# Wetland Baseline and Risk Assessment for the proposed Kiwano Battery Energy Storage System and Solar Photovoltaic Project

## Upington, Northern Cape, South Africa

April 2022

**CLIENTS**

ZITHOLELE CONSULTING

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|---|---|
| **Report Name** | **Wetland Baseline and Risk Assessment for the Proposed Kiwano BESS and PV Project** |
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| **Report Writer & Fieldwork** | **Ivan Baker**<br><br>Ivan Baker is Pr. Sci Nat registered (119315) in environmental science with Cand. Sci. Nat recognition in geological science. Ivan is a wetland and soil specialist with vast experience in wetlands, pedology, hydropedology and land contamination and has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following FC standards. Ivan completed training in Tools for Wetland Assessments with a certificate of competence and completed his MSc in environmental science and hydropedology at the North-West University of Potchefstroom. Ivan is also affiliated with the Fertiliser Society of South Africa after the acquiring a certificate of competence following the completion of the FERTASA training course. |
| **Reviewer** | **Andrew Husted**<br><br>Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant. |
| **Declaration** | The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science. |

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# Declaration

I, Ivan Baker declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

**Ivan Baker**

**Wetland Specialist**

The Biodiversity Company

April 2022

# 1 Introduction

The Biodiversity Company was commissioned to conduct a wetland baseline and impact (risk) assessment, as part of the environmental authorisation (EA) process for the proposed Kiwano Battery Energy Storage System (BESS) and Solar Photovoltaic (PV) project. The Kiwano BESS and PV project is part of Phase 2, and comprises an envisaged PV capacity of 58 MW, and BESS capacity of 40 MW / 200 MWh.

This assessment has been completed in accordance with the requirements of the published General Notice (GN) 509 by the Department of Water and Sanitation (DWS). This notice was published in the Government Gazette (no. 40229) under Section 39 of the National Water Act (Act no. 36 of 1998) in August 2016, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 509 process provides an allowance to apply for a WUL for Section 21(c) & (i) under a General Authorisation (GA), as opposed to a full Water Use Licence Application (WULA). A water use (or potential) qualifies for a GA under GN 509 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM). This assessment will implement the RAM and provide a specialist opinion on the appropriate water use authorisation. A 500 m regulation area has been (collectively) assigned to the project area and servitudes proposed for the project.

One wetland site visit was conducted from the 15$^{th}$ to the 17$^{th}$ of March 2022. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the proposed activity.

## 1.1 Project

Infrastructure associated with the project will include the following:

- Build a 7 km single Twin-Tern Upington/ Kiwano 132kV line on a double circuit support structure;
- Build Kiwano 132kV substation with 5 feeder bays: 1 for the income line, 4 for the BESS and PV plants, and make provision for future expansion to accommodate 4 more bays;
- Build the 40MW/200MWh BESS plant equipped with 2x40MVA 132/22kV transformers and connect it at Kiwano substation; and
- Build a 58MW PV plant with 2x40MVA 132/22kV transformers and connect it at Kiwano substation.

## 1.2 Aims and Objectives

The aim of the assessment was to determine the current state of the associated water resources in the area of study and the associated risks involved with the proposed activities. This was achieved through the following:

- The delineation and assessment of wetlands within the project area;
- The evaluation of the extent of site-related impacts;
- An impact assessment for the proposed development; and

- The prescription of mitigation measures and recommendations for identified risks.

### 1.3 Terms of Reference

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- The delineation, classification and assessment of wetlands within 500 m of the project area;
- Conduct a risk assessment relevant to the proposed project; and
- Recommendations relevant to associated impacts.

## 2 Receiving Area

The project area is located approximately 13 km south-west of Upington and approximately 2 km west of the Orange River, Northern-Cape Province (see Figure 2-2). The dominant land uses surrounding the project area includes agriculture (grazing) and renewable energy facilities. Two alternatives have been proposed, namely “Site A” and “Site B” (see Figure 2-3).

### 2.1 Vegetation Types

The Bushmanland Sandy Grassland (NKb 3) vegetation type is distributed throughout the Northern Cape Province, surrounding Aggeneys and a few isolated patches south of Copperton. The majority of this vegetation type is located in the shallow valley of the intermittent Koa River which is located west and south-east of Aggeneys, The altitude of this vegetation type ranges between 500 meters above sea level to 1 200 meters above sea level (Mucina & Rutherford, 2006).

The NKb 3 vegetation type is characterised by dense, sandy grassland plains with white grasses (*Schmidtia* and *Stipagrotstis*) and drought-resistant shrubs dominating. Ephemeral spring flora (*Gazania lichtensteinii* and *Grielum humifusum*) occurs after rainy winters (Mucina & Rutherford, 2006).

This vegetation type is least threatened with a target percentage of 21. Very little of this vegetation type has been transformed and therefore, no formal conservation areas exist. One main alien shrub threatens this vegetation type, namely *Prosopis* sp. with a very low chance of erosion.

### 2.2 Soils and Geology

The geology of the region is characterised by quaternary sediments (calcrete and sand) with some contribution of the Kalahari Group’s pre-Pleistocene sediments in the east of the NKb 3 vegetation type. The surface typically is covered by red sands deeper than 300 mm which is likely to form dunes.

The land types associated with the 500 m regulated area include the Ae 10 and Ag 1 land type. The Ae land type consists of red-yellow apedal soils which are freely drained. The soils tend to have a high base status and is deeper than 300 mm. The Ag land type is characterised by freely drained Red or Yellow-Brown Apedal soils with red soils being dominant. These soils are characterised by a high base status and is likely to be less than 300 mm deep.

## 2.3 Climate

Rainfall periods peak between February and April with a minor peak in November. The mean annual precipitation ranges from 70 to 110 mm (see Figure 2-1).

