



Wetland Impact Assessment for the ACWA Power Redstone PV BAR

**Tsantsabane Local Municipality, ZF Mgcawu
District Municipality, Northern Cape Province,
South Africa**

7/6/2026

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Project Title	Wetland Impact Assessment for the ACWA Power Redstone PV BAR	
Specialist Theme	Aquatic Biodiversity Theme	
Project Reference	ACWA Power Redstone PV – Wetland Baseline and Impact Assessment	
Report Version	7/6/2026	
Environmental Assessment Practitioner		
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Declaration	The Biodiversity Company and its associates act as independent consultants in accordance with the requirements of the South African Council for Natural Scientific Professions. We confirm that we have no affiliation with, or vested financial interest in, the proponent, other than remuneration for professional services rendered in terms of the Environmental Impact Assessment Regulations. We have no conflicting interests in the proposed activity or any secondary developments arising from the authorisation of the project, and our work has been undertaken objectively and in accordance with accepted scientific principles.	

¹ All work was undertaken under the guidance and supervision of a registered professional Rian Pienaar (Pr. Sci. Nat. 135544)

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1 Introduction

1.1 Background

The Biodiversity Company was commissioned to conduct a wetland impact assessment in support of the environmental authorisation process for the proposed ACWA Power Redstone PV project. The proposed development will be located within the Tsantsabane Local Municipality and ZF Mgcawu District Municipality in the Northern Cape Province (Figure 1-1 & Figure 1-2). A 500 m radius has been demarcated for the project to facilitate the identification of wetlands; this area is referred to as the Project Area of Influence (PAOI).

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

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

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 concerning the ecological viability of the proposed development and related activities.

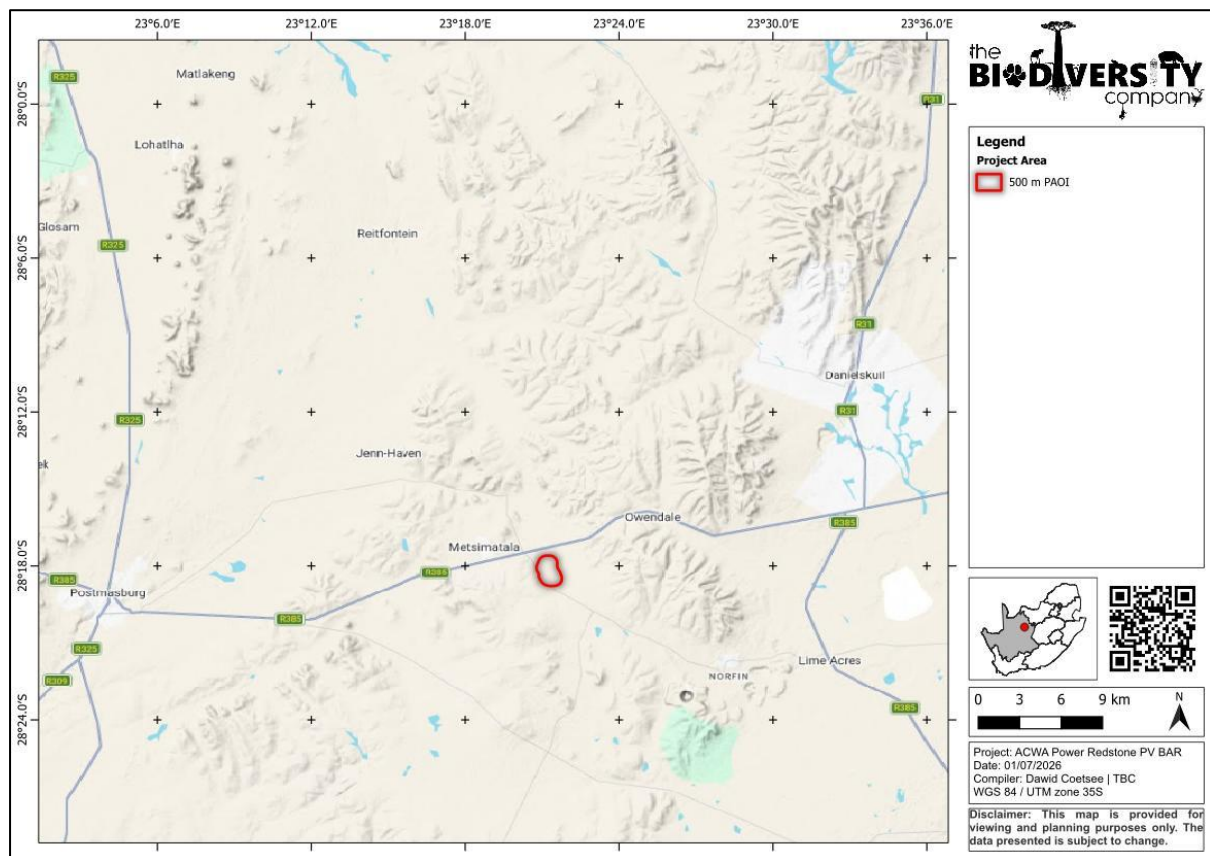


Figure 1-1 Location of the proposed project

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;
- An assessment of the related impacts through the use of the Risk Assessment Matrix (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 following information has been received from EIMS (Pty) Ltd and pertains to the project information.

ACWA Power Solar Reserve Redstone Solar Thermal Power Plant RF (Pty) Ltd (the Applicant) has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment (BA) process and compile the Basic Assessment Report (BAR) for the ACWA Power Solar Reserve Redstone Solar Photovoltaic (PV) Power Project (Redstone PV).

The Redstone PV is proposed as an auxiliary photovoltaic facility to support the existing ACWA Power Solar Reserve Redstone Solar Thermal Power Plant (CSP) by supplying renewable energy for its auxiliary load requirements. The proposed PV facility forms part of the broader Redstone CSP Power Project and will be located within the same approved project area. The integration of the Redstone PV is intended to enhance operational efficiency and reduce reliance on external electricity sources through the generation of on-site renewable energy.

1.3.1 Project Description

This section provides an overview of the proposed Redstone PV, including a description of the development components, project phases, and associated activities. The intention is to clearly describe the nature and extent of the proposed development to ensure a comprehensive understanding of the project.

1.3.1.1 Project Overview

The ACWA Power Solar Reserve Redstone Solar Photovoltaic (PV) Power Project (Redstone PV) is proposed as an auxiliary renewable energy facility to support the existing ACWA Power Solar Reserve Redstone Solar Thermal Power Plant (CSP). The purpose of the Redstone PV is to provide electricity for the auxiliary load requirements associated with the operation of the CSP facility.

The Redstone PV will form part of the broader Redstone CSP Power Project and will be developed within the same project area. The facility will have a generation capacity of up to approximately 19.5 MW (DC), with a design capacity of approximately 15 MW (AC), and will include energy storage of up to 30 MWh.

The Redstone PV is designed to generate renewable energy for self-consumption by the CSP facility, thereby reducing reliance on external power sources and improving operational efficiency.

1.3.1.2 Project Timeline

This section outlines the anticipated lifecycle of the Redstone PV, including the key project phases from planning through to decommissioning. The overall timeline is aligned with typical renewable energy project development processes and is integrated with the lifecycle of the associated CSP facility.

1.3.1.2.1 Planning and Authorisation Phase

The planning and authorisation phase includes the completion of all required regulatory processes, including the Basic Assessment process and the obtaining of an Environmental Authorisation (EA), as well as any other relevant approvals and permits required prior to construction.

This phase also includes detailed engineering design, procurement planning, and finalisation of project specifications.

1.3.1.2.2 Construction Phase

The construction phase will involve all site establishment and infrastructure installation activities required to develop Redstone PV. This includes vegetation clearing (where required), site preparation, installation of PV panels, electrical infrastructure, and associated support infrastructure.

The construction period is anticipated to be relatively short, approximately 2 to 6 months, due to the modular nature of photovoltaic infrastructure and the utilisation of existing CSP-related infrastructure where feasible.

1.3.1.2.3 Operational Phase

The operational phase will involve the ongoing generation of electricity from the Redstone PV and the provision of auxiliary power to the CSP facility. This phase includes routine operation, maintenance of PV panels and associated infrastructure, and monitoring of system performance.

The operational lifespan of the Redstone PV is expected to align with that of the Redstone CSP Power Project, typically approximately 25 years, subject to ongoing maintenance, technological upgrades, and potential refurbishment.

1.3.1.2.4 Decommissioning and Rehabilitation Phase

At the end of the operational life, the Redstone PV will be decommissioned, which includes the dismantling and removal of all infrastructure, recycling or disposal of materials where applicable, and the rehabilitation of disturbed areas.

Rehabilitation activities will aim to restore the site to a condition that is as close as reasonably possible to its pre-development state, or alternatively to a stable and functional post-use land condition, in accordance with the requirements of the Environmental Management Programme (EMPr).

1.3.1.3 Project Components

This section describes the key structural and functional components of the Redstone PV and the infrastructure required for its construction and operation. The Redstone PV will comprise several key components, which are described below.

1.3.1.3.1 Photovoltaic (PV) Panel Field

The PV panel field forms the primary energy generation component of the development and will consist of arrays of photovoltaic panels mounted on support structures.

The PV facility will consist of arrays of photovoltaic panels mounted approximately 3–5 m above ground level, oriented north to optimise solar energy capture. The panels may be fixed or tracking systems, depending on final engineering design. The panels will be arranged in rows (arrays) across the development footprint, covering an area of approximately 19.5 hectares.

1.3.1.3.2 Electrical Infrastructure

The electrical infrastructure is required to convert generated electricity into a usable form and transmit it within the internal network. The PV system will generate direct current (DC) electricity, which will be converted to alternating current (AC) using inverter units. The electrical components will include:

- Inverter units distributed across the PV field;
- Transformers to step up voltage levels (up to approximately 33 kV); and
- Underground and/or surface cabling connecting the PV system to the CSP facility.

Electricity generated by the Redstone PV will be transmitted to the CSP facility for auxiliary use.

1.3.1.3.3 Energy Storage System

The energy storage system is a critical component of the Redstone PV, enabling improved stability and operational flexibility.

The Redstone PV will include a battery energy storage system of up to approximately 30 MWh, which will:

- Stabilise energy supply;

- Support peak demand requirements; and
- Improve reliability of the auxiliary power system.

Battery storage units will be housed within containerised or enclosed structures.

1.3.1.3.4 Substation and Grid Integration

This component facilitates the integration of the Redstone PV into the existing electrical infrastructure associated with the CSP facility. A substation of up to approximately 11 kV may be constructed to enable connection of the Redstone PV to the internal CSP electrical network. Power generated by the facility will be transferred through internal cabling routes to the CSP power block.

1.3.1.3.5 Auxiliary Infrastructure and Services

In addition to the primary generation components, the Redstone PV will require various supporting infrastructure and services to enable construction and operation. Where possible, the Redstone PV will utilise existing infrastructure associated with the CSP facility, including:

- Access roads and internal circulation routes;
- Security infrastructure and controlled access;
- Water supply for cleaning and operational use;
- Waste management systems;
- Stormwater management infrastructure;
- Administrative and operational facilities; and
- Fire protection systems.

1.3.1.3.6 Associated activities and Infrastructure

In addition to the primary generation components described above, the Redstone PV requires a range of supporting activities and infrastructure to enable its construction, operation, and maintenance. These associated components are largely integrated with, or supported by, the existing infrastructure of the Redstone CSP facility, thereby reducing the need for extensive new infrastructure development. The key associated activities and infrastructure are described below.

1.3.1.3.7 Access and Transportation

Access to the Redstone PV will be achieved via existing access roads associated with the CSP facility. Internal circulation within the PV site will be facilitated by gravel access tracks between panel arrays for construction and maintenance purposes. Limited upgrades to existing access infrastructure may be required to accommodate construction traffic and equipment.

1.3.1.3.8 Power and Electrical Integration

The electricity generated by the Redstone PV will be used to supply the auxiliary load requirements of the CSP facility. Internal electrical integration will be achieved through on-site cabling and connection to the CSP electrical network. No export of electricity to the national grid is proposed as part of the Redstone PV, as the facility is designed for internal consumption.

1.3.1.3.9 Water Supply and Use

Water will be required on a limited basis during construction and operation. During construction, water will be used for dust suppression and general site activities, while during operation, water will primarily be used for periodic cleaning of PV panels. Water requirements will be met through existing supply systems associated with the CSP facility, and water use will be optimised to minimise consumption.

1.3.1.3.10 Waste Management

Construction and operational activities will generate both general and limited hazardous waste streams, including packaging materials, scrap materials, and small quantities of hazardous substances such as oils and chemicals. All waste will be managed in accordance with applicable legislation and best practice, including waste minimisation, recycling where feasible, and disposal at appropriately licensed facilities.

1.3.1.3.11 Stormwater Management

Stormwater management infrastructure will be implemented to control runoff, prevent erosion, and avoid the contamination of surrounding environments. Design measures will include appropriate drainage design, erosion control measures, and maintenance of natural drainage patterns where possible.

1.3.1.3.12 Security

Security infrastructure will be implemented to control access to the site and protect equipment. This will include perimeter fencing, controlled access points, and security monitoring systems consistent with those implemented at the CSP facility.

1.3.1.3.13 Human Resources and Labour

The construction phase will require a temporary workforce, while the operational phase will require a smaller permanent workforce for maintenance and monitoring activities. Where possible, employment opportunities will be sourced locally in line with applicable procurement and labour policies.

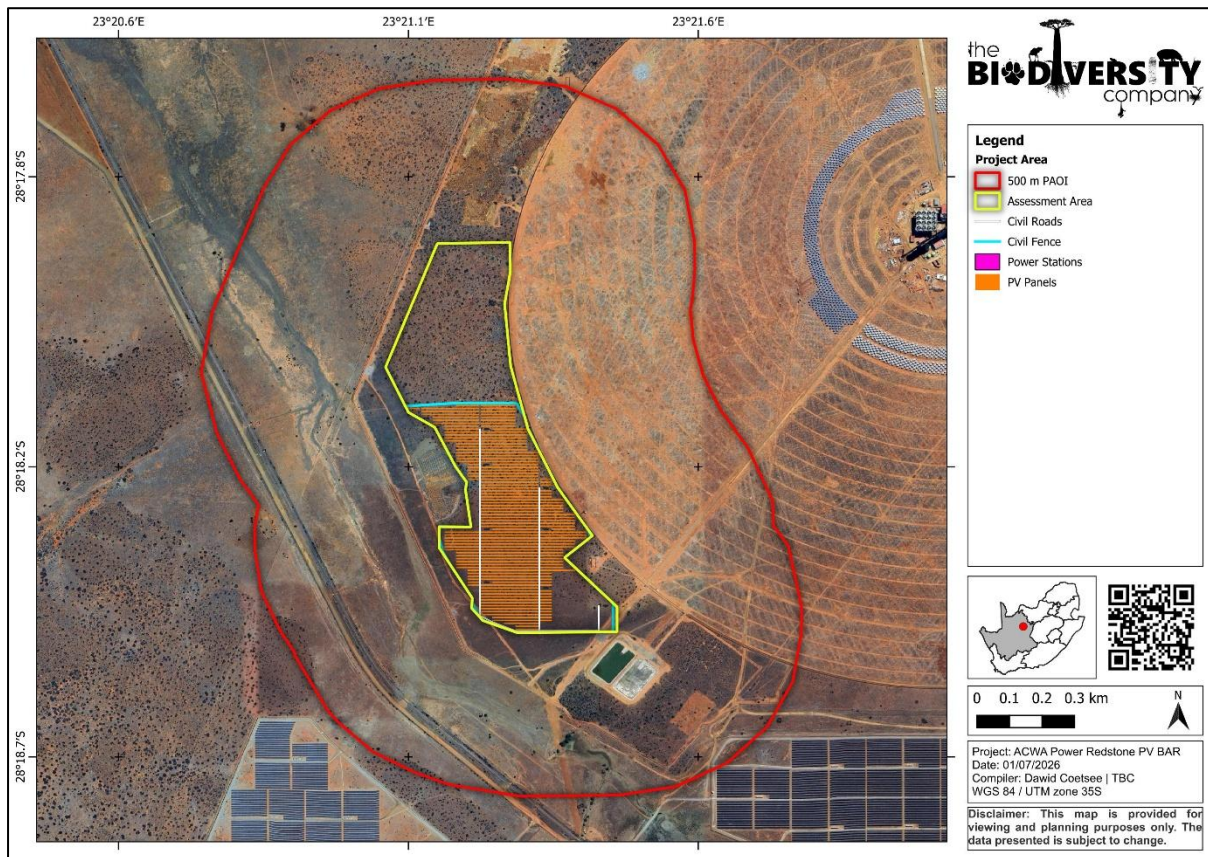


Figure 1-2 Proposed project site and project area of influence

1.4 Assumptions and Limitations

The following aspects were considered as limitations:

- It has been assumed that the spatial files provided to the specialist are accurate;
- Only the proposed available area, PV panels, and associated infrastructure within Figure 1-2 was provided as a layout by the time of the site visit;
- The seasonality of the surveys is not considered to be a limiting factor with regard to the identification and delineation of wetlands, the only limitation in this regard would be the identification of certain plant species. The results of the assessment are considered conclusive in the opinion of the specialist;
- Freshwater features within the larger 500 m PAOI were delineated and assessed via desktop;
- Areas characterised by external wetland attributes were the focus for this assessment, where potential wetlands were thereafter confirmed by soil form indicators; and
- The GPS used for water resource delineations is accurate to within five metres. Therefore, the wetland delineation plotted digitally may be offset by a maximum of five metres 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.

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.
	NEMA: Environmental Impact Assessment Regulations (2014) (GNR 326, 7 April 2017), Appendix 6 requirements	Minimum content for specialist reports.
	NEMA: Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020)	The minimum criteria for reporting. Protocol for the specialist assessment and minimum report content requirements.
	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.
Provincial	Conservation of Agricultural Resources Act, 1983 (Act 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.
	Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)	Provincial framework for sustainable utilisation and protection of wild animals, aquatic biota and plants; establishes permit systems (hunting, keeping, transport, trade), species schedules, offences, and protections for aquatic systems, riparian vegetation and wetlands.

1.5.1 National Water Act (NWA, 1998)

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

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

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem, 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).

1.5.2 National Environmental Management Act (NEMA, 1998)

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

1.5.3 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” for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment.

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	7.3
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.	3.1.4
The threat status of the ecosystem and species as identified by the screening tool	3.5.1
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)	3.1.4
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)	3.3

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	3.5
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:	4.1
(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); (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?	N/A
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	2.1
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	3.4
Additional environmental impacts expected from the proposed development	N/A
Any direct, indirect and cumulative impacts of the proposed development on site	4
The degree to which impacts and risks can be mitigated	4
The degree to which the impacts and risks can be reversed	4

The degree to which the impacts and risks can cause loss of irreplaceable resources	4
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies	3.4
Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr)	0
A motivation must be provided if there were development footprints identified as having a “low” aquatic biodiversity sensitivity and that were not considered appropriate	N/A
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

A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

2 Fieldwork

2.1 Freshwater Biodiversity Field Assessment

A field survey for the area was undertaken on the 30th of June 2026, during the dry season, to identify the presence of freshwater features (wetlands) and to delineate their spatial extents. Furthermore, to determine vegetation composition of the identified features and the likelihood of features to be used as habitat for fauna. The seasonality of the surveys is not considered to be a limiting factor with regard to the identification and delineation of wetlands, the only limitation in this regard would be the identification of certain plant species. The results of the assessment are considered conclusive in the opinion of the specialist.

3 Results & Discussion

3.1 Desktop Dataset Assessment

3.1.1 Climate

The climate for the predominant vegetation type (Olifantshoek Plains Thornveld) was used to draw inferences about the climate for the region. This vegetation type is located in the Northern Cape Province, specifically through the pediment areas of Korannaberg, Langeberg and Asbestos Mountains as well as some of those ridges to the west of the Langeberg. In addition, from the vicinity of Sonstraal in the north past Olifantshoek to the areas north of Niekerkshoop between Volop and Griekwastad in the south. Furthermore, from Griekwastad, this vegetation type stretches northwards to the flats west of the Lime Acres area (Mucina & Rutherford, 2006).

This region is characterised by summer and autumn rainfall with very dry winters. The mean annual precipitation is approximately 200 to 350 mm with frost frequently occurring during winter months (Mucina & Rutherford, 2006; Figure 3-1).

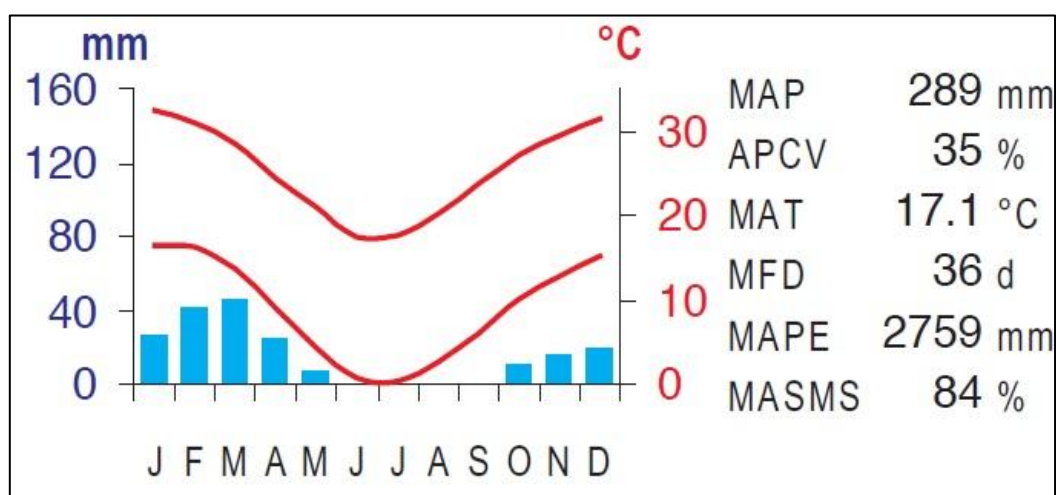


Figure 3-1 Climate for the project area based on the Olifants Plains Thornveld (SVk 13) (Mucina & Rutherford, 2006)

3.1.2 Soils and Geology

The vegetation type occurring throughout the project area's geology and soil is characterised by aeolian red sand from the Recent to Tertiary age (Kalahari Group). This region is dominated by calcrete and silcrete with some basaltic and andesitic lava. The most dominant soil form is that of deep Hutton soils (Mucina & Rutherford, 2006).

According to the Land Type Database (Land Type Survey Staff, 1972 - 2006), the PAOI is predominantly characterised by the Ae 214 land type. This land type consists of red-yellow apedal soils which are freely drained. The soils tend to have a high base status and is deeper than 300 mm.

3.1.3 Hydrological Characteristics

The PAOI falls within the Southern Kalahari Ecoregion, within the Vaal-Orange Water Management Area (WMA). At a finer scale, within the D73A quaternary catchment. The fine scale hydrological features are presented in the following section.

3.1.3.1 Topographical River Lines and Inland Water Areas

The topographical inland and river line data for the "2823" dataset indicated one non-perennial drainage feature within the PAOI (Figure 3-2). No inland water areas were identified within the PAOI.

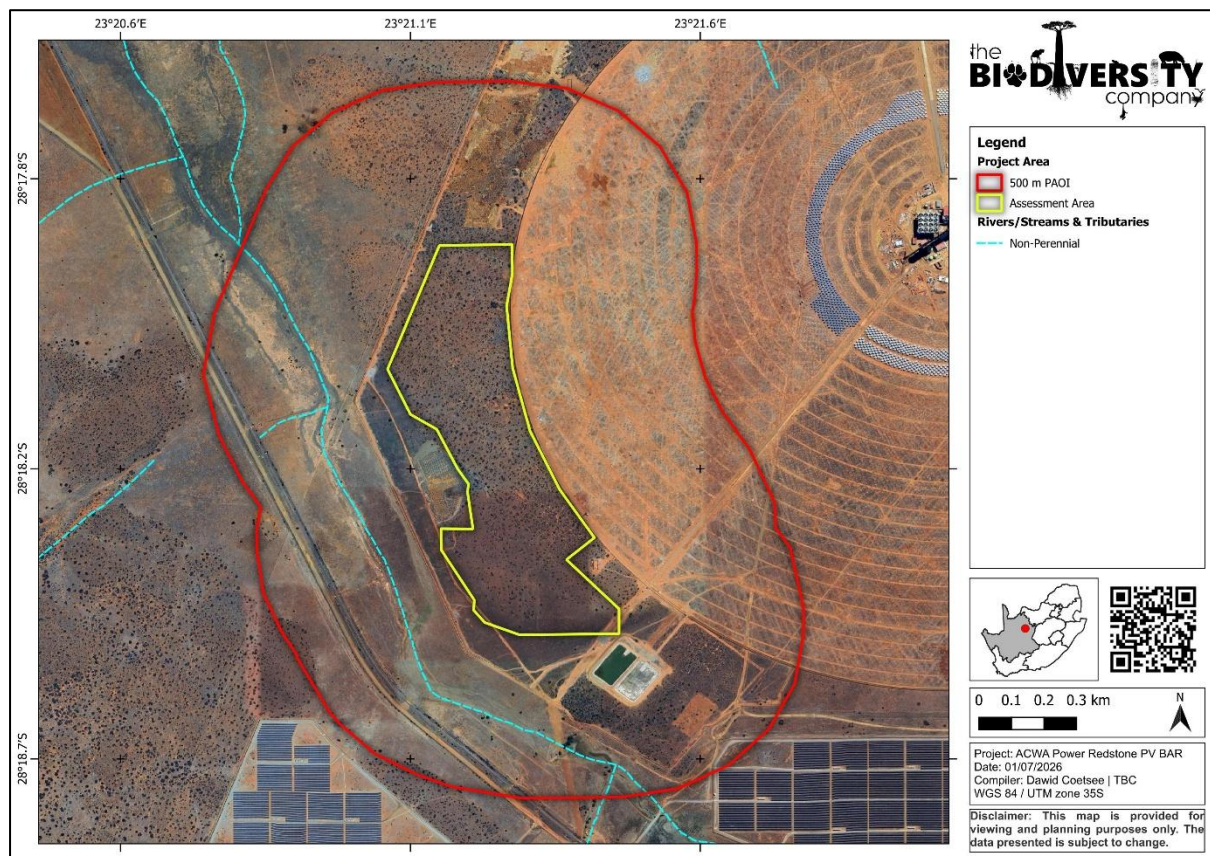


Figure 3-2 Topographical Inland Water Areas and River Lines that intersect the project area of influence

3.1.4 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
Strategic Water Source Areas	Relevant – PAOI does overlap with a GWSA.	3.1.4.1
Provincial Conservation Plan	Irrelevant – PAOI does not overlap with CBA and ESAs.	-
South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	Irrelevant – PAOI does not overlap with SAIIAE wetlands.	-
National Freshwater Priority Area	Irrelevant – PAOI does not overlap with NFEPA wetlands.	-

3.1.4.1 Strategic Water Source Areas

As displayed in Figure 3-3, the project area overlaps with the Southern Ghaap Plateau Groundwater Strategic Water Source Area.

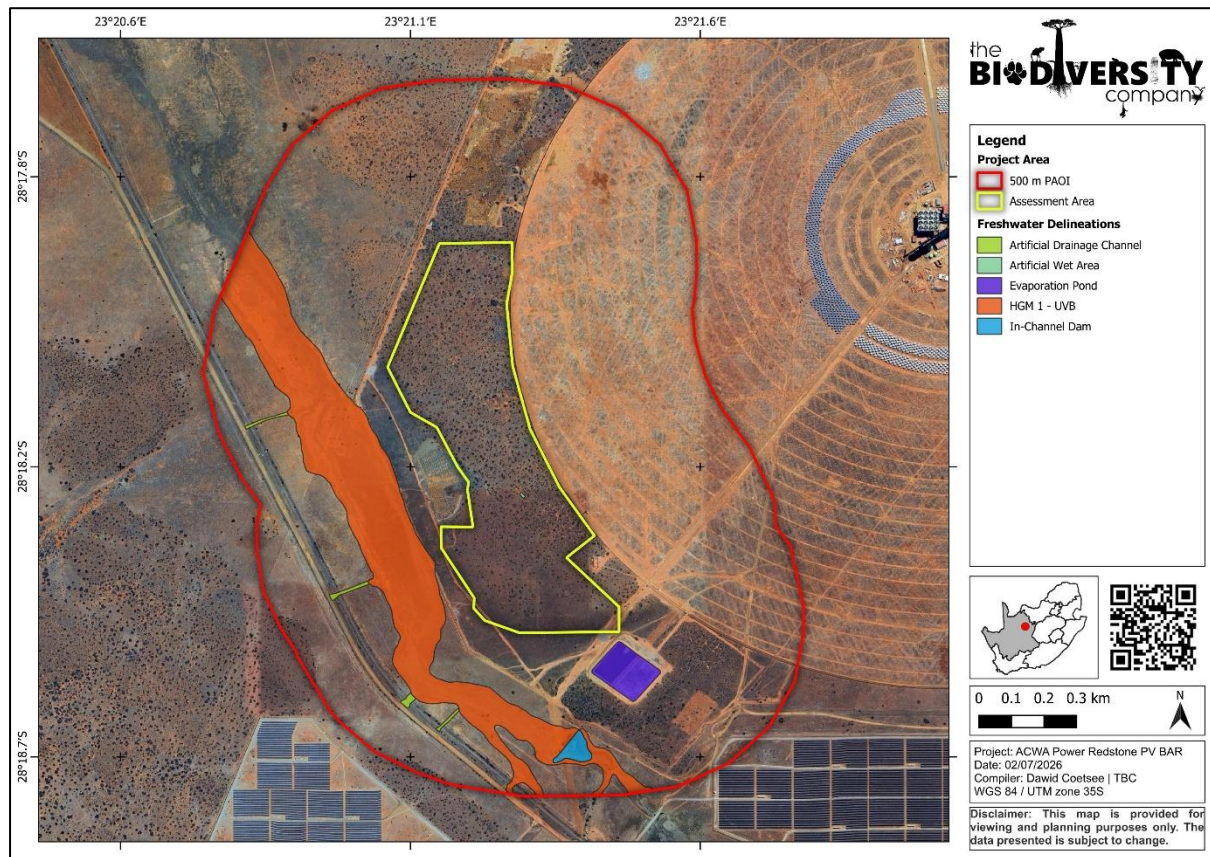


Figure 3-4 Delineation of wetland features within the project area of influence

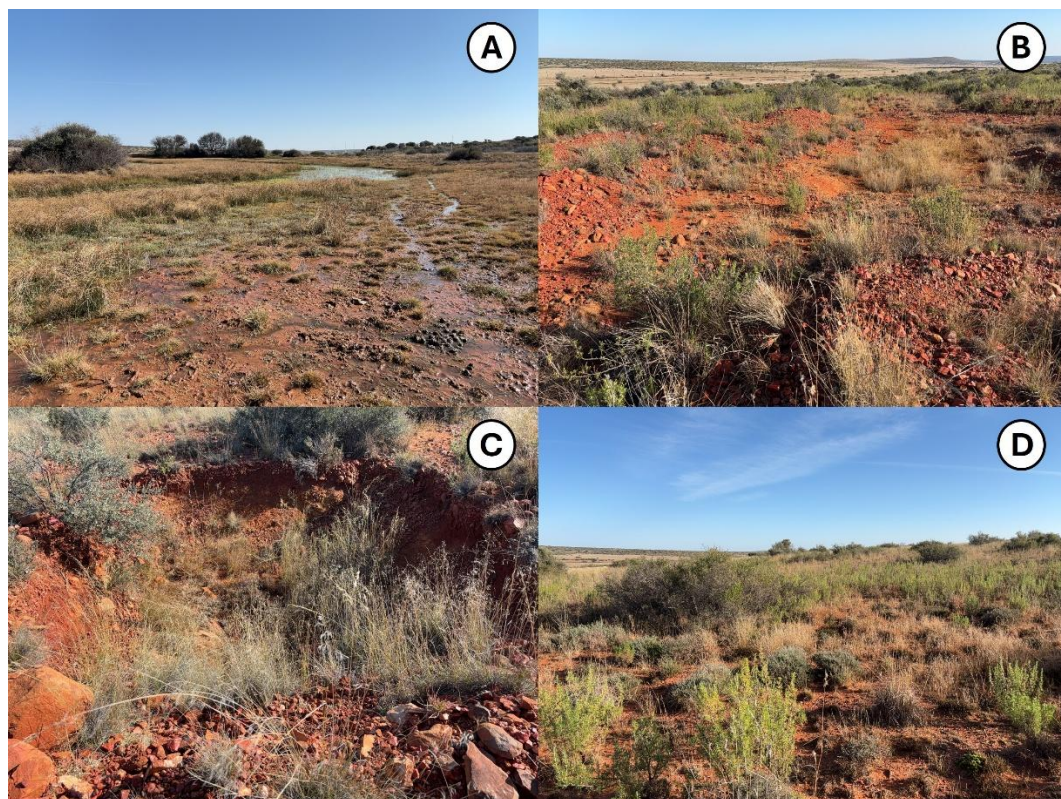


Figure 3-5 Representative photographs of the different identified features within the project area of influence. A) Unchannelled valley-bottom; B) Artificial wet area; C) Historical excavations; D) Terrestrial environment

3.2.2 Risk Screening

Table 3-3 provides the results of risk screening for the delineated wetlands and provides motivation for each of the determined categories.

Table 3-3 Risk screening results for the identified wetlands

HGM unit	Risk Status	Rationale
HGM 1	At Risk	This HGM unit was located within proximity of the proposed activities and downslope of the activities and, have therefore been determined as “At Risk”. It is anticipated that indirect impacts to the wetland systems are potential.
Artificial Drainage Channels Artificial Wet Area In-Channel Dam Evaporation Pond	Not applicable	Artificial drainage channels, artificial wet areas, dams, and evaporations ponds are predominantly man-made or anthropogenically induced systems/areas that are dependent on one or more induced drivers (e.g., engineered flow conveyance, altered runoff regimes, seepage, damming, discharge, or land-use-driven concentration of flows) for their initiation and ongoing persistence. Their ability to provide ecological services is therefore contingent on the long-term persistence and management of these drivers. As such, standard wetland risk assessment approaches are generally not directly applicable to these features, because their ecological processes, values, and sensitivities may be substantially different from those of natural wetlands and can change rapidly if the inducing drivers are modified, removed, or fail.

3.2.3 Classification and Description

The wetland classification as per SANBI guidelines (Ollis *et al.*, 2013) is presented in Table 3-4.

Table 3-4 Wetland classification as per SANBI guideline (Ollis *et al.*, 2013)

Wetland Unit	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	Southern Kalahari Ecoregion	Eastern Kalahari Bushveld Group 3	Valley Floor	Unchannelled valley-bottom	N/A	N/A

An unchannelled valley-bottom wetland, is a wetland located on a valley floor, characterised by the absence of a distinct river channel (Ollis *et al.*, 2013). These wetlands are defined by their diffuse water flows, which are not confined within channel banks, allowing water to spread across the valley floor. The primary water inputs for unchannelled valley-bottom wetlands include diffuse surface and subsurface flows from upstream channels that lose confinement, as well as seepage from adjacent valley side-slopes. The hydrodynamics of these wetlands are dominated by horizontal, unidirectional, diffuse surface flow, although infiltration and evapotranspiration can also be significant. This setting allows unchannelled valley-bottom wetlands to function as important sites for sediment deposition, water filtration, and habitat provision, supporting a diverse range of plant and animal species. Their unique hydrological and geomorphological characteristics make them vital components of the landscape, contributing to the overall ecological health of the valley systems in which they occur. Figure 3-6 presents a diagram of a typical unchannelled valley-bottom wetland, showing the dominant movement of water into, through and out of the system.

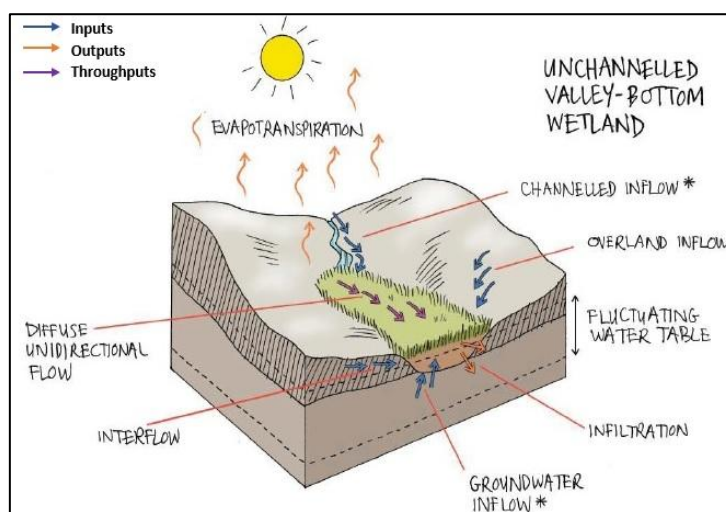


Figure 3-6 Amalgamated diagram of a typical unchannelled valley-bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al., 2013)

3.3 Wetland Functional and Ecological Assessment

3.3.1 Functional Assessment

Only natural features perceived to be “At - Risk” from the proposed activities were assessed further in terms of their ecological features.

3.3.1.1 General Functional Description

Unchannelled valley-bottom wetlands are characterised by their location in valley-bottoms without a distinct stream channel, resulting in diffuse water flow across the wetland. These wetlands are highly effective in sediment trapping due to their gentle gradients and the extensive areas that remain permanently saturated, which promote the deposition of sediments carried by runoff waters. The high levels of soil organic matter in these wetlands enhance their capacity for nitrate and toxicant removal, as the prolonged contact with runoff waters facilitates these processes. However, phosphate retention may be lower compared to other wetland types due to potential remobilization under prolonged anaerobic conditions. Unchannelled valley-bottom wetlands also contribute to streamflow regulation to some extent, although this is influenced by factors such as vegetation transpiration and soil characteristics. These wetlands play a crucial role in maintaining water quality and providing habitat for diverse species, making them vital components of the landscape (Kotze et al. 2009).

It should be noted that these characteristics are representative of ideal wetland features and may not necessarily represent the characteristics of all wetlands. The functionality of wetlands and the provision of benefits is largely dependent on wetland size and influence from abiotic drivers.

3.3.1.2 Ecosystem Services

The ecosystem services provided by the relevant HGM units on site were assessed and rated using the WET-EcoServices method (Kotze et al., 2009; updated Version 2, Kotze et al., 2020). The results of the assessment are presented in Table 3-5. The ecosystem services scores of the delineated wetlands classify as “Intermediate” for HGM 1. The main ecosystem services provided by these wetlands are localised in nature and include temporary water storage and attenuation, limited sediment and nutrient trapping, minor water-quality regulation, and habitat biodiversity support, although these functions are generally expressed at an “intermediate” level.

Table 3-5 Summary of the average ecosystem scores of the assessed wetland units

Wetland Unit				HGM 1	
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation	2.1	
			Streamflow regulation	1.5	
			Water Quality enhancement benefits	Sediment trapping	2.2
				Phosphate assimilation	2.0
				Nitrate assimilation	2.0
				Toxicant assimilation	1.8
				Erosion control	1.0
	Carbon storage	1.2			
	Direct Benefits	Provisioning benefits	Biodiversity maintenance	1.8	
			Provisioning of water for human use	0.6	
			Food for Livestock	1.6	
			Provisioning of harvestable resources	0.8	
			Provisioning of cultivated foods	0.2	
		Cultural benefits	Cultural heritage	0.2	
			Tourism and recreation	0.4	
			Education and research	0.5	
Class			Intermediate		

HGM 1 is performing several important ecological and hydrological functions. These included erosion control, through the stabilisation of soils and reduction in sediment mobilisation; flood attenuation, through the slowing and temporary spreading of flows during runoff events; biodiversity support, by providing habitat distinct from the surrounding terrestrial environment; surface water provision, particularly in the context of an arid landscape where freshwater features are limited; and ecological corridor functioning, by facilitating the movement of fauna through the landscape. Direct human-use benefits are relatively limited, with grazing representing the most apparent direct use of the wetland and buffer zone. Although the erosion control function is considered somewhat constrained by the dominance of non-woody vegetation, the corridor is nonetheless regarded as functionally important within the local landscape.

3.3.2 Present Ecological State

The wetlands identified within the project area have exhibited some degree of modification resulting from natural physical changes as well as anthropogenic impacts at both the local and catchment levels. Resultingly, the wetland scored an average Present Ecological State (PES) score within the “C – Moderately Modified” PES classes. The results of the wetland health and integrity assessment is provided in Table 3-6.

Table 3-6 Average Present Ecological State scores for the assessed wetlands

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Ecological Category	C	C	B	B
Combined Ecological Category	C			

The list below refers to the present-day local impacts observed within the assessed wetland areas:

- Alterations to wetland hydrology as a result of the in-channel dam and adjacent built-up infrastructure in the surrounding catchment, together with local land transformation that has likely modified natural runoff pathways, ponding patterns, and infiltration characteristics;
- Geomorphological disturbance (road and railway culvert crossings) associated with past and ongoing land-use activities, including local surface disturbance, soil compaction, and modification of natural wetland microtopography, with consequent disruption of natural sediment movement and deposition processes;
- Limited vegetation transformation and degradation, with the wetland and its surrounds occurring within a secondary grassland setting resulting in reduced natural wetland vegetation integrity and increased dominance of disturbance-tolerant species; and
- Localised erosion and sedimentation resulting from altered hydrological response and disturbed catchment conditions, further contributing to geomorphological instability and reduced wetland ecological functioning.

3.3.3 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) assessment was applied to the HGM units in conjunction with the ecosystem service scores in the preceding sections, to assess the levels of sensitivity and ecological importance of the wetland. Various components pertaining to the protection status of a wetland is considered for the EIS, including Strategic Water Source Areas (SWSA), the NFEPA Wetveg protection status and the protection status of the wetland itself considering the NBA wetland dataset. The results of the assessment are shown in Table 3-7. The wetlands average EIS scores fall within the “C – Moderate” class. The level of service provision by the wetlands influenced the overall EIS ratings.

Table 3-7 Aspects considered in the Ecological Importance and Sensitivity assessment

HGM Type	NFEPA Wet Veg			NBA Wetlands			SWSA (Y/N)	CBA / ESA (Y/N)	EIS Class
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level			
HGM 1 UVB	Eastern Kalahari Bushveld Group 3	Least Threatened	Not Protected	C Moderately Modified (Site visit)	Critically Endangered	Not Protected	N	N	C – Moderate

3.3.4 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) for the wetland areas was determined from the results of the PES and EIS assessments. These assessments indicated that all wetland features within the site had, to an extent, undergone transformation as a result of historical and current impacts. Nevertheless, despite the altered ecological integrity of these systems, they are considered to provide ecological services. The appropriate REC and RMO estimated for the wetland areas is presented in Table 3-8 below.

Table 3-8 Summary of the REC and RMO categories assigned to the relevant wetlands

C – Maintain
HGM 1

3.4 Buffer Requirements

The buffer requirements for the wetlands were calculated using the Site-Based Tool: Determination of Buffer Zone Requirements for Wetland Ecosystems (Macfarlane et al., 2014). The recommended pre-mitigation and post-mitigation buffer zones for the wetlands in relation to the proposed development area were calculated to be 32 m and 30 m, respectively, as presented in Table 3-9. The post-mitigation buffer zone is depicted in Figure 3-7. Given that the surrounding landscape is already modified, and that the proposed activity is not anticipated to constitute a high-impact land use, provided that all recommended mitigation measures are diligently implemented, these buffers are considered sufficient to maintain the resilience and ecosystem services of the wetlands. Furthermore, the specialist-assigned 30 m post-mitigation buffer is consistent with the minimum recommended buffers for low-impact land uses in already modified landscapes, as set out in Annexure 16 of the Buffer Zone Guidelines for Wetlands, Rivers and Estuaries (Macfarlane and Bredin, 2017).

Table 3-9 *Buffer requirements for the relevant wetland features*

Aspect	Recommended Pre-Mitigation Buffer	Recommended Post-Mitigation Buffer
HGM 1	32 m	30 m

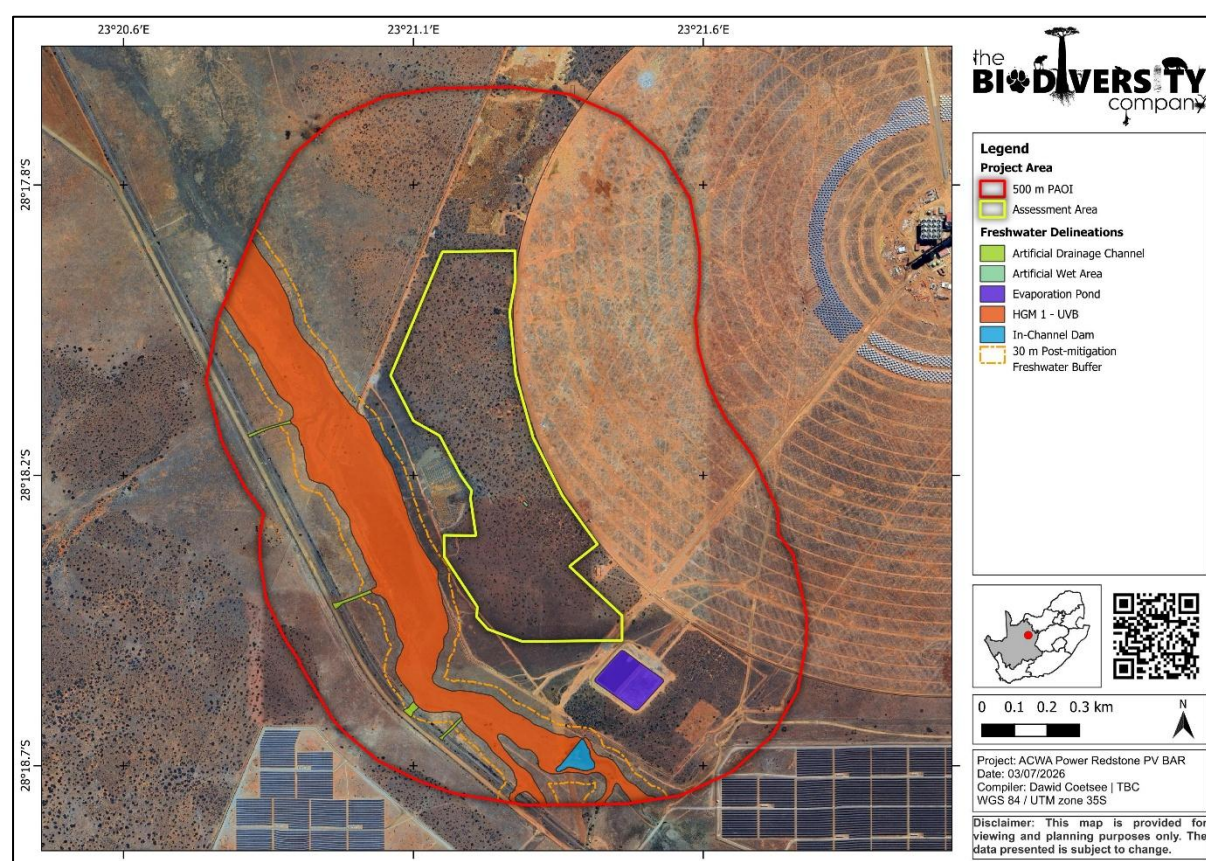


Figure 3-7 *Recommended Buffers for the identified wetlands in relation to the proposed development*

3.4.1 Regulation Zones

Table 3-10 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), water uses as defined in Section 21 (c) and 21 (i) of the NWA must be considered if the proposed activities fall within the regulated zones of a watercourse as defined in the Act.

