A WETLAND ASSESSMENT FOR THE CASTLE WIND ENERGY FACILITY PROJECT

De Aar, Northern Cape Province

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CLIENT

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1 Introduction

The Biodiversity Company was appointed to undertake a wetland delineation and functional assessment for the establishment of the Castle Wind Energy Facility (WEF). The Castle WEF falls northeast of De Aar, Northern Cape (Figure 1-1). The project components that have been considered for the assessment include the WEF and associated road networks, and also the powerline servitude. For the purposes of this report, the 500 m regulation area has been jointly considered for the two project components, but separate risk assessments have been achieved for each component. The baseline data provided herein refers to the combined 500 m regulation area.

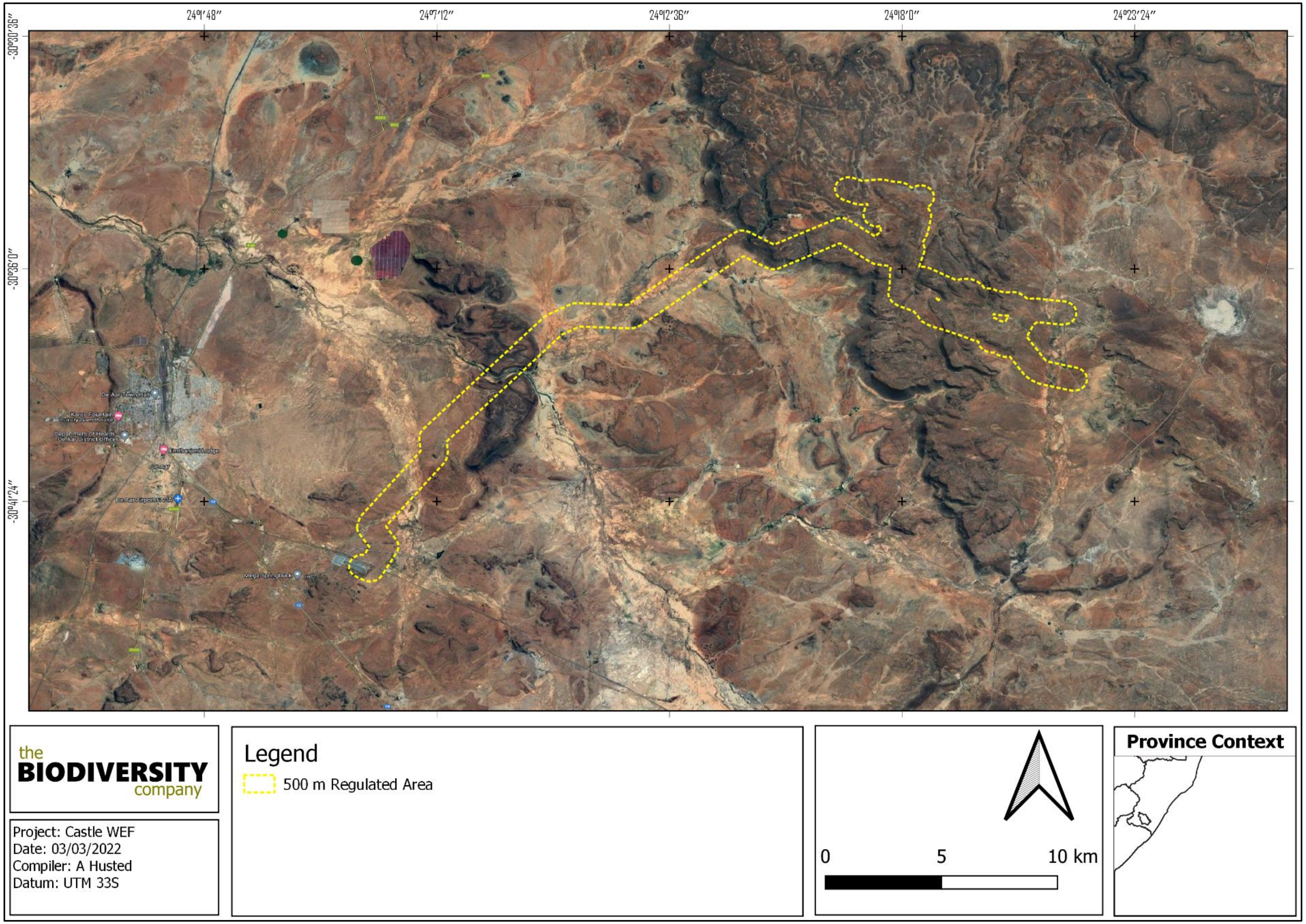
This assessment has also been completed in accordance with the requirements of the published General Notice (GN) 509 by the Department of Water and Sanitation (DWS). This notice was published in the Government Gazette (no. 40229) under Section 39 of the National Water Act (Act no. 36 of 1998) in August 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.

The purpose of the specialist studies is to provide relevant input into the water use authorisation process and provide a report for the proposed activities associated with the project. 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, as to the ecological viability of the proposed project.

1.1 Scope of Work

The aim of the wetland assessment was to provide information to guide the proposed project with respect to the current state of the associated wetlands in the project area. This was achieved through the following:

- The identification, deliniation and classiication of wetlands within the project area;
- A functional assessment of wetland systems;
- A risk assessment for the proposed development; and
- The prescription of mitigation measures and recommendations for identified risks.



Project: Castle WEF
Date: 03/03/2022
Compiler: A Husted
Datum: UTM 33S

Figure 1-1 ***The project location in relation to the nearby towns***

1.2 Specialist Details

Report Name	**A WETLAND ASSESSMENT FOR THE CASTLE WIND ENERGY FACILITY PROJECT**
Reference	**Castle WEF Access Road**
Submitted to	savannah environmental
Fieldwork / Report Writer	**Rowan Buhrmann** Rowan Buhrmann has experience in terrestrial ecology (specialised in grassland ecology) and climate change. He obtained his M.Sc in Plant EcoPhysiology, specifically assessing the effects of elevated temperatures on the Sandstone Sourveld grasslands in eThekwini.
Reviewer and Wetland Report Writer	**Andrew Husted** 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 principals of science.

2 Key Legislative Requirements

2.1 National Water Act (NWA, 1998)

The Department of Human Settlements Water and Sanitation (DHSWS) 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; and
- 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 DHSWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DHSWS in terms of Section 21 (c) and (i).

3 Methodology

3.1 Desktop Assessment

The following spatial datasets were utilised:

- Aerial imagery (Google Earth Pro);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- South African Inventory of Inland Aquatic Ecosystems (Van Deventer *et al*., 2019);
- The National Freshwater Ecosystem Priority Areas (Nel et al., 2011);
- Northern Cape Biodiversity Sector Plan;
- Contour data (5m);
- NASA Shuttle Radar Topography Mission Global 1 arc second digital elevation data; and
- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer et al., 2018).

3.2 Wetland Assessment

3.2.1 Wetland Identification and Mapping

The wetland areas will be delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 3-1. The outer edges of the wetland areas are 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 as a result 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.

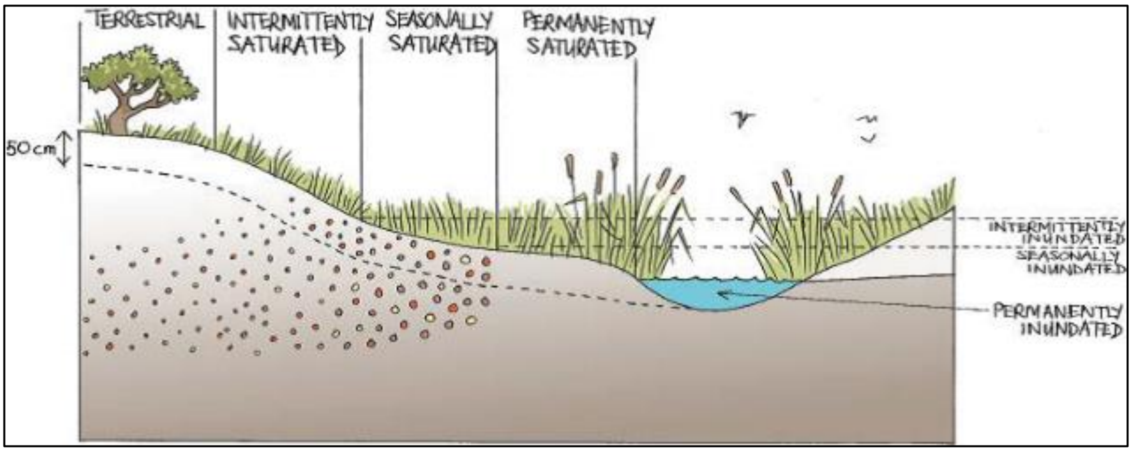


Figure 3-1 ***Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)***

3.2.2 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. EcoServices serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands will be 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 3-1).

Table 3-1 ***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

3.2.3 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 3-2.

Table 3-2 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

3.2.4 Importance and Sensitivity

The importance and sensitivity of water resources is determined in order 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 3-3.

Table 3-3 Description of Importance and Sensitivity categories

IS 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**

3.2.5 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 then also includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

3.2.6 Buffer Requirements

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

3.2.7 Risk Assessment

The risk assessment will be conducted in accordance with the DWS risk-based water use authorisation approach and delegation guidelines. The significance of the impact is calculated according to Table 3-4.

Table 3-4 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.

3.3 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The area was only surveyed during a single site visit and therefore, this assessment does not consider temporal trends;
- The project area was extensively ground truthed with only wetlands at an appreciable level of risk further assessed. The remainder of the 500 m regulated area has been delineated by means of desktop delineations; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by 5 m.

4 Results & Discussion

4.1 Desktop Assessment

4.1.1 Hydrological Setting

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the NBA 2018. Ecosystem threat status (ETS) of river and wetland ecosystem types are based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer *et al.,* 2019; Skowno *et al.,* 2019). The regulation area does overlap with an unlisted river system (Figure 4-1).

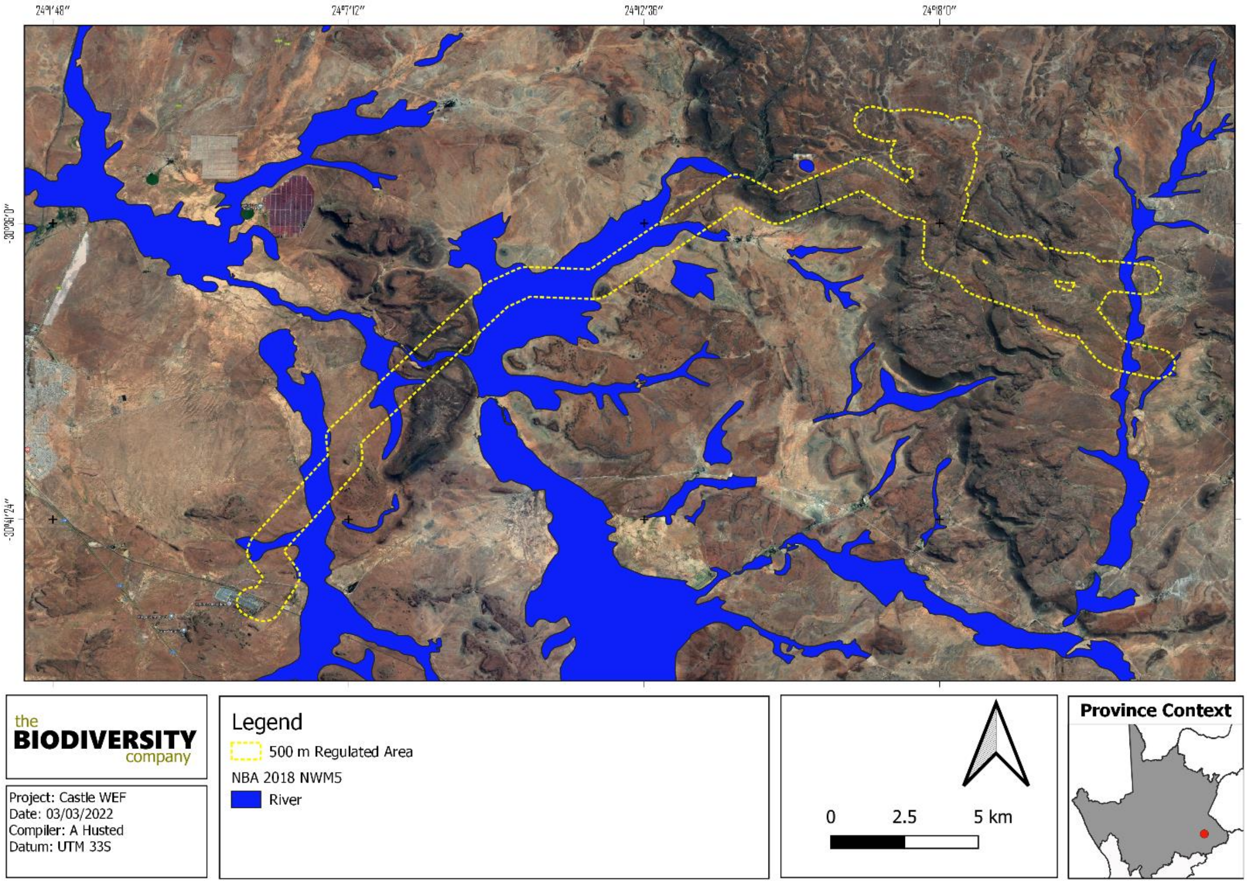


Figure 4-1 Map illustrating ecosystem threat status of rivers and protection level of wetland ecosystems in the regulation area

4.1.2 National Freshwater Ecosystem Priority Area Status

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.,* 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel *et al.,* 2011). Figure 4-2 shows the 500 m regulated area overlaps with non-FEPA wetlands and a priority FEPA river (code 1) and upstream management area (code 4).

