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**Wetland / Riparian Impact Assessment Report**

# A WETLAND / RIPARIAN IMPACT ASSESSMENT FOR THE PROPOSED POWER LINE FOR THE SONVANGER PHOTOVOLTAIC SOLAR POWER PLANT NEAR THEUNISSEN, FREE STATE PROVINCE

**July 2021**

**Prepared for: ENVIRONAMICS CC**
**Compiled by Dr BJ Henning**
**Document version 1.0 – Draft**

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# A WETLAND / RIPARIAN IMPACT ASSESSMENT FOR THE PROPOSED POWER LINE FOR THE SONVANGER PHOTOVOLTAIC SOLAR POWER PLANT NEAR THEUNISSEN, FREE STATE PROVINCE

May 2021

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**Compiled by:**
Dr BJ Henning

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**Reviewed by:**

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# REPORT DISTRIBUTION LIST

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| | Free State Department: Economic, Small Business Development, Tourism and Environmental Affairs |
| | Registered Interested and Affected Parties |

# DOCUMENT HISTORY

| Report no | Date | Version | Status |
|---|---|---|---|
| L21 069 EC | July 2021 | 1.0 | Draft |

### Declaration

I, Dr BJ Henning, declare that -

- I act as the independent specialist.
- I will perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the project proponent.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this project, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998; the Act), regulations and any guidelines that have relevance to the activity.
- I will comply with the Act, regulations and all other applicable legislation.
- I will consider, to the extent possible, the matters listed in Regulation 18 of the NEMA EIA Regulations.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the project proponent and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the project; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority or project proponent.
- All the particulars furnished by me in this document are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the Act.

_________________________________________

**SIGNATURE OF SPECIALIST**

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# 1 ASSIGNMENT

AGES Limpopo (Pty) Ltd was appointed by ENVIRONAMICS CC to conduct a riparian / wetland delineation specialist study and risk matrix as part of the objective to obtain the necessary Environmental Authorisation and Water Use License (if necessary) for the proposed development of a 132kV single-circuit power line to enable the connection of the authorised Sonvanger Photovoltaic Solar Power Plant (DFFE ref.: 14/12/16/3/3/2/672) to the national grid network. This will enable the evacuation of the generated solar electricity. A 200m wide and 22km long grid connection corridor is being assessed for the placement of the power line route. The power line is proposed to connect into the existing Oryx-Joel 132kV Line. A service road associated with the power line is also proposed to be developed.

A water use license is now applied for, in terms of section 21 of the National Water Act, 1998 (Act No. 36 of 1998) with specific reference to the following water uses:

- Section 21(c) "Impeding or diverting the flow of water in a water course".
- Section 21(i) "Altering the bed, banks or characteristics of a water course".

The study includes a wetland and riparian delineation and functionality assessment, with descriptions of the anticipated impacts (risks) associated with the proposed development activities and mitigation to reduce impacts. This assessment is essential as it will contribute to meeting the requirements of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) in conjunction with Regulation 982 of 4 December 2014 (as amended), promulgated in terms of Section 24 (5) of NEMA and Chapter 4 of the National Water Act, Act 36 of 1998 Section 21 (c) and (i).

The assignment is interpreted as follows: Compile a study on the riparian zones / wetlands of the site according to guidelines and criteria set by the Department of Water and Sanitation (DWS).

## 1.1. INFORMATION SOURCES

The following information sources were obtained for the study:

1. All relevant topographical maps, aerial photographs and information (previous studies and environmental databases) related to wetlands in the study area.
2. Requirements regarding the wetland survey as stipulated in the following guidelines:
    a. National Water Act (1998).
    b. A practical field procedure for identification and delineation of wetlands and riparian areas (DWAF, 2006).
    c. National Wetland Classification System for South Africa (SANBI, 2009).
    d. A Risk Assessment, as required in terms of the General Authorisation Notice 509 of 2016 (Gazette No.40229).

3. Guidelines regarding development in and around wetlands and riparian zones as stipulated by DWS.

## 1.2. REGULATIONS GOVERNING THIS REPORT

### 1.2.1. National Environmental Management Act, 1998 (Act No. 107 of 1998) - Gazette No. 43310 Government Notice R. 320

This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Gazette No. 43310 Government Notice R. 320. Specialist reports includes a list of requirements to be included in a specialist report for a wetland and riparian impact assessment:

1. A specialist report or a report prepared in terms of these regulations must contain:
    a. Details of
        i. The specialist who prepared the report; and
        ii. The expertise of that specialist to compile a specialist report, including a curriculum vitae.
    b. A declaration that the specialist is independent in a form as may be specified by the competent authority.
    c. An indication of the scope of, and purpose for which, the report was prepared.
    d. The date and season of the site investigation and the relevance of the season to the outcome of the assessment.
    e. A description of the methodology adopted in preparing the report or carrying out the specialized process.
    f. The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.
    g. An identification of any areas to be avoided, including buffers.
    h. A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.
    i. A description of any assumptions made and any uncertainties or gaps in knowledge.
    j. A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the

environment.

k. any mitigation measures for inclusion in the EMPr.

l. any conditions for inclusion in the environmental authorisation.

m. any monitoring requirements for inclusion in the EMPr or environmental authorisation

n. a reasoned opinion –

    i. As to whether the proposed activity or portions thereof should be authorised and

    ii. If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan.

o. A description of any consultation process that was undertaken during preparing the specialist report.

p. A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

q. Any other information requested by the competent authority.

#### 1.2.2. The National Water Act (Act No. 36 of 1998)

Chapter 4 of the National Water Act, Act 36 of 1998 specifies that:

“In general, a water use must be licensed unless it is listed in Schedule I, is an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a licence. The Minister may limit the amount of water which a responsible authority may allocate. In making regulations the Minister may differentiate between different water resources, classes of water resources and geographical areas.”

In section 21 of the NWA, water uses which are applicable to the proposed project, are listed as follows:

c. Impeding or diverting the flow of water in a watercourse.

i. Altering the bed, banks, course or characteristics of a watercourse.

General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998) states the following:

In accordance with GN 509 of 2016, a regulated area of a watercourse for Section 21(c) and 21(i) of the NWA, 1998 is defined as:

- The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam.
- In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench: or
- A 500 m radius from the delineated boundary (extent) of any wetland or pan.

This notice should be read together with the Risk Assessment provisions in the General Authorisation Notice in Relation to Section 21.

#### 1.2.3. Conservation of Agricultural Resources Act (Act No. 43 of 1983)

This Act controls the utilization and protection of wetlands, soil conservation and all matters relating thereto including prevention of veld fires, control of weeds and invader plants, prevention of water pollution resulting from farming practices and losses in biodiversity.

#### 1.2.4. The National Environmental Management Act (NEMA) (Act No. 107 of 1998)

This Act embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands and special attention is given to management and planning procedures.

### 1.3. TERMS OF REFERENCE

#### 1.3.1. Objectives

The project was done according to the following objectives:

- Conduct a desktop and field investigation to confirm the presence or absence of wetlands / riparian zones within the study area.
- Delineate and map the identified wetland / riverine area on site within the grid connection corridor.
- Classify riparian zones / wetlands according to their hydro-geomorphic characteristics.

- Determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of all wetlands and riparian areas on site.
- Determine the impacts and risks associated with the proposed development on the wetlands and / or riparian zones (risk assessment matrices).
- Compile a report with the findings and maps.

#### 1.3.2. Limitations and assumptions

The large study area did not allow for the finer level of assessment that can be obtained in smaller study areas. Therefore, data collection in this study relied heavily on data from representative sections, as well as general observations and a desktop analysis.

# 2 METHODS

## 2.1 WETLAND DELINEATION AND CLASSIFICATION

The National Water Act, Act 36 of 1998, defines wetlands as follows:

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

Wetlands were delineated according to the delineation procedure given in "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" (DWAF, 2003).

Wetland indicators are divided into different unit indicators which need to be given consideration in the delineation of wetlands (Figure 1). The outer edge of the temporary zone requires the delineator to take the following specific indicators into account:

- The terrain unit indicator helps to identify those parts of the landscape where wetlands are more likely to occur.
- The Soil Form Indicator identifies the soil forms, as defined by Macvicar (1991), which are associated with prolonged and frequent saturation.
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile because of prolonged and frequent saturation.
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

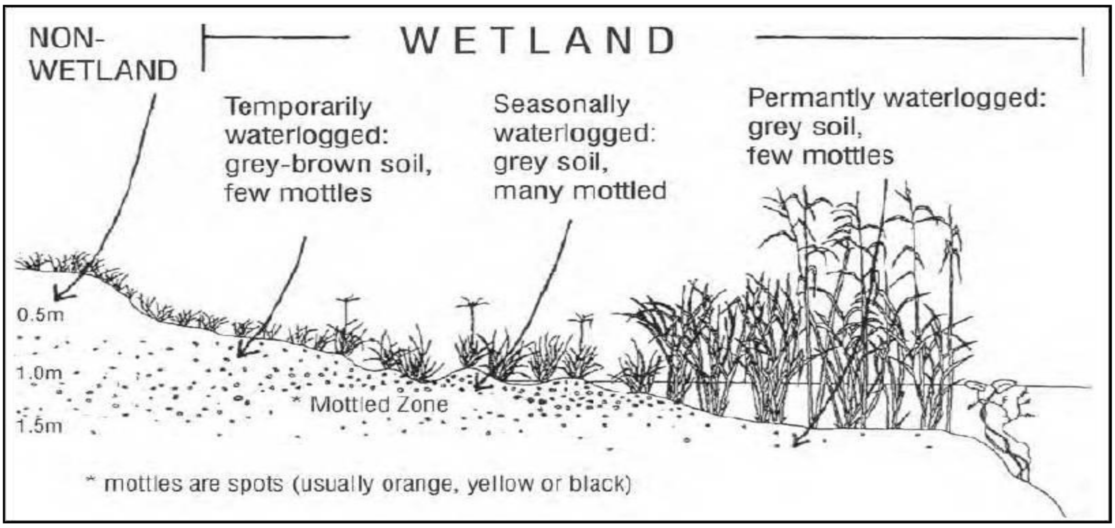


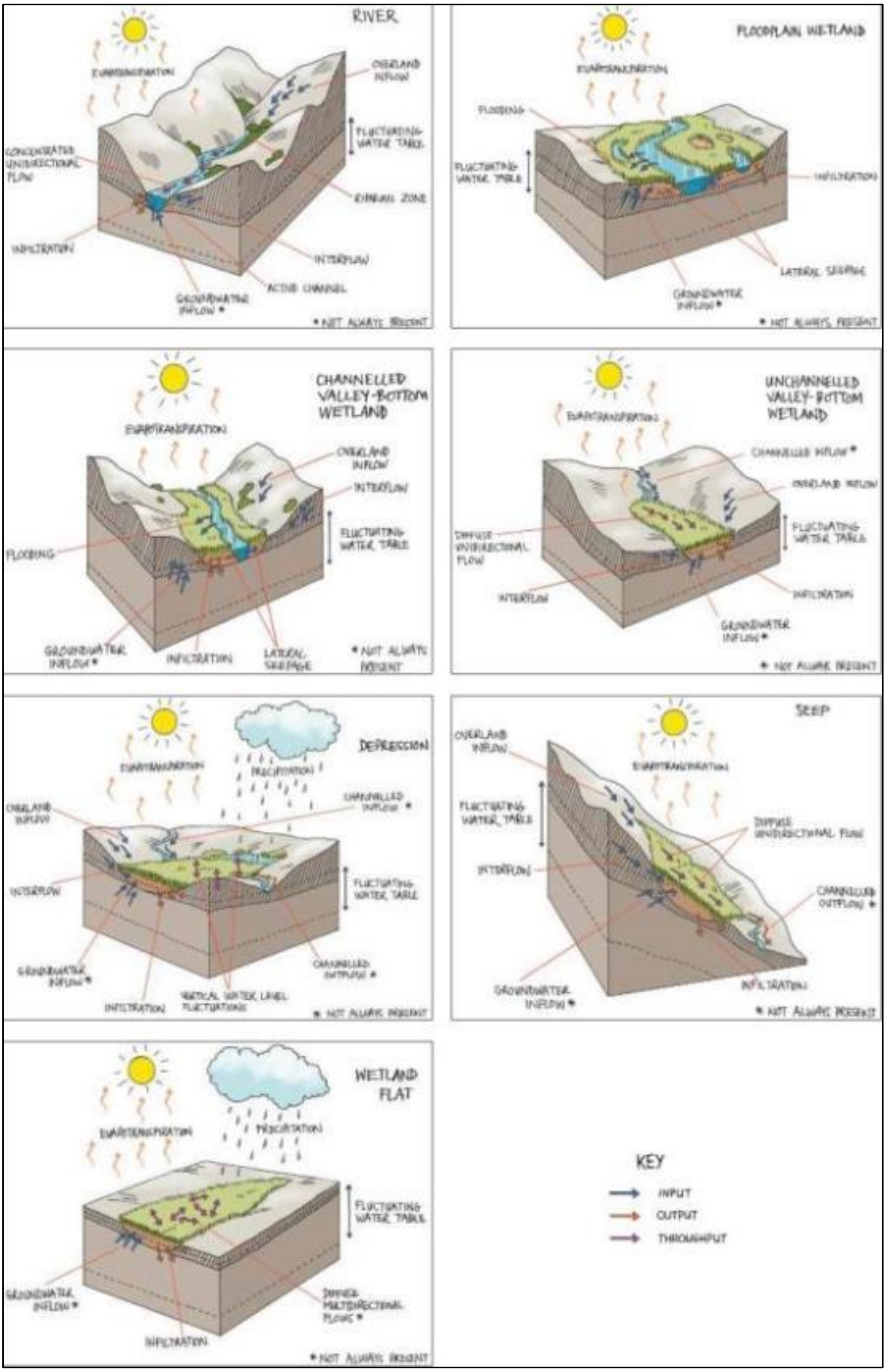

**Figure 1. A cross section through a wetland showing how the soil form indicators and vegetation changes from the centre to the edge of the wetland (adapted from Kotze, 1996)**

## 2.2 WETLAND CLASSIFICATION

The study area was sub-divided into transects and the soil profile was examined for signs of wetness within 50 cm of the surface using a hand auger along transects. The wetland boundaries were then determined by the positions of augured holes that showed signs of wetness as well as by the presence or absence of hydrophilic vegetation. The wetlands were subsequently classified according to their hydro-geomorphic setting based on the system proposed in the National Wetland Classification System (Table 1) (SANBI, 2009).

Furthermore, because of alluvial deposits being visible from the air, aerial photography was also used to assist in determining the extent of deposits, as well as the vegetation line indicating a difference in species composition or more vigorous growth. The aerial photographs were used to guide on-screen delineation of wetlands in ArcView GIS 3.3.

**Table 1. Wetland Unit types based on hydrogeomorphic characteristics (Adapted from Kotze *et al.* 2005).**



## 2.3 RIPARIAN DELINEATION AND CLASSIFICATION

Riparian areas often associated with streams or drainage lines are also important to protect due to the followings ecological and hydrological functions that it performs.

(DWAF, 2003):

- Stabilize stream banks.
- Store water and aid in flood attenuation.
- Improve water quality by trapping nutrients and sediment.
- Maintain natural water temperature for aquatic species.
- Provide shelter and food for avifauna and other animals.
- Provide corridors for movement and migration of different species; and
- Act as a buffer between aquatic ecosystems and adjacent land uses.

The riparian areas have their own unique set of indicators. DWAF (2003) states that to classify an area as a riparian area it must have one or more of the following attributes:

- Are associated with a watercourse.
- Contain distinctively different plant species than adjacent areas; and contain species like adjacent areas but exhibiting more vigorous or robust growth forms; and
- May have alluvial soils.

The delineation process requires that the following be considered:

- Topography associated with the watercourse (figure 2).
- Vegetation (figure 3); and
- Alluvial soils and deposited material.

Many riparian areas display wetland indicators and should be classified as wetlands. However, other riparian areas are not saturated long enough or often enough to develop wetland characteristics, but also perform a few important functions, which need to be safeguarded. In these areas alluvial deposits can predominate and/or the water table is too deep for most of the year to produce hydromorphic features in the top 50cm of the soil profile. These conditions do not support vegetation typically adapted to life in saturated soil and it is therefore important to delineate these riparian areas in addition to wetlands. Riparian areas commonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands generally display more diffuse flow and are lower energy environments.

The general approach for delineating riparian areas in the field is to identify the active channel or the lowest part of the river course. Most likely cues like water with associated emergent vegetation, sedges and reeds or alluvial soil and bedrock will be visible. From this point some topographic units like sandbars, active channel bank, flood benches and macro-channel bank with associated riparian vegetation will be identifiable. The next step would be to proceed upwards towards the macro-channel bank, taking note of alluvial soil, topographic units and vegetation indicators. The outer boundary will be the point on the edge of the macro channel bank where there is a distinct difference between the riparian and terrestrial vegetation. In some cases where riparian vegetation is unrecognisable, because of land-use activities, indicators like alluvial material and topographical units can still be used to visualize the edge of a riparian area. If you are adjacent to a watercourse, it is also important to check for the presence of riparian indicators. The riparian areas were identified using the following information:

- Topographical maps: Riparian areas normally occur within the flood area of a river or stream.
- Aerial photographs: As a result of alluvial deposits being visible from the air, aerial photography can assist in determining the extent of deposits, as well as the vegetation line indicating a difference in species composition or more vigorous growth.

A combination of the abovementioned indicators was used during the field survey that was conducted during July 2021 to identify the indicator plant species, soil types and specific topography related to the wetland areas. The outer boundaries were then recorded using a Global Positioning System (GPS). Riparian areas were mapped by means of the computer programme Arcview 3.3.

