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FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL AUTHORISATION AND WATER USE LICENCE APPLICATION PROCESSES FOR THE PROPOSED 132 KV OVERHEAD POWERLINE ROUTE AS PART OF THE PROPOSED SOL INVICTUS PHOTOVOLTAIC (PV) SOLAR POWER GENERATION FACILITY, NEAR AGGENEYS, NORTHERN CAPE PROVINCE

Prepared for

WSP: Environment & Energy, Africa

& Red Rocket South Africa (Pty) Ltd

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EXECUTIVE SUMMARY

A 132 kV overhead powerline is proposed to be routed from the new on-site substation to the existing Eskom Aggeneis substation as part of the proposed Sol Invictus photovoltaic (PV) solar power generation facility, located near Aggeneys in the Northern Cape Province. Standard overhead powerline construction methods will be employed, however, the position of the support structures associated with the proposed powerline were not available at the time of this assessment. A "jeep-track" maintenance path will be used during the operational phase.

During the site assessment, a single cryptic wetland and an episodic drainage line (considered to be watercourses as per the definition of the National Water Act, 1998 (Act No. 36 of 1998)) were identified and will be traversed by the proposed powerline route. The cryptic wetland is considered to be in a largely natural ecological condition with only a few modifications. Transformation of the land uses surrounding these watercourses (predominantly mining activities) has impacted on the overall hydrological functioning of the episodic drainage line and as such, is considered to be in a modetately modified ecological condition.

Following the ecological assessment of the watercourses, the Department of Water and Sanitation (DWS) Risk Assessment was undertaken in order to ascertain the significance of possible impacts which may occur as a result of the proposed powerline. The results of this assessment show that assuming mitigation measures are strictly enforced, with specific mention of ensuring that the support structures associated with the proposed powerline and the associated construction zone of influence are located outside the identified watercourses and their associated buffer zones, a low impact to the overall integrity of the watercourses is expected. It is, therefore, the opinion of the freshwater ecologist that the proposed powerline be considered favourably, from a freshwater ecological resource management point of view, provided that all mitigation measures as set-out in this report are implemented.

MANAGEMENT SUMMARY

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Environmental assessment and Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed 132 kilovolt (kV) overhead powerline (hereafter referred to as the proposed powerline) route as part as part of the proposed Sol Invictus photovoltaic (PV) solar power generation facility, located near Aggeneys in the Northern Cape Province. The proposed powerline will connect the proposed Sol Invictus PV solar power generation facility to the national grid via the existing Eskom Aggeneis substation.

The assessment took the following approach:

- A desktop study was conducted in which possible watercourses were identified for 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;
- The proposed powerline is located within quaternary catchment D82C and within the Lower Orange Water Management Area (WMA) and the Orange subWMA;
- During the site visit, one cryptic wetland and an episodic drainage line (considered to be watercourses) were identified and will be traversed by the proposed powerline.
- The detailed results of the field assessment are contained in Section 5 of this report. A summary of the assessment of the watercourses is provided in Table A below:

Table A: Summary of results of the field assessment of the identified watercourses.

Watercourse	PES	Ecoservices	EIS	REC, RMO & BAS
Cryptic wetland	A/B (Largely natural with only a few modifications)	Moderately Low (0,9)	Moderate (1,4)	REC: Category A/B BAS: Category: A/B RMO: Maintain
Episodic drainage line	Category: C (Moderately Modified)	Intermediate (1,2)	Moderate (1,6)	REC: Category C BAS: Category: C RMO: Maintain

Following the ecological assessment of the abovementioned watercourses, the Department of Water and Sanitation (DWS) Risk Assessment Matrix as defined in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), and impact assessment methodology as provided by the Environmental Assessment Practitioner (EAP) were undertaken to ascertain the significance of possible impacts which may occur as a result of the proposed powerline construction and operational activities. The following was considered in the application of the impact assessment method:

- The positions of the support structures or poles associated with the proposed powerline were not available at the time of this assessment; and
- At the time of this assessment the layout of the proposed access roads (potential new) was not available. As such, it is assumed that the existing informal farm 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 results of the risk/impact assessment are presented in Section 7 of this report and are summarised in Table B below.

Table B: Summary of the results of the impact assessment

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 watercourses. ➢ 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 watercourses. ➢ Disturbances of soil leading to potential impacts to the watercourses and increased sediment runoff from the construction site to the watercourses, in turn leading to altered watercourse habitat; ➢ Altered runoff patterns, leading to increased erosion of the watercourses where watercourses 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 watercourses.	**Low**
Operational Phase	Operation and maintenance of the powerline entailing potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses and increased risk of altered flow and hydrocarbons entering the watercourses. ➢ Disturbance to soil and ongoing erosion as a result of periodic maintenance activities..	**Low**

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 and installation of the support structures associated with the proposed powerline, pose a Low risk to the identified cryptic wetlands and episodic drainage line, provided that the support structures and the associated construction zone of influence are located outside the identified watercourses. Should the recommended mitigation measures as provided in the table above be implmented, with specific mention of ensuring that the support structures associated with the proposed powerline are located outside the identified watercourses and their calculated 10 m construction, 12 m operational phase buffers and 32 m NEMA ZoR, as a minimum, as well as keeping the construction footrpints as small as possible with suitable rehabilitation post-construction, no significant direct negative impacts to the watercourses, including their characteristics and goods and services provision are expected.

The results of this assessment show that assuming mitigation measures are strictly enforced, a low impact to the overall integrity of the watercourses are expected. It is, therefore, the opinion of the freshwater ecologist that the proposed powerline be considered favourably, from a freshwater ecological resource management point of view, provided that all mitigation measures as set-out in this report are implemented.

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 Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirements	Section in report
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-	Section 4 and 5
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: Table 1
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 5: Tables 3 and 4
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater).	Section 4: Table 1 The central portion of the proposed powerline is considered of high aquatic importance.
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: Table 6
2.4	Assessment of impacts - a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 5: Tables 3 and 4
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.). d. Assessment of the risks associated with water use/s and related activities.	Section 5: Tables 3 and 4
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);	Section 7: Table 6

	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).	
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: Tables 3 and 4
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: Table Tables 3 and 4
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).	N/A The closest estuary is 230 km from the proposed powerline
3.	**The report must contain as a minimum the following information:**	
3.1	Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;	Appendix G
3.2	A signed statement of independence by the specialist;	Appendix G
3.3	The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 5.2
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 3, Appendix C and Appendix D
3.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.2
3.6	Areas not suitable for development, to be avoided during construction and operation (where relevant);	Section 7: Table 6
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;	Section 7: Table 6
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	Section 7
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 7: Table 6
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being considered; and	Section 7: Table 6
3.11	A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected.	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: Table 6
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 4: Table 1 The central portion of the proposed powerline is considered of high aquatic importance
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	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, animans and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
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".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
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).
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
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 occurences).
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
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
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	The National Water Act, 1998 (Act No. 36 of 1998)
NWCS	National Wetland Classification System
PEMC	Present Ecological Management Class
PES	Present Ecological State
REC	Recommended Ecological Category
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRC	Water Research Commission

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 assessment and Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed 132 kilovolt (kV) overhead powerline (hereafter referred to as the "proposed powerline") as part of the proposed Sol Invictus photovoltaic (PV) solar power generation facility, near Aggeneys, in the Northern Cape Province (Refer to Section 2 for the project description).

In order to identify all watercourses that may potentially be impacted by the proposed powerline, a 500 m "zone of investigation" was implemented around the proposed powerline, 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 - will henceforth be referred to as the "investigation area".

The purpose of this report is to define the ecology associated with the proposed powerline in terms of the natural watercourse characteristics, including mapping of all watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES) of the natural watercourses associated with the proposed powerline. The Department of Water and Sanitation (DWS) Risk Assessment Matrix and impact assessment methodology as provided by the Environmental Assessment Practitioner (EAP), were 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.

This study further aims to provide detailed information to guide the proposed powerline in the vicinity of the watercourses, 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 EAP, by means of a reasoned opinion and recommendations, as to the viability of the proposed powerline from a watercourse management perspective.

1.2 Structure of this report

This report investigates the impact significance of the proposed powerline, as explained in Section 2 below, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as well as the National Water Act, 1998 (Act No. 36 of 1998) by means of the Risk Assessment Matrix, as promulgated in GN 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998). The following structure is applicable to this report:

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

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

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 defining the PES and EIS of the identified watercourses.

Section 5: Site Based Freshwater Assessment Results
This section reports the following:

- A description and delineation of the watercourses associated with the proposed powerline according to "Department of Water Affairs and Forestry (DWAF)[1] (2008): A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". All features are mapped according to their ecological sensitivity;
- Delineation of the watercourses within 500 m of the proposed powerline was undertaken using desktop methods 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 watercourses according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis et al., 2013);
- The EIS of the watercourses according to the method described by Rountree and Kotze, (2013);
- The services provided by the watercourses associated with the proposed powerline were assessed according to the method of Kotze *et al*. (2009) in which services to the ecology and to the people are assessed;
- The Index of Habitat Integrity of the watercourse according to the resource directed measures guideline as advocated by Kleynhans (2005);
- The Present Ecological State (PES) of the watercourses according to the resource directed measures guideline as advocated by MacFarlane *et al*. (2008); and
- The allocation of a suitable Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) to the watercourse 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 authorisation requirements.

Section 7: Impact and Risk Assessment
Provides the outcomes of the DWS Risk Assessment Matrix results and Impact Assessment methodology (as provided by the EAP) which highlights all potential impacts and that may affect the identified watercourses. 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.

1.3 Assumptions and limitations

The following assumptions and limitations are applicable to this report:

- All watercourses within 500 m of the proposed powerline were delineated in fulfilment of GN509 of the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods including use of topographic maps, historical photographs and digital satellite imagery;
- On-site delineation of the watercourses is confined to the proposed powerline and investigation area as depicted in Figures 1 and 2 below, and does not include the neighbouring and adjacent

[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.

properties, although land uses and possible catchment impacts occurring on surrounding properties were taken into consideration;

- 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 watercourses within the investigation area;
- The delineation of the identified watercourses associated with the proposed powerline, as provided in this report, is considered accurate taking into consideration the conditions at the time of assessment and undulating topography of the area;
- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the watercourse zones will need to be surveyed and pegged according to surveying principles;
- Watercourse and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater resource boundaries may occur, however, if the Department of Water Affairs and Forestry (DWAF) (2008) 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. However, it is expected that the proposed powerline activities have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of riparian and wetland ecology.

2 PROJECT DESCRIPTION

The proposed powerline will connect the proposed Sol Invictus PV solar power generation facility to the national grid via the existing Eskom Aggeneis substation. The proposed powerline is approximately 23 km long and is situated south west of the town of Aggeneys, in the Nama Khoi and Khâi-Ma Local Municipalities, Northern Cape Province (Figures 1 and 2). The proposed powerline traverses the following properties:

- Portion 2 of the Farm Aggeneys 56 (Aggeneis Substation);
- Portion 1 of the Farm Aggeneys 56;
- Portion 2 of the Farm Zuurwater 62;
- Portion 6 of the Farm Zuurwater 62;
- Portion 5 of the Farm Zuurwater 62;
- Portion 14 of the Farm Taaibosmond 66;
- Portion 6 of the Farm Taaibosmond 66; and
- Portion 5 of the Farm Taaibosmond 66 (Sol Invictus Solar PV Facility).

The proposed powerline will be a 132 kV steel single or double structure with kingbird conductor. Standard overhead line construction methodology will be employed – drill holes, plant poles, string conductor. Pole positions will only be available post the preferred bidder award, once the powerline design has started. However, it is not envisaged that any large excavations and stabilized backfill will be required; however, this will only be verified on site once the geotechnical assessment has been undertaken at each monopole (i.e., support structure) position (part of construction works). In addition

to the proposed powerline and associated infrastructure, an extension of the existing Eskom Aggeneis substation is proposed as part of the project (see Figure 1 below).

The method statement for the construction of the support structures associated with the proposed powerline, as illustrated in Figure 3 below, is provide below:

- Survey the line (peg structures, stays and gate positions)
- Install access road gates and create servitude road
- Excavate foundations based on designer foundation requirements (gravity type, pilling, micro-pilling)
- Excavate for stays
- Cast structure foundations
- Cast stay foundations
- Backfill with cement stabilised fill if required
- Erect structures
- Excavate and install additional earthing if required
- Install structure hardware
- String phase conductors
- Install optical ground wire (OPGW) hardware
- String OPGW conductor
- Install jumpers, vibration dampers, spacers, bird diverter, aviation spheres
- Rehabilitate the disturbed areas

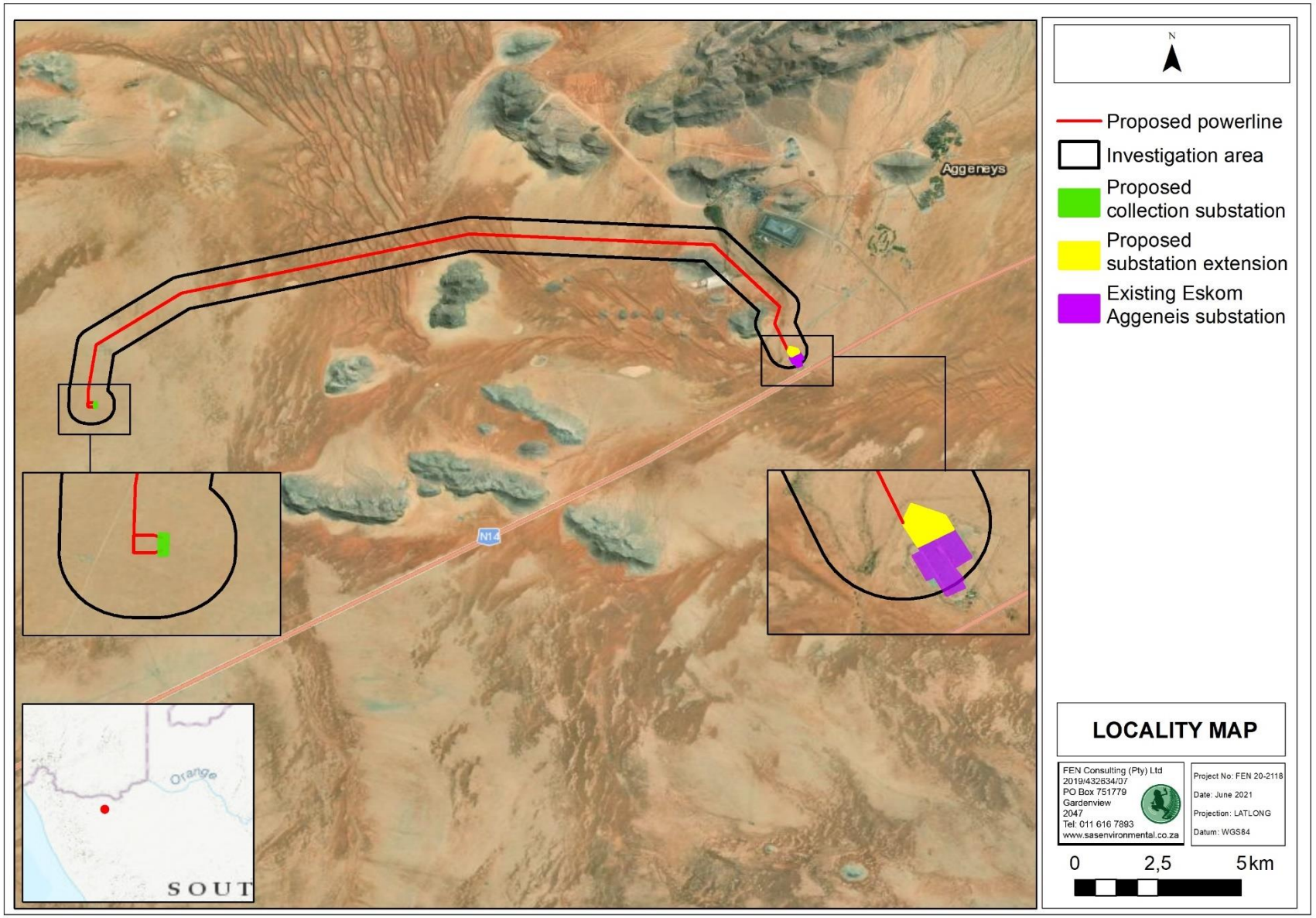


Figure 1: Digital satellite imagery of the proposed powerline and investigation area in relation to the surrounding environment.