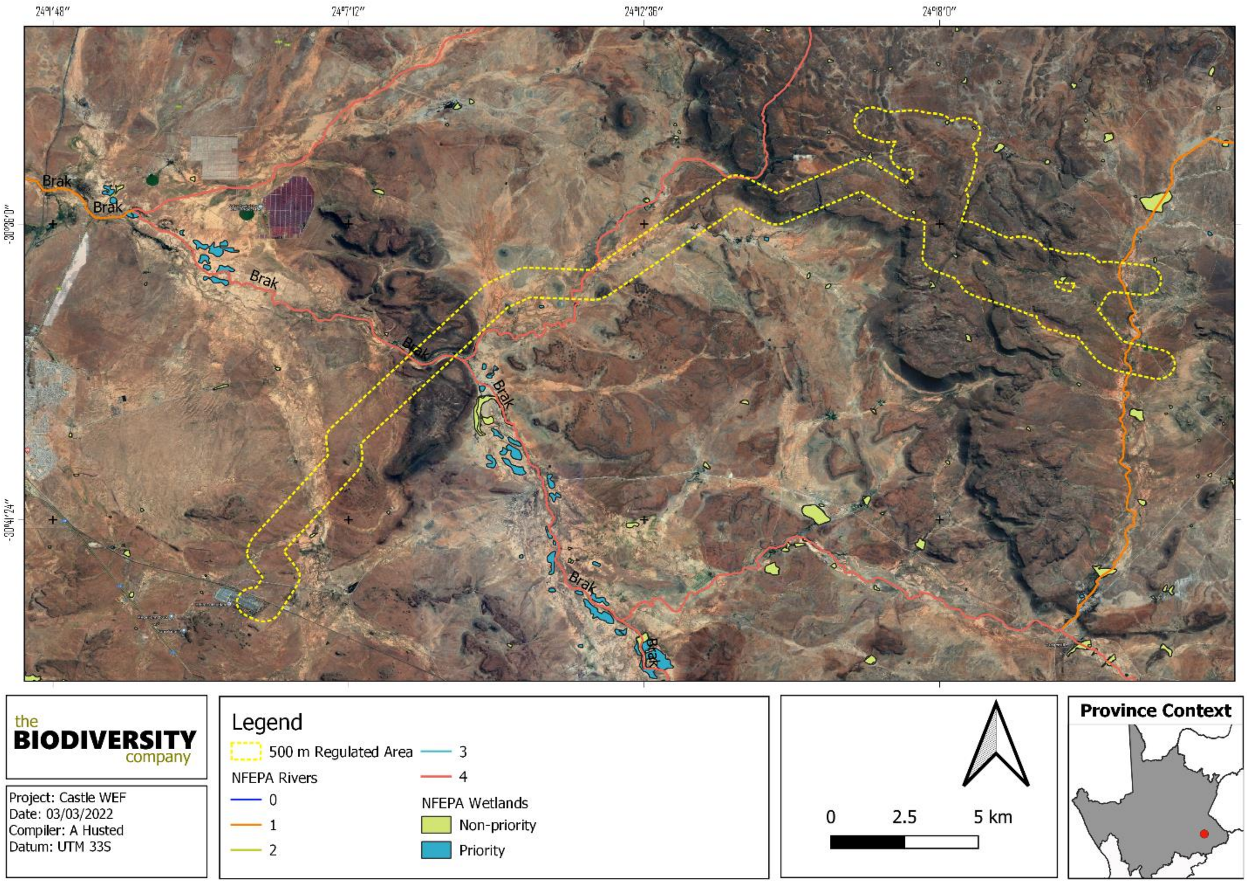


Figure 4-2 The regulation area in relation to the National Freshwater Ecosystem Priority Areas

4.1.3 Inland Water Features

A review of river lines and water bodies for quarter degree squared (QDS) 3024 indicated the presence of a number of drainage lines, a river line and inland water areas (dams) within the project area and 500m regulatory area (Figure 4-3 and Figure 4-4).

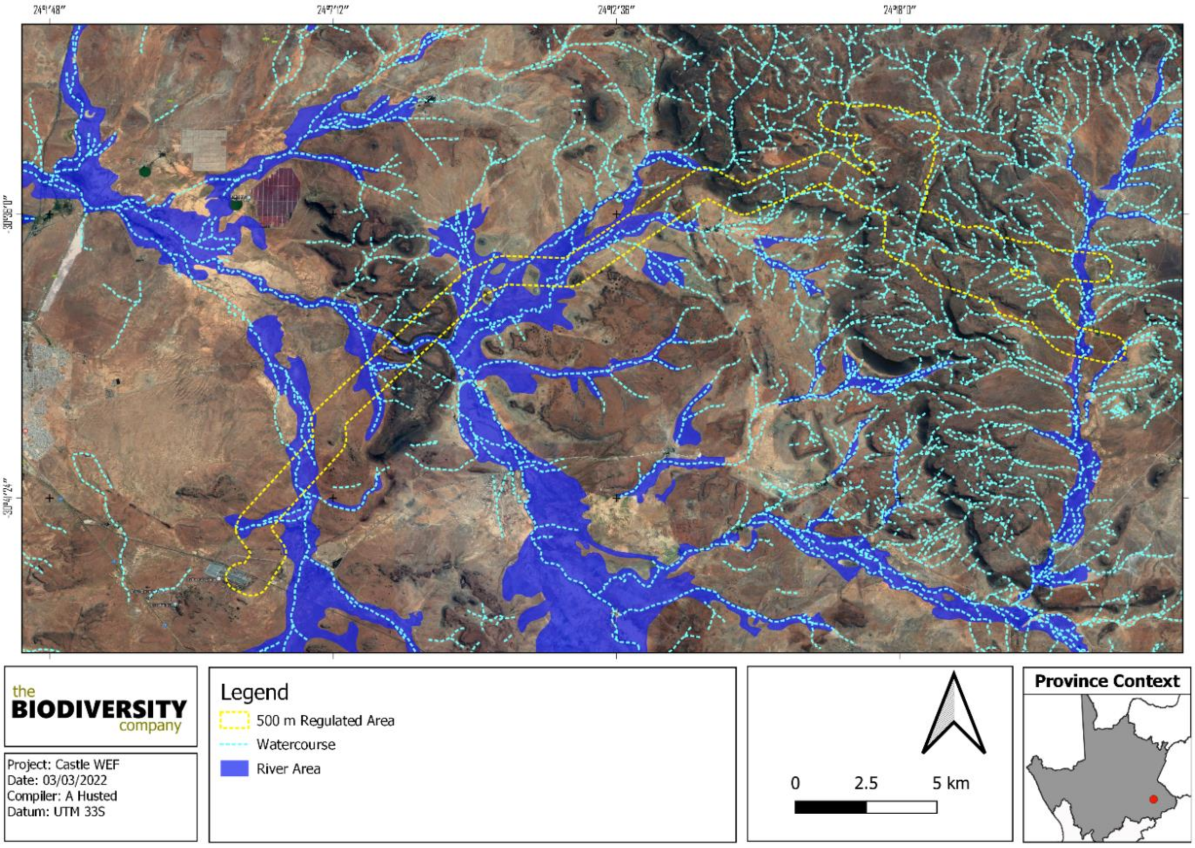


Figure 4-3 The river features associated with the regulation area

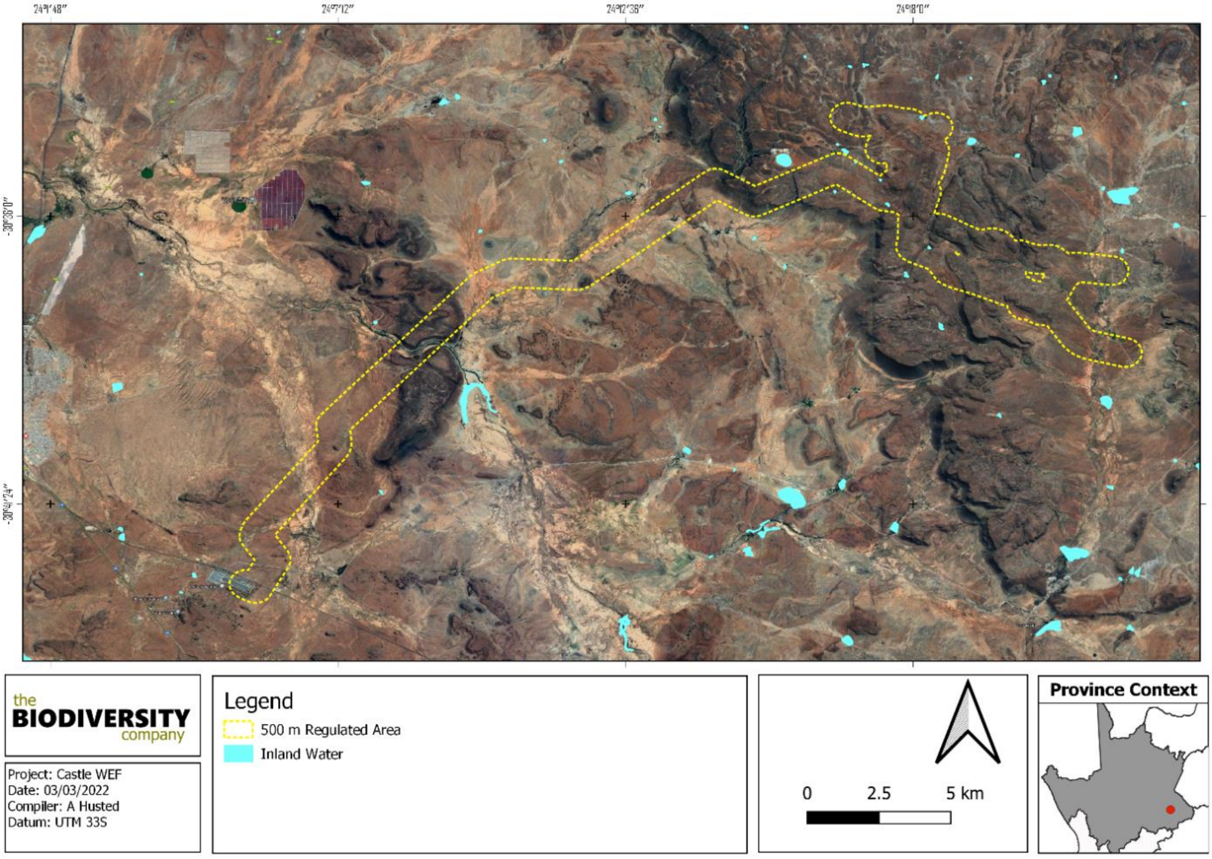


Figure 4-4 The inland water features associated with the regulation area

4.1.4 Vegetation Type

The regulation area is situated within two biomes, the Grassland and Nama Karoo biomes.

Nama Karoo Biome, which is a large, landlocked region on the central plateau of the western half of South Africa and extends into south-eastern Namibia. This is an arid biome with majority of the river systems being non-perennial. Apart from the Orange River and the few permanent streams in the southwest that originate in higher-rainfall neighbouring areas, the limited number of perennial streams that originate in the Nama-Karoo are restricted to the more mesic east. The low precipitation is unreliable (coefficient of variation of annual rainfall up to 40%) and droughts are unpredictable and prolonged. The unpredictable rainfall impedes the dominance of leaf succulents and is too dry in summer for dominance by perennial grasses alone, and the soils are generally too shallow, and the rainfall is too low for trees. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism.