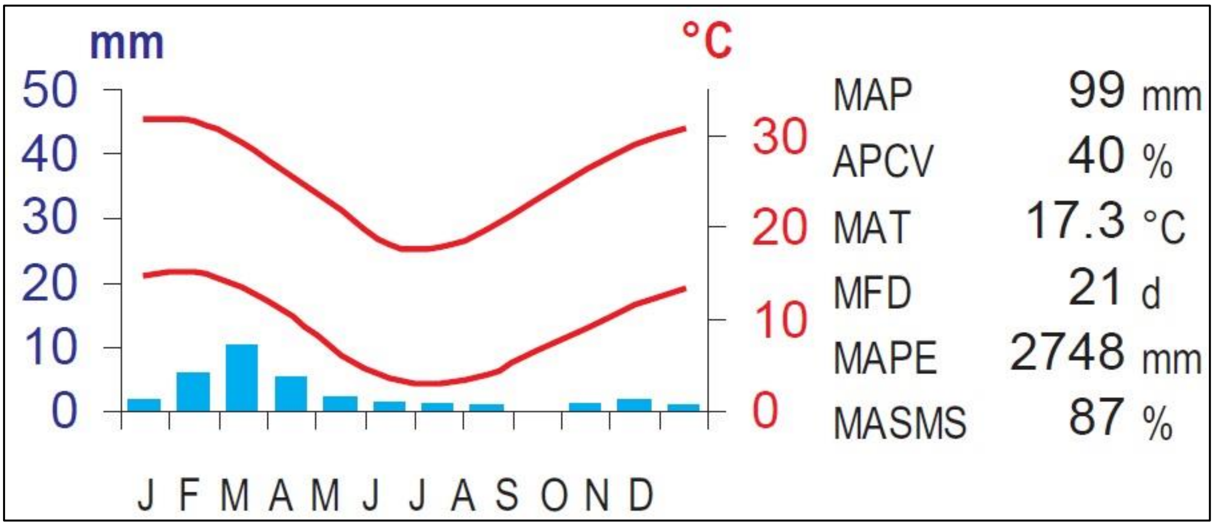


*Figure 2-1 Climate for the project area (Mucina & Rutherford, 2006).*

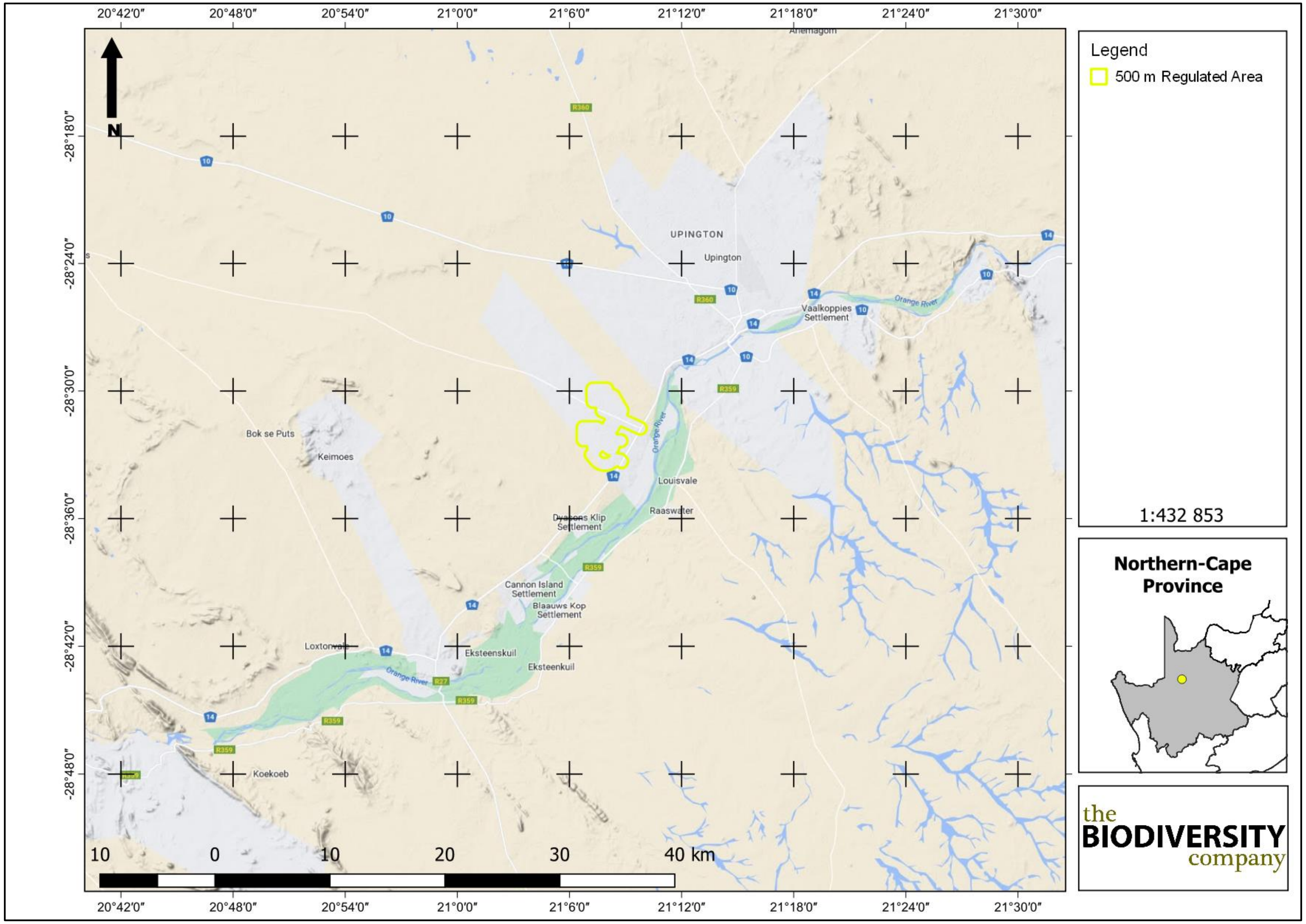


*Figure 2-2 Locality map of the project area*

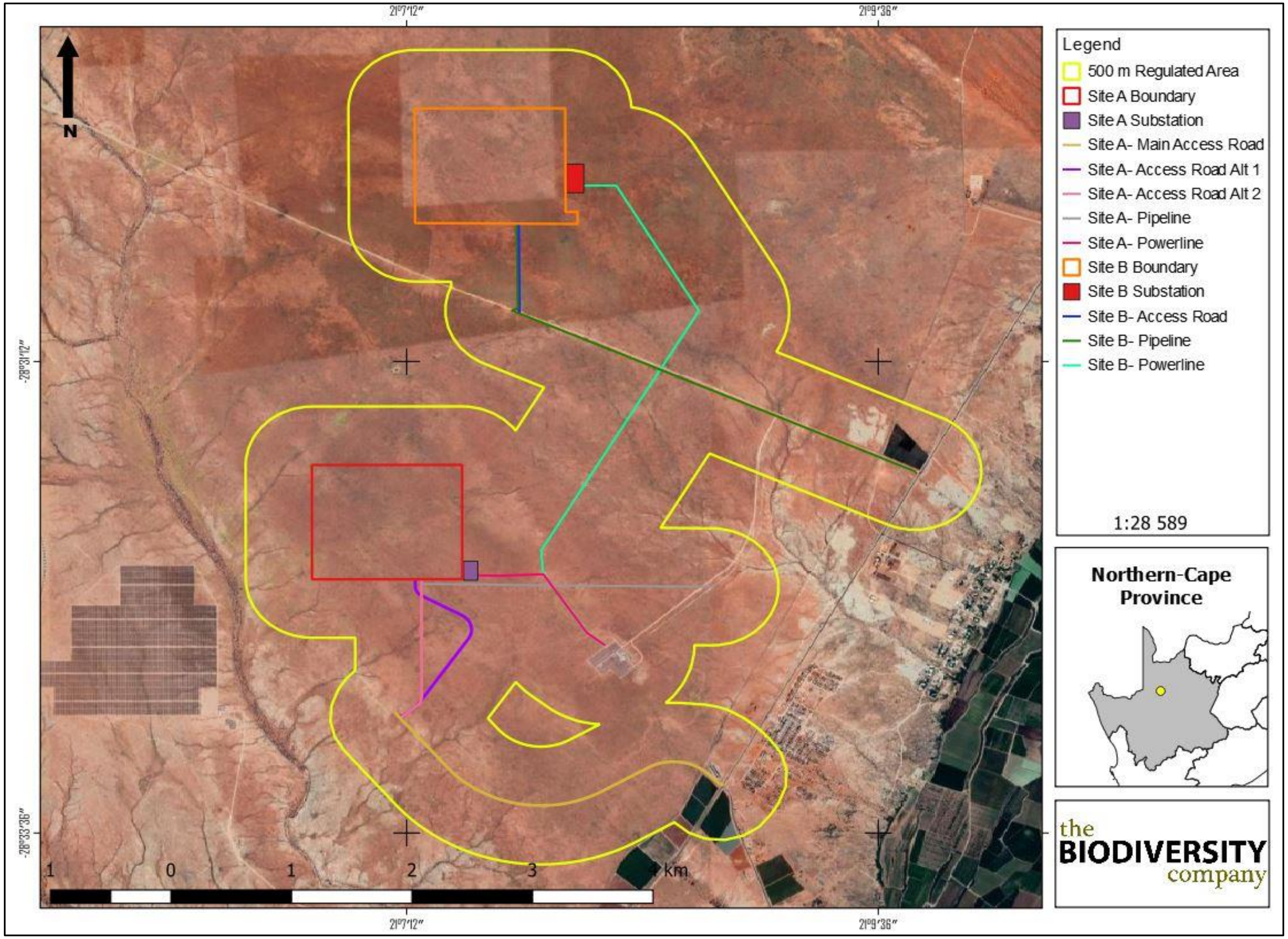


*Figure 2-3 Proposed layouts (Alternative A and B)*

## 2.4 Topographical River Line Data

Various non-perennial streams have been identified within the proposed project area by means of the “2821” quarter degree square topographical river line data set (see Figure 2-4). These areas represent concave drainage features and not necessarily wetland habitat.

