Nkurenkuru

ECOLOGY & BIODIVERSITY

UMMBILA ELECTRICAL GRID INFRASTRUCTURE, MPUMALANGA PROVINCE

EIA PHASE:

FRESHWATER RESOURCE STUDY AND ASSESSMENT

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I. DECLARATION OF CONSULTANT INDEPENDENCE

The consultants hereby declare that they:

- act/ed as the independent specialists in this application;
- regard the information contained in this report as it relates to specialist input/study to be true and correct at the time of publication;
- do not, and will not, have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA Environmental Impact Assessment Regulations, 2014, and any specific environmental management Act;
- do not, and will not, have any vested interest(s) in the proceedings of the proposed activities;
- have disclosed, to the applicant, EAP, and competent authority(-ies), any information that have, or may have, the potential to influence the decision of the competent authority(-ies) or the objectivity of any report, plan, or document required in terms of the NEMA Environmental Impact Assessment Regulations 2014, and any specific environmental management Act;
- are fully aware of, and meet, the responsibilities in terms of the NEMA Environmental Impact Assessment Regulations 2014 (specifically in terms of regulation 13 of GN No. R. 326), and any specific environmental management Act, and that failure to comply with these requirements may result in disqualification;
- have provided the competent authority(-ies) with access to all necessary information at their disposal at the time of publication regarding the application, whether such information is favourable to the applicant or not; and
- are aware that a false declaration is an offense in terms of regulation 48 of GN No. R. 326.

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October 2022

II. STATEMENT OF WORK

- This study has been executed in accordance with and meet the responsibilities in terms of:
  - NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326);
  - Procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998, when applying for Environmental Authorisation:
    - 3(c): Protocol for the assessment and reporting of environmental impacts on terrestrial animal species.
    - 3(d): Protocol for the assessment and reporting of environmental impacts on terrestrial plant species.

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Emoyeni Renewable Energy Farm (Pty) Ltd

1.2. Project

The project will be known as Ummbila Emoyeni EGI, and the entire study area with its collection of sites will generally be referred to either as the "study area" or the "study site". The combined footprint of the proposed infrastructure as well as the grid corridors will be referred to as the "development site".

1.3. Proposed Activity

Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of Electrical Grid Infrastructure (EGI) to support the Ummbila Emoyeni Renewable Energy Farm (which will comprise a 666MW Wind Energy Facility and a 150MW Solar Energy Facility), which aims to export energy to the national electricity grid. The project (hereafter also referred to as 'Ummbila Emoyeni EGI') is located ~6km south-east of Bethal and 1km east of Morgenzon, within the Mpumalanga Province on the following properties:

Parent Farm Number	Farm Portions
Farm 261 – Naudesfontein	15 R/E, 21
Farm 264 – Geluksplaats	0, 1, 3, 4, 5, 6 R/E, 8 R/E, 9R/E, 10, 11, 12
Farm 268 – Brak Fontein Settlement	6,7,10,11,12
Farm 420 – Rietfontein	8,9,10,11,12,15 R/E,16,18,19,22,32
Farm 421 - Sukkelaar	2, 2, 7, 9, 9 10, 10 11, 11 12, 12, 22 ,25 R/E, 34, 35, 36, 37, 37, 38, 39, 40, 42, 42
Farm 422 – Klipfontein	0, 2 R/E, 3 R/E, 4, 5, 6, 7, 8 R/E, 9, 10, 12, 13 R/E, 14 R/E, 16, 17, 18, 19, 20, 21, 22, 23
Farm 423 – Bekkerust	0 R/E, 1, 2 R/E, 4, 5 R/E, 6, 10, 11, 12, 13 14, 15, 17, 19 R/E, 20, 22, 23, 24,25
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Farm 458 – Goedgedacht	0, 2, 3, 4, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 21, 22, 23, 25, 26 R/E, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43
Farm 467 – Twee Fontein	0 R/E, 1 R/E, 4 R/E, 5, 6, 7 R/E, 8, 10
Farm 469 – Klipkraal	5 R/E, 6, 7, 8
Farm 548 – Durabel	0

The grid connection infrastructure will include:

» A new 400/132kV Main Transmission Substation (MTS), to be located on the Camden SOL Lines.
» Two 400kV loop-in loop-out power lines to the existing Camden-Sol 400kV transmission line.

- On-site switching stations (Eskom Portion) (132kV in capacity) at each renewable energy facility.
- Collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to onsite IPP S/Ss.
- 132kV power lines from the switching stations to the new MTS.
- Access roads up to 8m wide.

A summary of the details and dimensions of the planned infrastructure associated with the project is provided below in Table 1.

Table 1: Details or dimensions of typical infrastructure required for the Ummbila Emoyeni EGI.

Infrastructure	Footprint and dimensions
Onsite substations (Eskom Portion)	Development footprint: 4 IPP collector substations of 5ha each Capacity: 33kV/132kV
Collector Substation	Collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to onsite IPP substation.
132kV power lines	Servitude width: 18m Height: up to 40m Length: To be determined in EIA Phase Corridor width for assessment in EIA: 300m
Main Transmission Substation	Development footprint: 600m x 600m Capacity: 400/132kV Height: Up to 30m
Power line connection to national grid	Capacity and circuit: 400kV loop-in loop-out Servitude: 55m per line Height: Up to 40m Corridor width for assessment in EIA: 500m
Height of the power line towers (pylons)	40m
Access and internal roads	Access will likely be via the main road between Bethal and Morgenzon. This is the R35, a tarred and provincial road. Existing roads on the affected properties will be used where feasible and practical to provide direct access to the EGI. Where necessary, new access roads (up to 12 wide) will be established to provide access to the Main Transmission Substation (MTS). During construction, a permanent access road along the length of the power line corridor (300m wide) between 4 -6m wide will be established to allow for large crane movement. This track will then be utilised for maintenance during operation.
Temporary infrastructure	Temporary infrastructure, including laydown areas and a concrete batching plant, will be required during the construction phase. All temporary infrastructure will be rehabilitated following the completion of the construction phase, where it is not required for the operation phase.

The Ummbila Emoyeni Renewable Energy Farm is proposed in response to the identified objectives of national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the renewable energy facilities under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement

(REIPPP) Programme or a similar programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP), with the Ummbila Emoyeni Renewable Energy Farm set to inject up to 816MW of electricity into the national grid (wind and solar generation). Similarly, the location of the new generation in the Mpumalanga Province is important in the context of the Just Energy Transition (JET). The Ummbila Emoyeni Projects will provide valuable jobs and socio-economic benefits that are required in an area where coal fired generation will be phased out over the next 10 years. This will be vitally important if the JET is to be successfully implemented and is a transition for everyone.

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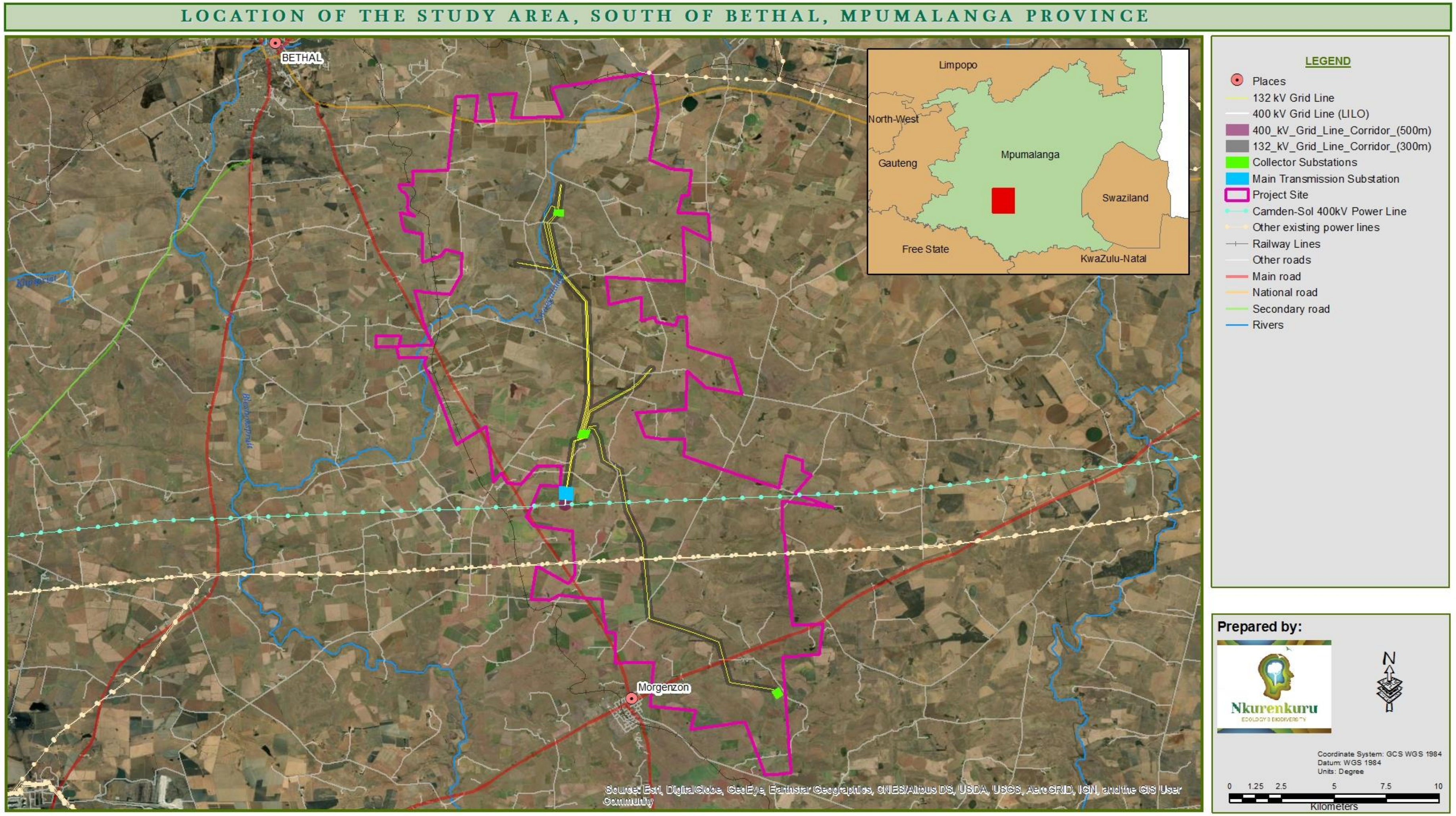

Figure 1: Locality of the study area and the proposed EGI, south of the town Bethal in the Mpumalanga Province. The inset map shows the main map extent (red square) within Mpumalanga, as well as the broader context of South Africa.

1.4. Terms of Reference (ToR)

The primary objective of the specialist freshwater resource assessment was to provide information to guide the proposed Wind Energy Facility development with respect to the potential impacts on the affected freshwater ecosystems within the project site. This main objected was done whilst adhering to the content requirements for specialist reports in accordance with the Specialist Assessment Protocol 20 March 2020. The focus of this study was solely on the specific Hydrogeomorphic Units (HGMs), within a radius of 500m of the proposed footprint and which will likely be impacted by the proposed development.

The focus of the work involved the undertaking of a specialist assessment of freshwater resource features, which included the following tasks:

- » Desktop identification and delineation of potential freshwater resource areas affected by the proposed development, or occurring within a 500m radius of the proposed development using available imagery, contour information and spatial datasets in a Geographical Information System (GIS);
- » Site-based (detailed in-field) delineation of the outer wetland boundary of wetland/watercourse areas within the project focal area and which were flagged during the desktop screening/risk assessment;
- » Classification of wetlands and riparian areas and assessment of conservation significance based on available data sets;
- » Description of the biophysical characteristics of the delineated freshwater habitats based on onsite observations and sampling (i.e. hydrology, soils, vegetation, existing impacts etc.);
- » Baseline functional assessment of wetland habitats based on field investigations, involving the:
    - PES (Present Ecological State/Condition) of the delineated wetland units;
    - EIS (Ecological Importance and Sensitivity) of the delineated wetland units;
    - Direct and indirect ecosystem services (functions) importance of the delineated wetland units only.
- » Impact assessment and identification of mitigation measures to reduce the significance of potential aquatic impacts for both the construction and operational phases of the pipeline project. For this section the same methodology and layout approach within the existing report was followed in order to maintain uniformity and coherence between the two reports.
- » Compilation of a specialist wetland assessment report detailing the methodology and findings of the assessment, together with relevant maps and GIS information.

1.5. Conditions of this Report

Findings, recommendations, and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. No form of this report may be amended or extended without the prior written consent of the author. Any recommendations, statements, or conclusions drawn from or based on this report must clearly cite or refer to this report. Whenever such recommendations, statements or conclusions form part of the main report relating to the current investigation, this report must be included in its entirety.

1.6. Relevant Legislation

The link between ecological integrity of freshwater resources and their continued provision of valuable ecosystem goods and services to burgeoning populations is well-recognised, both globally and nationally (Rivers-Moore et al., 2007). In response to the importance of freshwater aquatic resources, protection of wetlands and rivers has been campaigned at national and international levels. A strong legislative framework which backs up South Africa's obligations to numerous international conservation agreements creates the necessary enabling legal framework for the protection of freshwater resources in the country. Relevant environmental legislation pertaining to the protection and use of aquatic ecosystems (i.e. wetlands and rivers) in South Africa has been summarized below.

1.6.1. South African Constitution 108 of 1996

Section 24 of Chapter 2 of the Bill of Rights No. 108 of 1996 states that everyone has the right to:

(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that—
  (i) prevent pollution and ecological degradation;
  (ii) promote conservation; and
  (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

1.6.2. National Environmental Management Act 107 of 1998

Wetlands and other watercourses defined in the NWA are also protected in the National Environmental Management Act (Act 107 of 1998), (NEMA). The act lists several activities that require authorisation before they can be implemented. NEMA lists various activities that require authorisation when located within 32 m or less from the edge of a wetland or other watercourse type.

1.6.3. National Water Act (Act No. 36 of 1998)

According to the National Water Act (Act No. 36 of 1998), a water resource is defined as: "a watercourse, surface water, estuary, or aquifer. A watercourse in turn refers to

(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 to be a watercourse. Reference to a watercourse includes, where relevant, its bed and banks."

A wetland is defined as: "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 support or would support vegetation typically adapted to life in saturated soil."

Chapter 4 of the Act deals with the regulation of the use of water and the requirements for controlled activities, general authorisations, and licenses. In general, a water use must be licensed unless: it is listed in Schedule 1 of the Act as an existing lawful water use, or is permissible under a general authorisation, or if a responsible authority waives the need for a license.

According to the Department of Water and Sanitation (DWS), any activity that falls within the temporary zone of a wetland or the 1:100 year floodline (whichever is greater) qualifies as a Section 21 water use activity (depending on the use) and will thus require either a general authorization or Water Use License (WUL). According to the NWA, an application for a WUL should be submitted to the DWS if any of the above activities are to be undertaken.

Section 21 of the National Water Act (NWA Act No. 36 of 1998) covers the following activities, which might be applicable to the proposed project. According to Section 21 of the NWA and in relation to the river ecosystem, the following activity is considered a use, and therefore requires a water use license:

» 21 (c) impeding or diverting the flow of water in a watercourse;
» 21 (i) altering the bed, banks, course or characteristics of a watercourse;

In terms of Section 22 (1), a person may only undertake the abovementioned water uses if it is appropriately authorised:

22(1) A person may only use water

(a) without a licence
  (i) if that water use is permissible under Schedule 1;
  (ii) if that water use is permissible as a continuation of an existing lawful use; or
  (iii) if that water use is permissible in terms of a general authorisation issued under section 39;
(b) if the water use is authorised by a licence under this Act; or

(c) if the responsible authority has dispensed with a licence requirement under subsection (3).

1.6.4. National Water Act (Act No. 36 of 1998)

- The National Forests Act No. 84 of 1998;
- The Natural Heritage Resources Act No. 25 of 1999;
- The National Environmental Management: Protected Areas Act No. 57 of 2003;
- Minerals and Petroleum Resources Development Act No. 28 of 2002;

2. METHODOLOGY

2.1. Assessment Approach and Philosophy

2.1.1. Aquatic Biodiversity

The delineation and classification of freshwater resources were conducted using the standards and guidelines produced by the DWS (DWAF, 2005 & 2007) and the South African National Biodiversity Institute (SANBI, 2009).

In addition to these guidelines, the general approach to freshwater habitat assessment was furthermore based on the proposed framework for wetland assessment as proposed within the Water Research Commission's (WRC) report titled: "Development of a decision-support framework for wetland assessment in South Africa and a Decision-Support Protocol for the rapid assessment of wetland ecological condition" (Ollis et. al., 2014). A schematic illustration of the proposed decision-support framework for wetland assessment in South Africa is provided in Figure 2 below.

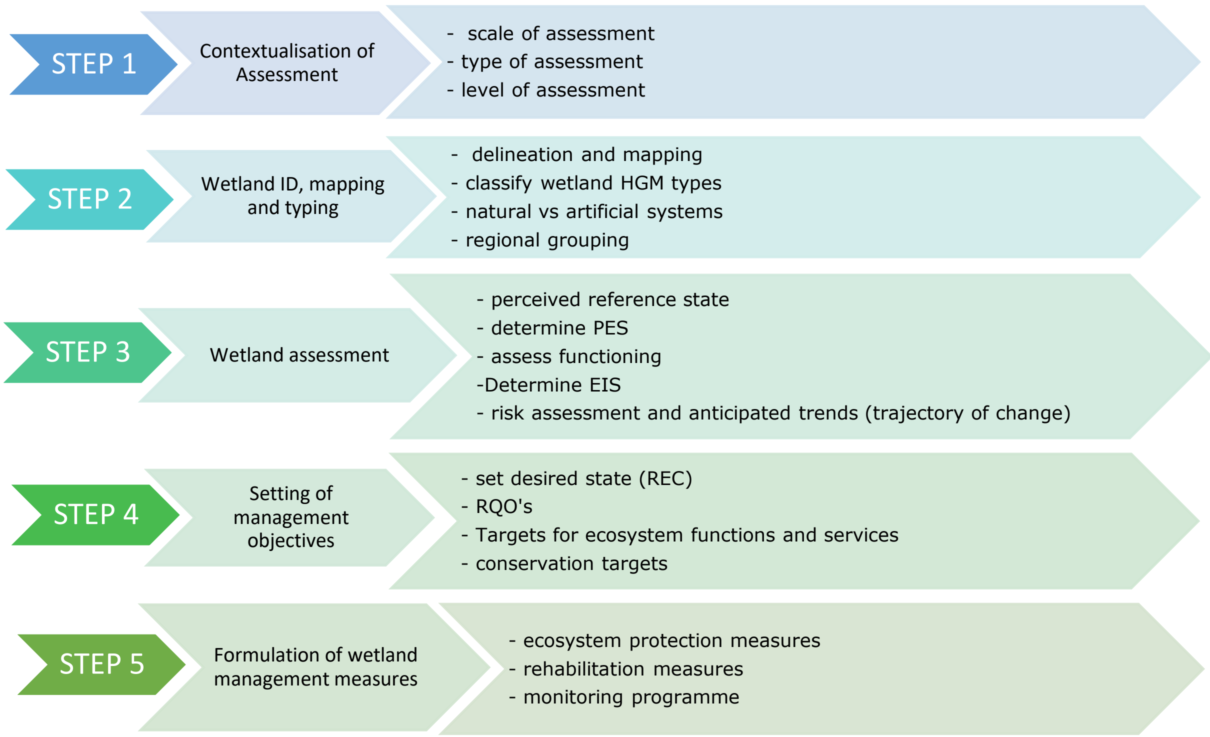

Figure 2: Proposed decision support framework for wetland assessment in South Africa (after Ollis et al., 2014)

2.2. Data Exploration and Review

The assessment was initiated with a survey of the pertinent literature, past reports and the various conservation plans that exist for the study region (Table 2). The desktop delineation of all freshwater resources (rivers / streams and wetlands) within 500m (DWS regulated area) of the proposed project site was undertaken by analysing available 5m contour lines and colour aerial photography supplemented by Google EarthTM imagery where more up to date imagery was needed. Digitization and mapping were undertaken using ArcGis software. All of the mapped freshwater resources were then broadly subdivided into distinct resource units (i.e. classified as either riverine or wetland systems / habitat). This was undertaken based on aerial photographic analysis and professional experience in working in the region.

Following the desktop identification and mapping exercise, freshwater resource features where confirmed and their boundaries refined in-field

Data sources from the literature and GIS spatial information was consulted and used where necessary in the study and include the following (also refer to Table 2: Information and data coverages used to inform the ecological assessment.

	Data/Coverage Type	Relevance	Source
Biophysical Context	**Colour Aerial Photography**	Desktop mapping of habitat/ecological features	National Geo-Spatial Information (NGI)
	Latest Google Earth™ imagery	To supplement available aerial photography	Google Earth™ On-line
	1:50 000 Relief Line (5m Elevation Contours GIS Coverage)	Desktop mapping of terrain and habitat features as well as drainage network.	Surveyor General
	1:50 000 River Line (GIS Coverage)	Highlight potential on-site and local rivers and wetlands and map local drainage network.	CSIR (2011)
	South African Vegetation Map (GIS Coverage)	Classify vegetation types and determination of reference primary vegetation	Mucina & Rutherford (2012; 2018); Dayaram et al., 2018
	NFEPA: river and wetland inventories (GIS Coverage)	Highlight potential on-site and local rivers and wetlands	CSIR (2011)
Conservation and Distribution Context	**National Biodiversity Assessment – Threatened Ecosystems** (GIS Coverage)	Determination of national threat status of local vegetation types	SANBI (2018)
	Mpumalanga Biodiversity Sector Plan: Critical Biodiversity Areas (GIS Coverage)	Determination of provincial /freshwater conservation priorities and biodiversity buffers	SANBI (2016)
	NFEPA: River, wetland and estuarine FEPAs (GIS Coverage)	Shows location of national aquatic ecosystems conservation priorities	CSIR (2011)
	Red Data Books (Red Data Lists of Plants)	Determination of endangered and threatened plants,	Red List of South African Plants (2011); http://redlist.sanbi.org/

for a summary):

Vegetation:

» South African National Vegetation Map (SANBI, 2018); (Mucina & Rutherford, 2006) and National List of Threatened Ecosystems (NEM:BA, 2011): vegetation types and their respective conservation statuses. The latest version of the National Vegetation Map was also consulted to check for any updates of the respective regions (Dayaram, et al., 2019); (SANBI, 2018).