The Grassland biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

- Seasonal precipitation; and
- The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees.

On a fine-scale vegetation type, the project area overlaps with Besemkaree Koppies Shrubland and Northern Upper Karoo (Figure 4-5).

The Northern Upper Karoo is described as follows:

Conservation – No portion conserved in statutory conservation areas. About 4% has been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by building of dams. Areas of human settlements are increasing in the north-eastern part of this vegetation type. Prosopis glandulosa, regarded as one of the most important invasive alien plants in South Africa, is widely distributed in this vegetation type.

The Besemkaree Koppies Shrubland is described as follows:

Conservation - About 5% statutorily conserved in the Rolfontein, Tussen Die Riviere, Oviston, Gariep Dam, Caledon and Kalkfontein Dam Nature Reserves. In addition, a small patch is also protected in the private Vulture Conservation Area. About 3% of the area has been lost through building of dams. Erosion varies from low to high.

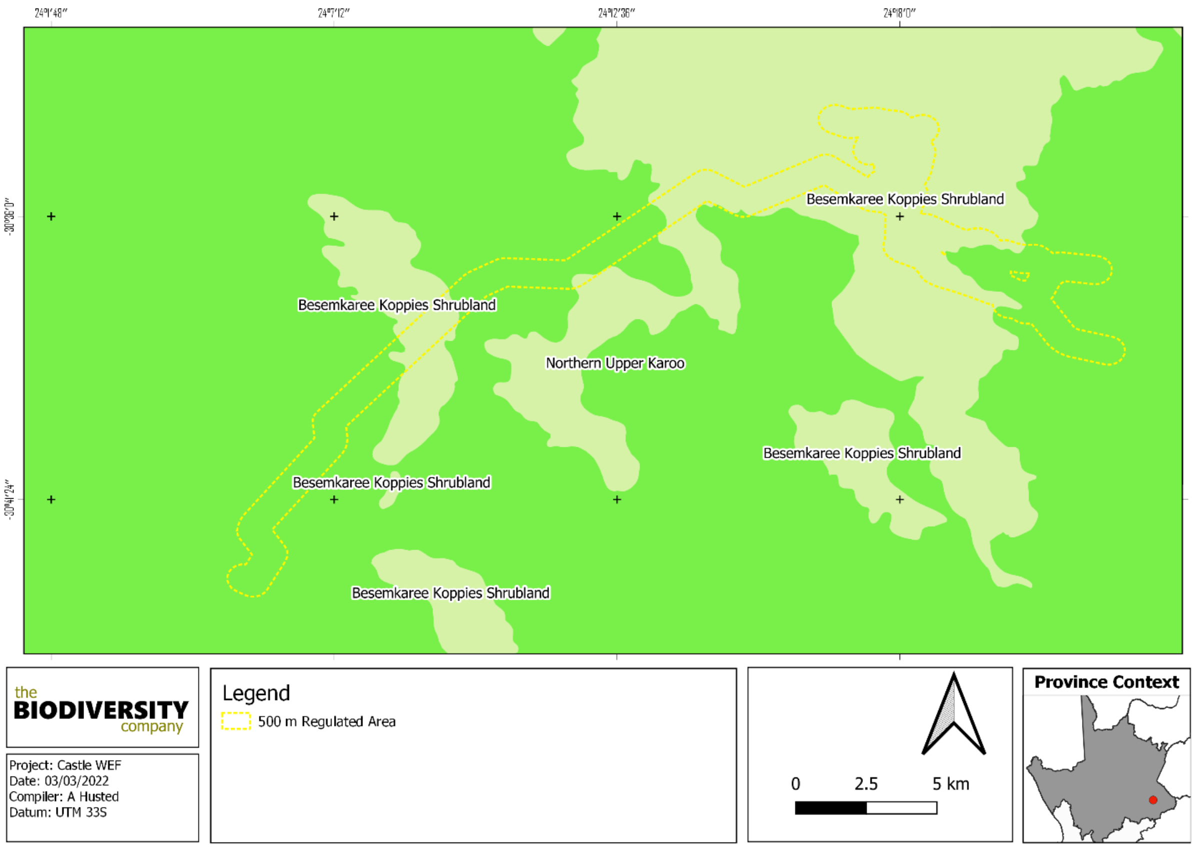


Figure 4-5 Map illustrating the vegetation types associated with the regulation area

4.2 Field Assessment

The following sections provide the results from the field survey for the proposed development that was undertaken during the 24th to the 28th of January 2022.

4.2.1 Classification and Extent

Based on a combination of desktop and in-field delineation, a total of seven (7) individual wetland hydrogeomorphic (HGM) units were identified and delineated within the AOI as defined by 500 m regulated area applied to the project area (Figure 4-6). Further to this, a network of drainage lines was also identified and delineated for the areas.

To facilitate the practical assessment of these wetlands, a novel classification system was devised that expands upon the level 1-4 national wetland classification system (Ollis *et al.,* 2013). First all of the wetlands were grouped into one of four main HGM types following Ollis *et al*. (2013). These included channeled valley bottoms (CVB), unchanneled valley bottoms (UCVB), depressions, and seeps. It was then necessary to increase the resolution of the assessment in a way that was both intuitive and ecologically meaningful to prioritise wetlands in lieu of the planned reserve determination.

To do this the wetlands were further classified under two criteria namely ecological state and degree of saturation[1]. In terms of ecological state, known PES ratings and current fieldwork results were used to classify each wetland as either (1) intact (largely natural to moderately modified) or (2) disturbed (largely modified to seriously modified). Lastly all wetlands were further classified following the principles of the Ollis *et al*. (2013) level 5 classification which considers hydroperiod, with each wetland being classified as either (a) perennial (permanently to seasonally inundated) or (b) non-perennial (seasonally to temporarily inundated). This yielded four main wetland groups into which each of the three main HGM types were classified namely (1a) intact-perennial, (1b) intact-non-perennial, (2a) disturbed-perennial and (2b) disturbed-non-perennial. This classification system yielded a total of 7 wetland subgroups or (hereafter called HGM units), these were each subjected to detailed assessment.

This classification represents a combination of both top down (landscape level classifications) and bottom up (by saturation level and degree of degradation based on landcover and, prior knowledge and fieldwork observation) classification approaches. A combination of top-down and bottom-up approaches to wetland classification is advocated by Sieben *et al*. (2018) on the premise that it provides the maximum information value for ecosystem service determination. The approach employed here, places emphasis on wetland classification by ecosystem services provision and the rationale behind this is that it the ecosystem services provided by a wetland provides the most useful and biologically meaningful interpretation of a wetland's value. The objective of the top-down, bottom-up approach was to uncover a simple and intuitive yet biologically meaningful classification that would allow for the thorough and repeatable scoring of a much smaller grouping of wetlands to uncover a gradient in their ecosystem services provision and therefore their overall importance which in turn would allow for the prioritisation of wetlands for reserve determination.

The level 1-4 classification of these HGM units as per the national wetland classification system (Ollis *et al.,* 2013) is presented in Table 4-1. Maps showing the extent of the wetland areas for Castle WEF are presented in Figure 4-6 - Figure 4-10.

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[1] It is important to note that this approach allows for the intuitive ordering of the wetland subgroups being assessed from higher (intact and permanently saturated) to lower (disturbed and temporarily saturated) ecological importance. It is based on the premise that (given similar catchment influences) wetlands that are more intact and saturated are likely to be of higher ecological importance and provide greater ecosystem services than those are more impacted and drier. This classification approach was devised in consideration of the need to prioritise wetlands for future reserve determination. It was opted for over a catchment-based approach as it provides a more ecologically meaningful classification while at the same time reducing the number of assessment units to a more manageable subset for the upcoming reserve determination.

Table 4-1 Wetland classification as per SANBI guideline (Ollis et al. 2013) for the Castle WEF AOI

Wetland System	Level 1	Level 2		Level 3	Level 4		
	System	**DWS Ecoregion/s**	**NFEPA Wet Veg**	**Landscape Unit**	**4A (HGM)**	**4B**	**4C**
			Group 1b				
HGM1	Inland	Nama Karoo	Dry Highveld Grassland Group 2	Valley Floor	CVB	N/A	N/A
			Group 2a				
HGM2	Inland	Nama Karoo	Dry Highveld Grassland Group 2, & Upper Nama Karoo	Valley Floor	CVB	N/A	N/A
			Group 2b				
HGM3	Inland	Nama Karoo	Dry Highveld Grassland Group 2, & Upper Nama Karoo	Valley Floor	CVB	N/A	N/A
HGM4					UCVB	N/A	N/A
HGM5					UCVB	N/A	N/A
HGM6				Plain	Depression	Endorheic	Without Channelled inflow
HGM7				Slope	Seep	With Channelled outflow	N/A

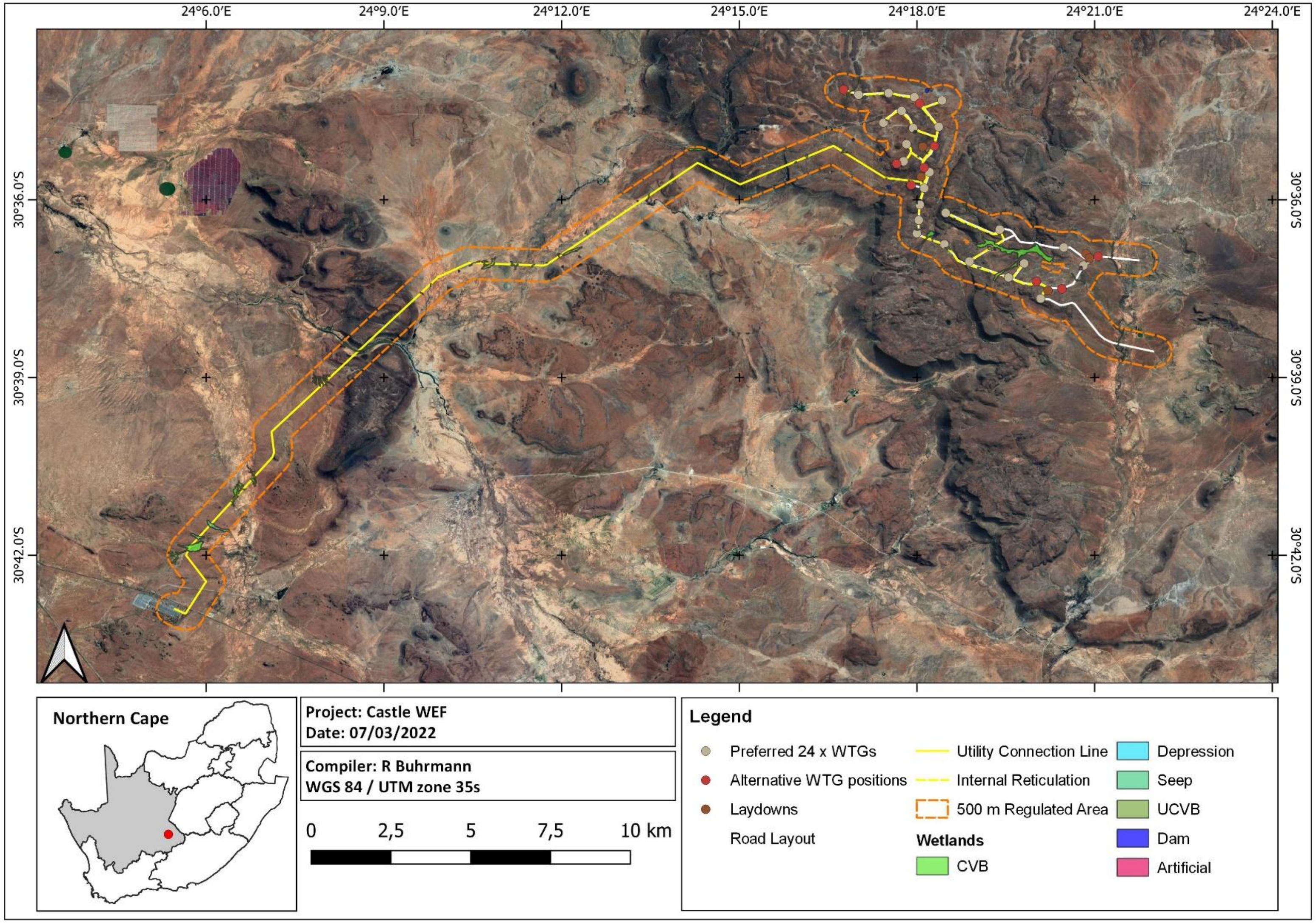

Figure 4-6 Wetlands within the Castle WEF AOI

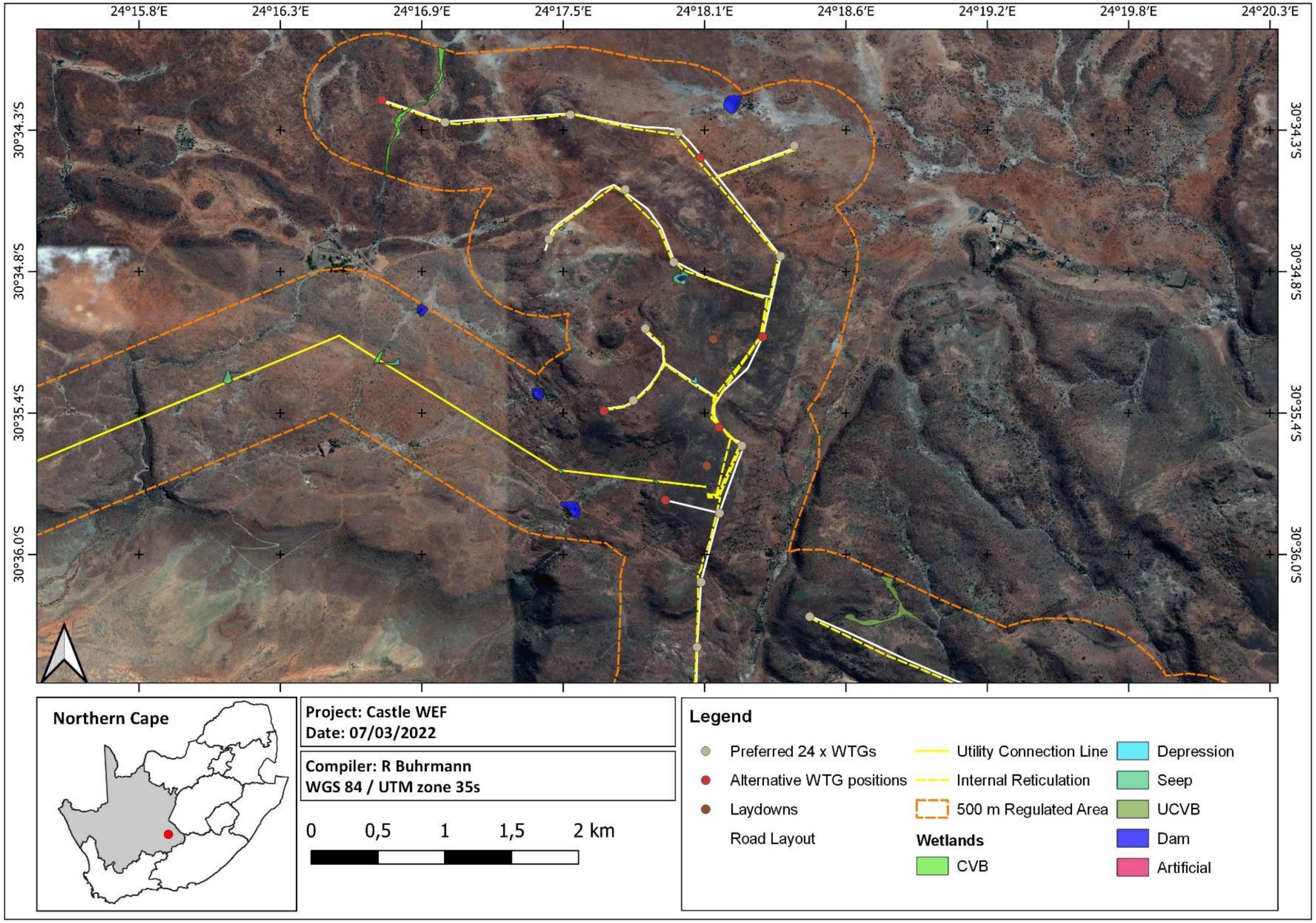

Figure 4-7 ***Wetlands within the Castle WEF AOI (Northern)***

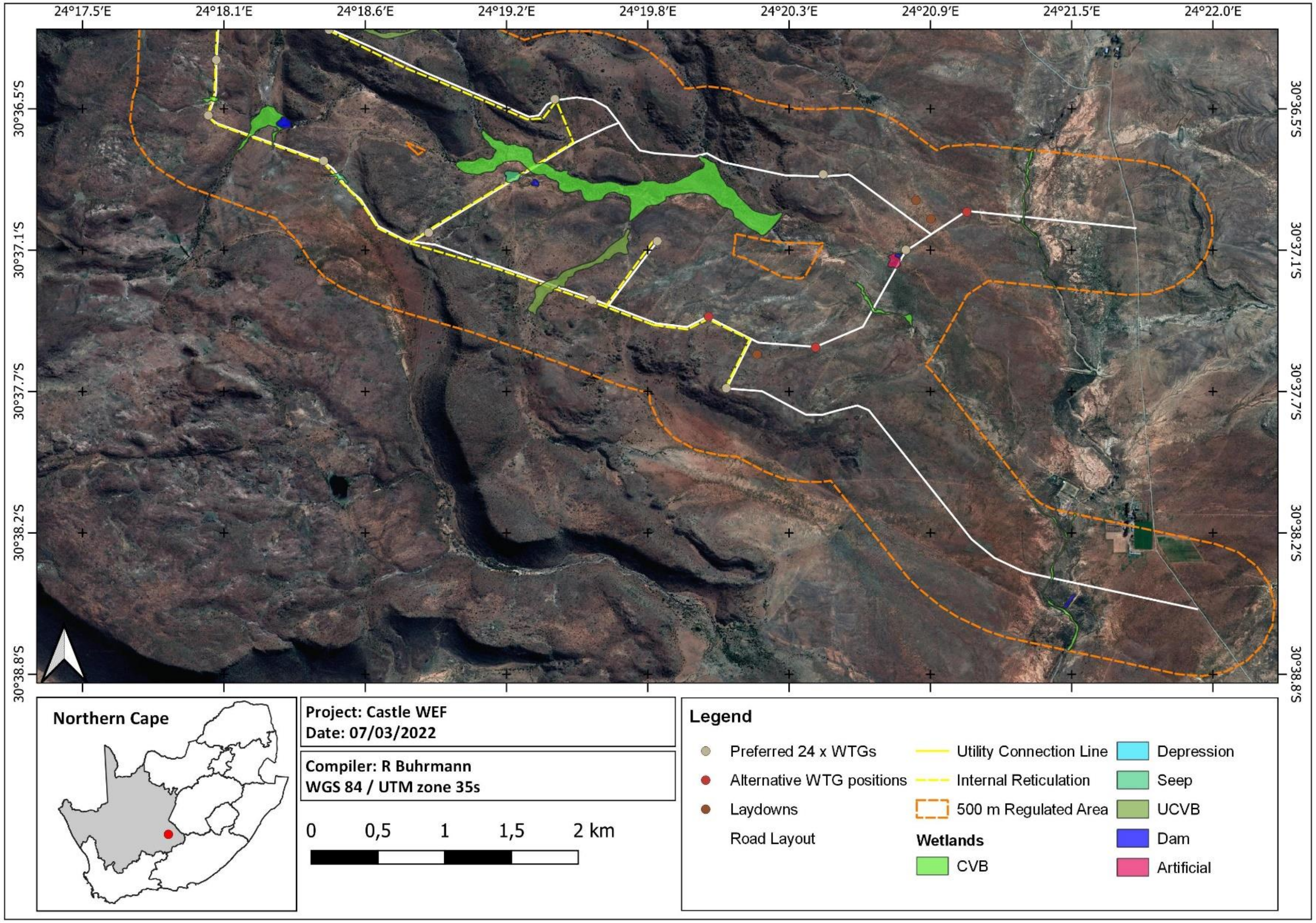

Figure 4-8 *Wetlands within the Castle WEF AOI (North Eastern)*

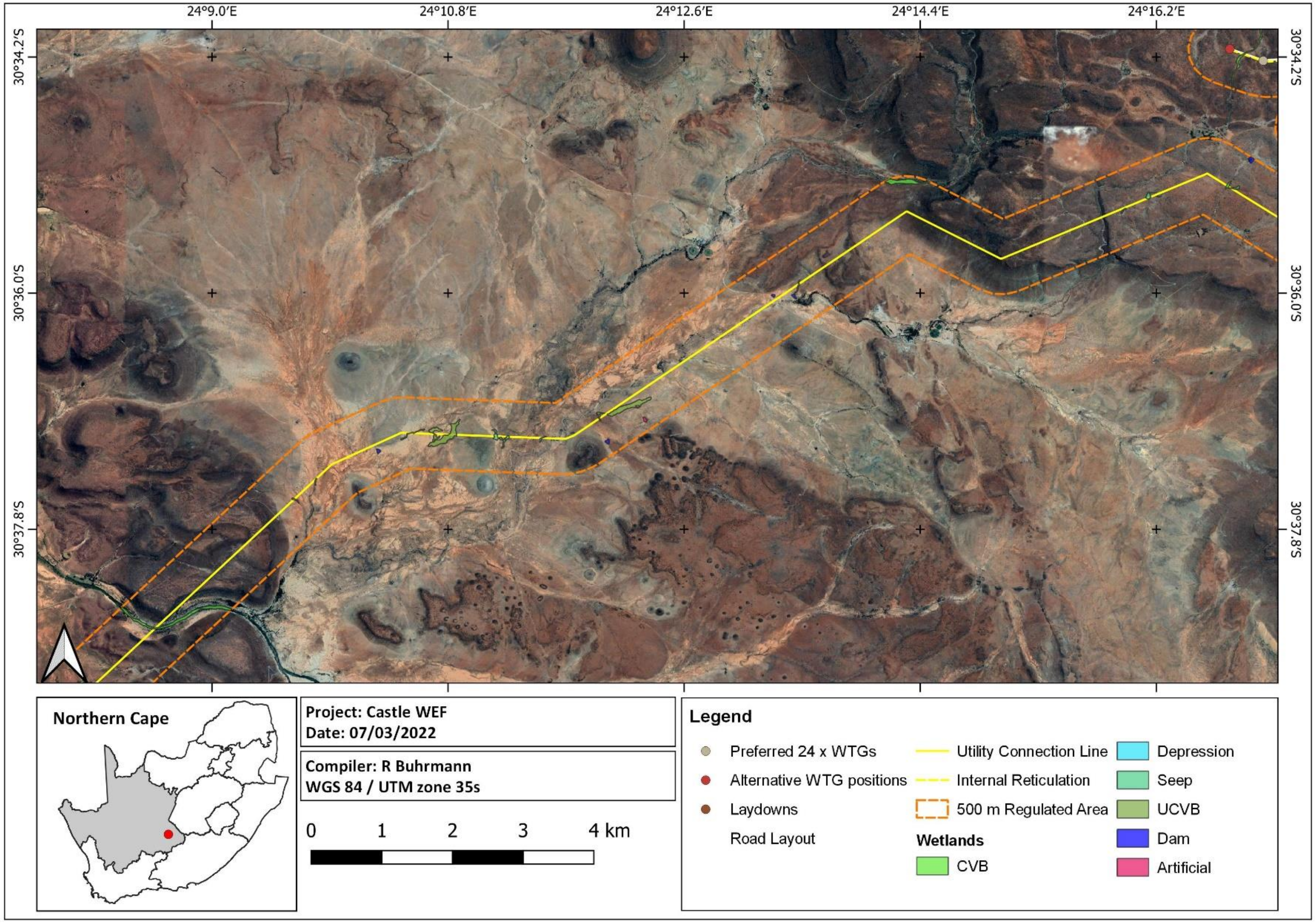

Figure 4-9 Wetlands within the Castle WEF AOI (Central)

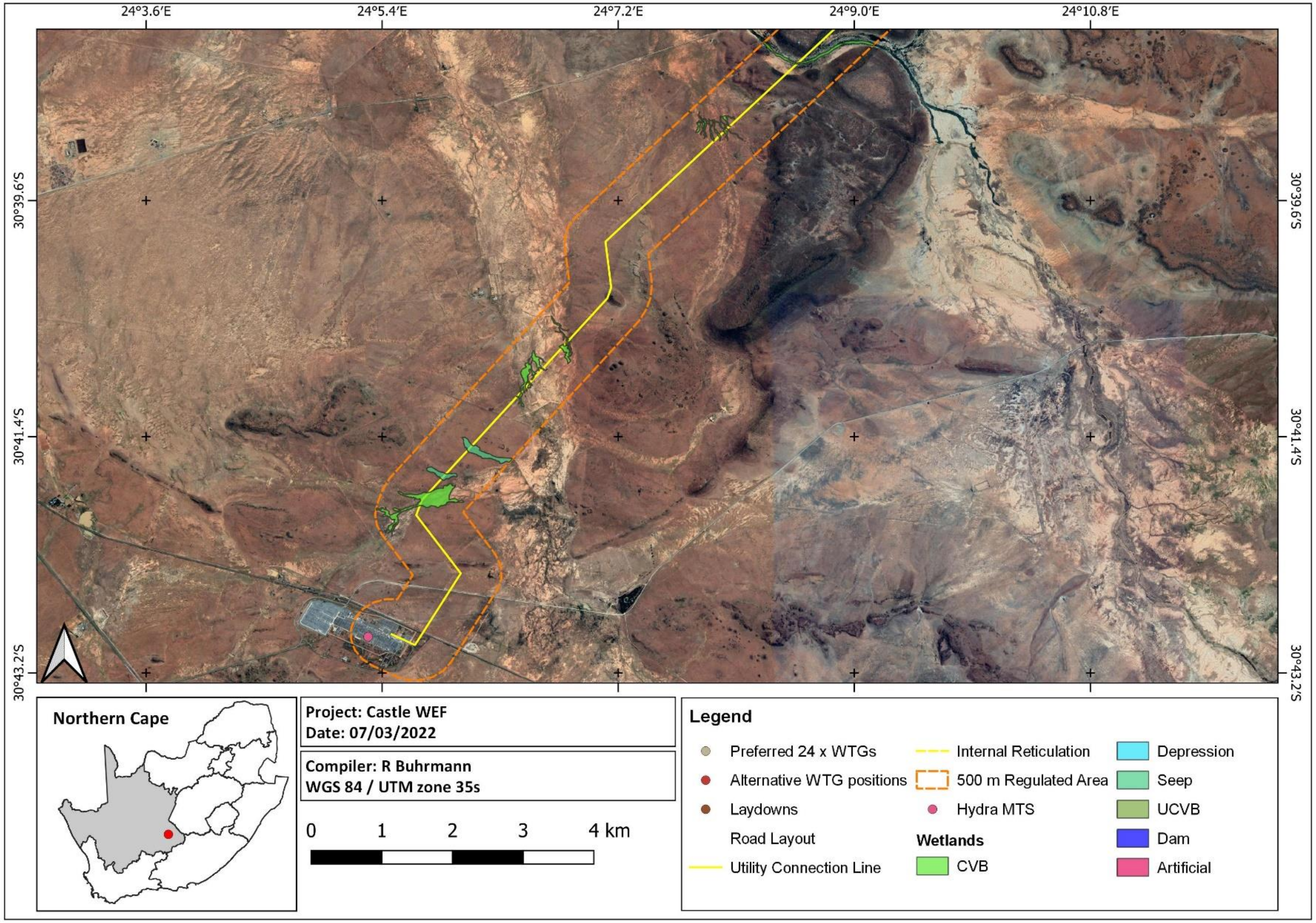

Figure 4-10 Wetlands within the Castle WEF AOI (Southern)

4.2.2 Wetland Characteristics

4.2.2.1 Hydrogeomorphology

Figure 4-11 presents a diagram of the HGM units, showing the dominant movement of water into, through and out of the various wetland HGM types (Ollis *et al*., 2013). A total of seven (7) wetland HGM units were identified for the Castle WEF area, representing four HGM types namely channelled valley bottoms (CVB), unchannelled valley bottoms (UCVB), depressions, and seeps wetlands. A general description of the wetland HGM types is provided below.

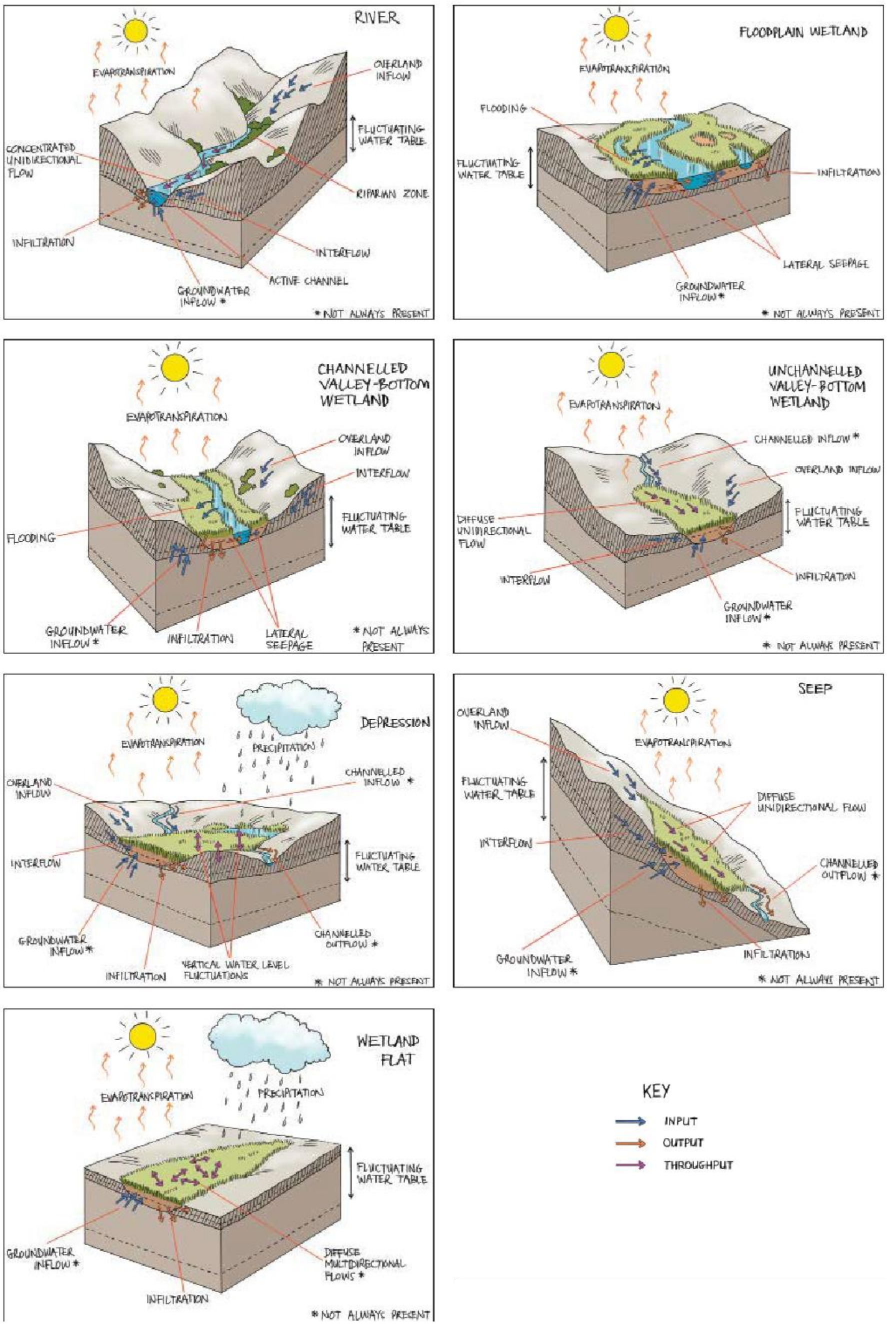

Figure 4-11 Amalgamated diagram of the wetland units, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

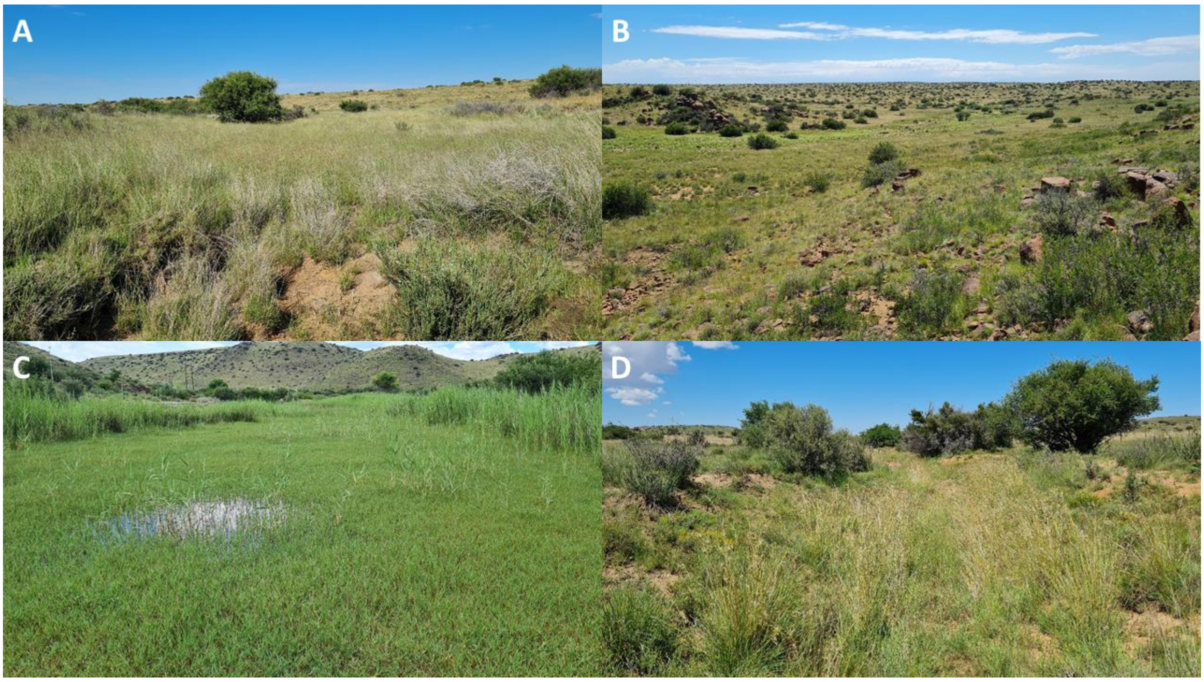

Figure 4-12 ***Wetland HGM units identified within for the Castle WEF regulated area. A) CVB wetland – 1b classification. B) UCVB wetland – 1b classification. C) CVB wetland – 2a classification. D) CVB wetland – 2b classification.***

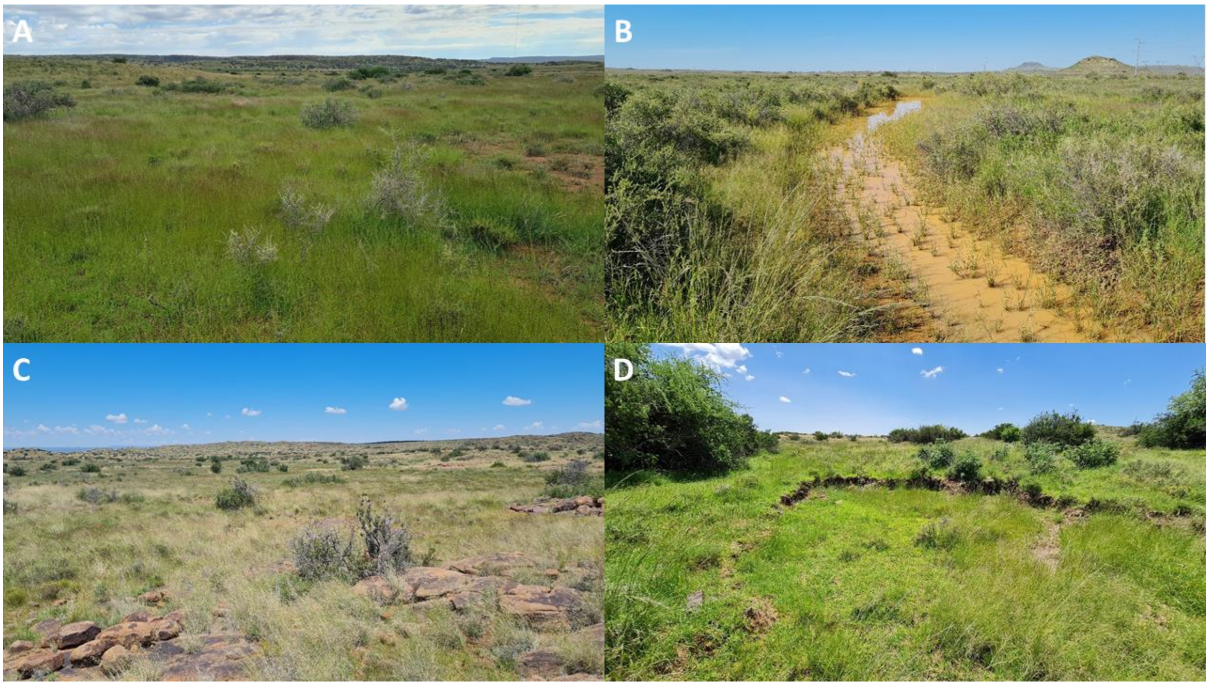

Figure 4-13 ***Wetland HGM units identified within for the Castle WEF regulated area. A) UCVB wetland – 2b classification. B) Depression wetland – 2b classification. C & D) Seep wetlands – 2a classification.***

4.2.2.2 General HGM Functional Descriptions

Channelled valley-bottom wetlands tend to contribute less to sediment trapping and flood attenuation than other systems. Channelled valley-bottom wetlands are well known to improve the assimilation of toxicants, nitrates and sulphates, especially in cases where sub-surface flows contribute to the systems' water source, (Kotze et al., 2009).

Unchanneled valley bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes. The shallow depths of surface water within this system adds to the degradation of toxic contaminants by means of sunlight penetration.

Hillslope seeps are well documented by (Kotze et al., 2009) to be associated with sub-surface ground water flows. These systems tend to contribute to flood attenuation given their diffuse nature. This attenuation only occurs while the soil within the wetland is not yet fully saturated. The accumulation of organic material and sediment contributes to prolonged levels of saturation due to this deposition slowing down the sub-surface movement of water. Water typically accumulates in the upper slope (above the seep). The accumulation of organic matter additionally is essential in the denitrification process involved with nitrate assimilation. Seeps generally also improve the quality of water by removing excess nutrient and inorganic pollutants originating from agriculture, industrial or mine activities. The diffuse nature of flows ensures the assimilation of nitrates, toxicants and phosphates with erosion control being one of the EcoServices provided very little by the wetland given the nature of a typical seep’s position on slopes.

The generally impermeable nature of depressions and their inward draining features are the main reasons why the streamflow regulation ability of these systems is mediocre. Regardless of the nature of depressions in regard to trapping all sediments entering the system, sediment trapping is another EcoService that is not deemed as one of the essential services provided by depressions, even though some systems might contribute to a lesser extent. The reason for this phenomenon is due to winds picking up sediments within pans during dry seasons which ultimately leads to the removal of these sediments and the deposition thereof elsewhere. The assimilation of nitrates, toxicants and sulphates are some of the higher rated EcoServices for depressions. This latter statement can be explained the precipitation as well as continues precipitation and dissolving of minerals and other contaminants during dry and wet seasons respectively (Kotze et al., 2009).

4.2.2.3 Vegetation

Vegetation is used as the primary wetland indicator. However, whilst wetland vegetation is adapted to life in saturated soil under normal circumstances, such features are not always present in arid to semi-arid environments such as the Northern Cape (based on experience within the region) due to the typically arid conditions of the region. The arid and temporary nature of these wetland systems has limited the number of wetland indicator species, and therefore soils were the predominant characteristic used to identify wetlands.

4.2.2.4 Hydromorphic Soils

According to (DWAF, 2005), soils are the most important characteristic of wetlands in order to accurately identify and delineate wetland areas. The Hutton soil form was prevalent throughout the Castle WEF and consists of an Orthic topsoil on top of a Red Apedal horizon.

Figure 4-14 ***Examples of soils identified for wetland systems. A) Alluvial deposits, B) Red apedal horizon, C) Orthic topsoil with signs of wetness, D) Gley horizon.***

4.2.3 Wetland Health

The present ecological state (PES) of the wetlands identified within the 500 m regulated area is provided in Table 4-2. Some notable impacts include (Figure 4-15);

- Grazing;
- Dams;
- Dirt roads; and,
- Erosion.

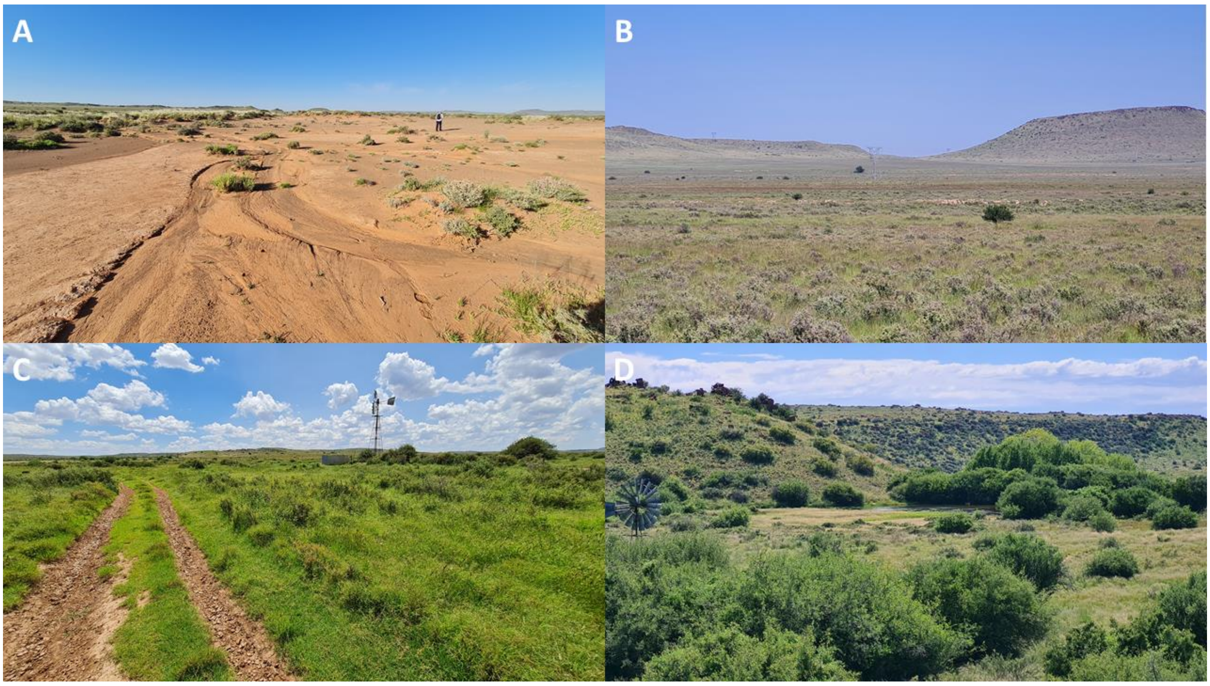

Figure 4-15 ***Aspects impacting the delineated systems; A) Erosion, B) Livestock and overgrazing, C) Dirt roads, D) Dams.***

Table 4-2 Summary of the scores for the wetland PES for the Castle WEF AOI

Unit	PES			
	Hydrology	Geomorphology	Vegetation	Overall
Group 1b				
HGM 1 – CVB	3.0	2.5	2.8	2.8
	Moderately Modified (Class C)	Moderately Modified (Class C)	Moderately Modified (Class C)	Moderately Modified (Class C)
HGM 4 – UCVB	3.0	2.9	2.5	2.8
	Moderately Modified (Class C)	Moderately Modified (Class C)	Moderately Modified (Class C)	Moderately Modified (Class C)
Group 2a				
HGM 2 – CVB	4.0	3.7	3.2	3.7
	Largely Modified (Class D)	Moderately Modified (Class C)	Moderately Modified (Class C)	Moderately Modified (Class C)
Group 2b				
HGM 3 – CVB	4.5	4.3	5.2	4.6
	Largely Modified (Class D)	Largely Modified (Class D)	Largely Modified (Class D)	Largely Modified (Class D)
HGM 5 – UCVB	4.5	3.6	4.8	4.3
	Largely Modified (Class D)	Moderately Modified (Class C)	Largely Modified (Class D)	Largely Modified (Class D)
HGM 6 – Depression	4.0	4.2	4.2	4.1
	Largely Modified (Class D)	Largely Modified (Class D)	Largely Modified (Class D)	Largely Modified (Class D)
HGM 7 – Seep	4.5	5.2	5.4	5.0
	Largely Modified (Class D)	Largely Modified (Class D)	Largely Modified (Class D)	Largely Modified (Class D)

4.2.4 Importance and Sensitivity

The Importance and Sensitivity ratings for each of the wetland HGM units is provided below. Several factors were considered when establishing the IS of the various wetlands. Regional to national scale considerations included NFEPA river or wetland status, protected areas as well as Ramsar wetlands. Local considerations included habitat integrity and diversity, likelihood of supporting conservation important species and potential for hosting significant congregations of local or migratory species.

At a regional scale the NFEPA Wetveg database recognises CVB, UCVB, and Seeps within the Upper Nama Karoo and Dry Highveld Grassland Group 2 as Critically Endangered and Not Protected (Nel *et al*., 2011), whereas depressions are recognised as Vulnerable and Not Protected. The following was also considered for the IS description for each AOI:

- They are not located within a Strategic Water Source Area;
- The Northern Upper Karoo and Besemkaree Koppies Shrubland is Least Concern;
- The project area does overlap with Critical Biodiversity Areas One; and
- The project area does overlap with Ecological Support Areas.

Table 4-3 Ecological importance and sensitivity for the Castle WEF AOI

HGM Type	Wet Veg			NBA Wetlands		SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018		

CVB	Upper Nama Karoo; Dry Highveld Grassland Group 2	Critically Endangered	Not Protected	D/E/F	Critically Endangered	No	**High**
UCVB		Critically Endangered	Not Protected	A/B	Critically Endangered	No	**High**
Depression		Vulnerable	Not Protected	A/B	Vulnerable	No	**Low**
Seep		Critically Endangered	Not Protected	C	Critically Endangered	No	**High**

4.2.5 Ecosystem Services

The ecosystem services provided by the wetlands identified were assessed and rated using the WET-EcoServices method (Kotze *et al*. 2008) (Table 4-4).

Overall, the wetlands generally provide important indirect regulating and supporting services relating to flood attenuation, streamflow regulation, sediment trapping and nutrient and toxicant removal. As the wetlands are not situated in a rural community setting (prevailing land use being grazing), the wetlands are not considered important from a cultural perspective nor in terms the direct provision of water and harvestable resources on a subsistence level.

The wetlands are also generally considered relatively important from a biodiversity maintenance perspective, supporting a unique and diverse floral assemblage while providing important foraging and movement corridors for a wide diversity of wetland associated fauna.

Of all the HGM units, HGM 1 and 4 provide the highest levels of ecosystem services with an overall score of Moderately High. Specifically, the systems play an important role in erosion control and carbon storage. The valley bottom wetlands with their broad, shallow flow paths and high saturation levels allow for the slow diffuse flows and consequently efficient trapping of sediments and assimilation of nutrients and toxicants. These aspects also make them important from a streamflow regulation perspective

The seeps likely play an important role in stream flow regulation and recharge for the catchment particularly during low flow periods.

Table 4-4 The ecosystem services being provided by the HGM units for the Castle WEF AOI

				Wetland Unit	**HGM1**	**HGM2**	**HGM3**	**HGM4**	**HGM5**	**HGM6**	**HGM7**
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits		Flood attenuation	**2.0**	**1.4**	**1.7**	**1.9**	**1.7**	**2.0**	**1.9**
				Streamflow regulation	**1.4**	**1.3**	**1.5**	**1.7**	**1.5**	**1.4**	**1.7**
			Water Quality enhancement benefits	Sediment trapping	**1.9**	**1.5**	**1.4**	**2.5**	**1.9**	**0.9**	**2.3**
				Phosphate assimilation	**1.7**	**1.6**	**1.5**	**1.8**	**1.5**	**1.2**	**1.8**
				Nitrate assimilation	**1.8**	**1.7**	**1.5**	**1.9**	**1.4**	**1.4**	**1.9**
				Toxicant assimilation	**1.6**	**1.4**	**1.4**	**1.5**	**1.5**	**1.2**	**2.1**
				Erosion control	**2.4**	**1.9**	**1.8**	**2.7**	**2.1**	**2.4**	**1.8**
				Carbon storage	**2.7**	**1.4**	**1.4**	**3.1**	**2.3**	**2.7**	**2.0**
	Direct Benefits			Biodiversity maintenance	**2.8**	**1.6**	**1.6**	**2.8**	**1.8**	**2.8**	**1.3**
		Provisioning benefits		Provisioning of water for human use	**1.3**	**1.4**	**1.2**	**1.3**	**1.3**	**1.4**	**0.8**
				Provisioning of harvestable resources	**1.7**	**1.5**	**1.3**	**1.8**	**1.5**	**1.8**	**0.2**
				Provisioning of cultivated foods	**1.8**	**1.7**	**1.6**	**1.7**	**1.6**	**1.8**	**0.2**
		Cultural benefits		Cultural heritage	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
				Tourism and recreation	**2.4**	**2.0**	**1.9**	**2.4**	**2.0**	**2.4**	**0.7**
				Education and research	**2.8**	**1.8**	**1.5**	**2.8**	**1.8**	**2.8**	**0.3**
				Overall	**29.6**	**23.2**	**22.3**	**30.9**	**24.9**	**27.2**	**20.0**

Average	**2.0**	**1.5**	**1.5**	**2.1**	**1.7**	**1.8**	**1.3**

4.2.6 Sensitivity and Buffer Analysis

The “*Buffer zone guidelines for wetlands, rivers and estuaries*” (Macfarlane *et al.,* 2014) was used to determine the appropriate wetland buffer zone for the proposed WEF.

The wetland buffer zone tool was used to calculate the appropriate buffer required for the powerline and also turbine developments. The model shows that the largest threat (High) posed during the construction phases is that of “increased sediment inputs and turbidity” for both developments. During the operational phase a moderate risk is posed by the possible “alteration to flow volumes”.

According to the buffer guideline (Macfarlane, *et al.,* 2014) a high-risk activity would require a buffer that is 95% effective to reduce the risk of the impact to a low-level threat.

The risks were then reduced to Low with the prescribed mitigation measures and therefore the recommended buffer was calculated to be 15 m and 30 m (Table 4-5) for the construction and operational phases for the powerline and turbine developments respectively.

Table 4-5 Post-mitigation buffer requirement

Required Buffer after mitigation measures have been applied	
Powerline	**15 m**
Turbine (and associated infrastructure)	**30 m**

A conservative buffer zone was suggested of 30 m for the construction and operation phases of the turbine development, this buffer is calculated assuming mitigation measures are applied. The buffer zone will not be applicable for proposed infrastructure that traverse wetland areas, however, for all secondary activities such as laydown yards and storage areas, the buffer zone must be implemented.

5 Risk Assessment

A risk assessment was conducted in line with Section 21 (c) and (i) of the National Water Act, 1998, (Act 36 of 1998) to investigate the level of risk posed by proposed project, namely the WEF and powerline. The risks posed by the proposed development to wetlands within the project areas are provided in the following tables for scenarios with and without mitigation. Three levels of risk have been identified and determined for the overall risk assessment, these include low, medium and high risk. High risk areas are associated with wetlands that will be directly impacted on by the proposed developments. Medium risk refers to wetland areas that are either on the periphery of the infrastructure and at an indirect risk, or wetland areas that could be avoided if feasible. Low risk areas are wetland systems beyond the project area that would be avoided. No high risks are expected for the WEF or powerline developments.

The high and medium risk areas were the priority for the risk assessment, focussing on the expected loss of wetland areas and the potential indirect risks. As a result of the likely loss of wetland areas, all aspects considered for the risk assessment pose a Moderate level of risk. The loss of wetland areas cannot be effectively mitigated, and in accordance with the mitigation hierarchy some form of compensation would be required.

5.1 WEF

No wetlands are directly affected by the proposed turbine footprint areas, with all the proposed turbines being beyond the recommended 30 m buffer area. A number of wetland systems are traversed by the proposed road network, and these crossings will be a key consideration for the risk assessment.

During construction (and without mitigation) the clearing and preparation of the crossing areas will lead to the disturbance and degradation of wetland vegetation, altering the hydrological regimes for these systems. These hydrological changes would potentially result in erosion of the systems. The clearing of these crossing areas, including portions of the larger road network and operation of vehicles/equipment may lead to increased sediment loads and contamination of wetlands and eutrophication of wetland systems with human sewerage and litter. It is also assumed that all non-essential aspects for the project not required for the crossings would adhere to 30 m buffer areas.

The constructed crossings may likely result in prolonged alterations to the hydrology of the surface run-off of the systems, but this is only expected for the wet season period. The concentrated flows may result in erosion of the downstream reaches. The continued use of the roads for access may continue to increase sediment loads and hydrocarbon contamination of wetlands. The management of stormwater is important for the minimisation of impacts to the receiving wetlands. Risks associated with decommissioning the road infrastructure centre on vegetation degradation from vehicle access and increased bare surfaces, runoff and potential for erosion from the removal of the infrastructure. A number of mitigation measures are provided in Table 5-2 which would, if implemented effectively, reduce the significance of all anticipated impacts to a more acceptable level. Due to the direct impacts posed to some wetland areas, and the prolonged nature of these impacts, the changes to the hydrology of these systems is expected to be Moderate for the relevant aspect in spite of mitigation measures.

Due to the Low post-mitigation risks identified for the proposed road crossings, it is the opinion of the specialist that the proposed development of the WEF should warrant a General Authorisation in terms of water use licensing.

Table 5-1 ***DWS Risk Impact Matrix for the proposed WEF (Andrew Husted Pr Sci Nat 400213/11)***

				Severity															
Activity	**Aspect**	**Impact**	**Mitigation Scenario**	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**	**Frequency of activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance**	**Risk Rating**	**Control Measures**
Construction																			
Site clearing and preparation	Clearing of vegetation and stripping and stockpiling topsoil as well as storage of equipment.	Direct loss, disturbance, and degradation of wetlands.	Without	3	2	3	3	2.8	3	2	7.8	3	2	5	1	11	85	**M**	• Minimize the disturbance footprint and the unnecessary clearing of vegetation outside of this area. • Educate staff and relevant contractors on the location and importance of the identified wetlands through toolbox talks and by including them in site inductions as well as the overall master plan. • Begin construction of the structures furthest down the system, working up the catchment. • Restrict all construction related activities to the structure footprint area. • Access construction areas by means of the shorted or least intrusive route through the wetland. Prioritize existing routes where possible. • Adhere to the prescribed wetland buffers. Restrict all non-essential activities (e.g. cement mixing and equipment wetland machinery storage) to outside of wetlands and their prescribed buffers. • Request the wetland spatial data, load it onto a GPS and use it to mark out the positions to plan for the required activities to reduce the disturbance footprint and the unnecessary clearing of vegetation. • Demarcate the construction area as well as the prescribed m buffer on the ground (e.g. painted wooden poles). • Construct as far as possible during winter when flow volumes are lowest. This will reduce impacts to wetlands due to soil poaching and vegetation trampling under
			With	2	2	2	2	2	2	1	5	2	2	5	1	10	50	**L**	

				Severity															
Activity	Aspect	Impact	Mitigation Scenario	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
																			peak saturation levels. Additionally, the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest during this time. • Promptly remove / control all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed. • Minimize unnecessary clearing of vegetation. • Landscape and re-vegetate all denuded areas as soon as possible.
		Increased bare surfaces, runoff and potential for erosion	Without	3	3	3	3	3	3	2	8	3	3	5	1	12	96	M	• Keep cleared and excavated area neat and tidy. Separate topsoil and sub-soil, and backfill in same order. • Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. • Mixing of concrete must under no circumstances take place in any wetland or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished. • Do not situate any of the construction material laydown areas within any wetland. • No machinery should be allowed to parked in any wetlands. Only machinery and equipment required to be in the wetlands is permitted, and must be operational. • Ensure topsoil is spread back over the cleared area. • Flatten and lightly till (no deeper than 30 cm) excavated / cleared areas to encourage vegetation establishment as soon as possible.
			With	2	2	1	1	1.5	2	2	5.5	2	2	5	1	10	55	L	
			Without	1	1	3	2	1.8	3	2	6.8	3	3	5	1	12	81	M	

Activity	Aspect	Impact	Mitigation Scenario	Severity					Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
				Flow Regime	Water Quality	Habitat	Biota	Severity											
		Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation	With	1	1	2	1	1.3	2	2	5.3	3	1	5	1	10	53	L	• Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed. • The use of herbicides is not recommended in or near wetlands (opt for mechanical removal). • Appropriately stockpile topsoil cleared from the project area. This can be used for rehabilitation of the intervention areas. • Clearly demarcate construction footprint, and limit all activities to within this area. • Minimize unnecessary clearing of vegetation. • Landscape and re-vegetate all denuded areas as soon as possible.
Installation of infrastructure	Site excavation and installation of material and structures	Increased sediment loads to downstream reaches and altered hydrology	Without	4	4	3	3	3.5	3	2	8.5	3	3	1	3	10	85	M	• See mitigation for increased bare surfaces, runoff, and potential for erosion • Re-instate topsoil and lightly till disturbance footprint. • Prioritise construction during the dry season, starting with the structure furthest down the system. • Excavations must only be made on a need basis and not left open. Excavations must preferably be either filled with gabions or backfilled within a day of the cut. • Structure should be dredged as construction progresses up the catchment and excessive sediment deposition is evident at a structure. • Implement rehabilitation of the areas as soon as possible for each structure, prioritise that vegetation has re-established. • Ensure culverts are correctly installed and set. Maximum size culverts are
			With	2	3	2	2	2.3	2	2	6.3	3	2	1	2	8	50	L	

				Severity															
Activity	Aspect	Impact	Mitigation Scenario	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
																			preferred, and the number of culverts should span the width of the channel. Avoid concentrating flows through a minimum number of culverts.
		Contamination of wetlands with hydrocarbons due to machinery leaks and eutrophication of wetland systems with human sewerage and other waste.	Without	2	3	2	3	2.5	3	2	7.5	3	3	1	3	10	75	M	• Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. • Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the wetland. • Regularly maintain stormwater infrastructure, pipes, pumps and machinery to minimise the potential for leaks. Check for oil leaks, keep a tidy operation, install bins and promptly clean up any spills or litter. • Provide appropriate sanitation facilities during construction and service them regularly. Alternatively provide off-site facilities for staff. No indiscriminate use of the wetland area for ablutions may be permitted.
			With	1	2	1	2	1.5	2	2	5.5	3	2	1	2	8	44	L	
		Contamination of wetlands with concrete.	Without	2	4	2	3	2.8	2	2	6.8	3	3	1	1	8	54	L	• It is preferable that pre-fabricated materials be used, with no pouring of concrete within the wetland areas. All manufacturing must be undertaken beyond the buffer area. • All materials and structures must be stored beyond the buffer, and only brought into the wetland for installation. Short-term storage (, 1 day) in a cleared area is permissible.
			With	1	2	1	2	1.5	2	2	5.5	3	2	1	1	7	39	L	

				Severity															
Activity	**Aspect**	**Impact**	**Mitigation Scenario**	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**	**Frequency of activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance**	**Risk Rating**	**Control Measures**
	Backfilling of excavations	Disruption of wetland soil profile and alteration of hydrological regime	Without	3	2	2	2	2.3	2	3	7.3	3	3	1	3	10	73	M	• Ensure that topsoil is appropriately stored and re-applied during backfilling and landscaping of the area. • Make sure that the soil is backfilled and compacted to accepted geotechnical standards to avoid conduit formation around the structures i.e. gabion baskets
			With	1	1	1	1	1	2	3	6	2	2	1	2	7	42	L	
Operation																			
Operation of the WEF.	Hardened surfaces.	Potential for increased stormwater runoff leading to Increased erosion and sedimentation.	Without	3	3	3	3	3	4	2	9	3	3	5	2	13	117	M	• Design and Implement an effective stormwater management plan. • Promote water infiltration into the ground beneath the solar panels. • Release only clean water into the environment. • Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in). • Re-vegetate denuded areas as soon as possible. • Regularly clear drains. • Minimise the extent of concreted / paved / gravel areas. • A covering of soil and grass (regularly cut and maintained) below the solar panels is ideal for infiltration. If not feasible then gravel is preferable over concrete or paving. • Avoid excessively compacting the ground beneath the solar panels.
			With	2	2	1	1	1.5	2	2	5.5	1	2	5	1	9	50	L	
	Crossings	Altered surface flow dynamics leading to Increased erosion and sedimentation	Without	2	2	2	2	2	4	2	8	2	2	5	2	11	88	M	• Design and Implement an effective stormwater management plan. • Install energy dissipaters at discharge areas.
			With	1	2	1	1	1.3	2	2	5.3	1	1	5	1	8	42	L	

Activity	Aspect	Impact	Mitigation Scenario	Severity															
				Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
																			• Stabilise banks susceptible to erosion/collapse with gabion baskets or bank stabiliser blankets
	Contamination.	Potential for increased contaminants entering the wetland systems.	Without	2	4	3	3	3	4	2	9	3	3	5	2	13	117	M	• Where possible minimise the use of herbicides to control vegetation. If herbicides must be used do so well prior to any significant predicted rainfall events.
			With	2	2	2	2	2	2	2	6	1	2	5	1	9	54	L	
Closure																			
Decommissioning of the facility.	Rehabilitation.	Potential loss or degradation of nearby wetlands through inappropriate closure.	Without	3	3	4	3	3.3	3	3	9.3	4	4	5	1	14	130	M	• Develop and implement a rehabilitation and closure plan. • Appropriately rehabilitate the project area by ripping, landscaping and re-vegetating with locally indigenous species.
			With	2	2	2	2	2	3	2	7	2	2	1	1	6	42	L	

5.2 Powerline

During construction (and without mitigation) the clearing and preparation of the powerline route and storage of equipment may lead to the disturbance and degradation of wetland vegetation, increased bare surfaces, runoff and potential for erosion. Additionally, the excavation, levelling and installation of towers may lead to increased sediment loads and contamination of wetlands with hydrocarbons due to leaks and spillages from machinery, equipment & vehicles as well as contamination and eutrophication of wetland systems with human sewerage and litter. It is also assumed that most wetland and buffers can be avoided for the project.

Once constructed the routine operation and maintenance of powerline route will invariably result in the degradation of vegetation due to mandatory and routine clearing of vegetation within the powerline servitude. These routes together with any residual disturbances from construction may facilitate proliferation of alien and invasive species, if not managed appropriately. Risks associated with decommissioning the powerline infrastructure centre on vegetation degradation from vehicle access and increased bare surfaces, runoff and potential for erosion from the removal of the tower infrastructure. A number of mitigation measures are provided in Table 5-2 which would, if implemented effectively, reduce the significance of all anticipated impacts to Low.

Overall, all anticipated risks are considered to have a Low impact significance provided that the mitigation measures presented in Table 5-2 are effectively implemented. Under this assumption, it is the opinion of the specialist that the proposed development of the powerline should not warrant any more than a General Authorisation in terms of water use licensing.

Table 5-2 DWS Risk Impact Matrix for the proposed project (Andrew Husted Pr Sci Nat 400213/11)

				Severity															
Activity	**Aspect**	**Impact**	**Mitigation Scenario**	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**	**Frequency of activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance**	**Risk Rating**	**Control Measures**
Construction																			
Clearing and preparation of powerline route including storage of equipment	Wetland vegetation deterioration and soil exposure.	Disturbance and degradation of wetland vegetation	Without	1	1	3	3	2	1	3	6	2	2	5	1	10	60	M	• Restrict the disturbance and clearance footprint to within 15 m on either side of the proposed powerline route (40 m disturbance corridor). • Avoid wetlands and buffers where feasible. Implement a rehabilitation plan. Cleared areas must be rehabilitated and stabilised to avoid impacts to adjacent wetland and buffer areas. • Although the prescribed post-mitigation buffer as per the national buffer determination tool is 15 m attempt wherever possible to maintain a 30 m buffer on the delineated wetlands to lower the potential for bird collisions which are highest near water resources. • Reduce the disturbance footprint and the unnecessary clearing of vegetation when traversing the identified drainage lines. • Make use of existing access routes as much as possible, before new routes are considered. Any selected "new" route must not encroach into the wetland areas.
			With	1	1	1	1	1	1	3	5	2	1	5	1	9	45	L	
		Increased bare surfaces, runoff and potential for erosion	Without	2	2	2	2	2	2	2	6	3	3	1	1	8	48	L	• Keep tower base excavation and soil heaps neat and tidy. • Limit construction activities in proximity (< 50 m) to wetlands to the dry season when storms are least likely to wash concrete and sand into wetlands. This is only where towers are within wetlands and buffer areas. • Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. • Mixing of concrete must under no circumstances take place in any wetland or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished. • Limit the placement of towers within wetlands and buffer areas where feasible. • Do not situate any of the construction material laydown areas within any wetland or buffer area. Try adhere to a 30 m buffer in these instances. • No machinery should be allowed to parked in any wetlands or buffer areas.
			With	1	1	1	1	1	2	2	5	3	1	1	1	6	30	L	

Activity	Aspect	Impact	Mitigation Scenario	Severity															Control Measures
				Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	
		Introduction and spread of alien and invasive vegetation	Without	1	1	3	3	2	1	2	5	3	3	5	1	12	60	M	• Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed. • Limit soil disturbance • The use of herbicides is not recommended in or near wetlands (opt for mechanical removal). • Appropriately stockpile topsoil cleared from the powerline footprint. • Clearly demarcate powerline construction footprint, and limit all activities to within this area. • Minimize unnecessary clearing of vegetation beyond the tower footprints and powerline corridors. • Lightly till any disturbed soil around the tower footprint to avoid compaction.
			With	1	1	2	1	1.25	1	2	4.25	3	1	1	1	6	26	L	
Excavation, levelling and installation of transmission towers.	Soil disturbance, sedimentation	Increased sediment loads to downstream reaches	Without	2	2	2	2	2	2	2	6	3	3	1	1	8	48	L	• See mitigation for increased bare surfaces, runoff and potential for erosion • Re-instate topsoil and lightly till transmission tower disturbance footprint.
			With	1	1	1	1	1	1	2	4	3	1	1	1	6	24	L	
		Contamination of wetlands with hydrocarbons due to leaks and spillages from machinery, equipment & vehicles as well as Contamination and eutrophication of wetland systems with human sewerage and litter.	Without	2	3	2	2	2.25	2	2	6.25	3	3	1	1	8	50	L	• Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. • Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering wetland or buffer areas. • Mixing of concrete must under no circumstances take place within the wetland or buffer areas. • Check for oil leaks, keep a tidy operation, and promptly clean up any spills or litter. • Provide appropriate sanitation facilities for workers during construction and service them regularly. • The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected must be disposed of at a licensed disposal facility; • The Contractor must be in possession of an emergency spill kit that must be complete and available at all times on site; • Any possible contamination of topsoil by hydrocarbons must be avoided. Any contaminated soil must be treated in situ or
			With	1	3	1	1	1.5	2	2	5.5	3	1	1	1	6	33	L	

				Severity															
Activity	**Aspect**	**Impact**	**Mitigation Scenario**	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**	**Frequency of activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance**	**Risk Rating**	**Control Measures**
																			be placed in containers and removed from the site for disposal in a licensed facility;
Operation																			
Routine operation and maintenance of powerline route	Clearing of wetland vegetation beneath powerline	Degradation of wetland vegetation wetland vegetation.	Without	1	1	1	3	1.5	2	1	4.5	3	1	5	1	10	45	L	• Clear vegetation in line with the 2010 Eskom Environmental Procedure Document entitled "Procedure for vegetation clearance and maintenance within overhead powerline servitudes". • Avoid the use of herbicides and diesel to treat stumps within the wetland and buffer areas. • Make use of existing access routes as much as possible, before new routes are considered. Any selected “new” route must not encroach into the wetland areas.
			With	1	1	1	23	6.5	2	1	9.5	3	1	5	1	10	95	L	
	Alien and Invasive species	Proliferation of alien and invasive species	Without	1	1	3	4	2.25	2	2	6.25	3	1	5	1	10	63	M	• In line with the 2010 Eskom Environmental Procedure Document entitled "*Procedure for vegetation clearance and maintenance within overhead powerline servitudes*" all alien vegetation along the transmission servitude should be managed in terms of the Regulation GNR.1048 of 25 May 1984 (as amended) issued in terms of the Conservation of Agricultural Resources Act, Act 43 of 1983. By this Eskom is obliged to control category 1, 2 and 3 plants to the extent necessary to prevent or to contain the occurrence, establishment, growth, multiplication, propagation, regeneration and spreading such plants within servitude areas.
			With	1	1	1	4	1.75	2	1	4.75	3	1	5	1	10	48	L	
Decommissioning																			
Removal of transmission towers and lines	Vehicle access	Degradation of wetland vegetation and proliferation of alien and invasive species	Without	2	2	2	3	2.25	1	2	5.25	3	1	5	1	10	53	L	• See mitigation for the impacts on direct loss, disturbance and degradation of wetlands and spread of alien and invasive plants. • Control should continue for a minimum of three years following decommissioning.
			With	1	1	2	3	1.75	1	2	4.75	3	1	5	1	10	48	L	
	Re-excavation of Transmission Towers	Increased bare surfaces, runoff and potential for erosion	Without	2	2	2	2	2	2	2	6	3	3	1	1	8	48	L	• See mitigation for increased bare surfaces, runoff and potential for erosion and increased sediment loads during construction
			With	1	1	1	1	1	2	2	5	3	1	1	1	6	30	L	

5.3 Recommendations

The following are recommendations made in support of the water resource assessment:

- Avoid the delineated wetland and buffers areas where feasible;
- A competent Environmental Control Officer (ECO) must oversee the construction phase of the project; and
- Crossing designs should be informed by hydrological demands of the systems, limiting impacts to flow regimes and enabling connectivity across the systems.

6 Conclusion and Impact Statement

Natural and artificial wetland systems were identified and delineated for the project, with the artificial systems consisting of dams and drainage features. The four natural wetland types identified for the project include channelled valley bottoms (CVB), unchanneled valley bottoms (UCVB), depressions, and seeps. These wetlands were further divided into seven HGM Units.

The CVB (HGM 1) and UCVB (HGM 4) wetlands overall ecosystem services score was Moderately High, whereas the other five HGM units scored Intermediate. Overall, the CVB (HGM 1 and HGM 2) and UCVB (HGM 4) wetlands were determined to have a Moderately Modified (Class C) present ecological state, with the remaining wetlands being Largely Modified (Class D). The overall ecological importance and sensitivity of the systems were determined to be high.

The recommended buffer was calculated to be 15 m and 30 m for the construction and operational phases for the powerline and turbine developments respectively.

6.1 Impact Statement

No wetlands are directly affected by the proposed turbine footprint areas, with all the proposed turbines being beyond the recommended 30 m buffer area. A number of wetland systems are traversed by the proposed road network, and these crossings will be a key consideration for the risk assessment. Due to the Low post-mitigation risks identified for selected aspects for the proposed road crossings, it is the opinion of the specialist that the proposed development of the WEF should warrant a General Authorisation in terms of water use licensing.

Regarding the powerline, it is anticipated risks are considered to have a Low impact significance provided that the mitigation measures are effectively implemented. Under this assumption, it is the opinion of the specialist that the proposed development of the powerline should not warrant any more than a General Authorisation in terms of water use licensing.

7 References

Department of Water Affairs and Forestry (DWS). 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Pretoria: Department of Water Affairs and Forestry.

DWA (Department of Water Affairs). 2021. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Draft. Compiled by RQS-RDM.

Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.C., and Collins, N.B. 2009. A Technique for rapidly assessing ecosystem services supplied by wetlands. Mondi Wetland Project.

Land Type Survey Staff. (1972 - 2006). Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Macfarlane, D.M. & Bredin, I. 2017. Buffer zone guidelines for wetlands, rivers and estuaries. Part 1: Technical manual.

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2014. Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. Final Consolidated Report. WRC Report No TT 610/14, Water Research Commission, Pretoria.

Macfarlane, D.M., Holness, S.D., von Hase, A., Brownlie, S., Dini, J. and Kilian, V. 2016. Wetland Offsets: A Best Practice Guideline for South Africa. WRC Report No. TT 660/16.

Macfarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. and Goge, C. 2007. A technique for rapidly assessing wetland health: WET-Health. WRC Report TT 340/08.

Mucina, L. & Rutherford, M.C. (Eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria, South African.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (Eds.). 2007. Vegetation map of South Africa, Lesotho and Swaziland. 1:1 000 000 scale sheet maps. 2nd ed. South African National Biodiversity Institute, Pretoria.

Nel JL, Murray KM, Maherry AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis DJ, Snaddon CD, Job NM, and Mbona N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

Rountree, MW and Kotze, DM. 2013. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). Joint Department of Water Affairs/Water Research Commission Study. Water Research Commission, Pretoria.

Savannah Environmental (2012). EIA Report: Ecology. Proposed Sannaspos 75 MW Solar Energy Facility. Preparwd for: SolaireDirect Southern Africa (Pty) Ltd

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.). 2019. South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria.

Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. and Van der Colff D. 2019. *South African National Biodiversity Assessment 2018: Technical Report.* Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E. & Snaddon, K. 2018. South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Version 3, final released on 3 October 2019. Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa.