ENVIRONMENTAL IMPACT ASSESSMENT (BAR) FOR THE PROPOSED GEEL KOP GRID CONNECTION INFRASTRUCTURE

NEAR GEELKOP, IN THE NORTHERN CAPE PROVINCE

AQUATIC IMPACT ASSESSMENT

FOR

Geel Kop Grid (PTY) LTD

BY

EnviroSci (Pty) Ltd

Dr Brian Colloty

1 Rossini Rd
Pari Park
Port Elizabeth
6070

DATE

9 December 2020

REVISION FINAL

Executive Summary

Geel Kop Grid (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct study of the proposed grid connection corridor assessing the potential impact of the transmission lines and any supporting infrastructure on the aquatic environment. This was based on a detailed 2 day site visit conducted in February 2020. The study area includes a 300m corridor (inclusive of alternatives) and is located south west of Upington in the Northern Cape Province, that will link 7 proposed PV facilities to the Upington MTS.

This assessment included the delineation of any natural waterbodies within the properties in question, as well as assessing the potential consequences of the proposed corridor on the surrounding watercourses and wetlands. This was based on information collected during the site visit and compared to assessment data collected in the same area in April 2010, July 2014, December 2016 and October 2018, spanning various seasons. The February 2020 survey followed heavy rainfall (>100mm) that fell in the region between December 2019 and late January 2020. This allowed for the collection of important detail on the extent and where heavy run-off occurs within these alluvial systems. That and if any extensive habitat / wetlands are supported within the site on a long term basis, i.e. hold water for more than three – four weeks, the typical time period required to support the life cycle on a number of aquatic plants and invertebrates.

The surveys adhered to the assessment criteria contained in the DWAF 2005/2008 delineation manuals, the National Wetland Classification System and the requisite habitat integrity methods to determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the observed aquatic systems. Note the PES rating scale is also used to show the Ecological Category of the system being assessed.

The PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was also adhered to.

It should be noted that the aquatic sensitivity spatial data will be provided to the applicant prior to the lodging of the application for environmental authorisation, in order for them to develop optimal pylon/tower positions. This would then allow for the avoidance of any critical habitats and where not possible provide mitigation to reduce the significance of the potential aquatic impacts. This process also then negated the need to assess any alternative sites and or alignments. This could also allow for the consolidation of access roads, transmission lines and substations, further limiting the overall or cumulative impacts within the greater region, i.e. beyond the Upington / Keimoes area.

The proposed development occurs within the D73F catchment associated with alluvial systems of the Nama Karoo ecoregion. These mainstem watercourses are short tributaries of the Orange River (ca. 1.6 to 17 km from any given point within the study area), which are ephemeral in nature and did not contain any wetland elements within the proposed alignment corridor. The occurrence of a number of pans is an important consideration, as the study area has been highlighted due to the presence of these in the Department of Environmental Affairs Screening Tool, which is discussed in greater detail in this report.

Overall, these watercourses are largely in a natural state, when compared the Orange River, which have modified floodplains and flows. Current and existing impacts occur in localised areas within the corridor and includes existing tracks and evidence of grazing (small livestock).

The only wetlands observed, included several depressions, but could be avoided by any development activities associated with this project as the towers could easily be placed outside of these areas. The National Wetland Inventory v5.2 spatial data (NWI), only indicated riverine floodplains, which were confirmed as alluvial channels in that database, as well as pans/depressions to the north and to the west of the area. The potential presence of these wetlands and the pans, resulted in the portions of

the corridors, receiving a Very High Aquatic sensitivity rating in the DEA Screening Tool, thus requiring the submission of an Aquatic Biodiversity Specialist Assessment and not an Aquatic Biodiversity Compliance Statement. It should be noted that several of pans contained in the NWI did not exist and only those delineated in this assessment were actually observed.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all the systems within the corridors have been assigned a condition score of AB (Nel et al. 2011), indicating that they are largely intact and perform an ecological function. However, the corridor systems are ephemeral and only carried water for a short periods as previously mentioned, thus the observed systems do not support any wide riparian zones and the vegetation associated with these watercourses were between 0.65 m and 14 m wide and contain mostly terrestrial species.

Twenty two woody plant species were found associated with the riparian and pan systems within the corridor. Although none of these were obligate or facultative river/wetland species, they do show a preference for areas exposed to runoff. Species outside of the corridor were dominated by *Vachellia erioloba* (Camel Thorn, Kameeldoring), *Vachellia haematoxylon* (Grey Camel Thorn), *Boscia albitrunca* (Shepard's Tree) and *Euclea pseudebenus* (Ebony Tree), all protected under the National Forest Act and NEMA Biodiversity Act.

The few grass or forbs species were successfully identified were all associated with the regional vegetation type, namely Bushmanland Arid Grassland (NKb 3), Kalaharia Karroid Shrubland (NKb5) and Gordonia Duneveld (SVkd 1).

The only obligate wetland plants observed were those found along the Orange River itself. Species observed included *Typha capensis, Phragmites australis, Prosopis glandulosa* and *Cyperus marginatus*. Notably the prevalence of *Prosopis*, an alien invasive tree species had increased between 2010 and this survey within the sites that had been visited previously by this report author. However, none of the project components would affect these species or habitats that they occur in, both from a hydrological and physical disturbance standpoint.

The National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al*., 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs). The corridor falls within a FEPA, a Fish FSA (Fish Support Area or Fish Sanctuary) and an Upstream FEPA, all associated with the Orange River. Although no permanent fish habitat occurs within the proposed development corridor, The FEPAs and Fish Sanctuaries are sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened fish species indigenous to South Africa. Furthermore, Fish sanctuaries in sub-quaternary catchments associated with a river reach in good condition (A or B Ecological Category) were selected as FEPAs; the remaining fish sanctuaries became Fish Support Areas.

FEPA, Fish Support Areas and Upstream FEPAS include sub-quaternary catchments that are important for migration of threatened and near threatened fish species or include support catchments (hydrological, sediment or nutrient input). Thus, these reaches need to be maintained in a condition that supports the associated populations of threatened fish species, which need not necessarily be an A or B ecological category.

The Present Ecological State scores (PES) for the alignment corridor was rated B – largely natural, while the associated reach along the Orange River, located at the confluence of these main watercourse was rated as follows (DWS, 2014 – where C = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Catchment Ecological Importance	Catchment Ecological Sensitivity
3151	C	Moderate	High

Although the Orange River reaches associated with the study area systems were rated as having a lower ecological state, the surrounding catchments, inclusive of the corridor, these were still considered to have a Moderate and High Ecological Importance and Ecological Sensitivity and for this reason the portions of the proposed corridor were included as a Critical Biodiversity Area Type 2 and Ecological Support Areas as shown in the Northern Cape CBA map.

The pan / depressions (> 0.5 ha) received a PES score of B, and EIS score of Medium. The score (PES = B) was due to the effect of grazing / trampling by animals searching for shade or water.

The PES and EIS scores were then translated in the respective sensitivity ratings of the various aquatic systems (Very High to Moderate), and used to prepare a sensitivity map, that will be used in guiding the preparation of the layout.

It is therefore recommended that all Mainstem Alluvial water courses and Pans (inclusive of the 48m buffer), which were rated as Very High Sensitivity be avoided, i.e. no transmission line towers, but could be spanned. These areas also corresponded to the Very High Sensitivity systems considered in the DEA Screening Tool spatial data, although this report considers their actual hydrogeomorphic classification, i.e. only the pans are considered a wetland type. Two areas with broad alluvial fans (inclusive of the buffer are too broad to be spanned (-28.585178°; 21.113415°-28.593801°; 21.094913°), therefore it is recommended that the towers must be placed outside of any active channels (delineated aquatic zones) with the final locality being determined during the design phase assisted by an aquatic specialist in a walkdown survey.

The remaining secondary aquatic systems (highly ephemeral, with no aquatic habitat) and located within the study area were considered Moderately Sensitive. No buffer was proposed, but again it is proposed that these areas be avoided where possible the positioning of towers and only spanned by the cables.

The following direct impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and include in the table below and assessed against the corridor:

Biodiversity Assessment Protocol Impacts found applicable to this project	Impacts assessed in this report below
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1 & 2
Changes in numbers and density of species	Impact 1 & 2
Faunal and vegetation communities inhabiting the site	Impact 1 & 2
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 3
Streamflow regulation	Impact 3
Erosion control	Impact 4

Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Impact 5
Cumulative Impacts	Impact 6

Impact 1: Loss of Very High Sensitivity systems, namely the mainstem alluvial water course and pans through physical disturbance although the proposed layout must avoid any of these systems (Figure 8).

Impact 2: Impact on secondary alluvial water courses (Moderate Sensitivity), through physical disturbance

Impact 3: Impact on all riparian and wetland systems through the possible increase in surface water runoff on riparian form and function through hydrological changes – access tracks and substations

Impact 4: Increase in sedimentation and erosion from any access tracks and substations

Impact 5: Risks on the aquatic environment due to water quality impacts

Impact 6: Cumulative impacts

In summary, the proposed corridor for the facility would not have a direct impact on the following:

- Any Very High sensitivity areas identified by the DEA Screening Tool if these areas are avoided by the transmission line towers and any new access tracks with the exception of the two areas indicated above.
- Mainstem rivers and Pans that do contain functioning aquatic environments that received a Very High sensitivity rating as indicated in Figure 8.

Therefore, based on the results of this report, the significance of the remaining impacts assessed for the aquatic systems after mitigation would be LOW. No differentiation could be made between the various alternative as the alignment corridors cross over the same systems either upstream or downstream of each other (alternatives).

