## SiVEST SA (PTY) LTD

# PROPOSED CONSTRUCTION OF THE MAYOGI SOLAR PHOTOVOLTAIC (PV) FACILITY AND ASSOCIATED GRID CONNECTION INFRASTRUCTURE, NEAR KIRKWOOD, EASTERN CAPE PROVINCE

# Aquatic Assessment


**DFFE Reference**: TBA
**Report Prepared by:** **EnviroSci (Pty) Ltd**
**Issue Date:** 27 July 2023
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## AQUATIC BIODIVERSITY ASSESSMENT

## EXECUTIVE SUMMARY


JUWI South Africa \ (Pty) Ltd, has appointed SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST") to undertake the required Environmental Authorisation Processes for the proposed construction of the Mayogi Solar PV Energy Facility and associated grid infrastructure near Kirkwood in the Eastern Cape Province.

The overall objective of the development is to generate electricity by means of renewable energy technology capturing solar energy to feed into the National Grid via short grid connection.

In terms of the Environmental Impact Assessment (EIA) Regulations, which were published on 04 December 2014 [GNR 982, 983, 984 and 985) and amended on 07 April 2017 [promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017], various aspects of the proposed development are considered listed activities under GNR 327 and GNR 324 which may have an impact on the environment and therefore require authorisation from the National Competent Authority (CA), namely the Department of Environment, Forestry and Fisheries (DFFE), prior to the commencement of such activities. Specialist studies have been commissioned to assess and verify the project under the new Gazetted specialist protocols.

The regulatory requirements are also discussed with regard the NEMA and the National Water Act in Section 4 of this report. The PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON BIODIVERSITY and in particular Aquatic Biodiversity related to Government Gazette 43110, 20 March 2020 and Appendix 6 of the NEMA EIA Regulations, have been adhered to.

This report fulfils the Aquatic Biodiversity Specialist Assessment Report criteria for assessment listed under the various Theme Sensitivity Protocols, where the following sensitivity ratings were contained in the Screening Tool Report Aquatic Biodiversity – Very High sensitivity related to presence of a National Freshwater Priority Ecosystem Area (NFEPA) across to the PV site and the grid alignment farm portion.

The verification of any of the Very High Sensitivity rated habitats / species localities is thus critical as the proposed development should then avoid these areas. During this assessment, a one-day site visit of the area was conducted in 25 November 2022, in which the habitats listed above were considered, together with a description of the general environment and species assemblages found present. This

spatial data supplied to the Applicant was used to develop the layout outside of these areas (inclusive of suitable buffers) as a mechanism of impact avoidance using fine scale mapping data.

The study area had received some rainfall, which aided in critically assessing the ecological character of the site, with particular reference to any linkages between the aquatic and terrestrial environment as indicated in the Screening Tool Results. The information collected, was also compared to previous assessments within the region by members of EnviroSci, used in the assessment various roads and quarries in the region.

The study area (farm portion) was dominated by one type of natural aquatic feature and a small number of artificial barriers associated with catchments and rivers, as follows:

- Ephemeral water course - with or without riparian vegetation. These range from narrow channels to broad flood plain areas typical of areas associated with Albany Alluvial vegetation units
- Dams and weirs / berms with no wetland or aquatic features.

The table below provides an overview of the sensitivity of various aquatic features (with buffers distances included) as it relates to the main project component types for the project. The features are shown spatially in Figure 9 of this report. The sensitivity ratings of High No-go and Low were determined through an assessment of the aquatic habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within systems, but this is considered acceptable since these areas have already been impacted.

**Results of the sensitivity rating / constraints assessment**

| Development Component | Waterbody type | Sensitivity rating of the respective waterbody type against the development type and the required buffer | Sensitivity rating override if an impact such as a road already occurs within the proposed footprint |
|---|---|---|---|
| **PV Panel areas** | Watercourses | No-go with 12m buffer | |
| | Artificial dams | Not Applicable = If these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required | |
| **Buildings / Substations & BESS** | Watercourses | No-go with 12m buffer | |
| | Artificial dams | Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required | |
| **Roads** | Watercourses | Moderate sensitivity related to roads, and as crossings will be required no buffer is applicable | LOW if an existing crossing / road or impact is already present, that must then be included in the potential road network |
| | Artificial dams (off channel only) | Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required | |
| **Overhead Lines** | Watercourses | Assumption is that the overhead lines could span these areas, but the towers/pylons should adhere to the buffer distances as indicated where possible as some of the alluvial system are very broad | |
| | Artificial dams (off channel only) | | |

In summary, any structures such as PV Panel areas, buildings, substations and BESS, should be placed outside of the observed watercourse (Figure 9), while roads and transmission could cross or span these areas (Figure 9).

Based then on this information the developer then formalised the layout to account for this and then based on the remaining activities within any regulated areas (watercourses), the following direct impacts were identified, which were aligned with those contained in the Biodiversity Assessment Protocol and were assessed in greater detail in this phase of the assessment:

**Construction & Decommissioning Phases**

- Impact 1: Loss of aquatic species of special concern
- Impact 2: Damage or loss of riparian systems, ephemeral watercourses in the construction phase
- Impact 3: Potential impact on localised surface water quality

**Operational phase**

- Impact 4: Impact on aquatic systems through the possible increase in surface water runoff on form and function - Increase in sedimentation and erosion

The project overall has aligned the proposed footprint with the aquatic features, allowing for retention of much of the natural environment so that the systems should remain largely unaffected. Therefore, the PV site and grid options, have a low intensity impact on the aquatic resources. The grid option is also favorable, but this option will need to span areas of a watercourse, and the final towers positions will be based on the recommendations of the aquatic specialist during the walk down

The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was possible, or the nature of the activities involve a low potential risk to aquatic resources even at great distance. Overall, it is expected that the impact on the environment would be Low (-). Noteworthy areas, that have been avoided by the PV areas, and Grid Options, include the High Sensitivity areas as shown in this report.

Based on the findings of this study, the specialist finds no reason to withhold an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented, coupled with a micrositing walkdown once all information is available.

## NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

| **Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6** | **Section of Report** |
|---|---|
| 1. (1) A specialist report prepared in terms of these Regulations must contain-<br>a) details of-<br>i. the specialist who prepared the report; and<br>ii. the expertise of that specialist to compile a specialist report including a curriculum vitae; | Appendix 1 CV |
| b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Attached to Report |
| c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 1.1 and 1.3 of this report |
| (cA) an indication of the quality and age of base data used for the specialist report; | Section 1.3 |
| (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | Section 5 |
| d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment; | Section 1.3 and 5 |
| e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Appendix 3 |
| f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives; | Section 5.1 |
| g) an identification of any areas to be avoided, including buffers; | Section 5 & 6 |
| 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; | Section 5 |
| i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 2 |
| 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) or activities; | Section 6 & 8 |

| | |
|---|---|
| k) any mitigation measures for inclusion in the EMPr; | Section 6 |
| l) any conditions for inclusion in the environmental authorisation; | Section 5. 6 and 8 |
| m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 6 |
| n) a reasoned opinion-<br>i. (as to) whether the proposed activity, activities or portions thereof should be authorised;<br>(iA) regarding the acceptability of the proposed activity or activities; and<br>ii. if the opinion is that the proposed activity, activities 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; | Section 8 |
| o) a description of any consultation process that was undertaken during the course of preparing the specialist report; | N/A |
| p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | N/A |
| q) any other information requested by the competent authority. | N/A |
| 2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply. | Yes - Appendix 2 |

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## AQUATIC BIODIVERSITY ASSESSMENT

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## Glossary of Terms

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: 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 under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: as per the National Water Act means -

  (a) a river or spring;
  (b) a natural channel in which water flows regularly or intermittently;
  (c) a wetland, lake or dam into which, or from which, water flows; and
  (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

## List of Abbreviations

| | |
|---|---|
| AER | Along Existing Roads – cables that are included in existing road servitudes |
| CARA | Conservation of Agricultural Resources Act |
| CBA | Critical Biodiversity Area |
| CSIR | Council for Scientific and Industrial Research |
| DDD | Data Deficient |
| DWS | Department of Water and Sanitation formerly the Department of Water Affairs |
| ECO | Environmental Control Officer |
| EIA | Environmental Impact Assessment |
| EIS | Ecological Importance and Sensitivity |
| EMPr | Environmental Management Programme Report |
| EN | Endangered |
| EO | Environmental Office |
| ESA | Ecological Support Area |
| GA | General Authorisation (WUA type) |
| GBIF | Global Biodiversity Information Facility |
| GIS | Geographic Information System |
| LC | Least Concern |
| NFEPA | National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011). |
| NT | Near Threatened |
| OHL | Overhead Line – transmission line cable that is not buried |
| ORC | Off road cable – underground or overhead transmission cable not within a road reserve |
| PES | Present Ecological State |
| SANBI | South African National Biodiversity Institute |
| SQ | Subquaternary catchment = Quinary catchment |
| VU | Vulnerable |
| WEF | Wind Energy Facility |
| WUA | Water Use Authorisation |
| WUL | Water Use License |
| WULA | Water Use License Application |

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## 1. INTRODUCTION

JUWI South Africa(Pty) Ltd, has appointed SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST") to undertake the required Environmental Authorisation Processes for the proposed construction of the Mayogi Solar Energy Facility and associated grid infrastructure near Kirkwood in the Eastern Cape Province.

The overall objective of the development is to generate electricity by means of renewable energy technology capturing solar energy to feed into the National Grid via short grid connection.

In terms of the Environmental Impact Assessment (EIA) Regulations, which were published on 04 December 2014 [GNR 982, 983, 984 and 985) and amended on 07 April 2017 [promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017], various aspects of the proposed development are considered listed activities under GNR 327 and GNR 324 which may have an impact on the environment and therefore require authorisation from the National Competent Authority (CA), namely the Department of Environment, Forestry and Fisheries (DFFE), prior to the commencement of such activities. Specialist studies have been commissioned to assess and verify the project under the new Gazetted specialist protocols.

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## 1.1 Terms of Reference

Please refer to Specialist ToR provided.

## 1.2 Specialist Credentials

Please see Appendix 1 - Specialist CVs

## 1.3 Assessment Methodology

These assessments were conducted using the following assessment process based on a full day of field work conducted in 25 November 2022, early summer with several of the associated plants showing early growth.

***Methodology summary***

- Initiated the assessment with a review of the available information for the region and the proposed project, this will also include review of the proposed project in relation to any conservation plans or assessments known for the area, e.g. Critical Biodiversity Area maps, National Waterbody Inventory and high-level groundwater availability maps etc.
- Conducted a site visit (November 2022) to inspect the surrounding waterbodies / features, to developed maps.
- Prepared a map demarcating the respective watercourses or wetland/s, i.e. the waterbody, its respective catchment and other areas within a 500m radius of the study area. This demonstrated, from a holistic point of view the connectivity between the site and the surrounding regions, i.e. the hydrological zone of influence while classifying the hydrogeomorphic type of the respective water courses / wetlands in relation to present land-use and their current state. The maps depicting demarcated waterbodies were delineated to a scale of 1:10 000, following the methodology described by the DWS, together with an estimation of their functionality, Habitat Integrity (IHI), Wet-Ecoservices (Wet-Health) and Socio-Cultural Importance of the delineated systems, whichever is relevant to the systems.
- Recommended buffer zones using the Macfarlane & Bredin (2017) approach to indicate any No-go / Sensitive areas around any delineated aquatic zones supported by any relevant legislation, e.g. any bioregional plans, conservation guidelines or best practice.
- Determined the Present Ecological State (PES) of any waterbodies including wetlands, estimating their biodiversity, conservation importance with regard ecosystem services during the site visit using recognised PES / EIS assessment methods to determine the state, importance and sensitivity of the respective wetland / watercourse systems.
- Identified and assessed the potential impacts of the proposed project using the revised project layout and description, based on a supplied impact assessment methodology (provided by SiVEST), including cumulative impacts and for construction, operations and decommissioning phases. Also assess the potential impact of the “no go” alternative.
- Provided recommendations and mitigations regarding project related impacts for inclusion into the Environmental Management Program (EMPr).