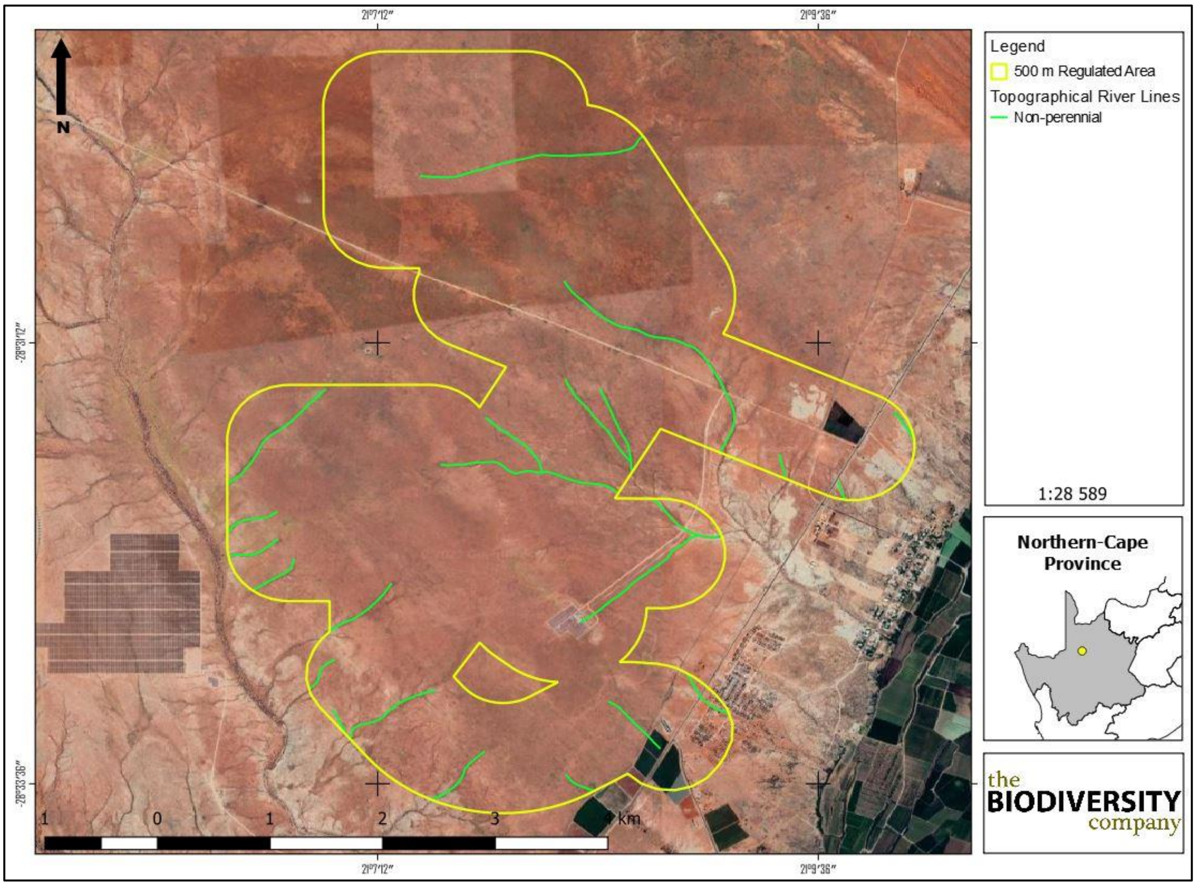


*Figure 2-4 Illustration of topographical river lines located within the 500 m regulated area*

# 3 Key Legislative Requirements

## 3.1 National Water Act (NWA, 1998)

The DWS is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource;
- The rehabilitation of the water resource;

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

## 3.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998), and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

# 4 Methodology

## 4.1 Wetland Identification and Mapping

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 4-1. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.

- The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);

- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile because of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

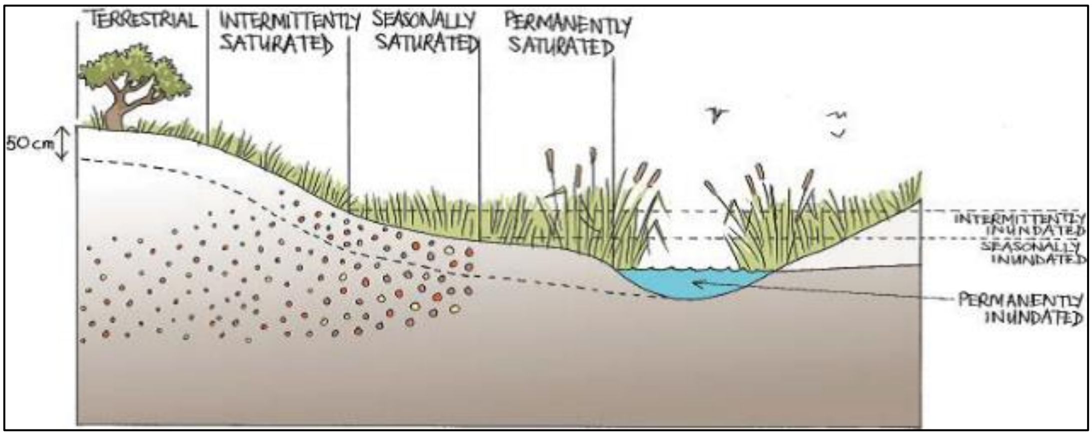


*Figure 4-1 Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)*

## 4.2 Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the project area. These delineations are illustrated by means of maps accompanied by descriptions.

## 4.3 Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Eco Services serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al*. 2008). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 4-1).

*Table 4-1 Classes for determining the likely extent to which a benefit is being supplied*

| Score | Rating of likely extent to which a benefit is being supplied |
|---|---|
| < 0.5 | Low |
| 0.6 - 1.2 | Moderately Low |
| 1.3 - 2.0 | Intermediate |
| 2.1 - 3.0 | Moderately High |
| > 3.0 | High |

## 4.4 Present Ecological Status

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 4-2.

*Table 4-2 The Present Ecological Status categories (Macfarlane, et al., 2008)*

| Impact Category | Description | Impact Score Range | PES |
|---|---|---|---|
| None | **Unmodified, natural** | 0 to 0.9 | A |
| Small | **Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. | 1.0 to 1.9 | B |
| Moderate | **Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact. | 2.0 to 3.9 | C |
| Large | **Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred. | 4.0 to 5.9 | D |
| Serious | **Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable. | 6.0 to 7.9 | E |
| Critical | **Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota. | 8.0 to 10 | F |

## 4.5 Importance and Sensitivity

The importance and sensitivity of water resources is determined in order to establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants is used to assign the Importance and Sensitivity (IS) category as listed in Table 4-3 (Rountree and Kotze, 2013).

*Table 4-3 Description of Importance and Sensitivity categories*

| EIS Category | Range of Mean | Recommended Ecological Management Class |
|---|---|---|
| Very High | 3.1 to 4.0 | A |
| High | 2.1 to 3.0 | B |
| Moderate | 1.1 to 2.0 | C |
| Low Marginal | < 1.0 | D |

## 4.6 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and also includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

## 4.7 Determining Buffer Requirements

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity.

## 4.8 Risk Assessment

The Department of Water and Sanitation (DWS) risk matrix assesses impacts in terms of consequence and likelihood. The significance of the impact is calculated according to Table 4-4.

*Table 4-4 Significance ratings matrix*

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

## 4.9 Knowledge Gaps

The following aspects were considered as limitations:

- Areas characterised by external wetland indicators have been the focus for this assessment. Areas lacking these characteristics have not been focussed on;
- High concentrations of drainage features and small pan-like features are located throughout the 500 m regulated area. Only those considered to be larger in extent and those with recent water accumulation have been delineated and considered to be more sensitive;
- It has been assumed that the extent of the project area provided to the specialist is accurate; and
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by a maximum of five meters to either side.

# 5 Results and Discussion

## 5.1 Wetland Delineation and Description

The wetland areas were delineated in accordance with the DWAF (2005) guidelines (see Figure 5-3). Various drainage features and some more significant depressions/pans were identified throughout the 500 m regulated area. None of these systems are characterised by hydromorphic signs of wetness, and therefore do not constitute wetland habitat. The drainage features are not characterised by riparian vegetation and grasses, these systems represent bare surfaces with evidence of surface run-off. A large number of small drainage features were identified within the assessment area.

The following Zones of Regulation (ZoR) are applicable to the drainage features identified within the assessment area:

- A 32 m Zone of Regulation in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) should be assigned to the drainage lines; and
- A 100 m ZoR in accordance with the National Water Act, 1998 (Act No. 36 of 1998) should be assigned to the drainage lines.

Regardless, it is recommended that the depressions which bare some functionality as well as the drainage features be conserved throughout the construction and operational phase. Those drainage features and depressions which bare more relevance due to recent deposition and movement of water (therefore not smaller insignificant features) were delineated and are illustrated in Figure 5-2 and Figure 5-3. The soils within these features are characterised by alluvial deposits rather than hydromorphic soils, which renders these systems non-wetland (Figure 5-1).