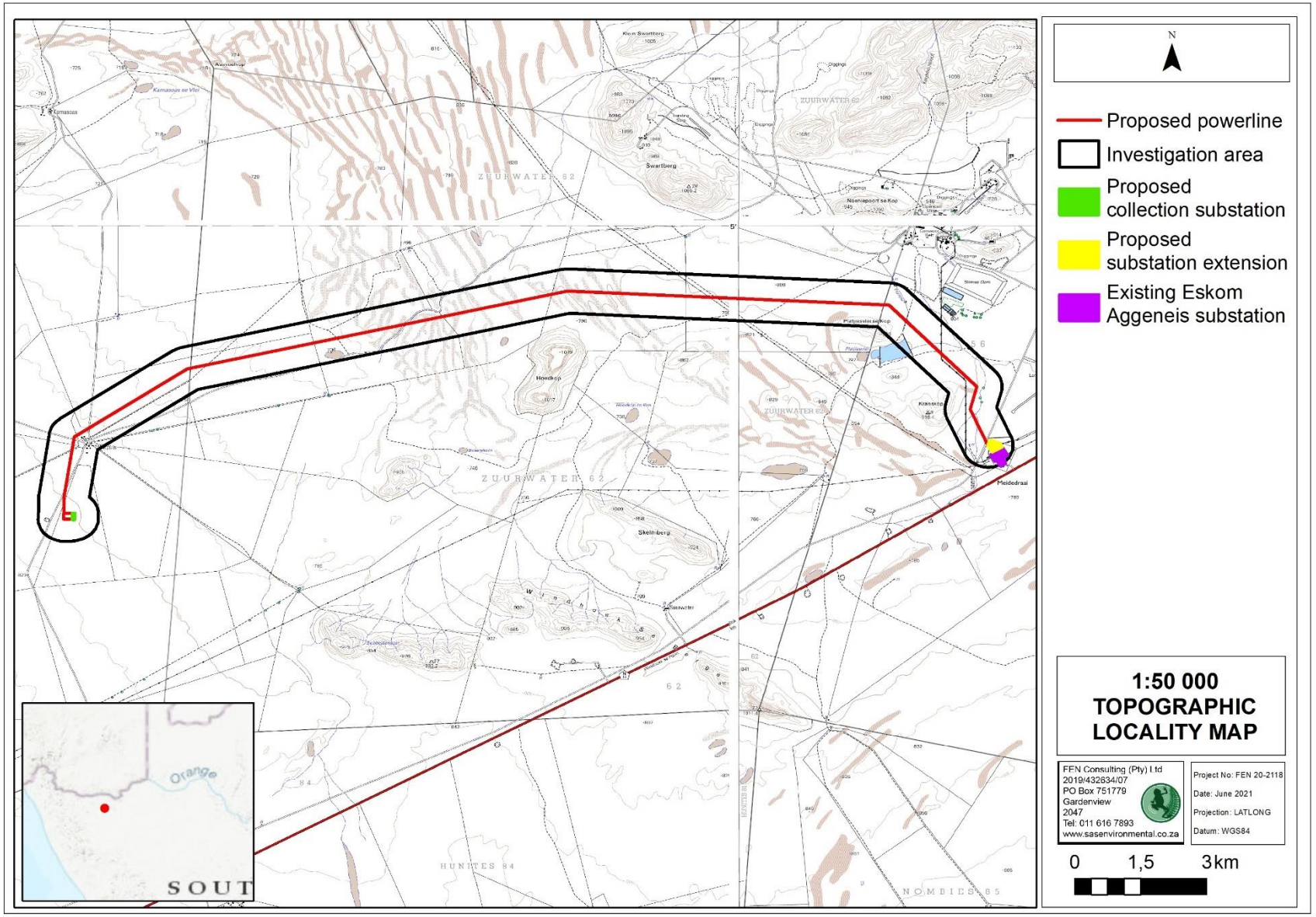


Figure 2: 1:50 000 topographical map of the proposed powerline and investigation area in relation to the surrounding environment.

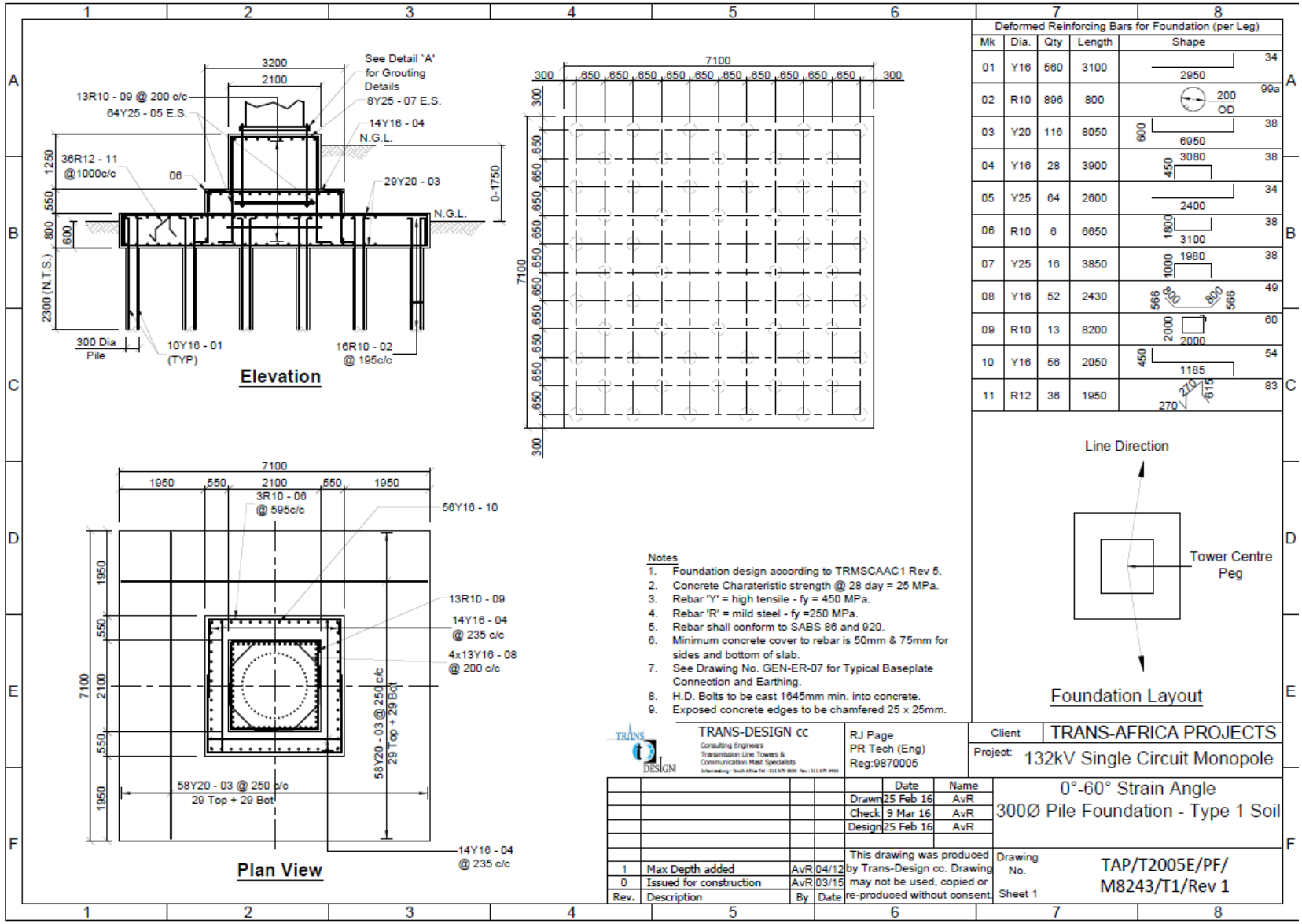


Figure 3: Preliminary layout of the support structures associated with the proposed powerline as provided by the proponent.

3 ASSESSMENT APPROACH

3.1 Watercourse Field Verification

As part of this assessment, the following definitions, as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

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

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

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

The watercourse 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 watercourses have several distinguishing factors including the following:

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

A field assessment was undertaken on the 14th to the 15th of June 2021 (Northern Cape winter season), during which the presence of any watercourse characteristics as defined by DWAF (2008) or wetland and riparian habitats as defined by the National Water Act, 1998 (Act No. 36 of 1998) were noted (please refer to Sections 4 and 5 of this report). In addition to the delineation process, detailed assessment of the delineated watercourse was undertaken, at which time factors affecting the integrity of the watercourse were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourse. A detailed explanation of the methods of assessment undertaken is provided in **Appendix C** of this report.

3.2 Sensitivity Mapping

All watercourses 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/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**.

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 at the scale required to inform the applicant of any potential environmental authorisation and/or water use authorisation processes that may be needed. Given these limitations, this information is considered useful as background information to the study and 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 relating to the characteristics of the watercourses associated with the proposed powerline and investigation area.

Aquatic ecoregion and sub-regions in which the proposed powerline is located		Detail of the proposed powerline in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database	
Ecoregion	Nama Karoo	FEPACODE (Figure 4)	The proposed powerline is located within a sub-quaternary catchment considered important as a Freshwater Ecosystem Priority Area (FEPACODE = 1). River FEPAs are important for achieving biodiversity targets for river ecosystems and threatened fish species and should therefore remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.
Catchment	Orange		
Quaternary Catchment	D82C		
WMA	Lower Orange	NFEPA Wetlands (Figure 5)	According to the NFEPA database (2011), no wetlands will be traversed by the proposed powerline. However, a natural depression wetland is indicated as occurring within the south western portion of the investigation area. The depression wetland is considered to be in a largely natural (Class A/B) ecological condition with only a few modifications. Three artificial unchanneled valley bottom wetlands are indicated within the eastern portion of the investigation area. During the field assessment, these features were identified to be associated with the existing mining activities.
subWMA	Orange		
Dominant characteristics of the Southern Kalahari (26.02) Aquatic Ecoregion Level 2 (Kleynhans *et al.*, 2007)			
Dominant primary terrain morphology	Plains, Slightly Irregular Plains (Scattered low hills) and Pans, Extremely Irregular Plains (Almost hilly), Hills, Slightly Irregular Plains, Plains		
Dominant primary vegetation types	Orange Rive Nama Karoo, Bushmanland Nama Karoo, Upper Nama Karoo	Wetland Vegetation Type	The proposed powerline is located within the Nama Karoo Bushmanland Wetland Vegetation Type, considered to be least threatened in terms of threat status according to Mbona *et al.* (2015)
Altitude (m a.m.s.l)	500 - 1300	NFEPA Rivers	According to the NFEPA database, no rivers are associated with the proposed powerline and investigation area.
MAP (mm)	0 - 300		
Coefficient of Variation (% of the MAP)	35 - >40		
Rainfall concentration index	45 - 65	**Detail National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 6)**	
Rainfall seasonality	Very late Summer, Winter	According to the NBA 2018: SAIIAE, a natural depression wetland is depicted as occurring within the south western portion of the investigation area. The depression wetland is indicated as being impacted by roads and is thus considered to be in a largely to critically modified (Class D/E/F) ecological condition. The depression wetland is considered to be critically endangered according to the ecosystem threat status (ETS) and no protected according to the ecosystem protection level (EPL). No rivers are indicated to be associated with the proposed powerline and investigation area.	
Mean annual temp. (°C)	16 - 20		
Winter temperature (July)	-2 - 20		
Summer temperature (Feb)	14 - 32		
Median annual simulated runoff (mm)	<5 - 10		
National Web Based Environmental Screening Tool (2020)		**Detail of the proposed powerline in terms of the Northern Cape Critical Biodiversity Areas (2016) (Figure 7)**	
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 mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	The central portion of the proposed powerline and investigation area (in line with Figure 3 below) are located in an area considered to be of very high aquatic importance. This is due to the area being located within a sub-quaternary catchment considered important as a Freshwater Ecosystem Priority Area, and potential presence of wetlands.	According to the Northern Cape Critical Biodiversity Areas (2016), the proposed powerline traverses several areas classified as Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA). More specifically, the north eastern portion of the proposed powerline and investigation area are located within areas classified as CBA 1, while the central and eastern portions thereof are located within areas classified as 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 western and south eastern portion of the proposed powerline and investigation area are located within ESAs. ESAs are important in supporting the functioning of CBAs and are often vital for delivering ecosystem services.	

CBA = Critical Biodiversity Area; C-Plan = Conservation Plan; DWS = Department of Water and Sanitation; EI = Ecological Importance; EMF = Environmental Management Framework; ES = Ecological Sensitivity; ESA = Ecological Support Area; FEPA = Freshwater Ecosystem Priority Area; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; WMA = Water Management Area.