» Botanical Database of Southern Africa (BODATSA), hosted by the South African National Biodiversity Institute (SANBI; https://posa.sanbi.org; also referred as POSA: Plants of Southern Africa): information on plant species recorded for the Quarter Degree Squares 2919BA, 2919BB, 2919BD and 2920AA. This is a larger area than required and is a conservative approach that ensures all species possibly occurring within the site have been represented. It also accounts for the fact that the site itself might not be well represented in national databases.

» Threatened Species Programme, Red List of South African Plants (SANBI, 2021): The IUCN conservation statuses of all listed species were extracted from this database.

Ecosystem:

» Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (Nel, et al., 2011). This includes rivers, wetlands, and catchments defined in the study area.
» Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (Government of South Africa, 2008).
» Critical Biodiversity Areas for the site and surroundings (CBA Map for Northern Cape; obtained from SANBI Biodiversity GIS (BGIS), specifically http://bgis.sanbi.org/Projects/Detail/203.

Table 2: Information and data coverages used to inform the ecological assessment.

	Data/Coverage Type	Relevance	Source
Biophysical Context	**Colour Aerial Photography**	Desktop mapping of habitat/ecological features	National Geo-Spatial Information (NGI)
	Latest Google Earth™ imagery	To supplement available aerial photography	Google Earth™ On-line
	1:50 000 Relief Line (5m Elevation Contours GIS Coverage)	Desktop mapping of terrain and habitat features as well as drainage network.	Surveyor General
	1:50 000 River Line (GIS Coverage)	Highlight potential on-site and local rivers and wetlands and map local drainage network.	CSIR (2011)
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	Red Data Books (Red Data Lists of Plants)	Determination of endangered and threatened plants,	Red List of South African Plants (2011); http://redlist.sanbi.org/

2.3. Baseline Freshwater Resource Assessment

The methods of data collection, analysis and assessment employed as part of the baseline freshwater habitat assessment are briefly discussed in this section.

The on-site / in-field assessment of the freshwater resource indicators was conducted on the 24th to 27th April 2022 (autumn). The area was, prior to the time of the survey, experiencing an above average rainfall season, and during the inspection, the conditions were regarded as optimal to access all wetland indicators. All of the dam features and natural freshwater features were inundated (70% - 95% capacity) during the inspection. However, the presence of inundation is not a prerequisite for the accurate delineation of freshwater resource features as other indicators were used as described below.

The assessments undertaken as part of this study are listed in Table 3 below along with the relevant published guidelines and assessment tools / methods / protocols utilised. A more comprehensive description of the methods listed below is included in Appendix 1.

Table 3: Summary of methods used in the assessment of delineated freshwater resources.

Method/Technique	Reference for Methods / Tools Used
Freshwater Resource Delineation	A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas' (DWAF, 2005).
Freshwater Resource Classification	National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al, 2013)
Freshwater Resource Condition/PES	Wetland Index of Habitat Integrity (DWAF, 2007): Modified to include additional criteria in order to include additional wetland types (seepages, depressions and unchanneled valley-bottom wetlands).
Freshwater Ecological Importance and Sensitivity (EIS)	EIS (Ecological Importance and Sensitivity) assessment tool (DWAF 1999c; Rountree & Malan, 2013): Slightly modified as follows: » Where the freshwater resource features comprised/provided the following features/functions or a combination of these features/functions, • Contained any faunal or floral Species of Conservation Concern (SCC); • Comprised of unique habitats; • Highly connected to other important habitats/features forming important ecological corridors; and • Provide unique and valuable ecosystems services (social and ecological); and the freshwater resource features were in natural to largely natural condition (PES: A/B); their EIS were upgraded to Very High. Likewise, should the freshwater resource feature be in a slightly to moderately modified condition (PES: C), the EIS will be upgraded to High.
Buffers for rivers and watercourses	Recommended buffers are in line with the watercourse and wetland buffers that have been recommended in the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (CSIR, 2015) and are deemed appropriate to the aquatic features and the proposed activities within the study area. Recommendations are made based on the wetlands functioning and site characteristics

2.4. Impact Assessment Methodology

The impact assessment methodology is in accordance with the recently revised 2014 EIA regulations. The significance of environmental impacts is a function of: the present environmental aspects that are to be impacted on, the probability of an impact occurring, and the consequence of such an impact occurring before, and after, implementation of proposed mitigation measures.

The significance of environmental impacts is to be assessed by means of the criteria of nature (descriptive), extent (scale), duration, magnitude (severity), probability (certainty), and direction (negative, neutral, or positive) (Figure 3). Summarized briefly:

» **Nature**: a description of what causes the effect, what will be affected, and how it will be affected.

- **Extent**: whether the impact will be site specific (limited to the immediate area or development site), local, or regional/provincial. A value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high).
- **Duration**:
    - the lifetime of the impact will be of a very short duration (0 – 1 year) — assigned a score of 1;
    - the lifetime of the impact will be of short duration (1 – 5 years) — assigned a score of 2;
    - medium-term (5 – 15 years) — assigned a score of 3;
    - long term (15 – 30 years) — assigned a score of 4; or
    - permanent (> 30 years) — assigned a score of 5.
- **Magnitude**: quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high and processes are altered to the extent that they temporarily cease, and 10 is very high and results in complete destruction of patterns, and permanent cessation of processes.
- **Probability** (of occurrence): the likelihood of the impact actually occurring. Probability is estimated on a scale of 1 – 5, where 1 is highly improbable (will likely not happen), 2 is improbable (possible, but likelihood still low), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will definitely occur regardless of any prevention measures).
- **Significance**: determined through a synthesis of the characteristics described above and can be assessed as **LOW**, **MEDIUM**, or **HIGH**.
- Direction: either positive, negative, or neutral.

Also implicitly considered is the degree to which the impact:

- can be reversed;
- may cause irreplaceable loss of resources; and
- can be mitigated.

Impact significance is calculated by combining the criteria as follows:

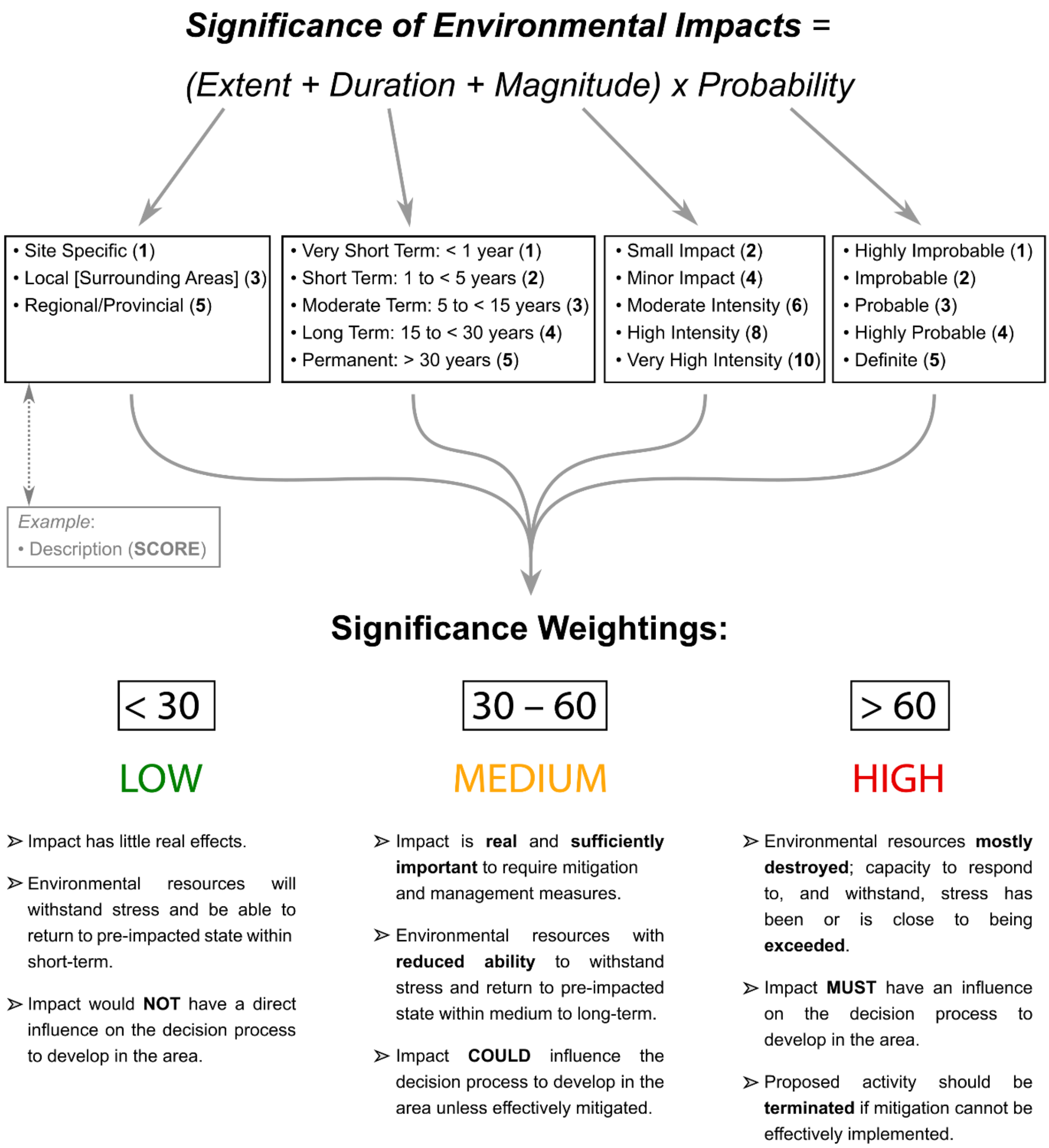

Figure 3: Calculation, description, and summary of Significance Weightings that result from calculating the Significance of Environmental Impacts.

2.5. Assumptions and Limitations

2.5.1. General Assumptions and Limitations

» This report deals exclusively within a defined area as well as downstream freshwater/aquatic resources that may potentially be impacted and which fall within the Regulated Areas (500 m) as defined by DWS.

- All relevant project information provided by the applicant and engineering design team to the specialist was correct and valid at the time that it was provided.
- Additional information used to inform the assessment was limited to data and GIS coverage's available for the Northern Cape Province at the time of the assessment.

2.5.2. Sampling Limitations and Assumptions

- While disturbance and transformation of habitats can lead to shifts in the type and extent of ecosystems, it is important to note that the current extent and classification are reported on here.
- The delineation of the outer boundary of riparian/wetland areas is based on several indicators, including topography, the presence of alluvial deposits and/or soil wetness, soil forms and vegetation indicators. The boundaries mapped in this specialist report, therefore, represent the approximate boundary of riparian/wetland habitat as evaluated by an assessor familiar and well-practiced in the delineation technique.
- The accuracy of the delineation is based solely on the recording of the relevant onsite indicators using a GPS. GPS accuracy will, therefore, influence the accuracy of the mapped sampling points and therefore resource boundaries and an error of 3 – 5m can be expected. All soil/vegetation/terrain sampling points were recorded using a Garmin etrex Touch 35 Positioning System (GPS) and captured using Geographical Information Systems (GIS) for further processing.
- Any freshwater resources that fall outside of the affected catchment (but still within the 500m DWS regulated area) and are not at risk of being impacted by the specific activity were not delineated or assessed. Such features were flagged during a baseline desktop assessment before the site visit.
- Sampling by its nature means that generally not all aspects of ecosystems can be assessed and identified.
- While every care is taken to ensure that the data presented are qualitatively adequate, inevitably conditions are never such that that is possible. The nature of the vegetation, seasonality, human intervention etc. limit the veracity of the material presented.
- No water sampling and analysis was undertaken.
- The vegetation information provided is based on onsite/ infield observations and not formal vegetation plots. As such, the species list provided only gives an indication of the dominant and/or indicator wetland/riparian species and thus only provides a general indication of the composition of the vegetation communities.
- No faunal sampling and/or faunal searches were conducted and the assessment was purely wetland and riverine habitat based.
- Probably the most significant potential limitation associated with such a sampling approach is the narrow temporal window of sampling.
    - Ideally, a site should be visited several times, during different seasons to ensure that the full complement of plant and animal species present is captured.

- However, this is rarely possible due to time constraints and therefore, the representation of the species sampled at the time of the site visit should be critically evaluated.
- The site was sampled on both occasions (site visits), following the wet season; however, the Spring season is regarded as a preferred season for such studies.
- The footprint was covered in detail and results are considered highly reliable and it is unlikely that there are any significant species or features present that were not recorded.

2.5.3. Baseline Assessment – Limitations and Assumptions

» All assessment tools utilised within this study were applied only to the resources and habitats located within the development footprint as well as the 500m DWS "regulated area" around the footprint area, and which are at risk of being impacted by the proposed development. Any resource located outside of the DWS "regulated area" and which is not a risk of being impacted was not assessed.
» It should be noted that the most appropriate assessment tools were selected for the analysis of the specific features and resources that may potentially be impacted by the proposed development. The selection was based on the specialist's knowledge and experience of these tools and their attributes and shortcomings.
» Furthermore, it should be noted that these assessment techniques and tools are currently the most appropriate available tools and techniques to undertake assessments of freshwater resources, there are however rapid assessment tools that rely on qualitative information and expert judgment. While these tools have been subjected to peer review processes, the methodology for these tools is ever-evolving and will likely be further refined in the near future. For the purposes of this assessment, the assessments were undertaken at rapid levels with somewhat limited field verification. It, therefore, provides an indication of the PES of the portions of the affected systems rather than providing a definitive measure.
» The PES, EIS and functional assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation. We have made an effort to substantiate all claims where applicable and necessary.
» The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the field survey and based on the assessor's working knowledge and experience with similar development projects.
» The impact descriptions and assessment are based on the author's understanding of the proposed development based on the site visit and information provided.
» Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report and standard mitigation measures to be included in the Environmental Management Programme (EMPr).

3. CONSERVATION AND FUNCTIONAL IMPORTANCE OF AQUATIC ECOSYSTEMS

Water affects every activity and aspiration of human society and sustains all ecosystems. “Freshwater ecosystems” refer to all inland water bodies whether fresh or saline, including rivers, lakes, wetlands, sub-surface waters, and estuaries (Driver et al., 2011). South Africa’s freshwater ecosystems are diverse, ranging from sub-tropical in the north-eastern part of the country, to semi-arid and arid in the interior, to the cool and temperate rivers of the fynbos. Wetlands and rivers form a fascinating and essential part of our natural heritage and are often referred to as the “kidneys” and “arteries” of our living landscapes and this is particularly true in semi-arid countries such as South Africa (Nel et al., 2013). Rivers and their associated riparian zones are vital for supplying freshwater (South Africa’s most scarce natural resource) and are important in providing additional biophysical, social, cultural, economic, and aesthetic services (Nel et al., 2013). The health of our rivers and wetlands is measured by the diversity and health of the species we share these resources with. Healthy river ecosystems can increase resilience to the impacts of climate change, by allowing ecosystems and species to adapt as naturally as possible to the changes and by buffering human settlements and activities from the impacts of extreme weather events (Nel et al., 2013). Freshwater ecosystems are likely to be particularly hard hit by rising temperatures and shifting rainfall patterns, and yet healthy, intact freshwater ecosystems are vital for maintaining resilience to climate change and mitigating its impact on human wellbeing by helping to maintain a consistent supply of water and for reducing flood risk and mitigating the impact of flash floods. We, therefore, need to be mindful of the fact that without the integrity of our natural river systems, there will be no sustained long-term economic growth or life (DEA et al., 2013).

Freshwater ecosystems, including rivers and wetlands, are also particularly vulnerable to anthropogenic or human activities, which can often lead to irreversible damage or longer-term, gradual/cumulative changes to freshwater resources and associated aquatic ecosystems. Since channelled systems such as rivers, streams, and drainage lines are generally located at the lowest point in the landscape; they are often the “receivers” of wastes, sediment, and pollutants transported via surface water runoff as well as subsurface water movement (Driver et al., 2011). This combined with the strong connectivity of freshwater ecosystems means that they are highly susceptible to upstream, downstream, and upland impacts, including changes to water quality and quantity as well as changes to aquatic habitat & biota (Driver et al., 2011). South Africa’s freshwater ecosystems have been mapped and classified into National Freshwater Ecosystem Priority Areas (NFEPAs). This work shows that 60% of our river ecosystems are threatened and 23% are critically endangered. The situation for wetlands is even worse: 65% of our wetland types are threatened, and 48% are critically endangered (Driver et al., 2011). Recent studies reveal that less than one-third of South Africa’s main rivers are considered to be in an ecologically ‘natural’ state, with the principal threat to freshwater systems being human activities, including river regulation, followed by catchment transformation (Rivers-Moore & Goodman, 2009). South Africa’s freshwater fauna also display high levels of threat: at least one-third of freshwater fish indigenous to South Africa are reported as threatened, and a recent southern African study on the conservation status of major freshwater-dependent taxonomic groups (fishes, molluscs, dragonflies, crabs, and vascular plants) reported far higher levels of threat in South Africa than in the rest of the region (Darwall et al., 2009). Clearly, urgent attention is required to ensure that representative natural examples of the different ecosystems that make up the natural heritage of this country for current and future generations to come. The degradation of South African rivers and wetlands is a concern now recognized by Government as requiring urgent action and the protection of freshwater resources, including rivers and wetlands, is considered fundamental to the sustainable management of South Africa's water resources in the context of the reconstruction and development of the country.

4. DESKTOP ANALYSIS

4.1. Regional/Local Biophysical Setting

The study site is located primarily (>95% of project site) within one Quaternary Drainage Region/Catchment (QDR) namely C11H QDR (Blesbokspruit River). Small portions of the project site extend into QDRs C11G and C11J, however almost all of the proposed infrastructure is restricted to the C11H QDR, with only one turbine falling within the C11J QDR. All of the above mentioned QDRs are located within the Upper Vaal Water Management Area. These QDRs are drained by numerous wetlands and watercourses with the larger drainage features being perennial, lower and upper foothill freshwater resource features. The smaller tributaries are typically non-perennial/seasonal, transitional and headwater freshwater resource features. The larger perennial freshwater resource features tend to drain in a south-western direction, whilst the smaller tributaries tend to drain perpendicular to the larger features (north-western, south-eastern).

The main drainage features within the region are the Blesbokspruit- Kwaggaslaagte- and Osspruit River. Both the Kwaggaslaagte- and Osspruit Rivers drain in south-western directions to feed into the Blessbokspruit River, which is regarded as an important upper tributary of the Vaal River (CSIR, 2018) (Van Deventer, et al., 2018) ((DWAF), 2006).

The Blesbokspruit River, itself is located approximately 7km west of the project site, with two smaller tributaries draining some of the central portions of the project site. On the other hand, both the Kwaggaslaagte- and Osspruit Rivers, flow through the project site (Kwaggaslaagte River flows across the north-western portion of the project site, whilst the Osspruit River flows across the southern portion). These freshwater resource features themselves drain fairly small portions of the project site, with the majority of the project site being drained by small, short tributaries of these rivers. As mentioned, most of the larger freshwater resource features are lower and upper foothill features, with the lower foothill features characterised by floodplains confined on one side (V2), whilst the upper foothill features are characterised by confined valley flood plains and wetlands (V4) (Rowntree & Wadeson, 1999). The smaller tributary freshwater resource features are typically characterised by confined valley floodplains (V4) and v-shaped valleys (V6).

All three major freshwater resource features and their tributaries have been classified as being Moderately Modified (PESS: C) by DWS in 1999, however according to a more recent survey (NBA, 2018), using different methods and techniques[1], the Present Ecological State/Ecological Importance/Ecological Sensitivity of freshwater resource features as well as their mainstems and tributaries (at a sub-quaternary level), were classified as:

» C11H1570 (PES/EIS: D) - Largely Modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred. (DWS, 2014).
» C11H1584, C11H1609, C11H1633 (PES/EIS: B) - Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged (DWS, 2014).
» C11H1711, 1704 (PES/EIS: C) - Moderately Modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. (DWS, 2014).

According to the PES/EIS assessment all of the freshwater resource features as well as their mainstems and tributaries are of moderate ecological importance (EI) and Ecological Sensitivity (ES)

The Hydrological Characteristics of the project site are summarised as follows:

» Mean Annual Precipitation = 676 mm (min: 629 mm; max: 723 mm);
» Mean Annual Runoff = 74 mm;
» Mean Annual Evaporation = 1400 - 1600 mm; and

The proposed WEF project is located within the Highveld ecoregion (11.05 level 2 ecoregion) (Kleynhans, et al., 2005). Numerous prominent and important rivers have their sources within this region namely the; Vet, Modder, Riet, Vaal, Olifants, Steelport, Maric, Crocodiver (west), Crocodile (east) and the Great Usutu. The project site falls within the Vaal River catchment. The characteristics of the ecoregion are:

» Topography can be described as plains with a moderate to low relief, as well as various grassland vegetation types (with moist types present towards the east and drier types towards the west and south);
» Rainfall varies from low to moderately high, with an increase from west to east. Coefficient of variation of annual precipitation are moderately high in the west, decreasing to low in the east;
» Drainage density is mostly low, but medium in some areas;
» Stream frequency varies between low to medium

[1] The methods used for assessing the ecological condition of the river ecosystem types differed from the NBA 2011 in that Present Ecological State (PES) categories were not modelled in the NBA 2018. The river condition data was determined by using (DWS, 2014) Present Ecological State/Ecological Importance/Ecological Sensitivity (PES/EI/ES) (also referred to as PES/EIS) data, which included mainstems and tributaries at a sub-quaternary level. These desktop data were updated with data that became available between 2011 and 2017. The ecological category was either updated or remained unchanged depending on which assessment was most recent (Van Deventer, et al., 2019)

» Median annual simulated runoff is moderately low to moderate, and
» Mean annual temperature is hot in the west and moderate in the east.

The proposed development area is situated within the Highveld Geomorphic Province, and the Northwestern Highveld Sub-province (Partridge, et al., 2010) and is drained by the north-bank Vaal River tributaries. The Blesbokspruit River flow in a valley with a broad and wide cross-sectional profile and flat to medium slope so that the sediment storage surrogate descriptors for this river and its tributaries are predominantly BF (broad valley widths and flat slopes) and WM (wide valley width and medium slopes). The potential for sediment storage within these surrogate descriptors is regarded as high. Furthermore, the Bleskbokspruit River and its tributaries are mainly characterised as having concave longitudinal profiles and linear BFCs (Best Fit Curves).

In terms of wetland features, characterising the project site, numerous wetland features have been identified within NBA's 2018 National Wetland MAP 5 (157 wetland features have been mapped) (refer to **Error! Reference source not found.** below). Of these 157 wetland features, 24 wetlands fall within the EGI development site, with 22 of these wetland features likely being directly impacted by the development (access road crossings, spanning of gridlines and one wetland features within development footprint for Collector Substation 3).

