Riverine Baseline Study & Risk Assessment for the Proposed Construction of the Proposed Hydra – Kronos 2nd 400 kV Line

Northern Cape, South Africa

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CLIENT

Prepared by:

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Report Name	**Riverine Baseline Study & Risk Assessment for the Proposed Construction of the Proposed Hydra – Kronos 2nd 400 kV Line**
Submitted to	DIGES
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Biography	Michael Ryan is a candidate registered specialist (125128) who works in the fields of Riverine Ecology and Hydrology with 5 years of experience in baseline river assessments and aquatics, with his SASS5 accreditation. Michael Ryan received his B. Sc Honours degree (Geography) from the University of Witwatersrand. Michael specialises in surface water monitoring and aquatic systems as well as habitat delineations in the form of floodline determination. Michael has experience in projects which include pipelines; dams; road upgrades; power stations; mining; etc across multiple African ,countries
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Biography	Prasheen Singh is a registered Professional Scientist in the field of Aquatic Science (Pr. Sci. Nat. 116822). He is an Aquatic Ecologist whose 10 years' experience comprises numerous Aquatic Scientific Studies, Peer Reviews, Research, and having served as a SANAS accredited Technical Signatory at an Ecotoxicology Laboratory. Prasheen attained his MSc in Aquatic Health at the University of Johannesburg, and completed training courses for wetlands, river eco-status monitoring, hydropedology, and ecosystem restoration. He is an accredited SASS5 Practitioner with the Department of Water and Sanitation since 2017.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Ecological Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

The Kronos Substation which the proposed 400 kV Line will be connected (June 2023)

Executive Summary

Specialist Opinion
It is the opinion of the specialists that the project poses no fatal flaws to the associated aquatic ecological features and the project qualifies for authorisation under the provisions of the General Authorisation provided that the mitigation measures held within are adhered to and no electrical pylons are placed within the delineated watercourses or associated buffers.

The Biodiversity Company was commissioned by Diges Group on behalf of Eskom Holdings Limited SOC Ltd ("Eskom") to conduct a riverine baseline study and impact (risk) assessment as part of the Basic Assessment (BAR) to apply for Environmental Authorisation (EA) and a Water Use Licence (WUL) for the proposed Construction of the Proposed Hydra – Kronos 2nd 400 kV Line.

Aquatics baseline

The National Web Based Environmental Screening Tool (NWBEST) has characterised the aquatic sensitivity of the rivers of the project area as 'Very High' - requiring an assessment. This was confirmed as the watercourses are designated as a Critical Biodiversity Areas or Ecological Support Areas and the remaining terrestrial habitat considered an Other Natural Area. These watercourses are considered Endangered ecosystems, bar the Ongers River system which is considered a Least Threatened ecosystem but remains not protected. The eastern section of the PAOI (Project Area of Influence) is also considered a groundwater Strategic Water Source Areas. Desktop present ecological state of the sub quaternary reaches crossed range from a category C (moderately modified) to a category D (largely modified), with most systems not applicable for assessment due to their ephemeral nature. The baseline survey observed isolated pools of water in certain watercourses (four of the eighty-six sampled systems) the resultant of a rainfall event the previous week and was not representative of the true ecological state of these systems. As a result, the ecological integrity of these systems should be conserved through habitat delineation and conservation. This was achieved through the delineation of the total sensitivities which should be avoided by any aspect of the proposed development, unless authorised by the Competent Authority.

Risk Assessment

A variety of risks have been identified for the proposed project for both the construction and operational phase. The impacts however are largely mitigated by the transmission line only crossing the watercourses by means of multiple single circuit angle steel towers with towers, substations and laydown yards outside of delineated riparian areas and associated buffers. Only the transmission line instillation specific mitigation measures are required to be added to the general EMPr with the remaining general ones already covered.

