AQUATIC ECOLOGY, BIODIVERSITY AND SPECIES

SPECIALIST ASSESSMENT

BASIC ASSESSMENT FOR THE PROPOSED SQUARE KILOMETRE ARRAY (SKA) FIBRE OPTIC CABLE BETWEEN BEAUFORT WEST AND CARNARVON

Report prepared for:	*Report prepared by:*
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Executive Summary

The CSIR appointed EnviroSci (Pty) Ltd to conduct an aquatic biodiversity assessment for the proposed installation of a fibre optic cable between Beaufort West and Carnarvon to complete the data connection between the Square Kilometre Array (SKA) radiotelescope and its data processing centre in Cape Town. This includes both underground and above ground (overhead) sections as required. It has been assumed that any temporary works areas (construction camps and laydowns) will be placed within previously disturbed areas along the route, and outside of any demarcated riverine / wetland areas as shown is this study.

The proposed alignment extends from Beaufort West in the south, and traverses the Nuweveld Mountains in a northerly direction, predominantly within the road reserves of the R381 / R63 roads. The area is characterised by rolling hills and valleys, with occasional cliffs and is covered rocky surface with low vegetation cover.

The findings of this report were supported by baseline data collected during a 3-day project-specific survey in August & October 2020, while adhering to the assessment criteria contained in the DWAF 2005 / 2008 delineation manuals and the Wetland / Riverine Classification System. The information collected for other projects between 2018 / 2019 (a total of 25 days) over various seasons while spanning the region between Beaufort West and Carnarvon, was also used in this assessment, where the R381 is used as an access road for those projects. This also includes a low-level aerial survey along the R381 / R63, to assess catchment wide connections between the aquatic systems.

Several important national and provincial scale conservation plans were also considered, with the results of those studies where relevant being included in this report. Most conservation plans are produced at a high level, so it is important to verify or groundtruth the actual status of the study area. Groundtruthing of aquatic resources in the project area was also important as the information was critical for the identification and mapping of important habitat where protected or endangered species are known to occur within the region.

The study area is dominated by various aquatic features associated with catchments and rivers, and are characterised as follows:

- Riverine: Alluvial Floodplain and tree riparian dominated systems, characterised by *Vachellia karroo* and / or *Sersia* species;
- Riverine: Incised channels with limited riparian vegetation or part of an alluvial valley. These are mostly associated with the central and northern portions of the cable alignment from Rosedene (just north of the Molteno Pass), northwards onto Carnarvon;
- Wetland: Valley bottom wetlands (mostly channelled);
- Pan (wetland): Endorheic Pan/Depressions; and
- Artificial: Dams, reservoirs and shallow borrowpits that were filled with surface water runoff.

Notably, most of the aquatic features within the study area are located within the riverine valleys and alluvial floodplains, linked to the rivers and their respective catchments. Wetlands can appear within riverine floodplains, while downstream riparian features are more dominant:

The catchments in the study area fall within the Great Karoo & Nama Karoo Ecoregions located in the Breede Gourits Catchment Management Agency and Orange Water Management Areas, with the majority of the project falling within the latter WMA, and include:

- Kuils / Gamka (J21A);
- Sak (D55A);
- Slangfontein se Leegte / Brak (D55C);
- Brak / Soutpoort (D55D);
- Gansvlei (D55G);
- Alarmleegte (D55F); and
- Carnarvonleegte (D54B).

During the site-specific assessment, all the mainstem systems were visited and groundtruthed in relation to the available aerial imagery to assess the difference between valley bottom wetland, riparian or alluvial areas. Previous visits in the region in 2019, allowed for the inspection of additional areas and the endorheic pans within the greater region but won’t be impacted upon by this development (i.e. > 500 m from the proposed alignment). Several major bridge crossings occur along the alignment, such as that located on the Brak River, while several artificial systems such as water inundated borrowpits and dams are also prevalent in the area.

Based on the information collected during the field investigations, the DWS (2014) PES/EIS ratings are verified and upheld for the riverine / alluvial systems. The natural wetlands were however rated independently and achieved Present Ecological State (PES) scores of B & B/C, while the Ecological Importance and Sensitivity (EIS) was rated as HIGH. This high rating was due to the fact that these systems retained water during the dry periods, with small pools still evident in areas downstream of these wetlands area even after very little rainfall in 2019/2020. These pools also create refugia for important fish and amphibians known to occur within the region, as well as provide drinking water to small mammals and livestock within the area.

The Moderate and High EIS rating for both natural watercourses and wetlands, is further substantiated by the fact that the affected catchments are included in both the National Freshwater Ecosystem Priority Area (NFEPAs) and the Western Cape and Northern Cape Provincial Biodiversity Spatial Plans Critical Biodiversity Area (CBA) spatial layers. These areas are highlighted as support areas for downstream rivers (Upstream FEPAs) and important corridors along the various river systems.

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

- Erosion and sedimentation associated with road crossings;
- Impeded water flow due to several in-channel farm dams; and
- Sedimentation and scour of channels due to undersized culverts within present day road crossings

The potential impacts identified during this assessment are:

Construction Phase

- Potential impact 1: Clearing of vegetation within wetland crossings.
- Potential impact 2: Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings.
- Potential impact 3: Loss of species of special concern.
- Potential impact 4: Spills and leaks from construction vehicles / machinery when working in or near the delineated systems, impacting localised surface water quality.
- Potential impact 5: Erosion and Sedimentation.

Operational Phase

- Potential impact 1: Creation of hard surfaces, resulting in runoff, erosion and sedimentation.

Decommissioning Phase

- Potential impact 1: Clearing of vegetation within wetland crossings.
- Potential impact 2: Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings.
- Potential impact 3: Loss of species of special concern.
- Potential impact 4: Spills and leaks from construction vehicles / machinery when working in or near the delineated systems.
- Potential impact 5: Erosion and Sedimentation.

Cumulative Impacts

- Cumulative impact 1: All activities within delineated areas, when combined with present day activities.

Considering the impacts assessed with mitigation the significance of these are summarised as follows:

Phase	Overall Impact Significance
Construction	Very Low
Operational	Very Low
Decommissioning	Very Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Very Low
Cumulative - Operational	Very Low
Cumulative - Decommissioning	Very Low

This is based on the following are key recommendations, which are also critical to the proposed mitigations:

- Where wetland areas aren't spanned with the overhead line cable installation (OHL), then the cables should be tied into the existing bridges. Should this not be an option, and the crossing distance suitable, then Horizontal Directional Drilling (HDD) is recommended. Failing these options, then it is suggested that hand dug trenching occur in these areas (i.e. no mechanical trenching is allowed to access these areas).
- Any of the activities, should also be monitored by an appointed aquatic specialist, to advise on micrositing, especially if unforeseen technical difficulties required routing changes, while the appointed Environmental Officer (EO) / Environmental Control Officer (ECO) should monitor on a daily basis, especially during periods of river flow.
- Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattresses as required.
- Activities should be limited to the demarcated servitude / road reserve as far as possible, to prevent additional cumulative impacts on these systems.
- Search and Rescue should be initiated prior to construction.
- The Construction Environmental Management Plan (EMP), must include a Specific Monitoring and Rehabilitation Plan related to the water course and wetland crossings.
- Monitoring should occur on a monthly basis for 6 months post construction and where any unstable soils occur, these must be protected with temporary stabilisation dependent on the scale of the impact i.e. sand bags - hay bales) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then this must be included into the General Authorisation (GA) application.

On these grounds the current overall impact on the aquatic environment is Very Low (with mitigation) and in summary the findings of this study, the specialist finds no reason to withhold an Environmental Authorisation (EA) or GA of any of the proposed activities, assuming that key mitigations measures are implemented with the final recommendations as follows:

- A key recommendation is that that during the construction mobilisation process, any required temporary construction camps, stockpiles and laydown areas are located outside of any delineated aquatic systems and within any existing disturbed areas.
- A final walkdown by an aquatic specialist must be conducted to ensure that the routing is installed within disturbed areas, within the road reserve servitude, and avoiding sensitive areas as far as possible.

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List of Abbreviations

CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DEFF	Department of Environmental Fisheries and Forestry
DHSWS	Department of Human Settlements, Water and Sanitation (formerly Department of Water and Sanitation)
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation (formerly the Department of Water Affairs)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GA	General Authorisation (Water Use Authorisation type)
GIS	Geographic Information System
HDD	Horizontal Directional Drilling
HGM	Hydrogeomorphic
IHI	Habitat Integrity
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
NWA	National Water Act (No. 36 of 1998)
NWCS	National Wetland Classification System
OHL	Overhead Line – (fibre optic cable that is not buried, but mounted on wooden poles)
PES	Present Ecological State
RHP	River Health Programme
SACNASP	South African Council for Natural and Scientific Professions
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SAPAD	South African National Protected Areas Database
SCC	Species of Conservation Concern
SQ	Subquaternary catchment = Quinary Catchment as used by DEFF
WCBSP	Western Cape Biodiversity Spatial Plan
Wet-Health	Wet-Ecoservices
WETLAND-IHI	Wetland Index of Habitat Integrity
WUA	Water Use Authorisation
WUL	Water Use License
WULA	Water Use License Application
WMA	Water Management Area

This report serves as the Aquatic Biodiversity and Species Specialist Assessment that was prepared as part of the Basic Assessment (BA) for the proposed installation of a fibre optic cable between Beaufort West and Carnarvon to complete a connection between the Square Kilometre Array (SKA) radio telescope to a data processing facility in Cape Town.

1. Introduction

The Council for Scientific and Industrial Research (CSIR) appointed EnviroSci (Pty) Ltd to conduct an aquatic biodiversity and ecology assessment for the proposed installation of a fibre optic cable along the route as shown Figure 1 and 2. The proposed cabling includes both underground and above ground (overhead) sections as required. It has been assumed that any temporary works areas (construction camps and laydowns) will be placed within previously disturbed areas along the route, and outside of any demarcated riverine / wetland areas as identified is this study.

The proposed alignment extends form Beaufort West in the south, and traverses the Nuweveld Mountains in a northerly direction, predominantly within the road reserves of the R381 / R63. The area is characterised by rolling hills and valleys, with occasional cliffs and is covered rocky surface with low vegetative cover, coupled to an arid climate, drives a mostly ephemeral aquatic environment.

The findings of this report were supported by baseline data collected during a 3 day project-specific survey in August & October 2020, while adhering to the assessment criteria contained in the DWAF 2005 / 2008 delineation manuals and the Wetland / Riverine Classification System. Information collected by EnviroSci for other projects (mainly large-scale electricity transmission line projects) between 2018 / 2019 (a total of 25 days), over various seasons between Beaufort West and Carnarvon, was also used in this assessment, where the R381 / R 63 is used as an access road for those projects. This also includes a low-level flight along the R381 to Droërivier, to assess catchment wide connections between the systems.

Several important national and provincial scale conservation plans were also considered, with the results of those studies, where relevant, being included in this report. Most conservation plans are produced at a high level, so it is important to verify or ground truth the actual status of the study area. Groundtruthing of aquatic resources in the project area was also important as the information was critical for the identification and mapping of important habitat where protected or endangered species are known to occur within the region.

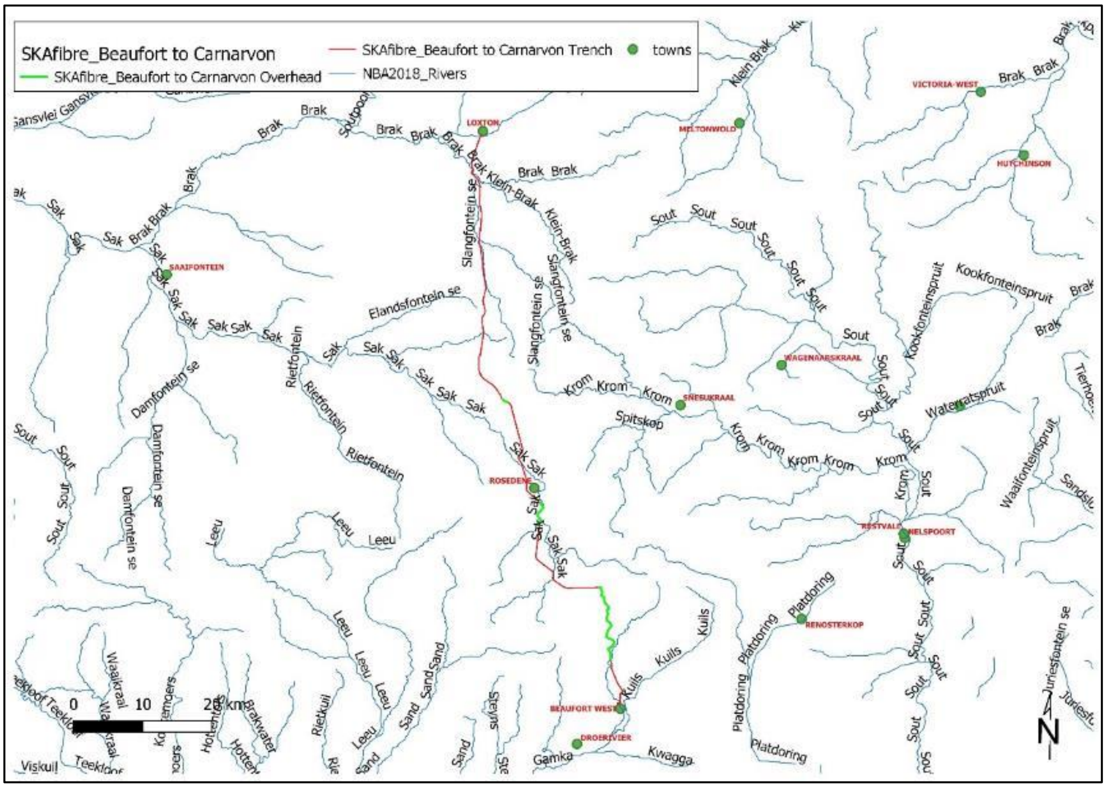

Figure 1: The buried and overhead cable sections between Beaufort West and Loxton, that spans Nuweveld mountains and the associated mainstem river systems (SANBI, 2018).

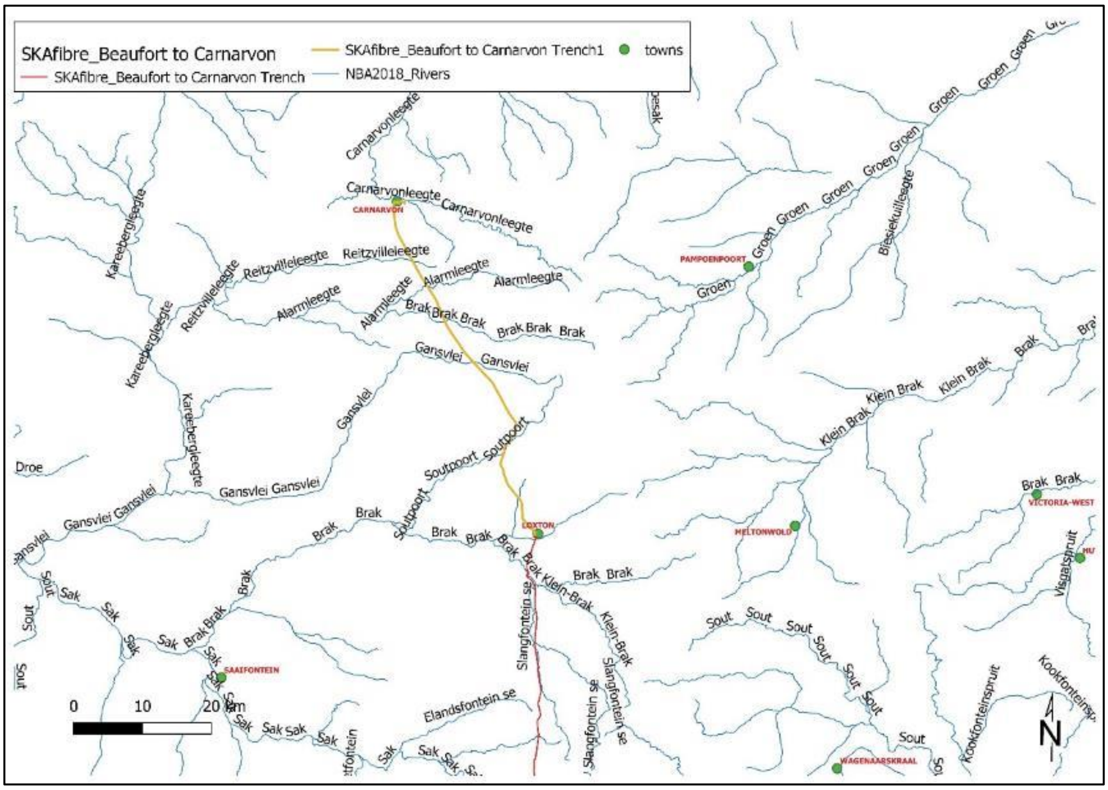

Figure 2: The buried cable sections between Loxton and Carnarvon, that span pediplains with associated alluvial mainstem river systems (SANBI, 2018), interspersed by inselbergs (Koppies).

