Appendix G.2

AQUATIC REPORT

SCIENTIFIC AQUATIC SERVICES

EIA-PHASE FRESHWATER ECOLOGICAL ASSESSMENT

AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED GRID CONNECTION ASSOCIATED WITH THE PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY NEAR ERMELO, MPUMALANGA PROVINCE.

Prepared for:	Phefumula Emoyeni One (Pty) Ltd
Report author:	P. da Cruz (Cert. Sci. Nat.) M Botha
Report reviewer:	P da Cruz (Cert. Sci. Nat.)
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Website: http://www.sasenvironmental.co.za

EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Phefumula Emoyeni One Grid Connection, related to the development of the Phefumula Emoyeni One Wind Energy Facility (WEF) in the Ermelo area of the Mpumalanga Province. The area of assessment consists of the grid connection components, including overhead power line corridors and substations (the components are collectively known as the 'study area'), along with a 500 m "zone of investigation (the investigation area), in accordance with Government Notice (GN) 4167 of December 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA).

This freshwater assessment has verified that the freshwater ecosystems in the study and investigation areas are all wetlands, with three hydrogeomorphic (HGM) forms being present – seep, unchanneled valley bottom and channelled valley bottom wetlands. The state of wetlands varies according to the impacts acting on the respective HGM unit, but wetlands were generally assessed to be in a largely natural to largely modified state with most wetland units displaying a moderate to high Ecological Importance and Sensitivity (EIS).

The impact assessment matrix as provided by the Environmental Impact Assessment Practitioner (EAP) and the DWS Risk Matrix (RAM) (as contained within GN 4167 of 2023) have been applied to the proposed development to determine the nature and significance of impacts that could potentially affect the study and investigation area freshwater environment. All activities associated with the construction or upgrading of proposed infrastructure that are located within / or would directly affect wetlands would pose a 'Medium' risk significance to the freshwater ecosystems within the study and investigation areas. Given the current OHPL alignment over extensive wetland areas, it is considered unlikely that all wetlands would be able to be spanned by the proposed powerline route. Potential direct impacts associated with power line tower placement inside wetland habitat was considered to pose a 'Medium' risk significance to the affected wetlands. All other activities would be associated with a 'Low' risk significance, in cases where the alignment of the proposed power lines is in relation to the drainage of the wetlands entailing that these are able to be spanned. In the light of the impacts associated with the development of the power line, it is recommended that a pre-development walkdown be undertaken by a freshwater specialist in order to ensure the optimal placement of towers / pylons along the proposed alignment. Further, although the proponent has amended the position of the substations to avoid freshwater ecosystems and their associated non-development buffer, particular attention must be given to ensure proper stormwater design and pollution protection as three of the substations will be located in the immediate catchment of wetlands.

Should these recommendations be actioned and provided that all other mitigation measures as stipulated in this report are adhered to, the proposed development can be considered acceptable in a freshwater environment context and can be authorised for development.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Phefumula Emoyeni One Grid Connection, related to the development of the Phefumula Emoyeni One Wind Energy Facility (WEF) in the Ermelo area of the Mpumalanga Province. The area of assessment consists of the grid connection components (including overhead powerline corridors and substations) (these components are collectively known as the 'study area'). This report has been prepared in support of the grid connection components application for Environmental Authorisation (EA), with a separate report compiled for the WEF components application for EA.

The purpose of this report is to define the ecology of the freshwater ecosystems associated with the study area and associated investigation area (defined as a 500 m radius around the study area), in line with GN 4167, as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended, in terms of freshwater characteristics, including mapping of the freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS) and defining the Present Ecological State (PES) of the freshwater ecosystems associated with the study area. The report also aims to define the socio-cultural and ecological service provision of the freshwater ecosystems and, additionally, outlines the Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) for the freshwater ecosystems. The assessment took the following approach:

- A scoping-phase freshwater assessment was conducted in July 2024, in which possible freshwater ecosystems within the study and investigation areas were identified and delineated by desktop methods for on-site investigation, and relevant national and provincial databases were consulted;
- An EIA-phase field assessment took place from the 26th to the 28th of June 2024 which confirmed that all freshwater ecosystems in the study area are wetlands, being seep and channelled valley bottom wetlands.
- After an amendment to the grid alignment by the proponent, an additional field assessment took place from the 5th to the 7th of February 2025 to assess a selection of additional wetlands that were not included as part of the original grid alignment extent.

The results of the assessments of the wetlands are presented in Section 4 of this report, and are summarised in the table below:

Table A: Summary of the assessment results.

Wetland System	Wetland Name	Present Ecological State (PES) / Ecostatus	Ecological Importance and Sensitivity (EIS)	Ecoservices	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
1	CVB 1 & 2	D (Largely Modified)	High	Very High to Very Low	REC: C; BAS: D; RMO: C/D Improve
	HSS 1 -4	B (Largely Natural)	Moderate	High to Very Low	REC: B; BAS: B; RMO: B Maintain
	HSS 5	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 1 & 2	D (Largely Modified)	Moderate	High to Very Low	REC: D; BAS: D; RMO: D Maintain
2	UCVB 3	C (Moderately Modified)	High	Very High to Very Low	REC: B; BAS: C; RMO: B/C Improve
3	HSS 6	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain
	HSS 7	C (Moderately Modified)	Moderate	Very High to Very Low	REC: C; BAS: C; RMO: C Maintain
	HSS 11	B (Largely Natural)	Moderate	Very High to Very Low	REC: B; BAS: B; RMO: B Maintain

Wetland System	Wetland Name	Present Ecological State (PES) / Ecostatus	Ecological Importance and Sensitivity (EIS)	Ecoservices	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
4	HSS 8 & 9	B (Largely Natural)	Moderate	Moderate to Very Low	REC: B; BAS: B; RMO: B Maintain
	HSS 10	C (Moderately Modified)	Moderate	Very High to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 4	B (Largely Natural)	Moderate	Moderate to Very Low	REC: B; BAS: B; RMO: B Maintain
	CVB 3 & 4	B (Largely Natural)	High	Very High to Very Low	REC: A; BAS: B; RMO: A/B Improve
5	CVB 5	C (Moderately Modified)	High	Very High to Very Low	REC: B; BAS: C; RMO: B/C Improve
	HSS 12-17	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 5 & 6	C (Moderately Modified)	Moderate	Moderate to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 7	C (Moderately Modified)	Moderate	Moderate to Very Low	REC: C; BAS: C; RMO: C Maintain
6	CVB 6	B (Largely Natural)	High	Very High to Very Low	REC: A; BAS: B; RMO: A/B Improve
	HSS 18	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain

The DWS Risk Assessment Matrix (2023) was applied to determine the significance of impacts of the proposed WEF facility on the receiving freshwater environment, with the summarised results detailed in Table B. All activities associated with the construction or upgrading of proposed infrastructure that are located within / or would directly affect wetlands would pose a ‘Medium’ risk significance to the freshwater ecosystems within the study and investigation areas. Given the current OHPL alignment over extensive wetland areas, it is considered unlikely that all wetlands can be spanned by the proposed powerline route. Potential direct impacts associated with powerline tower placement inside wetland habitat was considered to also pose a ‘Medium’ risk significance to the affected wetlands. All other activities would be associated with a ‘Low’ risk significance, in cases where the alignment of the proposed powerlines is in relation to the drainage of the wetlands entailing that these are able to be spanned.

Table B: Summary of the results of the risk assessment (after application of mitigation).

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
PRE-CONSTRUCTION	Potentially poor planning of project footprint / infrastructure layout by placing powerline towers within wetlands or their buffer zones and by placing substation footprints within wetland areas.	•Non-avoidance of freshwater ecosystems as part of planning for the proposed development and the resultant transformation / loss of freshwater habitat due to placement of infrastructure (power line towers) within freshwater ecosystems and their associated development exclusion buffers.	All Wetlands	C	Moderate	**M**
	Potentially poor planning of stormwater management for the project.	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of freshwater habitat through poor stormwater design.	All Wetlands	C	Moderate	**L**
CONSTRUCTION	**Development of OHPL DX1 to MTS.** Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**Indirect impacts (no infrastructure inside wetlands)** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	HSS 1 -4	B	Moderate	**L**
			UCVB 3	C	High	**L**
			HSS 5	C	Moderate	**L**
			CVB 1 & 2	D	High	**L**
			UCVB 1 & 2	D	Moderate	**L**

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
	Development of OHPL MTS to DX2 Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**Indirect impacts (no infrastructure inside wetlands)** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	CVB 3 & 4	B	High	L
			HSS 11	B	Moderate	L
			HSS 8	B	Moderate	L
			HSS 9; UCVB 4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	L
		Direct impacts (infrastructure likely inside wetlands) •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the downstream freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result	HSS 8	B	Moderate	M
			UCVB 3	C	High	M

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
		of disturbances in the catchment of the wetland.				
	Development of OHPL DX2 to DX3 Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**Indirect impacts (no infrastructure inside wetlands)** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	CVB 6	B	High	L
			CVB 5	C	High	L
			HSS 13-17	C	Moderate	L
			UCVB 7; HSS 18	C	Moderate	L
		Direct impacts (infrastructure likely inside wetlands) •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the downstream freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and	CVB 5	C	High	M

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
		construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchment of the wetland.				
	Development of MTS, DX2 and DX3 Substations Clearing of vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	**Footprint within very close proximity to wetlands:** •Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchments of the wetlands.	UCVB 3	C	High	L
			UCVB 6; HSS 18	C	Moderate	L
	Development of DX1 Substation Clearing of vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	**Footprint more than 100m from wetlands:** •Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchments of the wetlands.	CVB 1	D	High	L
	OHPL DX1 to MTS Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	HSS 1 -4	B	Moderate	L
			UCVB 3	C	High	L

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
			HSS 5	C	Moderate	L
			CVB 1 & 2	D	High	L
			UCVB 1 & 2	D	Moderate	L
	OHPL MTS to DX 2 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 3 & 4	B	High	L
			HSS 11	B	Moderate	L
			HSS 8	B	Moderate	L
			HSS 9; UCVB 4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	L
	OHPL DX 2 to DX 3 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 6	B	High	L
			CVB 5	C	High	L
			HSS 13-17	C	Moderate	L
			UCVB 7; HSS 18	C	Moderate	L
OPERATIONAL	**OHPL DX1 to MTS.** Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	HSS 1 -4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 5	C	Moderate	L
			CVB 1 & 2	D	High	L
			UCVB 1 & 2	D	Moderate	L
	OHPL MTS to DX2. Operation of the	•Disturbance to soil and vegetation relating to	CVB 3 & 4	B	High	L

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
	powerline and planned / emergency maintenance activities	movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	HSS 11	B	Moderate	L
			HSS 8	B	Moderate	L
			HSS 9; UCVB 4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	L
	OHPL DX2 to DX3 Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	CVB 6	B	High	L
			CVB 5	C	High	L
			HSS 13-17	C	Moderate	L
			UCVB 7; HSS 18	C	Moderate	L
	MTS, DX2 and DX3 Substations Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills / failure of transformers in the substation.	UCVB 3	C	High	L
			UCVB 6; HSS 18	C	Moderate	L
	DX1 Substation Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills / failure of transformers in the substation.	CVB 1	D	High	L

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
DECOMMISSIONING	Removal of all surface infrastructure from the project area.	•Disturbance of soil and vegetation that established within the decommissioning area and associated indirect impacts on downgradient wetland, including sediment ingress, increased stormwater flows and potential pollution from oils and other pollutants; •Potential proliferation of alien invasive vegetation.	All wetlands	C	Moderate	L

The impact assessment matrix as provided by the Environmental Impact Assessment Practitioner (EAP) has been applied to the proposed development to determine the nature and significance of impacts that could potentially affect the study and investigation area freshwater environment. *Before mitigation measures being applied*, the construction and placement of certain potential power line towers *within delineated freshwater ecosystem boundaries* would be associated with a “high” degree of impact due to the destruction of a certain area of wetland habitat and the operation of the powerlines and substations would be associated with a “medium” level of impact. *After mitigation measures have been applied* (and assuming that all tower positions are located outside of delineated wetland boundaries and the associated non-development buffer) all activities have been assessed to be associated with a low or very low impact significance.

In the light of the impacts associated with the development of the power line, it is recommended that a pre-development walkdown be undertaken by a freshwater specialist in order to ensure the optimal placement of towers / pylons along the proposed alignment. Further, although the proponent has amended the position of the substations to avoid freshwater ecosystems and their associated non-development buffer, particular attention must be given to ensure proper stormwater design and pollution protection as three of the substations will be located in the immediate catchment of wetlands. Should these recommendations be actioned and provided that all other mitigation measures as stipulated in this report are adhered to, the proposed development can be considered acceptable in a freshwater resource management context and can be authorised for development.

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environment, Forestry, and Fisheries screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as well as for the Environmental Impact Assessment (EIA) Regulations 2014 (as amended) requirements for Specialist Reports (Appendix 6).

No.	Requirements	Section in report
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Front Page and Appendix I
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution, and movement patterns	Section 4
2.2.2	Threat status, according to the national web-based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Sections 3 and 4
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3
2.2.4	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.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian, and floodplain habitat), wetlands, and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 4
2.3	Identify any alternative development footprints within the preferred development site which would be of a “low” sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	Section 7
2.4	Assessment of impacts - a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 7,8
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 3
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	Section 3
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: 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. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. 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.). d. Assessment of the risks associated with water use/s and related activities.	Section 7,8
2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of 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);	Section 7,8

	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); and e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services, especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage?	Section 7,8
2.4.6	How will the 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?	Section 7,8
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	NA – WEF Facility not in proximity to estuaries.
3.	**The report must contain as a minimum the following information:**	
3.1	Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;	Appendix I
3.2	A signed statement of independence by the specialist;	Appendix I
3.3	The duration, date, and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 1, 2, Appendix C, D,F
3.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.4
3.6	Areas not suitable for development, to be avoided during construction and operation (where relevant);	Section 8
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;	Section 8
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	Section 4.3
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 7
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being considered; and	N/A
3.11	A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected.	Summaries and Section 9.1
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Sections 4.3
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 7
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	Sections 6 and 7
3.15	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.	Summaries and Section 9.1
3.16	Any conditions to which this statement is subjected.	Summaries and Section 9.1

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Alluvial Material / Deposits	Sedimentary deposits resulting from the action of rivers, including those deposited within river channels, floodplains, etc
Apedal	A term indicating the degree of aggregation of soil particles within a soil horizon, where the material is well aggregated, but without well-formed peds (individual soil aggregates); in the context of the South African Soil Classification System, apedal soils also include structureless soils (e.g. sands) and somewhat more structured soils than the above description.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals, and micro-organisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes, and landscape of which they are integral parts.
Buffer:	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.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Catena	A repeated sequence of soil profiles that is related to relief features, indicating the same sequence when traced from the crest (interfluve) to the valley floor. Profiles change in character as one moves downslope (change in slope angle and drainage conditions), so that different degrees of leaching / translocation are encountered
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation, and/or hydrological indicators.
Drainage Density	A measure of the texture of a drainage system, expressed as the ratio of the total length of all stream channels within a catchment to the area of that catchment
Duplex Soils	Soils with a duplex morphology are characterised by the presence of a topsoil (A) horizon that differs markedly from the underlying subsoil in terms of texture, structure and composition, with an abrupt transition between the two soil horizons
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endorheic	A term given to an inward oriented pattern of drainage that is not connected to a wider drainage system
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.
Fluvial:	The physical interaction of flowing water and the natural channels of rivers and streams.
Graminoid	Grasses, sedges and rushes.
Groundwater:	Subsurface water in the saturated zone below the water table.
Herb	A small non woody plant in which the aerial parts die back at the end of every growing season
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution, and movement of water over, on, and under the land surface.
Hydroperiod	The term hydroperiod describes the different variations in water input and output that form a freshwater ecosystem characterising its ecology – i.e. the water balance of the wetland
Land Type	Distinct areas defined as part of the Land Type Survey of South Africa based on a unique combination of soil pattern, macroclimate and terrain form
Macro channel (bank)	The (overall) compound channel of a watercourse that is situated between the two outermost and highest-lying banks
Melanic	A type of topsoil horizon that is dark-coloured and usually well-structured
Perennial:	Flows all year round.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Reach	A longitudinal stretch of a river
Redoximorphic	Features within soil that are a result of the reduction, translocation and oxidation (precipitation) of Fe (iron) and Mn (manganese) oxides that occur when soils are saturated for sufficiently long periods of time to become anaerobic.
Riparian Area / Corridor	The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, 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
Vertic	Soils characterised by the presence of swelling and shrinking clays, typically formed where there is a distinct wet and dry period that affects the soils. These soils swell when they become saturated, and shrink again when they dry out, leading to characteristic 'cracking' on the surface of the ground
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam, or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may, in turn, have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
BAS	Best Attainable State
BGIS	Biodiversity Geographic Information Systems
BESS	Battery Energy Storage System
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
EC	Ecological Class
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMPr	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
ha	Hectares
HGM	Hydrogeomorphic
m	Meter
MAP	Mean Annual Precipitation
MW	Megawatt
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystems Priority Areas
NBA	National Biodiversity Assessment
NWA	National Water Act
OHPL	Overhead Powerline
PES	Present Ecological State
REC	Recommended Ecological Category
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WEF	Wind Energy Facility
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WUA	Water Use Authorisation
ZoR	Zone of Regulation

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Phefumula Emoyeni One Grid Connection associated with the Phefumula Emoyeni One Wind Energy Facility (WEF) in the Ermelo area of the Mpumalanga Province. The study area consists of a 400kV grid connection (overhead powerline) and associated assessment corridor as well as a new 400/132kV Main Transmission Substation (MTS) as well as three distribution substations / switching stations (collectively known as the 'study area'). A scoping-phase freshwater assessment was produced in May 2024 and this report has been produced in support of the EIA phase specialist reporting requirements.

In order to identify all freshwater ecosystems that may potentially be impacted by the development of the proposed Phefumula Emoyeni One Grid Connection infrastructure, a 500 m "zone of investigation" was implemented around the proposed study area, in accordance with Government Notice (GN) 4167 of December 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA), in order to assess possible sensitivities of the receiving freshwater environment. This area – i.e., the 500 m zone of investigation around the proposed Phefumula Emoyeni One Grid Connection - will henceforth be referred to as the 'investigation area'.

The purpose of this EIA phase freshwater report is to provide a description of the ecology of the freshwater ecosystems associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study and investigation area, including mapping of the natural freshwater ecosystems, verification of freshwater sensitivity in the context of the aquatic biodiversity sensitivity that has been assigned through the DFFE Web-based Screening Tool, assessment of the present ecological state (PES), Ecological Importance and Sensitivity (EIS) and ecosystem service provision and assessment of impacts on freshwater ecosystems that would potentially result from the development of the grid connection infrastructure through the application of an Impact Assessment Matrix and the DWS Risk Assessment Matrix (RAM) as contained within GN4167 of 2023.

1.2 Project description[1]

Phefumula Emoyeni One Pty Ltd is proposing to develop the Phefumula Emoyeni One WEF to be integrated to the national grid with a 400kV grid connection and establishing a new 400/132kV Main Transmission Substation (MTS) as well as three distribution substations / switching stations in order to support the Phefumula Emoyeni One WEF. The project will be located approximately 16km north of Ermelo in the Msukaligwa Local Municipality and Gert Sibande District Municipality, in the Mpumalanga Province of South Africa. The grid will be located over 22 farm portions and will be approximately 35 km.

The project is comprised of the following infrastructure:

- A new 400/132kV Main Transmission Substation (MTS), with 2 x 400 kV feeder bays (31 ha footprint);
- x Distribution (DX) substations (one per each phase). The IPP substation will be constructed adjacent to the DX substation:
    - DX1 (approximately 7.85 ha footprint;
    - DX2 (approximately 20.45 ha footprint;
    - DX3 (approximately 13.60 aa footprint;
- x 132kV overhead lines (OHL) from each DX substation to the MTS (total length approximately 36.4km:
    - DX1 (approximately 7.60 km in length);
    - Dx2 (approximately 22.4 km in length); and
    - DX3 (approximately 6.37 km in length).

[1] Note: the information in this section was provided by the proponent.

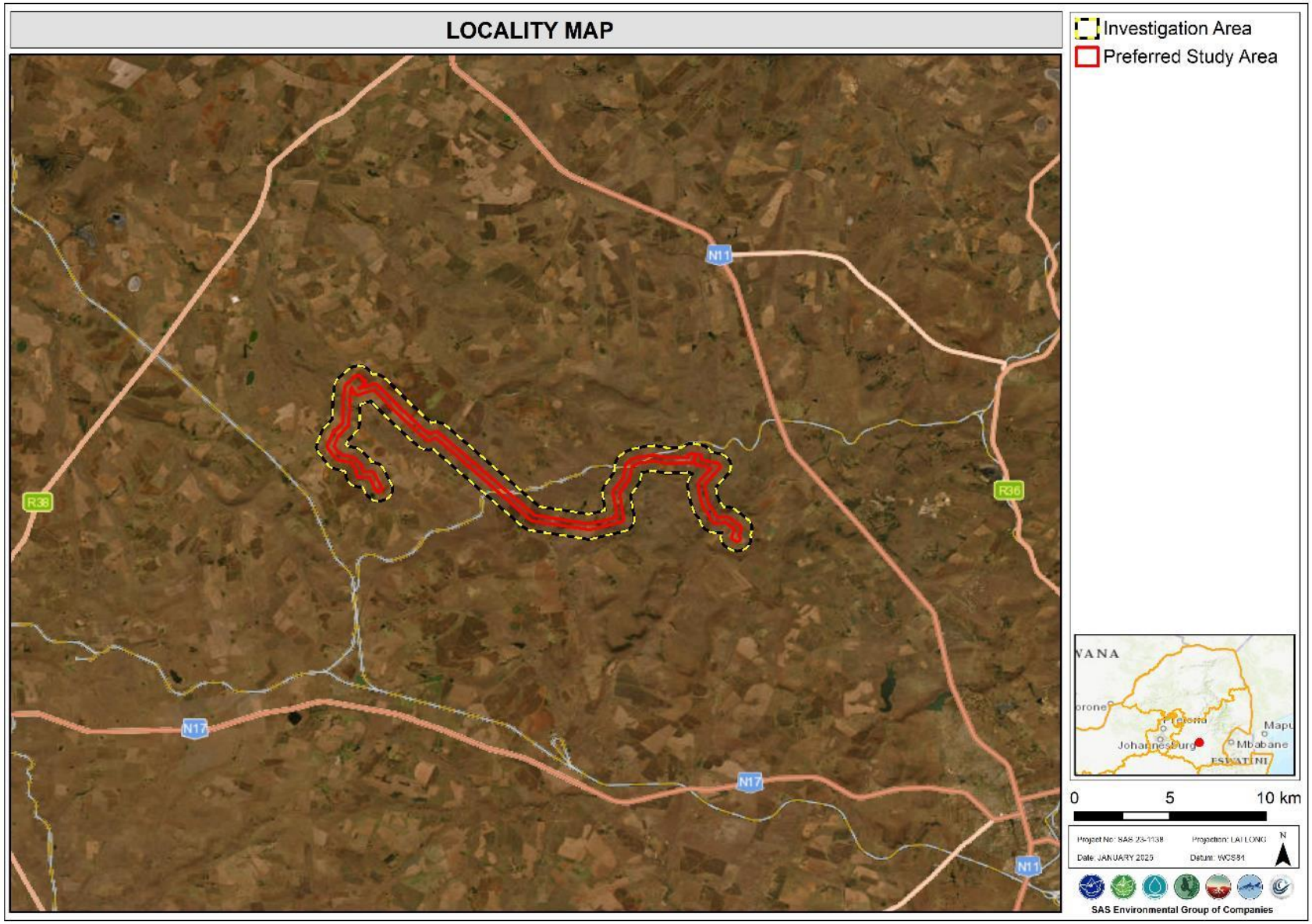


Figure 1: Digital satellite image depicting the location of the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area in relation to the surrounding area.

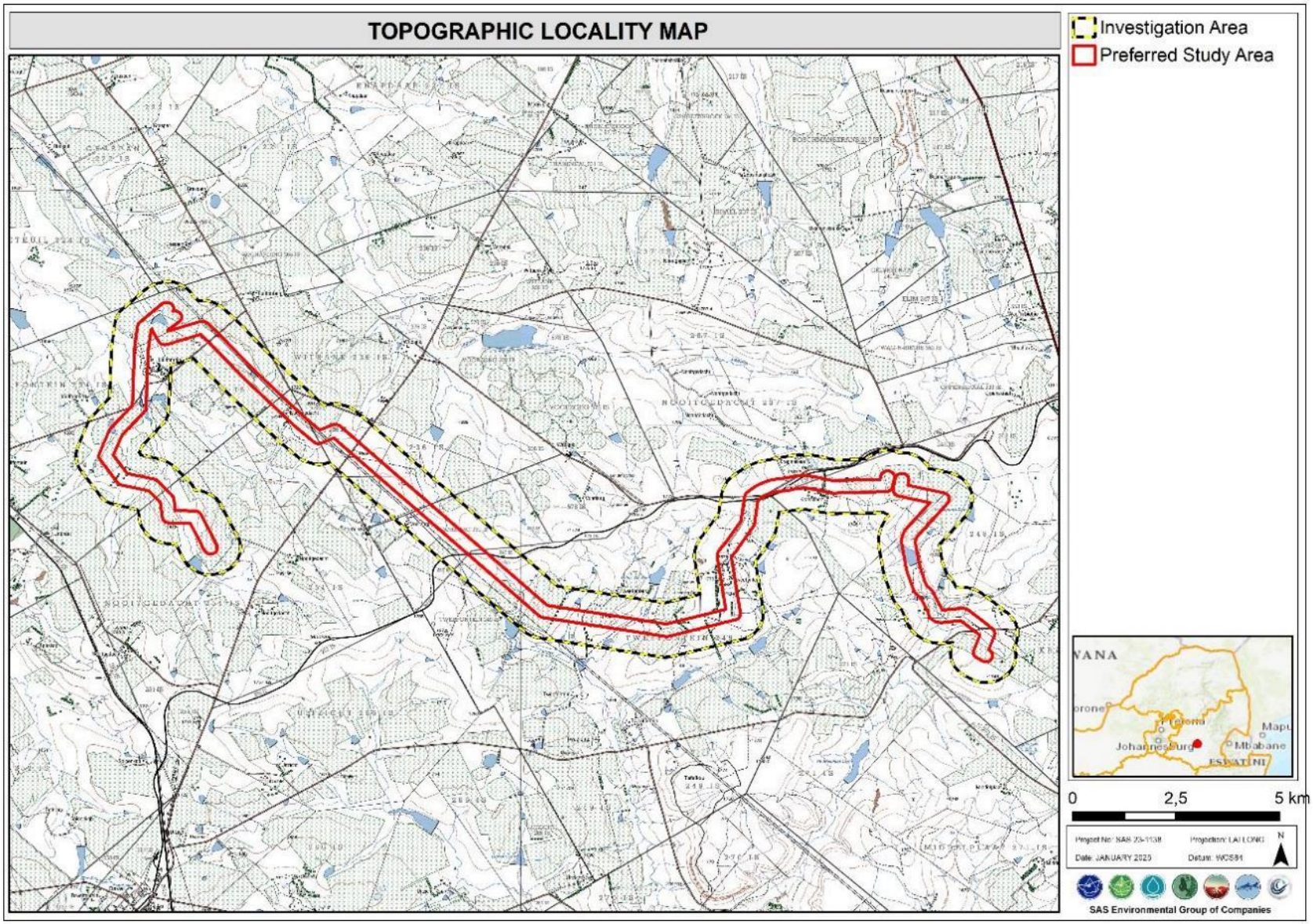


Figure 2: The proposed Phefumula Emoyeni One Grid Connection infrastructure, and associated investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area.

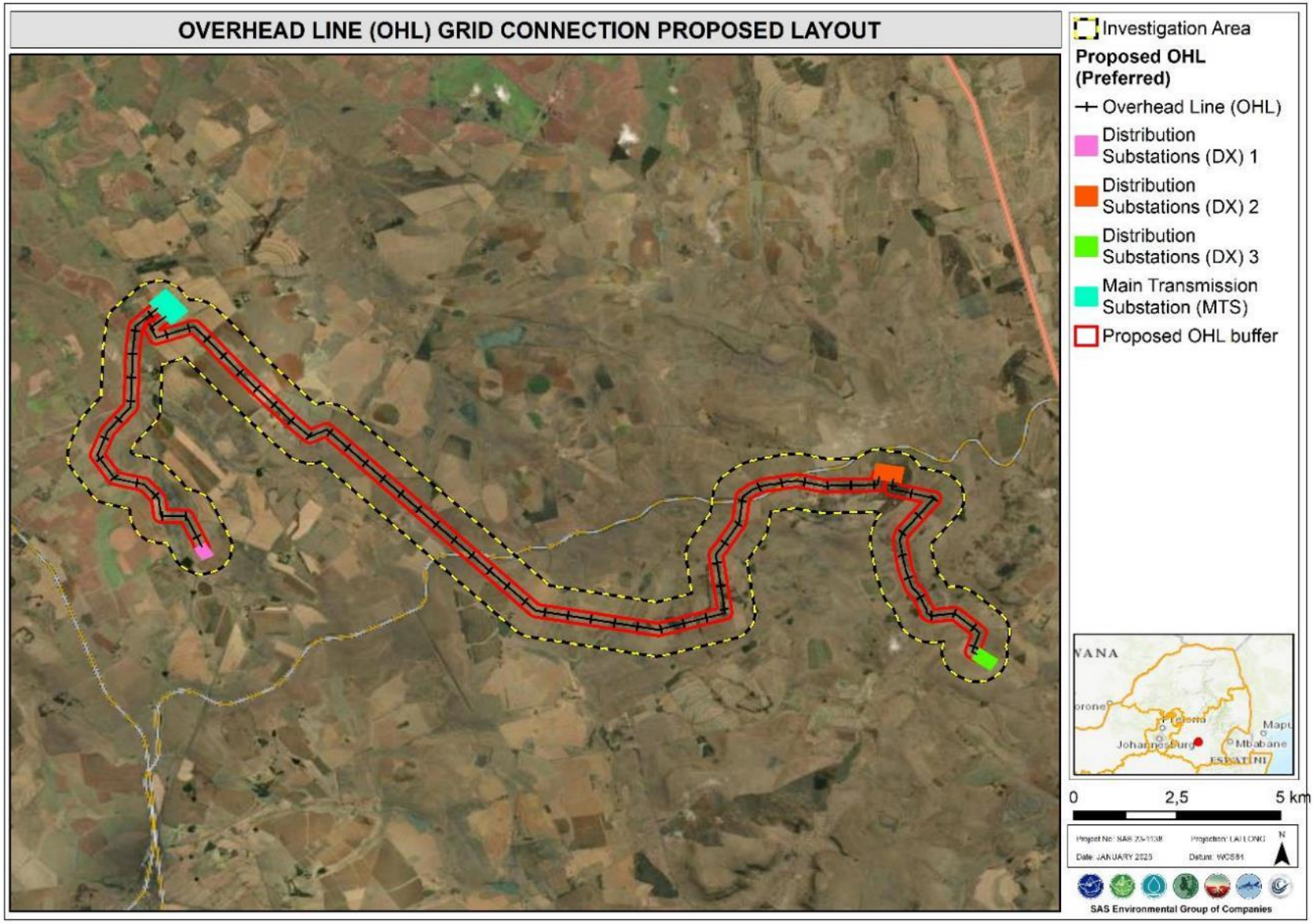


Figure 3: Proposed Layout of the Phefumula Emoyeni One Grid Connection infrastructure, and associated investigation area in relation to the surrounding area.

1.3 Scope of Work

Specific outcomes in terms of this EIA-phase freshwater assessment report are outlined below:

- A background study of relevant national, provincial, and municipal datasets (such as National Freshwater Ecosystem Priority Areas [NFEPA] (2011), and the National Biodiversity Assessment 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE) databases were undertaken to aid in defining the Ecological Importance and Sensitivity (EIS) of the freshwater ecosystems;
- All freshwater ecosystems associated with the study area and associated investigation area were delineated using desktop and subsequent in-field verification methods in accordance with GN 4167 of 2023 as it relates to activities as stipulated in the NWA and verified according to the "Department of Water Affairs and Forestry (DWAF)[2] (2008)[3]: A practical field procedure for identification of wetlands and riparian areas". Aspects such as soil morphological characteristics and wetness along with vegetation types were used to verify the freshwater ecosystems;
- The freshwater ecosystem classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The PES of the freshwater ecosystems was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.* (2008);
- The EIS of the freshwater ecosystems was determined according to the method described by Rountree and Kotze, (2013);
- The Ecoservices of the freshwater ecosystems were assessed according to "A technique for rapidly assessing ecosystem services supplied by wetlands" (Kotze *et al.,* 2020);
- The freshwater ecosystem boundaries, recommended development exclusion buffer and legislated zones of regulation (ZoR) were depicted for the freshwater ecosystems, where applicable;
- Allocation of a suitable Recommended Management Objective (RMO), Recommended Ecological Category (REC) and Best Attainable State (BAS) of the freshwater

[2] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA) and subsequently as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.
[3] Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

ecosystems were assigned based on the results obtained from the PES and EIS assessments;

- In the context of the WUA application, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (as contained within GN 4167 of 2023) was applied to identify potential impacts that may affect the freshwater ecosystems as a result of the proposed development, and to aim to quantify the significance thereof;
- In the context of the application for Environmental Authorisation (EA) in terms of the EIA Regulations of 2014, as amended, the WSP (EAP's) impact assessment matrix was also applied to assess potential impacts that may affect the freshwater ecosystems as a result of the proposed development, and to aim to quantify the significance thereof; and
- Management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact of the proposed development on the receiving freshwater environment have been presented.

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- All freshwater ecosystems associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and within 500 m in fulfilment of GN4167 were delineated using various desktop methods including the use of topographic maps, digital satellite imagery, and aerial photographs. Desk-based delineations were subject to ground-truthing which allowed for refinement of the delineations of the freshwater ecosystems upon completion of the in-field freshwater assessment;
- The layout provided for the OHPL corridors does not indicate tower positions and as such a detailed assessment of the impact of individual tower positions has been unable to be undertaken. As such a general assessment of the impact of towers has been made. It is important to note that a walkdown of tower positions has been proposed as a key recommendation of this report;
- In certain cases, where the corridor crosses a group of seep wetlands located in close proximity, and which share similar physical characteristics, often being uppermost tongues of the same seep wetland system, these have been collectively assessed in terms PES, EIS and EcoServices. As such, the wetlands were grouped into larger catchment systems, with wetlands belonging to the same HGM type and within the same general catchment system then being collectively assessed (i.e. all seep systems in System 1 is collectively assessed).

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the freshwater ecosystems will need to be surveyed and pegged according to surveying principles and with survey equipment;
- The delineations as presented in this report are regarded as the best estimate of the boundaries based on desk-based delineation with ground truthing based on the site conditions present during the EIA-phase grid connection site assessment;
- Wetland, riparian, and terrestrial ecosystem zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results;
- With regards to data sources used to provide background information on the sensitivity of the assessed areas, it is important to note that although all data sources provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the proposed Phefumula Emoyeni One WEF's actual site characteristics at the scale required to inform the environmental authorisation and water use authorisation processes;
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the existing activities have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of aquatic, riparian, and wetland ecology; and
- The only activities which were assessed were the Phefumula Emoyeni One Grid Connection infrastructure and identified freshwater ecosystems within 500 m thereof that may be impacted by the development footprint. All other activities located outside these boundaries that may intercept/create other potential impacts were not considered.

1.5 Legislative Requirements and Provincial Guidelines

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix B:

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA);

- The NEMA EIA Regulations of 2014, as updated (GN 982 of 04 December 2014);
- National Water Act, 1998 (Act No. 36 of 1998) as amended; and
- Government Notice (GN) 4163 as published in the Government Gazette 49833 of December 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended.

2 ASSESSMENT APPROACH

2.1 Freshwater Ecosystem Definition

The NWA is aimed at the protection of the country's water resources, defined in the Act as "a watercourse, surface water, estuary or aquifer". According to the NWA, a **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 in the *Gazette,* declare a watercourse;

For the purposes of this investigation, the definition of a freshwater ecosystem is considered to be synonymous with the definition of a watercourse as per the NWA and carries the same meaning as "watercourse" as defined by the Act.

The NWA further provides definitions of wetland and riparian habitats as follows:

Wetland habitat is "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 the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with composition and physical structure distinct from those of adjacent areas.

2.2 Freshwater Ecosystem Field Verification

Use was made of historical and current digital satellite imagery, topographic maps, and available provincial and national databases to aid in the delineation of the freshwater ecosystems at a desktop level prior to the undertaking of a site assessment. The following were taken into consideration when utilising the above desktop methods:

- Linear features: since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with freshwater ecosystems: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often showing as white/grey or black and outcrops or bare soils displaying varying chroma created by varying vegetation cover, geology, and soil conditions. Changes in the hue of vegetation, with freshwater ecosystem vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery, these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas, where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures which are distinct from the adjacent terrestrial areas, created by varying vegetation cover and soil conditions within the freshwater ecosystems.

A freshwater ecosystem site verification and assessment was undertaken from the 26th to the 28th of June 2024 (winter season), during which the presence of any freshwater ecosystem characteristics as defined by the Department of Water Affairs and Forestry (2008) and the NWA were noted and delineated (please refer to Section 4 of this report). After an amendment to the grid alignment by the proponent, an additional field assessment took place from the 5th to the 7th of February 2025 (summer season) to assess a selection of additional wetlands that were not included as part of the original grid alignment extent. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

The freshwater ecosystem delineation took place, as far as possible, according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” (DWAF, 2008). The foundation of the method is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;

- Distinctive hydromorphic soils;
- Vegetation that is adapted to saturated soils; and
- The presence of alluvial soil in stream systems.

It is important to note that vertic soils are predominant over large parts of the study area, particularly in valley bottom settings The presence of vertic soils poses difficulties for delineation of wetlands as due to their high (alkaline) pH status ≥8, typical signs of wetness (such as mottling) are not typically present in the soils and the standard delineation procedure for wetlands in South Africa that relies mostly on soil wetness indicators cannot be applied. Wetland delineation in vertic settings is further complicated within the Rensburg soil form – the soil form that is typically associated with wetlands in vertic soil settings – by the potential occurrence of the gley (G) horizon at extreme depth (of up to 2m), with the soil horizon showing redoximorphic characteristics being well below the typical rooting depth of herbaceous plants. Accordingly an adapted delineation methodology which was based on vegetation, terrain and hydrological indicators was applied.

In addition to the delineation process, a detailed assessment of the delineated freshwater ecosystems was undertaken. Factors affecting the integrity of the freshwater ecosystems were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the freshwater ecosystems. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.3 Impact Assessment, RAM and Recommendations

Following the completion of the assessment, an impact assessment (please refer to Appendix D for the method of approach) and the DWS RAM (please refer to Appendix E for the RAM methodology) were conducted. Recommendations were developed to address and mitigate impacts associated with the proposed Phefumula Emoyeni One Grid Connection's development's activities. These recommendations also include general 'best practice' management measures, which apply to the proposed development activities as a whole, and which are presented in Appendix I. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Section 2 of this report.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and is presented as a “dashboard” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for the integration of results by the reader to take place. Where required, further discussion and interpretation are provided, and information that was considered of importance was emboldened.

It is important to note that although all data sources are used to provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the proposed Phefumula Emoyeni One Grid Connection infrastructure’s actual site characteristics at the scale required to inform the EA processes. Nevertheless, this information is considered useful as background information to the study, is important in legislative contextualisation of risk and impact, and was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site assessment of key areas may potentially contradict the information contained in the relevant databases, in which case the site-verified information must carry more weight in the decision-making process. The information contained in the dashboard report below is intended to provide background to the landscape of the proposed Phefumula Emoyeni One WEF and the associated investigation area. Actual site conditions at the time of the assessment may differ from the background information provided by various datasets. Please refer to Section 4 for details pertaining to the site investigation results.

Table 1: Desktop data relating to the characteristics of the freshwater ecosystems associated with the Overhead Line (OHL) grid connection study area and associated investigation areas [Quarter Degree Squares (QDS) 2629BA, 2629BB, 2629BC and 2629BD].

Aquatic ecoregion and sub-regions in which study area is located		
Ecoregion	Highveld	
Catchments	Olifants North and Vaal Catchments	
Quaternary Catchment	B11A and C11F	
WMAs	Olifants and Upper Vaal	
subWMAs	Upper Olifants and Upstream Vaal	
Dominant characteristics of the Highveld Ecoregion (Kleynhans *et al.*, 2007)		
Ecoregion Level II	11.05	11.02
Dominant primary terrain morphology	Slightly undulating plains, slightly irregular undulating plains, few hills.	Moderately undulating plains and pans;
Dominant primary vegetation types	Moist Clay Highveld Grassland.	Moist Sandy Highveld Grassland
Altitude (m a.m.s.l)	1300 to 1900	
MAP (mm)	500 to 800	
Coefficient of Variation	20 to 29 (% of MAP)	
Rainfall concentration index	55 to 64	
Rainfall seasonality	Early summer	Early to mid-Summer
Mean annual temp. (°C)	14 to 16	12 to 8
Winter temperature (July)	0 to 18	0 to 20
Summer temperature (Feb)	12 to 26	10 to 26
Median annual runoff (mm)	20 to 150	20 to 80
Ecological Status of the most proximal sub-quaternary reach (2014)		
Sub-quaternary reach	C11F-01491 (Unnamed Tributary)	
Point Proximity	±4.6 km south of the investigation area	
Assessed by an expert?	Yes	
PES Category Median	Moderately Modified (C)	
Mean EI Class	Moderate	
Mean ES Class	Moderate	
Stream Order	1	
Default Ecological Class	C (Moderate)	

Details of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPA CODE	The study area and grid investigation area in the south and east is indicated within a **CODE 1 FEPA catchment**, while the remainder and the crossings are not indicated to be within a FEPA catchment. **FEPAs** achieve biodiversity targets for river ecosystems and threatened fish species and were identified in rivers that are currently in a good condition. Although the FEPA status applies to the actual river reach within the sub-quaternary catchment the surrounding land and smaller stream network needs to be managed in a way that maintain the good condition of the river reach.
Wetland Vegetation Type	The study area and investigation areas are located within the Mesic Highveld Grassland Group 3 and Group 4. These vegetation groups are considered to be Least Threatened (LT) according to Mbona *et al*. (2015).
NFEPA Wetlands	The NFEPA database indicates numerous wetlands within the study area and the associated investigation area, which are Channelled valley bottom (CVB) wetlands, unchannelled valley bottom (UCVB) wetlands, seeps, and flat wetlands. The CVB wetlands and associated seep and flat wetlands in the western sections which have formed a complex are indicated as being in a Moderately Modified (Class C) ecological Condition. The large seep and flat wetlands in the central section are indicated by the database to be in a largely Natural/Near-Natural (Class AB) ecological condition. The majority of the smaller seep wetlands are indicated by the database and the UCVB wetland to indicated to be in a Heavily to Critically Modified (Class Z) ecological condition.
NFEPA Rivers	According to the NFEPA (2011) database, the unnamed tributary of the Xspruit River is indicated by the database to traverse the study area and its associated investigation area in the eastern section. The Unnamed tributary of Xspruit River is indicated to be in a Natural to Near-Natural (RIVERCON A/B) ecological condition by the NFEPA Rivers Database.
Renewable Energy Development Zones (REDZs) within 30 km of the study area	
The study area is located within 30 km of the Emalahleni Phase 2 REDZ.	
Power Corridors within 30 km of the study area and associated study Area	
The study area is not located within 30 km of a power corridor.	
Renewable Energy EIA Applications within 30 km (REEIA, Q3_2024)	
The study area is located within 30 km of 9 approved wind energy projects and 3 approved solar energy projects.	
Mpumalanga Highveld Wetlands (MPHW) (2014)	
The MPHW indicates the presence of several floodplain, seep and channelled valley bottom (CVB) wetlands within the study and grid investigation area. The wetlands are largely indicated to be in a natural to near-natural (A/B) ecological condition. The floodplain wetlands are in the western sections and are indicated in a Moderately Modified (Class C) ecological condition. Several artificial impoundments (dams) are also indicated by the database.	

Strategic Water Source Areas (SWSA) (2017 & 2021)	
Surface water SWSAs are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. The SWSA for groundwater reflect areas that have high groundwater recharge and where the groundwater forms a nationally important resource. The 2021 MTPA database (Lötter, M.C. and Le Maitre, D) was used for surface water, while the WRC 2017 database (Le Maitre, D.C. *et al.*) was used for the groundwater SWSAs.	
The study area, the crossings, and the investigation areas are not indicated to be within a groundwater SWSA or within any surface water SWSA.	
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) for Rivers and Artificial Wetlands, and the Draft National Wetland Map 6 (2024) – Wetland Condition based on National Wetland Map 5 (2018)	
The NBA (2018) database like the NFEPA database, also indicates the presence of numerous channelled valley bottom (CVB), seep wetlands, and one depression wetland. The CVB wetlands are mostly indicated to be in a Largely to Critically Modified (Class D/E/F) ecological condition, Critically Endangered (ETS) and Not Protected (EPL). The seep wetlands are indicated to largely be in a Moderately Modified (Class C) ecological condition and in a Largely to Critically Modified (Class D/E/F) ecological condition. The seep wetlands are indicated by the database to be Critically Endangered (ETS) and Poorly Protected (EPL). The one depression wetland is indicated to be of Least Concern (ETS), Natural/Near-Natural (PES Class AB), and Poorly Protected (EPL). The NBA Rivers database further indicates the unnamed tributary of Xspruit River traversing the study area and is indicated to be in a Near Natural to Natural (class A/B) ecological condition, in a Critically Endangered (ETS), and Poorly Protected (EPL). The NBA Artificial Wetlands Database furthermore indicates numerous dams within the study and associated investigation area overlaying the seeps and CVB wetlands.	
Detail of the study area in terms of the Land Type Data (Job et al., 2019)	
The study and investigation areas are located within the Ab9, Bb4 and Ea23 land type groupings. **Ab soil types** are red and yellow, freely-drained apedal soils with Hutton, Griffin and Clovelly soils occupying more than 40% of the landscape. Ab Land Types are dominated by red soils (yellow soils <10%). In **Bb Land Types** dystrophic yellow-brown and grey soils are widespread. Ba and Bb Land Types are generally located in the eastern and central interior basins. A very large part of the South African interior is occupied by a catena in its perfect form represented by Hutton, Avalon, Bainsvlei, and Longlands soil forms. Glencoe, Wasbank, Westleigh and occasionally Tambankulu and Mispah (Hillside and Klipfontein series; or Dresden 1991 classification) plinthic soils are also present. Plinthic soils occupy at least 10% of the landscape. Where sedimentary rocks dominate the underlying geology, Pinedene and Kroonstad occupy lower slope positions, while Katspruit soil forms and streambeds are present in stable bottomland terrain positions. Duplex soils of the Valsrivier and Sterkspruit forms and alluvium (Dundee and Oakleaf forms) are dominant in many less stable bottomland sites. In addition, where basic igneous rocks are widespread, black clay soils of the Rensburg, Willowbrook and Bonheim soils also occupy bottomland positions. Mispah, Glenrosa and rock land are also common features of the landscape. Margalitic soils refers to black clays of the Rensburg, Arcadia, Willowbrook, Bonheim, Tambankulu, Mayo and Milkwood soil forms. **Ea Land Types** accommodate high base status, dark coloured and/or red structured soils, usually of clay texture, associated with basis igneous rocks. More than half of the land surface is covered by vertic, melanic or red structured diagnostic horizons. Duplex soils or exposed rock may cover significant portions of the land surface, but vertic, melanic or red structured horizons are dominant.	
National Web-Based Environmental Screening Tool (2020; accessed 2025)	
The Screening Tool is intended to allow for the pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	
The majority of the study and investigation area especially in the south and east are indicated to be of **very high aquatic biodiversity sensitivity**, with the exception of a sections in the north and west of the study area not associated with rivers and/or wetlands. **The triggering features for the very high aquatic biodiversity are:** ➢ Being within Critical Biodiversity Area (CBA) aquatic rivers (associated with the unnamed tributary of the Xspruit River) and CBA: Wetlands; ➢ Being within Ecological Support Area (ESA): Wetlands and important sub-catchment; ➢ Being within a Freshwater Ecosystem Priority Area (FEPA) sub-catchment in the east and south which is consistent with the FEPA CODE 1 designation by NFEPA (2011); and ➢ For proximity to natural/near natural (AB) rivers and Wetlands (depressions, seeps, and valley bottoms).	
Mpumalanga Biodiversity Sector Plan (MBSP, 2022): Freshwater Only	
Critical Biodiversity Area (CBA)	The areas along and adjacent to the unnamed tributary of the Xspruit River are indicated as Aquatic CBA River areas. Several sections of the channelled valley bottom wetlands (per the NBA: 2018 and MPHW: 2014 Databases) in the western sections are also indicated as CBA: Wetlands. CBA Areas that are required to meet biodiversity targets for species, ecosystems, or ecological processes. These include all areas required to meet biodiversity pattern targets and to ensure the continued existence and functioning of species and ecosystems, special habitats, and species of conservation concern; Critically Endangered ecosystems;

	and critical linkages (corridor 'pinch-points') to maintain connectivity. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species.
Ecological Support Area (ESA)	The areas adjacent to the unnamed tributary of the Xspruit River, the seep wetlands, and the remaining CVB wetlands are indicated as ESA Wetlands. The study area and investigation area in the south and east as indicated by FEPA:2011 database as a Code 1 FEPA catchment is indicated by the Mpumalanga Biodiversity Sector Plan database as an ESA Important sub-Catchment. ESAs. ESAs are areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services. ESAs need to be maintained in at least a functional and often natural state, supporting the purpose for which they were identified. They include features such as riparian habitat surrounding rivers or wetlands.
Other Natural Areas (ONA)	Patches of the study and investigation area in the central and western sections are indicated as ONAs. ONAs are areas that have been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.
Moderately or Heavily Modified Areas (Transformed)	Patches of the study and investigation area associated with agricultural areas are indicated as heavily modified areas. Heavily modified areas are those that have been heavily modified by human activity so that they are by-and-large no longer natural, and do not contribute to biodiversity targets. Some of these areas may still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly and, in many cases, irreversibly compromised.

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; EPL = Ecosystem Protection Level; ES = Ecological Sensitivity; ESA = Ecological Support Area; ETS = Ecosystem Threat Status; LT = Least Threatened; m.a.m.s.l = Meters Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA= National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; NP = Not Protected; ONA = Other Natural Areas; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area; OHPL = Overhead Powerline.

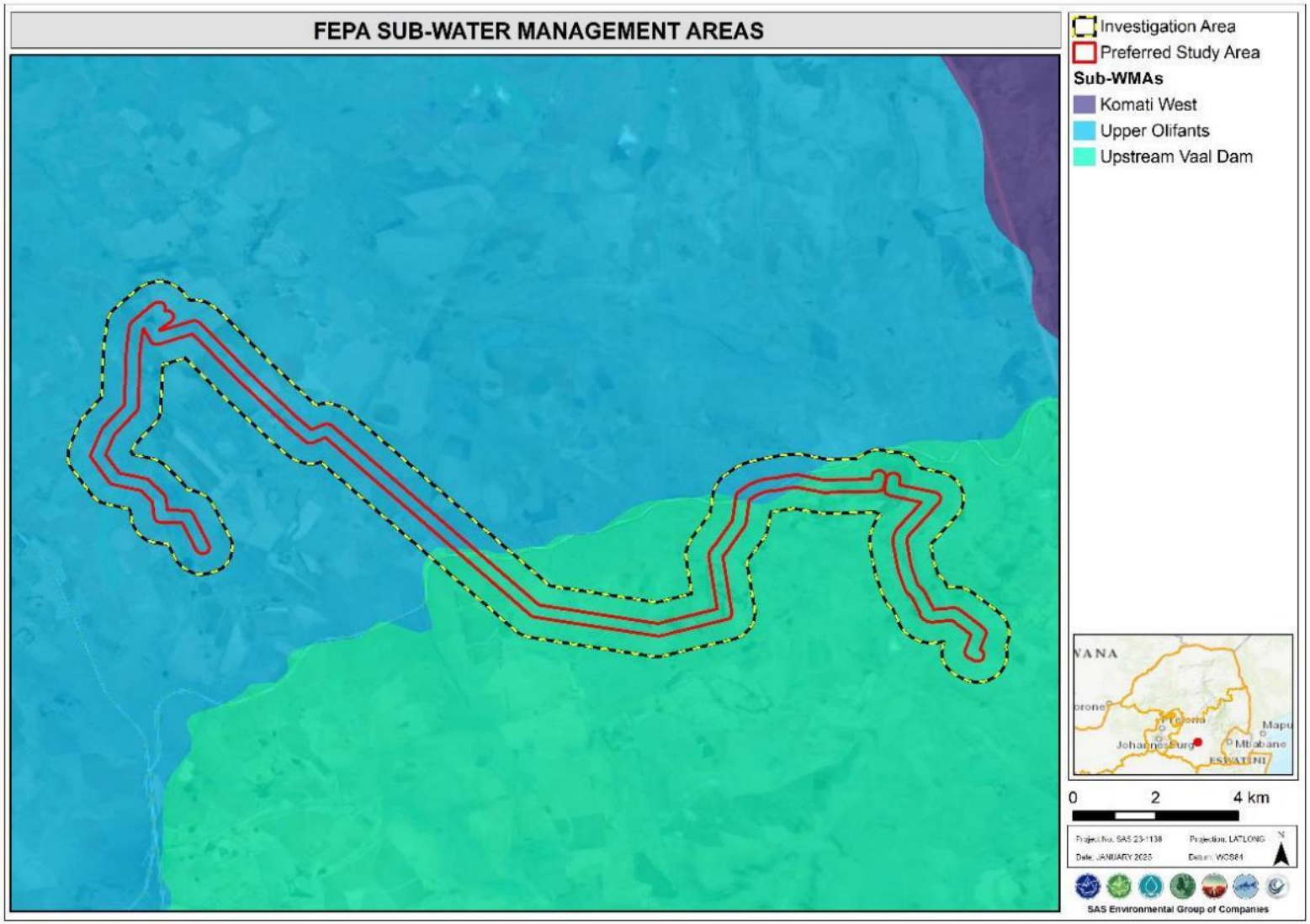


Figure 4: FEPA Sub WMAs associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area.

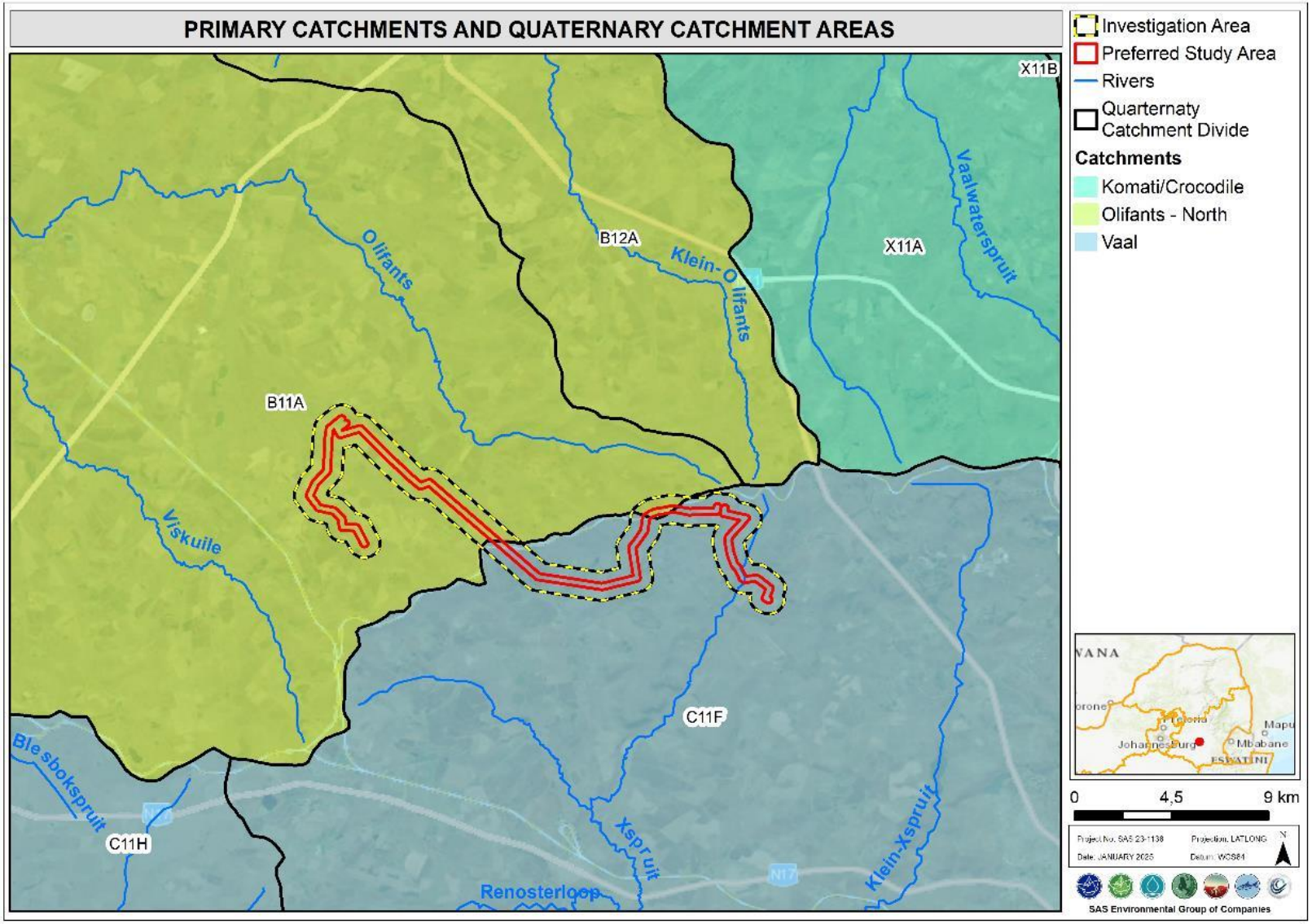


Figure 5: Quaternary catchments and overall surface water drainage associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area.

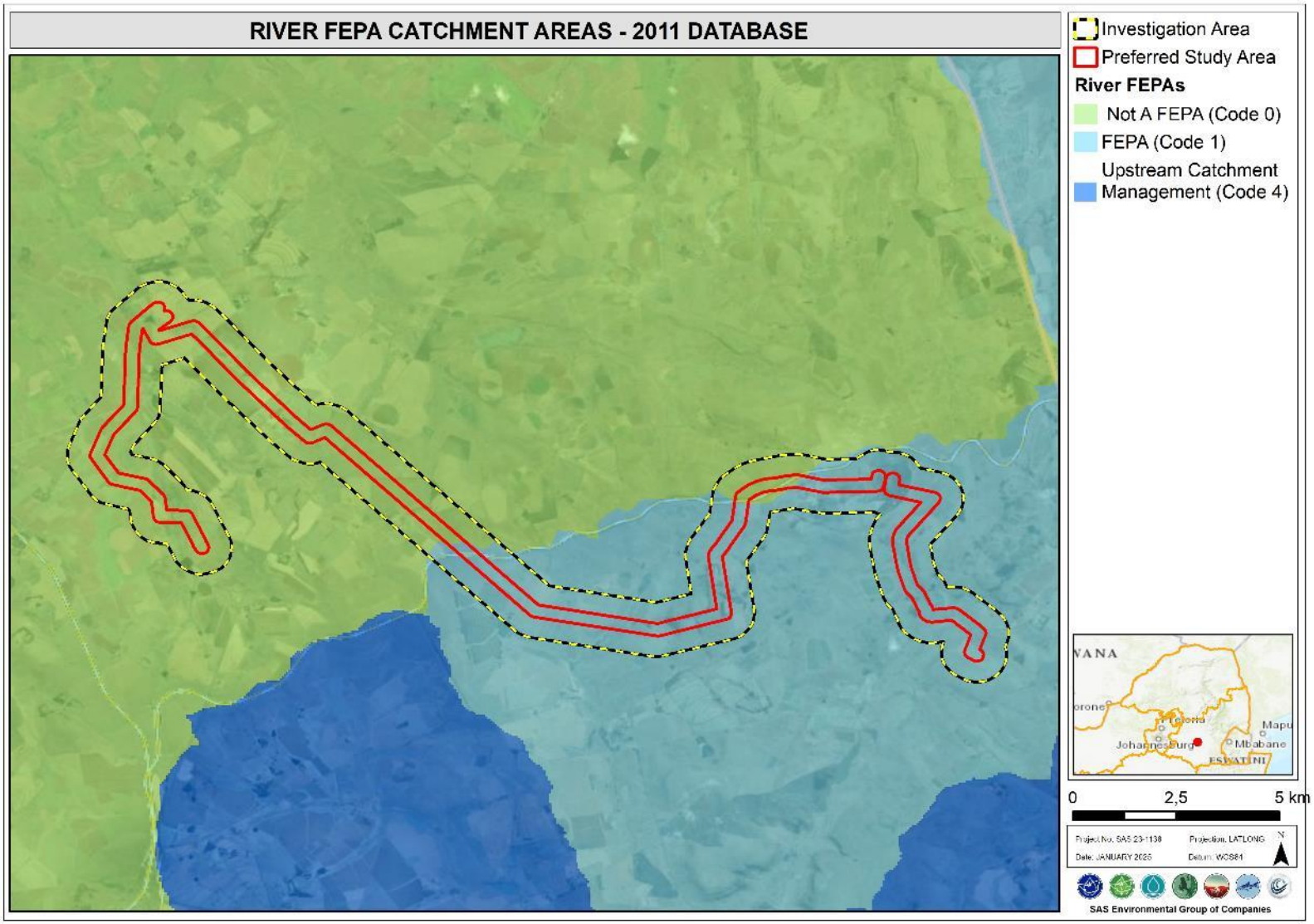


Figure 6: Freshwater Ecosystem Priority Areas (FEPAs) associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area according to the NFEPA (2011) database.

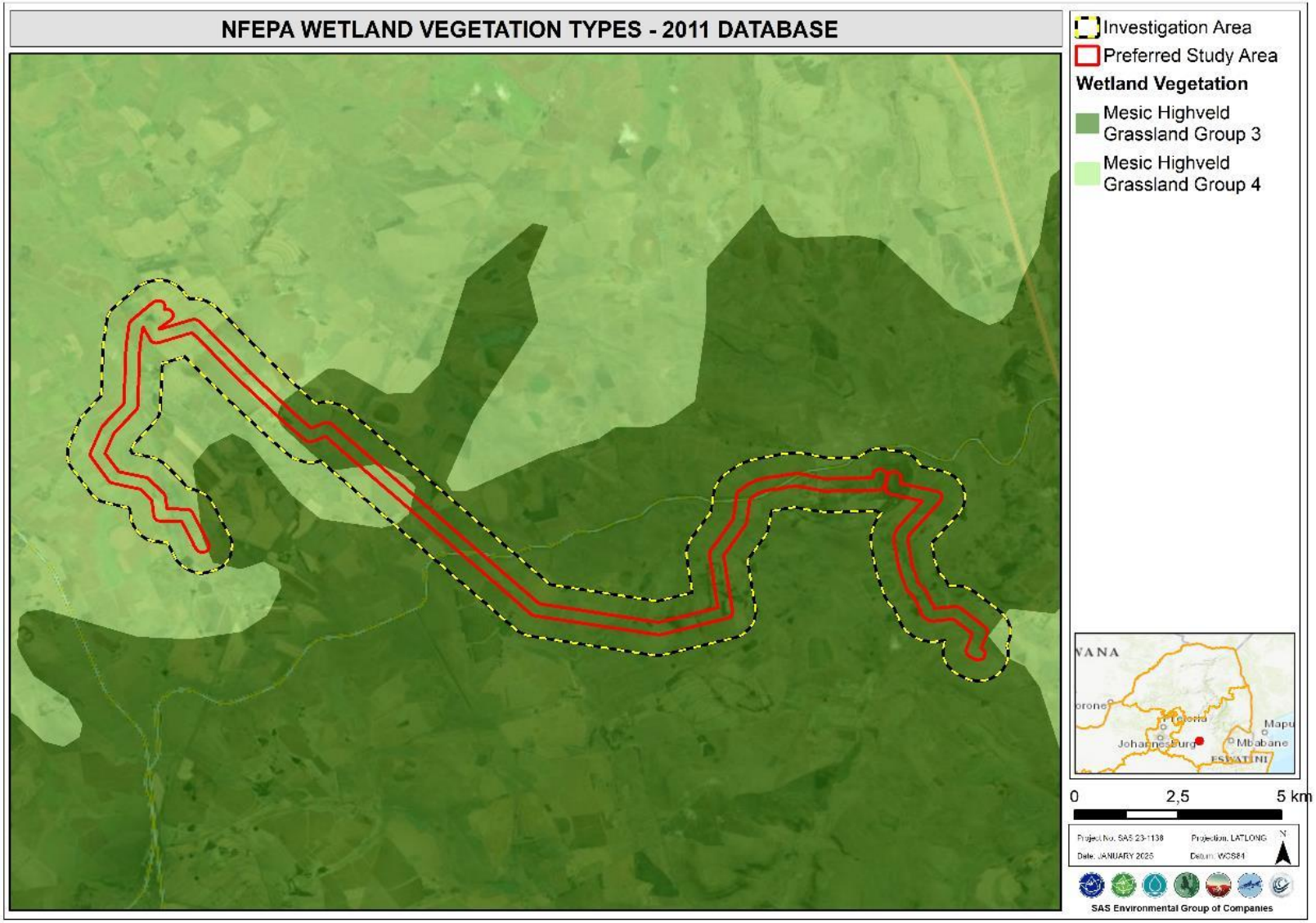


Figure 7: Freshwater ecosystems associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area according to the NFEPA (2011) database.

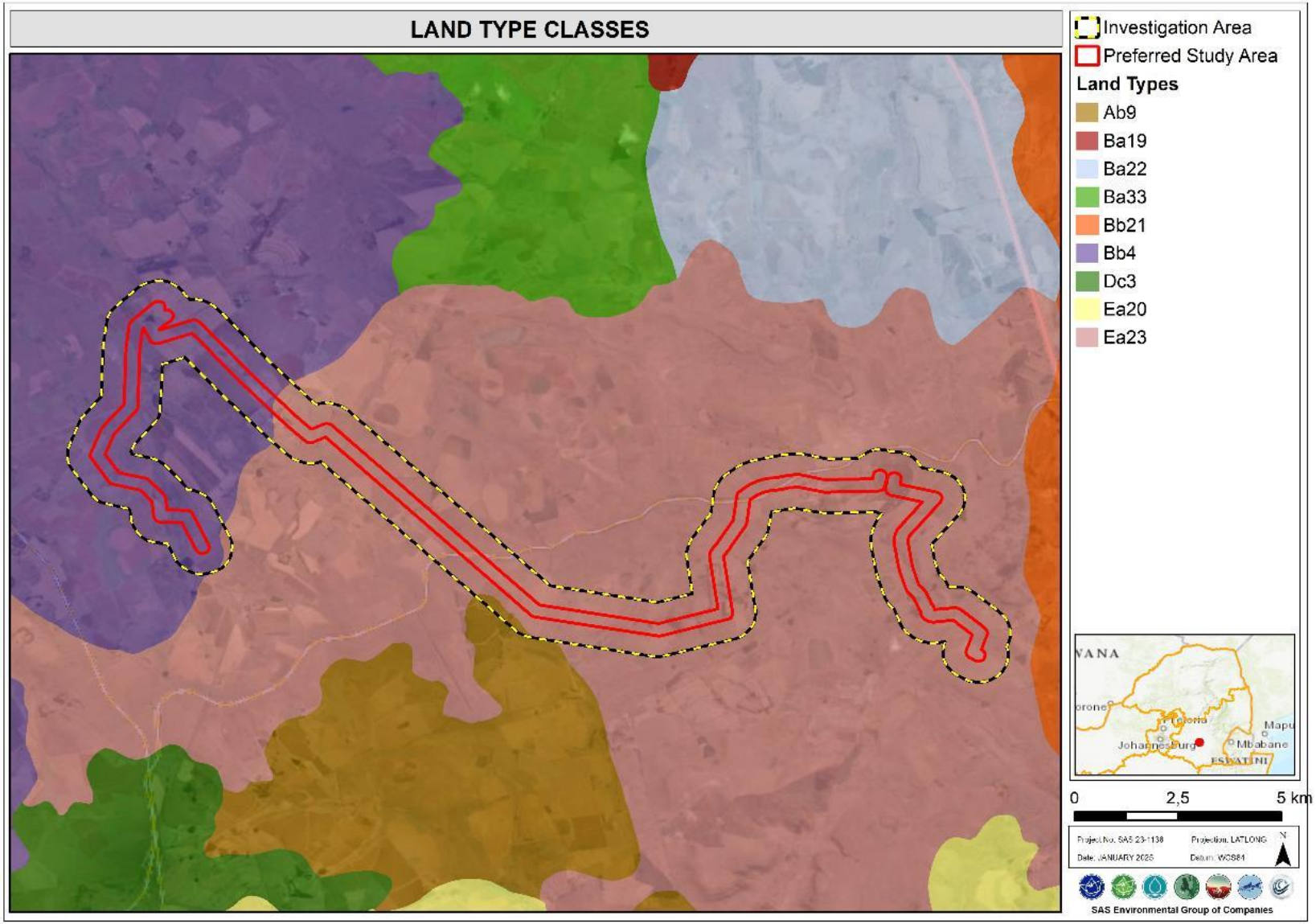


Figure 8: Land types located withing the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area.

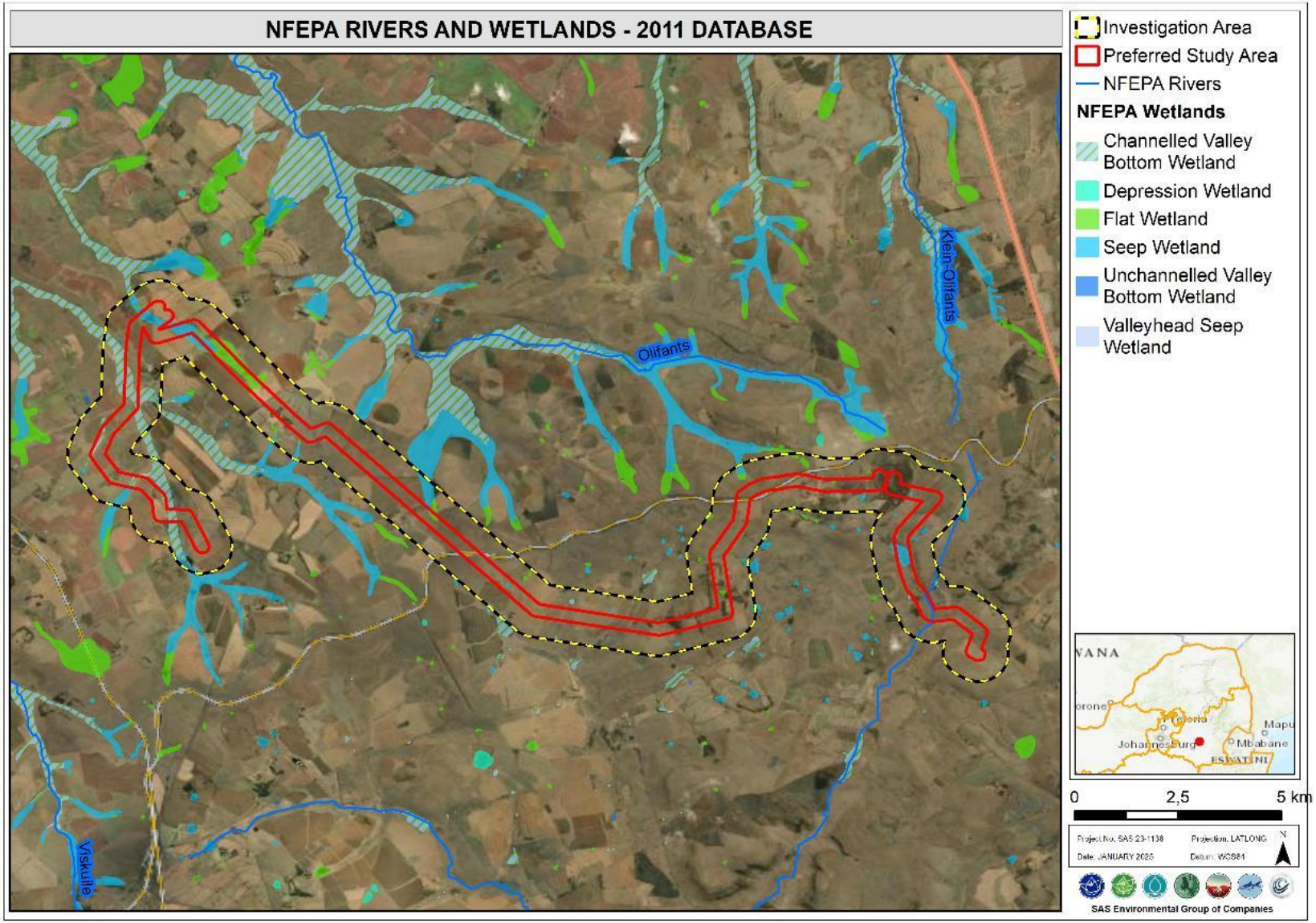


Figure 9: Freshwater ecosystems associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and associated investigation area according to the NFEPA (2011) database.

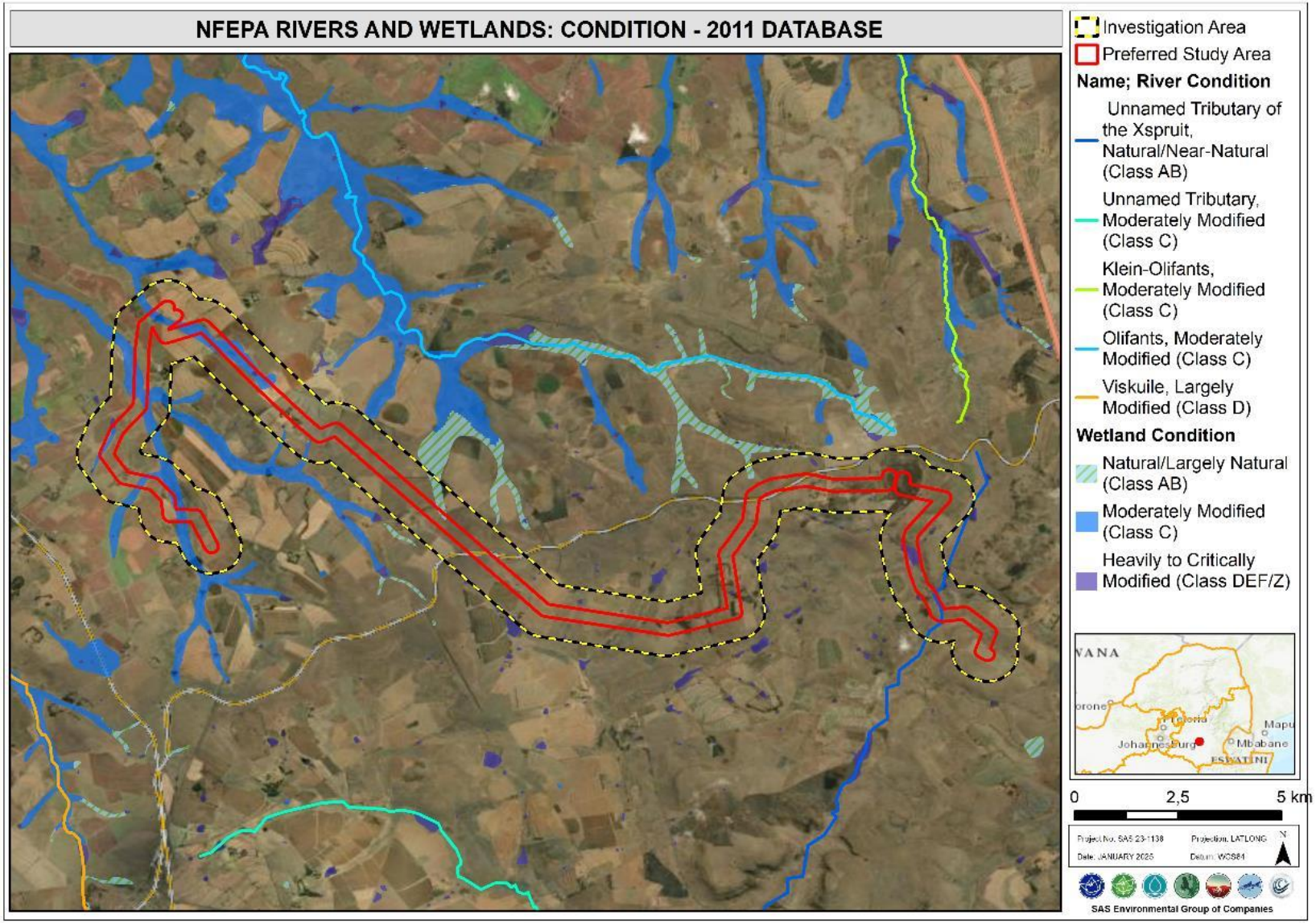


Figure 10: River and Wetland ecological condition associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and associated investigation area according to the NFEPA (2011) database.

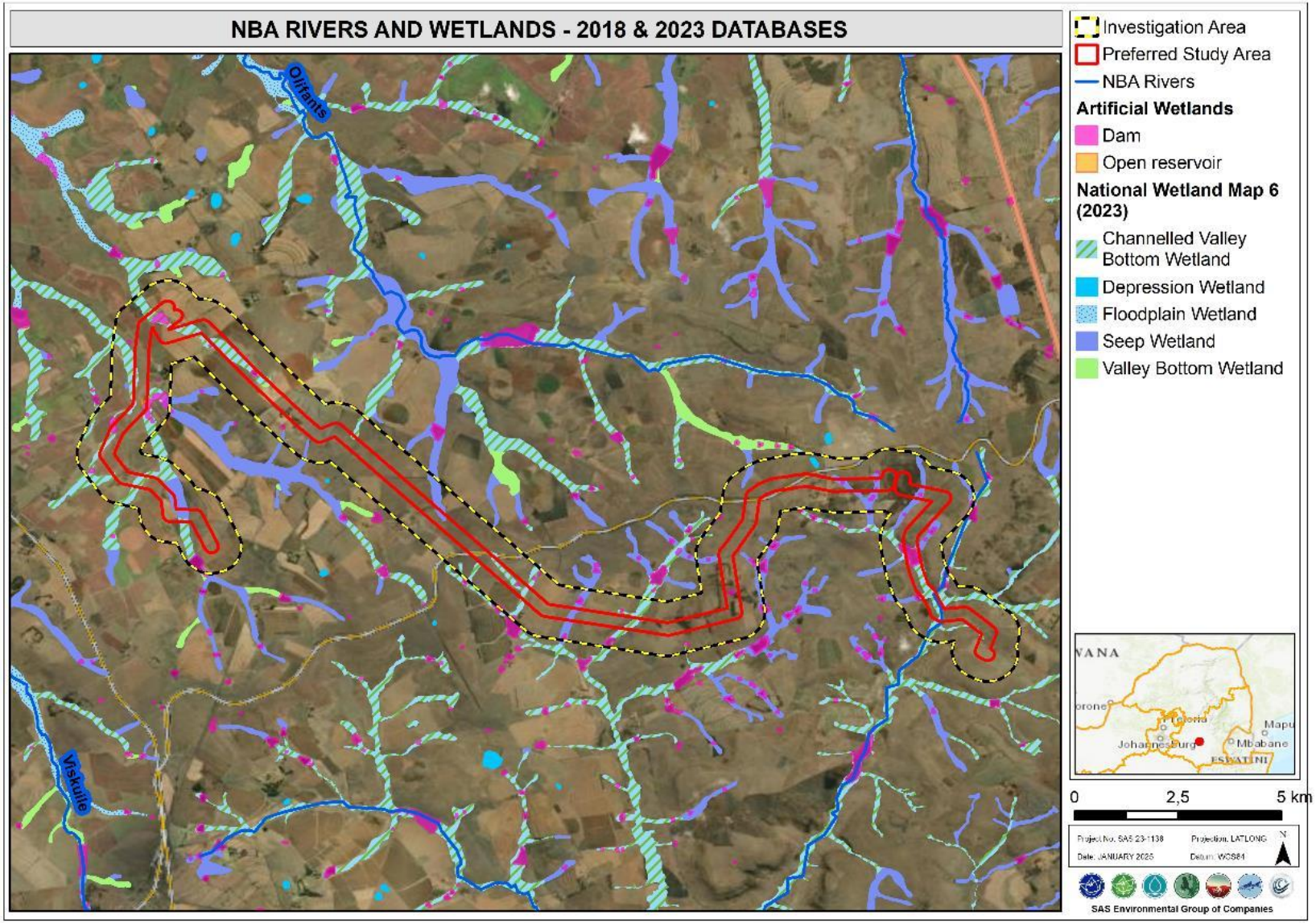


Figure 11: Freshwater ecosystems associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and associated investigation area according to the NBA (2018) database.

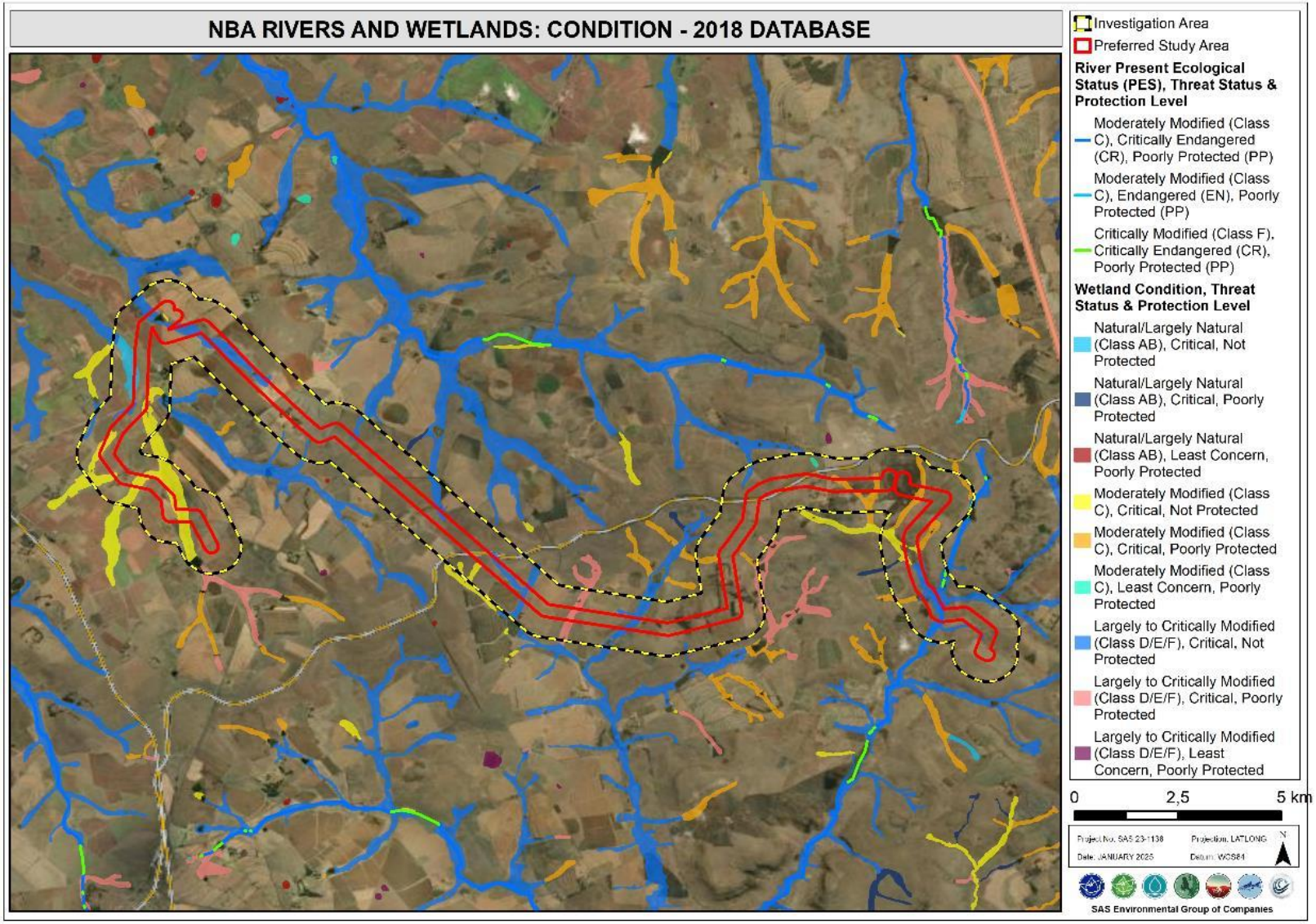


Figure 12: River and Wetland ecological condition associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and associated investigation area according to the NBA (2018) database.

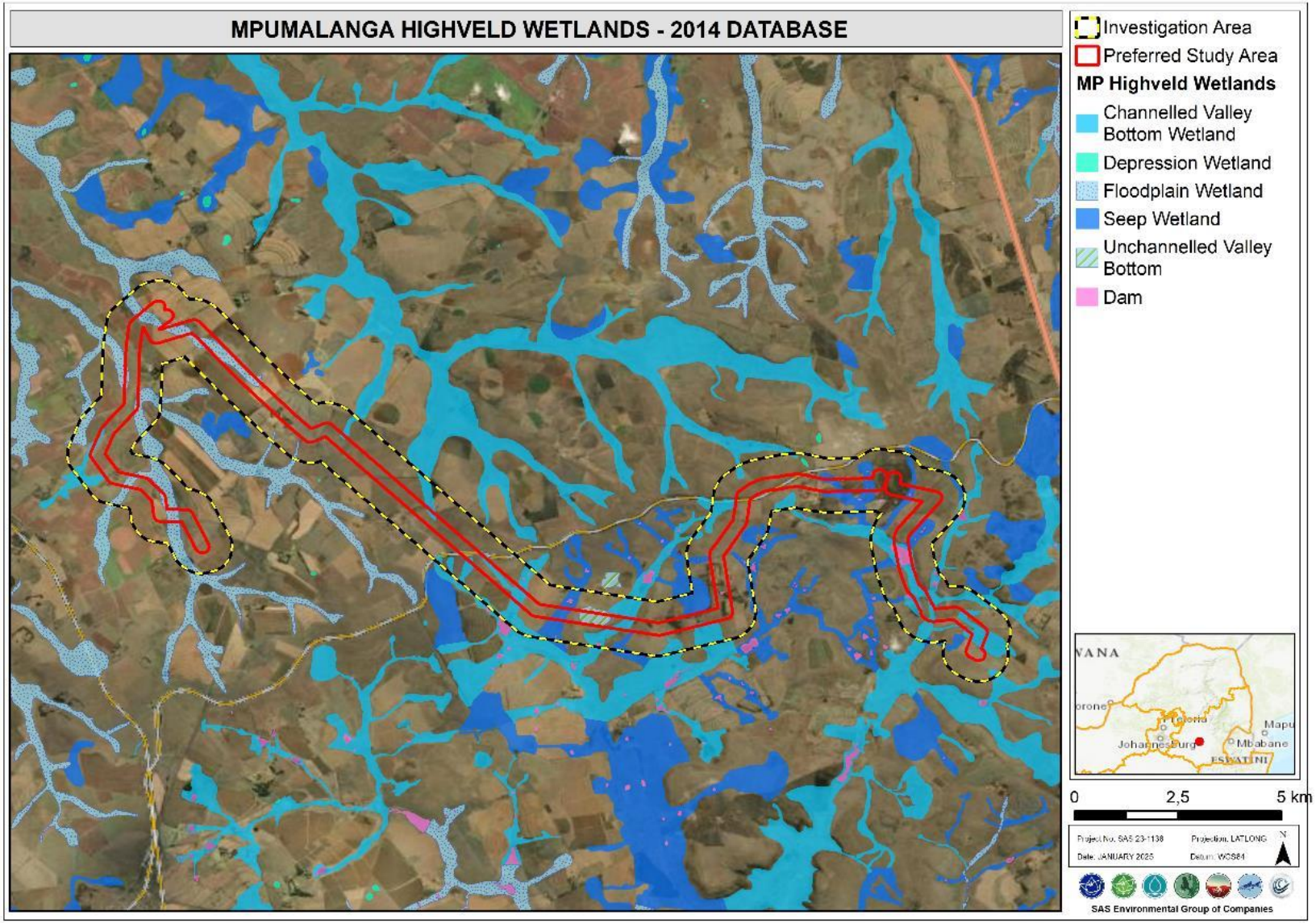


Figure 13: Freshwater ecosystems associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and associated investigation area according to the Mpumalanga Highveld Wetlands database.

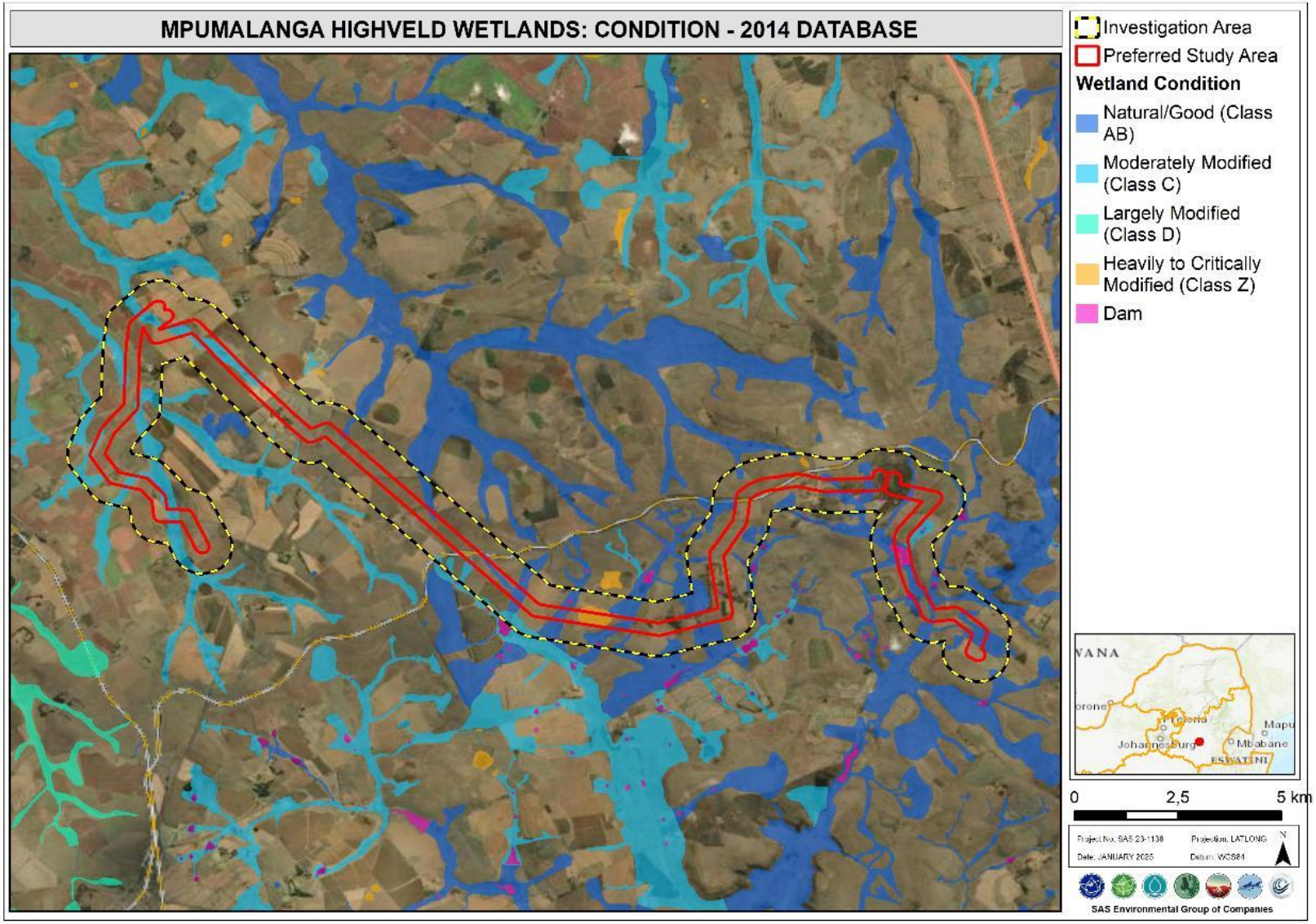


Figure 14: Freshwater ecosystem condition associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and associated investigation area according to the Mpumalanga Highveld Wetlands database.

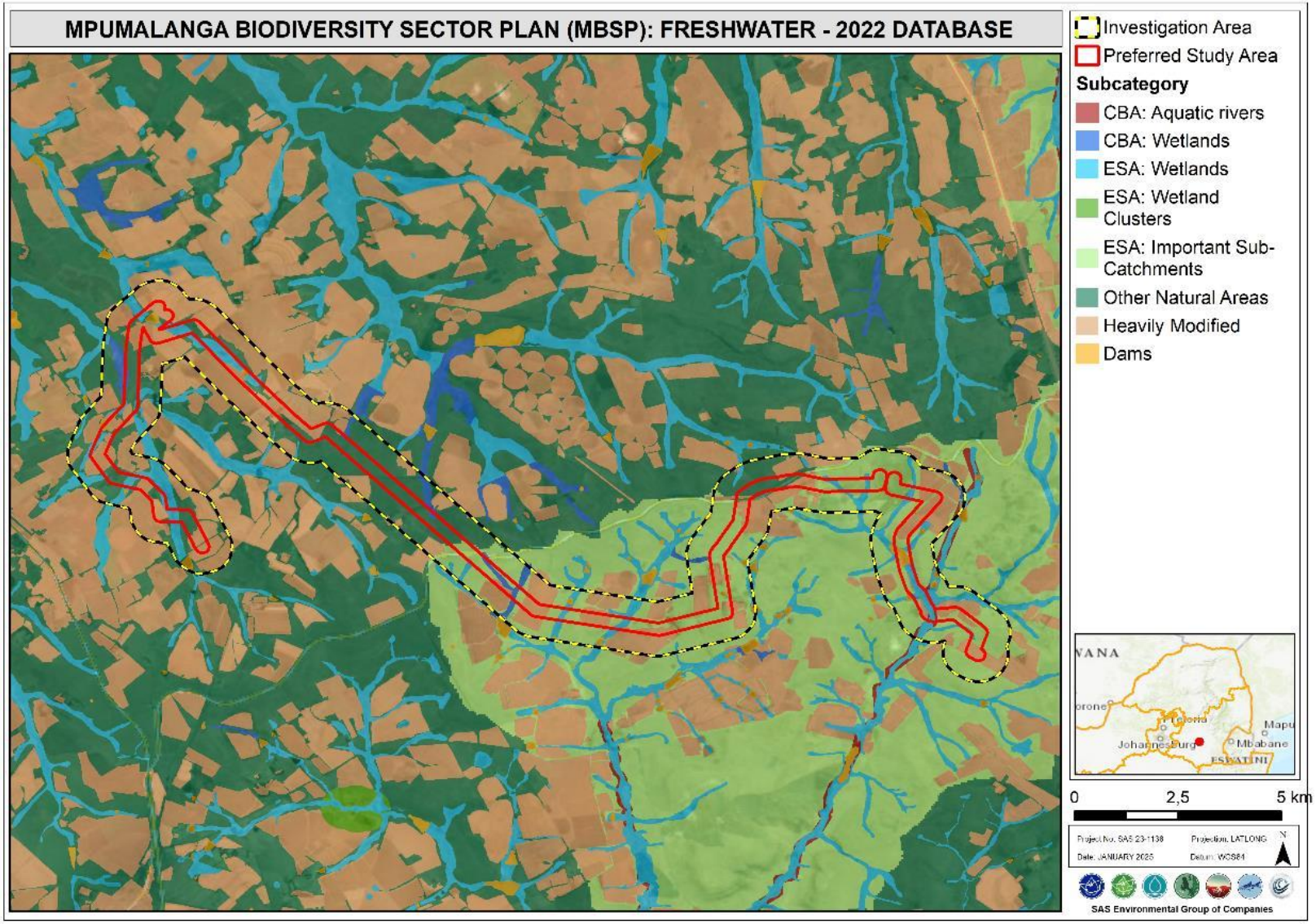


Figure 15: Areas of freshwater ecological importance associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure's study area and investigation area and associated investigation area is indicated by the Mpumalanga Biodiversity Sector Plan (2019).

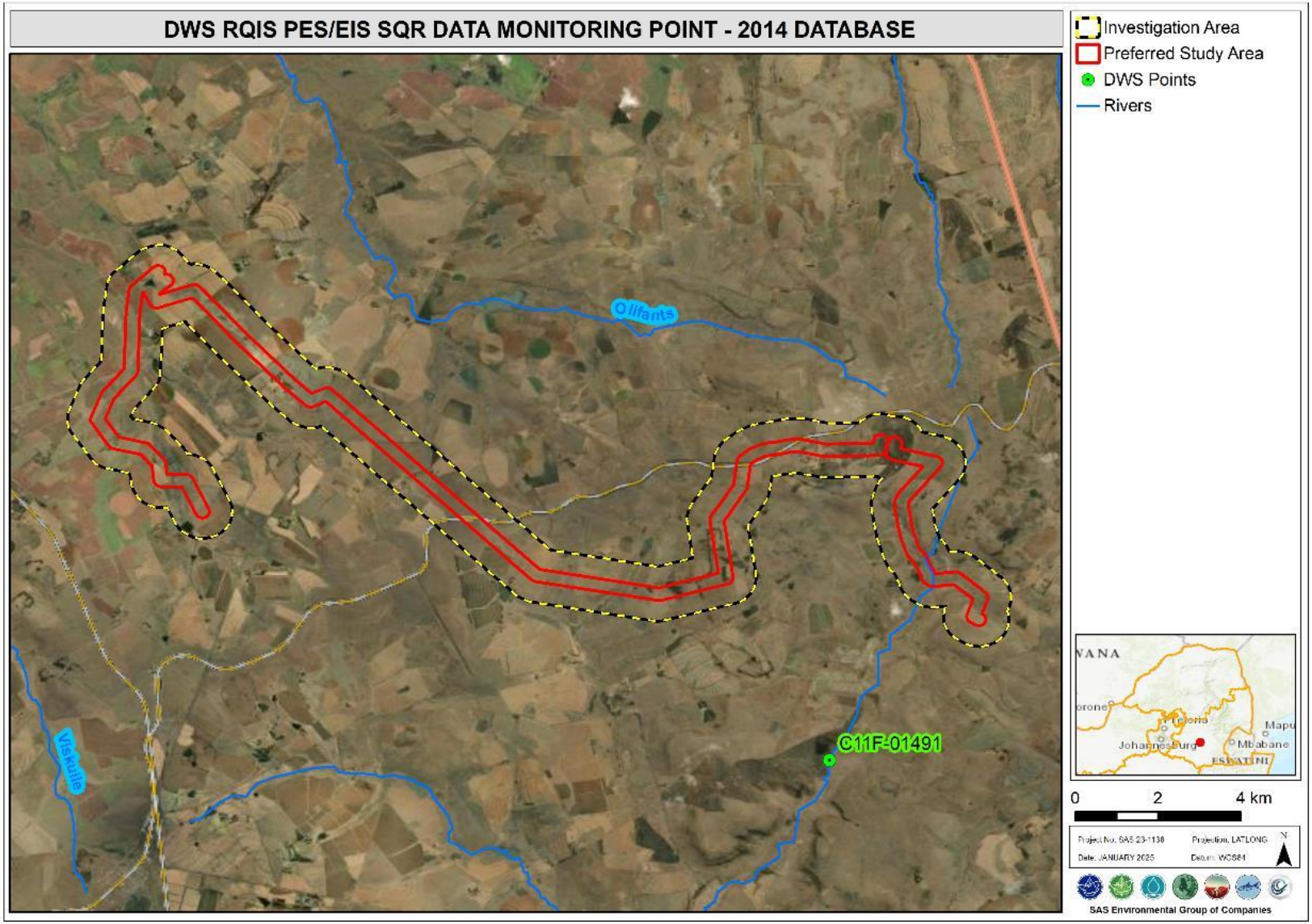


Figure 16: The relevant Sub-Quaternary Catchment Reach (SQR) associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure and associated investigation area according to the DWS (2014).

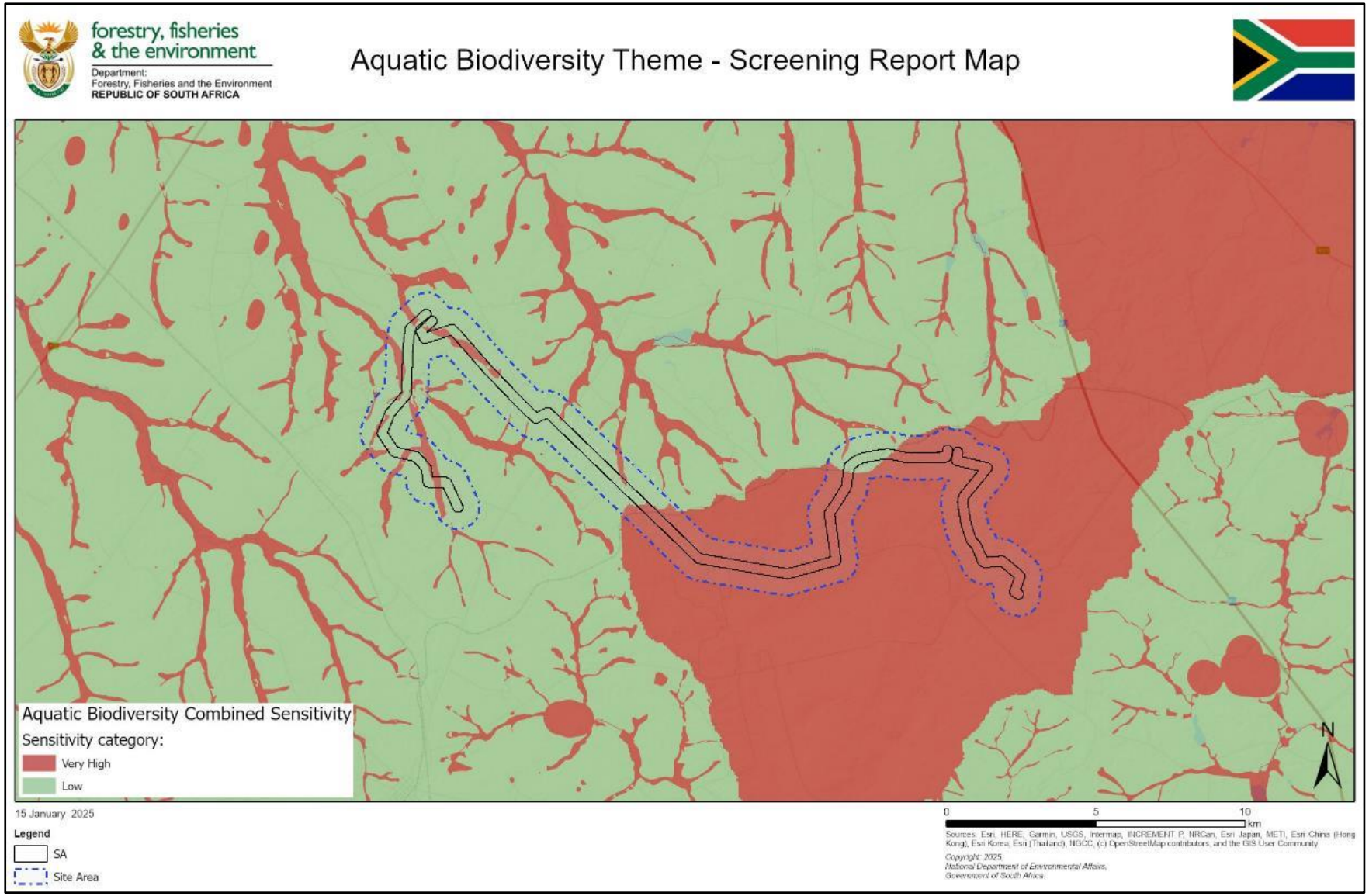


Figure 17: Map of relative aquatic biodiversity theme sensitivity for the proposed Phefumula Emoyeni One Grid Connection infrastructure's study area and investigation area according to the National Web-Based Environmental Screening Tool (Accessed 2023).

3.2 Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Information Services (RQIS) PES/EIS Database]

The PES/EIS database, as developed by the DWS RQIS department, was utilised to obtain additional background information on the project area. The PES/EIS database has been made available to consultants since mid-August 2014. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level. Descriptions of the aquatic ecology is based on information collated by the DWS RQIS department from available sources of reliable information, such as SA RHP sites, Ecological Water Requirements (EWR) sites and Hydro Water Management system (WMS) sites.

In this regard, information for the SQR of the rivers within the study and investigation areas was obtained. (Figure 16 above). Key information on fish species, invertebrates and background conditions, associated with the rivers detailed in the Tables below, as contained in this database and pertaining to the Present Ecological State (PES), ecological importance and ecological sensitivity for the river, are tabulated below.

Table 2 - Fish species previously collected from or expected in the SQR associated with C11F-01491 (Unnamed Tributary of the Xspruit River):

Fish species	C11F-01491 (Unnamed tributary of Xspruit River)	B11A-01369 (Olifants River)
Clarius gariepinus	X	✓
Enteromius anoplus	✓	✓
Enteromius neefi	X	✓
Enteromius paludinosus	✓	✓
Pseudocrenilabrus philander	✓	✓
Tilapia sparrmanii	✓	✓

Table 3: Freshwater macro-invertebrate species observed, or expected to occur at the sites:

Ecological status	C11F-01491 (Unnamed tributary of Xspruit River)	B11A-01369 (Olifants River)
Aeshnidae	✓	✓
Ancylidae	✓	✓
Atyidae	✓	✓
Baetidae > 2 Sp	✓	✓
Belostomatidae	✓	✓
Caenidae	✓	✓
Ceratopogonidae	✓	✓
Chironomidae	✓	✓
Coenagrionidae	✓	✓
Corbiculidae	✓	✓
Corduliidae	X	✓
Corixidae	✓	✓
Crambidae (Pyralidae)	X	✓
Culicidae	✓	✓
Dixidae	X	✓
Dytiscidae	✓	✓
Ecnomidae	X	✓
Gerridae	✓	✓
Gomphidae	✓	✓
Gyrinidae	✓	✓
Hirudinea	✓	✓
Hydracarina	✓	✓
Hydraenidae	X	✓
Hydrometridae	✓	✓
Hydrophilidae	✓	✓
Hydropsychidae 2 Sp	✓	✓

Ecological status	C11F-01491 (Unnamed tributary of Xspruit River)	B11A-01369 (Olifants River)
Hydroptilidae	✓	✓
Leptoceridae	✓	✓
Leptophlebiidae	✓	✓
Libellulidae	✓	✓
Lymnaeidae	X	✓
Muscidae	✓	✓
Naucoridae	✓	✓
Nepidae	✓	✓
Notonectidae	✓	✓
Oligochaeta	✓	✓
Physidae	✓	✓
Planorbinae	✓	✓
Pleidae	✓	✓
Potamonautidae	✓	✓
Psychodidae	X	✓
Simuliidae	✓	✓
Sphaeriidae	✓	✓
Tabanidae	✓	✓
Tipulidae	X	✓
Turbellaria	✓	✓
Uniondale	X	✓
Veliidae/Mesoveliidae	✓	✓

Table 4: Summary of the ecological status of the sub-quaternary (SQ) catchment reach associated with the freshwater ecosystems in proximity of the study area based on the DWS RQS PES/EIS dataset.

Ecological status	C11F-01491 (Unnamed tributary of Xspruit River)	B11A-01369 (Olifants River)
Synopsis		
PES Category Median	C (Moderately Modified)	C (Moderately Modified)
Mean EI class	Moderate	Moderate
Mean ES class	Moderate	High
Length	18.95	3.00
Stream order	1	2
Default EC[4]	(Moderate (C)	High (B)
PES Details		
Instream habitat continuity MOD	Moderate	Small
RIP/wetland zone continuity MOD	Moderate	Small
Potential instream habitat MOD activities	Moderate	Moderate
Riparian/wetland zone MOD	Moderate	Small
Potential flow MOD activities	Moderate	Moderate
Potential physico-chemical MOD activities	Small	Serious
EI Details		
Fish spp/SQ	4.00	6.00
Fish average confidence	1.00	1.00
Fish representivity per secondary class	Low	Low
Fish rarity per secondary class	Low	Low
Invertebrate taxa/SQ	39.00	48.00
Invertebrate average confidence	1.00	2.58
Invertebrate representivity per secondary class	High	High
Invertebrate rarity per secondary class	Low	High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Low	High
Habitat diversity class	Moderate	Very Low
Habitat size (length) class	Low	Very Low
Instream migration link class	High	Very High
Riparian-wetland zone migration link	High	Very High
Riparian-wetland zone habitat integrity class	High	Very High
Instream habitat integrity class	High	High
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Very high	Very High
Riparian-wetland natural vegetation rating based on expert rating	Low	High
Fish physical-chemical sensitivity description	Moderate	High
Fish no-flow sensitivity description	Moderate	High
Invertebrates physical-chemical sensitivity description	Very high	Very High
Invertebrates velocity sensitivity	Very high	Very High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	Low	High
Stream size sensitivity to modified flow/water level changes description	Low	Low
Riparian-wetland vegetation intolerance to water level changes description	Low	High

4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

4.1 Freshwater Ecosystem Characterisation and Delineation

The desk-based delineation and ground truthing confirmed the presence of numerous freshwater ecosystems that are distributed in most parts of the study area and within the associated investigation area. These freshwater ecosystems were confirmed to all be wetlands. The three confirmed wetland hydrogeomorphic (HGM) forms are:

- Seep wetlands;
- Unchannelled Valley Bottom wetlands and
- Channelled Valley Bottom wetlands.

The freshwater ecosystems identified were classified according to the Classification System (Ollis *et al.*, 2013) as Inland Systems. The freshwater ecosystems fall within the Highveld Aquatic Ecoregion and the Mesic Highveld Grassland Groups 3 and 4 WetVeg (wetland vegetation) groups, classified by Mbona *et al.* (2015) as "Least Concern". At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System, the systems were classified as per the summary in Table 5, below. The freshwater ecosystems are depicted in the maps in Figures 18-20 below.

Table 5: Characterisation at Levels 3 and 4 of the Classification System (Ollis *et al*., 2013) of the freshwater ecosystems associated with the Phefumula Emoyeni One Grid Connection study and investigation areas.

Freshwater Ecosystem HGM Type	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) Type
Channelled Valley Bottom Wetland	Valley floor—the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	A mostly flat wetland area located along a valley floor, characterised by the presence of an active channel running through it.
Unchanneled Valley Bottom Wetland	Valley floor—the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	A mostly flat wetland area located along a valley floor, but without the presence of a defined active channel running through it. Diffuse flow paths dominate in this HGM type.
Seep Wetland	Slope-an inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	A wetland area located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope.

It should be noted that dashboards below present the finding of the detailed assessment of wetlands in the study area. Despite the high density of wetlands associated with the study area, an attempt was made to assess as many individual wetland units as possible in terms

of the determination of PES, EIS, ecoservices and RMO / REC. There were instances however when first order tributaries (seeps) located very close together were collectively assessed.

4.2 Freshwater ecosystem: Site Verification Results

The study area is located within the context of the north-eastern highveld and is thus relatively high-lying with altitudes ranging from around 1680m to just over 1800m asl. From a wider drainage and surface water occurrence perspective the study area is of significance as it is located in a wider area in which two large regional rivers rise. This wider area contains parts of the headwaters of the Olifants (Lepelle) and Vaal Rivers. The study area straddles the catchment divide between the Olifants (drainage to the north) and Vaal Rivers (drainage to the south), and the study area thus straddles the continental divide, with drainage to the north flowing into the Indian Ocean via the Olifants River and Limpopo Rivers and drainage to the south flowing into the Atlantic Ocean via the Vaal and Orange Rivers. The study area accordingly falls over two quaternary catchments, with most the study area being located in the C11F catchment which comprises of parts of one of the uppermost catchments of the Vaal River and the remainder in the north-west part of the study area being located in the B11A catchment which is one of the uppermost catchments of the Olifants River, as drained by the headwaters of the Olifants River.

The nature of the terrain and soil and geological characteristics are the main drivers of freshwater occurrence and typology in the study area. The predominant geology of the wider area is characterised by sandstone and shales of the Vryheid Formation of the Ecca Group - sedimentary geology belonging to the Karoo Supergroup which characterises much of the interior of South Africa and the Mpumalanga Highveld. Such geology is typically associated with gently to moderately undulating terrain which is largely characteristic of the wider area. However, parts of the Grid Connection study area are typified by significant intrusions of Karoo dolerite, an igneous rock of much greater resistance to weathering than the dominant sedimentary rocks of the Ecca Group. The Karoo dolerites consist of a network of dolerite sills, sheets and dykes, which have intruded into the sedimentary geology.

The presence of igneous geology such as dolerite often leads to the formation of vertic and melanic soils – soils of highly clayey character that are typified by their distinctive swelling and shrinking characteristics in response to wetting and drying. Accordingly, the entire study area, is characterised by the Ea23 land type. Ea land types are characterised by high base status, dark coloured and/or red structured soils, usually of clay texture, associated with basis igneous rocks (Job *et al*, 2019). In Ea land types more than half of the land surface is covered by vertic,

melanic or red structured diagnostic horizons. Duplex soils or exposed rock may cover significant portions of the land surface, but vertic, melanic or red structured horizons are dominant (Job *et al,* 2019).

The Ea23 land type is strongly typified by the presence of vertic clay soils, especially in lower-lying parts of the landscape. As such the vast majority of the valley bottom terrain unit within this land type consists of vertic soil forms, particularly the Rensburg Soil Form, which can be a wetland-related soil form. Vertic soils are still predominant on the hillslopes within this land type, but other poorly draining clayey soil forms (e.g. Valsrivier and Bonheim) are present. From a wetland / hydromorphic soils perspective the occurrence of the Kroonstad Soil Form in approximately 20% of the hillslope terrain form is strongly indicative of the presence of wetlands as the Kroonstad soil form is a distinctive wetland soil form. Clay soils continue to dominate on the midslopes with the increasing presence of weathered or hard rock, and with an absence of soils displaying signs of wetness. Accordingly, from an analysis of the Ea23 land type, wetlands are mostly like to occur in bottomlands and to a lesser extent on footslopes, which was borne out by observations during the site visit where the Rensburg soil form was noted to be dominant in many valley bottom wetlands.

Observations from the field assessments indicate that melanic and primarily vertic soils are dominant in the valley bottoms across most of the wider WEF study area. This means that the dominant soil form in most of the valley bottom wetlands in the study area is the Rensburg Soil form, as evident in many exposed soil profiles along wetland channel banks in the wider area. Wetlands in vertic soil settings show certain distinctive characteristics – valley bottom wetlands and seeps are predominantly channelled, with the wetland often being narrow in lateral extent and with the wetland habitat with the entire later extent of the wetland often being limited to the confines of a single thread channel. This characteristic is often exacerbated by erosion with the vertic soils being highly erosive.

The moderately undulating terrain setting, with the presence of an east-west aligned high line (catchment divide) away from which surface flows drain southwards and northwards within shallow valley heads has resulted in a relatively high drainage density in the study area. Accordingly seeps are very common on the sloping ground in the upper slopes and valley heads within the higher lying, sloping ground that is located on either side of the Olifants-Vaal catchment divide in the study area. Such seeps are typically relatively narrow, often channelled features (as described above), with most seeps having experienced a degree of erosion.

Valley bottom wetlands in the wider area are generally narrow features with the absence of extensive lateral wetland habitat beyond the relatively incised wetland channel. This is true of many of the valley bottom wetlands crossed by the proposed OHPL corridors. The unchanneled systems were generally more extensive in terms of lateral wetland habitat, and often displayed wetland characteristics along the entire extent of the valley bottom.

Vegetatively, the study area is located within the grassland biome and accordingly wetlands are largely graminoid-dominated, with the occurrence of forbs and herbs, many of which are annual in nature. *Phragmites australis* reedbeds and *Typha capensis* are present in areas of permanent saturation (i.e. dams in the context of the study area). Many seeps were noted to be dominated by stands of *Imperata cylindrica.*

Freshwater ecosystems in the wider area are subject to a number of impacts, the most prominent of which is the transformation of wetland habitat and the hydrological and geomorphological alteration caused by the impounding (damming) of seeps and valley bottoms. Most of the larger valley seep wetlands in the study area have been dammed, with a cumulatively large area of wetland habitat having been transformed to open water habitats. The effects of such impounding features are pronounced in many wetlands where there is a clear vegetative response to increased wetness upstream of the impounding structure and much drier conditions downstream of it as insufficient water is allowed to bypass under the impounding structure. In the wider WEF area excessive erosion was noted in many places downstream of roads and dams, a likely geomorphological response to the depriving of sediment to the downstream reach by the impounding structure.
been infested with alien invasive vegetation such as poplars (*Populus sp*.)

Despite these varying impacting factors, wetlands in the study area perform several critically important ecosystem services, most notably of which is streamflow regulation, flood control, biodiversity maintenance and provision of critical resources to sustain parts of the rural economy in terms of livestock grazing and provision of water for irrigation. In a fragmented context of landuse related natural habitat transformation, wetlands provide highly important ecological corridors and linkages between residual areas of natural habitat.

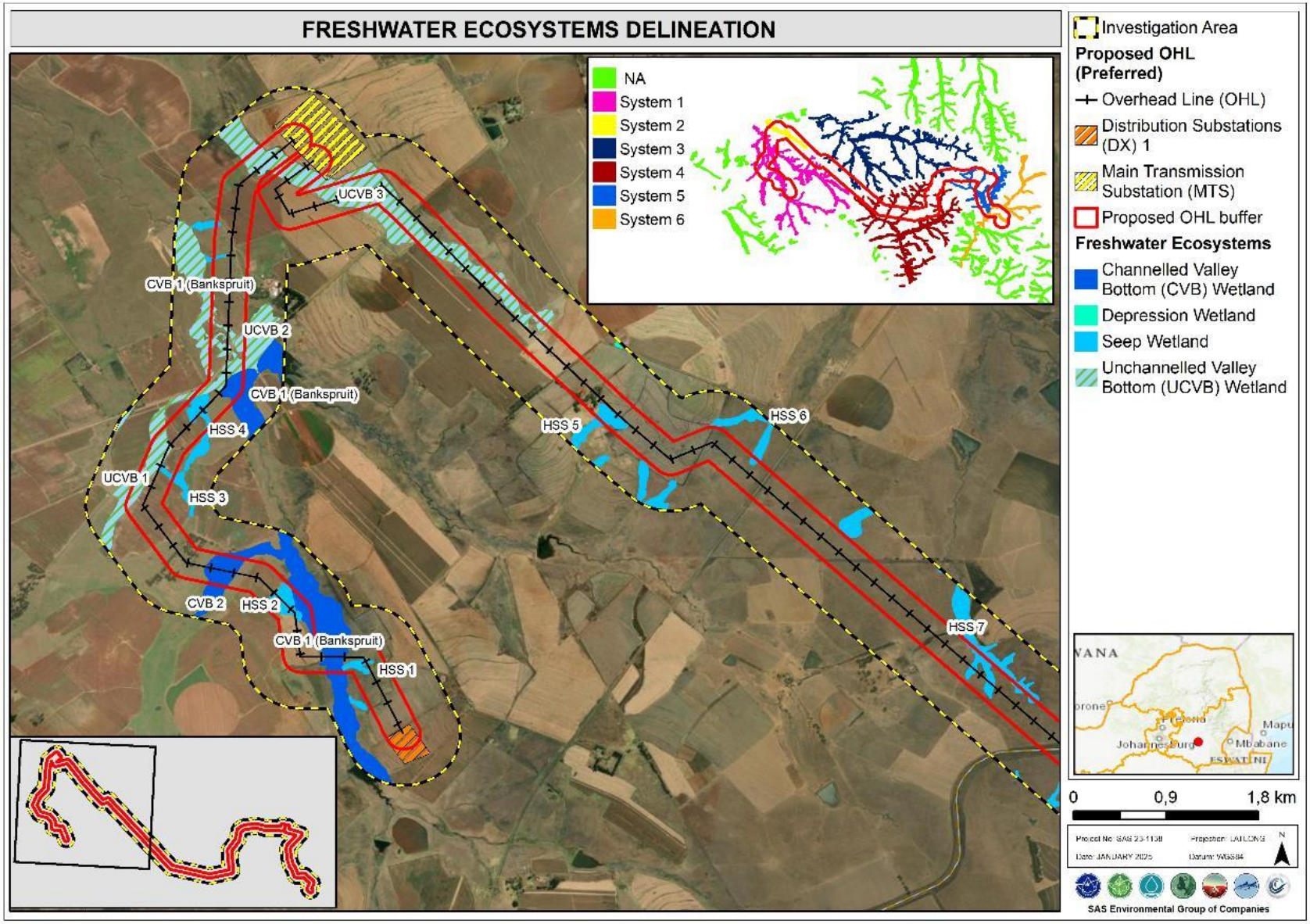


Figure 18: Delineated freshwater ecosystems associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area.

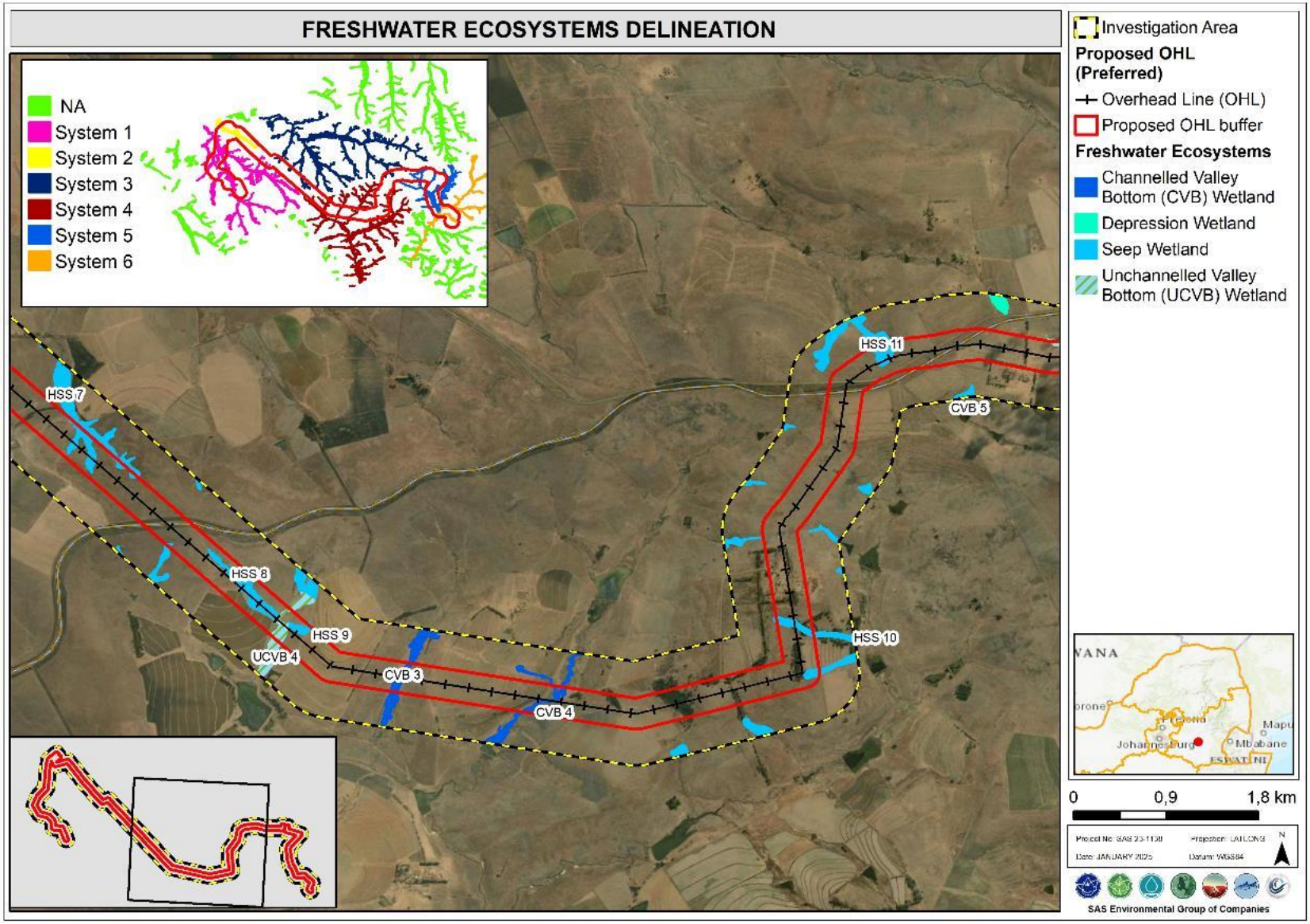


Figure 19: Delineated freshwater ecosystems associated with the Phefumula Emoyeni One Grid Connection infrastructure study and investigation areas.

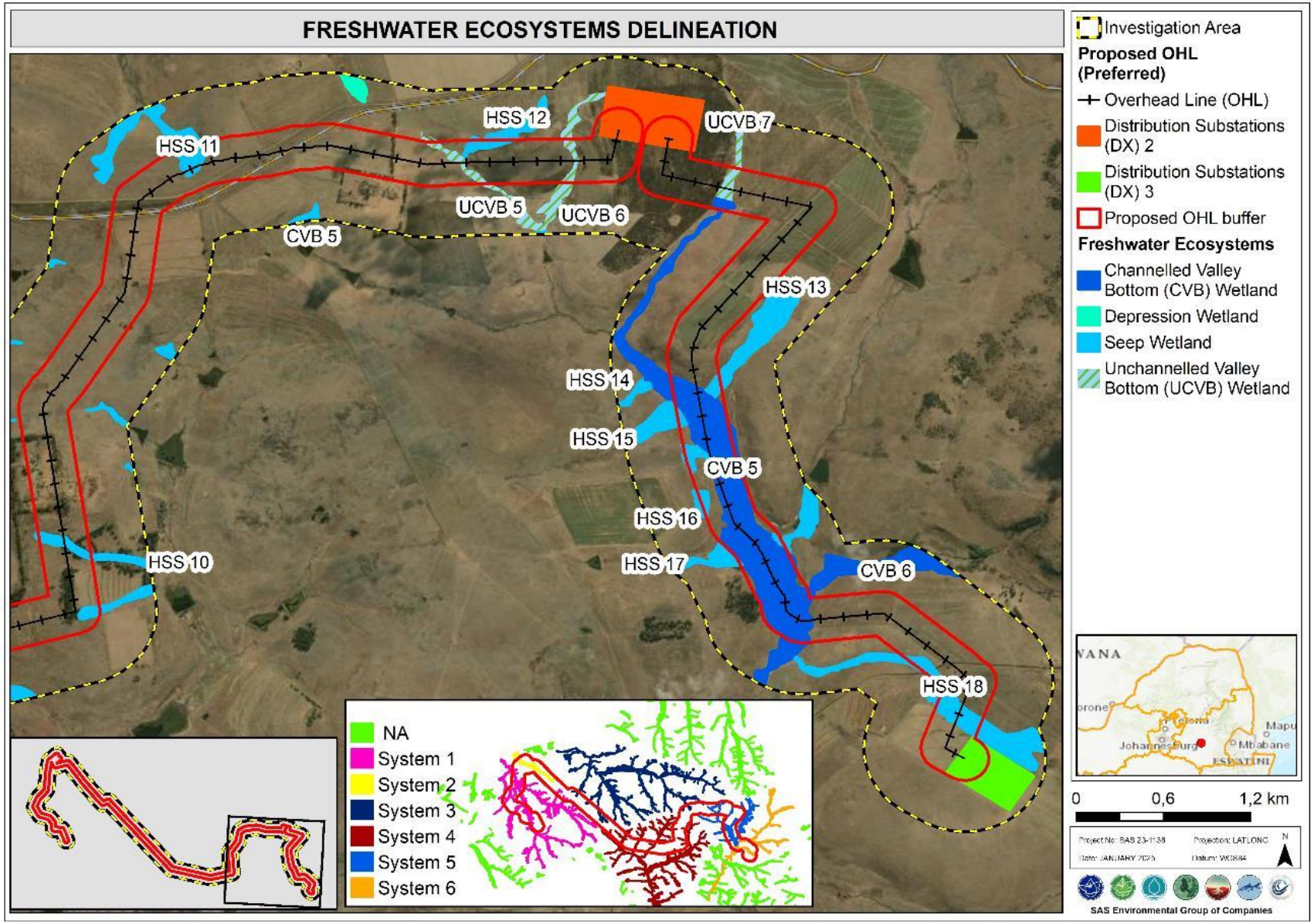


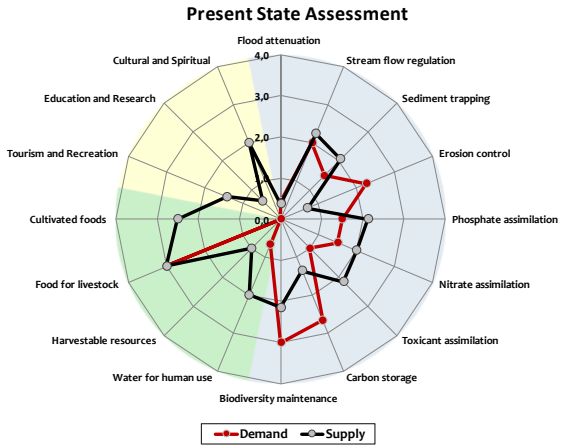
Figure 20: Delineated freshwater ecosystems associated with four road crossing structure upgrades.

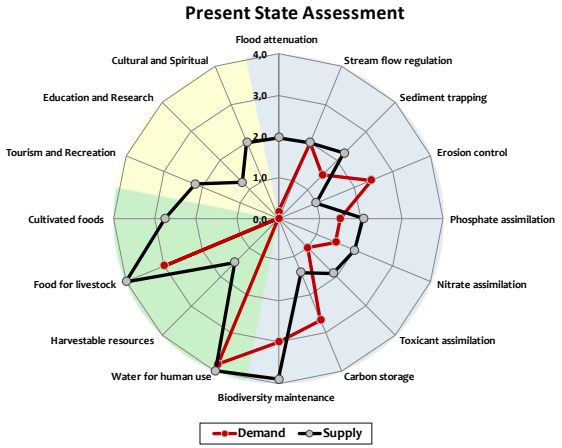
Table 6: Summary of the assessment of the wetlands in System 1.

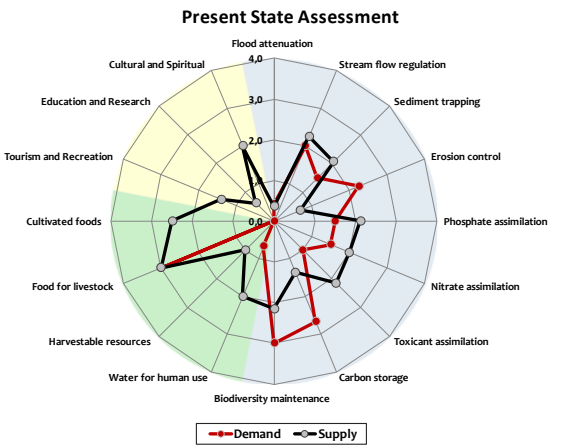


Photograph notes: Left: Representative photograph of a seep wetland (HSS 2) that feeds into the Bankspruit**; Centre:** Representative photograph of the Bankspruit CVB wetland**; Right:** Representative photograph of one of the UCVB wetlands (UCVB 1).

Ecological & socio-cultural service provision graphs:







Left: Seep wetlands**; Centre:** CVB wetlands**; Right:** UCVB wetlands.

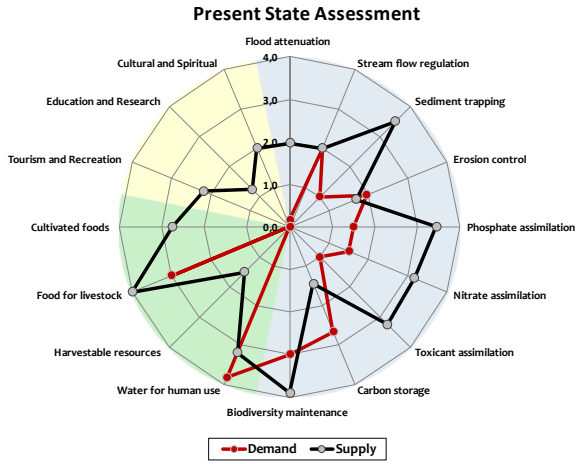
PES discussion

Seeps: PES Category: B or C; CVBs: PES Category D; UCVBs: PES Category D.

The PES scores of the Seep wetlands in System 1 ranges between largely natural and moderately modified, and remains largely intact, apart from their catchment areas, which are largely cultivated. The CVBs are considered largely modified, as these wetlands are significantly affected by overgrazing. Especially the Bankspruit portion assessed was found to be heavily incised, and the banks are trampled

<table>
<tr><td></td><td colspan="3">as a result of frequent cattle activity in the wetland. The CVBs are also affected by upstream dams which deprive the downstream valley bottom wetland units of flows in the drier parts of the year. Cattle grazing and browsing is a universal landuse-related modifier in the wetlands. Certain of the wetland units (i.e. UCVB 1) were subject to some AIP proliferation (i.e. Salix babylonica). Despite these modifiers, wetland habitat in many parts of the wetland reaches is still intact.</td></tr>
<tr><td>EIS discussion</td><td colspan="3">EIS Category: CVBs – High; All other wetlands - Moderate
The EIS of the Seep and UCVB wetland units within System 1 has been assessed to be “Moderate”, whilst the CVB wetlands is rated to be of “High” EIS. The higher score for the CVB wetlands is due to their larger size and greater diversity of habitat types in the landscape. The highest ranking aspect of EIS is the biodiversity and ecological value of the wetland units, being located in a FEPA catchment, and the potential utilisation of the seeps by bird Species of Conservation Concern (SCC). The landscape context is also important with freshwater ecosystems in the Mesic Highveld Grassland 3 freshwater ecosystem not being protected. Hydro-functional importance (i.e., provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control) supplied by the wetlands is of lower significance, due the relatively narrow lateral extent of the seeps and the channelled, relatively incised characteristics of the CVB wetland units, however streamflow regulation is locally important as supplied by the seep wetland units. The primary aspect of socio-cultural importance is the provision of year round grazing resources for cattle and the provision of water for such livestock.</td></tr>
<tr><td>Ecoservice Provision</td><td>Seeps & UCVBs: Food for Livestock –High;
CVBs: Biodiversity Maintenance & Water for human use – Very High;
All other services – Moderate to Very Low.
Food for livestock has been assessed to be the most significant provisioning service for the Seep and UCVB wetlands. Biodiversity maintenance also represents an important service, especially regarding the CVB wetlands due to their larger size and greater diversity of habitats. In addition, the biodiversity importance relates to the presence of these wetlands at the head of a FEPA catchment and their importance as a source of water for biota, as well as providing habitat that would be likely to be utilised by certain avifaunal SCC. Lastly the presence of active seepage within certain of the seeps is largely responsible for the streamflow function. Due to their location at the uppermost part of the wider drainage system, other regulating services such as flood attenuation and sediment trapping are less able to be provisioned by these wetland units. Cultural services are low in importance as the wetlands are located on privately owned property.</td><td>REC, RMO & BAS Category</td><td>REC Category: Various; RMO: CVBs - Improve ; All other wetlands – Maintain; BAS: Maintain
Since the Seep and UCVB wetland units have been assessed to have a moderate EIS rating, the ecological condition of these wetlands must be maintained. The high EIS rating of the CVB wetlands together with their largely modified PES leads to the preferred RMO to improve the PES of these wetlands. However, given the agricultural landscape setting of the CVB wetlands, and the involvement of multiple stakeholders in the management of the wetlands, it may not be practical to realistically improve the PES of these wetlands. At the very least however, the PES of the CVB wetlands must not be allowed to deteriorate further. This entails that development associated with the grid should carefully consider the impact on the wetlands to ensure that the ecological state of the wetland units does not become degraded due to the proposed grid (powerline) development. Accordingly the recommendations made in Section 7 are important to ensure realisation of the REC.</td></tr>
<tr><td colspan="4">Freshwater ecosystem drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):</td></tr>
<tr><td colspan="4">The Seep wetlands of System 1 are located within shallow upper valley heads, which then transitions into the UCVB wetlands on flatter terrain. Both these HGM units are typically characterised by very diffuse flows. The seep wetlands have no terrestrial buffer area as most of the terrestrial habitat outside the wetland habitat have been transformed for crop cultivation. It is expected that the original extent of the wetlands were once much larger before cultivation activities commenced in the area. Some of the seep wetlands are expected to be augmented by agricultural runoff, in cases where the crops are irrigated. No headcut erosion was noted to be present in the seep and UCVB wetlands and these were assessed to be largely geomorphologically stable. Both CVB wetland units were noted to have a relatively incised channel with limited lateral wetland habitat beyond the channel. This is particularly true for the Bankspruit CVB wetland. Trampling is also a major issue in the Bankspruit wetland, and which exacerbates gully and headcut erosion in the wetland. The hydrology of the CVB wetlands has been modified by impoundments which have changed the wetness regimes of both upstream and downstream parts of the wetlands, with some reduction in wetness downstream of the dam. Vegetatively the wetland units took the form of a moist grassland with herbaceous species such as Cyperus erectus, Juncus oxycarpus, Pennisetum thunbergii as well as a number of Helichrysum, Paspalum, and Setaria species being common throughout. Indigenous woody species are absent from these wetlands. A suite of fauna typical of the grasslands in the area is expected to be present in the wetland units.</td></tr>
<tr><td>Extent of modification anticipated</td><td colspan="3">All wetlands within System 1 are likely able to be spanned as the alignment of the proposed powerline is oriented perpendicularly to the direction of flow in most of the wetlands. Careful attention must be paid to the area near UCVB 1 and within CVB 1 (Bankspruit) near the road crossing however, as spanning these portions of the wetlands will be challenging considering the current layout. It would also be preferable to place support structures further away from the dams inside UCVB 1 and CVB 1. Providing no access roads are developed through the wetlands, and providing that the construction of the lines is conducted in a manner that results in no physical alteration of wetland habitat, the development of the powerline should not result in direct impacts on these wetlands.</td></tr>
<tr><td colspan="4">Impact Significance & Business Case:</td></tr>
<tr><td>Low</td><td colspan="3">The risk assessment has assigned a low degree of impact to the powerline development on these wetland units. This low impact is however premised on no towers being placed within the wetlands and that construction would not result in any direct habitat loss or transformation. It is thus highly important that the mitigation measures as proposed are implemented by the proponent.</td></tr>
</table>

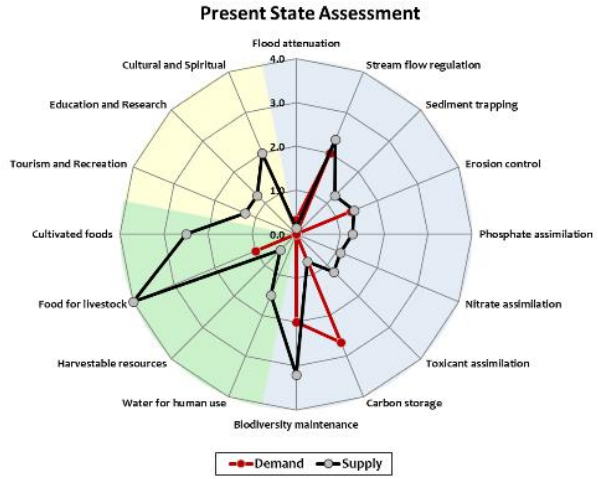
Table 7: Summary of the assessment of the UCVB wetland representing System 2.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td colspan="3">  
Photograph notes: Left: A portion of the UCVB wetland near the proposed MTS; Right: View of the larger instream dam inside the portion of UCVB 3 inside the OHPL corridor.</td></tr>
<tr><td>Ecoservice provision</td><td colspan="4">Food for Livestock, Biodiversity Maintenance and Water for Human Use –High
All other services – Moderate to Very Low
The most prominent ecoservice provided by the wetland is food for livestock, and is extensively utilised for this purpose. In contrast to some of the other wetlands (i.e. CVB systems) in the area, this wetland appears to be able to handle the stocking rates and does not show signs of overgrazing. The system also supports a moderately sized instream irrigation dam. Due to its large size, the UCVB wetland is expected to contribute significantly to biodiversity maintenance, and provide a large movement corridor amongst the cultivated areas. It is likely that the wetland provides habitat that would be utilised by certain avifaunal SCC. As a large system with mostly diffuse flow, the wetland is also expected to contribute to nutrient and toxicant assimilation, in light of the relatively high demands posed by the agricultural activities surrounding the wetland. Cultural services are low in importance as the wetlands are located on privately owned property.</td></tr>
<tr><td>PES/ discussion</td><td colspan="4">PES Category: C
The PES score of the UCVB wetland is given as moderately modified. Modifying features include cattle grazing, the instream dam with associated downstream flow reduction and deep flooding of wetland vegetation, augmentation of flow from the adjacent crop fields as well as road infrastructure crossing the wetland. Despite these features, the wetland remains ecologically functional, and is not subject to the severe levels of erosion that some of the other wetlands in the area are (i.e. the Bankspruit). It is not thought that the density of cattle and resultant grazing pressure is of a high enough intensity to adversely affect the wetland vegetation. AIP density was found to be low overall, except in areas in the dam footprint and near the dirt roads surrounding the maize fields.</td></tr>
<tr><td>EIS discussion</td><td>EIS Category: High
The EIS of the UCVB is considered high. The highest ranking aspect of EIS is the biodiversity and ecological value of the wetland unit, being located in a FEPA catchment, and the potential utilisation by bird Species of Conservation Concern (SCC). The landscape context is also important with freshwater ecosystems in the Mesic Highveld Grassland 3 freshwater ecosystem not being protected. Hydro-functional importance (i.e., provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control) supplied by the wetland is also of significance, due the largely diffuse flows in the</td><td>REC, RMO & BAS Category</td><td colspan="2">REC Category: B
RMO: B/C Improve
BAS: C (Maintain)
Since the wetland has been assessed to be in a moderately modified state, but with a high EIS rating, the RMO of the wetland is technically to improve the PES thereof. However, as discussed for System 1 above, given the agricultural landscape setting of the UCVB wetland, and the involvement of multiple stakeholders in the management of the wetlands, it may not be practical to realistically improve the PES of this wetland. At the very least however, the PES of the UCVB wetland must not be allowed to deteriorate further. This entails that development associated with the grid should carefully consider the impact on the wetland to ensure that the ecological state of</td></tr>
</table>

	wetland. The primary aspect of socio-cultural importance is the provision of year round grazing resources for cattle and the provision of water for such livestock.		the wetland does not become degraded due to the proposed grid (powerline) development. Accordingly the recommendations made in Section 7 are important to ensure realisation of the REC.
Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):			
The powerline route in this area is proposed to traverse a wide gently sloping valley which is drained by the UCVB wetland. The UCVB wetland has a medium sized catchment and is hydrologically characterised by lateral inputs from the adjacent valley footslopes rather than overbank topping. It was noted from satellite imagery that some sections of the wetland upstream of the instream dam does display some disjunct channelling, but these were not considered extensive enough to justify the wetland's classification as a channelled system. At the time of the field assessment in February 2025, these channels could not be readily distinguished, but were completely covered with vegetation. It is expected that the wetland is significantly augmented by runoff from the adjacent crop fields, in particular the field directly north of the wetland, which is under irrigation. The wetland as a whole was noted to be well vegetated and highly geomorphologically stable. A diverse assemblage of grasses and especially sedges occurs within the wetland. Herbaceous species such as *Cyperus erectus*, *Juncus oxycarpus*, *Pennisetum thunbergii* as well as a number of *Helichrysum, Paspalum*, and *Setaria* species were common throughout. Indigenous woody species are absent. A suite of wetland and aquatic fauna is expected to be present in the UCVB channel, although aquatic fauna is expected to be more limited in this wetland (compared to the CVB wetlands in the area) due to limited surface water outside the flooded area of the dam. Water in the UCVB was not tested, however it is expected that agricultural runoff from the adjacent crop fields would have some impact on the quality of surface water (if present).			
Extent of modification anticipated	If it is assumed that the current powerline route is accepted, some direct impacts on the UCVB wetland is considered likely. The powerline route crosses the system several times, and not all of these crossings are perpendicular to the streamflow. A length of the powerline route runs parallel to the longitudinal direction of the wetland, and in this case it is considered impractical to locate all support structures outside the delineated extent of the wetland. In this case, some moderate modification to the wetland is expected, more so if access roads need to be made inside the wetland habitat, which is considered likely with the current powerline route layout. Furthermore, a small section of the MTS footprint encroaches on the wetland, which is expected to result in habitat loss and degradation in this area.		
Risk Assessment Outcome & Business Case:			
Medium	The risk assessment has assigned a 'Medium' degree of impact to the powerline development on this wetland unit. This medium impact is attributed to the likelihood that at least some of the support structures would have to be placed within the wetland and construction would therefore result in direct habitat loss. A small portion of the MTS is also located in the wetland, and although the total habitat loss within the footprint area is very small, the risks associated with potential habitat degradation in this area is considered to be 'Medium' due to the proximity of the infrastructure to the wetland. It is highly important that the mitigation measures as proposed are implemented by the proponent.		

Table 8: Summary of the assessment of the wetlands representing System 3

Ecological & socio-cultural service provision graph:



Ecoservice provision	**Biodiversity Maintenance and Food for Livestock– High; Streamflow Regulation – Moderate;** **All other services – Low or Very Low** The supply value for Biodiversity Maintenance is higher than the demand value for these seep wetland units, which is reflective of their relatively unmodified state. Biodiversity importance relates to the presence of certain of these wetlands at the head of a FEPA catchment and their importance as a source of water for biota, as well as providing habitat that would be likely to be utilised by certain avifaunal SCC. The provisioning of food for livestock score is similarly reflective of a higher level of supply than demand, but the wetlands are locally important for providing grazable plants, as well as a supply of water for livestock. Lastly the presence of active seepage within certain of the seeps is largely responsible for the streamflow function. Such groundwater seepage occurs at times of the year when no other sources of water input into the streams and are responsible for maintaining any form of baseflow into the downstream wetland systems. Due to their location at the uppermost part of the wider drainage system, other regulating services such as flood attenuation and sediment trapping are less able to be provisioned. Cultural services are low in importance as the wetlands are located on privately owned property.

Photograph notes: **Left**: *Andropogon eucomus* grass within HSS 11 that is located at the head of the Olifants River catchment close to the continental divide with a catchment comprising of residual natural grassland underlain by doleritic geology; **Top right**: Most of the seeps in this area displayed headcut erosion, exacerbated by overgrazing; **Bottom right**: Channelised portion of a seep in this area with the shallow sandstone bedrock exposed as the channel bed. All the wetlands presented below as part of System 3 were assessed by SAS as part of the June 2024 freshwater assessment.

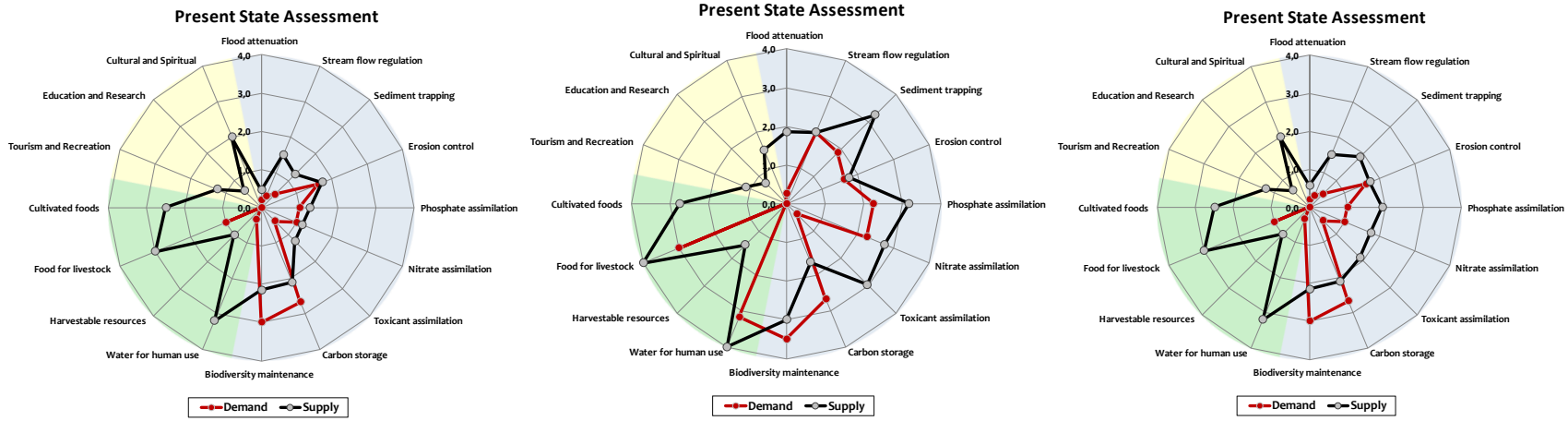
PES/ discussion	**PES Category: B or C** At an overall quaternary catchment level, the seep wetlands were assessed to be in a moderately modified condition, with HSS 11 (in the Olifants River catchment) being largely natural. None of the seeps were dammed or impounded, and the grazing effects by livestock on the seep wetlands, along with trampling of saturated soils is the single most significant modifier of these seeps. Livestock tend to graze vegetation in parts of the seeps which are characterised by saturated soils or seepage as the vegetation stays greener for longer at the end of summer and grows faster in the spring, which results in disturbance of soils. In a sloping setting, knickpoints can develop and certain wetland units were characterised by such incision and lateral erosion, resulting in desiccation and loss of wetland vegetation. Despite this factor a large portion of the wetland units retained natural vegetative composition.

EIS discussion	**EIS Category: Moderate** The EIS of all seep wetland units representative of System 3 has been assessed to be "Moderate". The highest ranking aspect of EIS is the biodiversity and ecological value of the wetland units, with those seeps in the Vaal River catchment being located in a FEPA catchment, and the potential utilisation of the seeps by bird Species of Conservation Concern (SCC). Hydro-functional importance (i.e., provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control) supplied by the wetlands is of low significance, due to their location at the very top of the catchment, however streamflow regulation is locally important as supplied by certain of the seep wetland units. The primary aspect of socio-cultural importance is the provision of year round grazing resources for cattle and the provision of water for such livestock.	**REC, RMO & BAS Category**	**REC Category: B or C** **RMO: Maintain** **BAS: B or C (Maintain)** Since the seep wetlands have been assessed to be in moderately modified state with a moderate EIS rating, the ecological condition of these wetlands must be maintained. This entails that development associated with the grid connection infrastructure in the catchment of the reaches of the wetlands and within the wetlands themselves should carefully consider the impact on the wetlands to ensure that the ecological state of the wetlands does not become further degraded due to the proposed development. Accordingly the recommendations made in Section 7 are important to ensure realisation of the REC.
Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):			
Slope and substrate are the key drivers of these wetlands; the ground slopes relatively steeply away from the interfluve on either side. This high-lying area is underlain by resistant dolerite which weathers to form vertic soils, resulting in seeps that are typically narrow and partly channelised. Certain of the seeps are characterised by groundwater seepage or discharge throughout the year. This seepage attracts livestock to the seeps and thus soils in these areas become badly trampled, with this physical disturbance of soils in a sloping setting resulting in knickpoint and resultant headcut erosion in some instances. The seeps are not dissimilar in vegetative composition to the surrounding grassland in terms of vegetative structure, but differ in terms of species composition by being characterised by plant species which can tolerate saturated soils. As these seeps do not differ markedly from the surrounding terrestrial grassland in terms of faunal biota.			
Extent of modification anticipated	The seeps traversed by the powerline corridor are mostly located at the margins of the corridor and are narrow features that drain perpendicularly to the alignment of the proposed powerline. The only direct crossing of the powerline is at HSS 7, but the crossing area is very narrow here and it is envisioned that the powerline can easily span this section of wetland. As such, provided that mitigation measures are adhered to there should be little impact associated with the development of a powerline in the corridor.		
Risk Assessment Outcome & Business Case:			
Low	All activities related to the development of the powerline route are associated with a Low degree of impact. This low impact is however premised on no towers being placed within the wetlands and that construction would not result in any direct habitat loss or transformation. It is thus highly important that the mitigation measures as proposed are implemented by the proponent.		

Table 9: Summary of the assessment of the wetlands representing System 4.

Photograph notes: Left: A representative photograph of one of the seep wetlands (HSS 8) in System 4 **; Centre:** An UCVB wetland (UCVB 4) which is fed by HSS 8**; Right:** The upper reaches of CVB 4, which was assessed in June 2024, as part of an assessment of a previous powerline route layout.

Ecological & socio-cultural service provision graphs:



Left: Seep wetlands**; Centre:** CVB wetlands**; Right:** UCVB wetlands.

PES discussion

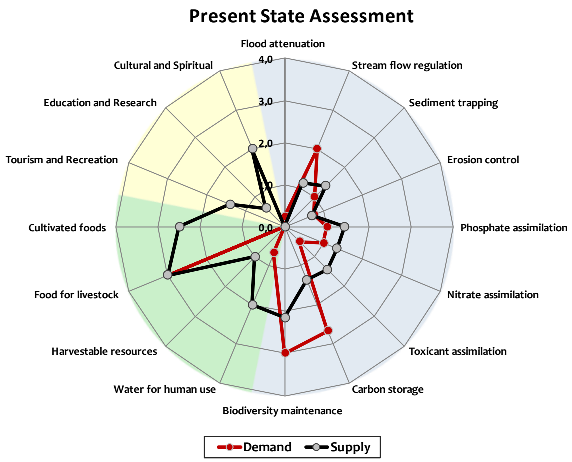
Seeps: PES Category: B or C; CVBs: PES Category B; UCVB: PES Category B.

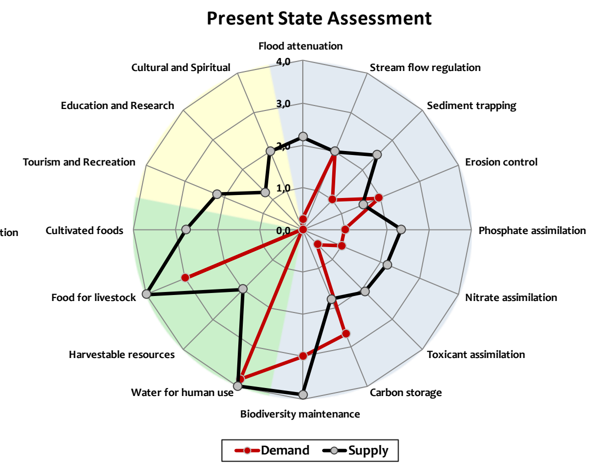
Overall, the wetland units in System 4 remain largely intact. The catchment areas of these wetlands are also less affected by cultivation activities, compared to many of the other seeps assessed (i.e. in System 1). Livestock grazing represents the main landuse in and around these wetlands. Erosion was also found to be minimal, especially for the seep and UCVB wetlands. It must be noted however, that one of the seep wetlands in System 4 (HHS 10) was significantly more modified, with dense woody AIPs along the entire length of the system, which is also expected to affect the hydrology of the system.

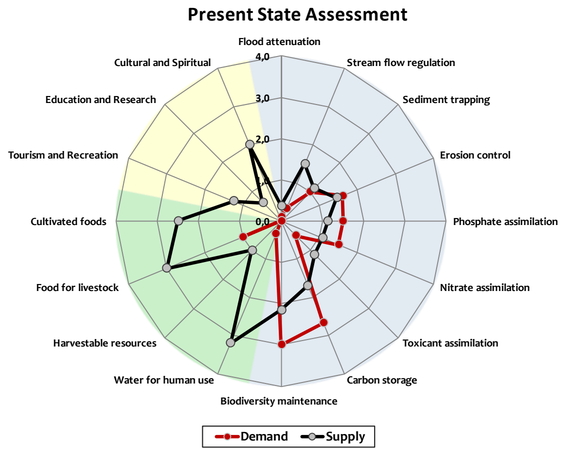
	The CVB wetlands were moderately incised, but not as severely as for some of the other CVB systems in the area. The instream components of the CVB wetlands have also been modified by small instream dams, but the effect of these features on the functioning of the wetlands as a whole is considered to be relatively small and localised.		
EIS discussion	**EIS Category: CVBs – High; All other wetlands - Moderate** The EIS of the seep and UCVB wetland units within System 4 has been assessed to be 'Moderate', whilst the CVB wetlands is rated to be of 'High' EIS. The higher score for the CVB wetlands is due to their relatively larger size and greater diversity of habitat types in the landscape. The highest ranking aspect of EIS is the biodiversity and ecological value of the wetland units, being located in a FEPA catchment, and the potential utilisation of the seeps by bird Species of Conservation Concern (SCC). The landscape context is also important with freshwater ecosystems in the Mesic Highveld Grassland 3 freshwater ecosystem not being protected.		
Ecoservice Provision	**Seeps & UCVBs: Food for Livestock, Biodiversity Maintenance –Moderate;** **CVBs: Biodiversity Maintenance, Food for Livestock & Water for human use – Very High;** **All other services – Moderate to Very Low.** The primary aspect of socio-cultural importance of all the wetlands is the provision of year round grazing resources for cattle and the provision of water for livestock. Biodiversity maintenance also represents an important service, in light of the intact nature of the wetlands encountered in System 4. The UCVB wetland in particular is expected to play a role in provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control, however the relatively small size of the wetland limits the importance of this system in providing these services at a landscape scale. Cultural services are low in importance as the wetlands are located on privately owned property.	**REC, RMO & BAS Category**	**REC Category: Various** **RMO: CVBs - Improve ; All other wetlands - Maintain** **BAS: Maintain** Since the seep and UCVB wetland units have been assessed to have a moderate EIS rating, and a PES value of B, it is recommended that the ecological condition of these wetlands be maintained. On the other hand, the high EIS rating of the CVB wetlands results in an RMO to improve the PES of these wetlands. As discussed for the other wetland systems above, the agricultural landscape setting of the CVB wetlands, and the involvement of multiple stakeholders in the management of the wetlands places a limitation on the practicality to improve the PES of these wetlands. The PES of the CVB wetlands must however at a minimum be maintained, if not improved. This entails that development associated with the grid should carefully consider the impact on the wetlands to ensure that the ecological state of the wetland units does not become degraded due to the proposed grid (powerline) development. Accordingly the recommendations made in Section 7 are important to ensure realisation of the REC.
Freshwater ecosystem drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):			
As with the wetlands in System 1, the seep wetlands associated with System 4 are located within shallow upper valley heads, which then transitions into UCVB wetlands on flatter terrain in the valley bottoms. Both the seep and UCVB HGM units are characterised by very diffuse flows. In contrast to the wetlands of System 1, the seep and UCVB wetlands of System 4 are much less affected by crop cultivation, and have a larger intact terrestrial buffer area surrounding them. These wetland units are also not affected by agricultural runoff. As such, the hydrological functioning of these systems are considered to be largely natural. No headcut erosion was noted to be present in the seep and UCVB wetlands and these were therefore assessed to be largely geomorphologically stable. Both CVB wetland units were moderately incised, but the levels of erosion in these wetland units were not considered far removed from the expected reference state. It is expected that the hydrology and geomorphological balance of the CVB wetlands may be affected to a limited degree by the presence of the small instream dams. Vegetatively the wetland units took the form of a moist grassland with herbaceous species such as *Cyperus erectus*, *Juncus oxycarpus* and *Pennisetum thunbergii*. Indigenous woody species are absent from these wetlands. A suite of fauna typical of the grasslands in the area is expected to be present in the wetland units.			
Extent of modification anticipated	It is envisioned that most of the wetlands will be easily spanned by the proposed powerline, as the crossings are perpendicular to the longitude of the stream channels. Providing no access roads are developed through the wetlands, and providing that the construction of the lines is conducted in a manner that results in no physical alteration of wetland habitat, the development of the powerline should not result in direct impacts on most of the wetlands in System 4. An exception to this is the crossing of HSS 8. The proposed powerline route runs parallel with the wetland channel for a considerable length, and in this case it may not be possible to locate support structures outside the wetland boundaries. If the powerline route cannot be moved outside the extent of this wetland, significant modification to this system is expected.		
Impact Significance & Business Case:			
Medium	The risk assessment has assigned a 'Medium' degree of impact to the powerline development over HSS 8 as it is considered unlikely that infrastructure inside the wetland habitat can be avoided given the current layout. The impact significance to the remaining wetlands in System 4 is however considered to be low, premised on the assumption that no towers are placed within the wetlands and that construction would not result in any direct habitat loss or transformation. It is thus highly important that the mitigation measures as proposed are implemented by the proponent.		

Table 10: Summary of the assessment of the wetlands representing System 5.

<table>
<tr><td colspan="2">


Photograph notes: Left: A representative photograph of one of the seep wetlands (HSS 15, in the foreground) above the CVB 5 instream dam; **Centre:** A section of CVB 5 with isolated clumps of *Salix babylonica*; **Right:** One of the UCVB wetlands (UCVB 5) which is located in an area consisting mainly of cultivated *Eragrostis teff* pastures.
</td></tr>
<tr><td>Ecological & socio-cultural service provision graphs:</td><td>




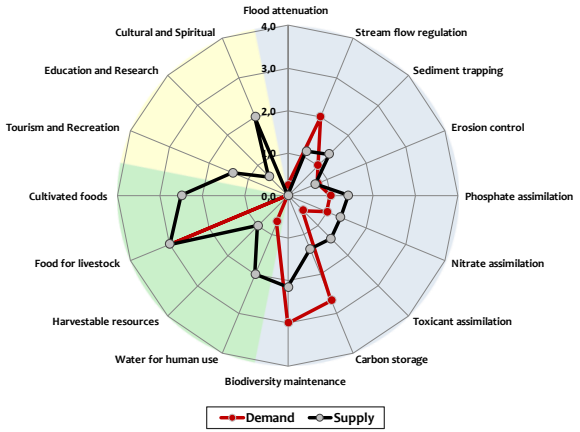


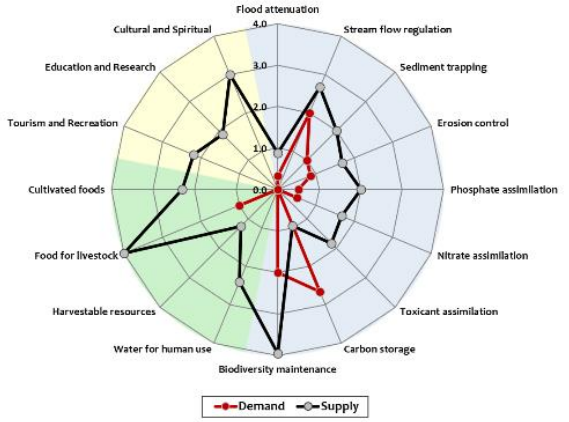
Left: Seep wetlands**; Centre:** CVB wetlands**; Right:** UCVB wetlands.
</td></tr>
<tr><td>PES discussion</td><td>
All wetlands: PES Category C.
All the wetlands assessed as part of System 5 were scored as moderately modified. The main modifying features of the seep wetlands include historical cultivation activities and the associated creation of draining canals in the wetlands, damming of some seeps and overgrazing which have resulted in the onset of headcut erosion along the upper reaches of the seeps. The UCVB wetlands are mostly
</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">associated with cultivated areas where Eragrostis teff pastures have been planted, and which have encroached on marginal portions of the wetlands. Some discard of solid waste (wire and building rubble) was also noted within some of the UCVB wetlands. A multitude of small instream dams have also been created in all the UCVB wetlands. The CVB wetland is impacted by the presence of instream dam infrastructure and AIP proliferation along sections of the wetland.</td></tr>
<tr><td>EIS discussion</td><td colspan="3">EIS Category: CVBs – High; All other wetlands - Moderate
The EIS of the seep and UCVB wetland units within System 5 has been assessed to be ‘Moderate’, whilst the CVB wetland is rated to be of ‘High’ EIS. The higher score for the CVB wetland is due to its larger size and greater diversity of habitat types in the landscape. The highest ranking aspect of EIS is the biodiversity and ecological value of the wetland units, being located in a FEPA catchment, and the potential utilisation of the seeps by bird Species of Conservation Concern (SCC). The landscape context is also important with freshwater ecosystems in the Mesic Highveld Grassland 3 freshwater ecosystem not being protected.</td></tr>
<tr><td>Ecoservice Provision</td><td>Seeps: Food for Livestock –High;
CVBs: Biodiversity Maintenance, Food for Livestock & Water for human use – Very High;
UCVBs: Biodiversity Maintenance, Food for Livestock & Water for human use – Moderate;
All other services – Moderate to Very Low.
As for most of the other wetlands assessed on site, the primary aspect of socio-cultural importance of all the wetlands in System 5 is the provision of year round grazing resources for cattle and the provision of water for livestock. Biodiversity maintenance also represents an important service, in light of the intact nature of the wetlands encountered in System 5. The UCVB wetlands in particular is expected to play a role in provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control. It is expected that the demand for these services is also heightened due to the agricultural setting of these wetlands. Cultural services are low in importance as the wetlands are located on privately owned property.</td><td>REC, RMO & BAS Category</td><td>REC Category: Various; RMO: CVBs - Improve ; All other wetlands – Maintain; BAS: Maintain
Since the seep and UCVB wetland units have been assessed to have a moderate EIS rating, the ecological condition of these wetlands must be maintained. The high EIS rating of the CVB wetland together with its moderately modified PES results in the RMO to improve the PES of this wetland. As discussed for the other wetland units above, the agricultural landscape setting of the CVB wetland, and the involvement of multiple stakeholders in the management of the wetlands places a limitation on the practicality to improve the PES of these wetlands. The PES of the CVB wetlands must however be maintained, if not improved. This entails that development associated with the grid should carefully consider the impact on the wetlands to ensure that the ecological state of the wetland units does not become degraded due to the proposed grid (powerline) development. Accordingly the recommendations made in Section 7 are important to ensure realisation of the REC.</td></tr>
<tr><td colspan="4">Freshwater ecosystem drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):</td></tr>
<tr><td colspan="4">As is applicable to the wetlands in System 1 and 4, the seep wetlands associated with System 5 are located within shallow upper valley heads, which then transitions into UCVB or CVB wetlands on flatter terrain in the valley bottoms. The UCVB wetlands were typically characterised by very diffuse flows, while many of the seep wetlands were moderately incised, especially at the upper reaches of the systems. As discussed above, the hydrogeomorphology of the seeps are adversely affected by historical cultivation activities and the associated creation of draining canals in the wetlands, instream dams and overgrazing which have resulted in the onset of headcut erosion along the upper reaches of the seeps. The immediate catchment areas of the UCVB wetlands are cultivated pastures, and as such the patterns and timing of flows in the catchment of these systems are modified. Some marginal losses of wetland habitat have also occurred due to encroachment of cultivated fields into wetland habitat. The CVB wetland is impacted by an instream dam, of which the dam wall has failed in recent years, resulting in streambed erosion. The eroded area of the broken dam wall represents a source of sediment to the downstream system. In addition, the dry dam basin is heavily invaded by herbaceous AIPs (e.g. Cirsium vulgare, NEMBA Category 1b). These impacts does however appear to be relatively localised within the dam area. The lower portions of the CVB wetland is more intact. Scattered woody AIPs (i.e. Salix babylonica and Populus × canescens) were however noted along portions of the wetland. Vegetatively the wetland units took the form of a moist grassland with herbaceous species such as Cyperus erectus, Juncus oxycarpus, Pennisetum thunbergii as well as a number of Helichrysum, Paspalum, and Setaria species being common throughout. Indigenous woody species are absent from these wetlands. A suite of fauna typical of the grasslands in the area is expected to be present in the wetland units.</td></tr>
<tr><td>Extent of modification anticipated</td><td colspan="3">It is envisioned that the UCVB wetlands will be easily spanned by the proposed powerline, as the crossings are perpendicular to the longitude of the stream channels. Providing no access roads are developed through these wetlands, and providing that the construction of the lines is conducted in a manner that results in no physical alteration of wetland habitat, the development of the powerline should not result in direct impacts on UCVB wetlands in System 5. There are no crossings of the proposed powerline route over any of the seep wetlands. Of concern is the powerline route within the vicinity of the CVB wetland. The proposed powerline route runs parallel with the system for a considerable length, and in this case it may not be possible to locate support structures outside the wetland boundaries. If the powerline route cannot be moved outside the extent of this wetland, modification to this system is expected as a result of tower placement and stringing of the powerline.</td></tr>
<tr><td colspan="4">Impact Significance & Business Case:</td></tr>
<tr><td>Medium</td><td colspan="3">The risk assessment has assigned a medium degree of impact to the powerline development over CVB 5 as it is considered unlikely that infrastructure inside the wetland habitat can be avoided given the current layout. The impact significance to the remaining wetlands in System 5 is however considered to be low, premised on the assumption that no towers are placed within the wetlands and that construction would not result in any direct habitat loss or transformation. The proposed footprint area of the DX 2 substation also encroaches on a marginal upstream portion of UCVB 6, and covers a significant portion of the wetland’s catchment. The expected risks associated with these activities on the wetland is considered to be moderate. It is thus highly important that the mitigation measures as proposed are implemented by the proponent.</td></tr>
</table>

Table 11: Summary of the assessment of the wetlands representing System 6.

Ecological & socio-cultural service provision graphs:





Top: Seep wetlands**; Bottom**: CVB wetland

Photograph notes: **Left**: The CVB wetland (CVB 6) which was assessed in June 2024, showing sandstone bedrock outcropping in a part of the channel bed of the reach; **Right**: A representation of the seep wetland in System 6 (HSS 18).

Ecoservice provision	**HSS 18: Food for Livestock –High;** **CVB 6: Biodiversity Maintenance, Food for Livestock & Water for human use – Very High;** **All other services – Moderate to Very Low.** The CVB wetland is likely to provide suitable and important habitat for the Cape Clawless Otter (*Aonyx capensis*) which is designated as NT. Both wetlands are considered important for livestock grazing. The provisioning of for livestock score is reflective of a higher level of supply than demand, but the wetlands are locally important for providing grazable plants, as well as a supply of water for livestock. The provision of services such as biodiversity maintenance is considered slightly lower than the estimated demand in the case of the seep wetland, given its lower PES value. The hydrological regulating services associated with these wetland units are lower, owing to the relatively deeply channelled nature of the CVB and the small size of the seep wetlands. Cultural services are low in importance as the wetlands are located on privately owned property with the only function being cattle grazing.
PES/ discussion	**HSS 18: PES Category: C** **CVB 6: PES Category: B** The CVB wetland drains a medium-sized catchment, but which is subject to relatively low levels of landuse-related disturbance due to much of the catchment area being characterised by vertic soils or rocky outcropping which has historically precluded the undertaking of cultivation. The catchment runoff is thus relatively natural, with limited occurrence of dense AIP trees / woodlots. Livestock (cattle) grazing occurs in the wetland units, with some impact on wetland vegetation robustness, but the impact of this, and the disturbance of vegetation by livestock trampling was noted to be low overall. The banks of the CVB wetland channel were very well vegetated and stable and no erosion was noted in any of the wetland units. The seep wetland runs adjacent a crop field, and a large section of the wetland vegetation appears to be secondary, and were likely cultivated in the past. Proliferation of herbaceous AIPs is also more pronounced in this system, particularly in the transitional zone between the modified crop field environment and the unmodified wetland habitat.

EIS discussion	**EIS Category: CVB 6 – High; HSS 18 - Moderate** The EIS of the CVB wetland unit has been assessed to be 'High' whilst the seep wetland was considered to have a 'Moderate' EIS. As with most of the other wetlands assessed on site, the highest ranking aspect of EIS is the biodiversity and ecological value of the wetlands, being located in a FEPA catchment and with the wider CVB being designated as a CBA. In addition the chances of the wetlands hosting bird Species of Conservation Concern (SCC) and threatened mammal species are deemed high. The landscape context is also important with freshwater ecosystems in the Mesic Highveld Grassland 3 freshwater ecosystem not being protected. This must be contextualised in terms of the largely natural state of the CVB wetland. Hydro-functional importance (i.e., provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control) supplied by the wetlands is of lower significance, due the relatively narrow lateral extent of the CVB and the limited size of the seep. The primary aspect of socio-cultural importance is the provision of year round grazing resources for cattle and the provision of water for such livestock.	**REC, RMO & BAS Category**	**REC Category: Various** **RMO: CVB 6 - Improve ; HSS 18 - Maintain** **BAS: Maintain** Since the seep wetland unit has been assessed to be in a moderately modified state with a moderate EIS rating, it is recommended that the ecological condition of the wetland be maintained. The high EIS rating of the CVB wetland together with its moderately modified PES results in the RMO to improve the PES of this system. As discussed for the other wetland systems above, the agricultural landscape setting of the CVB wetland, and the involvement of multiple stakeholders in the management of the wetlands places a limitation on the practicality to improve the PES of this wetland. The PES of the CVB wetlands must however be maintained, if not improved. This entails that development associated with the grid should carefully consider the impact on the wetlands to ensure that the ecological state of the wetland units does not become degraded due to the proposed grid (powerline) development. Accordingly the recommendations made in Section 7 are important to ensure that realisation of the REC.
Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):			
This location differs from most of the rest of the grid connection study area in that it is not located on high ground close to the primary catchment divide between the Vaal and Olifants River catchments. Conversely the DX 2 to DX3 powerline is proposed to traverse a wide gently sloping valley which is drained by a channelled valley bottom wetland. The CVB wetland has a medium sized catchment and is hydrologically characterised by lateral inputs from the adjacent valley footslopes rather than overbank topping. The CVB is accordingly characterised by a relatively limited lateral extent that does not extend far beyond the stream macro channel boundaries. The seep unit is located on the south-eastern side of the valley bottom on gently sloping ground. The seep is hydrologically connected to the CVB via channelled outflow. No erosion or significant deposition of sediment was noted in the CVB wetland and the channel banks of the CVB were noted to be well vegetated and highly stable. The upper reach of the seep wetland (in the powerline buffer area) was also noted to be geomorphologically stable, however, increased gully erosion was noted in this wetland below the road crossing. A diverse assemblage of grasses and especially sedges occurs within the wetlands. Within the narrow lateral area of wetland habitat on either side of the channel of the CVB, the dominant vegetation was noted to be the grass species *Pennisetum thunbergii* and stands of *Imperata cylindrica*. The seep wetland was characterised by herbaceous species such *as Cyperus erectus, Juncus oxycarpus*, *Pennisetum thunbergii* as well as *Paspalum,* and *Setaria* species. Indigenous woody species are absent. A suite of wetland and aquatic fauna is expected to be present in the CVB channel, with evidence of mammalian predators (Water Mongoose *Atilax paludinosus* and Cape Clawless Otter *Aonyx capensis*) eating freshwater mussels present along the reach. Water in the CVB was not tested as there was no flow at the time of the field assessment, however due to the absence of polluting sources in the wetland's catchment is expected to be fair.			
Extent of modification anticipated	The seep is able to be singly spanned without having to place powerline towers within the wetland, thus avoiding a direct impact. At the powerline crossing point of CVB 6, the wetland confluences with CVB 5, resulting in a broad expanse of wetland habitat in this area and this section may not be easily spanned. Some support structures may have to be placed in wetland habitat.		
Risk Assessment Outcome & Business Case:			
Medium	The risk assessment has assigned a medium degree of impact to the powerline development over CVB 6 as it is considered unlikely that infrastructure inside the wetland habitat can be avoided given the current layout. The impact significance of the proposed powerline route to the seep wetland is however considered to be low, premised on the assumption that no towers are placed within the wetland and that construction would not result in any direct habitat loss or transformation. It must be noted however that the proposed DX 3 substation is located within very close proximity to HSS 18, and indirect effects on the hydrology and vegetation components of the system is considered likely. It is thus considered highly important that the mitigation measures as proposed are implemented by the proponent.		

4.3 Freshwater Buffers

In order to offer a measure of protection to freshwater ecosystems in the study and investigation areas, non-developable buffer areas are necessary to be designated around all freshwater ecosystems in the study area. According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted however, that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

The Mpumalanga Biodiversity Spatial Plan Handbook (2014) provides guidance on freshwater buffers. In a freshwater context the handbook stipulates the following:

- For Freshwater CBAs – a buffer of 100 m should be used to buffer rivers and wetlands, unless DWS's river / wetland buffer tool has been applied;
- For ESA Important Sub-catchments and Fish Support Areas – generic buffers of 100 m should be established around streams and wetlands within these catchments; and
- For ESA Wetlands: Any further loss of area or ecological condition must be avoided, including if needed, a 100 m generic buffer around the wetland.

As detailed in section 3.1 most wetlands in the study area have been designated as ESA wetlands, with certain wetlands have been designated as CBA wetlands / rivers. Furthermore the part of the study area that is located within the Vaal River catchment falls within an ESA Important Sub-catchment. As all of these areas are associated with a 100m buffer the 100m MTPA buffer was applied as a preliminary freshwater buffer forming part of the designation of freshwater-related opportunities and constraints in the scoping phase freshwater assessment.

In order to provide a refinement of the buffer in the study the scientific buffer Guideline tool was applied to the wetlands in the study area. The buffer guideline provides an Excel™ based Buffer Zone Tool to determine suitable buffer zone requirements. The tool includes a rapid

desktop tool for determining potential aquatic impact buffer zone requirements together with a site-based tool for determining buffer zone requirements for rivers, wetlands and estuaries. Central to the tool is a buffer model, which is populated automatically from the data inputted. This is based on best available science and is used to generate buffer zone recommendations as part of the assessment process. Figure 21 below outlines an overview of the step-wise assessment process for buffer zone determination as applied through the tool. The buffer assessment was determined using site-based parameters using data collected for the (on-site) detailed assessment of freshwater ecosystems in the study area. Due to the size of the study area and different types of infrastructure proposed, certain assumptions had to be made, with the selection of roads as the worst-case (highest impact) type of development utilised. Table 12 details the results of the refined buffer assessment.

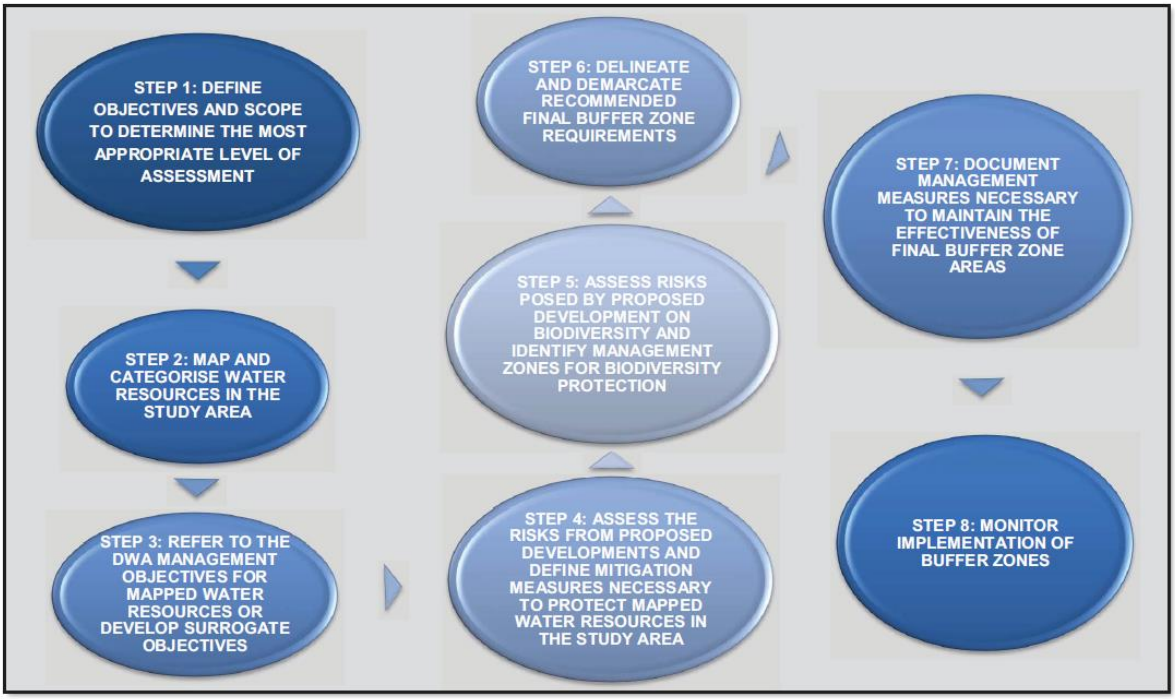


Figure 21: Overview of the step-wise assessment process for buffer zone determination as applied through the buffer tool

Table 12 - Buffers as recommended by the buffer tool for the Phefumula Emoyeni 1 Study Area wetlands

Freshwater Ecosystem	Construction phase buffer	Operational Phase buffer	Final aquatic impact buffer
Study Area wetlands (Systems 1-3)	12m	10m	**12m**
Study Area wetlands (Systems 4-6)	13m	10m	**13m**

The final aquatic impact buffer requirement is based on the maximum of the recommended buffers for the construction and operational phases and taking practical considerations into account.
A final buffer area of 13m was selected for all wetlands, following a conservative approach.. This buffer must be strictly enforced as a non-developable area within which no infrastructure or construction activities must occur if at all possible.

It should be noted that for certain activities with a higher risk of impact, especially in terms of pollution, a wider exclusion area around wetlands has been stipulated. As detailed in Section 7 below, all areas / activities that could reasonably pose a risk of pollution to freshwater ecosystems must be kept at least 100m from a wetland boundary. This applies to laydown areas and construction camps where dangerous goods or other pollutants may be stored.

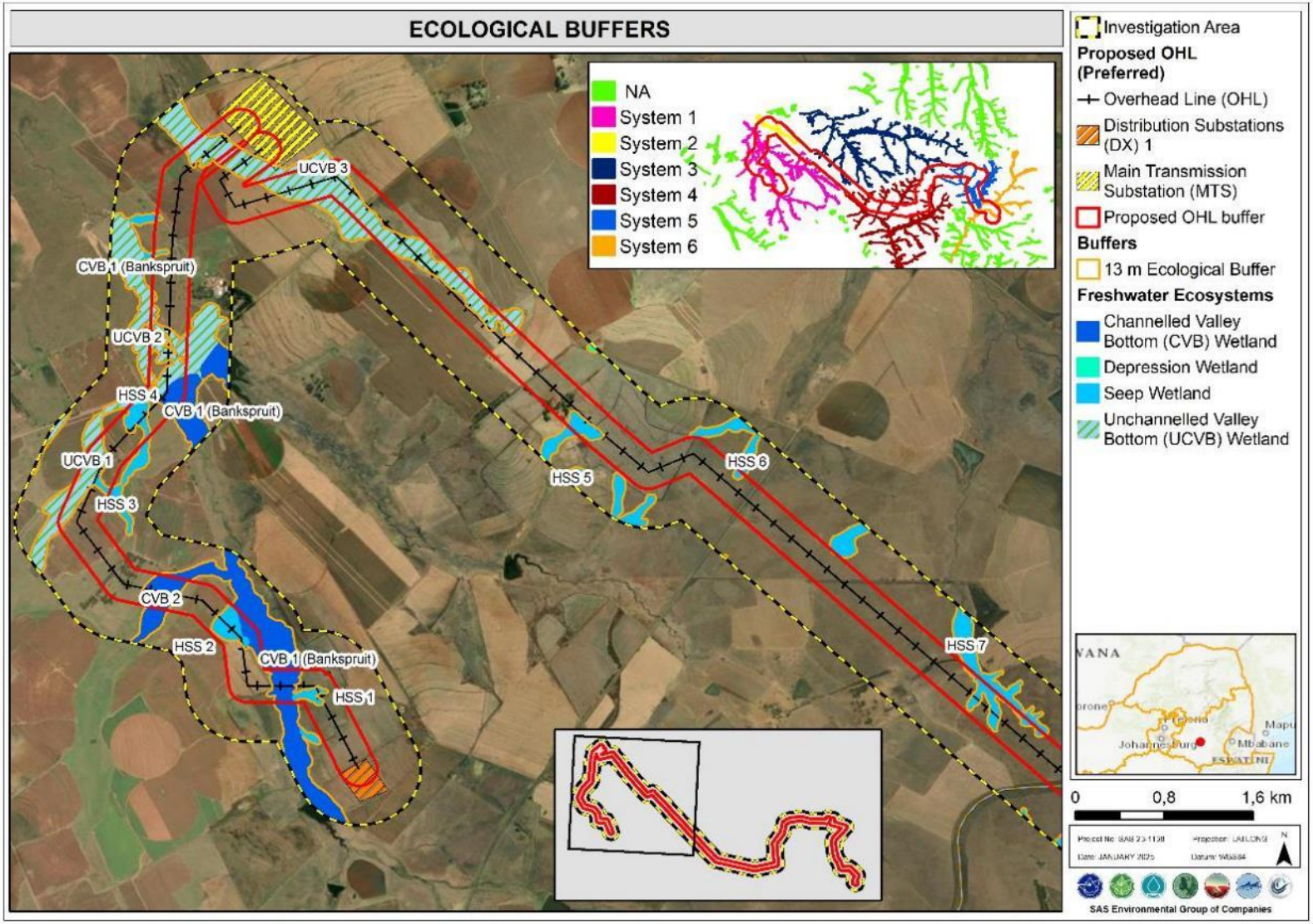


Figure 22: Buffers associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area.

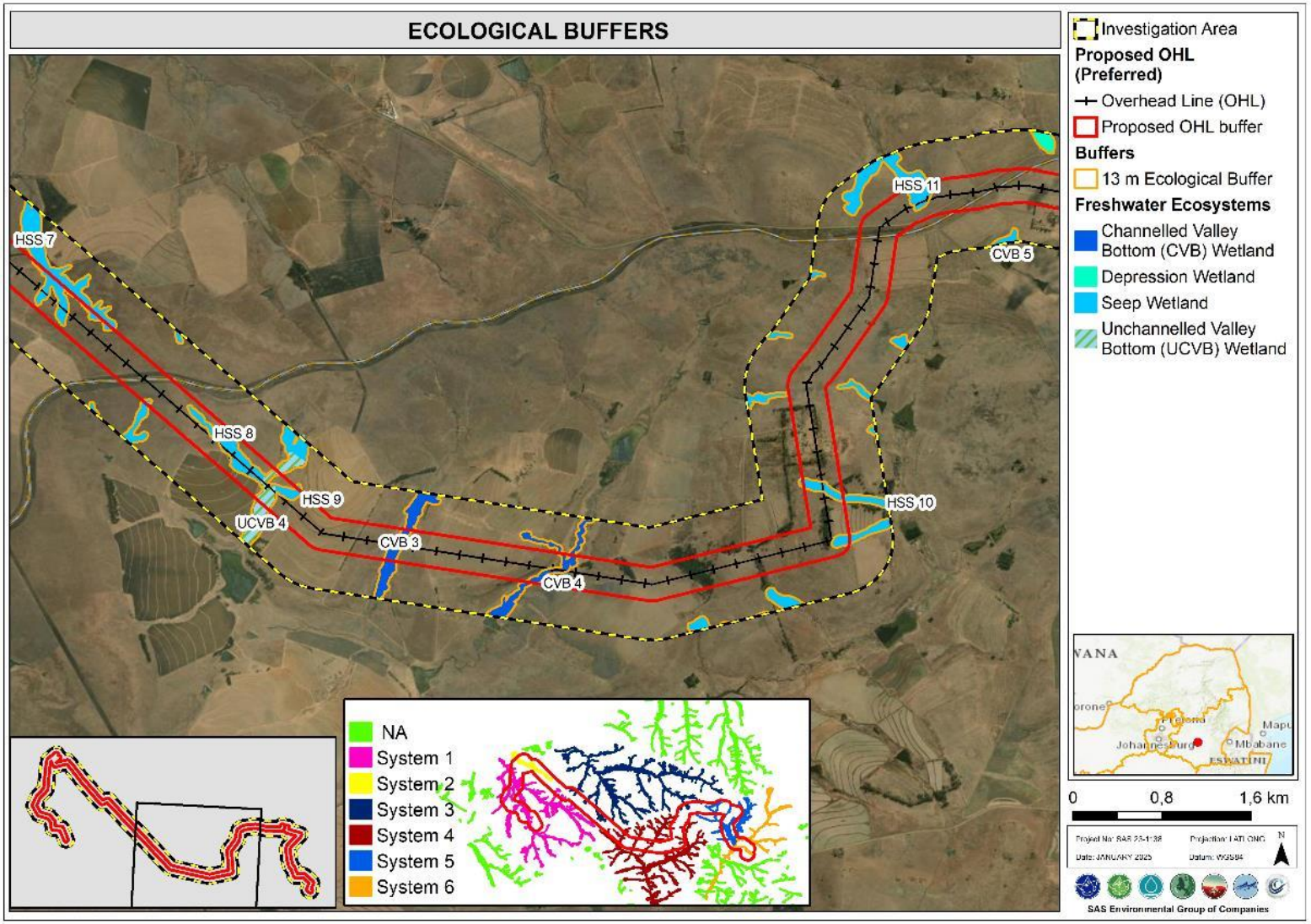


Figure 23: Buffers associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area.

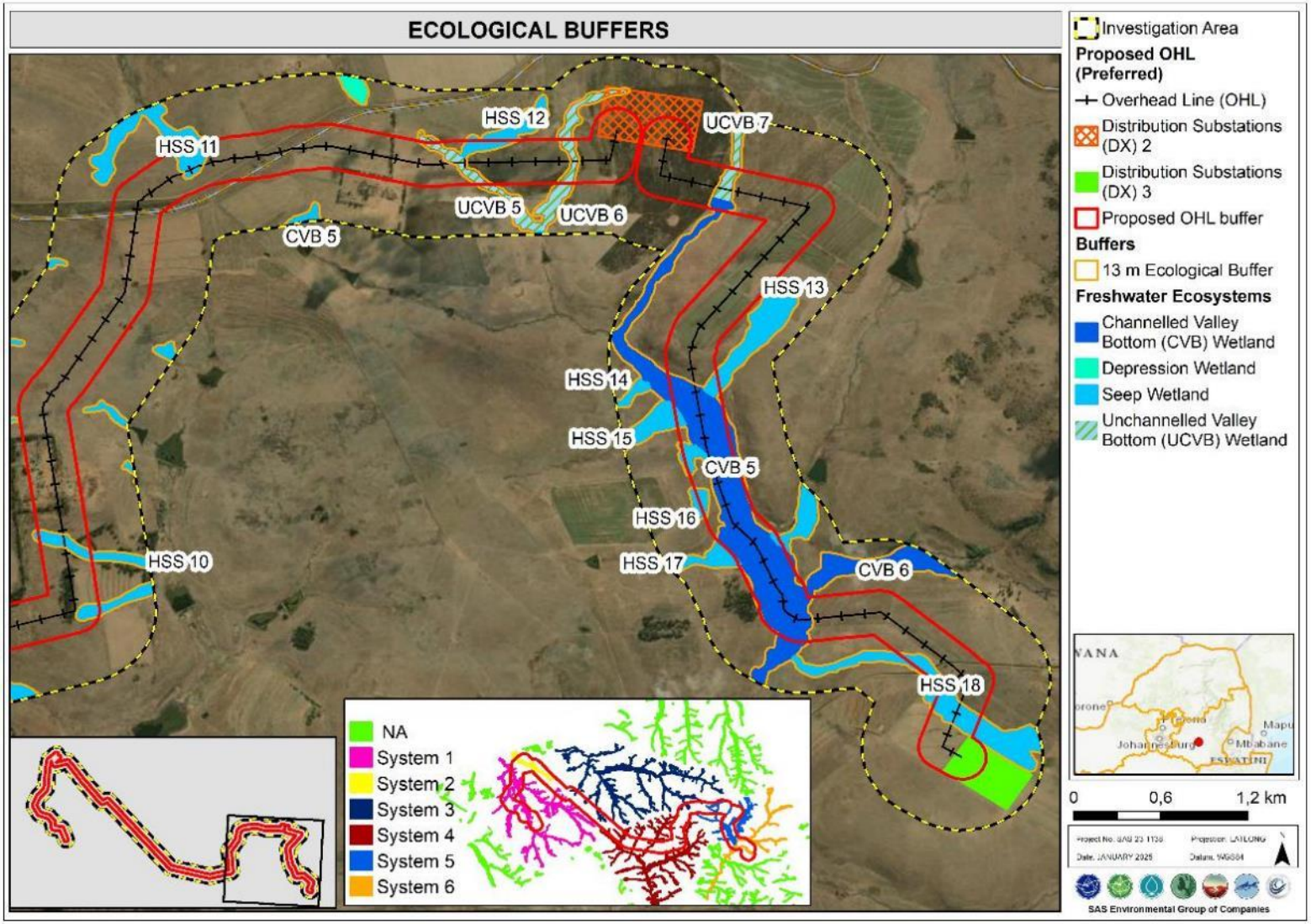


Figure 24: Buffers associated with the proposed Phefumula Emoyeni One Grid Connection infrastructure study area and associated investigation area.

5 LEGISLATIVE REQUIREMENTS

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix B:

- Constitution of the Republic of South Africa, 1996[4];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA);
- The NEMA EIA Regulations of 2014, as updated (GN 326 of 07 April 2017);
- The National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA); and
- Government Notice 4167 (GN4167) as published in the Government Gazette 49833 of December 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

Certain articles of legislation related to the above Acts and legislation impose potential zones of regulation on freshwater ecosystems in both a national and provincial context. The Zones of Regulation (ZoR) are not necessarily development exclusion zones, rather areas in which EIA and Water Use Authorisation legislative tools have been introduced for the protection and sustainable use of freshwater resources by requiring that certain types of activities within a freshwater ecosystem, or within a certain distance of a freshwater ecosystem require authorisation. The definition and motivation for a regulated zone of activity for the protection of freshwater ecosystems can be summarised as follows:

[4] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

Table 13: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use Authorisation Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) as amended. **Department of Water and Sanitation (DWS).**	Government Notice 4167 as published in the Government Gazette 49833 of December 2023 as it relates to the National Water Act, 1998 (Act No.36 of 1998) as amended. In accordance with GN4167 of December 2023 as it relates to the National Water Act, 1998 (Act No. 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 in 2017[5]. **Department of Forestry, Fisheries and the Environment (DFFE).**	**Activities of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended):** **Activity 12** *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—;* ***a) within a watercourse;*** *b) in front of a development setback;* *c) if no development setback exists, within **32 metres of a watercourse**, measured from the edge of a watercourse.* ***Activity 48:*** *The expansion of—* *(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or* *(ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more;* *where such expansion occurs—* *(a) **within a watercourse;*** *(b) in front of a development setback; or* *(c) if no development setback exists, within **32 metres of a watercourse,** measured from the edge of a watercourse;* **Activities of Listing Notice 3 (GN 324) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) applicable to Mpumalanga, outside of urban areas.** ***Activity 10**:* *The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage*

[5] Note – only listing notice activities that are associated with a zone of regulation are detailed in this table. This does not exclude the applicability of other potentially applicable activities that relate to the freshwater environment (e.g., Listing Notice 1 Activity 19) or any other applicable listing notice activity to the proposed development.

Regulatory authorisation required	Zone of applicability
	occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. *(f)Mpumalanga:* *(i) Outside urban areas:* *(hh). Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.* ***Activity 14**:* *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 10 square metres; or* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—;* ***a) within a watercourse;*** *b) in front of a development setback;* *if no development setback exists, within **32 metres of a watercourse**, measured from the edge of a watercourse* *(f) Mpumalanga -i. Outside urban areas:* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.* ***Activity 23:*** *The expansion of—* *(i) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; or* *(ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 10 square metres or more;* *where such expansion occurs—* *(a) **within a watercourse;*** *(b) in front of a development setback; or* *(c) if no development setback exists, within **32 metres of a watercourse,** measured from the edge of a watercourse;* *(f) Mpumalanga -i. Outside urban areas:* *(ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.*

Due to the predominance of wetlands in the study area, a 500m GN4167-related Zone of Regulation will apply to all freshwater ecosystems on the site.

In terms of the NEMA EIA Regulations, two different ZoR's could apply. Due to the proposed infrastructure development, both Listing Notice 1 Activities 12 and 48 which are associated with a 32m Zone of Regulation would potentially apply to the proposed development (should the activity trigger the 100m^2 threshold). Within areas designated by the 2014 Mpumalanga Biodiversity Sector Plan as ESAs or CBAs (most freshwater drainage in the study area has

been designated at ESAs), activities 14 and 23 of Listing Notice 3 would also apply to new infrastructure of freshwater ecosystems, as well as to any other infrastructure of >10m^2 in physical extent that is located within 32m of a freshwater ecosystem. These two LN3 activities are also associated with a 32m Zone of Regulation.

Lastly Activity 10 of Listing Notice 1, relating to the storage of dangerous goods with a combined capacity of >30 to <80 m^3 would be triggered within 100m of a freshwater ecosystem. Accordingly, should the proponent wish to store dangerous goods (e.g. fuel) on the development site, a 100m ZoR related to the NEMA EIA Regulations (in addition to the 32m ZoR) would apply to the development.

The applicable zones of regulation for the proposed Phefumula Emoyeni One Grid Connection can be summarised as follows:

- 32 m Zone of Regulation (NEMA EIA Regulations);
- (Potential) 100 m Zone of Regulation (NEMA EIA Regulations); and
- 500m Zone of Regulation (GN4167).

The respective zones of regulation as stipulated above are depicted in Figures 25-30 below.

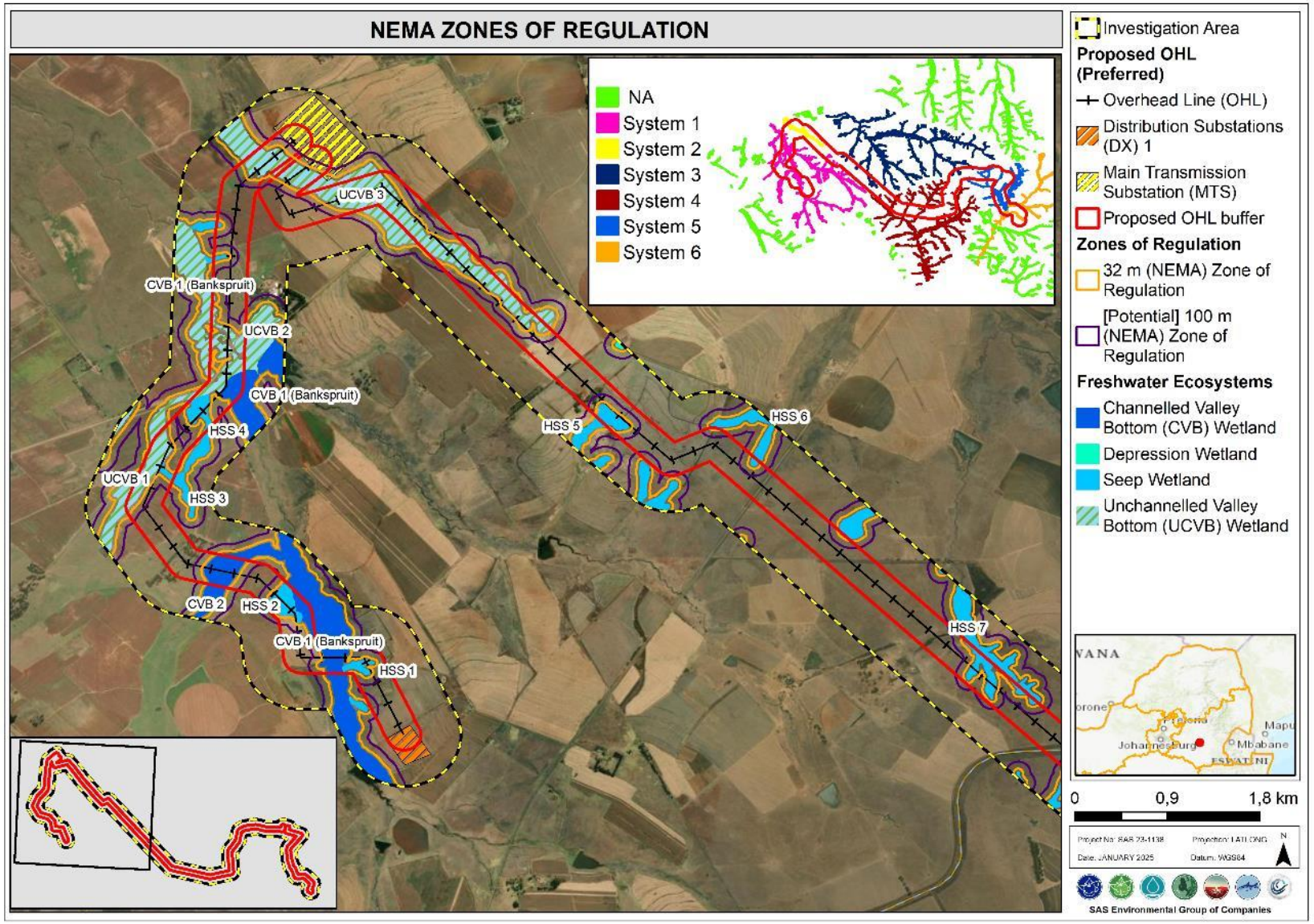


Figure 25: Conceptual presentation of the NEMA zones of regulation applicable to Phefumula Emoyeni One Grid Connection infrastructure in relation to the delineated freshwater ecosystems.

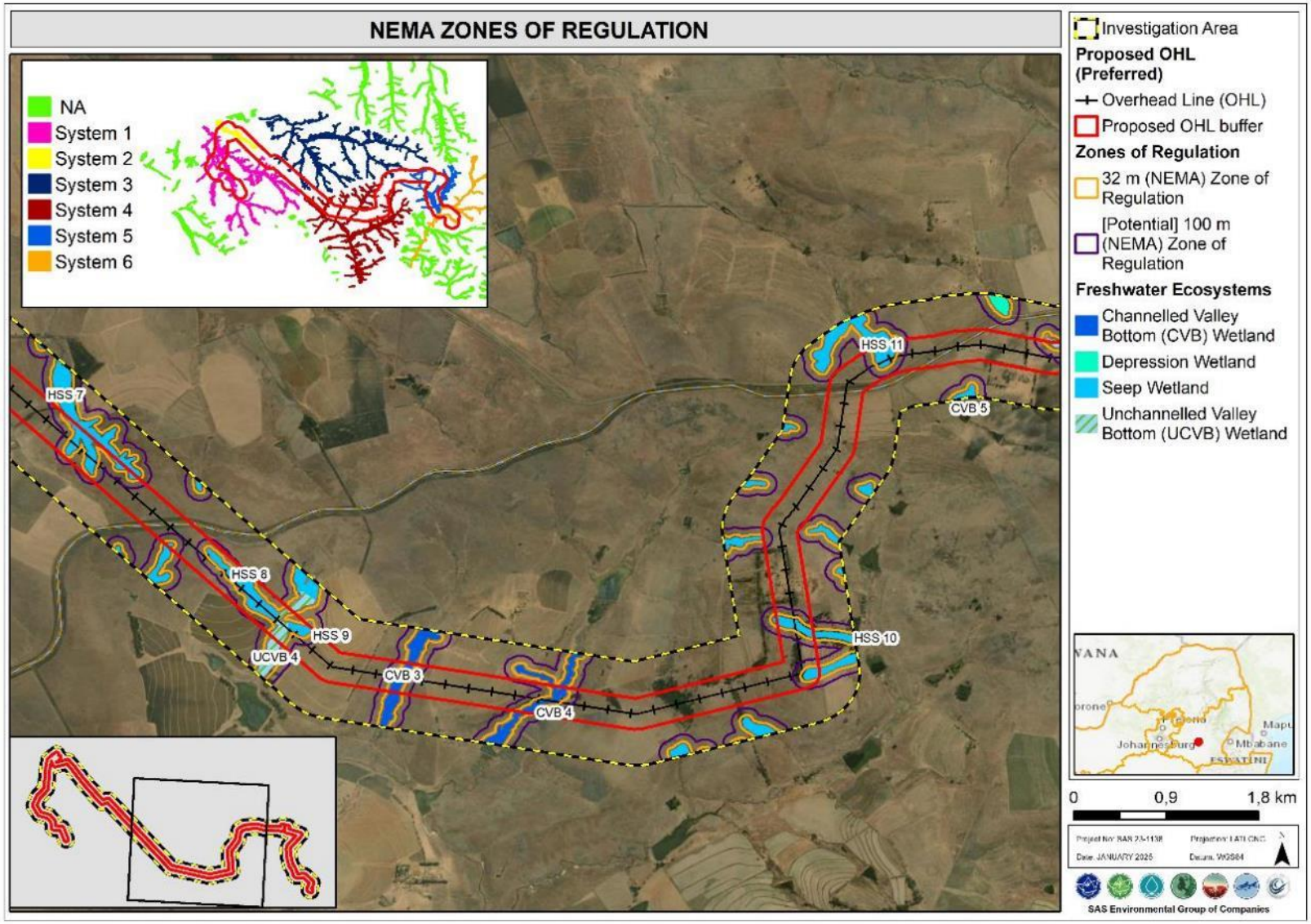


Figure 26: Conceptual presentation of the NEMA zones of regulation applicable to Phefumula Emoyeni One Grid Connection infrastructure in relation to the delineated freshwater ecosystems.

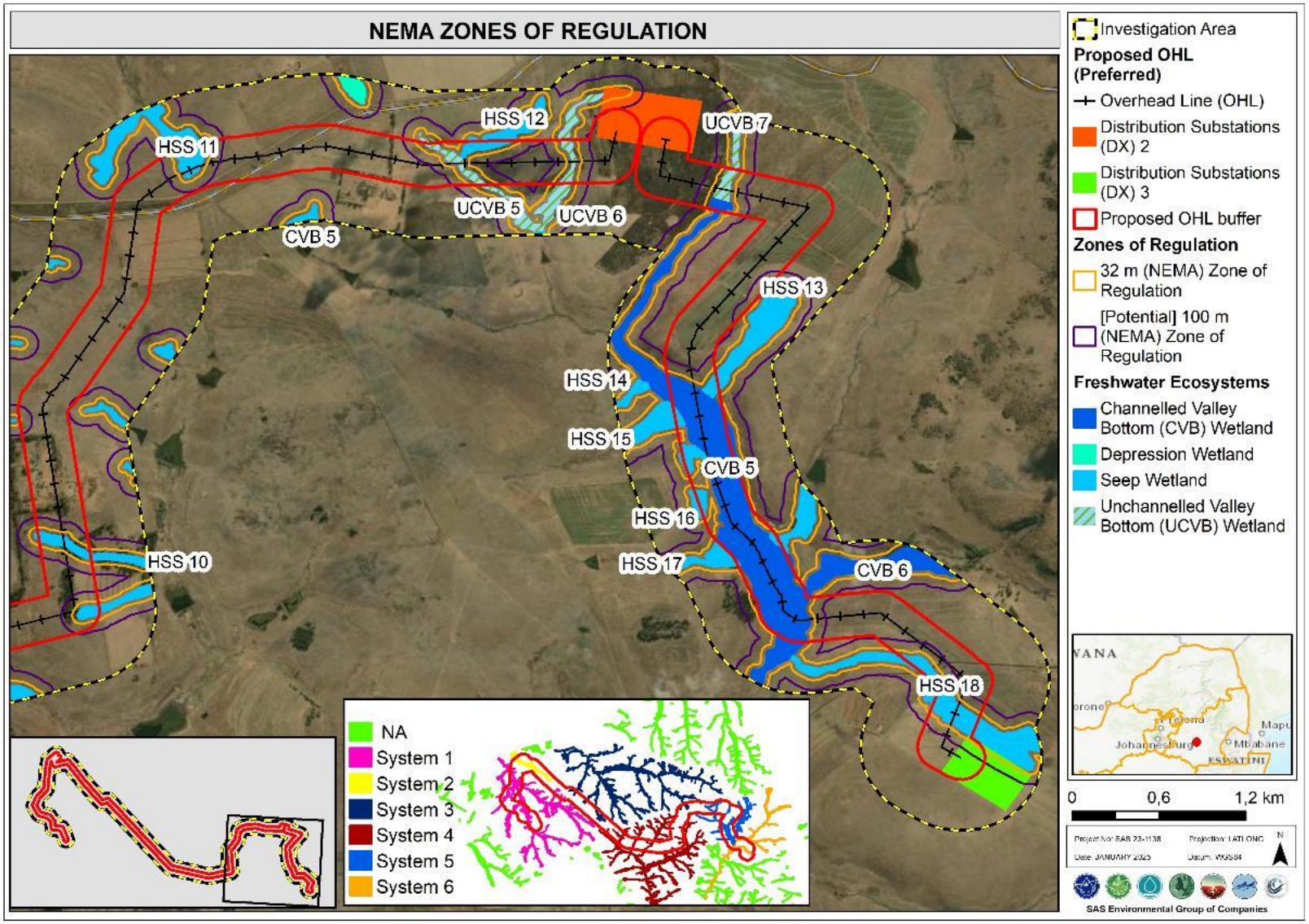


Figure 27 Conceptual presentation of the NEMA zones of regulation applicable to Phefumula Emoyeni One Grid Connection infrastructure in relation to the delineated freshwater ecosystems.

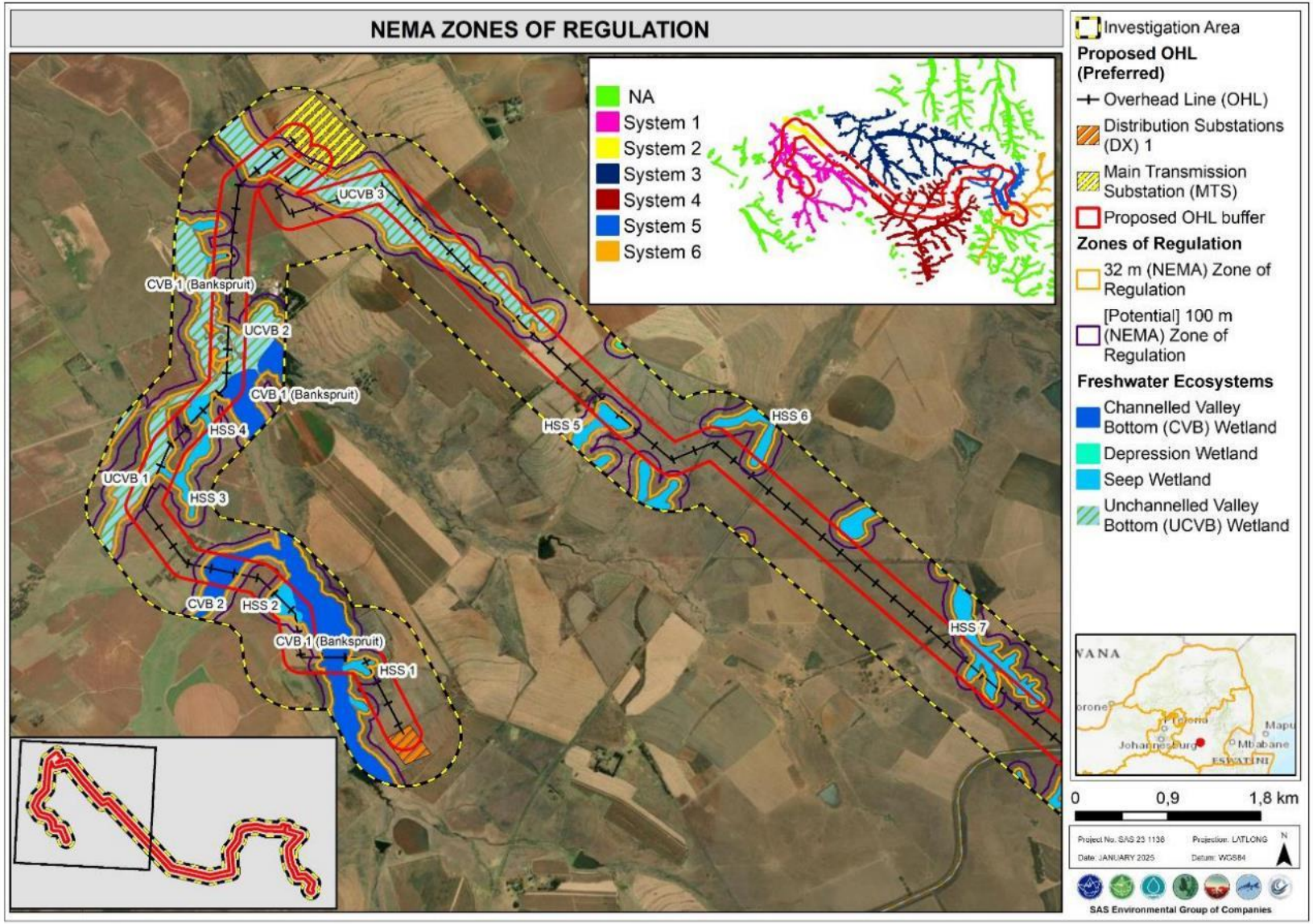


Figure 28: Conceptual presentation of the DWS zones of regulation applicable to Phefumula Emoyeni One Grid Connection infrastructure in relation to the delineated freshwater ecosystems.

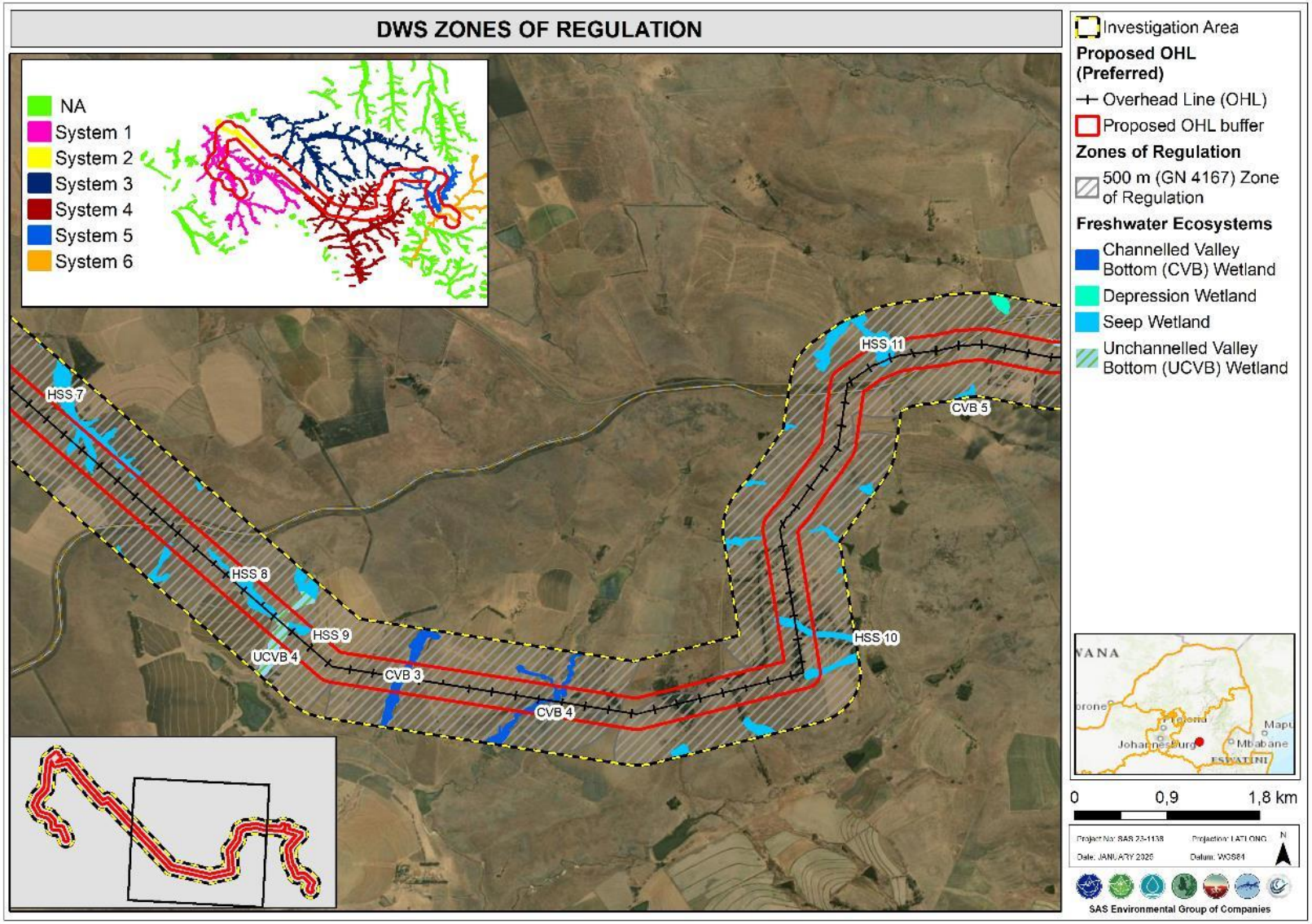


Figure 29: Conceptual presentation of the DWS zones of regulation applicable to the delineated freshwater ecosystems within the overhead powerline corridors.

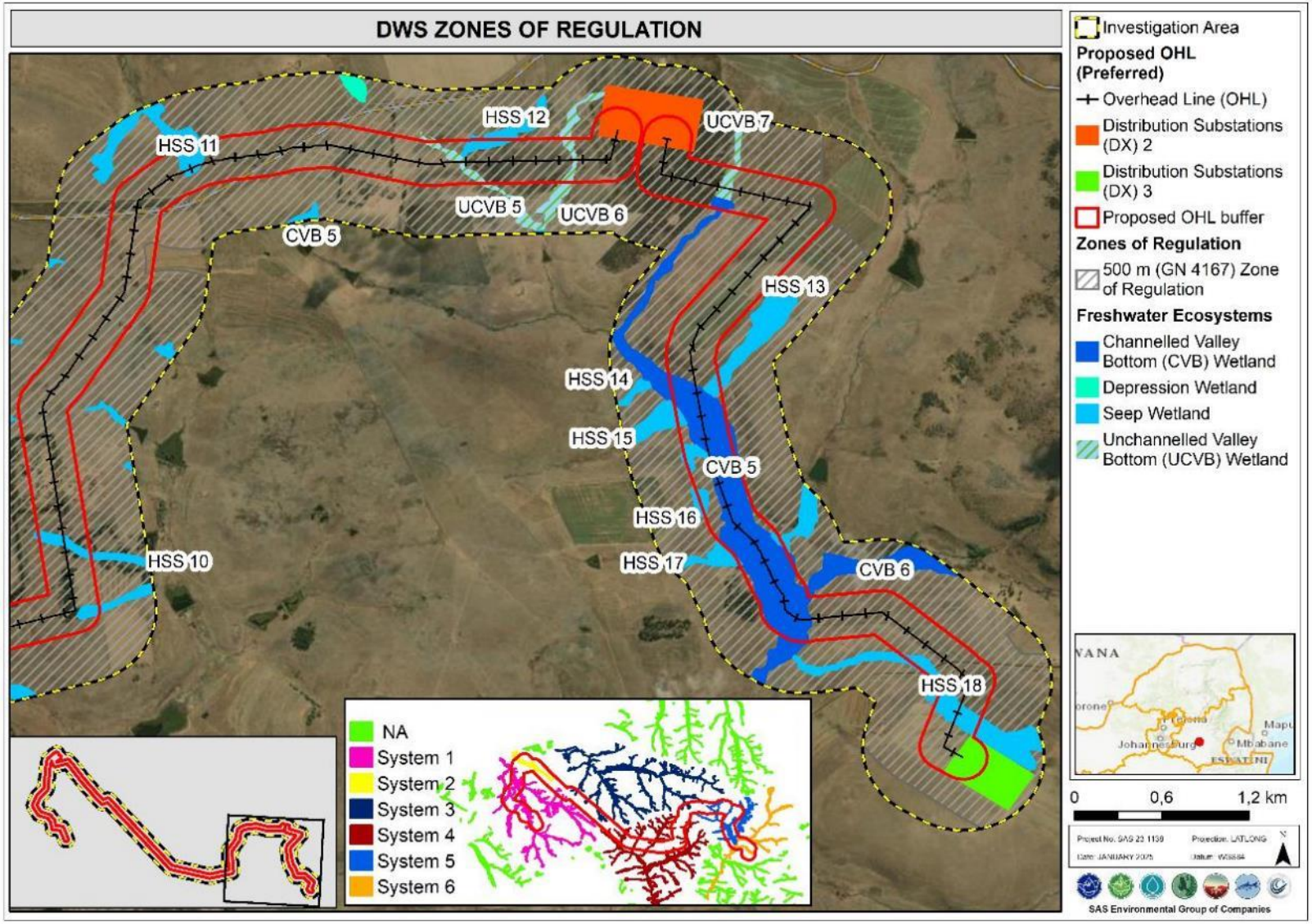


Figure 30: Conceptual presentation of the DWS zones of regulation applicable to the delineated freshwater ecosystems within the overhead powerline corridors.

6 FRESHWATER SENSITIVITY VERIFICATION

The protocol for the assessment of freshwater and aquatic biodiversity prepared in support of the Department of Forestry, Fisheries and Environment (DFFE) (previously the Department of Environmental Affairs (DEA)) National Web-based Environmental Screening Tool (2020), provides the criteria for the assessment and reporting of impacts on aquatic/freshwater biodiversity for activities requiring Environmental Authorisation (EA). For the aquatic / freshwater biodiversity theme, the requirements are for sites which support various levels of biodiversity. The relevant aquatic / freshwater biodiversity theme in the National Web-based Environmental Screening Tool (2020) has been provided by the South African National Biodiversity Institute (SANBI). Based on the sensitivity rating, a suitably qualified specialist must prepare the relevant report or opinion memorandum which is to be submitted as part of the EA application.

According to the guidelines, an applicant intending to undertake an activity on a site identified as being of “very high sensitivity” for an aquatic biodiversity theme must submit an Aquatic Biodiversity Impact Assessment, or if the area is identified as being of “low sensitivity” then an Aquatic Biodiversity Compliance Statement must be compiled and submitted to the competent authority. It is noted, however, that during a site survey undertaken by a suitably qualified freshwater ecologist should the sensitivity be determined different from that assigned by the screening tool (i.e. that a high risk to the regional aquatic biodiversity or freshwater ecosystems in the area is likely even though it is assigned as a “low” sensitivity, or if it is assigned a high sensitivity, however, the proposed development risks are deemed low) then the relevant assessment approach must be followed based on the site survey results and not the screening tool allocation.

As part of the process of the background information gathering, the screening tool was applied to the study and investigation areas. According to the screening tool, certain parts of the study area and investigation area of the Phefumula Emoyeni One Grid Connection are within areas of very high aquatic/ freshwater biodiversity significance, (Section 3.1, Figure 17) including most of the south-eastern and central parts of the study and investigation areas. The accords with the parts of the study area that are located in the C11F quaternary catchment and the very high sensitivity designation is due the catchment’s designation as a Phase 1 FEPA catchment. Within the north-western parts of the study and investigation areas, these areas have been largely designated as being of low sensitivity with the exception of certain larger wetland systems.

Based on the site verification undertaken by Scientific Aquatic Services and the findings thereof presented in this report, the designation of very high sensitivity to all freshwater features in the wider area by the DFFE Screening Tool has been supported through the findings of the freshwater assessment that has confirmed the very high sensitivity of all freshwater ecosystems (wetlands) that are present within the study and investigation areas. The ecological and hydrological functionality of the freshwater ecosystems in a study area context in the context of their designation of many of these as both FEPAs and CBAs renders them as ecologically very sensitive. Thus for areas in which freshwater ecosystems fall into an area of very high freshwater designation, the designation is supported. Conversely, the designation of catchments of wetlands in the central and south-eastern parts of the study area as very high is disputed. Although certain catchment areas of wetlands in this part of the study and investigation area consist of residual natural grassland, many areas are transformed primarily by crop cultivation and the sensitive of these catchment areas is a lower sensitivity.

Under the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity, (GN320 of March 2020), for areas of very high aquatic biodiversity sensitivity an Aquatic Biodiversity Assessment must be produced. Such a reporting approach (scoping and EIA-phase freshwater reports) have accordingly been compiled.

7 DWS RISK ASSESSMENT

7.1 Consideration of impacts and application of mitigation measures

Following the assessment of the freshwater ecosystems associated with the proposed grid connection, the DWS prescribed Risk Assessment Matrix (as prescribed by GN 4167 of December 2023) was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of these freshwater ecosystems.

The points below summarise the considerations taken when applying the DWS Risk Assessment Matrix (2023):

- The DWS Risk Assessment Matrix (2023) was applied assuming that a high level of mitigation will be implemented, thus the results, provided in this report presents the perceived impact significance ***post-mitigation***;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al.* (2013) would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- As no information on tower locations along the three OHPL corridors has been provided, the impacts of individual tower positions have been unable to be assessed in the RAM. The updated powerline route in some areas will likely necessitate the placement of powerline support structures inside the wetlands, unless the route alignment can be altered;
- The construction camp will be located in the substation footprints and has accordingly not been assessed separately as part of the RAM. The Operation and Control (O&C) building will be located within an existing building in Bethal, and as such this aspect has also not been assessed as part of the RAM;
- No information on access road usage and development relating to the OHPL alignments and substation sites has been provided and these aspects have been excluded from the RAM; and
- Most impacts are considered to be easily detectable, with the exception of potential contamination of surface and groundwater which will require some effort. Assessing these potential impacts falls outside of the scope of this freshwater ecosystem study.

7.2 Risk Assessment discussion of anticipated ecological impacts

There are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the freshwater ecosystems; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

A summary of the DWS Risk Assessment Matrix applied to the proposed development activities, is provided in the table below, whilst a comprehensive outcome of the risk assessment is presented in Appendix F.

Table 14 - Summary of the results of the DWS risk assessment matrix applied to the freshwater ecosystems associated with the proposed Phefumula Emoyeni 1 Grid Connection development.

Phase	Activity	Impact	Potentially affected watercourses			Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance				
PRE-CONSTRUCTION	Potentially poor planning of project footprint / infrastructure layout by placing powerline towers within wetlands or their buffer zones and by placing substation footprints within wetland areas.	•Non-avoidance of freshwater ecosystems as part of planning for the proposed development and the resultant transformation / loss of freshwater habitat due to placement of infrastructure (power line towers) within freshwater ecosystems and their associated development exclusion buffers.	All Wetlands	C	Moderate	100%	**36**	**M**	High
	Potentially poor planning of stormwater management for the project.	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of freshwater habitat through poor stormwater design.	All Wetlands	C	Moderate	40%	**10,8**	**L**	High
CONSTRUCTION	**Development of OHPL DX1 to MTS.** Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**<u>Indirect impacts (no infrastructure inside wetlands)</u>** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater;	HSS 1 -4	B	Moderate	40%	**8,4**	**L**	High
			UCVB 3	C	High	40%	**12,8**	**L**	High
			HSS 5	C	Moderate	20%	**4,2**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
		•Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	CVB 1 & 2	D	High		60%		**24**	**L**	High
			UCVB 1 & 2	D	Moderate		40%		**8,4**	**L**	High
	Development of OHPL MTS to DX2 Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**<u>Indirect impacts (no infrastructure inside wetlands)</u>** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing;	CVB 3 & 4	B	High		20%		**5,6**	**L**	High
			HSS 11	B	Moderate		20%		**4,2**	**L**	High
			HSS 8	B	Moderate		80%		**19,2**	**L**	High
			HSS 9; UCVB 4	B	Moderate		20%		**4,2**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
		•Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	UCVB 3	C	High		60%		**19,2**	**L**	High
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate		20%		**4,2**	**L**	High
		<u>Direct impacts (infrastructure likely inside wetlands)</u> •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the downstream freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchment of the wetland.	HSS 8	B	Moderate		100%		**30**	**M**	High
			UCVB 3	C	High		100%		**40**	**M**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
	Development of OHPL DX2 to DX3 Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**Indirect impacts (no infrastructure inside wetlands)** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	CVB 6	B	High		60%		**16,8**	**L**	High
			CVB 5	C	High		60%		**19,2**	**L**	High
			HSS 13-17	C	Moderate		20%		**3**	**L**	High
			UCVB 7; HSS 18	C	Moderate		60%		**12,6**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
		Direct impacts (infrastructure likely inside wetlands) •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the downstream freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchment of the wetland.	CVB 5	C	High		100%		**40**	**M**	High
	Development of MTS, DX2 and DX3 Substations Clearing of vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	**Footprint within very close proximity to wetlands:** ••Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation;	UCVB 3	C	High		100%		**29**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
		•Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the immediate catchments of the wetlands.	UCVB 6; HSS 18	C	Moderate		100%		**24**	**L**	High
	Development of DX1 Substation Clearing of vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	**Footprint more than 100m from wetlands:** •Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchments of the wetlands.	CVB 1	D	High		20%		**4**	**L**	High
	OHPL DX1 to MTS Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	HSS 1 -4	B	Moderate		40%		**8,4**	**L**	High
			UCVB 3	C	High		60%		**24**	**L**	High
			HSS 5	C	Moderate		20%		**4,2**	**L**	High
			CVB 1 & 2	D	High		60%		**21,6**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
			UCVB 1 & 2	D	Moderate		60%		**16,2**	**L**	High
	OHPL MTS to DX 2 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 3 & 4	B	High		60%		**16,8**	**L**	High
			HSS 11	B	Moderate		20%		**4,2**	**L**	High
			HSS 8	B	Moderate		80%		**24**	**L**	High
			HSS 9; UCVB 4	B	Moderate		60%		**12,6**	**L**	High
			UCVB 3	C	High		60%		**24**	**L**	High
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate		20%		**4,2**	**L**	High
	OHPL DX 2 to DX 3 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 6	B	High		60%		**16,8**	**L**	High
			CVB 5	C	High		80%		**25,6**	**L**	High
			HSS 13-17	C	Moderate		20%		**3**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
			UCVB 7; HSS 18	C	Moderate		60%		**12,6**	**L**	High
OPERATIONAL	**OHPL DX1 to MTS.** Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	HSS 1 -4	B	Moderate		20%		**2,4**	**L**	High
			UCVB 3	C	High		40%		**9,6**	**L**	High
			HSS 5	C	Moderate		20%		**2,4**	**L**	High
			CVB 1 & 2	D	High		20%		**3,2**	**L**	High
			UCVB 1 & 2	D	Moderate		20%		**2,4**	**L**	High
	OHPL MTS to DX2. Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	CVB 3 & 4	B	High		20%		**4,8**	**L**	High
			HSS 11	B	Moderate		20%		**3,6**	**L**	High
			HSS 8	B	Moderate		40%		**7,2**	**L**	High
			HSS 9; UCVB 4	B	Moderate		20%		**1,2**	**L**	High
			UCVB 3	C	High		40%		**9,6**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate		20%		**3,6**	**L**	High
	OHPL DX2 to DX3 Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	CVB 6	B	High		20%		**4,8**	**L**	High
			CVB 5	C	High		40%		**9,6**	**L**	High
			HSS 13-17	C	Moderate		20%		**2,4**	**L**	High
			UCVB 7; HSS 18	C	Moderate		20%		**3,6**	**L**	High
	MTS, DX2 and DX3 Substations Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants,	UCVB 3	C	High		80%		**19,2**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance						
		especially in the event of spills / failure of transformers in the substation.	UCVB 6; HSS 18	C	Moderate		80%		**14,4**	**L**	High
	DX1 Substation Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills / failure of transformers in the substation.	CVB 1	D	High		20%		**3,2**	**L**	High
DECOMMISSIONING	Removal of all surface infrastructure from the project area.	•Disturbance of soil and vegetation that established within the decommissioning area and associated indirect impacts on downgradient wetland, including sediment ingress, increased stormwater flows and potential pollution from oils and other pollutants; •Potential proliferation of alien invasive vegetation.	All wetlands	C	Moderate		80%		**21,6**	**L**	High

Table 15: Summary of the development-specific impacts and associated mitigation measures stipulated for the proposed Phefumula Emoyeni 1 Grid Connection.

Phase	Activity	Impact	Mitigation measures
Pre-construction Phase	Potentially poor planning of project footprint / infrastructure layout by placing powerline towers within wetlands and by placing substation footprints within wetland areas	•Non-avoidance of freshwater ecosystems as part of planning for the proposed development and the resultant transformation / loss of freshwater habitat due to placement of infrastructure within freshwater ecosystems and their associated development exclusion buffers.	•No tower locations for the proposed powerline alignments have been provided for assessment, but as a minimum no powerline towers must be placed within any of the wetlands in the corridor and a requisite buffer from the delineated boundaries must be maintained if at all possible;. •A walkdown by a freshwater specialist must be undertaken prior to the finalisation of the alignment to ensure that no towers are placed within wetland boundaries or in the non-development buffer.
	Potentially poor planning of stormwater management for the project.	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of freshwater habitat through poor stormwater design.	•Stormwater must be managed in such a manner that it must not adversely affect downgradient freshwater ecosystems. Accordingly a stormwater management plan must be developed for the development that ensures that stormwater drainage inputs to the freshwater ecosystems mimic the current baseline as far as possible. In order to achieve this, it is strongly recommended that the principles of SUDS be implemented into stormwater design and attenuation on the development site, especially at the substation sites; and •Due to the location of a number of seep wetlands relatively close downslope of the proposed substation boundaries, stormwater discharge off the substations must be carefully designed and such design must ensure that no point-source discharge occurs. Stormwater must be designed to be discharged in a diffuse manner into the area immediately downslope of the substation and it is recommended that swales be used for this purpose.
Construction Phase	**Development of OHPLs:** Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	•Transformation of freshwater vegetation, associated habitat and ecosystem services within freshwater ecosystems not proposed to be directly impacted from indirect impacts; •Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; •Risk of AIP proliferation in disturbed areas that could	•Given the current layout of the proposed OHPL route, it is considered unlikely that all wetlands can be spanned by the proposed powerline route, unless the powerline route itself can be adjusted to avoid placement of powerline towers inside wetlands if at all possible. •All construction areas must be clearly demarcated prior to the start of site clearing to prevent any accidental clearing of vegetation or construction impacts from adversely impacting areas outside of the development footprint (layout). •All construction and site clearing should ideally take place during the dry season to limit potential impacts to downgradient freshwater ecosystems as a result of construction activities; •A designated contractor laydown area(s) that is located outside the freshwater ecosystems and outside of a 100m radius of any wetland should be approved by the Environmental Control Officer (ECO) prior to use; •An ECO must be appointed in order to ensure all water related aspects are adequately mitigated for the duration of the construction phase; •All development footprint areas to remain within the approved development footprint and vegetation clearing to be limited to what is essential within those approved footprints;

Phase	Activity	Impact	Mitigation measures
		colonise the adjacent wetland areas; and •Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles.	•Retain as much indigenous vegetation as possible; •All vegetation removed as part of the site clearing activities must be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility; •During construction of the surface infrastructure regular spraying of non-potable water or the use of chemical dust suppressants, that are approved for use near freshwater ecosystems must be implemented to reduce dust and to ensure no smothering of vegetation within the freshwater ecosystems occurs from excessive dust settling. It is recommended that a suitably qualified specialist be consulted for approval of the product and conditions for use; •As soon as areas of vegetation are cleared, construction-phase stormwater controls must be implemented on the downgradient side of the cleared areas to mitigate the risk of stormwater transporting sediment towards wetlands; •The freshwater ecosystems outside the construction footprint not having authorised road crossings must be considered as no-go areas. No construction vehicles, nor construction personnel or vehicles may traverse through these freshwater ecosystems (except on approved road crossings); •As far as possible, existing roads must be utilised to gain access to construction sites; no new roads must be allowed to cross any wetlands; •All vehicle re-fuelling is to take place in specifically designated re-fuelling areas that must be located outside of a 100m radius of wetlands. **With regards to excavation activities:** •During excavation activities, the topsoil and vegetation must be stockpiled separately from other material outside the delineated extent of the freshwater ecosystems; •Excavated materials must not be contaminated, and it must be ensured that the minimum surface area is taken up by any stockpiled materials. The mixture of the lower and upper layers of the excavated soil must be kept to a minimum, so as for later use as backfill material after construction has commenced; •All exposed soils must be protected from wind using tarpaulins for the duration of the construction phase to prevent potential erosion and sedimentation of the freshwater ecosystems; •Suitable drainage must be ensured within construction areas (including contractor laydown areas, material storage facilities, etc.) in order to ensure that water does not pond or drain in a concentrated manner into the downgradient freshwater ecosystems. Consideration must be given to ensuring that stormwater is allowed to diffusely spread across the landscape, by ensuring adequate surface roughness of the surrounding terrestrial/freshwater area; •No concentrated runoff from the surface infrastructure construction areas must enter the freshwater ecosystems. This must be achieved by installing silt traps or placing hay bales downgradient of the construction footprint (until suitable basal vegetation cover has been restored) to ensure no sediment laden or concentrated runoff generates from the construction footprint; and •It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction.

Phase	Activity	Impact	Mitigation measures
			With regards to concrete mixing on site: Concrete and cement-related mortars can be toxic to aquatic life. Proper handling and disposal must minimise or eliminate discharges into the freshwater ecosystems. High alkalinity associated with cement, can dramatically affect and contaminate both soil and ground water. The following measures must be adhered to: •Fresh concrete and cement mortar must not be mixed near the freshwater ecosystems. Mixing of cement may be done within the construction camp, however, may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer. Consideration must be given to the use of ready mix concrete; • No mixed concrete may be deposited directly onto the ground within the freshwater ecosystems (outside of the designated area) or associated riparian habitat. A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing; •A washout area must be designated outside of the freshwater ecosystems, and wash water must be treated on-site or discharged to a suitable sanitation system; •Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be disposed of through the hazardous substance waste stream; and •Spilled or excess concrete must be disposed of at a suitable landfill site. Chain of custody documentation must be provided. **With regards to backfilling of excavated areas:** •Stockpiled material must be used as backfill material; •All excavated areas must be backfilled to the natural ground level with excavated material; and •Soil must be suitably compacted, and all construction material must be removed from the site upon the completion of construction or used in the rehabilitation process.
	Development of MTS, DX1. DX 2, DX 3 Substations and MTS: Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) and construction including laying of foundations (e.g. concrete works).	•Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and	•All construction areas must be clearly demarcated prior to the start of site clearing to prevent any accidental clearing of vegetation or construction impacts from adversely impacting areas outside of the development footprint (layout). •All construction and site clearing should ideally take place during the dry season to limit potential impacts to downgradient freshwater ecosystems as a result of construction activities; •A designated contractor laydown area(s) that is located outside the freshwater ecosystems and outside of a 100m radius of any wetland should be approved by the Environmental Control Officer (ECO) prior to use; •An ECO must be appointed in order to ensure all water related aspects are adequately mitigated for the duration of the construction phase; •All development footprint areas to remain within the approved development footprint and vegetation clearing to be limited to what is essential within those approved footprints; •Retain as much indigenous vegetation as possible;

Phase	Activity	Impact	Mitigation measures
		•Proliferation of alien and/or invasive vegetation as a result of disturbances.	•Where clearing of vegetation at a large scale is to be undertaken, no large-scale indiscriminate clearing of vegetation from the entire footprint must be undertaken. Rather blocks of vegetation must be systematically cleared of vegetation to avoid the creation of large volumes of dust and to control stormwater runoff during construction; •All vegetation removed as part of the site clearing activities (specifically where large areas need to be cleared) must be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility; •During construction of the surface infrastructure regular spraying of non-potable water or the use of chemical dust suppressants, that are approved for use near freshwater ecosystems must be implemented to reduce dust and to ensure no smothering of vegetation within the freshwater ecosystems occurs from excessive dust settling. It is recommended that a suitably qualified specialist be consulted for approval of the product and conditions for use; •As soon as areas of vegetation are cleared, construction-phase stormwater controls must be implemented on the downgradient side of the cleared areas to mitigate the risk of stormwater transporting sediment towards wetlands; •The freshwater ecosystems outside the construction footprint must be considered as no-go areas. No construction vehicles, nor construction personnel may traverse through these freshwater ecosystems (except on approved road crossings); •As far as possible, existing roads must be utilised to gain access to construction sites; •All vehicle re-fuelling is to take place in specifically designated re-fuelling areas that must be located outside of a 100m radius of wetlands. **See 3 above for mitigation relating to concrete works and excavation**
	Development of the OHPLs Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	•Stringing of the powerline cables must be done in such a way that no physical damage to wetlands being spanned occurs; •As such stringing across wetlands must be done by hand or by aerial means (e.g. through the use of a helicopter) with no use of equipment that would physically traverse the wetlands; and •No new roads must be developed as part of powerline stringing activities.
Operational phase	**Development of the OHPLs** Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and	•No indiscriminate movement of maintenance equipment or vehicles through the freshwater ecosystems may be permitted during standard operational activities or maintenance activities. Use must be made of the existing road crossings only; •Vehicles used in the development site must be regularly washed (on a non-permeable surface or off-site) to avoid the dispersal of seeds on any alien or invasive species into the freshwater ecosystems; •Should erosion be noted at the base of the towers that may potentially impact on a freshwater ecosystem, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation;

Phase	Activity	Impact	Mitigation measures
		•Altered water quality (if surface water is present) as a result of increased availability of pollutants	•The surface infrastructure areas must be inspected to ensure that no concentrated runoff from these areas form erosion gullies leading to erosion and sedimentation of the receiving freshwater ecosystems. Should these impacts be noted, these gullies/preferential flow paths must be infilled with in situ material and appropriately stabilised and/or revegetated; •Monitoring for the establishment for alien and invasive vegetation species must be undertaken. Should alien and invasive plant species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation. •Routine maintenance of existing access roads must be undertaken to ensure that no concentration of flow and subsequent erosion occurs due to the road crossings/instream infrastructure. Such maintenance activities must specifically be undertaken after high rainfall events; and •Due to the structural characteristics of the grass and sedge dominated wetlands in the study area consisting of grasses of short length, it is not considered necessary for vegetation in the wetlands to be mowed / cleared to prevent flashovers in the event of veld fires. As such no mowing / clearing of vegetation in the wetlands spanned by the proposed powerline must be undertaken. Rather the operators of the line must work with the respective landowners to ensure that firebreaks are created to prevent uncontrolled fires in the vicinity of the lines.
	Development of the Substations Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills / failure of transformers in the substation.	•Due to the location of a number of wetlands relatively close downslope of the proposed substation boundaries, stormwater discharge off the substations must be carefully designed and such design must ensure that no point-source discharge occurs. Stormwater must be designed to be discharged in a diffuse manner into the area immediately downslope of the substation and it is recommended that swales be used for this purpose; •All hazardous materials stored at the substation must be stored in a controlled bunded area. This includes the transformers which must be placed within a concrete bunded area that is able to hold a volume of liquid / material greater than the volume of the transformers; •No indiscriminate movement of maintenance equipment or vehicles through the freshwater ecosystems may be permitted during standard operational activities or maintenance activities. Use must be made of the existing road crossings only; •Unnecessary disturbances surrounding the perimeter of the surface infrastructure must be avoided; •Vehicles used in the development site must be regularly washed (on a non-permeable surface or off-site) to avoid the dispersal of seeds on any alien or invasive species into the freshwater ecosystems; •Should erosion be noted in the area surrounding the substation that may potentially impact on a freshwater ecosystem, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation; •The surface infrastructure areas must be inspected to ensure that no concentrated runoff from these areas form erosion gullies leading to erosion and sedimentation of the receiving freshwater ecosystems. Should these impacts

Phase	Activity	Impact	Mitigation measures
			be noted, these gullies/preferential flow paths must be infilled with in situ material and appropriately stabilised and/or revegetated; and •Monitoring for the establishment for alien and invasive vegetation species must be undertaken. Should alien and invasive plant species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation. •Routine maintenance of the roads must be undertaken to ensure that no concentration of flow and subsequent erosion occurs due to the road crossings/instream infrastructure. Such maintenance activities must specifically be undertaken after high rainfall events; •Stormwater from the substation must be allowed to diffusely spread across the landscape, by ensuring adequate surface roughness in the area or attenuating feature upgradient of the freshwater feature (through vegetation and rocky areas); •Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the freshwater ecosystems may be permitted to be undertaken;
DECOMMISSIONING	Removal of all surface infrastructure from the project area.	•Disturbance of soil and vegetation that established within the decommissioning area.	•No indiscriminate movement of construction equipment in the freshwater ecosystems may be permitted. Use must be made of the existing roads during the decommissioning phase; •High flood peaks from the decommissioning footprint areas can be mitigated by ensuring that no concentrated runoff from the surface infrastructure area and subsequent cleared area enters the freshwater ecosystems. The velocity of surface water flow from these areas must be reduced by the strategic placement of silt traps of hay bales as a means to obstruct flow but still allow flow to percolate at a reduced velocity and encourages a diffuse flow pattern. In this regard it is recommended at an alien and invasive plant species management plan be implemented during the decommissioning phase to specifically prevent the spread of any such species into the sensitive ecological areas; •Areas where surface infrastructure have been decommissioned and removed must be suitably compacted/ripped and revegetated to ensure that no erosion occurs which may contribute to the sediment load of the freshwater ecosystems; •Should erosion gullies be noted, these areas must be rehabilitated by infilling them with suitable soil and ensuring the area is vegetated. The increased surface roughness will discourage concentrated flow paths to develop and ensure diffuse flow patterns; and •All other construction mitigation measures must be implemented.

All activities associated with the construction of proposed infrastructure that are located within / or would directly affect wetlands (i.e. any towers placed within wetlands) would pose a 'Medium' risk significance to the freshwater ecosystems within the study and investigation areas. All other activities would be associated with a 'Low' risk significance. The relocation of the substations and MTS is highly important in the context of mitigating the direct impact on the directly affected wetlands.

As the tower locations and location of access roads do not form part of the latest iteration of the layout, a further assessment of these components of the project will need to be undertaken by a freshwater specialist. This will need to form part of a walkdown of all final pre-construction components as undertaken by a freshwater specialist to sign off on roads and final tower locations.

In addition, all mitigation measures as stipulated in the above table, must be implemented to prevent any edge effects and cumulative impacts from occurring on the freshwater ecosystems within the study and investigation areas.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, the significance of impacts arising from the proposed grid connection are likely to be reduced during the construction, operational and decommissioning phases assuming that a high level of mitigation takes place. Additional "good practice" mitigation measures applicable to a project of this nature are provided in **Appendix I** of this report.

8 IMPACT ASSESSMENT

This section presents the significance of potential impacts on the freshwater ecology of the freshwater ecosystems. In addition, it indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed activities and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

8.1 Impact assessment analysis

Following the assessment of the freshwater ecosystems associated with the proposed grid connection, the Impact Assessment Matrix as provided by the EAP was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the receiving freshwater environment.

There are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the freshwater ecosystems; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

A summary of the Impact Assessment Matrix applied to the proposed development activities, both pre- and post-mitigation is provided in the tables below.

Table 16: Significance of Potential Impacts *before application of mitigation* associated with the Phefumula-Emoyeni Grid Connection as based on the impact assessment) methodology.

Project Phase	Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Impact Significance
Construction	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) related to powerline towers outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	3	1	3	2	3	Low (27)
	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) related to powerline towers outside of the delineated wetland boundaries and associated 15m buffer and > 100m radius of wetland boundaries .	2	1	3	2	2	Low (16)
	Construction of powerline towers outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	3	1	3	2	3	Low (27)
	Construction of powerline towers outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	2	1	3	2	3	Low (24)
	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) related to the development of substations located outside of outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	3	2	3	2	3	Low (30)
	Clearing of Vegetation and movement of vehicles and equipment related to the potential development of power line towers within wetlands entailing destruction / impacting of certain area of wetland habitat.	5	2	5	2	5	High (68)
	Construction of infrastructure related to substations in the catchments of wetlands.	3	2	3	2	3	Low (30)
	Stringing of the powerlines across wetlands	3	2	3	2	3	Low (30)
Operation	Operation and maintenance of the powerlines located within 100 m of the delineated freshwater ecosystems	2	2	3	4	3	Moderate (33)
	Operation and maintenance of the substations located within 100 m of the delineated freshwater ecosystems	3	2	3	4	3	Moderate (36)
Decommissioning	Potential Direct and Indirect impacts related to removal of all surface infrastructure from the project area.	2	2	3	2	3	Low (27)

Table 17: Significance of Potential Impacts *after application of mitigation* associated with the Phefumula-Emoyeni Grid Connection as based on the impact assessment) methodology.

Project Phase	Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Impact Significance
Construction	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) related to power line towers outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	3	1	3	2	3	Low (16)
	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) related to powerline towers outside of the delineated wetland boundaries and associated 15m buffer and > 100m radius of wetland boundaries .	2	1	3	2	2	Very Low (8)
	Construction of powerline towers outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	3	1	3	2	3	Low (16)
	Construction of powerline towers outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	2	1	3	2	3	Low (16)
	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) related to the development of substations located outside of outside of the delineated wetland boundaries and associated 15m buffer and within 100m radius of wetland boundaries .	3	2	3	2	3	Low (20)
	Clearing of Vegetation and movement of vehicles and equipment related to the potential development of power line towers within wetlands entailing destruction / impacting of certain area of wetland habitat - **note mitigation would entail moving the towers out of the wetland to avoid a direct impact**	5	2	5	2	5	Low (18)
	Construction of infrastructure related to substations in the catchments of seep wetlands.	3	2	3	2	3	Low (18)
	Stringing of the powerlines across wetlands	3	2	3	2	3	Low (18)
Operation	Operation and maintenance of the powerlines located within 100 m of the delineated freshwater ecosystems	2	2	3	4	3	Low (22)
	Operation and maintenance of the substations located within 100 m of the delineated freshwater ecosystems	3	2	3	4	3	Low (24)
Decommissioning	Potential Direct and Indirect impacts related to removal of all surface infrastructure from the project area.	2	2	3	2	3	Low (18)

8.2 Cumulative Impacts

Freshwater ecosystems within the wider area of the eastern Mpumalanga Highveld are under continued threat due a variety of factors primarily related to landuse which, in the long term, may prove to be unsustainable. The expansion of agricultural landuses, in particular cultivation and mining (especially coal mining), as well as urban expansion typically result in transformative impacts on freshwater ecosystems. Development of renewable energy infrastructure, including wind and solar energy facilities can also form part of the cumulative impact on freshwater ecosystems. Other factors such as existing linear infrastructure (roads and railways) as well as climate change also exert impacts on the freshwater ecosystems in the wider region.

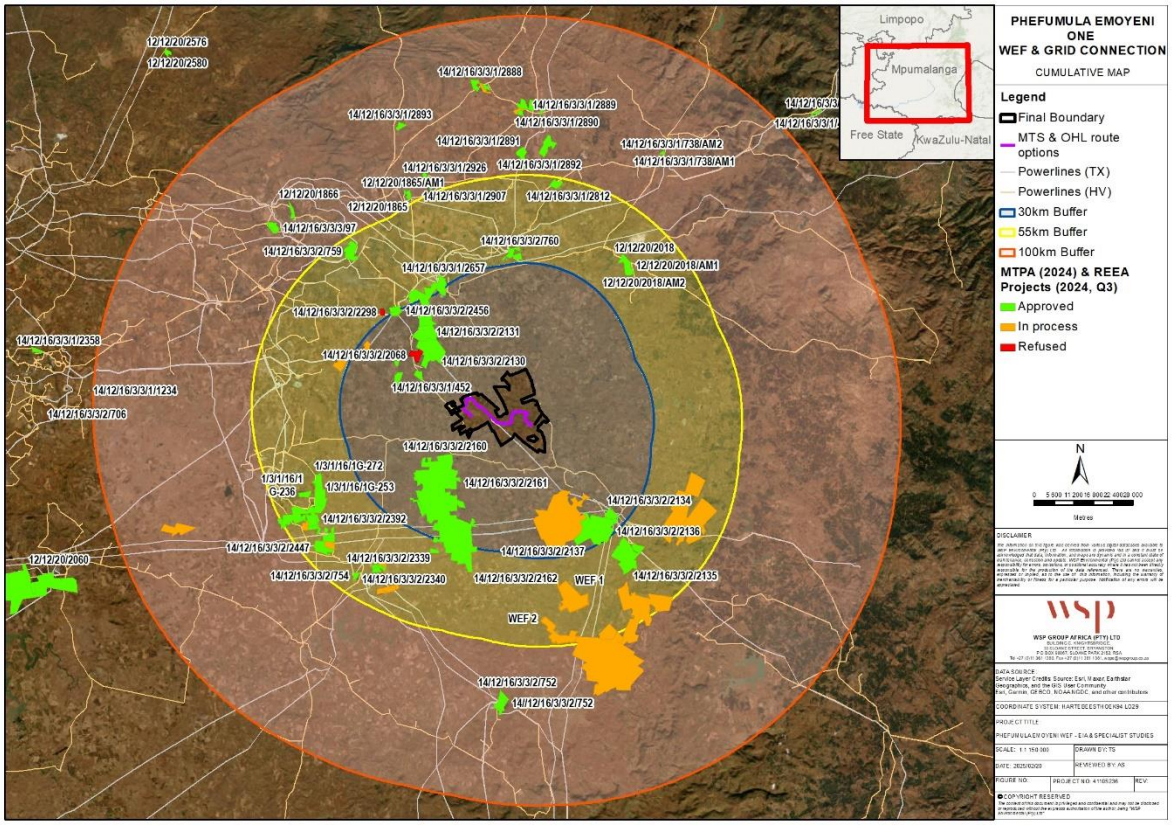


Figure 31 – Map showing Renewable Energy Developments within 100km of the proposed project.

The development of the Phefumula Emoyeni One Grid Connection infrastructure will impact freshwater resources, primarily in terms of the potential encroachment of wetland habitat in the footprint of the certain tower positions. This infrastructure has been recommended to be relocated to avoid this impact. Should this and other mitigation measures but cumulatively this will represent a larger area of wetland habitat loss. If mitigation measures including the

relocation are implemented, the impacting of upstream and downstream reaches of wetlands spanned by the powerlines and downgradient of the proposed substations will be greatly minimised or even avoided, thus avoiding a cumulative impact.

9 CONCLUSION

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Phefumula Emoyeni One Grid Connection, related to the development of the Phefumula Emoyeni One Wind Energy Facility (WEF) in the Ermelo area of the Mpumalanga Province. The area of assessment consists of the grid connection components (including overhead powerline corridors and substations). These components are collectively known as the 'study area'. This report has been prepared in support of the grid connection components application for Environmental Authorisation (EA), with a separate report compiled for the WEF components application for EA

The results of the assessments of the wetlands are presented in Section 4 of this report, and are summarised in the table below:

Table A: Summary of the assessment results.

Wetland System	Wetland Name	Present Ecological State (PES) / Ecostatus	Ecological Importance and Sensitivity (EIS)	Ecoservices	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
1	CVB 1 & 2	D (Largely Modified)	High	Very High to Very Low	REC: C; BAS: D; RMO: C/D Improve
	HSS 1 -4	B (Largely Natural)	Moderate	High to Very Low	REC: B; BAS: B; RMO: B Maintain
	HSS 5	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 1 & 2	D (Largely Modified)	Moderate	High to Very Low	REC: D; BAS: D; RMO: D Maintain
2	UCVB 3	C (Moderately Modified)	High	Very High to Very Low	REC: B; BAS: C; RMO: B/C Improve
3	HSS 6	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain
	HSS 7	C (Moderately Modified)	Moderate	Very High to Very Low	REC: C; BAS: C; RMO: C Maintain
	HSS 11	B (Largely Natural)	Moderate	Very High to Very Low	REC: B; BAS: B; RMO: B Maintain
4	HSS 8 & 9	B (Largely Natural)	Moderate	Moderate to Very Low	REC: B; BAS: B; RMO: B Maintain
	HSS 10	C (Moderately Modified)	Moderate	Very High to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 4	B (Largely Natural)	Moderate	Moderate to Very Low	REC: B; BAS: B; RMO: B Maintain

Wetland System	Wetland Name	Present Ecological State (PES) / Ecostatus	Ecological Importance and Sensitivity (EIS)	Ecoservices	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
	CVB 3 & 4	B (Largely Natural)	High	Very High to Very Low	REC: A; BAS: B; RMO: A/B Improve
5	CVB 5	C (Moderately Modified)	High	Very High to Very Low	REC: B; BAS: C; RMO: B/C Improve
	HSS 12-17	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 5 & 6	C (Moderately Modified)	Moderate	Moderate to Very Low	REC: C; BAS: C; RMO: C Maintain
	UCVB 7	C (Moderately Modified)	Moderate	Moderate to Very Low	REC: C; BAS: C; RMO: C Maintain
6	CVB 6	B (Largely Natural)	High	Very High to Very Low	REC: A; BAS: B; RMO: A/B Improve
	HSS 18	C (Moderately Modified)	Moderate	High to Very Low	REC: C; BAS: C; RMO: C Maintain

The DWS Risk Assessment Matrix (2023) was applied to determine the significance of impacts of the proposed WEF facility on the receiving freshwater environment, with the summarised results detailed in Table B. All activities associated with the construction or upgrading of proposed infrastructure that are located within / or would directly affect wetlands would pose a ‘Medium’ risk significance to the freshwater ecosystems within the study and investigation areas. This includes the proposed development of the DX2 and DX 3 substations as well as the Main Transmission Substation (MTS) in which the development area is located over part of the upper reaches of wetlands. Given the current OHPL alignment over extensive wetland areas, it is considered unlikely that all wetlands can be spanned by the proposed powerline route. Potential direct impacts associated with powerline tower placement inside wetland habitat was considered to also pose a ‘Medium’ risk significance to the affected wetlands. All other activities would be associated with a ‘Low’ risk significance, in cases where the alignment of the proposed powerlines is in relation to the drainage of the wetlands entailing that these are able to be spanned. In the light of the impacts associated with the development of the substations, the substations must be relocated to avoid directly impacting of the affected wetland that are located within the development area.

