FRESHWATER ECOLOGY ASSESSMENT FOR THE PROPOSED JUPITER SOLAR PHOTOVOLTAIC (PV) 1 TRANSMISSION INFRASTRUCTURE PROJECT

Pixley Ka Seme District Municipality, Northern Cape Province, South Africa

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Report Name	**FRESHWATER ECOLOGY ASSESSMENT FOR THE PROPOSED JUPITER SOLAR PHOTOVOLTAIC (PV) 1 TRANSMISSION INFRASTRUCTURE PROJECT**	
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Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.	

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1 Introduction

1.1 Background

The Biodiversity Company was commissioned by Sharpies Environmental Services CC (SES) to conduct a freshwater ecology assessment for the proposed development of the Jupiter Solar Photovoltaic (PV) 1 Transmission Infrastructure Project. This is conducted in an effort to receive Environmental Authorisation (EA) as well as a Water Use Licence (WUL) for the Jupiter Solar Cluster.

In order to establish the baseline environmental conditions as well as all potential risks attributed the construction of the Solar Cluster and associated infrastructure, freshwater surveys were conducted from the 17th to the 20th of October 2022, and the 20th June 2024, which constituted an early wet season survey and a dry season survey, respectively. The assessment included efforts to define the extent of the project area and baseline conditions of the systems within the project area. Furthermore, the identification and description of any sensitive receptors were recorded across the project area where the project infrastructure crossed any watercourse.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations (2014) (amended by GNR 326, 7 April 2017 and GNR. 517, 11 June 2021) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020) in terms of NEMA, dated 20 March and 30 October 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation” (Reporting Criteria).

This assessment has been completed in accordance with the requirements of the published General 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 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.

The purpose of the specialist assessment is to provide relevant input into the basic assessment process and provide a report for the proposed activities associated with the project. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.2 Project Description

Mulilo Renewable Energy (Pty) Ltd is proposing the development of a transmission corridor and associated infrastructure located on the the Remainder of the Farm Roode Kraal No. 28, the Remainder of the Farm Riet Fountain No. 6, the Remainder of the Farm Hartebeest Hoek No. 31, and the Remainder of the Farm Wagt en Biettje No. 5, for the proposed Jupiter Solar Photovoltaic (PV) 1 Transmission Infrastructure development near De Aar, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province (Figure 1-2). A 500 m area has been demarcated for the project to facilitate the identification of water resources within the regulatory zone. This area is referred

to as the project area of influence (PAOI). A detailed map of the PAOI and associated development footprint is presented in Figure 1-3.

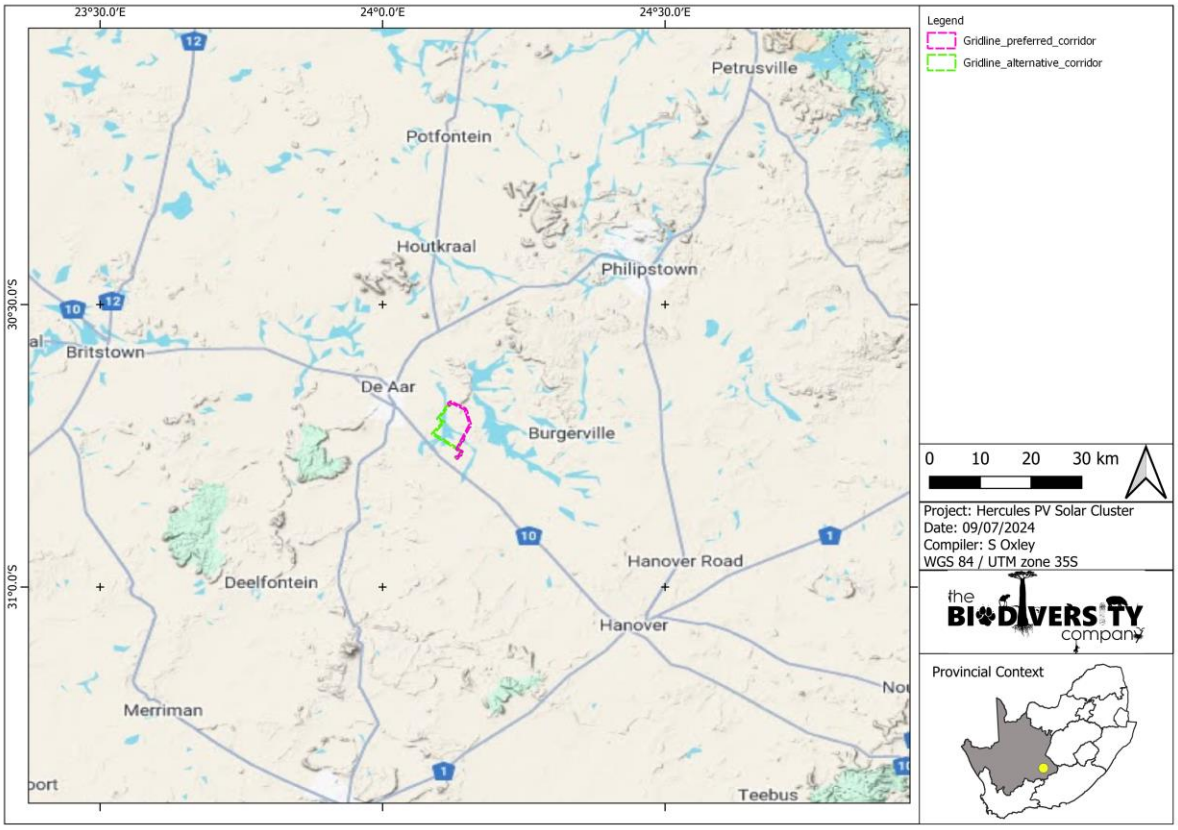


Figure 1-1 Locality map

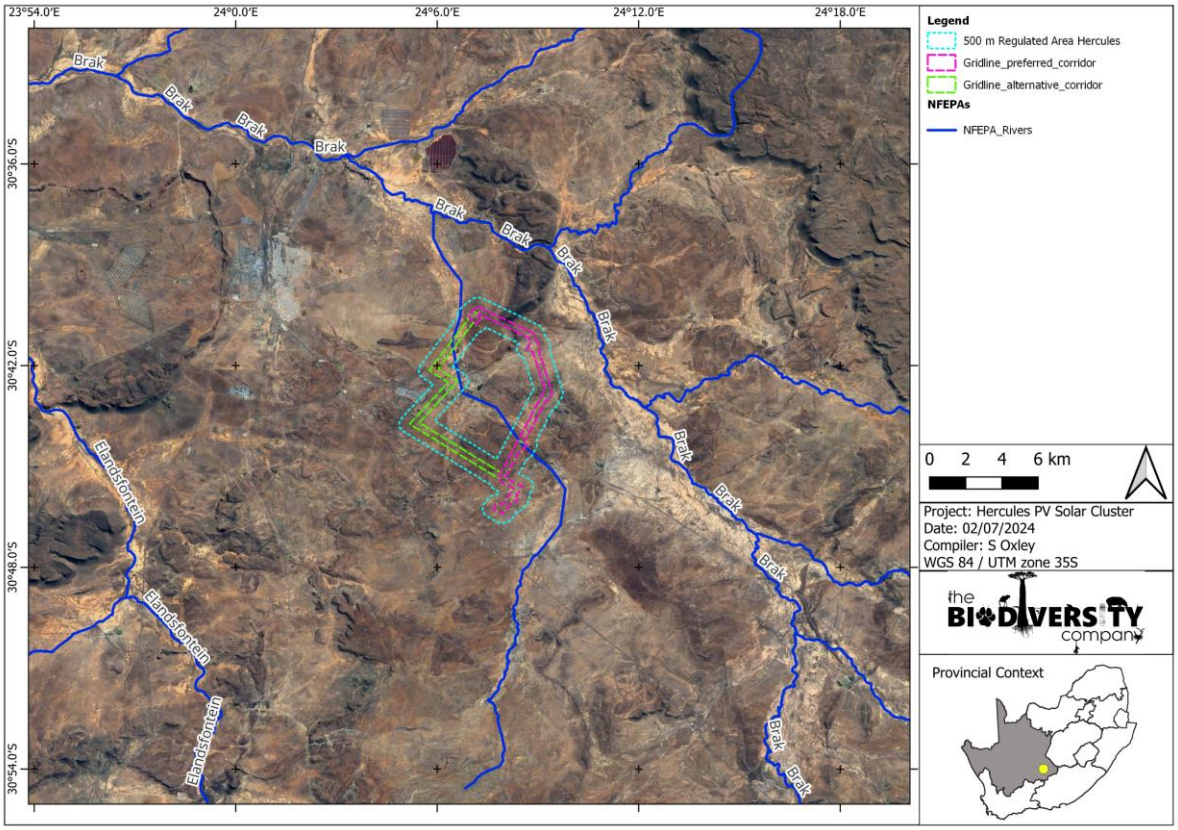


Figure 1-2 Map illustrating the preferred gridline, alternative and PAOI

The following information was provided by SES (2024). The proposed development will comprise the following (Figure 1-3):

- The Eskom Switching Station (SS) will be proposed adjacent to the proposed IPP Substation;
- A 132 kV Overhead Power Line (OHL) leading from the proposed Eskom Switching Station to the future Kestrel Main Transmission Station (MTS) (previously referred to as the Wag 'n Bietjie MTS approved through DFFE Ref: 14/12/16/3/3/1/2577/4);
- A 132kV Feeder bay will be constructed at the MTS and the 400 kV Busbar at the MTS will be extended; and
- The proposed development will also see to the installation of a new 400/132 kV transformer and bay at the MTS.

Project-specific components include:

- Battery Energy Storage Facility;
- Eskom Switching Station;
- IPP Substation;
- Laydown Area;
- Diesel Storage Facility (Hazardous substances storage area);
- Operational & Maintenance Area;

- Internal Roads with a maximum operational width of up to 6 m and a construction servitude of up to 8 m;
- External Roads (Access Road) with a maximum operational width of 8 m and a construction servitude of up to 10 m;
- A Solar Array; and
- Medium Voltage Power Station located throughout the solar array.

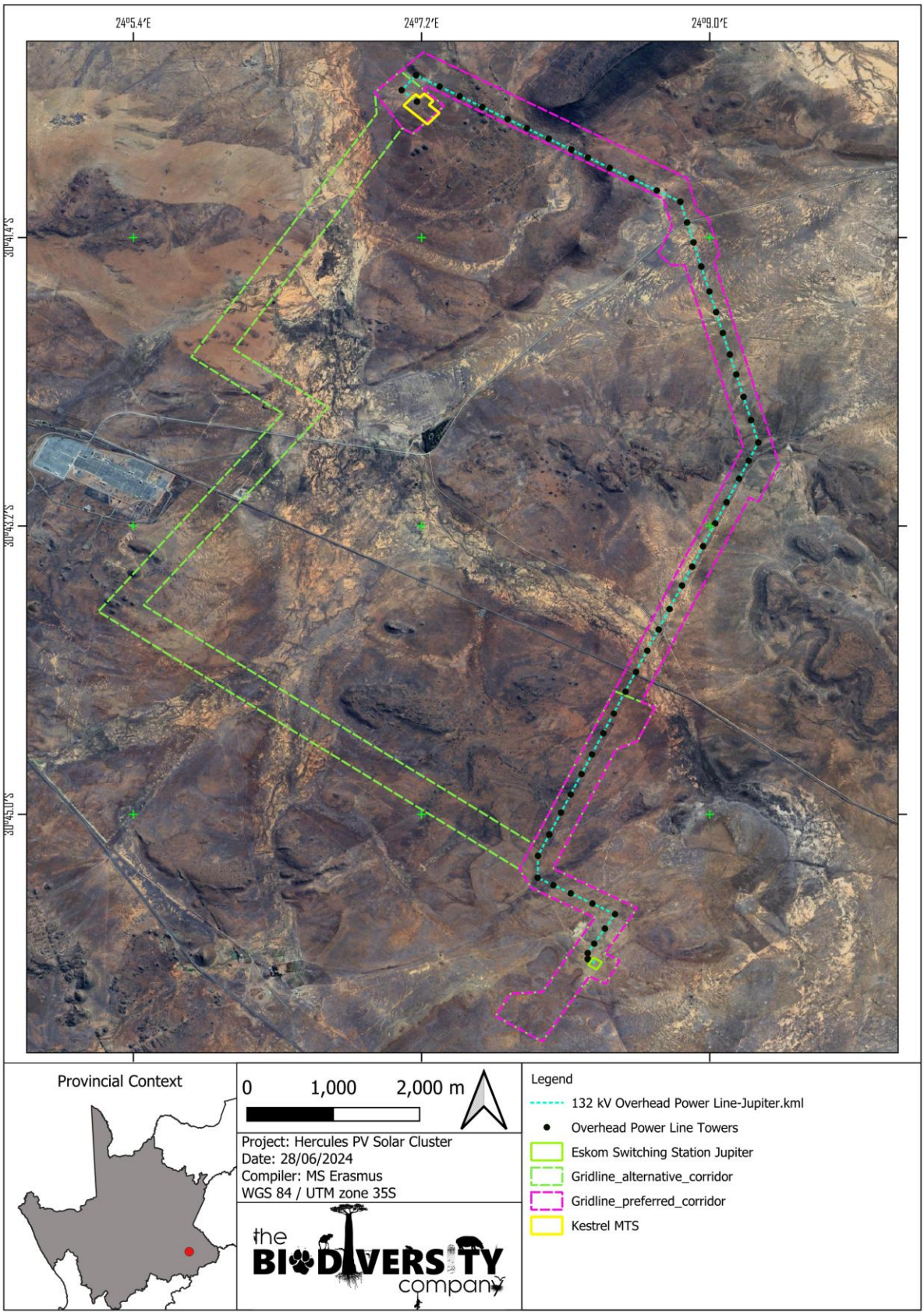


Figure 1-3: Map illustrating the location and layout design of the proposed Project

1.3 Assessment Scope of Work

The aim of the assessment is to provide the freshwater baseline and impact assessment for the proposed Jupiter Transmission Infrastructure Project. This was achieved through the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the Project Area of Influence (PAOI) and surrounding landscape;
- Field survey to determine the present ecological state (PES) of the local watercourses associated with the PAOI:
    - The assessment of water quality;
    - The assessment of habitat quality;
    - The assessment of biological responses;
- Determination of the aquatic theme sensitivity for the area;
- Delineate the Site Ecological Importance (SEI) within the PAOI;
- A risk assessment for the proposed transmission line; and
- The prescription of mitigation measures and recommendations for identified risks.

1.4 Assumptions and Limitations

The following aspects were considered as limitations of the assessment:

- It is assumed that the client has provided the specialist with all available data and information surrounding the project at the time of writing;
- It is assumed that all of this information is relevant and accurate;
- A single season aquatic ecology survey was completed for each alternative. Thus, temporal trends were not investigated;
- There was no surface flow in the watercourses associated with the PAOI;
- No baseline biomonitoring data/report(s) are available for the project area. Therefore, information presents the findings of the single season aquatic survey;
- Due to the ephemeral nature of the watercourses in the project area, the lotic systems contained insufficient water depth or flow therefore the macroinvertebrate and fish methodologies described could not be applied and therefore the focus of this report was habitat preservation;
- Any alterations and/or missing GIS information pertaining to the development layout subsequent to this assessment may affect the accuracy and/or outcomes of the assessment; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by 5 m.

1.5 Key Legislative Requirements

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

Table 1-1: A list of key legislative requirements relevant to biodiversity and conservation in the Northern Cape Province

Region	Legislation / Guideline	Comment
National	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)	Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017), Appendix 6 requirements
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Threatened or Protected Species Regulations	The protection of species and ecosystems that warrant protection
	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, GNR 320 of Government Gazette 43310 (March 2020)	The minimum criteria for reporting.
	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, GNR 1150 of Government Gazette 43855 (October 2020)	Protocol for the specialist assessment and minimum report content requirements.
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);	The regulation of waste management to protect the environment.
	National Water Act (NWA) (Act No. 36 of 1998)	The regulation of water uses.
	Alien and Invasive Species Regulations and, Alien and Invasive Species List 20142020, published under NEMBA	The regulation and management of alien invasive species.
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)	To provide for control over the utilization of the natural agricultural resources including the vegetation and the combating of weeds and invader plants.
Provincial	Northern Cape Planning and Development Act no. 7 of 1998	To provide for the management and conservation of the province's biophysical environment and protected areas.
	Northern Cape Nature Conservation act no. 9 of 2009	To inform land use planning, environmental assessments, land and water use authorisations, as well as natural resource management,

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.
- 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.
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take

place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

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, state 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.