Furthermore, four hydrogeomorphic units have been identified within the project site namely, channelled valley-bottom wetlands, floodplain wetlands, seepage wetlands and depression wetlands. Wetlands within the project site were predominantly seepages (67% of all wetlands) and combined, covered the second largest area within the project site (648.9 ha) (**Error! Reference source not found.** and **Error! Reference source not found.**). Second to the seepages were the channelled valley-bottom wetlands with 39 units identified within the project site (25%). However, even though these wetlands were fewer, they collectively covered a significantly larger area (1886.3 ha). Even though only three floodplain units were identified within the project site, these three units collectively covered just a few hectares less than the seeps (612.8 ha). Nine depression wetlands were identified within the project site and only covered a combined area of 4 ha.

According to the National Wetland Map 5 (SANBI, 2018), twenty wetland features have been mapped within the EGI development site, covering approximately 7% of the development area. One floodplain has been mapped by SANBI (2018), and cover approximately 32.56 ha of the development area (largest area of all wetland features). Eight channelled valley-bottom wetlands have been mapped and cover approximately 65.84 ha (4% of development area). Most of the hydrogeomorphic units mapped within the regulated area, are seepage wetlands, however these features are fairly small and collectively cover only 23.92 ha (1% of the regulated area).

In terms of the conditions of the wetlands (PES) located within the development area, the majority of the wetlands were moderately to significantly (heavily to severely/critically) modified, with 8 wetlands having a C PES and 9 wetlands having a D/E/F PES value. Only 3 wetlands are regarded as being natural to near-natural (**Error! Reference source not found.Error! Reference source not found.**).

Furthermore, all channelled valley bottom wetlands, floodplains and seeps are regarded as Critically Threatened Aquatic Ecosystems, whilst depression wetlands are regarded as Least Concerned Aquatic Ecosystems. Additionally, all channelled valley-bottom and floodplain wetlands are not protected whilst seepage and depression wetlands are poorly protected (**Error! Reference source not found.**).

Table 4: Summary of the wetlands identified within the development area according to the NBA 2018 Wetland Map 5.

Hydrogeomorphic Type	Number of Features	Coverage (ha)	Coverage (%)	Wetland Conditions (PES)			Ecosystem Threat Status	Ecosystems Protection Level
				A/B	C	D/E/F		
Channelled Valley-Bottom	8	65.84	4	1	1	6	Critically Threatened	Not Protected
Floodplain	1	32.56	1.85			1	Critically Threatened	Not Protected
Seep	11	23.92	1	2	7	2	Critically Threatened	Poorly Protected
Total	**14**	**277.81**	**6.85**	**3**	**8**	**9**		

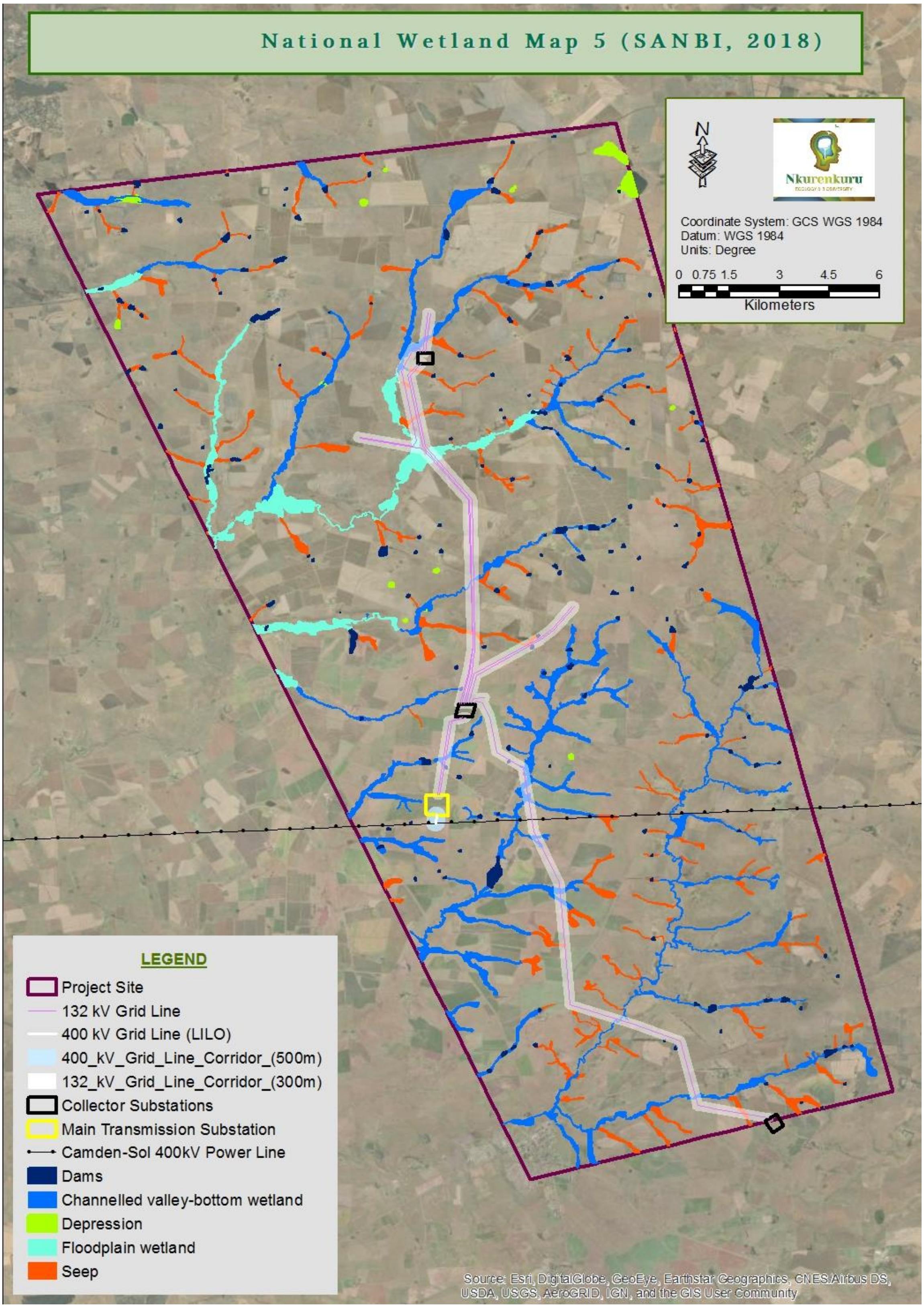

Figure 4: Regional drainage setting.

4.2. Land Use

Land use within the project site is mostly for farming. The study area consists of a mosaic of buildings/structures, active farmland ("agriculture"), fallow land (abandoned farmlands which consist of secondary vegetation; "fallow"), natural grasslands, and freshwater resource features or drainage areas (which is comprised of small streams, wetlands, shallow pans and depressions, and artificial dams).

Farming practices consist a mixture of cultivation (mainly maize with some soya bean cultivation), livestock farming (predominantly cattle on natural to near-natural grasslands and planted pastures), and to lesser extent game farming.

A common feature of the area are the numerous instream dams, mostly small in size, however a few larger dam features impound the larger floodplains and channelled valley-bottom wetland features. Erosion can generally be considered as moderate.

4.3. Conservation Planning / Context

Understanding the conservation context and importance of the study area and surroundings is important to inform decision making regarding the management of the aquatic resources in the area. In this regard, national, provincial, and regional conservation planning information available and was used to obtain an overview of the study site (

Table 5).

Table 5: Information and data coverages used to inform the freshwater resource assessment.

Relevant Conservation Feature		Location in Relationship to Project Site		Conservation Planning Status
NATIONAL LEVEL CONSERVATION PLANNING	**Strategic Water Source Areas for groundwater and surface water.**	Areas with high groundwater availability and of national importance	Top portion of the study site as well as a portion to the south-west.	Upper Vaal (SWSA_sw)
	National Freshwater Ecosystem Priority Area	River FEPAs (priority sub quaternary catchment areas)	One FEPA1 Priority Sub-Quaternary Catchment (SQC). » This FEPA1 SQC is associate with the Osspruit River. » Approximately 25% of the development area is located within this SQC.	One FEPA 1 Priority SQC
			» The bulk (75%) of the development area is located within Upstream Sub-Quaternary Catchments (five SQCs).	5X Upstream FEPA Catchments
		Kwaggalaagte River (FEPA ID: 1609) – Upstream FEPA River	» The Kwaggalaagte River flows in a southern to south-western direction across the northern half of the project area.	2X Upstream FEPA Rivers
		Un-named River (FEPA ID: 1633) – Upstream FEPA River	» Tributary of the Kwaggalaagte River. » Flows in a south-western direction across the north-half of the project site to terminate into the Kwaggalaagte River (within the project site)	
		Osspruit River (FEPA ID: 1704) – FEPA1 Priority River	» The Osspruit River flows in a south-western direction across the southern half of the project area.	1X FEPA 1 Priority River
		NFEPA Wetlands	» Seven wetlands within the project site is classified as FEPA priority wetlands. » The remaining three natural wetlands within the project site is not regarded as FEPA priority wetlands. » Approximately eight artificial wetlands (dams) occur within the project site	7 FEPA Priority Wetlands

CONSERVATION AND DISTRIBUTION CONTEXT	**MPBSP: Freshwater Critical Biodiversity Areas**	Ecological Support Areas (ESA)	» Wetland Clusters: ± 457.6 ha (1.6%) of project site; » Wetlands: ± 395.1 ha (1.4%) of project site; » Important Sub-catchments: ± 4860.9ha (16.8%) of project site.	Freshwater ESA
		Critical Biodiversity Areas (CBA)	» Rivers: ± 261.7 ha (0.9%) of project site; » Wetlands: ± 395 ha (0.1%) of project site	Freshwater CBA

4.3.1. Strategic Water Source Areas (SWSAs)

Strategic Water Source Areas (SWSAs) are defined as areas of land that either:

- supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important;
- have high groundwater recharge and where the groundwater forms a nationally important resource;
- areas that meet both criteria mentioned above.

They include transboundary Water Source Areas that extend into Lesotho and Swaziland.

The project site is located outside of any SWSA for groundwater water but is located within a SWSA for surface water; namely the Upper Vaal SWSA-sw (Figure 5).

Due to the nature of such electrical grid developments (limited footprint, limited use of chemicals, hazardous and toxic materials as well as the fact that the only likely direct impact on freshwater resources will be road crossings), there is a low probability that such developments will have a significant impact on important freshwater resource features. The most likely/significant impact will be a local change in runoff and infiltration patterns within the affected catchments, due to a local modification of roughage (vegetation cover) and natural geomorphology within and around the construction and infrastructure areas.

These impacts can however, be successfully mitigated through careful planning and with effective mitigation measures in place.

4.3.2. National Freshwater Ecosystem Priority Areas (2011) Database

The National Freshwater Ecosystems Priority Areas (NFEPA) (2011) database provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supports the sustainable use of water resources. The spatial priority areas are known as Freshwater Ecosystem Priority Areas (FEPAs).

FEPAs were identified based on:

- Representation of ecosystem types and flagship free-flowing rivers.
- Maintenance of water supply areas in areas with high water yield.
- Identification of connected ecosystems.
- Preferential identification of FEPAs that overlapped with"
    - Any free-flowing river
    - Priority estuaries identified in the National Biodiversity Assessment 2011.
    - Existing protected areas and focus areas for protected area expansion identified in the National Protected Area Expansion Strategy.

FEPA maps show various different categories, each with different management implications. The categories include river FEPAs and associated sub-quaternary catchments, wetland FEPAs, wetland clusters, Fish Support Areas (FSAs) and associated sub-quaternary catchments, fish sanctuaries, phase 2 FEPAs and associated sub-quaternary catchments, and Upstream Management Areas (UMAs).

4.3.2.1. NFEPA: River and Sub-Quaternary Catchments

A review of the NFEPA coverage for the study area (Figure 5) revealed that one FEPA1 priority sub-quaternary catchment will potentially be impacted by the proposed development. Such FEPA1 priority sub-quaternary catchments are drained by FEPA Rivers that meet biodiversity targets for river ecosystems and threatened fish species, and are currently in a good condition (A or B ecological category). Although FEPA status applies to the actual river reach within such a sub-quaternary catchment. The mapping of the whole sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach (Nel, et al., 2011).

Approximately 44% of the FEPA sub-quaternary catchment is located within the project site, whilst only 4% of the SQR is located within the proposed development area. The river associated with this sub-quaternary catchment is the Osspruit River (FEPA1 Priority River) and flows across the project site (within the southern half) (Nel, *et al*., 2011).

The Osspruit River is a fairly short (34 km) perennial watercourse, flowing in a largely south-western direction, feeding into the Blesbokspruit River. This river along with its smaller drainage networks, drains most of the southern portion of the project site. Furthermore, this river is classified as a Lower Foothill River (according to geomorphological zonation) with a mostly V4 (confined valley floodplain) and in some portions a V2 (flood plain confined to one side) valley form (Nel, et al., 2011). According to DWAFs 1999 Present Ecological State for mainstream rivers this watercourse was classified as Moderately Modified (Class C) (Kleynhans, 2000).

Furthermore, five Upstream sub-quaternary catchments are located within the project site (covering the remaining 75% of the project site). Most of these sub-quaternary catchments are fairly small to moderate in size, apart from the sub-quaternary catchment covering most of the central portion of the project site. All of these sub-quaternary catchments are drained by the Kwaggaslaagte River and its associated tributaries.

These UMAs represent sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas but do not include management areas for wetland FEPAs, which need to be determined at a finer scale (Nel, *et al*., 2011).

The Kwaggaslaagte River as well its associated smaller drainage networks/tributaries, drain most of the northern half of the project site. This river as well as the larger tributaries are perennial in nature and predominantly flow in a western to south-western direction, across the northern portion of the project site. The Kwaggaslaagte River is regarded as an important tributary of the upper reaches of the Blesbok River. The higher lying portion of the Kwaggaslaagte River as well as the higher lying tributaries are classified as Upper Foothill reaches whilst the lower lying portion of the Kwaggaslaagter River and associated tributaries are classified as Lower Foothill reaches (according to geomorphological zonation). The valley form of the Kwaggaslaagte River and associated tributaries are predominantly V4 (confined valley floodplain), and to a lesser extent, V2 (flood plain confined to one side) (Nel, et al., 2011). The Present Ecological State (DWAF, 1999) of the Kwaggaslaagte River and its associated tributaries are classified as Moderately Modified (Class C) (Kleynhans, 2000).

Refer to Section 4.3.1, for a description of the potential impacts, associated with the EGI development, on freshwater resource features and their associated catchments.

With meticulous planning, especially in terms of the layout design and location of infrastructure, as well as the implementation of effective mitigation measures, the significance of these impacts can be significantly reduced to acceptable levels. It is furthermore recommended that where watercourses/wetlands are to be crossed by the access routes, existing crossings should be used/upgraded.

4.3.2.2. NFEPA: Wetlands

A review of the NFEPA coverage for the study area (Figure 5) revealed that a large amount of wetland features occur within the project site (332 wetland features) (Nel, et al., 2011). However, according to the NFEPA coverage only eighteen (18) wetland features occur within the development area. Of these eighteen wetland features, eight are artificial wetland features (small farm dams). Of the ten (10) natural wetland features, three are

are classified as Non-FEPA wetlands, whilst seven (7) are have been listed as FEPA priority wetland features (Nel, et al., 2011).

With meticulous planning, especially in terms of the layout design and location of infrastructure, as well as the implementation of effective mitigation measures, the significance of these impacts can be significantly reduced to acceptable levels. It is furthermore recommended that the crossing of wetland features should be avoided as far as possible and where crossing of wetland/watercourse features are unavoidable, only existing crossings may be used or be upgraded.

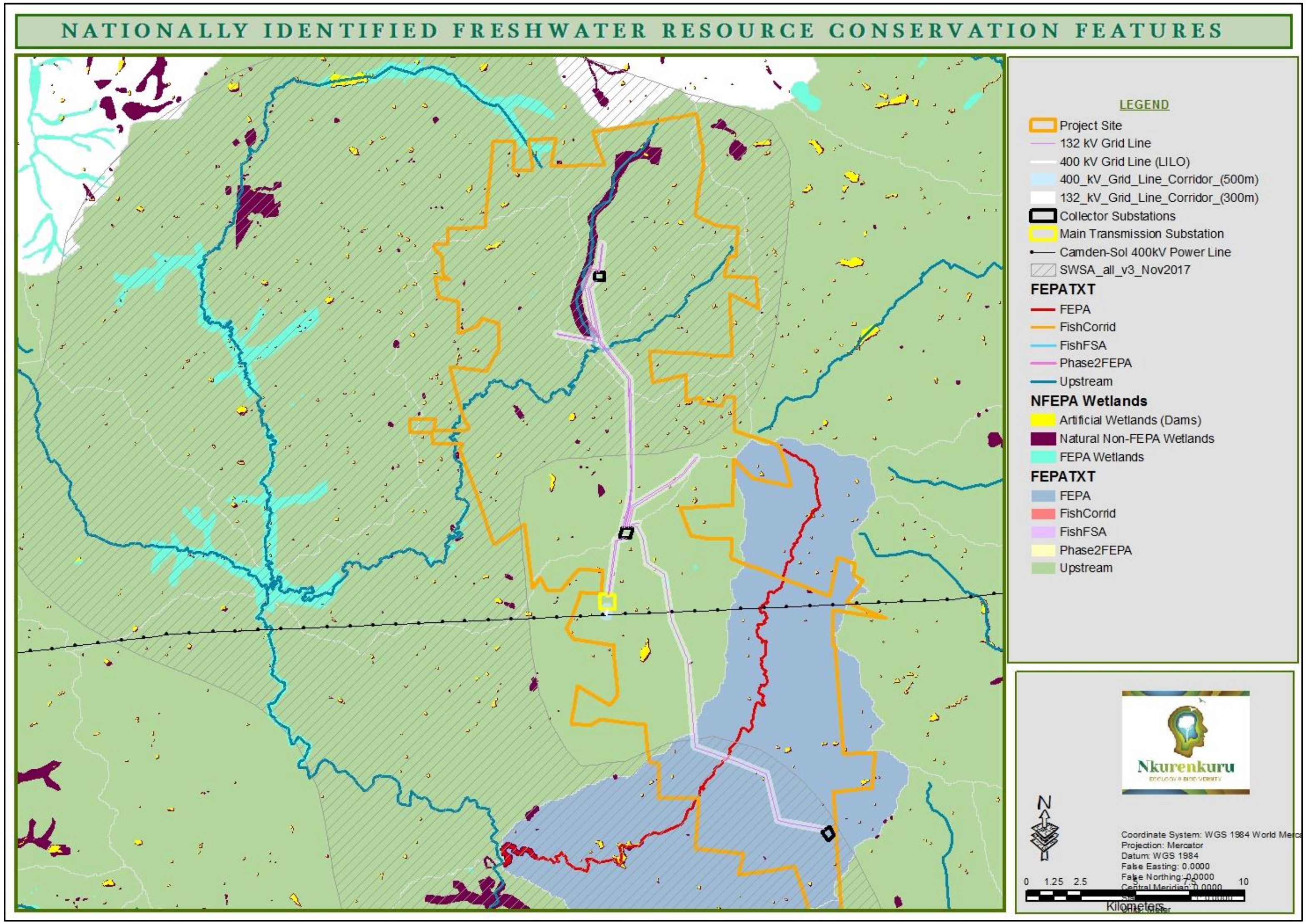

Figure 5: Nationally identified aquatic resource conservation priority areas found within the greater surroundings of the proposed project site as well as within the proposed development area.

4.3.3. Critical Biodiversity Areas and Broad Scale Ecological Processes

The Mpumalanga Biodiversity Conservation Plan (MBCP) is a plan developed conjointly by the Mpumalanga Tourism and Parks Agency (MPTA) and Department of Agriculture and land Administration (DALA) to guide conservation and land-use decisions in the province in order to support sustainable development.

Freshwater Critical Biodiversity Areas (CBA) have been identified for the entire Mpumalanga Province and are published by SANBI (http://bgis.sanbi.org/). This biodiversity assessment identifies CBAs representing biodiversity priority areas that should be maintained in a natural to near-natural state. CBA maps show the most efficient selection and classification of land portions to be safeguarded so that ecosystem functioning is maintained and national biodiversity objectives are met (see Table 6 for a summary of the different freshwater features underpinning the various CBA maps and also refer to

Table 7 for a summary of the land-use guidelines recommended for each feature).

According to Figure 6 and Figure 7, less than 1% of the development site comprises Freshwater CBAs (CBA Rivers: 0.54% and CBA Wetlands: 0.07%). In terms of ESAs; approximately 11% of the development area is located within an Important Catchment Area, whilst ESA Wetlands and Wetland Cluster, combined, only cover a little more than 8% of the project site.

As already mentioned, more recent, available wetland spatial data sets such as the indicate that wetland features have been under-mapped within the NFEPA Wetland coverage (main source used for identifying freshwater CBAs and ESAs). Subsequently, the coverage of ESA Wetlands should be much higher. This was confirmed during the desktop and in-field delineation of wetland features within the project site.

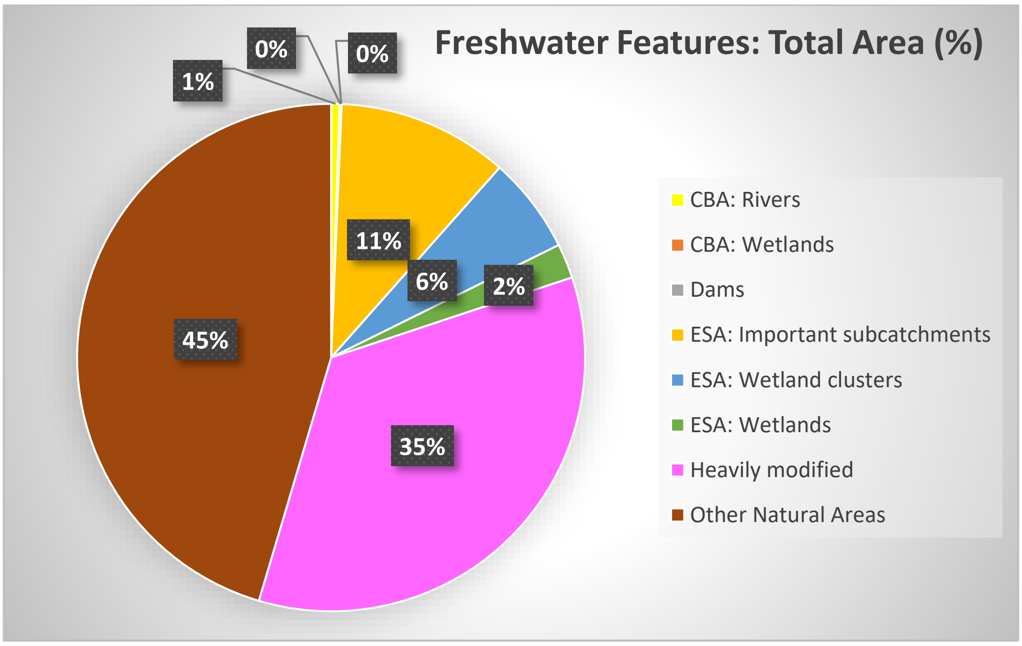

Figure 6: Percentage coverage of Freshwater CBAs within the development site.