1.1. Scope, Purpose and Objectives of this Specialist Report

The aim of this report is to provide a summary of the aquatic baseline and identify, discuss and assess the potential impacts that may arise should the project be authorised. The report also makes recommendations with regard to management and mitigation, to further reduce, avoid or mitigate the potential impacts, and ultimately ensure the responsible and sustainable use of South Africa's aquatic resources. This report, in part, aims to provide the Competent Authority with sufficient information regarding the projects impacts on aquatic resources to inform the taking of responsible decision on the application.

Certain aspects of the development, such as river crossings or any activities within 500 m of a wetland, will trigger the need for Section 21 Water Use License Applications (WULAs) or General Authorisation (GA) applications in terms of the National Water Act (Act No. 36 of 1998) (NWA). The pre-application process (Pre-application meeting) with the Department of Human Settlements, Water and Sanitation has been conducted to initiate the process, and GA has been confirmed.

Information regarding the state and function of the observed water bodies, including suitable no-go buffers areas and assessment of the potential direct and cumulative impact, where relevant, are also provided, but as the existing road already presents a solution to tie in the cable to existing bridges, the proposed buffer is thus only considered for areas that should be avoided.

Note that, with the exception of the "No Go" alternative (as required by the National Environmental Management Act (NEMA)), no alternatives apart from the preferred fibre-optic cable routing have been assessed.

1.2. Details of Specialist

This specialist assessment has been undertaken by Dr Brian Colloty of EnviroSci (Pty) Ltd who is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400268/07 the field of Ecological Science. A curriculum vitae is included in Appendix A of this specialist assessment.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist assessment.

1.3. Terms of Reference

- Initiate the assessment with a review of the available information for the region and the proposed project, this also included a review of the proposed project in relation to any conservation plans or assessments known for the area, e.g. Critical Biodiversity Area (CBA) maps, National Waterbody Inventory, and relevant Department of Environment, Forestry and Fisheries (DEFF) National Screening Tool data in preparation for the site assessment;
- Conduct a detailed site visit to inspect the surrounding waterbodies;
- Determine the Present Ecological State (PES) of any waterbodies incl. wetlands, estimating their biodiversity, conservation importance with regard ecosystem services during the site visit using recognised PES / Ecological Importance and Sensitivity (EIS) assessment methods to determine the state, importance and sensitivity of the respective wetland / watercourse systems;
- Prepare a map demarcating the respective watercourses or wetland/s, i.e. the waterbody, its respective catchment and other areas within a 500m radius of the study area. This will demonstrate, from a holistic point of view the connectivity between the site and the surrounding regions, i.e. the hydrological zone of influence while classifying the hydrogeomorphic type of the respective water courses / wetlands in relation to present land-use and their current state. The maps depicting demarcated waterbodies will be delineated to a scale of 1:10 000, following the methodology described by the DWS, together with an

estimation of their functionality, Habitat Integrity (IHI), Wet-Ecoservices (Wet-Health) and Socio-Cultural Importance of the delineated systems, whichever is relevant to the systems;

- Recommend buffer zones using the Macfarlane & Bredin (2017) approach to indicate any No-go / Sensitive areas around any delineated aquatic zones supported by any relevant legislation, e.g. any bioregional plans, conservation guidelines or best practice where relevant, noting the caveat with regards to the scale at which such plans are often derived.
- Assess the potential impacts, based on a supplied methodology, including cumulative impacts and for pre-construction, construction, operations and decommissioning phases.
- Provide mitigation measures regarding project-related impacts, including engineering services that could negatively affect demarcated wetland or water course areas.
- Supply geo-referenced GIS shape files of the wetland / riverine areas with buffers.
- Provide a separate Risk Assessment Matrix (RAM) as per the Department of Water and Sanitation (DWS) 2016 requirements to determine the WULA Requirements, i.e. indication of future permitting requirements if required.
- Provide an opinion / verification of the environmental sensitivities identified in the DEFF National Screening Tool as set out in the respective protocols published 20 March 2020.

2. Approach and Methodology

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

Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study.

For reference the following definitions are as follows:

Drainage line: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.

Perennial and non-perennial: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

Wetland: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).

Water course: as per the NWA means -

(a) a river or spring;

(b) a natural channel in which water flows regularly or intermittently;

(c) a wetland, lake or dam into which, or from which, water flows; and

(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

2.1 Waterbody classification systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects. **Coupled to this was the inclusion of other criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**

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

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

The NWCS process is provided in more detail in Section 2.3 below, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State (PES) is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment or any other activity that qualifies as a water use.

Ecological Water Requirements: This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the **Reserve Template**

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the (former) Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

2.2 Wetland definition

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

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

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard *et al*., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al*., 2013):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the NWA, where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa.

Table 1: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the NWA and ecosystems included in DWAF's (2005) delineation manual.

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

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

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

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

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the NWA, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).

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

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

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

2.3 National Wetland Classification System method

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

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

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

The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 3). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale.

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

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

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

Level 4 classifies the HGM units discussed earlier. The HGM units are defined as follows:

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

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

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

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

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

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other. The HGM unit (Level 4) is the focal point of the NWCS, with the upper levels (Figure 4– Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

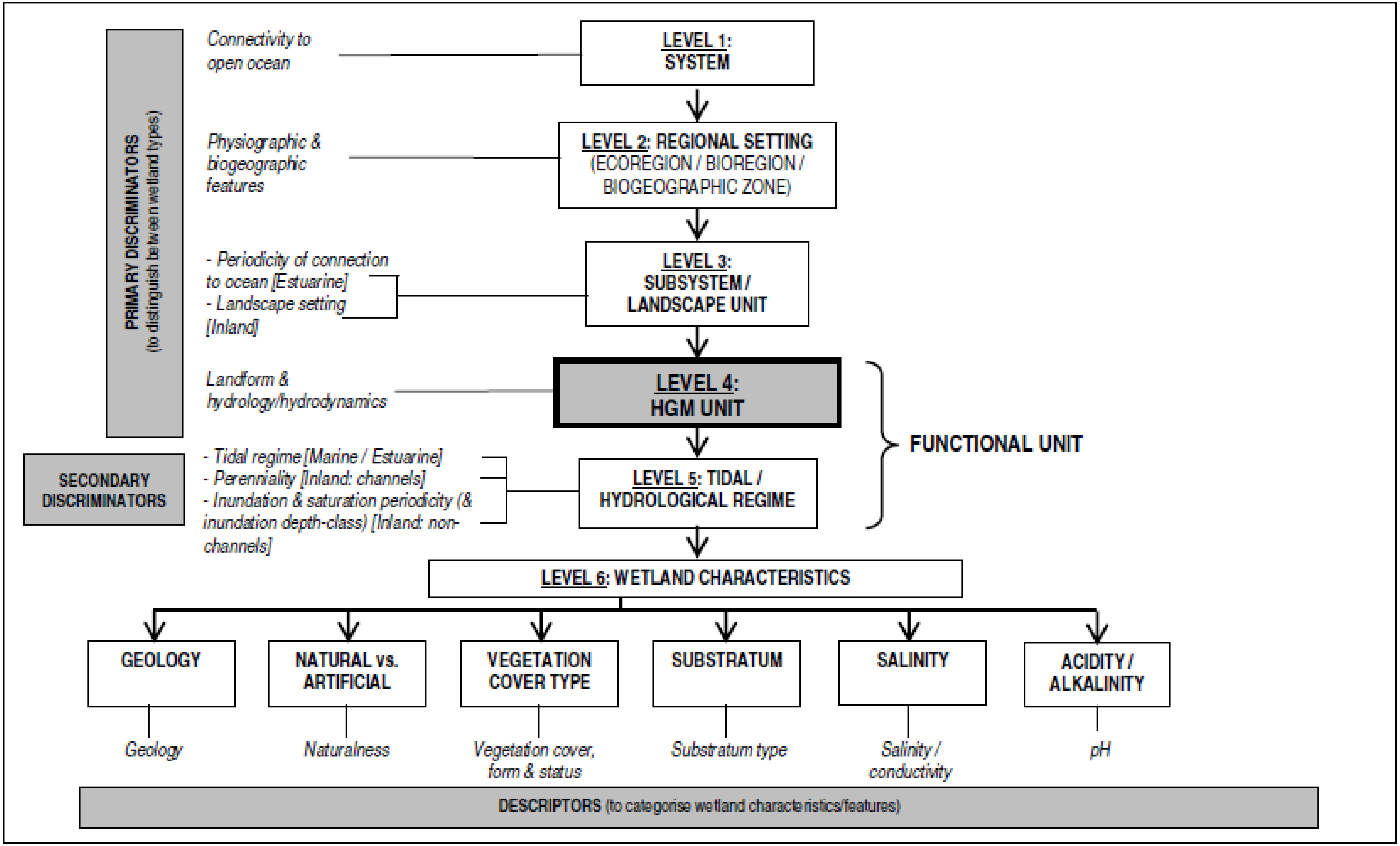

Figure 3: Basic structure of the NWCS, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied (from Ollis *et al*., 2013)

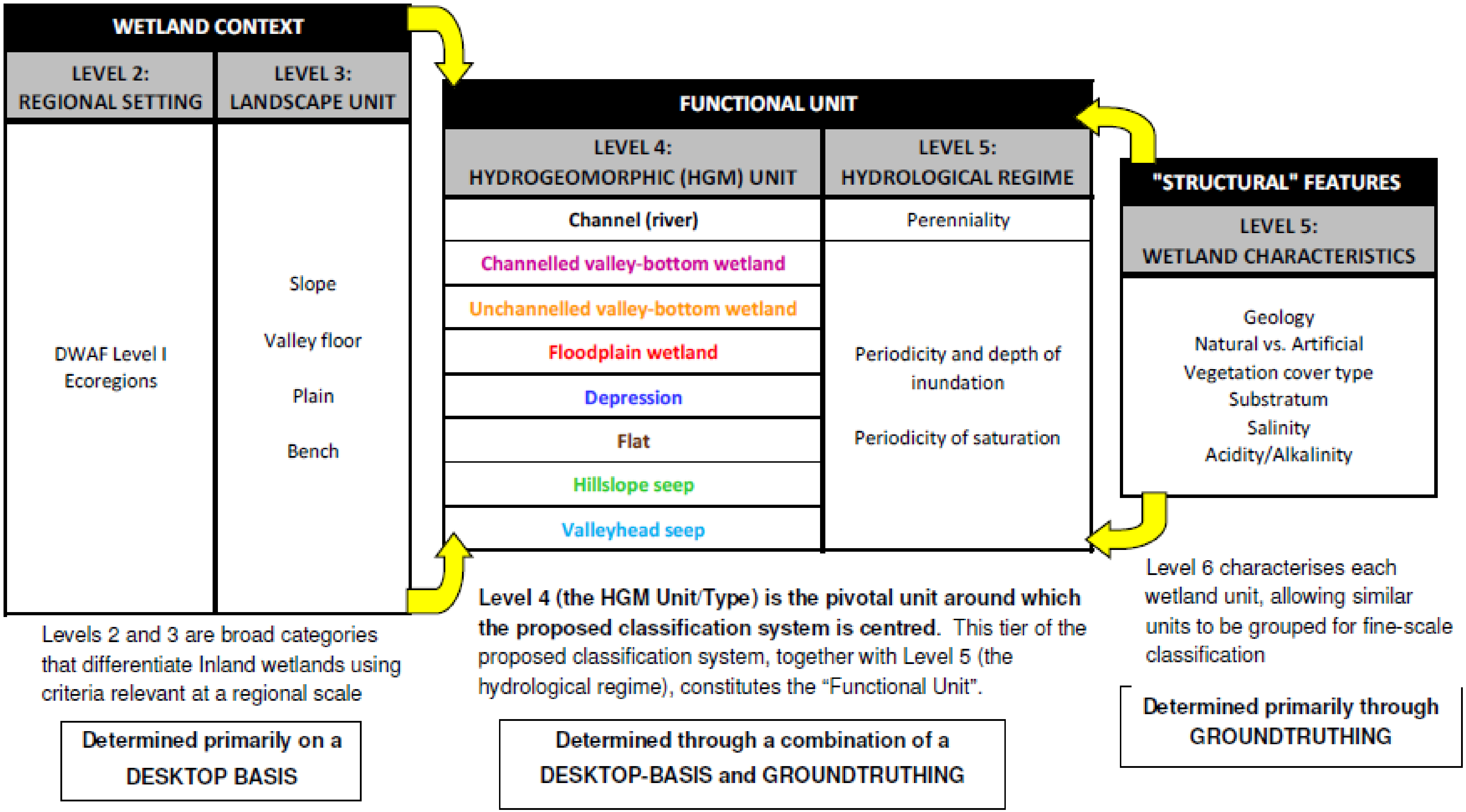

Figure 4: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al*., 2013)

2.4 Waterbody condition

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

Table 2: Description of A – F ecological categories based on Kleynhans et al. (2005)

<table>
<tr><th>ECOLOGICAL CATEGORY</th><th>ECOLOGICAL DESCRIPTION</th><th>MANAGEMENT PERSPECTIVE</th></tr>
<tr><td>A</td><td>Unmodified, natural.</td><td>Protected systems; relatively untouched by human hands; no discharges or impoundments allowed.</td></tr>
<tr><td>B</td><td>Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.</td><td>Some human-related disturbance, but mostly of low impact potential.</td></tr>
<tr><td>C</td><td>Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.</td><td rowspan="2">Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation.</td></tr>
<tr><td>D</td><td>Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.</td></tr>
<tr><td>E</td><td>Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.</td><td rowspan="2">Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality.</td></tr>
<tr><td>F</td><td>Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.</td></tr>
</table>

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

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

2.5 Aquatic ecosystem importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by SANBI as a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

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

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

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

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

Table 3 below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al*., 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 3: Summary of direct and indirect ecoservices provided by wetlands from Kotze et al., 2008

<table>
<tr><td rowspan="15">Ecosystem services supplied by wetlands</td><td rowspan="9">Indirect benefits</td><td rowspan="8">Hydro-geochemical benefits</td><td colspan="2">Flood attenuation</td></tr>
<tr><td colspan="2">Stream flow regulation</td></tr>
<tr><td rowspan="5">Water quality enhancement benefits</td><td>Sediment trapping</td></tr>
<tr><td>Phosphate assimilation</td></tr>
<tr><td>Nitrate assimilation</td></tr>
<tr><td>Toxicant assimilation</td></tr>
<tr><td>Erosion control</td></tr>
<tr><td colspan="2">Carbon storage</td></tr>
<tr><td colspan="3">Biodiversity maintenance</td></tr>
<tr><td rowspan="6">Direct benefits</td><td colspan="3">Provision of water for human use</td></tr>
<tr><td colspan="3">Provision of harvestable resources[2]</td></tr>
<tr><td colspan="3">Provision of cultivated foods</td></tr>
<tr><td colspan="3">Cultural significance</td></tr>
<tr><td colspan="3">Tourism and recreation</td></tr>
<tr><td colspan="3">Education and research</td></tr>
</table>

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

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

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

2.6 Impact assessment

Refer to Appendix E for the Impact Assessment methodology.

2.7 Information Sources

Table 4: Key information sources used to conduct this assessment.

Data / Information	Source	Date	Type	Description
South African National Protected Areas Database (SAPAD)	Department of Environmental Affairs	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Western Cape Biodiversity Spatial Plan (WCBSP)	Pool-Stanvliet, R., Duffell-Canham, A., Pence, G. & Smart, R. CapeNature / SANBI	2017	Report & Spatial	Spatial conservation planning units and associated management recommendations for the
National Biodiversity Assessment	South African National Biodiversity Institute	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including, vegetation types, wetlands and rivers.
Review of available data for a South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Water SA 44 (2) 184-199	van Deventer H., Smith-Adao, L. Petersen C., Mbona N., Skowno A., Nel, J.L.	2018	Report	Assessment of available spatial data regards aquatic ecosystems
Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.	Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S.	2011	Report	NFEPA
FrogMAP. 2019.	Animal Demography Unit. Accessed from http://frogmap.adu.org.za/?sp=400; on 2020-10-09	2020	Spatial databases	Frog distribution map
Northern Cape Biodiversity Spatial Plan	Holness, S & Oosthuysen, E. 2016. Northern Cape Critical Biodiversity Area map, SANBI BGIS	2016	Spatial	Spatial conservation planning units and associated management recommendations for the province

The reference list at the end of this report (Section 12) also includes various sources of literature with regard the assessment of birds and, amphibia associated with aquatic systems.

2.8 Assumptions, Knowledge Gaps and Limitations

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

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

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

2.9 Consultation Processes Undertaken

The draft version of this report was released for a 30-day commenting period. Several comments were received during the consultation phase and these relate to potential impacts related to works within the watercourses. The relevant responses are contained in the Comments and Response Report of the BAR.

The Water Use License Application has been initiated with detail from the report and the attached Risk Assessment Matrix (Appendix D) being used in the Pre-application meetings and site visit with the DHSWS in November 2020. A GA approach has been confirmed by the DHSWS as the appropriate water authorisation mechanism for the proposed fibre optic cable development.

