act (NEMA).

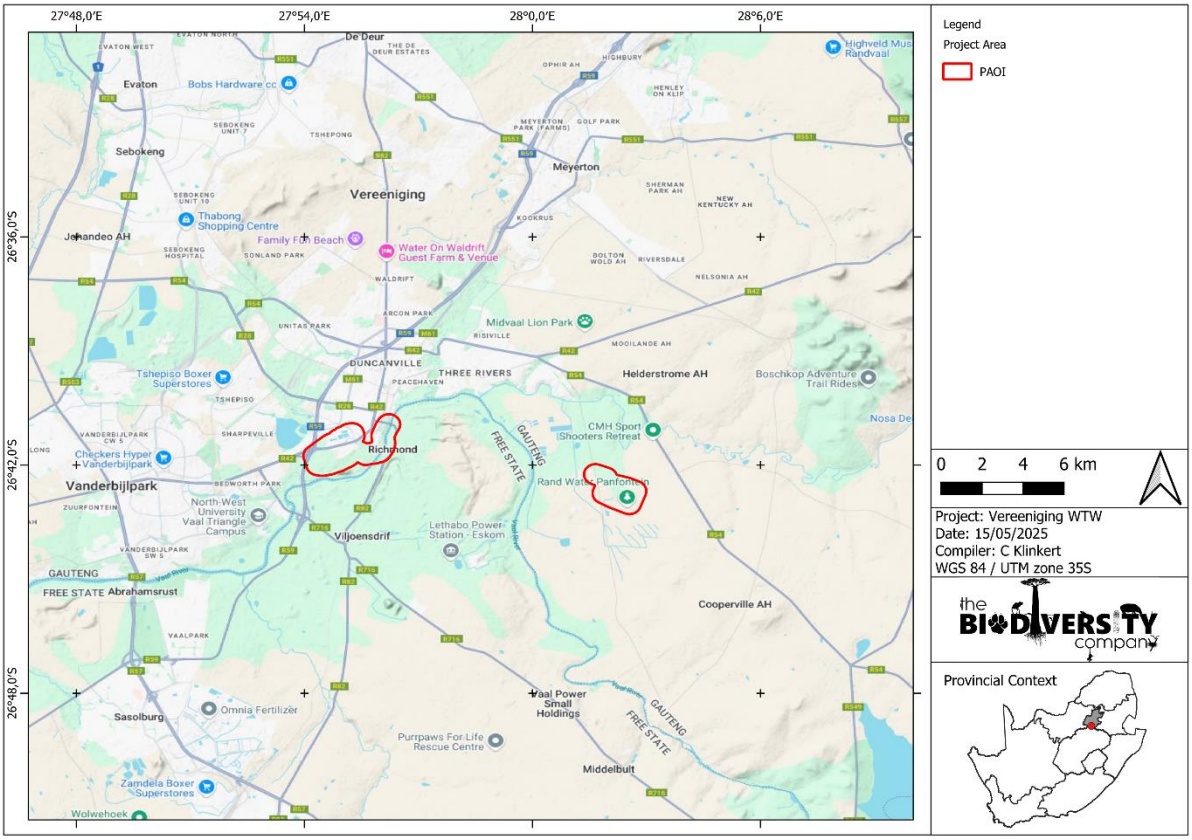

Figure 1-1 Location of the proposed project

1.1 Background Information

The baseline assessment for the Vereeniging WTW and associated sludge pipelines identified two main types of freshwater features: the Vaal River (a perennial river system) and nine seep wetlands within 500 m of the project footprint (see figures below). These wetlands fall within critically endangered vegetation types and are generally in a heavily altered state, with Present Ecological State ratings ranging from largely to seriously modified. The Vaal River, despite its degraded condition, retains high ecological importance, while the seep wetlands are of moderate importance. Collectively, these systems still provide essential services such as flood attenuation, sediment trapping, and water quality regulation, but require careful management and buffering to limit further impact during construction and operation.

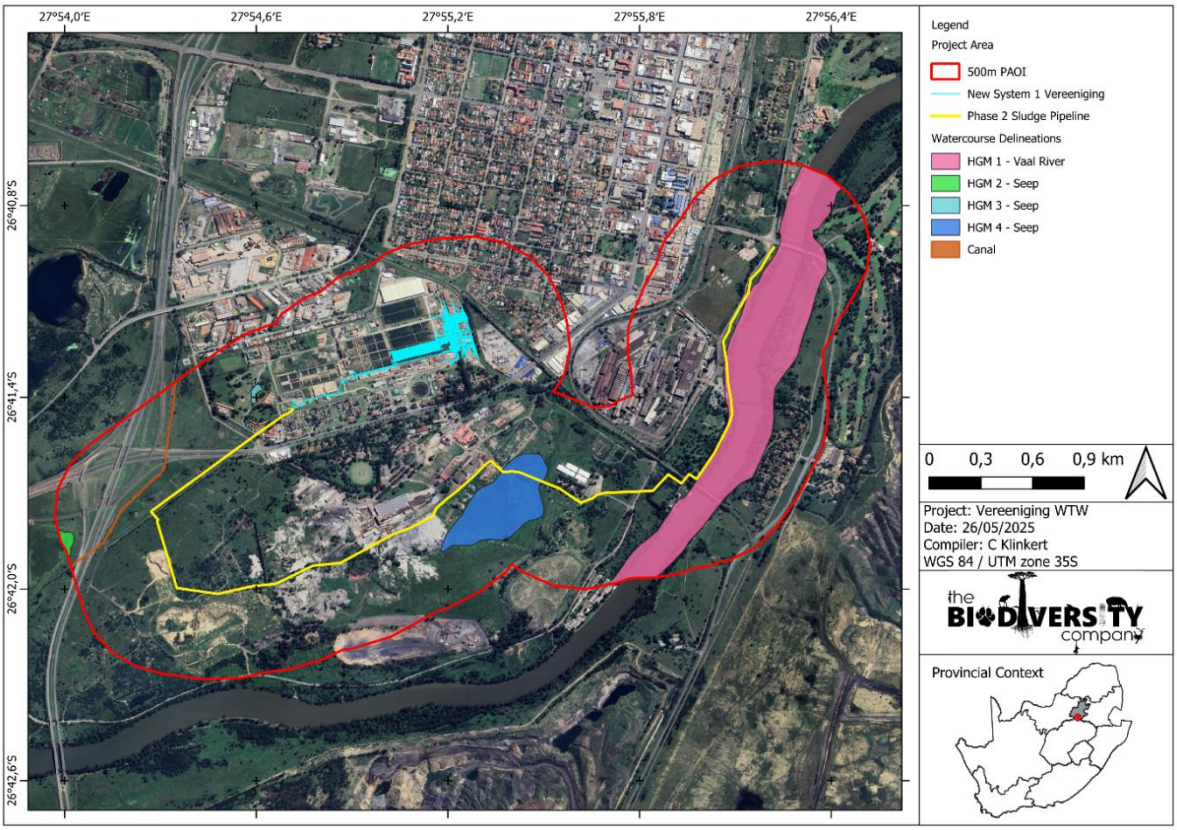

Figure 1-2 Delineations of the watercourse features for the Vereeniging WTW

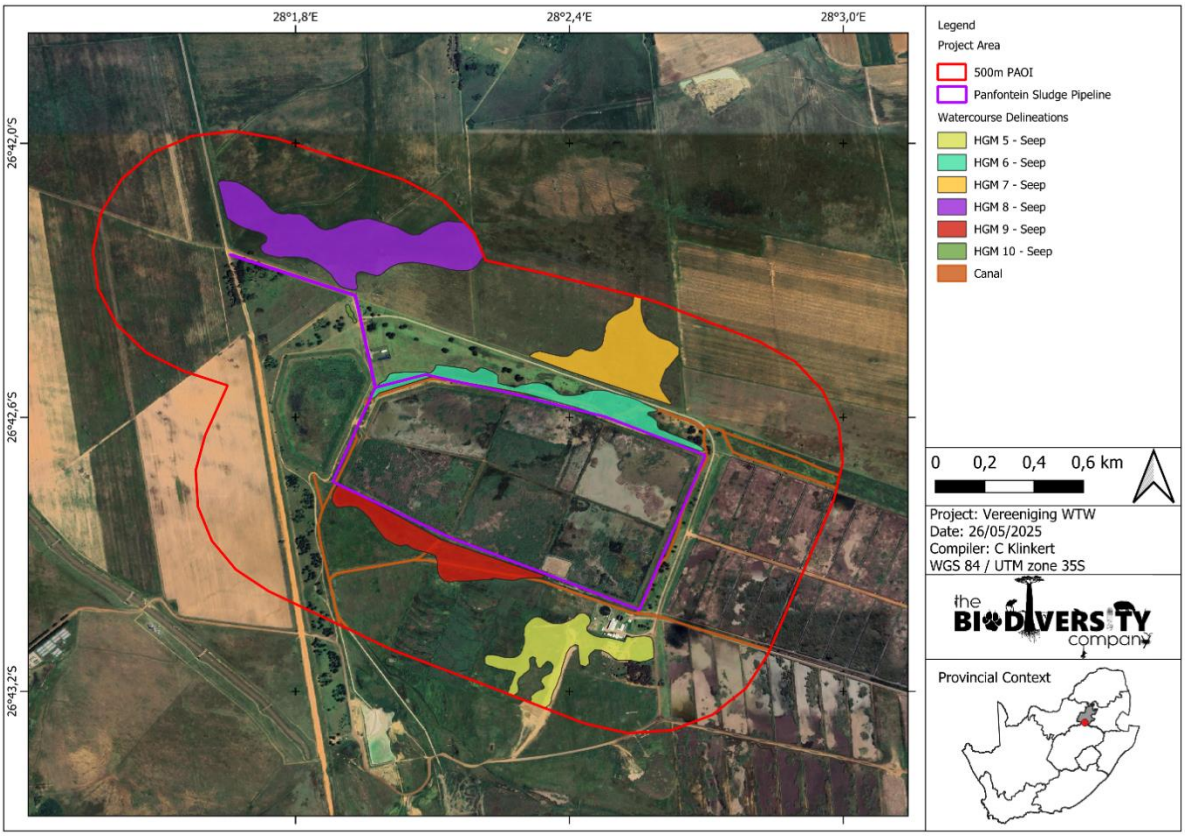

Figure 1-3 Delineations of the watercourse features for the Panfontein pipeline

1.2 Project Description and Technical Information

The purpose of this background information is to provide information to interested and/or affected parties (I&APs) about the Basic Assessment process, Water Use License Application and the Heritage Permit for the Construction & Maintenance of New System 1 at Rand Water Vereeniging Treatment Works, the Installation of approximately 7 Km Phase 2 Sludge Pipeline in Vereeniging, a 1.5 Km Sludge Line in Panfontein and Associated Infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng Province, South Africa.

The proposed project spans three locations but remains within the jurisdiction of the Servitude of Rand Water within the Sedibeng District Municipality, Gauteng Province, South Africa. The coordinates to the three sites are as follows (refer to the locality maps and the tables below).

The Vereeniging New System 1 at Rand Water Vereeniging Treatment Works will consist of the following infrastructure (but not limited to):

- Construction of a new 250 MLD flocculator and 225 MLD sedimentation tank.
- Installation of the de-sludge bridge.
- Construction of access roads.
- Installation of a raw water pipeline.
- Installation of a sludge pipeline.
- Demolition of System 1 tank (90 MLD) to allow for the installation of a new automated system capable of producing 1400 MLD.
- Construction of a Laboratory and
- The installation of a new Carbon Dioxide dosing Carbonisation Bay.

The Phase 2 Sludge Pipeline in Vereeniging will consist of the following infrastructure:

- Phase 2 of the sludge pipeline starts from the sludge pumping station inside Vereeniging Treatment Works and runs through mostly an established industrial area in the south of Vereeniging.
- The proposed sludge pipeline runs alongside as well as across some of these services, which also include Rand Water Bulk Water Pipelines to the Vaal River Crossing.
- The installation of approximately 7 km in length of 1000mm nominal internal diameter steel sludge pipe with an 8mm wall thickness to be laid from the Vereeniging Pumping Station to the Vaal River Crossing.