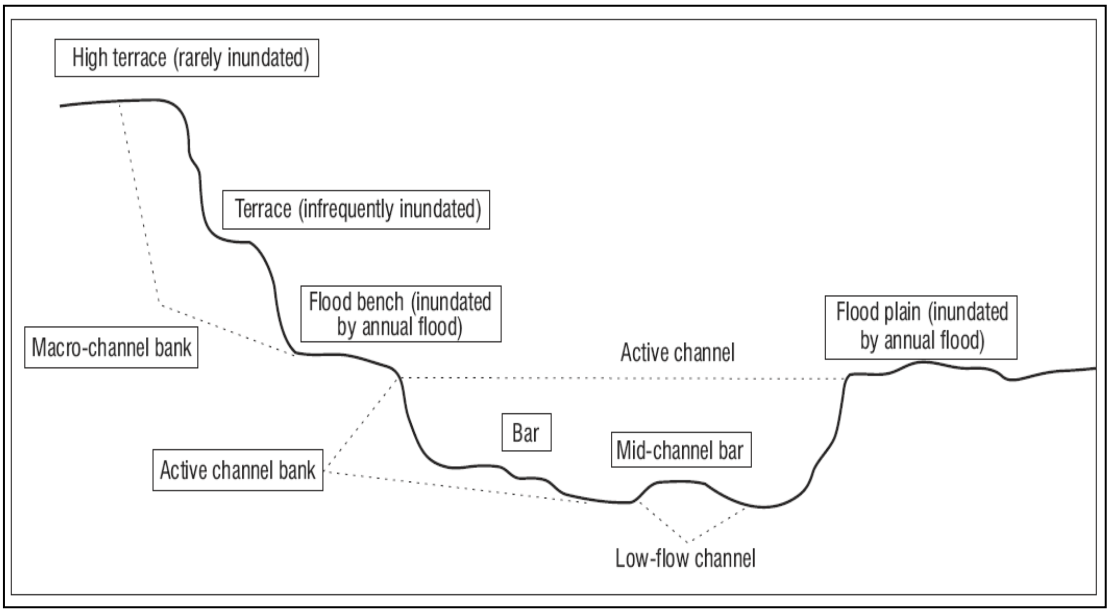



**Figure 2. Cross section of topography associated with a channel and floodplains.**

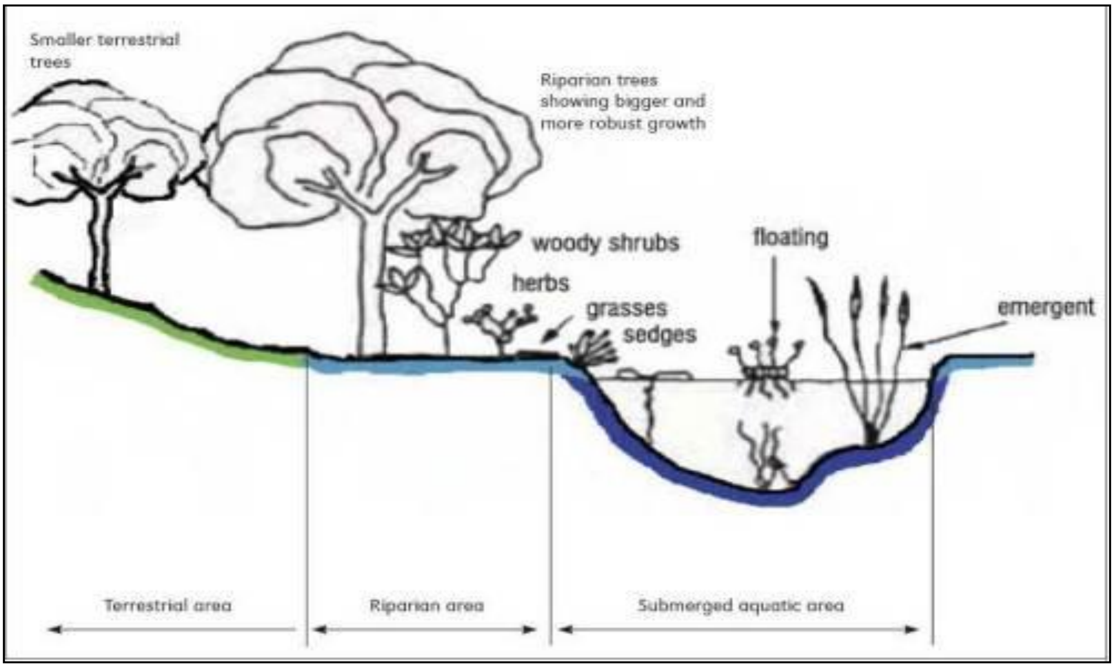



**Figure 3. Typical cross section of a river channel displaying riparian habitat (DWA, 2003)**

## 2.4 WETLAND INTEGRITY ASSESSMENTS

### 2.4.1 Present Ecological Status (PES) of wetlands

The Present Ecological State (PES) assessment of the wetlands within the study area was undertaken to determine the extent of departure of the wetlands from a natural state or reference condition. This method is based on the modified Habitat Integrity approach (Table 2) developed by Kleynhans (1999). Anthropogenic modification of the criteria and its attributes can have an impact on the ecological integrity of a wetland.

**Table 2. Habitat integrity assessment criteria for wetlands (Adapted from DWAF, 2003)**

| Criteria and Attributes | Relevance |
|---|---|
| **Hydrologic** | |
| **Flow Modification** | Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland. |
| **Permanent Inundation** | Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota. |
| **Water Quality** | |
| **Water Quality Modification** | From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland. |
| **Sediment Load Modification** | Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats. |
| **Hydraulic / Geomorphic** | |
| **Canalisation** | Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage. |
| **Topographic Alteration** | Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduce or changes wetland habitat directly in inundation patterns. |
| **BIOTA** | |
| **Terrestrial Encroachment** | Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions. |
| **Indigenous Vegetation Removal** | Transformation of habitat for farming, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and in increases potential for erosion. |
| **Invasive Plant Encroachment** | Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading). |
| **Alien Fauna** | Presence of alien fauna affecting faunal community structure |
| **Over utilisation of Biota** | Overgrazing, overfishing, etc. |
| **Attributes are rated and scored as follows:** Natural / Unmodified – 5 Largely Natural 4 Moderately Modified – 3.Largely Modified - 2..Seriously Modified – 1 Critically Modified - 0 | |

For this study, the scoring system as described in the document "Resource Directed Measures for Protection of Water Resources, Volume 4. Wetland Ecosystems" (DWAF, 1999) was applied for the determination of the PES (Table 2).

Two tools have recently been developed to facilitate the derivation of scores to reflect the present ecological sate, namely the Index of Habitat Integrity (IHI) DWA, 2007, and Wet-Health, developed by Macfarlane et al., 2008. Both these tools have limitations in that they were developed primarily to assess conditions of floodplain and valley bottom wetlands and Hill slope seepage wetlands linked to drainage lines. The former tool was developed to provide a rapid assessment of the PES specifically for application in reserve studies, while the latter tool was developed to support the Working for Wetlands program. The objective of the latter tool was to provide a semi quantitative assessment of the state of wetland prior to rehabilitation, and one post rehabilitation to demonstrate “improvement”. The intention in defining the health category (PES) of a wetland is to provide an indication of the current “condition” of a wetland to inform a management class. The latter provides the guidelines against that inform water quality and quantity required to maintain or improve the quality of the water resource.

The PES or health of wetlands has only been applied to the “natural” wetlands, i.e., those that have developed naturally because of the presence of water. Wetlands are rated on a scale of A to F, with A being a natural wetland and F being a completely modified and disturbed wetland (Table 3). The Wet-Health assesses the following four factors that influence the “health” or condition of wetlands and in this application floodplains and river channels associated with the site:

- Hydrology.
- Geomorphology.
- Vegetation, and ideally.
- Water quality.

The Present Ecological Status Class (PESC) of the wetlands was based on the available information for each of the criteria listed in Table 2 and the mean score determined for each wetland (Table 3). This approach assumes that extensive degradation of any of the wetland attributes may determine the PESC (DWAF, 2003).

**Table 3. Present Ecological Status Class Descriptions**

| CLASS | CLASS BOUNDARY | CLASS DESCRIPTION |
|---|---|---|
| A | >4 | **Unmodified, natural.**<br>• The resource base reserve has not been decreased.<br>• The resource capability has not been exploited |
| B | >3 and <=4 | **Largely natural with few modifications**.<br>• The resource base reserve has been decreased to a small extent.<br>• A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. |
| C | >2 and <=3 | **Moderately modified**.<br>• The resource base reserve has been decreased to a moderate extent.<br>• A change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. |

| CLASS | CLASS BOUNDARY | CLASS DESCRIPTION |
|---|---|---|
| D | 2 | **Largely modified**.<br>• The resource base reserve has been decreased to a large extent.<br>• Large changes in natural habitat, biota and basic ecosystem functions have occurred. |
| E | >0 and <2 | **Seriously modified**.<br>• The resource base reserve has been seriously decreased and regularly exceeds the resource base.<br>• The loss of natural habitat, biota and basic ecosystem functions is extensive. |
| F | 0 | **Critically modified**.<br>• The resource base reserve has been critically decreased and permanently exceeds the resource base.<br>• Modifications have reached a critical level and the resource has been modified completely with an almost total loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible. |

### 2.4.2 Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity (EIS) assessment was conducted according to the guidelines as discussed by DWAF (1999). Here DWAF defines “ecological importance” of a water resource as an expression of its importance to the maintenance of ecological diversity and function on local and wider scales. “Ecological sensitivity”, according to DWAF (1999), is the system’s ability to resist disturbance and its capability to recover from disturbance once it has occurred.

In the method outlined by DWAF a series of determinants for EIS (Table 4) are assessed for the wetlands on a scale of 0 to 4 (Table 5). The median of the determinants is used to determine the EIS of the wetland unit (Table 5).

**Table 4. Criteria for assessing the Ecological Importance and Sensitivity of Wetlands**

| **Determinant** |
|---|
| **PRIMARY DETERMINANTS** |
| 1. Rare & Endangered Species |
| 2. Populations of Unique Species |
| 3. Species/taxon Richness |
| 4. Diversity of Habitat Types or Features |
| 5. Migration route/breeding and feeding site for wetland species |
| 6. Sensitivity to Changes in the Natural Hydrological Regime |
| 7. Sensitivity to Water Quality Changes |
| 8. Flood Storage, Energy Dissipation & Particulate/Element Removal |
| |
| **MODIFYING DETERMINANTS** |
| 9. Protected Status |

| **Determinant** |
|---|
| **PRIMARY DETERMINANTS** |
| 10. Ecological Integrity |

| | |
|---|---|
| Score guideline | Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0 |
| Confidence rating | Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1 |

**Table 5. Ecological Importance and Sensitivity Classes**

| **Ecological Importance and Sensitivity Category (EIS)** | **Range of Median** |
|---|---|
| Very high<br>Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers. | >3 and <=4 |
| High<br>Wetlands that are ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers. | >2 and <=3 |
| Moderate<br>Wetlands that are ecologically important and sensitive on a provincial or local scale. The biodiversity of these Wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers. | >1 and <=2 |
| Low/marginal<br>Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these Wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers. | >0 and <=1 |

## 2.5 Risk assessment matrix

A Risk Assessment, as required in terms of the General Authorisation Notice 509 of 2016 (Gazette No.40229), for any development proposed within the 1:100-year floodline. The risk assessment should be based on the following ratings (Table 6).

## Table 6. Risk rating tables and methodology for the risk assessment

**SEVERITY**

How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, and habitat)?

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

**SPATIAL SCALE**

How big is the area that the aspect is impacting on?

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

**DURATION**

How long does the aspect impact on the resource quality?

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

**FREQUENCY OF THE ACTIVITY**

How often do you do the specific activity?

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

**FREQUENCY OF THE INCIDENT/IMPACT**

How often does the activity impact on the resource quality?

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

**LEGAL ISSUES**

How is the activity governed by legislation?

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

**DETECTION**

How quickly/easily can the impacts/risks of the activity be observed on the resource quality, people and property?

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

**RATING CLASSES**

| RATING | CLASS | MANAGEMENT DESCRIPTION |
|---|---|---|
| 1 – 55 | (L) Low Risk | Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. |
| 56 – 169 | M) Moderate Risk | Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required. |
| 170 – 300 | (H) High Risk | Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required. |

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

**CALCULATIONS**

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

**RISK ASSESSMENT <u>MUST BE CONDUCTED BY A SACNASP REGISTERED PROFESSIONAL MEMBER</u> AND THE ASSESSOR MUST:**

**1)CONSIDER BOTH CONSTRUCTION AND OPERATIONAL PHASES OF PROPOSED ACTIVITIES;**

**2) CONSIDER RISKS TO RESOURCE QUALITY POST MITIGATION CONSIDERING MITIGATION MEASURES LISTED IN TABLES PROVIDED;**

**3) CONSIDER THE SENSITIVITY (ECOLOGICAL IMPORTANCE AND SENSITIVITY – EIS) AND STATUS (PRESENT ECOLOGICAL STATUS - PES) OF THE WATERCOURSE AS RECEPTOR OF RISKS POSED;**

**4) CONSIDER POSITIVE IMPACTS/RISKS REDUCTION AS A VERY LOW RISK IN THIS ASSESSMENT;**

**5) INDICATE CONFIDENCE LEVEL OF SCORES PROVIDED IN THE LAST COLUMN AS A PERCENTAGE FROM 0 - 100%.**

# 3 STUDY AREA

## 3.1 LOCATION AND DESCRIPTION OF ACTIVITY

The activity entails the development of a 132kV single-circuit power line to enable the connection of the authorised Sonvanger Photovoltaic Solar Power Plant (DFFE ref.: 14/12/16/3/3/2/672) to the national grid network. This will enable the evacuation of the generated solar electricity. A 200m wide and 22km long grid connection corridor is being assessed for the placement of the power line route. The power line is proposed to connect into the existing Oryx-Joel 132kV Line. A service road associated with the power line is also proposed to be developed.