- Supplied the client with geo-referenced GIS shape files of the wetland / riverine areas and associated buffers to be used in the finalisation of the project layout and management of the project going forward.

## 2. ASSUMPTIONS AND LIMITATIONS

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are thus mostly based on instantaneous sampling. This limitation is common to many impact assessment type studies, but the findings are deemed adequate for the purposes of decision-making support regarding project acceptability, unless otherwise stated.

Therefore, due to the scope of the work presented in this report, a long-term investigation of the proposed site was not possible and as such not perceived as part of the Terms of Reference. However, a concerted effort was made to sample and assess as much of the potential site, as well as make use of any supporting literature, species distribution data and aerial photography.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

# 3. TECHNICAL DESCRIPTION

## 3.1 Project Location

JUWI is proposing to develop 2 x PV facilities and associated infrastructure on Farm No. 692 adjacent to the R75 approximately 13km southwest of Kirkwood. The site is located in the Sundays River Valley Municipality in the Sarah Baartman District Municipality of the Eastern Cape

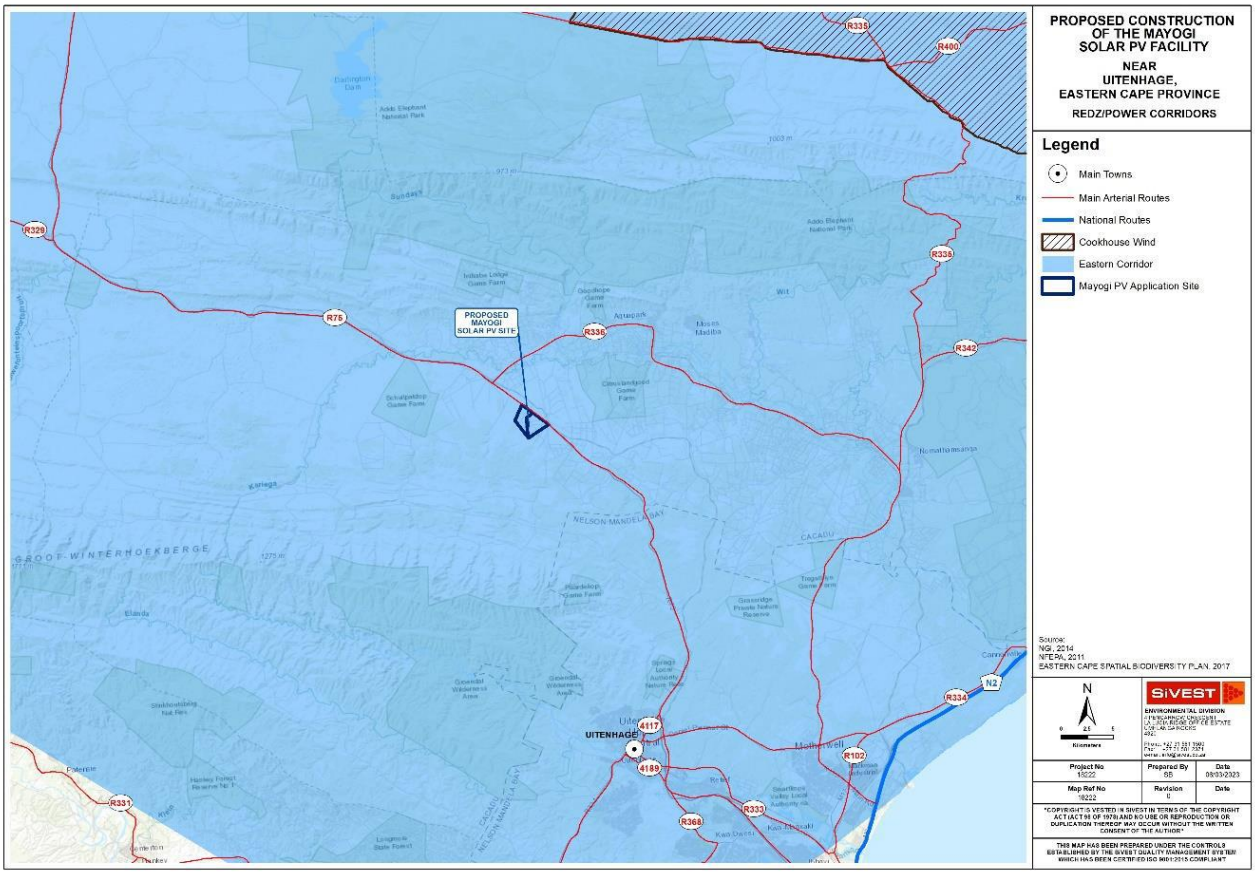


**Figure 1: Project Location**

### 3.2 Project Description

The overall objective of the development is to generate electricity by means of renewable energy technology capturing solar energy to feed into the National Grid via short grid connection as follows:

- PV Panel Array - To produce up to 80MW of DC installed capacity each, the proposed facility will require numerous linked PV panels connected in series, which will form solar PV arrays that will comprise the PV facility.
- The PV array will be wired to central inverters. The inverter is a MPPT (Maximum Power Point Tracking) inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency. The AC installed capacity should be around 70MW each to export.

Connection to the grid:

- Connecting the array to the electrical grid requires transformation of the voltage from LV voltage to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is LV AC and this is fed into step up transformers to 33kV. From the inverter transformer an RMU is uses to connect to the onsite substation
- The onsite substation will be required on the site to step the voltage from 33kV up to 132kV. After which the power will be evacuated into the national grid.
- A switching substation (and associated infrastructure) will be positioned close to the Eskom substation

## 4. LEGAL REQUIREMENT AND GUIDELINES

The following is pertinent to this study:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- Nature and Environmental Conservation Ordinance (No. 19 of 1974);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999) – could apply if cultural use or heritage is linked to any natural resources

Based on an assessment of the proposed activities and past engagement with DWS, the following Water Use Authorisations may be required based on thresholds as listed in the following Government Notices, however ultimately the Department of Water and Sanitation (DWS) must determine if a General Authorisation (GA) or full WULA will be required during the pre-application process as it relates to the following:

DWS Notice 538 of 2016, 2 September in GG 40243– Section 21 a & b water uses relating to the Abstraction and Storage of water.

- Government Notice 509 in GG 40229 of 26 August 2016 – Section 21 c & I water uses relating to the Impeding or diverting the flow of water in a watercourse and or altering the bed, banks, course or characteristics of a watercourse.
- Government Notice 665, 6 September 2013 in GG 36820 Section 21g relating to disposing of waste in a manner that may detrimentally impact on a water source which includes temporary storage of domestic wastewater i.e. conservancy tanks under Section 37 of the notice.

## 5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

The study area (farm portion) was dominated by one type of natural aquatic feature and a small number of artificial barriers associated with catchments and rivers, as follows:

- Ephemeral water course - with or without riparian vegetation (Plate 1 & 2). These range from narrow channels to broad flood plain areas typical of areas associated with Albany Alluvial vegetation units
- Dams and weirs / berms with no wetland or aquatic features.

Notably, most of the aquatic features within the study area are located N40B Quinary Catchment of the South Eastern Coastal Belt Ecoregion in the Mzimvubu-Tsitsikamma Catchment Management Agency (PE/Gqeberha Regional Office) (Figure 2). Notably the study area thus forms the upper catchment of the Sundays river systems respectively, but is not considered part of any wetland cluster, Strategic Water Resource Area, or International Bird area. The proposed site is also located outside of any National Protected Area Expansion Strategy conservation sites.

The Department of Forestry, Fisheries and Environment (DFFE) identified the aquatic environment for the study area as having a Very High Sensitivity, but this was based on the only the presence of a National Freshwater Priority Ecosystem Area (NFEPA) (See Figure 5 below). This is due to the fact that these quinary catchments are important areas in the greater Sundays River system, and the mainstem systems such as the Kariega River, downstream of the site act as important fish and invertebrate refugia, as well as make an important hydrological contribution to the region.

This particular FEPA was rated as such due to the presence of several fish species, listed below that includes one Vulnerable species indigenous fish, Oreochromis mossambicus (Mozambique tilapia).

| Taxa | Number of sampling occurrences between 2002 – 2011 | Status | Endemism | Conservation status (Non regional specific assessment GBIF) |
|---|---|---|---|---|
| *Anguilla mossambica* (Peters, 1852) | 1 | Native | Widespread | Least concern |
| *Clarias gariepinus* (Burchell, 1822) | 1 | Native | Widespread | Least concern |
| *Cyprinus carpio* Linnaeus, 1758 | 2 | Non-Native | Widespread | Vulnerable |
| *Enteromius pallidus* (Smith, 1841) | 1 | Native | Subregional endemic | Least concern |
| *Gambusia a*ffinis (Baird & Girard, 1853) | 2 | Non-Native | Widespread | Least concern |
| *Labeo umbratus* (Smith, 1841) | 1 | Native | Subregional endemic | Least concern |
| *Oreochromis mossambicus* (Peters, 1852) | 5 | Native | Widespread | Vulnerable |
| *Tilapia sparrmanii* Smith, 1840 | 1 | Native | Widespread | Least concern |

The presence of these Very High Sensitivity features was confirmed during this assessment, but linked to the drainage features and their association with a Threatened Ecosystem, namely riverine systems classified as the Endangered Albany Alluvial Vegetation unit - See Appendix 2 for Verification Statement.

No wetlands were found within the study area, only riverine features such as riparian thickets dominated by *Vachellia karroo, Searsia lancea, Euclea undulata and Gymonsporia buxifolia*

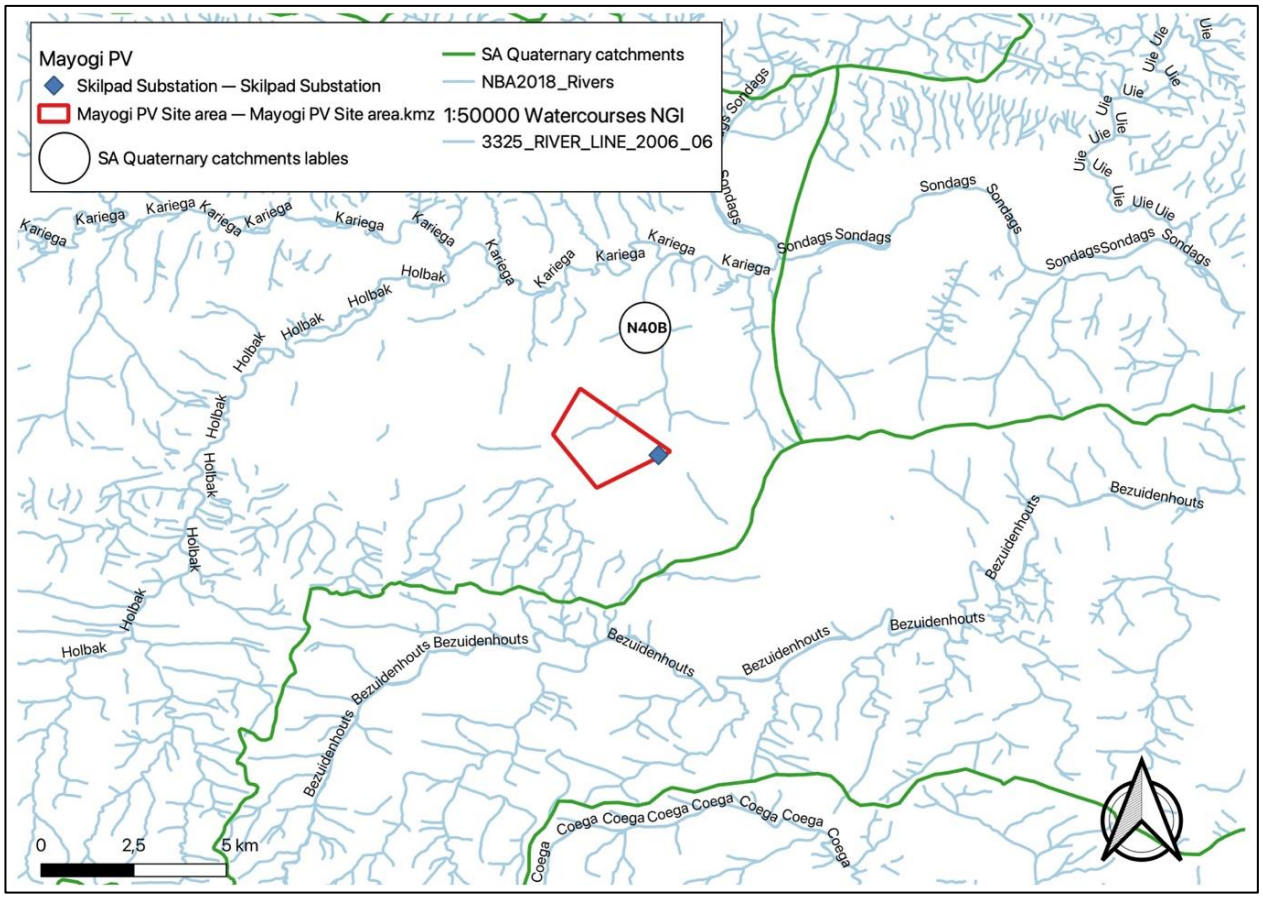


**Figure 2: Project locality map indicating the various quaternary catchments and mainstem rivers (Source DWS and NGI) within the project boundary**

**Plate 1: A watercourse with narrow riparian zone that almost bisects the site**

**Plate 2: The large dam that impedes any flows from the South Eastern portion of the site**

**Plate 3: A view of a minor watercourse observed on the wide plains located above the Skilpad Substation**

The groundtruthed delineations were then compared to current waterbody inventories (Figure 3) (van Deventer et al., 2020), 1: 50 000 topocadastral surveys mapping and the site. These inventories include wetland spatial data based on landcover 2007 data, previous assessments and wetland information retained by the Provincial authorities, combined into one database that formed part of the updated National Spatial Biodiversity Assessment, 2018.