From a developmental perspective, the following recommendations and additional requirements are provided:

- » The following buffer areas are recommended, and should be for maintaining the freshwater resource features REC (Recommended Ecological Category) allowing the persistence of the current present ecological status as well as their functions and services.
  - All watercourses and wetland features: 11m buffers from the outer edge of the freshwater resource features.

- » All freshwater features with their buffer areas have been classified as either Very High- or High sensitive and should be regarded as "No-Go" areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):

- Spanning of gridlines;
- Construction/upgrade of access roads and wetland/watercourse crossings:
    - the use/upgrade of existing roads and watercourse crossings are the preferred options;
    - Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.

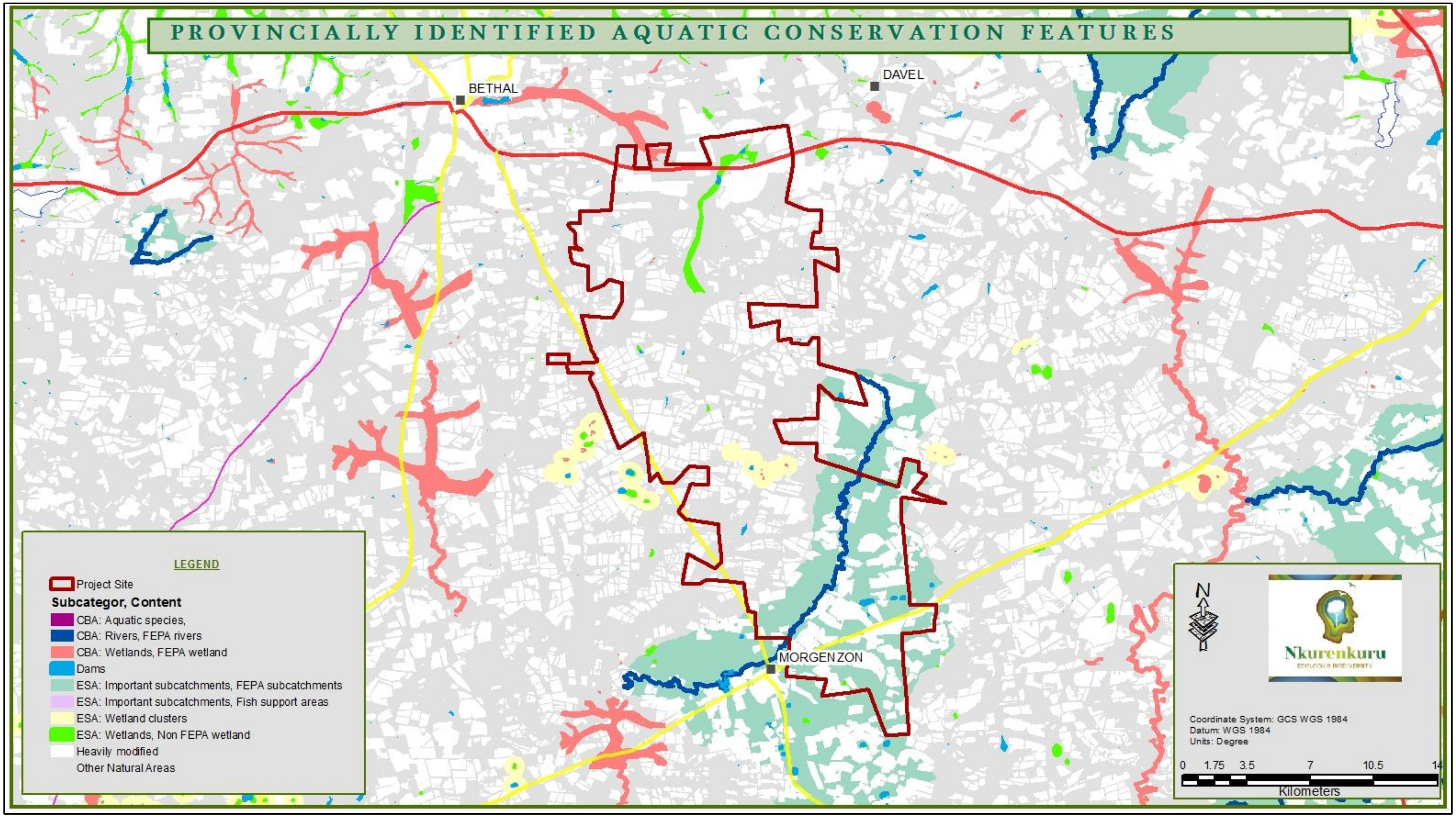

Figure 7: Provincially identified freshwater conservation priority areas found within the greater surroundings of project site.

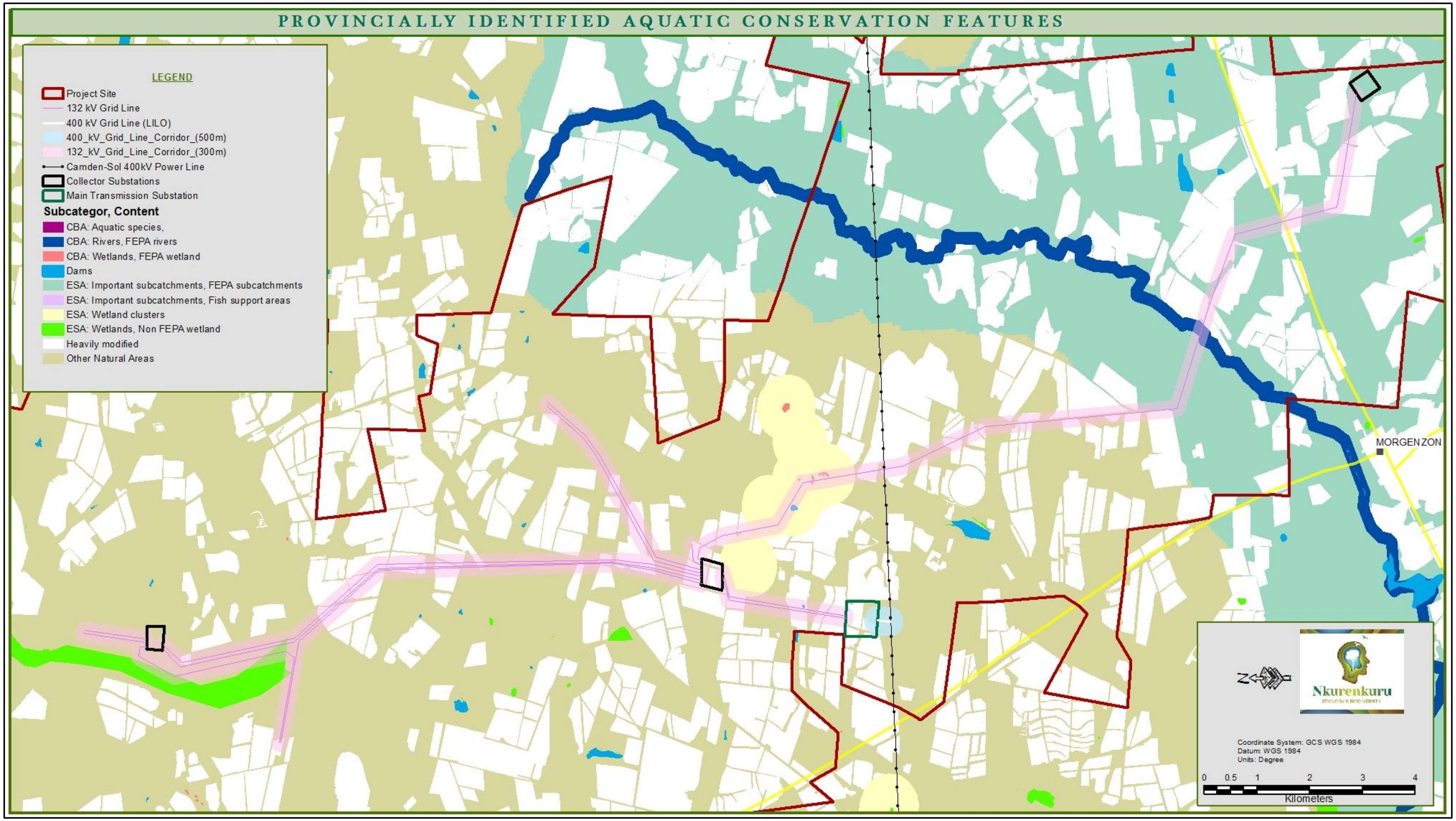

Figure 8: Provincially identified freshwater conservation priority areas found within the development area.

Table 6: Summary of the different categories occurring within the Mpumalanga Freshwater CBA map.

MAP CATEGORY	DESCRIPTION	SUB-CATEGORY	DESCRIPTION
Critical Biodiversity Areas (CBAs)	All areas required to meet biodiversity pattern and process targets; CBAs are areas of high biodiversity value that should be maintained in a natural or near-natural state.	CBA: Rivers	Rivers, with a 100 m buffer, that need to be maintained in a good ecological condition in order to meet biodiversity targets for freshwater ecosystems. This category includes FEPA rivers and all FEPA free-flowing rivers. The FEPA rivers include those required to meet biodiversity targets for threatened fish species.
		CBA: Wetlands	Wetlands that are important for meeting biodiversity targets for freshwater ecosystems; the ecological condition of these wetlands needs to be maintained or improved, and their loss or deterioration must be avoided. This category includes FEPA wetlands.
		CBA: Aquatic Species	Areas considered critical for meeting the habitat requirements for selected aquatic invertebrate species (dragonflies, damselflies, crabs). These species are known to occur only at one or a few localities and are at high risk of extinction if their habitat is lost. Fish species are included under the CBA River category
Ecological Support Areas (ESA)	Areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services.	ESA: Wetland Cluster	Clusters of wetlands embedded within a largely natural landscape to allow for the migration of fauna and flora between wetlands.
		ESA: Wetlands	All non-FEPA wetlands. Although not classed as FEPAs, these wetlands support the hydrological functioning of rivers, water tables and freshwater biodiversity, as well as providing a host of ecosystem services through the ecological infrastructure that they provide.
		ESA: Important Sub-catchments	Sub-catchments that either contain river FEPAs and/or Fish Support Areas.
		ESA: Fish Support Area	Sub-catchments that harbour fish populations of conservation concern, based on FEPA data augmented with regional data sets.
		ESA: Strategic Water Source Area	High rainfall areas that produce 50% of Mpumalanga’s runoff in only 10% of the surface area, thus supporting biodiversity and underpinning regional water security.

Other Natural Areas (ONA)	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.		
Moderately or Heavily Modified Areas	Areas in which significant or complete loss of natural habitat and ecological function has taken place due to activities such as ploughing, hardening of surfaces, open-cast mining, cultivation and so on.	Heavily Modified	Heavily Modified: All areas currently modified to such an extent that any valuable biodiversity and ecological function has been lost.
		Moderately Modified: Old lands	Artificial water bodies that have impacted on wetland or river ecosystems. These areas may still have a recharge effect on wetlands, groundwater and river systems and may support river- or water-dependent fauna and flora, such as water birds and wetland vegetation.

Table 7: Land-use guidelines for the various terrestrial and aquatic categories.

MAP CATEGORY	DESIRED MANAGEMENT OBJECTIVE	GUIDELINES
TERRESTRIAL FEATURES		
PA	Must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity. A benchmark for biodiversity.	» All operational aspects of managing these areas must be subject to their main purpose, which is to protect and maintain biodiversity and ecological integrity, and should be governed by a formally approved management plan and land-use activities that support the primary function of these areas as primary sites for biodiversity conservation. » The management plan must identify allowable activities, which should be consistent at least with the CBA Irreplaceable category; the location of these allowable activities should be captured in a zonation plan in the management plan. » Activities relating to the construction of roads, administrative or tourism infrastructure and services (such as water reticulation systems, power lines and the likes) that are required to support the primary function of the protected area and its allowable activities, must be subject to at least a basic scoping report, or a full EIA, as specified by NEMA, and the protected area management plan. » In the case of Protected Environments, a variety of agricultural land uses may be allowed, such as livestock grazing, plantation forestry and some cultivation. The location of these land-use activities must be informed by the CBA maps, and should be specified in the zonation plan of the management plan for the protected environment. All areas of natural habitat that are zoned for conservation use, should be subject to implementation of the land-use guidelines for protected areas, CBAs, and ESAs.
CBA: Irreplaceable	Maintain in a natural state with no further loss of natural habitat.	**General Guidelines.** » Biodiversity loss and land-use change in Irreplaceable CBAs should be monitored as a matter of priority, to prevent unauthorised land-use change or degradation by neglect or ignorance. » Where appropriate, these areas should be incorporated into the formal Protected Area system through biodiversity stewardship agreements (contract Nature Reserves or Protected Environments). Ideally, conservation management activities should be the primary land-use in all irreplaceable areas, or they should at least be » managed in ways that have no negative impact on species, ecosystems or ecosystem services. » Extensive (widespread, low-intensity) livestock or game ranching, if well-managed, is compatible with the desired management objectives for these areas. These land-uses are acceptable if they take into account the specific biodiversity features (e.g. rare

		species or vegetation remnants) and vulnerabilities (e.g. infestation by invasive alien plants) at each site, if they comply with recommended stocking rates, if any associated infrastructure (required to support the ranching activities) is kept to low levels. **Specific Guidelines (for meeting minimum requirements).** » In general, Irreplaceable sites must be avoided in terms of the mitigation hierarchy. » A specialist study must be part of the Scoping and EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert who is approved by the MTPA. » Applications for land use of any kind should be referred to the biodiversity specialists in MTPA and DARDLEA for evaluation. » Degraded areas included in the land parcel, but not the land-use proposal, should be restored to natural ecosystem functioning where possible. » Provision of alternative land as a 'biodiversity offset' in exchange for biodiversity loss in these areas CANNOT be considered except in exceptional circumstances and would need to be considered on a case by case basis.
CBA: Optimal	Maintain in a natural state with no further loss of natural habitat.	**General Guidelines.** » Acceptable land uses are those that are least harmful to biodiversity, such as conservation management, or extensive livestock or game farming. Large-scale cultivation, mining and urban or industrial development are not appropriate. » Extensive (widespread, low-intensity) livestock and game ranching, if well-managed (see above), is compatible with the desired management objectives for these areas. **Specific Guidelines (for meeting minimum requirements).** » If small-scale land-use change is unavoidable, it must be located and designed to be as biodiversity-sensitive as possible. » A specialist study must be part of the scoping and EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert who is SACNASP registered. » Provision for biodiversity offsets in exchange for biodiversity loss should only be considered as a last resort and at a ratio consistent with national policy.

5. AQUATIC/FRESHWATER RESOURCE BASELINE ASSESSMENT

This section sets out the findings of the baseline assessment of those water resources units and includes:

» Delineation, Classification and Habitat Descriptions;
» Present Ecological State (PES) Assessment;
» Ecological Importance and Sensitivity (EIS) Assessment;

The on-site / in-field assessment of the freshwater resource indicators was conducted by Gerhard Botha from Nkurenkuru Biodiversity and Ecology on the 24th to 27th of April 2022.

» Ultimately, 27 freshwater resource features were identified (**Error! Reference source not found.**) and delineated within the proposed development area and include;
  - Twelve (10) channelled valley-bottom wetlands
  - Two (2) unchanneled valley-bottom wetland,
  - Twelve (12) seepage wetlands; and
  - Three (3) floodplain wetlands
» Wetland features cover approximately 146.07 ha or 8% of the project site.
» Twenty-six (26) wetland features have been delineated within the 132 kV grid corridor, whilst no wetland features were recorded within the 400 kV grid corridor.
» Of these 26 wetland features, located within the survey area, approximately 22 - 24 features will likely be spanned by the power line and crossed by service roads.
» No wetland features have been identified within the footprint of the Main Transmission Substation
» No wetland features have been identified within the footprint of Collector Substations 1 and 2.
» A small seepage wetland has been identified and delineated within the footprint of the Collector Substation 3.

The dominant drainage/wetland features within the project site are the floodplain wetlands, within which almost all of the other wetland features drain into. All of the freshwater resource features on and around the site are intermittent or ephemeral, being inundated only for brief periods each year, with periods of drought that are unpredictable in duration.

Artificial wetland features (impoundments/dams) are also a noteworthy hydrological feature within the project site with ten dam features present within the development site. Most of these dam features are instream impoundments (especially common within the channelled valley-bottom wetlands) and are typically fairly small farm dams which is fairly easily breached or allow some seepage.

5.1. Aquatic/Freshwater Resource Delineation

The water body delineation and classification were conducted using the standards and guidelines produced by the DWS (DWAF, 2005 & 2007) and the South African National Biodiversity Institute (2009) (refer to Table 8, **Error! Reference source not found.**).

For the DWS definitions of different hydrological features refer to Appendix 1.

Table 8: Summary of the wetlands delineated and classified within the project site.

Hydrogeomorphic Type	Number of Features	Coverage (ha)	Coverage of Development Site (%)	Total Coverage of Project Site (%)	Wetland Conditions (PES)				
					A	B	C	D	E
Channelled Valley-Bottom	10	64.2	4	0.19	0	6	5	1	0
Uncahnnelled Valley-Bottom	2	8.79	0.5	0.03	0	2	0	0	0
Floodplain	3	22.22	1	0.06	0	3	0	0	0
Seep	12	52.39	3	0.15	2	2	3	6	0
Total	**27**	**147.61**	**8**	**0.43**	**2**	**13**	**8**	**7**	**0**

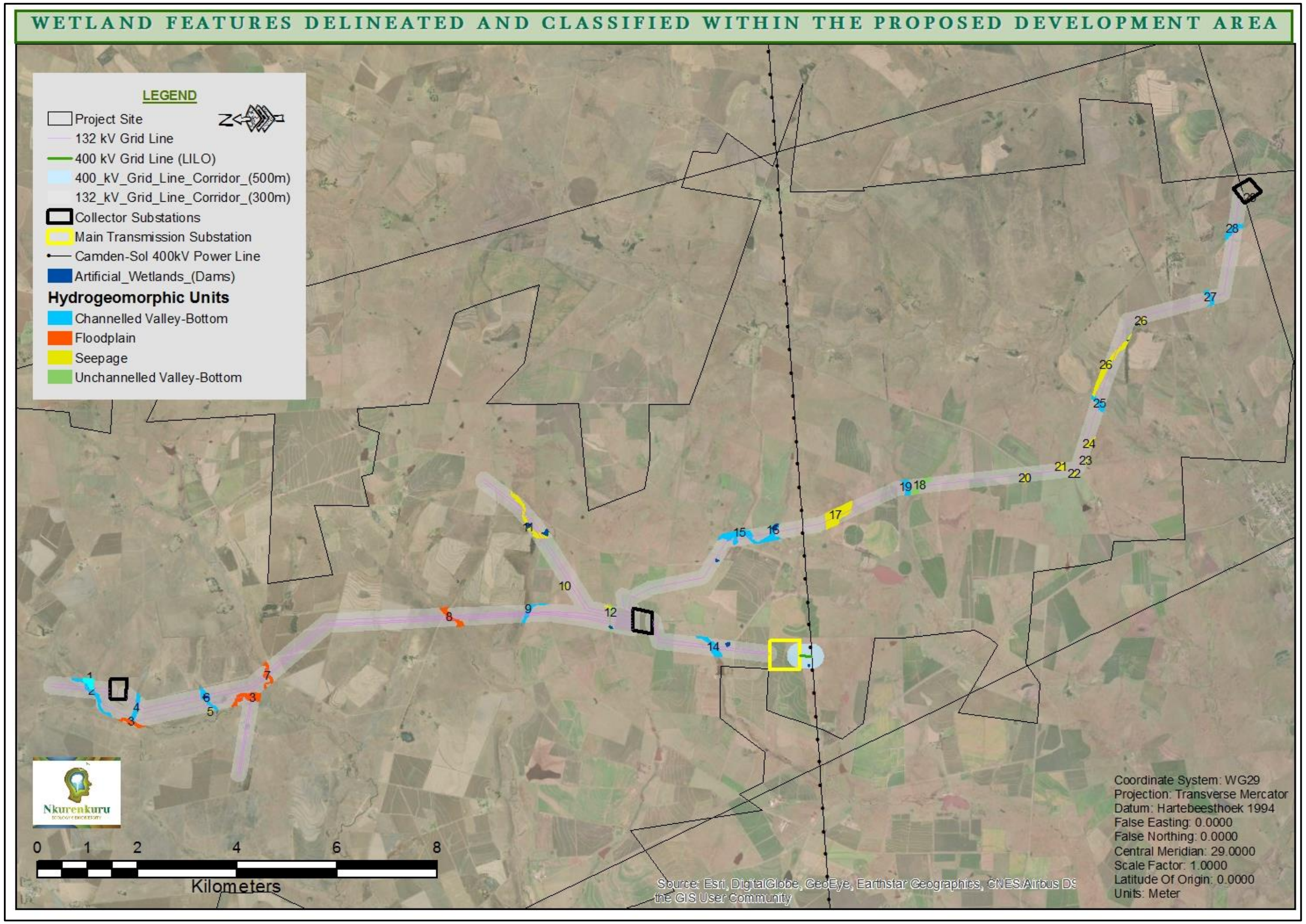

Figure 9: Mapping delineated and classified hydrogeomorphic wetland units occurring within the proposed development area.

5.2. Classification and Description of Surface Water Resource Features

5.2.1.1. Floodplain Wetlands

Floodplain wetlands are linear fluvial, net depositional valley bottom surfaces which have a meandering channel. These wetlands occur on mostly flat to gently-sloping land and are formed by the adjacent alluvial river channel. These floodplains wetlands are subject to periodic inundation by overtopping. The meandering channel flows within an unconfined to slightly confined (normally only to one side) depositional valley, and ox-bows or cut-off meanders frequently occur within the floodplain areas. The floodplain surface usually slopes away from the channel margins due to preferential sediment deposition along the channel edges and areas closest to the channel (natural levee). This can result in the formation of backwater swamps at the edges of the floodplain margins. River-derived depositional processes, may also result in the formation of point bars, scroll bars, and levees (Figure 10). The flat surfaces present along the along the margins of a river (deposited during previous eras of differing climate and/or sediment load), are known as terraces. Terraces are generally not geomorphologically active, (are not currently being built by river depositional processes). Floodplains are typically flooded (or inundated), on average, several times per year, during moderate peak flow events (such as a 1.5-year or 2-year flood). Terraces may be overtopped, but only by larger, less frequent floods (e.g. 50-year or 100-year events).