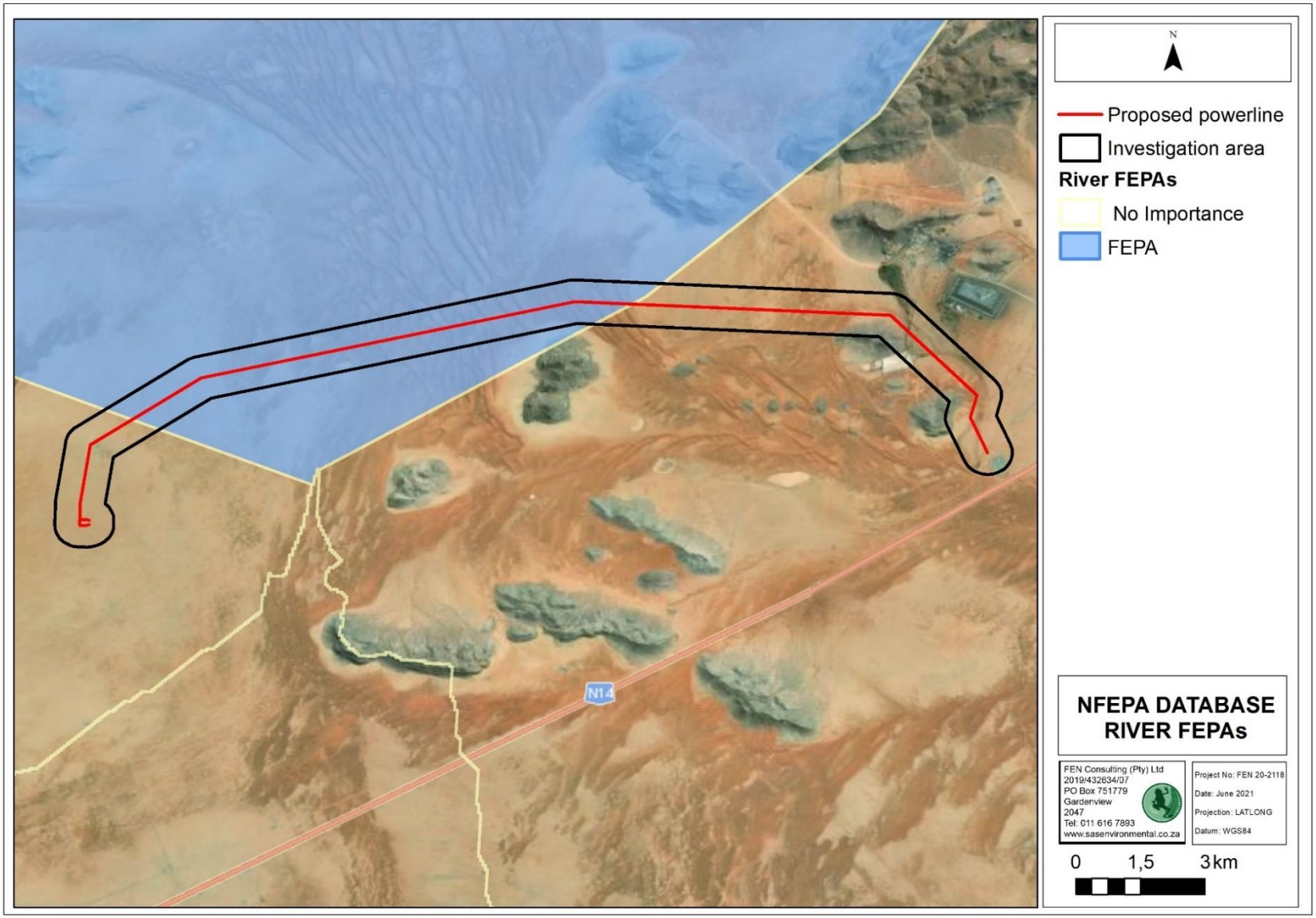


Figure 4: River FEPAs associated with the proposed powerline and investigation area as indicated by the NFEPA database (NFEPA, 2011).

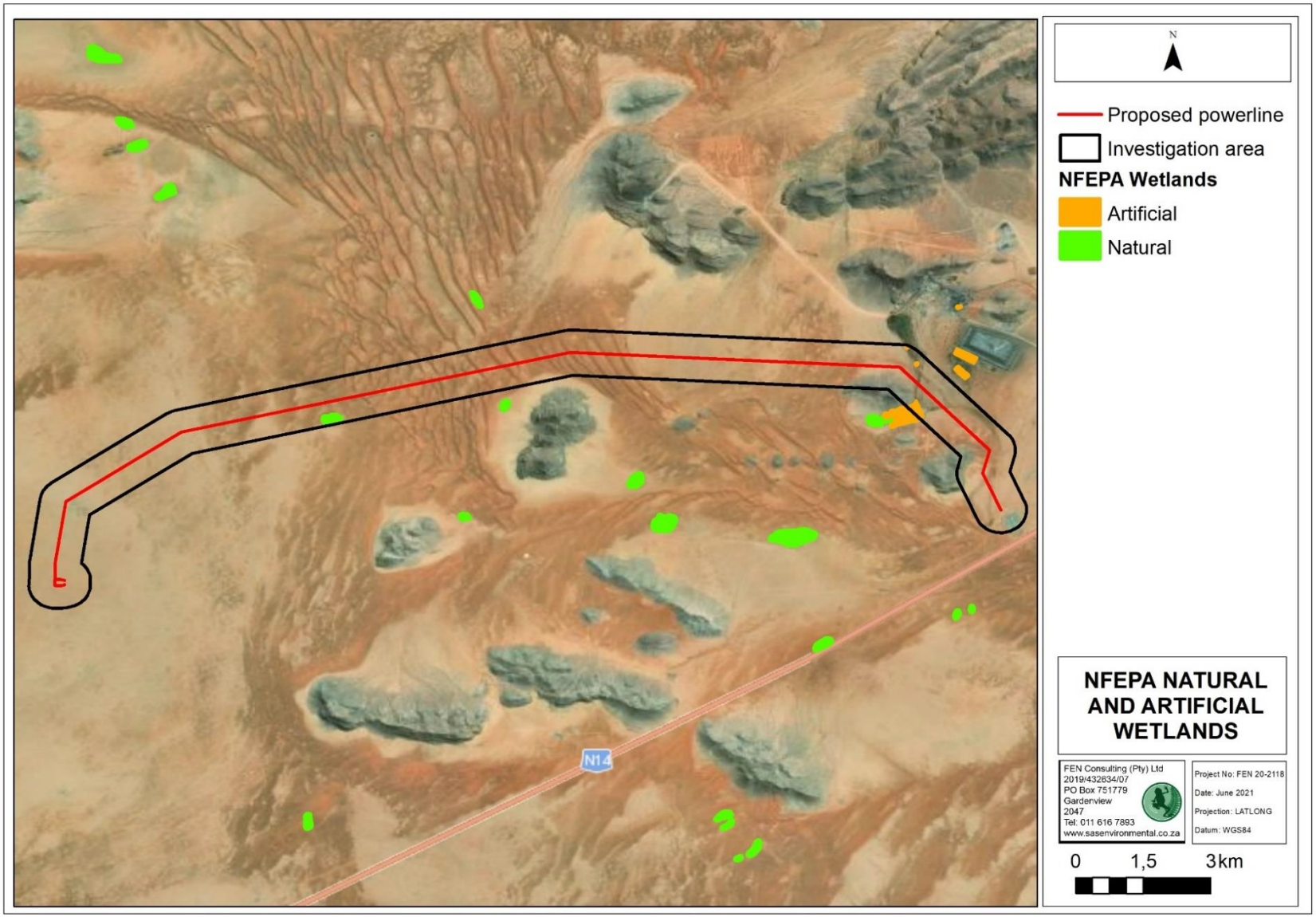


Figure 5: Natural and artificial systems associated with the proposed powerline and investigation area as depicted by the NFEPA (2011) database.

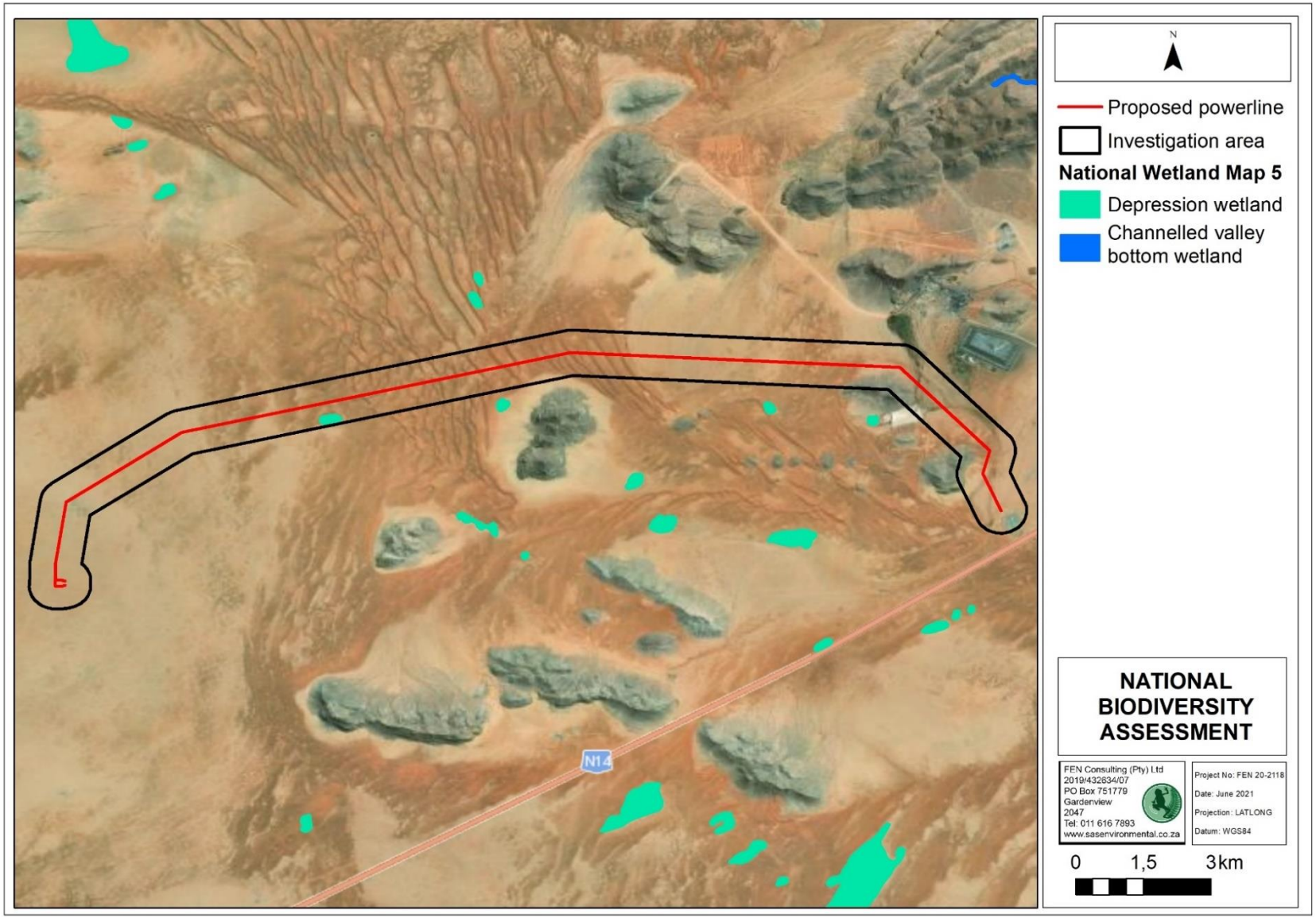


Figure 6: Wetland HGM units associated with the proposed powerline as depicted by the National Biodiversity Assessment (2018).

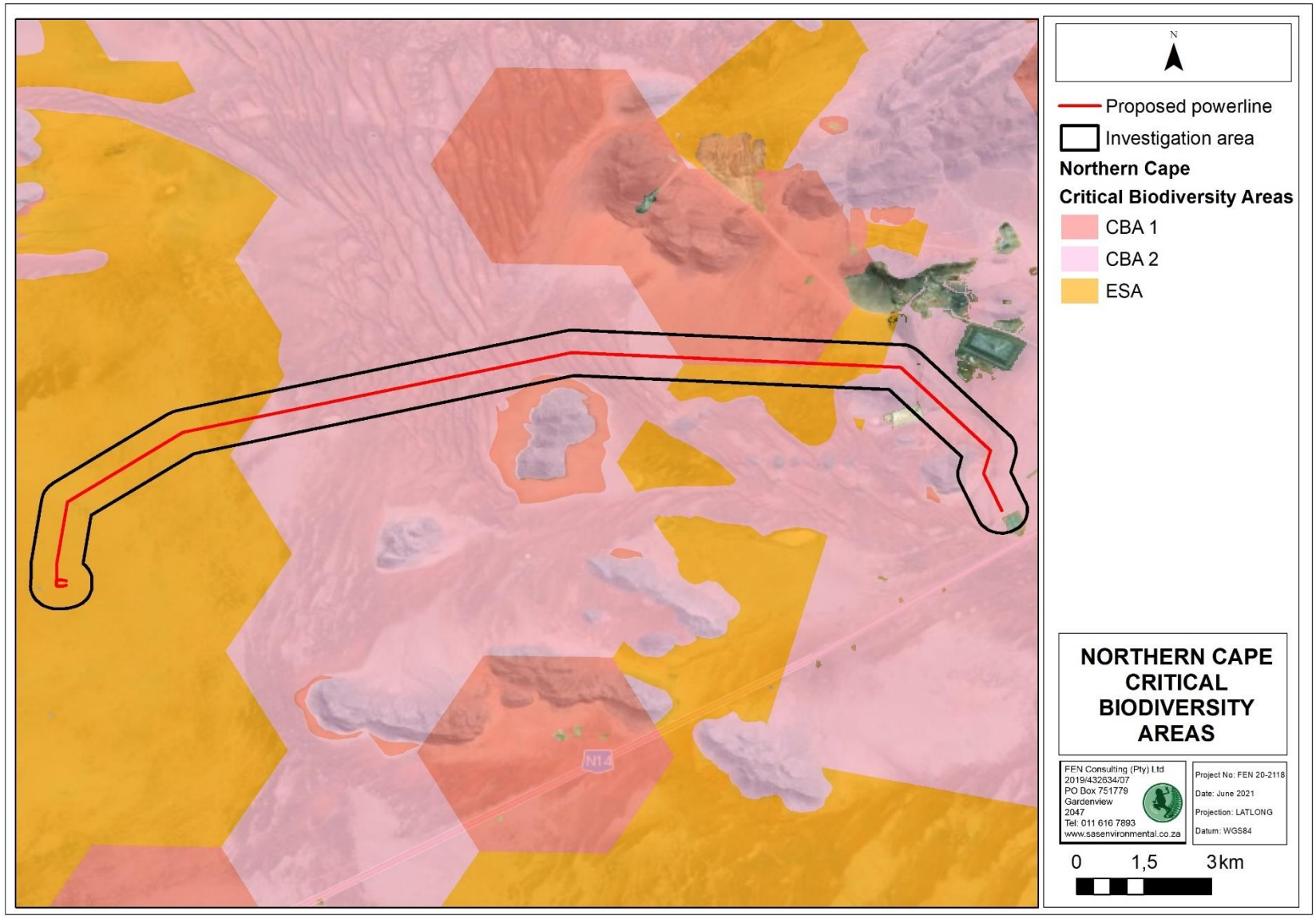


Figure 7: Critical Biodiversity Areas associated with the proposed powerline and investigation area, according to the Northern Cape Critical Biodiversity Areas (2016).

5 RESULTS: FRESHWATER ECOLOGICAL ASSESSMENT

5.1 5.1 Desktop assessment of historical vs. most recent imagery

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national wetland databases (as outlined in Section 4 of this report) were used to identify points of interest in the surrounding area at a desktop level. Based on the historical photograph (Figure 8), a diversity of signatures are identifiable that correspond with watercourses. In this regard, specific mention is made to the following:

- Linear features: since water flows/moves through the landscape, watercourses often have a distinct linear element to their signature which makes them discernable on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often show 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 watercourse 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.

On review of the historical imagery circa 1969, digital signatures depicting watercourses (areas of wet response indicated as white patches on the black and white photograph, consistent with signatures of depression wetlands) are visible within the investigation area (Figure 8). Other digital signatures recognised as runoff from the upgradient mountain areas are visible within the eastern portion of the investigation area (Figure 8). The surrounding landscape is noted to be largely undeveloped.

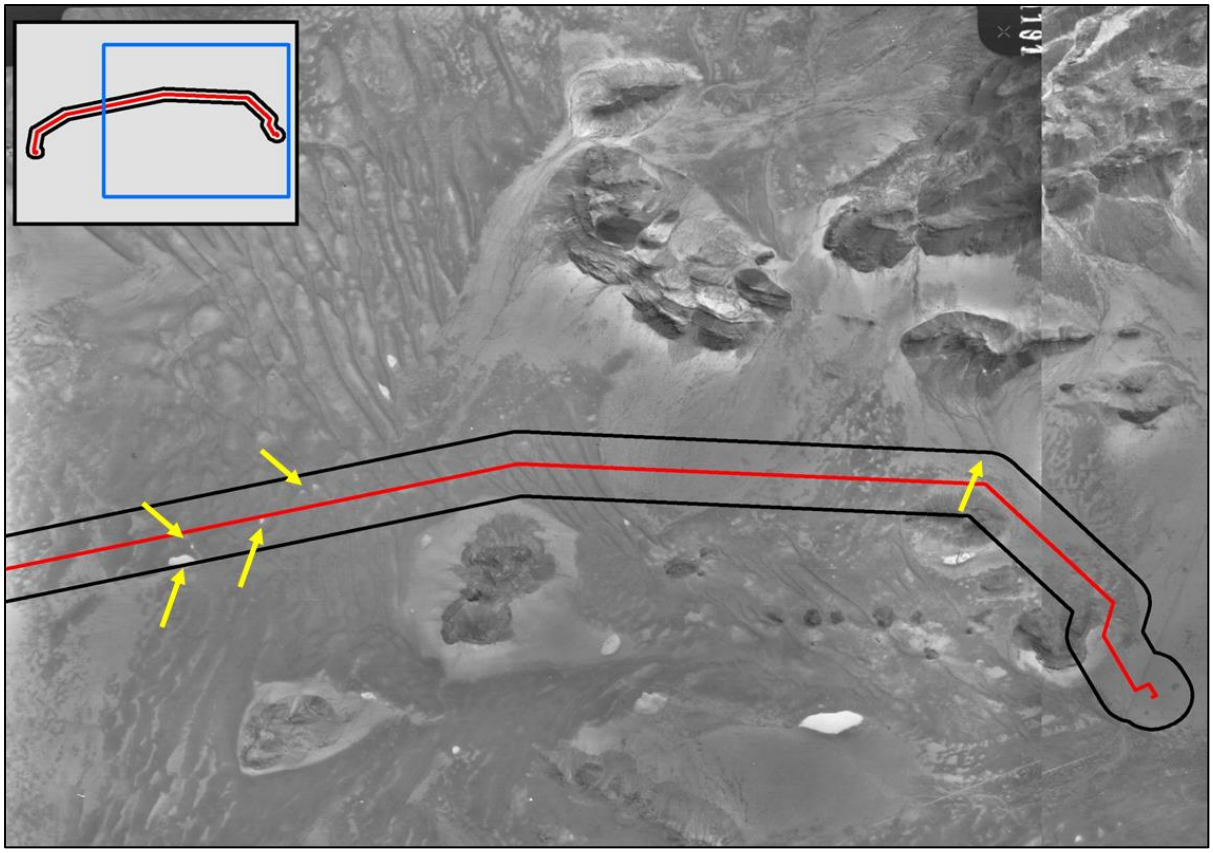


Figure 8: Historical imagery (1969) of the proposed powerline (red line) and associated investigation area (black outline) in relation to the surrounding area (Job 642, Photograph 1192). Digital signatures are visible as indicated by the yellow arrows.

On review of the latest digital satellite imagery circa 2021 (Figure 9), the digital signatures consistent with depression wetlands noted on the historical photograph are still visible within the investigation area as indicated by the yellow arrows (Figure 9). The surrounding land uses have changed significantly from that visible in the 1969 photograph with mining development and road infrastructure now present and potentially augmenting the surface water input into some of the drainage features present within the investigation area, hence the more pronounced digital signatures observed within the eastern portion of the proposed powerline compared to the historical photograph (Figure 9).

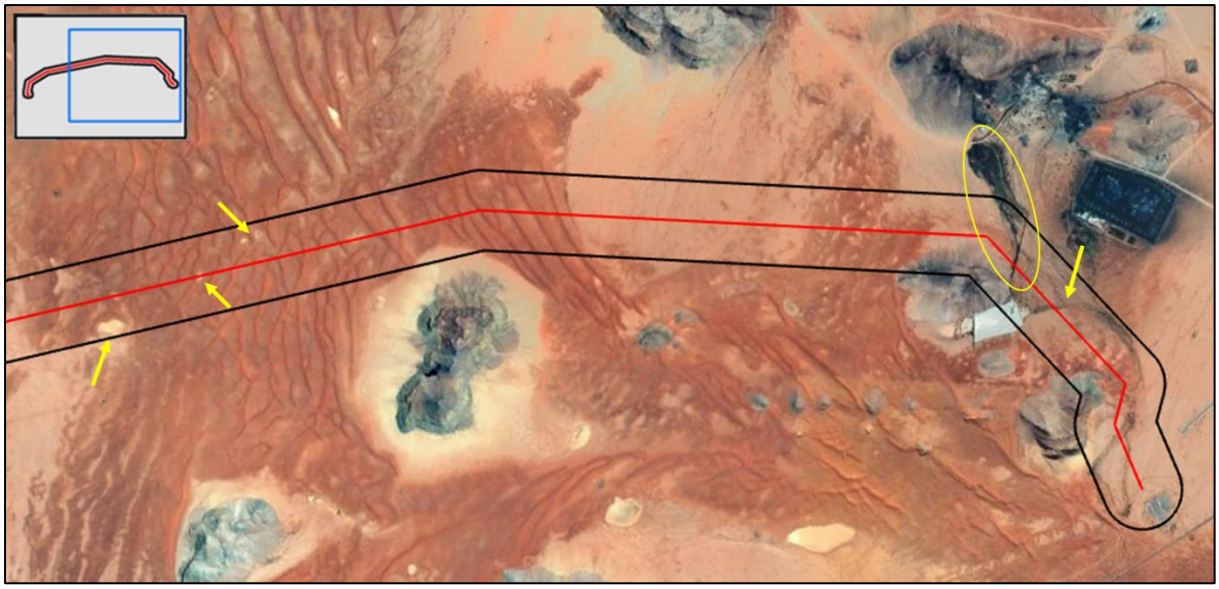


Figure 9: Latest digital satellite imagery circa 2021 of the proposed powerline (red line) and associated investigation area (black outline) in relation to the surrounding area. Establishment of mining activities is evident within the eastern portion of the investigation area. Digital signatures are visible as indicated by the yellow arrows. The feature within the eastern portion of the powerline may be augmented by seepage from the upgradient mining area (circled in yellow).

5.2 Field verification outcome

A site assessment was undertaken on the 14th to the 15th of June 2021 (Northern Cape winter period)[2], during which the presence of any areas presenting with watercourse characteristics as defined above were identified. 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 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 features identified within the investigation area are defined as either cryptic wetlands or episodic drainage lines.

The features identified during the site assessment were categorised according to their dominant characteristics, primarily topography, vegetation and soil characteristics. Up to six cryptic wetlands were identfied predominanely within the mid-western portion of the investigation area, one of which will be traversed by the proposed powerline. An episodic drainage line was identified within the eastern portion of the proposed powerline and will be traversed by the proposed powerline within this reach. The characterisation of these features is discussed in greater detail in Section 5.3 below

Other areas of increased wet response (lacking in either wetland or riparian characteristics) were also noted within the investigation area and given the undulating landscape of the local area, these were identified as either sheet flow/hill wash from the upgradient mountain areas, preferential surface flow

[2] 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 watercourses, which may otherwise be overlooked. Although the ideal time for the field assessment would have been in the wet season, the site conditions at the time of the field assessment are considered fair.

paths within the dune and interdune areas, and artificial channels and seepage associated with the existing mining development (particularly within the eastern portion of the investigation area, in line with the digital signatures observed in the most recent digital satellite imagery compared to the historical photograph (see Figures 8 and 9 above). Neither the sheet flow areas/diffuse hill wash, preferential surface flow paths nor artificial features met the definitions of a watercourse from an ecological perspective (as defined by the National Water Act, 1998 (Act No. 36 of 1998)) and therefore do not require any further assessment and were not delineated as part of this assessment.

5.3 Characterisation of the Watercourses

5.3.1 Cryptic wetlands

During the assessment, the following indicators were used to identify and delineate the boundaries of the cryptic wetlands:

- ***Topography/elevation*** was a key determinant in the identification of these features. Six cryptic wetlands were identified within the investigation area, all of which were situated within distinct, low-lying depressions in the landscape. All were clearly defined endorheic systems where surface water, when sufficient is present, will accumulate;
- ***Sediment deposits on plants*****:** the presence of sediment deposits on rocks or plants indicates minimum levels of inundation; thus a feature displaying such deposits is assumed to be seasonally inundated. The absence of such sediment deposits is inconclusive, and other indicators may be required to determine whether a feature is seasonally inundated. Whilst this is a subtle determinant of possible wetland conditions in some of the assessed features, it was nevertheless apparent in sufficient features to be utilised as an indicator;
- ***Soil wetness / morphological characteristics*****:** whilst soil wetness is considered by Day *et al* (2010) to be an unreliable indicator of wetlands in arid areas, consideration was nevertheless given to the soil classification and morphological characteristics, such as mottling, when present;
- ***Vegetation***: Due to the semi-arid climate of the study area, the absence of obligate[3] floral species was expected, and none were identified. According to Day *et al* (2010), the **absence** of both dryland and wetland plants from a site may equally be an indicator of a cryptic wetland. However, five floral indicators were generally present within the cryptic wetlands, and a combination of at least two of these within any given feature was considered sufficient, in conjunction with other indicators, to classify a feature as a cryptic wetland. These floral indicators were *Eragrostis bicolor, Eragrostis echinochloidea, Aristida congesta* subsp. *congesta, Cullen tomentosum* and *Ziziphus mucronate*. Typically, the woody or shrub component associated with cryptic wetlands is largely limited to the outer boundaries thereof.

Although the cryptic wetlands identified in the study area do not possess one of the key indicators typically associated with wetlands in South Africa, specifically, hydrophytic vegetation, they are nevertheless deemed to be potentially ecologically important and may play a significant role in the ecology of the area. Wetlands in arid areas are under-researched, particularly cryptic wetlands such as those identified in the study area, and little is known about the biodiversity associated with such systems (Henschel, unknown date, retrieved from http://fbip.co.za/wp-content/uploads/2018/08/Henschel-Abstract-2017-Small-Project.pdf, 18th March 2020). For example, cryptic wetlands such as those identified may host populations of invertebrates (mostly Branchiopods but also Phyllopods) which are considered keystone species of ephemeral pans globally, playing a pivotal role in the food web as prey (Henschel; unknown date of publication).

[3] Species almost always found in wetlands (>99% of occurrences).

Thus, it is the opinion of the specialist that the cryptic wetlands identified to be associated with the proposed powerline should be afforded the same protection as a wetland which meets the legislated definition thereof, and that suitable mitigation measures be implemented to minimise impacts to these features.

The figure below illustrates typical conditions of one of the larger cryptic wetlands identified within the mid-western and southern portion of the investigation area.

Figure 10: Examples of the larger cryptic wetland identified within the investigation area. The endorheic topographic setting is apparent in the photograph on the left, whilst the absence of shrubs or woody species within the centre of the depression is notable in the photograph on the right. Yellow dashed lines estimate the boundary of the cryptic wetland.

As noted above, one of the identified cryptic wetlands will be traversed by the proposed powerline (Figure 11), and as such was assessed in terms of relevant aspects (hydrology, geomorphology and vegetation components) in relation to the proposed powerline (see Section 5.5 below).

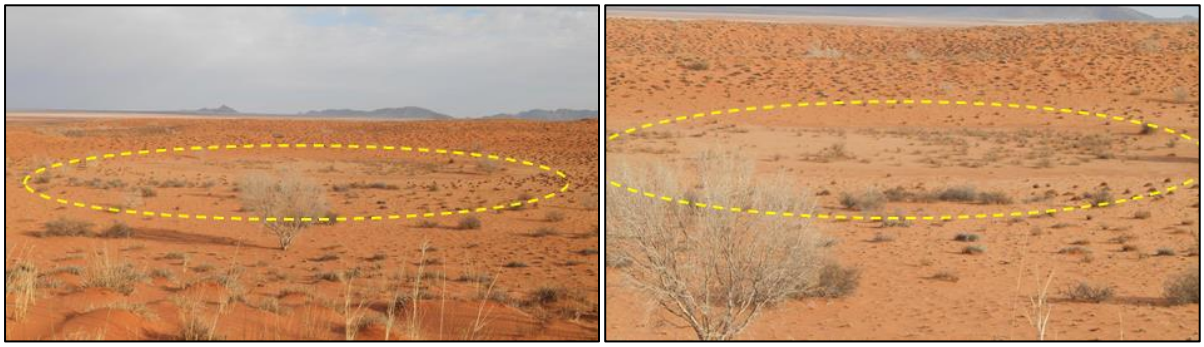


Figure 11: Representative photographs of the cryptic wetland identified to be traversed by the proposed powerline. Yellow dashed lines estimate the boundary of the cryptic wetland.

5.3.2 Episodic drainage line

One distinct episodic drainage line illustrated in Figure 12 below and the delineation thereof indicated in Figure 14 below was identified to be traversed by the eastern portion of the proposed powerline. The episodic drainage line flows in a general southerly direction and likely receives recharge from the upgradient mountain areas. The episodic drainage line was charachterised without riparian vegetation, grasses such as *Stipagrostis brevifolia* and *Stipagrostis cilliata* dominated the episodic drainage line. However, the vegetation associated with the riparian zone of the episodic drainage line was distinctly different from the surrounding upland areas in terms of species abundance and community structure, both of which are sufficient for providing a clear indication of the watercourse boundaries given the climatic conditions of the area. The upgradient and adjacent mining area and roads have potentially augmented the surface water input into this system, such that the system receives increased volumes of water, leading to development of prominent wetness indicators including the distinct wetness signatures visibile in the most recent digital satellite imagery (see Figure 9 on page 16).

Figure 12: Representative photographs of the episodic drainage line identified to be traversed by the eastern portion of the proposed powerline, flowing in a general southerly direction. Blue dashed arrows depict direction of flow.

5.4 Watercourse classification and delineation

Classification of the cryptic wetlands and episodic drainage lines 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 falling within the Nama Karoo Aquatic Ecoregion and the Nama Karoo Bushmanland Wetland Vegetation (WetVeg) group, considered "least threatened" by SANBI (2012) and Mbona *et al* (2015). The table below presents the further classification of these cryptic wetlands and episodic drainage lines at Levels 3 and 4 of the Classification System (Ollis *et al*, 2013).

Table 2: Characterization of the watercourses identified to be associated with the proposed powerline, according to the Classification System (Ollis *et al*., 2013).

Drainage system	Level 3: Landscape unit	Level 4: Hydrogeomorphic Unit
		HGM Type
Cryptic wetland	**Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.	**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.
Episodic drainage line	**Valley floor:** The base of a valley, situated between two distinct valley side-slopes.	**River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.

The identified watercourses as described above are presented in relation to the proposed powerline and investigation area in the figures below.

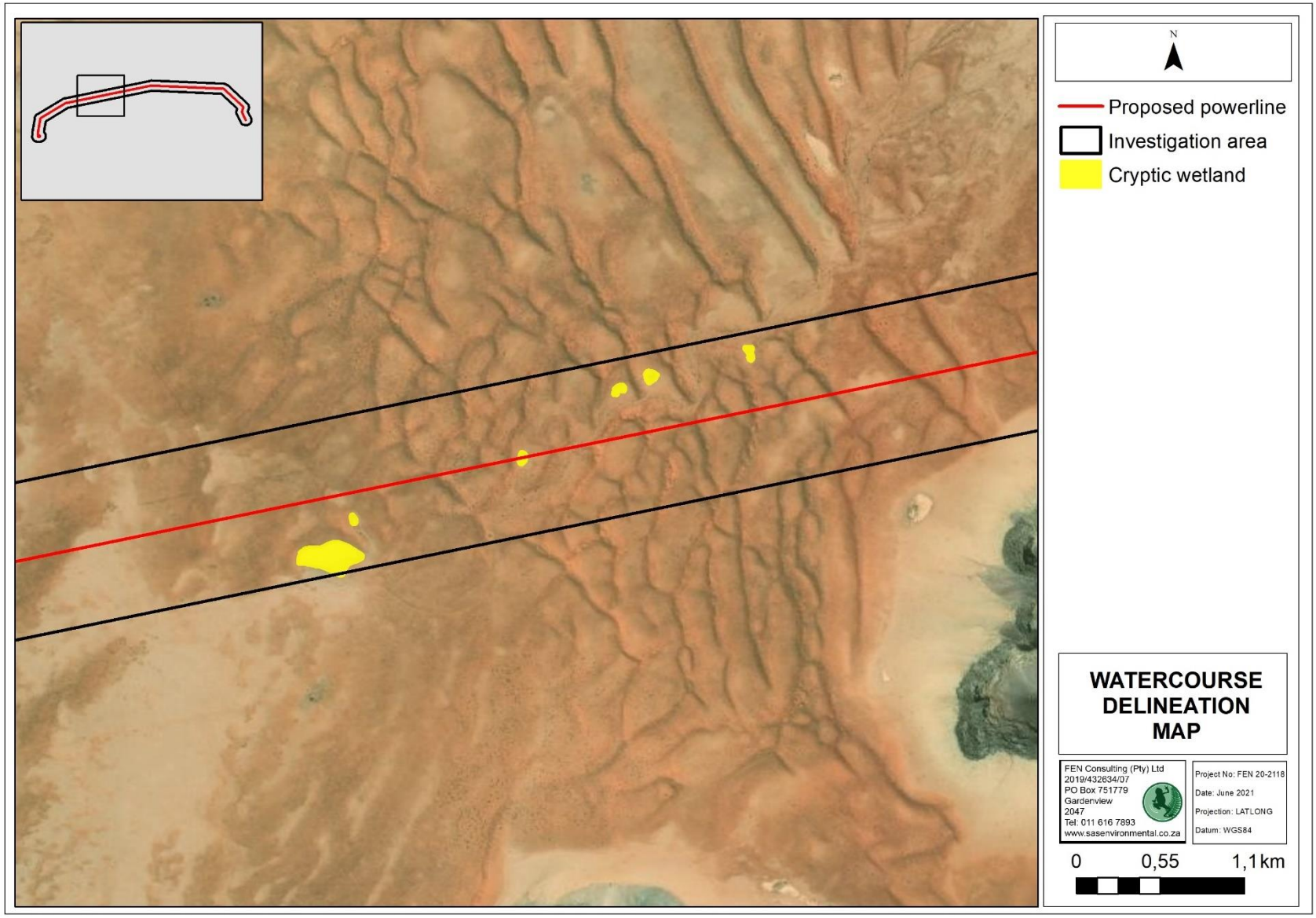


Figure 13: Map depicting the delineated extent of the cryptic wetlands associated with the proposed powerline and investigation area.

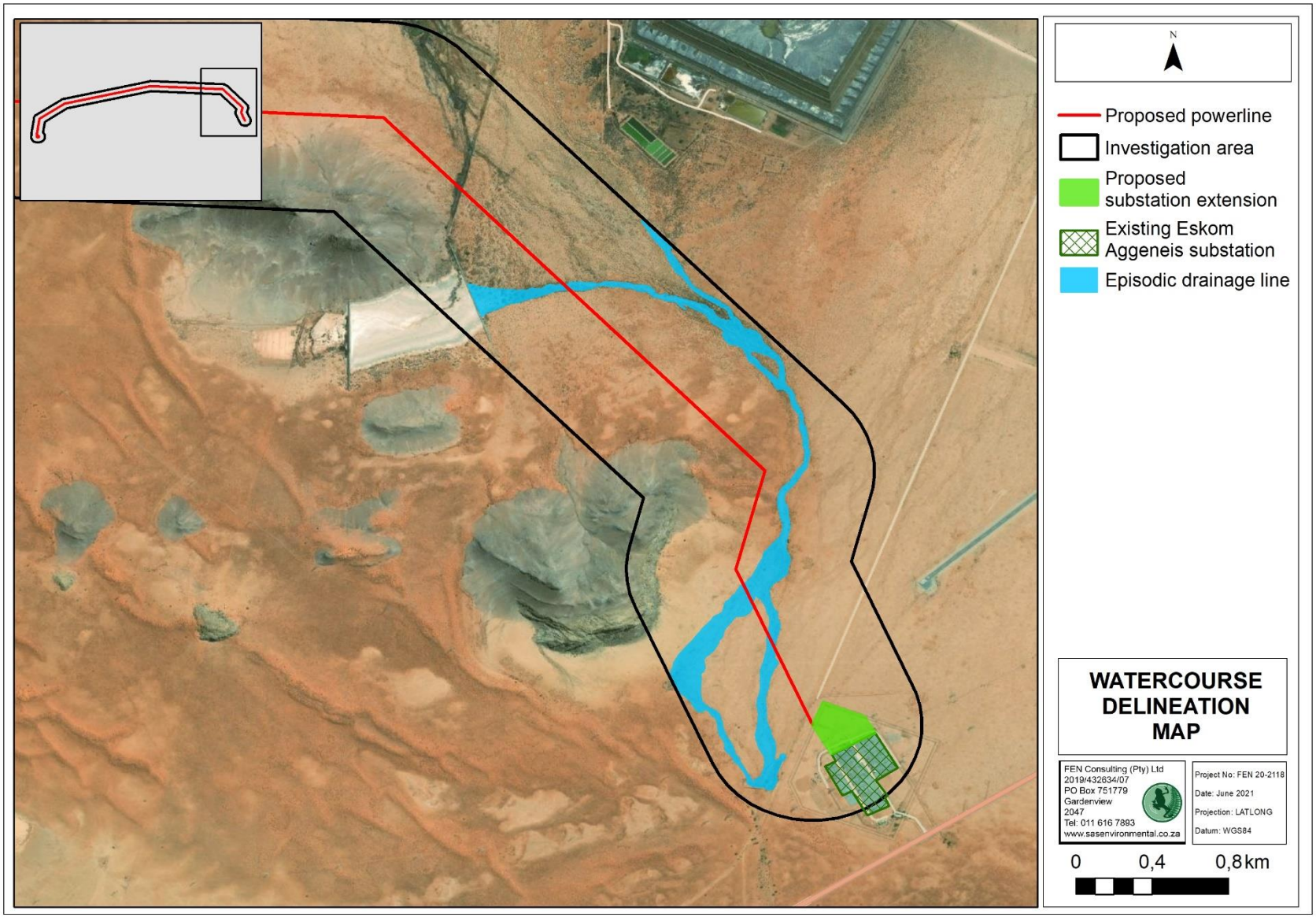
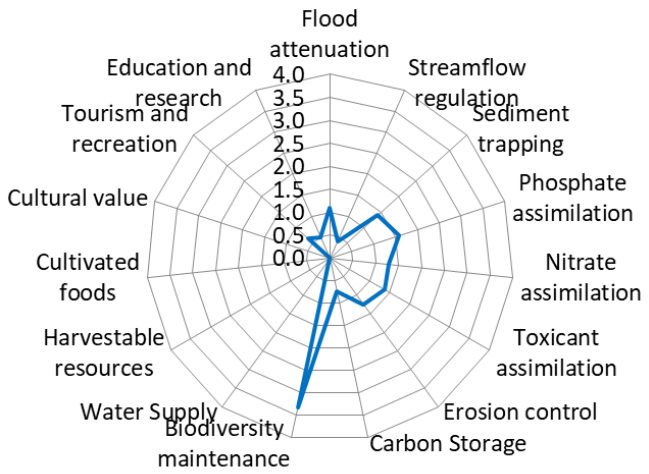
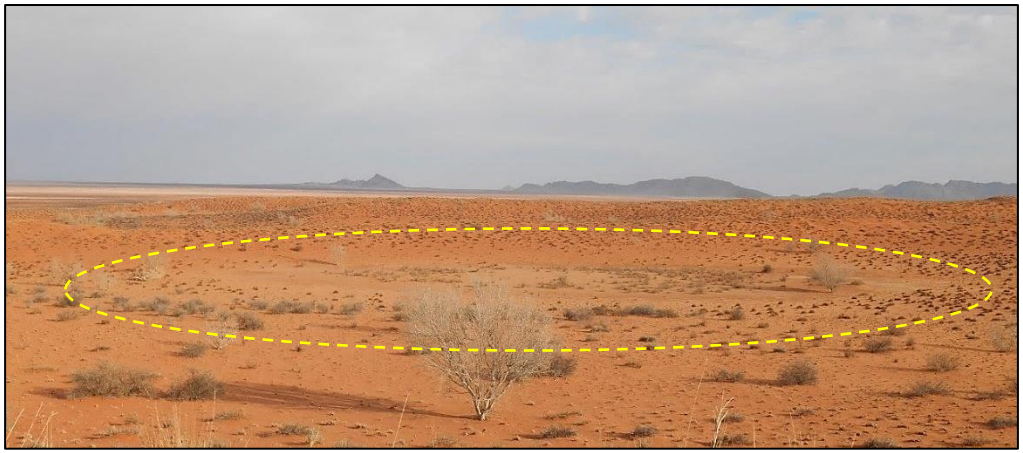


Figure 14: Map depicting the delineated extent of the episodic drainage line associated with the proposed powerline and investigation area.

5.5 Ecological assessment

Tables 3 and 4 summarise the findings of the field verification in terms of relevant aspects (hydrology, geomorphology and vegetation components) of the freshwater ecology of the cryptic wetland and episodic drainage line identified to be traversed by the proposed powerline. No quantum of risk is anticipated to the cryptic wetlands identified within the larger investigation area, hence they were not assessed further in terms of PES and EIS. The details pertaining to the methodology used to assess the cryptic wetland directly at risk and the episodic drainage line is available in **Appendix C** of this report.

Table 3: Summary of the assessment of the cryptic wetland to be traversed by the proposed powerline.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td colspan="2"> 
Figure 15: Representative photograph of the cryptic wetland at direct risk from the proposed powerline, illustrating the distinct endorheic setting, and the absence of woody species within the centre of the depression. Yellow dashed lines estimate the boundary of the cryptic wetland.</td></tr>
<tr><td>PES/ discussion</td><td>PES Category: A (Largely natural with only a few modifications)
Few to no impacts to the hydraulic and geomorphological processes of the cryptic wetlands were noted. Indirect impacts include informal farm roads within the vicinity of the cryptic wetland; however, these are not likely to have a notable effect given the semi-arid environment. Sedimentation may be problematic, as the inward-draining character of the cryptic wetland will lead to accumulation of sediment, in turn potentially leading to reduced capacity for retention of surface water, which in turn may impact on ecological service provision. However, aside from slight disturbances to soil within the cryptic wetland, no significant alterations to geomorphogical processes were noted. The floral communities tended to be homogenous, with the same floral species observed throughout.</td><td>Ecoservice provision</td><td>Moderately low (0,9)
Due to the highly ephemeral nature of the cryptic wetlands, as well as the endorheic geomorphological setting, ecological service provision is generally of low levels, with the exception of biodiversity maintenance, which is deemed ‘high’. Although no species of conservation concern (SCC) were noted at the time of the assessment, the limitations posed by the duration of the assessment present a “snap shot” of conditions, and further detailed studies would need to be undertaken over a greater period of time to ascertain the occurrence of floral and/or faunal SCC. Nevertheless, the wetland habitat on site forms part of a network of open spaces which may provide support for local fauna and flora within a semi-arid to arid climate.</td></tr>
<tr><td>EIS discussion</td><td>EIS Category: Moderate (1,4)
Cryptic wetlands are deemed important both in terms of biodiversity maintenance and on a landscape scale. They may provide important habitat, refugia, foraging and migratory sites for various faunal species on a seasonal basis. Additionally, whilst no floral SCC were identified during the site assessment, flora within this region, particularly geophytic species, have restricted growth and flowering periods and these may only emerge following adequate rainfall.</td><td>REC, RMO & BAS Category</td><td>REC Category: A
BAS: A
RMO: (Maintain)
Since the cryptic wetland associated with the proposed powerline is in a largely natural condition, ideally, it should remain as such. However, it is acknowledged that this cryptic wetland is at direct risk from the proposed powerline and therefore, maintenance of the PES may not be feasible. Please refer to the discussion below pertaining to impacts and mitigation measures.</td></tr>
</table>

Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):	
Very few impacts to the hydraulic regime and geomorphological processes were discerned during the site assessment.. The region is characteristically semi-arid, and although rainfall had been received between December 2020 - February 2021, at the time of conducting the assessment in June 2021, surface water was not present in the cryptic wetland. Nevertheless, based on the remote locality and significant distance from the existing mining activities and absence of impacts such as industry or cultivation, water quality, when present, will be the result of precipitation and therefore unpolluted. The vegetation communities associated with the cryptic wetland were largely limited to graminoid species (such as *Eragrostis bicolor,* and *Aristida congesta subsp. congesta*) and the forb *Cullen tomentosum*. The relative absence of fauna during the site assessment can be attributed to the crepuscular and secretive nature of many faunal species potentially occurring on site. Whilst little to no faunal species were observed within the assessed cryptic wetland during the site visit, such systems are noted to be important habitat for various Branchiopod species in the region, which are able to withstand extended periods of desiccation. Confirmation of the presence of these invertebrates by means of hatching out eggs under laboratory conditions did not form part of the scope of work; thus their presence or absence in this cryptic wetland cannot be ruled out without further investigation.	
Extent of modification anticipated	**None** No direct impacts (and therefore significant modification) to the cryptic wetland is anticipated should no physical footprint (i.e., support structures associated with the proposed powerline) be located within this cryptic wetland. as a result of the proposed powerline, although increased dust generation associated with construction activities is expected, which may potentially lead to smothering of biota and reduced water retention capacity. Indirect impacts may arise during the construction and active maintenance phase; however, these can be appropriately mitigated to reduce the risk significance. As such, it is recommended that access to site for construction or maintenance works should be limited to one designated access/maintenance road, indiscriminate driving through the wetlands is prohibited. Consequently, the extent of modification anticipated ranges from “none” to “fully reversible”, depending on the nature of the proposed activity.
Impact Significance & Business Case:	
Low	The activities associated with the construction and operational phases of the proposed powerline based on the alignment provided by the proponent, includes site preparation, excavation of foundation pits for the installation of support structures pose a Low risk to the cryptic wetland. Should the recommended mitigation measures as provided in the tables below be implemented, with specific mention of keeping the construction footprint as small as possible and ensuring that the support structures associated with the proposed powerline are located outside the identified cryptic wetland and associated buffer zone (see section 6 below), no direct negative impacts to the wetland are expected.

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

Table 4: Summary of the assessment of the episodic drainage line to be traversed by the proposed powerline.

Ecological & socio-cultural service provision graph:

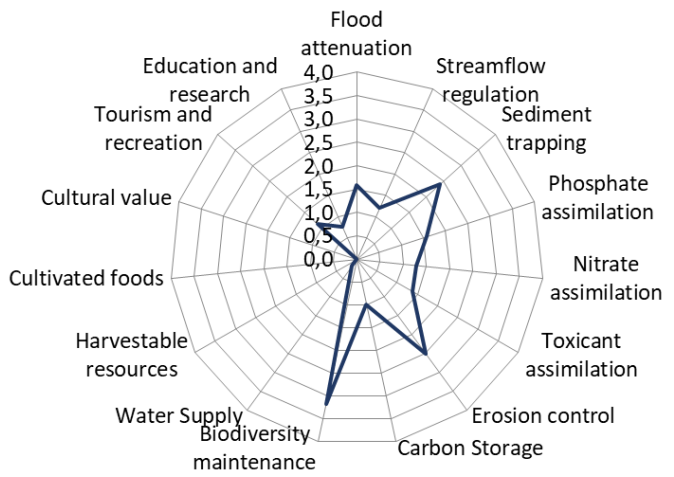


Figure 16: Representative photographs of portions of the episodic drainage line to be traversed by the proposed powerline. Whilst the species composition within the riparian zones was not distinctly different from that in the adjacent upland areas, the community structure was. Blue dashed lines depict direction of flow.

IHI discussion	**IHI Category: C (Moderately modified)** The episodic drainage line has been impacted by anthropogenic activities in the surrounding catchment, including the surrounding mining activities and associated road infrastructure which have altered the pattern, flow and timing of stormwater in the surrounding landscape. This has resulted in increased flood peaks in the episodic drainage line, significantly impacting the hydrology. Consequently, runoff from the upgradient and adjacent mining development and roads have potentially augmented the surface water input into this system such that the system receives increased volumes of water, leading to development of prominent wetness signatures (for example, see Figure 9 page 16).	**Ecoservice provision**	**Intermediate (1,2)** Despite the highly ephemeral nature of the episodic drainage line, ecological service provision is of intermediate levels, albeit at the lower end of the scale. Biodiversity maintenance is considered moderately high, whilst the capacity for providing other services such as sediment trapping and assimilation of nutrients is considered moderate although the opportunity to do so is reduced due to lack of surface water for the majority of the year. Direct service provision (such as water for human use) is low to very low as a result of the ephemerality of the system as well as its locality within privately owned, access-controlled land.
EIS discussion	**EIS Category: Moderate (1,6)** The episodic drainage line is considered ecologically important for the provisioning of certain ecological services, as well as for biodiversity maintenance. The system provides important foraging habitat and migratory corridors, linking to surrounding natural areas (although the presence of barriers such as fences may hinder the movement of larger fauna). The hydro-functional importance of the system is considered to be moderate due to important services such as hydrological connectivity while the direct human benefits are considered to be low as a result of the low dependency of people in the area on the watercourse for providing direct benefits such as water supply and harvestable resources.	**REC, RMO & BAS Category**	**REC Category: C** **BAS: C** **RMO: Maintain** Since the episodic drainage line is considered to be in a moderately modified ecological condition and of moderate ecological importance and sensitivity, the RMO is to maintain the ecological condition of the episodic drainage line. Thus, it is recommended that no further degradation to the watercourse should be permitted as a result of the proposed powerline. As such, it is also recommended that the construction and operation of the proposed powerline follow strict mitigation measures as outlined in this report (refer to Section 7).

Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):	
Episodic drainage lines are highly intermittent systems that flow or flood only in response to extreme rainfall events. However, the surrounding mining activities have potentially augmented the surface water input into this system through increased seepage reaching this system from the upgradient mining activities, essentially threatening the ephemeral nature of this episodic drainage line. Due to seepage from the upgradient mining development and catchment land use changes thereof, the surface water quality of the episodic drainage line is expected to be impaired No significant erosion was noted within the episodic drainage line. Alterations to the geomorphology and sediment balance of the episodic drainage line may result from sediment runoff from the upgradient mining area, transported to the system through the increased runoff and seepage from the mine. The floral species composition of the episodic drainage line did not necessarily vary significantly from that of the surrounding upland areas. However, given the semi-arid climate of the region, the episodic drainage line may be important for providing suitable browsing for large herbivores as well as structural diversity, favoured by avifauna, and act as migratory corridors for certain faunal species, linking the study site with adjacent open spaces.	
Extent of modification anticipated	**None.** No modification is anticipated to the extent of the episodic drainage line as long as no infrastructure is planned to be located within the delineated extent of the episodic drainage line. As such, it is highly recommended that the support structures associated with the proposed powerline be located outside the episodic drainage line and associated buffer zone (see Section 6 below). Well designed and strictly implemented mitigation measures will prevent indirect impacts, and any edge effects which may affect the episodic drainage line.
Impact Significance & Business Case:	
Low	Should the support structures associated with the proposed powerline not be located within the episodic drainage line, no direct impacts to the episodic drainage line are anticipated. Mitigation to prevent indirect impacts, particularly during construction, is essential. This includes ensuring that no sediment-laden runoff is allowed to report to the drainage line and this can be achieved by construction of silt-traps within the construction footprint and ensuring that the construction footprint as small as possible. Scheduling construction during periods of low to no rainfall (ideally during the dry winter period) will also aid in preventing sediment from reaching the system. No indiscriminate movement through the episodic drainage line should be permitted; demarcating the episodic drainage line as a sensitive environment for the duration of construction is essential to prevent unauthorised access.

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

6 LEGISLATIVE REQUIREMENTS

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[4];
- 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 zones of regulation. All of the natural watercourses will thus require further authorisation from the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform and the Department of Water and Sanitation (DWS). This report aids in providing relevant information for these 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).

The definition and motivation for a regulated zone of activity for the protection of the watercourse can be summarised as follows:

Table 5: Articles of legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). **Department of Water and Sanitation (DWS)**	**Government Notice 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 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.

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

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. **Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform**	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) Infrastructure or structures with a physical footprint of 100 square meters or more;* *Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse.* Excluding – … (dd) where such development occurs within an urban area… **Activity 19** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA regulations, 2014 (as amended) states "*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.*"

The following Zones of Regulation (ZoR) are applicable to the cryptic wetlands and episodic drainage line identified within the investigation area (Figures 17 and 18):

- A 32 m Zone of Regulation in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) was assigned for the cryptic wetlands and episodic drainage line;
- A 100 m ZoR in accordance with the National Water Act, 1998 (Act No. 36 of 1998) was assigned to the episodic drainage line; and
- A 500 m ZoR in accordance with the National Water Act, 1998 (Act No. 36 of 1998) was assigned to the cryptic wetlands.

In line with the WUA (NWA) process, a construction and operational phase buffer was also calculated for the cryptic wetlands within the investigation area using the "Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries" as developed by Macfarlane *et al*. (2015). The results of the buffer tool considering the practical mitigation measures as outlined in Table 6, indicate that a 10 m buffer is applicable to the construction phase and a 12 m buffer is applicable to the operational phase of the proposed powerline.

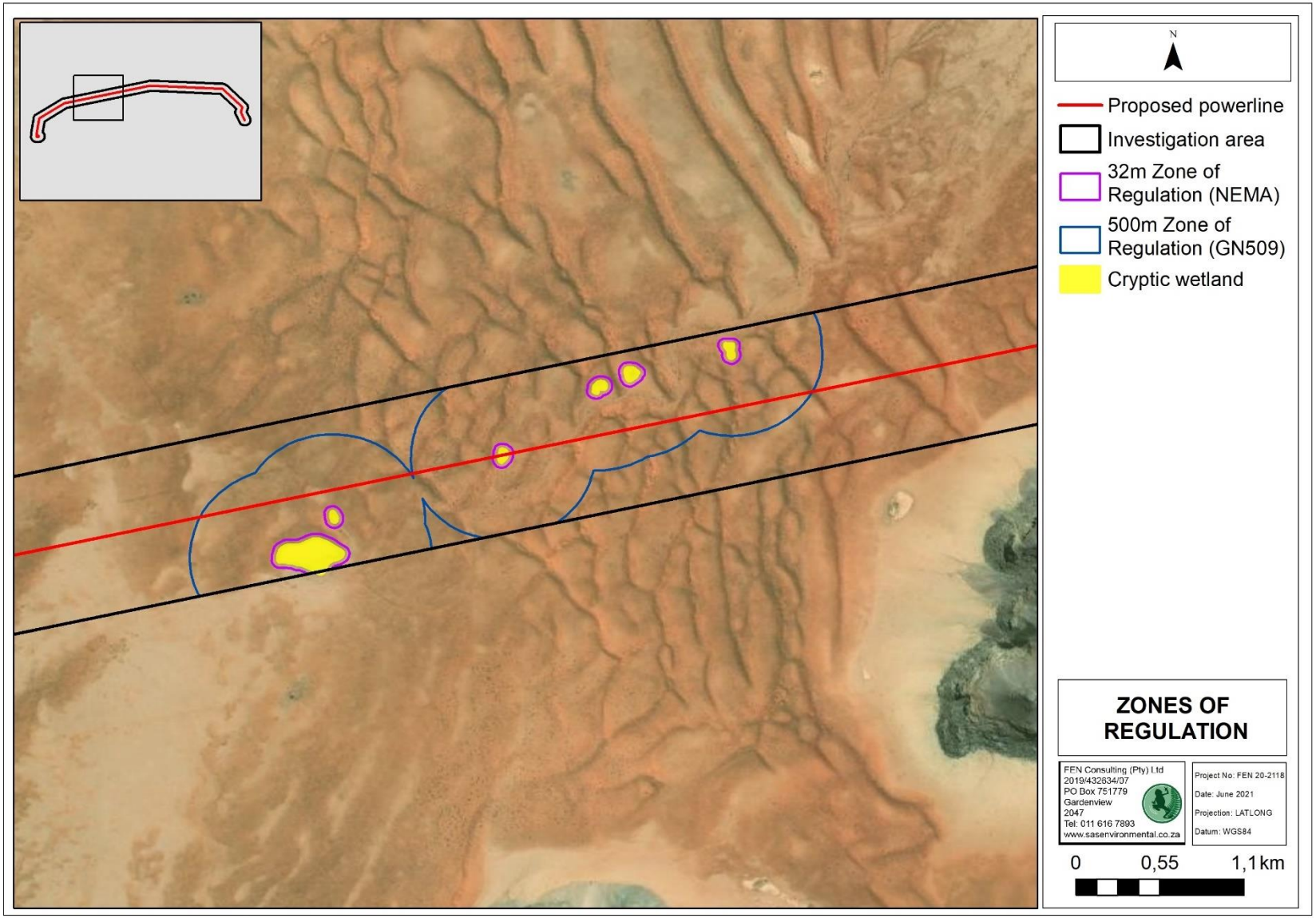


Figure 17: Cryptic wetlands identified within the investigation area of the proposed powerline with the associated zones of regulation in terms of NEMA and GN509 as it relates to the NWA.

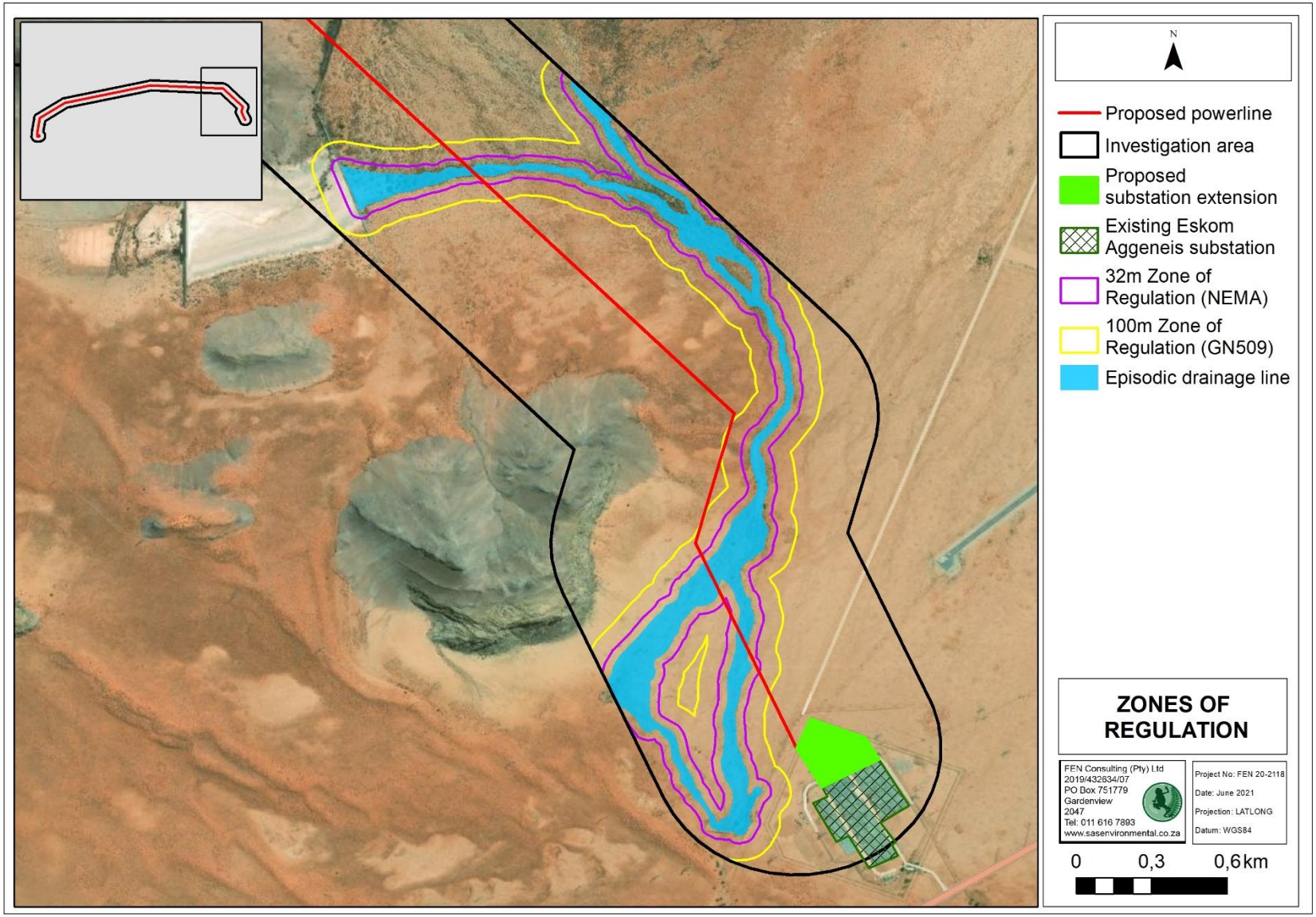


Figure 18: The episodic drainage line associated with the eastern portion of the proposed powerline and investigation area with the associated zones of regulation in terms of NEMA and GN509 as it relates to the NWA.

7 RISK AND IMPACT ASSESSMENT

This section provides the impact assessment outcomes and highlight all potential impacts and that may affect the identified watercourses. 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

Following the assessment of the identified watercourses, the DWS specified Risk Assessment Matrix (as promulgated in GN509 of 2016) was applied to ascertain the significance of risks associated with the individual activities on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the cryptic wetland and episodic drainage line directly at risk from the proposed powerline. The points below summarise the considerations undertaken:

- 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 watercourses;
- The proposed extension of the existing Eskom Aggeneis substation is located outside the 100 m GN509 ZoR of the episodic drainage line and was thus not considered in risk assessment;
- At the time of this assessment the layout of the proposed access roads (potential new) was not available. As such, it is assumed that the existing informal farm roads will be used as access roads. However, it is noted that the existing farm road can only access the powerline route to a certain point; thereafter, no existing roads available. The proponent has confirmed that there will be an 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. 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***;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the Department of Environmental Affairs (DEA) *et al* (2013) would be followed, i.e., the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- The activities relating to the proposed powerline are all highly site specific, not of a significant extent relative to the area of the cryptic wetlands 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 may be daily during this time;
- Most impacts are considered to be easily detectable;
- The considered mitigation measures are easily practicable; and
- It is recommended that the proponent make provision for rehabilitation of any edge effects which might affect the cryptic wetlands and episodic drainage line. This is especially applicable to re-sloping of the area to natural topography following installation of the support structures associated with the proposed powerline and ensure that no new preferential flow paths or erosion gullies form. This must be monitored through the operational phase.

7.1.1 Risk Assessment Discussion

There are five key ecological risks on the wetland that was assessed, namely:

- Loss of watercourse 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 watercourses;
- Impacts on water quality; and
- Proliferation of alien and invasive plant species.

The results of the risk assessment are summarised in Table 6 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.

Table 6: Summary of the results of the DWS risk assessment applied to the cryptic wetland and episodic drainage line at direct risk from the proposed powerline.

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of the impact
1	Construction Phase	Site preparation prior to construction activities	• Vehicular movement (transportation of construction materials); • Construction camp/contractor laydown and storage area	• Transportation of construction materials can result in disturbances to soil, and increased risk of sedimentation/erosion; and • Soil contamination and potential oil and hydrocarbon spills originating from construction vehicles. • Soil compaction leading to increased runoff and erosion within the vicinity of the watercourses.	1,25	3,25	13	42,25	L	• It is imperative that all construction works be undertaken during periods of low to no rainfall (thus preferably during the dry, winter months) when the flow/level of water is very low in the watercourses; • Due to the accessibility of the sites, no unnecessary crossing of the watercourses may be permitted and it is strongly recommended that the calculated 10 m construction buffer and 32m ZoR be considered a no-go area. This will limit edge effects, erosion and sedimentation of the watercourses during the construction phase; • Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the watercourse areas (including the cryptic wetlands identified within the larger investigation area) and their associated buffer zones; • Any material stockpiled should be kept to a minimum. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.	Fully Reversible
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 watercourses; • Increased sedimentation of the watercourses, leading to smothering of vegetation;	1,25	3,25	14	45,5	L		Fully Reversible

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of the impact
				• Dust pollution during construction which may impact on water quality; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.							
3	**Construction Phase**	Installation of the support structures 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 watercourses.	• Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream watercourse areas; • Disturbances of soil leading to potential impacts to the watercourses and increased sediment runoff from the construction site to the watercourses, in turn leading to altered watercourse habitat; • Altered runoff patterns, leading to increased erosion and sedimentation of the receiving watercourses down gradient of the development;	1,25	3,25	14	45,5	L	• It is imperative that all construction works be undertaken during periods of low to no rainfall (thus preferably during the dry, winter months), and no diversion of flow would be necessary; • It is strongly recommended that all support structures associated with the proposed powerline infrastructure be located outside the delineated extent of the identified watercourses and their calculated 10 m construction buffer buffer and 32 m NEMA ZoR; • The construction footprint and period should be kept as small and as short as possible, respectively; and construction activities within the delineated watercourses should be avoided; • Only a 5 m zone of disturbance should be permitted to be disturbed. This 5 m zone of disturbance will limit construction vehicles/personnel to disturb the surrounding area to watercourses, should the support structures be located in close proximity to a watercourse; • 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; • During excavation of the foundation pits, soil must be stockpiled upgradient of the excavated foundation pit and away from the watercourses. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum. The soil must be used to close off the pits, immediately after installation of the support structures.	**Fully Reversible**

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of the impact
				• Dust pollution during construction which may impact on water quality (if surface water is present).						• The bedding layer (such as clean gravel) should 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 watercourse or within close proximity to a watercourse; When the powerline is spun between the support structures, no vehicles may indiscriminately drive through the watercourses, use must be made of the dedicated access roads. <u>Control measures for concrete mixing on site (where applicable):</u> • No mixed concrete may be deposited outside of the designated construction footprint; • As far as possible, concrete mixing should be restricted to the contractor laydown area. Additionally, batter / dagga board mixing trays and impermeable sumps should be provided, onto which any mixed concrete can be deposited while it awaits placing; and • Any concrete potentially 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 excavated material and concrete encasing;</u> • Soil removed for excavating the foundation pit should be used as backfill material; • All excavated foundation 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 to allow vegetation establishment; • Any remaining soil following the completion of backfilling of the foundation pits is to be spread out thinly surrounding the constructed support structures (outside watercourses) to aid in the natural reclamation process; and	
4	**Construction Phase**		Potential mixing and casting of concrete for foundations associated with the proposed powerline support structures	Potential contamination of surface water (if present).	1,25	3,25	14	45,5	L		**Fully Reversible**

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of the impact
										• 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.	
5		Access route "jeep-track"	• Soil compaction for the access route	• Disturbances of soil resulting in altered runoff patterns within the vicinity of the watercourses; 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 watercourses; and • No formal paving should be used for the access route. *In situ* compaction of soil for the "jeep-track" as proposed is preferred.	

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of the impact
6	**OPERATIONAL PHASE**	Operation and maintenance of the powerline and access route.	• Potential indiscriminate movement of maintenance vehicles within close proximity of the watercourses; • Increased risk of sedimentation and/or hydrocarbons entering the watercourses 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	• Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the watercourses may be permitted; • During periodic maintenance activities of the powerline, monitoring for erosion should 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 watercourses and for access roads through or along the watercourses. 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.

Tables 7 - 10 below provide the outcome of the impact assessment for the above-listed activities, based on the methods presented in Appendix D.

Table 7: Construction phase – impact assessment of site preparation activities prior to the construction of the powerline.

Activity: Site preparation prior to construction activities, involving vehicular movement (transportation of construction materials) and the 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.

Potential impacts:

- Transportation of construction materials can result in disturbances to soil, and increased risk of sedimentation/erosion;
- Soil and surface water (if present) contamination from potentially spilled oils and hydrocarbons originating from construction vehicles.
- Soil compaction leading to increased runoff and erosion within the vicinity of the watercourses;
- Exposure of soils, leading to increased runoff, and erosion, and thus increased sedimentation of the watercourses;
- Increased sedimentation of the watercourses, leading to smothering of vegetation associated in the watercourses; and
- Proliferation of alien and/or invasive vegetation as a result of disturbances.

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	2	3	1	3	27	Low	-	High
With Mitigation	1	1	3	1	2	12	Low	-	High

Mitigation and Management Measures

- It is imperative that all construction works be undertaken during periods of low to no rainfall (thus preferably during the dry, winter months) when the flow/level of water is very low in the watercourses;
- Due to the accessibility of the sites, no unnecessary crossing of the watercourses may be permitted and it is strongly recommended that the calculated 10 m construction buffer and 32m ZoR be considered a no-go area. This will limit edge effects, erosion and sedimentation of the watercourses during the construction phase;
- Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the watercourse areas (including the cryptic wetlands identified within the larger investigation area) and their associated buffer zones;
- Any material stockpiled should be kept to a minimum. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.

Table 8: Construction phase – Installation of the support structures and spanning of the proposed powerline

Activity: Installation of the support structures and spanning of the proposed powerline entailing the excavation of pits for the support structures leading to stockpiling of soil, and potential movement of construction equipment and personnel within the watercourses.

Potential impacts:

- Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream watercourse areas;
- Disturbances of soil leading to potential impacts to the watercourses and increased sediment runoff from the construction site to the watercourses, in turn leading to altered watercourse habitat;
- Altered runoff patterns, leading to increased erosion and sedimentation of the watercourses where watercourses are within close proximity; and
- Dust pollution during construction which may impact on water quality (if surface water is present).

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	2	3	1	3	27	Low	-	High
With Mitigation	1	1	3	1	2	12	Low	-	High

Mitigation and Management Measures

- It is imperative that all construction works be undertaken during periods of low to no rainfall (thus preferably during the dry, winter months), and no diversion of flow would be necessary;
- It is strongly recommended that all support structures associated with the proposed powerline infrastructure be located outside the delineated extent of the identified watercourses and their calculated 10 m construction buffer buffer and 32 m NEMA ZoR;
- The construction footprint and period should be kept as small and as short as possible, respectively; and construction activities within the delineated watercourses should be avoided;
- Only a 5 m zone of disturbance should be permitted to be disturbed. This 5 m zone of disturbance will limit construction vehicles/personnel to disturb the surrounding area to watercourses, should the support structures be located in close proximity to a watercourse;
- 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;
- During excavation of the foundation pits, soil must be stockpiled upgradient of the excavated foundation pit and away from the watercourses. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum. The soil must be used to close off the pits, immediately after installation of the support structures;
- The bedding layer (such as clean gravel) should 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 watercourse or within close proximity to a watercourse; When the powerline is spun between the support structures, no vehicles may indiscriminately drive through the watercourses, use must be made of the dedicated access roads.

<u>Control measures for concrete mixing on site (where applicable):</u>

- No mixed concrete may be deposited outside of the designated construction footprint;
- As far as possible, concrete mixing should be restricted to the contractor laydown area. Additionally, batter / dagga board mixing trays and impermeable sumps should be provided, onto which any mixed concrete can be deposited while it awaits placing; and
- Any concrete potentially 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 excavated material and concrete encasing;</u>

- Soil removed for excavating the foundation pit should be used as backfill material;
- All excavated foundation 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 to allow vegetation establishment;
- Any remaining soil following the completion of backfilling of the foundation pits is to be spread out thinly surrounding the constructed support structures (outside watercourses) to aid in the natural reclamation process; and
- The

Mitigation and Management Measures
• 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.

Table 9: Construction phase – Preparation for the access route "jeep-track"

Activity: Soil compaction for the access route and associated disturbances of soil within the vicinity of the watercourses.

Potential impacts:
- Disturbances of soil resulting in altered runoff patterns within the vicinity of the watercourses; and
- Altered runoff patterns, leading to increased erosion and sedimentation of freshwater habitat.

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	3	1	3	24	Low	-	High
With Mitigation	1	1	1	1	2	8	Low	-	High

Mitigation and Management 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 watercourses; and
- No formal paving should be used for the access route. In situ compaction of soil for the "jeep-track" as proposed is preferred.

Table 10: Operation and maintenance of the powerline and access route.

Activity: Operation and maintenance of the powerline entailing potential indiscriminate movement of maintenance vehicles within close proximity to the watercourses and increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the access roads.

Potential impacts:
- Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; and
- Altered water quality (if surface water is present) as a result of increased availability of pollutants.

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	3	1	3	24	Low	-	High
With Mitigation	1	1	1	1	2	8	Low	-	High

Mitigation and Management Measures

- Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the watercourses may be permitted;
- During periodic maintenance activities of the powerline, monitoring for erosion should 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 watercourses and for access roads through or along the watercourses. 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/Impact Assessment Discussion

The activities associated with the construction and operational phases of the proposed powerline based on the alignment provided by the proponent, which include site preparation, excavation of foundation pits and installation of the support structures associated by the proposed powerline, pose a Low risk to the identified cryptic wetlands and episodic drainage line, should no physical footprint (i.e., support structures) be located within the identified watercourses and their calculated 10 m construction, 12 m operational phase buffers and 32 m NEMA ZoR, as a minimum. Should the recommended mitigation measures as provided in the tables above be implmented, with specific mention of ensuring that the support structures associated with the proposed powerline are located outside the identified watercourses and their associated buffer zone, as well as keeping the construction footrpints as small as possible with suitable rehabilitation post-construction, no significant direct negative impacts to the watercourses, including their characteristics and goods and services provision are expected.

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 Impacts

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future considered together with the impacts identified in Section 7.1 above. The proposed powerline between the on-site substation and the existing national grid is part of the Sol Invictus PV solar power generation facility. Since no surface infrastructure associated with the proposed powerline is located within any of the identified cryptic wetlands and episodic drainage line, the significance of the cumulative impacts of the proposed project is therefore regarded to be insignificant. If the mitigation measures, as set out in this report are adhered to, impacts from the proposed powerline construction activities will not exceed the boundaries of the investigation area and will not contribute significantly to cumulative impacts on watercourses on a regional scale.

8 CONCLUSION

FEN Consulting was appointed to conduct a specialist freshwater ecological assessment as part of the EAWUA processes for the proposed 132 kilovolt (kV) overhead powerline route as part as part of the proposed Sol Invictus PV solar power generation facility, located near Aggeneys, in the Northern Cape Province.

During the site assessment undertaken in June 2021, one cryptic wetland and an episodic drainage line (considered to be watercourses) were identified to be traversed by the proposed powerline. The episodic drainage line was identified within the eastern portion of the porposed powerline and is augmeneted by seepage from the upgradient mining area. Five cryptic wetlands were also identified within the larger investigation area for which no quantum of risk is anticipated as a result of the proposed powerline. The results of the ecological assessment of the cryptic wetland and episodic drainage line to be traversed by the proposed powerline, as discussed in Section 5 of this report, are summarised in the table below:

Table 11: Summary of results of the field assessment as discussed in Section 5.

Watercourse	PES	Ecoservices	EIS	REC, RMO & BAS
Cryptic wetland	A/B (Largely natural with only a few modifications)	Moderately Low (0,9)	Moderate (1,4)	REC: Category A/B BAS: Category: A/B RMO: Maintain
Episodic drainage line	Category: C (Moderately Modified)	Intermediate (1,2)	Moderate (1,6)	REC: Category C BAS: Category: C RMO: Maintain

Based on the findings of the watercourse assessment and the results of the 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 watercourses 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 implmented, with specific mention of ensuring that the support structures associated with the proposed powerline are located outside the identified watercourses and their calculated 10 m construction, 12 m operational phase buffers and 32 m NEMA ZoR, as well as keeping the construction footrpints as small as possible with suitable rehabilitation post-construction, no signficant direct negative impacts to the watercourses are expected.

The results of this assessment show that assuming mitigation measures are strictly enforced, a low impact to the overall integrity of the watercourses are expected. It is, therefore, the opinion of the freshwater ecologist that the proposed powerline be considered favourably, from a freshwater ecological resource management point of view, provided that all mitigation measures as set-out in this report are implemented.

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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 Consulting (Pty) Ltd and its staff reserve the right to 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	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.
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 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 wetland or riparian features encountered within the investigation 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**[5] (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**

[5] 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.

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

The purpose of assessing importance and sensitivity of watercourses is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Watercourses with higher ecological importance may require managing such watercourses 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 watercourses by DWA and thus enabling consistent assessment approaches across watercourse types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C7) of the wetland system being assessed.

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

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

5. WET-Health

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

Level of Evaluation

Two levels of assessment are provided by WET-Health:

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

Framework for the Assessment

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

Units of Assessment

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

Quantification of Present State of a wetland

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

Table C5: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change

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

Table C6: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

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

Overall health of the wetland

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

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

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

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

***PES Categories E and F are considered ecologically unnacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an 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 watercourses are 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 C8: Description of Recommended Ecological Category (REC) classes.

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

7. 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 redoxymorphic 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 and Impact 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'[6]. 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[7].

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,

[6] The definition has been aligned with that used in the ISO 14001 Standard.

[7] Some risks/impacts that have low significance will however still require mitigation

where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

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

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

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

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

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

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

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

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

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

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

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

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

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5

Located within the regulated areas

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

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

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to 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

Table D9: Calculations

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

The following points were considered when undertaking the assessment:

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

Control Measure Development

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

- Mitigation and performance improvement measures and actions that address the risks and impacts[8] 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;

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

- 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.

Reversibility and/or irreplaceable loss

The following indicates the rationale for the reversibility scoring in relation to the watercourses.

Table D10: Reversibility of impacts on the watercourse

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

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

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

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[9], indirect[10], secondary[11] as well as cumulative[12] impacts.
A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[13] presented in Table D11.

[9] Impacts that arise directly from activities that form an integral part of the Project.
[10] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[11] Secondary or induced impacts caused by a change in the Project environment.
[12] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[13] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Table D11: Impact Assessment Criteria and Scoring System

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

Impact Mitigation

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

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in **Figure D1** below.

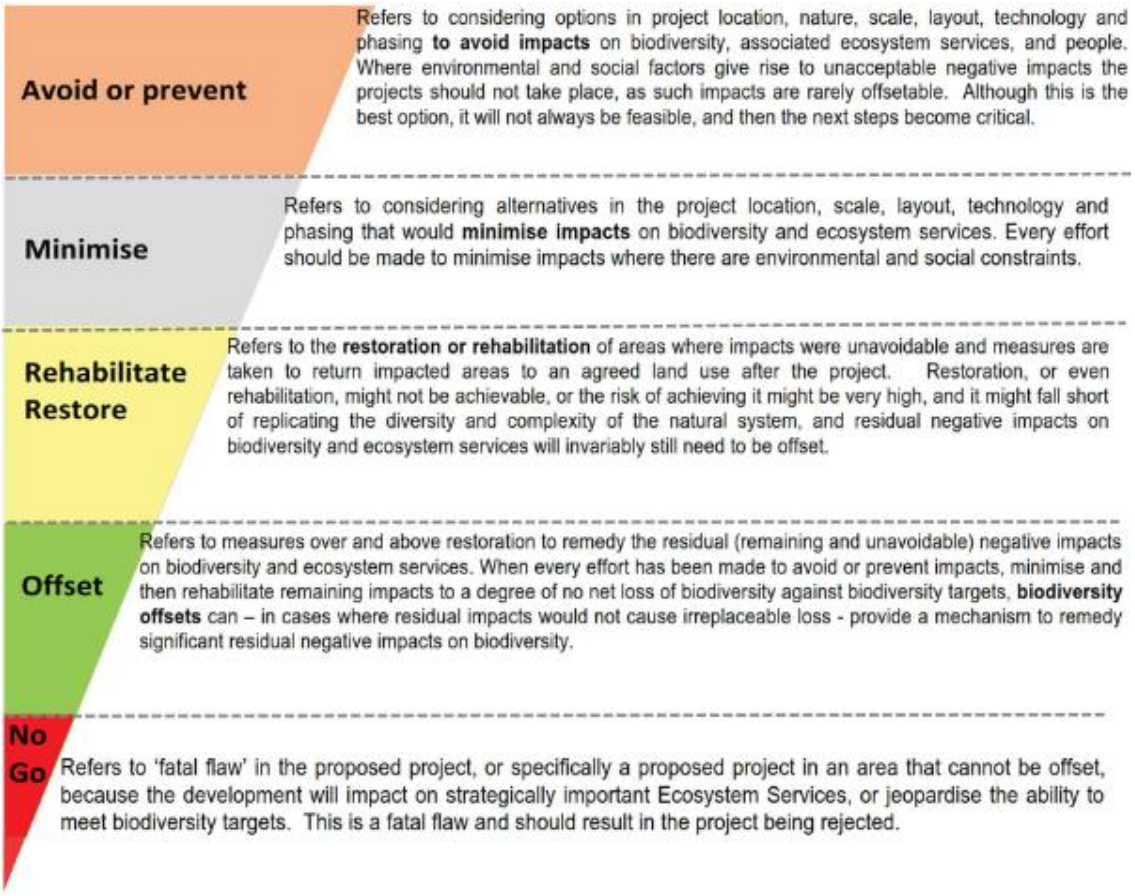


Figure D1: Mitigation Sequence/Hierarchy

APPENDIX E: Result of Field Investigation

Table E1: Presentation of the results of the Wet-Health assessment applied to the cryptic wetland at direct risk from the proposed powerline.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
Area weighted impact scores*			1.0	0.0	0.0	0.0	1.2	-1.0
PES Category			B	→	A	→	B	↓

Table E2: Presentation of the results of the IHI assessment applied to the episodic drainage line traversed by the proposed powerline.

INSTREAM IHI	MRU
Base Flows	-3.0
Zero Flows	2.5
Floods	3.5
HYDROLOGY RATING	**2.9**
pH	0.5
Salts	1.0
Nutrients	1.0
Water Temperature	1.0
Water clarity	1.0
Oxygen	1.0
Toxics	0.0
PC RATING	**1.3**
Sediment	1.0
Benthic Growth	1.5
BED RATING	**1.3**
Marginal	1.0
Non-marginal	1.0
BANK RATING	**1.0**
Longitudinal Connectivity	0.5
Lateral Connectivity	1.0
CONNECTIVITY RATING	**0.8**
INSTREAM IHI %	**68.1**
INSTREAM IHI EC	**C**
INSTREAM CONFIDENCE	**3.0**

RIPARIAN IHI	MRU
Base Flows	-2.0
Zero Flows	2.5
Moderate Floods	4.0
Large Floods	3.0
HYDROLOGY RATING	**2.8**
Substrate Exposure (marginal)	0.5
Substrate Exposure (non-marginal)	0.5
Invasive Alien Vegetation (marginal)	0.5
Invasive Alien Vegetation (non-marginal)	0.5
Erosion (marginal)	0.5
Erosion (non-marginal)	0.5
Physico-Chemical (marginal)	1.0
Physico-Chemical (non-marginal)	0.0
Marginal	1.0
Non-marginal	0.5
BANK STRUCTURE RATING	**0.9**
Longitudinal Connectivity	1.0
Lateral Connectivity	1.0
CONNECTIVITY RATING	**1.0**
RIPARIAN IHI %	**68.6**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**3.0**

Table E3: Presentation of the results of the Socio-cultural and Ecoservice provision provided by the watercourses assessed.

Ecosystem service	Cryptic wetland	Episodic drainage line
Flood attenuation	1.1	1.5
Streamflow regulation	0.4	1.3
Sediment trapping	1.4	2.4
Phosphate assimilation	1.6	1.5
Nitrate assimilation	1.3	1.4
Toxicant assimilation	1.4	1.4
Erosion control	1.3	2.5
Carbon Storage	0.8	1.0
Biodiversity maintenance	3.3	2.9
Water Supply	0.0	0.0
Harvestable resources	0.0	0.0
Cultivated foods	0.0	0.0
Cultural value	0.0	0.0
Tourism and recreation	0.6	0.6
Education and research	0.5	0.8
SUM	**13.6**	**17.3**
Average score	**0.9**	**1.2**

Table E4: Presentation of the EIS assessment applied to the cryptic and episodic drainage line associated with the proposed powerline.

Watercourse			Cryptic wetland	Episodic drainage line	
Ecological Importance and Sensitivity			Score (0-4)	Score (0-4)	*Confidence (1-5)*
Biodiversity support			A (average)	A (average)	(average)
			0,33	1,00	3,00
Presence of Red Data species			0	0	3
Populations of unique species			0	1	3
Migration/breeding/feeding sites			1	2	3
Landscape scale			B (average)	B (average)	(average)
			1,40	1,6	4,00
Protection status of the wetland			3	3	3
Protection status of the vegetation type			1	1	4
Regional context of the ecological integrity			1	1	4
Size and rarity of the wetland type/s present			1	2	4
Diversity of habitat types			1	1	4
Sensitivity of the wetland			C (average)		(average)
			0,60	0,67	2,67
Sensitivity to changes in floods			1	1	3
Sensitivity to changes in low flows/dry season			0	0	3
Sensitivity to changes in water quality			1	1	2
ECOLOGICAL IMPORTANCE & SENSITIVITY			**(max of A,B or C)**	**(max of A,B or C)**	*(average of A, B or C)*
		Fill in highest score:	**B**	**B**	**2,20**
Hydro-Functional Importance			Score (0-4)		*Confidence (1-5)*
Regulating & supporting benefits	**Flood attenuation**		1	2	4
	Streamflow regulation		0	0	4
	Water Quality Enhancement	***Sediment trapping***	1	1	4
		Phosphate assimilation	2	2	4
		Nitrate assimilation	1	1	4
		Toxicant assimilation	1	2	4
		Erosion control	1	1	4
	Carbon storage		1	1	4
HYDRO-FUNCTIONAL IMPORTANCE			**(average score)**	**(average score)**	**(average confidence)**
			1,00	1,30	4
Direct Human Benefits			Score (0-4)		*Confidence (1-5)*
Subsistence benefits	***Water for human use***		0	0	3
	Harvestable resources		0	0	4
	Cultivated foods		0	0	4
Cultural benefits	***Cultural heritage***		0	0	4
	Tourism and recreation		1	1	4
	Education and research		0	0	4
DIRECT HUMAN BENEFITS			(average score)		(average confidence)
			0,2	0,2	4

APPENDIX F: Risk Analysis and Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater 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 watercourses 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. It must be ensured that the freshwater 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, near to the watercourses 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 calculated 10 m construction buffer and 32 m NEMA ZoR around the watercourses, and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the wetland;
- 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 a maximum of two years for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble/silt 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 freshwater ecology of the proposed powerline

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 watercourse.

Table F1: Risk Assessment outcomes 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 watercourses; • Increased sedimentation of the watercourses, leading to smothering of vegetation associated with the watercourses; • 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 watercourses.	• Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream watercourse areas; • Disturbances of soil leading to potential impacts to watercourse vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered watercourse habitat; • Altered runoff patterns, leading to increased erosion and sedimentation of the receiving watercourses 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 watercourses; 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 watercourses; • Increased risk of sedimentation and/or hydrocarbons entering the watercourses 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**

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)
Nelanie Cloete	MSc. Environmental Management (University of Johannesburg) MSc. Botany (University of Johannesburg)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

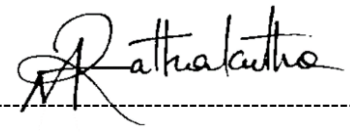
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

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

I, Kim Marais, 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

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
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 NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Water Resource and Botanical Discipline Lead
Joined SAS Environmental Group of Companies	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 400503/14)
Member of the South African Association of Botanists (SAAB)
Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
Member of the Grassland Society of South Africa (GSSA)
Member of the Botanical Society of South Africa (BotSoc)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State
Africa - Democratic Republic of the Congo (DRC)

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)

- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Plant species and Landscape Plan

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Environmental Control Officer monitoring

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

Short Courses

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

AREAS OF WORK EXPERIENCE

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

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

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 Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments