BTE RENEWABLES

ESIZAYO WIND ENERGY FACILITY

FRESHWATER ASSESSMENT

29 MARCH 2022

ORIGINAL

ESIZAYO WIND ENERGY FACILITY

FRESHWATER ASSESSMENT

BTE RENEWABLES

FINAL

PROJECT NO.: 41103481
DATE: MARCH 2022

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1 INTRODUCTION

WSP in Africa (WSP), a wholly owned affiliate of WSP Global Inc., was commissioned by BTE Renewables to undertake a hydrological assessment that is required for the Basic Assessment (BA) process for the proposed Esizayo 132kV powerline (herein referred to as the Project). The development of a 6.5km long 132kV overhead power line is required to connect the Esizayo Wind Energy Facility (WEF) Energy Facility to the national grid via the existing Eskom Komsberg substation.

This report will address the freshwater habitat systems (i.e. wetlands and watercourses) located within the project footprint and provide a high-level assessment of the potential environmental impacts associated with the proposed development.

1.1 TERMS OF REFERENCE

WSP has been commissioned to undertake a Wetland Assessment relating to the proposed project. The objective of the assessment is to identify freshwater habitats (wetland and riparian systems) present at the proposed site and within the regulated boundary of a watercourse and undertake an assessment of the impact associated with the proposed project.

This was undertaken in order to determine whether the Project and associated activities may impact on the regulated boundary of a watercourse (i.e. the outer edge of the 1:100-year flood line or delineated riparian habitat; and/or 500 m radius from the delineated boundary of a wetland, as defined in GN509 of 2016[1]).

The potential impacts associated with the construction and operation of the proposed Project on the identified watercourses were assessed and associated mitigation recommendations provided in order to conduct the Risk Assessment.

The scope of work undertaken broadly encompassed the following:

- Review of any existing reports relevant to the proposed Project;
- Identification and delineation of wetland and riparian systems;
- Description of the wetlands and riparian systems identified;
- A functional assessment of the identified wetlands and riparian systems, and
- An impact assessment considering the impacts that the proposed Project and associated activities may have on the identified wetland and/or riparian systems.

2 STUDY AREA

2.1 LOCALITY SETTING

The proposed Project is located in the Central Karoo District Municipality and withing the Laingsburg local Municipality of the Western Cape Province. The proposed transmission integration project entails the construction of a 132kV transmission line from the common substation at the proposed Esizayo WEF to connect to the existing Komsberg substation. The preferred transmission line route will then run adjacent to an existing road (R354) before running in a north-easterly direction to the existing Komsberg MTS Substation located approximately 2km north of the facility (**Figure 1**). The Project area is located approximately 30km Northeast of Laingsburg in the Western Cape (**Figure 2**).

The 132kV grid connection crosses the following properties:

[1] General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as Defined in Section 21 (c) or Section 21 (i).

- Farm Standvastigheid 210 Remainder; and
- Farm Aurora 285

2.2 PROJECT INFRASTRUCTURE

2.2.1 TRANSMISSION LINE

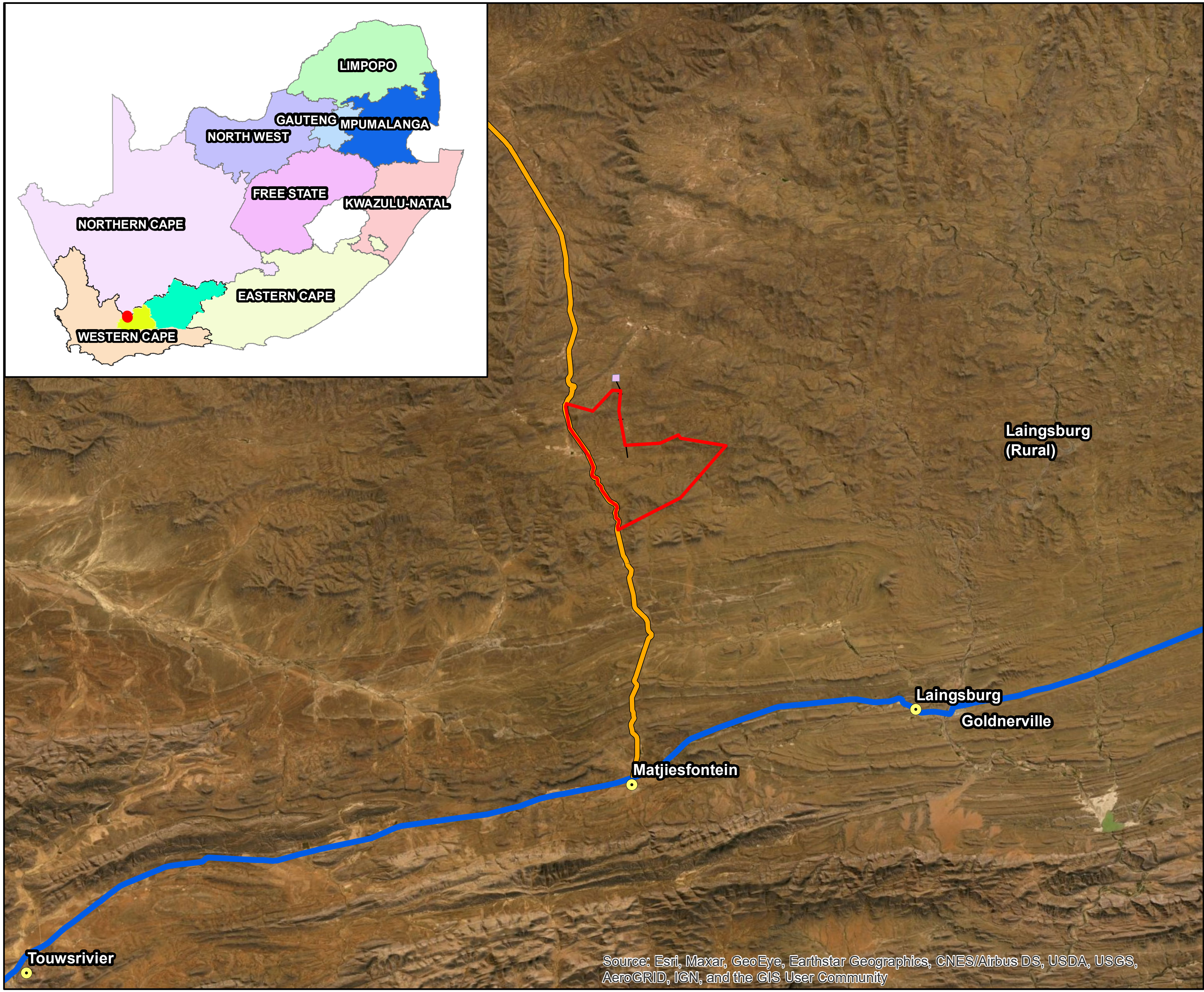
The transmission line will be a 132kV steel single or double structure with a kingbird conductor standing between 15m and 20m above ground level. Standard overhead line construction methodology will be employed – drill holes, planting of poles, stringing of cables. It is not envisaged that any large excavations and stabilized backfill will be required, however this will only be verified on site once the geotechnical assessment has been undertaken at each pole position (as part of construction works).

Pole positions will only be available post preferred bidder award once the powerline design has started.

2.2.2 SERVITUDE

The servitude width of the 132 kV transmission line (single and double circuit) is between 36m and 40m and the length of the transmission line is approximately 6.5km, which will result in a servitude area of approximately 26ha.

The servitude is required to ensure safe construction, maintenance, and operation of the powerline. Registration of the servitude grants BTE Renewables the right to erect, operate and maintain the powerline and to access the land to carry out such activities, but it does not constitute full ownership of the land. Construction and operation activities and access to the powerline must be carried out with due respect to the affected landowners.



BTE RENEWABLES
ESIZAYO WIND FARM
REGIONAL SETTING

Legend

- Esizayo SIte Boundary
- R354
- N1
- Proposed 132kV Line Route
- Komsburg Substation
- Laingsburg Local Municipality
- Central Karoo District Municipality

N

0 1 500 3 000 6 000 9 000 12 000
Meters

DISCLAIMER

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DATA SOURCE:

SOUTH AFRICAN DEPARTMENT OF RURAL DEVELOPMENT AND LAND REFORM-
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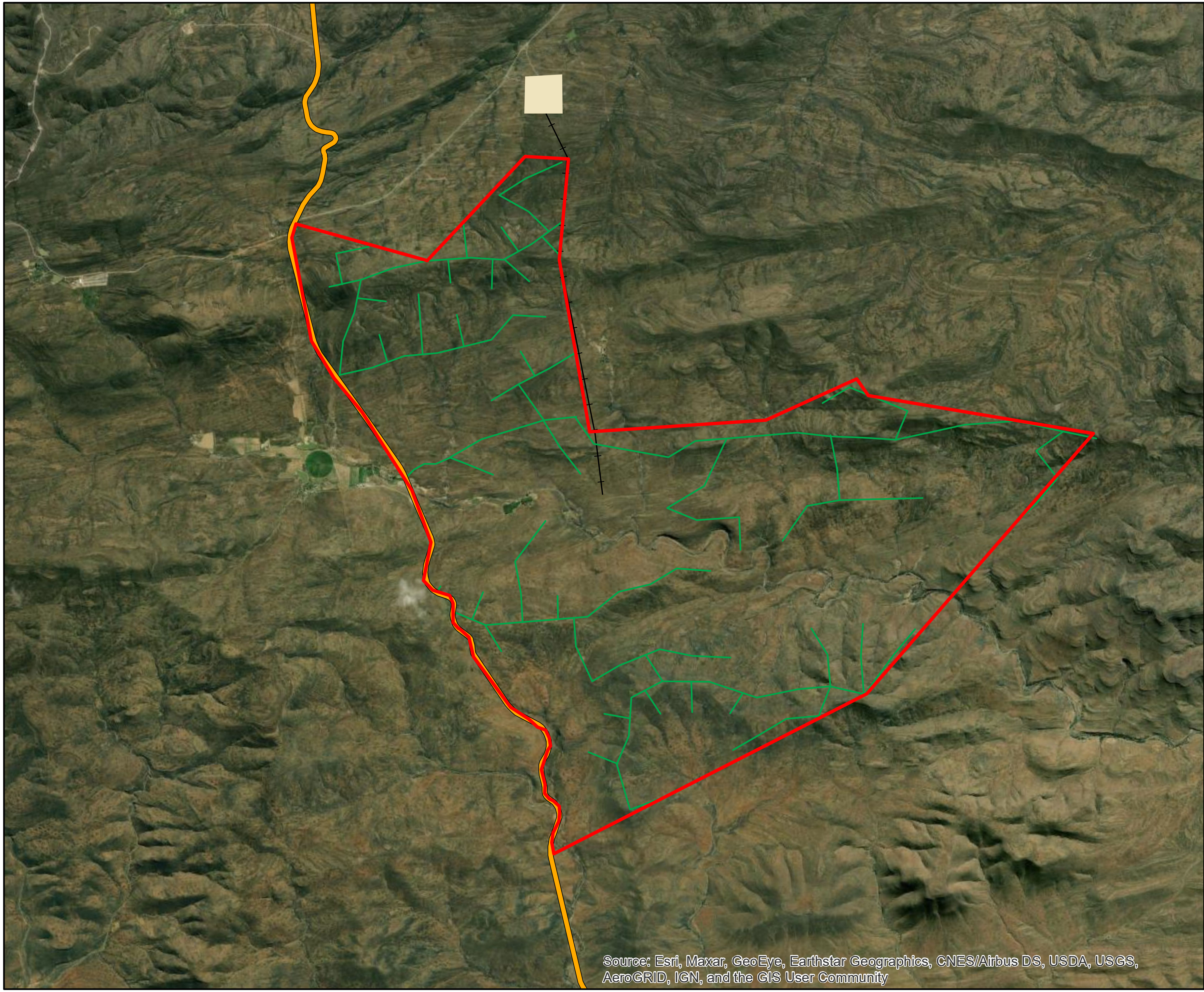
PROJECTION: GCS_WGS_1984

PROJECT TITLE:
DNG ENERGY - FEASIBILITY STUDY

SCALE: 1:400 000	DRAWN BY: TUMELO TSEPHE
DATE: 2021/05/19	REVIEWED BY: ZAKARIYA NAKHOODA

FIGURE NO: 2	PROJECT NO: 41103342	REV: 0



BTE RENEWABLES
ESIZAYO WIND FARM
LOCALITY SETTING

Legend

- Esizayo SIte Boundary
- Komsburg Substation
- R354
- Roads and Cables_Esiza...
- Proposed 132kV Line Route

N

0 305 610 1 220 1 830 2 440
Meters

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PROJECTION: GCS_WGS_1984

PROJECT TITLE:
DNG ENERGY - FEASIBILITY STUDY

SCALE: 1:80 000	DRAWN BY: TUMELO TSEPHE	
DATE: 2021/09/19	REVIEWED BY: ZAKARIYA NAKHOODA	
FIGURE NO: 2	PROJECT NO: 41103481	REV: 0

3 BASELINE RECEIVING ENVIRONMENT

This section describes the baseline environment for the proposed 132kV power line.

3.1 CLIMATE

The climate of the region is arid to semi-arid. Rainfall is low and occurs throughout the year but predominantly in the winter months between March and August. Mean annual precipitation is approximately 290mm, ranging from 180 – 410mm rainfall per year. The region experiences dry hot summers and the warmest month of the year is February which averages 23.4°C. The lowest average temperatures in the year occur in July, averaging approximately 9.3°C. The region experiences steady, strong winds between December and April; however the winds calm between the months of June and October.

3.2 LAND COVER

Based on the Mucina and Rutherford (2006) natural vegetation classification map, the area of the proposed project site is mostly Central Mountain Shale Renosterveld, with a minor contribution of Koedoesberge-Moordenaars Karoo. The Department of Agriculture, Forestry and Fisheries (DAFF) define the land use within the Esizayo Site, as predominantly Shrubland and Low Fynbos (DAFF, 2012). As shown in Figure 6, there are eight freshwater habitats located within a 500 m radius of the Esizayo Site boundary.

During the site visit, the vegetation was identified as mostly shrub-like vegetation and Fynbos which is primarily used for sheep grazing. Indigenous antelope (Springbok) were also present within site boundary.

3.3 SOILS AND GEOLOGY

Based on the information included in the land type maps of South Africa (AGIS, 2007) the soils in the region of the Esizayo Site are mostly "Glenrosa and/or Mispha forms with lime generally present in the landscape" and "miscellaneous land classes, rocky areas with miscellaneous soils".

The general geological description of the area is based on the 1:1 000 000 geological map for the Northern Cape Province, published by the Trigonometrical Survey Office in 1970 (Schifano *et.al.*,1970). The Esizayo Site is nested in the Roggeveld Mountains range, in the Larger Cape Fold belt system. The site is located on the Beaufort Series which forms part of the Karoo system. The rock type for the series comprises of shale, mudstone, sandstone and limestone (Schifano *et al.*, 1970). During the site visit, it was observed that shale and mudstone were the dominant rock type for the area.

3.4 TOPOGRAPHY

The topography of the area comprises of mountainous hillslopes (part of the Roggeveld Mountain Range) with small patches of open rocky ground in between these, and numerous watercourses and drainage channels. The hillslopes have an average gradient of 34.4 % and 1.1% on the open flat ground. The elevation of the Esizayo Site ranges from 984 m to 1 379 m above mean sea level (amsl).

3.5 HYDROLOGY

South Africa is divided into nine Water Management Areas (WMAs), where the proposed Esizayo wind power sites are situated in the Breede-Gouritz WMA 6 (Figure 3). The Esizayo Site lies within tertiary catchment J11, on the boarder of J11D and J11E (Figure 4). The J11 tertiary hydrological characteristics are summarised in

Table 1, including catchment area, Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) and Mean Annual Runoff (MAR). The MAE largely exceeds the MAP, reinforcing the arid conditions of the region.

Table 1: Quaternary J11D and J11E Catchments' Hydrological Characteristics

QUATERNARY	CATCHMENT AREA	MAP	MAE	MAR
J11D	801	240	2000	5.58
J11E	812	188	2060	3.50

Source: WRC/DWA, 2012

There are several watercourses/drainage channels present within the Esizayo Site, the main river being the Nuwerus, which runs through the site (**Figure 3**). However, a few of the watercourses that were visited within the site were dry and only the Nuwerus River exhibited small pools of water at intermittent section along the watercourse (Plate 1). Given the arid climatic condition of the region, the majority of the watercourses are ephemeral and are likely to only convey water during infrequent high rainfall events.

3.6 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS

The National Freshwater Ecosystem Priority Areas (NFEPA) is a tool developed to assist in the conservation and sustainable use of South Africa's freshwater ecosystems, including rivers, wetlands and estuaries. Nel *et al.* (2011) classified the freshwater ecosystems according to their Present Ecological State 'AB', 'C', and 'DEF' or 'Z' (**Table 2**).

Table 2: Description of NFEPA wetland conditions categories

PES Equivalent	NEEPA Condition	Description	% of total National wetland area
Natural or Good	AB	Percentage natural land cover ≥ 75%	47
Moderately Modified	C	Percentage natural land cover 25-75%	18
Heavily to critically modified	DEF	Riverine wetland associated with a D, E, F or Z ecological category river	2
	Z1	Wetland overlaps with a 1:50 000 'artificial' inland water body from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007)	7
	Z2	Majority of the wetland unit is classified as 'artificial' in the wetland locality GIS layer	4
	Z3	Percentage natural land cover ≤ 25%	20

According to the NFEPA database, a total of three wetland systems were identified within 500m of the proposed powerline (**Table 3, Figure 3**).

Table 3: NFEPA Wetlands Located within 500m buffer

HGM unit	Natural/Artificial	NFEPA Condition
Seep (S1)	Natural	AB
Seep (S2)	Artificial	Z3
Seep (S3)	Artificial	Z3

During the site visit, it was observed that Seep (S1) was representative of a channelled Valley Bottom type wetland and is currently utilised for small scale agricultural practices. Seeps S2 and S3 were observed as being dams that were located on the ephemeral tributaries.

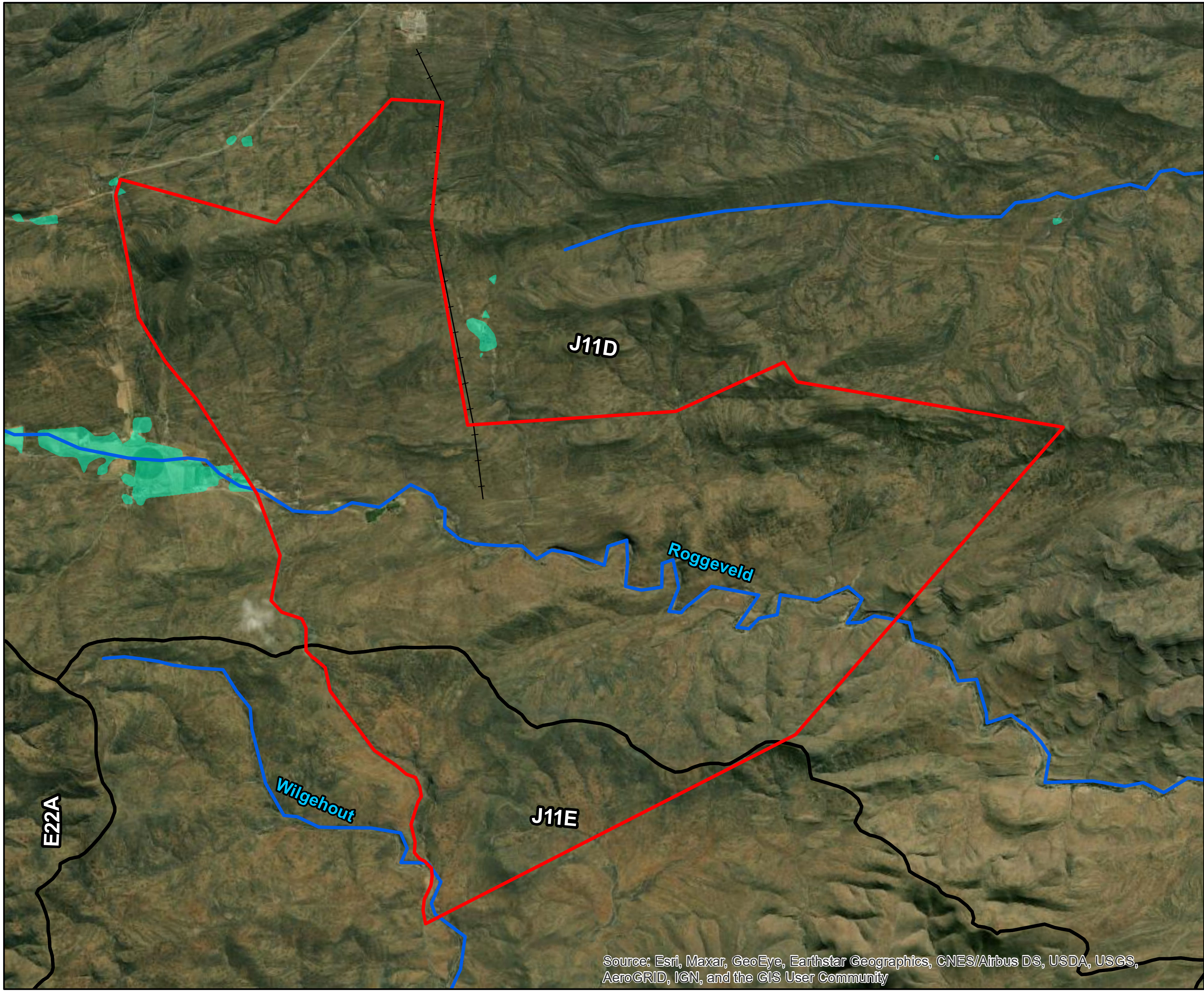
4 EXPERTISE OF THE SPECIALIST

The assessment was conducted by Zakariya Nakhooda with support from Karen King as summarised in **Table 4**.

Table 4: Qualifications and Expertise of the Specialists

Name	Qualification	Professional Registration	Experience
Zakariya Nakhooda	BSc Hydrology (Hons) and Environmental Sciences	Pr Sci Nat	Zakariya Nakhooda is a Wetland Assessment specialist and Hydrologist within WSP. He has 5+ years' work experience in environmental hydrology, wetland assessments and water use licence applications. He has completed a BSc degree in Hydrology and Geography/Environmental Sciences. He has also completed a BSc Honours degree in hydrology UKZN, and is currently pursuing an MSc degree in Hydrology. His interests include integrated water resources management, water quality, catchment hydrology and GIS.
Karen King	MSc Hydrology	Pr Sci Nat	Karen King is a professional soil scientist and hydrologist with WSP. She has 15+ years' work experience and specialises in soil classification, capability and risk studies, hydrological modelling, flood risk modelling, storm water management planning, mining/development hydrology (with adherence to GN704), water resources planning, wetland delineation, water research, agricultural studies and related risk assessments and management plans. Karen's modelling experience has focussed on the Pitman, ACRU, Hec-HMS, Hec-RAS and SWAT models. She has been primarily involved in the engineering and environmental hydrology and soil science fields, initially as a soil science lecturer at UKZN for 3 years, and then as a hydrologist in various engineering and environmental consultancies both in South Africa and in the United Kingdom.

BTE RENEWABLES
ESIZAYO WIND FARM
ENVIRONMENTAL SETTING



Legend

- Esizayo SIte Boundary
- Quatenary_c...
- Proposed 132kV Line Route
- Rivers
- NFEPA Wetland Seep

N

0 260 520 1 040 1 560 2 080
Meters

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DNG ENERGY - FEASIBILITY STUDY

SCALE: 1:67 666	DRAWN BY: TUMELO TSEPHE	
DATE: 2021/05/19	REVIEWED BY: ZAKARIYA NAKHOODA	
FIGURE NO: 2	PROJECT NO: 41103481	REV: 0

5 AIMS AND OBJECTIVES

The aim of this assessment was to complete a Wetland Habitat Assessment with the following objectives:

- Identify and delineate wetlands and/or riparian habitats within the proposed 132kV power line and servitude, and within the regulated area of a watercourse;
- Determine the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and functional importance of the identified wetlands and/ or riparian habitats; and,
- Determine whether the identified wetlands and/or riparian habitats have the potential to be impacted on by the proposed 132kV power line and servitude and associated activities.

In order to achieve the aforementioned objectives, the following activities were undertaken:

- Desktop identification and delineation of all watercourses (wetlands and riparian zones included) within the proposed 132kV power line and servitude utilising available site-specific data;
- Infield delineation and classification of the identified wetlands and riparian habitats within the proposed 132kV power line and servitude;
- Risk/impact probability screening of the identified wetlands and riparian habitats to determine which have any risk of being impacted upon by the proposed construction and operations;
- Determination of the wetlands and riparian habitats that have the potential to be impacted on by the proposed construction and operational activities of the proposed 132kV power line and servitude;
- Conduct an assessment of the PES, EIS and functional importance (wetland only) of the delineated wetland and riparian habitats; and,
- Compilation of the Impact Assessment.

6 METHODOLOGY

The methods and tools utilised to conduct the Wetland Habitat Assessment within the study area were determined utilising desktop and in-field assessments together with professional opinion. An in-depth description of each method is provided in the chapters that follow. National and provincial datasets were utilised to supplement the information gathered on site.

6.1 WETLAND IDENTIFICATION AND MAPPING

In order to identify the wetland types present, using Kotze *et al*. (2009) and Ollis *et al.* (2013), a characterisation of hydrogeomorphic (HGM) types was conducted. These have been defined based on the geomorphic setting of the wetland in the landscape (e.g. hillslope or valley bottom wetlands, whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated), how water flows through the wetland (diffusely or channelled) and how water exits the wetland (see **Figure 4** from Ollis *et al.* 2013).

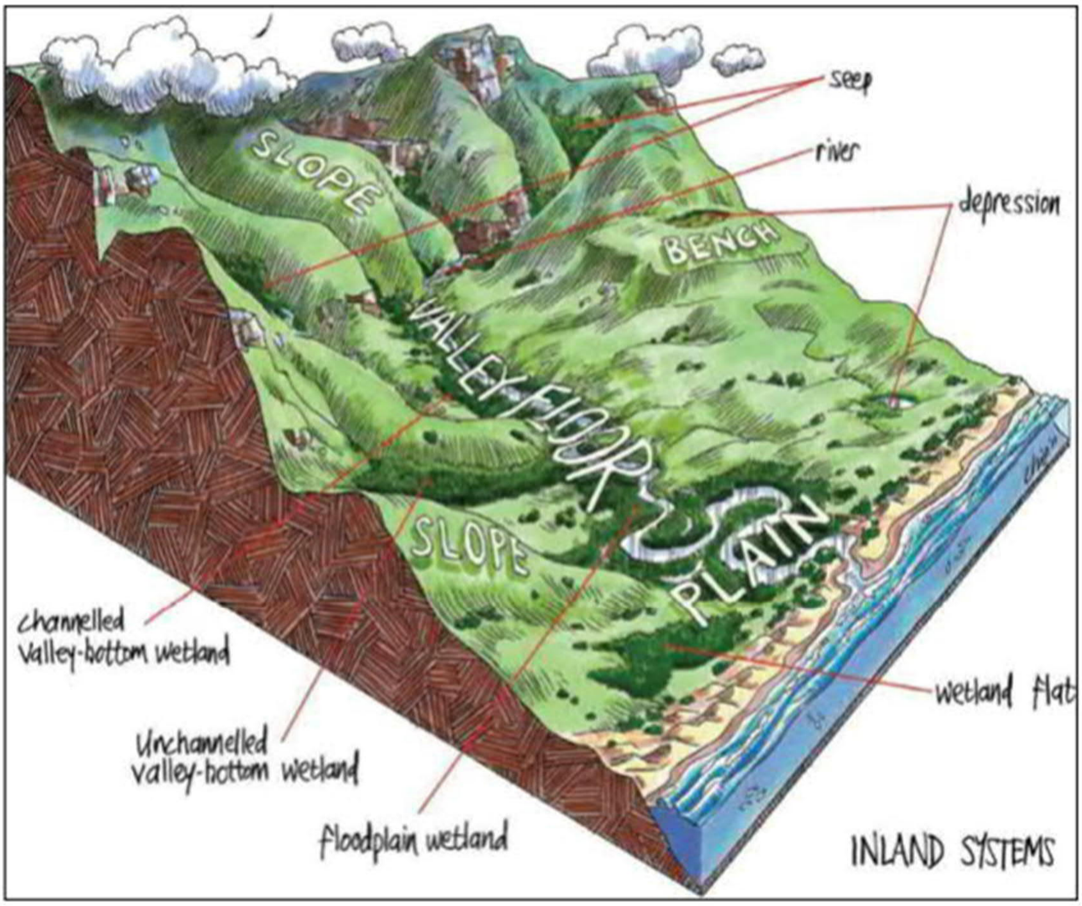


Figure 4: Illustration of wetland types and their typical landscape setting

6.2 DELINEATION

6.2.1 WETLAND DELINEATION

Wetland delineation includes the confirmation of the occurrence of a wetland and the determination of the outermost edge of the wetland. As an initial step, a desktop assessment utilising aerial imagery and available datasets was conducted to determine potential wetland and riparian habitats. This desktop analysis was vital due to the extent of the area under assessment. Following the desktop assessment, an in-field assessment was conducted between the 7th and 10th September 2021 to groundtruth and assess the desktop-identified systems, and identify any potential systems that may have been overlooked during the desktop assessment phase.

The outer boundary of the wetlands present at the site were identified and delineated according to the DWS wetland delineation manual, 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas' (DWAF, 2005a). The wetland indicators that are utilised in the detailed field delineation of wetlands:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Wetness Indicator identifies the morphological 'signatures' developed in the soil profile as a result of prolonged and frequent saturation (determined through soil sampling with a soil auger and examining the degree of soil mottling and gleying);
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils; and,
- The Soil Form Indicator.

According to the wetland definition used in the NWA, vegetation is the primary indicator, which must be present under normal circumstances. However, in practice, the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role. The reason for this is that vegetation responds relatively quickly to changes in the soil moisture regime or management and may be transformed, whereas the morphological indicators in the soil are far more permanent and will hold the signs of frequent saturation long after a wetland has been drained (perhaps for several centuries).

6.3 WETLAND FUNCTIONAL ASSESSMENT

Functional assessments were developed principally for evaluating the potential impacts of developments and/or projects which threaten wetland ecosystems, and are used to assess the success of wetland rehabilitation projects, by evaluating the change in wetland functioning over time (DWAF, 2004).

These protocols are usually designed to estimate the change in functioning resulting from the alteration of a wetland (either positive or negative). Minimally-impacted wetlands (within each wetland class) are used as a reference or benchmark. Each function is scored relative to that of reference wetlands in the same locality and class/type and subclass/subtype. The index value of each variable is accompanied by descriptions of estimates and measurements.

WET-Health (described below) is designed for the rapid assessment of the integrity of wetlands. It focuses on the question of how far a system has deviated from its historical, undisturbed reference condition, and does not assess ecosystem services. WET-EcoServices (Kotze *et al*., 2007), is designed for the rapid assessment of the delivery of ecosystem services by a wetland in its current state. It does not assess how far this state is from the reference condition (i.e., its integrity).

The WET-EcoServices tool (Kotze *et al*., 2005) allows measurement of ecosystem goods and services (eco-services) provided by a wetland system. Eco-services refer to the benefits obtained from ecosystems. These benefits may be derived from outputs that can be consumed directly, indirectly (which arise from functions or attributes occurring within the ecosystem), or possible future direct or indirect uses (Howe *et al*., 1991).

The WET-EcoServices tool provides structured guidelines that allow the importance of the wetland to be scored according to its ability to deliver various ecosystem services, shown in **Table 5**.

Table 5: Ecosystem Services Considered in a South African Context

Direct Benefits	Indirect Benefits
Cultural benefits	Regulating and supporting benefits
Cultural heritage	Flood attenuation
Tourism and recreation	Streamflow regulation
Education and research	Carbon storage
Provisioning benefits	Water quality enhancement benefits
Provision of cultivated foods	Sediment trapping
Provision of harvestable resources	Phosphate assimilation
Provision of water for human use	Nitrate assimilation
Biodiversity maintenance	Toxicant assimilation
	Erosion control

6.4 DETERMINING THE PRESENT ECOLOGICAL STATE (INTEGRITY) OF THE WETLANDS

WET-Health is a tool designed to assess the health (present state) or integrity of a wetland. Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland’s natural reference condition (Macfarlane *et al*., 2009). This tool is utilised to assess hydrological, geomorphological and vegetation health in three separate modules.

Hydrology is defined in this context as the distribution and movement of water through a wetland and its soils. This module focuses on changes in water inputs, as a result of changes in catchment activities and characteristics that affect water supply and its timing, as well as on modifications within the wetland that alter the water distribution and retention patterns within the wetland.

Geomorphology is defined in this context as the distribution and retention patterns of sediment within the wetland. This module focuses on evaluating current geomorphic health through the presence of indicators of excessive sediment inputs and/or losses for clastic (minerogenic) and organic sediment (peat).

Vegetation is defined in this context as the vegetation structural and compositional state. This module evaluates changes in vegetation composition and structure as a consequence of current and historic onsite transformation and/or disturbance.

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. The tool attempts to standardise the way that impacts are calculated and presented across each of the modules. This takes the form of assessing the spatial extent of impact of individual activities and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact.

An overall wetland health score is calculated by weighting the scores obtained for each module and combining them to give an overall combined score using the following formula:

Overall health rating = [(Hydrology*3) + (Geomorphology*2) + (Vegetation*2)] / 7

This overall score assists in providing an overall indication of wetland health/functionality which can in turn be used for recommending appropriate management measures.

Impact scores obtained for each of the modules reflect the degree of change from natural reference conditions. Resultant health scores fall into one of six health categories (A-F) on a gradient from "unmodified/natural" (Category A) to "severe/complete deviation from natural" (Category F) as depicted in **Table 6**.

Table 6: Health categories used by WET-Health for describing the integrity of wetlands

Impact Category	Description	Range	PES 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 recognizable.	6 – 7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	F

6.5 DETERMINING THE ECOLOGICAL IMPORTANCE AND SENSITIVITY OF WETLANDS

The Ecological Importance and Sensitivity of the wetlands present was determined by utilising a rapid scoring system. The system has been developed to provide a scoring approach for assessing the Ecological and Hydrological Functions, and the Direct Human Benefits of importance and sensitivity of wetlands. These scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze *et al.* (2008) on the assessment of wetland ecological goods and services from the WET-EcoServices tool (Rountree and Kotze, 2013). The aspects which are assessed in terms of their importance/sensitivity are indicated in **Table 7**. A rating of 0 (low sensitivity / low importance) to 4 (very high) is allocated to each aspect. An overall score is based on the highest score out of the three categories.

Table 7: Elements assessed to determine the Ecological Importance and sensitivity

Ecological/Biological Importance	Hydrological/Functional Importance	Importance of Direct Human Benefits
Biodiversity support	**Regulating and supporting benefits**	**Subsistence benefits**
– Presence of Red Data species	– Flood attenuation	– Water for human use
– Populations of unique species	– Streamflow regulation	– Harvestable resources
– Migration/breeding/feeding sites	**Water Quality Enhancement**	– Cultivated foods
Landscape scale	– Sediment trapping	**Cultural benefits**
– Protection status of the wetland	– Phosphate assimilation	– Cultural heritage
– Protection status of the vegetation type	– Nitrate assimilation	– Tourism and recreation
– Regional context of the ecological integrity	– Toxicant assimilation	– Education and research
– Size and rarity of the wetland type/s present	– Erosion control	
– Diversity of habitat types	**Carbon Storage**	
Sensitivity of the wetland		
– Sensitivity to changes in floods		
– Sensitivity to changes in low flows/dry season		
– Sensitivity to changes in water quality		
OVERALL IMPORTANCE *(highest out of the three categories)*		

6.6 ECOLOGICAL CLASSIFICATION AND DESCRIPTION

EcoClassification - the term used for the Ecological Classification process - refers to the determination and categorisation of the PES (health or integrity) of various biophysical attributes of watercourses relative to or close to the natural reference condition. The purpose of the EcoClassification process is to gain insights and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the watercourse.

The WET-Health is a tool designed to assess the health or integrity of a wetland (McFarlane *et al*., 2009). Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. Based on the delineation and classification, the systems identified do comprise of wetland like conditions (i.e. hydrological, geomorphic and vegetation).

The procedure of EcoClassification describes the health of a water resource and derives and formulates management targets / objectives / specifications for the resource. This provides the context for monitoring the water resource within an adaptive environmental management framework.

6.7 RECOMMENDED ECOLOGICAL CATEGORY

The recommended ecological category (REC) is the target or desired state of freshwater ecosystems required to meet water resource management objectives and quality targets. It is determined through the consideration of the PES, EIS and realistic opportunities to improve the PES that is driven by the context / setting. A generic matrix for the determination of RECs for water resources is shown in **Table 8** below.

Table 8: Generic Matrix for the Determination of REC for Water Resources

			EIS			
			Very High	**High**	**Moderate**	**Low**
PES	**A**	**Pristine/Natural**	A Maintain	A Maintain	A Maintain	A Maintain
	B	**Largely Natural**	A Improve	A/B Improve	B Maintain	B Maintain
	C	**Good-Fair**	B Improve	B/C Improve	C Maintain	C Maintain
	D	**Poor**	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	**Very Poor**	D Improve	E/F Improve	E/F Maintain	E/F Maintain

6.8 IMPACT ASSESSMENT

6.8.1 ASSESSMENT OF IMPACTS AND MITIGATION

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

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[2], indirect[3], secondary[4] as well as cumulative[5] 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[6] presented in **Table 9**.

Table 9: 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

[2] Impacts that arise directly from activities that form an integral part of the Project.
[3] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[4] Secondary or induced impacts caused by a change in the Project environment.
[5] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[6] 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.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

6.8.2 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 5** below.

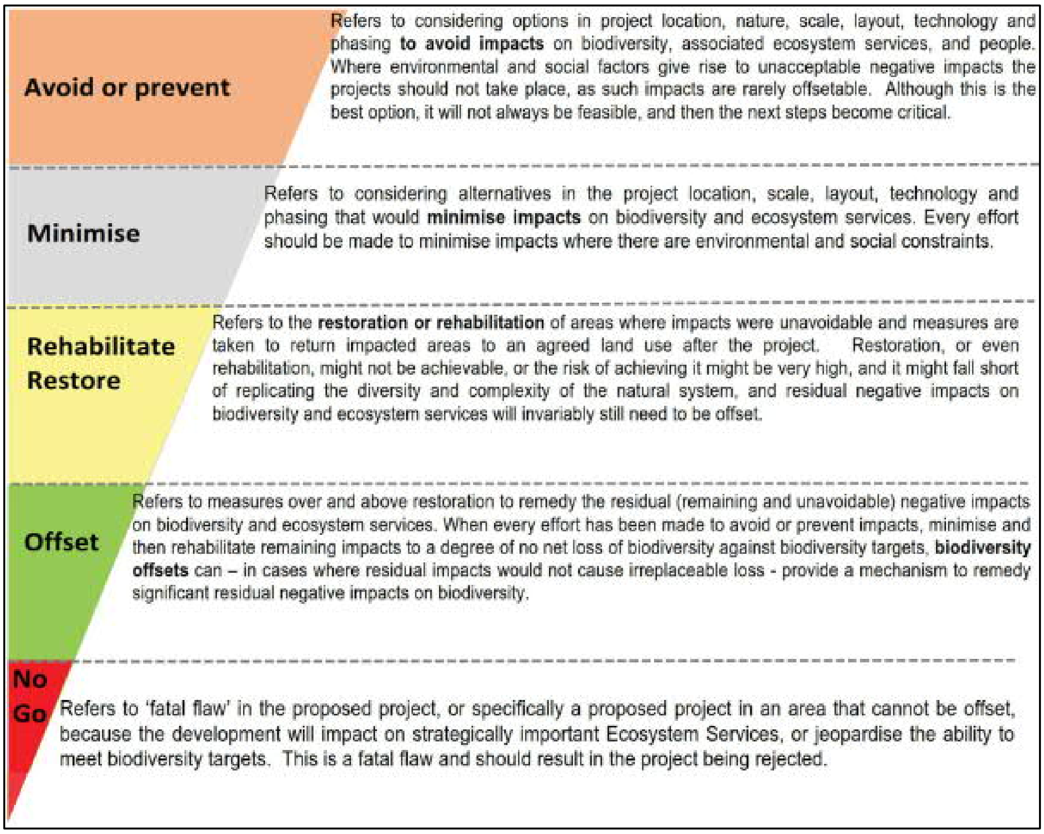


Figure 5: Mitigation Sequence/Hierarchy

7 KNOWLEDGE GAPS

Key assumptions and limitations relevant to the assessment included:

- The location and associated infrastructure were determined from information provided by BTE Renewables;
- Wetlands and/or riparian systems identified for delineation within the adjacent properties were based on a desktop review of available information and through a site inspection. This is reliant on various published data sources (e.g. aerial imagery and mapping) which have been assumed by WSP to be representative of site conditions;
- The wetland/riparian boundary comprises a gradually changing gradient of wetland/riparian indicators and varies both temporally and spatially; the wetland delineation thus occurs within a certain degree of tolerance;
- It should be recognised that there are several confounding effects on the interpretation of the historic and current extent, and functioning of the respective systems such as the historic and current industrial practices, roads, infilling, excavations/erosion, etc.;
- The wetland/riparian boundaries were accurately delineated based on the initial desktop review and site observations. The remaining watercourses were delineated at a desktop level and broadly verified in the field to obtain an extent of the wetland/riparian areas;
- This report accounts for the potential impacts of the proposed project and associated activities only; and,
- The findings, results, observations, conclusions and recommendations given in this report are based on WSP's best scientific and professional knowledge as well as available information.

8 RESULTS

8.1 WETLAND DELINEATION

A desktop assessment, utilising aerial imagery (2004 – 2021) and available datasets (NFEPA, 2011), was conducted to determine potential wetland or riparian habitats in the area under consideration. An in-field assessment was conducted in September 2021. The desktop review and subsequent infield assessment (through soil sampling and an analysis of vegetation) identified three seasonal channelled valley-bottom (CVB) wetlands and riparian zones associated with the ephemeral headwaters and tributaries (**Figure 6**).

8.1.1 DESCRIPTION AND FUNCTIONALITY OF THE WETLANDS

CHANNELLED VALLEY-BOTTOM WETLANDS

Channelled valley-bottom wetlands are characterised by their location on valley floors, the absence of characteristic floodplain features and the presence of a river channel flowing through the wetland (Ollis *et al.*, 2013). The dominant water inputs to these wetlands are from the river channel flowing through the wetland, either as surface flow resulting from flooding or as subsurface flow, and/or from adjacent valley-side slopes (as overland flow or interflow). Water generally moves through the wetland as diffuse surface flow, although occasional, short-lived concentrated flows are possible during flooding events (Ollis *et al.*, 2013).

Water generally exits a channelled valley-bottom wetland in the form of diffuse surface or subsurface flow into the adjacent river, with infiltration into the ground and evapotranspiration of water from these wetlands also being potentially significant (Ollis *et al.*, 2013). An illustration of the typical features associated with a floodplain wetland are presented in **Figure 7**.

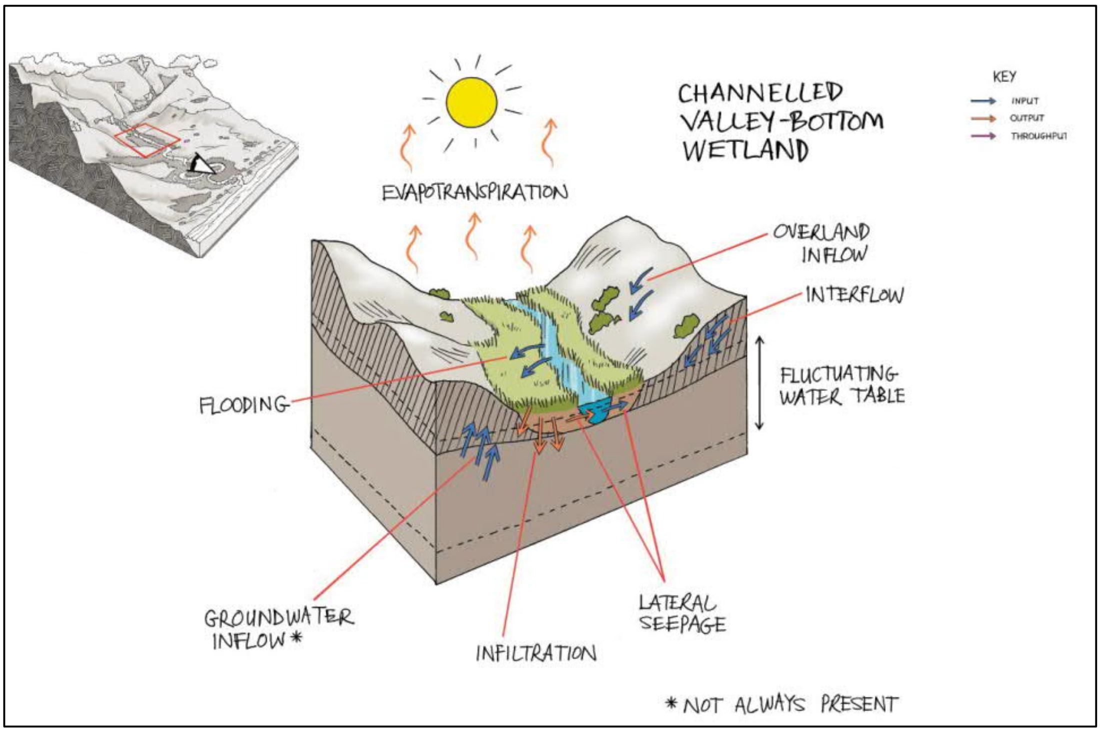
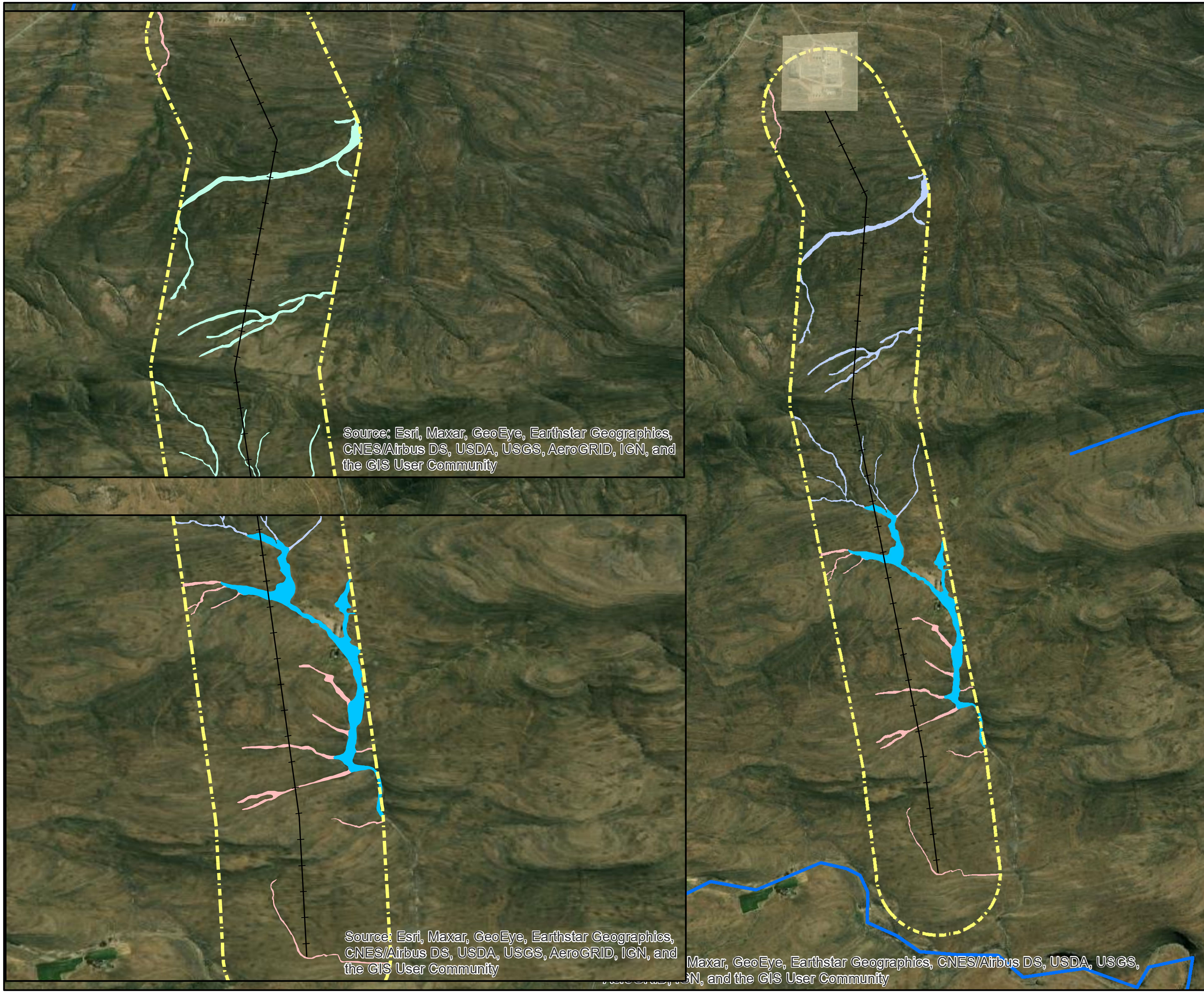


Figure 6: Conceptual Illustration of a Channelled Valley-Bottom Wetland (Ollis *et al.*, 2013)



BTE RENEWABLES
ESIZAYO WIND FARM
IDENTIFIED WATERCOURSES

Legend

Proposed 132kV Line Route

Komsburg Substation

Rivers

500m Buffer

Watercourses

CVB (Seasonal)

Riparian A (Ephemeral Headwaters)

Riparian A (Ephemeral Tributary)

N

0 150 300 600 900 1 200
Meters

DISCLAIMER

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DATA SOURCE:

SOUTH AFRICAN DEPARTMENT OF RURAL DEVELOPMENT AND LAND REFORM-
CHIEF DIRECTORATE: NATIONAL GEO SPATIAL INFORMATION

PROJECTION: GCS_WGS_1984

PROJECT TITLE:
DNG ENERGY - FEASIBILITY STUDY

SCALE: 1:40 000	DRAWN BY: TUMELO TSEPHE
DATE: 2021/05/19	REVIEWED BY: ZAKARIYA NAKHOODA

FIGURE NO: 2	PROJECT NO: 41103481	REV: 0

RIPARIAN ZONES

A riparian zone is a habitat, comprising bare soil, rock and/or vegetation that is: (i) associated with a watercourse; (ii) commonly characterised by alluvial soils; and (iii) inundated or flooded to an extent and with a frequency sufficient to support vegetation species with a composition and physical structure distinct from those of adjacent land areas (DWAF, 2005) (**Figure 8**). In terms of Section 1 of the NWA, riparian habitat is legally defined as: 'habitat that "…includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."

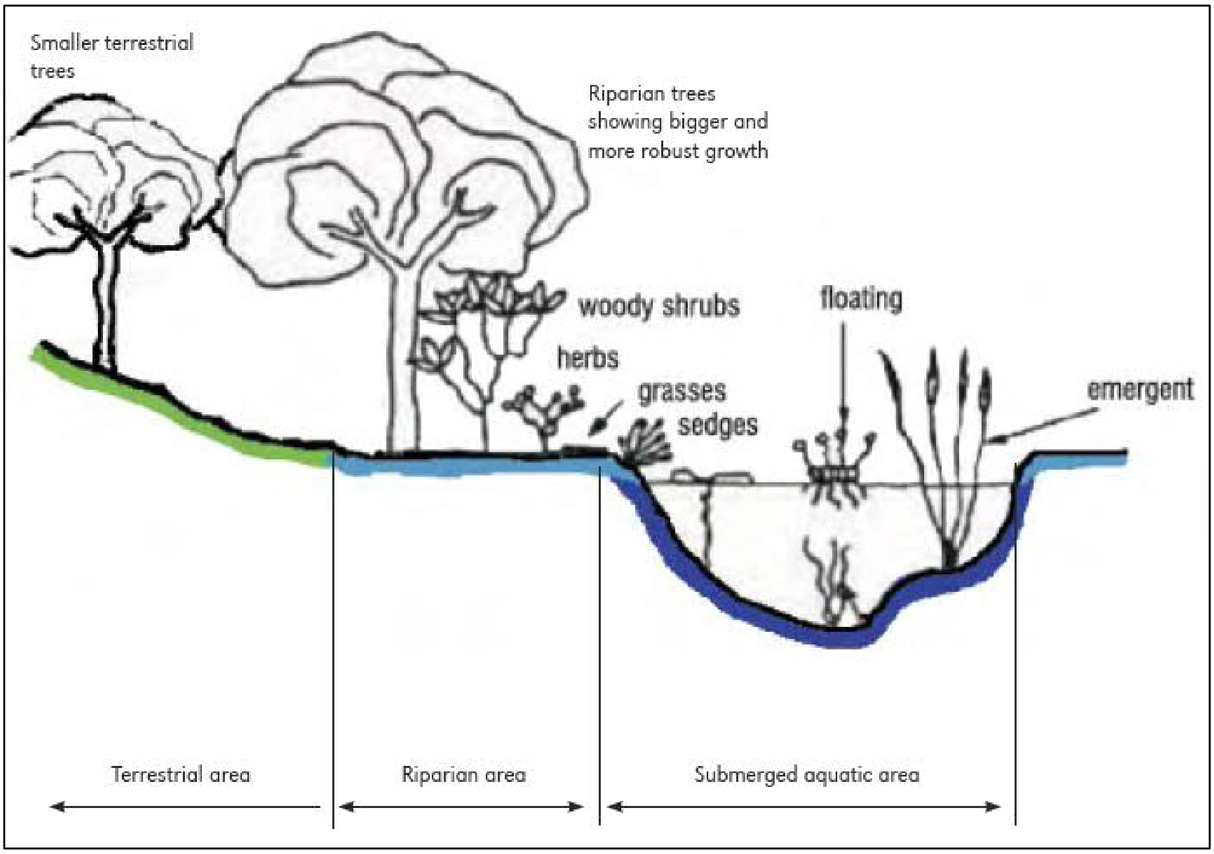

Figure 8: Typical Cross Section of a River Channel (DWAF, 2005)

8.2 WETLAND UNIT SETTING

The setting of the identified wetland was classified as per **Table 10** below.

Table 10: Wetland/Watercourse Unit Setting

Unit	Regional Setting (Level 2) (NFEPA WetVeg)	Landscape Setting (Level 3)	HGM Unit (Level 4)
CVB 1, 2 and 3	Karoo Shale Renosterveld	Valley Bottom	Channelled Valley Bottom
Riparian Zone (Headwaters)		Slope	Riparian Zone
Riparian Zone (Tributaries)		Slope	Riparian Zone

8.3 PES ASSESSMENT

8.3.1 CVB WETLAND SYSTEMS

The PES assessment of a wetland systems is based on an understanding of both catchment and on-site impacts and the impact that these aspects have on the wetland hydrology, geomorphology and vegetation. The level 1 WET-Health assessment determined the PES of the identified wetlands (**Table 11**).

Table 11: Overall PES of the Identified Wetlands

Unit	PES Score (out of 10)	Class
CVB1	2.4	C: Moderately Modified
CVB2	5.1	D: Largely Modified
CVB2	2.3	C: Moderately Modified

CVB 1

The system has been moderately modified owing to the changes in the surrounding land use. This includes the presence of road infrastructure, grazing and minor volumes of water abstraction. Additionally, minor evidence of sediment deposits, possibly emanating from the adjacent hillslopes was observed within the CVB 1 system possibly emanating from the adjacent hillslopes.

The hydrological, geomorphological and vegetation integrity of the system is assessed to decrease slightly over the next 5 years.

CVB 2

The system has been largely modified owing to the land use types within the system itself and on the banks. Historically natural areas have been transformed to agricultural areas, resulting in habitat loss and altered the movement and retention of flows.

The geomorphology of the system has been impacted upon by sediment deposition within. The system also experiences reduced flood peaks and transport of sediments as a result of current agricultural activities.

The activities that have occurred in the wetland to accommodate the agricultural activities have resulted in vegetation loss.

The hydrological, geomorphological and vegetation integrity of the system is assessed to decrease slightly over the next 5 years.

CVB 3

The system has been moderately modified owing to the changes in the surrounding land use. This includes the presence of road infrastructure, grazing, small scale agriculture (upslope) and minor volumes of upslope water abstraction. Additionally, minor evidence of sediment deposits, possibly emanating from the adjacent hillslopes and agricultural area was observed within the CVB 3 system possibly emanating from the adjacent hillslopes.

The hydrological, geomorphological and vegetation integrity of the system is assessed to decrease slightly over the next 5 years.

8.3.2 EPHEMERAL RIPARIAN SYSTEMS

For the purposes of this assessment, the present ecological state of the ephemeral riparian zone units was assessed at the process unit scale by qualitatively rating the condition of vegetation communities using the vegetation impact rating guidelines provided in the vegetation component of the Level 1 WET-Health tool (Macfarlane *et al*., 2008). The condition of the vegetation within each process unit was rated as a percentage condition or habitat value score (out of 100). This qualitative rating approach was considered acceptable in this context[7] owing to the absence of hydrogeomorphic conditions within the ephemeral riparian zones.

The riparian systems identified were assessed as being moderately modified (**Table 12**) owing to changes associated with the surrounding land use.

Table 12: Overall PES of the Identified Riparian Area

Unit	PES Score (out of 10)	Class
RH 1	2.4	C: Moderately Modified
RH 2	2.4	C: Moderately Modified
RH 3	2.4	C: Moderately Modified
RH 4	2.4	C: Moderately Modified
RH 5	2.4	C: Moderately Modified
RH 6	2.4	C: Moderately Modified
RT 1	2.5	C: Moderately Modified
RT 2	2.5	C: Moderately Modified
RT 3	2.9	C: Moderately Modified
RT 4	2.9	C: Moderately Modified
RT 5	2.9	C: Moderately Modified
RT 6	2.9	C: Moderately Modified
RT 7	2.9	C: Moderately Modified
RT 8	2.5	C: Moderately Modified
RT 9	2.5	C: Moderately Modified
RT 10	2.5	C: Moderately Modified
RT 11	2.5	C: Moderately Modified

8.4 ECOLOGICAL FUNCTIONAL ASSESSMENT

8.4.1 CVB WETLAND SYSTEMS

The typical functionality of channelled valley-bottom wetland tends to contribute less towards flood attenuation and sediment trapping compared to that of typical floodplain wetland types but would supply these benefits to a certain extent. The potential for removal of nutrients and toxicants would generally be expected to some degree, particularly from diffuse water inputs from adjacent hillslopes (Kotze *et al*. 2009).

The overall goods and services provided by the CVB wetland systems were assessed range between moderately high and moderately low. The scores on the higher end were as a result of maintenance of biodiversity within the systems, whereas the scores on the lower end related to water quality enhancement and use of the resource for cultural or recreational activities.

[7] It is important to note however that more formal sampling methods are prescribed to appropriately quantify current conditions and to act as a baseline.

8.4.2 EPHEMERAL RIPARIAN SYSTEMS

Riparian areas perform a variety of functions that are of value to society, particularly the protection and enhancement of water resources, and provision of habitat for plant and animal species.

The overall goods and services provided by the ephemeral riparian systems were assessed to range between moderate to high. The scores on the higher end were as a result of maintenance of biodiversity within the riparian zones, whereas the scores on the lower end related to water quality enhancement and use of the resource for cultural or recreational activities.

8.5 ECOLOGICAL IMPORTANCE AND SENSITIVITY

8.5.1 CVB WETLAND SYSTEMS

CVB 1 and CVB 3 wetland systems were assessed as having an overall moderate to high EIS (**Table 13**) driven by the high bio-diversity maintenance scores. It is not classified as a 'Wetland FEPA' (Nel *et al*., 2011) and is thus not considered important in meeting national wetland conservation targets.

The CVB 3 wetland system was assessed as having an overall moderate to low EIS (**Table 13**), owing to the modified nature of the system.

All three CVB systems have low direct benefits to society mainly due to the lack of harvestable resources.

Table 13: The EIS Assessment for the CVB Wetland Systems

Unit	Ecological/ Biological Importance	Functional/ Hydrological Importance	Direct Benefits to Society	Overall Importance (/4)	
CVB 1	2.6	1.6	0.5	2.6	Moderate-High
CVB 2	1.1	1.4	0.8	1.4	Moderate-Low
CVB 3	2.6	1.6	0.7	2.6	Moderate-High

8.5.2 EPHEMERAL RIPARIAN SYSTEMS

The ephemeral riparian systems were assessed as having an overall moderate to high EIS (**Table 14**), apart from RT 3 and RT 7, both having a moderate EIS. The EIS scores are driven by the high bio-diversity maintenance scores.

All the ephemeral riparian systems have low direct benefits to society mainly due to the lack of harvestable resources.

Table 14: The EIS Assessment for the Ephemeral Riparian Systems

Unit	Ecological/ Biological Importance	Functional/ Hydrological Importance	Direct Benefits to Society	Overall Importance (/4)	
RH 1	2.4	1.5	0.7	2.4	Moderate-High
RH 2	2.4	1.5	0.7	2.4	Moderate-High
RH 3	2.4	1.5	0.7	2.4	Moderate-High
RH 4	2.4	1.5	0.7	2.4	Moderate-High
RH 5	2.4	1.5	0.7	2.4	Moderate-High
RH 6	2.4	1.5	0.7	2.4	Moderate-High

Unit	Ecological/ Biological Importance	Functional/ Hydrological Importance	Direct Benefits to Society	Overall Importance (/4)	
RT 1	2.4	1.2	0.7	2.4	Moderate-High
RT 2	2.4	1.2	0.7	2.4	Moderate-High
RT 3	2.1	1.2	0.6	2.1	Moderate
RT 4	2.4	1.2	0.7	2.4	Moderate-High
RT 5	2.4	1.2	0.7	2.4	Moderate-High
RT 6	2.4	1.2	0.7	2.4	Moderate-High
RT 7	2.1	1.2	0.6	2.1	Moderate
RT 8	2.4	1.2	0.7	2.4	Moderate-High
RT 9	2.4	1.2	0.7	2.4	Moderate-High
RT 10	2.4	1.2	0.7	2.4	Moderate-High
RT 11	2.4	1.2	0.7	2.4	Moderate-High

8.6 RECOMMENDED ECOLOGICAL CATEGORY

8.6.1 CVB SYSTEMS

As summarised in **Table 15** below, the PES of wetland systems, CVB 1 to CVB 3 are in line with REC as per **Table 8** (Chapter 6.7) guidance. The management objective of the project should be to ensure that all impacts are minimised such that there is no change in PES for all systems assessed.

Table 15: Summary of the REC for the Wetland Systems

Unit	PES	EIS	REC	Management Objective
CVB 1	2.5 (C)	2.6 (Mod-High)	C	Maintain
CVB 2	5.1 (D)	1.4 (Mod- Low)	D	Maintain
CVB 3	2.3 (C)	2.6 (Mod-High)	C	Maintain

8.6.2 EPHEMERAL RIPARIAN SYSTEMS

As summarised in **Table 16** below, the PES of ephemeral riparian systems are in line with REC as per **Table 8** (Chapter 6.7) guidance. The management objective of the project should be to ensure that all impacts are minimised such that there is no change in PES for all systems assessed.

Table 16: Summary of the REC for the Ephemeral Riparian Systems

Unit	PES	EIS	REC	Management Objective
RH 1	2.4	2.4	C	Maintain
RH 2	2.4	2.4	C	Maintain
RH 3	2.4	2.4	C	Maintain

Unit	PES	EIS	REC	Management Objective
RH 4	2.4	2.4	C	Maintain
RH 5	2.4	2.4	C	Maintain
RH 6	2.4	2.4	C	Maintain
RT 1	2.5	2.4	C	Maintain
RT 2	2.5	2.4	C	Maintain
RT 3	2.9	2.1	C	Maintain
RT 4	2.9	2.4	C	Maintain
RT 5	2.9	2.4	C	Maintain
RT 6	2.9	2.4	C	Maintain
RT 7	2.9	2.1	C	Maintain
RT 8	2.5	2.4	C	Maintain
RT 9	2.5	2.4	C	Maintain
RT 10	2.5	2.4	C	Maintain
RT 11	2.5	2.4	C	Maintain

9 IMPACT ASSESSMENT

The impacts identified for the proposed 132kv powerline are assessed in the section that follows. The methodology for defining the significance of the respective impacts is described in section 6.8 of this report. The impacts have been assessed for the construction, operational and de-commissioning phases of the project.

9.1 CONSTRUCTION PHASE

The following activities will be carried out during the construction of the 132kV powerline.

- Drilling of holes (typically 2-3m in depth);
- Planting of poles;
- Stringing of conductors, and
- Possible excavations and stabilized backfill.

The anticipated impacts for the proposed 132kV powerline during the construction phase of the project are presented in **Table 17**, together with associated mitigative measures**.**

Table 17: Construction Phase Impact Assessment

Impact	**Alteration of the Natural Flow Regime**
Impact description	The construction of access roads and laydown areas may result in alterations to the natural flow regimes through increased runoff, water abstractions or flow diversions.
Mitigation	– No water should be abstracted from the wetland area. Ideally water required during the construction phase must be sourced from an external source (i.e. outside of the wetland contributing area). – Existing access routes should be utilised. Should access roads need to traverse watercourse, these should be perpendicular to the watercourse with appropriately designed culverts.

<table>
<tr><td></td><td>
– It is recommended that, where possible, laydown areas and construction camps are to be developed outside the riparian zone or 100m from a watercourse, whichever is greatest.
– The pole sites should be contoured to allow for surface water to readily drain away (as it would under natural conditions) and to prevent ponding of water within areas where it would not have ponded before the construction activities.
– Vegetation clearing, soil stripping and major earthmoving activities must be phased to minimise the extent of bare soils surfaces exposed at any one time. Ideally, this should be undertaken during the dry season.
– If possible, construction activities should be undertaken during the dry season.
</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>5</td><td>2</td><td>3</td><td>2</td><td>3</td><td>36</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td>14</td></tr>
<tr><td colspan="6">N3 - Moderate</td><td colspan="6">N1 – Very Low</td></tr>
</table>
</td></tr>
<tr><td>Impact</td><td>Water Quality</td></tr>
<tr><td>Impact description</td><td>Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems.</td></tr>
<tr><td>Mitigation</td><td>
– Areas for waste disposal should be clearly demarcated and should be bunded and on hard standing. These areas should be located outside the riparian zone or 100m from a watercourse, whichever is greatest.
– Ensure that no equipment is washed in the streams and wetlands of the area, and if washing facilities are provided, that these are located outside the riparian zone or 100m from a watercourse, whichever is greatest.
– Procedures for containment of leaks/spills as well as associated emergency response plans should be developed.
– Machinery and equipment must be inspected regularly for faults and possible leaks. If required, servicing of these should occur off outside the riparian zone or 100m from a watercourse, whichever is greatest.
– Potential contaminants used and stored at the proposed project site should be stored and prepared on bunded surfaces to contain spills and leaks.
– Adequate ablution facilities should be developed and located outside the riparian zone or 100m from a watercourse, whichever is greatest.
</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>1</td><td>2</td><td>4</td><td>36</td><td>2</td><td>2</td><td>1</td><td>2</td><td>3</td><td>21</td></tr>
<tr><td colspan="6">N3 - Moderate</td><td colspan="6">N2 - Low</td></tr>
</table>
</td></tr>
<tr><td>Impact</td><td>Loss of wetland and riparian functionality</td></tr>
</table>

<table>
<tr><td>Impact description</td><td>Degradation of wetland/riparian habitat due to the positioning of the powerline stand poles</td></tr>
<tr><td>Mitigation</td><td>– A layout plan must be compiled indicating the limits of disturbance associated with the proposed infrastructure in relation to the identified sensitive areas (i.e. wetlands). No-go areas and any stormwater infrastructure must be indicated on this plan together with erosion and sediment, controls and measures.
– Stringing should make use of a running block and span, limiting intrusion into the freshwater habitat systems.
– The pole sites should be contoured to allow for surface water to readily drain away (as it would under natural conditions) and to prevent ponding of water within areas where it would not have ponded before the construction activities.
– The identified wetlands and riparian areas are to be designated as “highly sensitive”.
– Planning the location of poles should factor in the wetlands and riparian areas, with pole placement taking place outside these systems.
– In the event that poles need to be placed within the wetland or riparian systems, an application for a Water Use Licence (WUL) in terms of Section 21 of the National Water Act (NWA) (Act 36 of 1998) must be undertaken</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>3</td><td>2</td><td>4</td><td>44</td><td>3</td><td>2</td><td>1</td><td>2</td><td>2</td><td>16</td></tr>
<tr><td colspan="6">N3 - Moderate</td><td colspan="6">N2 - Low</td></tr>
</table>
</td></tr>
<tr><td>Impact</td><td>Loss of wetland and riparian functionality</td></tr>
<tr><td>Impact description</td><td>Degradation of wetland/riparian habitat due to the need for access roads</td></tr>
<tr><td>Mitigation</td><td>– A layout plan must be compiled indicating the limits of disturbance associated with the proposed infrastructure in relation to the identified sensitive areas (i.e. wetlands). No-go areas and any stormwater infrastructure must be indicated on this plan together with erosion and sediment, controls and measures.
– The identified wetlands and riparian areas are to be designated as “highly sensitive”.
– Existing access routes must be utilised.
– Should the need for additional access routes arise, these should be perpendicular to the watercourse and developed with appropriately sized culvers.
– In the event that access roads need to be constructed, an application for a Water Use Licence (WUL) in terms of Section 21 of the National Water Act (NWA) (Act 36 of 1998) must be undertaken</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>5</td><td>2</td><td>3</td><td>2</td><td>4</td><td>48</td><td>3</td><td>2</td><td>1</td><td>2</td><td>3</td><td>24</td></tr>
<tr><td></td><td colspan="6">N3 - Moderate</td><td colspan="6">N2 - Low</td></tr>
<tr><td>Impact</td><td colspan="12">Increased soil erosion and sedimentation.</td></tr>
<tr><td>Impact description</td><td colspan="12">Increased soil erosion due to vegetation clearance, soil disturbance and high traffic movement on site. Subsequent potential sedimentation of watercourses.</td></tr>
<tr><td>Mitigation</td><td colspan="12">– During the construction phase sediment control measures must be adopted in order to prevent sediment entering the wetland.
– Vegetation clearing, soil stripping and major earthmoving activities must be phased to minimise the extent of bare soils surfaces exposed at any one time. Ideally, this should be undertaken during the dry season.
– Traffic of construction vehicles should be kept to a minimum to reduce soil compaction, and limited to existing or proposed roadways where practical.
– Soils excavated during construction of the infrastructure should be appropriately stored in stockpiles which are protected from erosion (i.e. through use of vegetation cover in the case of long-term stockpiles).
– Upon completion of construction, the laydown areas and construction camp sites are to be rehabilitated.
– Gabions or Reno Mattresses should be used where evidence of erosion is present.</td></tr>
<tr><td>Ease of mitigation</td><td colspan="12">Moderate</td></tr>
<tr><td rowspan="4">Significance rating</td><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>3</td><td>2</td><td>4</td><td>44</td><td>2</td><td>2</td><td>1</td><td>2</td><td>3</td><td>21</td></tr>
<tr><td colspan="6">N3 - Moderate</td><td colspan="6">N2 - Low</td></tr>
<tr><td>Impact</td><td colspan="12">Alien vegetation establishment</td></tr>
<tr><td>Impact description</td><td colspan="12">Potential for alien vegetation to colonise impacted areas.</td></tr>
<tr><td>Mitigation</td><td colspan="12">– It is essential that all alien invasive species be removed from the site.
– As part of the rehabilitation initiatives, an alien removal and monitoring plan should be established that addresses alien vegetation in the wetland areas. The programme is to include regular clearing of alien vegetation and monitoring thereof to assess the success of activities and recommend additional measures if required. Alien vegetation removal and monitoring is to be implemented based on the plan.</td></tr>
<tr><td>Ease of mitigation</td><td colspan="12">Moderate</td></tr>
<tr><td rowspan="2">Significance rating</td><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
</table>

	4	2	1	2	3	27	2	2	1	2	1	7
	N2 - Low						N1 – Very Low					

9.2 OPERATIONAL PHASE

The anticipated impacts for the proposed 132kV powerline during the operational phase of the project are summarised in **Table 18**. The impacts summarised below are relevant to the freshwater habitats identified within a 500m radius of the powerline.

Table 18: Operational Phase Impact Assessment

Impact	**Water Quality**											
Impact description	Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems.											
Mitigation	– Areas for waste disposal should be clearly demarcated and should be bunded and on hard standing. These areas should be located outside the riparian zone or 100m from a watercourse, whichever is greatest. – Ensure that no equipment is washed in the streams and wetlands of the area, and if washing facilities are provided, that these are located outside the riparian zone or 100m from a watercourse, whichever is greatest. – Procedures for containment of leaks/spills as well as associated emergency response plans should be developed. – Machinery and equipment must be inspected regularly for faults and possible leaks. If required, servicing of these should occur off outside the riparian zone or 100m from a watercourse, whichever is greatest. – Potential contaminants used and stored at the proposed project site should be stored and prepared on bunded surfaces to contain spills and leaks. – Adequate ablution facilities should be developed and located outside the riparian zone or 100m from a watercourse, whichever is greatest.											
Ease of mitigation	Moderate											
Significance rating	Pre-Mitigation						Post-Mitigation					
	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
	4	2	1	2	3	27	2	2	1	2	1	7
	N2 - Low						N1 - Very Low					
Impact	**Loss of wetland and riparian habitat**											
Impact description	Degradation of wetland/riparian habitat when undertaking maintenance activities											
Mitigation	– A layout plan must be compiled indicating the limits of disturbance associated with the proposed infrastructure in relation to the identified sensitive areas (i.e. wetlands). No-go											

<table>
<tr><td></td><td>areas and any stormwater infrastructure must be indicated on this plan together with erosion and sediment, controls and measures.
– The identified wetlands and riparian areas are to be designated as “highly sensitive”.
– Existing access routes should be utilised t o access the powerline infrastructure.</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>3</td><td>2</td><td>2</td><td>22</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>7</td></tr>
<tr><td colspan="6">N2 - Low</td><td colspan="6">N1 –Very Low</td></tr>
</table>
</td></tr>
<tr><td>Impact</td><td>Increased soil erosion and sedimentation.</td></tr>
<tr><td>Impact description</td><td>Increased soil erosion due to vegetation clearance, soil disturbance and high traffic movement on site. Subsequent potential sedimentation of watercourses.</td></tr>
<tr><td>Mitigation</td><td>– During maintenance, sediment control measures must be adopted in order to prevent sediment entering the wetland.
– Vegetation clearing, soil stripping and major earthmoving activities must be phased to minimise the extent of bare soils surfaces exposed at any one time. Ideally, this should be undertaken during the dry season.
– Traffic of maintenance vehicles should be kept to a minimum to reduce soil compaction, and limited to existing or proposed roadways where practical.
– Soils excavated during maintenance of the infrastructure should be appropriately stored in stockpiles which are protected from erosion (i.e. through use of vegetation cover in the case of long-term stockpiles).
– Upon completion of maintenance, the laydown areas and construction camp sites are to be rehabilitated.
– Gabions or Reno Mattresses should be used where evidence of erosion is present.</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>3</td><td>2</td><td>3</td><td>33</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td>14</td></tr>
<tr><td colspan="6">N3 - Moderate</td><td colspan="6">N1 – Very Low</td></tr>
</table>
</td></tr>
</table>

9.3 DECOMISSIONING PHASE

The anticipated impacts for the proposed 132kV powerline during the decommissioning phase of the project are summarised in **Table 19**. The impacts summarised below are relevant to the freshwater habitats identified within a 500m radius of the powerline.

Table 19: Decommissioning Phase Impact Assessment

<table>
<tr><th>Impact</th><th colspan="12">Water Quality</th></tr>
<tr><td>Impact description</td><td colspan="12">Potential spillage of hazardous substances such as oils, fuel, grease from vehicles, and sewage from on-site sanitation systems.</td></tr>
<tr><td>Mitigation</td><td colspan="12">– Areas for waste disposal should be clearly demarcated and should be bunded and on hard standing. These areas should be located outside the riparian zone or 100m from a watercourse, whichever is greatest.
– Ensure that no equipment is washed in the streams and wetlands of the area, and if washing facilities are provided, that these are located outside the riparian zone or 100m from a watercourse, whichever is greatest.
– Procedures for containment of leaks/spills as well as associated emergency response plans should be developed.
– Machinery and equipment must be inspected regularly for faults and possible leaks. If required, servicing of these should occur off outside the riparian zone or 100m from a watercourse, whichever is greatest.
– Potential contaminants used and stored at the proposed project site should be stored and prepared on bunded surfaces to contain spills and leaks.
– Adequate ablution facilities should be developed and located outside the riparian zone or 100m from a watercourse, whichever is greatest.</td></tr>
<tr><td>Ease of mitigation</td><td colspan="12">Moderate</td></tr>
<tr><td rowspan="4">Significance rating</td><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>1</td><td>2</td><td>3</td><td>27</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>7</td></tr>
<tr><td colspan="6">N2 - Low</td><td colspan="6">N1 - Very Low</td></tr>
<tr><td>Impact</td><td colspan="12">Loss of wetland and riparian habitat</td></tr>
<tr><td>Impact description</td><td colspan="12">Degradation of wetland/riparian habitat when undertaking decommissioning activities</td></tr>
<tr><td>Mitigation</td><td colspan="12">– A layout plan must be compiled indicating the limits of disturbance associated with the proposed infrastructure in relation to the identified sensitive areas (i.e. wetlands). No-go areas and any stormwater infrastructure must be indicated on this plan together with erosion and sediment, controls and measures.
– The identified wetlands and riparian areas are to be designated as “highly sensitive”.
– Rehabilitation of the sites must be undertaken in line with the bio-diversity assessment report outomes.
– Existing access routes should be utilised to access the powerline infrastructure.</td></tr>
<tr><td>Ease of mitigation</td><td colspan="12">Moderate</td></tr>
</table>

<table>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>3</td><td>2</td><td>2</td><td>22</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>7</td></tr>
<tr><td colspan="6">N2 - Low</td><td colspan="6">N1 –Very Low</td></tr>
</table>
</td></tr>
<tr><td>Impact</td><td>Increased soil erosion and sedimentation.</td></tr>
<tr><td>Impact description</td><td>Increased soil erosion due to vegetation clearance, soil disturbance and high traffic movement on site. Subsequent potential sedimentation of watercourses.</td></tr>
<tr><td>Mitigation</td><td>
– Sediment control measures must be adopted in order to prevent sediment entering the wetland.
– Vegetation clearing, soil stripping and major earthmoving activities must be phased to minimise the extent of bare soils surfaces exposed at any one time. Ideally, this should be undertaken during the dry season.
– Traffic should be kept to a minimum to reduce soil compaction, and limited to existing or proposed roadways where practical.
– Soils excavated during decommissioning of the infrastructure should be appropriately stored in stockpiles which are protected from erosion (i.e. through use of vegetation cover in the case of long-term stockpiles).
– Upon completion of decommissioning, the work area, laydown areas and construction camp sites are to be rehabilitated.
– Gabions or Reno Mattresses should be used where evidence of erosion is present.
</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
<tr><td>4</td><td>2</td><td>3</td><td>2</td><td>3</td><td>33</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td>14</td></tr>
<tr><td colspan="6">N3 - Moderate</td><td colspan="6">N1 – Very Low</td></tr>
</table>
</td></tr>
<tr><td>Impact</td><td>Alien vegetation establishment</td></tr>
<tr><td>Impact description</td><td>Potential for alien vegetation to colonise impacted areas.</td></tr>
<tr><td>Mitigation</td><td>
– It is essential that all alien invasive species be removed from the site.
– As part of the rehabilitation initiatives, an alien removal and monitoring plan should be established that addresses alien vegetation in the wetland areas. The programme is to include regular clearing of alien vegetation and monitoring thereof to assess the success of activities and recommend additional measures if required. Alien vegetation removal and monitoring is to be implemented based on the plan.
</td></tr>
<tr><td>Ease of mitigation</td><td>Moderate</td></tr>
<tr><td>Significance rating</td><td>
<table>
<tr><td colspan="6">Pre-Mitigation</td><td colspan="6">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td></tr>
</table>
</td></tr>
</table>

	4	2	1	2	3	27	2	2	1	2	1	7
	N2 - Low						N1 – Very Low					

10 CONCLUSIONS

A total of three CVB wetland systems were identified within 500m of the proposed 132kV powerline. Additionally, 17 riparian systems associated with the ephemeral tributaries and headwaters were also identified.

The CVB wetland systems, CVB1, CVB 2 and CVB 3 were assessed to have a **PES** of **C, D** and **C** respectively. The riparian systems were assessed to have a **PES** of **C**. The **EIS** of the wetland and riparian systems ranged between moderately low to moderately high for biodiversity maintenance.

The outcomes of the impact assessment determined that the construction, operation of the proposed infrastructure does have the potential to impact the identified wetland and riparian systems, with impact ratings between **Low** and **Medium**. However with mitigative measures in place the risks associated with the proposed infrastructure are **Low**.

Prior to undertaking the proposed activities, construction method statements and emergency response plans must be developed, with specific consideration given to the environment, including wetland habitats. Furthermore, the required authorisation must be attained from the Department of Water and Sanitation.

It is envisaged that the implementation of these measures would provide sufficient mitigation in order to reduce the environmental impact. If the recommended mitigative measures are implemented correctly, including adherence to the DWS Environmental Best Practice Guidelines and the Work Method Statements, the overall significance of the impacts may be reduced.

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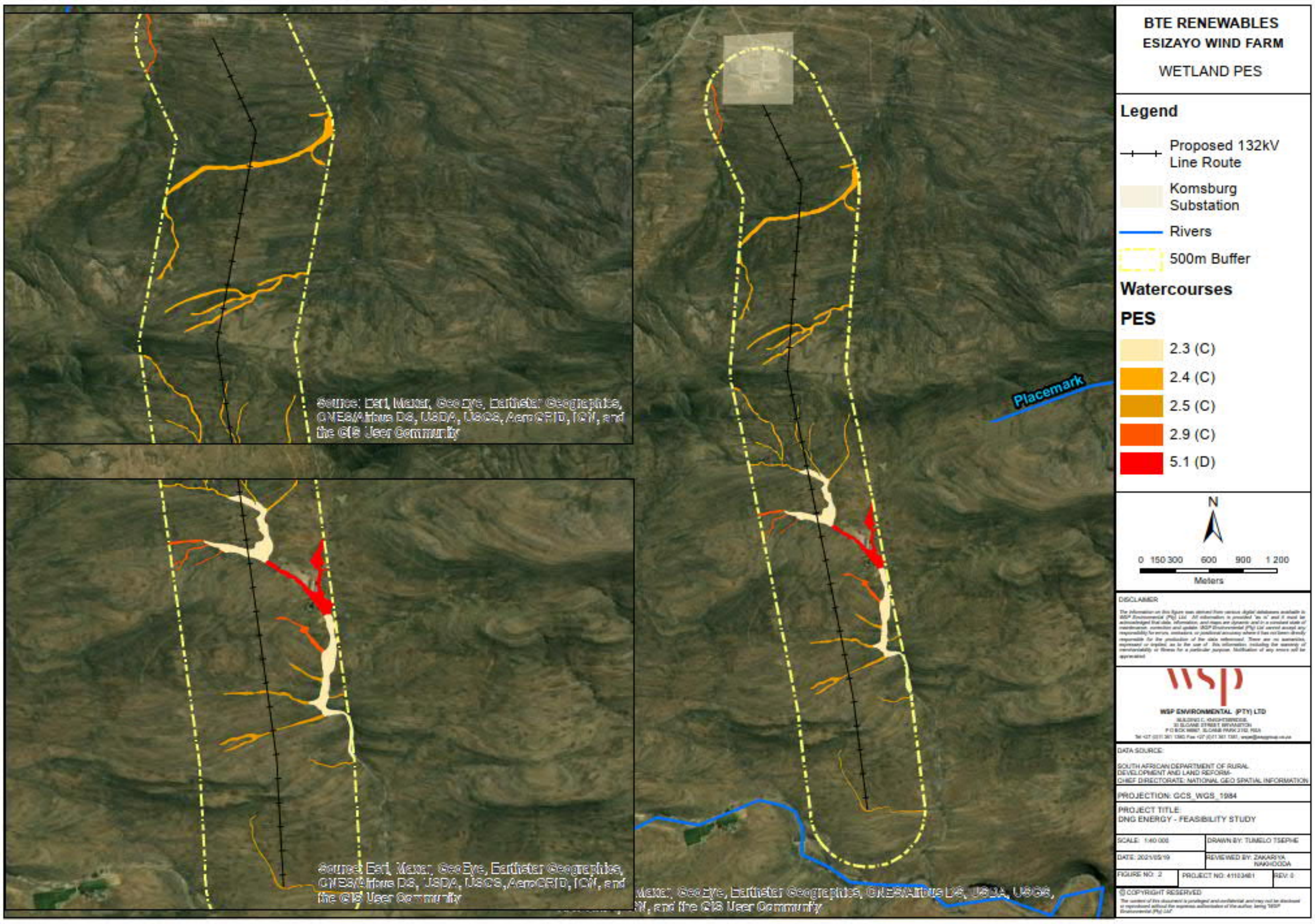
APPENDIX

A PES AND EIS IMAGES

APPENDIX

A-1 PES



APPENDIX

A-2 *EIS*