Water and sediment enter floodplain wetlands mainly as overspill from a major river channel during flooding (Figure 11). Water movement through the wetland is predominantly horizontal and bidirectional (i.e. in and out of the wetland), in the form of diffuse surface or subsurface flow, although significant temporary containment of water may occur in floodplain depressions. Water generally exits a floodplain wetland as diffuse surface and/or subsurface flow (often returning to the river channel), but infiltration and evapotranspiration of water from a floodplain wetland can also be significant, particularly if there are a number of depressional areas within the wetland.

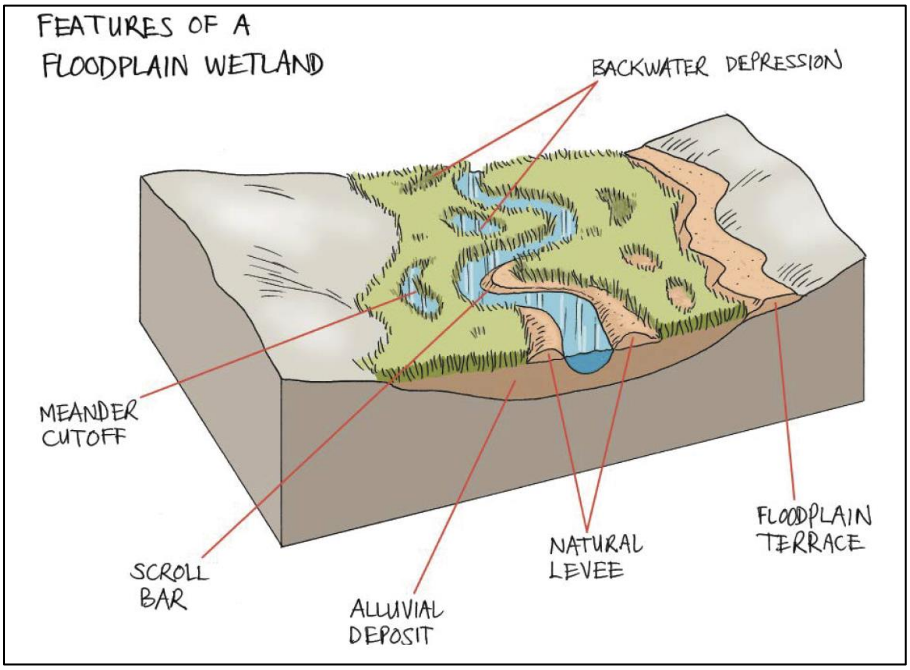

Figure 10: Illustration of the typical features/micro-habitats associated with floodplains wetlands (copied from Ollis et al., 2013).

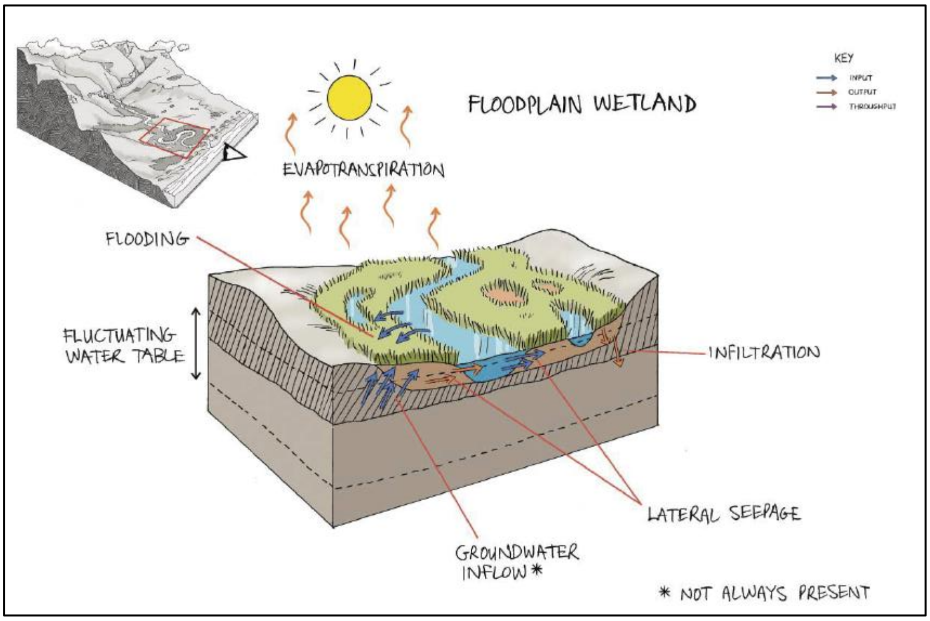

Figure 11: Conceptual illustration of a floodplain wetland, showing the dominant inputs, throughputs and outputs of water (copied from Ollis et al., 2013).

5.2.1.2. Channelled Valley-Bottom Wetlands:

Wetland systems characterised by their location within moderately well-defined valley floors with the presence of an active channel, but without typical diagnostic floodplain features. Flows within these systems are characteristically confined within a define channel. Dominant water inputs to these wetlands are from the watercourse/channel flowing through the wetland, predominantly as surface flow resulting from flooding, or as a form of overland flow from adjacent hillslopes and other smaller watercourses and valley-bottom wetlands, with substantially less groundwater discharge. Water generally exits a channelled valley-bottom wetland in the form of diffuse surface or subsurface flow in the adjacent river, with infiltration into the ground and evapotranspiration of water also being potentially significant Figure 12. The "master variable" responsible for shaping such an ephemeral watercourse is associated with the flow regime of the system, which includes variations and patterns in surface flow magnitude, frequency, duration, and timing (Poff et al., 1997). It follows that the size and shape of a watercourse is controlled in large part by the dominant discharge in a particular region (Lichvar & Wakeley, 2004). Fluvial morphology is frequently associated with extreme discharge events; streams and floodplains trap sediments and nutrients in addition to attenuating flood waters (Graf 1988; Leopold 1994).

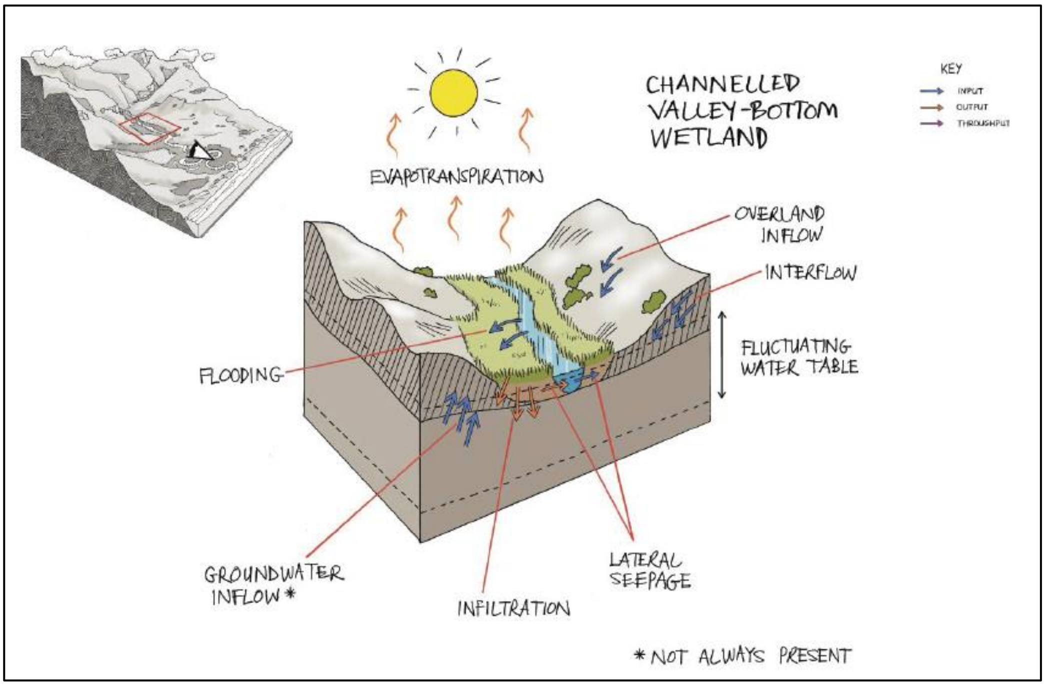

Figure 12: Conceptual illustration of a channelled valley-bottom wetland, showing the dominant inputs, throughputs and outputs of water (copied from Ollis et al., 2013).

5.2.1.3. <u>Unchannelled Valley-Bottom Wetlands:</u>

Unchannelled valley-bottom wetlands are characterised by their location on valley floors, an absence of distinct channel banks, and the prevalence of diffuse flows. These wetlands are generally formed when a river channel loses confinement and spreads out over a wider area, causing the concentrated flow associated with the river channel to change to diffuse flow (i.e. the river becomes an unchannelled valley-bottom wetland). This is typically due to a change in gradient brought about by a change in base level at the downstream edge of the wetland (for example, where an erosion-resistant dolerite dyke is present) and the resulting accumulation of sediment. In some cases, an unchannelled valley-bottom wetland could occur at the downstream end of a seep, where a slope grades into a valley near the head of a drainage line. Water inputs are typically from an upstream channel that becomes dominated by diffuse (surface and subsurface) flow as it enters the wetland and seepage from adjacent slopes (Figure 13). There may also be groundwater input into the wetland. Water characteristically moves through the wetland in the form of diffuse surface or subsurface flow, but the outflow may be in the form of either diffuse or concentrated surface flow. Infiltration and evapotranspiration from unchanneled valley-bottom wetlands can be significant, but horizontal, unidirectional, diffuse surface flow tends to dominate these wetland systems.

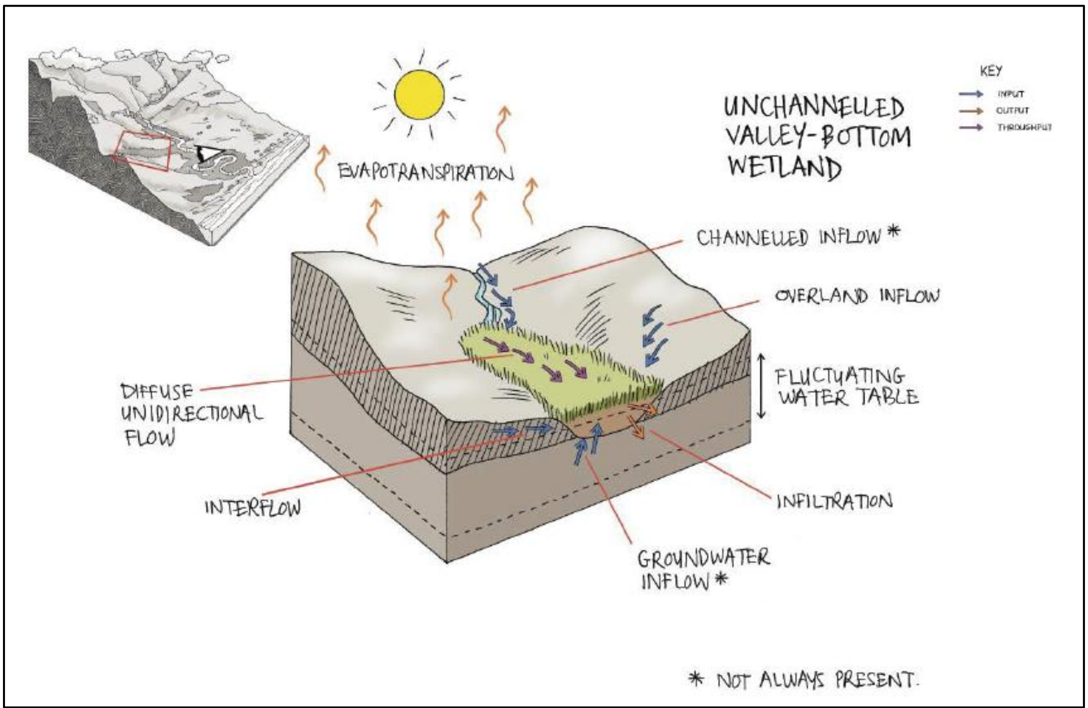

Figure 13: Conceptual illustration of an unchannelled valley-bottom wetland, showing the dominant inputs, throughputs and outputs of water (copied from Ollis et al., 2013).

5.3. Terrain and Soils

A hydromorphic soil displays unique characteristics resulting from its prolonged and repeated saturation. Once a soil becomes saturated for an extended time, roots and microorganisms gradually consume the oxygen present in pore spaces in the soil. In an unsaturated soil, oxygen consumed in this way would be replenished by diffusion from the air at the soil surface. However, since oxygen diffuses 10 000 times more slowly through water than through air, the process of replenishing depleted soil oxygen in a saturated soil is significantly slower. Thus, once the oxygen in a saturated soil has been depleted, the soil effectively remains anaerobic.

Prolonged anaerobic soil conditions result in a change in the chemical characteristics of the soil. Certain soil components, such as iron and manganese, which are insoluble under aerobic conditions, become soluble when the soil becomes anaerobic, and can thus be leached out of the soil profile.

Iron is one of the most abundant elements in soils, and is responsible for the red and brown colours of many soils. Once most of the iron has been dissolved out of a soil as a result of prolonged anaerobic conditions, the soil matrix is left a greyish, greenish or bluish colour, and is said to be gleyed.

A fluctuating water table, common in wetlands that are seasonally or temporarily saturated, results in alternation between aerobic and anaerobic conditions in the soil. Lowering of the water table results in a switch from anaerobic to aerobic soil conditions, causing dissolved iron to return to an insoluble state and be deposited in the form of patches, or mottles, in the soil. Recurrence of this cycle of wetting and drying over many decades concentrates these bright, insoluble iron compounds. Thus, soil that is gleyed but has many mottles may be interpreted as indicating a zone that is seasonally or temporarily saturated.

» Permanent saturated zones: Soil forms were mainly characterized by very dark black to dark greys brown vertic, and occasionally melanic soils containing varying amounts of organic material (low moderate to moderate amounts of organic material) and no mottles. These vertic/melanic topsoil horizons typically overly dark grey to light brownish grey gley subsoil horizons. The most prominent soil form found within this zone was Rensburg. Willowbrook was occasionally encountered as well as Mkuze (within floodplains). Towards, the far southern portion of the project site, where more loamy soils were encountered, the permanent saturated zone was characterized by both Rensburg as well as Katspruit soil forms.
» Seasonal and temporary saturated zones: Black to dark grey or dark grey-brown clay matrix with little organic material and some high chroma mottles (orange and yellow). The prominent soil forms encountered within this zone were Rensburg,

Mkuze, Glen and Bonhein and Rustenburg. Towards, the far southern portion of the project site, where more loamy soils were encountered, the seasonal saturated zone was characterized by Westleigh and Pindene soil forms. Organic material was fairly low. High chroma mottles (orange and yellow) were abundant.

5.4. Vegetation Description

The vegetation of the wetland areas are characterised by a 75 – 100% cover. Native trees were absent from the wetland areas, except for scattered individuals of *Salix babylonica* along larger river channels. The shrub layer was approximately 50 cm in height, with the forb layer being 50 cm and the graminoid layer 90 cm.

A total of 77 plant species (63 native and 14 alien) were recorded within this type. No endemic species were found is unit; however, one protected species was found, namely *Crinum bulbispermum*. The unit did not contain any Red List species.

Some of the dominant species were *Cyperus congestus*, *C. fastigiatus*, *C. rigidifolius*, *Eleocharis dregeana*, *Fingerhuthia sesleriiformis*, *Fuirena coerulescens*, *Leersia hexandra*, *Pennisetum thunbergii*, and *Setaria nigrirostris*. The following native species were unique to the wetland habitats:

- *Agrostis eriantha var. eriantha*
- *Alectra sessiliflora*
- *Aristida bipartita*
- *Brachiaria eruciformis*
- *Carex glomerabilis*
- *Crinum bulbispermum*
- *Cycnium tubulosum subsp. tubulosum*
- *Cyperus congestus*
- *Cyperus fastigiatus*
- *Cyperus haematocephalus*
- *Cyperus rigidifolius*
- *Denekia capensis*
- *Diclis rotundifolia*
- *Eleocharis dregeana*
- *Falkia oblonga*
- *Fingerhuthia sesleriiformis*
- *Fuirena coerulescens*
- *Gomphostigma virgatum*
- *Hemarthria altissima*
- *Hermannia erodioides*
- *Imperata cylindrica*
- *Jamesbrittenia aurantiaca*
- *Juncus exsertus*
- *Leersia hexandra*
- *Lobelia acutangula*
- *Lobelia sonderiana*
- *Mentha longifolia subsp. capensis*
- *Moraea pallida*
- *Nerine angustifolia*
- *Panicum coloratum*
- *Pelargonium minimum*
- *Pennisetum thunbergii*
- *Schoenoplectus decipiens*
- *Scirpoides burkei*
- *Sebaea leiostyla*
- *Setaria nigrirostris*
- *Trifolium africanum*
- *Wahlenbergia undulata*

All wetland areas that were inspected were in fairly good condition (no significant transformation, and/or secondary vegetation) and relatively free from any alien species, except for scattered individuals of *Cosmos bipinnatus*, *Oenothera rosea*, *Paspalum dilatatum*, *Physalis peruviana*, and *Schkuhria pinnata*. Three NEM:BA listed invasive species were also occasionally recorded, namely *Cirsium vulgare*, *Verbena bonariensis*, and *Xanthium spinosum*.

5.5. Present Ecological State (PES), Conservation Importance and Final Sensitivity Rating

Wetlands form at the interface between terrestrial and aquatic environments, and between groundwater and surface-water systems. The complex interaction of inflows and outflows of water, sediment, nutrients and energy over time is what shapes the physical template of the wetland and understanding theses fluxes and interactions considered is fundamentally important in developing an understanding the occurrence, morphology and dynamics of different wetland systems (Ellery et al., 2009).

The Present Ecological State (PES) of an aquatic system represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The Present Ecological State (PES) and the Ecological Importance and Sensitivity Scores (EIS) were based on the current state and function of the natural systems observed, or where systems contributed to the ecological character of the development footprint. These ratings were then translated in the respective sensitivity ratings of the various aquatic systems (High to Low), and used to prepare a sensitivity map, used in guiding the preparation of the layout. This was also conducted in conjunction with the other specialists to determine the layout to reduce the number of overall impacts.

The following summary is present of the PES/EIS score of the natural wetlands found within the project site.

Table 9: Summary of the wetlands PES/EIS.

Wetland Number	Hydrogeomorphic Type	Wetland Condition (PES)	Ecological Sensitivity (ES)	Ecological Importance (EI)	Final EI&S (after modification)
1	Channelled Valley-Bottom	C	Moderate	High	High
2	Channelled Valley-Bottom	B	Moderate	High	Very High
4	Channelled Valley-Bottom	C	High	Moderate	High
6	Channelled Valley-Bottom	D	High	Moderate	High
9	Channelled Valley-Bottom	C	High	Moderate	High
14	Channelled Valley-Bottom	C	Moderate	High	High
15	Channelled Valley-Bottom	B	Moderate	High	Very High
16	Channelled Valley-Bottom	C	High	Moderate	High
19	Channelled Valley-Bottom	B	Moderate	High	Very High
25	Channelled Valley-Bottom	B	Moderate	High	Very High
27	Channelled Valley-Bottom	B	Moderate	High	Very High
28	Channelled Valley-Bottom	B	Moderate	High	Very High
3	Floodplain	B	Moderate	High	Very High
3	Floodplain	B	Moderate	High	Very High
7	Floodplain	B	Moderate	High	Very High
8	Floodplain	B	Moderate	High	Very High
5	Seepage	A	High	Moderate	Very High
10	Seepage	D	High	Moderate	High
11	Seepage	D	High	Moderate	High
13	Seepage	A	High	Moderate	Very High
17	Seepage	C	Moderate	High	High
20	Seepage	D	High	Low	High
21	Seepage	C	High	Moderate	High
22	Seepage	D	High	Moderate	High
23	Seepage	B	High	Moderate	Very High
24	Seepage	B	High	Moderate	Very High
26	Seepage	D	Moderate	Moderate	High
26	Seepage	D	Moderate	Moderate	High
29	Seepage	C	High	Moderate	High
12	Unchannelled Valley-Bottom	B	High	Moderate	Very High
18	Unchannelled Valley-Bottom	B	High	Moderate	High

The bulk of the wetlands were in natural to moderately modified conditions, with instream farm dams, roads, grazing pressures and channel erosion being the most significant forms of disturbance.

The numerous small gravel dams and road crossings, found with most of the wetland features have had a low-moderate to moderate impact on the flow character of these wetland features as well as local vegetation cover and bed and channel morphology, however these impacts are mainly associated with a small area surrounding the source of the impact. Erosional features are also a common feature around theses disturbed areas.

Vegetation cover, in some areas, have been somewhat historically transformed due to historical land use practices (cattle grazing).

"*The Ecological Importance and Sensitivity (EIS) of a wetland is an expression of the importance of the aquatic resource for the maintenance of biological diversity and ecological functioning on local and wider scales; whilst Ecological Sensitivity (or fragility) refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Kleynhans & Louw, 2007).*

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits

A summary of the EI&S importance assessment scores and ratings for wetlands is provided in Table 9 above. The ES has been adjusted as follows:

- All wetland features with high lateral and longitudinal connectivity, especially in relationship to other wetland features have been upgraded to very high sensitive (**Error! Reference source not found.** and **Error! Reference source not found.**) due to the fact that these features, collectively contribute significantly to biodiversity maintenance, spatial heterogeneity, hydrological connectivity. Collectively these areas form ecological corridors for the movement of fauna and flora. Furthermore, these habitats provide valuable habitat for faunal Species of Conservation Concern (SCC) including:
    - Serval (*Leptailurus serval*): Near Threatened;
    - Vlei rat (*Otomys irroratus*): Near Threatened; and
    - Cape clawless otter (*Aonyx capensis*): Near Threatened.

- All endorheic wetland features, wetland features that are not directly connected to the larger extensive wetland network or that have been fractured/isolated through agricultural practices are classified as High Sensitive (**Error! Reference source not found.** and **Error! Reference source not found.**). Even though these wetland features do not provide functions and services to the extent of the more connected and larger wetland features, these wetlands still provide some functions and services. Furthermore, most of these wetland features are fairly small and any direct impacts on these wetland habitats may have a significant impact on the drivers of these wetland features as well as the associated biodiversity. Another feature of these wetlands is the fact that, even though small in size, they are located within relatively small catchment areas, thus these wetlands' percentage coverage in relationship to their catchments are fairly significant, making these wetland features vulnerable to catchment disturbances.