The Panfontein Sludge Pipeline will consist of the installation of an interconnection new sludge pipeline with approximately 1.5km in length and 800mm in diameter

1.3 Assumptions and Limitations

The following were considered as limitations:

- It is assumed that the client has provided the specialist with all available data and information pertaining to the project at the time of writing and that all this information is relevant and accurate; and
- It is assumed that the extent of the project area provided to the specialist is accurate.

1.4 Terms of Reference

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

- To inform and guide the rehabilitation of impacted water resources; and
- Report compilation detailing the compiled rehabilitation and monitoring plan.

2 Key Legislative Requirements

Section 24 of the Constitution of South Africa, 1996 (Act No. 108 of 1996) states that, 'everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development'.

There are several legal stipulations that require water resources to undergo rehabilitation. These stipulations are referred to in some capacity in the following Acts:

- National Environmental Management Act, 1998 (Act No. 107 of 1998, as amended (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA).

A key consideration is the requirement of 'duty of care' with regards to environmental remediation: stipulated in Section 28 of NEMA: 'Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.'

3 Rehabilitation

The National Water Act (No. 36 of 1998) stipulates requirements for rehabilitation of disturbed areas: 'A person who lawfully impedes or diverts the flow of water in a watercourse, or who alters the beds, banks or characteristics of a watercourse must take necessary measures to stabilise the diversion structure and surrounding area through:

- rehabilitation of the riparian habitat using only indigenous shrubs and grasses;
- rehabilitation of disturbed and degraded riparian areas;
- restoring and upgrading the riparian habitat integrity to sustain a biodiverse riparian ecosystem;
- removal of alien vegetation, and
- conducting an annual habitat assessment.'

These requirements have informed the rehabilitation plan which is intended to achieve the following:

- Allow for the trapping of sediment caused by adjacent deposition;
- To create diffuse streamflow across the wetland, ensuring prolonged saturation levels;
- The assimilation of toxicants, nitrates and phosphates; and
- Improve the ability of the systems to support biodiversity.

3.1 Rehabilitation Aim

The overall aim of the rehabilitation plan is to protect, rehabilitate and enhance ecological integrity of water resources that may be affected or impacted by the refurbishment of the project, ensuring the long-term sustainability of associated aquatic biodiversity and water related infrastructure.

3.1.1 Rehabilitation Approach

The approach of the project adopts an integrated, ecologically informed method that balances the protection of water resources with the development and management of essential infrastructure. The strategy emphasizes the use of environmentally friendly solutions, compliance with relevant environmental legislation, and alignment with broader goals of catchment health and resilience. The key elements of the approach include:

- Minimising disturbance ensuring that the construction activities are confined to designated areas with clear and visible demarcation to prevent unnecessary encroachment into sensitive areas such as watercourses and riparian buffers;
- Implementing rehabilitation measures as construction progresses, rather than waiting until completion, reduce erosion risks and encourage vegetation establishment;
- Restoring disturbed areas using local indigenous plant species to stabilise soil, support ecological recovery, and maintain biodiversity;
- Integrating practical erosion control measures during and post construction to protect aquatic ecosystems;
- Rehabilitating the effluent line and surrounding areas in a way support natural hydrological processes; and
- Establishing a monitoring programme to evaluate the success of rehabilitation efforts and allow for adjustments where necessary.

This approach promotes both environmental sustainability and operational functionality, supporting long-term water resource protection while facilitating the upgrade of essential municipal infrastructure.

3.1.2 Rehabilitation Objectives

The following is applicable:

- Protect and stabilise wetland areas by preventing further degradation by enforcing a buffer requirement around all hydrogeomorphic (HGM) units throughout the project's lifecycle where practical;
- Implement erosion control structures and stormwater management to reduce sediment and pollutant loads;
- Re-establish surface water flow and hydrological connectivity in disrupted valley bottom systems;

- Address artificial drainage or compaction where it impacts wetland water retention;
- Clear and control alien invasive species and re-introduce indigenous hydrophytes typical of each HGM unit;
- Maintain or improve moderate level ecosystem service delivery, particularly water regulation, sediment trapping, and biodiversity support;
- Establish a watercourse (wetlands, rivers and drainages) monitoring plan to evaluate rehabilitation effectiveness;
- Adjust rehabilitation actions based on monitoring data and site-specific challenges; and
- Ensure compliance with environmental legislation and industry best practices.

3.2 Strategy and Planning

To achieve the objectives of the rehabilitation plan, three elements will need to be met, namely:

- Appropriately strategise rehabilitation efforts;
- Effectively implement the rehabilitation measures to restore ecological integrity; and
- Maintain ecological integrity over the long-term.

3.3 Strategy and Planning

To achieve the aim of the rehabilitation plan, three objectives will need to be met, namely to (1) appropriately strategize rehabilitation efforts, (2) effectively implement the rehabilitation measures to restore ecological integrity and (3) maintain that integrity over the long-term. The table below presents the objectives along with their associated activities and the order they should take place.

Table 3-1 Activities required to meet the three main objectives for the rehabilitation project and the order in which they should take place.

Objective	Activity	Order
Plan	Legal framework	Planning
	Budget	Planning
	Personnel	Planning
	Authorization	Planning
	Rehabilitation Objectives	Planning
Restore	Landscaping and site preparation	1
	Erosion and sedimentation control	2
	Re-vegetation	3
	Alien vegetation removal and control	4
	Monitoring and Management	5
	General environmental considerations	6

3.3.1 Authorisations

It is essential that all necessary permission, authorisations and licenses be applied for before any in-field rehabilitation actions are taken. However, the following points are considered particularly pertinent and relevant to this project.

- It is important to note that the proposed rehabilitation and management plan may require a water use licence. The onus is on the applicant to conduct a risk assessment to inform a decision made by the Department of Water and Sanitation (DWS) as to whether the final rehabilitation activities to be implemented constitute either a general authorisation in terms of section 39 of NWA or a full Water Use Licence application;
- It would be prudent for the applicant/client to ensure that none of the proposed rehabilitation activities would require environmental authorisation in terms of NEMA; and
- The applicant will also have to practice the Duty of care, remediation of environmental damage and the polluter pays principle as stipulated in the Constitution, section 28 of NEMA and section 19 of the NWA. Under this principle the applicant is obliged, by law, to act responsibly and prevent and minimise harm to the environment and rectify it if / when it does occur.

3.3.2 Budget

Rehabilitation measures can be costly and there to be financial assurance that these costs will be met. It is the responsibility of the applicant to ensure that an annual budget is compiled for the implementation of rehabilitation project and that these costs are adequately captured into the financial budget. Costs should be allocated across three main phases namely planning, rehabilitation and monitoring and maintenance (ongoing). It is important that provision is made for, but not limited to the following:

- Relevant authorisations;
- Project planning and administrative cost;
- Equipment and materials;
- Appointment of contractors, personnel and specialists;
- Plans for engineered intervention structures;
- Contamination assessments (to identify sources of contamination and assess significance); and
- Implementation of a monitoring program.

3.3.3 Personnel, Roles and Responsibilities

The main responsibility for ensuring that rehabilitation efforts are effectively managed and implemented lies with applicant and the appointed environmental practitioner but also the contractors responsible for any direct or indirect disturbance of watercourses. The applicant should advise on the responsible contractor for the overseeing the management of the rehabilitation of the relevant areas of the project. The Ecological Control Officer (ECO) will be responsible for the monitoring and to identify aspects that may require further attention. This can be done in conjunction with an ecologist if necessary (overseeing and advisory role).

3.4 Rehabilitation Measures

The localised impacts identified for each of the units has been consolidated and taken into account the planned development project to inform the appropriate rehabilitation measures to be implemented for the development.

Table 3-2 The localised impacts identified for the assessed units

Assessed Unit	Local Impacts	Rehabilitation Measures
Watercourse	• Clearing of vegetation for the development • Erosion and sedimentation • Proliferation of alien vegetation	• Site Assessment & Planning • Erosion & Sediment control • Bank Stabilisation

	• Solid Waste • Infrastructure inefficiencies • Pollution from upstream areas • Water quality impacts related to construction activities	• Re-vegetation / landscaping for vegetation establishment using indigenous species • Alien vegetation removal & control. • Soil Management. • Solid waste removal • Pollution Control • Monitoring and maintenance

3.4.1 Site Assessment and Planning

A thorough site assessment must be completed by the applicant, contractor, ECO and a freshwater specialist. This is essential to ensure that all rehabilitation interventions are context specific, targeted and environmentally compliant. This phase establishes the 'on the ground' conditions of the proposed project. It allows for the identification of critical areas experiencing impacts particularly erosion and sedimentation. The data collected during this phase will inform the selection of appropriate rehabilitative measures. The following is recommended:

- Conduct a survey of the proposed project area through a visual inspection, noting and documenting areas of possible erosion, sediment accumulation, and bank instability of the watercourse;
- Use GPS mapping and georeferenced photographs to record location and severity of each area creating areas of prioritisation and planning;
- Classify and rank areas by severity and type of impact distinguishing between active erosion sites, passive sedimentation zones, and unstable banks;
- Determine staging areas for rehabilitation teams and machinery to avoid unnecessary disturbance to vegetation in the riparian zone and proximal watercourse;
- Develop a site-specific method statement and rehabilitation action plan indicating timeframes, materials, and responsible personnel; and
- Conduct pre-construction environmental awareness with the contractor(s) to communicate environmental sensitivities, no go areas and best practices.

The outcomes of the site assessment and planning phase will serve as a foundation for all subsequent rehabilitation activities. By identifying site specific risks, infrastructure needs, and ecological sensitivities beforehand, rehabilitative efforts will be targeted, compliant and will safeguard both environmental integrity and infrastructure functionality.

3.4.2 Erosion and Sedimentation Control

Erosion and sedimentation can cause significant environmental degradation during the construction phase especially in areas that are adjacent or proximal to watercourses. Proactive sediment and erosion control measures are not only vital but necessary to (1) stabilise the soil, (2) limit scouring and sediment displacement, (3) reduce flow velocities, (4) protect downstream habitats, and (5) maintain water quality. A combination of engineered and nature- based solutions should be considered depending on site conditions, severity of erosion, and accessibility. These measures should be implemented from the onset of construction and maintained throughout the project lifecycle. The following is recommended:

- Identify and demarcate all erosion risk areas for interventions. These areas will likely need to be reshaped and revegetated to provide bank or channel stability;
- Employ the use of sediment barriers such as silt fences and sandbags and place them along temporary excavations or areas susceptible to runoff counter sedimentation. The sediment

barriers act as a first line of defence, filtering runoff and trapping sediment before it reaches watercourse;

- Ensure that the erected silt fences are of geotextile fabric and attached to wooden posts arounds the stockpiles and at the toe of slopes;
- Ensure that the fences are trenched 200 -300 mm into the ground to prevent underflow;
- Stabilise all eroded edges, particular those that have been impacted by fast flowing water coming through the watercourse;
- Install energy dissipaters such as rock aprons, gabions, and reno mattresses at the outlets of drainage paths or where concentrated flow exits. These structures reduce the velocity of flowing water, preventing scouring and downstream erosion and sedimentation;
- Install or upgrade stormwater management systems where necessary to manage runoff and prevent to ensure proper drainage and flow management; and
- Shape the area to match the original slope and hydrological flow of the area and ensure that no water pooling occurs.

When properly implemented, erosion and sediment control measures greatly enhance the resilience of rehabilitated areas, reduce sedimentation in the watercourse. These interventions not only provide immediate physical stability but also support long-term ecological recovery and restoring natural drainage and flow patterns.

3.4.3 Bank Stabilisation

During the project, activities may lead to localized destabilisation of riparian zones. Stabilising these banks is essential not only for protecting water quality and aquatic habitats but also for safeguarding nearby infrastructure from undercutting and washout. An effective stabilisation strategy involves reshaping banks to a stable gradient, reinforcing erosion control measures, and re-establishing indigenous vegetation that binds soil and promotes ecological recovery. The following is recommended:

- Reshape banks to a stable gradient (ideally 1:3 or flatter) to reduce the risk of collapse and support natural revegetation;
- Employ the use of geotextiles, coir logs, or biodegradable erosion control blankets to protect the exposed soil during initial establishment;
- Plant indigenous riparian species to anchor soil and absorb the flow of energy;
- Where banks are steep or near critical infrastructure, use gabions and reno mattresses to provide mechanical support;
- Construct diversion berms or swales upslope of vulnerable banks to direct runoff from unstable areas; and
- Monitor stabilised banks seasonally for signs of erosion, vegetation failure, or invasive species and implement corrective action as needed.

Effective bank stabilisation is essential to ensuring he long-term protection of watercourses affected by the project. By combining engineered and nature-based solution, these measures will reduce erosion risk, support ecological recovery and safeguard surrounding infrastructure contributing to the overall success and sustainability of the rehabilitation effort.

3.4.4 Revegetation

Revegetation plays a fundamental role in the rehabilitation of areas disturbed during the project. The establishment of appropriate indigenous vegetation not only stabilises soil and educe erosion but also supports the recovery of ecological function within riparian and buffer zones. By restoring natural plant communities, revegetation enhances habitat availability, promotes biodiversity, improves water filtration and contributes to the long-term resilience of the rehabilitated landscape. The following is recommended:

- Because vegetation will be cleared for construction, minimise and limit clearance of the area to the minimum required to conduct rehabilitation efforts;
- Re-vegetation must follow landscaping activities in a phased approach over two consecutive growing seasons. This approach ensures that the entire system is not denuded of vegetation all at once and that any challenges / short comings identified in the first phase can be rectified in the second phase;
- Re-vegetation must involve the use of both re-seeding and mechanical transplanting. Re-seeding must occur in both the flow path and banks to establish a vegetation base while mechanical transplanting of plant sods must take place mainly within the flow path;
- Avoid creating a monoculture, as species diversity is the key to watercourse health and the provision of important ecosystem services such as erosion control and water quality enhancement;
- As the saturation, nutrient and oxygen levels will vary markedly depending on the hydrological zonation (permanent, seasonal and temporary) care must be taken to sow or plant the appropriate plant species in each re-vegetation zone (flow path or bank). The species are generally common and adaptable species that show a tolerance to disturbed soil conditions;
- Only locally indigenous species that are adapted to local climatic conditions must be used. Perennial species must be prioritised for transplanting. Good quality planting material or seed must be readily available;
- Re-vegetation must commence immediately after landscaping and the preparation of the seedbed, preferably in early spring when conditions for germination and rootstock establishment are optimal. Planting must preferably be timed to take place 1-3 days following a significant rainfall event when soils are within 10% of the field capacity (maximum saturation level);
- Topsoil must be stored for later use and where necessary supplemented with imported topsoil. With correct storage and replacement of topsoil species diversity must improve rapidly as species present in the seedbank also germinate;
- Transplanted vegetation can be sourced from nurseries and / or sustainably harvested from local wetlands, with due authorisation. Most of the plants must be harvested from the areas that will be scraped during the site clean-up and landscaped and supplemented with plants from surrounding watercourse;
- Re-grassing can be done by hand broadcasting and/ or hydroseeding, the best approach must be decided by the ECO once the local conditions are closely examined, and budgeting is finalised;
- Employ the use of brush packing techniques using cut branches and organic material to protect seedlings from runoff and wind while improving soil moisture retention;

- The entire re-vegetated area will have to be irrigated on a regular basis over at least the first three months, in order to increase the vegetation yield. Irrigation should be regular enough to ensure that the soil layer is saturated, but without causing erosion or surface run and without oversaturating the soil which will cause root rot and kill off many sensitive small shrub and geophyte species;
- General maintenance must be performed. This will involve alien and weed control as well as the regular thinning of unwanted plant encroachment. Continuous weed control is critical to ensure the success of re-vegetation and should be a high priority. Weeding around indigenous plants may be necessary to avoid competition and stress. This should be carried out as required but at least once per month during the first year;
- The area under rehabilitation is to be left undisturbed and all access prohibited, except when maintenance is being undertaken. In order to allow the movement of indigenous fauna, the use of closed face fences must be restricted, and brush cut should rather be used; and
- Avoid the use of fertilizers or any other chemicals or soil enhancers during re- vegetation.

3.4.5 Alien vegetation removal & control

Alien invasive species is a critical component of the rehabilitation process, the disturbance of natural and indigenous vegetation and soil can create suitable conditions for the encroachment of alien invasive species, which can compete with indigenous flora, disrupt ecosystem processes and reduce habitat quality. The following is recommended:

- An alien invasive species removal and control plan should be compiled and implemented;
- Identify and map existing invasive species within the development area;
- All invasive species located within the watercourse and buffer areas must be controlled/removed this improves the conditions of the watercourse as well as most importantly, decrease the competition between revegetated and alien invasive species;
- Regular monitoring and maintenance (such as removing AIP/weeds and encroachment) are to be conducted for successful revegetation/rehabilitation efforts. Monitoring consists of photo points and documentation of observations. It is recommended seasonally for the first two years of establishment and at least annually thereafter;
- General maintenance will involve AIP and weed control as well as thinning of encroachment. Continued weed control is critical to the success of re-vegetation and must be high priority. Weeding may be necessary to avoid competition and stress;
- AIP & Weed control during the first 2 years after rehabilitation established would likely control the undesired species until they can be outcompeted or shaded out. As with site prep, weed maintenance after can be accomplished by mechanical means. Care must be taken not to damage the emerging plants or the soil layer. Stringent weed management eventually will increase the site's resistance to further weed invasion by favouring the growth and establishment from the seedbank;
- If possible, the rehabilitated areas must be irrigated at regular intervals, taking care not to cause erosion or damage the soil surface by using an excessive force of water; and
- The project area is to be left undisturbed and all access prohibited, expect when maintenance is being undertaken and domestic animals must be kept out of the area.

3.4.6 Soil Management

During the construction phase of the project, excavation activities will occur. Whilst impacts on soil resources are expected to be minimal, there are still risks of erosion, sedimentation, and compaction. The following is recommended:

- Stockpile topsoil separately from subsoil to preserve its seedbank, nutrients and structure;
- Avoid compacting stockpiles;
- Avoid operating machinery (TLB's) on wet soils to reduce compaction risks;
- Rip compacted subsoil areas to a depth of 300m before topsoil replacement;
- Spread topsoil evenly over rehabilitated areas after construction;
- Avoid spreading topsoil during high wind or heavy rainfall events;
- Reseed disturbed areas with indigenous grasses or ground cover to stabilise soil quickly; and
- Inspect rehabilitated soils regularly for erosion, compaction or poor vegetation growth.

3.4.7 Solid waste removal

Effective waste and pollution management is essential during and after construction to prevent contamination of soil, water and vegetation and to ensure a safe and environmentally responsible development. Pollution prevention is critical to maintaining the ecological integrity of the site and compliance with environmental regulations. The following is recommended:

- Clearly mark areas for the separation and storage of general, recyclable and hazardous waste to prevent illegal dumping;
- All fuel, oil and chemical storage must be stored in bunded areas. Spill kits must be available on site, and personnel trained to respond swiftly to incidents;
- Conduct daily and weekly clean-ups to remove litter, debris, rubble, particularly near stormwater outlets and sensitive areas;
- Use water sprayers to suppress dust from stockpiles, access roads and exposed surfaces; and
- Prohibit the burning or burying of waste on site to avoid air and soil contamination, all waste must be removed to licensed disposal facilities.