1.6 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	8.3
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae	8.4
A signed statement of independence by the specialist(s)	8.3
The assessment must be undertaken on the preferred site and within the proposed development footprint	3.2.1
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.	3.1.9
The threat status of the ecosystem and species as identified by the screening tool	3.8
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
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 the 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)	3.1.9

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	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: (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 use and related activities change.	4
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 offstream 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
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
How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	-
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	2.1
The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant	8.1
A description of the assumptions made, any uncertainties or gaps in knowledge or data	1.4
The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant	3.3 and 3.4
Additional environmental impacts expected from the proposed development	-
Any direct, indirect and cumulative impacts of the proposed development on-site	-
The degree to which impacts and risks can be mitigated	4.6
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)	4.6
A motivation must be provided if there were development footprints identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate	-
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	6.3
Any conditions to which this statement is subjected	6

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

In line with the minimum requirements for aquatic biodiversity surveys field surveys for the project area and alternative area was undertaken on the 17th to the 20th of October 2022, (summer) and the 20th June 2024 (winter), respectively, to identify the presence and condition of freshwater resources and to delineate their spatial extents. Seasonality is not considered to be a limiting factor to the assessment of which the results are conclusive. The survey constituted a wet season/high flow and dry season/low flow assessment for the alternative and preferred route, respectively. A broader area was assessed as these conditions may be representative of the baseline conditions within similar watercourse features within the PAOI.

3 Results and Discussion

3.1 Desktop Dataset Assessment - Ecologically Important Landscape Features

The following spatial features describe the general area and associated freshwater resources (ecologically important landscape features). This assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and the South African National Biodiversity Institute (SANBI). The desktop analysis and their relevance to this project are summarised in Table 3-1.

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

Desktop Information Considered	Reasoning	Section
Strategic Water Source Areas	Irrelevant – The PAOI is 270 km from the closest SWSA.	3.1.1
Conservation Plan	Relevant – The entire PAOI overlaps with an ESA.	3.1.2
National Biodiversity Assessment (NBA)	Relevant – The PAOI's 500m Regulated Area overlaps with an unclassified wetland and one CR Wetland.	3.1.3
Aquatic Ecosystem Threat Status	Irrelevant – The PAOI does not intersect with any threatened watercourses.	3.1.4
Aquatic Ecosystem Protection Level	Irrelevant – The PAOI does not intersect any protected watercourses.	3.1.5
National Freshwater Ecosystem Priority Areas (NFEPA)	Relevant – The PAOI's 500m Regulated Area overlaps with unclassified wetlands and a FEPA Code 1 River which is a Freshwater Ecosystem Priority Area.	3.1.6
Protected Areas	Irrelevant – 10 km from the closest Protected Area.	3.1.7
Powerline Corridor	Relevant – The PAOI falls within the Central corridor	3.1.8
Renewable Energy Development Zones	Irrelevant – The PAOI doesn't fall within any REDZ	-
National Protected Areas Expansion Strategy	Irrelevant – The PAOI isn't close to any NPAES	-

3.1.1 Strategic Water Source Areas

Strategic Water Source Areas are areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. The areas supplying ≥ 50% of South Africa's water supply (which were represented by areas with a mean annual runoff of ≥ 135 mm/year) represent national Strategic Water Source Areas (SANBI, 2013). According to the most recent shapefile of the Strategic Water Source Areas (SWSAs) of South Africa, Lesotho and Swaziland, the project area is not located within the SWSAs with all SWSA aligned along the coast. The project area is considered local steppe climate

that receives limited rainfall (annual 353 mm) with an average annual temperature in De Aar of 17.4°C (climate-data.org, 2022). The PAOI does not overlap any SWSAs.

3.1.2 Conservation Plan

The Northern Cape Critical Biodiversity Area (CBA) Map for freshwater biodiversity (SANBI, 2008) was considered for the project area. The project area is considered an Ecological Support Area (ESA) with the majority of the SQR's considered a Critical Biodiversity Area (CBA 1 or 2) indicating the comparative sensitivity of these watercourses (Figure 3-1).

CBAs are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI, 2017). The PAOI overlaps with an ESA (Figure 3-1).

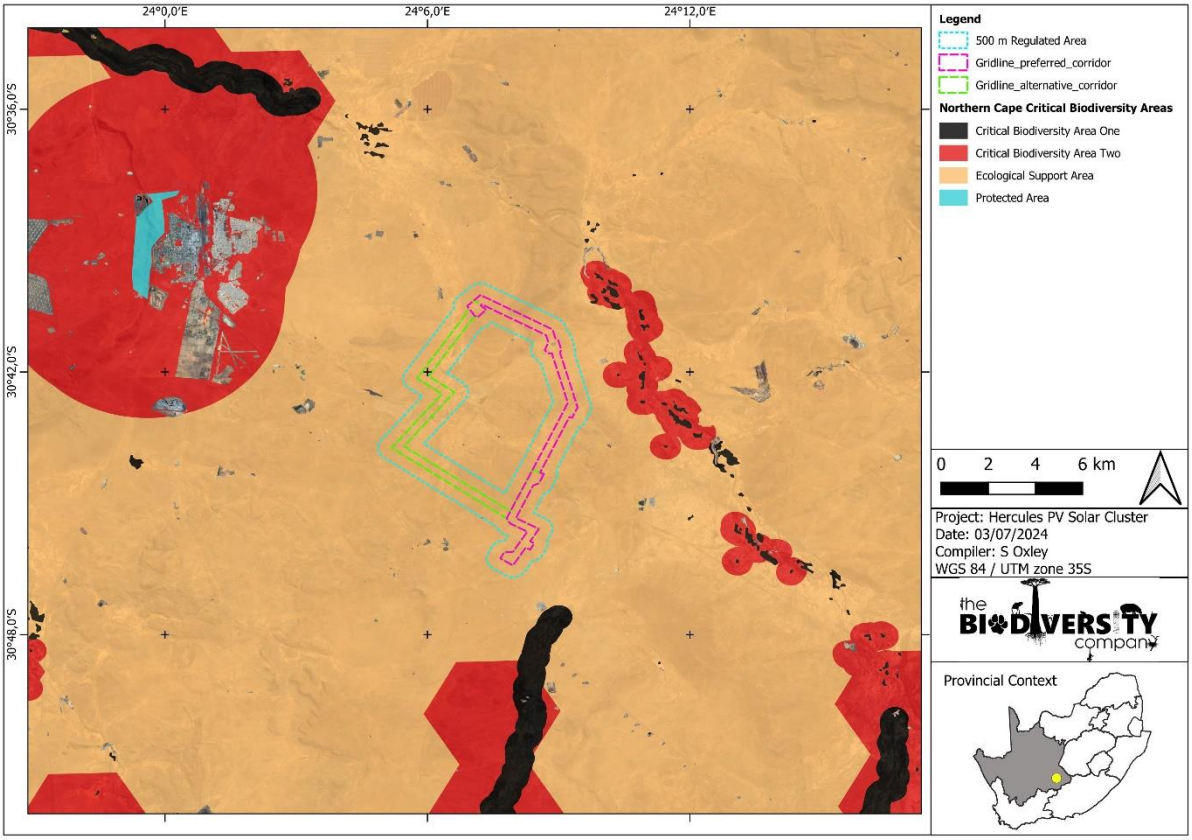


Figure 3-1: Illustration of the Freshwater Critical Biodiversity Areas within the project area (SANBI, 2008)

3.1.3 The National Biodiversity Assessment

The National Biodiversity Assessment (NBA) was completed as a collaboration between the SANBI, the DEA and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period (Van Deventer et al., 2019). The purpose of the NBA is to assess the state of South Africa's biodiversity to understand trends over time and inform policy and decision-making across a range of sectors (Van Deventer et al., 2019).

This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the NBA (2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (2018).

According to the NBA (Figure 3-2) the PAOI overlaps with a single unclassified wetland identified as a River and one CR Wetland.

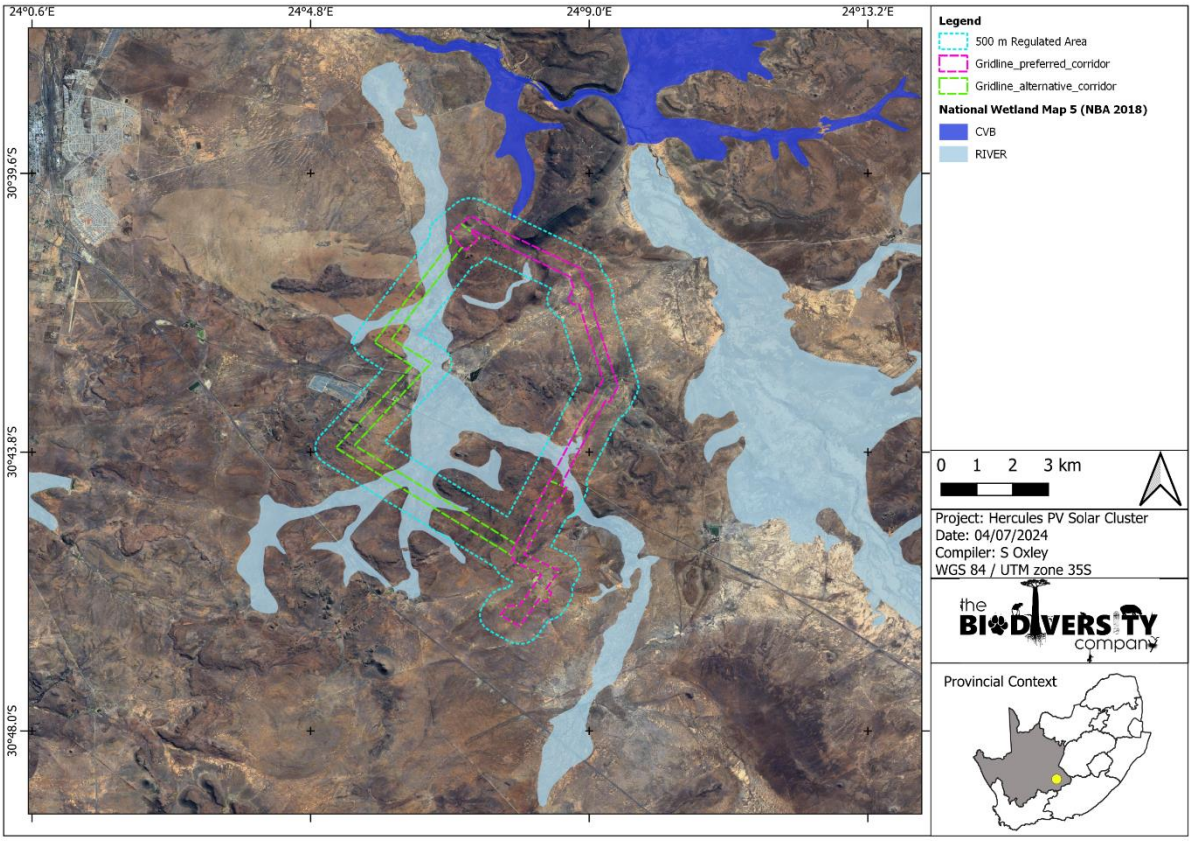


Figure 3-2: Illustration of the SAIIAE Freshwater Areas within the project area (SANBI, 2008)

3.1.4 Aquatic Ecosystem Threat Status

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, and composition, on which their ability to provide ecosystem services ultimately depends (Van Deventer et al., 2019).

Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Van Deventer et al., 2019). The Ecosystem Threat Status (ETS) of each river assessed was based on the extent to which the system had been modified from its natural condition (SANBI, 2018). According to the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) released with the National Biodiversity Assessment (NBA) of rivers, the rivers which were superimposed on the aquatic ecosystem threat status indicate that the PAOI does not cross or infringe any NBA ecosystems (Figure 3-3Figure 3-3). Systems which are of *Endangere*d and *Least Concern* are located outside of the project area.

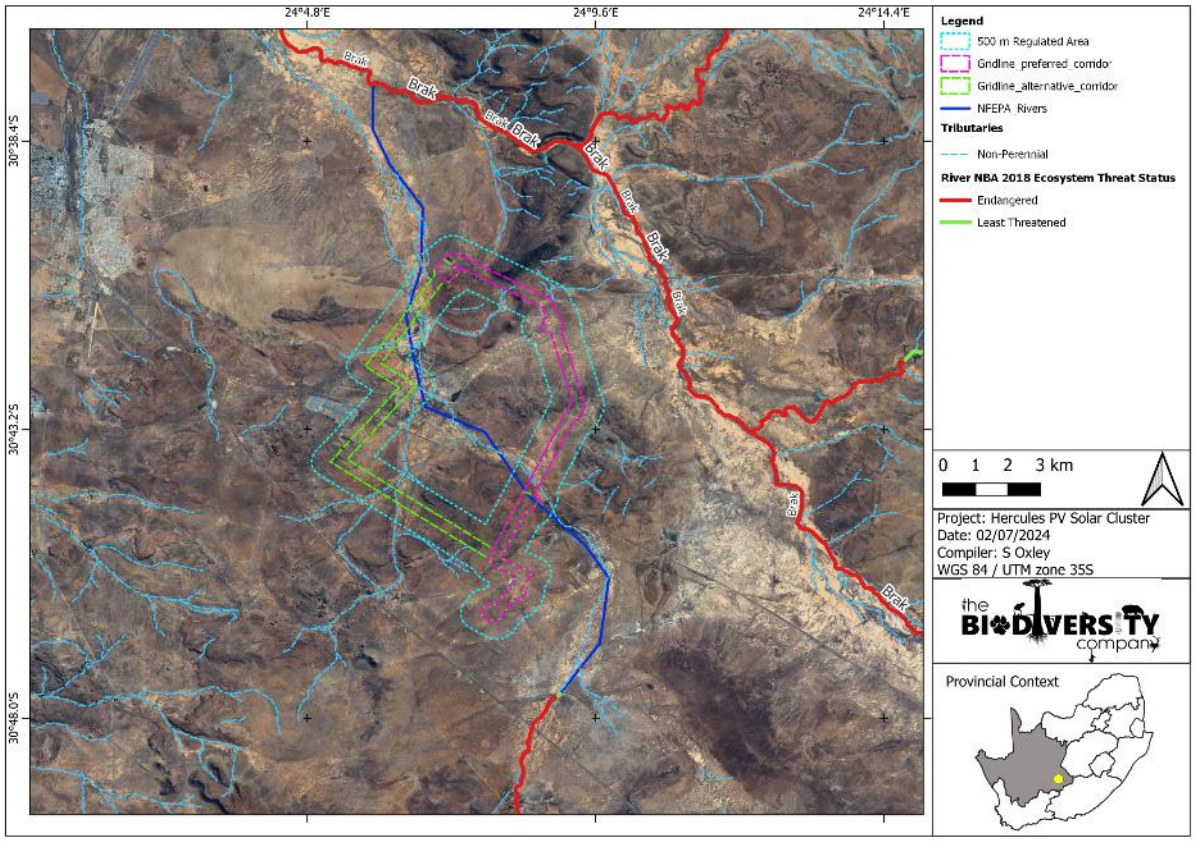


Figure 3-3: Illustration of the Ecosystem Threat Status of the project area (SANBI, 2018)

3.1.5 Aquatic Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Van Deventer et al., 2019). The Ecosystem Protection Level (EPL) of each river assessed was based on the extent (expressed as a percentage) to which the system has their biodiversity target located within protected areas and are in a natural or near-natural ecological condition. Rivers in protected areas need to be in good condition (A or B ecological category) to be considered as protected. Well protected rivers have 100% located within protected areas, while moderately protected and poorly protected river ecosystem types have at least 50% and 5% of their biodiversity target in protected areas, respectively. Not protected rivers form less than 5% (SANBI, 2018).

The project area was superimposed on the ecosystem protection level map to assess the protection status of aquatic ecosystems associated with the development (Figure 3-4). This indicates that no NBA aquatic ecosystems are located in the PAOI, rivers located outside the PAOI are considered *not protected.*

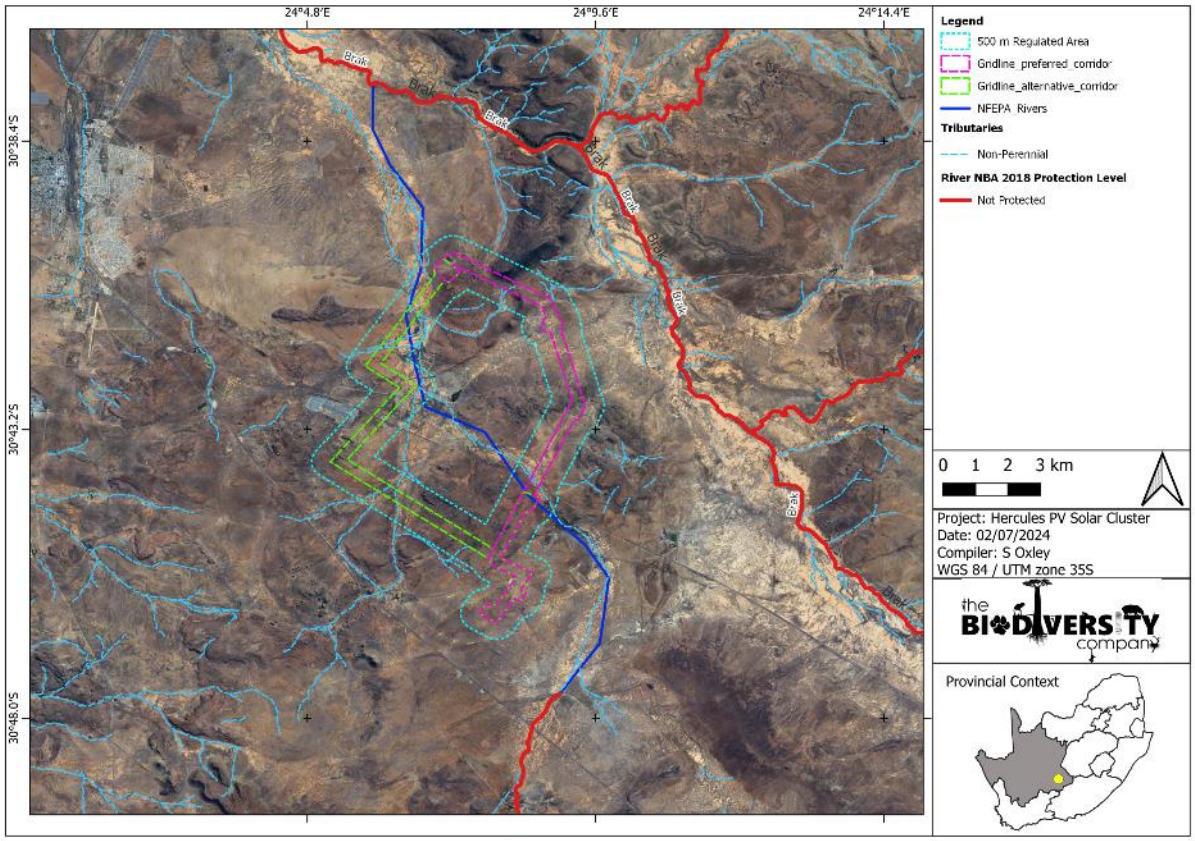


Figure 3-4: Illustration of the Ecosystem Protection Level of the project area (NBA, 2018)

3.1.6 National Freshwater Ecosystem Priority Areas (NFEPA)

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach to the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998). This directly applies to the National Water Act, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al.,* 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (NEM:BA) (Act 10 of 2004), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al*., 2011).

Due to the extent of the PAOI, it traverses three Sub-quaternary catchments (SQC) as presented in Figure 3-5 and Figure 3-6. These include the 5486, 5391 and 5332 SQC's with their statuses presented in Table 3-2. All SQCs are considered upstream management areas for downstream NFEPA's such as 5227 SQC. These catchments are further considered sensitive due to the presence of wetland clusters and wetland FEPA's. Care therefore should be taken to avoid degradation to the project area to avoid placing stress on the wetland FEPAs within the project area as well as downstream river NFEPA's.

Table 3-2: List of Sub-quaternary catchments and associated FEPA features

Catchment	Status
5486	2 WetCluster FEPAs Upper Nama Karoo - Channeled valley-bottom wetland Upper Nama Karoo - Depression Upper Nama Karoo - Unchanneled valley-bottom wetland Upper Nama Karoo - Valleyhead seep Upper Nama Karoo – Flat Upper Nama Karoo - Seep
5332	1 WetCluster FEPA Upper Nama Karoo - Channeled valley-bottom wetland Upper Nama Karoo - Depression Upper Nama Karoo - Unchanneled valley-bottom wetland Upper Nama Karoo - Valleyhead seep Upper Nama Karoo – Flat Upper Nama Karoo - Seep
5391	1 WetCluster FEPA Upper Nama Karoo - Channeled valley-bottom wetland Upper Nama Karoo - Unchanneled valley-bottom wetland Upper Nama Karoo - Valleyhead seep Upper Nama Karoo – Flat

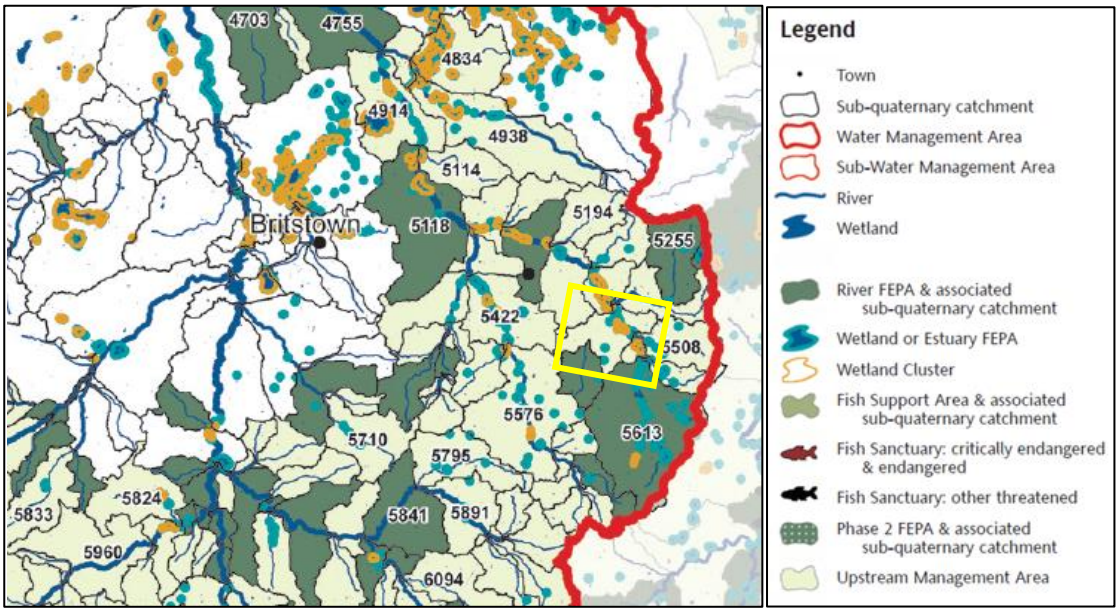


Figure 3-5: Map illustrating fish and river FEPAs for the project area, the project area is represented by the yellow square (Nel et al., 2011)

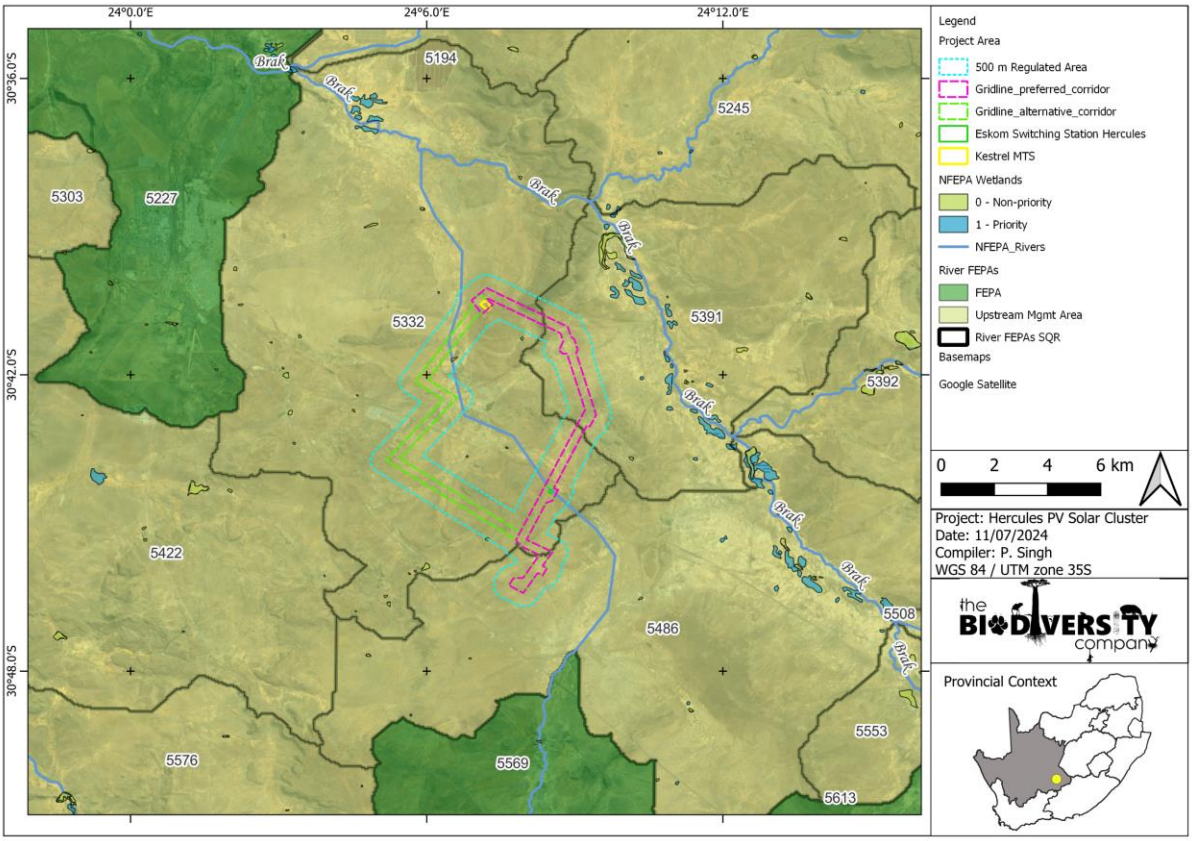


Figure 3-6: Layout of the proposed development area in relation to the riverine National Freshwater Priority Areas

3.1.7 Protected Areas

The Department of Environmental Affairs maintains a spatial database of Protected Areas and Conservation Areas. The Protected Areas and Conservation Areas (PACA) Database scheme is used for classifying protected areas (South Africa Protected Areas Database-SAPAD) and conservation areas (South Africa Conservation Areas Database-SACAD) into types and sub-types in South Africa. The definition of protected areas used in these documents follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the “System of Protected Areas”, which consists of the following kinds of protected areas: Special nature reserves, National parks, Nature reserves, Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003), World heritage sites declared in terms of the World Heritage Convention Act, Marine protected areas declared in terms of the Marine Living Resources Act, Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998), and Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970). The types of conservation areas that are currently included in the database include: Biosphere reserves, Ramsar sites, Stewardship agreements (other than nature reserves and protected environments), Botanical gardens, Transfrontier conservation areas, Transfrontier parks, Military conservation areas, and Conservancies.

According to the protected area spatial datasets, the PAOI does not overlap with any Protected, Conservation or Priority Focus Areas.

3.1.8 Strategic Transmission Corridors (EGI)

On the 16 February 2018 minister Edna Molewa published Government Notice No. 113 in Government Gazette No. 41445 which identified 5 strategic transmission corridors important for the planning of electricity transmission and distribution infrastructure as well as procedure to be followed when applying for environmental authorisation for electricity transmission and distribution expansion when occurring in these corridors.

On 29 April 2021, Minister Barbara Dallas Creecy published Government Notice No. 383 in Government Gazette No. 44504, which expanded the eastern and western transmission corridors and gave notice of the applicability of the application procedures identified in Government Notice No. 113, to these expanded corridors. More information on this can be obtained from https://egis.environment.gov.za/egi.

Figure 3-7 shows the project overlaps with the Central EGI corridor.

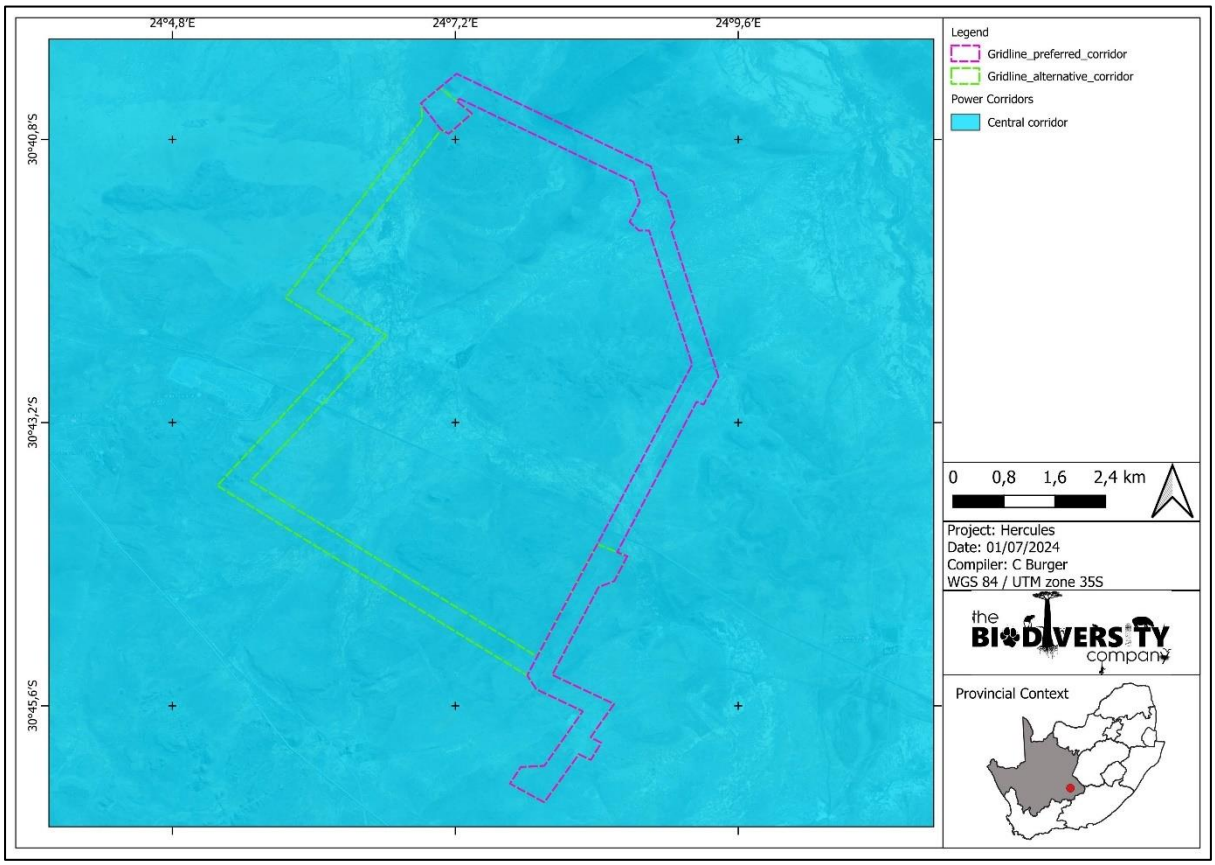


Figure 3-7 The PAOI in relation to the strategic transmission corridors

3.1.9 Freshwater Ecology

Desktop information for the SQR's associated with the Jupiter Transmission Infrastructure Project were obtained from DWS (2014). The PV Cluster has the potential to impede on multiple watercourses of which six are considered SQRs with the remainder being these systems tributaries. These six SQR's form part of the drainage network of the Brak River and one unnamed river (Table 3-3). The desktop PES category of the six reaches' ranges from a class B (largely natural) to a class C (moderately modified). The modification status of these reaches is a result of impacts to instream habitat, wetland and riparian zone continuity, flow modifications and potential impacts on physico-chemical conditions (water quality).

Table 3-3: Summary of the Present Ecological State of the SQRs associated with the transmission line (DWS, 2014)

SQR Importance and Sensitivity	Score
D62D-05553 (Brak River)	
Present Ecological Status	Moderately Modified (class C)
Ecological Importance	Moderate
Ecological Sensitivity	Low
Default Ecological Category	C
D62D-05486 (Brak River)	
Present Ecological Status	Moderately Modified (class C)
Ecological Importance	Moderate
Ecological Sensitivity	Low
Default Ecological Category	C
D62D-05391 (Brak River)	
Present Ecological Status	Moderately Modified (class C)
Ecological Importance	Moderate
Ecological Sensitivity	Low
Default Ecological Category	C
D62D-05332 (Brak River)	
Present Ecological Status	Largely Natural (class B)
Ecological Importance	Low
Ecological Sensitivity	Low
Default Ecological Category	D
D62D-05227 (Brak River)	
Present Ecological Status	Largely Natural (class B)
Ecological Importance	Moderate
Ecological Sensitivity	Low
Default Ecological Category	C
D62D-05569 (Unnamed)	
Present Ecological Status	Unassessed
Ecological Importance	Moderate
Ecological Sensitivity	Unassessed
Default Ecological Category	Unassessed

3.1.9.1 Hydrological Setting

The hydrological context of the project is presented in Figure 3-8. The Transmission Infrastructure project falls within the D62D quaternary catchment. This quaternary catchment falls within the Orange Water Management Area (WMA - 6) within the Nama Karoo aquatic ecoregion. The Transmission Infrastructure project area has the potential to impede on several sub quaternary reaches (SQR) (D62D-05553, D62D-05486, D62D-05391, D62D-05332 D62D-05227) of the Brak River and one unnamed SQR (D62D-05569), along with multiple tributaries of these systems.

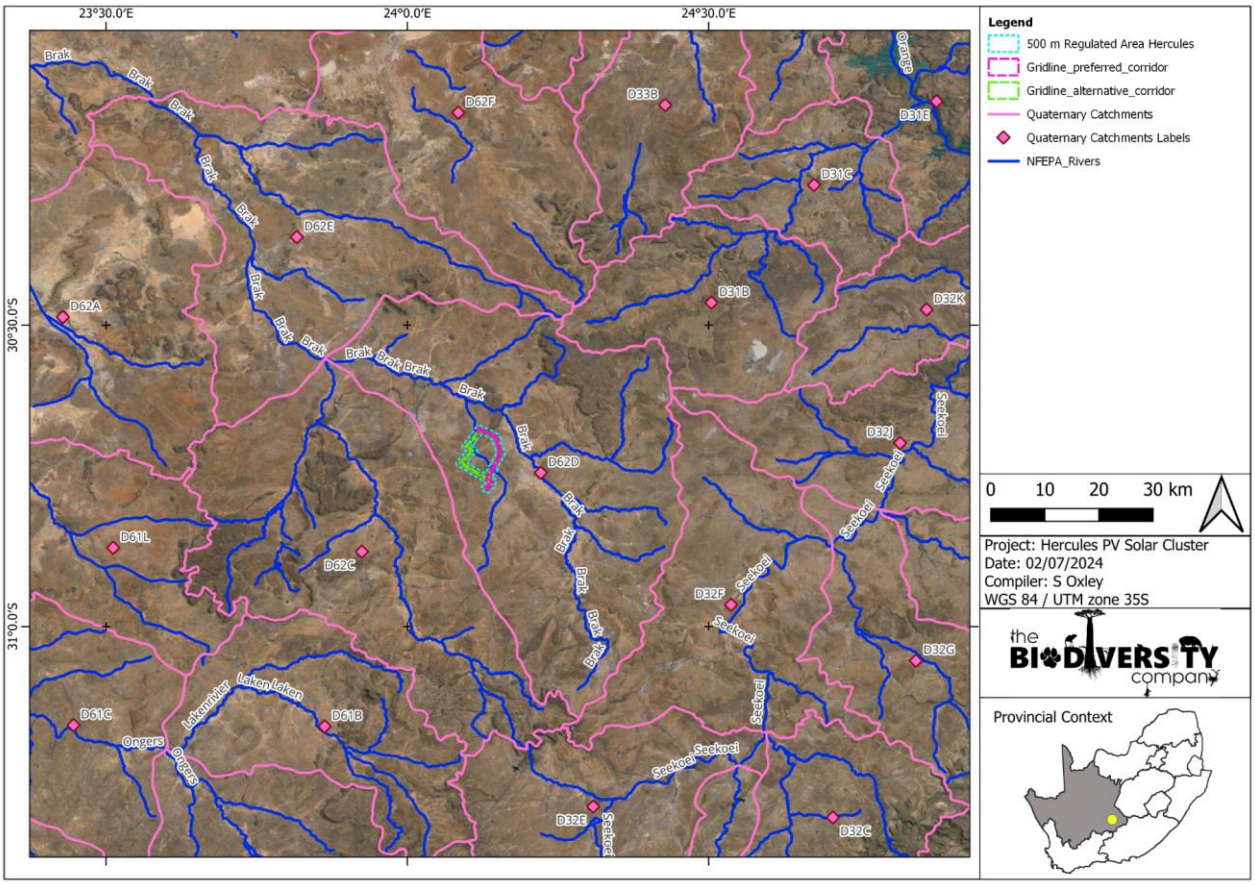


Figure 3-8: Hydrological context of the project area

3.1.10 Expected Fish Species

An expected species list was generated from DWS (2014), and Skelton (2001) for the D62D-05553 (Brak River), D62D-05486 (Brak River), D62D-05391 (Brak River), D62D-05332 (Brak River), D62D-05227 (Brak River) and D62D-05569 (Unnamed) SQR's. A total of 2 fish species are expected to occur throughout the rivers of the project area which are presented in Table 3-4. The conservational status of fish species was assessed against the latest IUCN database (IUCN, 2022).

The small barb species previously known as *Enteromius anoplus* (Chubbyhead barb) is expected within the downstream systems and was thought to be widely distributed across southern Africa with an IUCN listed status of Least Concern (LC) due to an extensive distribution range. However, according to a recent genetic study conducted by Kambikambi *et al.* (2021), *Enteromius anoplus* was reclassified into four distinct genetic lineages separated by major river systems, with *Enteromius oraniensis* (Orange River Chubbyhead barb) forming the Orange River lineage, a distinct species endemic to the Orange River system. These results render the current IUCN Red List assessment of *E. anoplus* obsolete. Kambikambi *et al.* (2021), suggest that there is thus the need for generating baseline information, including knowledge of ecological requirements, habitat utilization, distribution, life history and feeding ecology to support conservation and protection of these endemic fish. In absence of a threatened status these fish should be conserved through the precautionary principle and be treated as highly threatened for proposed developments until otherwise proven to be less threatened. Despite poor understanding of *E. anoplus*, there are no ichthyofauna expected which are considered species of conservation concern (SCC).

Table 3-4: Expected fish species

Species	Common Name	IUCN Status (2022)
Enteromius anoplus	Chubbyhead Barb	LC
Labeo umbratus	Moggel	LC

LC - Least Concern, NT – Near Threatened, VU – Vulnerable; x - not expected

Fish have different sensitivities or levels of tolerance to various aspects that they are subjected to within the aquatic environment. These tolerance levels are rated with a sensitivity score as presented in Table 3-5. These tolerance levels are scored to show each fish species' sensitivity to flow and physico-chemical modifications. The expected fish community within the watercourses of the PAOI are considered moderately tolerant to flow and physicochemical modification (Table 3-6). This applies as an average of the whole class and not each individual species.

Table 3-5: Intolerance rating and sensitivity of fish species

Sensitivity Score	Tolerance/Sensitivity Level
0-1	Highly tolerant = Very low sensitivity
1-2	Tolerant = Low sensitivity
2-3	Moderately tolerant = Moderate sensitivity
3-4	Moderately intolerant = High sensitivity
4-5	Intolerant = Very high sensitivity

Table 3-6: Sensitivities of the expected fish species

Species	Common Name	IUCN Status (2022)	Sensitivity	
			No-flow	No-flow
Enteromius anoplus	Chubbyhead Barb	LC	2.3	2.6
Labeo umbratus	Moggel	LC	2.7	1.6
Average Sensitivity			2.5	2.1

LC - Least Concern, NT – Near Threatened, VU – Vulnerable; x - not expected

The expected species are generated on a reach basis, and the occurrence of all species in the system is unlikely as different species are specialists of different habitats which are present along a reach. The multiple SQR's are considered geomorphologically similar however are considered non perennial/ephemeral in nature with low connectivity. As a result, the presence of the expected fish species is considered low as the systems dry up for extended periods of time with low connectivity hindering migration of ichthyofauna.

3.2 Survey Results

3.2.1 Investigation Sites

The sampling points for the study were selected to adequately assess the current state of the watercourses potentially impacted upon by the PV Cluster and associated infrastructure to identify the potential risks that may result from the construction and operation of the Jupiter PV Cluster Project. This was done to gain a holistic image of the system and which habitat may be affected. To achieve this, sites were selected along all accessible watercourses which fall within the 500 m regulated area of all the infrastructure, with some watercourses assessed outside of the regulated area to appropriately understand the associated systems functionality. The resultant number of watercourses traversed resulted in a sampling methodology where multiple sites were selected along NFEPA rivers, and a single site was selected along tributaries. Labels were assigned in a downstream direction numerically, beginning with the first or first two letters of the river it is located along. Tributaries were assigned a 'T' and dams assigned a 'D' after the initials of a river name. The NFEPA rivers and tributaries which were unnamed were assigned a name for the purposes of this report which coincide with the farm property or landowners that the watercourse flows through. These names include Roodekraal, De Jager, Van de Merve, De Aar and Elandsfontein. The selected sampling location and the location of each sampling site surveyed in October 2023 can be seen in Table 3-7 as well as Figure 3-9. Sampling sites surveyed in June 2024 can be seen in Table 3-8 as well as Figure 3-9. A broader area was assessed as these conditions may be representative of the baseline conditions within similar watercourse features within the PAOI.

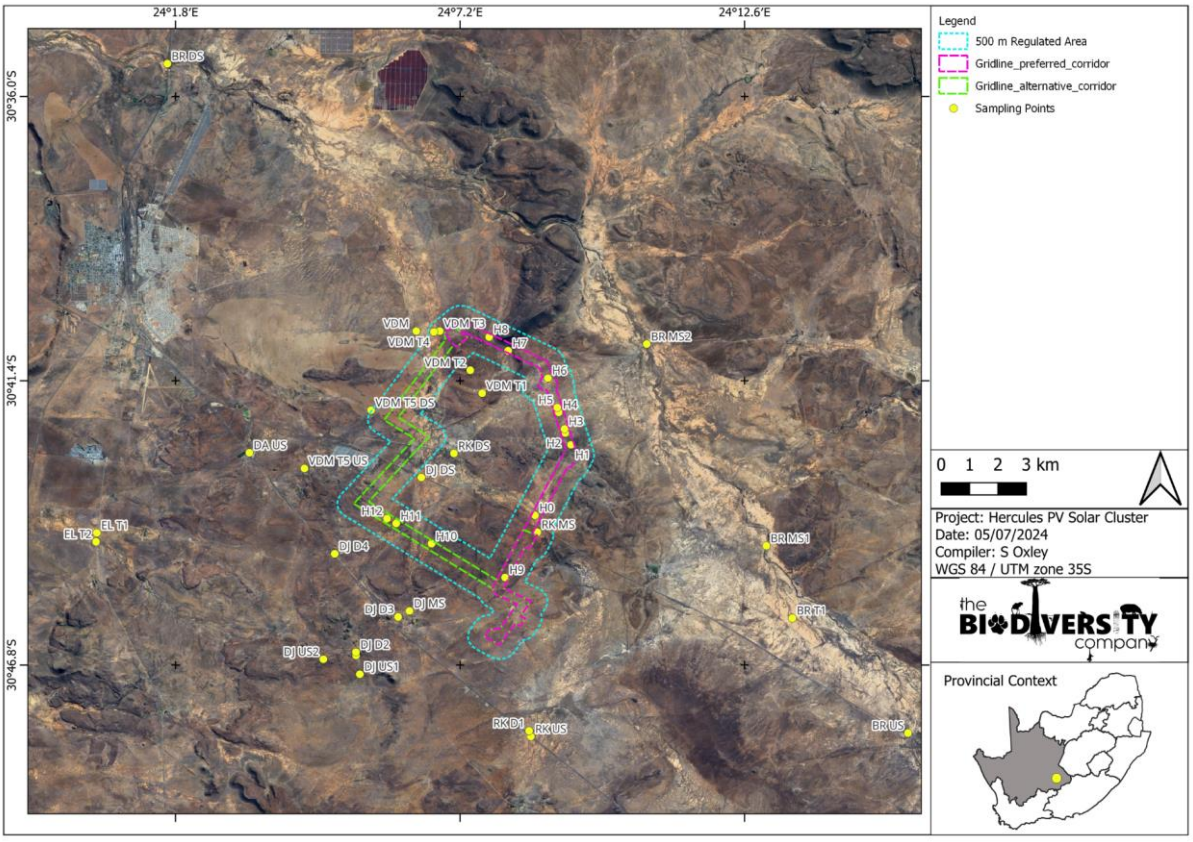


Figure 3-9: Selected sampling sites and tracks for the assessment

Table 3-7: Photos, co-ordinates and river name for the sites sampled (October 2022 and June 2024)

Site	Upstream	Downstream
River	Roodekraal	
RK MS		
GPS	30°44'16.48"S 24° 8'40.05"E	
RK DS		
GPS	30°42'46.72"S 24° 7'4.97"E	
River	Van de Merve	
VDM T1 US		
GPS	30°43'3.87"S 24° 4'14.77"E	
VDM T1 DS		
GPS	30°41'57.47"S 24° 5'30.69"E	

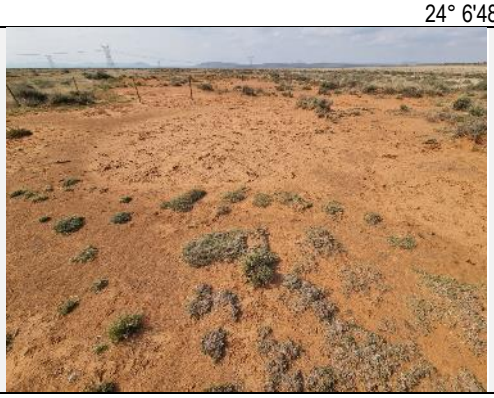
Site	Upstream	Downstream
VDM T2		
GPS	30°41'38.20"S 24° 7'37.18"E	
VDM T3		
GPS	30°41'11.95"S 24° 7'23.58"E	
VDM T4		
GPS	30°40'27.39"S 24° 6'48.86"E	
VDM T5		
GPS	30°40'28.34"S 24° 6'42.15"E	

Table 3-8: Photos, co-ordinates and river name for the sites sampled (June 2024)

Site	Upstream	Downstream
River	Roodekraal	
H0		
GPS	30°43'57.31"S 24° 8'37.29"E	
River	De Jager	
GPS	30°46'58.39"S 24° 5'17.83"E	
H2		
GPS	30°42'23.52"S 24° 9'11.83"E	
H3		
GPS	30°42'18.89"S 24° 9'10.93"E	
H5		

Site	Upstream	Downstream
GPS	30°41'54.54"S 24° 9'2.72"E	
H6		
GPS	30°41'21.06"S 24° 8'51.99"E	
H7		
GPS	30°40'49.80"S 24° 8'6.68"E	
River	Van de Merve	
H8		
GPS	30°40'34.11"S 24° 7'45.14"E	
H10		
GPS	30°44'29.56"S 24° 6'39.51"E	

Site	Upstream	Downstream
H11		
GPS	30°44'6.52"S 24° 5'59.25"E	
H12		
GPS	30°44'1.03"S 24° 5'48.76"E	

3.2.2 *In situ* Water Quality

In situ water quality analysis was conducted during the study at all accessible watercourses within the larger cluster project are that contained water. All unlisted sites were dry at the time of survey. This included rivers, tributaries, and drainage lines as well as dams. Results have been compared to limits stipulated in the Target Water Quality Range (TWQR) for aquatic ecosystems (DWS, 1996) and Resource Quality Objectives for the Lower Orange WMA. The results of the October 2022 assessment are presented in Table 3-9 with sites ordered in a downstream direction.

Table 3-9: In situ surface water quality results (October 2022)

Site	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/l)	Temperature (°C)
TWQR* RQO**	**6.5-9***	**550****	**>5.00**	**5-30***
River	Roodekraal			
RK D1	10.1	520	5.20	22.6
River	De Jager			
DJ US1	8.39	1 250	5.09	24.4
DJ D1	8.83	589	7.30	23.7
DJ D2	9.7	281	12.84	22.4
DJ D3	11.23	280	9.34	22.8
DJ D4	8.47	409	5.65	22.7
River	De Aar			
DA D1	8.95	323	6.25	17.7

*TWQR – Target Water Quality Range; **RQO – Resource Quality Objectives; Levels exceeding guideline levels are indicated in red; Elevated levels in yellow

The *in-situ* water quality for the watercourses associated with the Jupiter PV Cluster Project were isolated to the lentic systems in the areas bar DJ US1 which was a small shallow pool in the channel. Due to the lack of connectivity through surface flow of the watercourses, interpretation of water quality of the area is limited in both understanding and applicability. Therefore, no connections between systems were considered. Most of the lentic systems were artificial dams created to store water in the arid region where the rivers dry up. The *in-situ* water quality for the project area indicates most parameters were inside the prescribed TWQR limits. The exception to this is the pH within these systems which ranges from 8.39 at DJ US1 to 11.23 at DJ D3. The pH within the project area is all considered to be alkaline in nature with sites RK D1 (10.1), DJ D2 (9.7) and DJ D3 (11.23) above the prescribed TWQR limit of 9. The dissolved solids as measured by electrical conductivity ranged from 281 µS/cm at DJ D2 to 1250 µS/cm at DJ US1, with sites DJ US1 and DJ D1 elevated above the RQO limit of 550 µS/cm. The elevated concentration at DJ US1 is not well understood but is suspected to result from poor dilution potential as the systems solids loads concentrate as more water is evaporated due to high surface area and shallow depth (Figure 3-10). The source of the salt could result from agriculture, natural geology or from bird excrement concentration which cause nutrient loading in the isolated pool (Boros, *et al.*, 2008). Dissolved oxygen concentrations were considered high for stationary bodies of water all above the prescribed TWQR limit, with some concentrations as high as 12.84 mg/l (DJ D2). This was a result of aquatic vegetation such as oxygen weed (*Lagarosiphon*) throughout the dam. Temperature ranges were considered normal for the time of year.

Figure 3-10: The isolated pool at DJ US1

3.2.3 Habitat Integrity Assessment

The IHIA for the rivers located outside the PAOI was completed by grouping systems together with similar geomorphology, floral and anthropogenic influences. As a result, the ephemeral systems were considered collectively due to their considered insignificant differences. This was completed as described in the IHIA methodology component of this assessment. The special framework of which constitutes a 5 km reach of a system within the PAOI which would potentially be affected by the Jupiter Transmission Line Project was considered as opposed to the entire watercourse from source to confluence. The results thereof are shown in Table 3-10.

Table 3-10: Intermediate Habitat Integrity Assessment for the watercourses of the project area

Criterion	Impact Score	Weighted Score
Watercourse type	Ephemeral Drainage Areas	
	Instream	
Water abstraction	8	4.5
Flow modification	6	3.1
Bed modification	5	2.6
Channel modification	7	3.6
Water quality	3	1.7
Inundation	6	2.4
Exotic macrophytes	6	2.2
Exotic fauna	0	0.0
Solid waste disposal	2	0.5
Total Instream Score	**79.4**	
Instream Category	**B/C**	
	Riparian	

Indigenous vegetation removal	5	2.6
Exotic vegetation encroachment	7	3.4
Bank erosion	6	3.4
Channel modification	7	3.4
Water abstraction	5	2.6
Inundation	2	0.9
Flow modification	5	2.4
Water quality	3	1.6
Total Riparian Score	**79.9**	
Riparian Category	**B/C**	

The results of the habitat integrity assessment for the ephemeral systems indicates a largely natural to moderately modified state (class B/C) for both the instream and riparian habitat. This indicated that a small change in natural habitats and biota may have taken place, but the ecosystem functions are essentially unchanged. The influences on the systems of the project area are low with the ephemeral nature of the systems slowing down the potential for modification to the system to extend further, remaining greatly localized. The ephemeral nature of these systems does however lend itself to the types of modifications observed. Land users require water in the area and have therefore developed small instream dams to store water for activities such as agriculture and game farming (Figure 3-11). These also include instream weirs on the larger systems (Figure 3-12). Some lentic systems are noted as natural pans. These dams result in inundation of the systems as well as channel and flow modification in systems which would otherwise be dry. The dry river channels also make the identification of channels difficult and result in multiple road crossing structures traversing these channels. This results in small scale erosion and channel modification. On a larger scale these larger watercourses such as the Brak River are crossed by low level and large-scale bridges (Figure 3-13) as well as railways (Figure 3-14). Other sources of these types of modification result from livestock within the game farms where livestock trample watercourse banks removing vegetation and causing erosion (Figure 3-15). These disturbed areas create habitat availability for alien invasives to inhabit such as Mexican prickly poppy (*Argemone ochroleuca)* observed in the riparian areas (Figure 3-16). Exotic macrophytes were also observed within select instream dams in the form of oxygen weed (*Lagarosiphon*). Instream solid waste was minimal however some examples were present (Figure 3-17).

Figure 3-11: Dam wall at BR T1

Figure 3-12: Instream dam with associated weir along the Brak River

Figure 3-13: Road crossing over the Brak at BR US

Figure 3-14: Railway crossing the tributaries of the Roodekraal River

Figure 3-15: Erosion causing bank collapse in the Brak River

Figure 3-16 Example of alien invasives in the form of Argemone ochroleuca (Category 1b) at site DJ US2

Figure 3-17: Discarded barrels within the dam at RK D1

3.2.4 Present Ecological State

The PES assessment for the sampled watercourse is based on the collective data collected during the 2022 and 2024 surveys and the results are provided Table 3-11. The PES assessment indicated that the ephemeral drainage areas and wetland were in a class B/C 'Largely Natural to Moderately Modified' state, therefore compliant with the REC of class C (Moderately Modified).

Table 3-11: Present Ecological Status

Aspect Assessed	Ephemeral Drainage Areas	Ephemeral Wetland
Present Ecological State	B/C	B/C
REC	C	C
	Maintain	Maintain
DWS Ecostatus (DWS, 2014)	B	B

3.3 Riparian Habitat – Watercourse Extent

The PAOI crosses through two biomes, the Grassland and Nama Karoo biomes with the Nama Karoo biome corresponding with the watercourses. The Nama Karoo Biome, which is a large, landlocked region on the central plateau of the western half of South Africa and extends into south-eastern Namibia. This is an arid biome with majority of the river systems being non-perennial. Apart from the Orange River and the few permanent streams in the southwest that originate in higher-rainfall neighbouring areas, the limited number of perennial streams that originate in the Nama-Karoo are restricted to the more mesic east. The low precipitation is unreliable (coefficient of variation of annual rainfall up to 40%) and droughts are unpredictable and prolonged. The unpredictable rainfall impedes the dominance of leaf succulents and is too dry in summer for dominance by perennial grasses alone, and the soils are generally too shallow, and the rainfall is too low for trees. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism. Despite relatively low floristic diversity, the Nama-Karoo vegetation has a high diversity of plant life forms. These include co-occurring ephemerals, annuals, geophytes, C3 and C4 grasses, succulents, deciduous and evergreen chamaephytes and trees. This is probably a consequence of an ecotonal and climatically unstable nature of the region (Mucina & Rutherford, 2006).

Scattered rocky hills, mesas and inselbergs are distinctive features of an otherwise relatively homogeneous landscape. These features are either capped by or wholly comprised of dolerite, which is a fine- to medium-grained dark, intrusive igneous rock. The surrounding plains and lowland habitats are dominated by shale and sandstone, which is a fine- to medium-grained sedimentary rock. Due to their structure, these features provide greater heterogeneity in habitat and microclimate than the surrounding plains and therefore, support higher species richness and diversity (Petersen *et al*, 2020). Species richness and relative cover of the varying plant growth forms are driven by gradients of a combination soil, environmental and climatic parameters. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism. On a fine-scale vegetation type, the project area overlaps with Besemkaree Koppies Shrubland and Northern Upper Karoo (Figure 3-18).

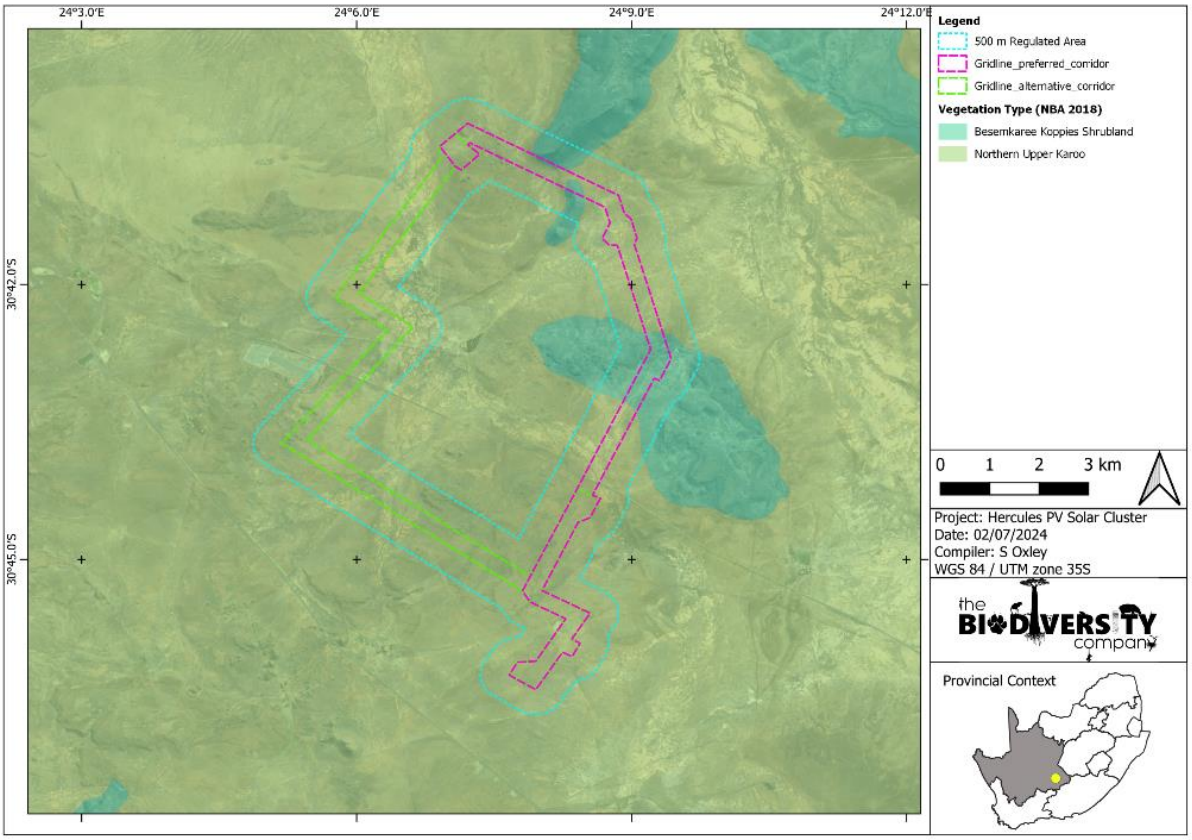


Figure 3-18: The vegetation types associated with the PAOI

The Northern Upper Karoo is restricted to the Northern Cape and Free State Provinces, specifically in the northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east. In the north, it is bordered by the towns of Niekerkshoop, Douglas and Petrusburg and in the south by Carnarvon, Pampoenpoort and De Aar. Additionally, there are a few patches in Griqualand West. Altitude varies mostly from 1000 to 1500 m (Mucina & Rutherford, 2006).

Its main vegetation feature is a shrubland dominated by dwarf karoo shrubs, grasses and *Senegalia mellifera* subsp. *detinens* and some other low trees (especially on sandy soils in the northern parts and vicinity of the Orange River). In terms of landscape features, it is flat to gently sloping, with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford, 2006).

The Besemkaree Koppies Shrubland is restricted to the Northern Cape, Free State and Eastern Cape Provinces. Within these provinces, it can be found on plains of Eastern Upper Karoo (between Richmond and Middelburg in the south and the Orange River) and within dry grasslands of the southern and central Free State. Additionally, there are also extensive dolerite-dominated landscapes along the upper Orange River that belong to this unit as well. It extends northwards to around Fauresmith in the northwest and to the Wepener District in the northeast. Altitude varies from 1 120 to 1 680 m (Mucina & Rutherford, 2006).

In terms of vegetation and landscape features, this vegetation type is characterised by slopes of koppies, butts and tafelbergs covered with two-layered karroid shrublands. The lower closed-canopy layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper loose canopy layer is dominated by tall shrubs, including several *Rhus* species, *Euclea crispa* subsp. *ovata*, *Diospyros austro-africana* and *Olea europaea* subsp. *africana* (Mucina & Rutherford, 2006).

The riparian areas within the project areas observed were uniform geomorphologically as well as in vegetation composition with few differences across river systems. Ephemeral channels had very shallow gradients with poorly sloping banks which were dominated by terrestrial vegetation which encroach on the riparian areas due to the lack of wetted soils. Large watercourses such as the Brak River represented the same geomorphological characteristics on a larger scale. Small sections of these watercourses presented wetted soils and allowed for hygrophilous vegetation to populate the channel. These drainage areas contained no large tree species. An example of the common riparian composition is presented in Figure 3-19. Drainage lines formed chasm/canyon channels where the steep gradient of the hillsides resulted in high levels of erosion. These were limited to hilly area and are rare.

Figure 3-19: Riparian areas of A – BR US; B – DJ US; C - VDM

The present vegetation within these drainage areas riparian areas included terrestrial shrubs such as: *Phymaspermum parvifolium, Lycium horridum; Eriocephalus ericoides subsp. Ericoides* (Figure 3-20) and *Amphiglossa triflora*. Larger shrubs included *Asparagus striatus* and *Melianthus comosus* (Figure 3-21). The hygrophilous vegetation included species of sedges such as *Afroscirpoides dioeca; Phragmites australis* (Figure 3-22), as well as *Cyperus usitatus.* Flowering plants included *Ruschia spinescens, Moreae pallida* (Figure 3-23), *Chrysocoma ciliata, Felicia muricata subsp. Muricata, Kniphofia linearifolia, Geigeria burkei, Helichrysum sp.* In between these listed plants were a variety of graminoids (grasses) which included: *Aristida sp.* (Figure 3-24)*, Chloris virgata, Cynodon dactylon, Enneapogon scaber, Eragrostis sp., Panicum impeditum, Sporobolus sp*., *Stipagrostis sp*. and *Tragus sp*. The presence of alien invasive species was small however one species was prevalent throughout the PAOI, namely *Argemone ochroleuca* which is a class Nemba 1b invasive. This is not an exhaustive list of present species within the riparian areas however does present an idea of the predominant species composition. For further information, consult the terrestrial biodiversity report (TBC, 2022).

Figure 3-20: A – Phymaspermum parvifolium, B – Lycium horridum; C - Eriocephalus ericoides subsp. ericoidess

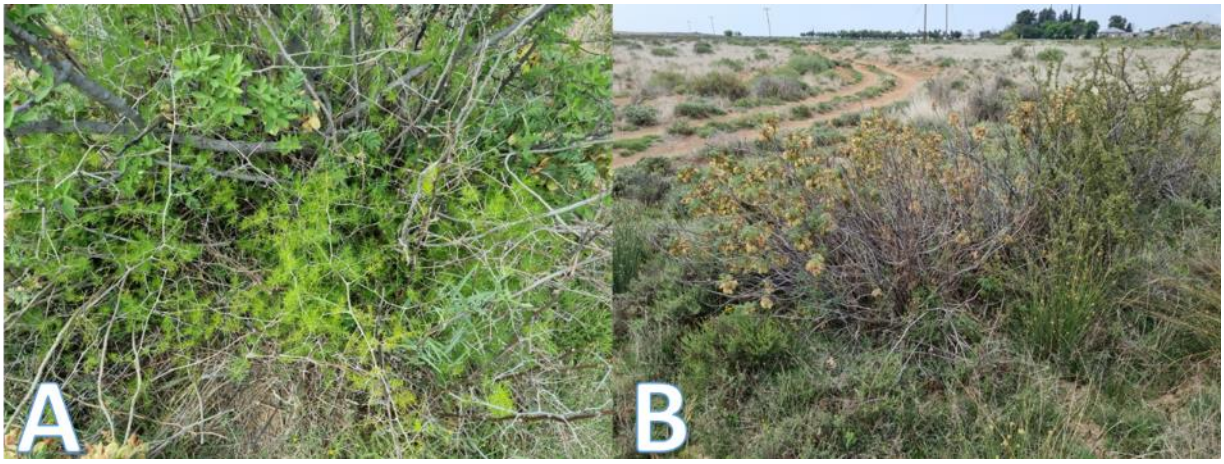


Figure 3-21: A - Asparagus striatus; B – Melianthus comosus

Figure 3-22 Afroscirpoides dioeca; B- Phragmites australis

Figure 3-23 A - Ruschia spinescens, B Moreae pallida

Figure 3-24: Example of an Aristida sp. in the riparian areas at DJ US2

Figure 3-25: Example of alien invasives in the form of Argemone ochroleuca (Category 1b) at site DJ MS

3.4 Buffer Zones

According to the buffer guidelines the maximum required buffer should be applied to a system (Macfarlane, *et al*., 2014). Riparian areas have high conservation value and can be considered most important part of a watershed for a wide range of values and resources. They provide important habitat for a large volume of wildlife and often forage for domestic animals. The vegetation they contain are an important part of the water balance for the hydrological cycle through evapotranspiration. They are crucial for riverbank stability and in preventing erosion within the channel (Elmore and Beschta, 1987). This is especially true for ephemeral systems where due to dry nature of the system, the habitat provided by vegetation within the riparian area are the only existing aspect of the watercourse until thunderstorm events. These systems therefore form drainage areas which are important corridors for terrestrial biodiversity. They are also highly sensitive as they form crucial channels for flood events to be contained and managed. Therefore, these drainage areas have been assigned a 50 m buffer (Norman, 1996, Peterjohn & Correl, 1984, Blanché, 2002 and Palone & Todd, 1997). This is because these lotic systems play a critical role in maintaining connectivity within the landscape. The delineated riparian areas and associated buffer zones are considered no go areas for any infrastructure such as pillars or towers for the transmission powerline or any Solar Photovoltaic Facilities. The delineation of the watercourse extents (drainage area) riparian zone observed in the study area are presented in Figure 3-27.

3.4.1 Regulation Area

Table 3-12 presents the defined areas for regulation and the associated legislation that is applicable for the delineated watercourse.

Table 3-12: Area of regulation and the associated legislation

Regulatory authorization required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). Department of Water and Sanitation (DWS)	Government Notice 4167 (previously GN 509 as published in the Government Gazette 49833 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) in accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21 c and 21 i 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.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended. Department of Environmental Affairs and Development Planning (DEA&DP)	Activity 12 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) states that: The development of: (xii) Infrastructure or structures with a physical footprint of 100 square meters or more; Where such development occurs— *a)* Within a watercourse; *b)* In front of a development setback; or *c)* If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse. Excluding – dd) where such development occurs within an urban area… Activity 19 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.

107 of 1998) EIA regulations, 2014 (as amended) states "The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic meters from a watercourse."

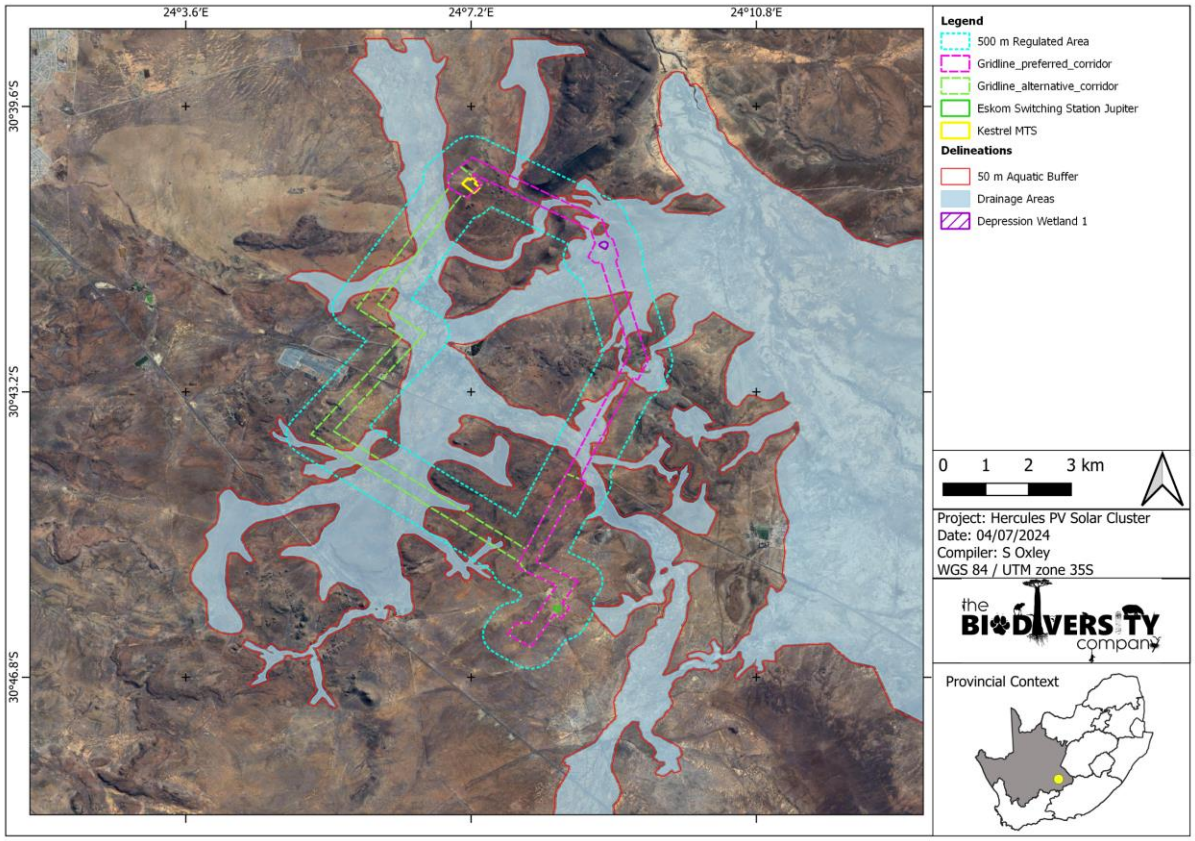


Figure 3-26: Riparian delineation and associated buffer of the watercourses associated with the project area

3.5 Aquatic Macroinvertebrate Assessment

At the time of survey there was no surface flow within the systems of the project area, bar the lentic systems on site. The South African Scoring System version 5 (SASS5) is not applicable in lentic systems as described Dickens and Graham (2002). Further the lack of surface connectivity between these waterbodies renders the methodology further ineffective. As a result, the focus of the assessment was the preservation of sensitive habitat.

3.6 Fish Communities

At the time of survey there was no surface flow within the systems of the project area, bar the lentic systems on site. Fish communities were therefore not considered, and the focus of the assessment was therefore on the preservation of sensitive habitat.

3.7 Site Ecological Importance

Based on the criteria provided in section 8.1.4 of this report, all aquatic habitats considered part of a watercourse within the PAOI were assigned a sensitivity category, i.e., a SEI category. The main habitat types identified across the project area were initially identified and pre-delineated largely based on aerial imagery from 2022. These main habitat types were then refined based on the field coverage and data collected during the survey. Three habitat units are delineated for the project area based on their geomorphology with all systems defined as drainage areas due to their ephemeral nature. The PAOI

was categorised as possessing aquatic habitats possessing a category of 'Very High' SEI (Table 3-13). The SEI of the PAOI is illustrated in Figure 3-27. It is important to note that this map does not replace any local, provincial, or national government legislation relating to these areas or the land use capabilities or sensitivities of these environments. The guidelines for interpreting the SEI category within the context of the proposed development are provided in below.

Table 3-13: Site Ecological Importance assessment summary of the habitat types delineated within the project area

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Drainage Areas	Medium > 50% of receptor contains natural habitat with potential to support SCC.	Very High Very large (> 100 ha) intact area for any conservation status of ecosystem type. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.	High	Low Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality.	Very High

Table 3-14: Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities (SANBI, 2020)

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The aquatic biodiversity theme sensitivity as indicated in the screening report (compiled by the National Web based Environmental Screening Tool) was derived to be 'Very High' (Figure 7 7), mainly due to the screening tool flagging the presence of rivers, a strategic water source area, wetland FEPA's and freshwater ecosystem priority area.

The completion of the aquatic biodiversity desktop and field assessments agrees with the 'Very High' sensitivity presented by the screening report. As discussed above, the watercourses of the project area are sensitive as they are considered freshwater ecosystem priority areas which are Critical Biodiversity Area (CBA 1 or 2) which are endangered and are poorly protected. These watercourses also comprise multiple wetland clusters and wetland NFEPA's. These areas contain > 50% natural habitat with potential to support SCC, > 100 ha of intact area for any conservation status of ecosystem type which have high habitat connectivity serving as functional ecological corridors with limited road network between intact habitat patches. Lastly the habitat is unlikely to be able to recover fully after a relatively long period (> 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality) due to the ephemeral nature of the system.

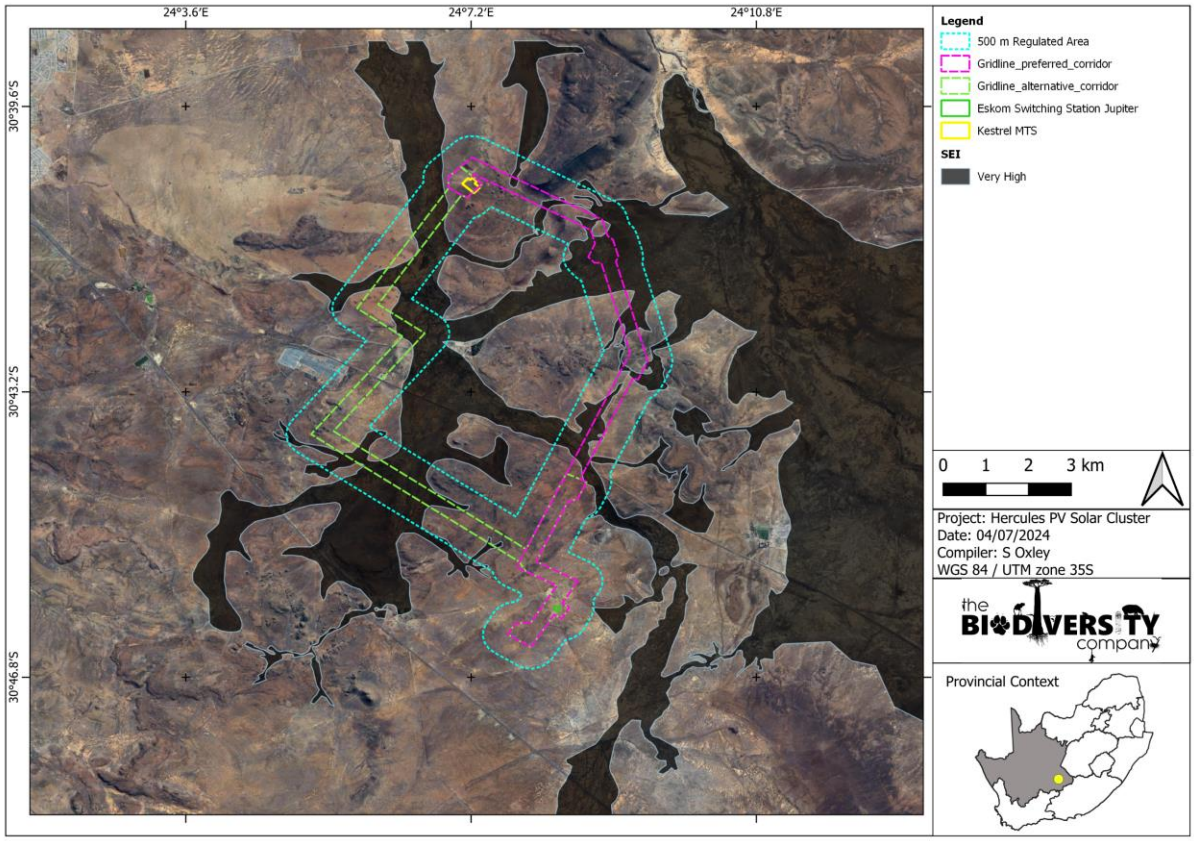


Figure 3-27: Aquatic Biodiversity SEI delineation relevant to the project area

3.8 Site Sensitivity Verification

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

- The National Web-based Environmental Screening Tool has characterised the Aquatic Biodiversity Theme sensitivity as “Low” for some sections of the project footprint; and

- The National Web-based Environmental Screening Tool has characterised the Aquatic Biodiversity Theme sensitivity as “Very High” for the project footprint as these watercourses comprise multiple wetland clusters and wetland NFEPA’s (Figure 3-28).

This approach has also taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 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” (DWS, 2020). The National Web Based Environmental Screening Tool (NWBEST) has characterised the aquatic sensitivity of the watercourses within the project area as “Very High” - requiring an assessment. The freshwater ecology of the immediate project area and further downstream areas are considered sensitive to disturbance from a hydrological and biological perspective. This is due to the screening tool flagging the presence of rivers.–These watercourses are considered sensitive due to their relatively small spatial scale when compared to terrestrial habitat with a large demand for the ecosystem services which they provide.

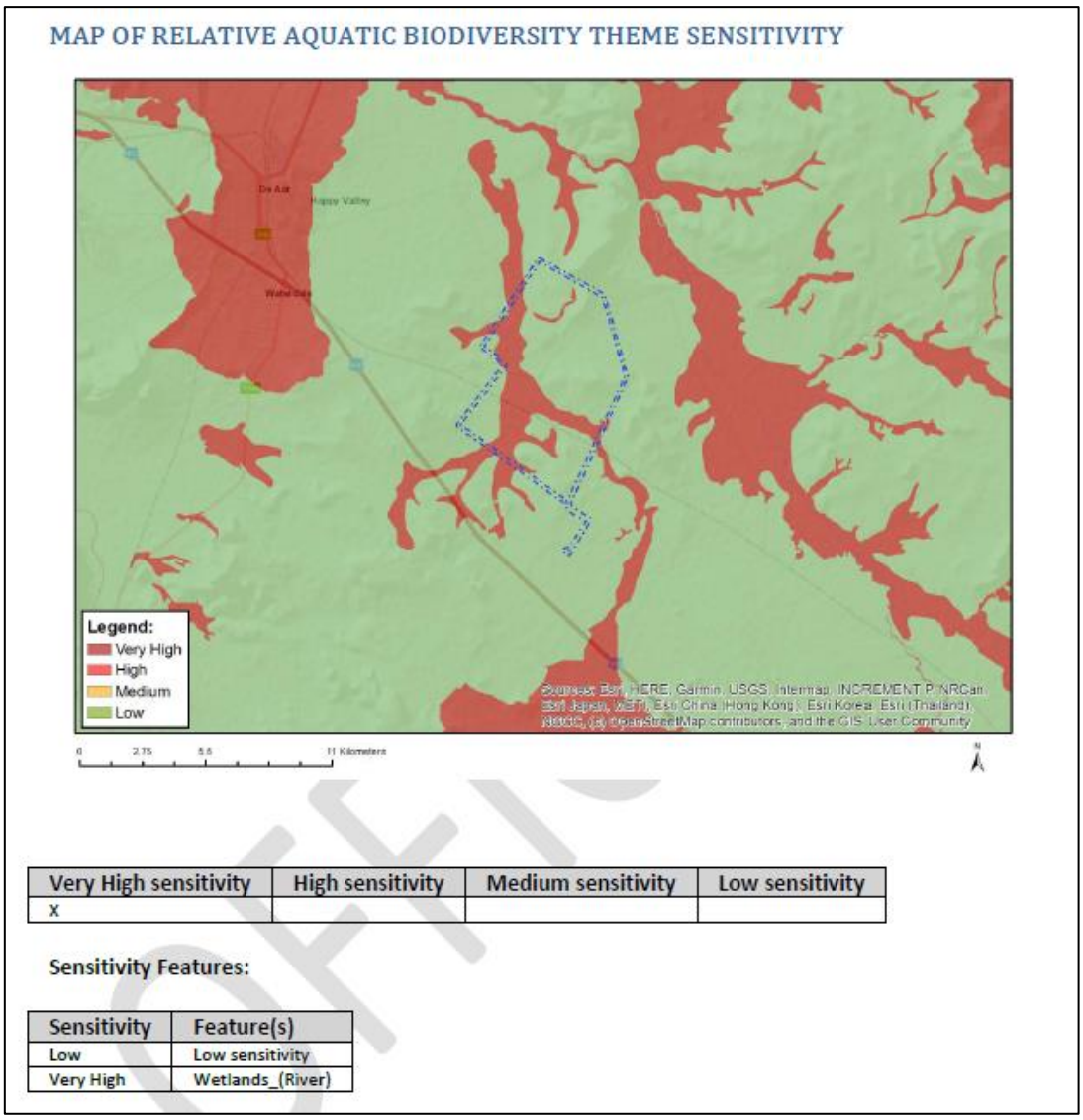


Figure 3-28: Aquatic Biodiversity Sensitivity (National Web based Environmental Screening Tool)

The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas in Table 3-15 below. A summative explanation for each result is provided as relevant. The specialist-assigned sensitivity ratings are based largely on the SEI process followed in the previous section and consideration is given to any observed or likely presence of sensitive fauna and flora.

Table 3-15: Summary of the screening tool vs specialist assigned sensitivities.

Screening Tool Theme	Screening Tool	Habitat	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Aquatic Theme	**Very High**	**Drainage Areas**	**Very High**	Validated – Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure.
		Depression wetland	**Very High**	Validated – Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure.

4 Impact / Risk Assessment

4.1 Current Impacts on Freshwater Biodiversity

Considering the anthropogenic activities and influences within the landscape, several negative impacts to aquatic biodiversity were observed within the project area, however limited in intensity unless otherwise stated. These include:

- Historic land modification from reference conditions;
- Farm roads and main roads (and associated altered surface hydrology and wash of hydrocarbons into watercourses. Both formal and informal river crossing structures have altered instream flow characteristics);
- Centre pivots and abstraction for these (and associated altered surface hydrology and wash of pesticides and herbicides into watercourses as contaminated return water);
- Grazing and trampling of natural vegetation by livestock in aquatic and watercourse areas;
- Minor encroachment of drainage areas by Alien and/or Invasive Plants (AIPs);
- Erosion from steep slopes, embankments and roads (especially roads lacking anti-erosion measures);
- Instream sedimentation;
- Existing OHLs and associated servitudes; and
- Fences and associated maintenance resulting in habitat fragmentation.

4.2 Alternatives Considered

Two alternative powerline options were proposed: the preferred option and the alternative. Given that both powerlines traverse similar habitats, a separate assessment for each was deemed unnecessary. An evaluation of the suitability of these alternatives can be found in Section 6.2. As a result, mitigation or management efforts will be the same for both alternatives.

4.3 Quantitative Risk and Impact Assessment

The Risk/Impact Assessment considered the impacts of the activity on the freshwater systems associated with the project area. 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 the project location, setting, scale, layout, technology, and phasing to avoid impacts. For this assessment, the specialist was provided with the location of the proposed activity and the study focussed on the water resources within and close to the project area. Mitigation measures should be implemented to negate potential impacts on the water resources associated with the project area.

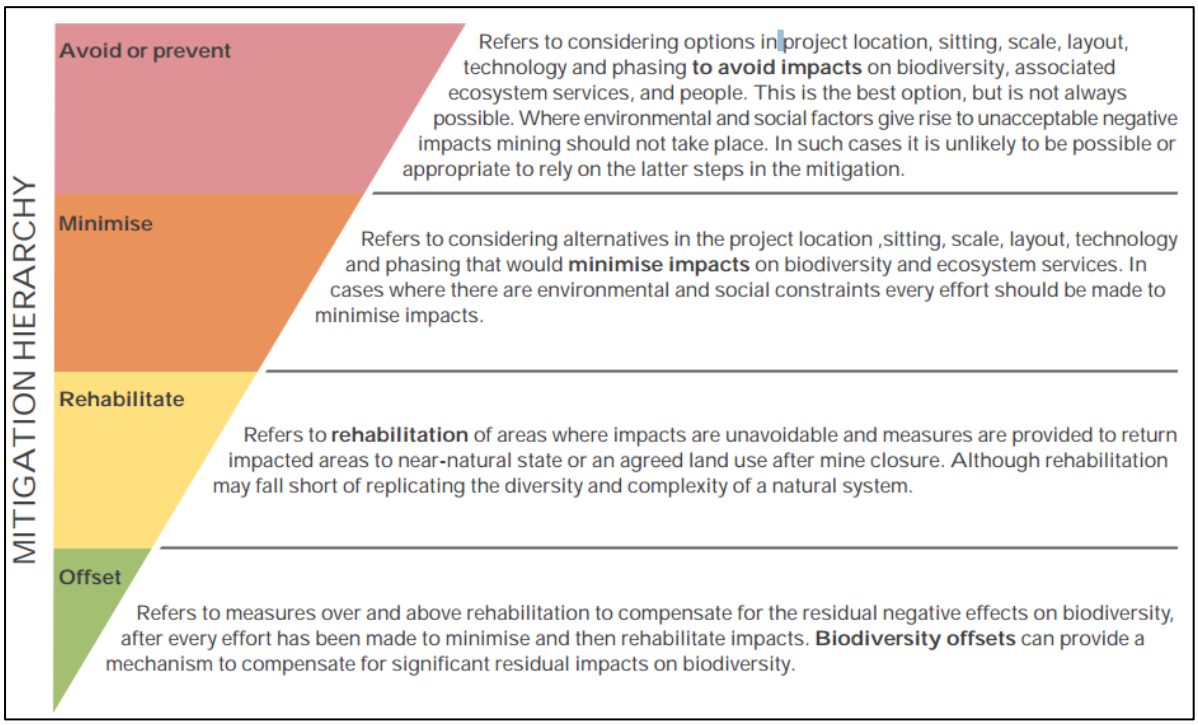


Figure 4-1: The mitigation hierarchy as described by the DEA (2013)

4.3.1 Potential Anticipated Impacts

Table 4-1 illustrates the DWS risk ratings associated with the project. The potential impacts are expected to threaten the integrity of sensitive receptors during the project activities if unmitigated. The pre-and post-mitigation significance ratings have been calculated considering various parameters, these results are presented in the subsequent tables. This risk-based impact assessment was conducted in line with Section 21 (c) and (i) of NWA to investigate the level of risk posed by the construction and operation of the proposed transmission line. Significance ratings for each identified risk are given for scenarios with mitigation.

Table 4-1: Summative results of the DWS Risk Assessment Matrix compiled by Prasheen Singh (Pr. Sci. Nat. 116822)

Phase	Activity	Impact		Significance (max = 100)	Risk Rating
CONSTRUCTION	Site clearing and preparation. Earthworks and Vehicle Movement. Road Construction. Civil Works. Transportation and Installation of towers. Wiring to Central Inverters. Storage and Use of Hazardous substances and Equipment.	Loss, disturbance and degradation of watercourse		12.6	L
		Increased bare surfaces, flood peaks and potential erosion		9.6	L
		Introduction and spread of alien and invasive vegetation		8.4	L
	Excavation and installation of Infrastructure	Decreased flow inputs to the watercourses		14.4	L
		Increased sediment loads to downstream reaches		19.2	L

OPERATIONAL	Operation of the Grid Corridor. Established Grid Corridor Area. Vehicle Traffic (Security Monitoring and Maintenance). Operation of on-site Stormwater Management.	Proliferation of alien and invasive species		9.6	L
		Nutrient enrichment of watercourse		8.4	L
		Introduction and spread of alien and invasive vegetation		12	L
DECOMMISSIONING	Removal of infrastructure	Degradation of vegetation and proliferation of alien and invasive species		12.6	L
		Increased bare surfaces, runoff and potential for erosion		14.4	L

The intended infrastructure was assessed as outlined by Section 1.1 and 1.2 of this report. The final layout was provided at the time of writing this report, hence the potential impact and risk of the Jupiter Transmission Infrastructure Project on associated watercourses could be determined. Alternatives were considered for this assessment. Considering the size of these drainage areas, their associated sensitivity and the volumes of water delivered by them (during the height of the rainy season), the primary objective should be to avoid trying to construct anything within them. As suggested by section 3.4, these areas and associated buffer zones are suggested as no go areas and should be avoided if possible.

To further understand the impacts of a transmission infrastructure on aquatic habitat the footprint should be understood. Transmission tower electrical pylons which don't have standard distances between pylons normally range from 150 m to 500 m apart. The use of pylons indicate that the transmission is not buried, and watercourses are largely avoided. This vegetation plays an important role in the maintenance of hydrological and sediment regimes of the watercourse. Removal of vegetation, particularly in the drainage areas has the potential to decrease infiltration and increase surface runoff. It also has the potential to result in erosion of the drainage area while at the same time increasing sediment loads and potentially toxicants delivered downstream. Lastly there will be access roads which are assumed to be the existing dirt road network and wouldn't result in further degradation of habitat. A decommissioning phase for the proposed development was considered and would pose risks and impacts similar to the construction phase. The project alternatives traverse similar habitats and watercourse features hence will pose similar risk and impacts. All activities and aspects associated with the transmission line infrastructure will have 'Low' impact significance post-mitigation.

Following the DEA mitigation hierarchy, the adverse effects to the receiving watercourses will need to be ameliorated through the implementation of watercourse rehabilitation. This could involve rehabilitation of disturbed drainage areas and banks to improve the phytoremediation capacity of the system. The proposed project therefore requires a DWS Water Use General Authorisation as the associated water use activities trigger sections 21 (c) impeding or diverting the flow of water in a watercourse, and (i) altering the bed, banks, courses or characteristics of a watercourse with 'Low' post-mitigation risks.

4.4 Unplanned Events

The planned activities will have known impacts as discussed above; however, unplanned events may occur on any project and may have potential impacts which will need mitigation and management. Table 4-2 is a summary of the findings from a watercourse ecology perspective. Please note not all potential

unplanned events may be captured herein and this must therefore be managed throughout all phases of the project.

Table 4-2: Unplanned Events, Risks and their Management Measures

Flooding during construction	**Significant habitat degradation of downstream areas.**	**A flood emergency response plan should be drafted, with adequate stormwater management required.**
Spills into the surrounding environment and watercourses	Contamination of habitat as well as water resources associated with a spillage.	A spill response kit must be available at all times. The incident must be reported on and if necessary, an experienced aquatic ecologist must investigate the extent of the impact and provide rehabilitation recommendations.
Uncontrolled erosion	Sedimentation of downslope watercourses	Erosion control measures must be put in place. Measures must include monthly inspections across the project footprint and should be adaptive based on site-conditions.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural Bushveld and ridge.	Appropriate/Adequate fire management plan need to be implemented to protect the veld from potential damage and livestock loss.

4.5 Cumulative Impacts

Cumulative impacts are assessed in context of the extent of the proposed project area; other developments in the SQR and Quaternary catchment areas; and general habitat loss and transformation resulting from other activities in the area. The impacts of projects are often assessed by comparing the post-project condition to a pre-existing baseline condition. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for freshwater fauna and flora.

Localised cumulative impacts include the cumulative effects from anthropogenic activities that are close enough (such as nearby farming activities within the area) to potentially cause additive effects on the environment or sensitive receivers. These include disruption of ecological corridors or habitat such as watercourses, impacts to groundwater and surface water quality, and transport of soils and instream habitat smothering impacts.

Long-term cumulative impacts due to the proposed electricity transmission footprint combined with the low density agricultural activities currently present has the potential to degrade watercourse habitat across the catchment. The cumulative impact of the project was rated as 'Low' should the project go ahead and involve the implementation of mitigation. (Table 4-3).

Table 4-3: Cumulative impact assessment for the development

Impact Nature: Loss / Degradation to Local Ecology		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Low	Moderate
Duration	Long term	Long term
Magnitude	Low	Moderate
Probability	Probable	Highly probable
Significance	Low	Moderate
Status (positive or negative)	Negative	Negative

Reversibility	Low	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

4.6 Mitigation Measures

The following mitigation measures are proposed in light of the above:

- Use the drainage area shapefiles to clearly demarcate (on the ground) the edge of the buffer on the watercourse (50 m buffer). Regard these as strict no-go areas and sign post as environmentally sensitive where possible.
- All activities (including driving and equipment storage) must remain outside of the watercourse and associated buffer identified on site that will be conserved.
- All infrustructure during both construction (e.g. laydown yards) and operation (e.g. offices, control room/s, storage facilities, inverters, and transformers) must remain outside of the watercourse and associated buffer identified on site that will be conserved
- Hold off on the clearing of vegetation as long as possible, ensuring that all environmental and water use authorisations are in place, the site construction materials are in place and the PV infrastructure is sourced and ready for construction prior to clearing.
- Take every measure to ensure that the bulk of the site clearing and earth moving activities take place in winter when rainfall is lowest (and the grass sward is thinnest) to minimize environmental damage, erosion, sedimentation and contamination.
- Post construction all remaining material is to be removed from site to the appropriate waste storage facility.
- All disturbed areas such the laydown areas need to be rehabilitated through revegetation.
- While clearing keep a nursery of plant sods (prioritise hydrophytes) in an on-site nursery rehabilitation of disturbed areas.
- Minimize the disturbance footprint and the unnecessary clearing of vegetation outside of this area.
- Develop a sound stormwater management plan that is engineered to promote rainfall infiltration and minimise the development of preferential flow paths. The stormwater plan would also benefit from Lidar based topography maps and / or site-specific contours that allow for the identification of flow paths.
- All low points, flow paths or clean water drains should be engineered to minimize erosion through the installation of small drop downs and flow attenuation structures especially out outlets into the floodplain.
- Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in or beds of aggregate).
- Consider the use of a coarse gravel beneath the solar panels to promote infiltration and minimize surface run-off and erosion during high rainfall events. The gravel should be free of heavy metal contaminants.
- Educate staff and relevant contractors on the location and importance of the identified watercourses through toolbox talks and by including them in site inductions as well as the overall master plan.

- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- Promptly remove / control all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs).
- Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash.
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation).
- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access.

5 Recommendations

The following recommendations are provided for the project:

- A competent Environmental Control Officer (ECO) must oversee the construction and associated rehabilitation phase of the project, with watercourse areas as a priority to limit the listed impacts on the watercourses. Two follow up ECO assessments/ audits must be carried out in the first and sixth months of operation. Ideally one of these audits should take place following a rainfall event. The ECO must be supplied with a copy of this report to familiarise themselves with the mitigation and recommendations prior to construction;
- A qualified Hydrologist with experience in arid areas must develop a suitable and adaptive Stormwater management plan to ensure no erosion takes place and that clean water reports back to the local watercourses;
- An adaptive rehabilitation plan needs to be implemented from the onset of the project. The key focus should be placed on stormwater and erosion prevention strategies for the development area. The plan should be adhered to for all stages of the project life;
- Therefore, an infrastructure monitoring and service plan must be compiled and implemented during the operational phase. This will include monitoring the road reserve route, all stormwater discharge points, energy dissipation structures, and stability of watercourse habitat in the project footprint. This service plan should be adaptive based on on-site conditions; and
- This report must consider the associated TBC terrestrial biodiversity report and associated mitigation and recommendations.

6 Conclusion

6.1 Aquatics baseline

The National Web Based Environmental Screening Tool (NWBEST) has characterised the aquatic theme sensitivity of the project area as “Very High”. The associated watercourses within the PAOI are predominantly designated as Ecological Support Areas. These watercourses also comprise multiple wetland clusters and wetland National Freshwater Ecosystem Priority Areas (NFEPA). The ecological integrity at a desktop level of the associated catchments ranges from a class B (largely natural) to a class C (moderately modified).

Groundtruthing efforts through fieldwork revealed all lotic systems bar site DJ US1 were dry at the time of the survey and therefore water quality was only tested in lentic systems however these had poor connectivity and were interpreted in isolation. In-situ water quality results indicated modified conditions in some of the sampled dams, due to high pH levels which were above the TWQR limit. The pH

concentrations throughout the project area were alkaline. Due to no surface flow in the watercourses associated with the PAOI, the macroinvertebrate and ichthyofauna assessment methodologies were not applicable. The Habitat Integrity Assessment indicated 'Largely Natural to Moderately Modified' (class B/C) instream and riparian habitat for the ephemeral systems with minor modification resulting from instream dams and road crossing structures among others. Although a broader area was assessed, these conditions may be representative of the baseline conditions within similar watercourse features within the PAOI.

The completion of the aquatic biodiversity desktop and field assessments therefore agrees with the 'Very High' sensitivity presented by the screening report due to these areas containing > 50% natural habitat with potential to support species of conservation concern (SCC), > 100 ha of intact area for any conservation status of ecosystem type which have high habitat connectivity serving as functional ecological corridors with limited road network between intact habitat patches. Lastly the habitat is unlikely to be able to recover fully after a relatively long period (> 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality) due to the ephemeral nature of the system.

6.2 Risk Assessment

A variety of risks have been identified for the proposed project for the construction, operational and decommissioning phases. These risks were assessed for the transmission infrastructure PAOI in relation to the watercourses. As a result, the risk matrix was completed with mitigation measures with the most significant noted mitigation measure being the avoidance of the delineated drainage areas and associated 50 m buffers. The project alternatives traverse similar habitats and watercourse features hence will pose similar risk and impacts. All activities and aspects associated with the transmission line infrastructure will have 'Low' impact significance post-mitigation.

6.3 Specialist Recommendation

It is the opinion of the specialists that after a consideration of the current sensitivity of the assessed systems, which was determined to be "Very High'' according to the site ecological importance, as well as the potential risks which may result from the Transmission Infrastructure Project, that authorisation may be granted as only low impact pylon tower infrastructure will be developed inside the delineated watercourses and 50 m buffer area. The proposed project requires a DWS Water Use General Authorisation as the associated water use activities trigger sections 21 (c) impeding or diverting the flow of water in a watercourse, and (i) altering the bed, banks, courses or characteristics of a watercourse with 'Low' post-mitigation risks..

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8 Appendices

8.1 Appendix A - Methodology

8.1.1 Freshwater Assessment

8.1.1.1 Desktop Spatial Assessment

The following information sources were considered for the desktop assessment;

- Aerial imagery (Google Earth Pro);
- The inland water dataset;
- Topographical river line data;
- Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) per Sub Quaternary Reaches (SQR) for Secondary Catchments in South Africa (DWS, 2014);
- The National Freshwater Ecosystem Priority Areas (NFEPA) (Nel *et al*., 2011);
- Provincial Conservation Plans;
- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al*., 2019);
- National Biodiversity Assessment (NBA) (Van Deventer *et al*., 2019);
- The SANBI National Wetland Map 5 (Van Deventer *et al*., 2019); and
- Contour data (5 m).

8.1.1.2 Water Quality

Water quality was measured *in-situ* using a handheld calibrated multi-parameter water quality meter. The constituents considered that were measured included: pH, electrical conductivity (µS/cm), water temperature (°C) and Dissolved Oxygen (DO) in mg/l.

8.1.1.3 Habitat Assessments

Habitat availability and diversity are major attributes of the biota found in a specific ecosystem, and thus knowledge of the quality of habitats is important in an overall assessment of ecosystem health. Habitat assessment can be defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour *et al*., 1996). Both the quality and quantity of available habitat affect the structure and composition of resident biological communities (USEPA, 1998). Habitat quality and availability play a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations to facilitate the interpretation of results.

8.1.1.4 Aquatic Habitat Integrity

The Intermediate Habitat Assessment Index (IHIA) as described in the Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999 was used to define the ecological status of all NFEPA river reaches. The reaches within the project area experience uniform influences with similar geomorphological processes. As a result, many river systems were grouped together.

The IHIA model will be used to assess the integrity of the habitats from a riparian and in-stream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale which are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

This model compares current conditions with reference conditions that are expected to have been present. Specification of the reference condition follows an impact-based approach where the intensity and extent of anthropogenic changes are used to interpret the impact on the habitat integrity of the system. To accomplish this, information on abiotic changes that can potentially influence river habitat integrity are obtained from surveys or available data sources. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology and physico-chemical conditions and how these changes would impact on the natural riverine habitats. The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 8-1 and Table 8-2 respectively.

Table 8-1: Criteria used in the assessment of habitat integrity (Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Water quality modification	Originates from point and diffuse point sources. Measured directly or alternatively agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also, a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochtonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the riverbank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 8-2: Descriptions used for the ratings of the various habitat criteria

Impact Category	Description	Score
None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	1-5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.	6-10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	11-15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	16-20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21-25

8.1.2 Aquatic Macroinvertebrate Assessment

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al.,* 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al.,* 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

8.1.2.1 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the "Aquatic Invertebrates of South African Rivers" Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made to family level (Thirion *et al.,* 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002).

Reference conditions reflect the best conditions that can be expected in rivers and streams within a specific area and reflect natural variation over time. These reference conditions are used as a benchmark against which field data can be compared. All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Nama Karoo – Lower Ecoregion (Figure 3). This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database. Ecological categories for the project area are based on biological banding presented in Table 8-3.

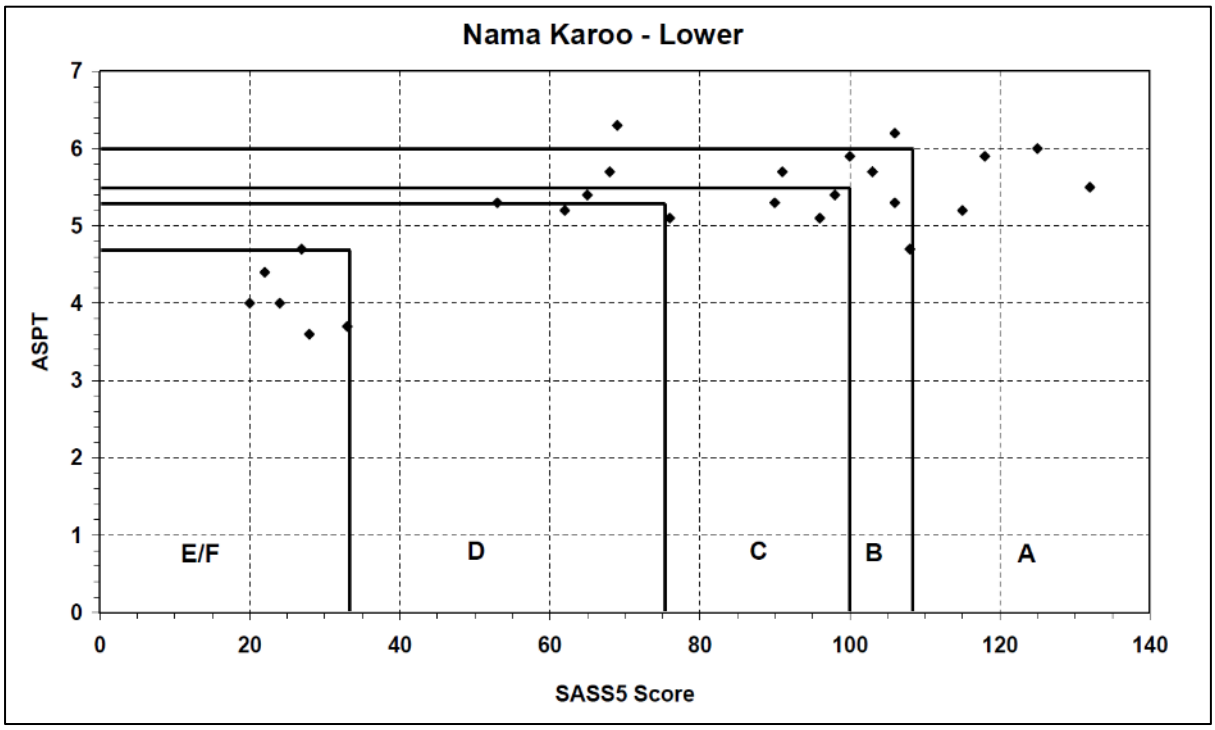

Figure 8-1: Biological Bands for the Nama Karoo – Lower Ecoregion, calculated using percentiles

Table 8-3: Biological Bands / Ecological categories for interpreting SASS data (adapted from Dallas, 2007)

Class	Ecological Category	Description
A	Natural	Unimpaired. High diversity of taxa with numerous sensitive taxa.
B	Largely natural	Slightly impaired. High diversity of taxa, but with fewer sensitive taxa.
C	Moderately modified	Moderately impaired. Moderate diversity of taxa.
D	Largely modified	Considerably impaired. Mostly tolerant taxa present.
E/F	Seriously Modified	Severely impaired. Only tolerant taxa present.

8.1.3 Fish Presence

Fish were sampled through electroshocking. All fish were identified in the field and released at the point of capture, in order not to cross fish populations. Fish species were identified using the guide Freshwater Fishes of Southern Africa (Skelton, 2001). The identified fish species were compared to those expected to be present for the quaternary catchment. The expected fish species list for the reach was developed from a literature survey to compare to the sampled species at site. Different fish species represent different sensitivities to water chemistry, habitat and flow (Kleynhans *et al*., 2007 and Skelton 2001). Fish have different sensitivities or levels of tolerance to various aspects that they are subjected to within the aquatic environment. These tolerance levels are rated with a sensitivity score as presented in Table 8-4. These tolerance levels are scored to show each fish species' sensitivity to flow and physico-chemical modifications.

Table 8-4: Intolerance rating and sensitivity of fish species

Sensitivity Score	Tolerance/Sensitivity Level
0-1	Highly tolerant = Very low sensitivity
1-2	Tolerant = Low sensitivity
2-3	Moderately tolerant = Moderate sensitivity
3-4	Moderately intolerant = High sensitivity
4-5	Intolerant = Very high sensitivity

8.1.4 Present Ecological State

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007) (Table 8-5) . For this study ecological classifications have been determined for biophysical attributes for the associated water course. This was completed using the river Ecoclassification manual by Kleynhans and Louw (2007). The areas considered in the PES assessment are outlined in the description of the project area section. The combined categories were assessed to determine the reach-based PES.

Table 8-5: Present Ecological State (PES) Categories

Category	Descriptions (Modifications)	Descriptions (Taxa)
A	**Natural**	
	Unmodified, natural.	Unimpaired. High diversity of taxa with numerous sensitive taxa.
B	**Largely Natural**	
	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Slightly impaired. High diversity of taxa, but with fewer sensitive taxa.
C	**Moderately Modified**	
	A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	Moderately impaired. Moderate diversity of taxa.
D	**Largely Modified**	
	A large loss of natural habitat, biota and basic ecosystem functions has occurred.	Considerably impaired. Mostly tolerant taxa present.
E	**Seriously Modified**	
	The loss of natural habitat, biota and basic ecosystem functions is extensive.	Severely impaired. Only tolerant taxa present.
F	**Critically Modified**	
	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	Severely impaired. Only tolerant taxa present.

8.1.5 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.

8.1.5.1 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 into potential wetland areas and serve to highlight the location and extent of rivers, drainage features, dams, wetlands, reservoirs, and other relevant inland waterbodies.

8.1.5.2 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 on 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 (Nel et al., 2011).
- Strategic Water Source Areas, 2021 (Lötter & Le Maitre, 2021).
- Provincial Conservation Plans.

8.1.5.2.1 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 has been altered from its natural condition.

8.1.5.2.2 National Freshwater Ecosystem Priority Areas, Rivers and Wetlands

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).

8.1.6 Riparian Habitat Delineation

The riparian delineation was completed according to DWAF (2005). Typical riparian cross sections and structures are provided in Figure 8-2. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Contour data obtained from topography spatial data was also utilised to support the infield assessment.

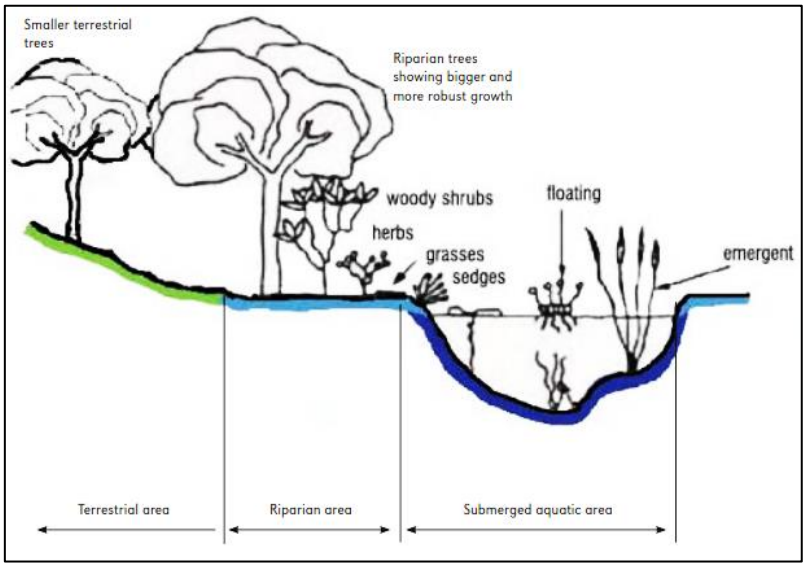

Figure 8-2: Riparian Habitat Delineations (DWAF, 2005)

8.1.7 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.

8.1.8 Site Ecological Importance

The different habitat types within the assessment area were delineated and identified based on observations during the field assessment as well as information from available satellite imagery. These habitat types were assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of Species of Conservation Concern (SCC) and their ecosystem processes.

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts).

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor. The criteria for the CI and FI ratings are provided in Table 8-6 and Table 8-7, respectively.

Table 8-6: Summary of Conservation Importance criteria

Conservation Importance	Fulfilling Criteria
Very High	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10 km^2. Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

Table 8-7: Summary of Functional Integrity criteria

Functional Integrity	Fulfilling Criteria
Very High	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts with no signs of major past disturbance.
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

BI can be derived from a simple matrix of CI and FI as provided in Table 8-8.

Table 8-8: Matrix used to derive Biodiversity Importance from Functional Integrity and Conservation Importance

Biodiversity Importance		Conservation Importance				
		Very high	High	Medium	Low	Very low
Functional Integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor as summarised in Table 8-9.

Table 8-9: Summary of Receptor Resilience criteria

Resilience	Fulfilling Criteria
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

After the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 8-10.

Table 8-10: Matrix used to derive Site Ecological Importance from Receptor Resilience and Biodiversity Importance

Site Ecological Importance		Biodiversity Importance				
		Very high	High	Medium	Low	Very low
Receptor Resilience	Very Low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very High	Medium	Low	Very low	Very low	Very low

Interpretation of the SEI in the context of the proposed activities is provided in Table 8-11.

Table 8-11: Guidelines for interpreting Site Ecological Importance in the context of the proposed activities

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa.

8.1.9 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 being given to the presence of observed or likely sensitive fauna and flora.

8.2 Appendix B – Risk and Impact Assessment

The risk assessment will be completed in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 4167 by the Department of Water and Sanitation (DWS) (previously GN 509 of 2016 and GN 3139 of 2023)). The significance of the impact is calculated according to Table 8-12.

Table 8-12: Significance ratings matrix

Rating	Class	Management Description
1 – 29	Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. License required.
61 – 100	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. License required.

8.2.1 Cumulative Impact Assessment

The following aspects as presented in Table 8-13 were considered in the cumulative impact assessment which refers to quantifying the significance (Table 8-14) of impacts in relation to the proposed development.

Table 8-13 Aspects and ratings considered in the cumulative impact assessment

Duration of Impact	Rating
One day to one month: Temporary	1
One month to one year: Short Term	2
One year to five years: Medium Term	3
Life of operation or less than 20 years: Long-Term	4
Permanent	5
Spatial Scope of Impact	**Rating**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected > 3000m	5
Severity of Impact	**Rating**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great/harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Sensitivity of Receiving Environment	**Rating**
Ecology is not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology is highly sensitive /important	4
Ecology is critically sensitive /important	5
Probability of impact	**Rating**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Consequence (Severity+Spatial Scope+Duration)	
Likelihood (Sensitivity of Receiving Environment X Probability of Impact)	
Significance (Consequence X Likelihood)	

Table 8-14 Significance ratings for the cumulative impact assessment

Significance	Class
0 - 15	Absent
16 -30	Low
31 - 45	
46 - 60	Moderate
61 - 75	
76 - 90	Moderately High
91 - 105	High
106 - 120	
120 - 135	Critical
136 - 150	

8.3 Appendix C – Specialist Declaration of Independence

I, Michael Ryan, 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.

Michael Ryan

Riverine Ecologist

The Biodiversity Company

November 2022

I, Dale Kindler, 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.

Dale Kindler

Aquatic Specialist

The Biodiversity Company

November 2022

I, Sarah Oxley, 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.

Sarah Oxley

The Biodiversity Company

July 2024

I, Prasheen Singh, declare that:

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

Prasheen Singh

Aquatic Specialist

The Biodiversity Company

July 2024

8.4 Appendix D – Specialist CVs

Sarah Oxley

M.Sc Aquatic Health

Project Manager

Cell: +27 71 441 2608

Email: sarah@thebiodiversitycompany.com

Identity Number: 9311110043082

Date of birth: 11 November 1993

Profile Summary

Dedicated and innovative professional with a passion for wildlife conservation, sustainability, and environmental stewardship.

Adept at leveraging expertise in research, data analysis, and biodiversity assessment to drive impactful conservation initiatives.

Proficient in QGIS for generating ecological maps and wildlife sightings heat maps, bolstering decision-making processes.

Experienced in content creation, blog writing, and website management to amplify conservation messaging across digital platforms.

Areas of Interest

Sustainability and Conservation.

Publication of scientific journals and articles.

Hydroponics & Aquaponics

Renewable Energy

Key Experience

- Basic Assessments
- Biodiversity & Ecological Impact Assessments.
- QGIS Mapping.
- Project Management.
- The use of diatoms to determine water quality.
- Aquatic Ecological Assessments
- Content Creation. (Facebook, LinkedIn & Instagram
- Research & Data Analysis
- Client Relationship Management

Country Experience

South Africa

Nationality

South African

Languages

English – Proficient

Qualifications

- MSc (University of Witwatersrand) – Aquatic Health.
- BSc Honours (University of Witwatersrand) – Environmental Sciences
- BSc Natural Science
- Fundamentals of Digital Marketing (The Open University)
- SEO Fundamentals (SEMrush)
- Beginner's Google Analytics

Signed:

Sarah Oxley

Prasheen Singh

M.Sc Aquatic Health (*Pr. Sci. Nat.*)

Cell: +27 69 206 9440
Email: prasheen@thebiodiversitycompany.com
Identity Number: 8904255091089
Date of birth: 25 April 1989

Profile Summary

Prasheen Singh is a SACNASP registered Professional Scientist in the field of Aquatic Science.

He is an Aquatic Ecologist and Water Quality Specialist whose 11 years' experience comprises numerous Aquatic Scientific Studies, Peer Reviews, Research, and served as a SANAS accredited Technical Signatory at an Ecotoxicology Laboratory. He is also a Steering Committee Member for the Water Research Commission

Prasheen attained his MSc in Aquatic Health at the University of Johannesburg, and completed training courses for wetlands, river eco-status monitoring, hydropedology, and ecosystem restoration. He is also an accredited SASS5 Practitioner with the Department of Water and Sanitation.

He has working experience throughout South Africa, specialising in water quality studies, aquatic biomonitoring, compliance audits, rehabilitation plans, monitoring plans and risk assessments. Prasheen is experienced in project management and strives to achieve and maintain scientific excellence in all specialist work.

Areas of Interest

Terrestrial and Aquatic Biodiversity.

Ecosystem Restoration, Protection and Conservation.

Environmental Awareness.

Key Experience

- Freshwater Ecological Studies
- SASS5 Macroinvertebrate Assessments, IHAS & MIRAI
- FRAI & Fish Population Structure Assessments
- Instream and Riparian Integrity Assessments
- Aquatic Impact and Risk Assessments
- DWS Risk Assessments
- Environmental Impact Assessments
- Surface water Quality
- Groundwater Quality
- Wastewater Quality
- SANS241 Drinking Water Quality
- Compliance Monitoring
- Water Use License Audits
- Aquatic Resources Rehabilitation Plans
- Aquatic Resources Monitoring Programs
- Ecotoxicity Testing
- GIS and Sensitivity Mapping (ArcGIS, QGIS)

Provincial Experience

Gauteng, Mpumalanga, Eastern Cape, Western Cape, Northern Cape, North West Province, Free State Province, Limpopo, KwaZulu-Natal

Nationality

South African

Languages

English – Proficient

Afrikaans – Basic

Qualifications

- MSc (University of Johannesburg) – Aquatic Health (*Cum Laude*).
- BSc Honours (University of Johannesburg) – Biodiversity and Conservation
- BSc (University of Johannesburg) – Life and Environmental Sciences
- Pr. Sci. Nat. (116822) – Aqua Science
- SASS 5 (2017-2024) – Department of Water Affairs and Sanitation River Health Programme
- River Ecostatus Monitoring Programme Training
- Wetland Management: Introduction and Delineation · University of Free State
- Official DWS Section 21(c) a (i) Water Use Authorisation Training Course – Departme of Water and Sanitation
- Hydropedology and Wetland Functioning – Water Busines Academy
- Ecosystem Restoration (Part and 2) – Learning for Nature

- End of Report -