A baseline map was then developed and refined using the 2022 survey data, noting that due to the complex nature of the topography and geology, the features were digitised at a scale of 1:5 000 (Figure 4).

Coupled to the aquatic delineations, information was collected on potential species that could occur within the watercourses, especially any conservation worthy species (Listed or Protected). However no aquatic plant species were observed.

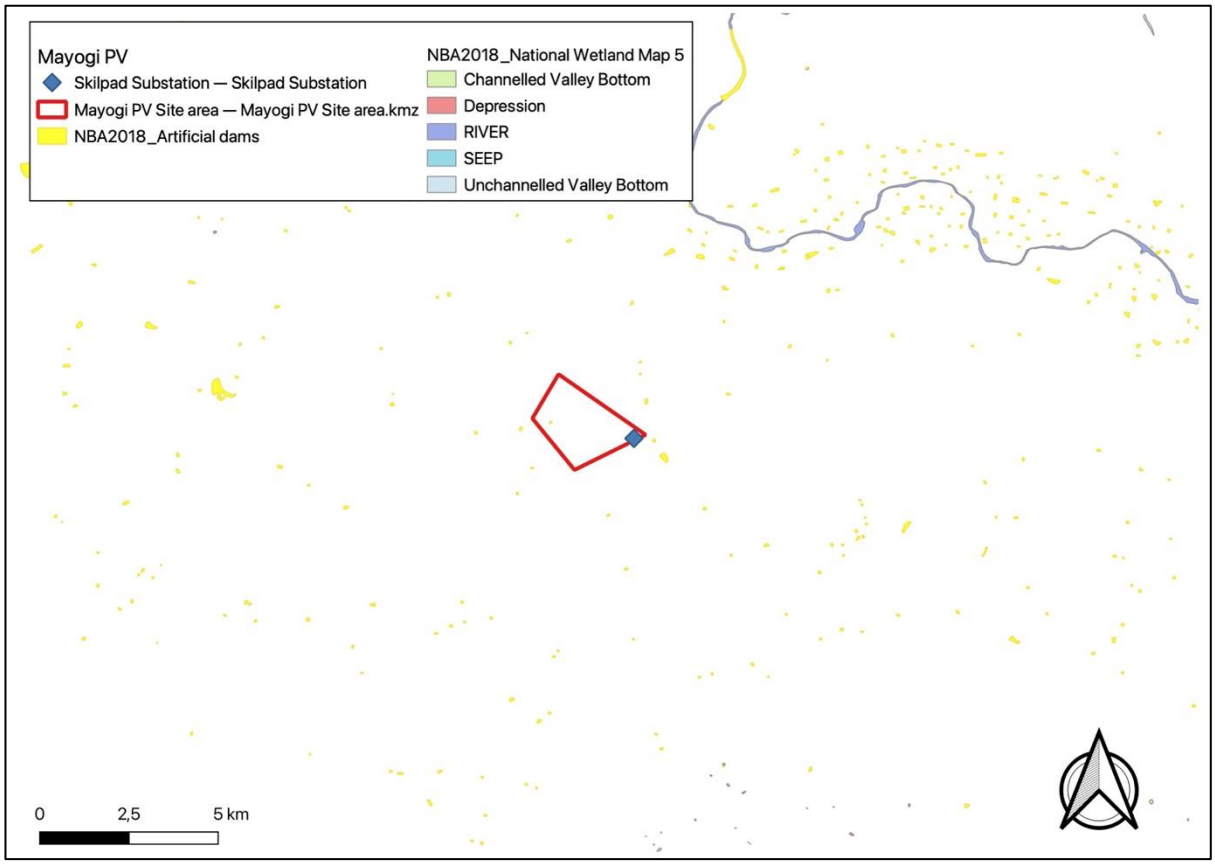


**Figure 3: National Wetland Inventory wetlands and waterbodies (van Deventer *et al*., 2020)**

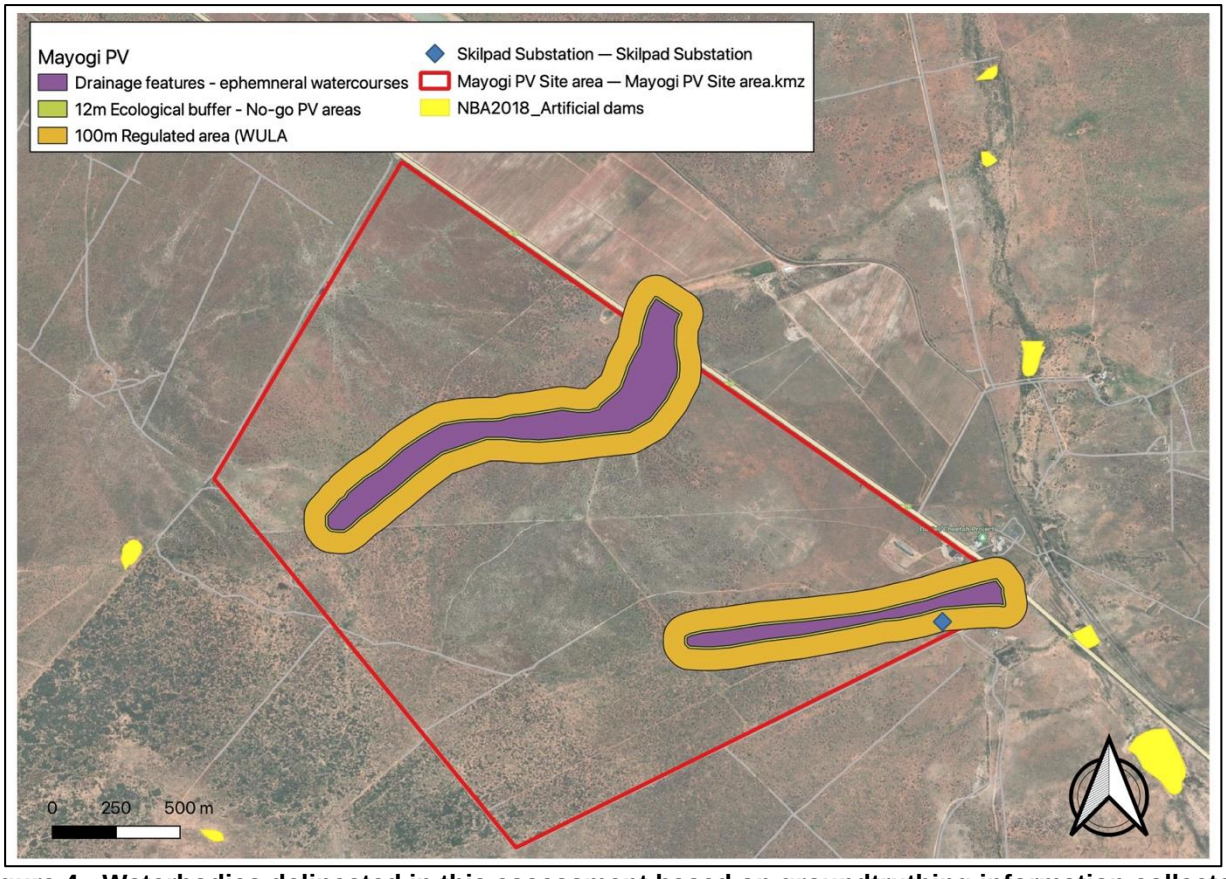


**Figure 4: Waterbodies delineated in this assessment based on groundtruthing information collected**

# 6. PRESENT ECOLOGICAL STATE AND CONSERVATION IMPORTANCE

The Present Ecological State (PES) of a river, watercourse or wetland 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 PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

All of the systems assessed by DWS (2014) on a Subquaternary level within the study area were rated as PES = C or Moderately Modified. While these were also rated as High in terms of Ecological Sensitivity and Low in terms of Ecological Importance respectively.

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine systems. The High Ecological Sensitivity rating for the natural water sources, is further substantiated by the fact that the affected catchments are included in both the National Freshwater Priority Atlas and the provincial Biodiversity Spatial Plan Ecological Support Area spatial layers (Figure 7 and 8).

Overall, these catchment areas and subsequent rivers / watercourses are largely in a natural state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with road crossings;
- Impeded water flow due to several in channel farm dams; and