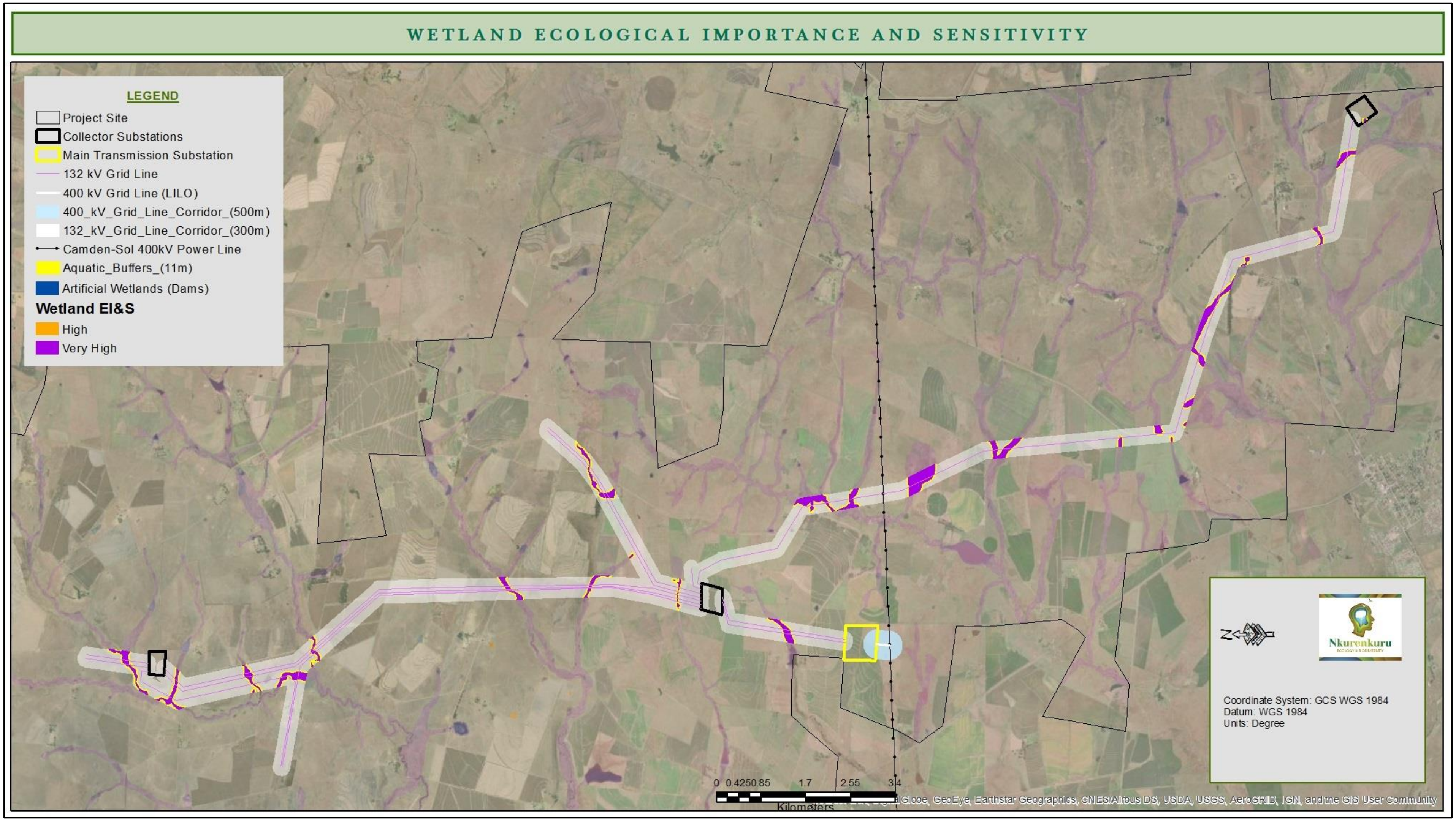

Figure 14: Wetland/Freshwater Resource Sensitivity mapping of the proposed development area.

5.6. Wetland Buffer Zones

In terms of the internal grid connection infrastructure, a buffer area of 11m have been recommended for all delineated freshwater resource features:

- The buffer areas applicable to the wetland areas are also regarded as "very high" sensitive due to their associated with the "very high" sensitive freshwater resource features.
    - All watercourses and their associated buffer areas should be spanned and no pylons may be allowed within these areas.
    - Apart from the spanning of the watercourses the only other activities allowed within the watercourses and associated buffers are the upgrade or of existing access routes/wetland crossings and where no acceptable crossings are available the construction of new crossings may be allowed, with the implementation of strict mitigation and monitoring measures.

6. ASSESSMENT OF PROPOSED IMPACTS

6.1. Identification of Potential Impacts and Associated Activities (General)

Freshwater ecosystems, are particularly vulnerable to human activities and these activities can often lead to irreversible damage or longer term, gradual/cumulative changes to these ecosystems. When making inferences on the impact of development activities on aquatic ecosystems it is important to understand that these impacts speak specifically to their effect on the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) or functional importance/value of aquatic ecosystems. All of these are linked to the physical components and processes of aquatic ecosystems, including hydrology, geomorphology and vegetation as well as the biota that inhabit these ecosystems. Anthropogenic activities can generally impact either directly (e.g. physical change to habitat) or indirectly (e.g. changes to water quantity & quality). Figure 14 shows how impacts to aquatic ecosystems such as habitat loss, flow modification and pollution can have a number of negative ecological consequences for the receiving aquatic environment, ranging from loss of sensitive species to reduced ecosystem goods & services provision.

Freshwater resource ecological impacts associated specifically with Ummbila Emoyeni EGI is discussed below. Potential impacts have been split into Construction- and Decommissioning Phase Impacts and Operational Phase Impacts.

According to the proposed layout, construction, operation and decommission will lead to potential direct and potential indirect loss of / or damage to freshwater resource features. This may potentially lead to localised loss of freshwater resources and may in-turn lead to downstream impacts that affect a greater extent of freshwater resources or impact on function and biodiversity. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to freshwater resource features can have an impact on the functioning of those features.

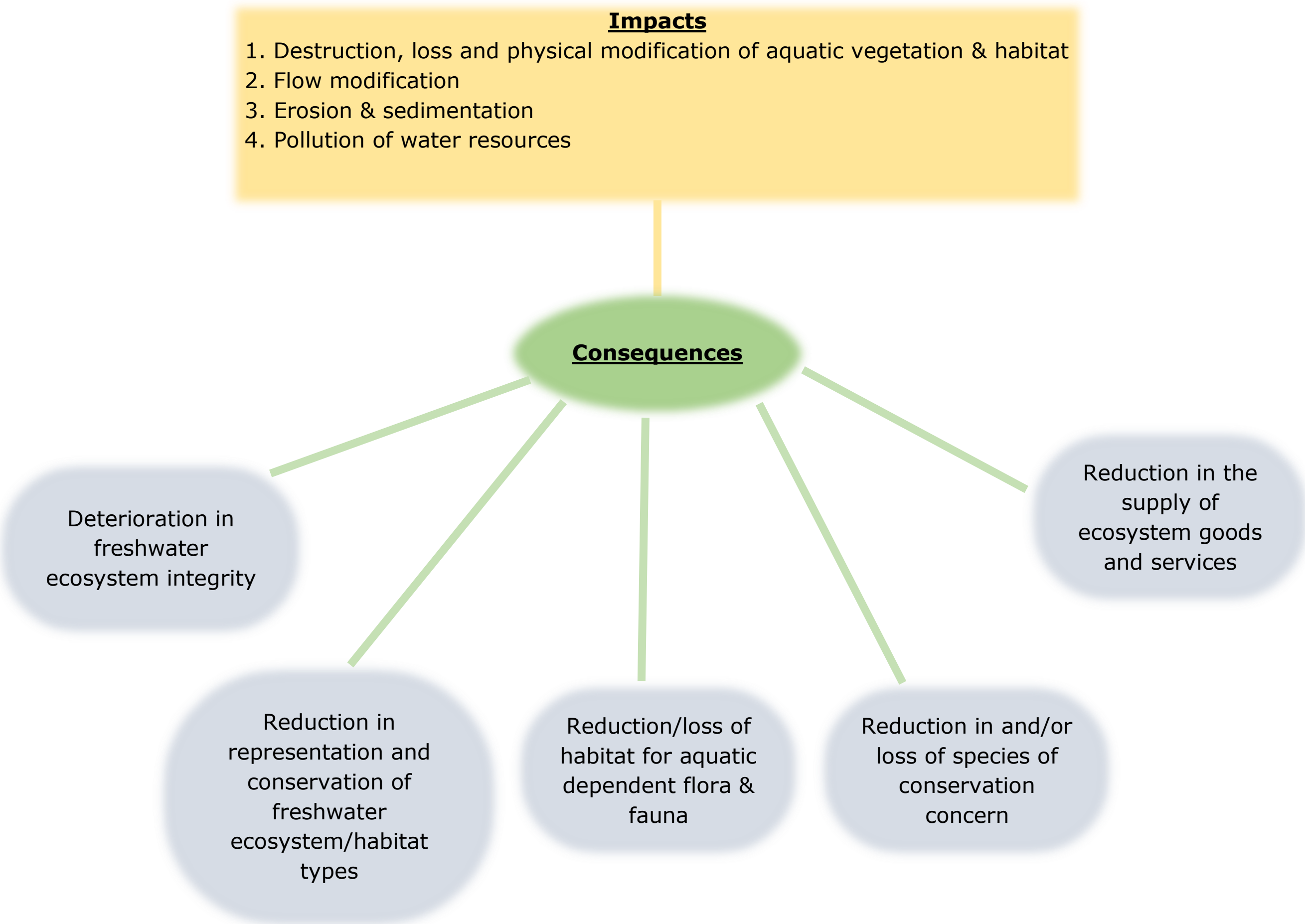

Figure 15: Negative ecological consequences for Freshwater Resource Features as a result of direct and indirect anthropogenic impacts.

6.2. Impact of Proposed Substation (Collection and Main Transmission) Infrastructure

For substation locations;

- Collector Substations 1 & 2 as well as the Main Transmission Substation: the proposed development footprints are located outside of any freshwater resource features and also within fairly similar geographical areas. As such, for all three substation locations, potential impacts associated with the construction, operation and decommission phases will very similar, with activities potentially leading to some indirect loss of / or damage to nearby/downslope freshwater resource features.

» Collector Substations 3: the proposed development footprint includes a small portion of a seepage wetland which feeds into a fairly large channelled valley-bottom wetland. As such, this potential development will result in some direct impacts on the seepage wetland and also potentially indirect loss of / or damage to downslope freshwater resource features.

Construction and Planning Phase

The development of substations requires initial high intensity disturbances of fairly small surface areas including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary, and the compaction of local soil within the development footprints. Concrete foundations will be necessary. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with temporary laydown and storage areas.

Potential impacts on nearby/downslope freshwater resource features may include:

» The increase in surface runoff and sediments carried into the nearby down slope freshwater resource features, subsequently potentially impacting local hydrological character of these freshwater resource features (e.g. water quality and hydro-geomorphological character).
» The potential spread of erosion from the source (within the development footprint area), into the wetland features, subsequently disturbing wetland soils, vegetation cover and local biota.
» Impairment of functions and services;

There is also the potential for some water quality impacts associated with hydrocarbon spills or associated with the other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of cement and other construction activities.

Generally, with mitigation measures in place, impacts on these downslope freshwater resource features can be avoided or will be localised, short-term and of low intensity and is expected to have a low to low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Operation Phase:

During the operation phase the facilities will operate continuously, mostly unattended and with low maintenance required for the duration of the associated REFs' lives (±20 years). The substations are likely to be monitored and controlled remotely, with maintenance only taking place when required.

The hard surfaces created by the development may lead to increased runoff (reduction in infiltration) and the potential interception and channelling of surface runoff. This may potentially lead to:

- A modification to the water input characteristic (input in quantity and a change in water input pattern);
- Increased erosion;
- Sedimentation of the downslope areas; and
- Impairment of freshwater resource functions and services

Subsequently, a localised long-term impact (more than 20 years) of low intensity could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

Decommission Phase:

During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

The proposed WEF development is anticipated to require high intensity disturbance of a limited surface area at the site of each wind turbine. Concrete foundations for the turbine towers will need to be constructed as well as permanent hard standing bases of compacted gravel adjacent to each turbine location for the cranes used to construct the turbines. Internal substations, warehouses, batching plants, and an Operational and Maintenance Building would also need to be constructed within the site. Temporary laydown areas and a construction site would need to be placed within the site for the construction works.

All of the above-mentioned supporting infrastructure are located well outside any freshwater resource features as well as their associated buffer areas and as such impacts on freshwater resource features will be avoided.

In terms of the location of the wind turbines, no wind turbines are located within any of the delineated freshwater resource features as well as their recommended buffer areas and as such direct impacts on freshwater resource features will be avoided.

Activities during the construction phase of the project could be expected to result in some disturbance of vegetation cover for clearing and preparation of the turbine and supporting infrastructure, this may potentially lead to some indirect impacts on downslope freshwater resource features. There is also the potential for some water quality impacts associated with the batching of concrete, from hydrocarbon spills or associated with the other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of concrete for wind turbines and other construction activities.

Generally, with mitigation measures in place, impacts will be localised, short-term and of low intensity and is expected to have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Operation Phase:

During the operation phase the turbines will operate continuously, unattended and with low maintenance required for the duration of the WEFs life (±20 years). The WEF is likely to be monitored and controlled remotely, with maintenance only taking place when required. The hard surfaces created by the development may lead to increased runoff, in particular on surfaces with a steeper gradient. This may lead to increased erosion and sedimentation of the downslope areas.

Subsequently, a localised long-term impact (more than 20 years) of low intensity (depending on the distance between the turbines and the freshwater features) could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

Decommission Phase:

During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

6.2.1. Assessments of Impacts

CONSTRUCTION PHASE	
Impact 1: Loss of freshwater resource features during the construction	
Environmental Parameter	Direct and indirect physical destruction or disturbance of aquatic habitat caused by vegetation clearing, disturbance of riparian/wetland habitat, encroachment/colonisation of habitat by invasive alien plants and alteration of watercourse/wetland geomorphological profiles (including stream beds and banks).

Issue/Impact/Environmental Effect/Nature	Possible ecological consequences may include: » Reduction in representation and conservation of freshwater ecosystem/habitat types; » Reduction in the supply of ecosystem goods & services; » Reduction/loss of habitat for aquatic dependent flora & fauna; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species). As already mentioned, » Only Collector Substation 3 will directly impact an aquatic habitat through the direct disturbance and replacement of a portion of the wetland zones These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in the loss and/or damage to vegetation and alteration of natural geomorphological and hydrological processes within the freshwater resource features. Compacted soils are also not ideal for supporting vegetation growth as they inhibit seed germination.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (56)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low – Destruction of wetland vegetation will not be remedied easily.	Low – Destruction of wetland vegetation will not be remedied easily.
Irreplaceable loss of resources	Local loss of resources	No loss of resources
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas. » Subsequently the proposed development footprint for the Collector Substation 3 should be amended in order to exclude the wetland area as well as its associated buffer area. » The recommended buffer areas between all the delineated freshwater resource features and proposed project activities should be maintained. » Infrastructure footprints and associated areas of disturbance should be minimised as far as practically possible » Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off. » Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and where	

	deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils). Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities » Stormwater from the substations and hard stand areas, must be managed using appropriate channels and swales when located within steeper areas. » The runoff should be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales. » Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the substation sites. » No stormwater runoff must be allowed to discharge directly into any water course from the substations, and flows from these substations should be allowed to dissipate over a broad area covered by natural vegetation.
Residual Impacts	Without Mitigation: » Locally altered vegetation structure, » Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. With Mitigation: » Residual impacts are unlikely to occur within these freshwater resource habitats.
Impact 2: Increase in sedimentation and erosion.	
Environmental Parameter	Alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition
Issue/Impact/Environmental Effect/Nature	Caused by soil erosion and earthworks that are associated with construction activities. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction/loss of habitat for aquatic dependent flora & fauna. This may furthermore, influence water quality downstream

	Pre-Mitigation Impact Rating	Post Mitigation Impact Rating
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Moderate (5)	Minor (3)
Probability	Highly Probable (4)	Very Improbable (1)
Significance	**Medium (40)**	**Low (6)**
Status	Negative	Negative
Reversibility	Moderate	High

Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas. » The proposed development footprint for the Collector Substation 3 should be amended in order to exclude the wetland area as well as its associated buffer area. » The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained. » Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off. » Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential. » Site rehabilitation should aim to restore surface drainage patterns, natural soil and vegetation as far as is feasible. » An erosion control management plan should be utilised to prevent erosion » There should be reduced activity at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased. » Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities » Stormwater from the substations and other hard stand areas, must be managed using appropriate channels and swales when located within steep areas. » Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the switching station sites. » Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. » Construction of gabions and other stabilisation features to prevent erosion, if deemed necessary. » No stormwater runoff must be allowed to discharge directly into any water course from the substations, and flows from these switching station sites should be allowed to dissipate over a broad area covered by natural vegetation.	
Residual Impacts	Without the implementation of mitigation measures altered stream bed morphology may result from the development, however this residual impact is highly unlikely to occur if the necessary mitigation measures are implemented.	
Impact 3: Potential impact on localised surface water quality.		
Environmental Parameter	Alteration or deterioration in the physical, chemical and biological characteristics of water resources (i.e. water quality) such as wetlands & rivers as a result of water/soil pollution. The term 'water quality' must be viewed in terms of the fitness or suitability of water for a specific use (DWAF,	

	2001). In the context of this impact assessment, water quality refers to its fitness for maintaining the health of aquatic ecosystems. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).	
Issue/Impact/Environmental Effect/Nature	During preconstruction and construction, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet concrete, shutter-oil, etc.) associated with site-clearing machinery, construction and maintenance activities could be washed downslope via the ephemeral systems.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Very Short Duration (1)	Very Short Duration (1)
Magnitude	Moderate (7)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (16)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» No activities may be allowed outside of the development areas, and especially within the identified downstream freshwater resource features and their associated buffer areas as these areas are regarded as no-go areas. » Implement appropriate measures to ensure strict use and management of all hazardous materials used on site » Implement appropriate measures to ensure Strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.) » Store hydrocarbons off site where possible, or otherwise implement hydrocarbon storage using impermeable floors with appropriate bunding, sumps and roofing. » Implement appropriate measures to ensure containment of all contaminated water by means of careful run-off management on the development site. » Implement appropriate measures to ensure strict control over the behavior of construction workers. » Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.	

	» Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the substations. » Waste should be stored on site in clearly marked containers in a demarcated area. » All waste material should be removed at the end of every working day to designated waste facilities at the main construction camp/suitable waste disposal facility. » All waste must be disposed of offsite. » Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited. » Designate a single location for refueling and maintenance, outside of any freshwater resource features. » Keep a spill kit on site to deal with any hydrocarbon leaks. » Remove soil from the site which has been contaminated by hydrocarbon spillage.
Residual Impacts	Residual impacts will be negligible after appropriate mitigation.

OPERATIONAL PHASE		
Impact 4: Impact on watercourse/wetland systems through the possible increase in surface runoff on watercourse/wetland form and function during the operation and decommissioning phases.		
Environmental Parameter	Alteration to the hydrological character of the freshwater resource features	
Issue/Impact/Environmental Effect/Nature	This might occur during the operation phase, when hard or compacted surfaces (hard engineered surfaces, roads etc.) increase the volume and velocity of the surface runoff. This could impact the hydrological regime through the increase in flows that are concentrated in certain areas. If flows are too concentrated with high velocities, scour and erosion may occur, with a complete reduction or disturbance of riparian habitat.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Whole Site (2)	Local (1)
Duration	Long Term (4)	Long Term (4)
Magnitude	Moderate (6)	Small (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (18)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Unlikely	Unlikely
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:	» Any storm-water within the site must be handled in a suitable manner as per the management measures in stormwater management plan » Stormwater from hardstand areas, buildings and the substation must be managed using appropriate channels and swales when located within steep areas. » No stormwater runoff must be allowed to discharge directly into the watercourses. o The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales when located within steep embankments. » Stormwater run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any stormwater leaving the WEF site.
Residual Impacts	Altered streambed/wetland morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.

Impact 5: Increase in sedimentation and erosion		
Environmental Parameter	Alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition	
Issue/Impact/Environmental Effect/Nature	For the operation phase, this refers to the alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition, caused by soil erosion, as well as instability and collapse of unstable soils during project operation. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and Reduction/loss of habitat for aquatic dependent flora & fauna.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Very Short Duration (1)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (18)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas. » Subsequently the proposed development footprint for the Collector Substation 3 should be amended in order to exclude the wetland area as well as its associated buffer area.	

	» Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential. » Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities » Stormwater from hardstand areas, buildings and the substation must be managed using appropriate channels and swales when located within steep areas. » Stormwater run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the WEF site.
Residual Impacts	Altered streambed morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.