The grid connection corridor is located directly to the west of the town of Theunissen (along the R30) and falls within the Masilonyana and the Matjhabeng Local Municipalities of the Lejweleputswa District Municipality, Free State Province (refer to the attached locality map).

Various properties are affected by the grid connection corridor, which includes:

- Afrikander Oord 80 (Portions 0 & 2),
- Ebenhaeser 401 (Portions 0, 1, 2 and 3),
- Erfbloem 12 (Portions 0, 4, 5 and 6), Excelsior 147 (Portions 1, 2 and 3),
- Goedemoed 143 (Portions 0, 2 and 3),
- Grottkau 410 (Portions 0, 3 and 5),
- Karreebooms Vallei (Portions 0, 2, 5, 6, 7 and 8),
- Leeuwbult 52 (Portions 0 and 3),
- Leeuwvlei 115 (Portions 0, 1, 2 and 3),
- Mamre 566 (Portions 0, 1, 2 and 3),
- Masilo 597 (Portions 0 and 12),
- Mooi Hoek 297 (Portions 0, 1, 4 and 5),
- Silesia 409 (Portions 0, 2 and 3),
- Smaldeel 262 (Portions 0, 1, 2, 8, 20, 21, 22, 23),
- Spes Bona 290 (Portions 0 and 2),
- Theunissen 252 (Portions 0 and 2),
- Vergelegen 85 (Portions 1, 4, 5 and 7).

The planned development footprint of the powerline was carefully selected after a pre-screening site visit was conducted on the 20th of July 2021. The aerial map of the powerline corridor is presented in Figure 5.

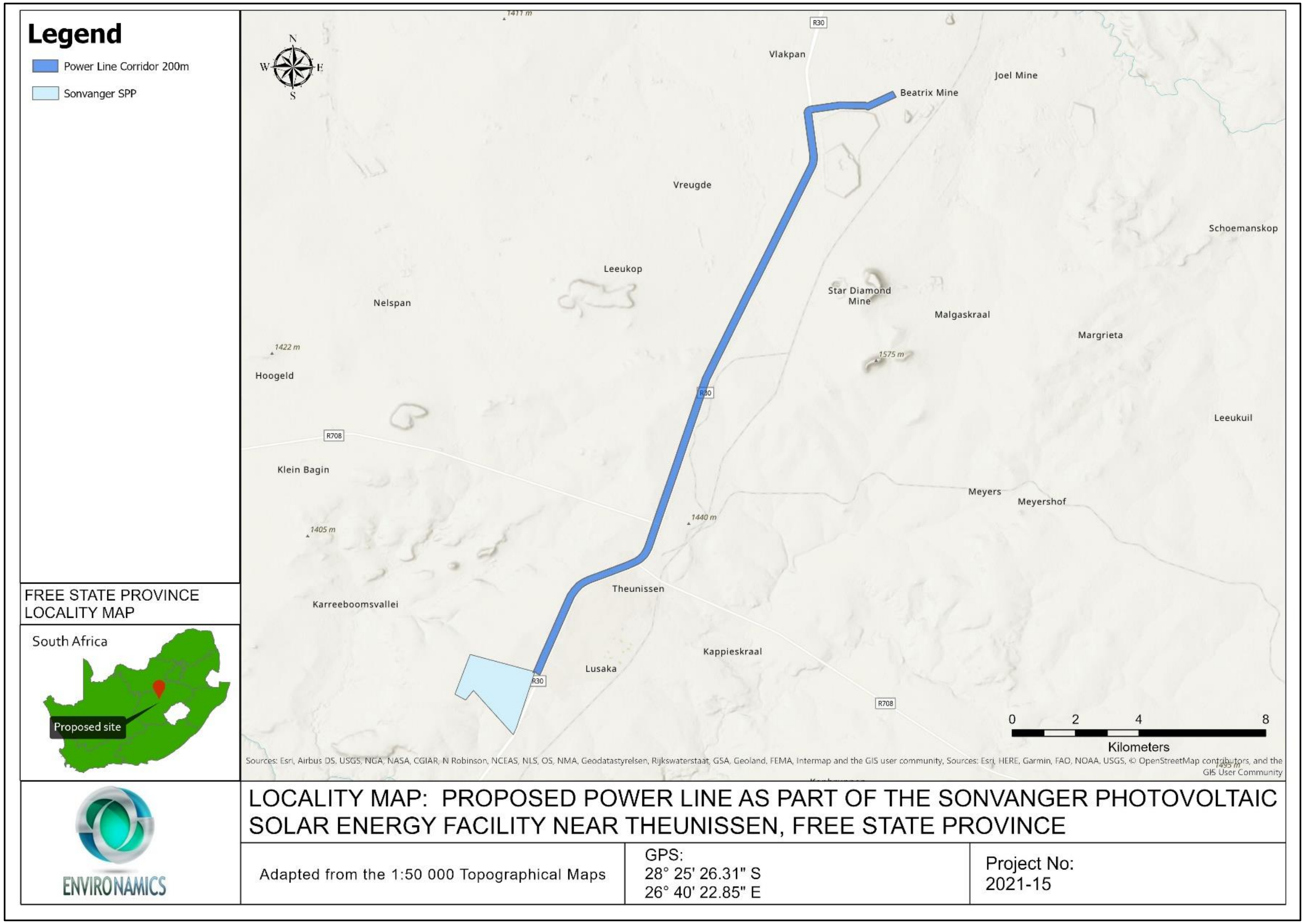



**Figure 4. Regional Location Map of the proposed powerline corridors**


**Figure 5. Aerial Map indicating the proposed location of the powerline corridor for the Sonvanger PV Plant**

## 3.2 CLIMATE

Climate in the broad sense is a major determinant of the geographical distribution of species and vegetation types. However, on a smaller scale, the microclimate, which is greatly influenced by local topography, is also important. Within areas, the local conditions of temperature, light, humidity and moisture vary greatly, and it is these factors which play an important role in the production and survival of plants (Tainton, 1981). The climate for the region can be described as warm-temperate. In terrestrial environments, limitations related to water availability are always important to plants and plant communities.

The spatial and temporal distribution of rainfall is very complex and has great effects on the productivity, distribution and life forms of the major terrestrial biomes (Barbour et al. 1987). The study area is situated within the summer and autumn rainfall region with very dry winters and frequent frost that occurs during the colder winter months. The spatial and temporal distribution of rainfall is very complex and has great effects on the productivity, distribution and life forms of the major terrestrial biomes (Barbour et al. 1987). The mean annual precipitation for the region is around 560mm. The mean annual temperature for the area is 15.2°C, and the mean annual frost days is 43 days. Mean Annual Potential Evaporation is 2226mm, with Mean Annual Soil Moisture Stress of 78%.

## 3.3 GEOLOGY AND SOIL TYPES

Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). A Land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The land type unit represented within the study area include the Bd20 and Dc16 land types (Land Type Survey Staff, 1987) (ENPAT, 2001). The land type, geology and associated soil types is presented in Table 2 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000).

**Table 7. Land types, geology, and dominant soil types of the proposed development site**

| Landtype | Soils | Geology |
|---|---|---|
| Bd20 | Plinthic catena: eutrophic; red soils not widespread upland duplex and margalitic soils rare | Shale, mudstone and sandstone of the Ecca and Beaufort Group. Aeolian and possibly colluvial sand overlies the rocks. |
| Dc16 | Prismacutanic and/or pedocutanic diagnostic horizons dominant. In addition, one or more of: vertic melanic red structured diagnostic horizons | Mudstone, shale, sandstone and grit of the Beaufort Group, Karoo Sequence with dolerite sills |

Soils associated with the site vary between very sandy on the plateaus and higher lying areas, to dark clayey soils in the low-lying plains and bottomlands.

## 3.4 TOPOGRAPHY, LANDUSES AND DRAINAGE

The study area lies completely within the Middle Vaal Water Management Area (WMA) and entirely within the Highveld ecoregion (Kleynhans et al., 2005).

The topography is characterised by slightly undulating plains with wetlands and / or drainage channels bisecting the area. The topography of the site can be described as generally favourable, when considering that most of the area consists of slopes of less than 1:5. The site is located at an altitude of between 900 and 940 meters above mean sea level (AMSL).

Most properties situated within a 500m radius are being used for livestock and crop cultivation. The proposed development land is used for livestock farming and maize cultivation at present. The natural vegetation of the site is mostly intact.

The site is located within the C41G, C41H and C42K quaternary catchments and is situated in the Middle Vaal Water Management Area. Drainage occurs as sheet-wash into the drainage channels on site that eventually drains into the major river namely the Palmietkuil Spruit and Bosluis Spruit that occurs along the periphery of the powerline corridor as well as the Krom Spruit to the south-east of the powerline corridor.

## 3.5 STRATEGIC WATER SOURCE AREAS (SWSA), NATIONAL FRESHWATER ECOSYSTEM PRIORITY AEAS (NFEPA) STATUS OF RIVERS AND WETLANDS ON SITE

NFEPA maps provide strategic spatial priorities for conserving South Africa’s freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or ‘FEPAs’. NFEPA maps were developed using the principles of systematic biodiversity planning, also known as systematic conservation planning (Margules and Pressey 2000). Systematic biodiversity planning is a well-established field of science in which South Africa is considered a world leader (Balmford 2003). The NFEPA maps and supporting information form part of a comprehensive approach to sustainable and equitable development of South Africa’s scarce water resources. For integrated water resources planning, NFEPA provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998). NFEPA products are therefore directly applicable to the National Water Act, feeding into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives. NFEPA products are also directly relevant to the National Environmental Management: Biodiversity

Act (Act 10 of 2004), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act. NFEPA products support the implementation of the National Environmental Management: Protected Areas Act (Act 57 of 2003) by informing the expansion of the protected area network.

The project area is located within proximity of a few NFEPA rivers, namely the Palmietkuilspruit, Bosluissprut and Kromspruit. None of the powerline corridor is bisected by NFEPA Rivers or wetlands, although some NFEPA pans occur near the powerline corridor as indicated in Figure 10.

Strategic Water Source Areas (SWSAs) are now 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; or
- Have high groundwater recharge and where the groundwater forms a nationally important resource; or
- Areas that meet both criteria (a) and (b).