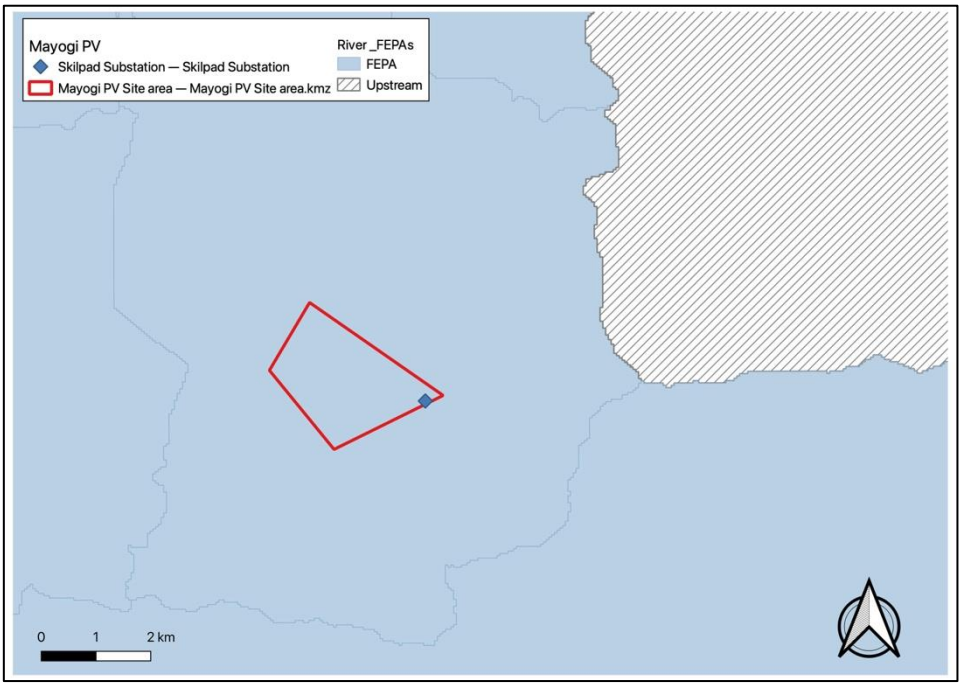


**Figure 5: The Freshwater Ecosystem Priority Areas for the study site (Nel *et al,* 2011)**

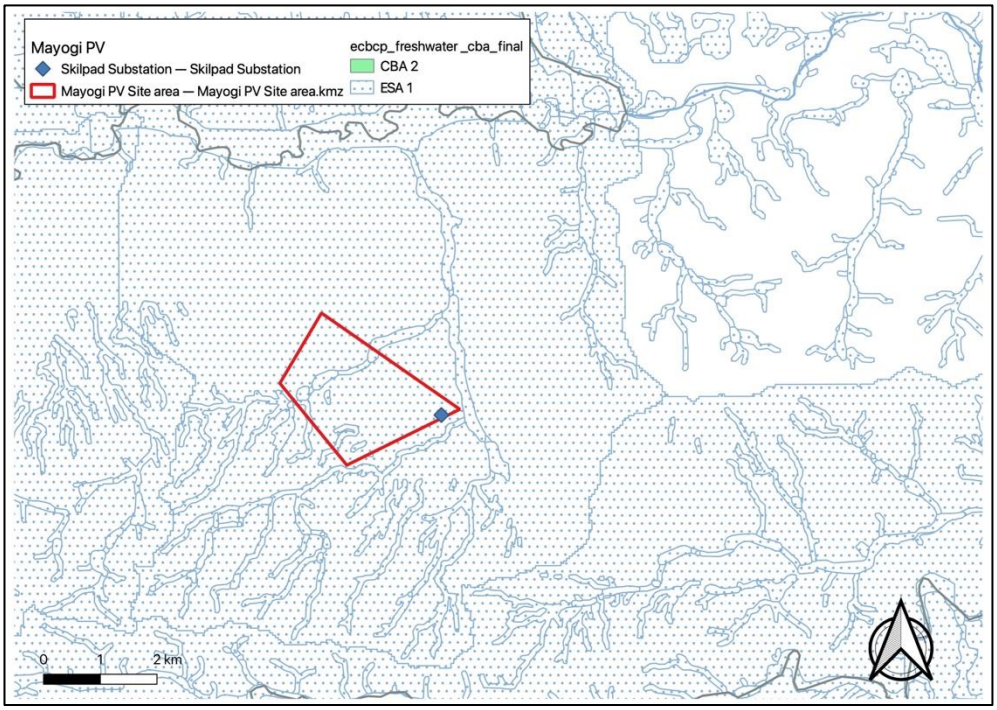


**Figure 6: The Critical Biodiversity Areas as per the Eastern Cape Biodiversity Conservation Plan – ECBCP, 2019**

## 6.1 Aquatic buffer zone

An aquatic impact buffer zone is defined as a zone of vegetated land designed and managed so that sediment and pollutant transport carried from source areas via diffuse surface runoff is reduced to acceptable levels (Macfarlane and Bredin 2016). Aquatic buffer zones are designed to act as barriers between human activities and sensitive water resources in order to protect them from adverse negative impacts. Buffer zones associated with water resources have been shown to perform a wide range of functions and have therefore been adopted as a standard measure to protect water resources and associated biodiversity.

Currently there are no formalised riverine or wetland buffer distances provided by the provincial authorities and as such the buffer model as described Macfarlane & Bredin (2017) for wetlands, rivers and estuaries was used. These buffer models are based on the condition of the waterbody, the state of the remainder of the site, coupled to the type of activity, as well as the proposed alteration of hydrological flows. Based then on available information for the site, the buffer model recommends a 12m buffer zone between the habitat and the activities (Table 1).

**Table 1: Determination of buffer zone requirements**

| Final aquatic impact buffer requirements (including practical management considerations) | |
|---|---|
| **Construction Phase** | **12** |
| **Operational Phase** | **8** |
| **Final aquatic impact buffer requirement** | **12** |

# 7. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

Using the baseline description and field data while considering the current disturbances and site characteristics, the following features were identified, then categorised into one of number pre-determined sensitivity categories to provide protect and/or guide the layout planning and possibly the design processes of the corridor and a suitable alignment for the grid within:

| | |
|---|---|
| High = No Go | "No go" areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile Therefore areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations |
| Medium | Buffer areas and or areas that are deemed to be of medium sensitivity but should still be avoided as this would minimise impacts and or the need for additional Water Use Authorisation |
| Low | Areas of low sensitivity or constraints, such as artificial systems with little to no biological value or would not result in any future licensing requirements e.g. dry earth wall farm dams |
| Neutral | Unconstrained areas (left blank in mapping) |

Table 2 below provides an overview of the sensitivity of various aquatic features (with buffers distances included) as it relates to the main project component types for the project. The features are shown spatially in Figure 7 & 8 below. The sensitivity ratings of High No-go and Low were determined through an assessment of the aquatic habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within systems, but this is considered acceptable since these areas have already been impacted.

These proposed constraints / buffers do not include bird and or bat specialist buffers / constraints as theirs buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

**Table 2: Results of the sensitivity rating / constraints assessment**

| Development Component | Waterbody type | Sensitivity rating of the respective waterbody type against the development type and the required buffer | Sensitivity rating override if an impact such as a road already occurs within the proposed footprint |
|---|---|---|---|
| **PV Panel areas** | Watercourses | No-go with 12m buffer | |
| | Artificial dams | Not Applicable = If these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required | |
| **Buildings / Substations & BESS** | Watercourses | No-go with 12m buffer | |
| | Artificial dams | Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required | |
| **Roads** | Watercourses | Moderate sensitivity related to roads, and as crossings will be required no buffer is applicable | LOW if an existing crossing / road or impact is already present, that must then be included in the potential road network |
| | Artificial dams (off channel only) | Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required | |
| **Overhead Lines** | Watercourses | Assumption is that the overhead lines could span these areas, but the towers/pylons should adhere to the buffer distances as indicated where possible as some of the alluvial system are very broad | |
| | Artificial dams (off channel only) | | |

In summary, any structures such as PV Panel areas, buildings, substations and BESS, should be placed outside of the observed watercourse (Figure 7), while roads and transmission could cross or span these areas (Figure 8).

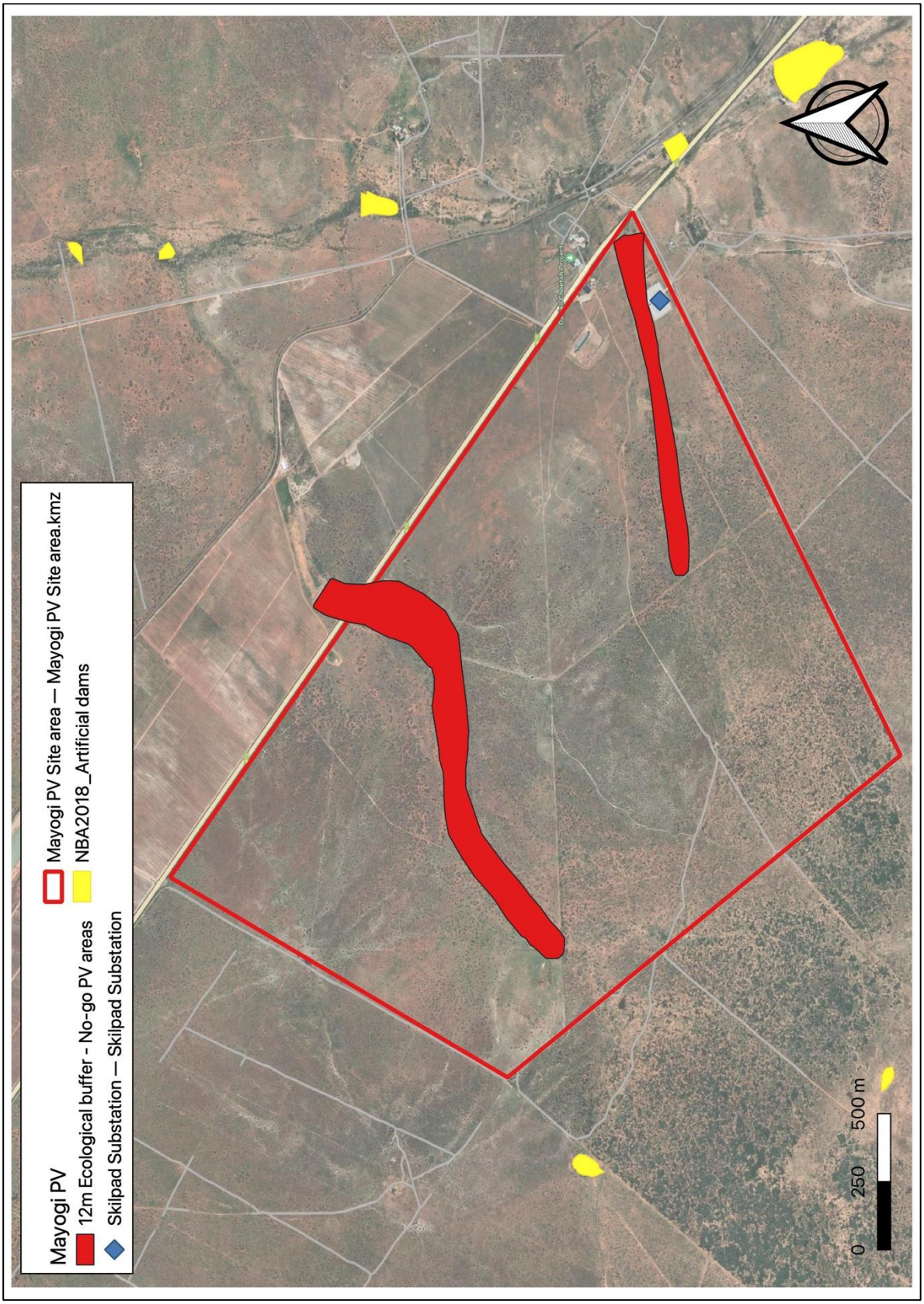


**Figure 7: The delineated watercourses inclusive of the respective buffers together the applied sensitivity rating applied to PV Panel areas, buildings, substations and BESS i.e. these systems have a HIGH sensitivity to the placement of these structures within these aquatic features**

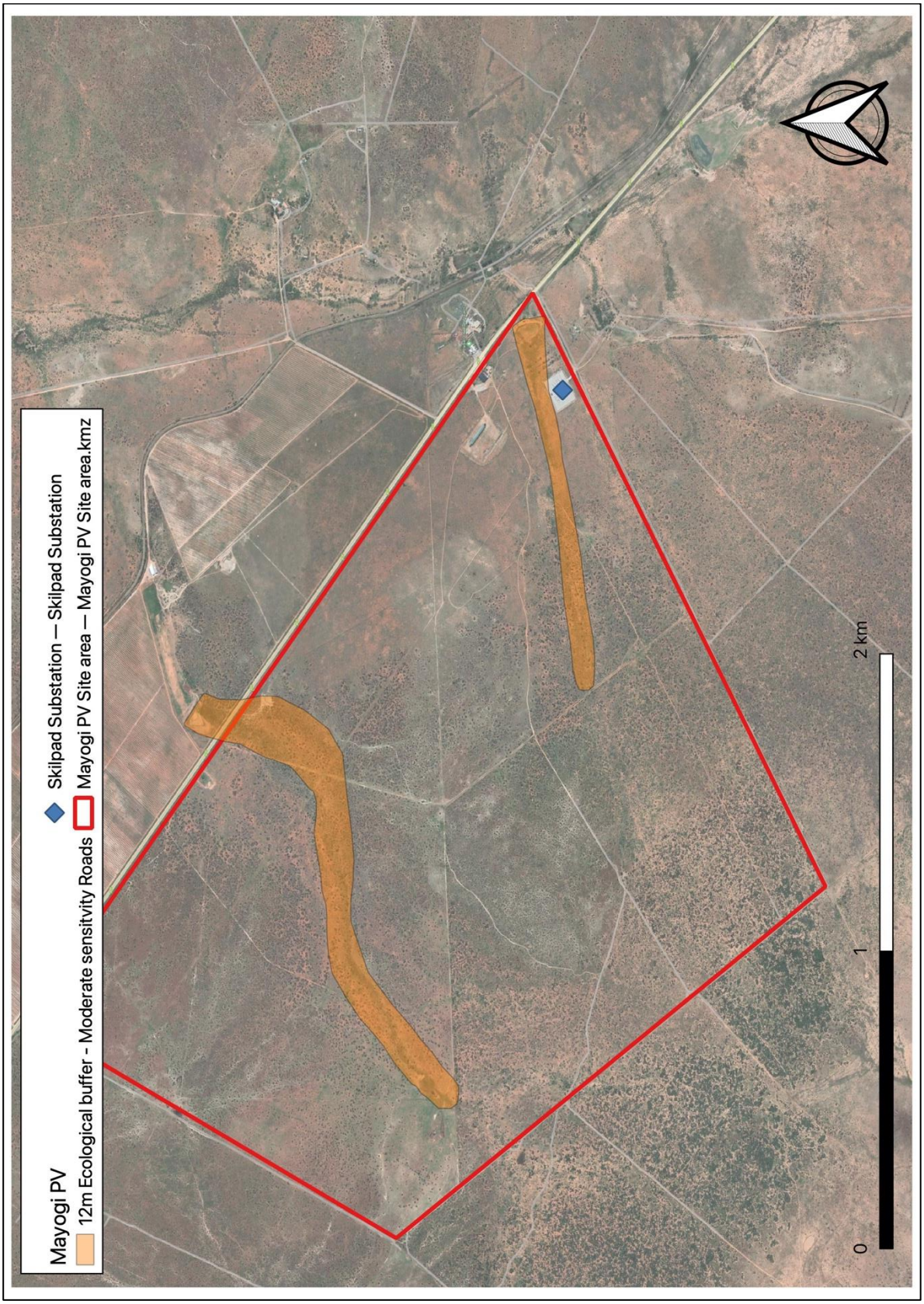


**Figure 8: The delineated watercourses inclusive of the respective buffer together the applied sensitivity rating applied to roads and transmission lines, i.e. these systems have a moderate sensitivity to the placement of these structures within these aquatic features especially if impacted areas are used.**

The following impacts were then assessed (Table 3 & 4 below), which are aligned with those contained in the Biodiversity Assessment Protocols and included in the table below and assessed against the proposed alignment and potential activities (Figure 9):

| **Biodiversity Assessment Protocol Impacts found applicable to this project** | **Impacts assessed in this report below** |
|---|---|
| Faunal and vegetation communities inhabiting the site | Impact 1, 2, 3 and 4 |
| Fragmentation (physical loss of ecological connectivity and or CBA corridors) | Impact 2 and 4 |
| Changes in numbers and density of species | Impact 2, 3, and 4 |
| Water quality changes (increase in sediment, organic loads, chemicals or eutrophication | Impact 3 |
| Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion) | Impact 4 |
| Streamflow regulation | Impact 4 |
| Erosion control | Impact 4 |
| No-Go Impact | Impact 5 |
| Cumulative Impacts | Impact 6 |

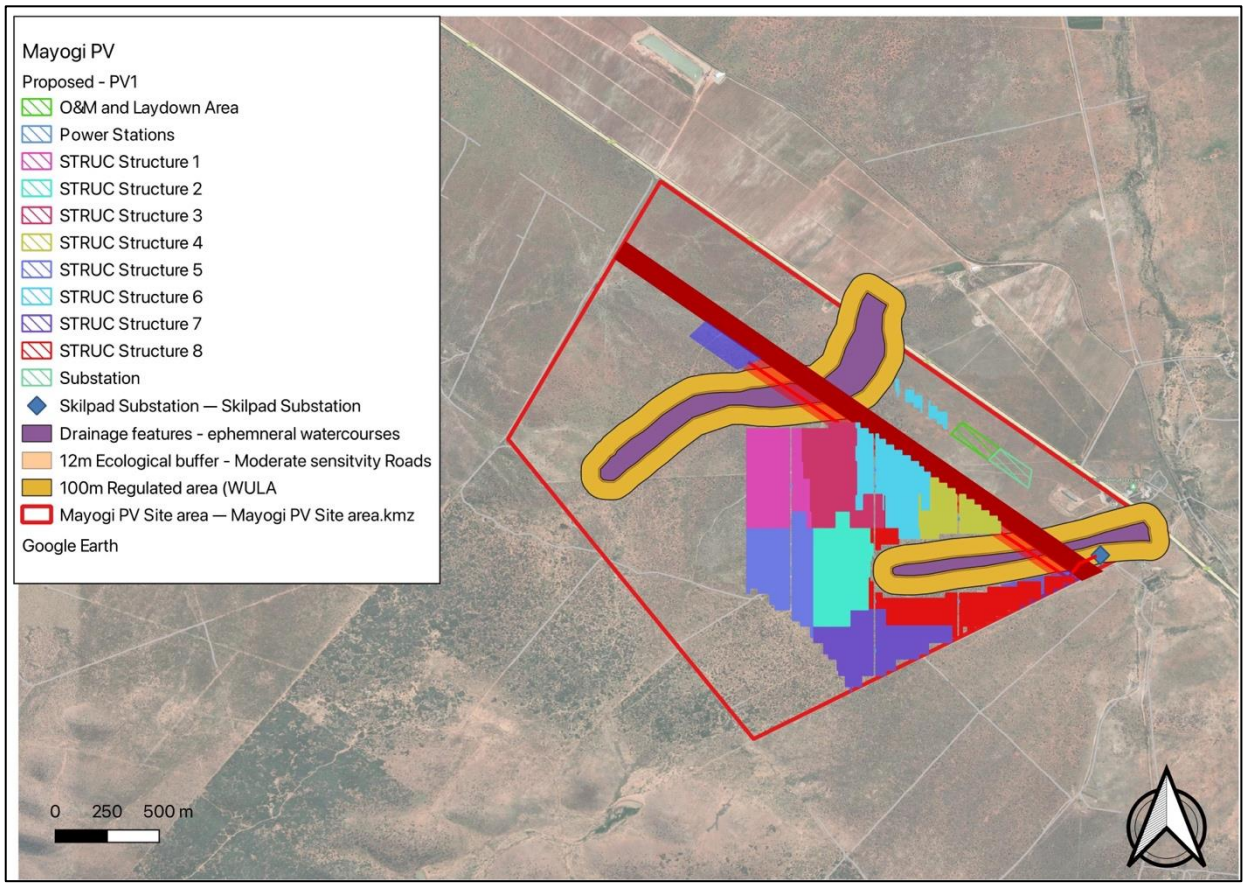


**Figure 9: The current layout where with the exception of the grid connections that will span the observed systems, all of the proposed infrastructure has been located outside of the watercourse, the ecological buffers and regulated WUA areas**

As highlighted above, the following impacts on the environment have been identified and will be assessed in greater detail as follows, as well as separately the No-Go and Cumulative impacts:

**Construction & Decommissioning Phases (Assessed separately for the SEF and the Grid options)**

- Impact 1: Loss of aquatic species of special concern
- Impact 2: Damage or loss of riparian systems, ephemeral watercourses and wetland systems in the construction phase
- Impact 3: Potential impact on localised surface water quality

**Operational phase (Assessed separately for the SEF and the Grid options)**

- Impact 4: Impact on aquatic systems through the possible increase in surface water runoff on form and function - Increase in sedimentation and erosion

## 7.1 SEF Construction & Decommissioning Phase

**Table 3: Rating of impacts for the construction and decommissioning phase**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| **Construction/ Decommissioning Phase** | | | | | | | | | | | | | | | | | | | | |
| Impact 1: Loss of aquatic species of special concern during the construction and or decommissioning of the solar facility | The construction activities will not result in the disturbance of aquatic habitats that may contain listed and or protected plant or animal species. However, none of these were observed during this assessment | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | LOW (-ve) | Develop and implement an Rehabilitation and Monitoring plan post Environmental Authorisation. This must be developed following the finalisation of the panel / road layout and a walk down has been completed. This plan should include protection of any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site<br><br>Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and<br><br>Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re- establishment of plant cover is desirable to prevent erosion. | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | LOW (-ve) |
| Impact 2: Damage or loss of riparian systems, ephemeral watercourses and wetland systems in construction and or | Construction could result in the loss of drainage systems that are fully functional and provide an ecosystem service within the site, especially where new access roads are | 2 | 3 | 2 | 2 | 3 | 2 | 24 | - | MEDIUM (-ve) | A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro- | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) |

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS | S | | E | P | R | L | D | I / M | TOTAL | STATUS | S |
| decommissioning of the solar facility although all areas have been avoided | required or road upgrades will widen any current bridges or drifts. Loss can also include a functional loss, through change in vegetation type via alien encroachment for example. | | | | | | | | | | siting of the final layout. All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings. Where roads and crossings are upgraded, the following applies: Existing pipe culverts must be removed and replaced with suitable sized box culverts, especially where road levels are raised to accommodate any large vehicles. River levels, regardless of the current state of the river / water course must be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). A detailed monitoring plan must be | | | | | | | | | |

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| | | | | | | | | | | | developed in the pre-construction phase by an aquatic specialist, where any delineated system occurs within 50 m of existing crossings. | | | | | | | | | |
| Impact 3: Potential impact on localised surface water quality (construction materials and fuel storage facilities) during the construction and or decommissioning of the solar facility | During construction earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the 30 000l fuel storage facility must be given. Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), with regard safe handling during the construction phase. This to avoid any | 1 | 3 | 2 | 2 | 3 | 3 | 33 | - | MEDIUM (-ve) | • All liquid chemicals including fuels and oil, including the BESS must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely.<br>• Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment).<br>• Mechanical plant and bowsers must not be refuelled or serviced within 100m of a river channel.<br>• All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses..<br>• Littering and contamination associated with construction activity must be avoided through effective construction camp management;<br>• No stockpiling should take place within or near a water course<br>• All stockpiles must be protected and located in flat areas where run- | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) |

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| | spills or leaks from this system | | | | | | | | | | off will be minimised and sediment recoverable; | | | | | | | | | |

## 7.2 SEF Operation

**Table 4: Rating of impacts for the operational phase**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| **Operation Phase** | | | | | | | | | | | | | | | | | | | | |
| Impact 4 Impact on aquatic systems through the possible increase in surface water runoff on form and function during the operational phase | Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosions and sedimentation of downstream areas. | 2 | 3 | 2 | 2 | 3 | 3 | 36 | - | MEDIUM (-ve) | A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. This stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | LOW (-ve) |

## 7.3 SEF No go Impact

**Table 5: Rating of impacts (No-go)**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| **No-Go** | | | | | | | | | | | | | | | | | | | | |
| Impact on aquatic resources should the project not go ahead (i.e. the No Go Alternative) | Should the project not proceed, then current status quo with regard the environment would remain unchanged. Overall, the area is largely in a natural state. But present day impacts do occur in localised areas and included the following:<br>• Increase in unpalatable species due to past grazing activities<br>Erosion as a result of road crossings;<br>• Several farm dams; and<br>• Undersized culverts within present day road crossings. | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) | Improve current grazing management, although this is occurring within the surrounding conservation areas and or areas that are used for any hunting / game farming<br>Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region<br>Install properly sized culverts with erosion protection measures at the present road / track crossings | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) |

## 7.4 Grid options Construction & Decommissioning Phase

**Table 6: Rating of impacts for the construction and decommissioning phase**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| **Construction/ Decommissioning Phase** | | | | | | | | | | | | | | | | | | | | |
| Impact 1: Loss of aquatic species of special concern during the construction or decommissioning of the grid options | The construction activities will not result in the disturbance of aquatic habitats that may contain listed and or protected plant or animal species. However, none of these were observed during this assessment | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | LOW (-ve) | Develop and implement an Rehabilitation and Monitoring plan post Environmental Authorisation. This must be developed following the finalisation of the tower positions and access tracks and a walk down has been completed. This plan should include protection of any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site<br><br>Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and<br><br>Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-establishment of plant cover is desirable to prevent erosion. | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | LOW (-ve) |
| Impact 2: Damage or loss of riparian systems, | Construction could result in the loss of drainage systems that are fully functional and provide an | 2 | 3 | 2 | 2 | 3 | 2 | 24 | - | MEDIUM (-ve) | A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) |

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| ephemeral watercourses and wetland systems in the construction or decommissioning of the grid options | ecosystem services within the site especially where new access roads to install any of the grid options as both alternatives will need to span watercourses with seeps.<br>Loss can also include a functional loss, through change in vegetation type via alien encroachment for example. | | | | | | | | | | development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout.<br>All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings. Where roads and crossings are upgraded, the following applies: etc).<br>It is recommended that no new tracks or towers / pylons are placed / constructed within any of the delineated aquatic zones. | | | | | | | | | |
| Impact 3: Potential impact on localised surface water quality (construction materials and fuel storage facilities) during the construction and decommissioning phases | During construction earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the | 1 | 3 | 2 | 2 | 3 | 3 | 33 | - | MEDIUM (-ve) | • All liquid chemicals including fuels and oil, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely.<br>• Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) |

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| | surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the 30 000l fuel storage facility must be given.<br>Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), with regard safe handling during the construction phase. This to avoid any spills or leaks from this system | | | | | | | | | | • Mechanical plant and bowsers must not be refuelled or serviced within 100m of a river channel.<br>• All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses..<br>• Littering and contamination associated with construction activity must be avoided through effective construction camp management;<br>• No stockpiling should take place within or near a water course<br>• All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable; | | | | | | | | | |

## 7.5 Grid Operation

**Table 7: Rating of impacts for the operational phase**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| **Operation Phase** | | | | | | | | | | | | | | | | | | | | |
| Impact 4 Impact on aquatic systems through the possible increase in surface water runoff on form and function during the operational phase from any of the access tracks, although none should cross the delineated systems | Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosions and sedimentation of downstream areas. | 2 | 3 | 2 | 2 | 3 | 3 | 36 | - | MEDIUM (-ve) | A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. This stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | LOW (-ve) |

## 7.6 Grid No go Impact

**Table 8: Rating of impacts (No-go)**

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+/-) | S |
| **No-Go** | | | | | | | | | | | | | | | | | | | | |
| Impact on aquatic resources should the project not go ahead (i.e. the No Go Alternative) | Should the project not proceed, then current status quo with regard the environment would remain unchanged. Overall, the area is largely in a natural state. But present day impacts do occur in localised areas and included the following:<br>• Increase in unpalatable species due to past grazing activities<br>Erosion as a result of road crossings;<br>• Several farm dams; and<br>• Undersized culverts within present day road crossings. | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) | Improve current grazing management, although this is occurring within the surrounding conservation areas and or areas that are used for any hunting / game farming<br>Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region<br>Install properly sized culverts with erosion protection measures at the present road / track crossings | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) |

## 7.7 Cumulative Impacts

A cumulative impact assessment was conducted by assessing this project in relation to any other proposed projects within a 35km radius. However, all of the reports were based on the premise that all layouts were developed on the basis of impact avoidance, with particular reference to the avoidance of Very High Sensitivity areas. Consequently, all the impacts that remain could be mitigated mostly through revegetation and / or proper stormwater management. Thus, all the impacts would be Medium to Low depending on the scale of the sites, but found acceptable.

***Table 9: Rating of cumulative impacts SEF & GRID***

| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | R | L | D | I / M | TOTAL | STATUS | S | | E | P | R | L | D | I / M | TOTAL | STATUS | S |
| **Cumulative Phase** | | | | | | | | | | | | | | | | | | | | |
| Cumulative Impact of various proposed projects and associated grid lines on the natural environment | The cumulative assessment considers the various proposed renewable projects that occur within a 35km radius of this site, where the author has either been involved in the assessment of these projects and or review of the past assessments as part of any required Water Use Licenses | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | LOW (-ve) | The premise of all the reviewed or assessed projects has been the avoidance of impacts on the Very High Sensitivity environments, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines or areas rated as LOW sensitivity. | 1 | 3 | 2 | 1 | 2 | 2 | 18 | - | LOW (-ve) |

## 7.8 Overall Impact Rating

**Table 10: Overall Impact Significance for the SEF (Pre- and Post-Mitigation)**

| Nature of impact and Phase | Overall Impact Significance (Pre -Mitigation) | Proposed mitigation | Overall Impact Significance (Post - Mitigation) |
|---|---|---|---|
| **Construction Phase** | | | |
| Impact 1: Loss of aquatic species of special concern | Low | Develop and implement an Rehabilitation and Monitoring plan post Environmental Authorisation. This must be developed following the finalisation of the panel / road layout and a walk down has been completed. This plan should include relocation of suitable plant species, but more important protect any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site<br><br>Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and<br><br>Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-establishment of plant cover is desirable to prevent erosion. | Low |
| Impact 2: Damage or loss of riparian systems, ephemeral watercourses and wetland systems in the construction phase | Medium | A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout.<br>All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints<br>Where roads and crossings are upgraded, the following applies:<br>Existing pipe culverts must be removed and replaced with suitable sized box culverts, especially where road levels are raised to accommodate any large vehicles.<br>River levels, regardless of the current state of the river / water course must be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown.<br>Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.<br>Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / | Low |

| Nature of impact and Phase | Overall Impact Significance (Pre -Mitigation) | Proposed mitigation | Overall Impact Significance (Post - Mitigation) |
|---|---|---|---|
| | | sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).<br>A detailed monitoring plan must be developed in the pre-construction phase by an aquatic specialist, where any delineated system occurs within 50 m of existing crossings. | |
| Impact 3: Potential impact on localised surface water quality (construction materials and fuel storage facilities) during the construction and decommissioning phases | Medium | • All liquid chemicals including fuels and oil, including the BESS must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely.<br>• Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment).<br>• Mechanical plant and bowsers must not be refuelled or serviced within 100m of a river channel.<br>• All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses.<br>• Littering and contamination associated with construction activity must be avoided through effective construction camp management;<br>• No stockpiling should take place within or near a water course<br>• All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable; | Low |
| **Operation Phase** | | | |
| Impact 4 Impact on aquatic systems through the possible increase in surface water runoff on form and function during the operational phase | Medium | A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. This stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks | Low |
| No-Go | Low | Improve current grazing management, although this is occurring within the surrounding conservation areas and or areas that are used for any hunting / game farming<br>Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region | Low |

| Nature of impact and Phase | Overall Impact Significance (Pre -Mitigation) | Proposed mitigation | Overall Impact Significance (Post - Mitigation) |
|---|---|---|---|
| | | Install properly sized culverts with erosion protection measures at the present road / track crossings | |
| Cumulative Impacts | Low | The premise of all the reviewed or assessed projects has been the avoidance of impacts on the Very High Sensitivity environments, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines or areas rated as LOW sensitivity. | Low |

**Table 11: Overall Impact Significance for the Grid options (Pre- and Post-Mitigation)**

| Nature of impact and Phase | Overall Impact Significance (Pre -Mitigation) | Proposed mitigation | Overall Impact Significance (Post - Mitigation) |
|---|---|---|---|
| **Construction Phase** | | | |
| Impact 1: Loss of aquatic species of special concern | Low | Develop and implement an Rehabilitation and Monitoring plan post Environmental Authorisation. This must be developed following the finalisation of the tower positions and access tracks and a walk down has been completed. This plan should include relocation of suitable plant species, but more important protect any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site<br><br>Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and<br><br>Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-establishment of plant cover is desirable to prevent erosion. | Low |
| Impact 2: Damage or loss of riparian systems, ephemeral watercourses and wetland systems in the construction phase | Medium | A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings. Where roads and crossings are upgraded, the following applies: etc).<br>It is recommended that no new tracks or towers / pylons are placed / constructed within any of the delineated aquatic zones. | Low |
| Impact 3: Potential impact on localised surface water quality (construction materials and fuel | Medium | • All liquid chemicals including fuels and oil, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and | Low |

| | | | |
|---|---|---|---|
| storage facilities) during the construction and decommissioning phases | | spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely.<br>• Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment).<br>• Mechanical plant and bowsers must not be refuelled or serviced within 100m of a river channel.<br>• All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses.<br>• Littering and contamination associated with construction activity must be avoided through effective construction camp management;<br>• No stockpiling should take place within or near a water course<br>• All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable; | |
| **Operation Phase** | | | |
| Impact 4 Impact on aquatic systems through the possible increase in surface water runoff on form and function during the operational phase from any of the access tracks, although none should cross the delineated systems | Medium | A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. This stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks | Low |
| No-Go | Low | Improve current grazing management, although this is occurring within the surrounding conservation areas and or areas that are used for any hunting / game farming<br>Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region<br>Install properly sized culverts with erosion protection measures at the present road / track crossings | Low |
| Cumulative Impacts | Low | The premise of all the reviewed or assessed projects has been the avoidance of impacts on the Very High Sensitivity environments, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines or areas rated as LOW sensitivity. | Low |

## 8. COMPARATIVE ASSESSMENT OF ALTERNATIVES

The developer proposes two grid options and these were assessed below:

### Key

| | |
|---|---|
| **PREFERRED** | The alternative will result in a low impact / reduce the impact / result in a positive impact |
| **FAVOURABLE** | The impact will be relatively insignificant |
| **LEAST PREFERRED** | The alternative will result in a high impact / increase the impact |
| **NO PREFERENCE** | The alternative will result in equal impacts |

| Alternative | Preference | Reasons (incl. potential issues) |
|---|---|---|
| **SUBSTATION SITE ALTERNATIVES** | | |
| Substation Option 1 | No preference | As these have all avoided the delineated systems, the buffers and regulated WUA zones |
| Substation Option 2 | No preference | As these have all avoided the delineated systems, the buffers and regulated WUA zones |
| Laydown Option 1 | No preference | As these have all avoided the delineated systems, the buffers and regulated WUA zones |
| Laydown Option 2 | No preference | As these have all avoided the delineated systems, the buffers and regulated WUA zones |

# 9. EMPR Recommendations

| Impact/Aspect | Mitigation/Management Actions | *Responsibility* | *Methodology* | Mitigation/Management Objectives and Outcomes | *Frequency* |
|---|---|---|---|---|---|
| Impact 1 Loss of species of special concern | Develop and implement an Rehabilitation and Monitoring plan post Environmental Authorisation. This must be developed following the finalisation of the panel / road layout and a walk down has been completed. This plan should include relocation of suitable plant species, but more important protect any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site<br>Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas | Developer & Aquatic specialist | Micrositing, Rehab and Monitoring Plan development. Species of special concern Relocation if required | Impact avoidance through micrositing and or species relocation, coupled to rehabilitation of disturbed areas | Once – pre-commencement |
| Impact 2: Damage or loss of riparian systems, ephemeral watercourses and wetland systems in the construction phase | A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout.<br>All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints<br>Where roads and crossings are upgraded, the following applies:<br>Existing pipe culverts must be removed and replaced with suitable sized box culverts, especially where road levels are raised to accommodate any large vehicles.<br>River levels, regardless of the current state of the river / water course must be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown.<br>Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.<br>Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).<br>A detailed monitoring plan must be developed in the pre-construction phase by an aquatic specialist, where any delineated system occurs within 50 m of existing crossings. | Developer / Engineer & Aquatic specialist | Walkdowns, and stormwater management planning | Impact avoidance through micrositing and development of suitable stormwater management and designs that prevent impedance or diversion of surface water | Pre-commencement and Construction Phase |

| Impact/Aspect | Mitigation/Management Actions | *Responsibility* | *Methodology* | Mitigation/Management Objectives and Outcomes | *Frequency* |
|---|---|---|---|---|---|
| Impact 3: Potential impact on localised surface water quality (construction materials and fuel storage facilities) during the construction and decommissioning phases | • All liquid chemicals including fuels and oil, including the BESS must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely.<br>• Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment).<br>• Mechanical plant and bowsers must not be refuelled or serviced within 100m of a river channel.<br>• All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses.<br>• Littering and contamination associated with construction activity must be avoided through effective construction camp management;<br>• No stockpiling should take place within or near a water course<br>• All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable; | Developer, Contractor and EO | Site monitoring of plant and any works activities | Minimises spills thought awareness raising, monitoring and rapid clean up if spills occur | Continuous |
| Impact 4 Impact on aquatic systems through the possible increase in surface water runoff on form and function during the operational phase | A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. This stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks | Developer | Stormwater Management Plan & erosion control | Soil conservation and erosion protection | Continuous |

# 10. CONCLUSION AND SUMMARY

## 10.1 Summary of Findings

The project overall has aligned the proposed footprint with the aquatic features, allowing for retention of much of the natural environment so that the systems should remain largely unaffected. Therefore, the PV site and grid options, have a low intensity impact on the aquatic resources. The grid option is also favorable, but this option will need to span areas of a watercourse, and the final towers positions must be based on the recommendations of the aquatic specialist during the walk down

The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance is possible, or the nature of the activities involve a low potential risk to aquatic resources even at great distance. Overall, it is expected that the impact on the environment would be Low (-). Noteworthy areas, that have been avoided by the PV areas, and Grid Options, include the High Sensitivity areas as shown in this report.

## 10.2 Conclusion and Impact Statement

Based on the findings of this study, the specialist finds no reason to withhold an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented, coupled with a micrositing walkdown once all information is available.

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## Appendix 1 Specialist CV

**CURRICULUM VITAE**
**Dr Brian Michael Colloty**
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Profession: Ecologist & Environemental Assessment Practitioner (Pr. Sci. Nat. 400268/07)
Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries
Years experience: 25 years

**SKILLS BASE AND CORE COMPETENCIES**

- 25 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 15 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

**TERTIARY EDUCATION**

- 1994: B Sc Degree (Botany & Zoology) - NMU
- 1995: B Sc Hon (Zoology) - NMU
- 1996: M Sc (Botany - Rivers) - NMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMU

**EMPLOYMENT HISTORY**

- 1996 – 2000 Researcher at Nelson Mandela University – SAB institute for Coastal Research & Management. Funded by the WRC to develop estuarine importance rating methods for South African Estuaries
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – August 2018 Owner / Ecologist of Scherman Colloty & Associates cc
- August 2018 Owner / Ecologist - EnviroSci (Pty) Ltd

**SELECTED RELEVANT PROJECT EXPERIENCE**

**World Bank IFC Standards**

- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

**South African**

- Plant and animal search and rescue for the Karusa and Soetwater Wind Farms on behalf of Enel Green Power, Current
- Plant and animal search and rescue for the Nxuba, Oyster Bay and Garob Wind Farms on behalf of Enel Green Power, 2018 - 2019
- Plant and Animal Search and Rescue for the Port of Ngqura, Transnet Landside infrastructure Project, with development and management of on site nursery, Current
- Plant and Animal Search and Rescue for the Port of Ngqura, OTGC Tank Farm Project (2019)
- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive), Department of Social Development (Military veterans housing, Despatch) and Nxuba Wind Farm, - current
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), biodiversity and wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – 2017
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - 2018
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 118 renewable projects in the past 9 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, Red Cap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farms), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).

## Appendix 2 – Site Verification Report

# SITE SENSITIVITY VERIFICATION (IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020

# SITE SENSITIVITY VERIFICATION (IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020

### INTRODUCTION

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification has been undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

### SITE SENSITIVITY VERIFICATION

Using the result of the specialist ecological impact assessment, that made use of past and current spatial databases, aerial images and field work conducted within and adjacent to the site over a number of years / seasons, various habitats were delineated and the rated in terms of their sensitivity.

### OUTCOME OF SITE SENSITIVITY VERIFICATION

Similar to the results of the Screening Tool, the study area contained three types of sensitivity, namely Very High (Figure 1). However, the extent of the Very High Sensitivity areas was defined at a finer scale based on site based verification and shown in Figure 2.

### NATIONAL ENVIRONMENTAL SCREENING TOOL

Based on the DFFE Screening Tool, the site contains areas of very high sensitivity due to the presence of a NFEPA. (Figure 1).

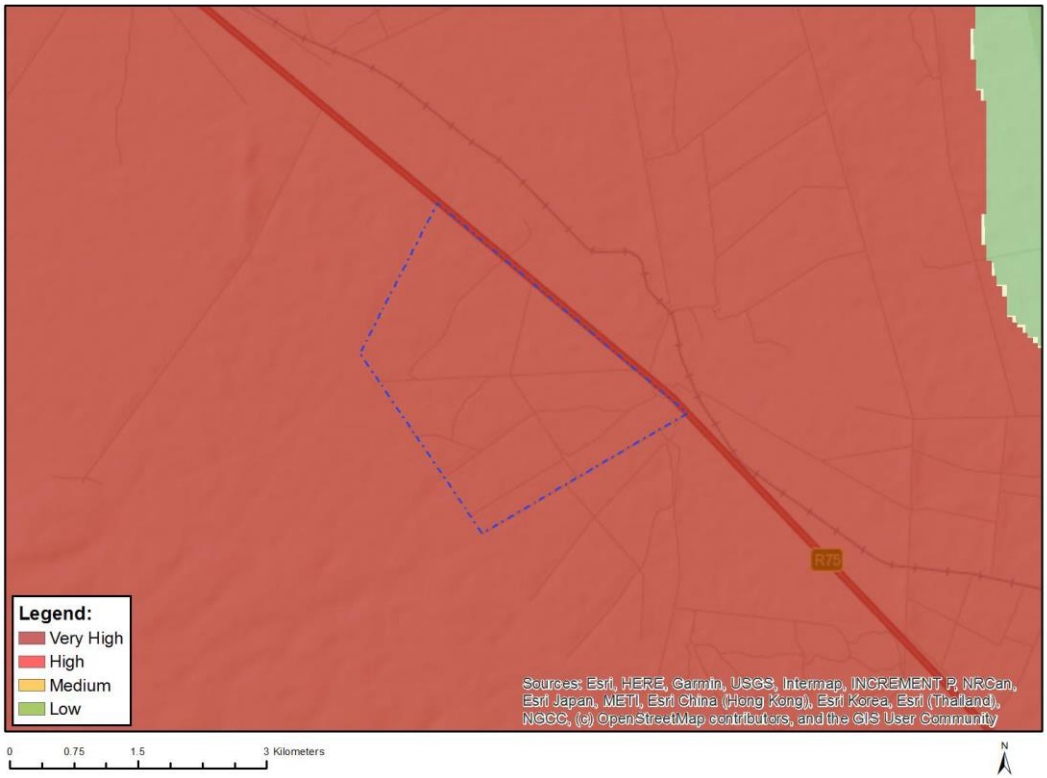


**Figure 1. DFFE Screening Tool outcome for the aquatic biodiversity theme**

Based on the above outcomes, the specialist refutes the environmental sensitivities identified on site. The findings have been informed by a site visit undertaken by Dr Brian Colloty in October /November 2022. The systems observed although sensitive and shown in this assessment as No-Go i.e. Very High sensitivity, are rated as such due to the importance of conserving their functional value in supporting downstream Albany Alluvial vegetation units that may remain. This vegetation type is listed as Endangered, thus any hydrological continuity must be protected.

Figure 2 below shows the sensitivity map produced following the desktop assessment as well as a groundtruthing exercises, with mapping of the observed features at a finer scale.

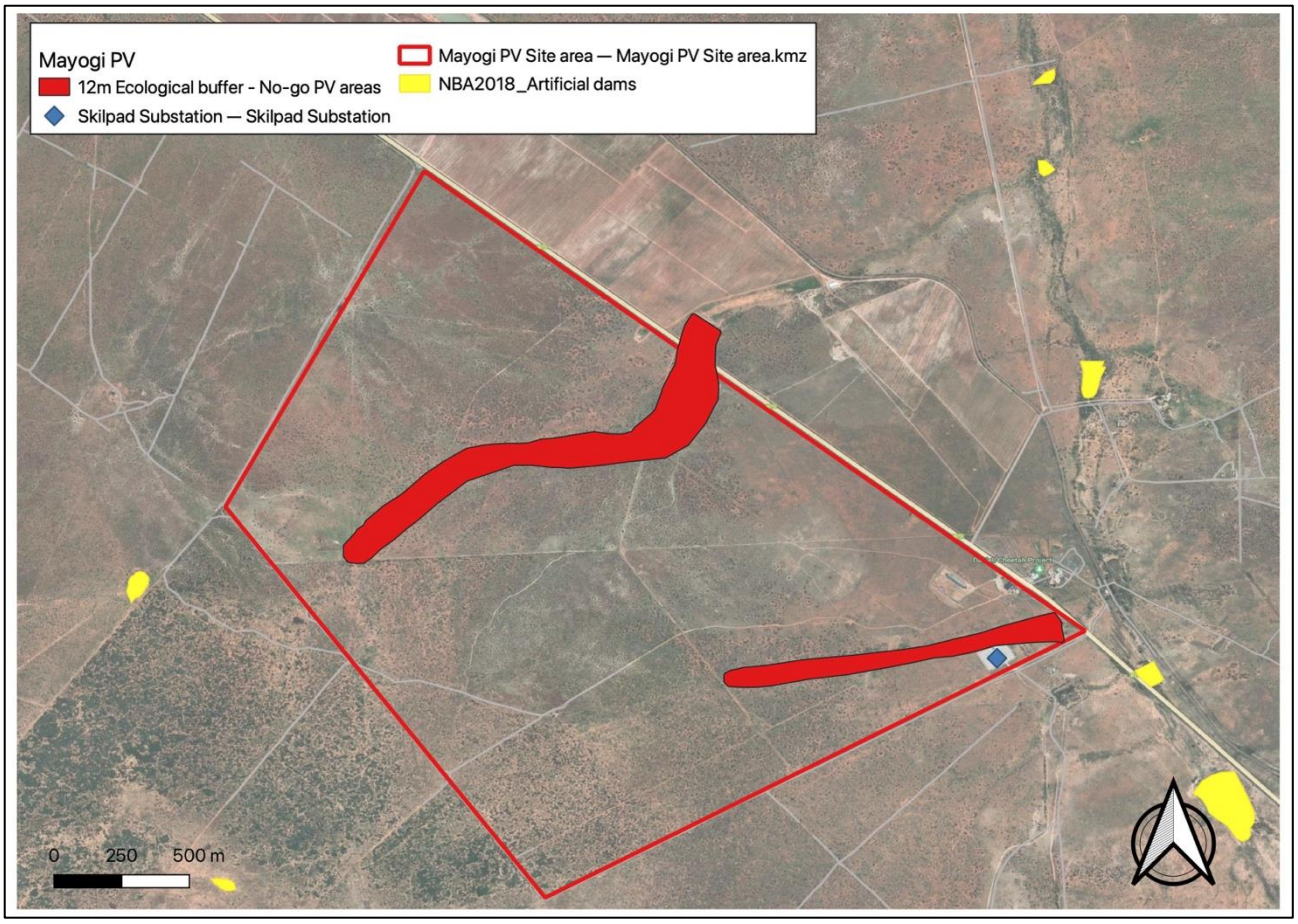


**Figure 2. Environmental sensitivity map produced by the aquatic specialist (High)**

## MOTIVATION OF THE OUTCOMES OF THE SENSITIVITY MAP AND KEY CONCLUSIONS

In conclusion, the DFFE Screening Tool identified one sensitivity ratings within the development footprint, namely, Very High. Although there is some overlap with the findings on site and the Screening Tool's outcome, the development footprint will be developed with cognisance of these sensitivities.

Therefore, environmental sensitivity input received from the aquatic ecology specialist was taken forward and considered within the EIA process and the impact to these areas assessed. Appropriate layout and development restrictions were implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist.

# Appendix 3: Detailed aquatic assessment methodology

This study followed the approaches of several national guidelines with regards to wetland assessment. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study area aquatic systems, applicable to the specific environment and, in a clear and objective manner, identify and assess the potential impacts associated with the proposed development site based on information collected within the relevant farm portions.

Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study. It is also important to understand the legal definition of a wetland, the means of assessing wetland conservation and importance and the relevant legislation aimed at protecting wetlands. These aspects will be discussed in greater depth in this section of the report, as they form the basis of the study approach to assessing wetland impacts.

For reference the following definitions are as follows:

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: The area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: 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 under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: As per the National Water Act means -

  (a) a river or spring;
  (b) a natural channel in which water flows regularly or intermittently;
  (c) a wetland, lake or dam into which, or from which, water flows; and
  (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

### 11.1 Waterbody classification systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects.

**Coupled to this was the inclusion of other criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**

The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS) (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al*., 2013).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in the wetland classifications as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water and Sanitation (DWS). The Ecological Reserve of a wetland or river is used by DWS to assess the water resource allocations when assessing WULAs

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

**Definition Box**
**Present Ecological State** is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.
**EcoStatus** is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology, and water quality).
**Reserve:** The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.
**Reserve requirements**: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).
**Ecological Reserve determination study**: The study undertaken to determine Ecological Reserve requirements.
**Licensing applications**: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment or any other activity that qualifies as a water use.
**Ecological Water Requirements**: This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the **Reserve Template**
**Water allocation process (compulsory licensing):** This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.
**Ecoregions** are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

### 11.2 Wetland definition

Although the National Wetland Classification System (NWCS) (Ollis *et al*., 2013) is used to classify wetland types it is still necessary to understand the definition of a wetland. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard et al., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al*., 2013):
*WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.*

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are 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 supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and

clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa. Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the NWA, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

- A high-water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

*It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines and rivers.*

**Table 2: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the NWA and ecosystems included in DWAF's (2005) delineation manual.**

| Ecosystem | NWCS "wetland" | National Water Act wetland | DWAF (2005) delineation manual |
|---|---|---|---|
| Marine | YES | NO | NO |
| Estuarine | YES | NO | NO |
| Waterbodies deeper than 2 m (i.e. limnetic habitats often described as lakes or dams) | YES | NO | NO |
| Rivers, channels and canals | YES | NO[1] | NO |
| Inland aquatic ecosystems that are not river channels and are less than 2 m deep | YES | YES | YES |
| Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface | YES | YES | YES[3] |
| Riparian [3] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface | NO | NO | YES[3] |

*[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act*

*[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods and would be considered riparian wetlands, as opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.*

*[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.*

### 11.3 National Wetland Classification System method

Due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS should be adopted. This classification approach has integrated aspects of the HGM approach used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (Ollis *et al*., 2013) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (Ollis *et al.,* 2013).

The classification system used in this study is thus based on Ollis *et al*. (2013) and is summarised below:

The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 2). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale.

This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

**Level 3** of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

**Level 4** classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

- Landform – shape and localised setting of wetland
- Hydrological characteristics – nature of water movement into, through and out of the wetland
- Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

**Level 5** of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

**Level 6** uses six descriptors to characterise the wetland types based on biophysical features. As with Level 5, these are non-hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other.

The HGM unit (Level 4) is the focal point of the NWCS, with the upper levels (Figure 3 Figure – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

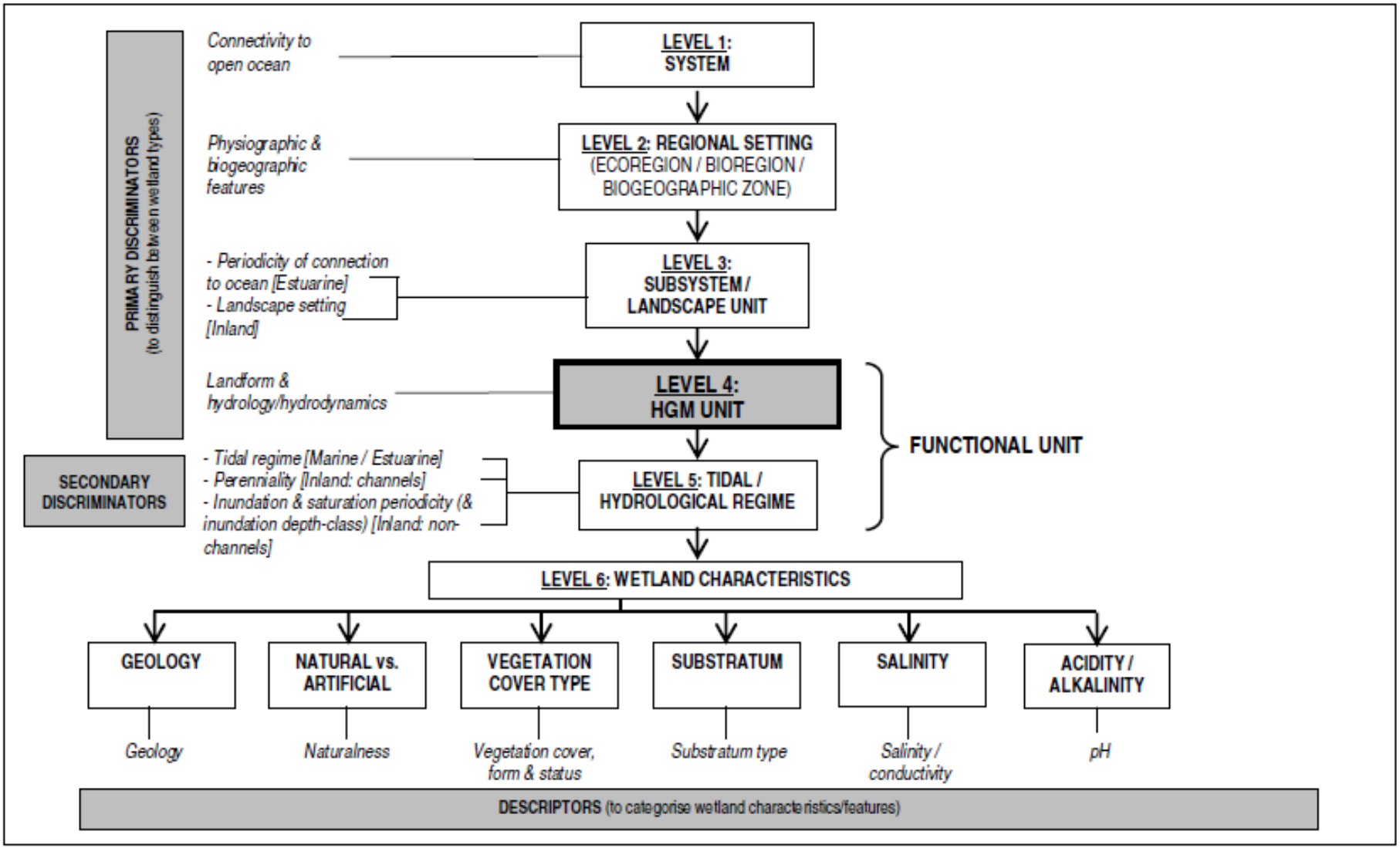


**Figure 2: Basic structure of the NWCS, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied**

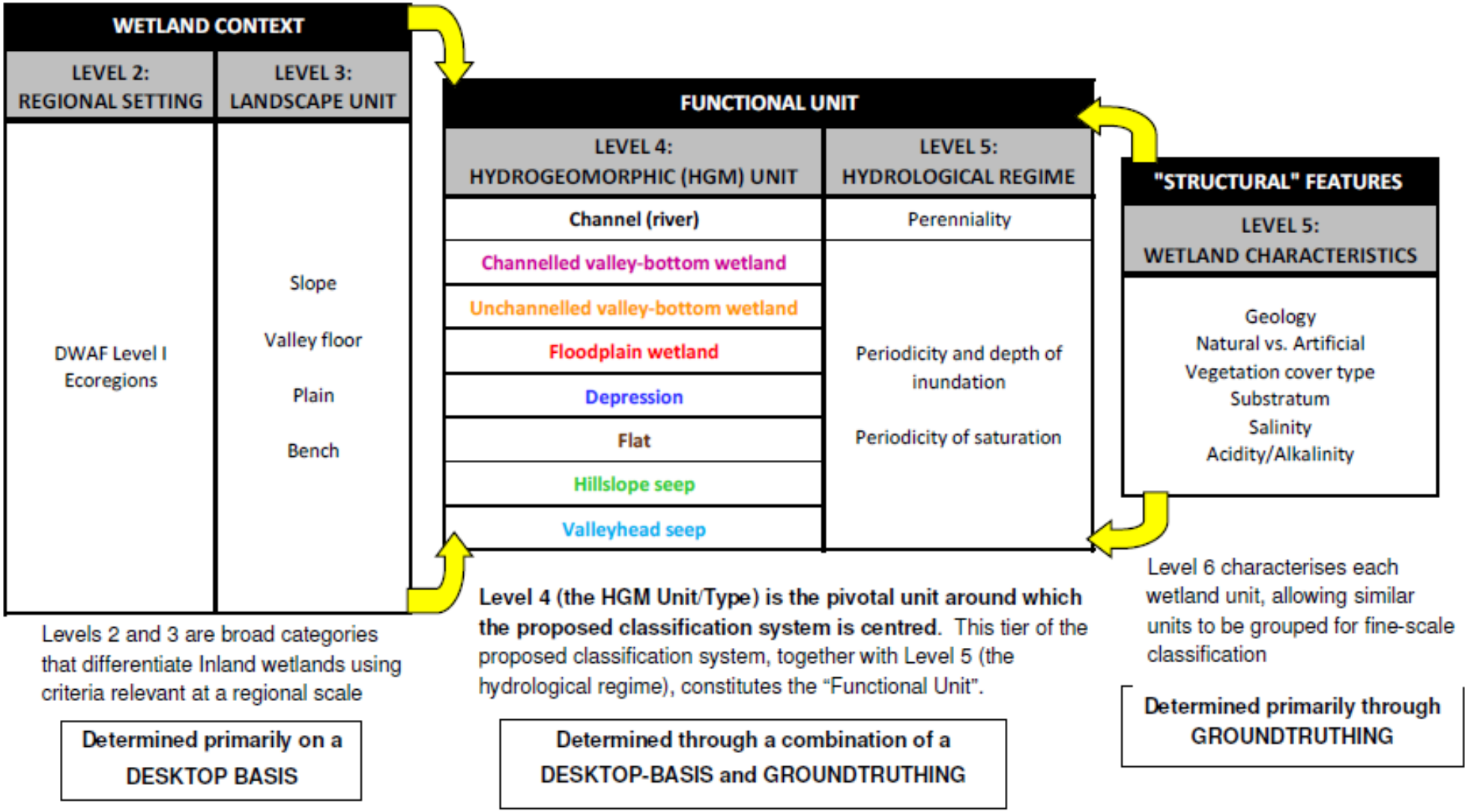


**Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al*., 2013)**

### 11.4 Waterbody condition

To assess the PES or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table ) and provide a score of the PES of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled with the degraded state of the wetlands in the study area, indicated that a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

**Table 3: Description of A – F ecological categories based on Kleynhans *et al*., (2005)**

| ECOLOGICAL CATEGORY | ECOLOGICAL DESCRIPTION | MANAGEMENT PERSPECTIVE |
|---|---|---|
| **A** | Unmodified, natural. | Protected systems; relatively untouched by human hands; no discharges or impoundments allowed |
| **B** | Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. | Some human-related disturbance, but mostly of low impact potential |
| **C** | Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. | **Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation** |
| **D** | Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred. | |
| **E** | Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive. | **Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality** |
| **F** | Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible. | |

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall PES score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWA’s River EcoStatus models which are currently used for the assessment of PES in riverine environments.

### 11.5 Aquatic ecosystem importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).
Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:

- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water-borne diseases.

In terms of this study, the wetlands provide ecological (environmental) value to the area acting as refugia for various wetland associated plants, butterflies and birds.

In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table  below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al.,* 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

**Table 4: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al*., 2008**

| | | | | |
|---|---|---|---|---|
| **Ecosystem services supplied by wetlands** | Indirect benefits | Hydro-geochemical benefits | Flood attenuation | |
| | | | Stream flow regulation | |
| | | | Water quality enhancement benefits | Sediment trapping |
| | | | | Phosphate assimilation |
| | | | | Nitrate assimilation |
| | | | | Toxicant assimilation |
| | | | | Erosion control |
| | | | Carbon storage | |
| | | Biodiversity maintenance | | |
| | *Direct benefits* | *Provision of water for human use* | | |
| | | *Provision of harvestable resources*[2] | | |
| | | *Provision of cultivated foods* | | |
| | | *Cultural significance* | | |
| | | *Tourism and recreation* | | |
| | | *Education and research* | | |

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation or rather, continuity or intactness with regards to ecological corridors; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of Conservation Concern (SCC) was observed, in which case it would receive a HIGH rating. Any system that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied.  Natural wetlands or Wetlands that resemble some form of the past landscape but receive a LOW conservation importance rating could be included into stormwater management features and should not be developed to retain the function of any ecological corridors