3. Description of Project Aspects relevant to Aquatic Biodiversity

3.1 Trenching, backfilling and compacting

Trenches will be dug 1 m deep and 200 mm – 300 mm wide. A combination of two types of machinery will be used to dig trenches: a Tractor Loader Backhoe (TLB) - used for more difficult terrain; and a Chain Trencher.

After the trench is dug, it will be prepared by adding soft soil where sharp rocks may damage the fibre duct. The fibre duct with cabling is then laid in the trench and the trench is backfilled first with approximately 400 mm of soft soil over the ducting. A compacting machine is used to compact the first 400 mm of the backfill, after which the remainder of the trench is the backfilled again to a level slightly above ground surface and then compacted to the same level and density as the surrounding soil.

3.2 Horizontal Directional Drilling (HDD)

Where the cabling needs to traverse sensitive environs, such as rivers, HDD techniques will be employed. For example, drilling will start 30 m away from the bank of the river, and will continue 2 m below the river bottom. The drill fluids / muds are not hazardous and do not pose any risk to the environment.

3.3 Overhead cabling

Some sections (notably the Molteno pass) are unfeasible to trench – here cabling will be installed overhead. Wooden poles with a total length of 9 m is buried 1.5 m deep, resulting in a total aboveground height of ~ 7.5 m. A combination of two techniques are used to dig holes: a drill mounted on the back of a truck; and a hand-held drill (used in areas inaccessible to the truck-mounted drill). Dug holes may remain open for a maximum of 3 days before the poles are planted.

Poles are planted using a truck with a mechanical arm. Where poles need to be planted in areas inaccessible by the pole-planting truck, manual labour will be used to plant the poles. Once the poles are planted the soil around the pole will be compacted. A dry cement mixture may also be used to secure the pole in place.

4. Baseline Environmental Description

The National Wetland Inventory (van Deventer *et al*., 2018), National Freshwater Ecosystems Priority Atlas (Nel *et al*. 2011), which is included into the National Biodiversity Assessment (SANBI, 2018), have indicated that several important as well Threatened riverine systems are traversed by the proposed cable alignment. These include portions of the Slangfontein, Sak, Brak, Alarmleegte, Soutpoort, and Gansvlei rivers that are listed as Endangered.

Furthermore, these spatial databases indicated that some of these systems are perennial, but having assessed and or travelled through the region for a number of years, all of the system would be considered non-perennial or ephemeral.

What is known is that the systems with larger valley bottom wetlands, do contain pools with moderate flows, but this is only within short river reaches along systems such as the Sak, Brak and Soutpoort Rivers. Substantial flows were observed within the Soutpoort River during high rainfall events that occurred in January and May 2020, when the report author travelled along the R381 during the time period (Plate 1).

Plate 1: Flows observed in the Southpoort River in May 2020, approximately 4 km upstream of the R381

4.1 Aquatic Biodiversity and Ecosystems

4.1.1 Aquatic Ecosystems

The study area is thus dominated by various aquatic features associated with catchments and rivers and are characterised as follows:

Riverine:	Alluvial Floodplain and tree riparian dominated systems, characterised by *Vachellia karroo* and or *Sersia* species.
Riverine:	Incised channels with limited riparian vegetation or part of an alluvial valley. These are mostly associated with the central and northern portions of the cable alignment from Rosedene (just north of the Molteno Pass), northwards onto Carnarvon.
Wetland:	Valley bottom wetlands (mostly channelled).
Pan (wetland):	Endorheic Pan/Depressions.
Artificial:	Dams, reservoirs and shallow borrowpits that were filled with surface water runoff.

Notably most these aquatic features within the study area are located within the riverine valleys and alluvial floodplains, linked to the rivers and their respective catchments (Figure 5 & 6) Wetlands can appear within riverine floodplains, while downstream riparian features are more dominant:

- Kuils / Gamka (J21A);
- Sak (D55A);
- Slangfontein se Leegte / Brak (D55C);
- Brak / Soutpoort (D55D);
- Gansvlei (D55G);
- Alarmleegte (D55F); and
- Carnarvonleegte (D54B).

These fall within the Great Karoo & Nama Karoo Ecoregions located in the Breede Gourits Catchment Management Agency and Orange Water Management Areas (WMAs), with the majority of the project falling within the latter WMA.

During the site specific assessment, all the mainstem systems were visited and groundtruthed in relation to the available aerial imagery to assess the difference between valley bottom wetland (Plate 2, 3 & 4), Riparian or alluvial areas (Plate 5, 6 & 7). Previous visits in the region in 2019, allowed for the inspection of additional areas and the endorheic pans within the greater region, but won't be impacted upon by this development (i.e. > 500 m from proposed alignment). Several major bridge crossing occur along the alignment, such as that located on the Brak River (Plate 8 & 9), while several artificial systems such as water inundated borrowpits and dams are also prevalent in the area (Plate 10).

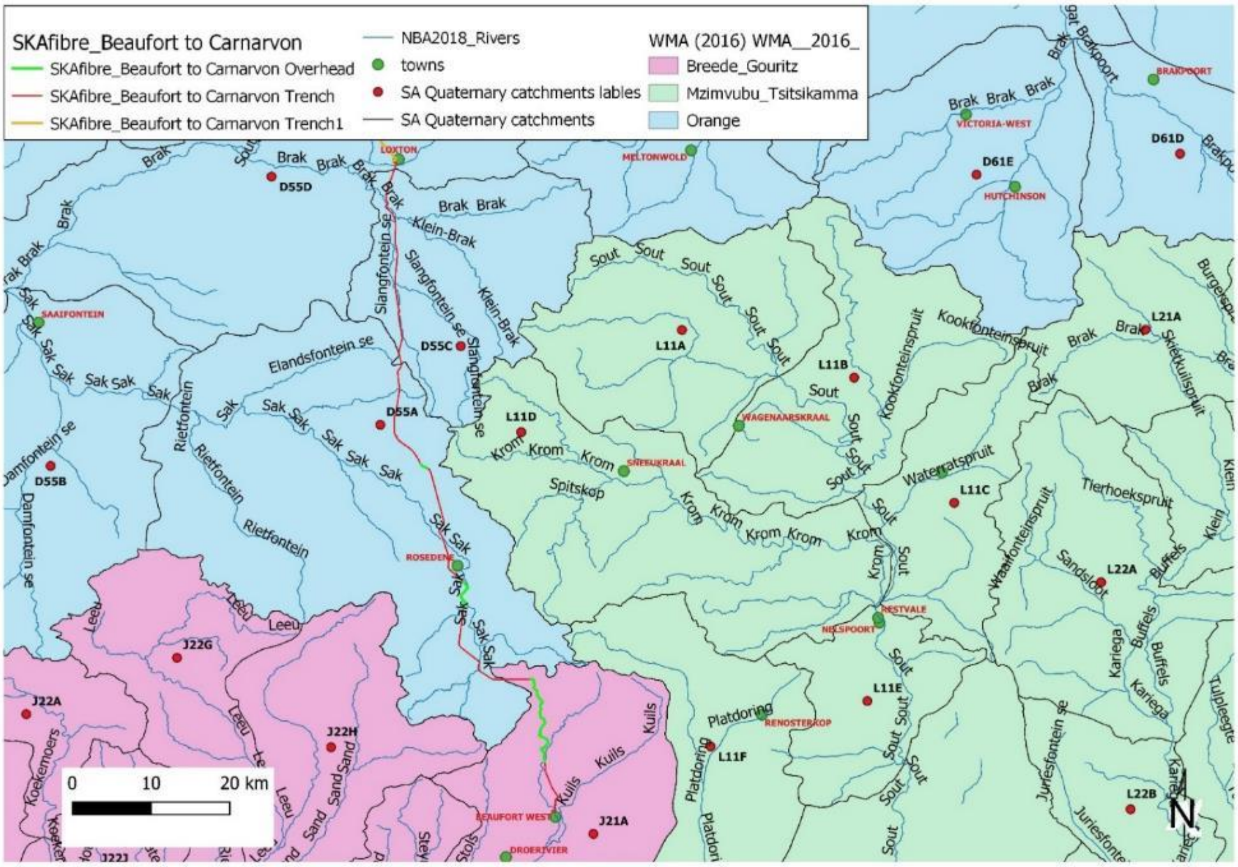

Figure 5: Mainstem rivers, quinary catchments and Water Management Areas traversed by the proposed cable between Beaufort West and Loxton

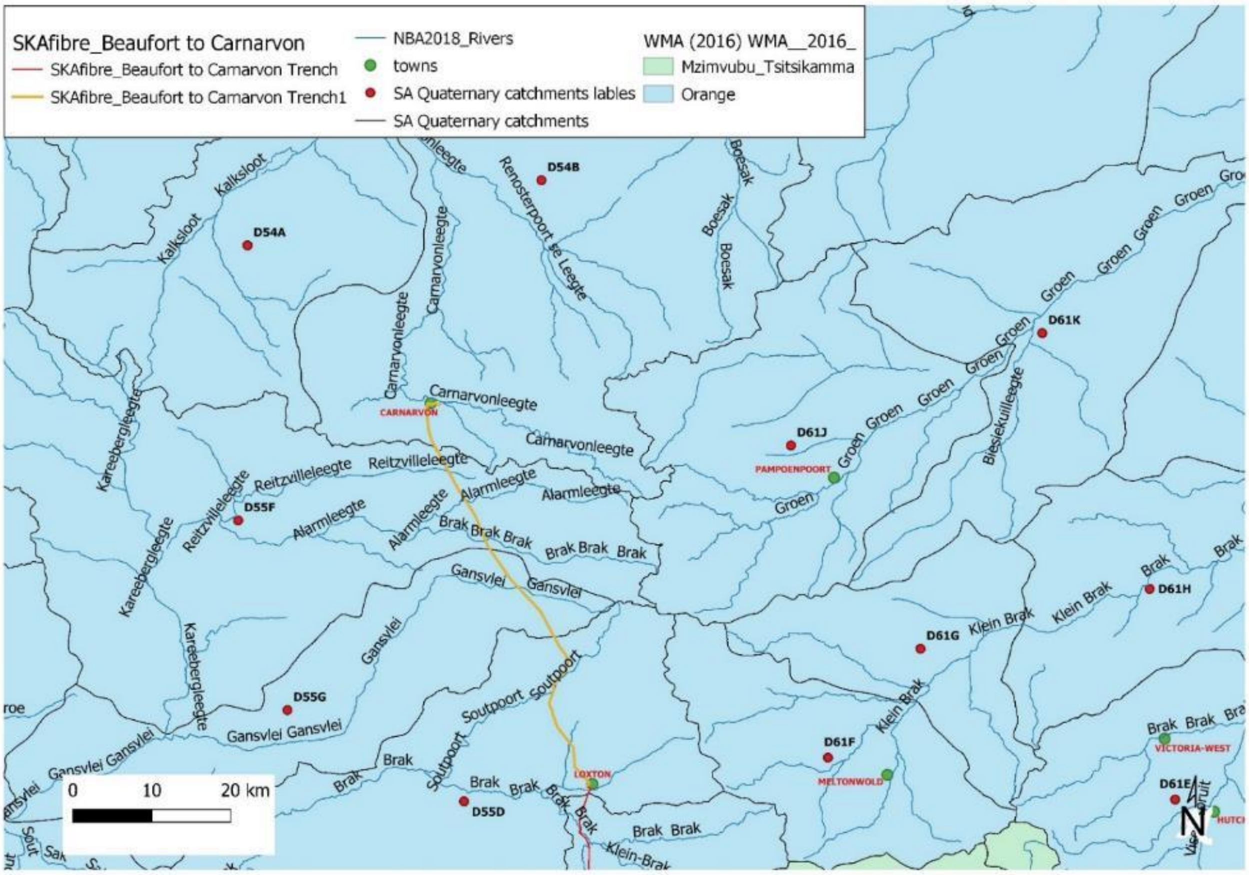

Figure 6: Figure 5: Mainstem rivers, quinary catchments and Water Management Areas traversed by the proposed cable between Loxton and Carnarvon

Plate 2: Large Valley Bottom wetland within Sak River, where the line will span via the overhead section of the cable (-32.070606S 22.454220E), noting that the wetland area must be avoided through means of HDD.

Plate 3: A channelled Valley Bottom Wetland on the Sak River along the surfaced section of the R381 (-32.1614S 22.4741E)

Plate 4: An aerial view of the same wetland shown in Plate 3 above, with a distinct channel meandering through the wetland areas (dark green = Sedges)

Plate 5: A alluvial riverine area with distinct riparian zone that develops intermittently along the floodplains more typical of the Brak and Slangfontein se Leegte systems

Plate 6: Aerial view of the drier alluvial systems (blue arrow, with little to no wetland features along the R381 closer to Loxton (road indicated by red arrow)

Plate 7: The sandy alluvial areas associated with the Gansvlei catchment along the R63 tarred portion of the alignment (-31.280294 S 22.301069 E)

Plate 8: Upstream view of the only major bridge along the cable alignment on the Brak River colonised by extensive *Phragmites australis* reedbeds. Here the proposed fibre optic cabling will be attached to the bridge

Plate 9: Downstream view of the wetland areas along the Brak River bridge crossing (-31.536364S 22.340223E)

Plate 10: Numerous small borrowpits are located along the road and these are inundated with water during high rainfall periods, but did not contain any significant aquatic species

4.1.2 Aquatic Species

Coupled to the aquatic delineations, information was collected on potential species that could occur within the wetlands and water courses, especially any areas that would contain open water for long periods and or conservation worthy species (Listed or Protected).

None of the dominant riparian / wetland associated plant species observed are listed or protected under any form of legislation. Plant species included the following;

- *Seersia lanceolata*
- *Vachellia karroo*
- *Ficinia nodusa*
- *Juncus effusus*
- *Carex spp*
- *Centella asiatica*
- *Erianthus capensis*
- *Sporobolus fimbriatus*
- *Cynodon incompletus*
- *Prosopis spp* (Exotic)
- *Eragrostis curvula*
- *Erharta calcynia*
- *Merxmuellera disticha*
- *Phragmites australis*
- *Cynodon dactylon*

Similarly, amphibian species are known to occur within the region based on collection data for Beaufort West and Karoo National Park, but little is known of the actual distribution of frogs within the study area. Therefore based on mapping data contained in Minter *et al*. (2004) and the FrogMAP spatial database, Table 5 indicates the potential frogs known to occur in the area and their preferred habitat, with three frog species being observed during this assessment.

None of these species are listed by the IUCN, but a special note is made by Minter *et al*. (2004), that detailed assessment of *Vandijkophrynus gariepensis gariepensis* (Karoo toad) is needed within the Nuweveld mountains. Two ectomorphic variations were collected (Karroo National Park - 3222BC), which possibly warrants subdivision into *Vandijkophrynus gariepensis gariepensis,* a larger and duller in colour variation found on the lower plains, and is different from the smaller and more brightly coloured specimens found only in isolated high lying mountain areas and should be raised to species status, namely, *Vandijkophrynus gariepensis nubicolus*.

Table 5: Potential and observed amphibians within the study area

FrogMAP. 2019. Animal Demography Unit. Accessed from http://frogmap.adu.org.za/?sp=400; on 2020.10.09.

Amphibian taxa	Common Name	Conservation Status (IUCN)	Likelihood of occurring based on previous records and or availability of habitat
Vandijkophrynus gariepensis gariepensis	Karoo toad	Least Concern	Observed
Cacosternum boettgeri	Common caco	Least Concern	Likely
Cacosternum karooicum	Karoo dainty frog	Least Concern	Unlikely
Strongylopus grayii	Clicking stream frog	Least Concern	Unlikely
Amietia fuscigula	Cape river frog	Least Concern	Observed
Xenopus laevis	African clawed toad	Least Concern	Observed
Tomopterna delanandii	Cape sand frog	Least Concern	Unlikely

No fish species were observed or have been recorded within the study area, although fish distributions in downstream areas, such as the Sak River, beyond the site boundaries (ca. 25km), indicate the following species, none of which are listed with conservation concern could occur:

- Chubbyhead Barb - *Enteromius anoplus*
- Vaal-orange Smallmouth Yellowfish - *Labeobarbus aeneus*
- Common carp - *Cyprinus carpio* (Exotic)
- Orange River Mudfish - *Labeo capensis*

5. Environmental Sensitivity

All of the systems that were assessed by DWS on a Subquaternary (quinary) level within the study area were rated as PES = B or Largely natural to C or Moderately Modified. While these were also rated as High to Moderate / Medium in terms of Ecological Sensitivity and Ecological Importance (DWS, 2014).

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine / alluvial systems. The natural wetlands were, however, rated independently and achieved PES scores of B & B/C, while the EIS was rated as HIGH. This high rating was due to the fact that these systems retained water during the dry periods, with small pools still evident in areas downstream of these wetlands area even after very little rainfall during 2020 (see Plate 4 above). These pools also create refugia for important fish and amphibians known to occur within the region, as well as provide drinking water to small mammals and livestock within the area.

