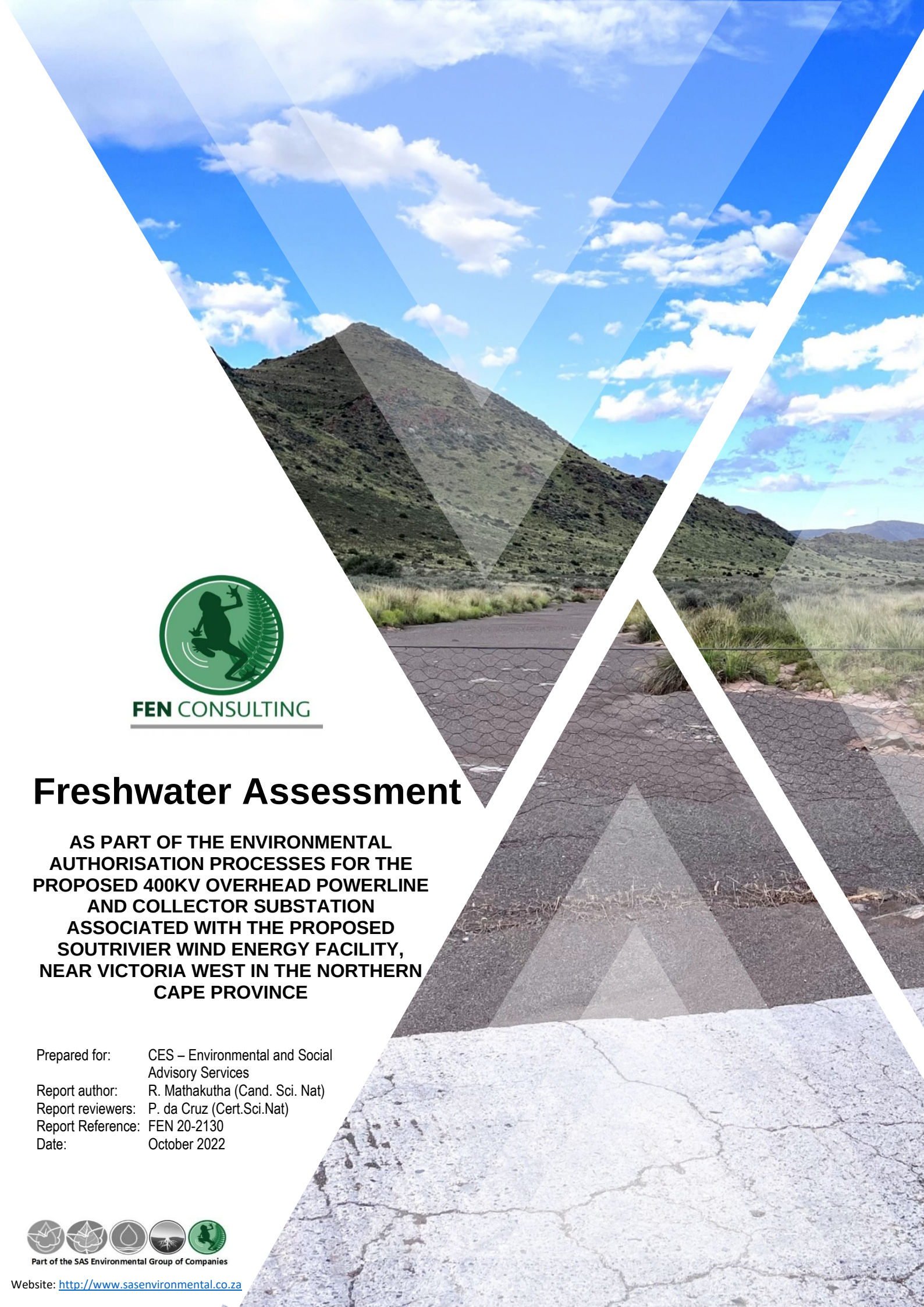

FEN CONSULTING

Freshwater Assessment

AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESSES FOR THE PROPOSED 400KV OVERHEAD POWERLINE AND COLLECTOR SUBSTATION ASSOCIATED WITH THE PROPOSED SOUTRIVIER WIND ENERGY FACILITY, NEAR VICTORIA WEST IN THE NORTHERN CAPE PROVINCE

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EXECUTIVE SUMMARY

A 400 kV overhead powerline and associated collector and on-site substation for the proposed Soutrivier Wind Energy Facility (WEF) are proposed to be developed and linked to the existing Eskom Gamma Substation. The proposed powerline will traverse mountain stream drainage lines, upper and lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Stilfonteinspruit and Brak River systems, as well as the Kookfonteinspruit and Brak Rivers. No wetlands were identified to be traversed by the proposed powerline.

It was determined that the proposed powerline will have a Low risk significance on the freshwater features with the implementation of mitigation measures. The Low risk significance is based on the premise that all powerline support structures will be located at least 32 m from a freshwater feature and any grading of existing roads (no formal upgrading or expansion of road crossings), particularly those that traverse freshwater features (should it be required) is only undertaken during the driest period of the year. The impact significance for the construction and operation of these components can be considered low with mitigation. The proposed collector and on-site substations are located outside the 100 m zone of regulation as per GN509 of the National Water Act, and the risk significance of these components was not considered as they are located outside the 100 m GN509 regulated area.

Based on the findings of the assessment, no fatal flaws in terms of freshwater ecological aspects were identified. With adherence to cogent, well-conceived and ecologically sensitive construction plans and the implementation of the mitigation measures provided in this report, and provided that general good construction practice is adhered to, the proposed powerline is considered acceptable from a freshwater conservation perspective.

MANAGEMENT SUMMARY

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed 400 kV overhead powerline and associated collector substation proposed development near Victoria West in the Northern Cape Province (hereafter referred to as the 'proposed powerline' and 'proposed collector substation', respectively and the 'proposed powerline' collectively. The on-site substation associated with the proposed Soutrivier Wind Energy Facility (WEF) was also included in this assessment and is proposed directly adjacent to the proposed collector substation. The proposed powerline will be routed from the proposed collector substation, across adjoining farmland for a distance of approximately 68 km to the existing Gamma Substation.

The purpose of this report is to provide a description and assessment of the ecology of the freshwater ecosystems associated with the proposed powerline including mapping of the natural freshwater features, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES). The Department of Water and Sanitation (DWS) Risk Assessment Matrix as promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the impacts associated with the proposed powerline and mitigatory measures were identified which aim to minimise the potential impacts.

A desktop study was conducted, in which the freshwater features were identified prior to the on-site investigation, and relevant national and provincial databases were consulted. The results of the desktop study are contained in Section 4 of this report.

A field assessment took place from the 27th to the 28th of February 2022. The freshwater features identified to be traversed by the powerline development and those identified within the investigation area can best be described as fluvial features associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Stilfonteinspruit and Brak River systems. These comprise of smaller drainage lines and minor tributaries (that drain the surrounding hilltops and were classified as mountain stream drainage lines and upper foothill tributaries based on their topographical setting and longitudinal zonation), and larger tributaries and rivers that are positioned within the lower gradient were classified as lower foothill tributaries and rivers associated with the aforementioned main river systems. No wetlands were

identified to be traversed by the proposed powerline, nor are there any identified within the investigation area.

The results of the ecological assessment of the freshwater features are discussed in Section 5 of this report and summarised in the table below.

Table A: Summary of results of the ecological assessment as discussed in Section 5.

Freshwater ecosystem	Present Ecological State (PES)	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
Brak River	C (Moderately modified)	Very Low to Moderately High	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Kookfonteinspruit River	C (Moderately modified)	Very Low to Moderately High	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River systems	C (Moderately modified)	Very Low to Moderately High	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Upper foothill tributaries associated with the Sout, Kookfonteinspruit and Tierhoekspruit River systems	B (Largely natural with few modifications)	Very Low to Very High	High	REC: B (Largely natural with few modifications) BAS: Category B RMO: B (Improve)
Mountain stream drainage lines associated with the Kookfonteinspruit and Brak River systems	B (Largely natural with few modifications)	Very Low to Very High	High	REC: B (Largely natural with few modifications) BAS: Category B RMO: B (Improve)

The proposed powerline will traverse several of the assessed freshwater features. The support structures are strongly recommended to be constructed outside the delineated freshwater features and outside the 32 m zone of regulation (ZoR) in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998), as far as feasible, but will still likely be located within the 100 m ZoR in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998). The proposed collector substation and on-site substation associated with the Soutrivier WEF are located outside the 100 m GN509 ZoR. The risk significance of these substations was thus not considered as they are located outside the 100 m GN509 regulated area and are considered to not pose a quantum of risk to the freshwater features due to their distance relative to the delineated freshwater features. At the time of this assessment the layout of the proposed access roads (potential new roads) was not available. As such, it is assumed that the existing informal roads will be used as access roads. A “jeep-track” maintenance path is proposed for the operational phase, which may likely be used to access the site during the construction phase and was thus included in the risk assessment. The DWS Risk Assessment was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the assessed freshwater features, and assuming that the support structures are installed outside the 32 m NEMA ZoR, as far as possible. A summary of the outcome of the risk assessment is provided in Table B.

Table B: Summary of the outcome of the DWS Risk Assessment for the proposed powerline (with the implementation of mitigation measures).

Impact and Aspect		Risk
Construction Phase	Site preparation prior to construction activities: ➢ Removal of vegetation within the construction footprint resulting in increased sedimentation risk to the freshwater features. ➢ Vehicular movement (transportation of construction materials), access to site and associated disturbances to soil.	**Low**
	Installation of the support structures and spanning of the proposed powerline entailing the excavation of foundation pits for the support structures leading to stockpiling of soil, and potential movement of construction equipment and personnel within the freshwater features. ➢ Disturbances of soil leading to potential impacts to the freshwater features and increased sediment runoff from the construction site to the freshwater features, in turn leading to altered freshwater habitat; ➢ Altered runoff patterns, leading to increased erosion of the freshwater features where freshwater features are within close proximity.	**Low**
	Soil compaction for the access route ("jeep-track") ➢ Disturbances of soil resulting in altered runoff patterns within the vicinity of the freshwater features.	**Low**
Operational Phase	Operation and maintenance of the powerline entailing potential indiscriminate movement of maintenance vehicles within the freshwater features or within close proximity to the freshwater features and increased risk of altered flow and hydrocarbons entering the freshwater features. ➢ Disturbance to soil and ongoing erosion as a result of periodic maintenance activities.	**Low**

No fatal flaws in terms of freshwater ecological aspects were identified. Should all the powerline support structures be located at least 32 m (as far as possible or feasible) from the delineated extent of a freshwater feature and the recommended mitigation measures be implemented, it is the opinion of the freshwater specialist that the risk significance of the proposed powerline can be considered Low. The construction period must be limited to occur within the dry period when there is little to no surface water within the freshwater features, particularly for the grading of existing roads (no formal upgrading or expansion of road crossings) those that traverse freshwater features (should it be required). All mitigation measures as provided must be implemented to prevent any negative edge effects from occurring on the freshwater features. Water Use Authorisation by means of General Authorisation (GA) in terms of Section 21(c) and (i) water uses, may potentially be obtained in consultation with the Department of Water and Sanitation (DWS). However, the DWS, the custodian of water resources in South Africa, must be consulted with regards to the outcome of this assessment.

Based on the findings of the freshwater ecological assessment and the results of the risk assessment, it is the opinion of the ecologist that the proposed powerline and substation development pose a **low risk to the integrity of the freshwater features** in the project area provided that adherence to cogent, well-conceived and ecologically sensitive construction plans are implemented and the mitigation measures provided in this report as well as general good construction practices are adhered to, the proposed 400 kV powerline and associated substations are considered acceptable.

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	
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover Page and Appendix G.
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 4.1: Table 1 and Section 4.2
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	Section 4: Table 1
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 4: Table 1
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 5:
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 powerline on the following very high sensitivity areas/ features:	
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Yes, with implementation of the proposed mitigation measures
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
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.) and d. Assessment of the risks associated with water use/s and related activities.	Section 5

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); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. Loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soil, etc).	Section 7
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 5
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 5
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 – Closest estuary is more than 200km south of the study area
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Appendix G
3.2	A signed statement of independence by the specialist.	Appendix G
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 3.1
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Section 3, Appendix C and Appendix D
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 1.3
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 6
3.7	Additional environmental impacts expected from the proposed powerline.	Section 7
3.8	Any direct, indirect and cumulative impacts of the proposed powerline on site.	Section 7
3.9	The degree to which impacts, and risks can be mitigated.	Section 7
3.10	The degree to which impacts, and risks can be reversed.	Section 7, Appendix F – Table F1
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 7
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 6
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.	Section 7
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed powerline and if the proposed powerline should receive approval or not.	Section 8
3.16	Any conditions to which this statement is subjected.	Section 8

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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.
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 flow into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Episodic drainage lines	Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
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 soil).
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soil with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
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.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act No. 36 of 1998) 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 soil, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius
AC	Alternating Current
BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CBANC	Critical Biodiversity Areas of the Northern Cape
DC	Direct Current
DFFE	Department of Forestry, Fisheries and the Environment
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
kV	Kilovolt
m	Meter
MAP	Mean Annual Precipitation
MC	Management Classes
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NBA	National Biodiversity Assessment
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NWCS	National Wetland Classification System
O&M	Operation and Maintenance
PEMC	Present Ecological Management Class
PES	Present Ecological State
REC	Recommended Ecological Category
REDZ	Renewable Energy Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Program (REIPPPP)
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SARERD	South African Renewable Energy Resource Database
SAS	Scientific Aquatic Services
SQR	Sub-quaternary catchment reach

subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WULA	Water Use Licence Application
WRC	Water Research Commission
ZOR	Zone of Regulation

1 INTRODUCTION

1.1 *Background*

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed 400 kV overhead powerline and associated collector substation development near Victoria West in the Northern Cape Province (hereafter referred to as the 'proposed powerline' and 'proposed collector substation', respectively and the 'proposed powerline' collectively) (Figures 1 and 2). The on-site substation associated with the proposed Soutrivier Wind Energy Facility (WEF) was also included in this assessment and is proposed directly adjacent to the proposed collector substation (Figure 1). The proposed powerline will be routed from the proposed collector substation, across adjoining farmland for a distance of approximately 68 km to the existing Eskom Gamma Substation. Please refer to Section 2 for the project description.

In order to identify all freshwater ecosystems that may potentially be impacted by the proposed powerline, a 500 m "zone of investigation" was implemented around the proposed powerline and proposed collector and on-site substations, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (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 powerline and substations - will henceforth be referred to as the 'investigation area'.

The purpose of this report is to provide a description and assessment of the ecology of the freshwater ecosystems associated with the proposed powerline and substation including mapping of the natural freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES). The Department of Water and Sanitation (DWS) Risk Assessment Matrix as promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the impacts associated with the proposed powerline and mitigatory measures were identified which aim to minimise the potential impacts. A pre-defined impact assessment methodology (as provided by the Environmental Assessment Practitioner (EAP)) was undertake fulfilment of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

This study further aims to provide detailed information to guide the proposed powerline in the vicinity of the freshwater ecosystems, to ensure the ongoing functioning of the ecosystems, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development. This report, after consideration of the above, must guide the proponent, by means of a reasoned opinion and recommendations, as to the viability of the proposed powerline from a freshwater resource management perspective.

1.2 *Structure of this report*

This report investigates the impact significance of the proposed powerline and substation, as explained the National Water Act, 1998 (Act No. 36 of 1998) (NWA) by means of the DWS Risk Assessment Matrix. The following structure is applicable to this report:

Section 1: Introduction
Provides an introduction, the structure of this report, the assumptions and limitations.

Section 2: Project Description
Provides the location of the proposed powerline as well as a brief summary of the proposed activities associated with the proposed powerline.

Section 3: Assessment Approach
Provides the relevant methodology and definitions applicable to this report, a description of the sensitivity mapping and the risk assessment approach.

Section 4: Desktop Assessment Results
Reports on the findings from the relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA], 2011 database; the National Biodiversity Assessment [NBA], 2018 database; the DWS Resource Quality Information System (RQIS) PES/ EIS, 2014 database and the Northern Cape Critical Biodiversity Areas database (2016)), were undertaken to aid in identifying any freshwater ecosystems.

The national web based Environmental Screening Tool by the Department of Forestry, Fisheries and Environment (DFFE) (previously the Department of Environmental Affairs (DEA)) (DEA, 2020), was undertaken to screen the proposed powerline for any environmental sensitivity, with specific focus on aquatic sensitivities. The results are presented in Section 4.

Section 5: Site Based Freshwater Ecosystem Assessment Results (Terms of Reference)

This section reports the following:

- A description and delineation of all freshwater ecosystems associated with the proposed powerline according to "Department of Water Affairs and Forestry (DWAF)[1] (2008)[2]: A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones";
- Delineation of all freshwater ecosystems (using desktop methods) within 500 m of the proposed powerline in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998);
- The classification of the freshwater ecosystems according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al.*, 2013);
- The Ecological assessment of the freshwater ecosystems utilised the following methodologies:
  - The EIS of the freshwater ecosystems according to the method described by DWAF (1999);
  - The services provided by the freshwater ecosystems according to the method of Kotze *et al.* (2020) (Version 2) in which services to the ecology and to the people are assessed;
  - The PES of the freshwater ecosystems was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.* (2008) and the River Eco Classification: Index of Habitat Integrity (IHI) as advocated by the Water Research Commission (WRC) and DWAF (2008), as applicable; and
- The allocation of a suitable Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) to the freshwater ecosystem based on the results obtained from the PES, Ecoservices and EIS assessments.

Section 6: Legislative Requirements
Provides the applicable legislative requirements based on the findings from Section 5 and indicates any applicable zones of regulation that may trigger various enviro-legal authorisation requirements.

Section 7: Impact and Risk Assessment

[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA). At present, the Department is known 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.

[2] Although 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.

Provides the outcomes of the DWS Risk Assessment Matrix results and Impact Assessment methodology (as provided by the EAP) which highlight all potential impacts and that may affect the identified freshwater ecosystems. Management and mitigation measures are provided and an assessment on the reversibility of the impact which should be implemented during the construction and operational phases of the proposed powerline in order to assist in minimising the impact on the receiving environment.

Section 8: Conclusion
Summarises the key findings and recommendations based on the risk assessment outcomes and legislative requirements.

1.3 *Assumptions and Limitations*

- The ground-truthing and delineation of the freshwater ecosystem boundaries and the assessment thereof, are confined to a site visit undertaken from the 27th to the 28th of February 2022. All freshwater ecosystems identified within the investigation area were delineated in fulfilment of GN 509 of the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods including use of topographic maps, historical and current digital satellite imagery and aerial photographs, with limited site verification. The delineations of freshwater ecosystems outside the proposed powerline route must not be utilised for any purpose, other than planning for the proposed powerline. Any areas that may have additionally been mapped will require field-based delineation and ground-truthing as directed by applicable legislation and best practice methods;
- Due to access limitations by some landowners and following heavy rains in the region and damage to the roads, and the landscape in some areas being rugged and very undeveloped, some reaches of the identified freshwater ecosystems were inaccessible. Therefore, verification points for these freshwater ecosystems were located at points as close as possible to the freshwater ecosystem reach of concern to be verified and, where necessary the conditions at the exact point required were inferred or extrapolated. The delineation of the identified freshwater ecosystems associated with the proposed powerline, as provided in this report, is considered accurate taking into consideration the conditions at the time of assessment and variable topography of the area; the results obtained are considered sufficiently accurate to allow informed planning and decision making to take place;
- The basis of South African methodologies for the formal identification and delineation of wetlands is primarily that of soil morphological indicators such as mottling and gleying, and presence of hydrophytic vegetation. However, a number of wetland types and conditions have been identified in which these soil morphological indicators do not readily apply, including temporary wetlands in very arid areas, which are often either 'too shallow, too saline, or too temporarily inundated" to exhibit typical wetland indicators in their soil (Day *et al*, 2010). Nevertheless, a number of abiotic and biotic features indicate periodic wetness and were thus used in conjunction with visual analysis of soil and topography to identify possible freshwater ecosystems associated with the proposed powerline;
- Only activities for which information was available at the time of compiling this report are considered in this report. Should detailed information be made available, it is highly recommended that it be reviewed and reassessed as part of this freshwater ecological assessment. The freshwater ecologist cannot be held liable should the outcome of this report not be considered feasible by the relevant authorities due to the lack of detailed information;
- Global Positioning System (GPS) technology is inherently somewhat inaccurate, and some inaccuracies due to the use of handheld GPS instrumentation may occur; however, the delineations as provided in this report are deemed appropriately accurate to fulfil the authorisation requirements;

- Wetlands and/or riparian zones and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative wetland or riparian species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundaries may occur. However, if the Department of Water Affairs and Forestry (DWAF)[3] (2008)[4] method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. The freshwater ecosystem delineation as presented in this report is, however, regarded as the best estimate of the boundaries based on the site conditions present at the time of the site visit and are deemed appropriately accurate to guide any future development plans.

2 PROJECT DESCRIPTION

The proposed 400 kV powerline will be routed from the proposed Soutrivier Wind Energy Facility (WEF) collector substation to the existing Eskom Gamma Substation, for a distance of approximately 68 km (Figures 1 and 2). A monopole or lattice pylon/support structure design will likely be used for the proposed powerline to allow sufficient clearance for birds. The positions of the powerline support structures were not available at the time of this assessment as the outcome of this assessment will guide the placement of these structures.

The Soutrivier WEF consists of three (3) sites with their own on-site substations, namely Soutrivier North, Soutrivier Central and Soutrivier South. The proposed collector substation will serve as a collector substation for the overall Soutrivier WEF sites. The proposed on-site substation associated with the Soutrivier South WEF site is located directly adjacent to the proposed collector substation and was included as part of the investigation area (Figures 1 and 2). The proposed collector substation and proposed Soutrivier South on-site substation are expected to cover an area of 1.5 ha each and will be located at the centre of the proposed Soutrivier South WEF site. The footprint area of the proposed substations will be levelled and compacted. If required, imported material will be sourced or excess material from the turbine foundations will be used as fill.

The proposed powerline will be routes along the existing Biesiespoort Road for much of its central extent (from the N12 to the after the Desert Dew Guest House). Access/maintenance to the site is assumed to be undertaken from the existing informal farm roads including the Biesiespoort Road. The proponent has confirmed that there will be informal access road (“jeep-track”) for maintenance activities that will most likely run underneath or adjacent to the powerline route, and will likely be used to access the site during construction.

[3] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA). At present, the Department is known 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.

[4] Although 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.

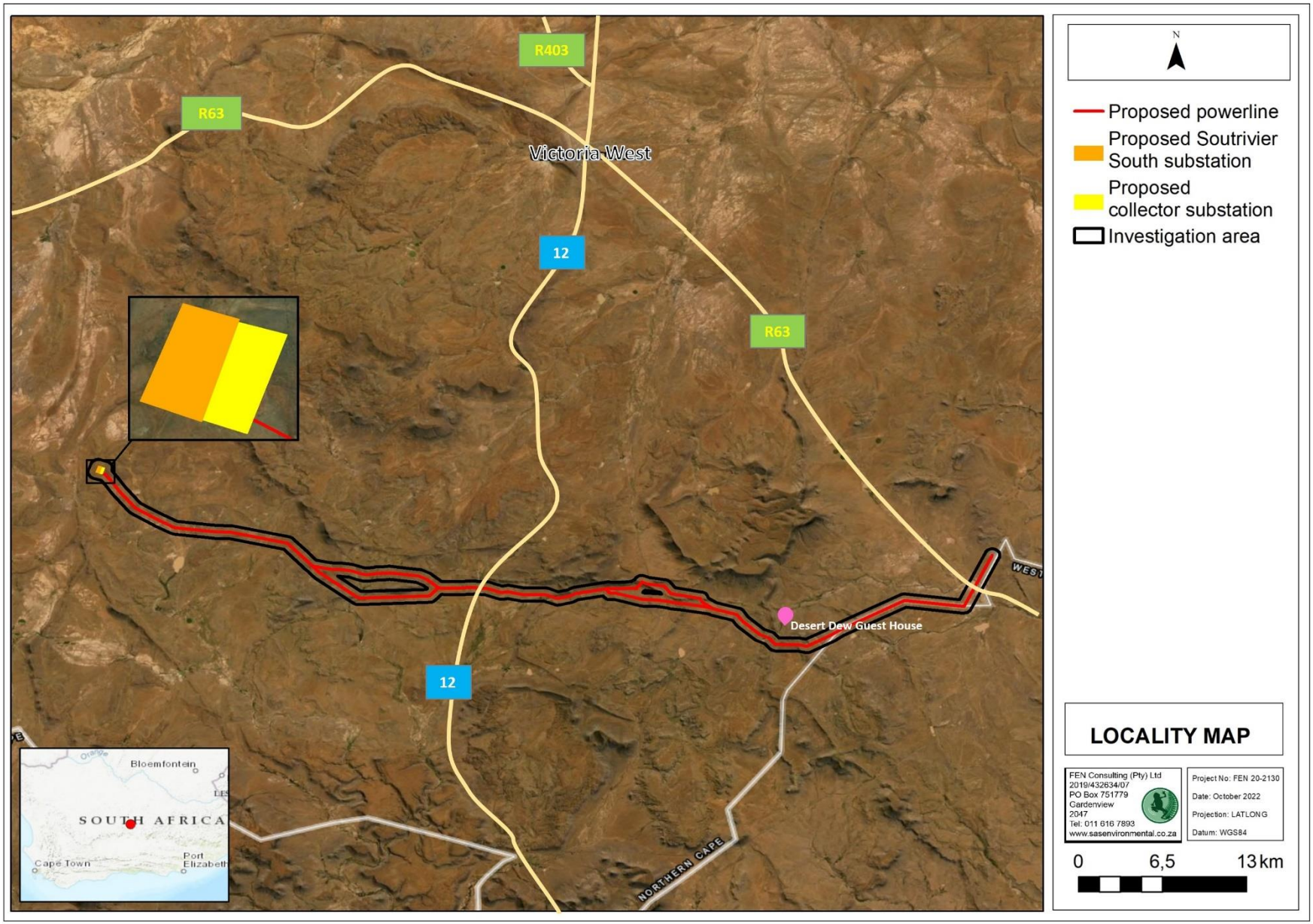


Figure 1: Digital satellite image depicting the proposed powerline and the investigation area in relation to the surrounding area.