3.4.8 Pollution Control

Due to the nature of the project, strict pollution prevention measures must be implemented to avoid contamination of nearby watercourses and surrounding environments. Construction activities and handling of wastewater and effluent pose risks of hydrocarbon leaks, chemical spills, and sediment-laden runoff. Effective mitigation is required to maintain water quality, safeguard aquatic ecosystems, and ensure compliance with environmental regulations. The following is recommended:

- Develop an emergency response plan should a spill occur. Report, contain and clean up the spill immediately;
- Mix concrete and cement only in designated areas with impermeable surfaces. Prevent wash water from entering stormwater drains or natural systems;
- Ensure temporary or bypass flows are managed correctly during construction, with no direct discharge into watercourses without appropriate treatment or authorisation; and

- Conduct pre-, during and post construction water quality monitoring (e.g., pH , dissolved oxygen, turbidity, E.coli, ammonia) to detect and address pollution events early.

3.5 Rehabilitation Monitoring Plan

Throughout the lifecycle of the rehabilitation plan, regular monitoring and adaptive management must be in place to detect any impacts to the environment and to remedy these as soon as detected. The on-site environmental representative and Applicant will be responsible for initiating and maintaining a suitable monitoring system. Monitoring personnel must be adequately trained in identifying both the impacts and causes of the impacts observed on site. The following monitoring plan is proposed for the respective measures. A step-by-step decision support table is presented in the table below.

Rehabilitation: During rehabilitation, monitoring is essential to ensure that all recommended rehabilitation aspects are successfully applied. This monitoring must be undertaken by the (Environmental Control Officer) ECO appointed to oversee the rehabilitation process.

Post-rehabilitation: After completion of the rehabilitation phase rehabilitated areas should be monitored to evaluate the success of the rehabilitation efforts. In the unlikely event of potential “risks” to the systems being identified, this inspection may allow for corrective measures to be applied. This monitoring must be undertaken by the appointed ECO.

Seasonal monitoring: The applicant must appoint an independent contractor to conduct seasonal (wet season) monitoring for a period of two years after the completion of the rehabilitation measures. The monitoring should be conducted during October or shortly after the first summer rains, and then towards the end of the growing season. The monitoring should inspect the following:

- Recovery of the vegetation layer;
- Extent of vegetation establishment;
- Hydrology and inundation of the systems;
- Erosion and sedimentation measures ; and
- The water quality.

Table 3-3 Example of a monitoring plan

Rehabilitation Measure	Timeframe	Monitoring Frequency	Actions
Site Assessment & Planning	Prior to construction	Once-off assessment prior to implementation	Conduct baseline survey; classify impacted areas; develop method statement.
Erosion and Sedimentation Control	During and post-construction	Weekly during construction; monthly post construction for 6 months	Inspect sediment fences, gully plugs, and stockpiles; replace or reinforce as needed.
Stormwater Management Measures	During and post-construction	Monthly after significant rainfall events	Check berms, swales, and sediment traps for blockage or erosion; maintain energy dissipators.
Re-vegetation	Immediately post-construction (summer)	Bi-weekly for the first 3 months; monthly for 2 years	Monitor seedling survival; irrigate; remove weeds; replace dead plants.
Soil Management	During and post-construction	Monthly inspections for 1 year	Check for compaction, erosion signs, and vegetation growth; re-rip or reseed if needed.
Water Quality	Pre, during and post-construction, ongoing	Bi-annual for 2 years (wet seasons)	Monitor water quality using standardized parameters

Solid Waste removal	During and post-construction	Weekly	Remove all anthropogenic waste and dispose off at licensed facility.
Alien Vegetation Control	Throughout and post-rehabilitation	Monthly for for 1st year, quarterly thereafter	Remove invasive species manually/chemically; monitor regrowth; support indigenous recovery.
Pollution Control	During and post-construction	Weekly during construction; monthly for 6 months post-construction after any spill incident	Inspect for leaks or signs of contamination. Record and report any pollution incidents and verify proper functioning of stormwater diversion and drainage measures to prevent contamination.

4 Conclusion

The rehabilitation (watercourse) and monitoring plan for the project serves to inform and guide rehabilitation efforts with the aim of ensuring that the environmental impacts associated with the project are effectively mitigated and the landscape including watercourses is restored to a stable, functional and sustainable state. By prioritising erosion, vegetation recovery, pollution prevention, and infrastructure upkeep. This plan supports ecological restoration, regulatory compliance and sustainable service delivery. Continued monitoring and management will be key to ensuring both environmental integrity and operational performance are maintained in the long-term.

5 References

Russell, W. 2009. WET-RehabMethods. National guidelines and methods for wetland rehabilitation.