ABANTU ENVIRONMENTAL SERVICES

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PROJECT NAME:
THE PROPOSED 10MWAC GROOTFONTEIN AGROVOLTAIC SOLAR ENERGY FACILITY AND 22KV OVERHEAD POWERLINE NEAR CALA WITHIN THE SAKHISIZWE LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE.

REPORT TITLE:
AQUATIC BIODIVERSITY IMPACT ASSESSMENT

DEDEAT REFERENCE: EC138/CH/LN1/M/26-13

DWS REF: WU51623

DATE: NOVEMBER 2026

ENVIRONMENTAL ASSESSMENT PRACTITIONER:
ABANTU ENVIRONMENTAL SERVICES (PTY) LTD

ABANTU ENVIRONMENTAL SERVICES

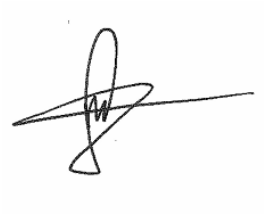
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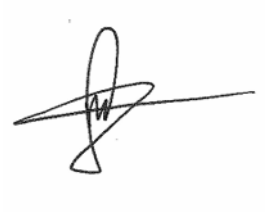
DOCUMENT REVISION STATUS

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DATE	September – November 2026	September - November 2026

DECLARATION OF INDEPENDENCE

I, **Mandilakhe Msutu,** in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Have and will not have vested interest in the operations of the facility;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member;
- Based on information provided to me by the project engineer and proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional ability; and
- Undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered.



Mr Mandilakhe Msutu (Pr.Sci.Nat)
Aquatic Biodiversity Specialist
03.11.2026

AQUATIC BIODIVERSITY IMPACT ASSESSMENT: GROOTFONTEIN AGROVOLTAIC SOLAR ENERGY FACILITY (SEF)

CONTACT INFORMATION AND EXPERTISE

Table 1. Environmental Specialist details

Aquatic Specialist:	Mr Mandilakhe Msutu (Reg. SACNASP, Pr. Sci.Nat)
Expertise:	Mandilakhe Msutu is an environmental specialist with 10 years of experience in scientific research and environmental consulting. His key expertise includes: • Environmental Assessment & Management • Fluvial Geomorphology • Surface Water Hydrology • Soil Science • Catchment Hydrological Modelling • Remote sensing & GIS applications for land use/cover change mapping **Qualifications** • B.Sc. Honours Environmental and Water Sciences (Environmental Assessment & Management, Surface Water Hydrology, Hydrogeology, Advanced Geographic Information System (GIS), Fluvial Geomorphology & Research Project. • B.Sc. Environmental and Water Sciences (Environmental & Waste Management, Groundwater Hydraulics, Surface Water Processes, Hydrogeology, Soil Science, Geomorphology, Remote Sensing & GIS, Mathematics, Statistics for Natural Science, Environmental Law and Regulations (NEMA, NWA etc), Life Sciences, Biodiversity and Conversational Biology & Introduction to Geology of South Africa & Earth dynamics.) **Registrations and memberships:** • Professional Natural Scientist (Pr. Sci.Nat) (SACNASP) Registration No. 116842

Table 2. Environmental Specialist details

Wetlands Specialist :	Mr Sive Mlamla
Expertise:	Sive Mlamla is an environmental scientist with 11 years of experience in scientific research, lecturing and environmental consulting. His key expertise includes environmental impact assessments, environmental compliance auditing, waste planning, proposal & business development, project management, strategic planning, research design & execution, remote sensing & GIS applications for land use/cover change mapping and fluvial geomorphology. **Qualifications** • M.Sc. Geography (Catchment Hydrology) • B.Sc. Honours Environmental Geography • B.Sc. Environmental Sciences (Botany and Geography) **Professional registrations:** • Registered Professional Natural Scientist (Pr.Sci.Nat) - Reg. No. 118495 – SACNASP • Registered Environmental Assessment Practitioner (Reg. EAP (EAPASA)) - Reg. No. 2022/5204 **Training:**

	• Practical Implementation of Environmental Auditing and Monitoring (2025) • WET-Health Tool & WET-EcoServices for Level 1B and Level 2 assessment (2025) • WET-Health Tool for Level 1A assessment (2025) • Environmental Impact Assessments (2025) • Introduction to Synthetic Aperture Radar and Applications (2024) • Earth Observation Data Analysis with Google Earth Engine (2023) • People Management Skills (2017) • Biodiversity spatial data management, acquisition, and analysis (2018) • Water Use Licence Applications via e-WULAAS (2020) • Remote Sensing (land use/cover classification) and SWAT hydrologic modelling (2017) **Registrations and memberships:** • Member of the South African Wetlands Society Reg. No. S9BPP477 • Member of the Southern African Association of Geomorphologists • Institute of Waste Management of Southern Africa (IWMSA) Reg No. 40120001

Table 3. Assistant specialist

Assistant Specialist:	Ms Zimkita Dalasile (Cand.Sci.Nat (SACNASP)
Expertise:	Junior Environmental Scientist with 4 years' experience in environmental consulting and scientific research. My expertise includes environmental management, water resource management, water quality management, aquatic ecosystems, environmental impact assessments, scientific report writing, data analysis, environmental monitoring and environmental compliance audits. **Qualifications** • MSc Environmental Management with Ecological Water Requirements (Management of Ecological Drivers in Aquatic Systems & Management of Ecological Responders in Aquatic Systems) Mini Dissertation: Strategies to manage nutrient inputs and their effectiveness: A case study of the Hartbeespoort Dam • Postgraduate Diploma Integrated Water Resource Management (Water Resource Management, Spatial Analysis for IWRM, Environmental Management & Water Regulations, Water Quality Management and Aquatics Ecosystems Management) • BSc. Environmental and Water Science (Geology, Environmental Assessment and Management, Hydrogeology, Hydrology and Advanced Geographical Information Systems for Environmental System) **Professional registration:** • Candidate Natural Scientist (Cand.Sci.Nat) Registration No. 132501 **Training:** • Introduction Environmental Impact Assessments (EIA) (2024)

REPORT REQUIREMENTS

Specialist Report Requirement Checklist (as per gazetted 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.)

Table 4. Aquatic Biodiversity Report requirements

Item No.	Requirement	Report Reference
2.1	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.	Section 0
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 1.1
2.3	The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:	Section 3
2.3.1	a description of the aquatic biodiversity and ecosystems on the site, including; (a) aquatic ecosystem types; and (b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;	Section 3
2.3.2	the threat status of the ecosystem and species as identified by the screening tool;	Section 1.2
2.3.3	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); and	Section 3
2.3.4	a description of the ecological importance and sensitivity of the aquatic ecosystem including: (a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and (b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).	Section 4.3.1 and 4.3.2
2.4	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.	N/A
2.5	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:	Section 5
2.5.1	is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 5
2.5.2	is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?	
2.5.3	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);	Section 5.1

	(b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub-catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns); (c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and (d) to what extent will the risks associated with water uses and related activities change;	
2.5.4	how will the proposed development impact on the functioning of the aquatic feature? This must include:	Section 5
	(a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system); (b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river); (c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled 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.);	Section 5
2.5.5	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?	
2.5.6	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?	
2.6	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to:	N/A
	(a) size of the estuary; (b) availability of sediment; (c) wave action in the mouth; (d) protection of the mouth; (e) beach slope; (f) volume of mean annual runoff; and (g) extent of saline intrusion (especially relevant to permanently open systems).	N/A
2.7	The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1	contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix A

2.7.2	a signed statement of independence by the specialist;	
2.7.3	a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 4
2.7.4	the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	Section 2
2.7.5	a description of the assumptions made, any uncertainties or gaps in knowledge or data;	Section 1.3
2.7.6	the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	Section 5.3
2.7.7	additional environmental impacts expected from the proposed development;	Section 5.1
2.7.8	any direct, indirect and cumulative impacts of the proposed development on site;	Section 5.1
2.7.9	the degree to which impacts and risks can be mitigated;	Section 5
2.7.10	the degree to which the impacts and risks can be reversed;	Section 5
2.7.11	the degree to which the impacts and risks can cause loss of irreplaceable resources;	
2.7.12	a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	Section **Error! Reference source not found.**
2.7.13	proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	Section 5.3
2.7.14	a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a “low” aquatic biodiversity sensitivity and that were not considered appropriate;	N/A
2.7.15	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	Section 6
2.7.16	any conditions to which this statement is subjected.	N/A

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ABBREVIATIONS

CBA	Critical Biodiversity Areas
DWS	Department of Water & Sanitation
ECBCP	Eastern Cape Biodiversity Conservation Plan
EAP	Environmental Assessment Practitioner
EI&S	Ecological Importance and Sensitivity
ESA	Ecological Support Area
I&APs	Interested and Affected Parties
IHI	Index for Habitat Integrity
IUA	Integrated Unit of Analysis
NFEPA	National Freshwater Ecosystem Priority Areas
NEMA	National Environmental Management Act
PA	Protected Areas
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SQR	Sub-Quaternary Reach
WMA	Water Management Area
WULA	Water Use Licence Application

1. INTRODUCTION

Abantu Environmental Services (Pty) Ltd was appointed to undertake an aquatic biodiversity assessment as part of an Environmental Authorisation (EA) process proposed Grootfontein Agrovoltaic Solar Energy Facility (SEF) in Macangceni within the jurisdiction of the Sakhisizwe Local Municipality (**Figure 1**). This report presents the aquatic biodiversity impact assessment report for the development.

1.1 PROJECT DESCRIPTION

The proposed development is a grid-connected photovoltaic (PV) power plant, designed to generate up to 10 MWac of clean electricity at the point of injection into the Eskom distribution network. The proposed development comprises of the following:

- PV Array Field
- O&M Building
- IPP Switching Station
- Eskom Macangceni SS
- Internal access road