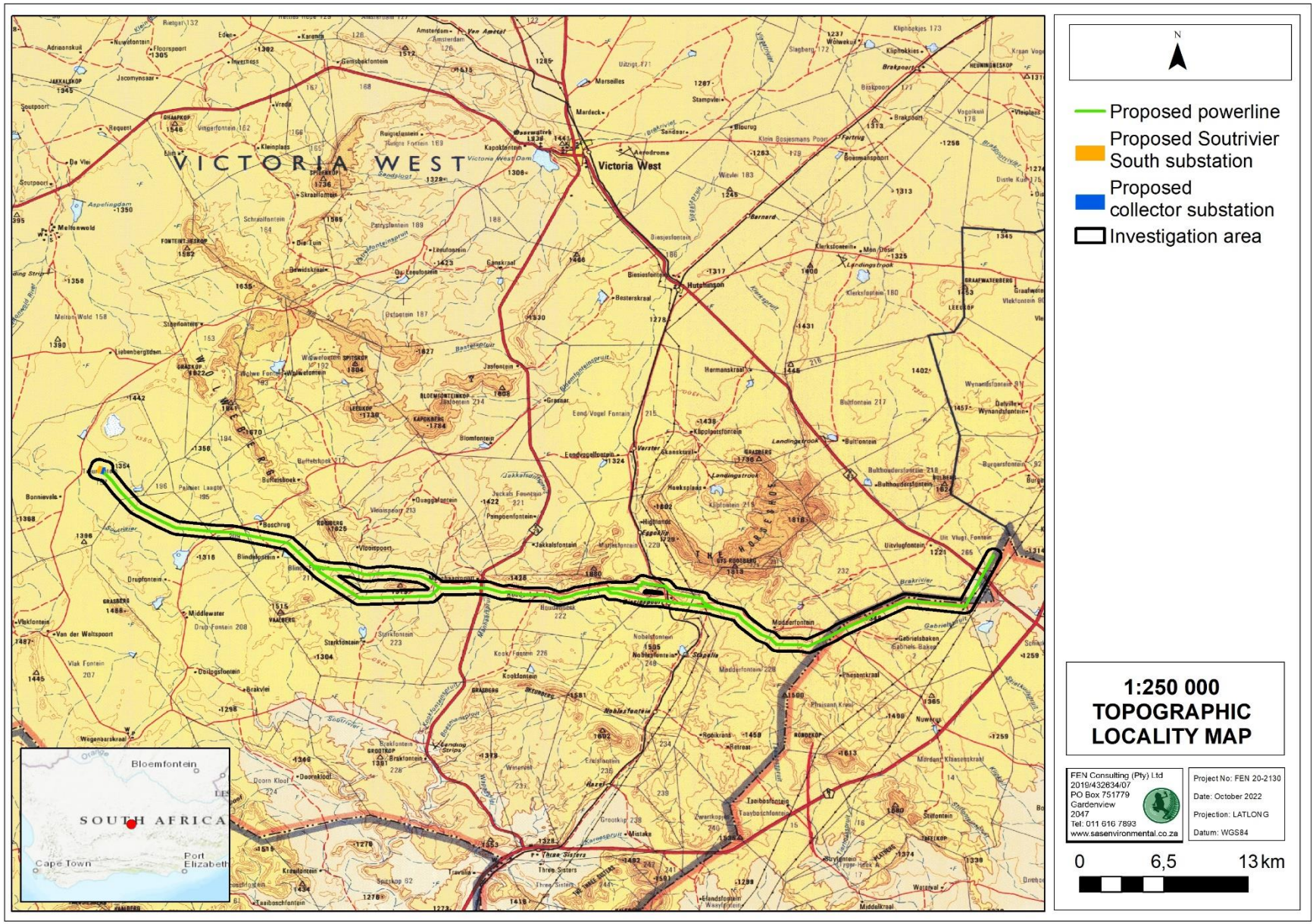


Figure 2: Location of the proposed powerline and the investigation area depicted on a 1:250 000 topographical map in relation to surrounding area.

3 ASSESSMENT APPROACH

3.1 *Freshwater Ecosystem Field Verification*

For the purposes of this investigation, the definition of a watercourse and wetland and riparian habitat was taken as per that in the National Water Act, 1998 (Act No. 36 of 1998), as amended (NWA). The definitions are as follows:

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 of the Gazette, declare a watercourse.

It should be noted that in this report "freshwater ecosystem / feature" is used and carries the same meaning as "watercourse" as defined by the NWA.

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."

Another widely used definition of wetlands is the one used under the Convention on Wetlands (Ramsar, 1971) '**wetlands**' are defined by Articles 1.1 and 2.1 as:

> Article 1.1: 'For the purpose of this Convention wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.'
>
> Article 2.1 provides that wetlands: 'may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands'.

This determining factor has been utilised in this assessment. Wetland soils can be termed hydric or hydromorphic soils. **Hydric soils** are defined by the United States Department of Agriculture's Natural Resources Conservation Service as being:

> *"soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part".*

These anaerobic conditions would typically support the growth of hydrophytic vegetation (vegetation adapted to grow in soils that are saturated and starved of oxygen) and are typified by the presence of redoximorphic features.

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

A field verification was undertaken from the 27th to the 28th of February 2022 (Northern Cape summer period)[5],, during which the presence of any wetland or riparian habitats as defined by DWAF (2008) and the National Water Act, 1998 (Act No. 36 of 1998), both of which are considered 'watercourses' according to the latter, were noted (please refer to Section 5 of this report). The freshwater ecosystem delineations took place 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 adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

In addition to the delineation process, detailed assessment of the delineated freshwater feature was undertaken, at which time 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 this freshwater ecosystem. A detailed explanation of the methods of assessment undertaken is provided in **Appendix C** of this report.

3.2 *Sensitivity Mapping*

All freshwater ecosystems associated with the proposed powerline were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map presented in Section 6 should guide the design, layout and management of the proposed powerline.

3.3 *Risk and Impact Assessment and Recommendations*

Following the completion of the assessment, the DWS Risk Assessment and Impact Assessment methodology (as provided by the EAP) were conducted (please refer to **Appendix D** for the methods of approach) and recommendations were developed to address and mitigate impacts associated with the proposed powerline. These recommendations also include general management measures, which apply to the proposed construction and operational activities. Mitigation measures have been developed to address issues in all phases throughout the life of the proposed powerline including planning, construction, and operation. The detailed mitigation measures are outlined in Section 7 of this report, while the general management measures which are considered to be best practice mitigation applicable to this project, are outlined in **Appendix F**.

[5] Site surveys are recommended to take place during a seasonal period where the probability of detecting an identifiable life history stage of vegetation species (such as facultative vegetation species) is highest and in the raining period to ensure optimised conditions for the identification of seasonal freshwater features, which may otherwise be overlooked. The site conditions at the time of the field assessment are considered acceptable as rainfall had occurred within the region weeks prior and leading up to the site assessment.

4 DESKTOP ASSESSMENT RESULTS

4.1 *National and Provincial Datasets*

The following section contains data accessed as part of the desktop assessment and presented as a "dashboard-style" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place. Where required, further discussion and interpretation are provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics associated with the proposed powerline at the scale required to inform the environmental authorisation and/or water use authorisation processes. Given these limitations, this information is considered useful as background information to the study, is important in legislative contextualisation of the risks and impacts, and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. It must, however, be noted that site verification 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.

Table 1: Desktop data (from desktop databases only) relating to the characteristics of the proposed powerline and its associated investigation area.

Aquatic ecoregion and sub-regions in which the proposed powerline and investigation area is located.			Detail of the proposed powerline and investigation area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion (Figure 3)	Nama Karoo and Drought Corridor		FEPACODE (Figure 5)	The central portion of the proposed powerline and investigation area are located in a sub-quaternary catchment considered to be important in terms of freshwater ecological priority areas FEPACODE 1. The eastern portion of the proposed powerline and investigation area are located in an Upstream Management Area (FEPACODE = 4). Upstream Management Areas are areas in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.
Catchment (Figure 4)	Orange and Gamtoos			
Quaternary Catchment (Figure 4)	L11A, L11B, L11C, L21A and D61E			
WMA	Lower Orange and Fish to Tsitsikamma			
subWMA	Orange Tributaries and Gamtoos			
Dominant characteristics of the Nama Karoo Level II (26.03 and 18.03) (Kleynhans *et al*., 2007)			NFEPA Wetlands (Figure 6)	According to the NFEPA database (2011), the proposed powerline will traverse several wetlands classified as natural and artificial. Several natural and artificial wetlands are also indicated within the investigation area. Generally, these wetlands are indicated to be in a heavily to critically modified ecological condition (Class Z3). A majority of the artificial wetland features were field verified to be artificial impoundments, some associated with natural freshwater features and others not.
Level II Code	26.03	18.03		
Dominant primary terrain morphology	Lowlands with Hills, Mountains and Lowlands, Hills	Lowlands, Hills and Mountains, Moderate and High Relief, Lowlands with mountains		
Dominant primary vegetation types	Eastern Mixed Nama Karoo, Upper Nama Karoo, Bushmanland Nama Karoo, Upland Succulent Karoo, Escarpment Mountain Renosterveld	Upper Nama Karoo, Xeric Succulent Thicket, Afromontane Forest, Sub-arid Thorn Bushveld, Valley Thicket, Eastern Thorn Bushveld.		
Altitude (m a.m.s.l)	1100 - 1500	0- 1900	Wetland Vegetation Type	The proposed powerline and investigation area are located within the Upper Nama Karoo Wetland Vegetation type. This wetland vegetation type is considered least threatened according to Mbona *et al.* (2015).
MAP (mm)	0 - 500	300- 600		
The coefficient of Variation (% of MAP)	30 - 40	25 - 35		
Rainfall concentration index	15 - 55	15 - 50	NFEPA Rivers (Figure 6)	As per the NFEPA database (2011), the unnamed tributary of Sout River is indicated within the western portion of the investigation areas and is traversed by the proposed powerline. The proposed powerline is also indicated to traverse the unnamed tributary of Kookfonteinspruit River, within the western portion of the investigation area. The Kookfonteinspruit River is indicated to be traversed by the central portion of the proposed powerline. The unnamed tributary of Sout River, the unnamed tributary of Kookfonteinspruit River and the Kookfonteinspruit River are indicated to be in a largely natural ecological condition with only a few modifications (Class A/B) The Brak River is indicated to be traversed by the eastern portion of the proposed powerline. The Brak River is indicated to be in a moderately modified ecological condition (Class C).
Rainfall seasonality	Very late Summer, Late Summer, Winter	Late Summer, Very Late Summer		
Mean annual temp. (°C)	14 - 18	14 - 20		
Winter temperature (July)	0 - 18	0 - 22		
Summer temperature (Feb)	12 - 30	8 - 30		
Median annual simulated runoff (mm)	<5 - 40	10 - 150		
Importance of the proposed powerline and investigation area according to the Northern Cape Critical Biodiversity Areas (2016) (Figure 7)				
According to the Northern Cape Critical Biodiversity Areas (2016), the western portions of the proposed powerline and investigation area are located within areas classified as Critical Biodiversity Area (CBA) 1 and CBA 2. CBAs are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. CBA 1 are areas likely to be in a natural condition while and CBA 2 are those areas that are potentially degraded or represent secondary vegetation and therefore require restoration where feasible. The eastern portions of the proposed powerline and investigation area are located within areas classified as Ecological Support Area (ESA) and Other Natural Areas (ONA). ESAs are important in supporting the functioning of CBAs and are often vital for delivering ecosystem services. ONA are areas not currently identified as a priority but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although not prioritised, habitat and species loss should still be minimised in these areas and ensure ecosystem functionality through strategic landscape planning.				

National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (National Wetland Map 5 is included in the NBA) (Figure 8)	
According to the NBA 2018: As per the NFEPA database (2011), the unnamed tributary of the Sout River and unnamed tributary of Kookfonteinspruit River are traversed by the western portion of the proposed powerline. The Kookfonteinspruit River is traversed by the central portion of the proposed powerline. The unnamed tributary of Sout River, unnamed tributary of Kookfonteinspruit River and the Kookfonteinspruit River, are indicated to be in a largely natural ecological condition with only few modifications (Class A/B), the Ecosystem Threat Status (ETS) of these tributaries and rivers is indicated as least threatened, and the Ecosystem Protection Level (EPL) is indicated as not protected. The Brak River is indicated to be traversed by the eastern portion of the proposed powerline. The Brak River is indicated to be in a moderately modified ecological condition (Class C), endangered according to the ETS and poorly protected according to the EPL. Several other freshwater features classified as rivers are indicated within the investigation area and mostly associated with the identified tributaries and river systems indicated to be traversed by the proposed powerline.	
National Web Based Environmental Screening Tool (2020): Aquatic Biodiversity sensitivity (Figure 9)	
The screening tool is intended for pre-screening of sensitivities in the landscape to be assessed within the EIA process. This assists with implementing the migration hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	The majority of the central to western and areas within the eastern portion of the proposed powerline and investigation area are indicated to be of high aquatic biodiversity sensitivity, due to the presence of rivers as indicated by the NBA (2018) Dataset. The remainder of the proposed powerline and investigation area are considered of low aquatic biodiversity sensitivity.

CBA = Critical Biodiversity Area; EI = Ecological Importance; EN = Endangered; EPL = Ecosystem Protection Level ES = Ecological Sensitivity; ESA = Ecological Support Area; ETS = Ecosystem Threat Status; m.a.m.s.l = Metres above mean sea level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Area; PA = Protected Area; PES = Present Ecological State; WMA = Water Management Area.

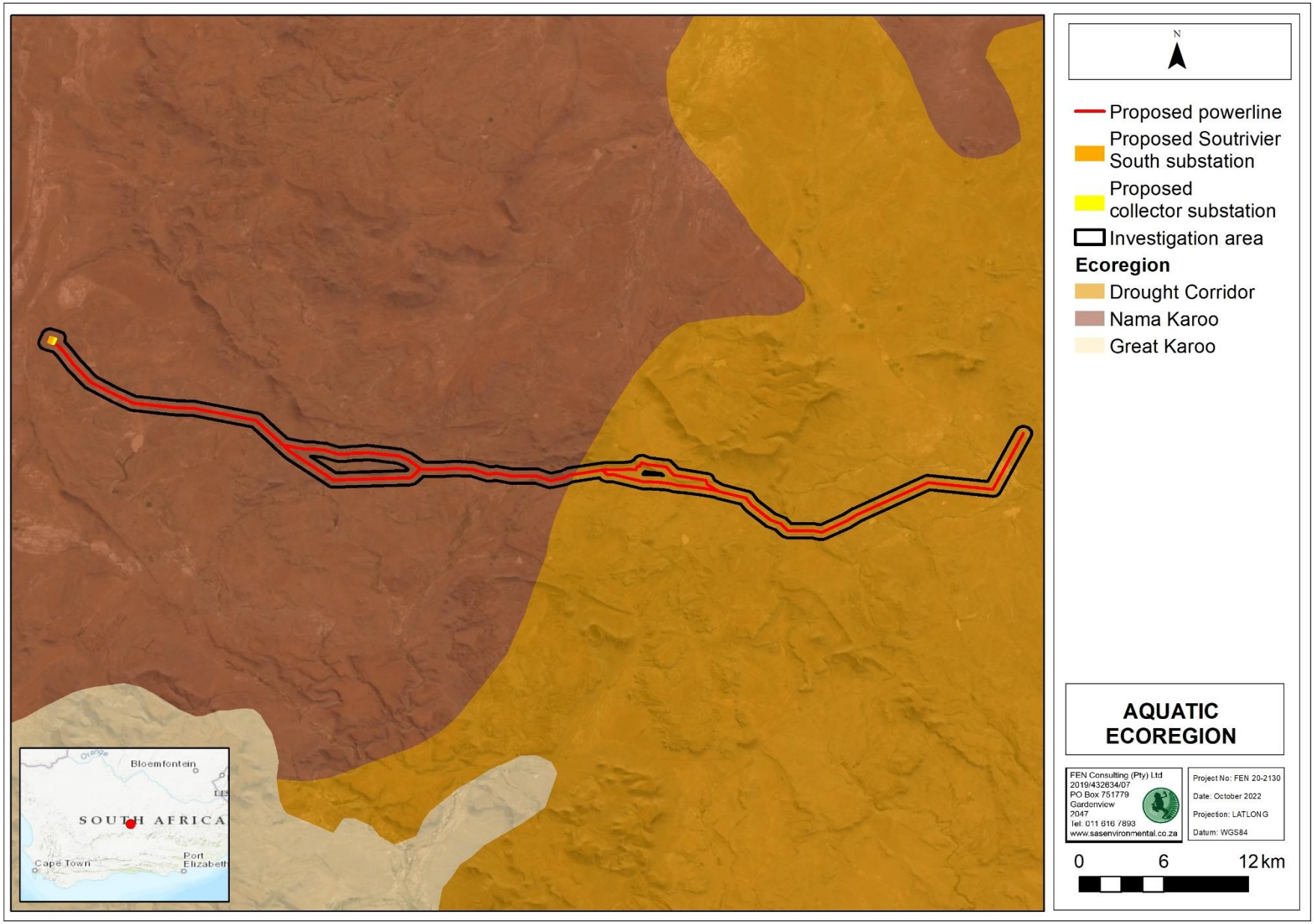


Figure 3: Aquatic ecoregion associated with the proposed powerline and investigation area.

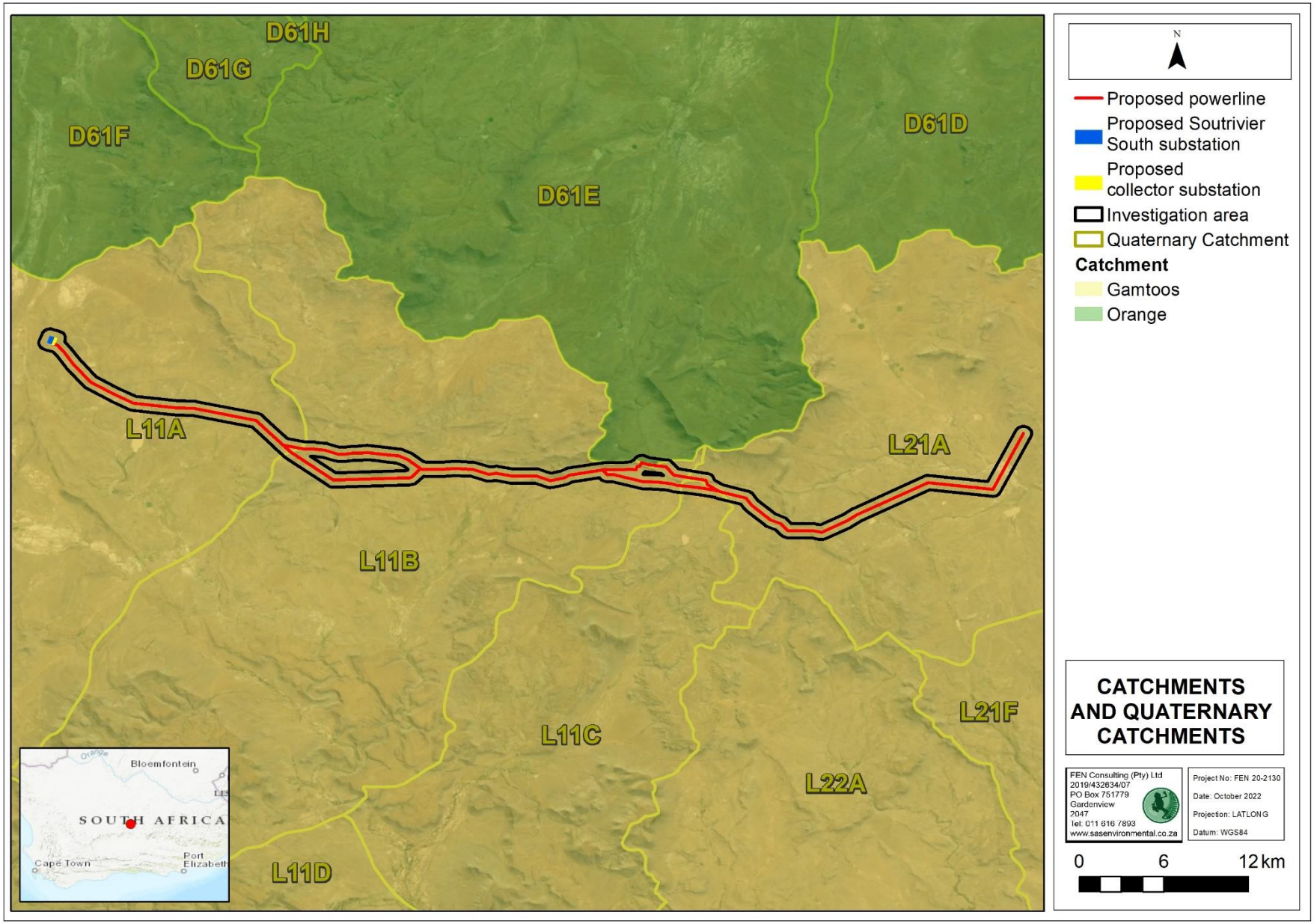


Figure 4: Catchments and quaternary catchments associated with the proposed powerline and investigation area.

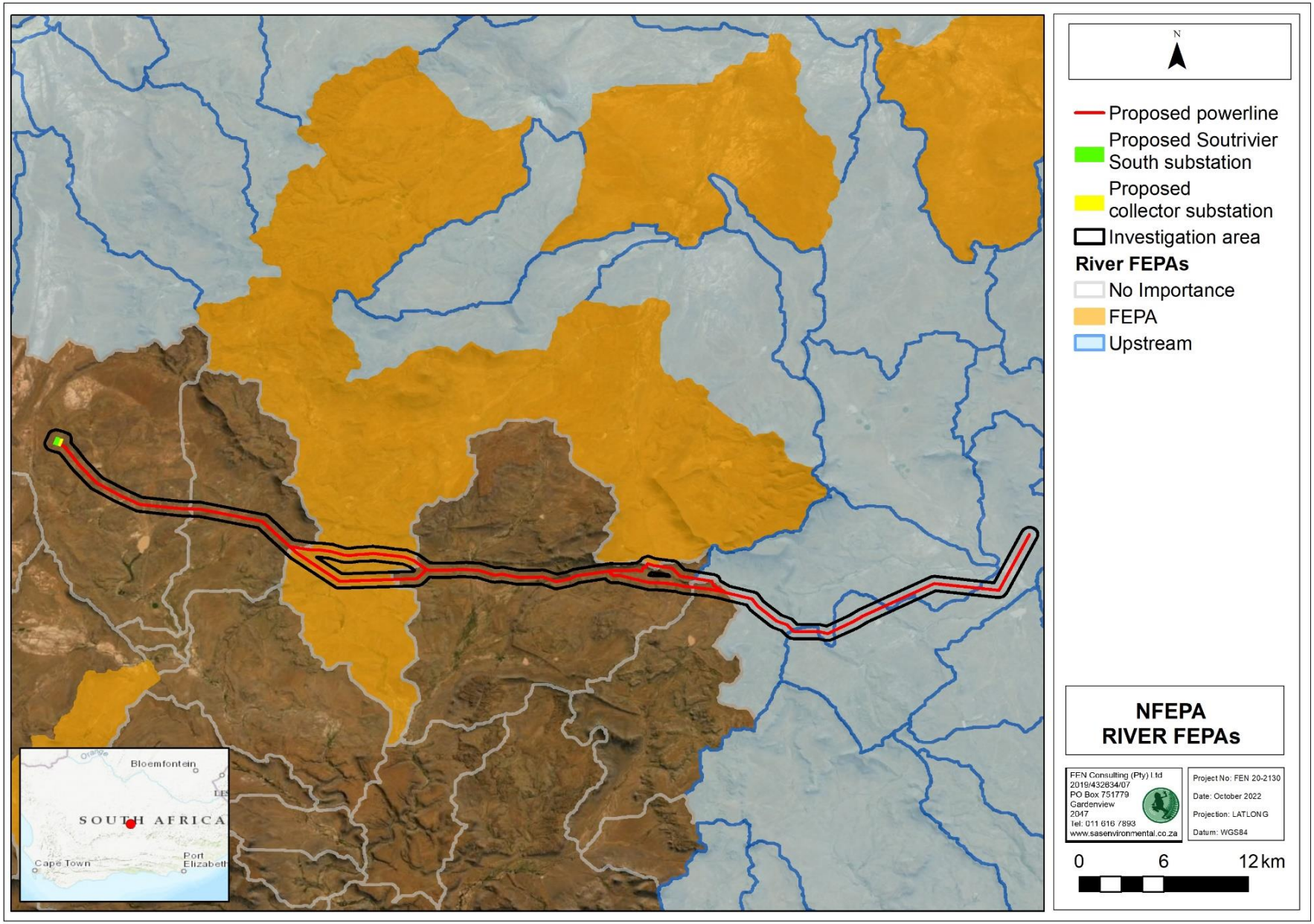


Figure 5: River FEPAs associated with the study and investigation areas, according to the NFEPA database (2011).

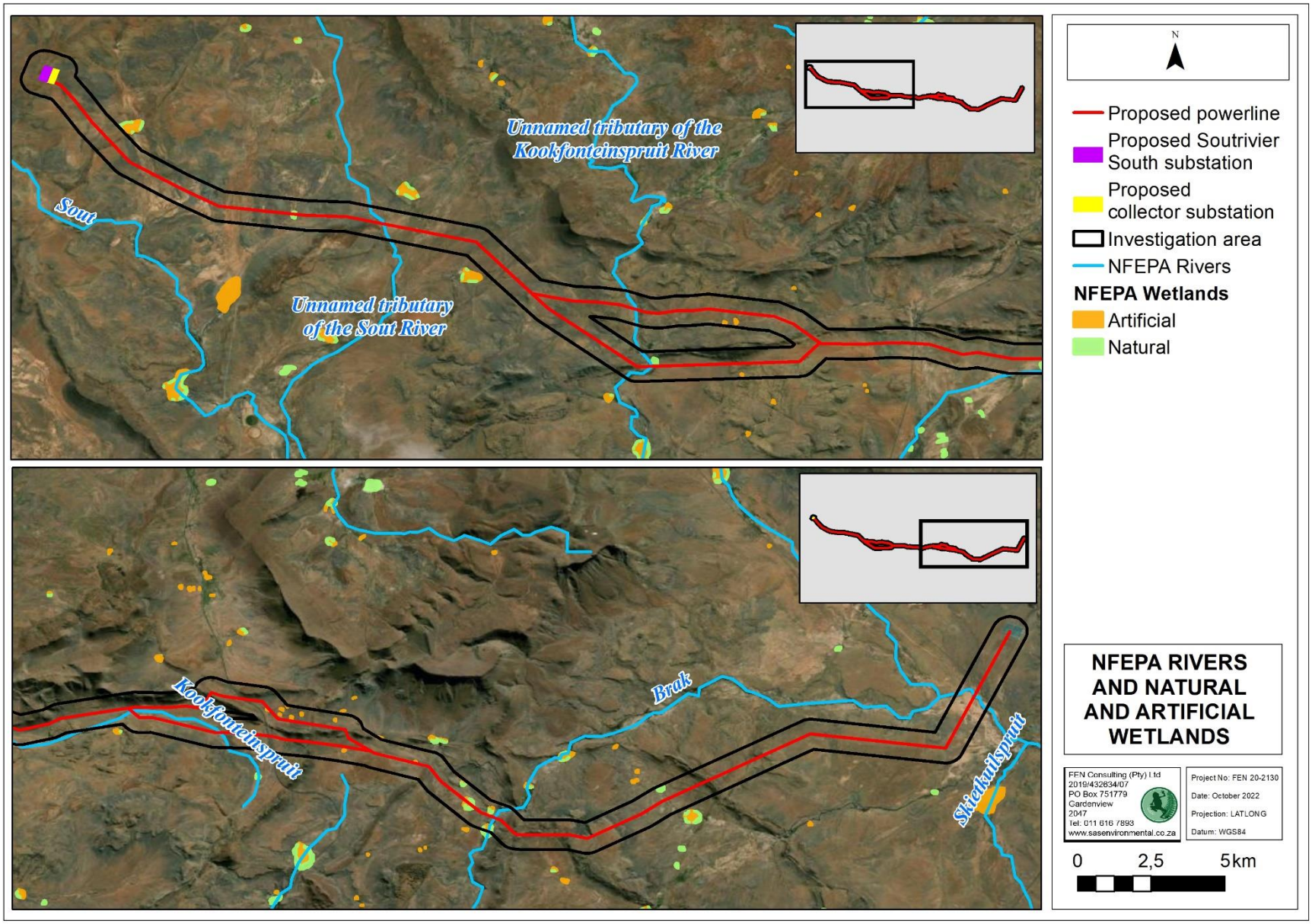


Figure 6: NFEPA rivers and natural and artificial wetlands associated with the proposed powerline and investigation area, according to the NFEPA database (2011).