*Figure 5-1 Alluvial soils within delineated features*

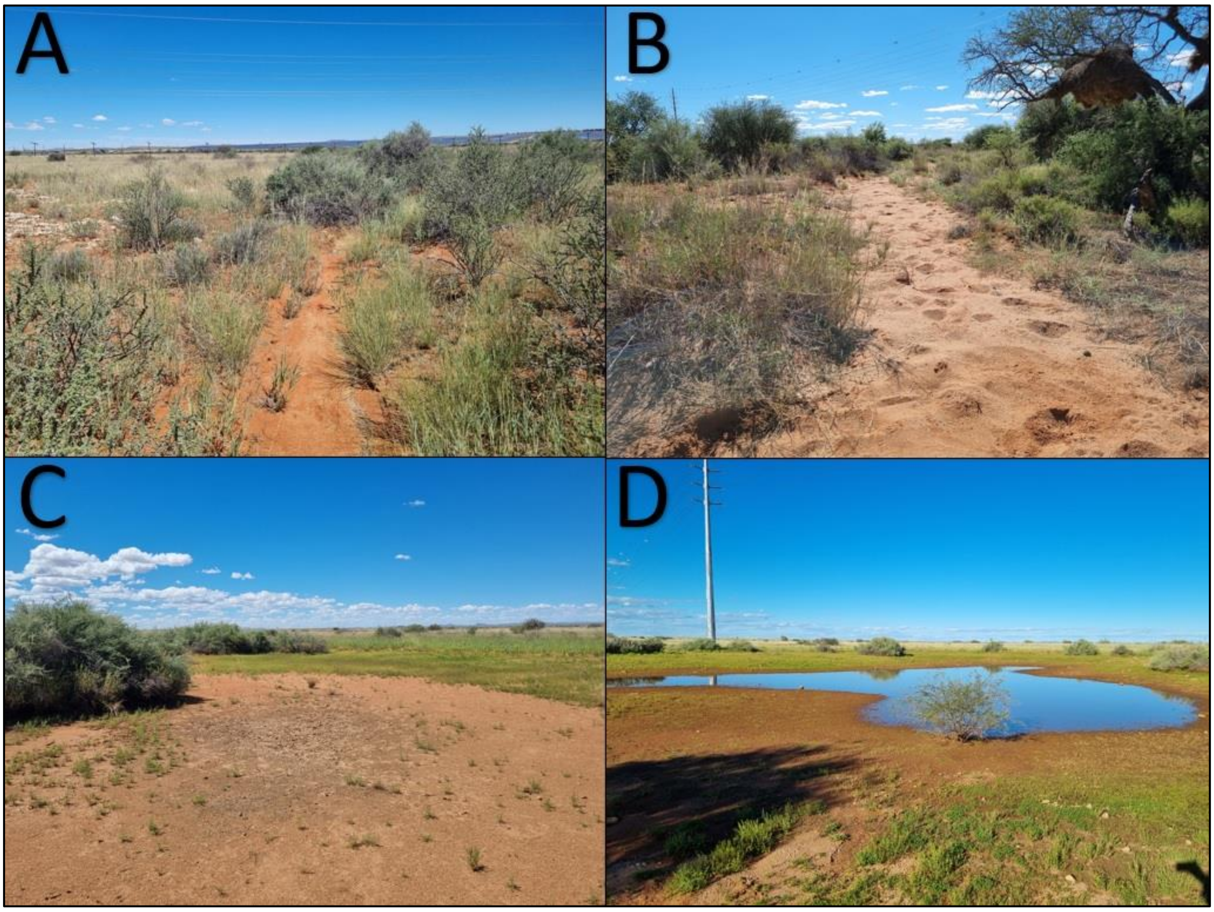


*Figure 5-2 Examples of the different HGM units delineated within the project area. A and B) Drainage features. C and D) Non-wetland depressions/pans*

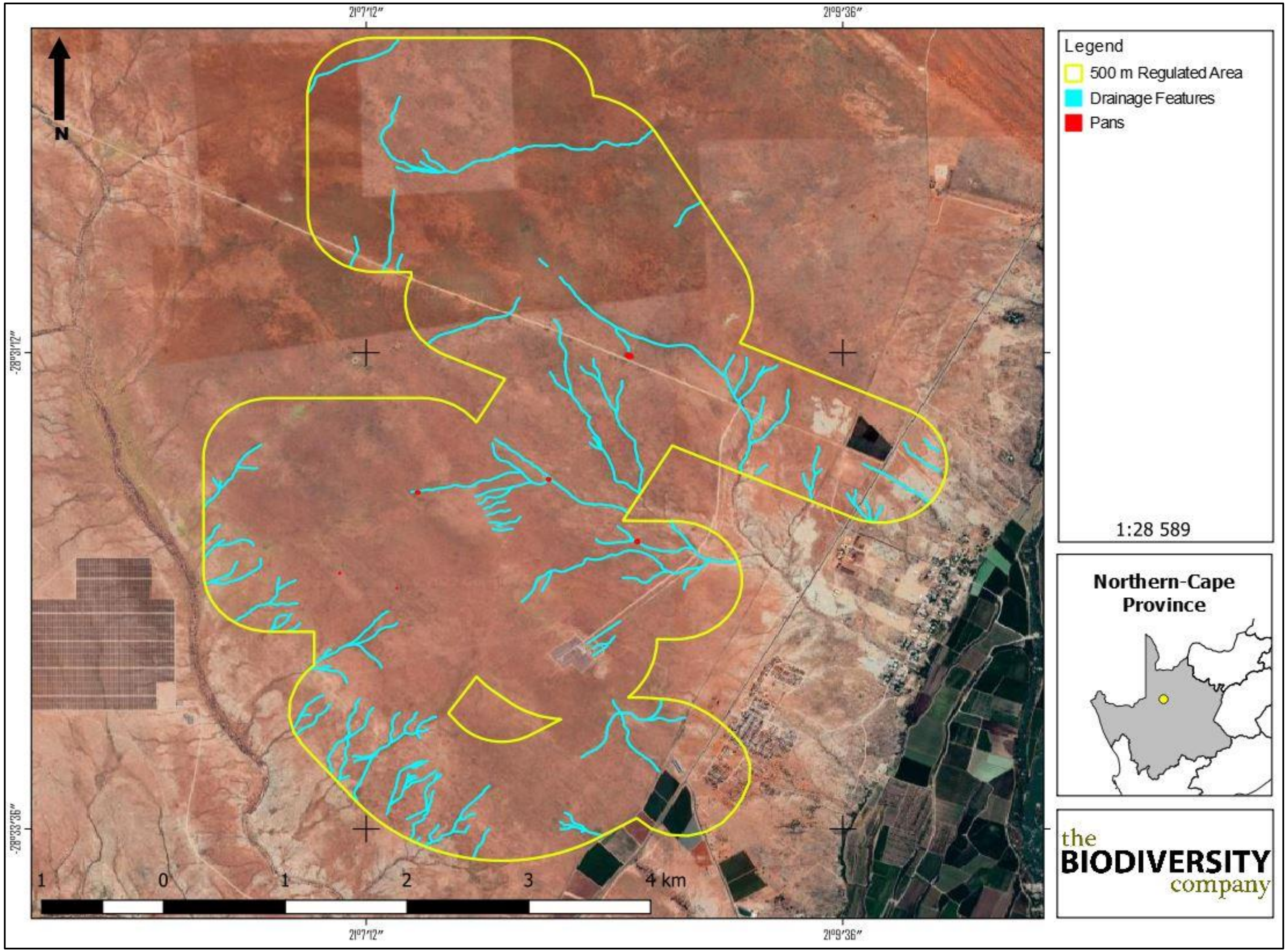


*Figure 5-3 Delineation of drainage features/depressions within 500 m regulated area*

## 5.2 Impact Assessment

Impacts pertaining to the wetland systems associated with the SPVs in the project area are summarised below. A general description of potential project impacts is provided below.

The impact assessment considered both direct and indirect impacts, to the delineated systems, by the different proposed activities. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the assessment (Figure 5-4). In accordance with the mitigation hierarchy, the preferred mitigation measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology, and phasing to avoid impacts.

It is evident from these illustrations that the proposed Options A and B are going to have direct and indirect impacts on the delineated drainage features. Both options will have access roads and powerlines crossing different drainage features as well as option B's PV facility will cross over a drainage system.

The first step in the mitigation hierarchy, namely "Avoidance" can be achieved for this project.

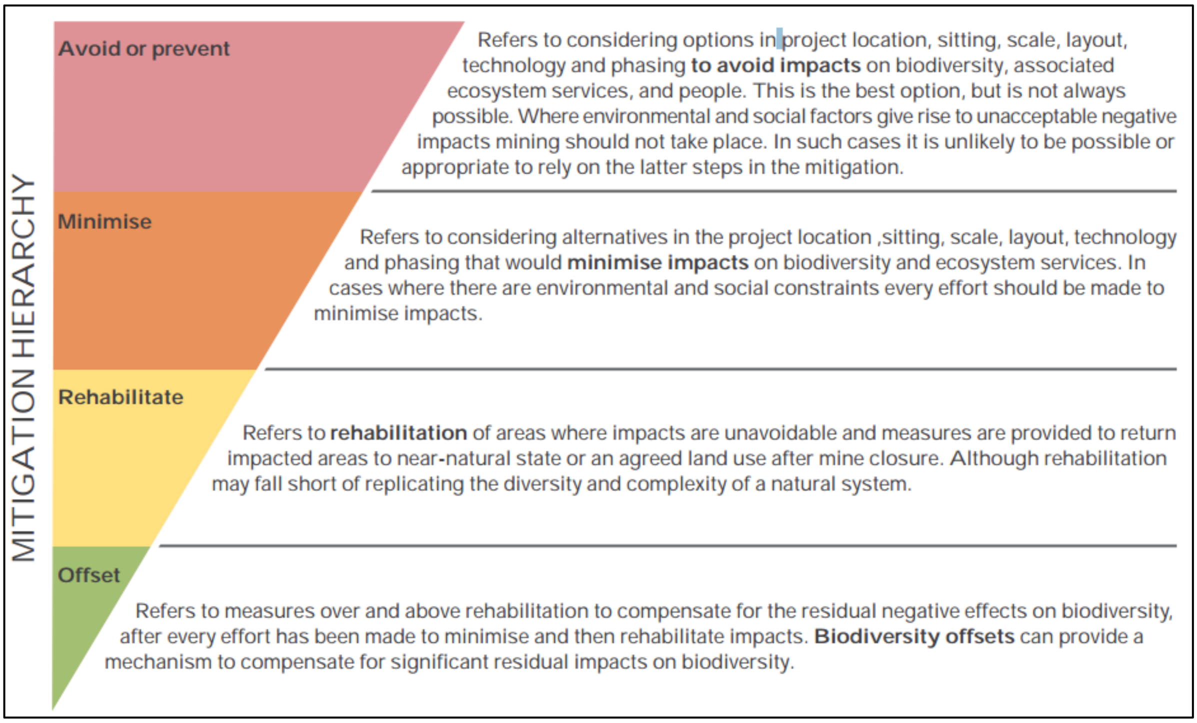


*Figure 5-4 The mitigation hierarchy as described by the DEA (2013)*

## 5.3 Option A

The different activities taking place for this project will pose different impacts on the delineated watercourses. The PV facility is in close proximity to a drainage system on the eastern side and two pans on the border of the area. The substation and BESS are located well away from any of the delineated watercourses and will thus have no impacts on the watercourses. The roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses and in return have the most mitigation measure to adhere too (see Figure 5-5, Table 5-1 and Table 5-2).

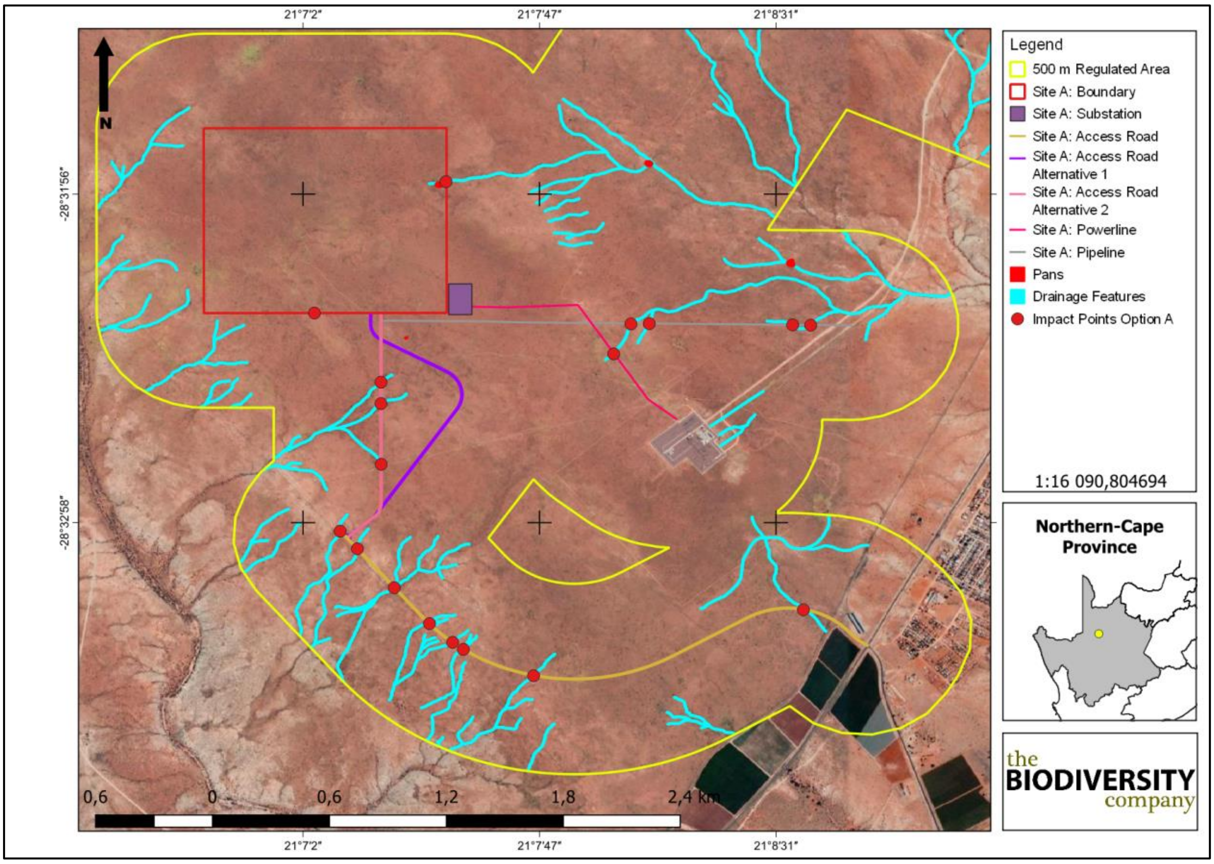


*Figure 5-5 Possible points where impacts may occur during development at option A.*

### 5.3.1 Construction

The following potential main impacts on the wetland functionality (based on the framework above) were considered for the construction phase of the proposed development. This phase refers to the period during construction when the proposed features are constructed; and is considered to have the largest direct impact. The following potential impacts to were considered (Table 5-1):

- Destruction, further loss, and fragmentation of the watercourses;
- Clearing of vegetation;
- Removal of soils;
- Altering overland flows; and

- Dust suppressants.

*Table 5-1 Assessment of significance of potential impacts on the wetland functionality associated with the construction phase of the project*

| Impact Description | | Impact type | Extent (E) | Duration (D) | Potential Intensity (P) | Likelihood (L) | Impact Rating & Significance (IR&S) |
|---|---|---|---|---|---|---|---|
| Impact | Direct Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 2 | 1 | 0,1 | 0 - LOW |
| Aspect: | **Construction of PV Facility** | Project Impact | 1 | 1 | 8 | 0,5 | 5 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Removal of Soils. Increase surface runoff. Loss of topsoil. | | Residual Impact | 1 | 1 | 2 | 0,2 | 1 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 2 | 5 | 2 | 0,2 | 2 - LOW |
| | | Confidence | High | | | | |
| **Impact Description** | | **Impact type** | **E** | **D** | **P** | **L** | **IR&S** |
| Impact | Direct Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 2 | 1 | 1 | 0,2 | 1 - LOW |
| Aspect: | **Construction of Roads** | Project Impact | 1 | 1 | 8 | 0,5 | 5 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Loss of topsoil. Loss of vegetation. Increase surface runoff. Increase erosion potential. | | Residual Impact | 2 | 1 | 4 | 0,2 | 1 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Moderate irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 2 | 5 | 4 | 0,2 | 2 - LOW |
| | | Confidence | Medium | | | | |
| **Impact Description** | | **Impact type** | **E** | **D** | **P** | **L** | **IR&S** |
| Impact | Indirect Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Neutral | Existing Impact | 1 | 1 | 4 | 0,1 | 1 - LOW |
| Aspect: | **Installation of powerlines** | Project Impact | 1 | 1 | 2 | 0,1 | 0 - LOW |
| Potential Impact: | | **Significance with Mitigation** | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Digging of holes for pylons. | | Residual Impact | 1 | 1 | 4 | 0,1 | 1 - LOW |
| | | Reversibility | Low reversibility | | | | |
| | | Irreplaceability | High irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 2 | 1 | 2 | 0,2 | 1 - LOW |
| | | Confidence | High | | | | |
| **Impact Description** | | **Impact type** | **E** | **D** | **P** | **L** | **IR&S** |
| Impact | Indirect Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 1 | 1 | 0,1 | 0 - LOW |
| Aspect: | **Installation of BESS and Substation** | Project Impact | 1 | 1 | 4 | 0,5 | 3 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Removal of Soils. Increase surface runoff. Loss of topsoil. | | Residual Impact | 1 | 1 | 2 | 0,2 | 1 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 1 | 1 | 1 | 0,1 | 0 - LOW |
| | | Confidence | High | | | | |

### 5.3.2 Operational Phase

The operational phase is the impacts of the daily activities when the development is functioning. These impacts are small impacts over a long-time frame. These impacts are associated with the movement of people to ensure that the facilities stay up to date. The main impacts are thus the traffic through the project area (Table 5-2). The following potential impacts were considered:

- Erosion inside wetland due to overland flows;
- Water quality impairment;
- Drainage pattern changes; and
- Deposition of dust.

The erosion and water quality impairment within the delineated watercourses "Low" pre-mitigation and "Very Low" post mitigation. To ensure that the water used to clean the PV panels does not impair the water quality workers should use normal tap water without any chemicals.

All proposed activities are expected to be long term (> 15 years) and have been considered "permanent" on this basis, which renders the decommissioning phase irrelevant.

*Table 5-2 Assessment of significance of potential impacts on the wetland functionality associated with the operational phase of the project*

| Impact Description | | Impact type | Extent (E) | Duration (D) | Potential Intensity (P) | Likelihood (L) | Impact Rating & Significance (IR&S) |
|---|---|---|---|---|---|---|---|
| Impact | Indirect Impact: | Significance without Mitigation | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 4 | 1 | 0,1 | 1 - LOW |
| Aspect: | Traffic during Maintenance | Project Impact | 1 | 5 | 2 | 1 | 8 - MOD |
| Potential Impact: | | Significance with Mitigation | | | | | |
| Traffic during maintenance will cause erosion and increase flow dynamics into the drainage systems. | | Residual Impact | 1 | 5 | 2 | 0,2 | 2 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | Cumulative Impact | | | | | |
| | | Cumulative Impact | 1 | 4 | 4 | 0,2 | 2 - LOW |
| | | Confidence | High | | | | |
| Impact Description | | Impact type | E | D | P | L | IR&S |
| Impact | Indirect Impact: | Significance without Mitigation | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 4 | 1 | 0,1 | 1 - LOW |
| Aspect: | Altered Overflow Dynamics | Project Impact | 1 | 5 | 2 | 1 | 8 - MOD |
| Potential Impact: | | Significance with Mitigation | | | | | |
| Overflow of water from the PV panels and roads | | Residual Impact | 1 | 4 | 1 | 0,2 | 1 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | Cumulative Impact | | | | | |
| | | Cumulative Impact | 1 | 4 | 2 | 0,2 | 1 - LOW |
| | | Confidence | High | | | | |

## 5.4 Option B

The different activities taking place for this project will pose different impacts on the delineated watercourses. There are multiple drainage systems running through the proposed PV facility area. The substation and BESS are located to the south of a drainage system and might have some indirect impacts on the system. The roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses and in return have the most mitigation measure to adhere too (see Figure 5-6, Table 5-3 and Table 5-4).

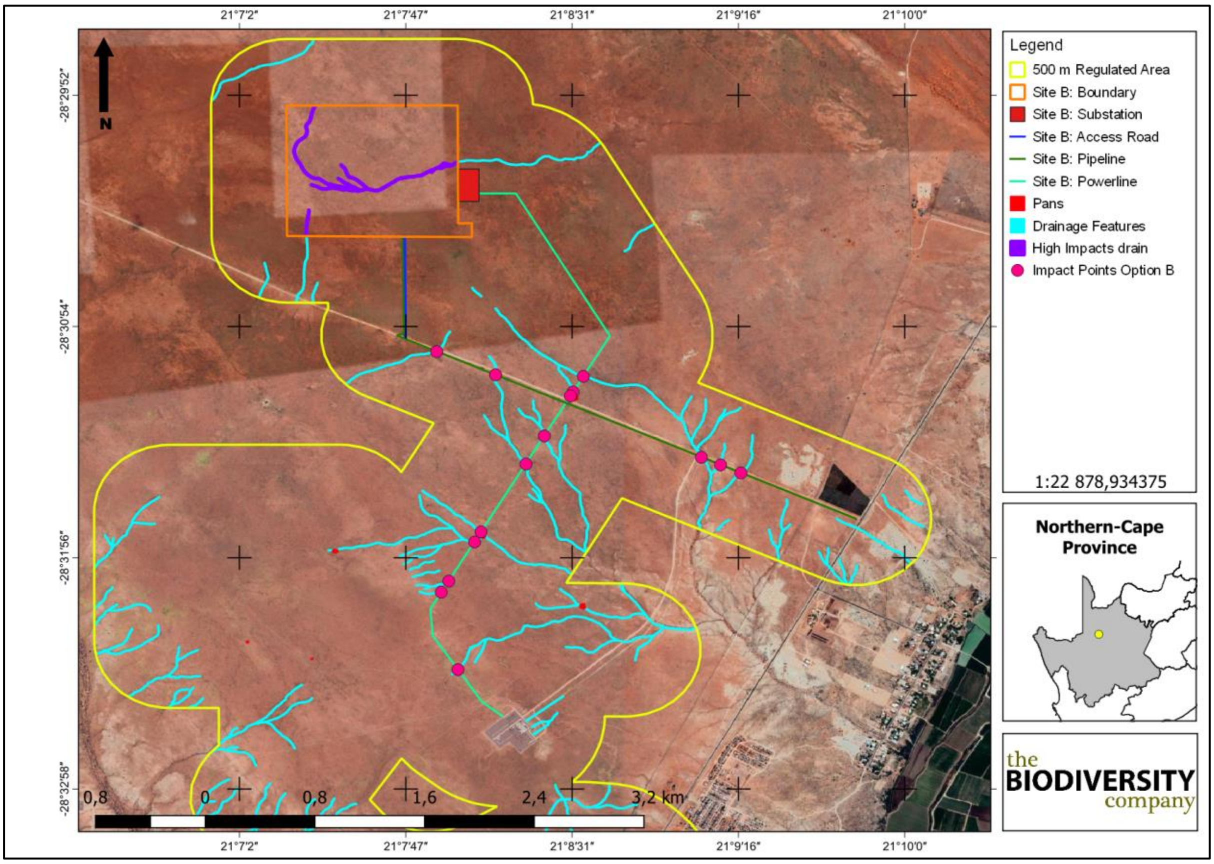


*Figure 5-6 Possible points where impacts may occur during development at option B.*

### 5.4.1 Construction

The following potential main impacts on the wetland functionality (based on the framework above) were considered for the construction phase of the proposed development. This phase refers to the period during construction when the proposed features are constructed; and is considered to have the largest direct impact. The following potential impacts to were considered (Table 5-1):

- Destruction, further loss, and fragmentation of the watercourses;
- Clearing of vegetation;
- Removal of soils;
- Altering overland flows; and
- Dust suppressants.

*Table 5-3 Assessment of significance of potential impacts on the wetland functionality associated with the construction phase of the project*

| Impact Description | | Impact type | Extent (E) | Duration (D) | Potential Intensity (P) | Likelihood (L) | Impact Rating & Significance (IR&S) |
|---|---|---|---|---|---|---|---|
| Impact | Direct Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 2 | 1 | 0,1 | 0 - LOW |
| Aspect: | **Construction of PV Facility** | Project Impact | 2 | 1 | 8 | 0,75 | 8 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Removal of Soils. Increase surface runoff. Loss of topsoil. | | Residual Impact | 1 | 1 | 2 | 0,5 | 2 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 2 | 5 | 2 | 0,2 | 2 - LOW |
| | | Confidence | High | | | | |
| **Impact Description** | | **Impact type** | **E** | **D** | **P** | **L** | **IR&S** |
| Impact | Direct Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 2 | 1 | 1 | 0,2 | 1 - LOW |
| Aspect: | **Construction of Roads** | Project Impact | 1 | 1 | 8 | 0,5 | 5 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Loss of topsoil. Loss of vegetation. Increase surface runoff. Increase erosion potential. | | Residual Impact | 2 | 1 | 4 | 0,2 | 1 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Moderate irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 2 | 5 | 4 | 0,2 | 2 - LOW |
| | | Confidence | Medium | | | | |
| **Impact Description** | | **Impact type** | **E** | **D** | **P** | **L** | **IR&S** |
| Impact | Indirect Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Neutral | Existing Impact | 1 | 1 | 4 | 0,1 | 1 - LOW |
| Aspect: | **Installation of powerlines** | Project Impact | 1 | 1 | 2 | 0,1 | 0 - LOW |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Digging of holes for pylons. | | Residual Impact | 1 | 1 | 4 | 0,1 | 1 - LOW |
| | | Reversibility | Low reversibility | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Irreplaceability | High irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 2 | 1 | 2 | 0,2 | 1 - LOW |
| | | Confidence | High | | | | |
| **Impact Description** | | **Impact type** | **E** | **D** | **P** | **L** | **IR&S** |
| Impact | Indirect Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 1 | 1 | 0,1 | 0 - LOW |
| Aspect: | **Installation of BESS and Substation** | Project Impact | 1 | 1 | 4 | 0,5 | 3 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Removal of Soils. Increase surface runoff. Loss of topsoil. | | Residual Impact | 1 | 1 | 2 | 0,2 | 1 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 1 | 1 | 1 | 0,1 | 0 - LOW |
| | | Confidence | High | | | | |

### 5.4.2 Operational Phase

The operational phase is the impacts of the daily activities when the development is functioning. These impacts are small impacts over a long-time frame. These impacts are associated with the movement of people to ensure that the facilities stay up to date. The main impacts are thus the traffic through the project area (Table 5-4). The following potential impacts were considered:

- Erosion inside wetland due to overland flows;
- Water quality impairment;
- Drainage pattern changes; and
- Deposition of dust.

The erosion and water quality impairment within the delineated watercourses “Low” pre-mitigation and “Very Low” post mitigation. To ensure that the water used to clean the PV panels does not impair the water quality workers should use normal tap water without any chemicals.

All proposed activities are expected to be long term (> 15 years) and have been considered “permanent” on this basis, which renders the decommissioning phase irrelevant.

*Table 5-4 Assessment of significance of potential impacts on the wetland functionality associated with the operational phase of the project*

| Impact Description | | Impact type | Extent (E) | Duration (D) | Potential Intensity (P) | Likelihood (L) | Impact Rating & Significance (IR&S) |
|---|---|---|---|---|---|---|---|
| Impact | Indirect Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 4 | 1 | 0,1 | 1 - LOW |
| Aspect: | Traffic during Maintenance | Project Impact | 1 | 5 | 2 | 1 | 8 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Traffic during maintenance will cause erosion and increase flow dynamics into the drainage systems. | | Residual Impact | 1 | 5 | 2 | 0,2 | 2 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 1 | 4 | 4 | 0,2 | 2 - LOW |
| | | Confidence | High | | | | |
| **Impact Description** | | **Impact type** | **E** | **D** | **P** | **L** | **IR&S** |
| Impact | Indirect Impact: | **Significance without Mitigation** | | | | | |
| Impact Direction: | Negative | Existing Impact | 1 | 4 | 1 | 0,1 | 1 - LOW |
| Aspect: | Altered Overflow Dynamics | Project Impact | 1 | 5 | 2 | 1 | 8 - MOD |
| Potential Impact: | | **Significance with Mitigation** | | | | | |
| Overflow of water from the PV panels and roads | | Residual Impact | 1 | 4 | 1 | 0,2 | 1 - LOW |
| | | Reversibility | Moderate reversibility | | | | |
| | | Irreplaceability | Low irreplaceability | | | | |
| | | **Cumulative Impact** | | | | | |
| | | Cumulative Impact | 1 | 4 | 2 | 0,2 | 1 - LOW |
| | | Confidence | High | | | | |

## 5.5 Risk Assessment

Due to the presence of drainage features (non-perennial) and non-wetland depressions/pans within the 500 m regulatory area, a risk assessment was conducted in line with Section 21 (c) and (i) of the National Water Act, 1998, (Act 36 of 1998).

A number of moderate risks (without mitigation) were identified for the construction phase of the project, these are largely attributed to the direct impact of these aspects on the watercourses. Implementation of the prescribed mitigation measures will reduce the level of risk posed by these aspects to low. The duration of these aspects is also expected to be short in duration. Moderate risks without mitigation were identified for the operational phase of the project, but this is attributed to the longevity of this phase. However, based on the assumption that the prescribed mitigation measures will be implemented the level of risk is reduced to low for this phase of the project. Only low risks were identified for the decommissioning phase of the project, which is also expected to have a short duration. This phase will also allow for the recovery of the systems.

For the proposed linear route alternatives, mitigation measures are largely associated with avoiding the delineated watercourse areas and implementing recommended buffer zones. Impacts are associated with any planned crossing. The impact table for the developments are jointly presented in Table 5-5 and DWS risk assessment presented in the subsequent tables. Risks associated with the proposed project range from moderate to low without mitigation measures (worst case scenario), and with the implementation of adequate mitigation measures, all post-mitigation risks to the watercourses are rated as Low.

*Table 5-5 Impacts assessed for the proposed development*

| Activity | Aspect | Impact |
|---|---|---|
| **Andrew Husted (Pr Sci Nat 400213/11)** | | |
| **Construction phase** | Clearing of vegetation | The clearing of vegetation and stripping of topsoil will increase runoff and increase the potential of erosion and sedimentation of the watercourses. The operation of equipment, vehicles and machinery brings the risk of contaminants polluting the systems. Access routes change drainage. |
| | Stripping and stockpiling of topsoil | |
| | Establish working area | |
| | Excavations / foundations | |
| | Vehicle access | |
| | Leaks and spillages from machinery, equipment & vehicles | |
| | Solid waste disposal | |
| | Human sanitation& ablutions | |
| | Re-fuelling of machinery and vehicles | |
| | Laydown & storage areas | |
| **Operation phase** | Operation of facility | The placement of poles within the system may impact on the hydro-dynamics of the watercourse. The access route will alter drainage, and also be a potential source of sedimentation. |
| | Service routes | |
| **Decommissioning phase** | Removal of infrastructure | The removal of the poles/underground cables and access route will restore the hydrodynamics to some extent. The operation of equipment, vehicles and machinery brings the risk of contaminants polluting the systems. |
| | Vehicle access | |
| | Leaks and spillages from machinery, equipment & vehicles | |
| | Solid waste disposal | |
| | Human sanitation& ablutions | |
| | Re-fuelling of machinery and vehicles | |
| | Laydown & storage areas | |

*Table 5-6 DWS Risk Impact Matrix for the proposed project*

| Aspect | Flow Regime | Water Quality | Habitat | Biota | Severity | Spatial scale | Duration | Consequence |
|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | |
| Clearing of vegetation | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 6 |
| Stripping and stockpiling of topsoil | 3 | 3 | 2 | 2 | 2.5 | 1 | 1 | 4.5 |
| Establish working area | 2 | 3 | 3 | 3 | 2.75 | 1 | 1 | 4.75 |
| Excavations / foundations | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 4 |
| Vehicle access | 2 | 3 | 2 | 3 | 2.5 | 1 | 1 | 4.5 |
| Leaks and spillages from machinery, equipment & vehicles | 1 | 3 | 2 | 2 | 2 | 1 | 1 | 4 |
| Solid waste disposal | 1 | 3 | 1 | 2 | 1.75 | 1 | 1 | 3.75 |
| Human sanitation& ablutions | 1 | 2 | 1 | 2 | 1.5 | 1 | 1 | 3.5 |
| Re-fuelling of machinery and vehicles | 1 | 3 | 2 | 2 | 2 | 1 | 1 | 4 |
| Laydown & storage areas | 2 | 3 | 2 | 2 | 2.25 | 1 | 1 | 4.25 |
| **Operational Phase** | | | | | | | | |
| Operation of facility | 2 | 1 | 1 | 2 | 1.5 | 1 | 4 | 6.5 |
| Service route | 2 | 3 | 2 | 2 | 2.25 | 2 | 4 | 8.25 |
| Human sanitation& ablutions | 1 | 2 | 1 | 2 | 1.5 | 1 | 4 | 6.5 |
| Re-fuelling of machinery and vehicles | 1 | 3 | 2 | 2 | 2 | 1 | 4 | 7 |
| Laydown & storage areas | 2 | 3 | 2 | 2 | 2.25 | 1 | 4 | 7.25 |
| **Decommissioning Phase** | | | | | | | | |
| Removal of infrastructure | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 4 |
| Vehicle access | 2 | 3 | 2 | 3 | 2.5 | 2 | 1 | 5.5 |
| Leaks and spillages from machinery, equipment & vehicles | 1 | 3 | 2 | 2 | 2 | 1 | 1 | 4 |
| Solid waste disposal | 1 | 3 | 1 | 2 | 1.75 | 1 | 1 | 3.75 |
| Human sanitation& ablutions | 1 | 2 | 1 | 2 | 1.5 | 1 | 1 | 3.5 |
| Re-fuelling of machinery and vehicles | 1 | 3 | 2 | 2 | 2 | 1 | 1 | 4 |
| Laydown & storage areas | 2 | 3 | 2 | 2 | 2.25 | 1 | 1 | 4.25 |

*Table 5-7 DWS Risk Assessment Continued*

| Aspect | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Sig. | Without Mitigation | Confidence Level | Control Measures | With Mitigation |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | | | |
| Clearing of vegetation | 3 | 3 | 5 | 2 | 13 | 78 | **Moderate*** | 80% | Section 5.6 | Low |
| Stripping and stockpiling of topsoil | 3 | 3 | 5 | 2 | 13 | 58.5 | **Moderate*** | 80% | Section 5.6 | Low |
| Establish working area | 1 | 2 | 5 | 2 | 10 | 47.5 | **Moderate*** | 80% | Section 5.6 | Low |
| Excavations / foundations | 2 | 2 | 5 | 2 | 11 | 44 | **Moderate*** | 80% | Section 5.6 | Low |
| Vehicle access | 2 | 2 | 5 | 2 | 11 | 49.5 | **Moderate*** | 80% | Section 5.6 | Low |
| Leaks and spillages from machinery, equipment & vehicles | 2 | 2 | 1 | 3 | 8 | 32 | **Low** | 80% | Section 5.6 | Low |
| Solid waste disposal | 2 | 2 | 1 | 2 | 7 | 26.25 | **Low** | 80% | Section 5.6 | Low |
| Human sanitation& ablutions | 2 | 2 | 1 | 2 | 7 | 24.5 | **Low** | 80% | Section 5.6 | Low |
| Re-fuelling of machinery and vehicles | 2 | 2 | 1 | 2 | 7 | 28 | **Low** | 80% | Section 5.6 | Low |
| Laydown & storage areas | 2 | 2 | 1 | 2 | 7 | 29.75 | **Low** | 80% | Section 5.6 | Low |
| Clearing of vegetation | 3 | 3 | 5 | 2 | 13 | 78 | **Moderate*** | 80% | Section 5.6 | Low |
| **Operational Phase** | | | | | | | | | | |
| Operation of facility | 3 | 2 | 1 | 2 | 8 | 52 | **Moderate*** | 80% | Section 5.6 | Low |
| Service route | 3 | 2 | 1 | 2 | 8 | 66 | **Moderate*** | 80% | Section 5.6 | Low |
| Human sanitation& ablutions | 2 | 2 | 1 | 2 | 7 | 45.5 | **Low** | 80% | Section 5.6 | Low |
| Re-fuelling of machinery and vehicles | 2 | 2 | 1 | 2 | 7 | 49 | **Low** | 80% | Section 5.6 | Low |
| Laydown & storage areas | 2 | 2 | 1 | 2 | 7 | 50.75 | **Low** | 80% | Section 5.6 | Low |
| **Decommissioning Phase** | | | | | | | | | | |
| Removal of infrastructure | 2 | 2 | 1 | 2 | 7 | 28 | **Low** | 80% | Section 5.6 | Low |
| Vehicle access | 2 | 2 | 5 | 2 | 11 | 60.5 | **Low** | 80% | Section 5.6 | Low |
| Leaks and spillages from machinery, equipment & vehicles | 2 | 2 | 1 | 3 | 8 | 34 | **Low** | 80% | Section 5.6 | Low |
| Solid waste disposal | 2 | 2 | 1 | 2 | 7 | 28 | **Low** | 80% | Section 5.6 | Low |
| Human sanitation& ablutions | 2 | 2 | 1 | 2 | 7 | 26.25 | **Low** | 80% | Section 5.6 | Low |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Re-fuelling of machinery and vehicles | 2 | 2 | 1 | 2 | 7 | 28 | **Low** | 80% | Section 5.6 | Low |
| Laydown & storage areas | 2 | 2 | 1 | 2 | 7 | 26.25 | **Low** | 80% | Section 5.6 | Low |