Thus, based on the findings of this study no objection to the authorisation of any of the proposed activities is made at this point based on the current layout as provided by the developer, i.e. the preferred alternative.

This report also indicates the watercourses and pans within 500m of the development area. Any activities within these areas, the buffers or 500m from the wetland boundary will require a Water Use license under Section 21 c and i of the National Water Act (Act 36 of 1998). The preferred alternative alignment would have fewer applications as it is further away from the pan identified.

As the proposed activities have the potential to create erosion, the following recommendations are reiterated:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the EMP to mitigate.

- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination / leaks outside of any delineated waterbodies and their buffers. Washing and cleaning of equipment should also be done in berms or bunds, to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel.

- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.
- It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within watercourse areas (including buffers) to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation preconstruction.

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ACRONYMS

CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
EIA	Ecological Importance and Sensitivity
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUL	Water Use License
WULA	Water Use License Application

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

DEA Screening Tool Summary			
Requirement	**Completed / Assessed**	**Date**	**Comments**
Desktop and satellite imagery analysis	Yes	5 March 2020	
Preliminary On-site inspection	No	27-29 February 2020	Several summer / winter, as well low and high rainfall periods have been observed within the region over the years
Additional information			**Results**
1:50 000 topocadastral maps	Yes	5 March 2020	Cadastre and indicated features unchanged
Google Earth	Yes	5 March 2020	Used as the basis of GIS mapping and corridor verification
National Wetland Inventory Spatial Data	Yes	5 March 2020	Natural and artificial systems present
National Vegetation Spatial Data	Yes	5 March 2020	Bushmanland Arid Grassland
Threatened Ecosystems Spatial Data	Yes	5 March 2020	None
Conservation Plans (WCBSP, ECBCP, NCBSP etc)	Yes	5 March 2020	Northern Cape Biodiversity Spatial Plan - CBA 2 and ESA
National Freshwater Ecosystem Priority AREA (NFEPA)	Yes	5 March 2020	NFEPA, Fish Support Area (FSA) & Upstream FEPAS
Strategic Water Resource Area	Yes	5 March 2020	None
Free flowing Rivers	Yes	5 March 2020	None
Wetland Clusters	No	5 March 2020	Yes
Critical Biodiversity Area (CBA)	Yes	5 March 2020	Yes
Ecological Support Area (ESA)	Yes	5 March 2020	Yes
Ecological Importance and Sensitivity of Site (EIS)	Yes	5 March 2020	Moderate
Description of ecosystem processes (movement of surface water, recharge/discharge & sediment transport etc)	Yes	5 March 2020	Ephemeral alluvial systems with little to no riparian zones

Historic Reference Condition and Present Ecological State (PES) of rivers (instream, riparian, floodplain), wetlands or estuaries and possible changes to channel and flow regime (surface & groundwater)	Yes	5 March 2020	PES = B Reference Condition B	
Review of Screening Tool results	**Present**	**Confirmed / Disputed (if disputed photographic evidence must be included into assessment)**	**Aquatic Biodiversity Specialist Assessment Protocol Required (Y/N or N/A)**	**Aquatic Biodiversity Compliance Statement Protocol required (Y / N or N/A)**
Very High Aquatic Habitat	YES	Confirmed, but avoided by the proposed corridor	YES	N/A
Low Aquatic Habitat	No	Confirmed	N/A	N/A
ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY PROTOCOL REQUIREMENTS				
Aquatic Biodiversity Specialist Assessment Protocol	YES	**Aquatic Biodiversity Compliance Statement Protocol**		**NO**
Reason	VERY HIGH aquatic habitats	*Reason*		
Proposed Site (Site Sensitivity)	Moderate only within the footprint	Proposed Site (Site Sensitivity)		
Preferred Site (Site Sensitivity)	Not Assessed as site specific sensitive no-go areas were provided at the onset of the design process in order to avoid the systems that were rated a No-Go where feasible	Preferred Site (Site Sensitivity)		
ANTICIPATED IMPACT AND IF REQUIRING ASSESSMENT IN THE SPECIALIST ASSESSMENT	**(Y/N)**	**AQUATIC BIODIVERSITY COMPLIANCE STATEMENT REQUIREMENTS**		**(Y/N**
Aquatic features		**Aquatic features**		
Alteration in baseflow (increase or Reduction of overall flows)	No	Preferred site and proposed development footprint assessed		Yes
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Yes	LOW site sensitivity confirmed		Yes with additional No-Go areas provided by the aquatic specialist including buffers
Change in hydrogeomorphic typing (Unchannelled valley bottom wetland to Channelled Valley Bottom Wetland)	No	Confirm whether or not the proposed development will have an impact on the aquatic features		Impacts will still occur

Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Yes	
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Yes	
Loss or degradation of unique characters or features (waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, pans/ depressions)	No	
Ecosystem regulating and supporting services		
Flood attenuation	No	
Streamflow regulation	Yes	
Sediment trapping	No	
Phosphate assimilation	No	
Nitrate assimilation	No	
Toxicant assimilation	No	
Erosion control	Yes	
Carbon storage	No	
Ecosystem Community Composition		
Changes in numbers and density of species	Yes	
Integrity (condition, viability, predator prey ratios, dispersal rates)	Yes	
Faunal and vegetation communities inhabiting the site	Yes	
Estuary function (where applicable)		
Size of estuary	N/A	
Availability of sediment	N/A	
Wave action in mouth	N/A	
Protection of mouth	N/A	
Beach slope	N/A	
volume of Mean Annual Runoff	N/A	

Extent of saline intrusion (especially where relevant to Permanently Open Systems	N/A		
REPORTING REQUIRMENTS ADDRESSED OR INCLUDED IN THE ASSESSMENT / COMPLIANCE STATEMENT (REPLACING SECTION 6 OF NEMA REGUALTIONS (REPORTING REQUIREMENTS			
Details of SACNASP author included (Registration number, field of expertise and CV	YES	Details of SACNASP author included (Registration number, field of expertise and CV attached in appendix 1.	
Signed statement of independence	YES	Signed statement of independence	
Statement of duration, date and season of site inspection, methods and models use, as well as equipment	YES	A baseline profile description of biodiversity and ecosystems of the site	
Description of assumptions and limitations (uncertainties & knowledge gaps)	YES	The methodology used to verify the sensitivities of the aquatic biodiversity features on the site including the equipment and modelling used where relevant.	
Local of No-Go areas for construction and operation	YES	In the vase of linear activity, confirmation from the aquatic biodiversity specialist that in their opinion, based on the mitigation and remedial measures proposed the land cane be returned to the current state within two years of completion of the construction phase.	
Additional environmental impacts	YES	Proposed impact management actions and impact management outcomes or any monitoring requirements for inclusion in the EMPr.	
Direct, indirect and cumulative impacts assessed	YES	Description of assumptions and limitations (uncertainties & knowledge gaps).	
Degree to which impacts and risks can be mitigated	YES	Any conditions to which approval is subject	
Degree to which impact or risks can be reversed	YES	Signed copy of assessment must be appended to the BAR or EIA	
Degree to which impact or risks can cause the loss of irreplaceable resources	YES		
Inclusion of a suitable construction and operational buffer using accepted methodologies	YES		
Proposed impact management actions and impact management outcomes for inclusion in the EMPr	YES		

Motivation for using High Sensitive Areas versus available Low Biodiversity Sensitive Areas	YES	
Substantiated statement based on the findings of the specialist assessment, regarding the acceptability or no of the proposed development and if the proposed development should receive approval or not	YES	
Any conditions to which approval is subject	YES	
Signed copy of assessment must be appended to the BAR or EIA	YES	

Note: The above screening and protocol summary table remains intellectual property of EnviroSci (Pty) Ltd may not be distributed unless part of this this document.

SPECIALIST DECLARATION

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Geelkop Grid, Northern Cape Province.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447

Pretoria 0001 **Physical address**: Department of Environmental Affairs Attention: Chief Director: Integrated Environmental Authorisations Environment House 473 Steve Biko Road Arcadia Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at: Email: EIAAdmin@environment.gov.za

1.

2. SPECIALIST INFORMATION

Specialist Company Name:	EnviroSci (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr Brian Colloty			
Specialist Qualifications:	Ph.D			
Professional affiliation/registration:	SACNASP Pr Sci Nat 400268/07 Ecological			
Physical address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal code:	6070	Cell:	0834983299	
Telephone:	0413662077	Fax:	-	
E-mail:	b.colloty@gmail.com			

3. DECLARATION BY THE SPECIALIST

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

EnviroSci (Pty) Ltd

Name of Company:

15 June 2020

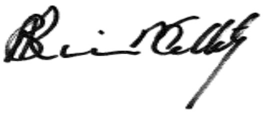
Date

SPECIALIST REPORT DETAILS

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Member SAEIES.

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs and or Department of Water and Sanitation.



Signed: ……………… Date:…15 June 2020………..

Appendix 1 of this report contains a detailed CV

1. Introduction

Geel Kop Grid (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct study of the proposed grid connection corridor assessing the potential impact of the transmission lines and any supporting infrastructure on the aquatic environment (Figure 1). This was based on a detailed 2 day site visit conducted in February 2020. The study area includes a 300m corridor and is located south west of Upington in the Northern Cape Province, that will link 7 proposed PV facilities via 3 switching stations to the either the Geel Kop collector switching station (Alt 1) or Bushmanland PV collector switching station (Alt 2)] and then via a 132kV powerline to the Upington MTS.

This assessment included the delineation of any natural waterbodies within the properties in question, as well as assessing the potential consequences of the proposed corridor on the surrounding watercourses and wetlands. This was based on information collected during the site visit and compared to assessment data collected in the same area in April 2010, July 2014, December 2016 and October 2018, spanning various seasons. The February 2020 survey followed heavy rainfall (>100mm) that fell in the region between December 2019 and late January 2020. This allowed for the collection of important detail on the extent and where heavy run-off occurs within these alluvial systems. That and if any extensive habitat / wetlands are supported within the site on a long term basis, i.e. hold water for more than three – four weeks, the typical time period required to support the life cycle on a number of aquatic plants and invertebrates.

The surveys adhered to the assessment criteria contained in the DWAF 2005/2008 delineation manuals, the National Wetland Classification System and the requisite habitat integrity methods to determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the observed aquatic systems. Note the PES rating scale is also used to show the Ecological Category of the system being assessed.

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It should be noted that the aquatic sensitivity spatial data will be provided to the applicant prior to the lodging of the application for environmental authorisation, in order for them to develop optimal pylon/tower positions. This would then allow for the avoidance of any critical habitats and where not possible provide mitigation to reduce the significance of the potential aquatic impacts. This process also then negated the need to assess any alternative sites and or alignments. This could also allow for the consolidation of access roads, transmission lines and substations, further limiting the overall or cumulative impacts within the greater region, i.e. beyond the Upington / Keimoes area.

Several important national, provincial and municipal scale conservation plans were also reviewed, with the results of those studies being included in this report. Most conservation plans are produced at a high level, so it is therefore important to verify the actual status of the study area during this initial phase, prior to the final development plan being produced.

1.2 Aims and objectives

The aim of this report is to provide the applicant with the requisite delineation of any natural waterbodies, while providing the competent authority with the relevant information to make an informed decision.

Certain aspects of the development may also trigger the need for a Section 21 c & i, Water Use License Applications (WULAs) (or General Authorisation [GA] applications) such as river or water course crossings or any activities within 500m of a wetland boundary. These applications must be submitted to the Department of Water and Sanitation (DWS) and information contained in this report must be used in the supporting documentation.

Information with regard to the state and function of the observed water bodies, suitable no-go buffers and assessment of the potential impacts are also provided.

1.3 Assumptions and Limitation

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of the aquatic communities, 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. No baseline long-term monitoring was undertaken as part of this assessment. However, a concerted effort was made to assess as much of the potential development area and the study area, as well as make use of any available literature, species distribution data and aerial photography. Furthermore, based on the previous assessments undertaken between 2010 and 2020 in the area, this was not foreseen as a huge limiting factor. The level of investigation undertaken is sufficient to inform this assessment.

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.

For the purposes of this report it is assumed that any existing tracks will be used to access the corridor, but a track will be required along the length of the grid for construction and maintenance (Figure 1), but the tracks wont cross any areas rated with a Very High Sensitivity and where possible the proposed PV access road (Figure 1) will be used. Similarly no towers will be placed within these areas as well unless any technical constraints are encountered, then a site specific assessment of the pylon placement must be conducted based on the information on hand.

A further assumption is that water will be sourced from the Kai !Garib Local Municipality and not illegally abstracted from any surrounding watercourses, particularly if dust suppression is required.

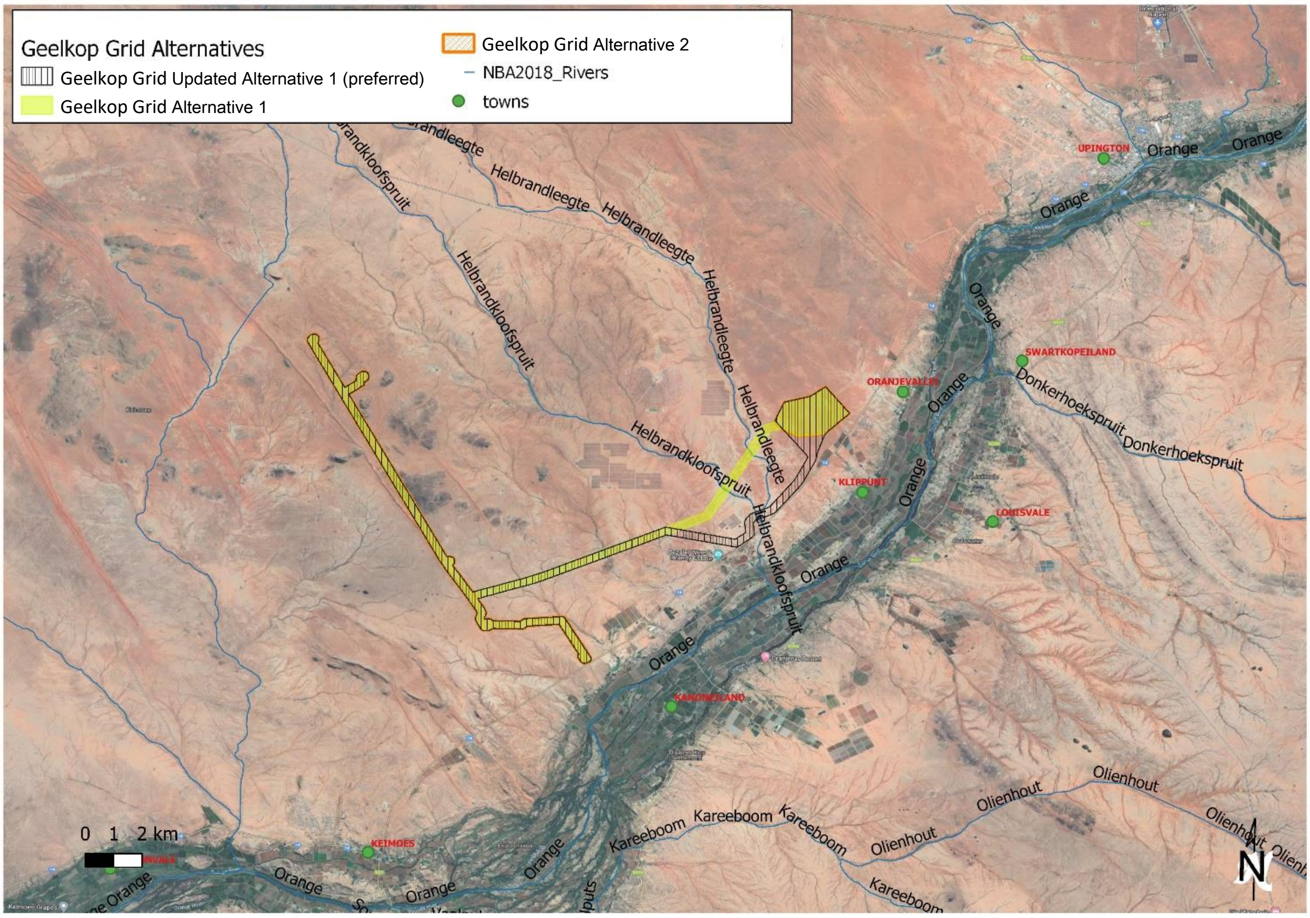

Figure 1: The 300m grid corridor in relation to surrounding landscape, noting the proposed access road for the various PV facilities

2. Terms of Reference

The following scope of work was used as the basis of this study to fulfil the above requirements as provided by the EAP:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with the Specialist Assessment Protocol 20 March 2020, as amended.
- Adherence to all appropriate best practice guidelines, relevant legislation and authority requirements;
- Provide a thorough overview of all applicable legislation, guidelines;
- Cumulative impact identification and assessment as a result of other developments in the area (including; a cumulative environmental impact table(s) and statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered);
- Identification of sensitive areas to be avoided (including providing shapefiles/kmls);
- Assessment of the significance of the proposed development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be 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.
- Comparative assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures in order to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (e.g. permits, licenses etc) and specialist comment if the proposed development should be authorised.

3. Project Description

The following information was provided by the client:

Project Description: Geel Kop Grid (Pty) Ltd proposes the construction and operation of grid connection infrastructure for the seven proposed Geel Kop cluster PV facilities near Upington in the Northern Cape Province. The grid connection infrastructure comprises the following:

- Three switching stations:
  - GK Solar PV switching station;
  - Shrubland PV switching station; and
  - Karroid PV switching station.
- One collector switching station [Geel Kop collector switching station (Alt 1) or Bushmanland PV collector switching station (Alt 2)];
- Four single or double circuit 33kV or 132kV lines from the substations / switching stations to the chosen collector switching station;
- One double circuit 132kV power line from the chosen collector switching station / substation to the Upington Main Transmission Substation (MTS).

Additional associated infrastructure will also be required for the grid connection solution, including access roads, feeder bays (inclusive of line bays, busbars, bussection and protection equipment), switching stations, a fibre and optical ground wire (OPGW) layout, insulation and assembly structures.

A grid connection corridor approximately 300m wide and 34 km long is being assessed to allow for the optimisation of the grid connection and associated infrastructure to accommodate the identified environmental sensitivities. The grid connection infrastructure will be developed within the 300m wide grid connection corridor.

4. Methodology

This study followed the approaches of several national guidelines regarded for aquatic assessment and wetland assessments. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study area systems applicable to the specific environment and in a clear and objective manner, assess the potential impacts associated with the proposed development area based on information collected over a number of years for this and other proposed projects.

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, a system that also differentiates between riverine and wetland aquatic systems.

4.1 Waterbody Classification Systems

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

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

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

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

Definition Box

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

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

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

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

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

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment.

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

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

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

4.2 Wetland Definition

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

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

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

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

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa.

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

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

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

The site surveys included sampling (soil auguring) and species identification to ascertain the presence of any of the listed attributes.

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

Table 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[1]	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]

Where:

[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.

4.3 National Wetland Classification System method

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

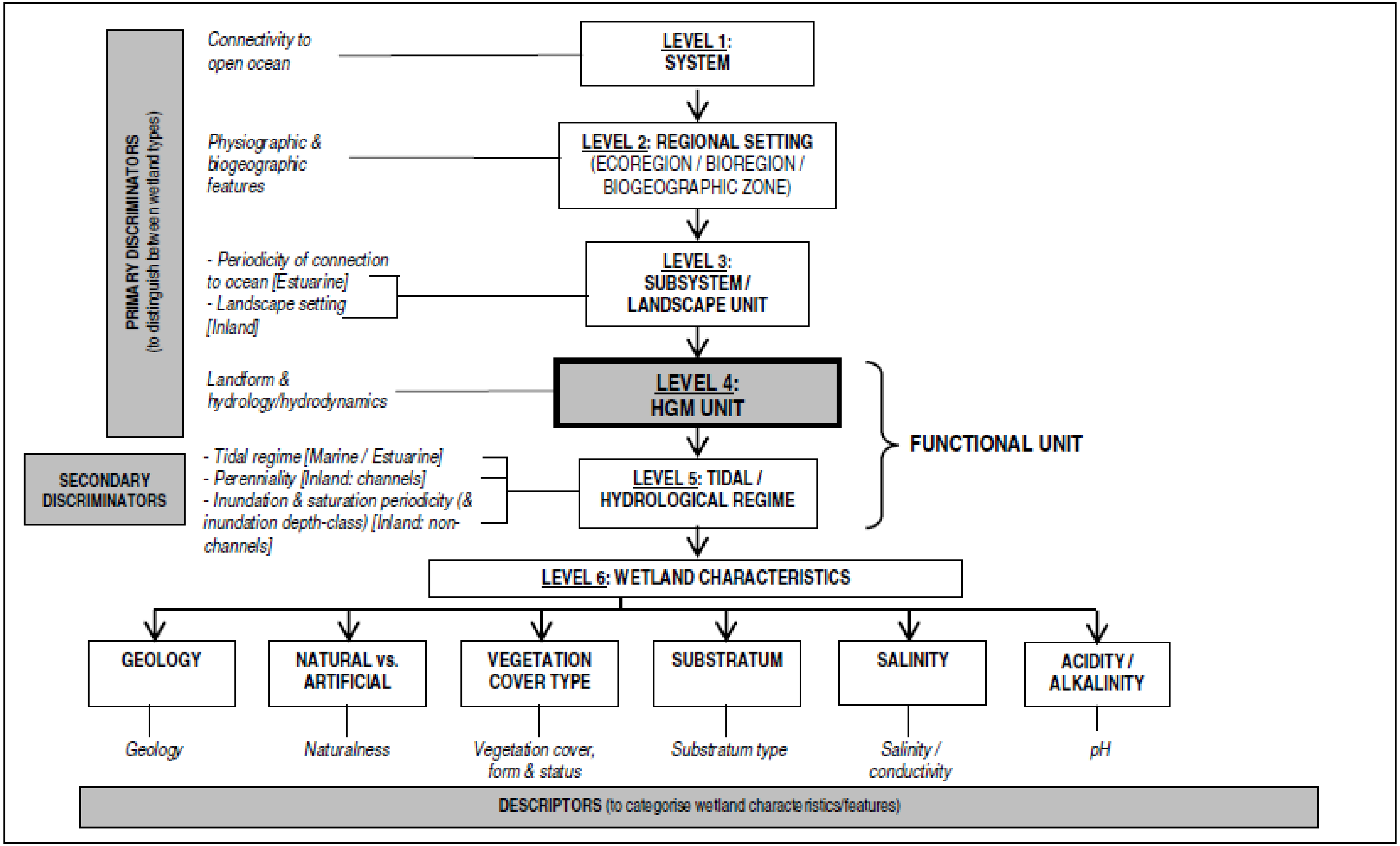

Figure 2: Basic structure of the NWCS, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From Ollis *et al.*, 2013).

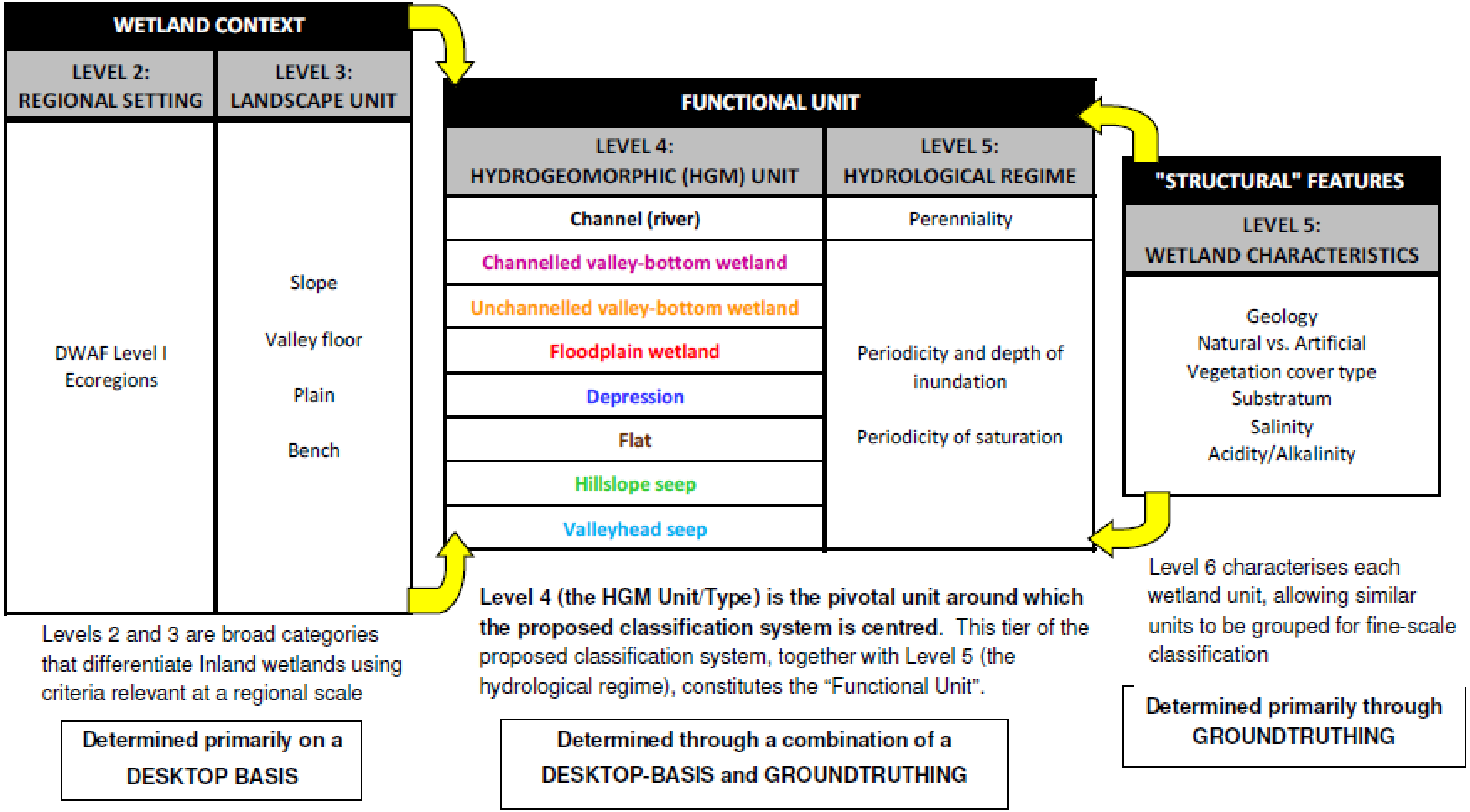

Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al.*, 2013).

4.4 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 (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled size and functioning 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)

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

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

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

4.5 Aquatic Ecosystem Importance and Function

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

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

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

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

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

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

Table 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

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

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

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

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetlands were 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.

4.6 Relevant Wetland Legislation and Policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa, 1996;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974)
- National Forest Act, 1998 (No. 84 of 1998)
- National Heritage Resources Act, 1999 (No. 25 of 1999)

NEMA and the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) would also apply to this project. These Acts have categorised many invasive plants together with associated obligations on the landowner.

4.7 Provincial Legislation and Policy

Currently there are no formalised riverine or wetland buffer distances provided by the provincial authorities and as such the buffer model as described Macfarlane & Bredin (2017) for wetlands, rivers and estuaries was used.

These buffer models are based on the condition of the waterbody, the state of the remainder of the site, coupled to the type of development, as wells as the proposed alteration of hydrological flows. Based then on the information known for the site the buffer model provided the following:

Rivers

- Construction period: 48 m
- Operation period: 42 m
- Final: 48 m

Wetlands (Pans)

- Construction period: 47 m
- Operation period: 43 m
- Final: 47 m

Therefore the final buffer for all systems rated as Very High was 48m, noting that development would have to take place within the secondary systems, so no buffer was proposed for these areas as the suitability of each area affected was assessed to determine if infrastructure could be placed within that particular area.

Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora. Any plants found within the development area are described in the ecological assessment.
- National Freshwater Ecosystems Priority Areas (NFEPA) – (Nel *et al.,* 2011). This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.

5. Description of the affected environment

The proposed development occurs within the D73F catchment associated with alluvial systems of the Nama Karoo ecoregion (Figure 4). These mainstem watercourses are short tributaries of the Orange River (ca. 1.6 to 17 km from any given point within the study area), which are ephemeral in nature and did not contain any wetland elements within the proposed alignment corridor. The occurrence of a number of pans is an important consideration, as the study area has been highlighted due to the presence of these in the Department of Environmental Affairs Screening Tool, which is discussed in greater detail in this report.

Overall, these watercourses are largely in a natural state, when compared the Orange River, which have modified floodplains and flows. Current and existing impacts occur in localised areas within the corridor and includes existing tracks and evidence of grazing (small livestock).

The only wetlands observed, included several depressions, but could be avoided by any development activities associated with this project as the towers could easily be placed outside of these areas. The National Wetland Inventory v5.2 spatial data (NWI) (Figure 5), only indicated riverine floodplains, which were confirmed as alluvial channels in that database, as well as pans/depressions to the north and to the west of the area. The potential presence of these wetlands and the pans, resulted in the portions of the corridor, receiving a Very High Aquatic sensitivity rating in the DEA Screening Tool, thus requiring the submission of an Aquatic Biodiversity Specialist Assessment and not an Aquatic Biodiversity Compliance Statement. It should be noted that several of pans contained in the NWI did not exist and only those delineated in this assessment were actually observed.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment (Figure 6), all the systems within the corridor have been assigned a condition score of AB (Nel et al. 2011), indicating that they are largely intact and perform an ecological function. However, the corridor systems are ephemeral and only carried water for a short periods as previously mentioned, thus the observed systems do not support any wide riparian zones and the vegetation associated with these watercourses were between 0.65 m and 14 m wide and contain mostly terrestrial species.

Twenty two woody plant species were found associated with the riparian and pan systems within the corridor. Although none of these were obligate or facultative river/wetland species, they do show a preference for areas exposed to runoff. Species outside of the corridor were dominated by *Vachellia erioloba* (Camel Thorn, Kameeldoring), *Vachellia haematoxylon* (Grey Camel Thorn), *Boscia albitrunca* (Shepard’s Tree) and *Euclea pseudebenus* (Ebony Tree), all protected under the National Forest Act and NEMA Biodiversity Act.

The few grass or forbs species were successfully identified were all associated with the regional vegetation type, namely Bushmanland Arid Grassland (NKb 3), Kalaharia Karroid Shrubland (NKb5) and Gordonia Duneveld (SVkd 1).

The only obligate wetland plants observed were those found along the Orange River itself. Species observed included *Typha capensis, Phragmites australis, Prosopis glandulosa* and *Cyperus marginatus*. Notably the prevalence of *Prosopis*, an alien invasive tree species had increased between 2010 and this survey within the sites that had been visited previously by this report author. However, none of the project components would affect these species or habitats that they occur in, both from a hydrological and physical disturbance standpoint.

The National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al*., 2011), also earmarked sub-quaternaries (Figure 6), based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs). The corridor falls within a FEPA, a Fish FSA (Fish Support Area or Fish Sanctuary) and an Upstream FEPA, all associated with the Orange River. Although no permanent fish habitat occurs within the proposed development corridor, The FEPAs and Fish Sanctuaries are sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened fish species indigenous to South Africa. Furthermore, Fish sanctuaries in sub-quaternary catchments associated with a river reach in good condition (A or B Ecological Category) were selected as FEPAs; the remaining fish sanctuaries became Fish Support Areas.

FEPA, Fish Support Areas and Upstream FEPAS include sub-quaternary catchments that are important for migration of threatened and near threatened fish species or include support catchments (hydrological, sediment or nutrient input). Thus, these reaches need to be maintained in a condition that supports the associated populations of threatened fish species, which need not necessarily be an A or B ecological category..

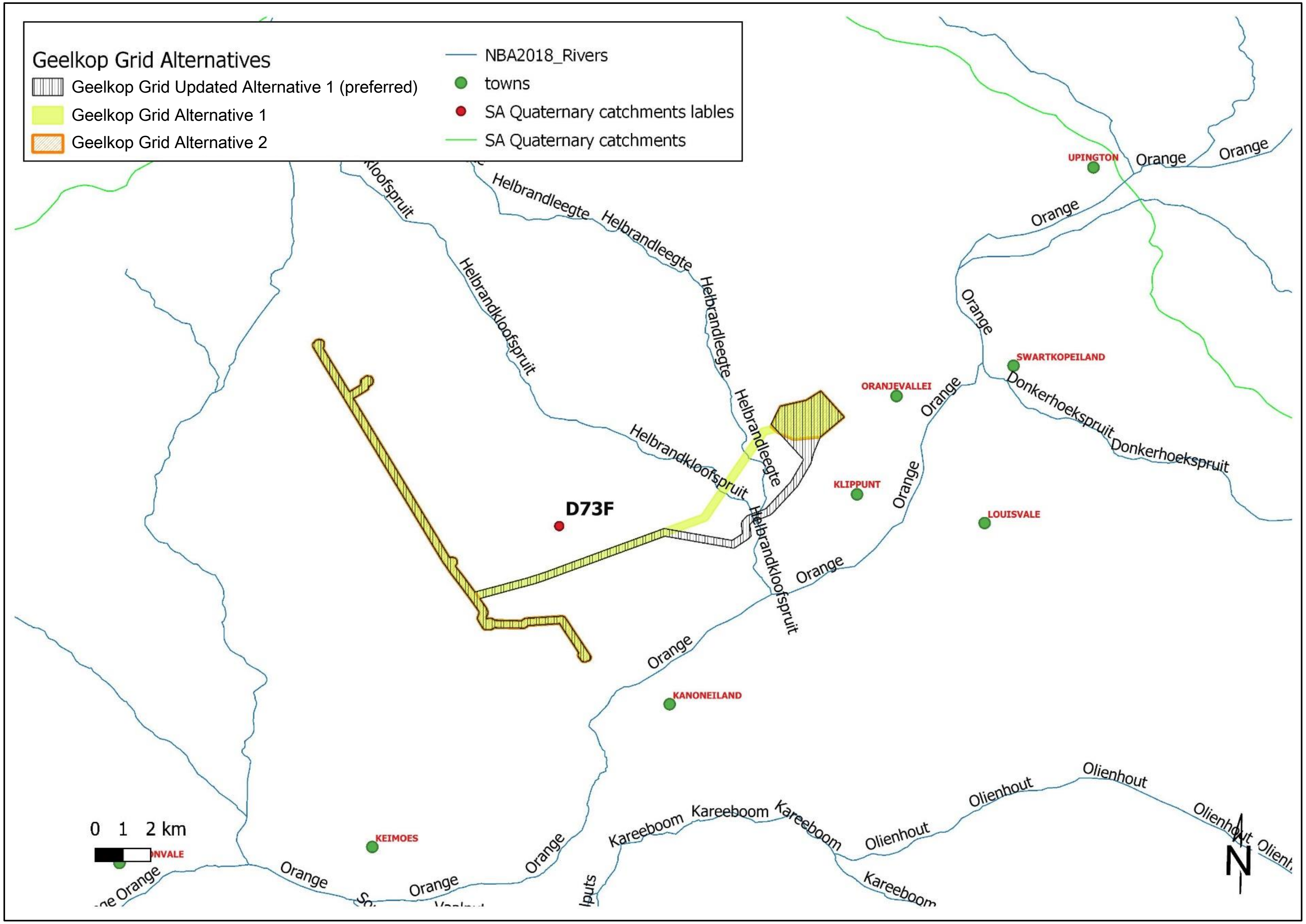

Figure 4: Project locality map indicating the various quaternary catchment boundaries (green line) in relation to the grid corridor (Source DWS and NGI).

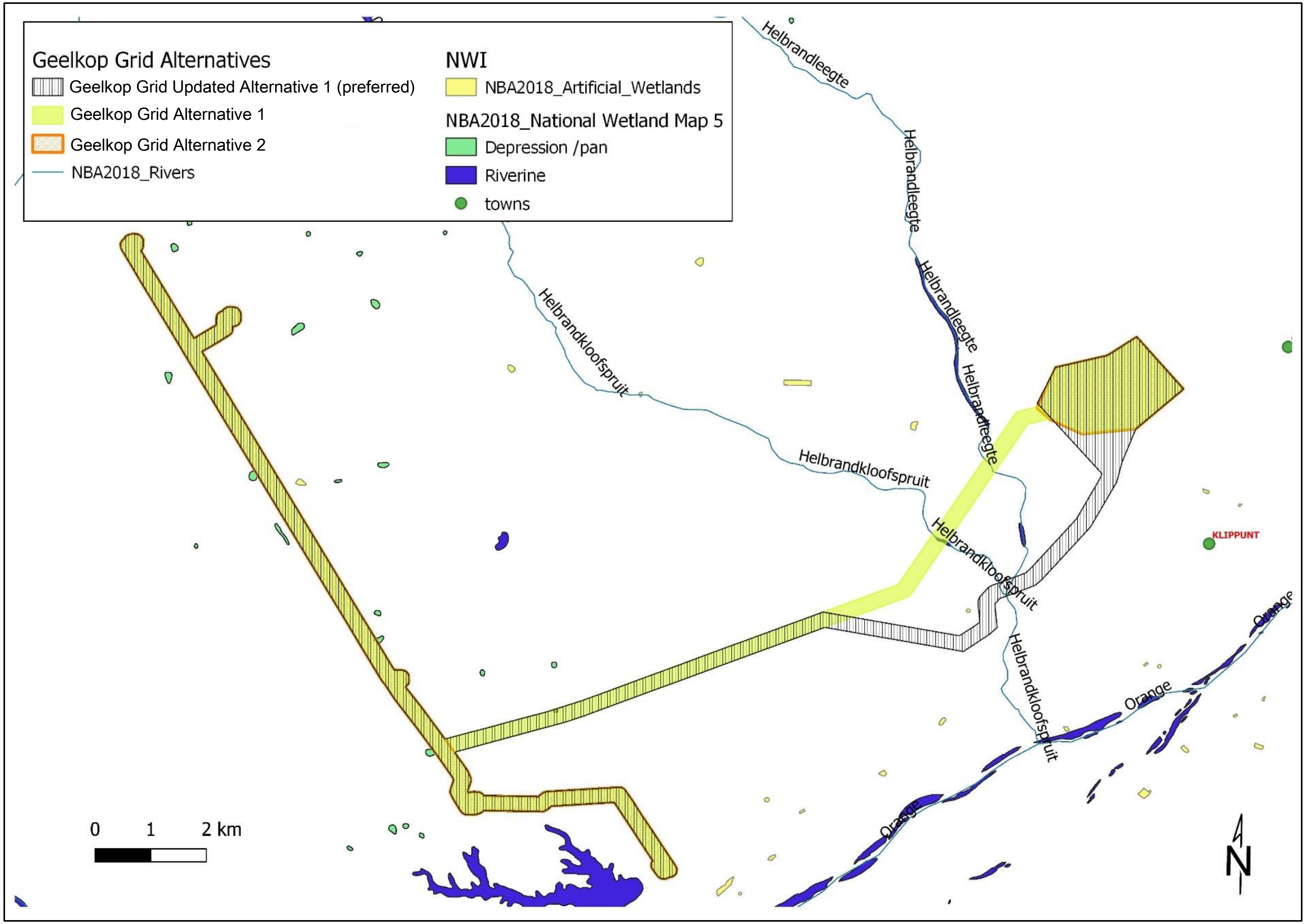

Figure 5: The various waterbodies identified in the National Wetland Inventory V5.2 (2018)

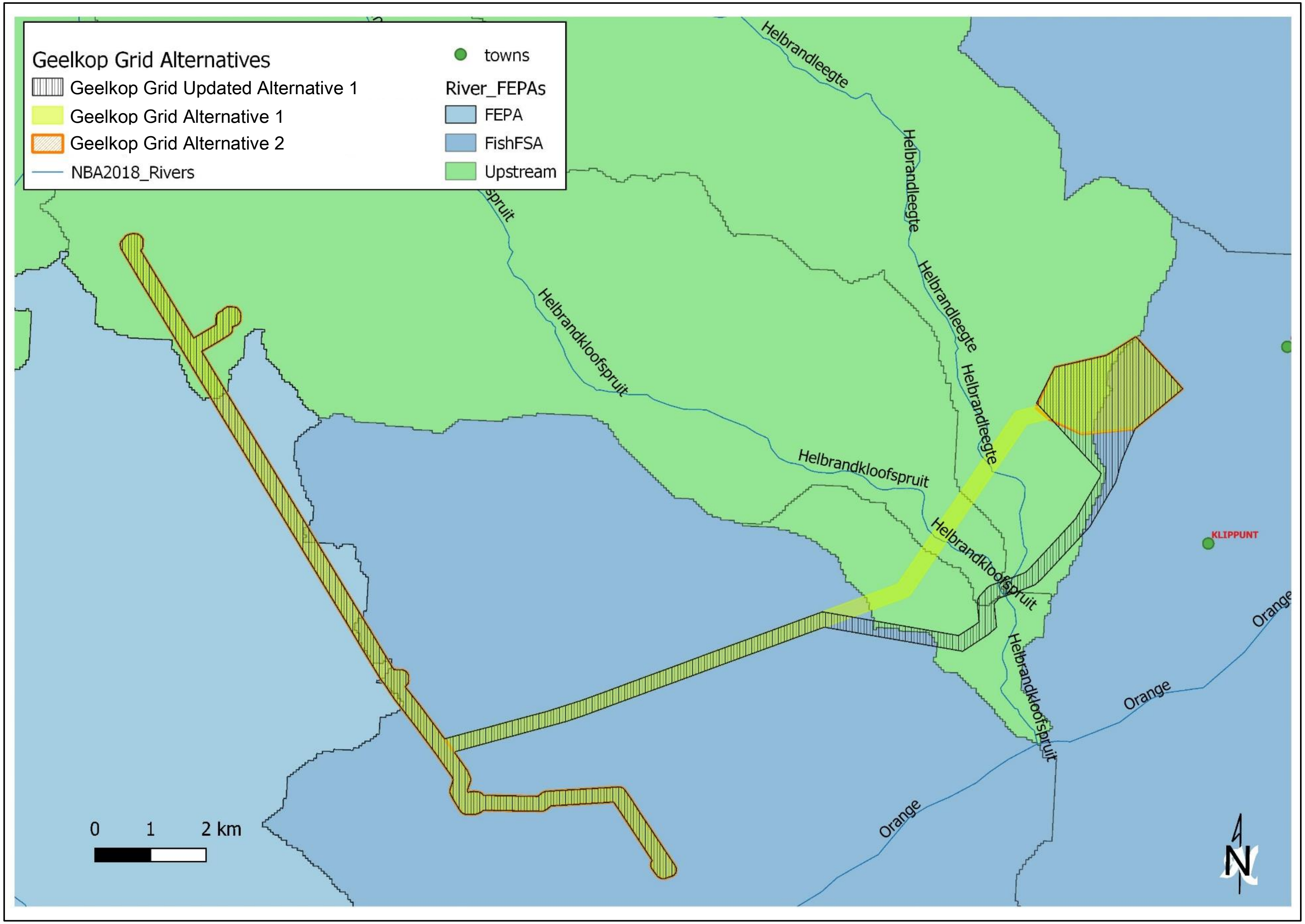

Figure 6: The respective sub quaternary catchments rated in terms of Freshwater Ecosystem Priority Areas (FEPAs) in relation to the study area

6. Present Ecological State, conservation importance and final sensitivity rating

The Present Ecological State scores (PES) for the alignment corridor was rated B – largely natural, while the associated reach along the Orange River, located at the confluence of these main watercourse was rated as follows (DWS, 2014 – where C = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Catchment Ecological Importance	Catchment Ecological Sensitivity
3151	C	Moderate	High

Although the Orange River reaches associated with the study area systems were rated as having a lower ecological state, the surrounding catchments, inclusive of the corridor, these were still considered to have a Moderate and High Ecological Importance and Ecological Sensitivity and for this reason the portions of the proposed corridor were included as a Critical Biodiversity Area Type 2 and Ecological Support Areas as shown in the Northern Cape CBA map (Figure 7).

The pan / depressions (> 0.5 ha) received a PES score of B, and EIS score of Medium. These score (PES = B) were due to the effect of grazing / trampling by animals searching for shade or water.

The PES and EIS scores were then translated in the respective sensitivity ratings of the various aquatic systems (Very High to Moderate), and used to prepare a sensitivity map (Figure 8), that will be used in guiding the preparation of the layout.

It is therefore recommended that all Mainstem Alluvial water courses and Pans (inclusive of the 48m buffer), which were rated as Very High Sensitivity be avoided, i.e. no transmission line towers, but could be spanned. These areas also corresponded to the Very High Sensitivity systems considered in the DEA Screening Tool spatial data, although this report considers their actual hydrogeomorphic classification, i.e. only the pans are considered a wetland type.

The remaining secondary aquatic systems (highly ephemeral, with no aquatic habitat) and located within the study area were considered Moderately Sensitive (Figure 8). No buffer was proposed, but again it is proposed that these areas be avoided by in the positioning of towers and only spanned by the cables.

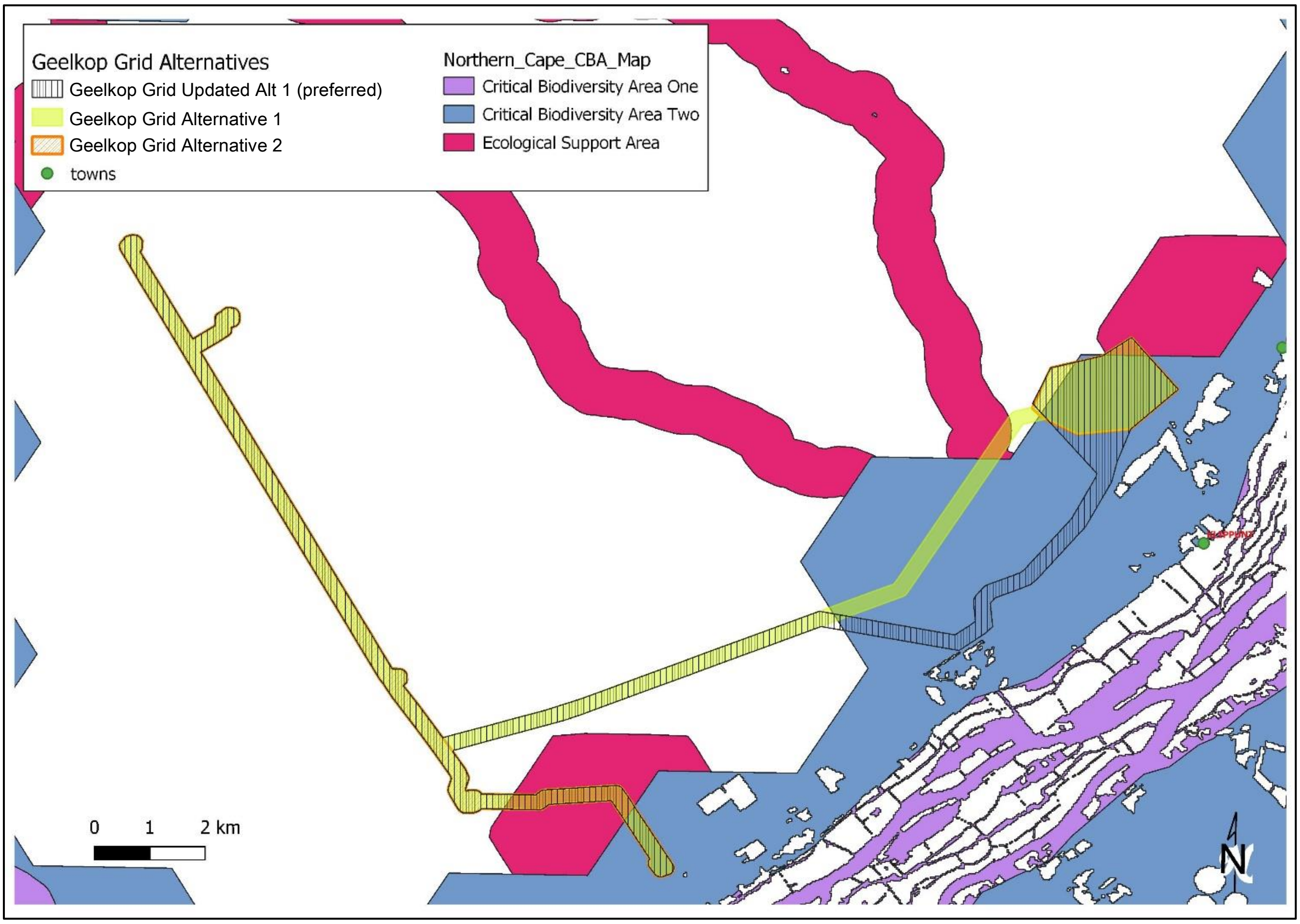

Figure 7: Critical Biodiversity Areas as per the Northern Cape Critical Biodiversity Areas Map

In summary the following aquatic systems were thus observed together with their respective sensitivity ratings based on information collected during this assessment:

Hydrogeomorphic Type and setting	Ecosystem functionality	Sensitivity (Refer to Figure 8)	Comment
Main stem alluvial watercourses (Plate 1) and Pan	Near natural and important alluvial habitat away from the Orange River or unique habitat that contain wetland characteristics (Pans/Depression)	Very High	No development will occur within these areas and the layout must accommodate this aspect, with the exception that access roads, must make use of existing crossings and / or tracks (previously impacted)
Secondary alluvial systems, with defined channel and riparian vegetation (scattered trees – non obligate) (Plate 2)	Important in preventing erosion of landscape during high volume flows	Moderate	No towers should be placed within these areas, access should be within impacted areas or areas verified by the specialist. Two areas with broad alluvial fans (inclusive of the buffer are too broad to be spanned (-28.585178°; 21.113415° & -28.593801°; 21.094913°), therefore it is recommended that the towers must be placed outside of any active channels (delineated aquatic zones) with the final locality being determined during the design phase assisted by an aquatic specialist
Secondary alluvial systems, with no defined channel and riparian vegetation (scattered trees – non obligate) and fragmented	Important in preventing erosion of landscape during high volume flows	Moderate	

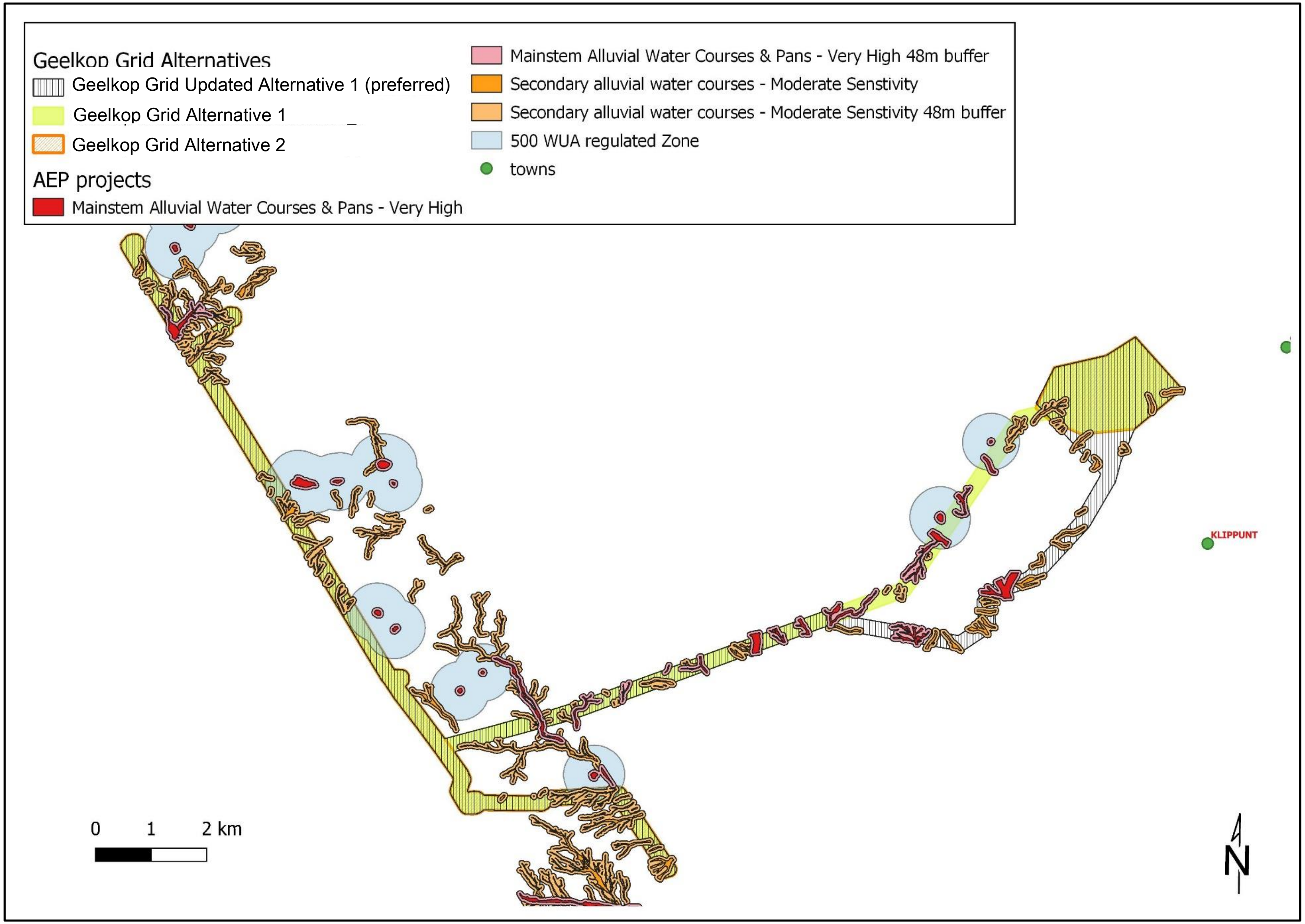

Figure 8: Delineated wetlands (pans) and watercourses in relation to the activities, with buffers, sensitivity ratings and the 500m regulated WULA zone.

Plate 1: Mainstem alluvial watercourse with a Very High sensitivity rating, which will be avoided by the development footprint

Plate 2: Secondary alluvial systems, with defined channel and some riparian vegetation (scattered trees – non obligate

7. Permit requirements

Based on an assessment of the proposed activities and past engagement with DWS, the following WULs/ GA's could be required based on the following thresholds as listed in the following Government Notices, however ultimately the Department of Water and Sanitation (DWS) will determine if a GA or full WULA will be required during the pre-application process (Phase 1):

- **DWS Notice 538 of 2016, 2 September in GG 40243**– Section 21 a & b, Abstraction and Storage of water.
- **Government Notice 509 in GG 40229 of 26 August 2016 –** Section 21 c & i, 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 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, where storage is between 5000 – 10 000m^3 a General Authorisation is applicable.

	Water Use Activity	Applicable to this development proposal
S21(a)	Taking water from a water resource	Yes if not sourced from the local Water Board or a municipal supply.
S21(b)	Storing water	Not likely
S21(c)	Impeding or diverting the flow of water in a watercourse	Yes – several new crossings of watercourses will be required, as well as activities within 500m of a wetland boundary.
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 and then O/M buildings / and substations require a license (GA if volumes are below 10 000 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	Yes – several new crossings of watercourses will be required, as well as activities within 500m of a wetland boundary.

	Water Use Activity	Applicable to this development proposal
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

DWS WILL DETEMINE IF A GA OR WULA APPLICATION WILL BE REQUIRED DURING THE PREAPPLICATION PHASE AND TYPICALLY IF ONE OF THE ABOVE WATER USES REQUIRES A WULA THEN ALL APPLICATIONS WILL BE TREATED AS A WULA AND NOT GA. THE SUBMISSION PROCESS AND DETAIL REQUIREMENTS DO HOWEVER NOT DIFFER, ONLY THE PROCESSING TIMEFRAMES (60 vs 300 DAYS) DO.

8. Impact assessment

The following direct impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and include in the table below and assessed against the corridors, noting that the proposed alternatives cross the same systems just either upstream or downstream of each other, and based on the assumptions and mitigation proposed, the impacts for each corridor would thus be the same:

Biodiversity Assessment Protocol Impacts found applicable to this project	**Impacts assessed in this report below**
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1 & 2
Changes in numbers and density of species	Impact 1 & 2
Faunal and vegetation communities inhabiting the site	Impact 1 & 2
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 3
Streamflow regulation	Impact 3
Erosion control	Impact 4
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Impact 5
Cumulative Impacts	Impact 6

Impact 1: Loss of Very High Sensitivity systems, namely the mainstem alluvial water course and pans through physical disturbance although the proposed layout could avoid any of these systems (Figure 8).

Impact 2: Impact on secondary alluvial water courses (Moderate Sensitivity), through physical disturbance

Impact 3: Impact on all riparian and wetland systems through the possible increase in surface water runoff from the substations and any access tracks on riparian form and function through hydrological changes

Impact 4: Increase in sedimentation and erosion

Impact 5: Risks on the aquatic environment due to water quality impacts

Impact 6: Cumulative impacts

The impacts were assessed as follows:

Nature: Impact 1: Loss of Very High Sensitivity systems, namely the mainstem alluvial water course and pans through physical disturbance although the proposed layout could avoid any of these systems.		
	Without mitigation	**With mitigation**
Extent	High (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (7)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**High (70)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: The layout planning must take cognisance of the sensitivity layers as shown in Figure 8, to avoid these areas or cross such areas using existing tracks / roads or where the impacts would be low or can easily be mitigated. Where new access roads are required, they should avoid aquatic features, but if these are required, specific walk downs should be conducted to find a suitable crossing position and erosion control implemented. This must be coupled to a post authorisation walkdown of the line once the final tower positions and access points are known so that new impacts don't arise and effective site-specific mitigation and recommendations can be provided. A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. The walkdown must also then assist with the placement of the towers in the two areas with broad alluvial fans (inclusive of the buffer are too broad to be spanned (-28.585178°; 21.113415°-& -28.593801°; 21.094913°), therefore it is recommended that the towers must be placed outside of any active channels (delineated aquatic zones) with the final locality being determined during the design phase assisted by an aquatic specialist All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings. Prosopis (alien invasive riparian tree) is prevalent, thus care in transporting any material, while ensuring that such materials is free of alien seed, coupled with pre and post alien clearing must be stipulated in the EMPr.		
Cumulative impacts: When compared to the surrounding transmission lines (roads and infrastructure - operational), this impact would be negligible as they have shown limited impacts have occurred when compared to other land use activities within the region.		
Residual impacts:		

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area is unlikely.

Nature: Impact 2 - Impact on secondary alluvial water courses (Moderate Sensitivity), through physical disturbance.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: The layout planning must take cognisance of the sensitivity layers as shown in Figure 8, to avoid these areas or cross such areas using existing tracks / roads or where the impacts would be low or can easily be mitigated. Where new access roads are required, they should avoid aquatic features, but if these are required, specific walk downs should be conducted to find a suitable crossing position and erosion control implemented. This must be coupled to a post authorisation walkdown of the line once the final tower positions and access points are known so that new impacts don't arise and effective site-specific mitigation and recommendations can be provided. A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings. Prosopis (alien invasive riparian tree) is prevalent, thus care in transporting any material, while ensuring that such materials is free of alien seed, coupled with pre and post alien clearing must be stipulated in the EMPr.		
Cumulative impacts: When compared to the surrounding transmission lines (roads and infrastructure - operational), this impact would be negligible as they have shown limited impacts have occurred when compared to other land use activities within the region		
Residual impacts:		

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area is unlikely.

Nature: Impact 3 - Impact on riparian systems through the possible increase in surface water runoff on riparian form and function. Increase in hard surface areas, such as the substations and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within the riparian systems, which are currently ephemeral, i.e. riparian systems species composition changes, which then results in habitat change / loss.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
• The layout planning must take cognisance of the sensitivity layers as shown in Figure 8, to avoid these areas or cross such areas using existing tracks / roads or where the impacts would be low or can easily be mitigated. • Where new access roads are required, specific walk downs should be conducted to find the ideal crossing position and erosion control implemented. This must be coupled to a post authorisation walkdown of the line once the final tower positions and access points are known so that new impacts don't arise and effective site-specific mitigation and recommendations can be provided. • A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. • The stormwater management plan must be developed post EA, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems. • Stormwater systems must be inspected on an annual basis to ensure these are functional. • Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas • Transmission lines – Any areas disturbed during the operations of the transmission line, including the access tracks must be inspected on a annual basis for signs of erosion or scour. Where these are identified efforts to stabilise the areas *(with reno mattresses, Gabions, Vegetation other suitable intervention) should be immediately implemented and monitored.		
Cumulative impacts: When compared to the surrounding transmission lines (roads and infrastructure - operational), this impact would be negligible as they have shown limited impacts have occurred when compared to other land use activities within the region		

Residual impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development area is unlikely.		
Nature: Impact 4 - Increase in sedimentation and erosion within the development footprint An increase in hard surface areas, and or roads that require stormwater management increases runoff from a site through the concentration of surface water flows. These higher volume flows, with increased velocity can result in downstream erosion and sedimentation if not managed.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: • The stormwater management plan must be developed post EA, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems. • Stormwater systems must be inspected on an annual basis to ensure these are functional. • Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas • Transmission lines – Any areas disturbed during the operations of the transmission line, including the access tracks must be inspected on a annual basis for signs of erosion or scour. Where these are identified efforts to stabilise the areas *(with reno mattresses, Gabions, Vegetation other suitable intervention) should be immediately implemented and monitored.		
Cumulative impacts: Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will be washed into the Orange River, although currently no direct connections with the Orange River, extreme high flows do enter the river from the development area.		
Residual impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development area.		

Nature: Impact 5 – Impact on localised surface water quality During both preconstruction, construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities, as well as maintenance activities, could be washed downslope via the ephemeral systems.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes (high)	

Mitigation:

- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more 45 m from a watercourse and wetland. Chemicals used for construction must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early;
- Occurrences of erosion and sedimentation must be monitoring during construction and addressed as soon as possible to avoid losing this material into the drainage lines.
- Littering and contamination of water sources during construction must be prevented by effective construction camp management;
- Emergency plans must be in place in case of spillages onto road surfaces and water courses;
- No stockpiling should take place within a water course;
- All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Stockpiles must be located away from river channels;
- The construction camp and necessary ablution facilities meant for construction workers must be beyond the 48 m buffer for very high sensitivity systems described previously

Cumulative impacts:

None as no direct connection between the development area and Orange River remains

Residual impacts:

Residual impacts will be negligible after appropriate mitigation.

Nature: Impact 6 – Cumulative Impacts In the assessment of this project, a number of projects have been assessed by the report author within a 35km radius and or other sites were accessed during the course of travelling between the various projects. Of these potential projects, this report author has been involved in the initial EIA aquatic assessments or has managed / assisted with the WUL process for several of these projects. All of the projects have indicated that their intention with regard to mitigation, i.e. selecting the best possible sites to minimise the local and regional impacts, or improving the drainage or hydrological conditions within these rivers, the cumulative impact could be seen as a net benefit. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such as stormwater management, and that flows within these systems are sporadic.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (2)
Probability	Probable (3)	Definite (5)
Significance	**Low (18)**	**Medium (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes (high)	
Development and implementation of rehabilitation plan post Environmental Authorisation, i.e. Once the final tower positions and road layout have been finalised and the walk down post approval has been completed. All mitigation measures provided in the forgoing impact assessment tables should be implemented.		
Residual impacts: Residual impacts will be negligible after appropriate mitigation.		

9. Conclusion and Recommendations

In summary, the proposed corridor for the facility would not have a direct impact on the following:

- Any Very High sensitivity areas identified by the DEA Screening Tool if these areas are avoided by the transmission line towers and any new access tracks. Two areas with broad alluvial fans (inclusive of the buffer are too broad to be spanned (-28.585178°; 21.113415° & -28.593801°; 21.094913°), therefore it is recommended that the towers must be placed outside of any active channels (delineated aquatic zones) with the final locality being determined during the design phase assisted by an aquatic specialist during the walkdown.
- Mainstem rivers and Pans that do contain functioning aquatic environments that received a Very High sensitivity rating as indicated in Figure 8.

Therefore, based on the results of this report, the significance of the remaining impacts assessed for the aquatic systems after mitigation would be LOW. No differentiation could be made between the various alternative as the alignment corridors cross over the same systems either upstream or downstream of each other (alternatives).

Thus, based on the findings of this study no objection to the authorisation of any of the proposed activities is made at this point based on the current layout as provided by the developer, i.e. the preferred alternative.

This report also indicates the watercourses and pans within 500m of the development area. Any activities within these areas, the buffers or 500m from the wetland boundary will require a Water Use license under Section 21 c and i of the National Water Act (Act 36 of 1998). The preferred alternative alignment would have fewer applications as it is further away from the pan identified.

As the proposed activities have the potential to create erosion, the following recommendations are reiterated:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the EMP to mitigate.

- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination / leaks outside of any delineated waterbodies and their buffers. Washing and cleaning of equipment should also be done in berms or bunds, to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel.

- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.

- All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

- It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within watercourse areas (including buffers) to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation preconstruction.

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12. Appendix 1 - Specialist CV

CURRICULUM VITAE

- **Dr Brian Michael Colloty**
- **7212215031083**

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Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07)

Member of the South African Wetland Society

Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries

Years experience: 25 years

SKILLS BASE AND CORE COMPETENCIES

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

TERTIARY EDUCATION

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

EMPLOYMENT HISTORY

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

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

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

South African

- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive), Department of Social Development (Military veterans housing, Despatch) and Nxuba Wind Farm, - current
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), biodiversity and wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – 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 - current
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.

- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 105 renewable projects in the past 6 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, RedCap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farm), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).