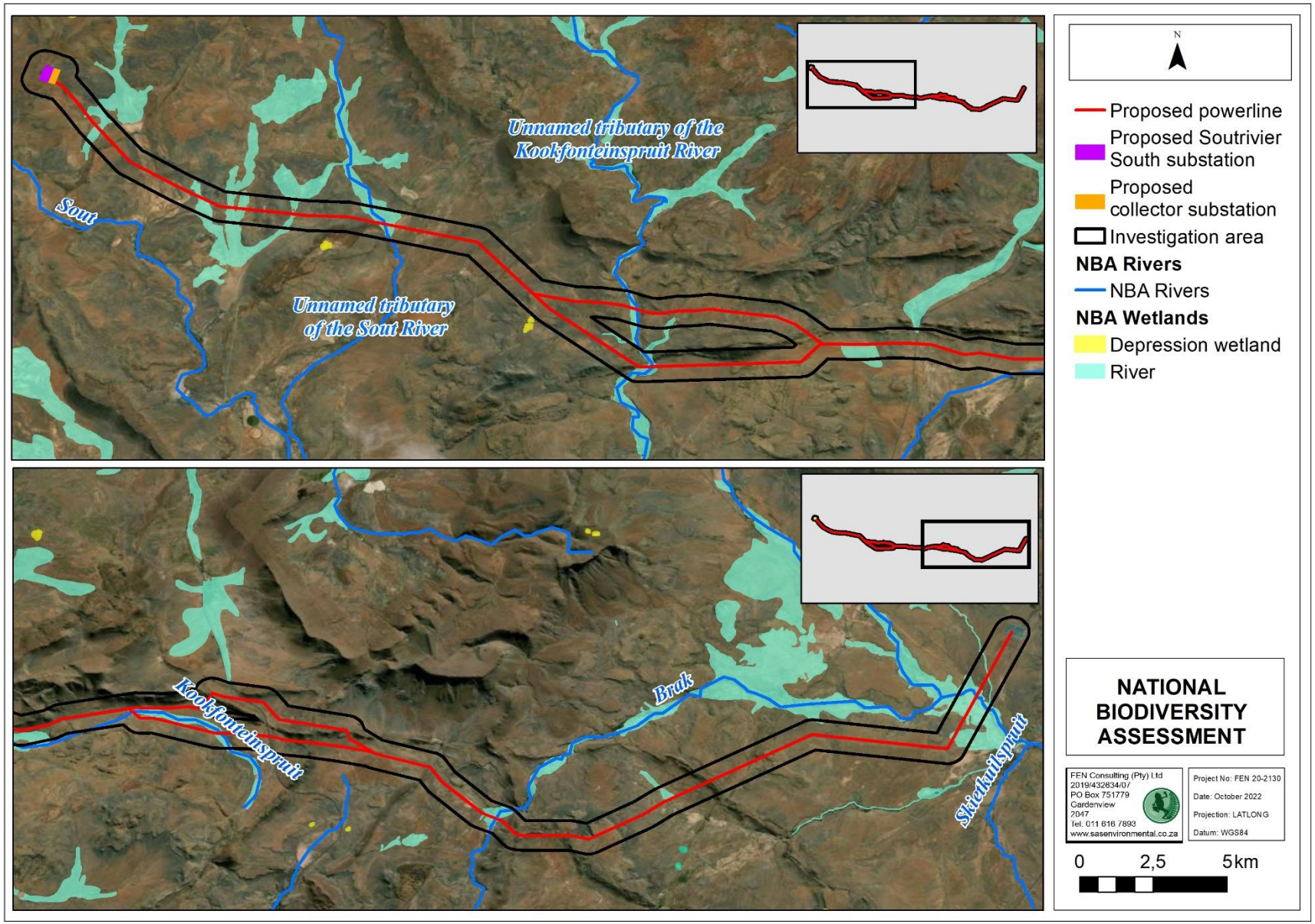


Figure 7: Wetland hydrogeomorphic (HGM) units and rivers associated with the proposed powerline and investigation area according to the National Biodiversity Assessment (2018).

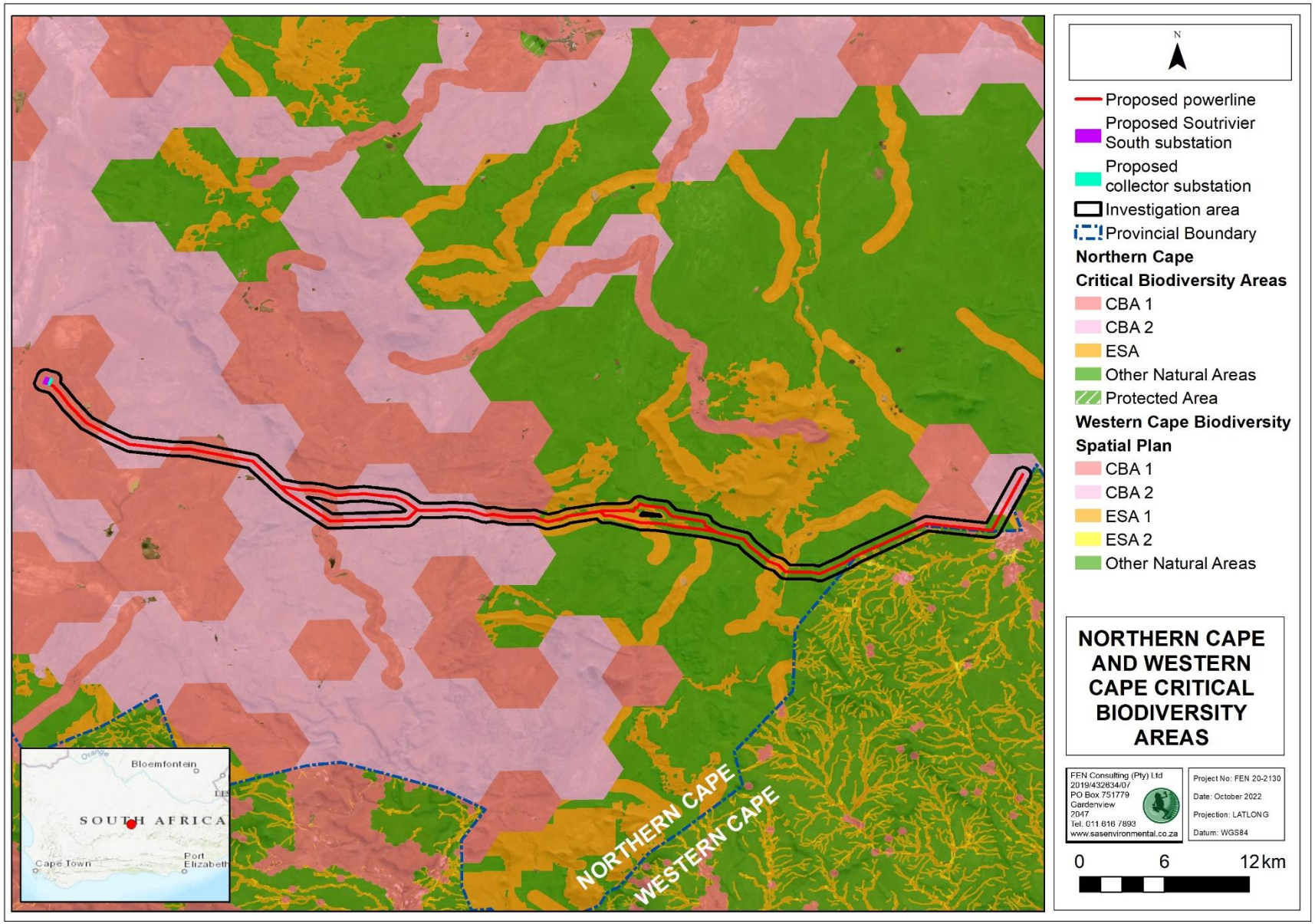


Figure 8: Critical Biodiversity Areas associated with the study and investigation areas, according to the Northern Cape Critical Biodiversity Areas (2016).

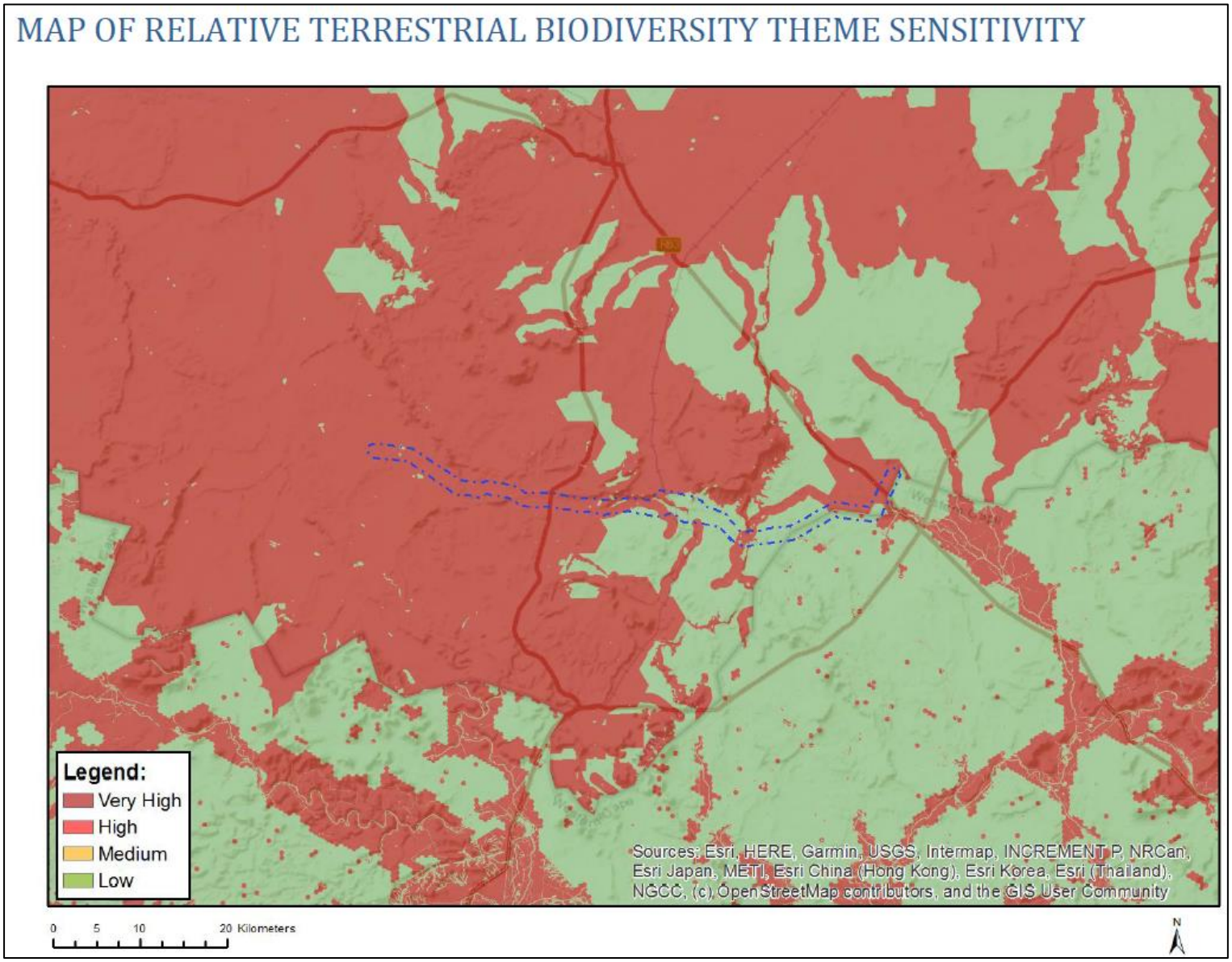


Figure 9: Map depicting the aquatic biodiversity sensitivity theme associated with the investigation area (blue dashed outline) extracted from the national web based Environmental Screening Tool by the DFFE (previously the Department of Environmental Affairs (DEA)), National web based environmental screening tool (2020).

4.2 *Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES/EIS Database]*

The PES/EIS database, as developed by the DWS RQS department, was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as the South Africa River Health Programme (SA RHP) sites, Ecological Water Requirements (EWR) sites and Hydro Water Management System (WMS) sites.

Key information on background conditions associated with the SQR as contained in this database and pertaining to the PES and EIS is tabulated below and visually represented in Figure 10 that follows.

- L11A-06517 (Unnamed tributary of Sout River)
- L11B-06451 (Unnamed tributary of Kookfonteinspruit River)
- L11B-06546 (Kookfonteinspruit River)
- L11C-06656 (Unnamed tributary of
- D61E-06466 (Unnamed tributary of Brak River)
- D61E-06470 (Unnamed tributary of Brak River)

The Ecological Importance (EI) data for SQR D61E-06466 and D61E-06470 indicates that no fish and no macro-invertebrate species occur at these sites.

The Ecological Importance (EI) data for the SQR L11A-06417, L11B-6451 and L11B-06546 indicates that the fish species *Barbus anoplus* may occur at these sites.

The EI data for SQR Monitoring points indicates that the following macro-invertebrate taxa are expected to occur at these sites:

Macro-Invertebrates	L11A-06517	L11B-06451	L11B-06546	L11C-06656
Ancylidae		X	X	X
Baetidae 1 sp	X			
Belostomatidae				X
Caenidae		X	X	X
Ceratopogonidae	X		X	
Chironomidae	X	X	X	X
Coelenterata			X	
Coenagrionidae		X	X	X
Corixidae	X			
Culicidae	X	X	X	X
Dytiscidae	X		X	X
Elmidae/dryopidae				
Ephydridae			X	
Gerridae	X	X	X	X
Gomphidae		X	X	X
Gyrinidae	X		X	
Haliplidae			X	
Hydracarina				
Hydraenidae			X	
Hydrophilidae			X	X
Libellulidae		X	X	X
Muscidae				
Naucoridae	X	X	X	X
Notonectidae	X	X	X	X
Oligochaeta		X	X	X
Planorbinae			X	
Pleidae			X	
Potamonautidae		X	X	X

Macro-Invertebrates	L11A-06517	L11B-06451	L11B-06546	L11C-06656
Simuliidae		X	X	X
Tabanidae				
Tipulidae				
Turbellaria		X	X	X
Veliidae/mesoveliidae	X	X	X	X

Table 2: Summary of the ecological status of the sub-quaternary catchment (SQ) reached associated with the proposed powerline and investigation areas based on the DWS RQS PES/EIS database.

	L11A-06517	L11B-06451	L11B-06546	L11C-06656	D61E-06466	D61E-06470
Synopsis						
PES Category Median	Moderately Modified	Moderately Modified	Moderately Modified	Moderately Modified	None	None
Mean EI class	Moderate	Moderate	Moderate	Moderate	Moderate	High
Mean ES class	Moderate	Moderate	Moderate	Moderate	None	Low
Length	44.48	43.24	25.92	20.79	19.55	23.95
Stream order	1	1	1	1	1	1
Default EC[4]	C (Moderate)	C (Moderate)	C (Moderate)	C (Moderate)	None	None
PES Details						
Instream habitat continuity MOD	Large	Large	Large	Large	None	None
RIP/wetland zone continuity MOD	Moderate	Small	Small Large	Small	None	None
Potential instream habitat MOD activities	Small	Large	Large	Moderate	None	None
Riparian/wetland zone MOD	Small	Small	Small	Small	None	None
Potential flow MOD activities	Serious	Large	Moderate	Large	None	None
Potential physico-chemical MOD activities	Moderate	Small	None	Small	None	None
EI Details						
Fish spp/SQ	1,00	1,00	1,00	None	None	None
Fish average confidence	1,00	1,00	1,00	None	None	None
Fish representivity per secondary class	Low	Low	Low	None	None	None
Fish rarity per secondary class	Moderate	Moderate	Moderate	None	None	None
Invertebrate taxa/SQ	15	15,00	25,00	18.00	None	None
Invertebrate average confidence	1.00	1,00	2,36	1.00	None	None
Invertebrate representivity per secondary class	Moderate	Moderate	High	Moderate	None	None
Invertebrate rarity per secondary class	Very low	Very Low	Very High	Very High	None	None
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Low	Low	Low	Low	None	None
Habitat diversity class	Low	High	Low	Very Low	Low	Very High
Habitat size (length) class	Very high	Very High	Moderate	Moderate	Low	Low
Instream migration link class	Moderate	Moderate	Moderate	Moderate	None	None
Riparian-wetland zone migration link	High	Very High	Very High	Very High	None	None
Riparian-wetland zone habitat integrity class	Very high	Very High	Very High	Very High	None	None
Instream habitat integrity class	Very high	Moderate	Moderate	High	None	None
Riparian-wetland natural vegetation rating based on	Very High	Very High	Very High	Very High	Very High	Very High

	L11A-06517	L11B-06451	L11B-06546	L11C-06656	D61E-06466	D61E-06470
percentage natural vegetation in 500m						
Riparian-wetland natural vegetation rating based on expert rating	Low	Low	Low	Low	Very Low	Low
ES Details						
Fish physical-chemical sensitivity description	Moderate	Moderate	Moderate	None	None	None
Fish no-flow sensitivity	Moderate	Moderate	Moderate	None	None	None
Invertebrates physical-chemical sensitivity description	Moderate	Moderate	Moderate	Moderate	None	None
Invertebrates velocity sensitivity	High	High	High	High	None	None
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	Low	Low	Low	Low	None	None
Stream size sensitivity to modified flow/water level changes description	High	High	High	High	None	None
Riparian-wetland vegetation intolerance to water level changes description	Low	Low	Low	Low	Very Low	Low

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

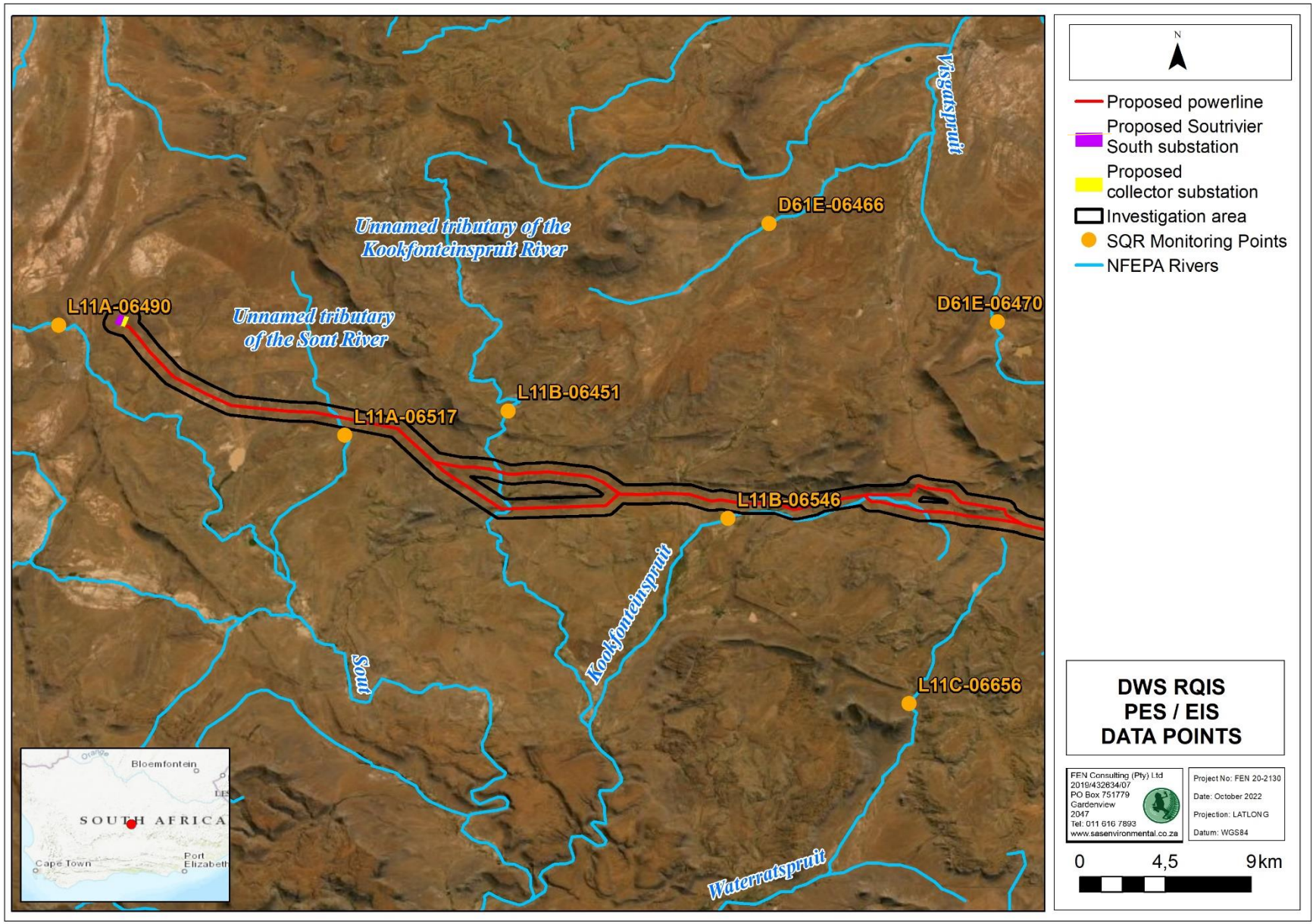


Figure 10: DWS RQIS PES/EIS sub-quaternary catchment reaches (SQRs) indicated relative to the proposed powerline and investigation area.

5 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

5.1 *Field verification and delineation*

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national freshwater ecosystem databases (as outlined in Section 4 of this report) were used to identify points of interest associated with the proposed powerline at a desktop level. In this regard, specific mention is made of the following:

- 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: water flow paths often showing as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with freshwater 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, created by varying vegetation cover and soil conditions.

These points of interest were verified during the site assessment undertaken from the 27th to the 28th of February 2022. The proposed powerline will be routed from the proposed collector substation, across adjoining farmland for a distance of approximately 68 km to the existing Gamma Substation, and will traverse several freshwater features along its route. The proposed collector substation and on-site substation associated with the proposed Soutrivier WEF are located outside the delineated extent of the identified freshwater features.

The industry standard guidelines provided by DWAF (2008) for the identification and delineation of wetlands and riparian zones was used as a basis for the delineation of the freshwater features identified on site. However, due to the typically arid conditions of the region, additional indicators, as provided by Day *et al.* (2010) were utilised. Whilst the presence of "vegetation typically adapted to life in saturated soil" under "normal circumstances" is the key determinant in the definition of a wetland according to the National Water Act, 1998 (Act 36 of 1998), such features are not always present in wetlands in arid to semi-arid environments such as the Northern Cape (based on experience within the region). The general surrounding landscape in terms of the freshwater features identified and vegetation type of the local area was noted to be uniform, presenting a transition between upper foothill to lower foothill drainage systems connected to larger river systems downstream. The freshwater features identified during the site assessment were thus categorised according to their dominant characteristics, primarily topography, vegetation and soil characteristics. The characterisation of these features is discussed in greater detail in Section 5.2 below.

The freshwater features identified to be traversed by the proposed powerline comprise of smaller drainage lines and minor tributaries (that drain the surrounding hilltops), and larger tributaries and rivers that are positioned within the lower gradient; these freshwater features can be best described as fluvial features associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Stilfonteinspruit and Brak River systems. Most of these freshwater features are episodic[6] (drainage lines and minor tributaries) to ephemeral[6] (larger tributaries and rivers) with relatively scarce rainfall events causing short-lived

[6] "Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years." (Uys and O'Keeffe, 1997, in Rossouw *et. al*, 2006).

periods of flow. No wetlands were identified to be traversed by the proposed powerline, nor were any identified within the investigation areas.

Artificial impoundments were also identified within the investigation area, including instream artificial impoundments associated with the identified freshwater features. However, these were not assessed due their artificial nature.

5.2 *Freshwater ecosystem classification*

Classification of the freshwater features identified to be traversed by the proposed powerline was undertaken at Levels 1 - 4 of the Classification System (Ollis *et al*, 2013) as outlined in **Appendix C** of this report. These systems were classified as Inland Systems (Level 1), located within the Nama Karoo and Drought Corridor Ecoregions (Level 2). Ecoregions are groups of rivers within Southern Africa, which share similar physiography, climate, geology, soils and potential natural vegetation (see Table 1 for details on the dominant characteristics of the Nama Karoo Ecoregion in which the identified freshwater ecosystems are located). Table 3 below presents the classification from Level 3 to 4 of the Classification System (Ollis *et al*, 2013).

Given that the Level 4 classification places the identified freshwater features into one HGM type i.e., rivers (Table 3), these freshwater features were further classified into sub-categories at Level 4B (longitudinal zonation / geomorphological zones) of the Classification System (Ollis *et al*, 2013) (Table 3). Longitudinal zonation (or geomorphological zones) are groups of rivers, or segments of rivers, within an ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of longitudinal zonal classification has been widely adopted by ecologists to explain variations in physical characteristics and associated biological distributions down the length of a river, to allow for the grouping of rivers into ecologically similar units and for the comparison between similar river types (Rowntree and Wadeson, 1999).

Table 3: Classification of the freshwater ecosystems proposed to be traversed.

Freshwater ecosystem	Level 3: Landscape Unit	LEVEL 4: Hydrogeomorphic (HGM) UNIT	
		Level 4A: HGM Type	Level 4B: Longitudinal zonation / Geomorphological Zone
Riparian feature	**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.	**River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.	**Mountain stream**: Steep-gradient stream (characteristic gradient 0.040–0.099) dominated by bedrock and boulders, locally cobble or coarse gravels in pools. Reach types include cascades, bedrock fall, step-pool, plane bed. Approximate equal distribution of 'vertical' and 'horizontal' flow components. **Upper foothills:** Moderately steep (characteristic gradient 0.005–0.019), cobble-bed or mixed bedrock-cobble bed channel, with plane bed, pool-riffle or pool-rapid reach types. Length of pools and riffles/rapids similar. Narrow floodplain of sand, gravel or cobble often present.
	Valley Floor: the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.		**Lower foothills:** Lower gradient (characteristic gradient 0.001–0.005), mixed-bed alluvial channel with sand and gravel dominating the bed, locally may be bedrock-controlled. Reach types typically include pool-riffle or pool-rapid, sand bars common in pools. Pools of significantly greater extent than rapids or riffles. Floodplain often present.

Considering the above, the freshwater features identified to be traversed by the proposed powerline were generally classified as rivers and categorised into mountain stream drainage lines, upper foothill tributaries and lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Stilfonteinspruit and Brak River systems. Figure 11 below illustrates the grouping of these freshwater features into geomorphological zones.

The identified mountain stream drainage lines describe the non-perennial systems (which comprise of episodic drainage lines without riparian vegetation) located in the shallow valleys along the undulating slopes of the surrounding mountainous area. Concentration of flow within this upslope position leads to drainage towards the larger tributaries and rivers (Figure 11). These mountain stream drainage lines are characterised by a small catchment and can be considered part of the headwaters of the larger upper foothill and lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Stilfonteinspruit and Brak River systems. Although these mountain stream drainage lines cannot be classified as riparian resources in the traditional sense, due to the lack of saturated soil and riparian vegetation, they do still function as waterways, through episodic conveyance of water. However, based on the definition of a watercourse (see Section 3) water flows regularly or intermittently within these drainage lines, conveying water from the upgradient catchment area into the downgradient tributaries and eventually into the larger riverine systems located within and outside of the investigation area. As such, they can be considered as watercourses due to their importance for hydrological functioning as they do function as waterways and therefore enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998).

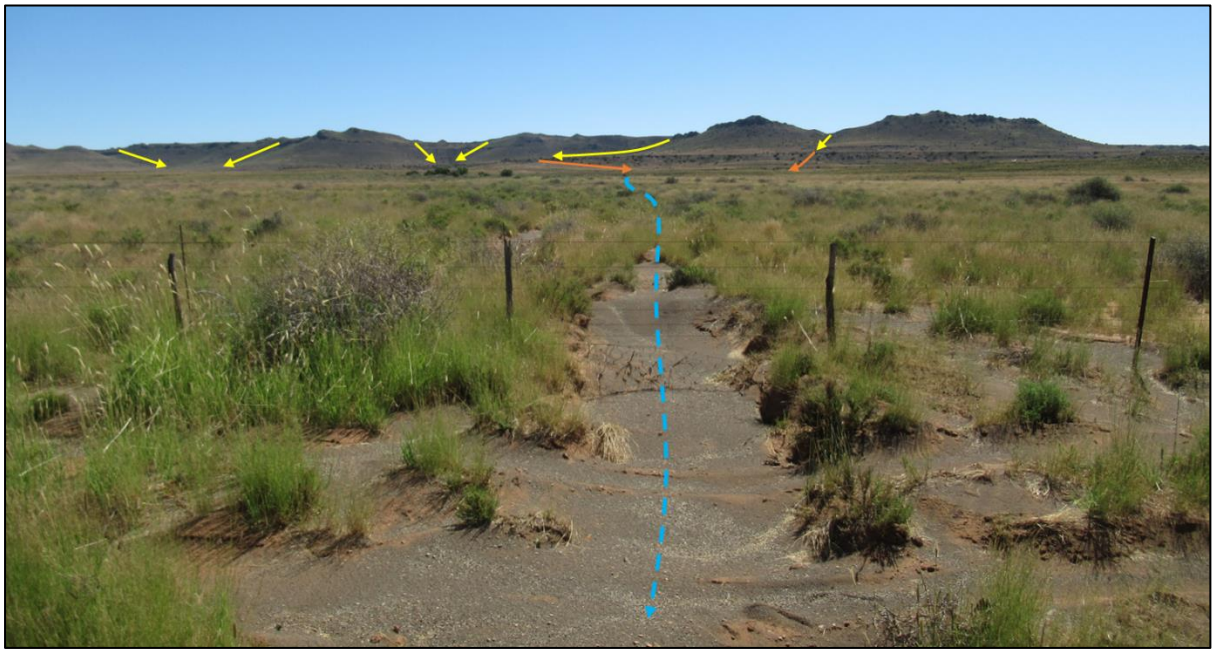


Figure 11: The freshwater features identified within the investigation area and general surrounding landscape, originate as mountain stream drainage lines (yellow line) located along a steep gradient and high in the catchment, that drain into the upper foothill tributaries (orange line) located along a moderately steep gradient, which eventually drain into lower foothill tributaries and rivers (blue dashed line) typically located along a lower gradient.

The delineated extent of the identified freshwater features is depicted on Figures 12 to 17 below in relation to the proposed powerline.

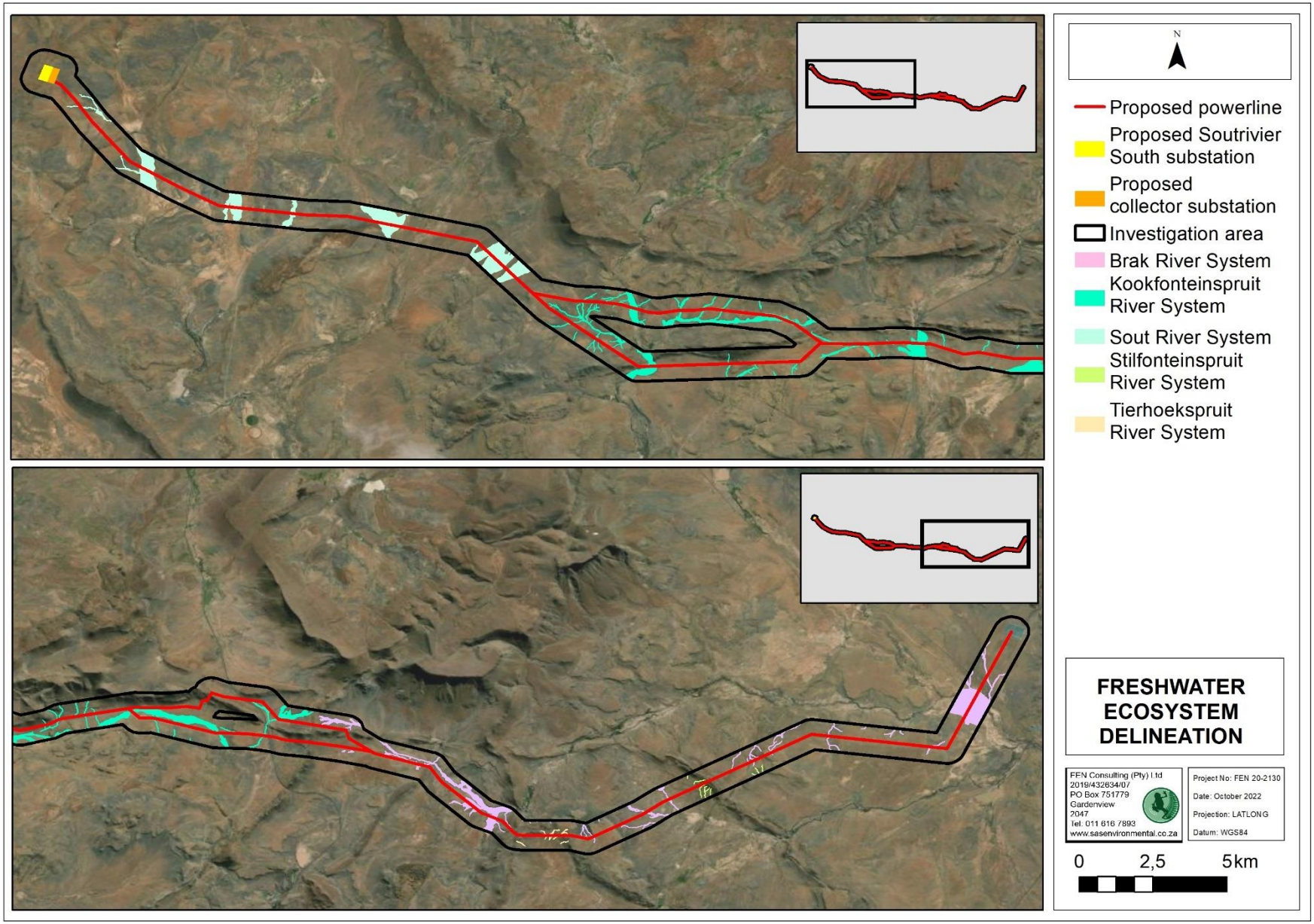


Figure 12: The locality of the delineated freshwater ecosystems associated with the proposed powerline.

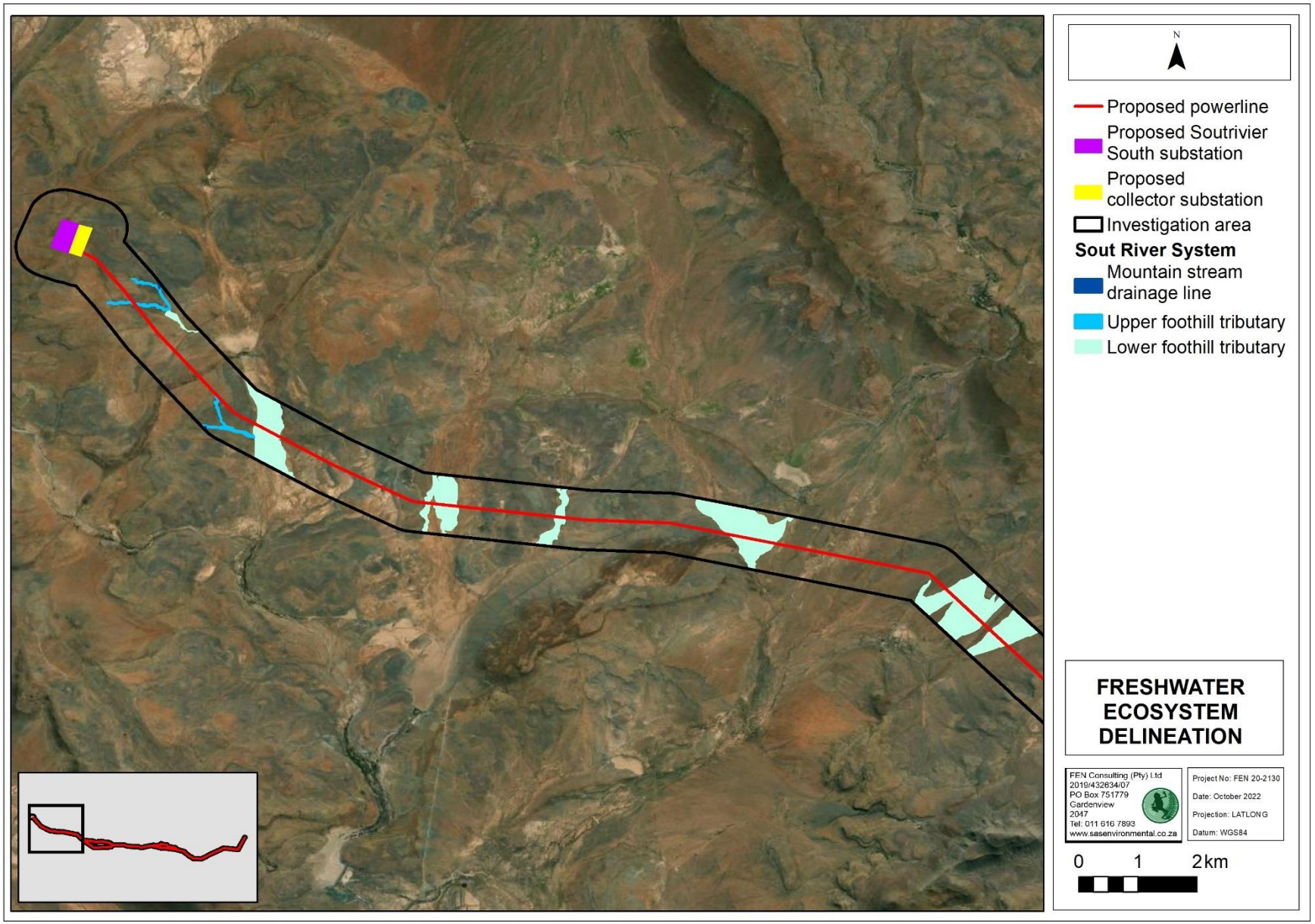


Figure 13: The locality of the delineated freshwater ecosystems associated with the eastern portion of the proposed powerline.

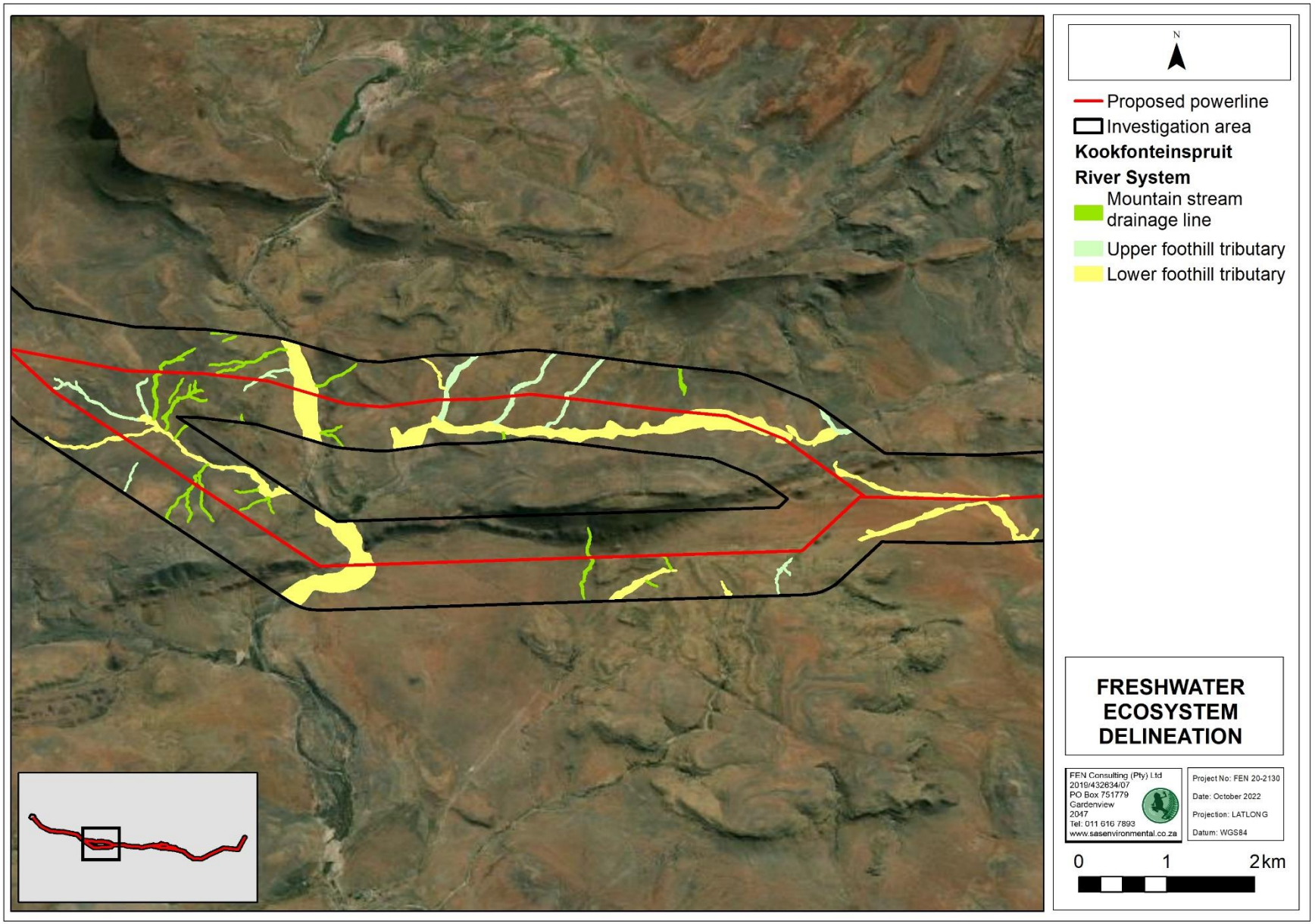


Figure 14: The locality of the delineated freshwater ecosystems associated with the central eastern portion of the proposed powerline.

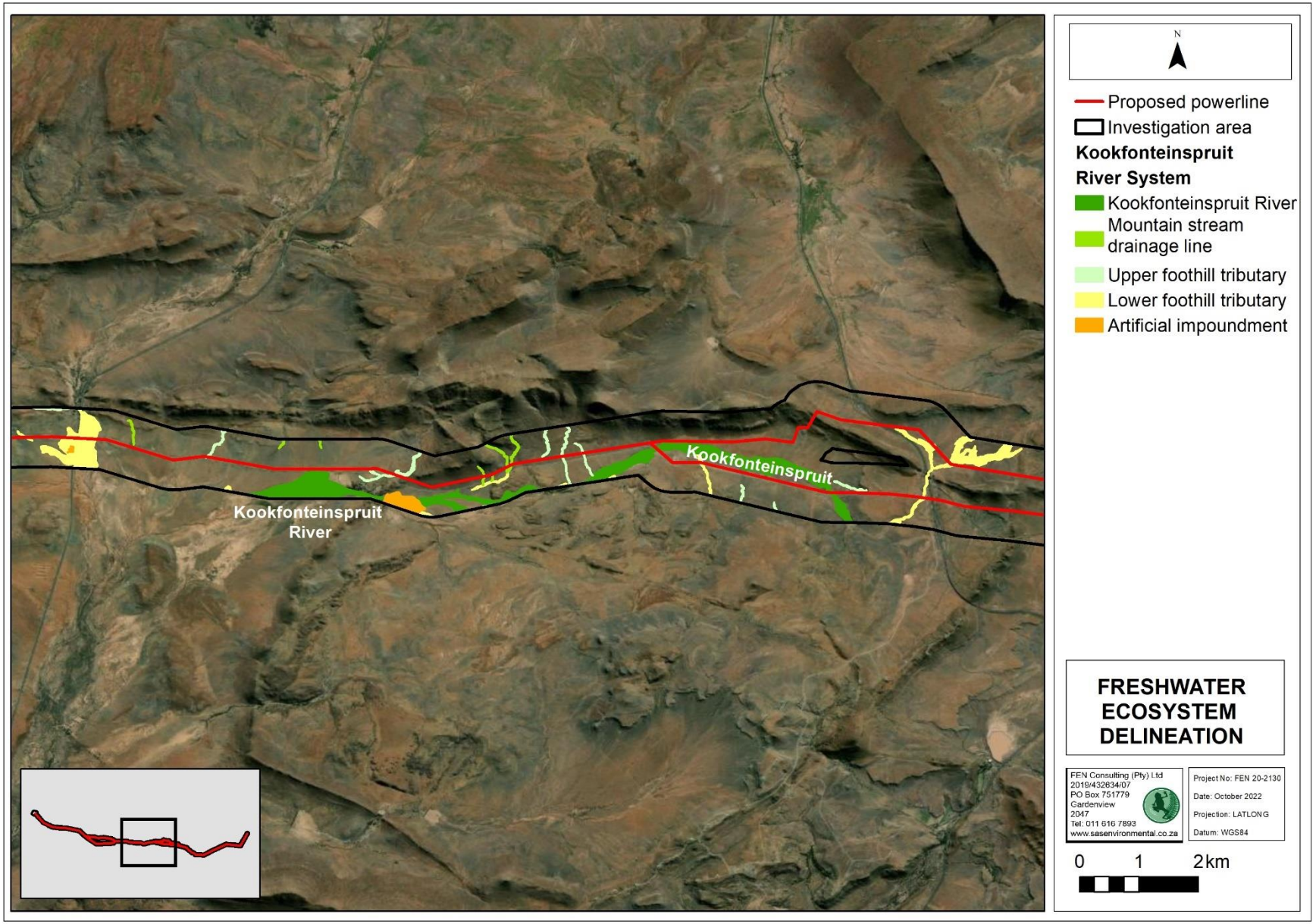


Figure 15: The locality of the delineated freshwater ecosystems associated with the central portion of the proposed powerline.

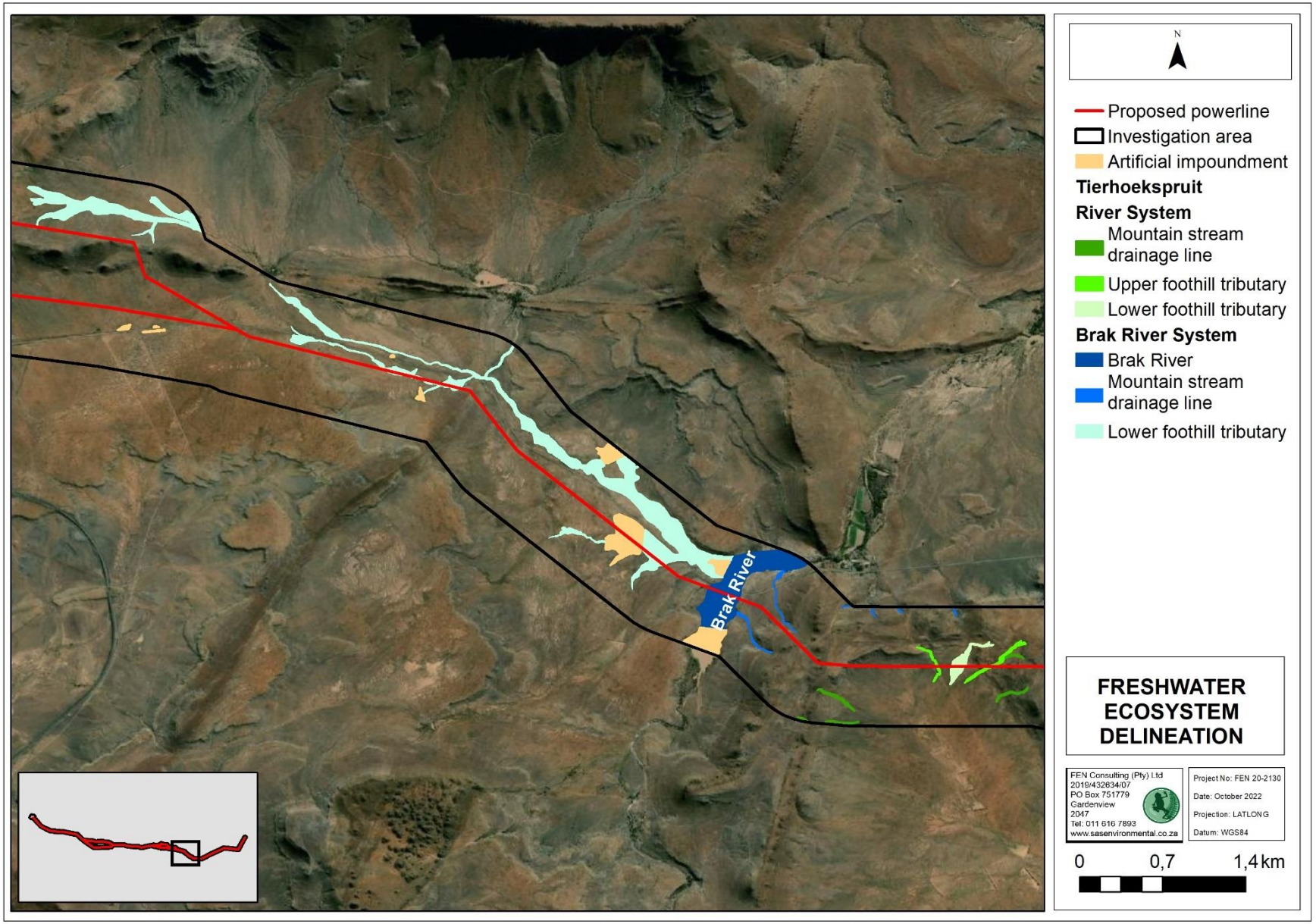


Figure 16: The locality of the delineated freshwater ecosystems associated with the central western portion of the proposed powerline.

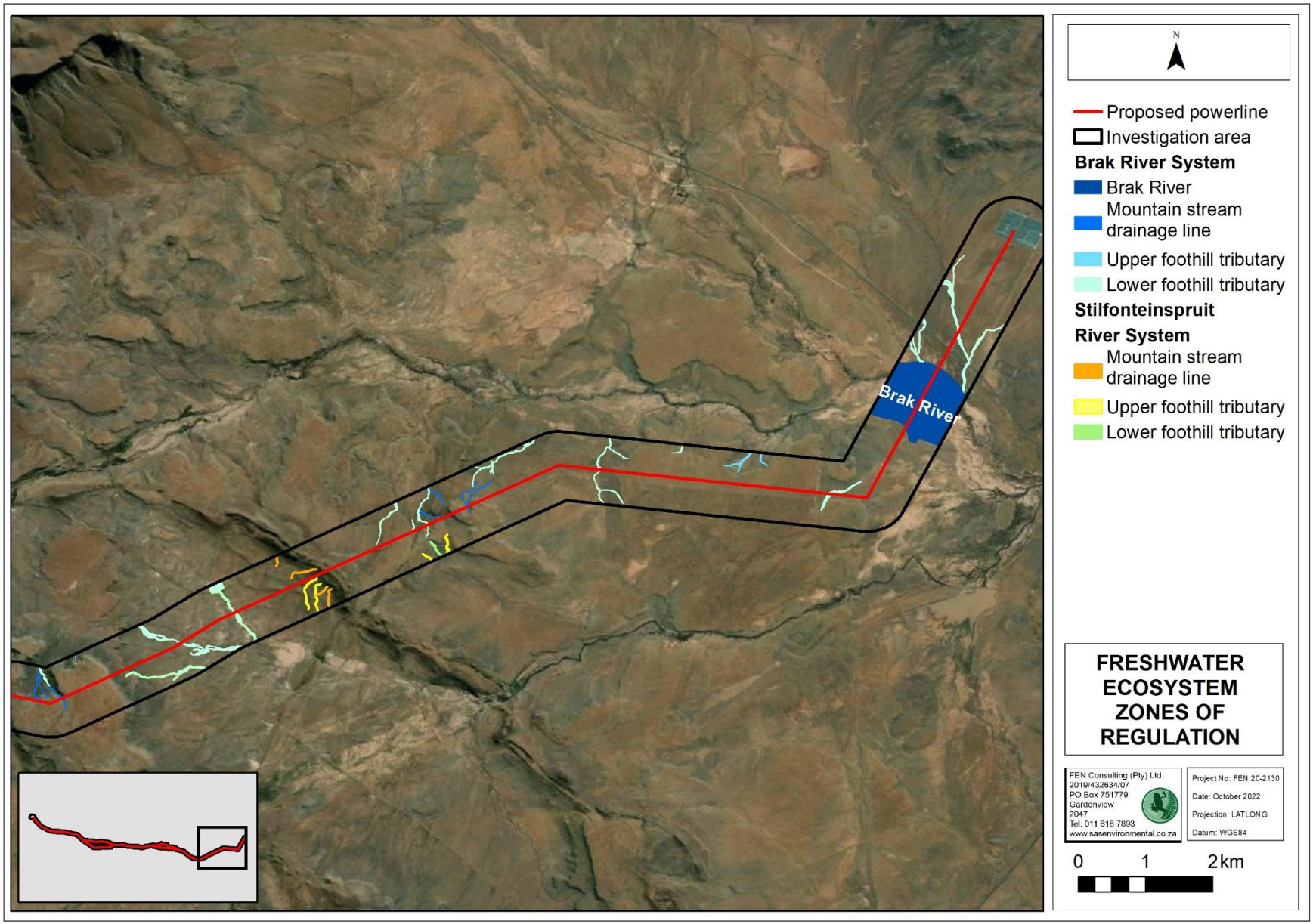


Figure 17: The locality of the delineated freshwater ecosystems associated with the western portion of the proposed powerline.