## 5.6 Mitigation Measures

The following mitigation measures have been prescribed to ensure the conservation of drainage features by limiting any indirect impacts;

### 5.6.1 General

The following mitigation measures are aimed at the conservation of wetlands in general;

- The contractors used for the construction should have spill kits available prior to construction to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly;
- All construction activities must be restricted to the development footprint area. This includes laydown and storage areas, ablutions, offices etc.;
- During construction activities, all rubble generated must be removed from the site;
- Construction vehicles and machinery must make use of existing access routes;
- All chemicals and toxicants to be used for the construction must be stored in a bunded area;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- All removed soil and material stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- No dumping of construction material on site may take place; and
- All waste generated on site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

### 5.6.2 Construction of PV Facility

- Keep the footprint of the PV facility as small as possible;
- When removing topsoil keep it separate to be able to use it to fill up holes;
- Revegetate bare areas after construction, and
- Construction should be done during dry season.

### 5.6.3 Construction of Roads

- The footprint area of the road should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- Exposed road surfaces awaiting grading must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion of the road;
- Silt traps and fences must be placed in the preferential flow paths along the road to prevent sedimentation of the watercourse;
- Temporary stormwater channels should be filled with aggregate and/or logs (branches included) to dissipate flows;
- A suitable stormwater plan must be compiled for the road. This plan must attempt to displace and divert stormwater from the road and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced with energy dissipaters and flows discharged into the local watercourses;
- All areas outside of the demarcated areas should be declared a 'no-go' area during the construction phase and all efforts must be made to prevent access to this area from construction workers and machinery;
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces and not conducting activities on windy days which will increase the likelihood of dust being generated;
- Areas that are cleared during construction need to be re-vegetated with indigenous vegetation to prevent erosion and reduce the likelihood of encroachment by alien invasive plant species upon completion of the road; and
- Any topsoil that is removed during construction must be appropriately removed and stored. This includes on-going maintenance of such topsoil piles so that they can be utilised during decommissioning phases and re-vegetation.

### 5.6.4 Construction of Powerlines

- Move pylons outside of the drainage systems;
- Make sure to revegetate bare areas after construction, and
- Ensure that construction is done during dry season.

### 5.6.5 Construction of Substation and BESS

- Keep the footprint as small as possible;
- Install spill trays under the BESS;
- Store topsoil's to use to fill up holes after installation, and
- Revegetate the bare areas after installation.

### 5.6.6 Conservation of Drainage Systems

This section is critical to those drainage systems proposed to be crossed by means of roads;

- Crossings are to be constructed during the low flow period;
- Well-engineered, and wide enough culvert systems should be installed at all drainage systems, including those minor systems not identified during the site assessment;
- It is critical to spread flows across the system, avoiding incisions in the landscape caused by concentrated flows. Temporary stormwater channels should be filled with aggregate and/or logs (branches included) to dissipate flows;
- It is recommended that the material surrounding and holding the culverts in place include a coarse rock layer that has been specifically incorporated to increase the porosity and permeability to accommodate flooding and very low flows;
- The culverts used in the design should be as large as possible, partially sunken and energy dissipating material must be placed at the discharge area of each culvert to prevent erosion of these areas.
- The use of larger culverts will prevent the build-up of debris by allowing the free movement of debris through the large culverts;
- Culverts should avoid inundation (damming) of upstream areas by facilitating streamflow and catering properly for both low flows and high flows;
- Surface run-off from the roads flowing down the embankments often scours the watercourse on the sides of the culvert causing sedimentation of the channel. This should be catered for with adequate concreted stormwater drainage depressions and channels with energy dissipaters that channel these flows into the river in a controlled manner;
- The culvert installations should further take into account the scouring action of high flows and gabion structures or similar should be placed on both sides of the culvert on the embankments both upstream and downstream. This will serve as retention of the soils from scouring around and underneath the culvert structures aiding in the protection of the structure;
- Large aggregate outsourced or from the project area (if available) can be used for energy dissipation in the channel downstream of the culverts to reduce the likelihood of scouring the riverbed and sedimentation of the catchment. It is preferable that larger aggregate be used to avoid flows removing material from the site;
- Signs of erosion must be addressed immediately to prevent further erosion;
- Monthly erosion monitoring must take place from May to August to identify erosion alongside the proposed road;
- Silt traps and fences must be placed in the preferential flow paths along the road to prevent sedimentation of the watercourse; and
- In addition to the roads, there are three wind turbines (wind turbines in specific that are located in close proximity to the identified drainage systems, these are to be moved to ensure that no development takes place within 15 m of the drainage systems.

## 5.7 Recommendations

The following recommendations have been made to ensure the conservation of the delineated watercourses during the construction and operational phase;

- Those powerline pylons located near drainage features needs to be moved away far enough so that the edge of the pylon's footprint areas is located at least 10 m away from the edge of the drainage feature; and
- Stormwater management principles must be incorporated for the design of the site, these include:
  - Prevent concentration of stormwater flow at any point where the ground is susceptible to erosion;
  - Reduce stormwater flows as far as possible by the effective use of attenuating devices (such as swales, berms, silt fences). As construction progresses, the stormwater control measures must be monitored and adjusted to ensure complete erosion and pollution control at all times;
  - Minimse the area of exposure of bare soils to minimse the erosive forces of wind, water and all forms of traffic;
  - Plan and construct stormwater management systems to remove contaminants before they pollute surface waters or groundwater resources;
  - Contain soil erosion, whether induced by wind or water forces, by constructing protective works to trap sediment at appropriate locations. This applies particularly during construction;
  - Avoid situations where natural or artificial slopes may become saturated and unstable, both during and after the construction process;
  - Design and construct roads to avoid concentration of flow along and off the road;
  - Design culvert inlet structures to ensure that the capacity of the culvert does not exceed the pre-development stormwater flow at that point. Provide detention storage on the road and/or upstream of the stormwater culvert;
  - Design outlet culvert structures to dissipate flow energy. Any unlined downstream channel must be adequately protected against soil erosion.
  - Where construction causes a change in the vegetative cover of the site that might result in soil erosion, the risk of soil erosion by stormwater must be minimised by the provision of appropriate artificial soil stabilisation mechanisms or re-vegetation of the area; and
  - Preferably all drainage channels on site and contained within the larger area of the property (i.e. including buffer zone) should remain in the natural state so that the existing hydrology is not disturbed.

## 6 Conclusion and Impact Statement

Various non-wetland drainage features and depressions were identified within the 500 m regulated area. None of these systems are characterised by wetland features as only alluvial soils and no hydrophytic vegetation is present.

During the assessment it was observed that there are 2 non-wetland pans located inside options A's PV area and that the roads and powerlines will have 18 crossing with drainage systems. Given the size of the pans and the drainage systems the impacts of the activities will be limited.

Option B have a big drainage system running through the PV area. This options powerline and roads will also have 15 crossings of the drainage systems. This option does have an existing road that will minimise the impact of the new development. The main concern will be the drainage system inside the PV area but will not be reason to not develop in the area.

Either of the two alternatives may be chosen as neither pose any threats towards wetland resources. Therefore, the proposed activities may proceed as have been planned with the condition that all mitigation measures and recommendations (including a surface hydrology study) be considered by the issuing authority.

Due to the presence of non-perennial watercourses within the 500 m regulatory area, a risk assessment was completed in line with Section 21 (c) and (i) of the National Water Act, 1998, (Act 36 of 1998). There are expected low post-mitigation risks expected for both alternatives, and a General Authorisation is permissible for either.

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