DECOMMISSIONING PHASE		
Impact 6: *Loss of freshwater resource features*.		
Environmental Parameter	Direct physical destruction or disturbance of aquatic habitat caused by vegetation disturbance of riparian/wetland habitat, encroachment/colonisation of habitats by invasive alien plants and alteration of river/wetland geomorphological profiles (including stream beds and banks).	
Issue/Impact/Environmental Effect/Nature	Possible ecological consequences may include: » Reduction in representation and conservation of freshwater ecosystem/habitat types; » Reduction in the supply of ecosystem goods & services; » Reduction/loss of habitat for aquatic dependent flora & fauna; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species). As already mentioned, » Only Collector Substation 3 will directly impact an aquatic habitat through the direct disturbance and replacement of a portion of the wetland zones These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in the loss and/or damage to vegetation and alteration of natural geomorphological and hydrological processes within the freshwater resource features. Compacted soils are also not ideal for supporting vegetation growth as they inhibit seed germination.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)

Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (56)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low – Destruction of wetland vegetation will not be remedied easily.	Low – Destruction of wetland vegetation will not be remedied easily.
Irreplaceable loss of resources	Local loss of resources	No loss of resources
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas. » Any areas disturbed during the decommissioning phase should be encouraged to be rehabilitated as fast and effective as possible and where deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).	
Residual Impacts	Without Mitigation: » Locally altered vegetation structure, » Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. With Mitigation: » Residual impacts are unlikely to occur within these freshwater resource habitats.	
Impact 7: Increase in sedimentation and erosion.		
Environmental Parameter	Alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition	
Issue/Impact/Environmental Effect/Nature	Caused by soil erosion and earthworks that are associated with decommissioning activities. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction/loss of habitat for aquatic dependent flora & fauna. This may furthermore, influence water quality downstream	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Moderate (5)	Minor (3)
Probability	Highly Probable (4)	Very Improbable (1)

Significance	**Medium (40)**	**Low (6)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas. » Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures. » All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable. » There should be reduced activity at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.	
	»	
Residual Impacts	Altered streambed morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.	
Impact 8: Potential impact on localised surface water quality.		
Environmental Parameter	Alteration or deterioration in the physical, chemical and biological characteristics of water resources (i.e. water quality) such as wetlands & rivers as a result of water/soil pollution. The term 'water quality' must be viewed in terms of the fitness or suitability of water for a specific use (DWAF, 2001). In the context of this impact assessment, water quality refers to its fitness for maintaining the health of aquatic ecosystems. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).	
Issue/Impact/Environmental Effect/Nature	During decommissioning, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet concrete, shutter-oil, etc.) associated with site-clearing machinery, construction and maintenance activities could be washed downslope via the ephemeral systems.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)

Duration	Very Short Duration (1)	Very Short Duration (1)
Magnitude	Moderate (7)	Minor (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (12)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation Measures	» Implement appropriate measures to ensure strict use and management of all hazardous materials used on site » Implement appropriate measures to ensure Strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.) » Implement appropriate measures to ensure containment of all contaminated water by means of careful run-off management on the development site. » Implement appropriate measures to ensure strict control over the behavior of construction workers. » Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced. » Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the substation and WEF.	
Residual Impacts	Residual impacts will be negligible after appropriate mitigation.	

6.3. Impact of Proposed Gridline Infrastructure (400 kV LILO and 132 kV Gridlines)

For the proposed 132 kV Gridline:

» Twenty-four (26) freshwater resource features have been delineated within the grid corridor. Of these 26 features, located within the survey area, approximately 22 - 24 freshwater resource features will likely be spanned by the power line and crossed by service roads.

For the proposed 400 kV LILO Gridline:

» No natural wetland feature has been delineated, within the grid corridor.

- Whilst one artificial wetland feature (small gravel dam) has been identified.
- This gridline will not directly impact any natural freshwater resource feature.

Construction and Planning Phase

Such power lines require initial high intensity disturbances and vegetation clearance of fairly small surface areas around the pylon locations. Disturbances and vegetation clearance within the remainder of the servitude (right of way) will be minimal and mostly restricted to the twin tracks/service routes. Due to the low growing nature of the vegetation underneath the pylons, vegetation clearance underneath the power lines are unmercenary. Local levelling of earth, compaction of local soil and casting of concrete and cement will be required within the pylon locations. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with temporary laydown and storage areas.

Due to the fact that pylons can span watercourses/wetlands without any placement of pylons within the watercourses themselves, direct impacts relating to the construction of the pylons are avoidable/unlikely. However, during the spanning process some direct impacts/damage may occur to the watercourse/wetland vegetation, however this is expected to be minimal.

The most likely direct impact to the delineated freshwater resource features (to be spanned) will be as a result of watercourse crossings, especially where new crossings will have to be created.

Potential impacts on freshwater resource features may include:

- The increase in surface runoff and sediments carried into the nearby down slope freshwater resource features, subsequently potentially impacting local hydrological character of these freshwater resource features (e.g. water quality and hydro-geomorphological character).
- The potential spread of erosion from the source (within the development footprint area), into the wetland features, subsequently disturbing wetland soils, vegetation cover and local biota.
- Impairment of functions and services;
- Alteration to the hydrological and hydro-geomorphological character of the wetland as a result of a modification to the wetland morphology (watercourse crossings);
- Local disturbance and loss of indigenous vegetation cover (watercourse crossings and spanning of the power line across watercourses);
- Loss of local biota (including potentially rare, endangered, endemic and/or protected species) (watercourse crossings).
- Fracturing and isolation of wetland features.

There is also the potential for some water quality impacts associated with hydrocarbon spills or associated with the other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of cement and other construction activities.

Generally, with mitigation measures in place, impacts on these downslope freshwater resource features can be avoided or will be localised, short-term and of low intensity and is expected to have a low to low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Operation Phase:

During the operation phase the facilities will operate continuously, mostly unattended and with low maintenance required for the duration of the associated REFs' lives (±20 years). Maintenance on the power line will only take place when required.

The hard and compacted surfaces created around the pylon locations and along the access routes and crossings may lead to increased runoff (reduction in infiltration) and the potential interception and channelling of surface runoff. This may potentially lead to:

- » A modification to the water input characteristic (input in quantity and a change in water input pattern);
- » Increased erosion;
- » Sedimentation of the downslope areas; and
- » Impairment of freshwater resource functions and services

Subsequently, a localised long-term impact (more than 20 years) of low intensity could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

Decommission Phase:

During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

6.4. Assessment of Impacts

CONSTRUCTION PHASE	
Impact 1: Loss of freshwater resource features during the construction.	
Environmental Parameter	Direct physical destruction or disturbance of narrow strips of aquatic/wetland habitat by pylon construction and road crossings, being

	replaced by hard engineered surfaces during construction. This biological impact would however be localised, as a large portion of the remaining catchment and watercourses would remain intact.	
Issue/Impact/Environmental Effect/Nature	Possible ecological consequences may include: » Reduction in representation and conservation of freshwater ecosystem/habitat types; » Reduction in the supply of ecosystem goods & services; » Reduction/loss of habitat for aquatic dependent flora & fauna; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species). As already mentioned, only the 132 kV gridline and associated infrastructure will have an impact on wetland habitats. These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in the loss and/or damage to vegetation and alteration of natural geomorphological and hydrological processes within the freshwater resource features. Compacted soils are also not ideal for supporting vegetation growth as they inhibit seed germination.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Small (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (27)**
Status	Negative	Negative
Reversibility	Low – Destruction of wetland vegetation will not be remedied easily.	Low – Destruction of wetland vegetation will not be remedied easily.
Irreplaceable loss of resources	Local loss of resources	No loss of resources
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» No pylons may be placed within the delineated wetland features and their associated 15m buffer areas; however, the pylons may span these features. » Use as far as possible the existing roads. » No activities or movement shall be allowed outside of the approved development footprint. » Any erosion problems observed, to be associated with the relating activity, should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » Any disturbed areas should be monitored to ensure that these areas do not become subject to invasive alien plant growth. » No unnecessary vegetation clearance may be allowed.	

	» No vehicles may refuel within watercourses/wetlands/riparian vegetation. » Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off. » Where no existing wetland road crossings are available the construction of new crossings can be considered. o Where new watercourse/wetland crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (reduce footprint as much as possible). o All crossings over watercourses/wetlands should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river/wetland channel. o The erosion and stormwater management measures included in the stormwater management plan for the EGI must be implemented. o Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area within the river beds. o During the construction phase, monitor culverts to see if erosion issues arise and if any erosion control is required. o Where possible, culvert bases must be placed as close as possible with natural levels in mind so that these don’t form additional steps / barriers. o Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off. o Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor’s EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils). o All alien plant re-growth must be monitored, and should it occur, these plants should be eradicated.
Residual Impacts	Without Mitigation: » Locally altered vegetation structure, » Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. With Mitigation: » Residual impacts are unlikely to occur within these freshwater resource habitats.
Impact 2: Increase in sedimentation and erosion.	
Environmental Parameter	Alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition
Issue/Impact/Environmental Effect/Nature	Caused by soil erosion and earthworks that are associated with construction activities. Possible ecological consequences associated with this impact may include:

	» Deterioration in freshwater ecosystem integrity; and » Reduction/loss of habitat for aquatic dependent flora & fauna. This may furthermore, influence water quality downstream	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Short Duration (2)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (18)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» The duration of construction work within the watercourses/wetlands must be minimised as far as practically possible through proper planning and phasing. » Use existing service roads as far as possible when crossing any watercourses/wetlands. » Where new watercourse/wetland crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian/wetland vegetation (reduce footprint as much as possible). » All crossings over watercourses/wetlands should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river channel/ and wetland feature. » During the construction phase, monitor culverts to see if erosion issues arise and if any erosion control is required. » Where possible, culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers. » Any erosion observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils). » Silt traps should be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas. o These silt traps must be regularly monitored and maintained and replaced / repaired immediately as and when required. These	

	measures should be regularly checked, maintained and repaired when required to ensure that they are effective » Topsoil should be removed and stored separately outside of wetland areas and should be re-applied where appropriate as soon as possible, to encourage and facilitate the rapid regeneration of the natural vegetation on cleared areas. » Where practical, phased development and vegetation clearing should be applied so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods. » Construction of gabions and other stabilisation features to prevent erosion if deemed necessary. » There should be reduced activity at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.	
Residual Impacts	Altered streambed morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.	
Impact 3: Potential impact on localised surface water quality.		
Environmental Parameter	Alteration or deterioration in the physical, chemical and biological characteristics of water resources (i.e. water quality) such as wetlands & rivers as a result of water/soil pollution. The term 'water quality' must be viewed in terms of the fitness or suitability of water for a specific use (DWAF, 2001). In the context of this impact assessment, water quality refers to its fitness for maintaining the health of aquatic ecosystems. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).	
Issue/Impact/Environmental Effect/Nature	During preconstruction and construction, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet concrete, shutter-oil, etc.) associated with site-clearing machinery, construction and maintenance activities could be washed downslope via the ephemeral systems.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Very Short Duration (1)	Very Short Duration (1)
Magnitude	Moderate (7)	Minor (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (12)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Local loss of resources	Unlikely

Can impacts be mitigated?	Yes, to a large extent
Mitigation:	» No activities may be allowed outside of the development area. » Implement appropriate measures to ensure strict control over the behavior of construction workers. » Appropriate ablution facilities should be provided for construction workers. » Working protocols incorporating pollution control measures (including approved method statements by the Contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced. » Implement appropriate measures to ensure strict use and management of all hazardous materials used on site. » Implement appropriate measures to ensure strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.). » Waste should be stored on site in clearly marked containers in a demarcated area. » All waste material should be removed at the end of every working day to designated waste facilities at the main construction camp/suitable waste disposal facility. » All waste must be disposed of offsite. » Working protocols incorporating pollution control measures and approved method statements for the project must be strictly enforced and implemented by the contractor/s. » Implement appropriate measures to ensure the containment of all contaminated water through careful run-off management on the development site. » Store hydrocarbons off site where possible, or otherwise implement hydrocarbon storage using impermeable floors with appropriate bunding, sumps and roofing. » Handle hydrocarbons carefully to limit spillage. » Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited. » Designate a single location for refueling and maintenance, outside of any freshwater resource features. » Keep a spill kit on site to deal with any hydrocarbon leaks. » Remove soil from the site which has been contaminated by hydrocarbon spillage.
Residual Impacts	Residual impacts will be negligible after appropriate mitigation.

OPERATIONAL PHASE	
Impact 4: Impact on watercourse/wetland systems through the possible increase in surface runoff on watercourse/wetland form and function during the operation and decommissioning phases.	
Environmental Parameter	Alteration to the hydrological character of the freshwater resource features

Issue/Impact/Environmental Effect/Nature	This might occur during the operation phase, when hard or compacted surfaces (hard engineered surfaces, roads etc.) increase the volume and velocity of the surface runoff. This could impact the hydrological regime through the increase in flows that are concentrated in certain areas. If flows are too concentrated with high velocities, scour and erosion may occur, with a complete reduction or disturbance of riparian habitat.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Long Term (4)
Magnitude	Small (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (14)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Unlikely	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation. » For the crossing of small wetlands with gentle gradients: o Road structures should be stabilized up to the level of the watercourse bed to allow for natural flow across the road. o It is crucial that the road surface is level within the watercourse without any flow concentration. » Where the road structure will be built up to the level of the terrestrial land adjacent to the river/wetland bed (larger watercourses/wetland with stronger flows, deeper channels and steeper embankments): o Engineering team must provide an effective means to allow/simulate natural flow patterns without the consecration/modification of flow through the culverts which must be incorporated into the detailed stormwater management plans based on the final design . o Culverts should be sized to transport not only water, but other materials that might be mobilized (i.e. debris) and cause blockages to flow. o Appropriate erosion protection measures must be installed to reduce bed erosion / scour. » The base (invert) of culverts must be aligned with the natural ground level of the bed of the channel to limit risks of erosion. Where necessary, additional measures such as drop-inlets or stepped inlet weirs must be constructed to address such risks.	
Residual Impacts	Altered streambed/wetland morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.	

Impact 5: Increase in sedimentation and erosion		
Environmental Parameter	Alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition	
Issue/Impact/Environmental Effect/Nature	For the operation phase, this refers to the alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition, caused by soil erosion, as well as instability and collapse of unstable soils during project operation. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and Reduction/loss of habitat for aquatic dependent flora & fauna.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Very Short Duration (1)
Magnitude	Moderate (5)	Small (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (15)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» Any disturbed areas should be encouraged to be rehabilitated as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils). » Any erosion problems observed should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. » These silt traps must be regularly monitored and maintained and replaced / repaired immediately as and when required. These measures should be regularly checked, maintained and repaired when required to ensure that they are effective	
Residual Impacts	Altered streambed morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.	

DECOMMISSIONING PHASE

Impact 6: *Loss of freshwater resource features*.		
Environmental Parameter	Direct physical destruction or disturbance of aquatic habitat caused by vegetation disturbance of riparian/wetland habitat, encroachment/colonisation of habitats by invasive alien plants and alteration of river/wetland geomorphological profiles (including stream beds and banks).	
Issue/Impact/Environmental Effect/Nature	Possible ecological consequences may include: » Reduction in representation and conservation of freshwater ecosystem/habitat types; » Reduction in the supply of ecosystem goods & services; » Reduction/loss of habitat for aquatic dependent flora & fauna; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species). As already mentioned, only the 132 kV gridline and associated infrastructure will have an impact on wetland habitats. These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in the loss and/or damage to vegetation and alteration of natural geomorphological and hydrological processes within the freshwater resource features. Compacted soils are also not ideal for supporting vegetation growth as they inhibit seed germination.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (27)**
Status	Negative	Negative
Reversibility	Low – Destruction of wetland vegetation will not be remedied easily.	Low – Destruction of wetland vegetation will not be remedied easily.
Irreplaceable loss of resources	Local loss of resources	No loss of resources
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. » Disturbed areas will need to be rehabilitated and revegetated. » Any erosion problems observed, to be associated with the relating activity, should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » No unnecessary vegetation clearance may be allowed.	

	» No vehicles may refuel within watercourses/wetlands/riparian vegetation. » No activities or movement shall be allowed outside of the approved decommissioning footprint. » Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) will be required.	
Residual Impacts	Without Mitigation: » Locally altered vegetation structure, » Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. With Mitigation: » Residual impacts are unlikely to occur within these freshwater resource habitats.	
Impact 7: Increase in sedimentation and erosion.		
Environmental Parameter	Alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition	
Issue/Impact/Environmental Effect/Nature	Caused by soil erosion and earthworks that are associated with decommissioning activities. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction/loss of habitat for aquatic dependent flora & fauna. This may furthermore, influence water quality downstream	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Short Duration (2)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (18)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:	» The duration of decommissioning work within the watercourses/wetlands must be minimised as far as practically possible through proper planning and phasing. » Watercourse/wetland areas other than the immediate impact areas are to be demarcated as no-go areas for vehicles and construction personnel. The immediate decommissioning site within a watercourse/wetland area is therefore permissible for activities associated with the decommissioning phase.	

	» Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils). » Any erosion problems observed during the construction and operational phases should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures. » Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. o These silt traps must be regularly monitored and maintained and replaced / repaired immediately as and when required. These measures should be regularly checked, maintained and repaired when required to ensure that they are effective » Excavated soils should be stockpiled on the upslope side of the excavated trench so that eroded sediments off the stockpile are washed back into the trench; » Excavated soils will need to be replaced in the same order as excavated from the trench, i.e. sub-soil must be replaced first and topsoil must be replaced last (this will maximise opportunity for re-vegetation of disturbed areas). » There should be reduced activity during the decommissioning phase at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.
Residual Impacts	Altered streambed morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.
Impact 8: Potential impact on localised surface water quality.	
Environmental Parameter	Alteration or deterioration in the physical, chemical and biological characteristics of water resources (i.e. water quality) such as wetlands & rivers as a result of water/soil pollution. The term 'water quality' must be viewed in terms of the fitness or suitability of water for a specific use (DWAF, 2001). In the context of this impact assessment, water quality refers to its fitness for maintaining the health of aquatic ecosystems. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).
Issue/Impact/Environmental Effect/Nature	During decommissioning, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet concrete, shutter-oil, etc.) associated with site-clearing machinery, construction and maintenance activities could be washed downslope via the ephemeral systems.

	Pre-Mitigation Impact Rating	Post Mitigation Impact Rating
Extent	Neighbouring Areas (3)	Local (1)
Duration	Very Short Duration (1)	Very Short Duration (1)
Magnitude	Moderate (7)	Minor (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (12)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation Measures	» Implement appropriate measures to ensure strict use and management of all hazardous materials used on site » Implement appropriate measures to ensure Strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.) » Implement appropriate measures to ensure containment of all contaminated water by means of careful run-off management on the development site. » Implement appropriate measures to ensure strict control over the behavior of construction workers. » Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced. » Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the substation and WEF.	
Residual Impacts	Residual impacts will be negligible after appropriate mitigation.	

6.5. Cumulative Impacts

The grid connection infrastructure is part of the Ummbila Emoyeni Renewable Energy Facility. There are also other approved REFs in the area, and which contain their own grid connection infrastructure. From a cumulative perspective, these grid connection infrastructures, have very limited impacts on local and regional freshwater resource features due to their narrow linear and relative small footprints as well as the fact that most of these infrastructures are located outside of fresh water resource features and tend to be located in close proximity to one another, limiting the impact area and allowing for sharing of access/service roads.

A few existing power lines traverse the broader area, furthermore, the following existing renewable energy projects (and associated transmission infrastructure) were considered in terms of their potential cumulative terrestrial ecological impacts (located within a 30 km radius of the Ummbila EGI) (refer to Figure 16).

Apart from the planned Ummbila renewable energy projects (three PV solar facilities and one wind energy facility), only three other renewable facilities are located within the 30 km radius namely:

» The proposed 9.5 MW Forzando North Coal Mine PV Solar Facility to the north; and
» the 95.9 MW Tutuka PV Solar Facility to the west; and
» the proposed 200 MW Hendrina South WEF

Of the proposed renewable energy facilities, all except for the 9.5MW Forzando North Coal Mine PV Solar Facility and the Hendrina South WEF, are located within the Upper Vaal Water Management Area. Subsequently, the Forzando PV facility as well as the Hendrina South WEF will be excluded from the cumulative assessment.

The proposed Ummbila WEF, Ummbila Solar PV Projects as well as the Ummbila EGI and a few existing power lines are located within Kwaggalaagt River's catchment which is an important tributary of the Blesbokspruit River. Subsequently these developments are likely to have a cumulative impact on this important freshwater resource feature as well as the wetland features associated with this river. The Tukuta PV facility is located within a separate quaternary catchment, with the Leeuspruit River being the primary drainage feature. As such this PV facility can also be excluded from the proposed cumulative impact assessment.

Based on the proposed location of the Ummbila Solar PV facilities as well as the Ummbila WEF's turbine locations, no freshwater resource features will be directly impacted by the mentioned infrastructure as the infrastructure are located well outside of any freshwater resource features as well as their recommended buffer areas.

Subsequently, the most significant potential impact associated with the Ummbila Emoyeni Renewable Energy project are as a result of the associated infrastructure, most notably access roads and watercourse/wetland crossings. The potential contribution of watercourse/wetland road crossings to cummulative impacts on freshwater resource features within the region can be significantly reduced through effective mitigation measures.

Subsequently it can be concluded that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.

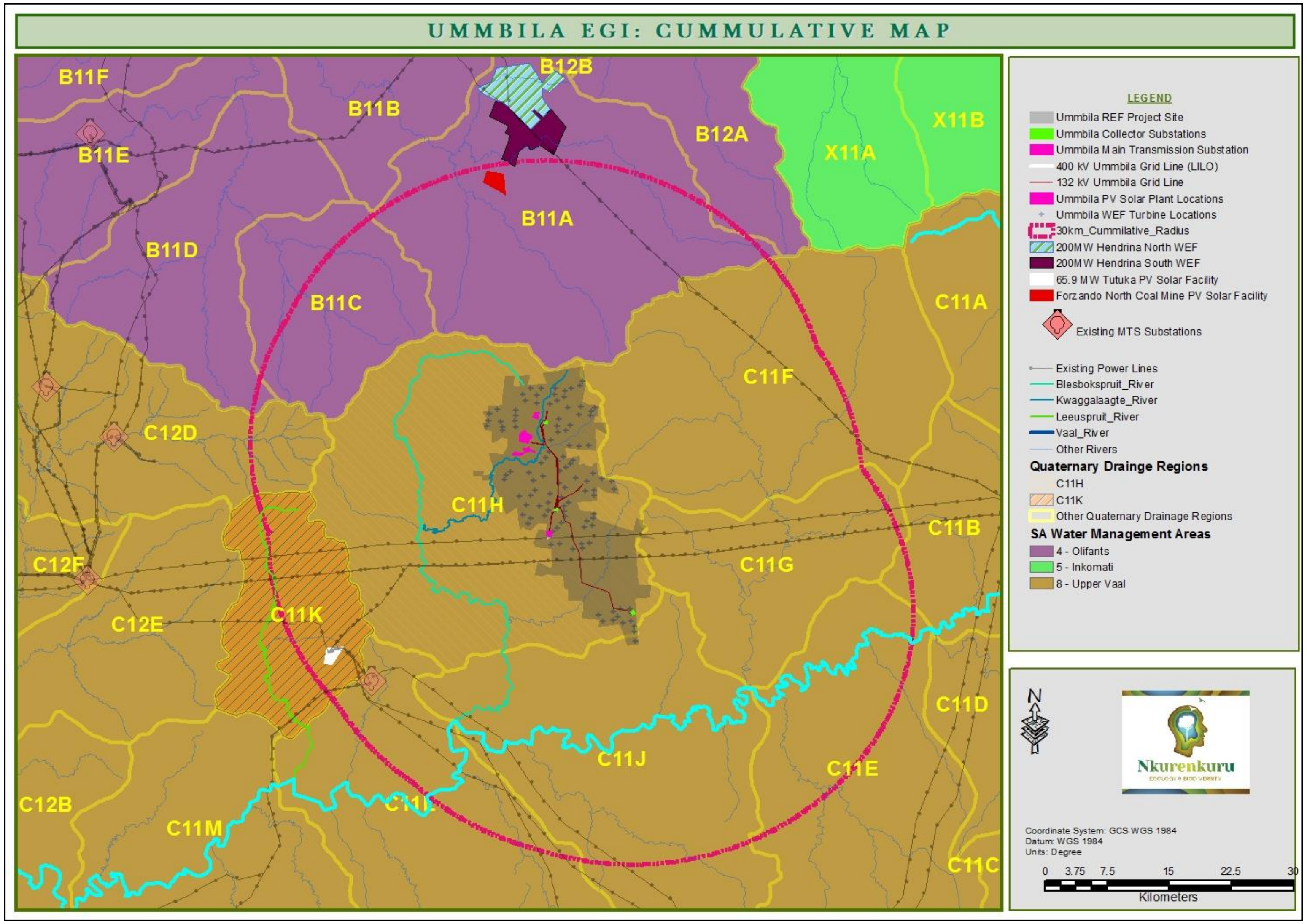

Figure 16: Location Map of the proposed Ummbila EGI relative to existing grid infrastructure as well as other renewable facilities planned within a radius of 30 km.