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

Both types of authorisations (NEMA and NWA) are applicable, given that the proposed development occurs within the relevant regulated zones (Figure 3-8).

Table 3-10 **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 metres or more; Where such development occurs— (a) Within a watercourse; (b) In front of a development setback; or (c) If no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse. excluding – (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves. 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 metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.”

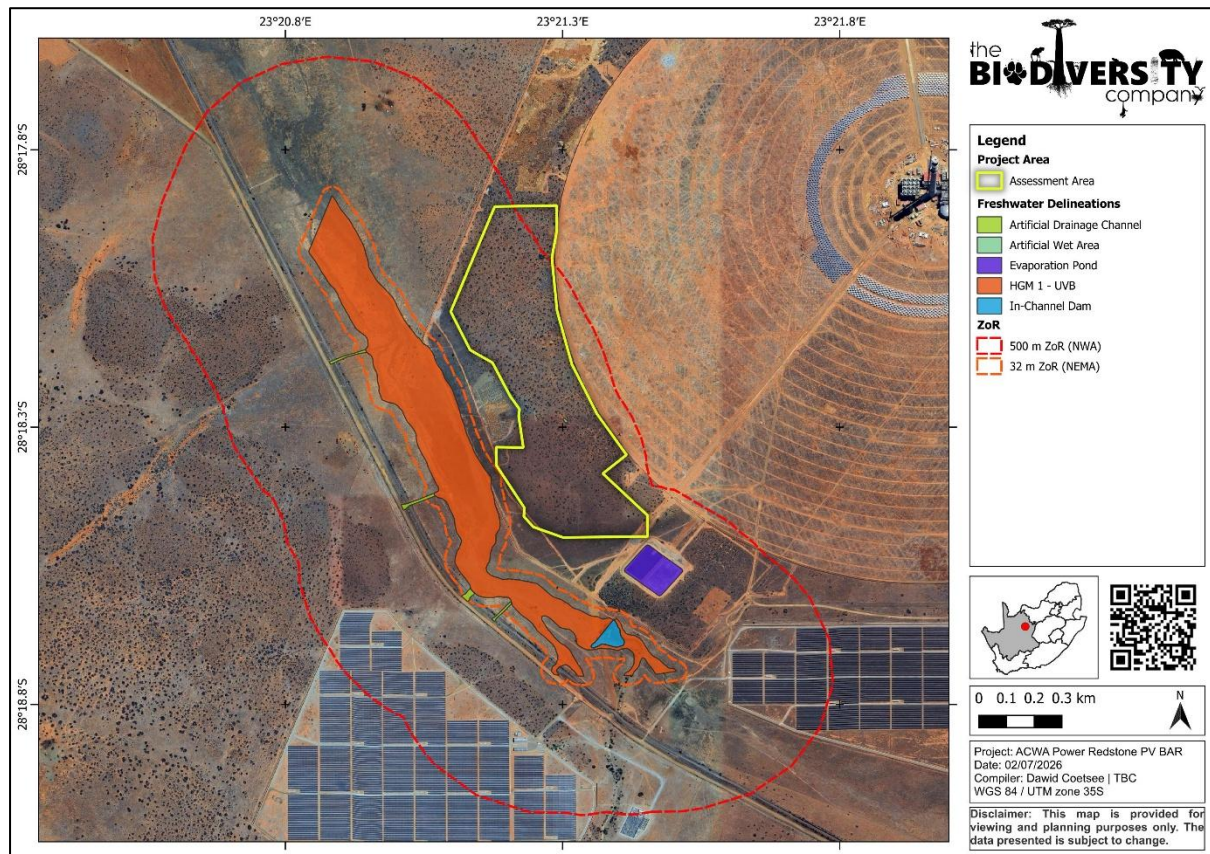


Figure 3-8 Zones of Regulation in relation to the identified freshwater features within the project area of influence

3.5 Site Sensitivity Verification

3.5.1 Desktop Ecological Sensitivity

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

- Aquatic Biodiversity Theme sensitivity is “Very High” for the Assessment Area within the PAOI (Figure 3-9) attributed to the presence of a FEPA Subcatchment.

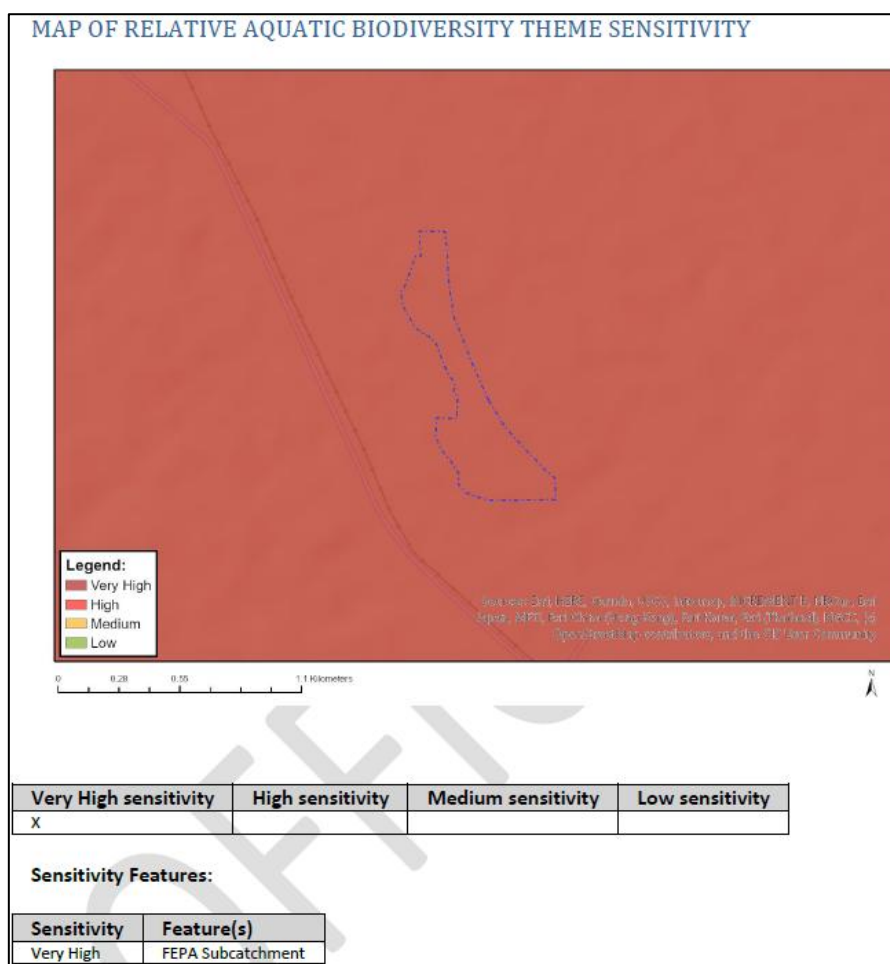


Figure 3-9 Aquatic Biodiversity Theme Sensitivity for the project site

3.5.2 Screening Tool Comparison

The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas in Table 3-11 below. A summative explanation for each result is provided as relevant. The specialist-assigned sensitivity ratings are based on the presence or absence of wetlands, the nature of features and the PES and EIS assessment processes followed in the previous section. Furthermore, consideration is given to any observed or likely presence of sensitive fauna and flora. The sensitivities are displayed in Figure 3-10.

Table 3-11 Summary of the screening tool vs specialist assigned sensitivities

Aspect	Screening Tool Theme	Environmental Screening Tool Sensitivity	Specialist Sensitivity	Tool Validated or Disputed by Specialist - Reasoning
HGM 1	Aquatic Biodiversity Theme	Very High	Very High	Validated – This area is representative of a natural wetland that provides suitable and significant habitat and functionality to support freshwater biodiversity.
30 m Buffer		Very High	Medium	Disputed – These areas are representative of the wetland area periphery and are of importance in terms of supporting intactness of the features they encompass.
Artificial Drainage Channels Artificial Wet Area In-Channel Dam Evaporation Pond		Very High	Low	Disputed – These are artificial features which were constructed by human intervention and are therefore reliant on human induced drivers for long-term persistence which if removed, altered or stopped will result in the features not being present. The features do not provide naturally supported ecological services.



Figure 3-10 *Freshwater Sensitivity for the project area of influence*

4 Risk and Impact Assessment

4.1 Quantitative Risk and Impact Assessment

The Risk / Impact Assessment considered the indirect impacts, to the wetland systems. 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.

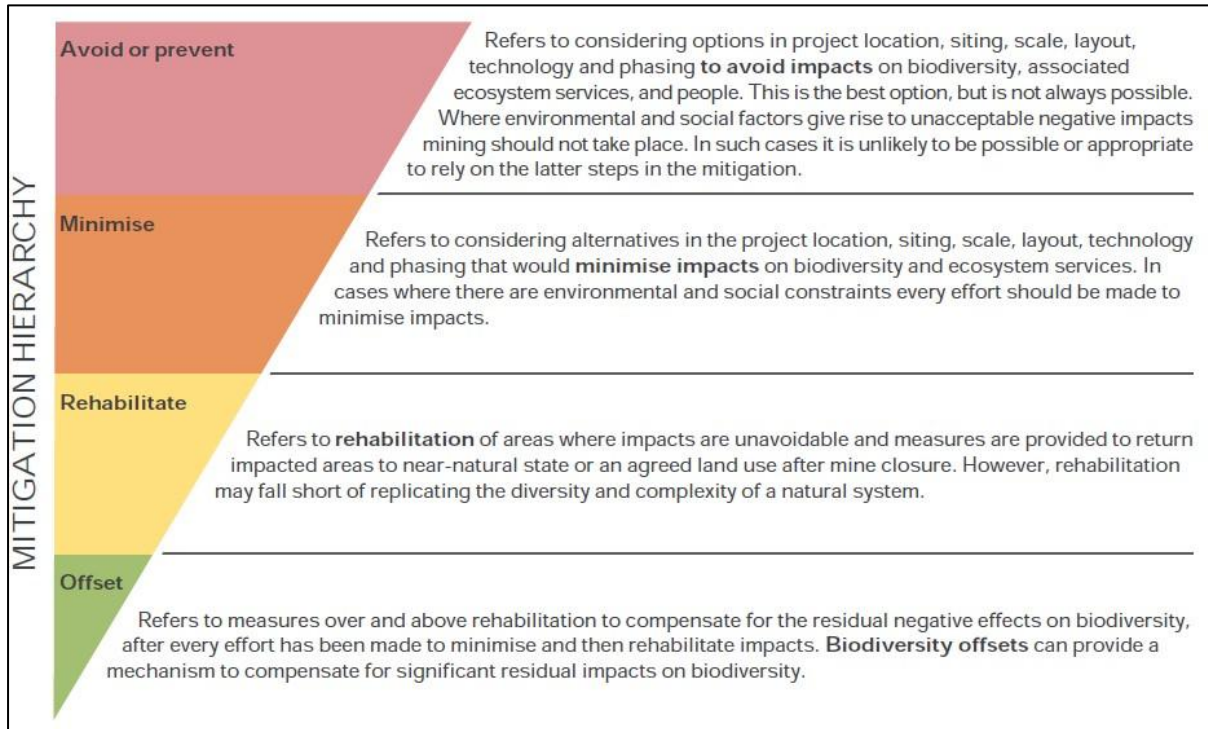


Figure 4-1 The mitigation hierarchy as described by the DEA (2013)

A risk assessment was conducted for the proposed development (Table 4-1). For this assessment, the specialist was only provided with the assessment area and the proposed layout for the PV infrastructure. Wetlands were identified within the 500 m PAOI therefore impacts to the systems are potential. Based on the spatial files provided for the proposed development, the PV infrastructure encroaches the buffer area of HGM 1 but does not intersect. The focus for mitigation was thus placed on minimising potential impacts.

It is anticipated that the project will pose “Low” post-mitigation risks, provided that the suggested mitigation measures are implemented and that the buffer area of HGM 1 is fully avoided. The greatest risk to HGM 1 is likely to arise from the localised disturbance of its buffer, which may alter shallow hydrological pathways and result in indirect impacts such as erosion, sedimentation, and reduced wetland functioning.