They include transboundary Water Source Areas that extend into Lesotho and Swaziland. All surface water SWSAs are in high rainfall areas where baseflow is at least 11 25 mm/a, which is evidence of a strong link between groundwater and surface water in the SWSAs. The aquifers sustain baseflow, contribute to runoff and, especially, contribute to dry season flows. Sustained river flows are important as they support people and communities who depend directly on rivers for their water, especially during the dry season and droughts.

The 2018 national and transboundary surface-water SWSAs cover about 124 075 $km^2$ (10% of the region) and provide a MAR of 24 954 million $m^3$ (50% of the total). The greatest volume of MAR is generated by the Southern Drakensberg (9% of national and transboundary MAR), followed by the Eastern Cape, Northern Drakensberg and Maloti Drakensberg, and the Boland. The Boland has the highest MAR per unit area (3588 $m^3$/ha/year), followed by Table Mountain, the Northern Drakensberg and the Mpumalanga Drakensberg.

Seven of these SWSAs are transboundary areas because Lesotho and Swaziland include portions of important SWSAs for South Africa. The portions of the SWSAs that fall within Lesotho (Eastern Cape, and the Southern, Northern and Maloti Drakensberg) cover 18 570 $km^2$ and generate a MAR of about 3522 million $m^3$. This MAR sustains the Orange and Caledon Rivers and supplies water to Gauteng via the Lesotho Highlands water supply system. In the case of Swaziland, the portions of the SWSAs falling in this country (Ekangala Drakensberg, Mbabane Hills, Upper Usutu) total 9376 $km^2$ and produce a MAR of about 2053 million $m^3$. In total, the SWSAs in these two countries produce about 11% of the total MAR, which is a substantial contribution that needs to be protected.

The project area is not located within any SWSA as indicated in Figure 6.

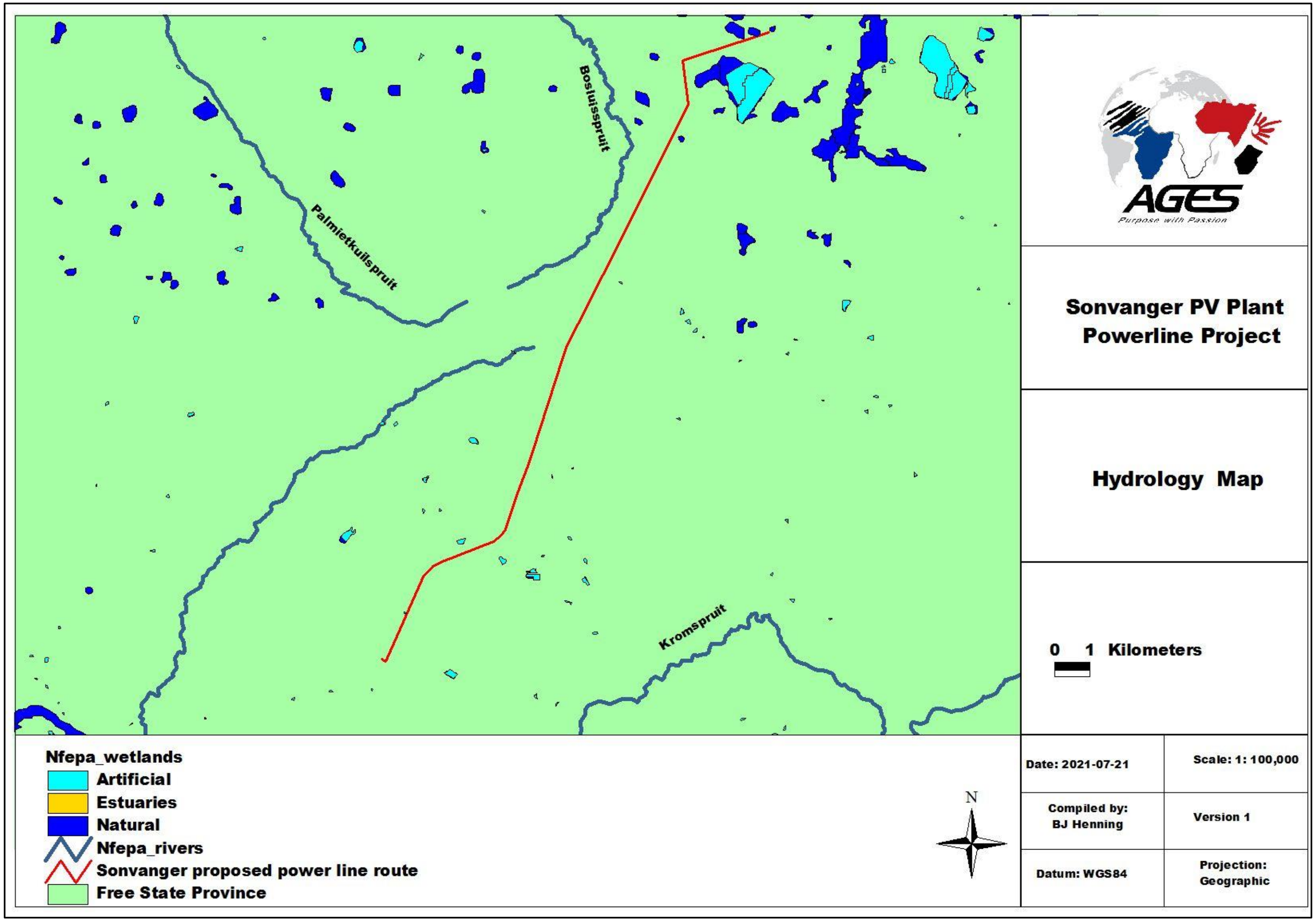



Figure 6. Location of the project area in relation to NFEPA Rivers and SWSA

## 3.6 BIOME AND VEGETATION TYPES

The development site lies within the Grassland Biome which is found chiefly on the high central plateau of South Africa. Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. Trees are absent except in a few localised habitats. Geophytes are often abundant. Frost, fire and grazing maintain the grass dominance and prevent the establishment of trees (Low & Rebelo, 1996).

The Highveld Ecoregion draws its name from the high interior plateau known as the Highveld, and the expansive cover of species-rich communities of grasses. The ecoregion is bordered by the Drakensberg in the east, the arid Karoo and Kalahari in the west, and the low-lying bushveld to the north. The Highveld Plateau is flat with elevations varying from 1,400 m to 1,800 m. The flat topography means that the landscape is traversed by many meandering rivers, with the grassland community historically playing an important role in natural water purification of the westward flowing rivers that originate on the Drakensberg escarpment (Davies and Day 1998). The functioning of this ecosystem has been disrupted in many areas by water transfer projects that have been built to supply greater Johannesburg with water (Davies and Day 1998).

The Highveld Grassland Ecoregion has further suffered extensive degradation. Because it is one of the best areas for farming in South Africa, large tracts of land have already been converted to agriculture, mainly for corn production. Urban expansion, fire, and overgrazing have led to increased fragmentation, as has coal mining and afforestation for stands of exotic trees, especially by species of Eucalyptus (Low and Rebelo, 1998; Cowling et al. 1997). Over several hundred years, particularly around towns, planted wattle (*Acacia mearnsii*) has become invasive, and is prone to rapid expansion upriver watersheds. In the future, expanded surface activity associated with mining below the grassland may become a greater concern as companies develop new technology to make deep mining of coal more profitable (Mallett 1999).

The most recent classification of the area by Mucina & Rutherford (2006) shows that the site is classified as Central Free State Grassland and Vaal-Vet Sandy Grassland (Figure 7).

The landscape of the Central Free State Grasslands is characterised by undulating plains supporting short grassland. Under natural conditions it is dominated by *Themeda triandra* but is dominated by *Eragrostis curvula* and *E. chloromelas* in disturbed habitats. Dwarf Karoo-shrubs establish in severely degraded clayey bottomlands and overgrazed and trampled low-lying areas are prone to *Vachellia karroo* encroachment. From a conservation point of view, this unit is described as Least Concern. Almost a quarter of the area of it is being transformed for crop cultivation and building of large dams such as Allemanskraal, Erfenis, Groothoek, Koppies, Weltevrede and Kroonstad Dams. Small portions are conserved in the Willem Pretorius, Rustfontein and Koppies Dam Nature Reserves as well as in some private nature reserves.

The Vaal-Vet Sandy Grasslands vegetation unit is described as plains-dominated landscape with some scattered slightly irregular undulating plains and hills. Mainly low tussock grasslands with an abundant karroid element. *Themeda triandra* is dominant in this vegetation unit. This vegetation type is described as Endangered because approximately 63% of it has been transformed for commercial crop cultivation and grazing pressure from cattle and sheep. Only 0.3% of this vegetation type is statutorily conserved in Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolwespruit and Soetdoring Nature Reserves.

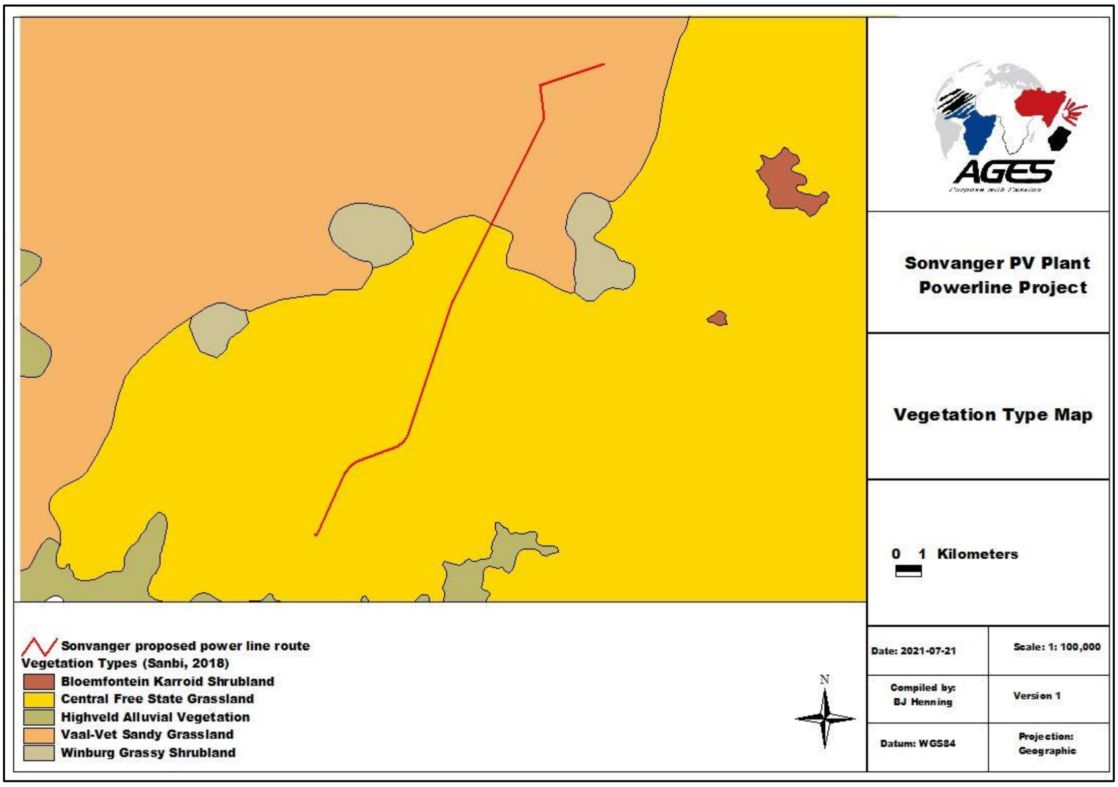



**Figure 7. Vegetation Types of the proposed Sonvanger PV Plant powerline corridor**

# 4 RESULTS

## 4.1 HYDROGEOMORPHIC UNITS

DWAF (2003) states that to classify an area as a wetland it must have one or more of the following attributes:

- Hydromorphic soils that exhibit features characteristic of prolonged saturation.
- The presence of hydrophytes (even if only infrequently).
- A shallow water table that results in saturation at or near the surface, leading to the development of anaerobic conditions in the top 50cm of the soil.