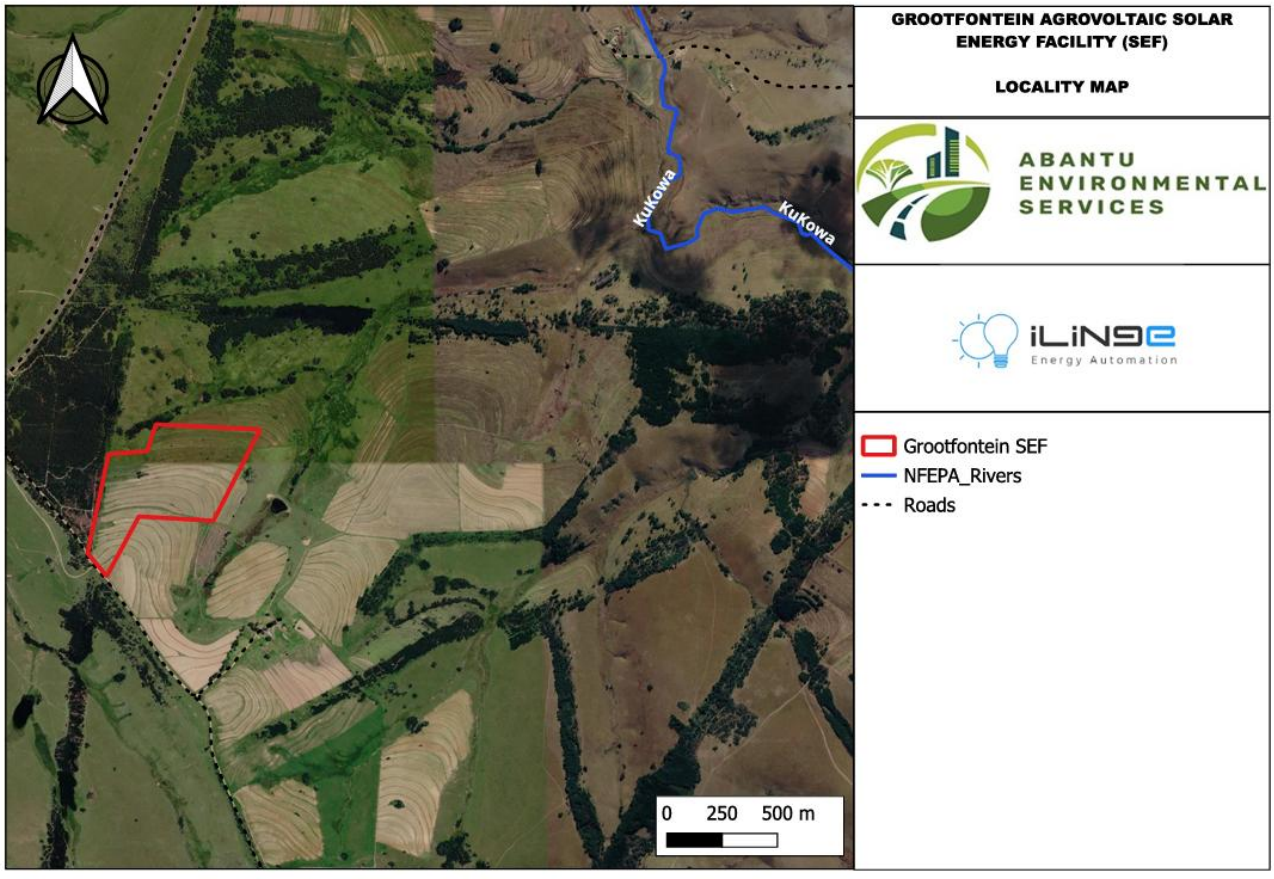


Figure 1. Locality map

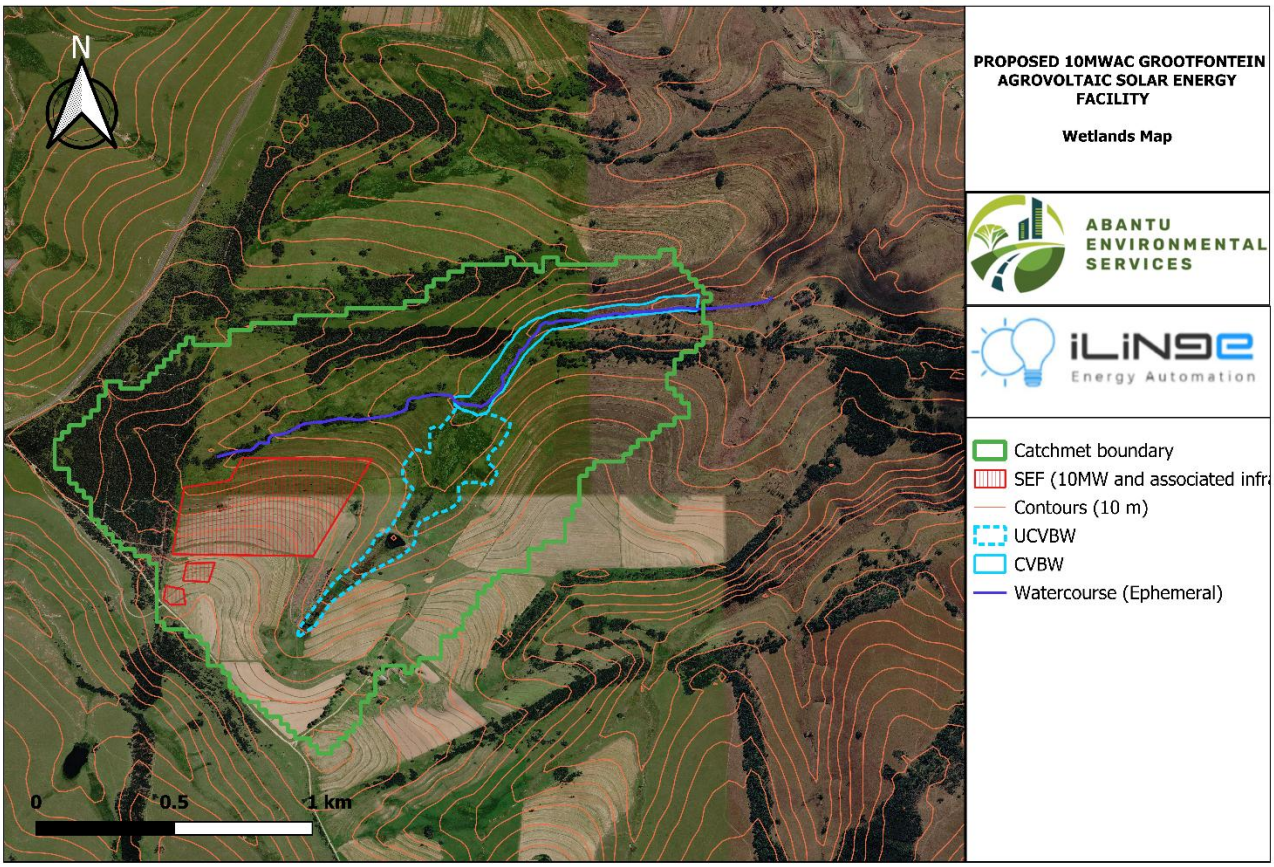


Figure 2. Site specific map

1.2 LEGISLATIVE REQUIREMENTS

According to the protocols specified in GN 320 (Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity) of the National Environmental Management Act (NEMA; Act No. 107 of 1998), assessment and reporting requirements for aquatic biodiversity are associated with a level of environmental sensitivity identified by the national web-based environmental screening tool (screening tool). An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of:

- **Very High** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment; or
- **Low** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement.

The screening tool classified the aquatic biodiversity theme for the study area as **Very High** sensitivity, with mapped sensitivity features including aquatic ESA 1, FEPA Subcatchment and SWSA (sw)_Eastern Cape Drakensberg.

According to the protocol, prior to commencing with a specialist assessment a site sensitivity verification must be undertaken to confirm the sensitivity of the site as indicated by the screening tool:

- Where the information gathered from the site sensitivity verification differs from the screening tool designation of **Very High** aquatic biodiversity sensitivity, and it is found to be of a **Low** sensitivity, an Aquatic Biodiversity Compliance Statement must be submitted.

Similarly, where the information gathered from the site sensitivity verification differs from the screening tool designation of **Low** aquatic biodiversity sensitivity, and it is found to be of a **Very High** sensitivity, an Aquatic Biodiversity Specialist Assessment must be submitted.

The following legislation is directly relevant when assessing the aquatic environment relating to the proposed project.

Table 5. Applicable legislation

Legislation / guideline	Application to the project
National Environmental Management Act (NEMA) (Act 107 of 1998), as amended	Framework environmental management principles and duty of care informing avoidance/mitigation and sustainable development decision-making.
EIA Regulations, 2014 (as amended) and Listing Notices (as amended)	Project triggers listed activities requiring Environmental Authorisation; prescribes public participation and specialist report requirements.
National Water Act (Act 36 of 1998)	Determines whether the works trigger Section 21 water uses (commonly 21(c) and/or 21(i) for in channel/riparian works; and potentially discharge related uses where applicable); includes pollution prevention duty (Section 19).
General Authorisations / WULA requirements (where applicable)	Confirms whether water uses may be authorised under GA or require WULA and informs licence/GA conditions relevant to aquatic protection.
GN 320 (2020): Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	Governs aquatic biodiversity specialist assessment process and minimum report content, including Screening Tool sensitivity-driven outputs and site sensitivity verification.
NEM: Biodiversity Act (NEMBA) (Act 10 of 2004)	Provides for protection of listed threatened/protected species and invasive species management relevant to aquatic/riparian habitats.
Eastern Cape Biodiversity Conservation Plan (ECBCP)	Spatial biodiversity planning layer identifying CBAs/ESAs guiding avoidance and mitigation in sensitive areas.
National Freshwater Ecosystem Priority Areas (NFEPA)	Freshwater ecosystem priority mapping to contextualise ecological importance and support sensitivity/risk motivation.

1.3 ASSUMPTIONS AND LIMITATIONS

The findings and recommendations of this report may be susceptible to the following uncertainties and limitation:

- The report is based on currently available information and, as a result, limited by the information provided by the client.
- Aquatic ecosystems vary both temporally and spatially. Once-off surveys such as this are therefore likely to miss certain ecological information due to seasonality, thus limiting accuracy and confidence.
- The field assessment was undertaken during July 2026 and therefore represents the condition of the watercourse at the time of the survey only.
- No detailed assessment of aquatic biota, including fish, aquatic macroinvertebrates and aquatic vegetation, was undertaken.
- The scope of work did not include in situ or laboratory water quality sampling.

2. METHODOLOGY

The aim of this assessment is to identify areas of aquatic importance and to evaluate these in terms of their conservation importance. In line with the assessment and reporting requirements set out in the protocol, this report includes two main study components: a desktop literature review, supplemented by a field survey within the proposed development footprint and extended areas of influence.

2.1 DESKTOP ASSESSMENT

The aim of the desktop literature review component was to collate and review the extensive available ecological information related to important biodiversity and conservation features and key ecological processes and function.

The following sources were consulted for the desktop literature review.

Table 6. Utilised data and associated source

Data	Source
Google Earth Pro	Google Earth Pro
National Screening Tool	DFFE
DWS Ecoregions	DWA (2005)
Eastern Cape Biodiversity Conservation Plan (ECBCP)	South African National Biodiversity Institute (SANBI), obtained from BGIS
Desktop Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub	Resource Quality Information Service (RQIS) DWS (2014)

Data	Source
Quaternary Reaches for Secondary Catchments in South Africa	
National Freshwater Ecosystem Priority Areas (NFEPA)	CSIR (2011), obtained from BGIS
National Vegetation Map	SANBI obtained from BGIS
National Wetland Map 5	CSIR and SANBI

2.2 WETLAND DELINEATION AND ASSESSMENT

The following definitions, as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance to this study:

Watercourse means:

a) A river or spring;
b) A natural channel in which water flows regularly or intermittently;
c) A wetland, lake or dam into which, or from which water flows; and
d) Any collection of water, which the Minister may, by notice of the Gazette, declare a watercourse.

Wetland means:

"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Riparian habitat includes:

"The physical structure and associated vegetation of areas associated with a watercourse which are commonly characterised by alluvial soil, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas".

2.2.1 WETLAND DELINEATION

The wetland areas were delineated using the method contained within the DWAF guideline 'A practical field procedure for the identification and delineation of wetlands and riparian areas' (DWAF, 2005). This guideline document stipulates that consideration be given to four specific wetland indicators required to determine the outer edge of the temporary boundary of a wetland.

These indicators are:

- **The Terrain Unit Indicator** helps to identify those parts of the landscape where wetlands are more likely to occur.

- **The Soil Form Indicator** identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- **The Soil Wetness Indicator** identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- **The Vegetation Indicator** identifies hydrophilic vegetation associated with frequently saturated soils.

According to the wetland definition used in the National Water Act, vegetation is the primary indicator, which must be present under normal circumstances. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

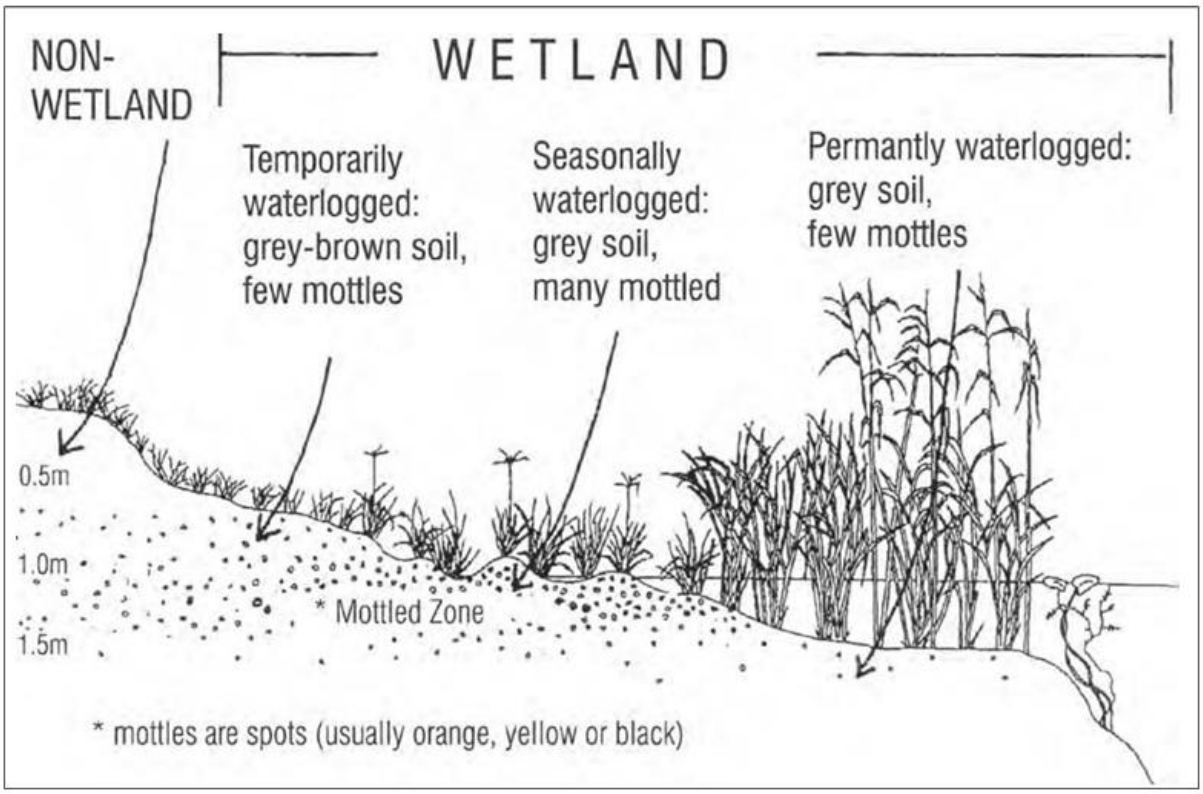


Figure 3. Cross section through a wetland, indicating how the soil wetness and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland (DWAF, 2005).

2.2.2 WETLAND CLASSIFICATION

The Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al., 2013) is the most widely used system in South Africa. The system relies on hydrogeomorphic (HGM) principles that were first proposed by Brinson (1993). Brinson (1993) explains how hydrology and geomorphology (hydrogeomorphic) are two fundamental features that determine the way in which a wetland functions, which can lead to an understanding of the relationship between organisms and the environment. Sieben et al. (2018) reason that the hydrogeomorphic classification is most useful for water resource planning as it provides information about how the wetland is connected to the drainage network, identifies how

water moves through the wetland, and can be used to superficially derive the ecosystem services that a wetland unit provides at a broad-scale.

Figure 4 below indicates the hydro-geomorphic setting of inland wetlands in South Africa, as well as the wetland classification applied to wetlands for assessment (Ollis *et al.,* 2013).

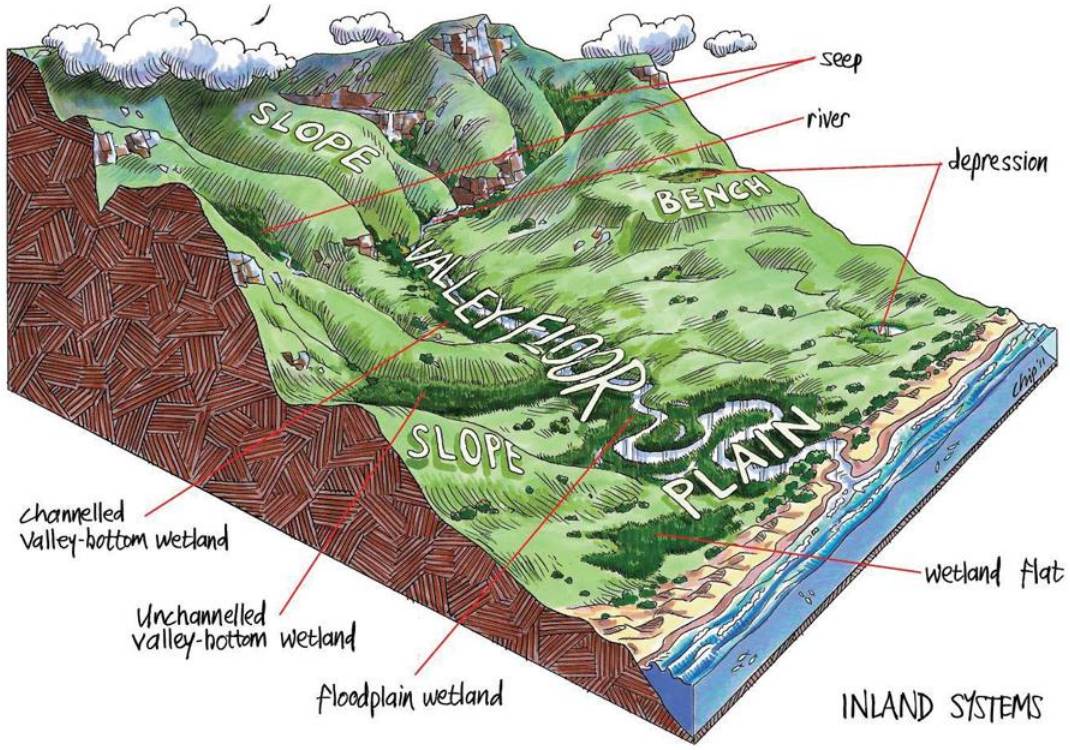


Figure 4. Hydrogeomorphic setting (Ollis *et al.,* 2013)

Hydro-geomorphic types	Description	Source of water maintaining the wetland[1]	
		Surface	Sub-surface
Floodplain	Valley bottom areas with a well-defined stream channel, gently sloped & characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*

Hydro-geomorphic types	Description	Source of water maintaining the wetland[1]	
		Surface	Sub-surface
Valley bottom with a channel	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/***
Valley bottom without a channel	Valley bottom areas with no clearly defined stream channel usually gently sloped and characterized by alluvial sediment deposition, generally leading to accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/***
Hillslope seep with stream channel	Slopes on hillsides, which are characterized by colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.	*	***
Isolated hillslope seepage	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes pans)	A basin shaped area with a closed elevation contour that allows for accumulation of surface water (i.e., it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/***	*/***

2.2.3 WETLAND PRESENT ECOLOGICAL STATE

The WET-Health tool is designed to assess the Present Ecological State (PES) or ecological health of a wetland (Macfarlane *et al.,* 2020). The tool accounts for four inter related components that influence wetland health. These consist of three core drivers of wetland change namely hydrology, geomorphology and water quality, along with vegetation as a responding variable. A separate PES score is derived for

each of these components, which are then combined into a single PES score for the wetland hydrogeomorphic unit. The scores for each component and the overall score fall into one of six Ecological Categories.

Table 7. Guideline for interpreting the magnitude of impacts on wetland integrity

Impact Category	Description	Impact score
None	No discernible modification or the modification is such that it has no impact on this component of wetland integrity	0-0.9
Small	Although identifiable, the impact of this modification on this component of wetland integrity is small.	1-1.9
Moderate	The impact of this modification on this component of wetland integrity is clearly identifiable but limited.	2-3.9
Large	The modification has a clearly detrimental impact on this component of wetland integrity. Approximately 50% of wetland integrity has been lost.	4-5.9
Serious	The modification has a highly detrimental effect on this component of wetland integrity. Much of the wetland integrity has been lost but remaining integrity is still clearly identifiable.	6-7.9
Critical	The modification is so great that the ecosystem processes of this component of wetland integrity are almost totally destroyed, and 80% or more of the integrity has been lost.	8-10

Table 8. PES Categories Scores as defined WET-Health Version 2 (Macfarlane et al., 2020).

Ecological Category	Description	Impact score	PES score (%)
A	Unmodified, natural.	0-0.9	90-100
B	Largely natural with few modifications. A slight change in ecosystem processes is discernible, and a small loss of natural habitats and biota may have taken place.	1-1.9	80-89
C	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	60-79
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	40-59
E	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	20-39
F	Critically modified. Modifications have reached a critical level, and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	0-19

2.2.4 WETLAND ECOSYSTEM SERVICES

Wetlands are specialised systems that perform ecological functions vital for human welfare and environmental sustainability. The WET Ecoservices tool (Kotze *et al.,* 2020), is a technique for rapidly assessing ecosystem services supplied by wetlands, was used to determine the key ecological services

provided by each wetland in the study area. The rapid field assessment (level 2) approach was applied, and the following services were examined and rated:

• Flood attenuation	• Nitrate removal	• Harvestable natural resources
• Streamflow regulation	• Toxicant and pathogen removal	• Food for livestock
• Sediment trapping	• Carbon storage	• Cultivated foods
• Erosion control	• Biodiversity maintenance	• Tourism and recreation
• Phosphate removal	• Water supply	• Education and research
		• Cultural and spiritual experience

Each of the above-listed services was scored according to the following general level of service provided.

Table 9. Categories used for reporting the overall importance of ecosystem services (Kotze *et al.,* 2020)

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

2.2.5 WETLAND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The EIS of the wetlands was determined by utilising a rapid scoring system that was developed by Rowntree (2013), which incorporates aspects of the WET-Ecoservices tool (Kotze et al., 2007) and earlier DWS EIS assessment tools. The purpose of assessing the EIS of a watercourse is to identify those watercourses that are of high conservation concern, primarily as a result of their ability to provide ESS at an above average level, biodiversity function or are specifically susceptible to impacts/disturbances within the catchment area.

Three proposed suites of criteria for assessing the EIS of wetlands form the basis of this tool, namely:

- EIS score derived using aspects of the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999);
- Hydro-function importance score derived from the WET-EcoServices tool for the assessment of wetland ecosystem services Kotze et al. (2020); and
- Direct human benefits score derived from the WET-EcoServices tool for the assessment of wetland ecosystem services Kotze et al. (2020).

The highest score out of the three abovementioned suites is then used to determine the overall EIS category of the wetland system.

Table 10. Template used to calculate the overall Ecological Importance and Sensitivity of a wetland (Rowntree, 2013).

ECOLOGICAL IMPORTANCE AND SENSITIVITY		
Ecological Importance	**Score (0-4)**	**Confidence (1-5)**
Biodiversity support		
Presence of Red Data species		
Populations of unique species		
Migration/breeding/feeding sites		
Landscape scale		
Protection status of the wetland		
Protection status of the vegetation type		
Regional context of the ecological integrity		
Size and rarity of the wetland type/s present		
Diversity of habitat types		
Sensitivity of the wetland		
Sensitivity to changes in floods		
Sensitivity to changes in low flows/dry season		
Sensitivity to changes in water quality		
ECOLOGICAL IMPORTANCE & SENSITIVITY		
Flood attenuation		
Streamflow regulation		
Sediment trapping		
Phosphate assimilation		
Nitrate assimilation		
Toxicant assimilation		
Erosion control		
Carbon storage		
HYDROLOGICAL/FUNCTIONAL IMPORTANCE		
Water for human use		
Harvestable resources		
Food for livestock		
Cultivated foods		
Tourism and Recreation		
Education and Research		
Cultural and Spiritual		
IMPORTANCE OF DIRECT HUMAN BENEFITS		
OVERALL IMPORTANCE		

Table 11. Ecological importance and sensitivity categories

General Description	Range of EIS score
Very High: Wetlands that are considered ecologically important and sensitive on a national or even international scale. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and ≤4
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and ≤3
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and ≤2
Low/Marginal: Wetlands that are not ecologically important or sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and ≤1

2.3 AQUATIC ECOLOGY ASSESSMENT METHODS/TOOLS

2.3.1 PRESENT ECOLOGICAL STATE

Drainage lines and rivers are natural channels in which water flows permanently or intermittently following rainfall. These are assessed using the Index of Habitat Integrity (IHI; Kleynhans, 1996) which measures the impact of human disturbance on riparian and instream habitats. The IHI is a rapid assessment of the severity of impacts affecting habitat integrity within a defined segment of a watercourse. The method can be applied to both perennial and non-perennial watercourses. The instream impacts considered were water abstraction; flow modification; bed modification; channel modification; physio-chemical modification; inundation; alien macrophytes; and rubbish dumping. The riparian impacts assessed were vegetation removal; exotic vegetation; bank erosion; channel modification; water abstraction; inundation; flow modification; physico-chemistry. Each of the impacts was given a score based on their degree of modification, along with a confidence rating based on the level of confidence in the score.

Table 12. Descriptive classes for assessment of habitat modifications (Kleynhans, 1996)

Impact Class	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

Impact Class	Description	Score
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

Each of the allocated scores are then moderated by a weighting system (**Table 13**), which is based on the relative threat of the impact to the habitat integrity of the riverine system. The total score for each impact is equal to the assigned score multiplied by the weight of that impact. The estimated impacts (assigned score / maximum score [25] X allocated weighting) of all criteria are then summed together, expressed as a percentage and then subtracted from 100 to determine the Present Ecological State score (or Ecological Category) for the instream and riparian components, respectively.

Table 13. Criteria and weights used for the assessment of habitat integrity (Kleynhans, 1996)

Instream Criteria	Weight	Riparian Zone Criteria	Weight
Water abstraction	14	Indigenous vegetation removal	13
Flow modification	13	Exotic vegetation encroachment	12
Bed modification	13	Bank erosion	14
Channel modification	13	Channel modification	12
Water quality modification	14	Water abstraction	13
Inundation	10	Inundation	11
Alien/Exotic macrophytes	9	Flow modification	12
Alien/Exotic aquatic fauna	8	Water quality	13
Solid waste disposal	6		
Total	**100**	**Total**	**100**

An IHI class is then determined based on the resulting score. These results provide an indication of the site-specific PES which can be used as a baseline from which to monitor impacts in the future.

Table 14. Index of habitat integrity classes and descriptions

Integrity Class	Description	Score
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60-79

Integrity Class	Description	Score
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically / Extremely modified. Modifications have reached a critical level and the 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.	0-19

2.3.2 ECOLOGICAL IMPORTANCE AND SENSITIVITY

The ecological importance of a river is an expression of its importance to the maintenance of biological diversity and ecological functioning on local and wider scales. Ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience). Both abiotic and biotic components of the system are taken into consideration in the assessment of ecological importance and sensitivity (Kleynhans & Louw, 2007).

The Ecological Importance and Sensitivity (EIS) assessment considers several biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale. The median of the resultant score is calculated to derive the EIS category.

Table 15. Scale used to assess determinants presumed to indicate Importance or Sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (SA Red Data Books)

Table 16. Ecological Importance and Sensitivity Categories

EISC	General Description	Median
Very High	Quaternaries/delineations unique on a national and international level based on unique biodiversity. These rivers are usually very sensitive to modifications.	>3-4
High	Quaternaries/delineations considered unique on national scale based on biodiversity. These rivers may be sensitive to modifications but have capacity for use.	>2-≤3
Moderate	Quaternaries/delineations considered unique on a provincial or local scale due to biodiversity. These rivers are not usually very sensitive to modifications.	>1-≤2
Low/marginal	Quaternaries/delineations not unique on any scale. These rivers are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

2.4 MPACT ASSESSMENT METHODOLOGY

The criterion for determining impact significance has been defined in accordance with the criteria drawn from Appendix 3 of the Environmental Impact Assessment Regulations, 2014. The levels of detail described in the EIA regulations were fine-tuned by assigning specific values to each impact identified. The impact ratings are be informed by fieldwork, desktop analysis and expertise of the specialist. The significance of potential impacts that may result from the proposed development will be determined in order to assist the competent authority in making a decision.