Table 4-1 Summative results of the Risk Assessment conducted for the proposed development

Phase	Activity	Impact	Potentially affected watercourses	Significance (max = 100)	Risk Rating
			Name/s		
Construction	Construction of Solar Panels, BESS, and Fencing (Within 500m of wetlands) Site clearing and preparation Earthworks and vehicle movement Road construction Temporary and portable ablutions Civil works Transportation and installation of PV panels Wiring to central inverters Storage and use of hazardous substances and equipment	Altered Hydrology and induced erosion and sedimentation from soil compaction	HGM 1	18	L
		Loss of native vegetation and habitat fragmentation with proliferation of alien species from vegetation clearance	HGM 1	18	L
		Impaired water quality from contaminated runoff (accidental chemical and oil spills from machinery and equipment used for clearance activities and road development and leaks from temporary ablutions)	HGM 1	14.4	L
	Construction of the Access Road and Associated Stormwater Management Systems (Within 500m of wetlands) Site clearing and preparation Earthworks and vehicle movement Temporary and portable ablutions Civil works Transportation, storage and installation of road materials Road construction Storage and use of hazardous substances and equipment Construction of stormwater management systems Final reshaping, retaining and landscaping	Altered Hydrology and induced erosion and sedimentation from soil compaction	HGM 1	16.2	L
		Loss of native vegetation and habitat fragmentation with proliferation of alien species from vegetation clearance	HGM 1	16.2	L
		Impaired water quality from contaminated runoff (accidental chemical and oil spills from machinery and equipment used for clearance activities and road development and leaks from temporary ablutions)	HGM 1	13.2	L
Operation	Operation of Solar Facility and associated infrastructure (Within 500m of wetlands) Infrastructure including (Substation, Roads, Fencing, PV Panels) Stormwater management Maintenance including washing panels	Altered overland flows from facility, hardened surfaces (roads) within and around the facility and stormwater management with induced erosion and sedimentation of watercourses	HGM 1	18	L
		Water quality impairment from contaminated runoff	HGM 1	14.4	L
		Continued proliferation of alien invasive vegetation	HGM 1	21.6	L

	Maintenance of the Access Road and Associated Stormwater Management Systems (Within 500m of wetlands) Vehicle traffic Operation of stormwater management systems	Potential wetland contamination due to polluted runoff and from indiscriminate dumping of litter	HGM 1		13.2	L
		Altered overland flows from hardened surface of the road leading to the facility and stormwater management with induced erosion and sedimentation of watercourses	HGM 1		19.8	L
Decommissioning	Removal of Solar Facility Infrastructure (Within 500m of wetlands) Dismantlement and deconstruction of structures Relandscaping Waste Management Stormwater Management	Altered Hydrology and induced erosion and sedimentation from soil compaction	HGM 1		18	L
		Loss of native vegetation and habitat fragmentation with proliferation of alien species from vegetation clearance	HGM 1		18	L
		Impaired water quality from contaminated runoff (accidental chemical and oil spills from machinery and equipment used for clearance activities and road development and leaks from temporary ablutions)	HGM 1		14.4	L

4.1.1 Impact Assessment

The proposed development has the potential to result in localised disturbance to freshwater habitat, particularly in relation to HGM 1, where the proposed development occurs in close proximity to the wetland and associated buffer. In this context, the main impact pathways are associated with the alteration of surface water flow patterns, increased runoff concentration, sediment mobilisation, erosion, and possible deterioration in water quality arising from construction and operational activities. During the construction phase, vegetation clearing, soil disturbance, excavation, the movement of machinery, and the establishment of compacted or hardened surfaces may increase the susceptibility of exposed soils to erosion, particularly during rainfall events. This may result in the transport of sediment into downstream drainage features and the riparian corridor, with associated effects on channel stability, habitat quality, and water quality. There is also a risk of contamination from hydrocarbons, cement, wastewater, litter, and other construction-related pollutants if these are not appropriately managed.

During the operational phase, the principal risks are likely to remain associated with stormwater management and the concentration or redirection of runoff from transformed surfaces. If not properly controlled, these changes may increase flow velocity at discharge points, promote localised scour and erosion, and contribute to sediment deposition or water quality deterioration within the receiving freshwater environment. In addition, poor housekeeping, accidental spills, or inadequate maintenance of infrastructure may result in chronic low-level contamination of runoff, with secondary effects on riparian habitat condition. The legacy PV assessment similarly found that freshwater impacts were largely linked to runoff generation, erosion, sedimentation, and pollution risk, and that such impacts could be reduced to acceptable levels where appropriate mitigation was applied.

The impacts associated with the proposed activities were assessed using the EIMS impact matrix, and the results are presented in Table 4-2. The assessment considers the anticipated impacts associated with the construction, operational, and decommissioning phases of the proposed project. The results indicate that impacts are generally of moderate significance prior to mitigation and can be reduced to low significance post mitigation, provided that the recommended mitigation measures and prescribed buffer requirements are implemented.

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

Impact	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Indirect loss, disturbance and degradation of wetlands	Construction	-7.5	-3.5	-3.94
Mitigation - Finalise the construction layout to avoid HGM 1 and its associated buffer as far as practicable. - Demarcate the wetland boundary, buffer area, and all no-go areas before construction commences, and maintain this demarcation for the duration of construction. - Restrict all construction activities, laydown areas, stockpiles, vehicle parking, and machinery movement to the approved construction footprint only. - Use existing access routes as far as practicable and prohibit the creation of informal tracks near the wetland. - No direct encroachment into the delineated wetland footprint is permitted unless specifically authorised. - Any accidental disturbance to wetland edge or buffer areas must be rehabilitated immediately using suitable indigenous vegetation and appropriate soil reinstatement measures.				
Increased bare surfaces, runoff and potential for erosion	Construction	-7.5	-4	-4.5
Mitigation - Store fuels, oils, chemicals, and other hazardous substances in bunded areas outside wetland and buffer areas and away from drainage pathways. - Refuelling, servicing, and maintenance of vehicles and machinery must only take place in designated areas on impermeable or suitably contained surfaces outside wetland buffer areas. - Drip trays must be used for all stationary plant and during mobile refuelling and servicing activities. - Spill kits must be available in all active work areas, and personnel must be trained in spill prevention and spill response procedures. - Any spill must be contained immediately, and contaminated soil or absorbent material must be removed and disposed of at a licensed facility where required. - Regularly inspect and maintain machinery and vehicles to prevent leaks. - No storage, handling, or disposal of hydrocarbons, oils, chemicals, or hazardous waste may occur within the wetland or its associated buffer. - Develop and implement a Stormwater Management Plan (SWMP). - Install erosion and sediment control measures (silt fences, sediment basins, check dams, etc.). - Appropriately store excavated material to minimise impacts on water resources. - Maintain buffer zones around watercourses and wetlands. - Control dewatering discharge using sediment traps and erosion controls. - Implement the SWMP for all project-affected areas. - Implement erosion and sediment control measures. - Regularly inspect and maintain erosion control measures. - Minimise unnecessary loss of topsoil through stripping, stockpiling and reuse. - Strip topsoil correctly and prevent mixing with subsoil. - Manage and protect topsoil stockpiles from erosion and degradation. - Avoid stripping and replacement of wet topsoil. - Restrict vehicle and machinery movement to designated routes. - Rehabilitate disturbed areas as soon as practical. - Restrict vegetation clearing to approved construction footprints. - Phase construction works to minimise unnecessary disturbance and facilitate early rehabilitation. - Implement rehabilitation and revegetation of disturbed areas as soon as practical.				
Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation	Construction	-7.5	-4	-4.5
Mitigation - Store fuels, oils, chemicals, and other hazardous substances in bunded areas outside wetland and buffer areas and away from drainage pathways. - Refuelling, servicing, and maintenance of vehicles and machinery must only take place in designated areas on impermeable or suitably contained surfaces outside wetland buffer areas. - Drip trays must be used for all stationary plant and during mobile refuelling and servicing activities. - Spill kits must be available in all active work areas, and personnel must be trained in spill prevention and spill response procedures. - Any spill must be contained immediately, and contaminated soil or absorbent material must be removed and disposed of at a licensed facility where required. - Regularly inspect and maintain machinery and vehicles to prevent leaks.				

- No storage, handling, or disposal of hydrocarbons, oils, chemicals, or hazardous waste may occur within the wetland or its associated buffer. - Demarcate sensitive biodiversity areas, wetlands, buffers and no-go areas. - Develop and implement a construction layout plan identifying disturbance areas, no-go areas and buffer zones. - Restrict vegetation clearing to approved construction footprints only. - Phase construction activities to minimise unnecessary disturbance and facilitate early rehabilitation. - Prevent the introduction of invasive species through cleaning of equipment before entering the site. - Develop and implement an Alien Invasive Species Management Plan. - Undertake progressive rehabilitation and revegetation of disturbed areas. - Restrict vehicle movement to designated access roads and routes. - Implement environmentally responsible pest control measures where required. - GWA6 – Maintain wetland buffer zones and prohibit stockpiling, refuelling and other disturbance within buffers. - Develop and implement an Alien Invasive Management Plan. - Rehabilitate disturbed areas and revegetate as soon as practical.				
Increased sediment loads to downstream reaches	Construction	-7.5	-4	-4.5
Mitigation - Store fuels, oils, chemicals, and other hazardous substances in bunded areas outside wetland and buffer areas and away from drainage pathways. - Refuelling, servicing, and maintenance of vehicles and machinery must only take place in designated areas on impermeable or suitably contained surfaces outside wetland buffer areas. - Drip trays must be used for all stationary plant and during mobile refuelling and servicing activities. - Spill kits must be available in all active work areas, and personnel must be trained in spill prevention and spill response procedures. - Any spill must be contained immediately, and contaminated soil or absorbent material must be removed and disposed of at a licensed facility where required. - Regularly inspect and maintain machinery and vehicles to prevent leaks. - No storage, handling, or disposal of hydrocarbons, oils, chemicals, or hazardous waste may occur within the wetland or its associated buffer. - Develop and implement a Stormwater Management Plan (SWMP), including dirty-water control, drainage systems, attenuation structures and erosion prevention measures. - Install erosion and sediment control measures such as silt fences, sediment basins and check dams. - Store excavated material appropriately to minimise impacts on watercourses and wetlands. - Maintain wetland and watercourse buffer zones and prevent stockpiling within these areas. - Control dewatering discharge using sediment traps, energy dissipators and vegetated buffers. - Implement the Stormwater Management Plan across all project-affected areas. - Implement erosion and sediment control measures. - Regularly inspect and maintain erosion and sediment control measures. - Minimise unnecessary loss of topsoil through stripping, stockpiling and reuse. - Protect topsoil stockpiles against erosion and sediment loss. - Restrict vehicle movement to designated routes to prevent soil disturbance and erosion. - Rehabilitate disturbed areas progressively to reduce sediment generation. - Phase construction activities to minimise exposed surfaces and facilitate early rehabilitation. - Implement progressive rehabilitation and revegetation of disturbed areas.				
Contamination of wetlands with hydrocarbons due to machinery leaks and spill incidents	Construction	-6.75	-3.5	-3.94
Mitigation - Store fuels, oils, chemicals, and other hazardous substances in bunded areas outside wetland and buffer areas and away from drainage pathways. - Refuelling, servicing, and maintenance of vehicles and machinery must only take place in designated areas on impermeable or suitably contained surfaces outside wetland buffer areas. - Drip trays must be used for all stationary plant and during mobile refuelling and servicing activities. - Spill kits must be available in all active work areas, and personnel must be trained in spill prevention and spill response procedures. - Any spill must be contained immediately, and contaminated soil or absorbent material must be removed and disposed of at a licensed facility where required. - Regularly inspect and maintain machinery and vehicles to prevent leaks. - No storage, handling, or disposal of hydrocarbons, oils, chemicals, or hazardous waste may occur within the wetland or its associated buffer.				
Alteration of hydrological regime	Construction	-8.25	-4	-4.5
Mitigation				

- Site infrastructure must be micro-sited to avoid hydrologically important areas and to minimise interception, redirection, ponding, or concentration of surface runoff toward HGM 1. - The number of drainage and low-flow crossings must be minimised as far as practicable. - Maintain natural drainage pathways and diffuse overland flow patterns as far as practicable during construction. - Clean and dirty water must be separated at all times, and no dirty water may be discharged into the wetland or adjacent drainage features. - Stormwater controls must be designed and implemented to prevent concentrated flows from reaching HGM 1. - All temporary drainage measures and discharge points must be monitored and adjusted where signs of scour, incision, pooling, or altered flow routing are observed. - Any disturbance that alters runoff routing toward the wetland must be corrected immediately.				
Continued proliferation of alien invasive vegetation	Operation	-7.5	-3.5	-3.5
Mitigation - Conduct regular monitoring for alien invasive vegetation along disturbed margins, access roads, stormwater features, wetland edges, and other disturbed parts of the operational footprint. - Maintain vegetated buffer areas around HGM 1 to reduce disturbance and limit opportunities for invasive spread. - Alien invasive plant control during operation must focus on containment and reduction of spread into wetland and buffer areas as far as reasonably practicable. - Remove or control invasive species in disturbed wetland-edge and buffer areas, with priority given to species and locations most likely to spread into the wetland. - Mechanical control should be used within or near wetland areas unless otherwise approved. - Follow-up clearing must be undertaken where regrowth occurs, and invasive species should be controlled before seed set where feasible.				
Potential wetland contamination due to polluted runoff and from indiscriminate dumping of litter	Operation	-7.5	-3.5	-3.5
Mitigation - Maintain good housekeeping standards across the facility at all time. - Prohibit the dumping of waste, spoil, litter, or discarded materials within wetland areas, buffer areas, or drainage influence zones. - Store all waste in designated areas outside wetland buffer areas and remove it regularly to an authorised disposal or recycling facility. - Inspect and maintain ablution and wastewater facilities to prevent leaks, overflow, or discharge into the surrounding environment. - Ensure stormwater controls maintain the separation of clean and dirty water, and that only clean water is released to the environment. - Monitor wetland edges and drainage features periodically for signs of pollution, waste accumulation, or declining condition, and implement remedial action where necessary.				
Increased water inputs to wetland	Operation	-6.75	-4	-4
Mitigation - Design and maintain stormwater infrastructure so that runoff from roads, hard surfaces, and associated infrastructure is attenuated and discharged diffusely rather than as concentrated point discharges wherever practicable. - Prevent stormwater from being directed into HGM 1 via channels, culverts, ruts, or poorly designed outlets. - Retain and maintain vegetated buffer areas around the wetland to slow runoff, trap sediment, and promote infiltration. - Inspect all stormwater outlets, culverts, and drainage structures routinely and after major rainfall events for scour, erosion, sediment build-up, or flow concentration. - Repair erosion, rutting, scour, or outlet failure promptly where identified. - Avoid the creation of informal maintenance tracks or disturbed flow pathways within wetland or buffer areas.				
Degradation of wetland vegetation and proliferation of alien and invasive species	Decommissioning	-6.75	-4	-4.5
Mitigation - Restrict decommissioning activities to the minimum practicable footprint and retain wetland buffer demarcation until all works are complete. - Use existing access routes as far as practicable and avoid unnecessary disturbance to adjacent wetland or buffer vegetation. - Strip and stockpile topsoil separately in disturbed areas and re-use it during rehabilitation. - Rehabilitate all temporary disturbed areas as soon as practicable following infrastructure removal, using suitable indigenous vegetation where feasible. - Monitor disturbed areas for alien invasive species establishment and implement follow-up control where required. - Ensure that all laydown, stockpiling, waste handling, and temporary activity areas remain outside wetland and buffer areas.				
Disruption of wetland soil profile, hydrological regime and increased sediment loads	Decommissioning	-6.75	-4	-4.5

Mitigation

- Implement erosion and stormwater controls for the duration of decommissioning and maintain them until all disturbed areas are stable and adequately rehabilitated.
- Remove infrastructure in a controlled manner that minimises soil disturbance, compaction, and unnecessary exposure of bare surfaces.
- Maintain diffuse drainage patterns as far as practicable and prevent the concentration of runoff toward HGM 1.
- Stabilise exposed soils promptly and repair erosion features immediately where they develop.
- Stockpile soil and demolition material outside wetland and buffer areas on stable ground and protect all stockpiles from erosion and rain-wash.
- Inspect disturbed areas, stormwater controls, and wetland margins after rainfall events and implement corrective action where failures or sediment movement are observed.

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 wetland catchment and its downslope wetland features (Table 4-3).

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

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community of the wetland areas;
- Keep the final design of the defined project area consistent to avoid intersecting with an overlapping wetland buffer; and
- Limit the construction area to the defined project areas and only impact those areas where it is unavoidable to do so otherwise.

Table 4-3 Mitigation Measures and Monitoring and Management Outcomes

Mitigation Measure	Phase	Intended Management Outcome	Timeframe	Monitoring Frequency	Target	Monitoring Tool	Responsible Parties
Restrict all site clearing, grubbing, vehicle movement, laydown, storage, and construction activities to the approved footprint only. Existing access routes must be used preferentially before any new tracks are considered. No informal tracks may be created within wetland or buffer areas.	Construction / Decommissioning	Minimise unnecessary soil compaction, vegetation loss, and edge disturbance adjacent to HGM 1.	Throughout construction and decommissioning	Daily by site supervision; weekly by ECO	No disturbance outside approved footprint or designated access routes	Site inspections; photographic monitoring; non-compliance register	Contractor; Site Manager; ECO
Major vegetation clearing, grubbing, and bulk earthworks should, as far as practicable, be undertaken during drier periods. Clearing must be phased so that the extent and duration of exposed bare soil is kept to the minimum practicable at any one time.	Construction / Decommissioning	Reduce erosion, sediment mobilisation, and runoff impacts to HGM 1 during high-risk activities.	During vegetation clearing and earthworks	Weekly during active earthworks; after rainfall events	Exposed soils minimised; no extensive unattended bare areas left vulnerable to erosion	Site inspections; construction method statements; photographic record	Contractor; Site Manager; ECO
A stormwater management plan must be prepared and implemented prior to large-scale clearing and earthworks. The plan must maintain diffuse surface flow as far as practicable, prevent the concentration of runoff into ruts, temporary channels, culverts, outlets, or other preferential flow paths discharging toward HGM 1, and ensure separation of clean and dirty water. No dirty water may be discharged into the wetland or associated drainage pathways.	Pre-construction / Construction / Decommissioning	Maintain natural runoff behaviour as far as practicable and prevent hydrological alteration of HGM 1.	Prior to construction and throughout active works	Weekly during active works; after rainfall events	Stormwater controls implemented and functioning; no direct or concentrated dirty water discharge to HGM 1	Stormwater management plan; site inspections; rainfall-event inspection records	Civil Engineer; Contractor; ECO
Erosion and sediment controls must be installed before construction begins in all areas where runoff may reach HGM 1. Suitable controls may include sediment traps, sediment fences, berms, low level humps, brush-packing, mulch, geotextiles, silt barriers, and energy dissipaters. All outlets and discharge points must be stabilised against scour.	Construction / Decommissioning	Prevent erosion, sediment transport, scour, and sediment deposition in HGM 1 and downstream reaches.	Prior to and throughout active works	Weekly; after rainfall events	No uncontrolled erosion features; sediment controls installed, maintained, and effective	Erosion control inspection checklist; photographic monitoring; maintenance records	Contractor; Site Engineer; ECO

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Topsoil and subsoil must be stripped, stockpiled, and reinstated separately in all disturbed areas. Stockpiles must be located outside wetland and buffer areas on stable ground and protected from erosion and rain-wash. Disturbed areas not required for operation must be decompacted where necessary, stabilised, and rehabilitated as soon as practicable following completion of works.	Construction / Decommissioning / Post-construction	Preserve soil structure and fertility and improve successful rehabilitation of disturbed areas.	During all earthworks and rehabilitation	Weekly during earthworks; monthly during rehabilitation until stable	Topsoil handled separately; stockpiles protected; disturbed areas stabilised and rehabilitated	Site inspections; soil handling records; rehabilitation records	Contractor; ECO; Rehabilitation Specialist where required
Vegetation clearing must be limited to the authorised footprint only. Indigenous vegetation within wetland buffer areas and along wetland margins must be retained wherever possible to maintain infiltration, soil stability, sediment filtering, and habitat continuity. Disturbed wetland-edge and buffer areas must be rehabilitated with suitable indigenous vegetation where feasible.	Construction / Decommissioning / Post-construction	Minimise loss of native vegetation and maintain ecological functioning adjacent to HGM 1.	Throughout construction and decommissioning; during rehabilitation	Weekly during active disturbance; monthly during rehabilitation	No unnecessary clearing in buffer areas; disturbed edge/buffer areas rehabilitated	Site inspections; rehabilitation audits; photographic monitoring	Contractor; ECO; Rehabilitation Specialist
An alien invasive plant management programme must be implemented for disturbed areas, access roads, stockpile areas, laydown areas, stormwater features, wetland edges, and buffer areas. Management must focus on containment and reduction of spread into HGM 1 and associated buffers. Mechanical control must be used within or near wetland areas unless an alternative method is specifically approved. Follow-up clearing must be undertaken where regrowth occurs.	Construction / Operation / Decommissioning	Prevent the establishment and spread of alien invasive species into HGM 1 and adjacent buffer areas.	Throughout project life	Monthly during construction; quarterly during operation; monthly during decommissioning where disturbance occurs	No significant spread of invasive species into HGM 1 or wetland buffer areas	Invasive species monitoring records; site inspections; maintenance logs	Contractor; Operations Manager; ECO
Fuels, oils, chemicals, and other hazardous substances must be stored in bunded areas outside wetland and buffer areas and away from drainage pathways. Refueling, servicing, and maintenance of vehicles and machinery must only occur in designated contained areas outside wetland buffers. Drip trays must be used for stationary plant and mobile refueling equipment, and spill kits must be available in all active work areas.	Construction / Decommissioning	Prevent hydrocarbon and chemical contamination of HGM 1 from leaks, spills, and poor storage practices.	Throughout construction and decommissioning	Daily by contractor; weekly by ECO	No refueling or hazardous storage within wetland/buffer areas; no uncontained spills; spill kits available and functional	Site inspections; hazardous substances register; spill register	Contractor; HSE Officer; ECO

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Appropriate portable or temporary ablation facilities must be provided and located outside wetland and buffer areas and away from drainage pathways. Facilities must be serviced regularly to prevent leaks or overflow. No dirty water may be discharged to the environment. Any contaminated soil resulting from spills, leaks, or overflow must be removed and disposed of at a licensed facility where required.	Construction / Decommissioning	Prevent sewage-related contamination and polluted runoff from entering HGM 1.	Throughout construction and decommissioning	Weekly; after any incident	No sewage leaks, overflow, or dirty water discharge to HGM 1 or adjacent drainage lines	Site inspections; service records; incident register	Contractor; HSE Officer; ECO
Cement and concrete mixing must take place only in designated areas outside wetland and buffer areas, using suitable liners, trays, or impermeable surfaces. Waste, spoil, and litter must be stored in designated areas outside wetland buffers and removed regularly to authorised facilities. No dumping, littering, concrete wash water, or contaminated runoff may enter HGM 1.	Construction / Decommissioning	Prevent contamination of HGM 1 from concrete, waste, litter, and general construction pollutants.	Throughout construction and decommissioning	Weekly; during each concrete-related activity	No concrete mixing, wash water discharge, dumping, or littering within wetland/buffer areas	Site inspections; waste manifests; photographic record	Contractor; Site Supervisor; ECO
Operational stormwater management measures must be maintained in good working order. Runoff from roads, hardened surfaces, panel areas, and associated infrastructure must be controlled so that flows are attenuated and discharged diffusely rather than as concentrated point discharges wherever practicable. Stormwater outlets, culverts, and road drainage structures must be protected against scour and inspected routinely.	Operation	Prevent altered overland flows, erosion, scour, and sedimentation of HGM 1.	Throughout operation	Monthly; after major storm events	Stormwater controls functioning; no direct erosive discharge to HGM 1; no uncontrolled scour at outlets	Operational inspection checklist; maintenance records; photographic monitoring	Operations Manager; Maintenance Team; ECO
Vegetated buffer areas around HGM 1 and associated drainage features must be retained and maintained wherever possible to slow runoff, trap sediment, and promote infiltration. Informal maintenance tracks may not be created within wetland or buffer areas, and any erosion, rutting, or outlet failure identified during operation must be repaired promptly.	Operation	Reduce operational runoff impacts and prevent progressive edge disturbance and habitat degradation.	Throughout operation	Monthly; after major storm events	Buffer vegetation retained; no informal tracks in wetland/buffer areas; erosion repaired promptly	Site inspections; maintenance logs; photographic record	Operations Manager; Maintenance Team; ECO
Good housekeeping must be maintained across the facility at all times. Chemicals, fuels, cleaning materials, and hazardous substances used during maintenance must	Operation	Prevent operational contamination of HGM 1 from polluted runoff, litter,	Throughout operation	Monthly; after any spill incident	No contaminated runoff, waste, or litter entering HGM 1;	Site inspections; incident register; waste	Operations Manager; Maintenance Team; ECO

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be stored and handled in bunded areas outside wetland buffers. Panel washing, equipment cleaning, maintenance activities, wastewater handling, and waste storage must be managed so that contaminated runoff does not enter HGM 1. Dumping of waste, spoil, or litter within wetland or drainage influence zones is prohibited.		spills, and maintenance-related activities.			hazardous materials stored correctly	management records	
HGM 1, wetland edges, buffers, stormwater outlets, and disturbed margins must be inspected periodically for evidence of pollution, erosion, sediment accumulation, vegetation decline, or invasive species spread. Where deterioration is detected, corrective action must be implemented as soon as practicable.	Operation	Detect and address declining wetland condition before impacts become entrenched.	Throughout operation	Quarterly; after major storm events where required	No ongoing deterioration of HGM 1 without corrective action being implemented	Monitoring reports; site inspections; photographic record	Operations Manager; ECO; Freshwater Specialist if required
Decommissioning activities, including dismantling, temporary laydown, waste handling, and access, must be restricted to the minimum practicable footprint. Existing access routes must be used as far as practicable. All waste, rubble, and redundant material must be removed by authorised waste service providers, and no temporary activity areas may be established within wetland or buffer areas.	Decommissioning	Minimise disturbance and contamination risks during infrastructure removal.	Throughout decommissioning	Weekly during active decommissioning	No disturbance outside approved decommissioning footprint; all waste removed lawfully; no activity in wetland/buffer areas	Site inspections; waste manifests; decommissioning audit records	Contractor; Site Manager; ECO
Erosion and stormwater controls must remain in place for the duration of decommissioning and until all disturbed areas are stable. Exposed soils must be stabilised promptly, natural drainage patterns must be maintained as far as practicable, and all temporary disturbed areas must be rehabilitated with appropriate topsoil replacement and vegetation re-establishment as soon as practicable after infrastructure removal.	Decommissioning / Post-decommissioning	Prevent residual erosion, altered runoff, sediment delivery, and long-term degradation of HGM 1 following decommissioning.	Throughout decommissioning and until disturbed areas are stable	Weekly during decommissioning; monthly post-rehabilitation until stable; after rainfall events	Disturbed areas stabilised and rehabilitated; no residual erosion or sediment movement toward HGM 1	Site inspections; rehabilitation records; photographic monitoring	Contractor; ECO; Rehabilitation Specialist

4.3 Recommendations

It is recommended that the final layout avoid HGM 1 and the associated recommended buffer as far as practicable, and that all infrastructure be placed within the least sensitive parts of the site as far as practically possible. All wetland boundaries, buffer areas, and no-go areas should be clearly demarcated prior to construction, and no direct encroachment into the delineated wetland footprint should be permitted unless specifically authorised.

It is further recommended that the mitigation measures contained in Table 4-3 be implemented in full for all project phases, with specific emphasis on stormwater control, erosion and sediment management, pollution prevention, rehabilitation, and alien invasive plant control.

Should the project be authorised and proceed with the current or a similar layout, all construction activities occurring within or immediately adjacent to the HGM 1 buffer be overseen by an Environmental Control Officer and/or suitably qualified wetland specialist to ensure compliance with demarcated no-go areas, implementation of mitigation measures, and prevention of unauthorised disturbance to the wetland footprint.

5 Conclusion

One (1) wetland unit, namely HGM 1, was identified within the project area and assessed further as the wetland feature at risk. As outlined in Section 3.3, HGM 1 was determined to be in a “C – Moderately Modified” Present Ecological State (PES), achieved a “Moderate” Ecological Importance and Sensitivity (EIS) rating, and was assigned a “Intermediate” ecosystem services category. Based on the buffer assessment, a 30 m post-mitigation buffer was recommended around the wetland.

The potential impacts associated with the proposed development are predominantly indirect and relate mainly to altered hydrology, erosion and sedimentation, vegetation disturbance, alien invasive species proliferation, and water quality deterioration from contaminated runoff or poor site management. Provided that the delineated wetland footprint and recommended buffer are avoided, and that the mitigation measures are implemented in full, no direct loss of wetland habitat is anticipated.

5.1 Risk and Impact Statement

Taking into account the findings of the freshwater assessment, the RAM, and the proposed mitigation measures, the post-mitigation risk ratings for impacts to HGM 1 fall within the “Low” risk category for the construction, operation, and decommissioning phases. The impact assessment similarly indicates that the identified impacts can be reduced to “low” residual levels through the implementation of appropriate avoidance, stormwater management, erosion and sediment control, pollution prevention, rehabilitation, and monitoring measures.

Assuming adherence to the recommended 30 m post-mitigation buffer and the mitigation measures, it is more appropriate to refer to the anticipated freshwater impacts as localised and indirect disturbance risks, rather than definitive wetland service loss. Should the final layout change materially, or should any direct encroachment into the delineated wetland footprint or associated buffer become necessary, the freshwater assessment and associated risk evaluation should be updated accordingly.

5.2 Specialist Opinion

From a wetland specialist perspective, the proposed development can be supported, provided that HGM 1 and the recommended buffer are avoided and that the mitigation measures are implemented in full. The principal risks to HGM 1 are indirect and are considered manageable through appropriate layout refinement, stormwater management, erosion and sediment control, pollution prevention, rehabilitation, and environmental monitoring.

Should direct encroachment into the delineated wetland footprint or associated buffer become necessary at any stage, or should the final layout differ materially from that assessed in this report, the freshwater assessment and the relevant authorisation requirements should be revisited prior to such works proceeding.

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7 Appendix Items

7.1 Appendix A - Methodology

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).

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.

7.1.2 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 practice the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

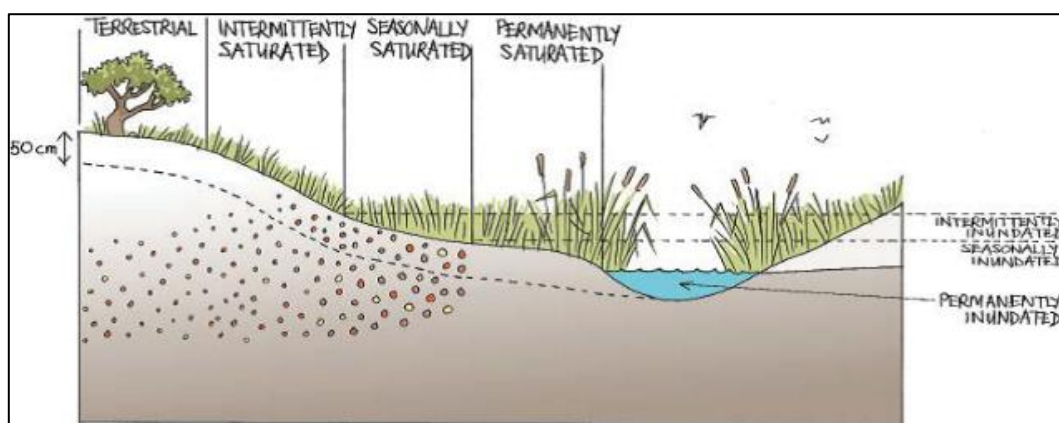


Figure 7-1 Cross section of a wetland, indicating how the soil wetness and vegetation indicators respond to changes in topography (Ollis et al. 2013)

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 Wetland Functional and Ecological Assessment

7.1.3.1 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; updated Version 2, Kotze et al. 2020). 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 the supply of benefits (Kotze et al. 2009)

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

Table 7-2 The Importance categories assigned to the benefits (Kotze et al. 2020)

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 – 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

7.1.3.2 Present Ecological Status

The overall approach as described by Macfarlane et al. 2009 and Macfarlane et al. 2020, 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 7-3.

Table 7-3 The Present Ecological Status categories (Macfarlane et al. 2020)

Impact Category	Description	Impact Score Range	PES Score (%)	PES
None	Unmodified, natural	0 to 0.9	90-100	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	80-89	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	60-79	C
Large	Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	40-59	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	20-39	E
Critical	Critically Modified. 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	0-19	F

7.1.3.3 Ecological Importance and Sensitivity

The importance and sensitivity of water resources is determined in order to identify 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 7-4.

Table 7-4 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

7.1.3.4 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) (Table 7-5) 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 7-5 Recommended Ecological Category and Recommended Management Objectives for water resources based on Present Ecological State and Ecological Importance and Sensitivity scores

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

7.1.4 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.

7.1.5 Site Sensitivity Verification

The baseline aquatic / freshwater sensitivity of the project area was obtained using the National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended). The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas based on the specialist assigned Ecological Importance and Sensitivity of the different systems (where applicable), with consideration been given to the presence of observed or likely sensitive fauna and flora.

7.2 Appendix B - Risk and Impact Assessment

7.2.1 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 7-6.

Table 7-6 ***Significance ratings matrix***

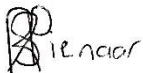
Rating	Class	Management Description
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on 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.

Appendix C - Specialist Declaration of Independence

Declaration

I, Rian Pienaar, declare that:

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



Rian Pienaar

Ecologist

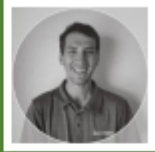
The Biodiversity Company

July 2026

7.3 Appendix D - Specialist CVs

Rian Pienaar

Pr Sci Nat 135544 +27 78 505 0201 rian@thebiodiversitycompany.com



PROFILE SUMMARY

Environmental scientist and Pri Sci Nat (SACNASP 135544) with ~5+ years' specialist consulting experience across Southern Africa. Specialist expertise in wetland delineation and ecological assessments, wetland offset strategy design, rehabilitation and monitoring plans, as well as soil classification and agricultural potential assessments. Experienced in delivering high-quality field surveys and technical reporting aligned with in-country legislative requirements and international lender standards, and currently manages the operations at TBC.

PERSONAL INFO

Nationality: South African
Date of birth: 23 May 1994

EXPERIENCE

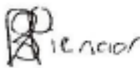
Environmental Impact Assessments (EIA)
Environmental Management Programmes (EMP)
Project Management
Logistics

SKILLS

- ✓ Wetland functional assessments
- ✓ Ecology
- ✓ Rehabilitation
- ✓ Monitoring & Management Plans

LANGUAGES

English – Proficient
Afrikaans – Proficient



Signed: Rian Pienaar

ACADEMIC QUALIFICATIONS

North-West University (2020): MASTER OF SCIENCE (MSc) – Environmental Sciences (Cum Lauda):
Title: The use *Clarias gariepinus* and associated helminthic parasites as bio-indicators of metal pollution in a subtropical ecosystem.

North-West University (2018): BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCE – Aquatic Ecosystem Health

North-West University (2018): BACHELOR OF SCIENCE IN ENVIRONMENTAL AND BIOLOGICAL SCIENCES – Zoology and Microbiology

PROFESSIONAL EXPERIENCE

Sept 2020 – **The Biodiversity Company**
Present Wetland Ecology

Jan 2018 – **National Aquatic Bioassay Facility (NABF)**
Dec 2018 Intern

INTERNATIONAL EXPERIENCE

South Africa, Mozambique, Botswana, Eswatini