The Moderate and High EIS rating for both natural water courses and wetlands, is further substantiated by the fact that the affected catchments are included in both the National Freshwater Priority Atlas and the provincial CBA spatial layers (Figure 7 and 8). These areas are highlighted as support areas for downstream rivers (Upstream FEPAs) and important corridors along the various river systems (Figure 7 & 8).

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

- Erosion and sedimentation associated with road crossings;
- Impeded water flow due to several in channel farm dams; and
- Sedimentation and scour of channels due to undersized culverts within present day road crossings.

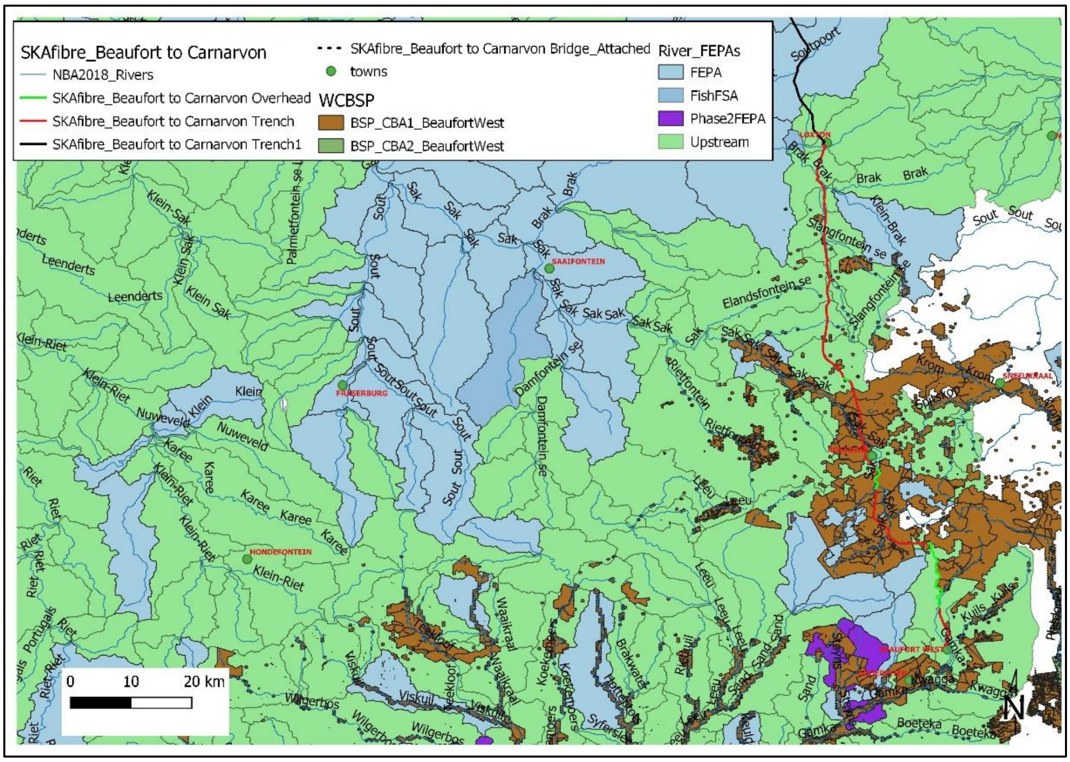

Figure 7: Spatial conservation plans and priority areas for the Beaufort West to Loxton portion of the cable alignment.

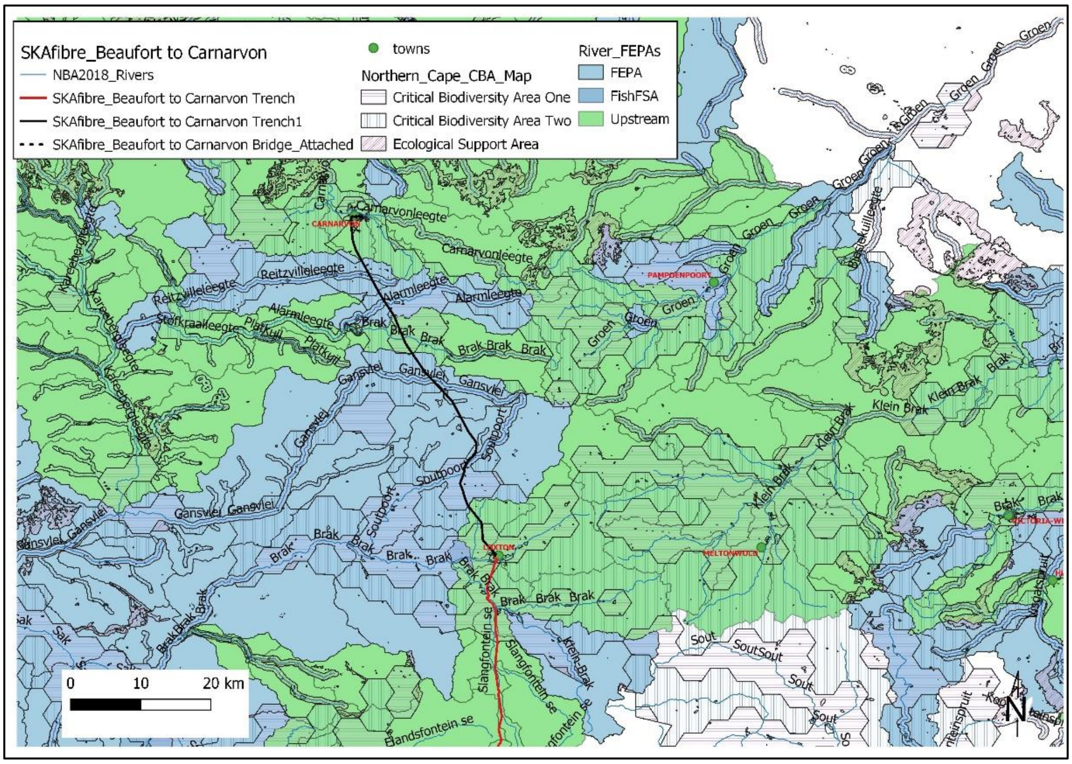

Figure 8: Spatial conservation plans and priority areas for the Loxton to Carnarvon portion of the cable alignment.

5.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

Figure 9 below extracted from the DEFF Screening Tool does not indicate the exact position of the Very High sensitivity area, as indicated in the text of the report, but it is assumed that based on the importance of the known quinary catchments (NFEPAs), presence of wetlands, CBAs, and important rivers. A large number of the systems traversed by the project would have received this rating (Very High).

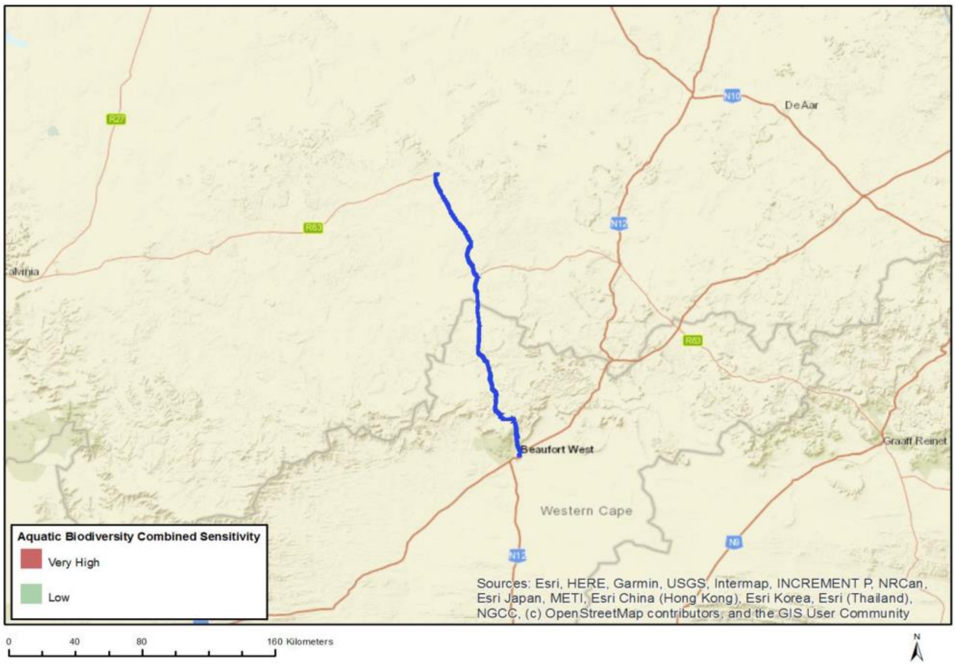

Figure 9: The map presented in the National Screening Tool results (note, due to the extent of the proposed fibre optic cable and the scale of the map automatically output by the Tool, the distribution of sensitivity classes within the study area is not visible).

5.2 Specialist Sensitivity Analysis and Verification

Using the baseline description and field data, while considering the current disturbances and site characteristics, the following features were identified and then categorised based on their sensitivity:

HIGH	All Valley Bottom Wetlands received the high sensitivity rating. Although these will be traversed, mostly by the overhead cable sections, it must be ensured that the towers are placed outside any of these delineated areas. Where the cable will be installed underground via trenching, it is advised that previously disturbed areas, or areas with minimal wetland plant growth be selected, or HDD be employed.
MEDIUM	This included all riverine systems, with or without riparian vegetation or that formed part of an alluvial system.
LOW	Areas of low sensitivity or constraints, such as artificial systems and minor 1:50 000 water courses
Neutral	Unconstrained areas (left blank in mapping)

Figure 10 a – k below indicates the proposed activities in relation to the delineated systems and the respective sensitivity ratings, noting that the delineated Pan / Depressions which would be considered having a High Sensitivity, are not shown in these maps as they are relatively far away from the proposed cable route and will thus be avoided by the proposed construction activities.

It is important to note that no buffers were proposed, as the alignment of the cable will follow the existing road and where buried will predominantly be located within the current servitude, and is thus installed in an existing footprint of disturbance, especially where the roads are maintained. The only caveat being that all stockpiles, laydown areas and construction camps must be located well outside of any delineated systems.

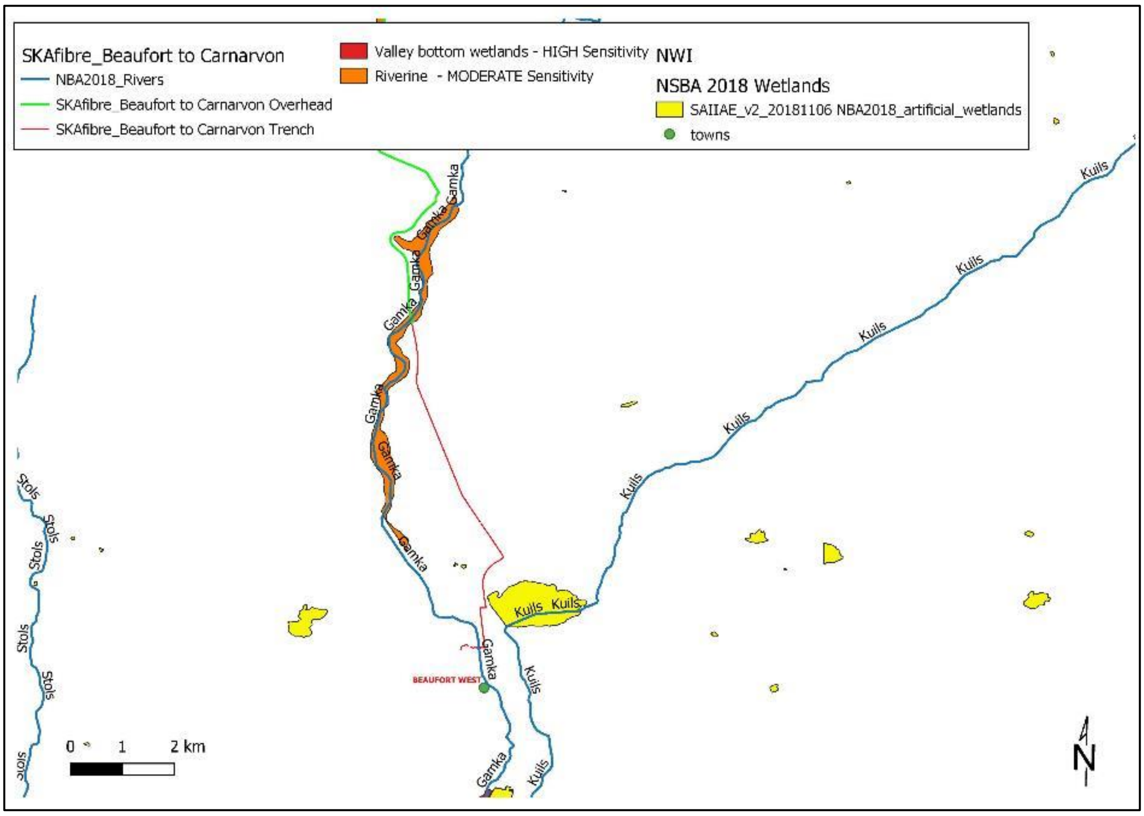

Figure 10a: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW.

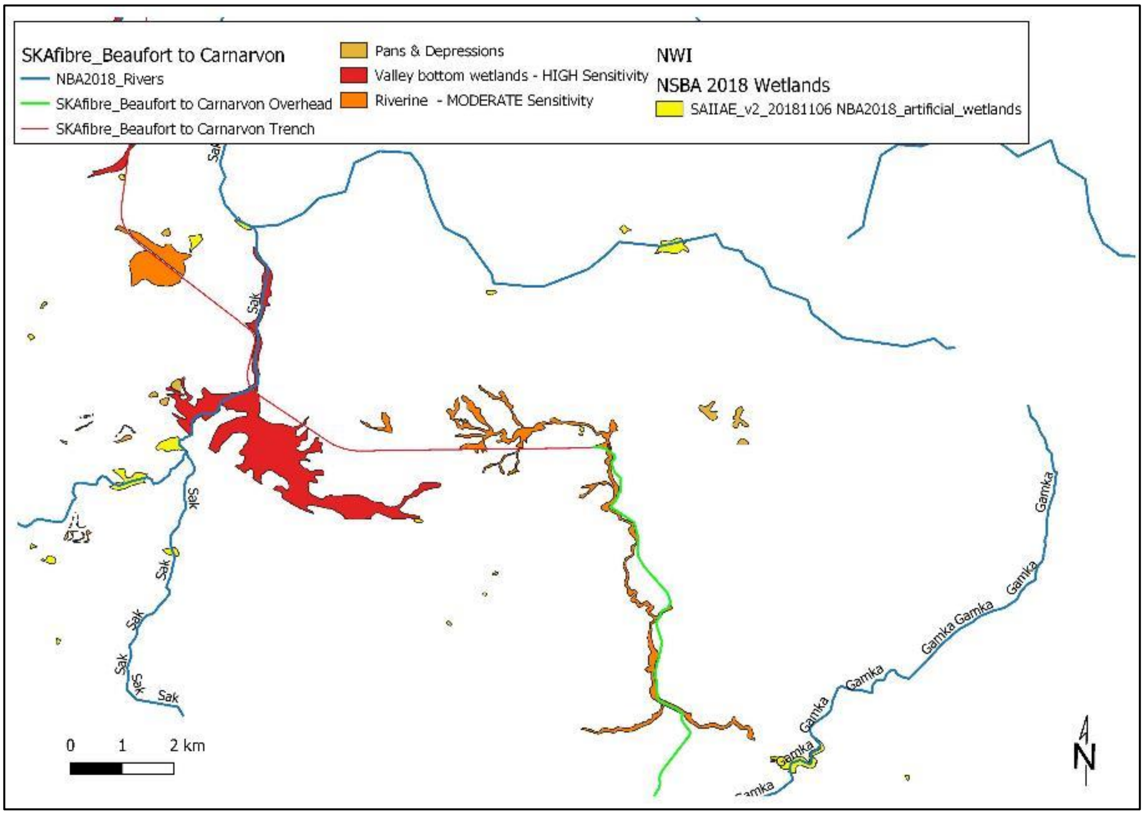

Figure 10b: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW.

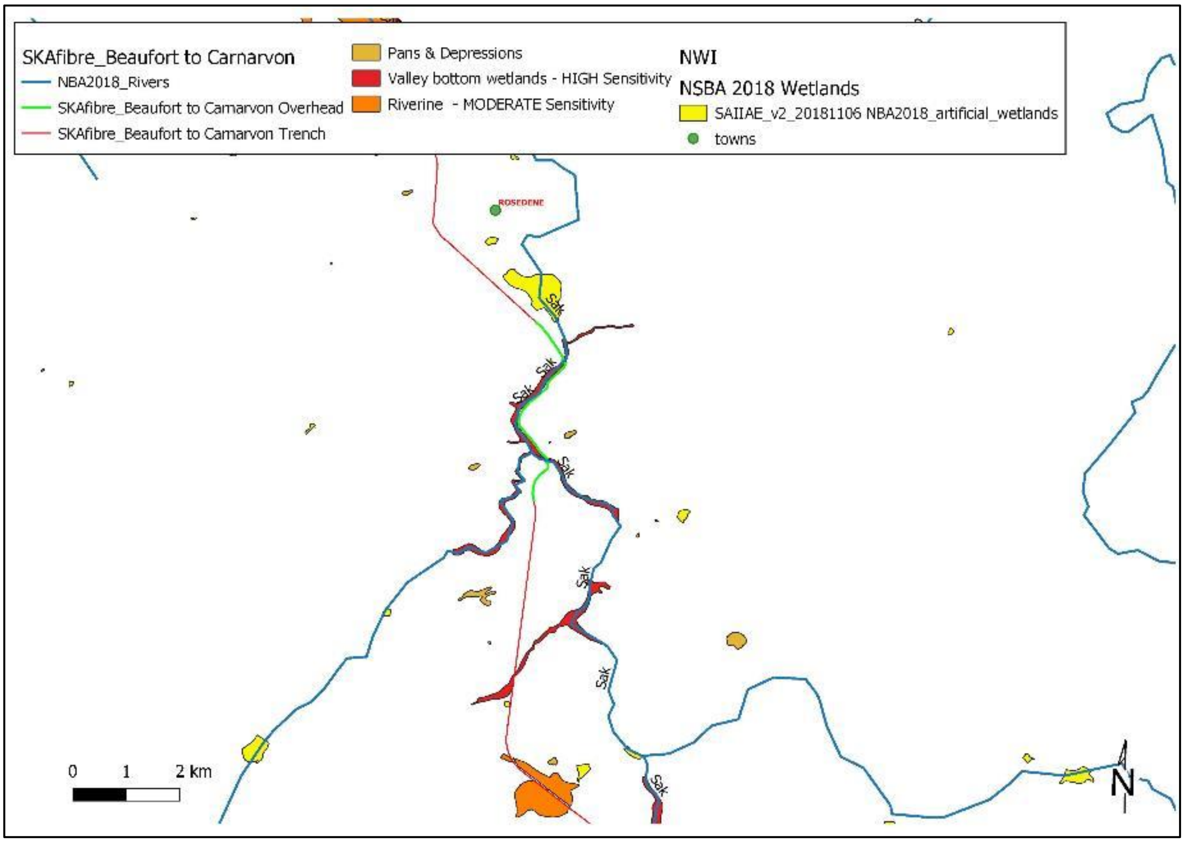

Figure 10c: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW.

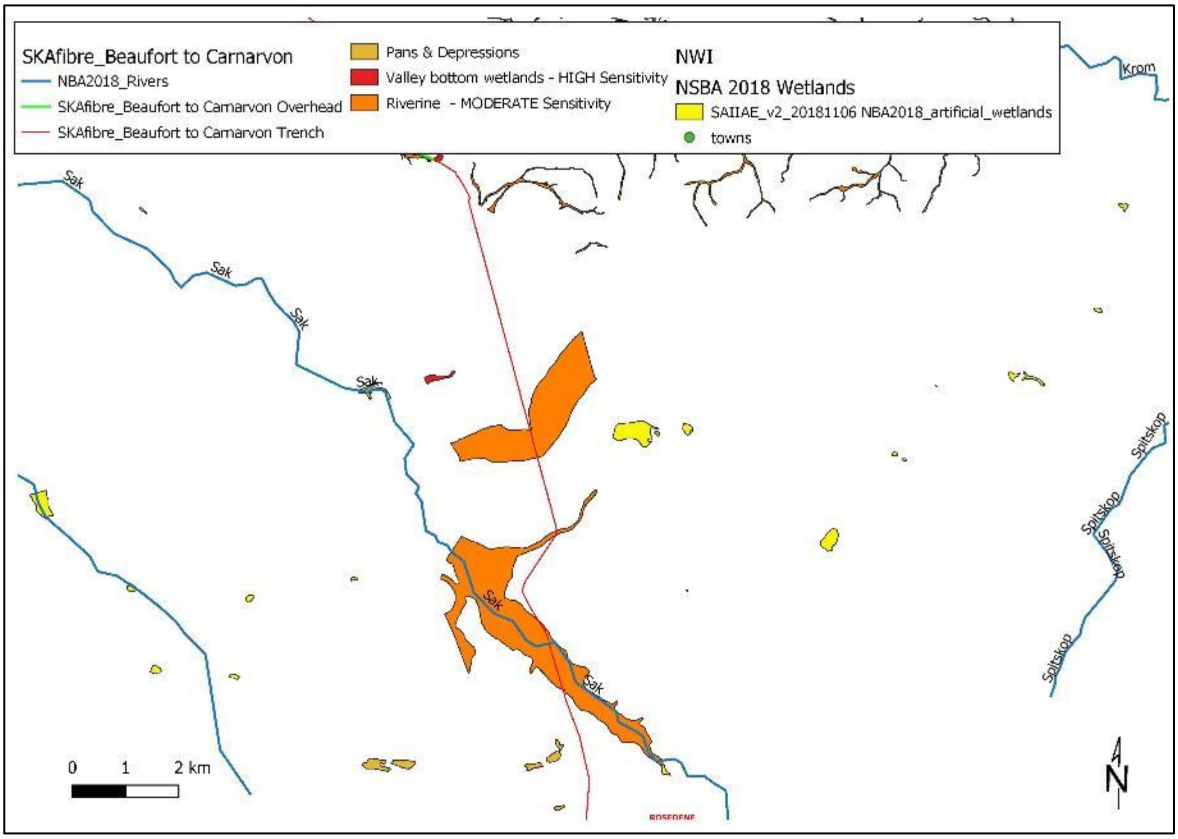

Figure 10d: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW.

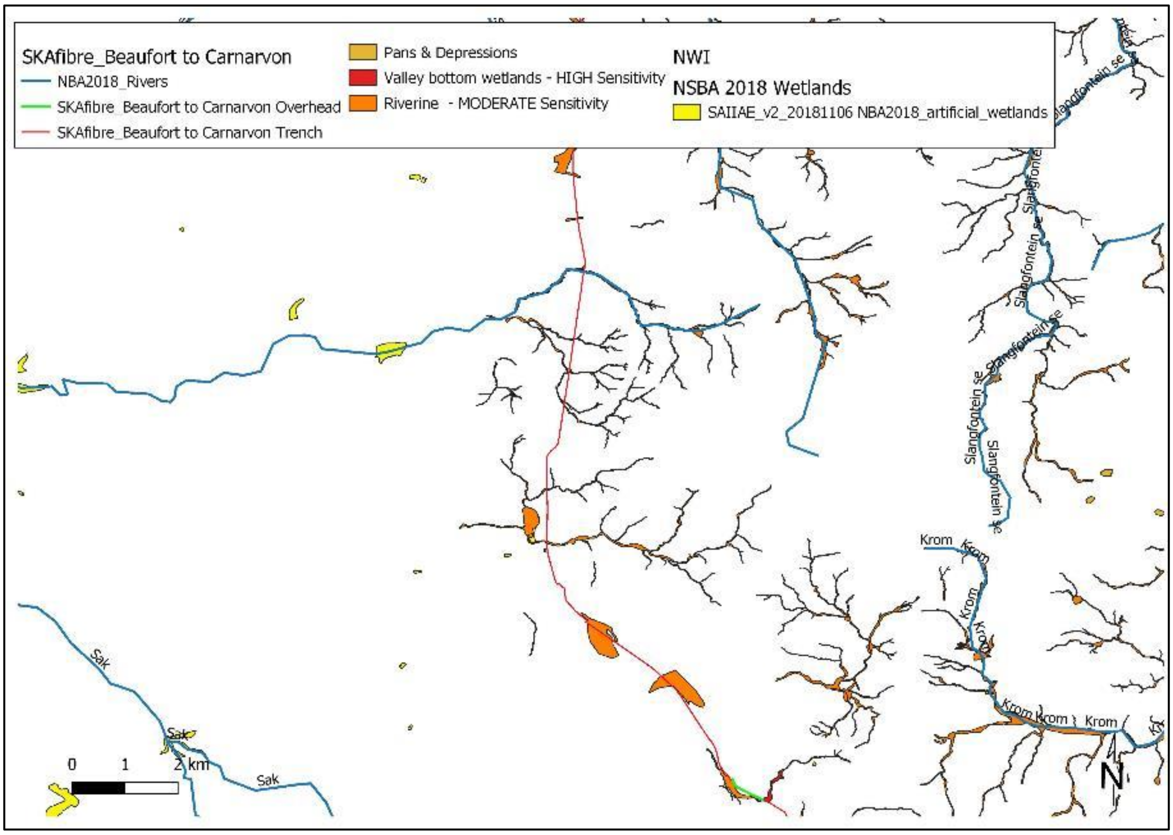

Figure 10e: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

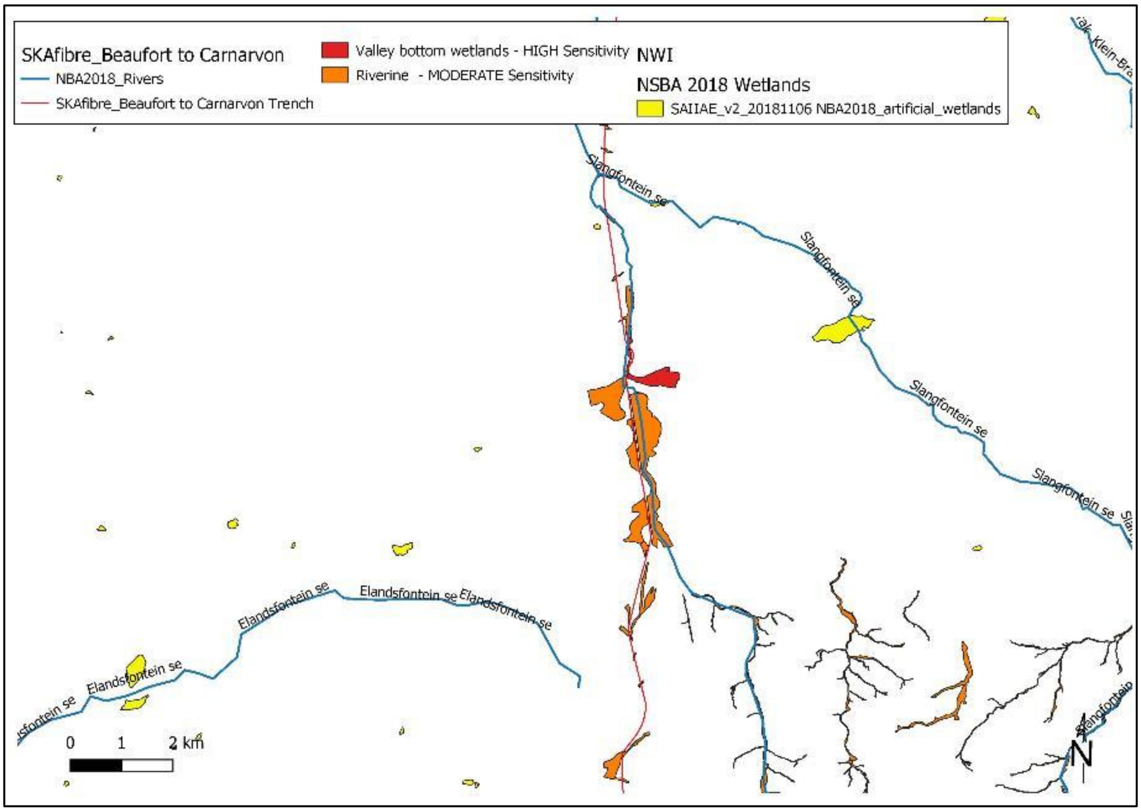

Figure 10f: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

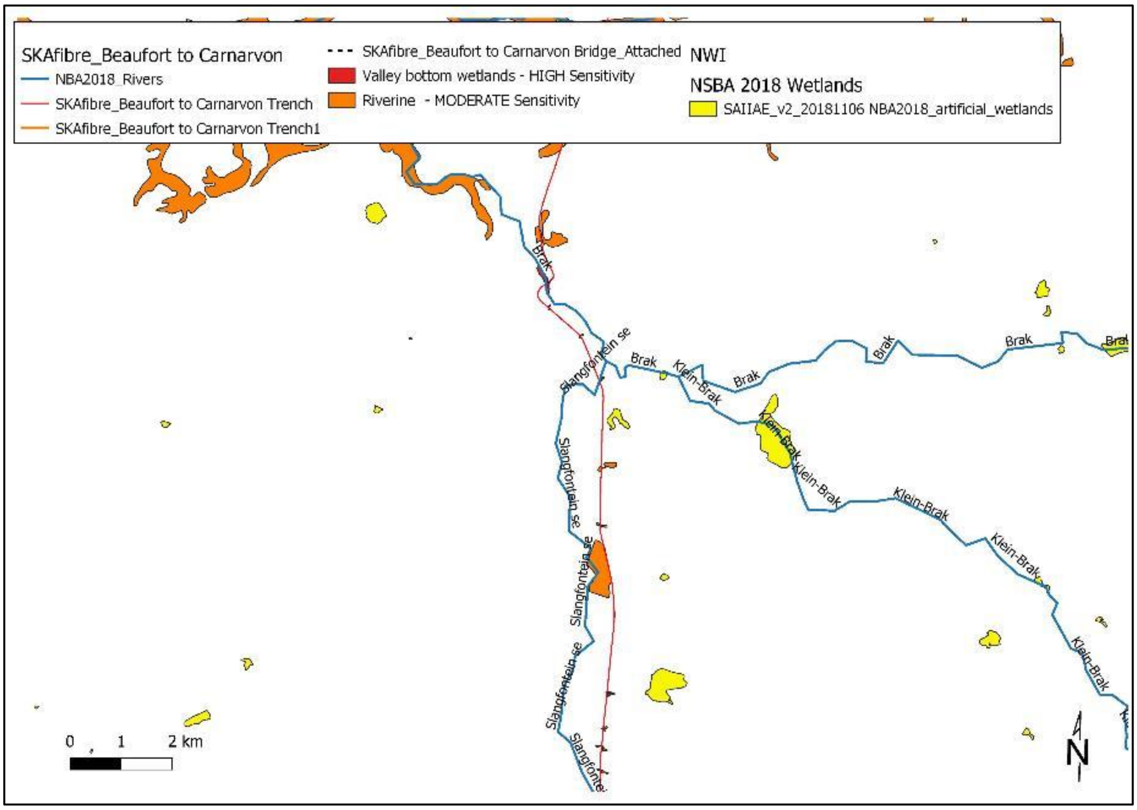

Figure 10g: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

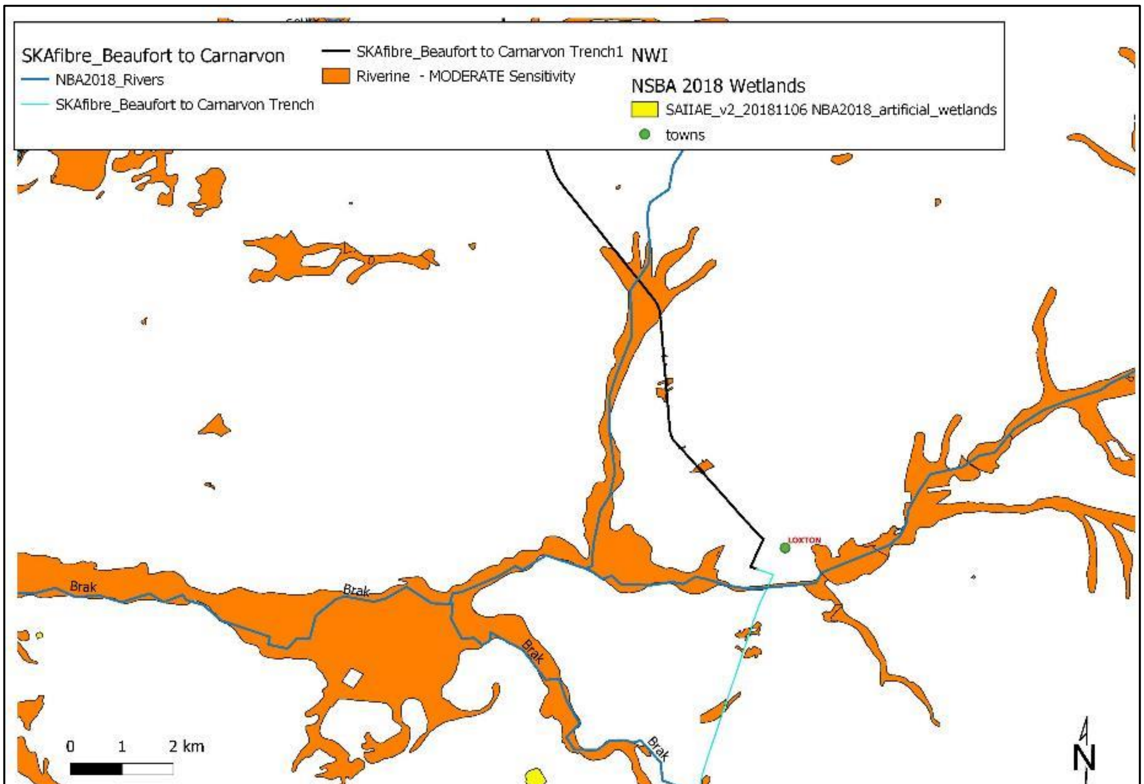

Figure 10h: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

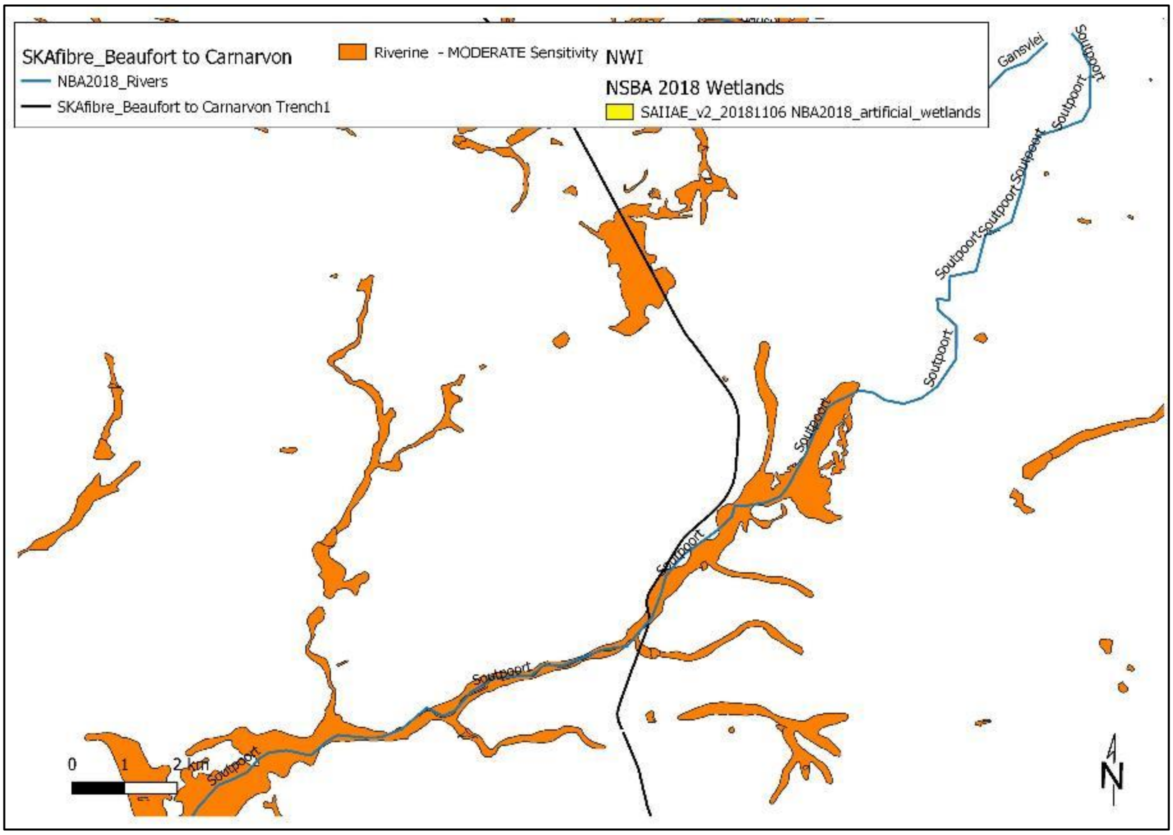

Figure 10i: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

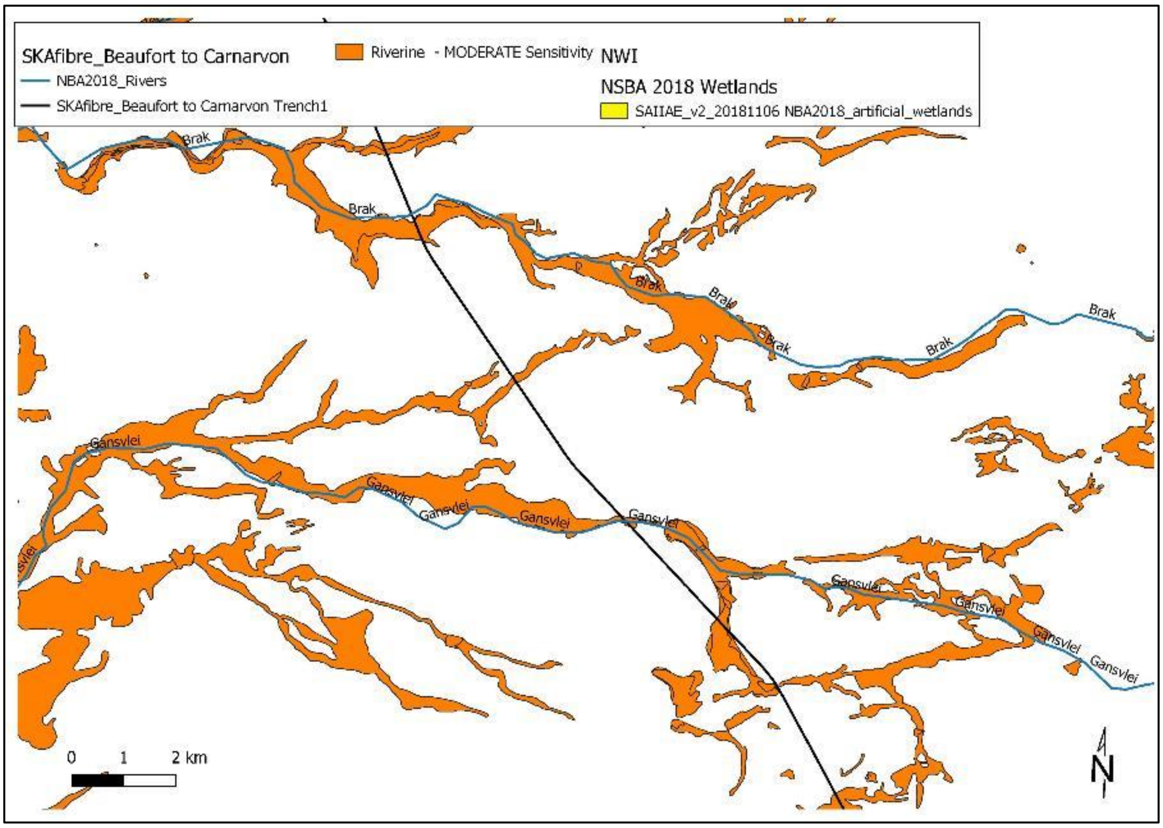

Figure 10j: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

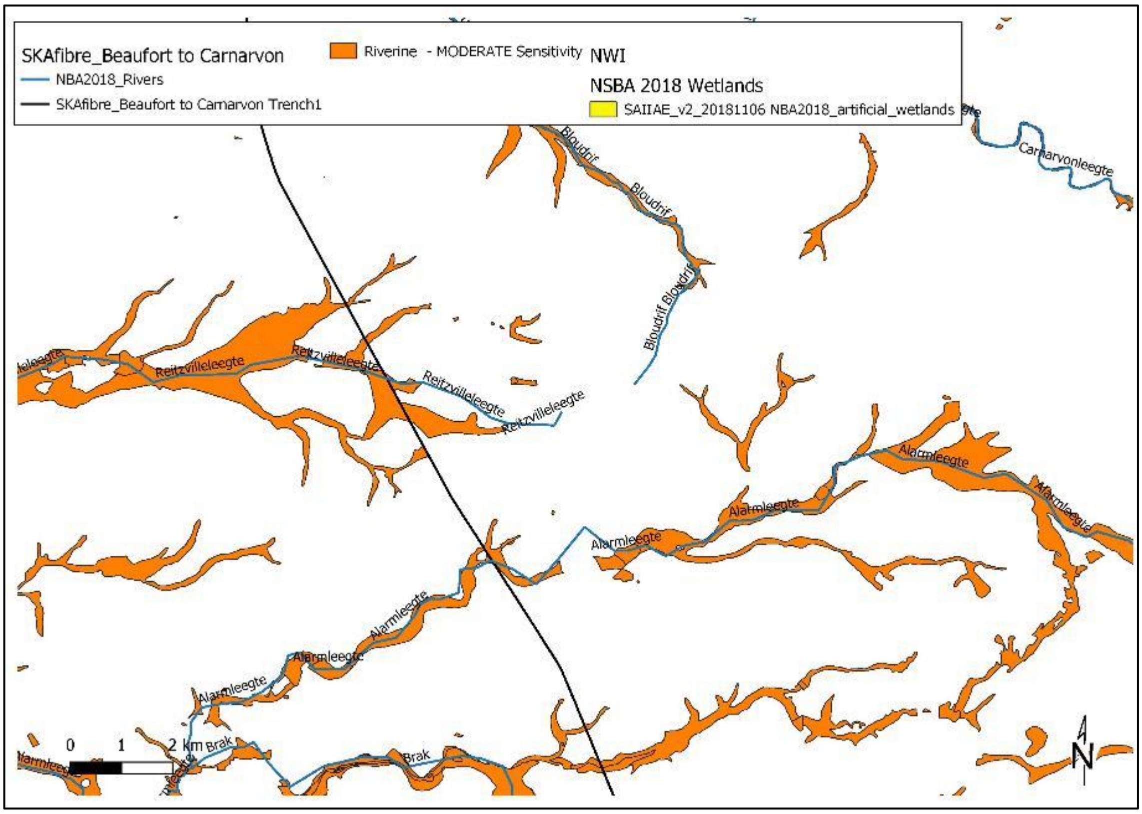

Figure 10k: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

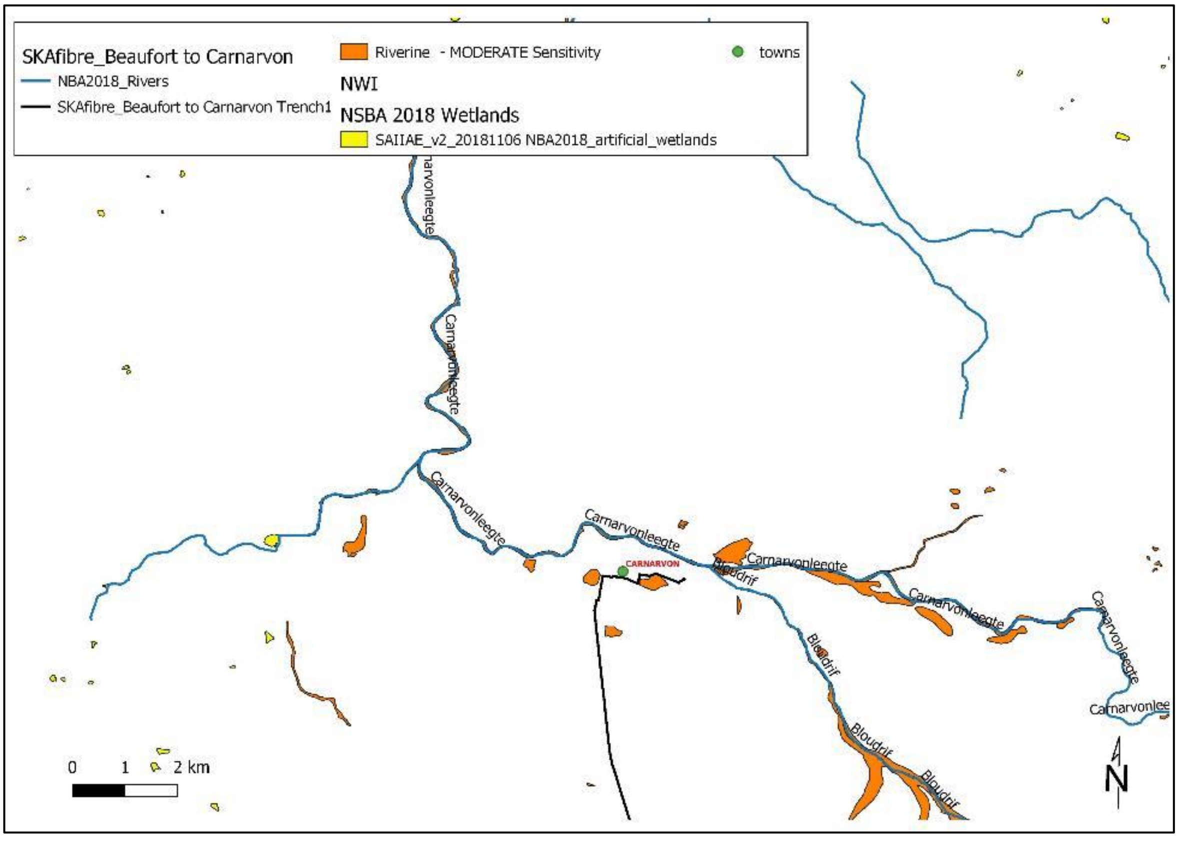

Figure 10l: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed cable alignment, where all artificial systems are rated as LOW

5.2.1 Sensitivity Analysis Summary Statement

When compared to the results of the National Screening Tool results in relation to the receiving environment, i.e. cable predominantly within an existing road reserve, the Very High sensitivity ratings could be upheld for the wetland areas, while the remaining aquatic systems, based on their sensitivity and the disturbances mentioned, were rated as Moderate Sensitivity. Additional detail in this regard is provided in the site verification included in Appendix C.

6. Issues, Risks and Impacts

Due to the nature and limited width of the proposed cable footprint, the overall impacts are related to the construction and decommissioning phases of the project, i.e. when the soils are disturbed when the cables are placed or removed from the trenched sections of the alignment. It has been assumed that the overhead cable sections will have the poles placed outside of the demarcated wetland areas in particular and would thus have less of an impact.

The potential impacts identified during the assessment are:

Construction Phase

- Potential impact 1: Clearing of vegetation within wetland crossings.
- Potential impact 2: Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings.
- Potential impact 3: Loss of species of special concern.
- Potential impact 4: Spills and leaks from construction vehicles / machinery when working in or near the delineated systems, impacting localised surface water quality.
- Potential impact 5: Erosion and Sedimentation.

Operational Phase

- Potential impact 1: Creation of hard surfaces, resulting in runoff, erosion and sedimentation

Decommissioning Phase

- Potential impact 1: Clearing of vegetation within wetland crossings.
- Potential impact 2: Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings.
- Potential impact 3: Loss of species of special concern.
- Potential impact 4: Spills and leaks from construction vehicles / machinery when working in or near the delineated systems.
- Potential impact 5: Erosion and Sedimentation.

Cumulative Impacts

- Cumulative impact 1: All activities within delineated areas, when combined with present day activities.

7. Impact Assessment

7.1 Potential Impacts during the Construction Phase

IMPACT 1: Clearing of vegetation within wetland crossings – Direct impact

As several wetland were identified along the proposed route, especially in the southern portion of the cable alignment. There exists the potential for clearing of valley bottom wetland vegetation within the delineated systems, while Pans / Depression will be avoided.

Clearing of wetland vegetation would be limited as presently the R381 / R63 crosses these systems, while the larger systems south of Rosedene towards Beaufort West will have overhead lines, i.e. spanned and thus avoided.

Regardless, both means of crossing these system would thus limit the impact on flow regime through avoidance (spanned or buried), thus limiting the potential impact on water quality, habitat and biota in the long term or operational phases of the project once the vegetation has re-established.

IMPACT 2: Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings – Direct Impact

Clearing of any riparian vegetation or disturbance of any bed or banks of alluvial systems would be limited as presently the R381 / R63 crosses these systems. This would limit the impact on flow regime through avoidance, thus reducing the potential impact on water quality, habitat and biota. This, coupled to the fact that limited habitat, that is accustomed to disturbance occupies the site, exists along the roads where the cabling is proposed – i.e. alluvial dominated systems that transport large volumes of sediment during high flow conditions.

IMPACT 3: Loss of species of special concern – Direct Impact

Several plant SCCs within the region are conservation worthy or are protected by the respective Provincial bodies of legislation, but no listed species were observed within any of the systems.

IMPACT 4: Spills and leaks from construction vehicles / machinery when working in or near the delineated systems, impacting localised surface water quality – Direct Impact

Leaks from machinery, vehicles or certain construction materials such as cement / concrete used during the construction phase have the potential to result in very localised pollution, should any spill / leaks occur within the watercourse / wetlands observed. These are likely to occur, but on a small scale, with quick remediation.

IMPACT 5: Erosion and Sedimentation – Direct Impact

Impact on localised surface water quality and habitat degradation, should the unstable soils will erode resulting in downstream sedimentation. This impact would have a limited effects on the natural watercourse / alluvial systems, as these already carry natural sediment loads when flowing, but this impact is more related to the wetland areas. Any disturbances within these areas, could impact on the flow and dynamics within the wetland areas in particular, although on a limited scale.

Impact Summary: Construction Phase

Impact 1	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Clearing of vegetation within wetland crossings	*Status*	*Negative*	*Low*	*Where wetland areas aren't spanned with the OHL, cables should be tied into the existing bridges. Should this not be an option, and the crossing distance suitable, then HDD is recommended. Failing these options, it is suggested that hand dug trenching occur in these areas (i.e. no mechanical trenching is allowed to*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

				access these areas). Any of the activities, should also be monitored by the appointed aquatic specialist and EO/ECO on a daily basis, especially during periods of river flow. Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems		

Impact 2	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings	*Status*	*Negative*	*Low*	*Where riverine areas aren't spanned with the OHL, then the cables should be tied into the existing bridges. Should this not be an option, and the crossing distance suitable, then HDD is recommended. Any of the activities, should also be monitored by the appointed aquatic specialist and EO/ECO on a daily basis, especially during periods of river flow. Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. Activities should take place inside of the demarcated servitude / road reserve as far as possible, to prevent additional cumulative impacts on these systems*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact 3	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Loss of species of special concern	*Status*	*Negative*	*Low*	*Search and Rescue should be initiated prior to construction. Develop Construction EMP, Monitoring and Rehabilitation Plan*	***Very Low***	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Unlikely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact 4	*Impact Criteria*	*Significance and Ranking*	*Potential mitigation measures*	*Significance and Ranking*	*Confidence Level*

			(Pre-Mitigation)		*(Post-Mitigation)*	
CONSTRUCTION PHASE						
Impact on localised surface water quality ***(Spills and leaks from construction vehicles / machinery when working in or near the delineated systems)***	*Status*	*Negative*	*Low*	*Construction EMP, Monitoring via appointed aquatic specialist and EO / ECO. No refuelling and or servicing of machinery and vehicles should occur within the delineated systems.*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact 5	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Erosion and Sedimentation	*Status*	*Negative*	*Low*	*Construction EMP, Monitoring via aquatic specialist and EO /ECO with daily inspection of works areas. Where any unstable soils occur, these must be protected with temporary stabilisation (sand bags or hay bales dependent on the scale of the operation) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then this must be include into the GA application, however it is recommended that active revegetation of the area be encouraged, i.e. once construction has been completed, the disturbed areas are demarcated as exclusion areas from additional disturbance, thus preventing compaction / disturbance of area.*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

7.2 Potential Impacts during the Operational Phase

IMPACT 1: Creation of hard surfaces, resulting in runoff, erosion and sedimentation – Indirect impact

This impact would be limited to any additional hard surface areas, although limited to manhole structures and any supporting infrastructure. Any such structures have then ability to generate surface water runoff, which then has the potential to create erosion with downstream sedimentation. Noting the alluvial nature of the receiving environment and the size and position of the structures, this impact is unlikely to occur.

Impact 1	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Creation of hard surfaces resulting in runoff, erosion and sedimentation	*Status*	*Negative*	*Low*	*Monitoring should occur on a monthly basis for 6 months post construction and where any unstable soils occur, these must be protected with temporary stabilisation dependent on the scale of the impact i.e. sand bags - hay bales) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then this must be include into the GA application.*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Unlikely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

7.3 Potential Impacts during the Decommissioning Phase

IMPACT 1: Clearing of vegetation within wetland crossings – direct impact

Any wetland vegetation that had re-established would need would be cleared, but as in the construction phase this would be limited as presently the R381 / R63 crosses these systems, while the larger systems south of Rosedene towards Beaufort West will have overhead lines, i.e. spanned and thus avoided.

IMPACT 2: Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings – Direct Impact

Clearing of any riparian vegetation that re-established post construction or disturbance of any bed or banks of alluvial systems would be limited as presently the R381 / R63 crosses these systems. This would limit the impact on flow regime through avoidance, thus reducing the potential impact on water quality, habitat and biota. This coupled to the fact that limited habitat, that is accustomed to disturbance occupies the site, i.e. alluvial dominated systems that transport large volumes of sediment during high flow conditions would be affected.

IMPACT 3: Loss of species of special concern – Direct Impact

Several SCCs within the region are conservation worthy or are protected by the respective Provincial bodies of legislation, but no listed species were observed within any of the systems.

IMPACT 4: Spills and leaks from construction vehicles / machinery when working in or near the delineated systems, impacting localised surface water quality – Direct Impact

Leaks from plant / machinery or certain construction materials such as cement / concrete used during the decommissioning phase have the potential to result in very localised pollution, should any spill / leaks occur within the watercourse/wetlands observed. These are likely to occur, but on a small scale, with quick remediation.

IMPACT 5: Erosion and Sedimentation – Direct Impact

Impact on localised surface water quality and habitat degradation, should the unstable soils will erode resulting in downstream sedimentation. This impact would have a limited impact on the natural watercourse / alluvial systems, as these already carry natural sediment loads when flowing, but this impact is more related to the wetland areas. Any disturbances within these areas, could impact on the flow and dynamics within the wetland areas in particular, although on a limited scale.

Impact Summary: Decommissioning Phase

Impact 1	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISIONING PHASE						
Clearing of vegetation within wetland crossings	*Status*	*Negative*	*Low*	*Any of the activities, should also be monitored by the appointed EO/ECO on a daily basis, especially during periods of river flow. Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact 2	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISIONING PHASE						
Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings	*Status*	*Negative*	*Low*	*Any of the activities, should also be monitored by the appointed EO/ECO on a daily basis, especially during periods of river flow. Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact 3	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISIONING PHASE						
Loss of species of special concern	*Status*	*Negative*	*Low*	*Search and Rescue of SCCs that may have established should be initiated prior to decommissioning.* *Implement EMP, Monitoring and Rehabilitation Plan*	***Very Low***	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Unlikely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact 4	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISIONING						
Impact on localised surface water quality ***(Spills and leaks from construction vehicles / machinery when working in or near the delineated systems)***	*Status*	*Negative*	*Low*	*Construction EMP, Monitoring via EO / ECO and daily inspection of plant. No refuelling and or servicing of plant should occur within the delineated systems.*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact 5	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISIONING PHASE						
Erosion and Sedimentation	*Status*	*Negative*	*Low*	*Construction EMP, Monitoring via EO /ECO with daily inspection of works areas, where any unstable soils occur, these must be protected with temporary stabilisation (sand bags or hay bales dependent on the scale of the operation) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then this must be include into the GA application, however it is recommended that active revegetation of the area be encouraged, i.e. once decommissioning has been completed, the disturbed areas are demarcated as exclusion areas, thus preventing compaction / disturbance of area.*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

7.4 Cumulative Impacts

When assessing the impacts, it is unlikely that additional large scale impacts on the aquatic environment would occur, this being based on the fact that once stable / vegetated, the buried cable sleeves would not create any additional disturbances to the flow regime and or aquatic habitats observed. This is assuming that the mitigation in the construction, operational and decommissioning phases are adhered to.

Impact 1: All activities within delineated areas, when combined with present day activities

The cumulative impact of the present day roads combined with the proposed project activities that include disturbance of soils and movement of plant within any aquatic zones.

Impact Summary: Cumulative Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Additional activities within delineated aquatic areas within proximity to road reserves / servitudes	*Status*	*Negative*	*Low*	*All projects should adhere to the site-specific recommendations in their respective EMPrs to ensure that impacts are mitigated where possible – including avoidance of identified sensitive systems and usage of existing disturbance corridors.*	***Very low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Unlikely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				
OPERATIONAL PHASE						
Additional activities within delineated aquatic areas within proximity to road reserves / servitudes	*Status*	*Negative*	*Very Low*	*All projects should adhere to the site-specific recommendations in their respective EMPrs to ensure that impacts are mitigated where possible - including usage of existing disturbance corridors and stabilisation of erosion points (sand bags in the short term) using gabions and reno mattress as required.*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Low*				
	Probability	*Unlikely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				
DECOMMISSIONING PHASE						
Additional activities within delineated aquatic areas within proximity to road reserves / servitudes	*Status*	*Negative*	*Low*	*All projects should adhere to the site-specific recommendations in their respective EMPrs to ensure that impacts are mitigated where possible. With regard the fibre line, Construction EMP, Monitoring via EO /ECO with daily inspection of works areas, where any unstable soils occur, these must be protected with temporary stabilisation (sand bags or hay bales dependent on the scale of the operation) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then this must be include into the GA application, however it is recommended that active revegetation of the area be encouraged, i.e. once decommissioning has been completed, the disturbed areas are demarcated as exclusion*	***Very Low***	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Low*				
	Probability	*Unlikely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

				areas, thus preventing compaction / disturbance of area.		

7.5 Impact Assessment Summary

An overall summary of the various impacts and within the various phases of the project are summarised below in Table 6:

Table 6: Overall Impact Significance (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Very Low
Operational	Very Low
Decommissioning	Very Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Very Low
Cumulative - Operational	Very Low
Cumulative - Decommissioning	Very Low

8. Legislative and Permit Requirements

The following is pertinent to this study with regard protection of water resources or aquatic ecosystems for safe and equitable use, to provide human needs as per their rights contained in the following:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act
  - Outlines Activities that require Environmental Authorisation (EA) prior to commencement.
- National Water Act, 1998 (Act No. 36 of 1998)
  - Outlines Water Uses that require a WUL or GA prior to commencement (discussed in more detail below).
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999) – applies if cultural use or heritage is linked to any aquatic resources (refer to the Heritage Specialist Study (CTS Heritage, 2020)).

Based on an assessment of the proposed activities (Table 7) and past engagement with DHWS, the following Water Use Authorisations may be required based on the following thresholds as listed in the following Government Notices, however ultimately the DHSWS must determine whether a GA or full WULA will be required during the pre-application process as it relates to the following.

DWS Notice 538 of 2016, 2 September in GG 40243– Section 21 a water uses relating to the Abstraction of water.
Government Notice 509 in GG 40229 of 26 August 2016 – Section 21 c & I water uses relating to the Impeding or diverting the flow of water in a watercourse and or altering the bed, banks, course or characteristics of a watercourse.
Government Notice 665, 6 September 2013 in GG 36820 Section 21g relating to disposing of waste in a manner that may detrimentally impact on a water source which includes temporary storage of domestic waste water i.e. conservancy tanks under Section 37 of the notice.

Table 7: Summary of potential water uses

	Water Use Activity	Applicable to this development proposal
S21(a)	Taking water from a water resource	Yes, if water is abstracted from new and or existing boreholes, dams or rivers.
S21(b)	Storing water	Only if water is stored within a dam. The use of tanks and reservoirs is thus advised as these don't require a license
S21(c)	Impeding or diverting the flow of water in a watercourse	If any works (permanent or temporary) are located within a watercourse or within 500m of a wetland boundary then a GA process can potentially be followed if the DWS Risk Assessment Matrix indicates that all impacts with mitigation are LOW (see Appendix D).
S21(d)	Engaging in a stream flow reduction activity	Not applicable
S21(e)	Engaging in a controlled activity	Not applicable
S21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit	Not applicable
S21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Typically, the conservancy tanks at construction camps require a license (GA if volumes are below 5000 m^3)
S21(h)	Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process	Not applicable
S21(i)	Altering the bed, banks, course or characteristics of a watercourse	If any works (permanent or temporary) are located within a watercourse or within 500m of a wetland boundary then a GA process can potentially be followed if the DWS Risk Assessment Matrix indicates that all impacts with mitigation are LOW (see Appendix D).
S21(j)	Removing, discharging or disposing of water found underground for the continuation of an activity or for the safety of persons	Not applicable
S21(k)	Using water for recreational purposes	Not applicable

DHSWS DETERMINES WHETHER A GA OR WULA APPLICATION WILL BE REQUIRED DURING THE PREAPPLICATION PHASE – FOR THE PROPOSED FIBRE OPTIC CABLE A GA HAS BEEN DETERMINED AS AN APPORIATE WATER USE AUTHORISATION MECHANISM.

9. Water Use License Risk Assessment Matrix

As indicated in the section above, if any of the Section 21c & i activities are considered Low risk, based on the outcomes of the DWS Risk Assessment Matrix (refer to Appendix D for full results), then a GA could be issued.

The Risk Assessment Matrix impacts are rated as LOW, and thus a GA process is recommended as being sufficient. DHSWS ultimately determines whether a GA process is acceptable, when coupled to any other of the proposed uses. Based on the Risk Assessment Matrix results, pre-application consultation and site visit by the DHSW, Environmental Assessment Practitioner and Project Proponent in November 2020, a GA has been confirmed as the appropriate WUA mechanism for the proposed fibre optic cable.

10. Environmental Management Programme Inputs

The following are key recommendations, which are also critical to the proposed mitigations:

- Where wetland areas aren't spanned with the OHL, the cables should be tied into the existing bridges. Should this not be an option, and the crossing distance suitable, then HDD is recommended. Failing these options, then it is suggested that hand dug trenching occur in these areas (i.e. no mechanical trenching is allowed to access these areas).
- Any of the activities, should also be monitored by the appointed aquatic ecologist and EO/ECO on a daily basis, especially during periods of river flow.
- Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems.
- Search and Rescue should be initiated prior to construction.
- The EMPr, must include a Specific Monitoring and Rehabilitation Plan related to the water course and wetland crossings, and specifically to the prevention of erosion and sedimentation as these system are prone to scour, with rehabilitation options being limited due to the sparse nature of the vegetation.
- Monitoring should occur on a monthly basis for 6 months post construction and where any unstable soils occur, these must be protected with temporary stabilisation dependent on the scale of the impact i.e. sand bags - hay bales) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then the GA must be amended to include these areas.

11. Final Specialist Statement and Authorisation Recommendation

A variety of aquatic features, mostly ephemeral in nature were identified within the study area and, where required, the layout has taken some cognisance of these features through the inclusion of section of cable on overhead lines or attached to bridges. On these grounds the current overall impact on the aquatic environment is Very Low (with mitigation).

11.1. Statement and Reasoned Opinion

Based on the findings of this study, the specialist finds no reason to withhold an authorisation of any of the proposed activities, assuming that the key recommended mitigations measures are implemented.

11.2. EA Condition Recommendations

- A key recommendation is that that during the construction mobilisation process, that the temporary construction camps, stockpiles and laydown areas are located outside of any delineated aquatic systems and within any existing disturbed areas
- A final walkdown by an aquatic specialist must be conducted to ensure that any of the proposed structures are placed within disturbed areas within the servitude as far as possible, sensitive systems are avoided and appropriate construction methods (e.g. hand-dug trenching and HDD) are employed as necessary.

12. References

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Appendix A - Specialist Expertise

CURRICULUM VITAE
Dr Brian Michael Colloty
7212215031083

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Port Elizabeth, 6070
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083 498 3299

Profession: Ecologist (Pr. Sci. Nat. 400268/07) Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries
Years experience: 25 years

SKILLS BASE AND CORE COMPETENCIES

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

TERTIARY EDUCATION

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

EMPLOYMENT HISTORY

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

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

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

South African

- Nuweveld Wind Farms aquatic assessment for RedCap renewables, (3 wind farms and 130km transmission line) - current
- Plant and animal search and rescue for the Karusa and Soetwater Wind Farms on behalf of Enel Green Power, Current
- Plant and animal search and rescue for the Nxuba, Oyster Bay and Garob Wind Farms on behalf of Enel Green Power, 2018 - 2019
- Plant and Animal Search and Rescue for the Port of Ngqura, Transnet Landside infrastructure Project, with development and management of on site nursery, Current
- Plant and Animal Search and Rescue for the Port of Ngqura, OTGC Tank Farm Project (2019)
- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive), Department of Social Development (Military veterans housing, Despatch) and Nxuba Wind Farm, - current
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - 2018
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 125 renewable projects in the past 9 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, Red Cap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. . Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).

Appendix B - Specialist Statement of Independence

Note from the CSIR: Specialists to please complete this section. We will add the actual specialist declaration (on the DEFF prescribed form) as an appendix to the BA Report.

I, ____Brian Colloty____________________________, 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 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist: _______ __________________

Name of Company: ______EnviroSci (Pty) Ltd___________________

Date: _______29 / 10 / 2020__________________

Appendix C: Site Sensitivity Verification

Prior to commencing with the Aquatic Biodiversity Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	28 August – 2 October 2020
Specialist Name	Dr Brian Colloty
Professional Registration Number	400268/07
Specialist Affiliation / Company	EnviroSci (Pty) Ltd

Government Notice No. 320, dated 20 March 2020, includes the requirement that an Initial Site Sensitivity Verification Report must be produced for a development footprint. As per Part 1, Section 2.3, the outcome of the Initial Site Verification must be recorded in the form of a report that-

(a) Confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;

(b) Contains a motivation and evidence of either the verified or different use of the land and environmental sensitivity;

(c) Is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

This report has been produced specifically to consider the aquatic biodiversity theme and addresses the content requirements of (a) and (b) above. The report will be appended to the respective specialist study included in the Scoping and EIA Reports produced for the projects.

<u>Site sensitivity based on the aquatic biodiversity theme included in the Screening Tool and specialist assessment</u>

Based on the DEA Screening Tool, the site contains areas of very high sensitivity due to the presence of CBAs, wetlands and rivers. The remaining area within the development footprint is deemed to be of low sensitivity (See Figure 1).

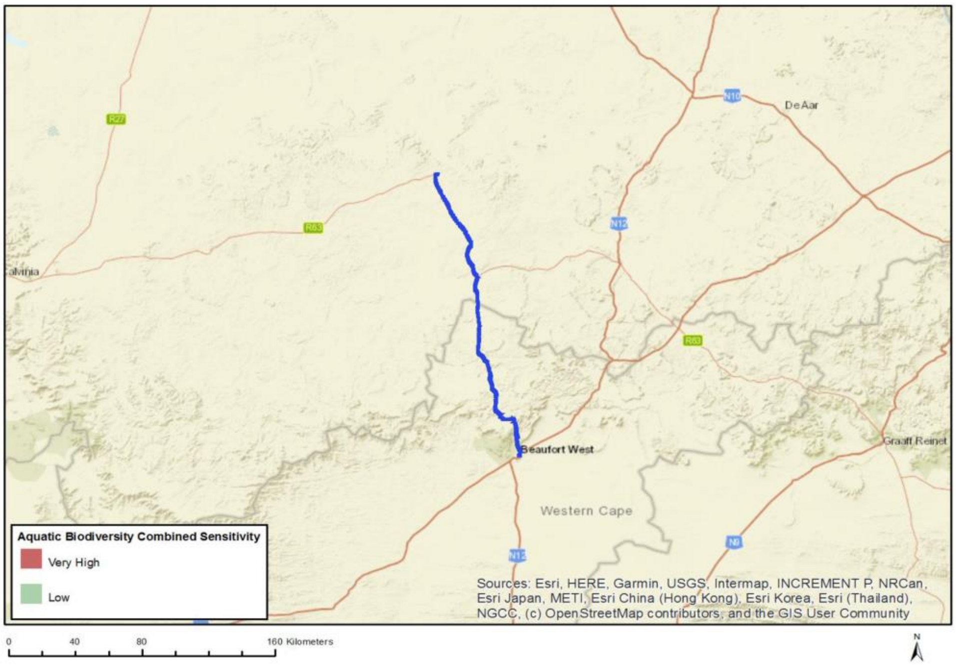

Figure 1. DEA Screening Tool outcome for the terrestrial biodiversity theme

Based on the above outcomes, the specialist **confirms** the environmental sensitivities identified on site, informed by a site visit undertaken by Dr Brian Colloty in March, May and September 2019 and August / October 2020. The photo plates below shows the various aquatic features present on site. This information was then compared to current wetland inventories, 1: 50 000 topocadastral surveys mapping and the site. A baseline map was then developed which was refined, noting that due to the complex of the topography and geology, the river lines were digitised at a scale of 1:2000.

Plate 1: Large Valley Bottom wetland within Sak River, where the line will span via the overhead section of the cable (-32.070606S 22.454220E), noting that the present tower location must be located outside of this wetland area

Plate 2: A channelled Valley Bottom Wetland on the Sak River along the surfaced section of the R381 (-32.1614S 22.4741E)

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Plate 3: An aerial view of the same wetland shown in Plate 3 above, with a distinct channel meandering through the wetland areas (dark green = Sedges)

Plate 4: A alluvial riverine area with distinct riparian zone that develops intermittently along the floodplains more typical of the Brak and Slangfontein se Leegte systems

Plate 5: Aerial view of the drier alluvial systems (blue arrow_, with little to no wetland features along the R381 closer to Loxton (road indicated by red arrow)

Plate 6: The sandy alluvial areas associated with the Gansvlei catchment along the R63 tarred portion of the alignment (-31.280294 S 22.301069 E)

Plate 7: Upstream view of the only major bridge along the cable alignment on the Brak River colonised by extensive *Phragmites australis* reedbeds

Plate 8: Downstream view of the wetland areas along the Brak River bridge crossing (-31.536364S 22.340223E)

Plate 9: Numerous small borrowpits are located along the road and these are inundated with water during high rainfall periods, but did not contain any significant aquatic species

Figure 10 a-L of the specialist report above indicates the fine scale delineation and resultant sensitivity maps produced following the desktop assessment as well as a groundtruthing exercises. The PES of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

With the exception of the Gamka River (PES = B or Largely natural), the remainder of the systems assessed by DWS were rated as PES = C or Moderately Modified. While all the rivers were rated as Moderate / Medium in terms of Ecological Sensitivity and Ecological Importance.

<u>Motivation of the outcomes of the sensitivity map and key conclusions</u>

In conclusion, the DEA Screening Tool identified two sensitivity ratings within the development footprint, namely, very high and low. Although there is some overlap with the findings on site and the Screening Tool’s outcome, the development footprint contains various sensitivities (High, moderate, and low) that were identified following the undertaking of several site visits and spatial input considerations.

Appendix D: DWS Risk Assessment Matrix

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

NAME and REGISTRATION No of SACNASP Professional member: ......Dr Brian Colloty.............................. Reg no. ......Ecologist 400268/07...................................

Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

#NAME?

No.	Phases	Activity	Aspect	Impact	Severity: Flow Regime	Severity: Physico & Chemical (Water Quality)	Severity: Habitat (Geomorph + Vegetation)	Severity: Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes	PES AND EIS OF WATERCOURSE
1	Construction & Decommissioning phase	**Clearing of vegetation within wetland crossings**	Clearing of valley bottom wetland vegetation within the delineated systems, while Pans/Depression will be avoided	Clearing of wetland vegetation would be limited as present the R381 crosses these systems, while the larger systems south of Rosedene towards Beaufort West will have overhead lines, i.e. spanned and thus avoided). Regardless, both means of crossing these system would thus limit the impact on flow regime through avoidance, thus limiting the potential impact on water quality, habitat and biota	1	1	1	1	1	2	2	5	2	3	5	1	11	55	LOW	90-100	Where wetland areas aren't spanned with the OHL, then the cables should be tied into the existing bridges. Should this not be an option, and the crossing distance suitable, then directional drilling is recommended. Failing these options, then it is suggested that hand dug trenching occur in these areas (i.e. no plant is allowed to access these areas). Any of the activities, should also be monitored by the appointed EO/ECO on a daily basis, especially during periods of river flow. Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems		Wetland PES scores ranged between B & B/C within the road servitude assessed, with the exception of the road crossings the impacts within the greater area are minimal. The EIS was rated as High for the systems, as they provide habitat / refugia for several animal species, and contribute to downstream systems (Fish)
2	Construction & Decommissioning phase	**Clearing of vegetation within riverine (with riparian and or alluvial systems) crossings**	Clearing of within any of the delineated channel	Clearing of any riparian vegetation or disturbance of any bed or banks of alluvial systems would be limited as presently the R381 crosses these systems. This would limit the impact on flow regime through avoidance, thus reducing the potential impact on water quality, habitat and biota	1	1	1	1	1	1	2	4	2	3	5	1	11	44	LOW	90-100	Where riverine areas aren't spanned with the OHL, then the cables should be tied into the existing bridges. Should this not be an option, and the crossing distance suitable, then directional drilling is recommended. Any of the activities, should also be monitored by the appointed EO/ECO on a daily basis, especially during periods of river flow. Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems		PES scores ranged between B - C within the road servitude assessed, with the exception of the road crossings, the impacts within the greater area are minimal. The EIS was rated as High to Moderate for the systems, as they provide habitat / refugia for several animal species, and contribute to downstream systems (Fish)
3	Construction & Decommissioning phase	**Loss of Species of Special Concern**	Several plant species within the region are conservation worthy or are protected by the respective Provincial bodies of legislation, but no listed species were observed within any of the systems.	Loss of threatened or protected plant species	1	1	1	3	1,5	1	1	3,5	1	1	5	1	8	28	LOW	100	Search and Rescue should be initiated prior to construction. Construction EMP, Monitoring and Rehabilitation Plan		Wetland PES = B & B/C Rivers B - C EIS High to Moderate
4	Construction & Decommissioning phase	**Spills and leaks from construction vehicles / machinery when working in or near the delineated systems**	Impact on localised surface water quality	Leaks from plant / machinery during the construction phase	1	2	1	3	1,75	1	1	3,75	2	2	5	1	10	37,5	LOW	90-100	Construction EMP, Monitoring via EO / ECO and daily inspection of plant. No refuelling and or servicing of plant should occur within the delineated systems.		Wetland PES = B & B/C Rivers B - C EIIS High to Moderate
5	Construction & Decommissioning phase	**Erosion and Sedimentation**	Impact on localised surface water quality and habitat degradation	Unstable soils will erode and create sedimentation downstream	1	2	2	2	1,75	1	1	3,75	2	2	5	1	10	37,5	LOW	90 - 100	Construction EMP, Monitoring via EO /ECO with daily inspection of works areas, where any unstable soils occur, these must be protected with temporary stabilisation (sand bags or hay bales dependent on the scale of the operation) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then this must be include into the GA application, however it is recommended that active revegetation of the area be encouraged, i.e. once construction has been completed, the disturbed areas are demarcated as exclusion areas, thus preventing compaction / disturbance of area.		Wetland PES = B & B/C Rivers B - C EIIS High to Moderate
6	Operational Phase	**Creation of hard surfaces**	Additional hard surface areas although limited to manhole structures and any supporting infrastructure	Unstable soils will erode and create sedimentation downstream	1	2	2	1	1,5	1	2	4,5	2	2	5	1	10	45	LOW	90-100	Monitoring should occur on a monthly basis for 6 months post construction and where any unstable soils occur, these must be protected with temporary stabilisation dependent on the scale of the impact i.e. sand bags - hay bales) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then this must be include into the GA application		Wetland PES = B & B/C Rivers B - C EIIS High to Moderate
7	Cumulative impacts	**All activities within delineated areas, when combined with present day activities**	The cumulative impact of the present day roads combined with the proposed project require assessment	When assessing the impacts, it is unlikely that additional large scale impacts on the aquatic environment would occur, this being based on the fact that once stable / vegetated the buried cable sleeves would not create any additional disturbances to the flow regime and or aquatic habitats observed. This is assuming that the mitigation in the construction and operational phase are adhered to.	1	1	1	1	1	1	1	3	1	1	5	1	8	24	LOW	90-100	With the combination of the proposed buried and OHL cables, limited to an existing road servitude it is envisaged that the impacts would remain LOW. This is assuming the mitigation listed above are implemented. It is therefore envisaged that the PES & EIS of the systems would remain the same		Wetland PES = B & B/C Rivers B - C EIIS High to Moderate

Appendix E: Impact Assessment Methodology

The impact assessment includes:

- the nature, significance and consequences of the impact and risk;
- the extent and duration of the impact and risk;
- the probability of the impact and risk occurring;
- the degree to which impacts and risks can be mitigated;
- the degree to which the impacts and risks can be reversed; and
- the degree to which the impacts and risks can cause loss of irreplaceable resources.

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

The impact assessment methodology includes the following aspects:

- Nature of impact/risk - The type of effect that a proposed activity will have on the environment.

- Status - Whether the impact/risk on the overall environment will be:
    - Positive - environment overall will benefit from the impact/risk;
    - Negative - environment overall will be adversely affected by the impact/risk; or
    - Neutral - environment overall not be affected.

- Spatial extent – The size of the area that will be affected by the impact/risk:
    - Site specific;
    - Local (<10 km from site);
    - Regional (<100 km of site);
    - National; or
    - International (e.g. Greenhouse Gas emissions or migrant birds).

- Duration – The timeframe during which the impact/risk will be experienced:
    - Very short term (instantaneous);
    - Short term (less than 1 year);
    - Medium term (1 to 10 years);
    - Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or
    - Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).

- Consequence – The anticipated consequence of the risk/impact:
    - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);

- Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
  - Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

- Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
  - High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
  - Moderate reversibility of impacts;
  - Low reversibility of impacts; or
  - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).

- Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts have been further assessed in terms of the following:

- Probability – The probability of the impact/risk occurring:
  - Extremely unlikely (little to no chance of occurring);
  - Very unlikely (<30% chance of occurring);
  - Unlikely (30-50% chance of occurring)
  - Likely (51 – 90% chance of occurring); or
  - Very Likely (>90% chance of occurring regardless of prevention measures).

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 1).

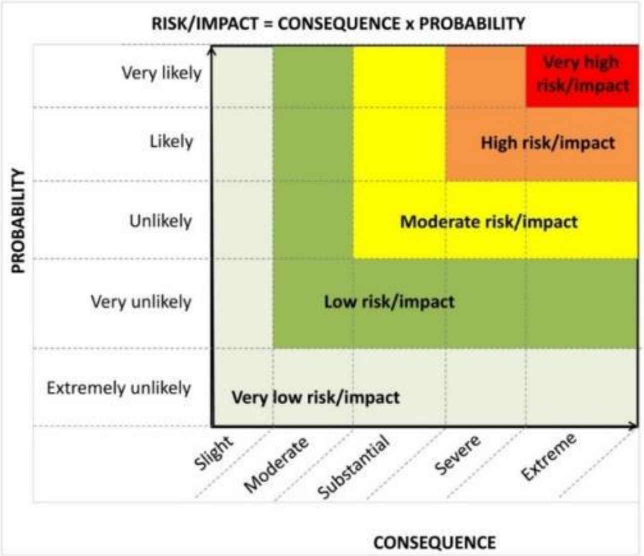

Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- Significance – Will the impact cause a notable alteration of the environment?
  - Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);
  - High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and
  - Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- Very low = 5;
- Low = 4;
- Moderate = 3;
- High = 2; and
- Very high = 1.

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
- Low;
- Medium; or
- High.

Appendix F: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

COMPLIANCE WITH THE PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY ISSUED 20 MARCH 2020, REPLACING REQUIREMENTS OF APPENDIX 6 – GN R326 EIA REGULATIONS OF 7 APRIL 2017

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: *2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;* *a) aquatic ecosystem types; and* *b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;*	*Section 4 Page 21 of this report*
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	*Appendix C Page 55 of this report*
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	*Section 4 Page 21 of this report*
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including: *a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and* *b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).*	*Section 4 Page 21 of this report*
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	*Section 4 Page 21 and Sections 5, 6 and 7 of this report*
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: *2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?*	*Section, 5, 6 and 7 of this report, but in essence the proposed development will have little to no impact on the receiving aquatic environment if the proposed alignment coupled to the listed mitigations*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	*Section where this has been addressed in the Specialist Report*
2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present? *2.5.3. How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include:* *a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);* *b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);* *c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and* *d) to what extent will the risks associated with water uses and related activities change;*	*are adhered to. i.e. the risk to the aquatic environment are low due to the nature of the environment and the present disturbance already present (road servitude)*
2.5.4. how will the proposed development impact on the functioning of the aquatic feature? This must include: *a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system);* *b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river);* *c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley -bottom wetland);* *d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);* *e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and* *f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);*	*Section, 5, 6 and 7 of this report, but in essence the proposed development will have little to no impact on the receiving aquatic environment if the proposed alignment coupled to the listed mitigations are adhered to. i.e. the risk to the aquatic environment are low due to the nature of the environment and the present disturbance already present (road servitude)*
2.5.5. how will the proposed development impact on key ecosystems regulating and supporting services especially: *a) flood attenuation;* *b) streamflow regulation;* *c) sediment trapping;*	*Section, 5, 6 and 7 of this report, but in essence the proposed development will have little to no impact on the receiving aquatic environment*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
d) phosphate assimilation; *e) nitrate assimilation;* *f) toxicant assimilation;* *g) erosion control; and* *h) carbon storage?*	*if the proposed alignment coupled to the listed mitigations are adhered to. i.e. the risk to the aquatic environment are low due to the nature of the environment and the present disturbance already present (road servitude)*
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	*Section, 5, 6 and 7 of this report, but in essence the proposed development will have little to no impact on the receiving aquatic environment if the proposed alignment coupled to the listed mitigations are adhered to. i.e. the risk to the aquatic environment are low due to the nature of the environment and the present disturbance already present (road servitude)*
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: *a) size of the estuary;* *b) availability of sediment;* *c) wave action in the mouth;* *d) protection of the mouth;* *e) beach slope;* *f) volume of mean annual runoff; and* *g) extent of saline intrusion (especially relevant to permanently open systems).*	*N/A as none of these environments were found present*
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	*Yes*
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	*Appendix A Page 52*
2.7.2. a signed statement of independence by the specialist;	*Appendix B Page 54*
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 4 pg 21and Appendix C pg 55*
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	*Section 2 pg 10*
2.7.5. a description of the assumptions made, any uncertainties or gaps in knowledge or data;	*Section 2.8 pg 20*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	*Section 4.2 Pg 32*
2.7.7. additional environmental impacts expected from the proposed development;	*Section 5, 6 and 7*
2.7.8. any direct, indirect and cumulative impacts of the proposed development on site;	*Section 5, 6 and 7*
2.7.9. the degree to which impacts and risks can be mitigated;	*Section 5, 6 and 7*
2.7.10. the degree to which the impacts and risks can be reversed;	*Section 5, 6 and 7*
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	*Section 5, 6 and 7*
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	*Section 4*
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	*Section 5, 6 and 7*
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	*N/A*
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	*Section 11 pg 49*
2.7.16. any conditions to which this statement is subjected.	*Section 11 pg 49*
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, that are to be included in the EMPr.	*Yes*
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*Yes*