5.3 *Freshwater ecosystem delineation*

The outer boundary of the identified freshwater features was delineated according to the guidelines advocated by DWAF (2008). The delineations as presented in this report are regarded as a best estimate based on the site conditions present at the time of the assessment. During the field assessment, the following indicators were used in order to determine the boundary of the riparian features identified to be associated with the proposed powerline and associated investigation area:

- **Topography/elevation** played a significant role in determining in which parts of the landscape freshwater features are most likely to occur. Since freshwater ecosystems occur where there is a prolonged presence of water in the landscape, the most common place one could expect to find a freshwater feature is in the valley bottom position (DWAF, 2008). Freshwater ecosystems may also be generally located along the floor of a relatively wide valley with a low gradient (e.g., alongside the lower reaches of a lower foothill (DWAF, 2008)). As discussed above, the main tributaries and rivers are located in the lower foothill and valley bottom position (Figure 11). Most other freshwater features including the mountain stream drainage lines and upper foothill tributaries are also located in valleys, however on relatively much steeper land between undulating hills within the upslope that slopes towards the larger downstream system where concentration of flow leads to drainage towards the larger tributaries and rivers (Figure 11).
- **Vegetation associated with riparian areas:** the identification of riparian areas relies heavily on vegetative indicators. Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs:
    - in species composition relative to the adjacent terrestrial area; and
    - in the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the health, density, crowding, size, structure and/or numbers of individual plants.

The topographical setting of the identified freshwater features had a strong bearing on the width and spatial distribution of the riparian corridor in relation to the main channel. The mountain stream drainage lines are typically characterised by a confined channel with the riparian zone (if any) restricted to the active channel. The upper foothill tributaries are typically characterised by a semi-confined channel, as with the mountain stream drainage lines, the riparian zone of the upper foothill was not observed to be different from the surrounding terrestrial environment, hence confined in extent. In the larger lower foothill tributaries and river systems, the riparian corridor extends beyond the confines of the primary channel, with the presence of a number of parallel-running secondary channels that are hydrologically activated when higher flows occur along the system.

Only within the larger lower foothill tributaries and rivers was a change in riparian vegetation identified from that of the surrounding terrestrial vegetation (Figure 18), where a mix of low tree and shrub species associated with the Upper Nama Karoo vegetation type, typical of the local biome, and graminoid and sedge species including *Ficinia nodosa* and *Scirpoides dioecus* were observed (Figure 18). Trees and shrubs are less prominent along the rocky mountain stream drainage lines and upper foothill tributaries located in the upper reaches of the lower foothill tributaries and river systems.

Figure 18: Photographs depicting the vegetation component of the larger foothill freshwater systems i.e., Kookfonteinspruit River System, associated with the proposed powerline, which hosts tree, graminoid and sedge species in its marginal zones, which can be easily distinguished (yellow dashed line) from the surrounding terrestrial vegetation.

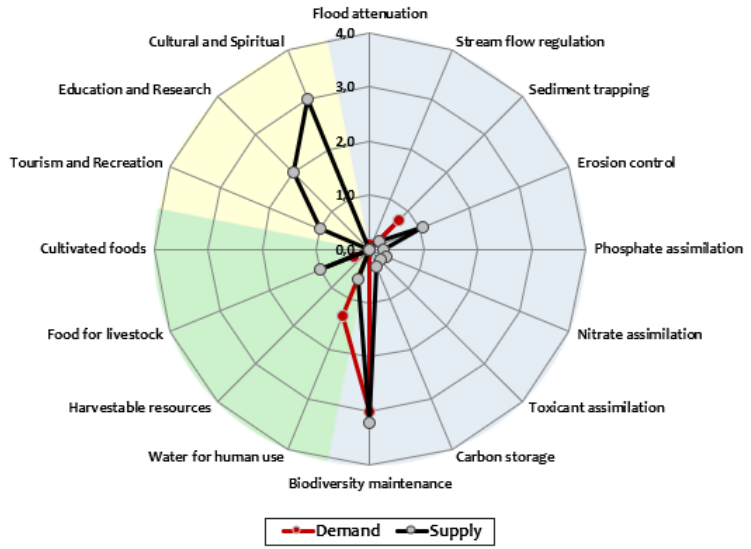
- ***The presence of alluvial soil:*** The presence of alluvial soil was used as an indicator of riparian zones, as defined by the National Water Act, 1998 (Act No. 36 of 1998). The occurrence of alluvial deposited material adjacent to the active channel is a good indicator of the riparian zone of a riparian freshwater feature (such as that of the identified rivers and tributaries). Alluvial soil is soil derived from materials deposited by flowing water, especially in the valley bottom position. Riparian areas often, but not always, have alluvial soil (Figure 19). While the presence of alluvial soil cannot always be used as a primary indicator to delineate riparian features accurately, it can be used in conjunction with the topographical and vegetative indicators. Unlike wetland areas, riparian zones are usually not saturated for a long enough period of time for redoximorphic features to develop. This is because riparian features are mainly driven by surface flow, originating from its local catchment which flows through the freshwater feature and does not persist for significant periods of time in the riparian features as with wetlands. This is specifically true for the mountain stream drainage lines and to a certain extent, upper foothill tributaries, that experience flash flooding in response to rainfall events.

Figure 19: Typical alluvial soil present within the active channel of a lower foothill tributary of the Sout River associated with the western extent of the proposed powerline.

Tables 4 to 6 provide a summary of the ecological assessment of the freshwater features in terms of relevant aspects (hydrology, geomorphology and vegetation components) associated with the identified freshwater features. Due to the similar characteristics of the mountain stream drainage lines and that of the upper foothill tributaries, and lower foothill tributaries, and each of these freshwater ecosystem types having been subjected to the same anthropogenic impacts, the ecoservice provision, hydrological regime, geomorphological characteristics, water quality and habitat of these freshwater features were assessed in a combined fashion. The details pertaining to the methodology used to assess the freshwater features is contained in **Appendix C**.

Table 4: Summary of results of the assessment of the mountain stream drainage lines associated with the Kookfonteinspruit and Brak River systems proposed to be traversed by the proposed powerline.

Ecological & socio-cultural service provision graph:



Freshwater ecosystem characteristics overview:

The proposed powerline will traverse the lower reaches of the mountain stream drainage lines associated with the Kookfonteinspruit and Brak River systems along the central western to eastern extent of the proposed powerline, respectively. These mountain stream drainage lines arise from the slopes of the surrounding mountainous area. The identified mountain stream drainage lines can be considered part of the headwaters of these larger river systems as they are located in the landscape where runoff flows as surface water over impermeable bedrock at the point of outcropping. The local catchment of these mountain drainage lines remains largely untransformed. Thus, the upper reaches of these drainage systems are in a fairly intact ecological condition as they are not exposed to severe anthropogenic impacts given their location along a steep gradient associated with the surrounding slopes. Contrarily, the lower reaches of these mountain stream drainage lines, which transition into the upper foothill tributaries, have been exposed to anthropogenic impacts such as road and powerline crossings. These disturbances have resulted in small changes to the existing flow patterns of the mountain stream drainage lines. Therefore, due to the position of the mountain stream drainage lines in the landscape, they are considered largely intact, with limited change to the cover, abundance and species composition.

Figure 20: Representative photographs of the mountain stream drainage lines associated with the Kookfonteinspruit and Brak River systems. (Left) Position of the mountain stream drainage lines (yellow dashed lines) within the upslope position where concentration of flow leads to drainage towards the larger river systems; (Middle) these mountain stream drainage lines are defined by an unvegetated channel of exposed bedrock. No significant change between the vegetation associated with the edge of the drainage line channel to that of the surrounding terrestrial area is evident; and (Right) The lower reach of a mountain stream drainage line along an existing road (i.e., Biesiespoort Road) where the proposed powerline will be routed. The mountain stream drainage lines tend to flow as rills within the lower lying areas.

Assessment of the Mountain Stream drainage lines of the Kookfonteinm River System	**IHI Outcome**	**IHI Riparian PES Category: B (Largely natural with few modifications)** Due to the position of the mountain stream drainage lines in the landscape, they are considered largely intact, with limited anthropogenic impacts which have resulted in minor modification to the mountain stream drainage lines. Minor informal road crossings were determined to be an anthropogenic impacting factor.	**EIS Discussion**	**High** The mountain stream drainage lines are considered of ecological importance on a landscape scale, primarily due to the mountain stream drainage lines being located in areas classified as CBA 1 and 2, and ESA and Other Natural Areas according to the Northern Cape Critical Biodiversity Areas (2016). Additionally, the central western and eastern portions of the investigation area are located in a sub-quaternary catchment classified as a FEPA and an upstream catchment management area (according to NFEPA, 2011). Even though modifications to these mountain stream drainage lines have occurred, they still provide habitat to biota given the high degree of connectivity of these features with the surrounding landscape.
	Ecoservice provision	**Ecoservice Provisioning: Very Low to Very High** The mountain stream drainage lines are considered of very high importance for the supply of biodiversity maintenance, of which the demand for this service is also considered very high in the catchment. The mountain stream drainage lines are Important for providing habitat (function as migratory corridors), erosion control, and the provision of cultural services due to their overall scenic beauty as part of the surrounding mountainous area.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: A/B (Improve)** The RMO is to, at minimum, maintain these mountain stream drainage lines in their current ecological state, as any potential impacts may also impact cumulatively on the downstream larger Kookfonteinm River System. Small scale rehabilitation of areas which may potentially be directly and indirectly impacted by the proposed powerline must be undertaken.
Assessment of the Mountain Stream drainage lines of the Brak River System	**IHI Outcome**	**IHI Riparian PES Category: B (Largely natural with few modifications)** Due to the position of the mountain stream drainage lines in the landscape, they are considered largely intact, with limited anthropogenic impacts which have resulted in minor modification to the mountain stream drainage lines. Minor informal road crossings were determined to be an anthropogenic impacting factor.	**EIS Discussion**	**High** The mountain stream drainage lines are considered of ecological importance on a landscape scale, primarily due to the mountain stream drainage lines being located in areas classified as CBA 1 and 2, and ESA and Other Natural Areas according to the Northern Cape Critical Biodiversity Areas (2016). Additionally, the central western and eastern portions of the investigation area are located in a sub-quaternary catchment classified as a FEPA and an upstream catchment management area (according to NFEPA, 2011). Even though modifications to these mountain stream drainage lines have occurred, they still provide habitat to biota given the high degree of connectivity of these features with the surrounding landscape.
	Ecoservice provision	**Ecoservice Provisioning: Very Low to Very High** The mountain stream drainage lines are considered of very high importance for the supply of biodiversity maintenance, of which the demand for this service is also considered very high in the catchment. The mountain stream drainage lines are Important for providing habitat (function as migratory corridors), erosion control, and the provision of cultural services due to their overall scenic beauty as part of the surrounding mountainous area.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: A/B (Improve)** The RMO is to, at minimum, maintain these mountain stream drainage lines in their current ecological state, as any potential impacts may also impact cumulatively on the downstream larger Brak River System. Small scale rehabilitation of areas which may potentially be directly and indirectly impacted by the proposed powerline must be undertaken.
Impact Significance:	**Low** (With the implementation of mitigation measures)	No powerline support structures may be constructed within the delineated extent of the mountain stream drainage lines and no indiscriminate traversing of these freshwater features during the spanning of the cables must take place, however, existing roads traversing some of the mountain stream drainage lines may be upgraded if required (with limited new roads to be developed through the mountain stream drainage lines). Such activities are identified to pose a low, direct negative impact to the mountain stream drainage lines. Should road upgrading/grading activities within the mountain stream drainage lines only be undertaken during the dry period (which will not require any kind of diversion of flow) and the recommended mitigation measures be applied, the impact significance can be reduced to a low risk significance.		

Table 5: Summary of results of the assessment of the upper foothill tributaries associated with the Sout, Kookfonteinspruit and Tierhoekspruit River systems proposed to be traversed by the proposed powerline.

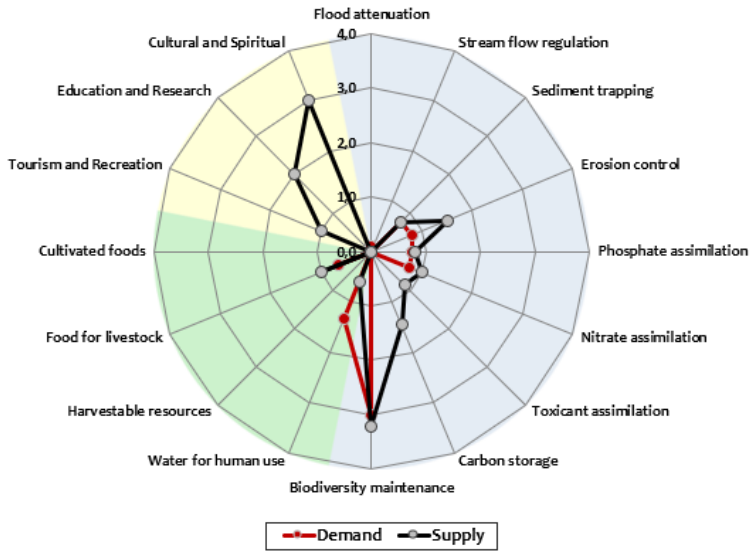
Ecological & socio-cultural service provision graph:	Freshwater ecosystem characteristics overview:
	The proposed powerline will traverse the lower reaches of the upper foothill tributaries associated with the Sout, Kookfonteinspruit and Tierhoekspruit River systems. The upper foothill tributaries are located along a moderately steep gradient (but still noticeable) along the surrounding slopes. These tributaries are typically fed by runoff from the surrounding catchment including the mountain stream drainage lines to which they are connected. These upper foothill tributaries flow in a generally southerly direction and ultimately flow into the larger lower foothill tributaries and river systems located downstream. These upper foothill tributaries are characterised by a semi-confined channel, alternating between exposed bedrock and an alluvial substrate (gravel and coarse sand) (Figure 21). The vegetation composition within these upper foothill tributaries is not different from the surrounding terrestrial environment and is indicative of the natural species composition expected of the vegetation type (Figure 21). However, the vegetation vigour or robustness was noted to be higher within these tributaries as a result of the periodic presence of surface water. The reaches of the upper foothill tributaries to be traversed by the proposed powerline are mostly impacted by gravel road crossings (Figure 21) and agricultural activities (including livestock grazing) and their associated edge effects encroaching into these systems, albert to a limited extent given the position of these upper foothill tributaries in a moderately steep gradient where anthropogenic activities are limited

Figure 21: Representative photographs of the upper foothill tributaries associated with the Sout, Kookfonteinspruit and Tierhoekspruit River systems. (Left) Position of an upper foothill tributary (yellow dashed line) along a gentle gradient flowing into an existing road crossing where the powerline will traverse; (Middle) the identified upper foothill tributaries are typically characterised by semi-confined channel and vegetation which is not distinct from the surrounding terrestrial vegetation; and (Right) An upper foothill tributary (yellow dashed line) with exposed bedrock within the active channel flowing into a larger lower foothill tributary associated with the Kookfonteinspruit River system (blue line).

Assessment of the Upper foothill tributaries of the Sout and Kookfonteinspruit River Systems	**IHI Outcome**	**IHI Riparian PES Category: B (Largely natural with few modifications)** These tributaries are fairly intact, with road crossings and minimal agricultural activity (livestock grazing) noted as the only anthropogenic activity to impact on the tributaries. The vegetation composition is representative of the vegetation of the biome and consists of indigenous species.	**EIS Discussion**	**High** The upper foothill tributaries are considered of ecological importance on a landscape scale, primarily due to the upper foothill tributaries being located in areas classified as CBA 1 and 2, and ESA and Other Natural Areas according to the Northern Cape Critical Biodiversity Areas (2016). Additionally, the central western and eastern portions of the investigation area are located in a sub-quaternary catchment classified as a FEPA and an upstream catchment management area (according to NFEPA, 2011). Even though modifications to these upper foothill tributaries have occurred, they still provide habitat to biota given the high degree of connectivity of these features with the larger river systems.
	Ecoservice provision	**Ecoservice Provisioning: Very Low to Very High** The upper foothill tributaries are considered of very high importance for the supply of biodiversity maintenance, of which the demand for this service is also considered very high in the catchment. The upper foothill tributaries are Important for providing habitat (function as migratory corridors), erosion control, and the provision of cultural services due to their overall scenic beauty forming part of the surrounding mountainous area and intact ecological state.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: A/B (Improve)** The RMO is to, at minimum, maintain these upper foothill tributaries in their current ecological state, as any potential impacts may also impact cumulatively on the downstream larger Sout and Kookfonteinspruit River Systems. Small scale rehabilitation of areas which may potentially be directly and indirectly impacted by the proposed powerline must be undertaken.
Assessment of the Upper foothill tributaries of Tierhoekspruit River System	**IHI Outcome**	**IHI Riparian PES Category: B (Largely natural with few modifications)** These tributaries are fairly intact, with road crossings and minimal agricultural activity (livestock grazing) noted as the only anthropogenic activity to impact on the tributaries. The vegetation composition is representative of the vegetation of the biome and consists of indigenous species.	**EIS Discussion**	**High** The upper foothill tributaries are considered of ecological importance on a landscape scale, primarily due to the upper foothill tributaries being located in areas classified as CBA 1 and 2, and ESA and Other Natural Areas according to the Northern Cape Critical Biodiversity Areas (2016). Additionally, the central western and eastern portions of the investigation area are located in a sub-quaternary catchment classified as a FEPA and an upstream catchment management area (according to NFEPA, 2011). Even though modifications to these upper foothill tributaries have occurred, they still provide habitat to biota given the high degree of connectivity of these features with the larger river systems.
	Ecoservice provision	**Ecoservice Provisioning: Very Low to Very High** The upper foothill tributaries are considered of very high importance for the supply of biodiversity maintenance, of which the demand for this service is also considered very high in the catchment. The upper foothill tributaries are Important for providing habitat (function as migratory corridors), erosion control, and the provision of cultural services due to their overall scenic beauty forming part of the surrounding mountainous area and intact ecological state.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: A/B (Improve)** The RMO is to, at minimum, maintain these upper foothill tributaries in their current ecological state, as any potential impacts may also impact cumulatively on the downstream larger Tierhoekspruit River System. Small scale rehabilitation of areas which may potentially be directly and indirectly impacted by the proposed powerline must be undertaken.
Impact Significance:	**Low** (With the implementation of mitigation measures)	No powerline support structures may be constructed within the delineated extent of the upper foothill tributaries and no indiscriminate traversing of these freshwater features during the spanning of the cables must take place, however, existing roads traversing some of the upper foothill tributaries may be upgraded if required (with limited new roads to be developed through the upper foothill tributaries). Such activities are identified to pose a low, direct negative impact to the upper foothill tributaries. Should road upgrading/grading activities within the upper foothill tributaries only be undertaken during the dry period (which will not require any kind of diversion of flow) and the recommended mitigation measures be applied, the impact significance can be reduced to a low risk significance.		

Table 6: Summary of results of the assessment of the lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River systems proposed to be traversed by the proposed powerline.

Ecological & socio-cultural service provision graph:

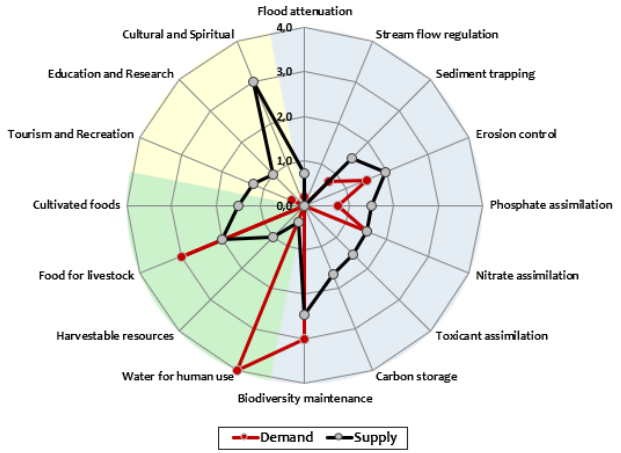


Figure 22: Alluvial flats along a lower foothill tributary of the Sout River with *Salsola aphylla* and *Pentzia incana* in the background

Freshwater ecosystems characteristics overview:

The proposed powerline will traverse the Kookfonteinspruit and Brak Rivers and lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River systems. These freshwater systems are located along a lower gradient and are fed by runoff from the catchment and upper foothill and mountain stream drainage lines. Due to their location within the foothill position characterised by an extensive area of low relief of relatively level, gently undulating or uniformly sloping land, the identified Kookfonteinspruit and Brak Rivers and the majority of the lower foothill tributaries associated with these river systems are akin to wide floodplains and are extensive in width. The Kookfonteinspruit and Brak Rivers and the lower foothill tributaries contain a main (active) channel, a feature of most fluvial systems. The depth, width, and relative location of the channel varied amongst all of these freshwater systems but were similar in terms of displaying a relatively less incised channel with the presence of a number of secondary, lateral channels displaying moderate sinuosity. The channel beds alternate between exposed bedrock and an alluvial substrate (gravel, coarse sand and cobbles rounded by fluvial action, typically deposited within the channel floor and on the inner bed). Along most of the larger river systems (Kookfonteinspruit and Brak Rivers), alluvial terraces were noted to exist adjacent to the primary channel (Figure 22). These alluvial terraces consisted of fine silty substrate deposited in situ by fluvial action during large scale flood events. Where these extensive alluvial flats were found, these displayed characteristics of river floodplains, being characterised by relatively unconsolidated sediment, shaped by wind and water action to display undulating 'micro-terrain' in the form of low mounds and depressions (Figures 22 and 23). These mounds were relatively low in height, approximately 20 cm in certain places. These areas formed part of the riparian zone of these lower foothill freshwater features and were largely vegetated, with vegetation cover largely consisting of the salt-tolerant succulent shrub *Salsola aphylla* and *Pentzia incana* (Sheep Bush) associated with the Upper Nama Karoo vegetation type, typical of the local biome (Figures 22 and 23). When examined spatially across the study area, freshwater features containing wider riparian zones with extensive alluvial terraces were found to more commonly occur within the lower lying areas coinciding with the identified lower foothill tributaries and rivers. All channel margins are characterised by shrubs that are slightly larger than the surrounding upland vegetation (Figure 23). This differentiation in height possibly reflects increased moisture availability within the freshwater features as compared to surrounding upland areas. Riparian zones were noted to end where the vegetation changed to typical karoo dwarf shrubveld (bossie veld), along with a change in slope and substrate.

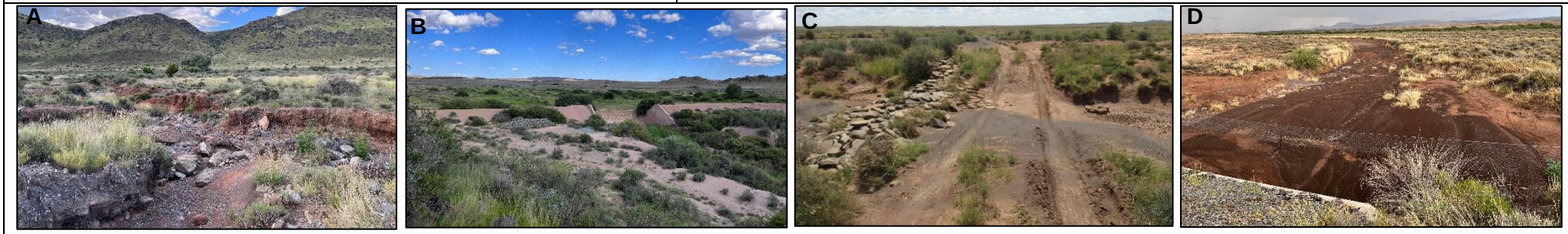


Figure 23: (A) Bank incision / erosion observed within a lower foothill tributary associated with the Tierhoekspruit River system (B) a large instream artificial impoundment associated with the and the Kookfonteinspruit River; (C) a road crossing through a lower foothill tributary of the Sout River; and (D) Primary (active) channel of the Brak River associated with the eastern extent of the proposed powerline.