Table B: Summary of the results of the risk assessment (after application of mitigation).

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
PRE-CONSTRUCTION	Potentially poor planning of project footprint / infrastructure layout by placing powerline towers within wetlands or their buffer zones and by placing substation footprints within wetland areas.	•Non-avoidance of freshwater ecosystems as part of planning for the proposed development and the resultant transformation / loss of freshwater habitat due to placement of infrastructure within freshwater ecosystems and their associated development exclusion buffers.	All Wetlands	C	Moderate	M
	Potentially poor planning of stormwater management for the project.	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of freshwater habitat through poor stormwater design.	All Wetlands	C	Moderate	L
CONSTRUCTION	**Development of OHPL DX1 to MTS.** Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**<u>Indirect impacts (no infrastructure inside wetlands)</u>** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	HSS 1 -4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 5	C	Moderate	L
			CVB 1 & 2	D	High	L
			UCVB 1 & 2	D	Moderate	L

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
	Development of OHPL MTS to DX2 Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**Indirect impacts (no infrastructure inside wetlands)** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	CVB 3 & 4	B	High	L
			HSS 11	B	Moderate	L
			HSS 8	B	Moderate	L
			HSS 9; UCVB 4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	L
		Direct impacts (infrastructure likely inside wetlands) •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the downstream freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result	HSS 8	B	Moderate	M
			UCVB 3	C	High	M

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
		of disturbances in the catchment of the wetland.				
	Development of OHPL DX2 to DX3 Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**Indirect impacts (no infrastructure inside wetlands)** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.	CVB 6	B	High	**L**
			CVB 5	C	High	**L**
			HSS 13-17	C	Moderate	**L**
			UCVB 7; HSS 18	C	Moderate	**L**
		Direct impacts (infrastructure likely inside wetlands) •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the downstream freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and	CVB 5	C	High	**M**

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
		construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchment of the wetland.				
	Development of MTS, DX2 and DX3 Substations Clearing of vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	**Footprint within or within very close proximity to wetlands:** •Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchments of the wetlands.	UCVB 3	C	High	L
			UCVB 6; HSS 18	C	Moderate	L
	Development of DX1 Substation Clearing of vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	**Footprint more than 100m from wetlands:** •Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchments of the wetlands.	CVB 1	D	High	L
	OHPL DX1 to MTS Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	HSS 1 -4	B	Moderate	L
			UCVB 3	C	High	L

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
			HSS 5	C	Moderate	L
			CVB 1 & 2	D	High	L
			UCVB 1 & 2	D	Moderate	L
	OHPL MTS to DX 2 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 3 & 4	B	High	L
			HSS 11	B	Moderate	L
			HSS 8	B	Moderate	L
			HSS 9; UCVB 4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	L
	OHPL DX 2 to DX 3 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 6	B	High	L
			CVB 5	C	High	L
			HSS 13-17	C	Moderate	L
			UCVB 7; HSS 18	C	Moderate	L
OPERATIONAL	**OHPL DX1 to MTS.** Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	HSS 1 -4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 5	C	Moderate	L
			CVB 1 & 2	D	High	L
			UCVB 1 & 2	D	Moderate	L
	OHPL MTS to DX2. Operation of the	•Disturbance to soil and vegetation relating to	CVB 3 & 4	B	High	L

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
	powerline and planned / emergency maintenance activities	movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	HSS 11	B	Moderate	L
			HSS 8	B	Moderate	L
			HSS 9; UCVB 4	B	Moderate	L
			UCVB 3	C	High	L
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	L
	OHPL DX2 to DX3 Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	CVB 6	B	High	L
			CVB 5	C	High	L
			HSS 13-17	C	Moderate	L
			UCVB 7; HSS 18	C	Moderate	L
	MTS, DX2 and DX3 Substations Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills / failure of transformers in the substation.	UCVB 3	C	High	L
			UCVB 6; HSS 18	C	Moderate	L
	DX1 Substation Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills / failure of transformers in the substation.	CVB 1	D	High	L

Phase	Activity	Impact	Potentially affected watercourses			Risk Rating
			Name/s	PES	Overall Watercourse Importance	
DECOMMISSIONING	Removal of all surface infrastructure from the project area.	•Disturbance of soil and vegetation that established within the decommissioning area and associated indirect impacts on downgradient wetland, including sediment ingress, increased stormwater flows and potential pollution from oils and other pollutants; •Potential proliferation of alien invasive vegetation.	All wetlands	C	Moderate	L

The impact assessment matrix as provided by the Environmental Impact Assessment Practitioner (EAP) has been applied to the proposed development to determine the nature and significance of impacts that could potentially affect the study and investigation area freshwater environment. Before mitigation measures being applied, the potential development of any towers within wetland boundaries would be associated with a “high” degree of impact due to the destruction of a certain area of wetland habitat. The operation of the powerlines and substations would be associated with a “medium” level of impact. After mitigation measures have been applied (and assuming that the Substation footprints are relocated) all activities have been assessed to be associated with a low or very low impact significance.

9.1 Impact Statement

It is the reasoned opinion of the freshwater specialist that the proposed Phefumula Emoyeni One Grid Connection infrastructure development can be granted environmental authorisation. As the current layout does not indicate the position of proposed powerline towers or access roads, the finalised position of this infrastructure must be assessed as part of a walkdown assessment of this infrastructure by a freshwater specialist. This recommendation must be included as a condition of authorisation and this and all other mitigation measures must be included in the EMPr. Should these recommendations be actioned and provided that all other mitigation measures as stipulated in this report are adhered to, the proposed development can be considered acceptable in a freshwater environment context and can be authorised for development.

10 REFERENCES

Day, J., Day, E., Ross-Gillespie, V., and Ketley, A. 2010. *The Assessment of Temporary Wetlands During Dry Conditions*. Report to the Water Research Commission (WRC). Report Number TT 434/09.

Department of Water Affairs and Forestry (DWAF). 2008. *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas,* prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. X. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water Affairs and Forestry (DWAF). 2005. *Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas.*

Department of Water and Sanitation (DWS). 2014. *A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: C2 Compiled by RQIS-RDM: Online available: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx*

Job N.M., le Roux P.A.L., Turner D.P., van der Waals J.H., Grundling A.T., van der Walt M., de Nysschen G.P.M., and Paterson D.G. 2019. *Developing wetland distribution and transfer functions from land type data as a basis for the critical evaluation of wetland delineation guidelines by inclusion of soil water flow dynamics in catchment areas - Volume 1: Improving the Management of Wetlands by Including Hydropedology and Land Type Data at Catchment Level.* WRC Report No. 2461/1/18

Kleynhans C.J., Thirion C. and Moolman J. 2005. *A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland.* Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria

Kleynhans C.J., Thirion C., Moolman J, Gaulana L. 2007. *A Level II River Ecoregion Classification System for South Africa, Lesotho and Swaziland.* Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria

Kotze D.C., Marneweck G.C., Batchelor, A.L., Lindley D.S. and Collins N.B. 2009*. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands.* WRC Report No TT 339/08, Water Research Commission, Pretoria.

MTPA. 2014. *Mpumalanga Biodiversity Sector Plan Handbook*. Compiled by Lötter M.C., Cadman, M.J. and Lechmere-Oertel R.G. Mpumalanga Tourism & Parks Agency, Mbombela (Nelspruit).

National Water Act (NWA) 36 of 1998.

Macfarlane D.M., Kotze D.C., Ellery W.N., Walters D., Koopman V., Goodman P. and Goge C. 2008. *WET-Health: A technique for rapidly assessing wetland health.* WRC Report No. TT 340/08. Water Research Commission, Pretoria.

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

NFEPA: Driver, A., Nel, J.L., Snaddon, K., Murray, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. Water Research Commission. Report No. 1801/1/11. Online available: http://bgis.sanbi.org/nfepa/project.asp

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems.* SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

Rountree, M.W. and Kotze, D.C. 2013. Appendix A3: Ecological Importance and Sensitivity Assessment. In: Rountree, M. W., Malan, H.L., and Weston, B.C. Eds. *Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0)*. WRC Report No. 1788/1/12. Pretoria.

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

Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon,

K., Tererai, F. & Van der Colff, D. 2019. *South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.*

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E. & Snaddon, K. *2018. South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Version 3, final released on 3 November 2019. Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.*

APPENDIX A – Terms of Use and Indemnity

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APPENDIX B – Legislation

LEGISLATIVE REQUIREMENTS

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in 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 Department of Water and Sanitation (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) & (i).
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection.** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. *(b)* An MEC for environmental affairs in a province may, by notice in *the Gazette,* publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): *(a)* critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; *(b)* endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and *(d)* protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs *(a), (b)* or (c).
Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates	NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004)	Alien species are defined, in terms of the NEMBA as: (a) A species that is not an indigenous species; or (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2017): ➢ **Category 1a:** Invasive species that require compulsory control; ➢ **Category 1b:** Invasive species that require control by means of an invasive species management programme; ➢ **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and ➢ **Category 3:** Ornamentally used plants that may no longer be planted.
Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA (Act 36 of 1998) as amended	GN 4167 outlines the parameters and process of a General Authorisation (GA), which replaces the need to apply for a licence in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA. The notice replaces GN 509 of 2016. The GA sets out the need to determine the regulated area of a watercourse, as well as the degree of risk posed by an activity/ies related to a particular water use. In accordance with GN 4167 of December 2023, the regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) the outer edge of the 1 in 100-year flood line 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; b) in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or c) In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans. The GA only applies to the use of water in terms of Section 21(c) and (i) of the NWA where the risk class is LOW as determined through the application of the Risk Matrix as prescribed in the Notice. The GA also does not apply where other Section 21 water uses are triggered, does not apply for most sewage infrastructure and pipelines carrying hazardous materials, water uses associated with hazardous materials, water uses associated with water and wastewater treatment works, and for most mining-related water uses. The GA may be exercised as follows: i) Section 21(c) or (i) water use activities that are determined to pose a LOW Risk as determined through the application of the Risk Matrix as prescribed in the Notice can be undertaken subject to the general conditions of the GA; ii) Section 21(c) or (i) water use activities set out in Appendix D1 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA. Such water use activities in Appendix D1 include inter alia emergency river crossings, fence erection, solar renewable infrastructure that has no direct impact on watercourses and mini-scale hydropower developments; iii) Prescribed water use activities undertaken by certain State Owned Entities as detailed in Appendix D2 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA; iv) Maintenance work associated an existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix can be undertaken ; v) River and stormwater management activities including maintenance of infrastructure as contained in a river management plan or similar management plan, may be

	conducted subject to the approval of such a plan by the relevant DWS regional office or catchment management agency; vi) Rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix can be conducted; and vii) Emergency work arising from an emergency situation and or incident associated with the persons' existing lawful water use entitlement can be undertaken, provided that all work is executed and reported in the manner prescribed in the Emergency protocol contained in Appendix C of the GA. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
National Environmental Management: Waste Act, No 59 of 2008 (NEMWA)	NEMWA, which reforms the law regulating waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution; provides for national norms and standards for regulating the management of waste by all spheres of government and provides for the licensing and control of waste management activities.

APPENDIX C – Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and Ecostatus of the larger aquatic system within which the freshwater ecosystems present or in close proximity of the study area are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of or within the study area.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The freshwater ecosystems encountered within the study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Table C1: Proposed classification structure for Inland Systems, up to Level 3.

<table>
<tr><th colspan="3">WETLAND / AQUATIC ECOSYSTEM CONTEXT</th></tr>
<tr><th>LEVEL 1:
SYSTEM</th><th>LEVEL 2:
REGIONAL SETTING</th><th>LEVEL 3:
LANDSCAPE UNIT</th></tr>
<tr><td rowspan="4">Inland Systems</td><td rowspan="4">DWA Level 1 Ecoregions
OR
NFEPA WetVeg Groups
OR
Other special framework</td><td>Valley Floor</td></tr>
<tr><td>Slope</td></tr>
<tr><td>Plain</td></tr>
<tr><td>Bench
(Hilltop / Saddle / Shelf)</td></tr>
</table>

Table C2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean[6] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

[6] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e., the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2009).

3. WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation
Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment
A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment
Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland
The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of the impact of individual activities and then separately assessing the *intensity* of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores, and Present State categories are provided in the table below.

Table C3: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D

Impact category	Description	Impact score range	Present State category
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Table C4: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland

Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

4. Freshwater ecosystem Function Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[7] The assessment of the ecosystem services supplied by the identified freshwater ecosystems was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;

[7] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the freshwater ecosystems. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the freshwater ecosystems.

Table C5: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

5. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purposed of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other freshwater ecosystem types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C6) of the wetland system being assessed.

Table C6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

6. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the freshwater ecosystem (sections above), with the objective of either maintaining, or improving the ecological integrity of the freshwater ecosystem in order to ensure continued ecological functionality.

Table C7: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

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

***PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a freshwater ecosystem fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater ecosystem may receive the same class for the REC as the PES if the freshwater ecosystem is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the freshwater ecosystem.

Table C8: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

7. General Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C8 below.

Table C9: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.* 2008]

Class	Description	Score (% of total)
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
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

4. Index of Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans et al. 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C3 below.

Table C10: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans et al. 2008]

Class	Description	Score (% of total)
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
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

8. Freshwater ecosystem delineation

The freshwater ecosystem delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators and can accordingly be classified as both. If you are adjacent to a freshwater ecosystem, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the freshwater ecosystem;
- vegetation; and
- alluvial soils and deposited material.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).

APPENDIX D – Risk Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[8]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as freshwater features, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[9].

[8] The definition has been aligned with that used in the ISO 14001 Standard.
[9] Some risks/impacts that have low significance will however still require mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table D3: Duration (How long does the aspect impact on the resource quality)

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table D4: Frequency of the activity (How often do you do the specific activity)

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to freshwater ecosystems and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on freshwater ecosystems are notably and require mitigation measures on a higher level, which costs more and require specialist input. License required.
170 – 300	(H) High Risk	Freshwater ecosystem(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.

A low risk class must be obtained for all activities to be considered for a GA

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[10] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:

[10] Mitigation measures should address both positive and negative impacts.

- Avoidance or prevention of impact;
- Minimisation of impact;
- Rehabilitation; and
- Offsetting.

➢ Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and

➢ Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

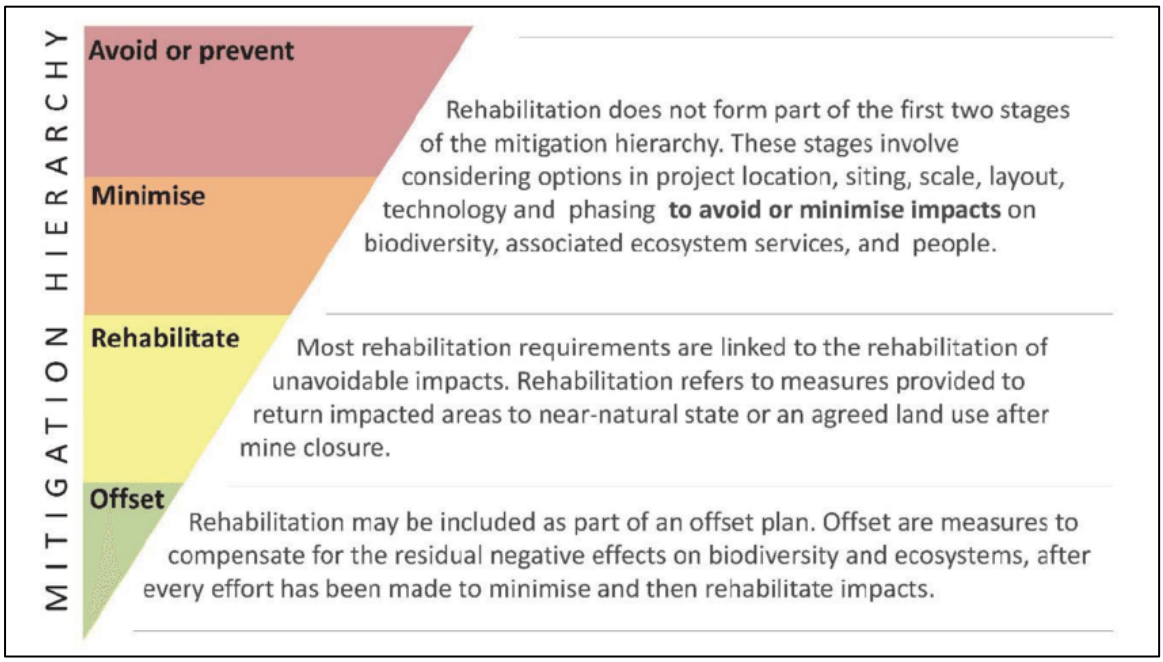

Figure D1: Impact Minimisation hierarchy as advocated by the DEA *et al.*, (2013)

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources traversed by or in close proximity of the proposed project.

Table D10: Reversibility of impacts on the freshwater ecosystems

Reversibility Rating:	**Irreversible** (the activity will lead to an impact that is permanent)
	Partially reversible (The impact is reversible to a degree e.g. acceptable revegetation measures can be implemented but the pre-impact species composition and/or diversity may never be attained. Impacts may be partially reversible within a short (during construction), medium (during operation) or long term (following decommissioning) timeframe
	Fully reversible (The impact is fully reversible, within a short, medium or long-term timeframe)

APPENDIX E – Risk Assessment

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
PRE-CONSTRUCTION	Potentially poor planning of project footprint / infrastructure layout by placing powerline towers within wetlands or their buffer zones.	•Non-avoidance of freshwater ecosystems as part of planning for the proposed development and the resultant transformation / loss of freshwater habitat due to placement of infrastructure within freshwater ecosystems and their associated development exclusion buffers.	All Wetlands	C	Moderate	3	1	3	3	1	**6**	2	4	**12**	**3**	**36**	100%	**36**	**M**	High
	Potentially poor planning of stormwater management for the project.	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of	All Wetlands	C	Moderate	2	1	2	2	1	**4**	1	4	**9**	**3**	**27**	40%	**10, 8**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
		freshwater habitat through poor stormwater design.																		
CONSTRUCTION	**Development of OHPL DX1 to MTS.** Clearing of vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	**<u>Indirect impacts (no infrastructure inside wetlands)</u>** •Transformation of freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or	HSS 1 -4	B	Moderate	2	1	2	1	2	**4**	1	2	**7**	**3**	**21**	40%	**8,4**	**L**	High
			UCVB 3	C	High	2	1	2	1	2	**4**	2	2	**8**	**4**	**32**	40%	**12,8**	**L**	High
			HSS 5	C	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	20%	**4,2**	**L**	High
			CVB 1 & 2	D	High	2	1	2	2	3	**6**	2	2	**10**	**4**	**40**	60%	**24**	**L**	High
			UCVB 1 & 2	D	Moderate	2	1	2	1	2	**4**	1	2	**7**	**3**	**21**	40%	**8,4**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
		transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.																		
	Development of OHPL MTS to DX2 Clearing of	**<u>Indirect impacts (no infrastructure inside wetlands)</u>** •Transformation of	CVB 3 & 4	B	High	1	1	1	1	2	**4**	1	2	**7**	**4**	**28**	20%	**5,6**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
	vegetation and terrain levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	freshwater vegetation, associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water	HSS 11	B	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	20%	**4,2**	**L**	High
			HSS 8	B	Moderate	2	1	2	1	1	**4**	2	2	**8**	**3**	**24**	80%	**19,2**	**L**	High
			HSS 9; UCVB 4	B	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	20%	**4,2**	**L**	High
			UCVB 3	C	High	2	1	2	1	1	**4**	2	2	**8**	**4**	**32**	60%	**19,2**	**L**	High
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	20%	**4,2**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
		quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.																		
		Direct impacts (infrastructure likely inside wetlands) •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the	HSS 8	B	Moderate	3	1	3	3	1	**6**	2	2	**10**	**3**	**30**	100%	**30**	**M**	High
			UCVB 3	C	High	3	1	3	3	2	**6**	2	2	**10**	**4**	**40**	100%	**40**	**M**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
		downstream freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchment of the wetland.																		
	Development of OHPL DX2 to DX3 Clearing of vegetation and terrain	**Indirect impacts (no infrastructure inside wetlands)** •Transformation of freshwater vegetation,	CVB 6	B	High	1	1	1	1	2	**4**	1	2	**7**	**4**	**28**	60%	**16, 8**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
	levelling (bulk earthworks) and construction of powerline towers including laying of foundations (e.g. concrete works).	associated habitat and ecosystem services within downgradient freshwater ecosystems related to indirect impacts, including hydrological alteration due to stormwater discharges, increased erosion or development of new erosion, and deposition of increased sediment from dust or transported by stormwater; •Transportation of construction materials can result in disturbances to soils, increased risk of sedimentation/erosion and dust generation; •Altered water quality in downgradient	CVB 5	C	High	2	1	2	2	1	**4**	2	2	**8**	**4**	**32**	60%	**19,2**	**L**	High
			HSS 13-17	C	Moderate	1	0	1	1	0	**2**	1	2	**5**	**3**	**15**	20%	**3**	**L**	High
			UCVB 7; HSS 18	C	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	60%	**12,6**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
		wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; •Risk of AIP proliferation in disturbed areas that could colonise the adjacent wetland areas.																		
		Direct impacts (infrastructure likely inside wetlands) •Destruction of a certain area of wetland habitat in the construction footprint; •Earthworks and exposure of soil could result in sedimentation of the downstream wetland, which may be transported as runoff into the downstream freshwater	CVB 5	C	High	3	1	3	3	2	**6**	2	2	**10**	**4**	**40**	100%	**40**	**M**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
		ecosystem areas and may smother vegetation associated with the freshwater ecosystems; •Altered water quality (if surface water is present) as a result of vehicle movement and construction activities (including the concrete works and spills); and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchment of the wetland.																		
	Development of MTS, DX2 and DX3 Substations Clearing of	**Footprint within very close proximity to wetlands:** •Earthworks and exposure of soil could result in	UCVB 3	C	High	3	3	3	3	2	**6**	1	2	**9**	**4**	**36**	80%	**39**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
	vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchments of the wetlands.	UCVB 6; HSS 18	C	Moderate	3	3	3	3	2	**6**	2	2	**10**	**3**	**30**	80%	**24**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
	Development of DX1 Substation Clearing of vegetation and terrain levelling (bulk earthworks) and construction of substation infrastructure including laying of foundations (e.g. concrete works).	**Footprint more than 100m from wetlands:** •Earthworks and exposure of soil could result in sedimentation of downgradient wetlands, which may be transported as runoff into the downgradient wetlands and may smother wetland vegetation; •Altered water quality in downgradient wetlands (if surface water is present) as a result of pollution as a result of oils (e.g. from spills) and concrete mixing; and •Proliferation of alien and/or invasive vegetation as a result of disturbances in the catchments of the wetlands.	CVB 1	D	High	1	0	1	1	1	**2**	1	2	**5**	**4**	**20**	20%	**4**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
	OHPL DX1 to MTS Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	HSS 1 -4	B	Moderate	2	1	2	2	2	**4**	1	2	**7**	**3**	**21**	40%	**8,4**	L	High
			UCVB 3	C	High	3	1	3	3	2	**6**	2	2	**10**	**4**	**40**	60%	**24**	L	High
			HSS 5	C	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	20%	**4,2**	L	High
			CVB 1 & 2	D	High	2	1	2	2	3	**6**	1	2	**9**	**4**	**36**	60%	**21, 6**	L	High
			UCVB 1 & 2	D	Moderate	2	1	2	2	3	**6**	1	2	**9**	**3**	**27**	60%	**16, 2**	L	High
	OHPL MTS to DX 2 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 3 & 4	B	High	1	1	1	1	2	**4**	1	2	**7**	**4**	**28**	60%	**16, 8**	L	High
			HSS 11	B	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	20%	**4,2**	L	High
			HSS 8	B	Moderate	3	1	3	3	2	**6**	2	2	**10**	**3**	**30**	80%	**24**	L	High
			HSS 9; UCVB 4	B	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	60%	**12, 6**	L	High
			UCVB 3	C	High	3	1	3	3	2	**6**	2	2	**10**	**4**	**40**	60%	**24**	L	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	20%	**4,2**	L	High
	OHPL DX 2 to DX 3 Stringing of the lines across wetlands.	•Potential damage to wetland habitat and vegetation as a result of stringing activities.	CVB 6	B	High	1	1	1	1	2	**4**	1	2	**7**	**4**	**28**	60%	**16,8**	L	High
			CVB 5	C	High	2	1	2	2	1	**4**	2	2	**8**	**4**	**32**	80%	**25,6**	L	High
			HSS 13-17	C	Moderate	1	0	1	1	0	**2**	1	2	**5**	**3**	**15**	20%	**3**	L	High
			UCVB 7; HSS 18	C	Moderate	1	1	1	1	2	**4**	1	2	**7**	**3**	**21**	60%	**12,6**	L	High
OPERATIONAL	**OHPL DX1 to MTS.** Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills	HSS 1 -4	B	Moderate	1	1	1	1	1	**2**	1	1	**4**	**3**	**12**	20%	**2,4**	L	High
			UCVB 3	C	High	2	1	2	2	2	**4**	1	1	**6**	**4**	**24**	40%	**9,6**	L	High
			HSS 5	C	Moderate	1	1	1	1	1	**2**	1	1	**4**	**3**	**12**	20%	**2,4**	L	High
			CVB 1 & 2	D	High	1	1	1	1	1	**2**	1	1	**4**	**4**	**16**	20%	**3,2**	L	High
			UCVB 1 & 2	D	Moderate	1	1	1	1	1	**2**	1	1	**4**	**3**	**12**	20%	**2,4**	L	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
		from vehicles / machinery involved in maintenance activities.																		
	OHPL MTS to DX2. Operation of the powerline and planned / emergency maintenance activities	•Disturbance to soil and vegetation relating to movement of vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	CVB 3 & 4	B	High	1	1	1	1	2	**4**	1	1	**6**	**4**	**24**	20%	**4,8**	L	High
			HSS 11	B	Moderate	1	1	1	1	2	**4**	1	1	**6**	**3**	**18**	20%	**3,6**	L	High
			HSS 8	B	Moderate	2	1	2	1	1	**4**	1	1	**6**	**3**	**18**	40%	**7,2**	L	High
			HSS 9; UCVB 4	B	Moderate	1	1	1	1	2		1	1	**2**	**3**	**6**	20%	**1,2**	L	High
			UCVB 3	C	High	2	1	2	1	1	**4**	1	1	**6**	**4**	**24**	40%	**9,6**	L	High
			HSS 6; HSS 7; HSS 10; UCVB 5 & 6; HSS 12	C	Moderate	1	1	1	1	2	**4**	1	1	**6**	**3**	**18**	20%	**3,6**	L	High
	OHPL DX2 to DX3 Operation of the	•Disturbance to soil and vegetation relating to movement of	CVB 6	B	High	1	1	1	1	2	**4**	1	1	**6**	**4**	**24**	20%	**4,8**	L	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
	powerline and planned / emergency maintenance activities	vehicles / equipment through freshwater ecosystems as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of spills from vehicles / machinery involved in maintenance activities.	CVB 5	C	High	2	1	2	2	1	**4**	1	1	**6**	**4**	**24**	40%	**9,6**	**L**	High
			HSS 13-17	C	Moderate	1	0	1	1	0	**2**	1	1	**4**	**3**	**12**	20%	**2,4**	**L**	High
			UCVB 7; HSS 18	C	Moderate	1	1	1	1	2	**4**	1	1	**6**	**3**	**18**	20%	**3,6**	**L**	High
	MTS, DX2 and DX3 Substations Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills /	UCVB 3	C	High	2	1	2	2	2	**4**	1	1	**6**	**4**	**24**	80%	**19,2**	**L**	High
			UCVB 6; HSS 18	C	Moderate	2	1	2	2	2	**4**	1	1	**6**	**3**	**18**	80%	**14,4**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses				Intensity of Impact on Resource Quality						Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)		Severity (max = 20)	Importance rating (max = 5)		Consequence (max = 100)		Likelihood (Probability) of impact		Significance (max = 100)	Risk Rating	Confidence level
							Abiotic Habitat (Drivers)			Biota (Responses)																	
			Name/s	PES	Overall Watercourse Importance		Hydrology	Water Quality	Geomorph	Vegetation	Fauna																
		failure of transformers in the substation.																								
	DX1 Substation Operation of the Substation, including maintenance activities	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities that could affect downgradient wetlands; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants, especially in the event of spills / failure of transformers in the substation.	CVB 1	D	High		1	0	1	1	1		**2**	1	1		**4**	**4**		**16**		20%		**3,2**	**L**	High

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
DECOMMISSIONING	Removal of all surface infrastructure from the project area.	•Disturbance of soil and vegetation that established within the decommissioning area and associated indirect impacts on downgradient wetland, including sediment ingress, increased stormwater flows and potential pollution from oils and other pollutants; •Potential proliferation of alien invasive vegetation.	All wetlands	C	Moderate	3	2	3	3	2	**6**	2	1	**9**	**3**	**27**	80%	**21, 6**	**L**	High

APPENDIX F – Impact Assessment Methodology

ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct , indirect , secondary as well as cumulative impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria presented in Table G1.

Table F1 - Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can

be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

he mitigation sequence/hierarchy is shown in Figure G2 below.

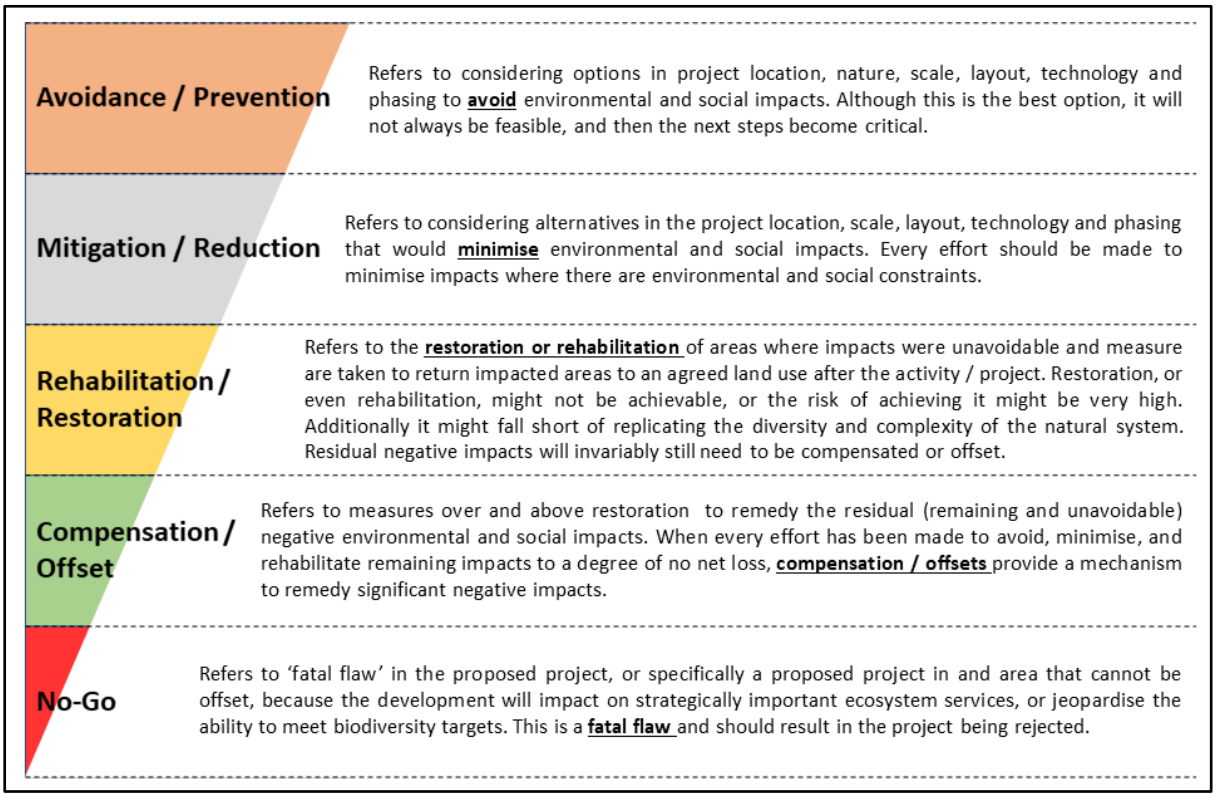

Figure F2 – The mitigation hierarchy

APPENDIX G –Results of Detailed Assessment

APPENDIX H – General "Good Housekeeping" Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecosystem ecology and biodiversity will include any activities which take place in close proximity to the proposed servitude that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater ecosystem identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should only encroach into the freshwater ecosystem if considered absolutely essential;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes should avoid freshwater ecosystem areas and be restricted to existing or pre-approved access roads and should not traverse the freshwater ecosystem;
- Appropriate sanitary facilities must be provided for the life of the repair and maintenance phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and "spill" bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practised near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas. Whilst not considered severe at this time, the vegetation component within the freshwater ecosystem environment is already transformed. However, alien invasive species are opportunistic, and where disturbances do occur, they will promulgate; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the freshwater ecosystem must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998); and
- Species-specific and area-specific eradication recommendations:
    - Footprint areas should be kept as small as possible when removing alien plant species; and

- No vehicles should be allowed to drive through designated sensitive freshwater ecosystems areas during the eradication of alien and weed species.

Soils

- Sheet runoff from compacted areas should be slowed down by the strategic placement of berms;
- It is considered ideal that activities occur within the current season (low rainfall) to minimise impacts of sedimentation;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;
- Temporary stockpiling of excavated material from trenches can be retained alongside trenches, as required for backfilling. Any soil to be stockpiled for longer than a month should be moved to a designated stockpile area, as approved by the Environmental Control Officer (ECO);
- All soils compacted during the repair and maintenance phase should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area, as well as the immediate vicinity of the proposed work area, should be removed.

APPENDIX I – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden: MSc (Environmental Management) (University of Johannesburg)

Paul da Cruz BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum Member of the Gauteng Wetland Forum; Member of International Association of Impact Assessors (IAIA) South Africa; Member of the Land Rehabilitation Society of South Africa (LaRSSA)		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.

Signature of the Specialist

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Paul da Cruz, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.

Signature of the Specialist.

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF PAUL DA CRUZ

PERSONAL DETAILS

Position in Company	Senior Ecologist
Joined SAS Environmental Group of Companies	2022

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Certificated Scientist at South African Council for Natural Scientific Professions (SACNASP)
Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA)
Member of the South African Wetland Society (SAWS)

EDUCATION

Qualifications

BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand)	1998
BA (Geography) (University of the Witwatersrand)	1997

Short Courses

Taxonomy of Wetland Plants (Water Research Commission)	2017
Advanced Grass Identification (Frits van Outshoorn)	2010
Grass Identification (Frits van Outshoorn),	2009
Soil Form Classification and Wetland Delineation; (TerraSoil Science)	2008

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana
International – United Kingdom (England and Scotland); USA

DEVELOPMENT SECTORS OF EXPERIENCE

1. Renewable energy (Wind and solar)
2. Linear developments (energy transmission, telecommunication, pipelines, roads, border infrastructure)
3. Nature Conservation and Ecotourism Development
4. Commercial development
5. Residential development
6. Environmental and Development Planning and Strategic Assessment
7. Industrial/chemical; Non-renewable power Generation

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- EIA / BA Applications
- Environmental Authorisation Amendments
- EMPr Compilation
- Environmental Compliance Monitoring (Environmental Auditing)
- Environmental Screening Assessments and Listing Notice 3 Trigger Identification / Mapping
- Strategic Environmental Assessments and Environmental Management Frameworks
- EIA / Specialist Study Peer Review

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Assessments in support of Environmental Screening Assessments, Precinct Planning & SEA
- Wetland Construction (Compliance) Monitoring

Biodiversity Assessments

- Avifaunal Assessments
- Strategic Biodiversity Assessment

Visual Impact Assessment

- Visual Impact Assessments

GIS / Spatial Analysis

- GIS Spatial Analysis and Listing Notice 3 mapping.