Two wetland types were identified on the site for the proposed powerline corridor namely:

- Valleybottom wetland with channel.
- Depressions:
  - Exorheic depressions (man-made dams).
  - Endorheic depressions (pans & off stream dams).

The other drainage features on the proposed powerline corridor are classified as channels (rivers) with riparian woodland. The rivers are classified as Floodplain Rivers.

The wetland and riparian map for the wetlands and rivers are presented in Figure 8.

### 4.1.1 Valleybottom wetlands

A few valleybottom wetlands were identified in the central and southern section of the powerline corridor. Valley bottom wetlands are classified as low-lying, gently sloped areas that receive water from an upstream channel and/or form adjacent hillslopes, not subject to periodic over-bank flooding by a river channel. Surface water in the valley bottom wetlands of the study area flows only seasonally, although the channels are in most cases non-perennial. This wetland vegetation comprises atypical (azonal) vegetation, mainly because of the prolonged moist conditions of the soils. The soils are clayey and do have relatively high-water retention abilities.

A channelled valley-bottom wetland is classified as a mostly flat valley-bottom wetland dissected by and typically elevated above a channel (Photograph 1). Dominant water inputs to these areas are typically from the channel, either as surface flow resulting from overtopping of the channel bank/s or as interflow, or from adjacent valley-side slopes (as overland flow or interflow). Water generally moves through the wetland as diffuse surface flow, although occasional, short-lived concentrated flows are possible during flooding events. Small depressional areas within a channelled valley-bottom wetland can result in the temporary containment and storage of water within the wetland. Water generally exits in the form of diffuse surface flow and interflow, with the infiltration and evaporation of water from these wetlands also being potentially significant (particularly from depressional areas). The hydrodynamic nature of channelled valley-bottom wetlands is characterised by bidirectional horizontal flow, with limited vertical fluctuations in depressional areas (SANBI, 2009).

Unchanneled valley-bottom wetland can be described as: a mostly flat valley-bottom wetland area without a major channel running through (Photograph 2). This wetland type is characterised by an absence of distinct channel banks and the prevalence of diffuse flows, even during and after high rainfall events. Water inputs are typically from an upstream channel, as the flow becomes dispersed, and from adjacent slopes (if present) or groundwater. Water generally moves through the wetland in the form of diffuse surface flow and/or interflow (with some temporary containment of water in depressional areas), but the outflow can be in the form of diffuse or concentrated surface flow. Infiltration and evaporation from unchanneled valley-bottom wetlands can be significant, particularly if there are a few small depressions within the wetland area. Horizontal, unidirectional diffuse surface-flow tends to dominate in terms of the hydrodynamics.

The vegetation structure of the valley bottom wetlands varies from the actual channels being closed grassland in certain areas, to a muddy riverbed with alluvial sand and reeds along the riverbanks. The drainage channels that from part of the channelled valley bottom wetlands is mostly perennial.

The most abundant and most conspicuous plant species is hygrophilous grasses such as *Andropogon eucomis, Hyparrhenia tamba, Eragrostis gummiflua* and *Setaria sphacelata*. Other plants associated with valley bottom channels are *Juncus effusus, Schoenoplectus corymbosus, Verbena bonariensis, Persicaria serrulata* and *Typha capensis*.

Unfortunately, the valley bottom wetlands provide a distribution route for weeds and invading trees. Many of the usual weeds were recorded together with *Xanthium strumarium* (Large cocklebur) *Datura stramonium, Tagetes minuta* and *Bidens bipinnata*. Weeds and invaders should be removed, as well as destruction of such plants in a safe place and manner.

**Photograph 1. Valleybottom wetland with channel in the project area**

**Photograph 2. Valleybottom wetland without channel in the project area**

### 4.1.2 Depressions

The depressions in the project area can be classified into two variations namely man-made dams (Photograph 3) or natural pans classified as endorheic depressions (Photograph 4). A depression is classified as a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. For 'depressions with channelled inflow', concentrated overland flow is typically a major source of water for the wetland, whereas this is not the case for 'depressions without channelled inflow'. Dominant hydrodynamics are (primarily seasonal) vertical fluctuations. Depressions may be flat-bottomed (in which case they are often referred to as 'pans') or round-bottomed (in which case they are often referred to as 'basins') and may have any combination of inlets and outlets or lack them completely. Water exits by means of concentrated surface flow in channels for exorheic depressions, although the primary means of water still exits as evaporation. The vegetation associated with depressions is mostly sedges and bulrushes depending on the depth of the water and the substrate. Species such as *Persicaria serullata, Typha capensis, Schoenoplectus corymbosus, Ludwigia stolonifer* and *Leersia hexandra* mostly grow along the shallow edges of dams and pans in the project area on a muddy substrate. The riparian woodland is characterised by *Vachellia karroo, Ziziphus mucronata* and *Grewia flava*.

**Photograph 3. Man-made dam and concrete canal in the project area**

**Photograph 4. Endorheic depression (pan) in the project area**

#### 4.1.2.1.1 River channels and floodplains

The major river in the northern section of the project area (Photograph 5) with the associated riparian vegetation are ecologically sensitive, forming important, limited and specialised habitats for several plant and fauna species. The species composition is unique and relatively limited in distribution and coverage. This habitat also forms linear corridors linking different open spaces. The riverine woodland would be important dry season refuge areas for many fauna species in their natural state. It is also a centre of floral diversity. Riparian areas have been identified as important dry season refuge areas for a variety of large mammal species. The impacts on the sensitive riparian ecosystems, regardless of the source, need to be restricted. Impacts on this system include erosion, habitat loss and degradation and the associated impacts on faunal and floral diversity, dewatering of marshes and wetlands, water abstraction as well as increased sedimentation (SANParks 2003). Continued impacts on the riverine ecosystems may also ultimately reduce the capacity of this system to absorb dramatic flooding events. The band of trees that occurs along the channel can be classified as riparian vegetation. This vegetation is very important for connectivity with adjacent vegetation as well as a migratory route for riparian animals.

The drainage channel on site is non-perennial. Channels are subdivided further within this level of the hierarchy into six geomorphological zones, as defined by Rowntree and Wadeson (2000). These zones are based largely on gradient which influences flow velocity and channel characteristics such as substratum particle size that are important characteristics of riverine habitat types. The following geomorphological zones occur in the project area and described as follows (after Rowntree and Wadeson 2000):

- Lowland River: a low-gradient alluvial fine-bed channel. It may be confined but has a fully developed meandering pattern within a distinct floodplain that develops in unconfined reaches where there is increased silt content in bed or banks. Characteristic gradient: 0.0001- 0.001.

The Palmietspruit that bisects the area can be described as a floodplain river or a lowland river. The floodplain is not classified as a floodplain wetland, but a river with some wetland characteristics in the channel and its banks.

A floodplain, is flat or nearly flat land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge (Figure 8). It includes the floodway, which consists of the stream channel and adjacent areas (riparian woodland, hydrophilic grassland, Photograph 10) that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current. In other words, a floodplain is an area near a river or a stream which floods easily. Floodplains are made by a meander eroding sideways as it travels downstream. When a river breaks its banks and floods, it leaves behind layers of rock and mud. These gradually build up to create the floor of the flood plain. Floodplains generally contain unconsolidated sediments, often extending below the bed of the stream. These are accumulations of sand, gravel, loam, silt, and/or clay, and are often important aquifers, the water drawn from them being pre-filtered compared to the water in the river.

The vegetation associated with the floodplain is mostly microphyllous woodland and hygrophilous grasses in the project area. Species such as *Vachellia karroo, Searsia pyroides, Ziziphus mucronata* and *Searsia lancea* mostly grow in the floodplain area (Photograph 5), together with grass species such as *Sporobolus africanus* and *Eragrostis rotifer*.

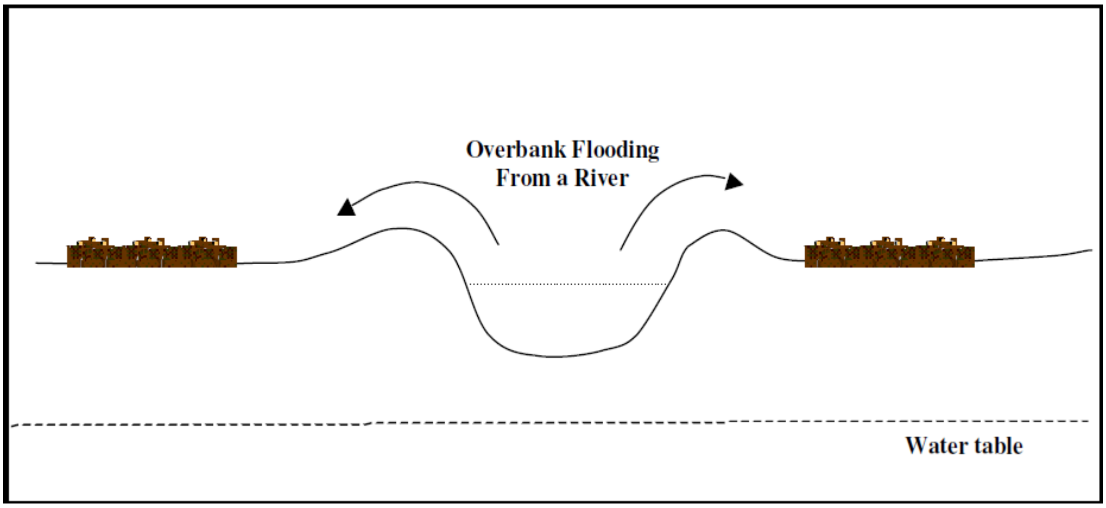



Figure 8. Cross section through a floodplain

Photograph 5 The floodplain river in the project area of the powerline corridor

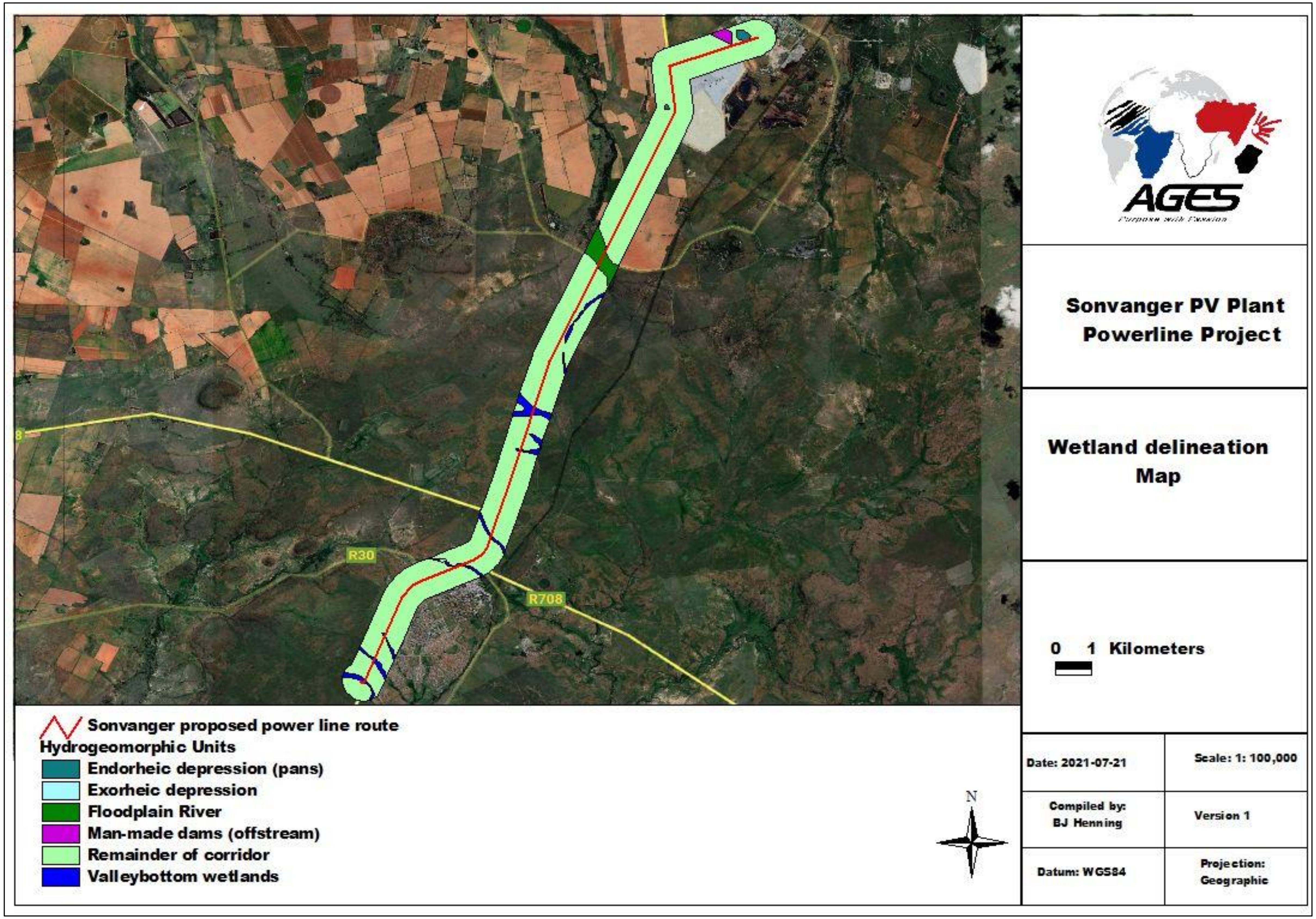



**Figure 9. Riparian / wetland delineation map of the proposed powerline corridor**

## 4.2 WETLAND / RIVERINE INTEGRITY ASSESSMENTS

In determining the integrity of the drainage system, the condition of the site and the indirect and direct disturbances is considered. The impoundments, roads, alien invasive vegetation species, pollution, sedimentation and density roughness elements was taken into account in determining the PES and EIS of the riparian / wetland units on site (Table 8). Appendix A and B indicate the scores for the PES and EIS respectively.

Evidence was observed on site of transformation of the floristic characteristics of the site at least to some extent. Impacting activities which may have altered the expected floristic composition include alien infestation, impoundment and road crossings. The valleybottom wetlands and riverine areas were assessed.

**Table 8. Present Ecological State and Ecological Importance & Sensitivity of the wetland and riparian systems on the proposed development site**

| Hydro-geomorphic Unit | PES | EIS |
|---|---|---|
| Valleybottom wetlands with / without channels<br>Floodplain Rivers | Class C: Moderately modified | Moderate |

Anthropogenic disturbance of soil and primary vegetation have altered the natural hydrological functioning of the drainage systems (wetlands and riverine areas) associated with the proposed powerline corridor. The reference state was probably Class B that changed to a Class C.

However, the biotic and abiotic characteristics clearly indicated that the drainage system is functional in terms of flood attenuation, erosion control, sediment trapping and biodiversity. The limited presence of facultative wetland plant species such as sedges, and the absence of temporary pools limit the ability of this wetland system to contribute to streamflow regulation. All the wetlands' components on site were found to be limiting in their ability to improve water quality by removing nitrates, phosphates, and other toxicants. The drainage system as an entity (dam, non-perennial and valleybottom wetlands) has a Class C PES (Moderately Modified). The riparian woodland plays an important role as a corridor for fauna in the area and has only been impacted by upstream agricultural activities and road crossings. The state of the individual hydrologic component functions is as follows:

- **Hydrologic:** Class D – Largely Modified
- **Water quality**: Class C: Moderately Modified
- **Hydraulic / Geomorphic**: Class C: Moderately Modified

- **Biota**: Class C: Moderately Modified

Considering the importance as a fauna corridor as well as the red data species associated with the riverine woodland and wetlands, the area has a MODERATE EIS. This HGM unit is therefore considered to be ecologically sensitive and important. The biodiversity of this riparian zone may be sensitive to flow and habitat modification, while the channel plays a significant role in moderating the quantity and quality of water entering downstream areas.

# 5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE WETLAND AND RIPARIAN ZONES

The proposed development will have a potential direct or indirect impact on the wetlands and riparian habitat. Mitigation (including rehabilitation) of the impacts and should rather focus on the management of stormwater, erosion prevention and connection with the larger system. Indirect impacts could occur because of construction activities (dust, spillages etc.). The following section deals with the anticipated impacts of the proposed development on the wetland of the site.

## 5.1 IMPACT ON THE CHARACTERISTICS OF THE WATERCOURSE I.E. FLOW REGIME, HABITAT, BIOTA, WATER QUALITY AND GEOMORPHOLOGY DUE TO CONSTRUCTION WITHIN FLOODLINE ZONE

### 5.1.1 Description of impact:

The construction activities associated with the proposed powerline development will potentially have an impact on the wetland areas and water levels, whether it is through direct or indirect impacts at the crossings. The clearance of vegetation for the powerline development will either have a direct or indirect impact on the wetlands and smaller drainage channels. Loss of the riparian and instream habitat will also result in permanent loss or displacement of the invertebrates, birds and small mammals' dependant on the wetland vegetation for feeding, shelter and breeding purposes. All functions associated with the riverine zones and the surrounding landscape will be compromised if mitigation measures are not applied correctly. Other indirect impacts of the construction of the powerline development on the characteristics of the water course include impacts on water quality and changes to the geomorphology should the development cause impacts on downstream areas.

### 5.1.2 Mitigation measures:

- Clearing of vegetation at the crossings for the powerline corridors should be scheduled for the drier winter months and limited to areas immediately needed for construction. Vegetation stripping should occur in parallel with the progress of construction to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Only selected plant species must be used in the re-vegetation process.
- Minimize soil exposure around the powerline development. Re-vegetate exposed

areas surrounding the powerline development and allow a sufficient buffer between the cropland development to prevent sedimentation into the wetlands / rivers.

- Manage water effectively on, to, within, and from this site.
- The location where the powerline crosses the drainage channels should be the least sensitive area. The site should be indicated by an ecologist after consultation by the engineers. The following mitigation measures and management actions should be taken to minimize potential impacts of the line crossing drainage channels:
    - Identify areas of historic or potential vulnerability, such as geologically unstable materials or areas subject to flooding.
    - Avoid problematic areas and avoid power line locations in areas of high natural hazard risk, such as landslides, rock-fall areas, steep slopes (over 60-70%), wet areas, saturated soils, etc.
    - Avoid or minimize construction in narrow canyon bottoms or on flood plains of rivers that will inevitably be inundated during major storm events.
    - Minimize changes to natural drainage patterns and crossings to drainages. Drainage crossings are potentially problematic, so they must be well designed. Changes to natural drainage patterns or channels often result in either environmental damage or failures.
    - Perform scheduled maintenance to be prepared for storms. Ensure that culverts have their maximum capacity, ditches are cleaned, and that channels are free of debris and brush than can plug structures.
    - Typically keep cut and fill slopes as flat as possible and well covered (stabilized) with vegetation to minimize slumping as well as minimize surface erosion. Well-cemented but highly erosive soils may be best to resist surface erosion with near-vertical slopes that minimize the surface area exposed to erosion.
    - Use deep-rooted vegetation for biotechnical stabilization on slopes. Use a mixture of good ground cover plus deep-rooted vegetative species,

preferably native species, to minimize deep-seated mass instability as well as offer surface erosion control protection.

- Locate the power line on narrow sections of rivers and in areas of bedrock where possible. Avoid fine, deep alluvial deposits (of fine sand and silt) that are scour susceptible and problematic, or which otherwise require costly foundations.
- Ensure that structural designs for the power line crossing the drainage channels include appropriate design criteria and have good foundations to prevent failures during floods.
- Place retaining structures, foundations, and slope stabilization measures into bedrock or firm, in-place material with good bearing capacity to minimize undermining, rather than placing these structures on shallow colluvial soil or on loose fill material.

- The power line should not negatively impact on the actual riparian area itself, and the pylons should be placed outside any riparian zones.
- All development activities should be restricted to the footprint areas of the proposed powerline development. The Environment Site Officer (ESO) should demarcate and control these areas. Storage of building equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries.
- The Environment Control Officer (ECO) should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment and specifically wetlands. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation.
- Rehabilitation of the development area after construction have been completed should be considered a high priority and all areas rehabilitated should be audited after construction has ceased by a suitably qualified environmentalist.
- Should the development be approved by authorities, environmental monitoring of environmental aspects should be implemented during and after the

construction phase of the development to ensure that minimal impact is caused to the floodline or wetlands of the area.

- Demarcate all riparian boundaries with pegs and danger tape.
- Edge effects of pre-construction and construction activities, including erosion, sedimentation and alien/weed control, need to be strictly managed in wetland areas as well as their associated buffer zones (i.e. 32m buffer).
- The following general rehabilitation measures should be implemented in the disturbed riparian zone:
  - All disturbed surface areas will be re-shaped to resemble the surrounding natural topography. Surfaces will be ripped / scarified, and re-vegetated with indigenous grass species.
  - As far, as is practical, implement concurrent rehabilitation processes to limit degradation of soil biota.
  - Terrestrial invasive removal programs must be maintained throughout the proposed development as well as in the aftercare and maintenance phases.

## 5.2 SOIL COMPACTION AND INCREASED RISK OF SEDIMENT TRANSPORT AND EROSION

### 5.2.1 Description of impact:

The use of heavy machinery during the construction process of the powerline development will result in the compaction of soil, resulting in decreased infiltration of rainwater and increased surface run-off volumes and velocities leading to a greater erosion risk. The hardened surfaces of the road and compacted soils of the proposed development area will also lead to an increase in surface run-off during storm events which will likely be discharged via stormwater outlet points, concentrating flows leaving the exposed areas. This can lead to erosion and channel incision in the wetland / riparian zones and change the downstream habitat. This could result in higher velocity flows with greater erosive energy which can result in channel incision and gully erosion downstream within the channel riparian zones.

Soil erosion also promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous fauna and flora.

The development will cause insignificant changes to the sediment regime of the area considering that no major rivers or drainage channels occur on site.

### 5.2.2 Mitigation measures

- Stringent controls must be put in place to prevent any unnecessary disturbance or compaction of alluvial soils. Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilized and any alien plants which establish should be cleared and follow up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area). Topsoil should preferably be separated from the subsoil, and topsoil sections should be kept intact as deep as possible.
- Reprofiling of the banks of disturbed drainage areas to a maximum gradient of 1:3 to ensure bank stability.
- Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles. This is especially relevant for the stormwater outlet area.
- Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion.
- Erosion control mechanisms must be established as soon as possible. Further financial provision should be continued over the subsequent years to allow for maintenance of the gabions, reno mattresses, and associated structures.
- A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-construction.
- If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is preferable as it will not be associated with the nitrogen

negative period associated with organic material that is not composted.

- Vehicle traffic should not be allowed on the rehabilitated areas, except on allocated roads. It will have a negative impact due to the dispersive/compaction characteristics of soils and its implications on the long term.
- Appropriate design and mitigation measures must be developed and implemented to minimise impacts on the natural flow regime of the watercourse i.e., through placement of structures/supports and to minimise turbulent flow in the watercourse.
- The indiscriminate use of machinery within the in-stream and riparian habitat will lead to compaction of soils and vegetation and must therefore be strictly controlled.
- A buffer zone of 32 meters should be implemented around the drainage channels and riparian zone to prevent sediment changes to the channels. No activities or disturbance may take place within the 32m buffer.
- Perform scheduled maintenance to be prepared for storms. Ensure that culverts have their maximum capacity, ditches are cleaned, and that channels are free of debris and brush than can plug structures.

## 5.3 SOIL AND WATER POLLUTION

### 5.3.1 Description of impact:

Construction work will also carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on fauna and flora.

### 5.3.2 Mitigation measures

- Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.
- No dumping of waste should take place within the wetland / riparian zone. If any spills occur, they should be immediately cleaned up.

- Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility.
- Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously.
- All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier.
- Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
- A speed limit (preferably 40 km/hour) should be enforced on dirt roads.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with the label and application permit directions and stipulations for terrestrial and aquatic applications.

## 5.4 SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES

### 5.4.1 Description of impact:

The construction almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project.

Furthermore, the spread of the alien invasive species through the area will be accelerated when seeds are carried by storm water into the drainage features and riparian zones on the site that will cause environmental degradation and indigenous species to be displaced.

### 5.4.2 Mitigation measures

- Alien and invader vegetation must not be allowed to colonise in the area. Control involves killing alien invasive plants present, seedlings and establishing an alternative plant cover to limit re-growth. The use of indigenous plants must be encouraged in the rehabilitated areas (stormwater canals), and stockpiles containing mostly exotic or weedy species should receive specialised handling and should be invasion. Control should begin prior to construction phase considering small populations of AIS occur around the sites.
- Institute strict control over materials brought onto site, which should be inspected for seeds and steps taken to eradicate these before transport to the site. The contractor is responsible for the control of weeds and invader plants.
- Rehabilitate disturbed areas as quickly as possible.
- Institute a monitoring programme to detect alien invasive species early.
- Institute an eradication/control programme for early intervention if invasive species are detected. The use of indigenous plants must be encouraged in the rehabilitated areas (stormwater canals), and stockpiles containing mostly exotic or weedy species should receive specialised handling and should be covered for extended periods to inhibit seedling germination of these species. Active management and eradication of exotic / alien plant species should also occur when seedlings are found.

## 5.5 RISK ASSESSMENT MATRIX FOR THE CONSTRUCTION AND OPERATIONAL PHASES OF THE DEVELOPMENT

Appendix C indicates the risk assessment matrices for the proposed powerline development. The most significant impacts are habitat destruction, erosion and soil compaction, although impacts such as alien species invasion and spillages are limited during the construction phase or can be successfully mitigated.

# 6 DISCUSSION & CONCLUSION

The riparian / wetland delineation for the Sonvanger Solar Plant Powerline project was done according to the criteria set by the Aquatic Biodiversity Compliance Protocols (2020), Department of Water Affairs and Forestry (2003) and the National Wetland Classification System for South Africa (SANBI, 2009). The soils, vegetation associated with wetlands and landscape were all used as parameters in identifying the wetlands and riparian zones.

Two wetland types were identified namely a valleybottom wetland and depressions (pans and man-made dams). The non-perennial channels can be classified as 'River channels', although these drainage channels are not wetlands in the 'true' sense of the word but should rather be described as water courses as stipulated in the National Water Act. The channels are floodplain river channels. Baseline soil information, landscape profile and vegetation were used to confirm riparian and terrestrial properties within the study area. The impacts associated with the construction site is reflected in the results of the PES assessment which indicates that the riparian zones, wetlands and water courses are 'Moderately Modified'.

The EIS of the drainage system on site are MODERATE and are ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.

An impact assessment was conducted for the wetlands and riparian zones on site in addition to the mitigation measures recommended to ensure the protection of the riverine ecosystems. Impacts relating to the proposed development on the water courses / riparian zones are as follows:

- Impact on the characteristics of the watercourse i.e., flow regime, habitat, biota, water quality and geomorphology due to construction within floodline zone.
- Soil erosion and sedimentation.
- Water pollution from spillages, vehicle emissions and dust.
- Spread and establishment of alien invasive species in wetlands.

Specific mitigation measures need to be implemented in the areas surrounding the riparian zones and water courses to prevent any negative impacts other than the impacts that will be caused during the clearance of the power line servitude.

Provided that all the mitigation measures and recommendations surrounding the water courses and riparian zones are strictly adhered to (i.e. impacts managed to a low acceptable level) the development of the solar development can be supported.

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# 8 APPENDIX A PES SCORES OF THE WETLANDS

| Criteria and Attributes | Relevance | Channels with riparian woodland |
|---|---|---|
| **Hydrologic** | | **Class D Largely Modified** |
| Flow Modification | Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland. | 2 |
| Permanent Inundation | Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota. | 2 |
| **Water Quality** | | **Class C: Moderately Modified** |
| Water Quality Modification | From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland. | 3 |
| Sediment Load Modification | Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats. | 3 |
| **Hydraulic / Geomorphic** | | **Class C: Moderately Modified** |
| Canalisation | Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage. | 3 |
| Topographic Alteration | Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduce or changes wetland habitat directly in inundation patterns. | 2 |
| **BIOTA** | | **Class C: Moderately Modified** |
| Terrestrial Encroachment | Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions. | 3 |
| Indigenous Vegetation Removal | Transformation of habitat for farming, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and in increases potential for erosion. | 2 |
| Invasive Plant Encroachment | Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading). | 2 |
| Alien Fauna | Presence of alien fauna affecting faunal community structure | 2 |
| Over utilisation of Biota | Overgrazing, overfishing, etc. | 3 |
| **Total** | | 27 |
| **Mean** | | 2.45 |
| **Category** | | **C** |
| **Ecological Management Class** | | **Moderately Modified** |

# 9 APPENDIX B EIS SCORES OF THE WETLANDS IN THE STUDY AREA

| **Determinant** | **Channels with riparian woodland** |
|---|---|
| **PRIMARY DETERMINANTS** | |
| 1. Rare & Endangered Species | 2 |
| 2. Populations of Unique Species | 1 |
| 3. Species/taxon Richness | 2 |
| 4. Diversity of Habitat Types or Features | 2 |
| 5. Migration route/breeding and feeding site for wetland species | 2 |
| 6. Sensitivity to Changes in the Natural Hydrological Regime | 2 |
| 7. Sensitivity to Water Quality Changes | 2 |
| 8. Flood Storage, Energy Dissipation & Particulate/Element Removal | 2 |
| | |
| **MODIFYING DETERMINANTS** | |
| 9. Protected Status | 0 |
| 10. Ecological Integrity | 2 |
| TOTAL* | 17 |
| MEDIAN | 1.7 |
| **OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE** | **Moderate** |

# 10 APPENDIX C RISK ASSESSMENT MATRIX FOR THE POWERLINE DEVELOPMENT SITE (ALL DRAINAGE CHANNEL CROSSINGS)