Assessment of the Kookfonteinspruit and Brak Rivers	**IHI Outcome**	**IHI Riparian PES Category: C (Moderately modified)** The Kookfonteinspruit and Brak Rivers have been impacted by ongoing surrounding agricultural development, instream impoundments and gravel road crossings. These disturbances have resulted in some bank erosion and an increase in the presence of ruderal and alien vegetation species (albeit not considered extensive).	**EIS Discussion**	**High** The Kookfonteinspruit and Brak Rivers are considered of ecological importance on a landscape scale, primarily due to these rivers being located in areas classified as CBA 1 and 2, and ESA and Other Natural Areas according to the Northern Cape Critical Biodiversity Areas (2016). Additionally, the central western and eastern portions of the investigation area are located in a sub-quaternary catchment classified as a FEPA and an upstream catchment management area (according to NFEPA, 2011). Even though modifications to the Kookfonteinspruit and Brak Rivers have occurred, they still provide habitat to biota given the high degree of connectivity in the landscape.
	Ecoservice provision	**Ecoservice Provisioning: Very Low to Moderately High** The Kookfonteinspruit and Brak Rivers are considered of very high importance for the supply of water for human use due to the dependence on these systems for agricultural purposes in a semi-arid context, signified by the presence of instream artificial impoundments. These rivers are also considered of moderately high importance for biodiversity maintenance and food for livestock. The rivers are also considered of importance for erosion control due to the low gradient and high surface roughness offered by the vegetation.	**REC Category, BAS and RMO**	**REC: Category C (Moderately modified)** **BAS: Category B RMO: B/C (Improve)** The RMO is to, at minimum, maintain the Kookfonteinspruit and Brak Rivers in their current ecological state, as any potential impacts may also impact cumulatively on the downstream reaches of these river systems. Small scale rehabilitation of areas which may potentially be impacted by the proposed development must be undertaken.
Assessment of the lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River Systems	**IHI Outcome**	**IHI Riparian PES Category: C (Moderately modified)** The Kookfonteinspruit and Brak Rivers and lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River systems have been impacted by ongoing surrounding agricultural development, instream impoundments and gravel road crossings. These impacts resulted in change to the cover, abundance and species composition of the vegetation component and selective erosion.	**EIS Discussion**	**High** The lower foothill tributaries are considered of ecological importance on a landscape scale, primarily due to the lower foothill tributaries being located in areas classified as CBA 1 and 2, and ESA and Other Natural Areas according to the Northern Cape Critical Biodiversity Areas (2016). Additionally, the central western and eastern portions of the investigation area are located in a sub-quaternary catchment classified as a FEPA and an upstream catchment management area (according to NFEPA, 2011). Even though modifications to these lower foothill tributaries have occurred, they still provide habitat to biota given the high degree of connectivity of these features with the larger river systems.
	Ecoservice provision	**Ecoservice Provisioning: Very Low to Moderately High** The lower foothill tributaries associated with the major river systems are considered of very high importance for the supply of water for human use due to the dependence on these systems for agricultural purposes in a semi-arid context. These tributaries are also considered of moderately high importance for biodiversity maintenance and food for livestock, and erosion control.	**REC Category, BAS and RMO**	**REC: Category C (Moderately modified)** **BAS: Category B RMO: B/C (Improve)** The RMO is to, at minimum, maintain these lower foothill tributeries in their current ecological state, as any potential impacts may also impact cumulatively on the downstream larger Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River systems. Small scale rehabilitation of areas which may potentially be impacted by the proposed development must be undertaken.

Impact Significance:	**Low** (With the implementation of mitigation measures)	No powerline support structures may be constructed within the delineated extent of the Kookfonteinspruit and Brak Rivers and lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River systems and no indiscriminate traversing of these freshwater features during the spanning of the cables must take place, however, existing roads traversing some of these freshwater features may be upgraded if required (with limited new roads to be developed through the lower foothill tributaries and rivers). Such activities are identified to pose a low, direct negative impact to the lower foothill tributaries and rivers. Should road upgrading/grading activities within the lower foothill tributaries only be undertaken during the dry period (which will not require any kind of diversion of flow) and the recommended mitigation measures be applied, the impact significance can be reduced to a low risk significance.

All comprehensive results calculated are available in **Appendix E.**

6 LEGISLATIVE REQUIREMENTS & SENSITIVITY MAPPING

The following legislative requirements were considered during the assessment. A detailed description of these legislative requirements is presented in Appendix B of this report:

- The Constitution of the Republic of South Africa, 1996[7];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

It is important to note that in terms of the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) (See Appendix B), all of the natural watercourses within the investigation area will be regulated by Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) as well as the applicable NEMA zones of regulation. All of the natural watercourses will thus require authorisation from the Department of Water and Sanitation (DWS). This report aids in providing relevant information for the authorisation processes.

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 to be "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 to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on watercourses 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).

Table 7: 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 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as: • the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the **absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse** where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.

[7] 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.

Regulatory authorisation required	Zone of applicability
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended. **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; or* *c) if no development setback exists, within **32 metres of a watercourse**, measured from the edge of a watercourse.* **Activity 19:** *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from –* *(a) 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 the Northern and Western Cape, 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 occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.* *Western Cape:* *ii. All areas outside urban areas;* *Northern Cape:* *ii. Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland;* *iii. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* ***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; or* *(c) if no development setback has been adopted, within **32 metres of a watercourse**,* *Northern Cape:* *ii. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;*

Regulatory authorisation required	Zone of applicability
	(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; *Western Cape:* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus 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 18:*** *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *Northern Cape:* *i) Outside urban areas:* *(ii) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland; or* **Activity 23:** *The expansion of –* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority;* *Where such development occurs-* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse*

A 32 m Zone of Regulation (ZoR) in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) was assigned to all identified freshwater features within the investigation area (Figures 24 to 28). A 100 m Zone of Regulation in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (in the absence of a defined 1 in 100 year floodline) was applied to all identified freshwater features within the investigation area (Figures 24 to 28). In addition, in terms of the Listing Notice (LN) 3 (GN 324) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended), a 100 m ZoR also applies to these freshwater features, therefore, EA will apply to areas within 100 m of the freshwater features for certain LN3 activities (Table 7).

The proposed powerline will encroach into the 100 m GN509 regulated area, thus Water Use Authorisation (WUA) from the DWS is required prior to commencement of any construction. Based on the outcome of the DWS Risk Assessment as per Section 7, Water Use Authorisation by means of General Authorisation in terms of Section 21(c) and (i) water uses are required to be obtained in consultation with the DWS.

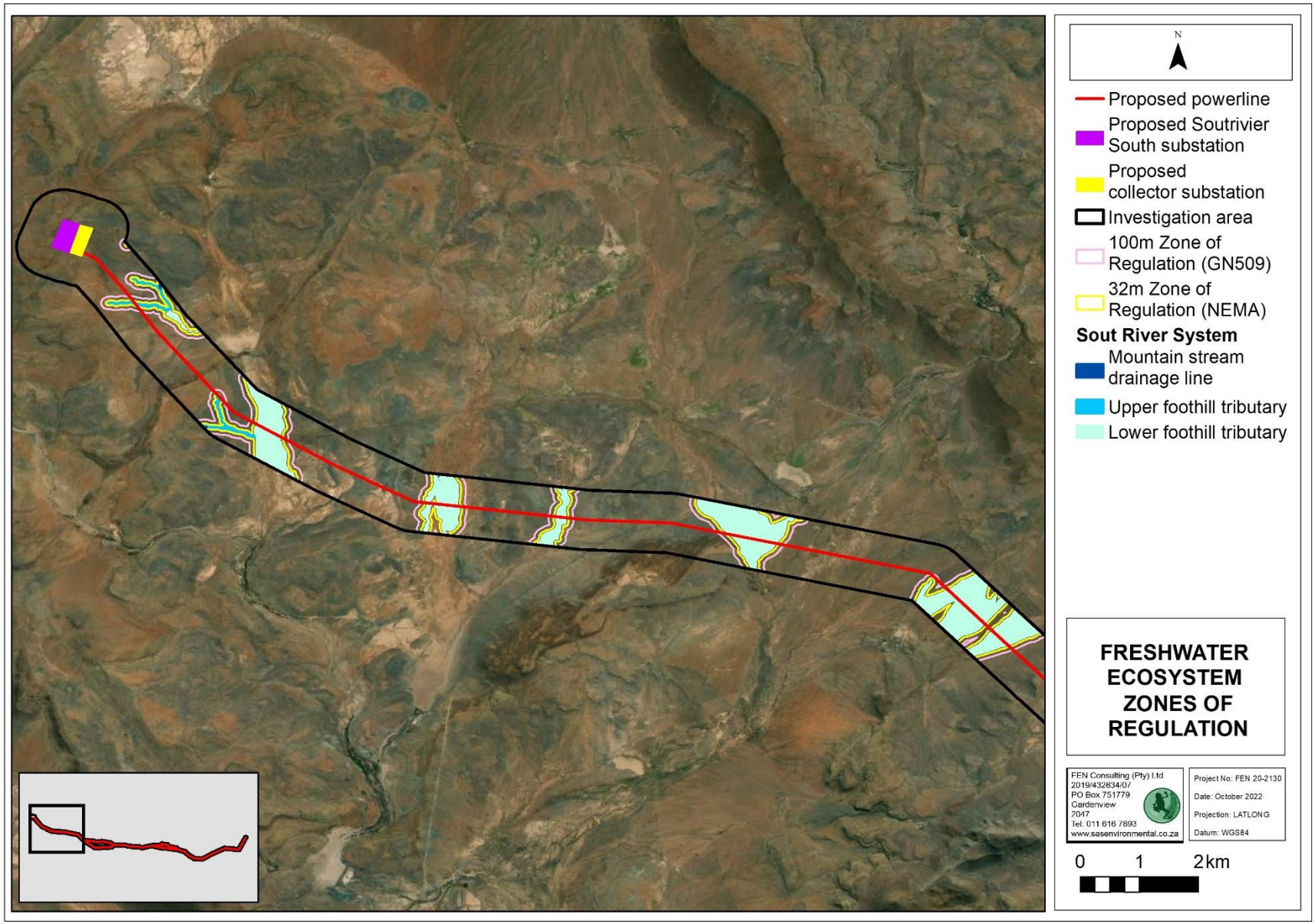


Figure 24: The conceptual presentation of the zones of regulation in relation to the delineated freshwater ecosystems in terms of NEMA and GN509 as it relates to the NWA for the freshwater ecosystems associated with the western portion of the investigation area.

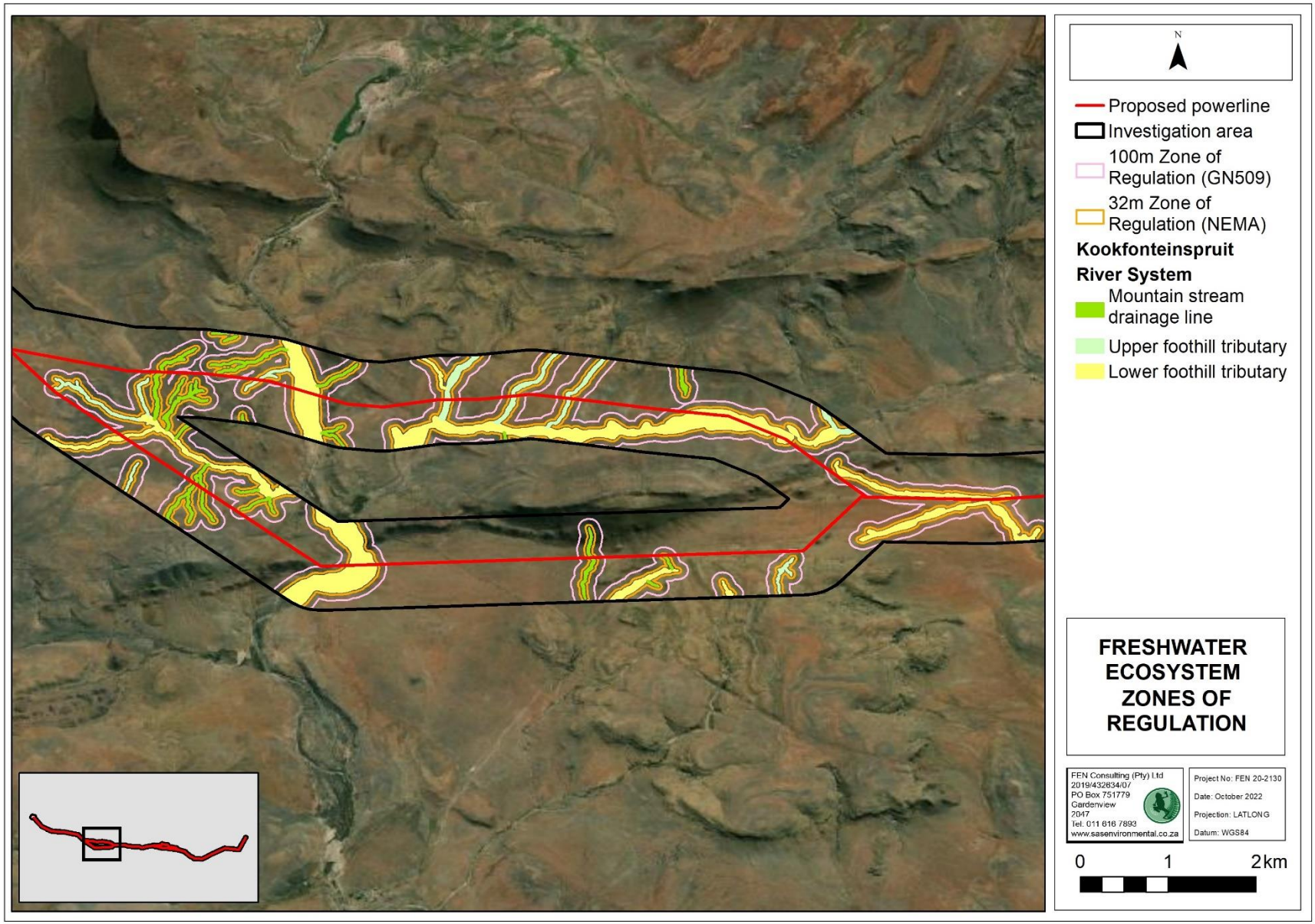


Figure 25: The conceptual presentation of the zones of regulation in relation to the delineated freshwater ecosystems in terms of NEMA and GN509 as it relates to the NWA for the freshwater ecosystems associated with the central western portion of the investigation area.

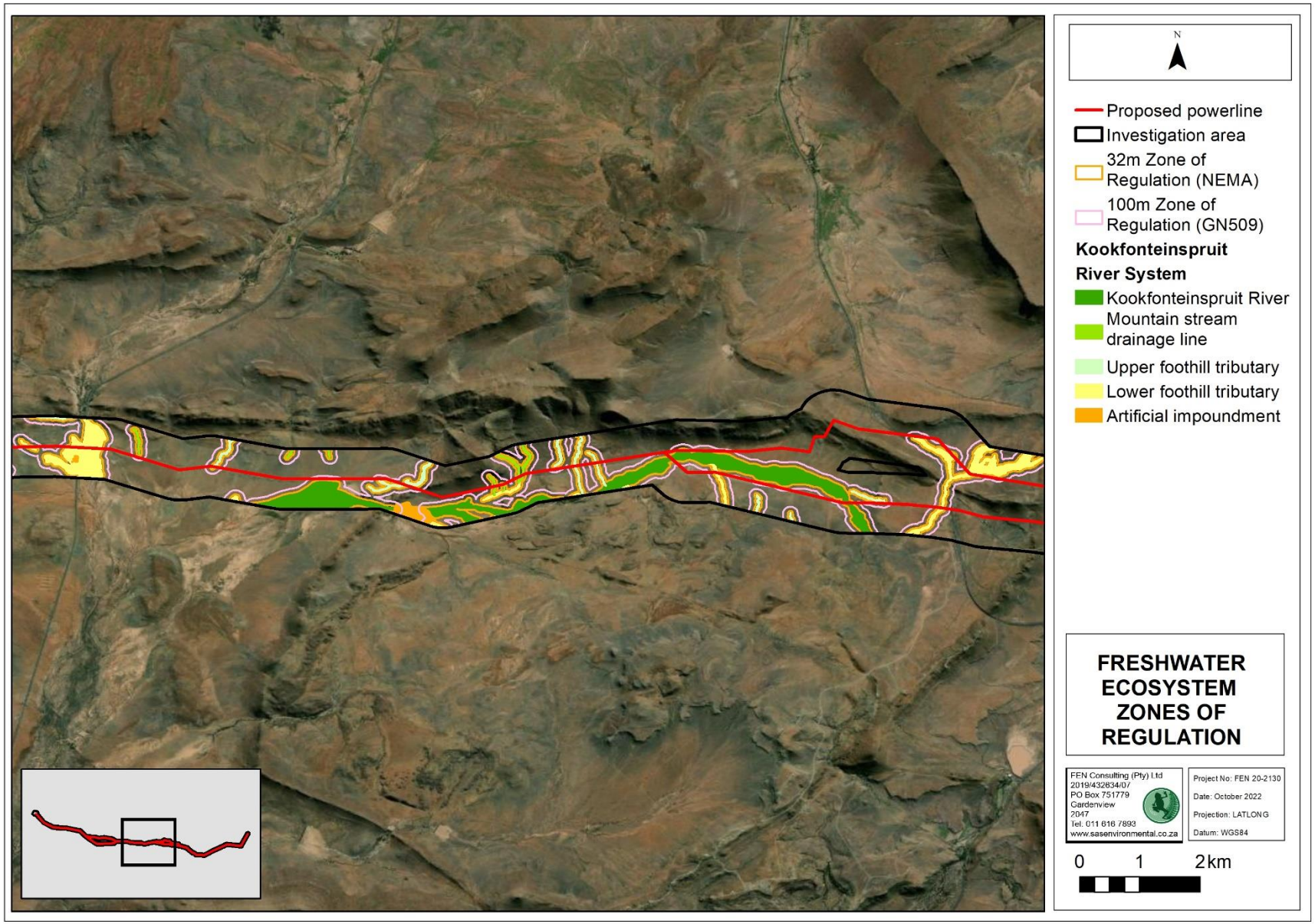


Figure 26: The conceptual presentation of the zones of regulation in relation to the delineated freshwater ecosystems in terms of NEMA and GN509 as it relates to the NWA for the freshwater ecosystems associated with the central western portion of the investigation area.

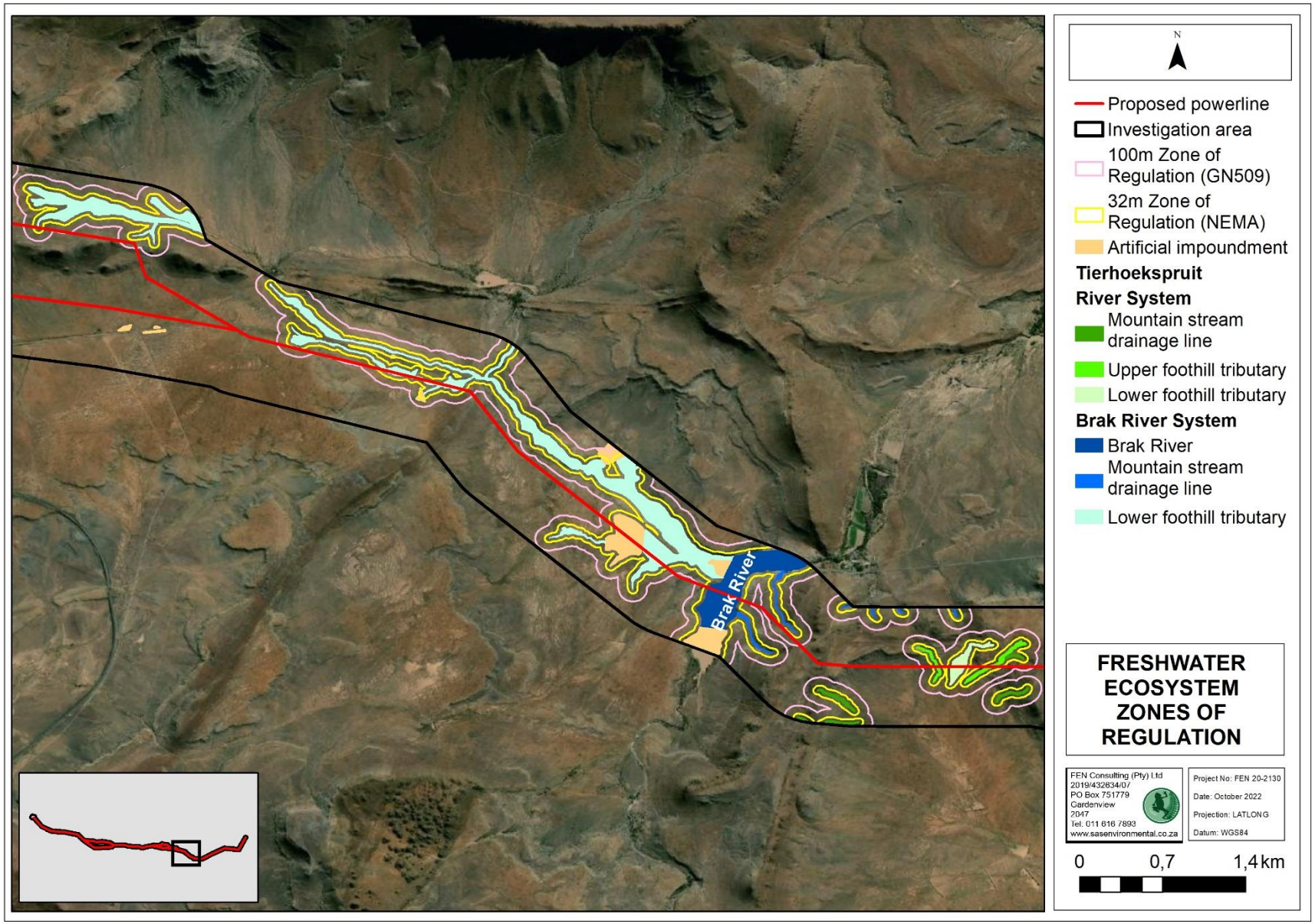


Figure 27: The conceptual presentation of the zones of regulation in relation to the delineated freshwater ecosystems in terms of NEMA and GN509 as it relates to the NWA for the freshwater ecosystems associated with the central portion of the investigation area.

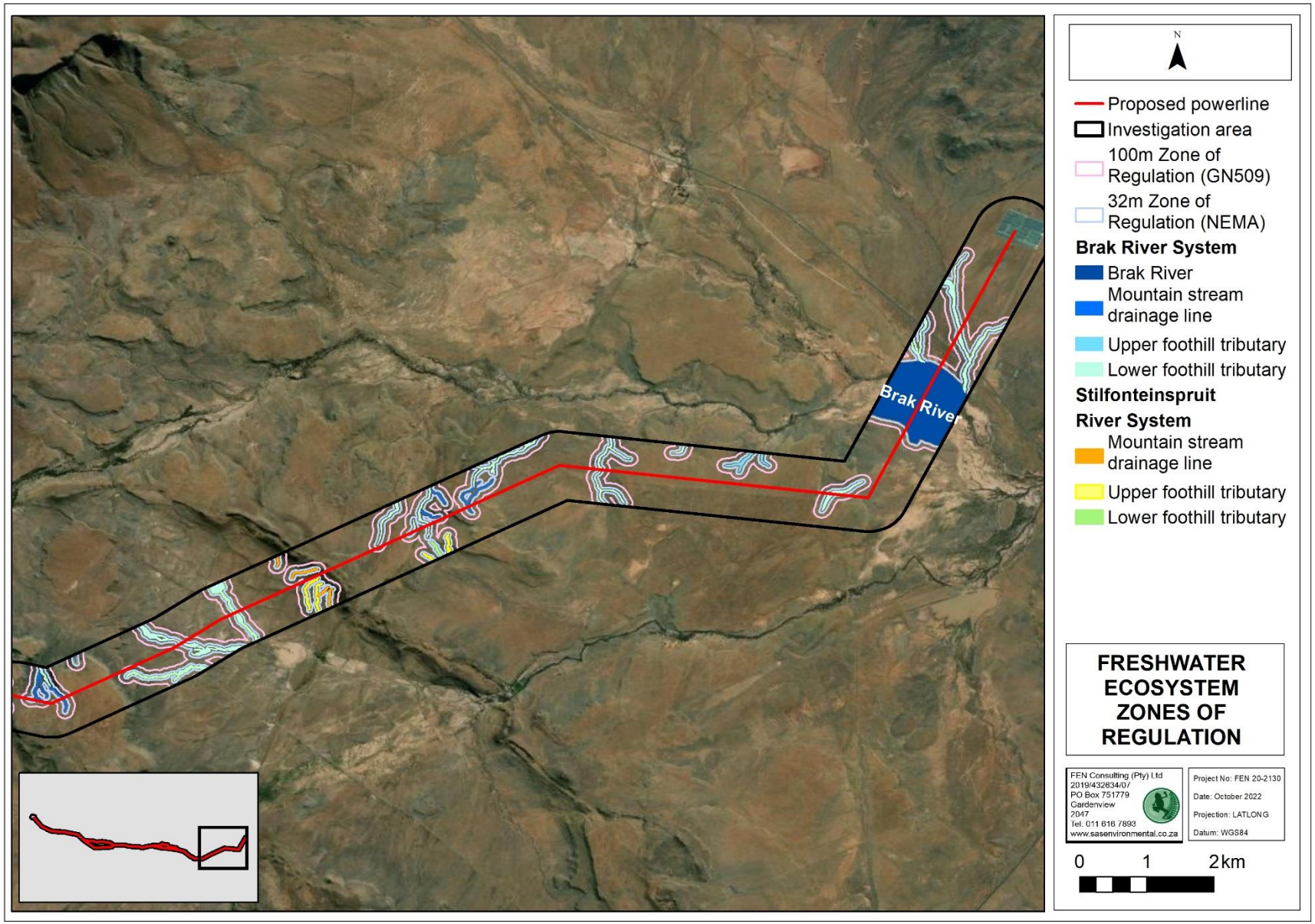


Figure 28: The conceptual presentation of the zones of regulation in relation to the delineated freshwater ecosystems in terms of NEMA and GN509 as it relates to the NWA for the freshwater ecosystems associated with the eastern portion of the investigation area.

7 RISK AND IMPACT ASSESSMENT

This section provides the impact assessment outcomes and highlights all potential impacts that may affect the identified freshwater ecosystems. The risk assessment is undertaken according to the DWS specified Risk Assessment Matrix (as promulgated in GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)), and results translated into the impact assessment methodology provided by the EAP (refer to Section 7.2). Management and mitigation measures are provided which should be implemented during the various development phases to assist in minimising the impact on the receiving environment.

7.1 *Risk Assessment considerations and outcome*

Following the assessment of the freshwater features identified to be traversed by the proposed powerline, the impact assessment was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the identified freshwater features. The points below summarise the considerations made when applying the impact assessment:

- The risk assessment was applied considering the risk significance of the proposed powerline as described in Section 2 and depicted in Figures 1 and 2;
- The proposed Soutrivier South on-site substation and proposed collector substation are located outside the 100 m GN509 Zone of Regulation. The risk significance of these substations was thus not considered as they are located outside the 100 m GN509 regulated area and are considered to not pose a quantum of risk to the freshwater features due to their distance relative to the delineated freshwater features;
- Support structures or pole positions associated with the proposed powerline were not available at the time of compiling this report, thus recommendations are made regarding the pole positions in consideration of the identified freshwater features;
- At the time of this assessment the layout of the proposed access roads (potential new roads) was not available. As such, it is assumed that the existing informal roads (including the Biesiespoort Road to a certain extent) will be used as access roads. However, it is noted that the existing farm roads can only access the powerline route to a certain point; thereafter, no existing roads available. The proponent has confirmed that there will be informal access roads (“jeep-track”) for maintenance activities that will most likely run underneath or adjacent to the powerline route, and will likely be used to access the site during construction. As such, the proposed “jeep-track” is assessed in both the construction and operational phases of the proposed powerline;
- The risk assessment was applied assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report present the perceived impact significance post-mitigation;
- Transmission powerlines are not typically associated with impacts on surface water resources within non-woody environments, as the powerlines do not have a physical footprint over the length of the powerline other than the footprint of each support structure. As the lines are strung above the ground and as the support structures are spread, most freshwater systems are able to be ‘spanned’ by the power lines and thus avoided from being physically affected. Powerlines can however be associated with impacts on surface water resources if the support structures are placed within a freshwater feature. The process of constructing the powerline can also cause impacts on surface water resources, especially if certain mitigation measures and procedures are not followed. These potential impacts are explored in greater detail in the table below;

- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the Department of Environmental Affairs (DEA) *et al* (2013)[8] would be followed, i.e., the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required. In this regard, the risk assessment was undertaken assuming that the location of the proposed powerline support structures will be located, as far as possible, at least 32 m (outside the 32 m regulated zone in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998)) from the delineated extent of a freshwater feature due to the quantum of risk being lower for any areas more than 32 m from the delineated extent of freshwater features. However, it is acknowledged that the riparian zone may potentially be of a width that entails that the area is not able to be singly spanned by the proposed power line (e.g., the wide lower foothill freshwater features including the Brak River and other lower foothill tributaries), thus resulting in support structures having to be placed within the riparian zone. This will require the clearing of vegetation within the powerline servitude, resulting in impacts of greater intensity to the riparian zone and thus likely a moderate risk significance score. It is therefore advised that when the layout of the support structures become available, it must be assessed for its risks on the receiving freshwater environment and suitable mitigation measures developed;
- Since it is expected that the 100 m GN509 ZoR and 100 m ZoR in terms of NEMA (as above) cannot be avoided for the placement of support structures (spanning width is usually at 80 to 400 m), the legal issues for the construction of support structures were scored a maximum value of "5";
- The activities relating to the proposed powerline are all highly site specific, not of a significant extent relative to the area of the freshwater ecosystems assessed, and therefore have a limited spatial extent;
- While the operation of the proposed powerline will be a permanent activity, the installation thereof is envisioned to take no more than a few months. However, the frequency of the construction impacts in a given area may be daily during this time;
- Most impacts are considered to be easily detectable; and
- The considered mitigation measures are easily practicable.

7.1.1 **Risk Assessment Discussion**

There are five key ecological risks on the freshwater features that were assessed, namely:

- Loss of freshwater habitat and ecological structure resulting in impacts to biota;
- Changes to the socio-cultural and service provision;
- Impacts on the hydrology and sediment balance of the freshwater features;
- Impacts on water quality; and
- Proliferation of alien and invasive plant species.

The results of the risk assessment are summarised in Table 8 below, including key mitigation measures for each activity that must be implemented in order to reduce the impacts of the proposed activities, as described in Section 2 of this report. Kindly refer to **Appendix F** for the full risk assessment table scorings as well as reversibility scorings and good housekeeping practices that must be implemented

[8] The Department of Forestry, Fisheries and the Environment (DFFE) was formerly known as the Department of Environmental Affairs (DEA). 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.

Table 8: Summary of the results of the DWS risk assessment applied to the freshwater features at risk from the proposed powerline.

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
1	Construction Phase	Site preparation prior to construction activities.	• Vehicular movement (transportation of construction materials); • Construction of camp/contractor laydown and storage area	• Transportation of construction materials can result in disturbances to soil, and increased risk of sedimentation/erosion; • Soil contamination and potential oil and hydrocarbon spills originating from construction vehicles; and • Soil compaction leading to increased runoff and erosion within the vicinity of the freshwater features.	1,25	3,25	3	**42,25**	L	**It is assumed that the proposed powerline support structures will be located outside of the freshwater features and at least 32 m (as far as possible/feasible) from the delineated edge of a freshwater feature – this in itself is considered a mitigation measure, which entails no direct negative impacts from occurring to the freshwater features. Should the following mitigation measures (pertaining to the construction of the proposed powerline) be applied, a Low risk significance can be expected:** • **It is imperative that all construction works (with specific mention of potential upgrading of any road crossings) be undertaken during the driest period of the year when the flow is very low in the freshwater features;** • Due to the accessibility of the sites, no unnecessary crossing of the freshwater features may be permitted and it is strongly recommended that the delineated freshwater features be considered a no-go area. This will limit edge effects, erosion and sedimentation of the freshwater features during the construction phase; • The reaches of the freshwater features where no activities are planned (i.e., where no support structures or spanning of the powerline over the freshwater features is planned) must be considered no-go areas; • Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the freshwater features and preferably outside their associated 100 m NEMA / GN509 ZoR as it would also help the proponent avoid the LN3 activities triggered within 100 m of watercourses; • **Clearing of powerline servitudes of vegetation. Technically, only a very limited width strip of woody vegetation above a minimum clearance height needs to be cleared, all lower woody vegetation and other herbaceous vegetation must remain and not be cleared. Clearing of the entire width of the servitude through freshwater features must not occur. Keep woody vegetation below the minimum clearance height, and no indiscriminate removal of vegetation within the servitude must occur**. This is considered feasible for the freshwater features identified to be associated with the proposed powerline as they are mostly characterised by low growing shrub and graminoid vegetation species;	Fully reversible
2			Removal of vegetation and associated disturbances to soil, and access to the site, including grading of existing informal farm roads (access roads will be maintained as informal gravel roads, or a typical jeep track type road).	• Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the receiving freshwater features; • Increased sedimentation of the freshwater features, leading to smothering of vegetation; • Dust pollution during construction which may impact on water quality; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	1,25	3,25	14	**45,5**	L		Fully reversible

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
										• Removed vegetation outside the delineated freshwater features must be stockpiled outside of the delineated boundary of a freshwater feature. The footprint areas and height of these stockpiles must be kept to a minimum; • The removed (indigenous) vegetation must be reinstated after the construction phase. However, alien/invasive vegetation species present and removed must not be reinstated but must be disposed of at a registered garden refuse site and may not be burned or mulched on site.	
3		Installation of the support structures (further than 32 m but within 100 m of the delineated freshwater features) and spanning of the proposed powerline.	• Excavation of foundation pits for the support structures leading to stockpiling of soil; • Potential movement of construction equipment and personnel within the freshwater features.	• Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream freshwater ecosystems; • Disturbances of soil leading to potential impacts to the freshwater features and increased sediment runoff from the construction site to the freshwater features, in turn leading to altered freshwater habitat; • Altered runoff patterns, leading to increased erosion and sedimentation of the receiving freshwater features down gradient of the development; • Dust pollution during construction which may impact on water quality (if surface water is present).	1,25	3,25	14	**45,5**	**L**	• **Stringing of the line (i.e., pulling the cables into place) needs to be done manually across freshwater features and must not entail the movement of machinery across the feature, unless as part of an approved existing access track / road across the feature**; • The construction footprint and period must be kept as small and as short as possible, respectively; and construction activities within the delineated freshwater features must be avoided; • Only a 5 m zone of disturbance / construction right of way must be permitted to be disturbed. This 5 m construction right of way will limit construction vehicles/personnel to disturb the area surrounding any freshwater features, should the support structures be located in close proximity to a freshwater feature; • Protect exposed stockpiles (if necessary) from wind and limit the time in which the stockpiled soil is exposed, by covering with a suitable geotextile such as hessian sheeting; • Excavation of foundation pits for the support structures may result in loose sediments within the landscape, specifically if works are undertaken during a period of rainfall (if applicable); • During excavation activities, soil must be stockpiled upgradient of the excavated area. Mixture of the lower and upper layers of the excavated soil must be kept to a minimum. This soil must be used to backfill the pits (support structures), immediately after installation of the support structures and/or other infrastructure; • Material used as bedding material (at the bottom of the excavated foundation pit) must be stockpiled outside of the 32m NEMA ZoR and as close as possible to the support structures footprint area. Once the pit has been excavated, the bedding	Fully reversible

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
4			• Mixing and casting of concrete for foundations.	• Potential contamination of surface water (if present).	1,25	3,25	14	**45,5**	**L**	material must be directly placed within the foundation pit, rather than stockpiling it alongside the foundation pit; • The bedding layer (such as clean gravel) must be spread evenly and compacted uniformly to the required density using a hand tamper (one man operator) in order to minimise the use of large machinery within the freshwater feature or within close proximity to a freshwater feature; • When the powerline is strung between the support structures, no vehicles may indiscriminately drive through the freshwater features, use must be made of the existing access roads. <u>Control measures for concrete mixing on site:</u> • No mixed concrete may be deposited outside of the designated construction footprint; • As far as possible, concrete mixing must be restricted to the batching plant. Additionally, batter / dagga board mixing trays and impermeable sumps must be provided, onto which any mixed concrete can be deposited while it awaits placing; and • Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site. <u>With regards to backfilling of the concrete encasing:</u> • Soil removed for excavating the pit must be used as backfill material; • All excavated pits must be compacted to natural soil compaction levels to prevent the formation of preferential surface flow paths and subsequent erosion. Conversely, areas compacted as a result of construction activities must be loosened to natural soil compaction levels; • Any remaining soil following the completion of backfilling of the pits are to be spread out thinly surrounding the installed support structures (outside of the delineated freshwater features) to aid in the natural reclamation process; and • The construction footprint must be limited to the foundation pit area associated with the support structures and recommended 5 m construction buffer (to allow for the stockpiling and movement of personnel). The area must be rehabilitated after the completion of the construction phase, including revegetation thereof with indigenous vegetation. In addition, alien vegetation eradication of the footprint area must be undertaken where applicable. Hydroseeding of disturbed areas is recommended.	Fully reversible

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
5		Access route "jeep-track"	• Soil compaction for the access route	• Disturbances of soil resulting in altered runoff patterns within the vicinity of the freshwater features; and • Altered runoff patterns, leading to increased erosion and sedimentation of freshwater habitat.						• All footprint areas must remain as small as possible and vegetation clearing to be limited to what is absolutely essential; • No vegetation clearing must take place in the freshwater features; and • No formal paving must be used for the access route. *In situ* compaction of soil for the "jeep-track" as proposed is preferred.	
5	**OPERATIONAL PHASE**	Operation and maintenance of the powerline and access route.	• Potential indiscriminate movement of maintenance vehicles within close proximity of the freshwater features; • Increased risk of sedimentation and/or hydrocarbons entering the freshwater features via stormwater runoff from the access roads	• Disturbance to soil and ongoing erosion as a result of periodic maintenance activities; • Altered water quality (if surface water is present) as a result of increased availability of pollutants	1	3	12	36	L	• **Clearing of powerline servitudes of vegetation. All lower woody vegetation and other herbaceous vegetation must remain and not be cleared. Clearing of the entire width of the servitude through freshwater features must not occur even during maintenance activities. Keep woody vegetation below the minimum clearance height, and no indiscriminate removal of vegetation within the servitude must occur**. This is considered feasible for the freshwater features identified to be associated with the proposed powerline as they are mostly characterised by low growing shrub and graminoid vegetation species; • Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the freshwater features may be permitted; • During periodic maintenance activities of the powerline, monitoring for erosion must be undertaken; • Should erosion be noted at the base of the support structures, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation; • Monitoring for the establishment of alien and invasive vegetation species must be undertaken, specifically where the support structures are within close proximity (within 32 m) to the freshwater feature and for access roads through or along the freshwater features. Should alien and invasive plant species be identified, they must be removed and disposed of as and the area must be revegetated with suitable indigenous vegetation.	Fully reversible

7.2 *Impact Assessment*

The results of the DWS specified Risk Assessment Matrix (as promulgated in GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)) are translated into the impact assessment methodology provided by the EAP. Kindly refer to **Appendix F** for the full risk assessment table scorings

Tables 9 to 12 below provides the summary of the impact assessment outcome for the above-listed activities, based on the methods presented in Appendix D, with suitable mitigation measures provided.

Table 9: Construction phase – impact assessment of site preparation activities prior to the construction of the powerline.

Impact 1: Site preparation prior to construction activities		
	Before mitigation	**After mitigation**
Vehicular movement (transportation of construction materials)	MODERATE NEGATIVE	LOW NEGATIVE
Construction of camp/contractor laydown and storage area	MODERATE NEGATIVE	LOW NEGATIVE
Removal of vegetation and associated disturbances to soil	HIGH NEGATIVE	LOW NEGATIVE

Mitigation measures:

- It is strongly recommended that the proposed powerline support structures be located outside of the freshwater features and at least 32 m (as far as possible/feasible) from the delineated edge of a freshwater feature – this in itself is considered a mitigation measure, which entails no direct negative impacts from occurring to the freshwater features. Should the following mitigation measures (pertaining to the construction of the proposed powerline) be applied, a Low risk significance can be expected;
- It is imperative that all construction works (with specific mention of potential upgrading of any road crossings) be undertaken during the driest period of the year when the flow is very low in the freshwater features;
- Due to the accessibility of the sites, no unnecessary crossing of the freshwater features may be permitted and it is strongly recommended that the calculated the delineated freshwater features be considered a no-go area. This will limit edge effects, erosion and sedimentation of the freshwater features during the construction phase;
- The reaches of the freshwater features where no activities are planned (i.e., where no support structures or spanning of the powerline over the freshwater features is planned) must be considered no-go areas;
- Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the freshwater features and their associated 32 m NEMA Zone of Regulation (ZoR);
- Clearing of powerline servitudes of vegetation. Technically, only a very limited width strip of woody vegetation above a minimum clearance height needs to be cleared, all lower woody vegetation and other herbaceous vegetation must remain and not be cleared. Clearing of the entire width of the servitude through freshwater features must not occur. Keep woody vegetation below the minimum clearance height, and no indiscriminate removal of vegetation within the servitude must occur. This is considered feasible for the freshwater features identified to be associated with the proposed powerline as they are mostly characterised by low growing shrub and graminoid vegetation species;
- Removed vegetation outside the delineated freshwater features must be stockpiled outside of the delineated boundary of a freshwater feature. The footprint areas and height of these stockpiles must be kept to a minimum; and

- The removed (indigenous) vegetation must be reinstated after the construction phase. However, alien/invasive vegetation species present and removed must not be reinstated but must be disposed of at a registered garden refuse site and may not be burned or mulched on site.

Table 10: Installation of the support structures and spanning of the proposed powerline.

Impact 2: Installation of the support structures (outside the delineated extent of the freshwater feature but potentially within 32 m of the delineated freshwater features) and spanning of the proposed powerline		
	Before mitigation	**After mitigation**
Excavation of foundation pits for the support structures leading to stockpiling of soil	MODERATE NEGATIVE	LOW NEGATIVE
Potential movement of construction equipment and personnel within the freshwater features	MODERATE NEGATIVE	LOW NEGATIVE
Mixing and casting of concrete for foundations	HIGH NEGATIVE	LOW NEGATIVE

Mitigation measures:

- Stringing of the line (i.e., pulling the cables into place) needs to be done manually across freshwater features and must not entail the movement of machinery across the feature, unless as part of an approved existing access track / road across the feature;
- The construction footprint and period must be kept as small and as short as possible, respectively; and construction activities within the delineated freshwater features must be avoided;
- Only a 5 m zone of disturbance / construction right of way must be permitted to be disturbed. This 5 m construction right of way will limit construction vehicles/personnel to disturb the surrounding area to freshwater features, should the support structures be located in close proximity to a freshwater feature;
- Protect exposed stockpiles (if necessary) from wind and limit the time in which the stockpiled soil is exposed, by covering with a suitable geotextile such as hessian sheeting;
- Excavation of foundation pits for the support structures may result in loose sediments within the landscape, specifically if works are undertaken during a period of rainfall (if applicable);
- During excavation activities, soil must be stockpiled upgradient of the excavated area. Mixture of the lower and upper layers of the excavated soil must be kept to a minimum. This soil must be used to backfill the pits (support structures), immediately after installation of the support structures and/or other infrastructure;
- Material used as bedding material (at the bottom of the excavated foundation pit) must be stockpiled outside of the 32m NEMA ZoR and as close as possible to the support structures footprint area. Once the pit has been excavated, the bedding material must directly be placed within the foundation pit, rather than stockpiling it alongside the foundation pit;
- The bedding layer (such as clean gravel) must be spread evenly and compacted uniformly to the required density using a hand tamper (one man operator) in order to minimise the use of large machinery within the freshwater feature or within close proximity to a freshwater feature;
- When the powerline is strung between the support structures, no vehicles may indiscriminately drive through the freshwater features, use must be made of the existing access roads.

<u>Control measures for concrete mixing on site:</u>

- No mixed concrete may be deposited outside of the designated construction footprint;
- As far as possible, concrete mixing must be restricted to the batching plant. Additionally, batter / dagga board mixing trays and impermeable sumps must be provided, onto which any mixed concrete can be deposited while it awaits placing; and

- Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site.

With regards to backfilling of the concrete encasing:

- Soil removed for excavating the foundation pit must be used as backfill material;
- All excavated pits must be compacted to natural soil compaction levels to prevent the formation of preferential surface flow paths and subsequent erosion. Conversely, areas compacted as a result of construction activities must be loosened to natural soil compaction levels;
- Any remaining soil following the completion of backfilling of the pits are to be spread out thinly surrounding the installed support structures (outside of the delineated freshwater features) to aid in the natural reclamation process; and
- The construction footprint must be limited to the foundation pit area associated with the support structures and recommended 5 m construction buffer (to allow for the stockpiling and movement of personnel). The area must be rehabilitated after the completion of the construction phase, including revegetation thereof with indigenous vegetation. In addition, alien vegetation eradication of the footprint area must be undertaken where applicable. Hydroseeding of disturbed areas is recommended.

Table 11: Preparation for the access route "jeep-track".

Impact 3: Soil compaction for the access route and associated disturbances of soil within the vicinity of the freshwater features		
	Before mitigation	**After mitigation**
Soil compaction for the access route	MODERATE NEGATIVE	LOW NEGATIVE

Mitigation measures:

- All footprint areas must remain as small as possible and vegetation clearing to be limited to what is absolutely essential;
- No vegetation clearing must take place in the freshwater features; and
- No formal paving must be used for the access route. In situ compaction of soil for the "jeep-track" as proposed is preferred.

Table 12: Operation and maintenance of the powerline and access route.

Impact 4: Operation and maintenance of the powerline entailing potential indiscriminate movement of maintenance vehicles within close proximity to the freshwater features		
	Before mitigation	**After mitigation**
Potential indiscriminate movement of maintenance vehicles within close proximity of the freshwater features	MODERATE NEGATIVE	LOW NEGATIVE
Increased risk of sedimentation and/or hydrocarbons entering the freshwater features via stormwater runoff from the access roads	HIGH NEGATIVE	LOW NEGATIVE

Mitigation measures:

- Clearing of powerline servitudes of vegetation. All lower woody vegetation and other herbaceous vegetation must remain and not be cleared. Clearing of the entire width of the servitude through freshwater features must not occur even during maintenance activities. Keep woody vegetation below the minimum clearance height, and no indiscriminate removal of

vegetation within the servitude must occur. This is considered feasible for the freshwater features identified to be associated with the proposed powerline as they are mostly characterised by low growing shrub and graminoid vegetation species;
- Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the freshwater features may be permitted;
- During periodic maintenance activities of the powerline, monitoring for erosion must be undertaken;
- Should erosion be noted at the base of the support structures, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation;
- Monitoring for the establishment of alien and invasive vegetation species must be undertaken, specifically where the support structures are within close proximity (within 32 m) to the freshwater feature and for access roads through or along the freshwater features. Should alien and invasive plant species be identified, they must be removed and disposed of as and the area must be revegetated with suitable indigenous vegetation.

7.3 *Risk and Impact Assessment discussion*

The activities associated with the construction and operational phases of the proposed powerline based on the alignment provided by the proponent include site preparation, excavation of foundation pits for the installation of powerline support structures at least 32 m from the delineated extent of freshwater features; these activities pose a Low risk significance to the identified freshwater features, with the implementation of the recommended mitigation measures. The intensity of impacts pre-mitigation ranges from moderate negative to high negative (Tables 9 to 12), the latter due to impacts to water quality which could be severe to aquatic life and have the potential to spread over a larger spatial scale, and the removal of vegetation within the freshwater features with respect to servitude vegetation clearing. The proposed Soutrivier South on-site substation and proposed collector substation are located outside the 100 m GN509 ZoR, thus no direct negative impacts from the construction of the substations on the identified freshwater ecosystems are expected. All mitigation measures as stipulated in Sections 7.2 and 7.2 above must be implemented to prevent any negative edge effects from occurring on the freshwater features.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, the significance of impacts arising from the proposed powerline are likely to be reduced during the construction and operational 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 F** of this report.

7.4 *Cumulative Impact Statement*

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Sections 7.1 and 7.2 above.

Direct and indirect impacts identified within the assessed freshwater features can predominantly be attributed to informal road crossings leading to limited alien and invasive species establishment. Considering that the proposed powerline support structures and substation will be located outside the assessed freshwater features (thus avoiding direct negative impacts), increased vehicular movement and infrastructure in the surrounding landscape may result in indirect edge effects. Such edge effects may have cumulative impacts to the freshwater features, with specific mention of alien and invasive species establishment and increased sediment loads. With management and mitigation measures implemented during the construction phase and monitoring of support structures and substation for any

erosion during the operational phase, the direct and indirect negative impacts can be reduced, thus cumulative impact on the larger catchment can, therefore, be considered low/limited.

8 CONCLUSION

FEN Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the EA and WUA processes for the proposed 400 kV overhead powerline and associated collector substation associated with the proposed Soutrivier WEF development near Victoria West in the Northern Cape Province.

During the site visit undertaken from the from the 27th to the 28th of February 2022, several freshwater features (best described as fluvial features) associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Stilfonteinspruit and Brak River systems were identified to be traversed by the proposed powerline. These comprise of smaller drainage lines and minor tributaries (that drain the surrounding hilltops and were classified as mountain stream drainage lines and upper foothill tributaries based on their topographical setting and longitudinal zonation), and larger tributaries and rivers that are positioned within the lower gradient were classified as lower foothill tributaries and rivers associated with the aforementioned main river systems. No wetlands were identified to be traversed by the proposed powerline, nor are there any identified within the investigation area.

The results of the ecological assessment of the freshwater features are discussed in Section 5 of this report and summarised in the table below:

Table 13: Summary of results of the ecological assessment as discussed in Section 5.

Freshwater feature	PES	Ecoservices	EIS	REC /BAS/RMO
Brak River	C (Moderately modified)	Very Low to Moderately High	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Kookfonteinspruit River	C (Moderately modified)	Very Low to Moderately High	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Lower foothill tributaries associated with the Sout, Kookfonteinspruit, Tierhoekspruit, Brak and Stilfonteinspruit River systems	C (Moderately modified)	Very Low to Moderately High	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Upper foothill tributaries associated with the Sout, Kookfonteinspruit and Tierhoekspruit River systems	B (Largely natural with few modifications)	Very Low to Very High	High	REC: B (Largely natural with few modifications) BAS: Category B RMO: B (Improve)
Mountain stream drainage lines associated with the Kookfonteinspruit and Brak River systems	B (Largely natural with few modifications)	Very Low to Very High	High	REC: B (Largely natural with few modifications) BAS: Category B RMO: B (Improve)

Based on the findings of the freshwater ecological assessment and the results of the DWS Risk Assessment and Impact Assessment (as provided by the EAP), it is the opinion of the ecologist that the proposed powerline poses a Low impact to the integrity of the freshwater features proposed to be traversed provided that adherence to cogent, well-conceived and ecologically sensitive construction plans are implemented and the mitigation measures provided in this report as well as general good construction practice are adhered to. Should the recommended mitigation measures as provided in this document be implemented, with specific mention of ensuring that the support structures associated with the proposed powerline are located outside the identified freshwater features and at least 32 m from the delineated extent of the freshwater features as far as feasible, as well as limiting the construction

period for the dry period when there is little to no surface water within the freshwater features (particularly for the grading of existing roads that traverse freshwater features), no significant direct negative impacts to the freshwater features are expected. The proposed Soutrivier South on-site substation and proposed collector substation are located outside the 100 m GN509 Zone of Regulation. The risk significance of these substations was thus not considered as they are located outside the GN509 regulated area.

The results of this assessment show that assuming mitigation measures are strictly enforced, a low impact to the overall integrity of the freshwater features is expected. WUA by means of a GA in terms of Section 21(c) and (i) water uses, therefore, may potentially be obtained in consultation with the DWS. However, the DWS, as the custodian of water resources in South Africa, must be consulted with regards to the outcome of this assessment. It is therefore recommended that the mitigation measures as provided in this report and the good housekeeping measures as per Appendix F be implemented to prevent any direct/indirect impacts from occurring on the freshwater features. The proposed development is not considered fatally flawed.

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APPENDIX A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and FEN CC and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

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APPENDIX B: Legislative Requirements

The Constitution of the Republic of South Africa, 1996[9]	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 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 normalization 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, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 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 Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The objectives of this act are (within the framework of the National Environmental Management Act) to provide for: ➢ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ the use of indigenous biological resources in a sustainable manner; ➢ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➢ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➢ to provide for co-operative governance in biodiversity management and conservation; and ➢ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit. Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof. ***National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (Alien and Invasive Species Regulations, 2014)*** 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. In terms of alien and invasive species. This act in terms of alien and invasive species aim 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. Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as: (a) a species that is not an indigenous species; or

[9] 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.

	(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, 2014): ➢ **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. ➢ **Category 3**: Ornamentally used plants that may no longer be planted.
National Environmental Management: Biodiversity Act, 2004(Act No.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).
National Water Act , 1998 (Act No. 36 of 1998)	The National Water Act, 1998 (Act No. 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). A watercourse is defined as: 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.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act , 1998 (Act No. 36 of 1998)	In accordance with Government Notice (GN)509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 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. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their 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; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. 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.

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 watercourses and drainage line features present in close proximity of the proposed powerline 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 feature present in the vicinity of the proposed powerline.

1.2 *Department of Water and Sanitation (DWS) Resource Quality Information Services Present Ecological State / Ecological Importance and Sensitivity (PES/EIS) Database (2014)*

The PES/EIS database as developed by the DWS RQIS department was utilised to obtain 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 (subquat reach) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites. The results obtained serve to summarise this information as a background to the conditions of the watercourse traversed by the proposed linear development.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All watercourses encountered within the study area was assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis et. al., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	**LEVEL 2: REGIONAL SETTING**	**LEVEL 3:LANDSCAPE UNIT**
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Units 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[10]** (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.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups
For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the 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) groups' 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 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

[10] 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.

- **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-Ecoservices (2009)

"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" (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands 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;
- 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 wetlands. 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 wetland.

Table C3: 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

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 the table below.

Table C4: 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

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

The purpose 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 watercourse 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 (see table below) of the wetland system being assessed.

Table C5: 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 watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C6: Recommended management objectives (RMO) for watercourses 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 watercourse fall into one of these PES categories, a REC class D is allocated by default, as the minimum acceptable PES category.**

A watercourse may receive the same class for the REC as the PES if the watercourse 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 watercourse.

Table C7: 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. Watercourse Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act, 1998 (Act No. 36 of 1998) as "land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".
The wetland zone delineation took place according to the method presented in the DWAF (2005) document "A practical field procedure for identification and delineation of wetlands and riparian areas.

An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The position in the landscape, which will help identify those parts of the landscape where wetlands are more likely to occur;
- The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
- The presence of wetland vegetation species; and
- The presence of redoximorphic soil feature, which are morphological signatures that appear in soil with prolonged periods of saturation.

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 (DWAF, 2005 and 2008).
Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soil and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

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.

DWS Risk Assessment Methodology

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'[11]. 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 wetlands, 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; and
- **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[12].

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, 1998 (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.

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

"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, an 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 watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA (after the application of mitigation measures)

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 develop 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[13] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - 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.

Recommendations

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

[13] Mitigation measures should address both positive and negative impacts

Ecological Impact Assessment Method of assessment (as provided by the EAP)

The CES rating scale has been updated to meet the requirements outlined in Appendix 2 of the EIA Regulations (2014, as amended). This methodology takes into consideration the following criteria, and includes the new criteria for assessing post mitigation significance (residual impacts), by incorporating the principles of reversibility and irreplaceability:

1. Nature of impact
2. Type of impact
3. Duration (previously called temporal scale by CES)
4. Extent (previously called the spatial scale by CES)
5. Probability (previously called likelihood by CES)
6. Severity or benefits

The overall significance rating for the impact is then obtained from the above six criteria.

It is recommended that we use the terminology aligned to SA regulations i.e. Duration; Extent and Probability (as opposed to temporal scale, spatial scale and likelihood).

If required or deemed necessary, you can also define the Degree of confidence or certainty that you attach to your rating.

TableD10 below provides definitions for Criteria 3,4 & 5,

Table D10: Temporal, Spatial, Likelihood Scales defined.

Duration (Temporal Scale)		**Score**
Short term	Less than 5 years	1
Medium term	Between 5-20 years	2
Long term	Between 20 and 40 years (a generation) and from a human perspective also permanent	3
Permanent	Over 40 years and resulting in a permanent and lasting change that will always be there	4
Extent (Spatial Scale)		
Localised	At localised scale and a few hectares in extent	1
Study Area	The proposed site and its immediate environs	2
Regional	District and Provincial level	3
National	Country	3
International	Internationally	4
Probability (Likelihood)		
Unlikely	The likelihood of these impacts occurring is slight	1
May Occur	The likelihood of these impacts occurring is possible	2
Probable	The likelihood of these impacts occurring is probable	3
Definite	The likelihood is that this impact will definitely occur	4

Criteria 6: Severity Scales

- The severity of the impact - the severity/beneficial scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it, and how effective the mitigation might be. The word 'mitigation' means not just 'compensation', but includes concepts of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable (Table D11).

Table D11: Impact Severity explained

Impact Severity *(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)*		***Score***
Very severe	**Very beneficial**	**4**
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.	
Severe	**Beneficial**	**3**
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.	
Moderately severe	**Moderately beneficial**	**2**
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.	
Slight	**Slightly beneficial**	**1**
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.	
No effect	**Don't know/Can't know**	
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

Applying the criteria to ASSESS environmental significance before mitigation

The CES rating scale has been updated to meet the requirements outlined in Appendix 2 of the EIA Regulations (2014, as amended). This methodology takes into consideration the following criteria, and includes the new criteria for assessing post mitigation significance (residual impacts), by incorporating the principles of reversibility and irreplaceability:

7. Nature of impact
8. Type of impact
9. Duration (previously called temporal scale by CES)
10. Extent (previously called the spatial scale by CES)
11. Probability (previously called likelihood by CES)

12. Severity or benefits

The overall significance rating for the impact is then obtained from the above six criteria.
It is recommended that we use the terminology aligned to SA regulations i.e. Duration; Extent and Probability (as opposed to temporal scale, spatial scale and likelihood).
If required or deemed necessary, you can also define the Degree of confidence or certainty that you attach to your rating.

The scores for the three criteria in Table D12 are added to obtain a composite score. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is then obtained by reading off the matrix presented in TableD12. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

Table D12: Matrix used to determine the overall significance of the impact based on the likelihood and effect of the impact

SEVERITY		COMPOSITE DURATION, EXTENT & PROBABILITY SCORE									
		3	4	5	6	7	8	9	10	11	12
	Slight	3	4	5	6	7	8	9	10	11	12
	Mod severe	3	4	5	6	7	8	9	10	11	12
	Severe	3	4	5	6	7	8	9	10	11	12
	Very severe	3	4	5	6	7	8	9	10	11	12

The **environmental significance** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

It is clear that an impact that has a *slight severity* could be of MODERATE significance because it is permanent (4), has a regional affect (3) and is definite. This elevates it from a LOW to a MODERATE rating. Conversely, a *moderately severe* impact could be rated as LOW since it is short term (1), localised (1) and only probable (3). An impact rated as *severe* could be of VERY HIGH significance because it is permanent (4), of national importance (3) and is definite (4). For example, the impact on a frog species of conservation concern (SCC) might only be rated as *severe* as a result of the project actions, but because the loss is permanent and of national importance (it's a SCC) and is definite, we rate the significance as VERY HIGH and not HIGH. If the impact was long term and not permanent then it would be rated as HIGH.

The Significance Rating Scale is defined in Table D13 below.

TableD13: Description of Environmental Significance Ratings and associated range of scores

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
VERY HIGH NEGATIVE	**VERY BENEFICIAL**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. *Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.* *Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.*	
HIGH NEGATIVE	**BENEFICIAL**

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. *Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.* *Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.*
MODERATE NEGATIVE / **SOME BENEFITS**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. *Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant*.
LOW NEGATIVE / **FEW BENEFITS**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. *Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.* *Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.*
NO SIGNIFICANCE
There are no primary or secondary effects at all that are important to scientists or the public. *Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.*
DON'T KNOW
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. *Example: The effect of a particular development on people's psychological perspective of the environment.*

Significance Post Mitigation[14]

Once mitigation measure are proposed, the following criteria are then used to determine the overall post mitigation significance of the impact:

- Reversibility: The degree to which an environment can be returned to its original/partially original state.
- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table D14 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

[14] Note that the application of reversibility and irreplaceability must be applied for South Africa impact assessments, as it is a regulatory requirement. For projects in other geographies it is optional.

Table D14: Criteria considered post mitigation

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*
Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

Degree of Confidence

If you wish, you may also mention the confidence you have in your impact ratings, but this is not a legislative requirement. It does, however, assist in determining the level of certainty of our impact predictions.

Degree of Confidence *(The confidence with which one has predicted the significance of an impact)*	
Certain	I am more than 90% sure of the facts that underpin my assessment, my data is current and the information I have is comprehensive enough for me to be *certain* of my impact rating.
Confident	I am more than 70% sure of the facts that underpin my assessment, my data is current and the information I have, although not comprehensive, is enough for me to be *confident* in my impact rating.
Undecided	I am between 40% and 70% sure of the facts that underpin my assessment, but my data is scant and the information I have is outdated, not very site specific and/or has other limitations so I am *undecided if* my impact rating is correct. I have therefore adopted a precautionary approach when rating this impact.
Unconvinced	I am less than 40% sure of the facts that underpin my assessment, my data is scant and the information I have is very outdated. I lack site specific information and details on the nature of the impact, as its effect is not well researched. I am therefore *unconvinced* that my impact rating is correct. I have therefore adopted a precautionary approach when rating this impact.

APPENDIX E: Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the IHI assessment applied to the mountain stream drainage lines.

RIPARIAN IHI	
Base Flows	0,0
Zero Flows	0,0
Moderate Floods	1,0
Large Floods	1,0
HYDROLOGY RATING	0,6
Substrate Exposure (marginal)	1,5
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,5
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	1,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	1,0
Physico-Chemical (non-marginal)	1,0
Marginal	1,5
Non-marginal	1,0
BANK STRUCTURE RATING	1,3
Longitudinal Connectivity	0,0
Lateral Connectivity	0,0
CONNECTIVITY RATING	0,0
RIPARIAN IHI %	84,6
RIPARIAN IHI EC	B
RIPARIAN CONFIDENCE	2,9

Table E2: Presentation of the results of the IHI assessment applied to upper foothill tributaries.

	MRU
INSTREAM IHI	
Base Flows	-2.0
Zero Flows	0.0
Floods	1.0
HYDROLOGY RATING	1.1
pH	1.0
Salts	0.5
Nutrients	1.0
Water Temperature	1.0
Water clarity	1.0
Oxygen	1.0
Toxics	
PC RATING	1.5
Sediment	1.0
Benthic Growth	0.0
BED RATING	0.6
Marginal	1.0
Non-marginal	1.0
BANK RATING	1.0
Longitudinal Connectivity	1.0
Lateral Connectivity	1.0
CONNECTIVITY RATING	1.0
INSTREAM IHI %	78.6
INSTREAM IHI EC	B/C
INSTREAM CONFIDENCE	3.0

RIPARIAN IHI	
Base Flows	0,0
Zero Flows	0,0
Moderate Floods	1,0
Large Floods	1,0
HYDROLOGY RATING	0,6
Substrate Exposure (marginal)	1,5
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,5
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	1,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	1,0
Physico-Chemical (non-marginal)	1,0
Marginal	1,5
Non-marginal	1,0
BANK STRUCTURE RATING	1,3
Longitudinal Connectivity	0,0
Lateral Connectivity	0,0
CONNECTIVITY RATING	0,0
RIPARIAN IHI %	84,6
RIPARIAN IHI EC	B
RIPARIAN CONFIDENCE	2,9

Table E2: Presentation of the results of the IHI assessment applied to the lower foothill tributaries and rivers.

	MRU
INSTREAM IHI	
Base Flows	-2.0
Zero Flows	0.0
Floods	1.0
HYDROLOGY RATING	**1.1**
pH	1.0
Salts	1.0
Nutrients	1.0
Water Temperature	1.0
Water clarity	1.0
Oxygen	1.0
Toxics	
PC RATING	**1.5**
Sediment	1.0
Benthic Growth	1.0
BED RATING	**1.0**
Marginal	1.0
Non-marginal	1.0
BANK RATING	**1.0**
Longitudinal Connectivity	1.0
Lateral Connectivity	1.0
CONNECTIVITY RATING	**1.0**
INSTREAM IHI %	**77.0**
INSTREAM IHI EC	**C**
INSTREAM CONFIDENCE	**3.0**

	MRU
RIPARIAN IHI	
Base Flows	-2.0
Zero Flows	0.0
Moderate Floods	1.0
Large Floods	1.0
HYDROLOGY RATING	**1.1**
Substrate Exposure (marginal)	2.0
Substrate Exposure (non-marginal)	2.0
Invasive Alien Vegetation (marginal)	3.5
Invasive Alien Vegetation (non-marginal)	3.5
Erosion (marginal)	2.0
Erosion (non-marginal)	2.0
Physico-Chemical (marginal)	0.5
Physico-Chemical (non-marginal)	1.5
Marginal	3.5
Non-marginal	3.5
BANK STRUCTURE RATING	**3.5**
Longitudinal Connectivity	0.5
Lateral Connectivity	0.5
CONNECTIVITY RATING	**0.5**
RIPARIAN IHI %	**59.2**
RIPARIAN IHI EC	**C/D**
RIPARIAN CONFIDENCE	**3.0**

Table E4: Presentation of the results of the Ecoservices assessment applied to the mountain stream drainage lines (rows without values indicate calculations that are only taken for wetlands and not riparian systems).

		Present State				Future State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,0	0,1	0,0	Very Low	0,0	0,1	0,0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!	-	-	#VALUE!	#VALUE!
	Sediment trapping	0,2	0,8	0,0	Very Low	0,2	0,8	0,0	Very Low
	Erosion control	1,1	0,0	0,0	Very Low	1,1	0,0	0,0	Very Low
	Phosphate assimilation	0,2	0,0	0,0	Very Low	0,2	0,0	0,0	Very Low
	Nitrate assimilation	0,3	0,0	0,0	Very Low	0,3	0,0	0,0	Very Low
	Toxicant assimilation	0,3	0,0	0,0	Very Low	0,3	0,0	0,0	Very Low
	Carbon storage	0,3	0,0	0,0	Very Low	0,3	0,0	0,0	Very Low
	Biodiversity maintenance	3,2	3,0	3,2	Very High	3,2	3,0	3,2	Very High
PROVISIONING SERVICES	Water for human use	0,6	1,3	0,0	Very Low	0,6	1,3	0,0	Very Low
	Harvestable resources	0,0	0,0	0,0	Very Low	0,0	0,0	0,0	Very Low
	Food for livestock	1,0	0,3	0,0	Very Low	1,0	0,3	0,0	Very Low
	Cultivated foods	#VALUE!	0,0	#VALUE!	#VALUE!	#VALUE!	0,0	#VALUE!	#VALUE!
CULTURAL SERVICES	Tourism and Recreation	1,0	0,0	0,0	Very Low	1,0	0,0	0,0	Very Low
	Education and Research	2,0	0,0	0,5	Very Low	2,0	0,0	0,5	Very Low
	Cultural and Spiritual	3,0	0,0	1,5	Moderately Low	3,0	0,0	1,5	Moderately Low

Table E5: Presentation of the results of the Ecoservices assessment applied to the upper foothill tributaries (rows without values indicate calculations that are only taken for wetlands and not riparian systems).

		Present State				Future State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,0	0,1	0,0	Very Low	0,0	0,1	0,0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!	-	-	#VALUE!	#VALUE!
	Sediment trapping	0,8	0,8	0,0	Very Low	0,8	0,8	0,0	Very Low
	Erosion control	1,5	0,8	0,4	Very Low	1,5	0,8	0,4	Very Low
	Phosphate assimilation	0,8	0,8	0,0	Very Low	0,8	0,8	0,0	Very Low
	Nitrate assimilation	1,0	0,8	0,0	Very Low	1,0	0,8	0,0	Very Low
	Toxicant assimilation	0,9	0,0	0,0	Very Low	0,9	0,0	0,0	Very Low
	Carbon storage	1,4	0,0	0,0	Very Low	1,4	0,0	0,0	Very Low
	Biodiversity maintenance	3,2	3,0	3,2	Very High	3,2	3,0	3,2	Very High
PROVISIONING SERVICES	Water for human use	0,6	1,3	0,0	Very Low	0,6	1,3	0,0	Very Low
	Harvestable resources	0,0	0,0	0,0	Very Low	0,0	0,0	0,0	Very Low
	Food for livestock	1,0	0,7	0,0	Very Low	1,0	0,7	0,0	Very Low
	Cultivated foods	#VALUE!	0,0	#VALUE!	#VALUE!	#VALUE!	0,0	#VALUE!	#VALUE!
CULTURAL SERVICES	Tourism and Recreation	1,0	0,0	0,0	Very Low	1,0	0,0	0,0	Very Low
	Education and Research	2,0	0,0	0,5	Very Low	2,0	0,0	0,5	Very Low
	Cultural and Spiritual	3,0	0,0	1,5	Moderately Low	3,0	0,0	1,5	Moderately Low

Table E6: Presentation of the results of the Ecoservices assessment applied to the lower foothill tributaries and rivers (rows without values indicate calculations that are only taken for wetlands and not riparian systems).

		Present State				Future State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,7	0,2	0,0	Very Low	0,7	0,2	0,0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!	-	-	#VALUE!	#VALUE!
	Sediment trapping	1,5	0,8	0,4	Very Low	1,5	0,8	0,4	Very Low
	Erosion control	2,0	1,5	1,2	Low	2,0	1,5	1,2	Low
	Phosphate assimilation	1,5	0,8	0,4	Very Low	1,5	0,8	0,4	Very Low
	Nitrate assimilation	1,5	1,5	0,8	Very Low	1,5	1,5	0,8	Very Low
	Toxicant assimilation	1,5	0,0	0,0	Very Low	1,5	0,0	0,0	Very Low
	Carbon storage	1,7	0,0	0,2	Very Low	1,7	0,0	0,2	Very Low
	Biodiversity maintenance	2,5	3,0	2,5	Moderately High	2,5	3,0	2,5	Moderately High
PROVISIONING SERVICES	Water for human use	0,4	4,0	0,9	Low	0,4	4,0	0,9	Low
	Harvestable resources	1,0	0,0	0,0	Very Low	1,0	0,0	0,0	Very Low
	Food for livestock	2,0	3,0	2,0	Moderate	2,0	3,0	2,0	Moderate
	Cultivated foods	1,5	0,0	0,0	Very Low	1,5	0,0	0,0	Very Low
CULTURAL SERVICES	Tourism and Recreation	1,3	0,3	0,0	Very Low	1,3	0,3	0,0	Very Low
	Education and Research	1,0	0,0	0,0	Very Low	1,0	0,0	0,0	Very Low
	Cultural and Spiritual	3,0	0,0	1,5	Moderately Low	3,0	0,0	1,5	Moderately Low

Table E7: Presentation of the EIS assessment applied to the assessed freshwater features.

Watercourse			Mountain stream drainage line	Upper foothill tributary	Lower foothill tributary and rivers
Ecological Importance and Sensitivity			Score (0-4)		
Biodiversity support			**A (average)**		
			0,67	1,00	1,00
Presence of Red Data species			0	0	0
Populations of unique species			0	1	1
Migration/breeding/feeding sites			2	2	2
Landscape scale			**B (average)**		
			2,00	2,60	2,20
Protection status of the wetland			2	2	2
Protection status of the vegetation type			2	2	2
Regional context of the ecological integrity			2	3	2
Size and rarity of the wetland type/s present			2	4	3
Diversity of habitat types			2	2	2
Sensitivity of the wetland			**C (average)**		
			1,67	1,67	2,00
Sensitivity to changes in floods			2	2	3
Sensitivity to changes in low flows/dry season			1	1	1
Sensitivity to changes in water quality			2	2	2
ECOLOGICAL IMPORTANCE & SENSITIVITY (max of A,B or C)			**B**		**B**
Hydro-Functional Importance			**Score (0-4)**		
Regulating & supporting benefits	**Flood attenuation**		1,7	2,4	1,8
	Streamflow regulation		1,6	2,4	2,2
	Water Quality Enhancement	*Sediment trapping*	1,6	2	1,8
		Phosphate assimilation	1,9	1,9	1,9
		Nitrate assimilation	1,7	1,7	1,7
		Toxicant assimilation	1,8	1,6	1,8
		Erosion control	2,1	1,3	1,8
	Carbon storage		0,8	1,3	0,8
HYDRO-FUNCTIONAL IMPORTANCE (average score)			2	2	2
Direct Human Benefits			**Score (0-4)**		
Subsistence benefits	*Water for human use*		0,7	0,7	0,7
	Harvestable resources		0,6	0,8	0,8
	Cultivated foods		0,4	0,6	0,4
Cultural benefits	*Cultural heritage*		0,5	0,5	0,5
	Tourism and recreation		2	1,1	2,5
	Education and research		0,8	2	1,8
DIRECT HUMAN BENEFITS (average score)			0,83	0,95	1,12

APPENDIX F: Risk Analysis and Mitigation Measures

General construction management and good housekeeping practices

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

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into watercourses unless absolutely essential and where project activities are located in the watercourses. It must be ensured that the watercourse habitat is off-limits to construction vehicles and non-essential personnel;
- 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 (if applicable) should avoid watercourses and be restricted to existing roads where possible;
- Appropriate sanitary facilities must be provided for the life of the construction 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 practiced 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

- Removal of the alien and weed species encountered on the property 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)) Removal of species should take place throughout the construction, operational, and maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - 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 wetland areas during the eradication of alien and weed species.

Soil

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soil;

- No stockpiling of topsoil is to take place within the recommended buffer zone around the watercourses (unless specified otherwise), and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the watercourses;
- All soil compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas 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/silt removed from the construction area must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed powerline should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

Risk significance on the watercourse ecology of the project area

The table below serves to summarise the anticipated impacts that might occur during the construction and operational phases as well as the mitigation measures that must be implemented in order to maintain and enhance the ecological integrity of the resource.

Table F1: DWS Risk Assessment outcome for the proposed powerline.

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
1	Construction Phase	Site preparation prior to construction activities	Vehicular movement (transportation of construction materials)	• Transportation of construction materials can result in disturbances to soil, and increased risk of sedimentation/erosion; and • Soil and stormwater contamination from potentially spilled oils and hydrocarbons originating from construction vehicles.	2	1	1	1	**1,25**	1	1	3,25	5	2	5	1	**13**	**42,25**	L	**High**
2			Removal of vegetation within the development footprint and associated disturbances to soil, and access to the site, potentially including grading of existing informal farm roads.	• Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the receiving freshwater features; • Increased sedimentation of the freshwater features, leading to smothering of vegetation associated with the freshwater features; • Dust pollution during construction which may impact on water quality; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	2	1	1	1	**1,25**	1	1	3,25	5	3	5	1	**14**	**45,5**	L	**High**

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
3		Installation of the support structures; spanning of the proposed powerline Installation of the support structures; spanning of the proposed powerline	• Excavation of foundation pits for the support structures leading to stockpiling of soil; • Potential movement of construction equipment and personnel within the freshwater features.	• Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream freshwater areas; • Disturbances of soil leading to potential impacts to freshwater vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered freshwater habitat; • Altered runoff patterns, leading to increased erosion and sedimentation of the receiving freshwater features down gradient of the development; • Dust pollution during construction which may impact on water quality (if surface water is present).	2	1	1	1	**1,25**	1	1	**3,25**	5	3	5	1	**14**	**45,5**	**L**	**High**

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
4			Potential mixing and casting of concrete for foundations associated with the proposed powerline support structures	Potential contamination of surface water (if present).	1	2	1	1	**1,25**	1	1	**3,25**	5	3	5	1	**14**	**45,5**	**L**	**High**
5		Access route "jeep-track"	Soil compaction for the access route	• Disturbances of soil resulting in altered runoff patterns within the vicinity of the freshwater features; and • Altered runoff patterns, leading to increased erosion and sedimentation of freshwater habitat.	1	1	2	2	**1.5**	1	1	**3.5**	5	2	5	1	**13**	**45.5**	L	**High**

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
6	**OPERATIONAL PHASE**	Operation and maintenance of the powerline and access route	• Potential indiscriminate movement of maintenance vehicles within close proximity of the freshwater features; • Increased risk of sedimentation and/or hydrocarbons entering the freshwater features via stormwater runoff from the access roads	• Disturbance to soil and ongoing erosion as a result of periodic maintenance activities; • Altered water quality (if surface water is present) as a result of increased availability of pollutants	1	1	1	1	**1**	1	1	**3**	3	3	5	1	**12**	**36**	**L**	**High**

Table F2: Impact Assessment outcome for the proposed powerline.

	Nature	Duration	Extent	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Construction Phase: Site preparation prior to construction activities										
Vehicular movement (transportation of construction materials);	Negative	Short term	Study Area	Moderately severe	Probable	MODERATE NEGATIVE	Reversible	Resource will not be lost	Easily achievable	LOW NEGATIVE
Construction of camp/contractor laydown and storage area	Negative	Short term	Study Area	Moderately severe	Probable	MODERATE NEGATIVE	Reversible	Resource will not be lost	Easily achievable	LOW NEGATIVE
Removal of vegetation and associated disturbances to soil	Negative	Short term	Study Area	Severe	Probable	HIGH NEGATIVE	Reversible	Resource will not be lost	Achievable	LOW NEGATIVE
Impact 2: Construction Phase: Installation of the support structures (outside the delineated extent of the freshwater feature but potentially within 32 m of the delineated freshwater features) and spanning of the proposed powerline										
Excavation of foundation pits for the support structures leading to stockpiling of soil	Negative	Short term	Study Area	Moderately severe	Probable	MODERATE NEGATIVE	Reversible	Resource will not be lost	Easily achievable	LOW NEGATIVE
Potential movement of construction equipment and	Negative	Short term	Regional	Moderately severe	Probable	MODERATE NEGATIVE	Reversible	Resource will not be lost	Achievable	LOW NEGATIVE

	Nature	Duration	Extent	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
personnel within the freshwater features										
Mixing and casting of concrete for foundations	Negative	Short term	Regional	Severe	Probable	HIGH NEGATIVE	Reversible	Resource will not be lost	Achievable	LOW NEGATIVE
Impact 3: Construction Phase: Access route "jeep-track"										
Soil compaction for the access route	Negative	Short term	Study Area	Moderately severe	Probable	MODERATE NEGATIVE	Reversible	Resource will not be lost	Easily achievable	LOW NEGATIVE
Impact 4: Operational Phase: Operation and maintenance of the powerline and access route.										
Potential indiscriminate movement of maintenance vehicles within close proximity of the freshwater features	Negative	Long term	Study Area	Moderately severe	Probable	MODERATE NEGATIVE	Reversible	Resource will not be lost	Easily achievable	LOW NEGATIVE
Increased risk of sedimentation and/or hydrocarbons entering the freshwater features via stormwater runoff from the access roads	Negative	Short term	Regional	Severe	Probable	MODERATE NEGATIVE	Reversible	Resource will not be lost	Achievable	LOW NEGATIVE

APPENDIX G: Details, Expertise and Curriculum Vitae of Specialists

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

Rabia Mathakutha MSc Plant Science (University of Pretoria)
Paul da Cruz BA (Hons) Geography and Environmental Studies (University of the Witwatersrand)

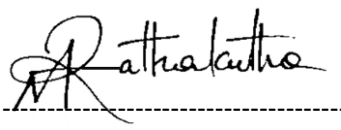
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services (Pty) Ltd		
Name / Contact person:	Rabia Mathakutha		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7539	Cell:	083 739 2284
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	rabia@sasenvgroup.co.za		
Qualifications	MSC Plant Science		
Registration / Associations	Registered Candidate Member of the South African Council for Natural Scientific Professions (SACNASP)		

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

I, Rabia Mathakutha, 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

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF RABIA MATHAKUTHA

PERSONAL DETAILS

Position in Company	Field Ecologist Wetland ecology
Joined SAS Environmental Group of Companies	2020

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Candidate member of the South African Council for Natural Scientific Professions (SACNASP – Reg. No. 120040)
Member of the Western Cape Wetland Forum (WCWF)
South African Association of Botany (SAAB)

EDUCATION

Qualifications

MSc Plant Science (University of Pretoria)	2018
BSc (Hons) Environmental Science (Biogeography) (University of KwaZulu-Natal)	2015
BSc Environmental Science (Life Science stream) (University of KwaZulu-Natal)	2014

Short Courses

Tools for Wetland Assessment (Rhodes University)	2021
Official DWS Section 21 (c) and (i) Water Use Authorisation Course	2018
Basic and Applied Statistics in R	2016

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Western Cape, Northern Cape, Eastern Cape
Africa – Lesotho, Mozambique

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species Plan

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

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