CUMULATIVE IMPACTS		
Impact 9: Impact ecological processes as well as ecological functioning of important freshwater/wetland habitats associated with the Kwaggaspruit and Blesbokspruit Rivers.		
Environmental Parameter	Compromised ecological processes as well as ecological functioning of important habitats associated with the Kwaggaspruit and Blesbokspruit Rivers	
Issue/Impact/Environmental Effect/Nature	Transformation of intact freshwater resource habitats could potentially compromise ecological processes as well as ecological functioning of important habitats and would contribute to habitat fragmentation and potential disruption of habitat connectivity and furthermore impair their ability to respond to environmental fluctuations. This is especially of relevance for larger watercourses and wetlands serving as important groundwater recharge and floodwater attenuation zones, important microhabitats for various organisms and important corridor zones for faunal movement	
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects within the area**
Extent	Local (2)	Local (2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Small (2)	Minor (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (20)**
Status	Negative	Negative
Reversibility	Moderate to Low	Moderate to Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation:	» Existing crossings should be utilized/upgraded » The construction of new crossings may only be considered where no other viable option exists. » Where new water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (reduce footprint as much as possible). » All crossings over watercourses/wetlands should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river channel, » Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area within the river beds.	

	» During the construction and operation /decommissioning phases, monitor culverts to see if erosion issues arise and if any erosion control is required. » Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't from additional steps / barriers. » Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off. » Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils). » All alien plant re-growth must be monitored and should it occur these plants should be eradicated. » During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. o Disturbed areas may need to be rehabilitated and revegetated. » Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.

7. CONCLUSION AND RECOMMENDATIONS

Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of Electrical Grid Infrastructure (EGI) to support the Ummbila Emoyeni Renewable Energy Farm (which will comprise a 666MW Wind Energy Facility and a 150MW Solar Energy Facility), which aims to export energy to the national electricity grid. The project is located ~6km south-east of Bethal and 1km east of Morgenzon, within the Mpumalanga Province.

This study has been commissioned to meet the requirements of the EIA process in the form of a EIA Assessment as set out by the National Environmental Management Act (1998) and a Water Use Licence Application as set out by the National Water Act (Act 36 of 1998). Furthermore, this study should and has been done in accordance with the "newly" Gazetted Protocols 3(a),(c) and (d) in terms of Section 24(5)(a) and 24(5)(h) of NEMA (Published on the 20th of March 2020); and meet the requirements as set out within the Aquatic Biodiversity Protocol published in GN NO. 1105 of 30 October 2020.

- A total of 27 freshwater resource features were identified and delineated within the proposed development area and include;
  - Twelve (10) channelled valley-bottom wetlands
  - Two (2) unchanneled valley-bottom wetland,
  - Twelve (12) seepage wetlands; and
  - Three (3) floodplain wetlands

- Wetland features cover approximately 146.07 ha or 8% of the project site.
- Twenty-six (26) wetland features have been delineated within the 132 kV grid corridor, whilst no wetland features were recorded within the 400 kV grid corridor.
- Of these 26 wetland features, located within the survey area, approximately 22 - 24 features will likely be spanned by the power line and crossed by service roads.
- No wetland features have been identified within the footprint of the Main Transmission Substation
- No wetland features have been identified within the footprint of Collector Substations 1 and 2.
- A small seepage wetland has been identified and delineated within the footprint of the Collector Substation 3.

The dominant drainage/wetland features within the project site are the floodplain wetlands, within which almost all of the other wetland features drain into. All of the freshwater resource features on and around the site are intermittent or ephemeral, being inundated only for brief periods each year, with periods of drought that are unpredictable in duration.

Artificial wetland features (impoundments/dams) are also a noteworthy hydrological feature within the project site with ten dam features present within the development site. Most of these dam features are instream impoundments (especially common within the channelled valley-bottom wetlands) and are typically fairly small farm dams which is fairly easily breached or allow some seepage.

Overall, with the exception of erosion, dams and present road crossings (most prominent impacts), these freshwater systems are still in a fairly natural, to moderate functional condition.

All wetland features with high lateral and longitudinal connectivity, especially in relationship to other wetland features have been upgraded to very high sensitive due to the fact that these features, collectively contribute significantly to biodiversity maintenance, spatial heterogeneity, hydrological connectivity. Collectively these areas form ecological corridors for the movement of fauna and flora. Furthermore, these habitats provide valuable habitat for faunal Species of Conservation Concern (SCC) including:

- Serval (*Leptailurus serval*): Near Threatened;
- Vlei rat (*Otomys irroratus*): Near Threatened; and
- Cape clawless otter (*Aonyx capensis*): Near Threatened.

All endorheic wetland features, wetland features that are not directly connected to the larger extensive wetland network or that have been fractured/isolated through agricultural practices are classified as High Sensitive. Even though these wetland features do not provide functions and services to the extent of the more connected and larger wetland features, these wetlands still provide some functions and services. Furthermore, most of these wetland features are fairly small and any direct impacts on these wetland habitats may have a significant impact on the drivers of these wetland features as well as the associated biodiversity. Another feature of these wetlands is the fact that, even though small in size, the are located within relatively small catchment areas, thus these wetlands' percentage coverage in relationship to their catchments are fairly significant, making these wetland features vulnerable to catchment disturbances.

A wetland buffer area of 11 m from the outer edge of wetland features are recommended, and should be implemented for maintaining the freshwater resource features REC (Recommended Ecological Category) allowing the persistence of the current present ecological status as well as well as their functions and services.

All freshwater features with their buffer areas have been classified as either Very High- or High sensitive and should be regarded as "No-Go" areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):

- only activities relating to the route access and the spanning of the gridlines:

- the use/upgrade of existing roads and watercourse crossings are the preferred options;
- Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.

With mitigation measures in place, impacts on the freshwater resource features' integrity and functioning can be potentially reduced to sufficiently low levels. This would be best achieved by incorporating the recommended management & mitigation measures into an Environmental Management Programme (EMPr) for the site, together with appropriate rehabilitation guidelines and ecological monitoring recommendations.

Based on the outcomes of this study it is my considered opinion that the proposed project detailed in this report could be authorised from a freshwater resource perspective.

8. REFERENCES

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9. APPENDICES

Appendix 1 Specialist Curriculum Vitae

CURRICULUM VITAE:

Nkurenkuru

Gerhard Botha

Name:	:	Gerhardus Alfred Botha
Date of Birth	:	11 April 1986
Identity Number	:	860411 5136 088
Postal Address	:	PO Box 12500 Brandhof 9324
Residential Address	:	3 Jock Meiring Street Park West Bloemfontein 9301
Cell Phone Number	:	084 207 3454
Email Address	:	gabotha11@gmail.com
Profession/Specialisation	:	Ecological and Biodiversity Consultant
Nationality:	:	South African
Years Experience:	:	8
Bilingualism	:	Very good – English and Afrikaans

Professional Profile:

Gerhard is a Managing Director of Nkurenkuru Ecology and Biodiversity (Pty) Ltd. He has a BSc Honours degree in Botany from the University of the Free State Province and is currently completing a MSc Degree in Botany. He began working as an environmental specialist in 2010 and has since gained extensive experience in conducting ecological and biodiversity assessments in various development field, especially in the fields of conventional as well as renewable energy generation, mining and infrastructure development. Gerhard is a registered Professional Natural Scientist (Pr. Sci. Nat.)

Key Responsibilities:

Specific responsibilities as an Ecological and Biodiversity Specialist include, inter alia, professional execution of specialist consulting services (including flora, wetland and fauna studies, where required), impact assessment reporting, walk through surveys/ground-truthing to inform final design, compilation of management plans, compliance monitoring and audit reporting, in-house ecological awareness training to on-site personnel, and the development of project proposals for procuring new work/projects.

Skills Base and Core Competencies

- Research Project Management
- Botanical researcher in projects involving the description of terrestrial and coastal ecosystems.
- Broad expertise in the ecology and conservation of grasslands, savannahs, karroid wetland, and aquatic ecosystems.
- Ecological and Biodiversity assessments for developmental purposes (BAR, EIA), with extensive knowledge and experience in the renewable energy field (Refer to Work Experiences and References)
- Over 3 years of avifaunal monitoring and assessment experience.
- Mapping and Infield delineation of wetlands, riparian zones and aquatic habitats (according to methods stipulated by DWA, 2008) within various South African provinces of KwaZulu-Natal, Mpumalanga, Free State, Gauteng and Northern Cape Province for inventory and management purposes.
- Wetland and aquatic buffer allocations according to industry best practice guidelines.
- Working knowledge of environmental planning policies, regulatory frameworks, and legislation
- Identification and assessment of potential environmental impacts and benefits.
- Assessment of various wetland ecosystems to highlight potential impacts, within current and proposed landscape settings, and recommend appropriate mitigation and offsets based on assessing wetland ecosystem service delivery (functions) and ecological health/integrity.
- Development of practical and achievable mitigation measures and management plans and evaluation of risk to execution
- Qualitative and Quantitative Research
- Experienced in field research and monitoring
- Working knowledge of GIS applications and analysis of satellite imagery data
- Completed projects in several Provinces of South Africa and include a number of projects located in sensitive and ecological unique regions.

Education and Professional Status

Degrees:

- *2015:* Currently completing a M.Sc. degree in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2009:* B.Sc. Hons in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2008:* B.Sc. in Zoology and Botany, University of the Free State, University of the Free State, Bloemfontein, RSA.

Courses:

- *2013*: Wetland Management (ecology, hydrology, biodiversity, and delineation) – University of the Free State accredited course.
- *2014*: Introduction to GIS and GPS (Code: GISA 1500S) – University of the Free State accredited course.

Professional Society Affiliations:

- The South African Council of Natural Scientific Professions: Pr. Sci. Nat. Reg. No. 400502/14 (Botany and Ecology).

Employment History

- December 2017 – Current: Nkurenkuru Ecology and Biodiversity (Pty) Ltd
- 2016 – November 2017: ECO-CARE Consultancy

- *2015 - 2016*: Ecologist, Savannah Environmental (Pty) Ltd
- *2013 – 2014*: Working as ecologist on a freelance basis, involved in part-time and contractual positions for the following companies
    - Enviroworks (Pty) Ltd
    - GreenMined (Pty) Ltd
    - Eco-Care Consultancy (Pty) Ltd
    - Enviro-Niche Consulting (Pty) Ltd
    - Savannah Environmental (Pty) Ltd
    - Esicongweni Environmental Services (EES) cc
- *2010 - 2012*: Enviroworks (Pty) Ltd

Publications

Publications:

- Botha, G.A. & Du Preez, P.J. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. S. *Afr. J. Bot*., **98**: 172-173.

Congress papers/posters/presentations:

- Botha, G.A. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. 41st Annual Congress of South African Association of Botanists (SAAB). Tshipise, 11-15 Jan. 2015.
- Botha, G.A. 2014. A description of the vegetation of the Nxamasere floodplain, Okavango Delta, Botswana. 10st Annual University of Johannesburg (UJ) Postgraduate Botany Symposium. Johannesburg, 28 Oct. 2014.

Other

- Guest speaker at IAIAsa Free State Branch Event (29 March 2017)
- Guest speaker at the University of the Free State Province: Department of Plant Sciences (3 March 2017):

References:

- Christine Fouché
  Manager: GreenMined (Pty) LTD
  Cell: 084 663 2399
- Professor J du Preez
  Senior lecturer: Department of Plant Sciences
  University of the Free State
  Cell: 082 376 4404

Appendix 2 Specialist Work Experience and References

WORK EXPERIENCES

&

References

Gerhard Botha

ECOLOGICAL RELATED STUDIES AND SURVEYS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Ecological Assessment (Basic Assessment)	Moeding Solar
2019	Expansion of the Raumix Aliwal North Quarry, Eastern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	GreenMined
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Faunal and Flora Rescue and Protection Plan	Zevobuzz
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Zevobuzz
2018	Proposed Kruisvallei Hydroelectric Power Generation Scheme in the Ash River, Free State Province	Ecological Assessment (Basic Assessment)	Zevobuzz
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Ecological Assessment (Basic Assessment)	Eskom
2018	Clayville Thermal Plant within the Clayville Industrial Area, Gauteng Province	Ecological Comments Letter	Savannah Environmental
2018	Iziduli Emoyeni Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Emoyeni Wid Farm Renewable Energy
2018	Msenge Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Amakhala Emoyeni Renewable Energy

2017	H2 Energy Power Station near Kwamhlanga, Mpumalanga Province	Ecological Assessment (Scoping and EIA phase assessments)	Eskom
2017	Karusa Wind Farm (Phase 1 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	Soetwater Wind Farm (Phase 2 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Ecological Assessment	Savannah Environmental
2016 - 2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Ecological Assessment (Scoping and EIA phase assessments)	Cresco
2016	Buffels Solar 2 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	Buffels Solar 1 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	132kV Power Line and On-Site Substation for the Authorised Golden Valley II Wind Energy Facility near Bedford, Eastern Cape Province	Ecological Assessment (Basic Assessment)	Terra Wind Energy
2016	Kalahari CSP Facility: 132kV Ferrum–Kalahari–UNTU & 132kV Kathu IPP–Kathu 1 Overhead Power Lines, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Kalahari CSP Facility: Access Roads, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Karoshoek Solar Valley Development – Additional CSP Facility including tower infrastructure associated with authorised CSP Site 2 near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 7 and 8 Facilities near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 9 Facility near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Lehae Training Academy and Fire Station, Gauteng Province	Ecological Assessment	Savannah Environmental
2016	Metal Industrial Cluster and Associated Infrastructure near Kuruman, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Northern Cape Department of Economic Development and Tourism
2016	Semonkong Wind Energy Facility near Semonkong, Maseru District, Lesotho	Ecological Pre-Feasibility Study	Savannah Environmental
2015 - 2016	Orkney Solar PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy
2015 - 2016	Woodhouse 1 and Woodhouse 2 PV Facilities near Vryburg, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy
2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy
2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy

2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions
2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Expansion of the existing Komsberg Main Transmission Substation near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Proposed Karusa Facility Substation and Ancillaries near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Eskom Karusa Switching Station and 132kV Double Circuit Overhead Power Line near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Karusa Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Facility Substation, 132kV Overhead Power Line and Ancillaries, near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Soetwater Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Expansion of the existing Scottburgh quarry near Amandawe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2015	Expansion of the existing AFRIMAT quarry near Hluhluwe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2014	Tshepong 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Transalloys circulating fluidised bed power station near Emalahleni, Mpumalanga Province	Ecological Assessment (for EIA)	Trans-Alloys
2014	Umbani circulating fluidised bed power station near Kriel, Mpumalanga Province	Ecological Assessment (Scoping and EIA)	Eskom
2014	Gihon 75MW Solar Farm: Bela-Bela, Limpopo Province	Ecological Assessment (for EIA)	NETWORX Renewables

2014	Steelpoort Integration Project & Steelpoort to Wolwekraal 400kV Power Line	Fauna and Flora Pre-Construction Walk-Through Assessment	Eskom
2014	Audit of protected *Acacia erioloba* trees within the Assmang Wrenchville housing development footprint area	Botanical Audit	Eco-Care Consultancy
2014	Rehabilitation of the N1 National Road between Sydenham and Glen Lyon	Peer review of the ecological report	EKO Environmental
2014	Rehabilitation of the N6 National Road between Onze Rust and Bloemfontein	Peer review of the ecological report	EKO Environmental
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks
2011	Rocks Farm chicken broiler houses	Botanical Assessment (for EIA)	EnviroWorks
2011	Botshabelo 132 kV line	Ecological Assessment (for EIA)	CENTLEC
2011	De Aar Freight Transport Hub	Ecological Scoping and Feasibility Study	EnviroWorks
2011	The proposed establishment of the Tugela Ridge Eco Estate on the farm Kruisfontein, Bergville	Ecological Assessment (for EIA)	EnviroWorks
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Vegetation Rehabilitation Plan for illegally cleared areas	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Invasive Plant Management Plan	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Protected and Endangered Species Walk-Through Survey	NEOTEL
2011	Optic Fibre Infrastructure Network, Swartland Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2011	Optic Fibre Infrastructure Network, City of Cape Town Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2010	Construction of an icon at the southernmost tip of Africa, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	New boardwalk from Suiderstrand Gravel Road to Rasperpunt, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	Farm development for academic purposes (Maluti FET College) on the Farm Rosedale 107, Harrismith	Ecological Assessment (Screening and Feasibility Study)	Agri Development Solutions
2010	Basic Assessment: Barcelona 88/11kV substation and 88kV loop-in lines	Botanical Assessment (for EIA)	Eskom Distribution
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks

WETLAND DELINEATION AND HYDROLOGICAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
In progress	Steynsrus PV 1 & 2 Solar Energy Facilities near Steynsrus, Free State Province	Wetland Assessment	Cronimet Mining Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Wetland Assessment (Basic Assessment)	Moeding Solar
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Wetland Assessment (Basic Assessment	Zevobuzz
2017	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy

2017	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Surface Hydrological Assessment (Basic Assessment)	Eskom
2017	Expansion of the Elandspruit Quarry near Ladysmith, KwaZulu-Natal Province	Wetland Assessment	Raumix
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Aquatic Assessment & Flood Plain Delineation	Savannah Environmental
2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Surface Hydrological Assessment (EIA phase)	Cresco
2016	Wolmaransstad Municipality 75MW PV Solar Energy Facility in the North West Province	Wetland Assessment (Basic Assessment)	BlueWave Capital
2016	BlueWave 75MW PV Plant near Welkom Free State Province	Wetland Delineation	BlueWave Capital
2016	Harmony Solar Energy Facilities: Amendment of Pipeline and Overhead Power Line Route	Wetland Assessment (Basic Assessment)	BBEnergy

AVIFAUNAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Avifauna Assessment (Basic Assessment)	Moeding Solar
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Avifauna Assessment (Basic Assessment)	Eskom
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Avifauna Assessment (Basic Assessment)	Eskom
2016	TEWA Solar 1 Facility, east of Upington, Northern Cape Province	Wetland Assessment (Basic Assessment	Tewa Isitha Solar 1
2016	TEWA Solar 2 Facility, east of Upington, Northern Cape Province	Wetland Assessment	Tewa Isitha Solar 2

ENVIRONMENTAL IMPACT ASSESSMENT

- Barcelona 88/11kV substation and 88kV loop-in lines – BA (for Eskom).
- Thabong Bulk 132kV sub-transmission inter-connector line – EIA (for Eskom).
- Groenwater 45 000 unit chicken broiler farm – BA (for Areemeng Mmogo Cooperative).
- Optic Fibre Infrastructure Network, City of Cape Town Municipality – BA (for Dark Fibre Africa (Pty) Ltd).
- Optic Fibre Infrastructure Network, Swartland Municipality – BA (for Dark Fibre Africa).
- Construction and refurbishment of the existing 66kV network between Ruigtevallei Substation and Reddersburg Substation – EMP (for Eskom).
- Lower Kruisvallei Hydroelectric Power Scheme (Ash river) – EIA (for Kruisvallei Hydro (Pty) Ltd).
- Construction of egg hatchery and associated infrastructure – BA (For Supreme Poultry).

- Construction of the Klipplaatdrif flow gauging (Vaal river) – EMP (DWAF).

ENVIRONMENTAL COMPLIANCE AUDITING AND ECO

- National long haul optic fibre infrastructure network project, Bloemfontein to Laingsburg – ECO (for Enviroworks (Pty) Ltd.).
- National long haul optic fibre infrastructure network project, Wolmaransstad to Klerksdorp – ECO (for Enviroworks (Pty) Ltd.).
- Construction and refurbishment of the existing 66kV network between Ruigtevallei Substation and Reddersburg Substation – ECO (for Enviroworks (Pty) Ltd.).
- Construction and refurbishment of the Vredefort/Nooitgedacht 11kV power line – ECO (for Enviroworks (Pty) Ltd.).
- Mining of Dolerite (Stone Aggregate) by Raumix (Pty) Ltd. on a portion of Portion 0 of the farm Hillside 2830, Bloemfontein – ECO (for GreenMined Environmental (Pty) Ltd.).
- Construction of an Egg Production Facility by Bainsvlei Poultry (Pty) Ltd on Portions 9 & 10 of the farm, Mooivlakte, Bloemfontein – ECO (for Enviro-Niche Consulting (Pty) Ltd.).
- Environmental compliance audit and botanical account of Afrisam's premises in Bloemfontein – Environmental Compliance Auditing (for Enviroworks (Pty) Ltd.).

OTHER PROJECTS:

- Keeping and breeding of lions (*Panthera leo*) on the farm Maxico 135, Ficksburg – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Keeping and breeding of lions (*Panthera leo*) on the farm Mooihoek 292, Theunissen – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Keeping and breeding of wild dogs (*Lycaon pictus*) on the farm Mooihoek 292, Theunissen – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Existing underground and aboveground fuel storage tanks, TWK AGRI: Pongola – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks on Erf 171, TWK AGRI: Amsterdam – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 14 000 L of fuel (diesel) aboveground on Erf 32, TWK AGRI: Carolina – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 23 000 L of fuel (diesel) above ground on Portion 10 of the Farm Oude Bosch, Humansdorp – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 16 000 L of fuel (diesel) aboveground at Panbult Depot – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks, TWK AGRI: Mechanisation and Engineering, Piet Retief – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks on Portion 38 of the Farm Lothair, TWK AGRI: Lothair – Environmental Management Plan (for TWK Agricultural Ltd).