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')

Rating	Definition of Rating	Score
A. *Spatial extent* *– the area in which the impact will be experienced*		
None		0
Local	Confined to project or study area or part thereof (e.g. site)	1
Regional	The region, which may be defined in various ways, e.g. cadastral, catchment, topographic	2
(Inter) national	Nationally or beyond	3
B. *Intensity* *– the magnitude or size of the impact*		
None		0
Low	Natural and/or social functions and processes continue albeit in a slightly modified way	1
Medium	Natural and/or social functions and processes continue albeit in a modified way	2
High	Natural and/or social functions or processes are severely altered	3
C. *Duration* *– the time frame for which the impact will be experienced*		
None		0
Short-term	Up to 2 years	1
Medium-term	2 to 20 years	2
Long-term	More than 20 years	3

***Combined Score* (A+B+C)**	
Consequence Rating	
Not significant	0 – 2
Very low	3 – 4
Low	5
Medium	6
High	7
Very high	8 – 9

Probability *– the likelihood of the impact occurring*		
Improbable	< 40% chance of occurring	0
Possible	40% - 70% chance of occurring	1
Probable	> 70% - 90% chance of occurring	2
Definite	> 90% chance of occurring	3

Significance Rating	*Possible Impact Combinations*	
	Consequence	*Probability*
Insignificant	Very Low	Improbable
	Very Low	Possible
Very Low	Very Low	Probable
	Very Low	Definite
	Low	Improbable
	Low	Possible
Low	Low	Probable
	Low	Definite
	Medium	Improbable
	Medium	Possible
Medium	Medium	Probable
	Medium	Definite
	High	Improbable
	High	Possible
High	High	Probable
	High	Definite
	Very High	Improbable
	Very High	Possible
Very High	Very High	Probable
	Very High	Definite

Confidence of assessment	**Rating**
The degree of confidence in predictions based on available information, Specialists' judgment and/or specialist knowledge.	Low
	Medium
	High

3. AQUATIC BIODIVERSITY DESKTOP ASSESSMENT

3.1 TOPOGRAPHY

The proposed development area is located on gently undulating agricultural terrain. Elevations range from approximately 1476 m to 1511 m above mean sea level. The land gradually rises from the western portion of the site to a broad, gently rounded crest near the centre, before gradually sloping downward towards the eastern boundary.

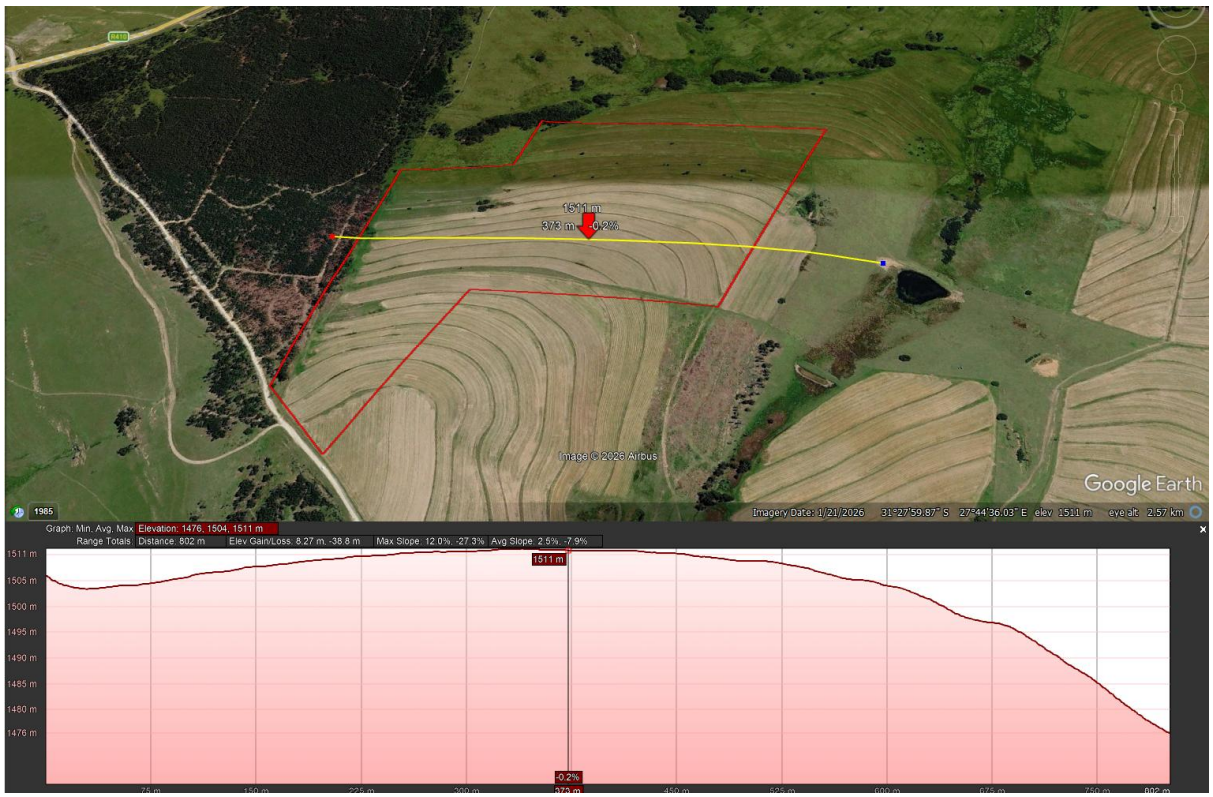


Figure 5. Topographic profile of the development site.

3.2 CLIMATE

Sakhisizwe Local Municipality experiences a temperate interior climate that is strongly influenced by its location within the foothills of the Drakensberg Mountains and its varying topography. The municipality lies at elevations ranging from approximately 750 m to 2 600 m above sea level, resulting in climatic variation across the area. Higher-lying areas generally experience cooler temperatures and greater rainfall than the lower-lying western regions (Sakhisizwe Local Municipality, 2024).

The municipality experiences warm, wet summers and cold, dry winters, which are characteristic of the summer rainfall region of the Eastern Cape. Approximately 70 to 80% of the annual rainfall occurs during the summer months, mainly in the form of high-intensity convective thunderstorms that are occasionally accompanied by hail. Winter rainfall contributes only 20 to 30% of the annual total, with snowfall occurring

periodically in the higher elevation areas during the winter months (Sakhisizwe Local Municipality, 2024). Rainfall distribution varies considerably across the municipality due to differences in altitude and topography. The higher eastern areas receive approximately 700–800 mm of rainfall annually, while the drier western areas receive between 200 mm and 300 mm per year.

3.3 GEOLOGY AND SOILS

The geology of the study area is predominantly underlain by mudstones and sandstones of the Tarkastad Subgroup and the Molteno Formation of the Karoo Supergroup, with intrusive Jurassic-age dolerite bodies also occurring throughout the area (Mucina & Rutherford, 2006). Soils derived from this sedimentary parent material are well drained, exceed 800 mm in depth and have a clay content ranging from 15% to 55%. These soils are predominantly represented by the Hutton, Clovelly, Griffin and Oatsdale soil forms. In areas underlain by dolerite, the dominant soil forms include the Balmoral, Shortlands and Vimy soil forms, which are generally characterised by higher clay contents and greater inherent fertility than soils developed on sedimentary parent material (Soil Classification Working Group, 2018).

The study area is primarily associated with the Ac and Fa land types (Land Type Survey Staff, 2006). The Ac land type typically occurs on gently undulating plains and low hills where deep, well-drained apedal soils dominate. These soils have moderate to high agricultural potential and support extensive grassland vegetation, although productivity varies according to rainfall and management practices. The Fa land type is associated with terrain influenced by dolerite intrusions and comprises moderately deep to deep clay-rich soils with relatively high natural fertility. These land types also occur on gently sloping to undulating landscapes and support grazing and cultivated agriculture where climatic conditions are favourable. Variations in parent material, soil depth and clay content across the Ac and Fa land types influence drainage characteristics, vegetation composition, erosion susceptibility and overall land capability within the study area.

3.4 VEGETATION

According to South African National Biodiversity Institute (SANBI) vegetation map (VegMap,2018) the proposed site falls within the Drakensberg Foothill Moist Grassland, under the Sub-Escarpment Grassland Bioregion. The Drakensberg Foothill Moist vegetation type occurs around KwaZulu Natal and Eastern Cape provinces on gently undulating plains and foothills. The vegetation is characterised by species-rich, mesic grassland dominated by perennial grasses, including *Themeda triandra, Tristachya leucothrix, Eragrostis curvula and Heteropogon contortus*. Forb diversity is typically high, particularly in areas that have experienced limited agricultural transformation. Woody vegetation is generally sparse

and largely confined to drainage lines, rocky outcrops and sheltered slopes, where scattered shrubs and small trees may occur (Mucina & Rutherford, 2006; SANBI, 2018). The vegetation develops on moderately deep to deep, well-drained soils derived primarily from sandstone, mudstone and dolerite geology (Mucina & Rutherford, 2006). The Drakensburg Foothill Moist Grassland is classified as Least concern.

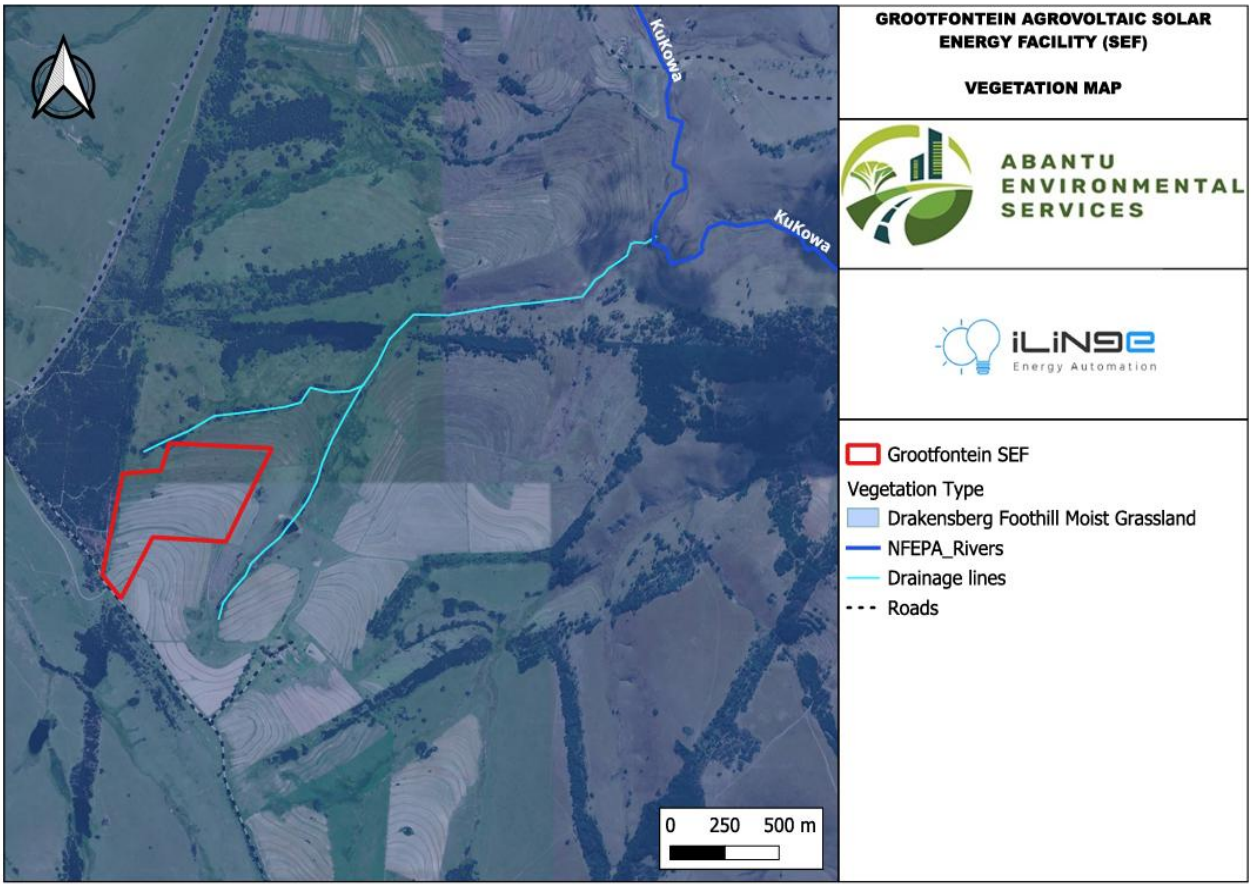


Figure 6. Vegetation Map

3.5 BIODIVERSITY CONSERVATION PLANS- EASTERN CAPE BIODIVERSITY CONSERVATION PLAN, 2019

The Eastern Cape Biodiversity Conservation Plan (ECBCP) (2019) replaces the ECBCP (2007) in its entirety and provides a map of important biodiversity areas, outside of the Protected Areas network, which must be used to inform land use and resource-use planning and decision making. The objectives of the ECBCP (2019) are to:

1) Identify the minimum spatial requirements needed to maintain a living landscape that continues to support all aspects of biodiversity and retain/maintain essential ecological infrastructure. This is achieved through the selection of areas, based on achieving targets, which represent important biodiversity pattern AND ecological processes;

2) Serve as the primary source of biodiversity information for land use planning and decision making; and

3) Inform conservation and restoration action in important biodiversity areas.

The aim of the ECBCP (2019) was to map biodiversity priority areas through a systematic conservation planning process. The main outputs of the ECBCP include Protected Areas (PA), Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA), Other Natural Areas (ONA) and No Natural Habitat Remaining (NNR) for both terrestrial and aquatic ecosystems. The ECBCP (2019) has been adopted by DEDEAT as a systematic biodiversity plan for the Eastern Cape Province.

According to the ECBCP (2019), the proposed development site is located within aquatic ESA 1 (see **Figure 7**).

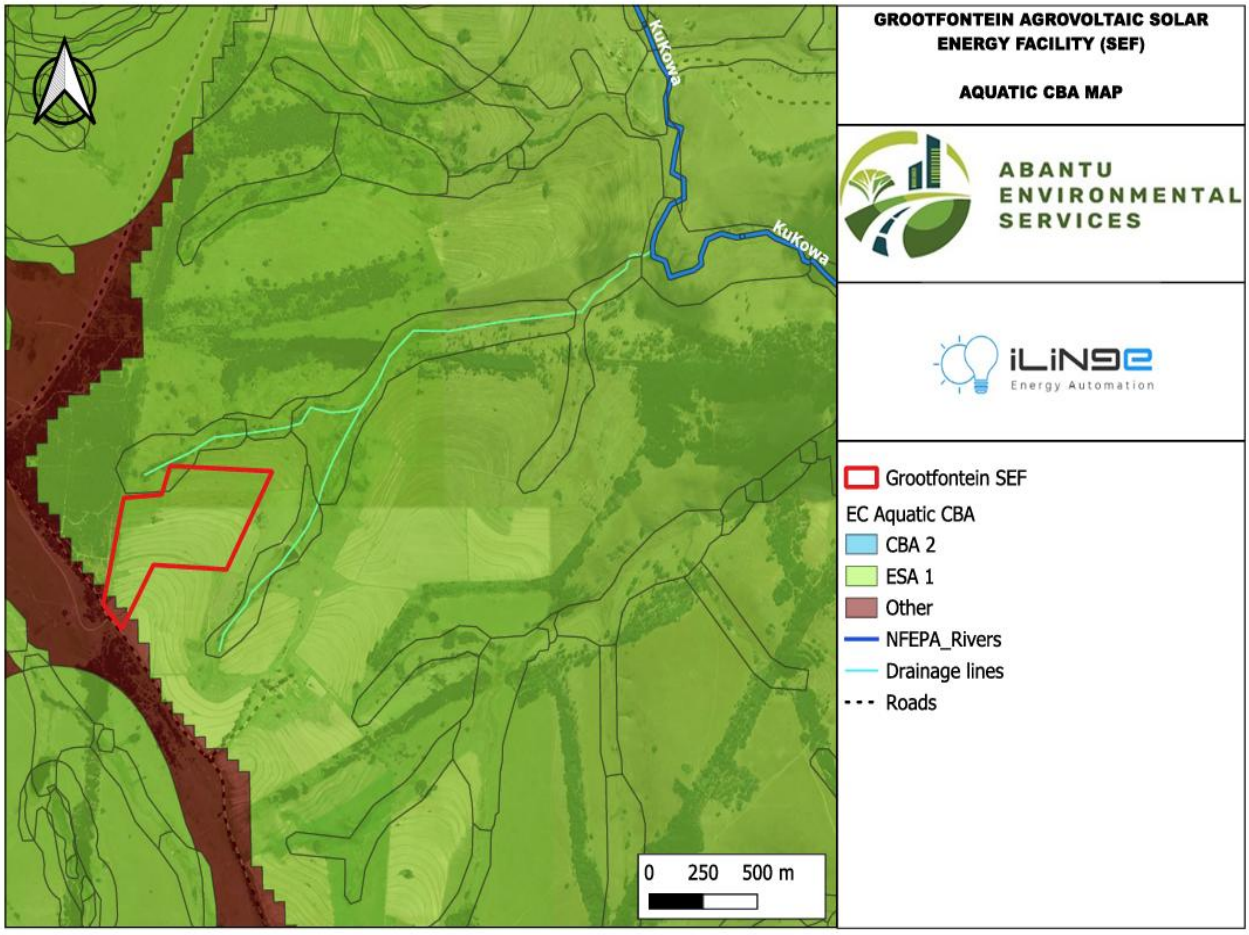


Figure 7. Aquatic Map

3.6 HYDROLOGY

The project area falls within the Mzimvubu- Tsitsikamma Water Management Area, within T11A quaternary catchment. The T11A catchment area falls within the South Eastern Uplands Level 1 Ecoregion (16.06) Level 2 Ecoregion. Two ephemeral drainage lines occur along the northern and eastern boundaries of the SEF area which drains into the NFEPA KuKowa River.

3.7 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS (NFEPA)

The Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011a) (The Atlas) which represents the culmination of the National Freshwater Ecosystem Priority Areas project (NFEPA), a partnership between SANBI, CSIR, WRC, DEA, DWA, WWF, SAIAB and SANParks, provides a series of maps detailing strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources.

Freshwater Ecosystem Priority Areas (FEPA's) were identified through a systematic biodiversity planning approach that incorporated a range of biodiversity aspects such as ecoregion, current condition of habitat, presence of threatened vegetation, fish, frogs and birds, and importance in terms of maintaining downstream habitat. The Atlas incorporates the National Wetland Inventory (NWI Wetlands) (SANBI, 2011) to provide information on the distribution and extent of wetland areas. River, wetland and estuarine FEPAs should be regarded as significant water resources and should be regarded as ecologically important and as generally sensitive to changes in water quality and quantity, owing to their role in protecting freshwater ecosystems and supporting sustainable use of water resources.

According to the NFEPA datasets the development does not overlap any FEPA rivers. The NFEPA dataset identifies a mapped wetland feature within 500 m of the proposed development footprint (see **Figure *8***).

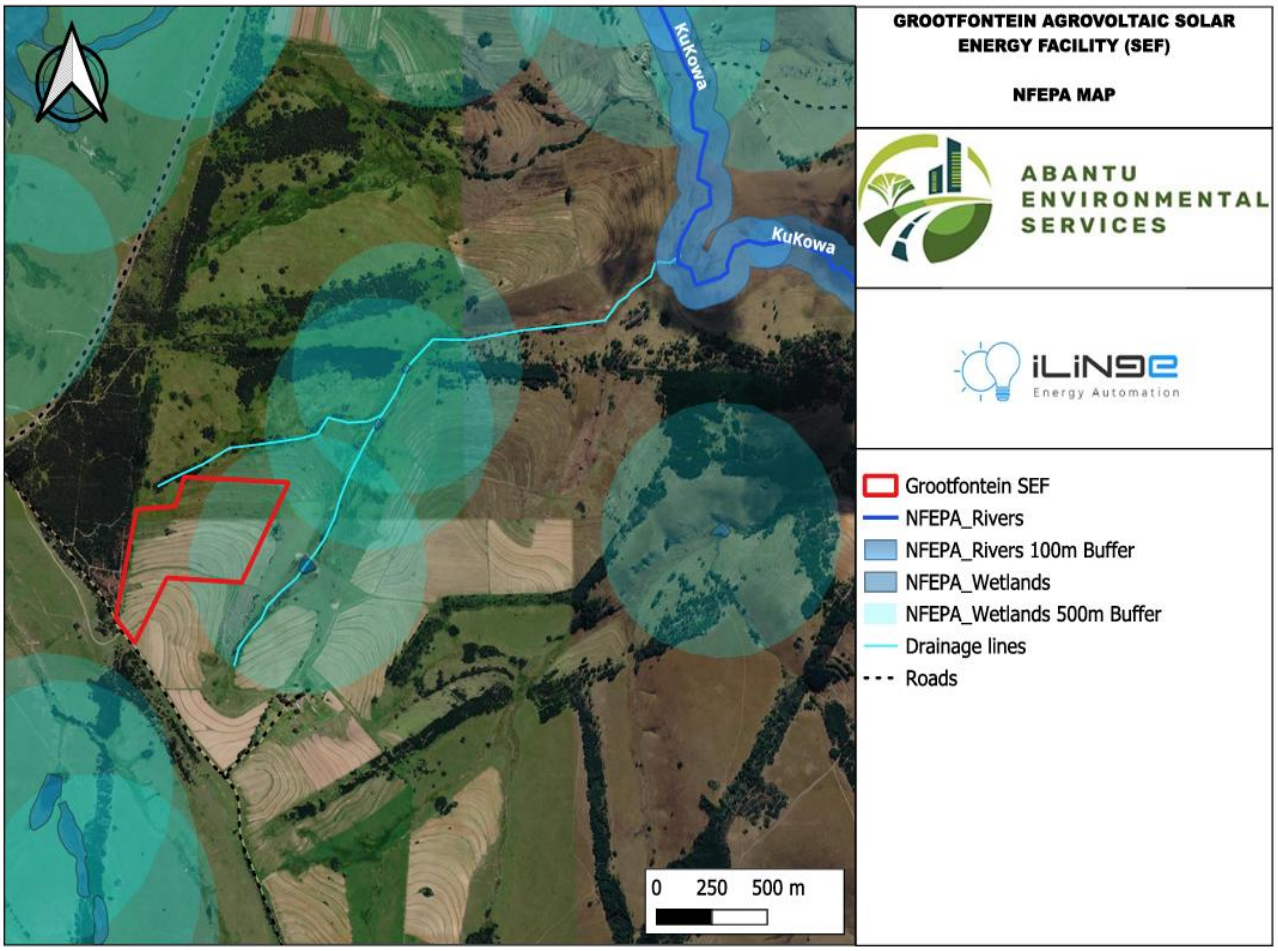


Figure 8. NFEPA map

3.8 NATIONAL WETLAND MAP 5 (NWM5)

The National Wetland Map version 5 (NWM5) shows the distribution of inland wetland ecosystem types across South Africa and includes estuaries and the extent of some rivers. A confidence map was compiled to identify areas where wetland extent and hydrogeomorphic (HGM) units (which contributed to defining the inland wetland ecosystem types together with the regional setting) attained at a higher level of certainty compared to other areas.

Higher levels of certainty are associated [code 5 in field Confidence_nr] with areas that have been visited in field by a wetland specialist(s) over multiple seasons and cycles of the wetland hydroperiod and are therefore more accurately represented in the dataset. Codes 4 to 1 indicate lower levels of confidence that the extent and HGM unit are represented well.

The National Wetland Map version 5 (NWM5) shows no inland wetland ecosystems. The level of confident for the study area is low, illustrating a very low confidence (see ***Figure 9***).

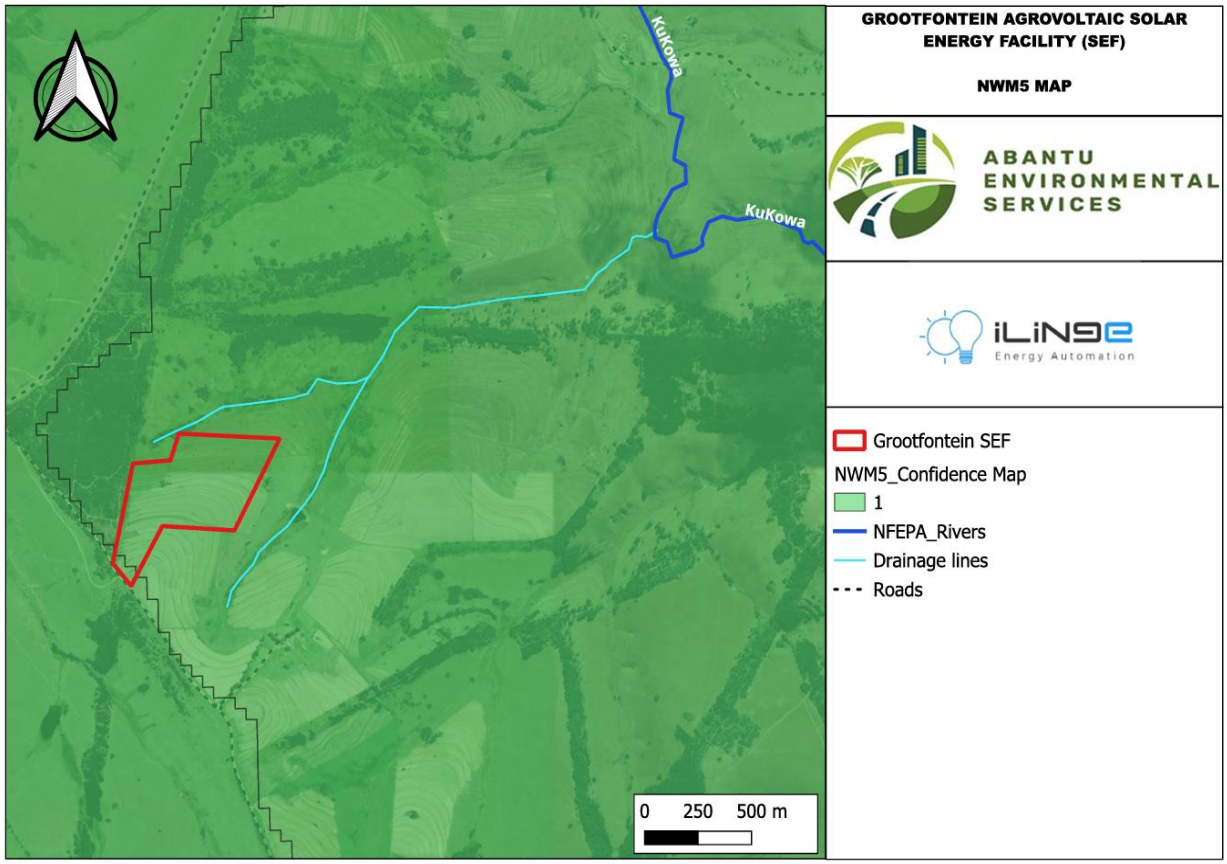


Figure 9. NWM5 Map

3.9 STRATEGIC WATER SOURCE AREA

Strategic Water Source Areas (SWSAs) are now defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b). They include transboundary Water Source Areas that extend into Lesotho and Swaziland. All surface water SWSAs are located in high rainfall areas where baseflow is at least 11 25 mm/a, which is evidence of a strong link between groundwater and surface water in the SWSAs. The aquifers sustain baseflow, contribute to runoff and, especially, contribute to dry season flows. Sustained river flows are important as they support people and communities who depend directly on rivers for their water, especially during the dry season and droughts.

According to the national screening tool report the proposed site falls within the Eastern Cape Drakensberg SWSA, however according to the SWSA datasets the proposed development footprint does not fall within the identified SWSA.

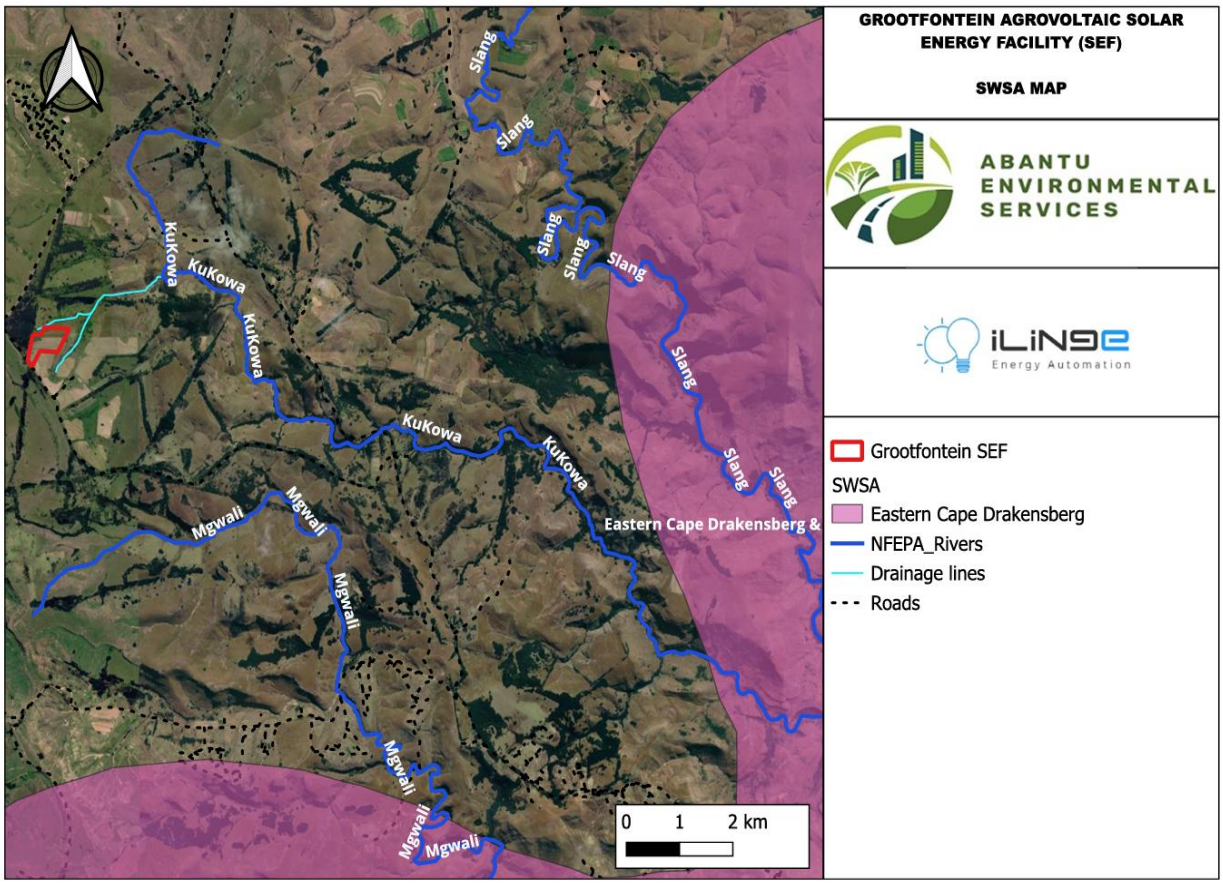


Figure 10. SWSA Map

3.10 BUFFER ZONE DETERMINATION

A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted in order to reduce the impact of adjacent land uses on the wetland or riparian area (DWAF, 2005). Buffer zones have been shown to have a variety of functions and have been proposed as a standard mitigation measure to protect or limit potential impacts on wetlands and other watercourses. Some generic functions of buffer zones are the following:

- Sediment trapping
- Erosion control
- Nutrient retention
- Maintaining basic hydrological processes
- Reducing impacts on water resources from upstream activities and adjoining land uses and
- Providing habitat for various aspects of biodiversity

4. SITE SPECIFIC FINDINGS

The sections below present the results of the aquatic biodiversity assessment undertaken on 26 July 2026 and 26 October 2026. The site assessment confirmed the presence of wetland areas and a drainage line, with the drainage line observed to be dry at the time of the assessment.

4.1 INVESTIGATION SITES

Sampling points (see **Table *17***) were selected to assess the current condition and characteristics of the associated aquatic features. The proposed development is located within 500m of wetlands and drainage lines as well as artificial dams which have been created to support agricultural activities onsite.

Table 17. Sampling points

Wetland features
Sampling point 1- 31°28'16.36"S; 27°45'0.32"E
 
Sampling point 2- 31°28'13.11"S; 27°45'3.23"E




Sampling point 3- 31°28'9.79"S; 27°45'6.14"E




Sampling point 4- 31°28'4.85"S; 27°45'13.05"E




Sampling point 5- 31°27'50.47"S; 27°45'22.68"E





4.2 WETLAND ASSESSMENT FINDINGS

The results presented below are based on the findings of the desktop assessment as well as the field investigation conducted for the study.

4.2.1 WETLAND IDENTIFICATION AND CLASSIFICATION

The field delineation of the wetlands areas was conducted in accordance with the Department of Water and Sanitation (DWS) document, "A practical field procedure for identification and delineation of wetlands and riparian areas" (2005). The wetland survey was conducted in July 2026 and October 2026. A hand-held auger used to collect soil samples on the identified wetlands.

(a) Soil wetness and soil form indicator

The watercourses onsite have water and support a host of hydrophytes and terrestrial plant species. Hydric soils are defined as those that typically show characteristics (redoximorphic features) resulting from prolonged and repeated saturation.

Table 18. Soil samples

SOIL SAMPLES	
HGM UNIT 1	
	
HGM UNIT 2	
	

(b) Vegetation indicator

According to DWAF (2005), vegetation is regarded as a key component to be used in the delineation procedure for wetlands. Vegetation also forms a central part of the wetland definition in the National Water Act, Act 36 of 1998. The wetter sections of the assessment corridor were characterised by grasses and spike rushes (*Eleocharis spp.*)



Figure 11. Wetland associated vegetation

The Classification System for Wetlands and Other Aquatic Ecosystems (Ollis, et al., 2013) in South Africa is a hierarchical framework designed to standardise the identification and categorisation of aquatic ecosystems. **Table *19*** below provides a summary of the watercourses classified from level 1 to 4.

Table 19. Summary of the result of the study area with application of Levels 1 to 4 of the Classification System for Wetlands and Other Aquatic Ecosystems in South Africa

Unit	Level 1	Level 2	Level 3	Level 4
	System	REGIONAL SETTING	Landscape unit	4A (HGM Unit)
HGM 1	Inland	South Eastern Uplands	Valley floor	Unchanneled Valley Bottom
HGM 2	Inland	South Eastern Uplands	Valley floor	Channeled Valley Bottom

4.2.2 WETLAND DELINEATION

The initial wetland identification process was conducted on a desktop level using available datasets such as NFEPA, SAIIAE and Google Earth Pro to identify the presence of wetlands within 500m radius of the project site. The NFEPA dataset showed the presence of two wetland systems within 500m radius of the project site. Following the desktop assessment of the site, two site visits were conducted on the 26 July

2026 and 26 October 2026. During the site visits, areas within the 500m radius of the study site boundary were accurately assessed for wetlands characteristics.

(a) CONTRIBUTING DRAINAGE AREAS AND 200 M BUFFERS

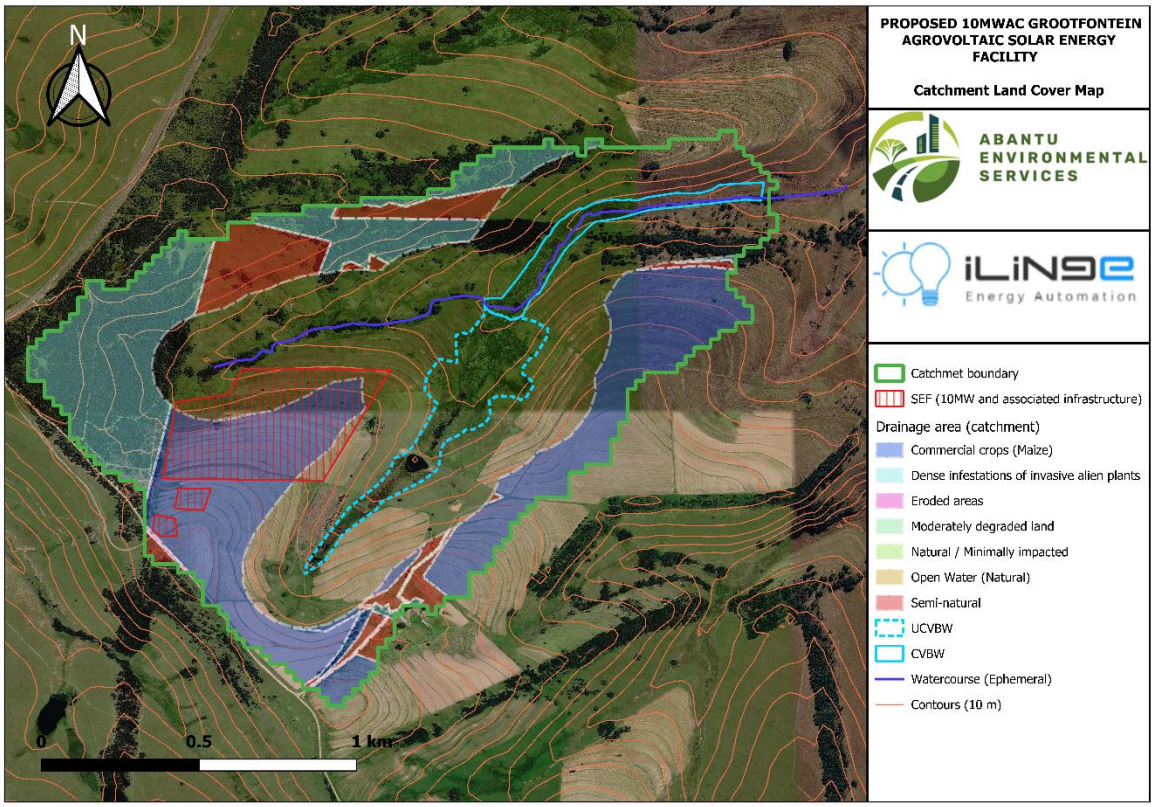


Figure 12. Catchment land use/cover of the wetlands in the proposed development area

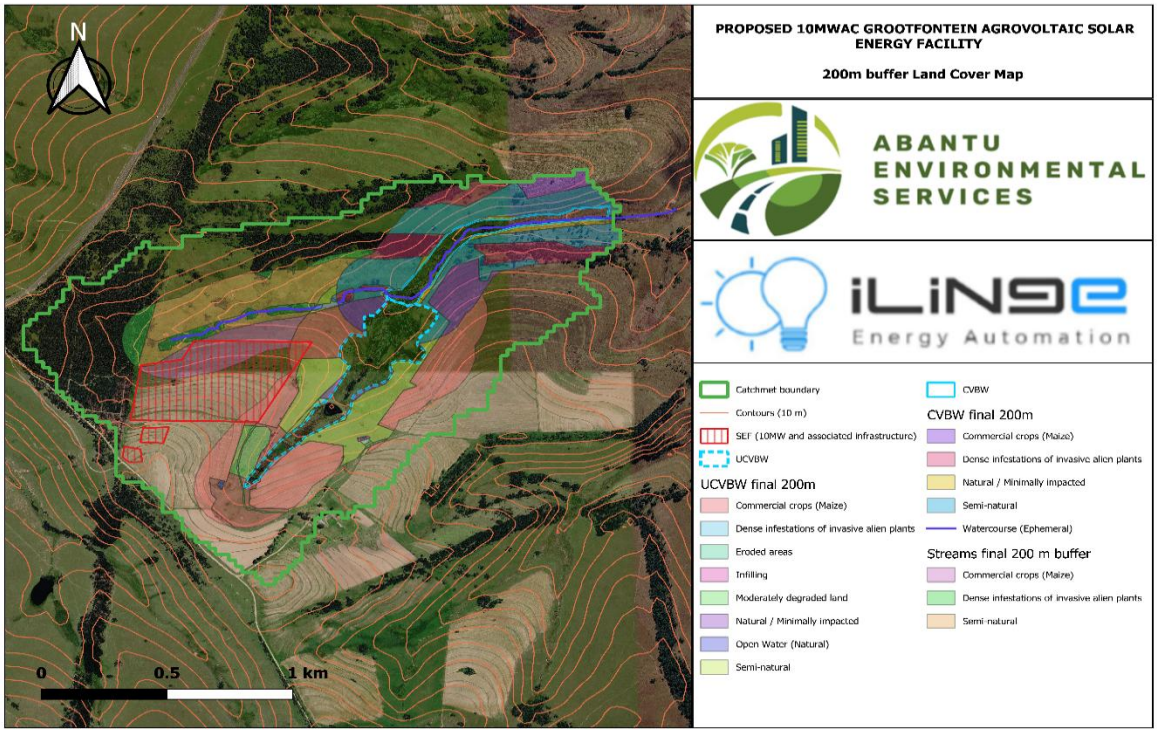


Figure 13. The 200m buffers of the ephemeral tributary north of the site and the wetlands around the proposed development area

(b) DELINEATED WETLAND SYSTEMS

The assessment delineated two systems namely; Unchanneled Valley Bottom Wetland (UCVBW) and a Channelled Valley Bottom Wetland (CVBW), south and north of the proposed development, from upper watershed to downstream, respectively. The UCVBW (14.97 ha) is located at a distance of approximately 150 m away from the development footprint and it characterized mostly by disturbance such as *Acacia mearnsii* infestation, erosion and *Zea mays* L crop fields in its outer edges.

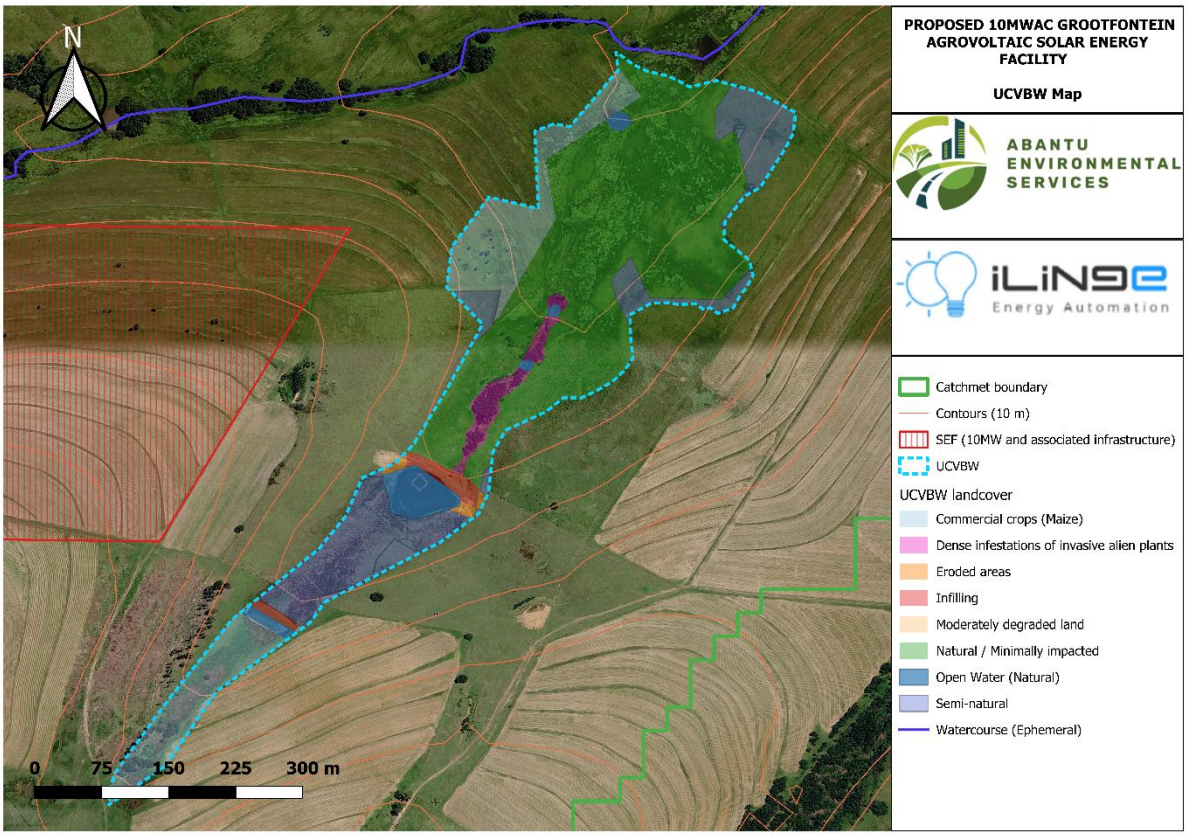


Figure 14. Delineated unchanneled valley bottom

Figure *16* shows the conditions of the unchanneled valley bottom.



Figure 15. Conditions at the corridor of the unchanneled valley bottom

The downstream CVB (7.02 ha) is further away from the development site located about 400 m downstream and the wetland is a natural to semi natural conditions.

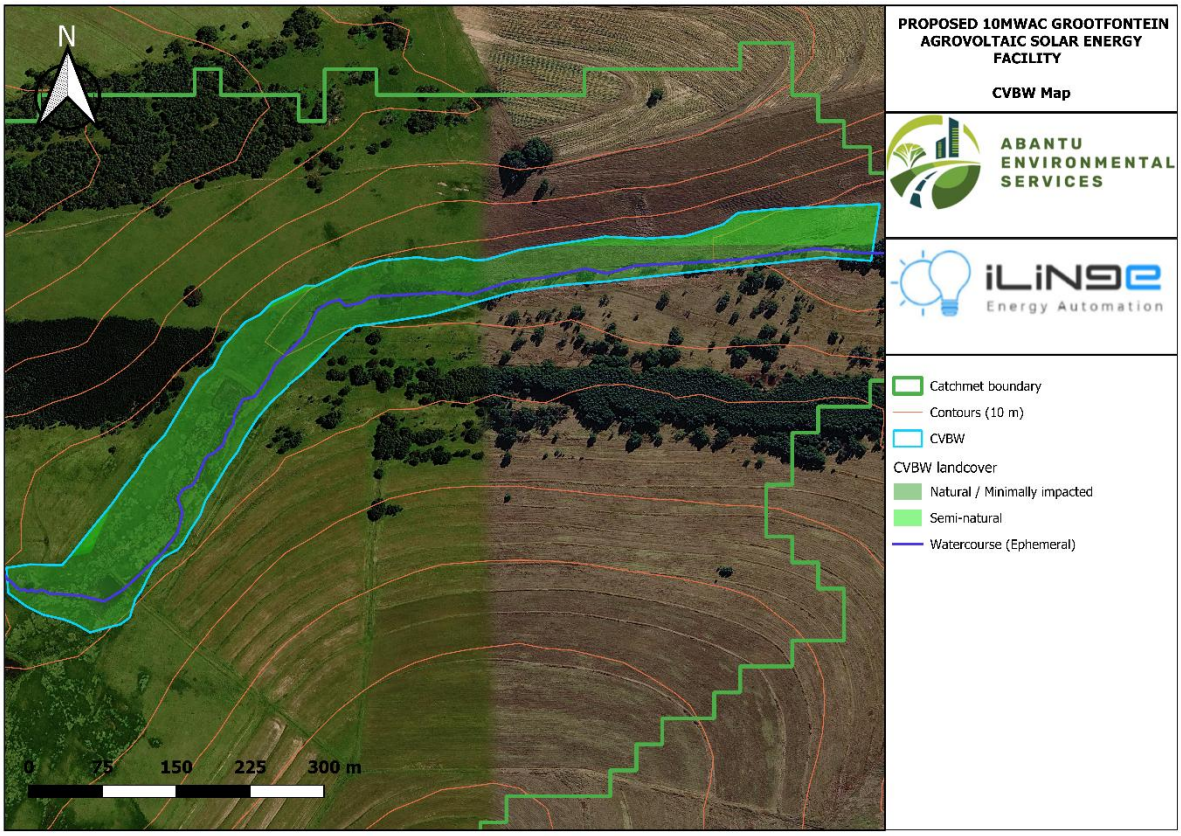


Figure 16. Delineated channeled valley bottom



Figure 17. Conditions of the channeled valley bottom

4.2.3 WETLAND PRESENT ECOLOGICAL STATE

The PES of the UCVBW is C (64%) i.e. the system is Moderately modified, and this is explained by the existing agricultural cultivation, eroded areas and invasive vegetation encroachment occurring within the catchment area and the wetland its system. This system is even encroached on its edges by portions of maize fields.

WET-Health Level 1B assessment: PES Summary

	Wetland PES Summary			
Wetland name	UCVBW_Cala			
Assessment Unit	1			
HGM type	Unchanneled VB wetland			
Wetland area (Ha)	15.0 Ha			
Unadjusted (modelled) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4.7	3.1	2.3	3.6
PES Score (%)	53%	69%	77%	64%
Ecological Category	D	C	C	C
Combined Impact Score	3.6			
Combined PES Score (%)	64%			
Combined Ecological Category	C			
Hectare Equivalents	9.6 Ha			
Confidence (modelled results)	Low: Relatively low probability of connection to regional aquifer but missing information on the degree of connectivity, the lowering of the water table, and/or groundwater quality			
Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4.7	3.1	2.3	3.6
PES Score (%)	53%	69%	77%	64%
Ecological Category	D	C	C	C
Trajectory of change				
Confidence (revised results)	Not rated	Not rated	Not rated	Not rated
Combined Impact Score	3.6			
Combined PES Score (%)	64%			
Combined Ecological Category	C			
Hectare Equivalents	9.6 Ha			

Figure 18. PES summary (UCVBW)

The PES of the CVBW is C (77%) i.e. the system is Moderately modified and this is explained by the existing agricultural cultivation and invasive vegetation encroachment occurring within the catchment area of the system. Additionally, the channel exhibits signs of erosion and incision with steep exposed banks and localised bank undercutting.

	Wetland PES Summary
Wetland name	CVBW_Cala
Assessment Unit	2
HGM type	Channelled VB wetland not laterally maintained
Wetland area (Ha)	7.0 Ha

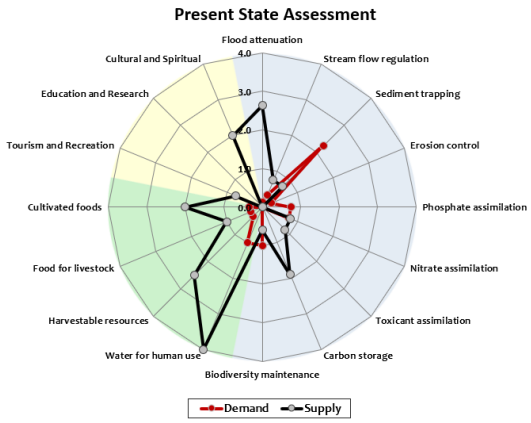
Unadjusted (modelled) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.4	2.1	1.8	1.4
PES Score (%)	66%	79%	82%	86%
Ecological Category	**C**	**C**	**B**	**B**
Combined Impact Score	2.3			
Combined PES Score (%)	77%			
Combined Ecological Category	**C**			
Hectare Equivalents	5.4 Ha			
Confidence (modelled results)	Low: Relatively low probability of connection to regional aquifer but missing information on the degree of connectivity, the lowering of the water table, and/or groundwater quality			
Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.4	2.1	1.8	1.4
PES Score (%)	66%	79%	82%	86%
Ecological Category	**C**	**C**	**B**	**B**
Trajectory of change				
Confidence (revised results)	Not rated	Not rated	Not rated	Not rated
Combined Impact Score	2.3			
Combined PES Score (%)	77%			
Combined Ecological Category	**C**			
Hectare Equivalents	5.4 Ha			

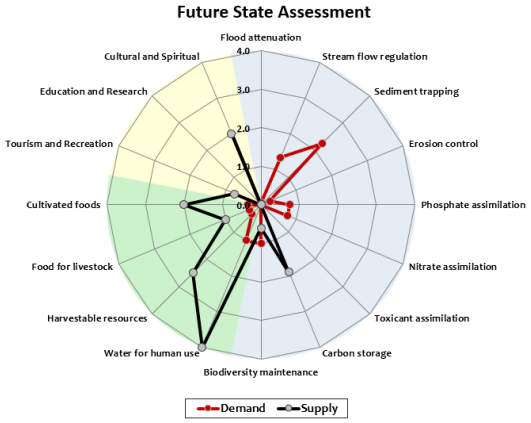
Figure 19. PES Summary (CVBW)

4.2.4 WETLAND ECOSYSTEM SERVICES

The table below provide the summary of the ecosystem services provided by the assessed wetlands based on the WET_EcoServices Tool.

		Present State				Future State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	2.6	0.1	1.2	Low	0.0	0.0	0.0	Very Low
	Stream flow regulation	0.8	0.3	0.0	Very Low	0.0	1.3	0.0	Very Low
	Sediment trapping	0.8	2.3	0.4	Very Low	#VALUE!	2.3	#VALUE!	#VALUE!
	Erosion control	No scores	0.3	No scores	No scores	No scores	0.3	No scores	No scores
	Phosphate assimilation	No scores	0.8	No scores	No scores	No scores	0.8	No scores	No scores
	Nitrate assimilation	0.8	0.8	0.0	Very Low	0.0	0.8	0.0	Very Low
	Toxicant assimilation	0.8	0.0	0.0	Very Low	No scores	0.0	No scores	No scores
	Carbon storage	1.9	0.0	0.4	Very Low	1.9	0.0	0.4	Very Low
	Biodiversity maintenance	0.6	1.0	0.0	Very Low	0.6	1.0	0.0	Very Low
PROVISIONING SERVICES	Water for human use	4.0	1.0	3.0	High	4.0	1.0	3.0	High
	Harvestable resources	2.5	0.3	1.2	Low	2.5	0.3	1.2	Low
	Food for livestock	1.0	0.3	0.0	Very Low	1.0	0.3	0.0	Very Low
	Cultivated foods	2.0	0.3	0.7	Very Low	2.0	0.3	0.7	Very Low
CULTURAL SERVICES	Tourism and Recreation	0.8	0.0	0.0	Very Low	0.8	0.0	0.0	Very Low
	Education and Research	0.0	0.0	0.0	Very Low	0.0	0.0	0.0	Very Low
	Cultural and Spiritual	2.0	0.0	0.5	Very Low	2.0	0.0	0.5	Very Low





4.3 HABITAT ASSESSMENT FOR WATERCOURSES

Habitat quality and availability plays a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations in order to facilitate the interpretation of results (Ollis et al., 2006). The quality of the instream and riparian habitat influences the structure and function of the aquatic community in a stream; therefore, assessment of the habitat is critical to any assessment of ecological integrity.

In the current study, the instream and riparian habitat assessment was based on the Index of Habitat Integrity (IHI). The tables below provides the results of the habitat assessment of the identified northern drainage line.

4.3.1 INDEX OF HABITAT INTEGRITY

The IHI is a tool developed to assess river habitat integrity and forms part of the River EcoStatus Monitoring Program (REMP) (Kleynhans, 2007a). The evaluation of Habitat Integrity provides a measure of the degree to which a river has been modified from its natural state, in other words, an indication of the present ecological state (PES) of the watercourse. A desktop level and reach-based Habitat Integrity (IHI) was applied and observations made during the field survey were used to supplement the data used within the index. Results are presented in **Table *20*** and **Table *21***.

Table 20. Instream habitat integrity

Instream impact	Score (0-25)	Weight	Weighted impact
Water abstraction	10	14	5.6
Flow modification	10	13	5.20
Bed modification	7	13	3.64
Channel modification	10	13	5.2
Physio-chemical modification	7	14	3.92
Inundation	0	10	0.00
Alien/Exotic macrophytes	0	9	0.00
Alien/Exotic aquatic fauna	0	8	0.00
Rubbish dumping	6	6	1.44

IHI Instream score	**75**
Integrity class:	**C**

Table 21. Riparian habitat integrity

Riparian impact	Score (0-25)	Weight	Weighted impact
Indigenous vegetation removal	8	13	4.16
Exotic vegetation encroachment	14	12	6.42
Bank erosion	10	14	5.60
Channel modification	7	12	3.36
Water abstraction	7	13	3.64
Inundation	0	11	0.00
Flow modification	5	12	2.40
Physio-chemical modification	4	13	2.08
IHI Riparian score	**64**		
Integrity class:	**C**		

4.3.2 ECOLOGICAL IMPORTANCE AND SENSITIVITY

The Ecological Importance and Sensitivity (EIS) of the assessed reach was evaluated using the Kleynhans (1999) approach, which considers a range of biotic and aquatic habitat determinants. The overall EIS category was derived from the median of the determinant scores. The results of the assessment are presented in **Table 22**. The ecological importance and sensitivity category of the northern drainage line was determined as being Low.

Table 22. Results of the EIS assessment for the drainage line

Determinants	Score (0-4)
Rare and endangered biota	0
Unique biota	0
Intolerant biota	1
Species/taxon richness	1
Diversity of aquatic habitat types or features	2
Refuge value of habitat types	2
Sensitivity of habitat to flow changes	2
Sensitivity to flow related water quality changes	1
Migration route/corridor for instream and riparian biota	1
National parks, Wilderness areas, Nature reserves, Natural Heritage sites, and natural area	2
EIS score	**1**
EIS category	**Low**

5. IMPACT ASSESSMENT

5.1 IDENTIFIED POTENTIAL IMPACTS

The following potential aquatic ecosystem impacts have been identified for the proposed development (**Table *23***).

Table 23. Identified impacts

Impact	Description
Construction Phase	
Disturbance of drainage lines and wetland systems	Construction activities such as vegetation clearance, excavations, stockpiling and establishment of associated infrastructure may directly or indirectly impact wetlands or drainage lines occurring within or in close proximity to the development footprint. Such activities may affect the ecological functioning of the wetland and drainage line systems.
Loss and degradation of aquatic and wetland habitat	Vegetation clearing, earthworks, infrastructure development and movement of construction machinery may result in the loss, degradation or fragmentation of wetland and aquatic habitat.
Erosion and sedimentation	Vegetation clearing, soil disturbance, excavation and exposed surfaces may increase the potential for soil erosion and mobilisation of sediment. Sediment may subsequently be transported into drainage lines and wetlands, resulting in sediment deposition and potential alteration or degradation of aquatic habitats.
Deterioration of surface water quality	Construction activities may introduce pollutants or contaminants into nearby drainage lines and wetland systems through runoff, accidental spills and inappropriate waste management, potentially affecting aquatic ecosystems.
Operation Phase	
Alteration of surface runoff	Solar panels, access roads and other hardened or compacted surfaces may alter the distribution and velocity of surface runoff across the site. Concentrated runoff may increase localised erosion and sediment transport and may alter the quantity and pattern of water reaching nearby wetlands and drainage systems.
Ongoing disturbance associated with maintenance/agricultural activities.	Routine maintenance, vehicle movement, vegetation management and agricultural activities associated with the agrovoltaic facility may cause disturbance where undertaken close to wetlands or drainage lines.

5.2 IMPACT ASSESSMENT

All identified impacts for the proposed development are assessed and findings are entailed in **Table *24***.

Table 24. Impact rating

	Impact	Mitigation	Extent	Intensity	Duration	Consequence	Consequence	Probability	Probability	Significance	Status	Confidence
Construction	**Direct**											
	Disturbance of drainage lines and wetland systems	Without	1	3	3	7	High	3	Definite	**High**	- ve	High
		With	1	2	2	5	Low	2	Probable	**Low**	- ve	High
	Loss and degradation of aquatic and wetland habitat	Without	1	3	2	6	Medium	3	Definite	**Medium**	- ve	High
		With	1	2	2	5	Low	2	Probable	**Low**	-ve	High
	Erosion and sedimentation	Without	1	3	2	6	Medium	3	Definite	**Medium**	- ve	High
		With	1	2	2	5	Low	2	Probable	**Low**	-ve	High
	Deterioration of surface water quality	Without	1	2	3	6	Medium	3	Definite	**Medium**	- ve	High
		With	1	2	2	5	Low	2	Probable	**Low**	-ve	High
Operations	**Direct**											
	Alteration of surface runoff	Without	2	2	2	6	Medium	3	Definite	**Medium**	- ve	High
		With	1	1	1	3	Very low	2	Probable	**Very Low**	- ve	High
	Ongoing disturbance associated with maintenance/agricultural activities	Without	2	2	2	6	Medium	2	Probable	**Medium**	- ve	High
		With	1	2	1	4	Very low	2	Probable	**Very Low**	- ve	High

5.3 MITIGATION MEASURES

Table 25 identities mitigation measures that have been identified during the assessment for the proposed development.

Table 25. Mitigation measures

Impact	Description
Construction Phase	

Disturbance of drainage lines and wetland systems	• The relevant authorizations should be obtained prior to commencement of the development
	• The layout should be amended to ensure;
	  ○ that the northern boundary of the development footprint is located outside the recommended 100 m buffer of the northern drainage line.
	  ○ The O&M building and any planned sanitation system should be located outside the any regulated water areas
	• Stormwater management plan for construction phase should be compiled and implemented
	• Delineated wetlands and drainage lines and associated buffers must be demarcated prior to construction and treated as no-go areas.
	• No construction activities may occur within delineated wetlands, drainage lines or their approved buffers.
	• Construction camps, ablutions, laydown areas, stockpiles, refuelling areas and waste storage areas must be located outside wetlands and drainage lines.
	• Construction activities must be restricted to the development footprint.
	• Site camp locality must be selected in conjunction with the project Environmental Control Officer (EC)
	• Rehabilitated areas should be regularly monitored, and measures must be implemented to ensure that the reinstated topsoil does not wash away

Loss and degradation of aquatic and wetland habitat	• Limit vegetation clearing to the area required for construction. • Clearly demarcate the approved working footprint and treat areas outside it as no-go areas. • Temporarily disturbed areas must be rehabilitated and revegetated after construction.
Erosion and sedimentation	• Erosion and sediment barriers must be installed immediately downstream of active work areas (including soil stockpiles) as necessary to trap any excessive sediments generated during construction. • All temporary erosion and sediment control measures must be monitored for the duration of the construction phase and repaired immediately when damaged. • Exposed soils must be stabilised and stockpiles must be located away from wetlands and drainage pathways.
Deterioration of surface water quality	• Refuelling and maintenance of machinery must not occur within wetlands, drainage lines or their buffers. • Fuels, oils, chemicals and cement must be stored and handled in designated controlled areas away from aquatic features. • Spill response kits must be available on site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site.
Operation Phase	
Alteration of surface runoff	• Runoff from panels, access roads and other compacted areas must not be concentrated directly into wetlands or drainage lines.

Impact	Description
	• A stormwater management plan must be compiled for the approval of the Department prior to commissioning • Similarly. An Alien and Invasive Vegetation Species Management Plan must be compiled for the approval of the Department prior to commissioning • Vegetation covers beneath and between solar panels should be maintained as far as practicable to promote infiltration and reduce runoff velocity.
Ongoing disturbance associated with maintenance/agricultural activities.	• Maintenance vehicles and agricultural activities must remain within the development footprint. • Agricultural activities must be restricted to approved areas and must not encroach into aquatic areas.

6. CONCLUSION

This aquatic biodiversity assessment reveals that the proposed development is located outside the aquatic features under the assessment. Therefore, it does not directly impact the aquatic systems. Notwithstanding, the development is within regulated water areas of the aquatic systems under this assessment which are;

- An ephemeral tributary traversing north of the site in a downstream direction
- UCVBW located south of the development and
- A downstream located CVBW located towards the catchment outlet.

The overall assessment of the aquatic systems rates them as Moderately modified with a PES of C however constituted by varying levels for various indicators such as Hydrology, Geomorphology, Water Quality and Vegetation ranging from B- D, with the latter PES identified for the Hydrology module of the UCVBW. The implementation of the recommended mitigation measures, the impacts are expected to reduce to Low or Very Low significance. From an aquatic biodiversity perspective, the proposed development is therefore considered acceptable, provided that the recommended mitigation measures are effectively implemented and all required environmental and water related authorisations are compiled with.

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APPENDIX A- SPECIALIST CV