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Declaration

I, Michael Ryan declare that:

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

[redacted]

Michael Ryan

Riverine Ecologist

The Biodiversity Company

June 2023

Declaration

I, Prasheen Singh declare that:

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

[redacted]

Prasheen Singh

Aquatic Specialist

The Biodiversity Company

June 2023

1 Introduction and Background

The modification of land use within a river catchment has the potential to degrade local water resources (Wepener *et al.,* 2005). Infrastructure which traverses a river thus have the potential to negatively impact on local water resources and ecosystem services. In order to holistically manage water resources in South Africa, the use of standard water quality sampling methods is considered in-effective. Non-point and point source pollutants are dynamic and can fluctuate according to several factors such as rainfall, industrial discharges and extensive pollutant seepage. Aquatic ecology is permanently exposed to the dynamic conditions within water bodies and can therefore be an effective reflection of the environmental conditions within a management area. Considering this, the monitoring of aquatic ecology is regarded as an effective tool in water management strategies. This can therefore be used to assess the current state of any system.

The Biodiversity Company was commissioned by Diges Group on behalf of Eskom Holdings SOC Ltd ("Eskom") to conduct a riverine baseline study and impact (risk) assessment as part of the Basic Assessment (BAR) to apply for Environmental Authorisation (EA) and a Water Use Licence (WUL) for the proposed Construction of the Proposed Hydra – Kronos 2nd 400 kV Line. A Basic Assessment process as a compliance report will be undertaken for the project in support of the application for authorisation. The proposed project includes the following:

1. Hydra – Kronos 2nd 400 kV line
    - Construct a second ±187 km 400 kV line from Hydra to Kronos Substation
    - Bypass series compensation on the 1st Hydra – Kronos 400 kV line
2. Kronos Substation
    - Extend 400 kV busbar at Kronos Substation
    - Establish and equip a new 400 kV feeder bay at Kronos Substation
3. Hydra Substation
    - Equip existing 400 kV feeder bay at Hydra Substation

In order to establish the baseline environmental conditions as well as all potential risks attributed by the construction of the transmission line and associated infrastructure, a single survey was conducted from the 5th to 9th of June 2023, which constitutes a dry season survey. The assessment included efforts to define the extent of the project area of influence (PAOI) and baseline conditions of the systems within the PAOI. Furthermore, the identification and description of any sensitive receptors were recorded across the project area where the transmission line crossed any watercourse. This was achieved by determining the PAOI as a 500 m regulated area surrounding the proposed new transmission line and assessing each watercourse within this area. This includes the Holput farm. The transmission line corridor route within the PAOI is laid out in Figure 1-2.

The motivation for this transmission line is in the assistance of Eskom's electricity generation capacity by creating a viable manner to transport electricity generated by the newly developed solar and wind farms in the region to the areas which require it. The proposed route is also considered favourable from an ecological perspective due to the presence of an existing transmission line between the Kronos and Hydra Substations and therefore the proposed transmission line will not pose a new source of modification to the PAOI (Figure 1-1).

Figure 1-1: Existing transmission line from the Hydra to Kronos Substations

The approach was informed by the Environmental Impact Assessment Regulations. 2014 (amended by GNR 326, 7 April 2017 and GNR. 517, 11 June 2021) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March and 30 October 2020: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria).

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP), enabling informed decision making as to the ecological viability of the proposed development and to provide an opinion on whether any environmental authorisation process or licensing is required for the proposed activities.

1.1 Scope/Objectives

The aim of the assessment is to provide the water resource baseline and impact assessment for the proposed transmission line project. This was achieved through the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the Project Area of Influence (PAOI) and surrounding landscape;
- Field survey to determine the PES of the local watercourses:
  - The assessment of water quality;
  - The assessment of habitat quality;
  - The assessment of biological responses;
- A risk assessment for the proposed transmission line; and
- The prescription of mitigation measures and recommendations for identified risks.

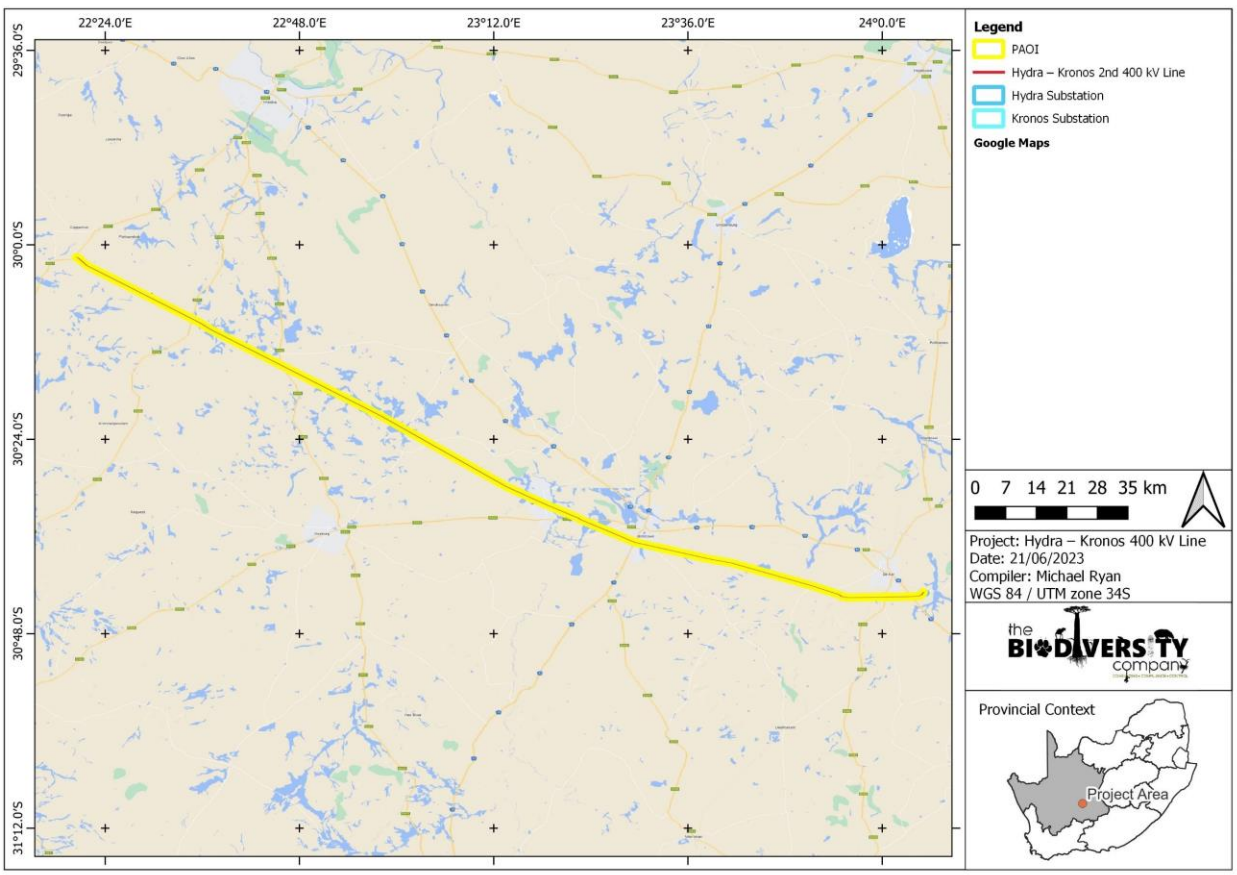

Figure 1-2: Map outlining the path and section of the proposed transmission line

2 Document Structure

The table below provides the minimum requirements for aquatic specialist assessments, and the relevant sections in the reports where these requirements are addressed. These are as per the "Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity" gazetted 20 March 2020, published in Government Notice No. 320:

Item	Section/Page	Comment
The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of aquatic sciences.	i	
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	i	CV available on request
A signed statement of independence by the specialist(s).	vii &viii	
The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 4	
A baseline description of the aquatic biodiversity and ecosystems on the site, including: (a) aquatic ecosystem types; (b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns.	Sections 8 & 9	
The threat status of the ecosystem and species as identified by the screening tool;	Section 8	
An indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e., if the site includes a wetland or a river freshwater ecosystem priority area (NFEPA) or sub catchment, a strategic water source area (SWSA), a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area);	Section 8.1	
A description of the ecological importance and sensitivity of the aquatic ecosystem including: (a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g., movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and (b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).	Section 8	
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 5	
A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant.	Section 5	
A description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 6	
The assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification.	Sections 9.1.3 & 9.2	Recommendation have been included to avoid sensitive areas
Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present? How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include: (a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g., suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);	Section 10	

(b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g., sand movement, meandering river mouth or estuary, flooding or sedimentation patterns); (c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g., at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and (d) to what extent will the risks associated with water uses and related activities change.		
How will the proposed development impact on the functioning of the aquatic feature? This must include: (a) base flows (e.g., too little or too much water in terms of characteristics and requirements of the system); (b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g., seasonal to temporary or permanent; impact of over -abstraction or instream or off stream impoundment of a wetland or river); (c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchanneled valley- bottom wetland to a channelled valley -bottom wetland); (d) quality of water (e.g., due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); (e) fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and (f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g., waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);	Section 9	
How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Sections 9 & 10	
A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant).	Sections 9.1.3 & 9.2	
Additional environmental impacts expected from the proposed development.	Section 10	
Any direct, indirect and cumulative impacts of the proposed development.	Section 10	
The degree to which impacts and risks can be mitigated.	Section 10	
The degree to which the impacts and risks can be reversed.	Section 10	
The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 10	
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 9.2	
Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr).	Section 10	
A motivation must be provided if there were development footprints identified as per above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate.		N/A
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not;	Section 11	
Any conditions to which this above statement is subjected	Sections 8, 9 & 10	

3 Terms of Reference

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

- Review of existing desktop information and literature (where available);
- Description of methodology used
- Determining the Present Ecological Status (PES) of the local watercourses;
- Determine the Environmental Importance and Sensitivity (EIS) of watercourses;
- An impact assessment for the proposed activities; and
- The prescription of mitigation measures, and recommendations for identified risks.

4 Project Area and Hydrological Setting

The project area for the proposed Hydra – Kronos Transmission Line is extensive due to the linear nature of the project and includes two operation and maintenance substations. The proposed transmission line traverses approximately 188 km of land from De Aar to Copperton in the Northern Cape. The line therefore traverses three local municipalities [(Siyathemba Local Municipality (NC077), Kareeberg Local Municipality (NC074) and Emthanjeni Local Municipality (NC073) within the Pixley ka Seme District Municipality (DC7)]. The proposed transmission line is aligned with an existing transmission line between the Hydra and Kronos Substations and therefore has an existing service road along the transmission line which can be accessed at multiple points from main roads such as the N10 in De Aar. The proposed transmission line begins at the Hydra Substation (30°42'52.02"S 24° 5'5.24"E) heading in a north westerly direction towards the Kronos Substation (30° 1'29.58"S 22°20'20.63"E).

4.1 Hydrological Context

The hydrological context of the project is also extensive as presented in Figure 4-1. The transmission line starts in the east with the Hydra Substation in D62D quaternary catchment and traverses the landscape to the west into the D62C quaternary catchment followed by the D62E quaternary catchment, D62A quaternary catchment, D62B quaternary catchment and D62H quaternary catchment until ending in the D54D quaternary catchment at the Kronos substation. These quaternary catchments fall within the Orange Water Management Area (WMA - 6) or the old Lower Orange WMA (14) within the Nama Karoo aquatic ecoregion. The proposed transmission line will directly be crossing the D62C-05422 (Elandsfontein River), D62C-05419 (Elandsfontein River), D62A-05344 (Unnamed), D62A-05339 (Unnamed), D62A-05205 (Ongers River), D62A-05138 (Ongers River), D62B-05105 (Sand River), D62B-05081 (Sand River) and D62B-05070 (Sand River) NFEPA rivers along with multiple tributaries of these systems as well as tributaries which flow into the D62D-05391 (Brak) and D54G-04542 (Unnamed River) SQR's.

4.2 Sampling Sites

The sampling points for the study were selected to adequately assess the current state of the watercourses traversed by the proposed transmission line to identify the potential risks that may result from the construction and operation of the proposed Hydra – Kronos 2nd 400 kV

Transmission Line. This was done to gain a holistic image of the system and which habitat may be affected. To achieve this, sites were selected along all accessible watercourses which fall within the 500m regulated area of all the infrastructure (PAOI). Therefore, a single site was selected along each watercourse with site labels following the sequence where NFEPA rivers are named by the river name, tributaries of these rivers are labels with the first letter of the river followed by a “T” to indicate that it’s a tributary, followed by a number which increasing from east to west (downstream direction). Wetlands are labelled with “W” indicating that they are a wetland system followed by the first letter of the watercourse they belong to, followed by the first letter of the type of wetland system (R=river, D=depression), followed by a number which increases from east to west (downstream direction). The selected sampling site locations and photographs in an upstream and downstream direction at each site can be seen in Table 4-1 as well as Figure 4-2 – with zoomed in maps of the sampling sites provided in Figure 4-3, Figure 4-4, Figure 4-5, Figure 4-7 and Figure 4-8.

Table 4-1: Photos, co-ordinates and river name for the sites sampled (June 2023)

Site Label	River System	Upstream	Downstream
BT1	Brak		
GPS	30°42'42.86"S 24° 6'39.57"E		
WER1	Elandsfontein		
GPS	30°44'10.54"S 24° 0'20.12"E		

Site Label	River System	Upstream	Downstream
ET1	Elandsfontein		
GPS	30°43'31.04"S 23°57'15.16"E		
ET2	Elandsfontein		
GPS	30°43'47.93"S 23°56'43.41"E		
Elandsfontein Eastern Limb	Elandsfontein		
GPS	30°43'11.31"S 23°54'9.45"E		

Site Label	River System	Upstream	Downstream
WER2	Elandsfontein		
GPS	30°42'58.17"S 23°54'3.21"E		
WER3	Elandsfontein		
GPS	30°42'56.52"S 23°53'57.32"E		
ET3	Elandsfontein		
GPS	30°42'14.61"S 23°51'32.72"E		

Site Label	River System	Upstream	Downstream
Elandsfontein Western Limb	Elandsfontein		
GPS	30°41'44.34"S 23°49'52.59"E		
WER5	Elandsfontein		
GPS	30°40'12.05"S 23°44'39.48"E		
ET5	Elandsfontein		
GPS	30°39'59.09"S 23°43'52.08"E		

Site Label	River System	Upstream	Downstream
ET4	Elandsfontein		
GPS	30°39'49.46"S 23°43'26.36"E		
WER6	Elandsfontein		
GPS	30°40'7.79"S 23°43'4.24"E		
ET6	Elandsfontein		
GPS	30°39'31.60"S 23°42'38.40"E		

Site Label	River System	Upstream	Downstream
ET7	Elandsfontein		
GPS	30°39'17.31"S 23°41'27.21"E		
OT1	Ongers		
GPS	30°39'6.23"S 23°40'30.21"E		
OT2	Ongers		
GPS	30°39'5.98"S 23°40'23.35"E		

Site Label	River System	Upstream	Downstream
OT3	Ongers		
GPS	30°38'43.88"S 23°38'55.91"E		
OT4	Ongers		
GPS	30°39'11.33"S 23°38'38.29"E		
WOR1	Ongers		
GPS	30°38'17.02"S 23°37'31.48"E		

Site Label	River System	Upstream	Downstream
WOR2	Ongers		
GPS	30°38'15.88"S 23°35'20.73"E		
OT5	Ongers		
GPS	30°38'14.22"S 23°35'13.96"E		
WOR3	Ongers		
GPS	30°37'54.26"S 23°34'41.71"E		

Site Label	River System	Upstream	Downstream
WOR4	Ongers		
GPS	30°37'19.90"S 23°32'27.00"E		
OT6	Ongers		
GPS	30°37'18.93"S 23°32'6.31"E		
OT7	Ongers		
GPS	30°36'26.31"S 23°28'48.48"E		

Site Label	River System	Upstream	Downstream
OT8	Ongers		
GPS		30°36'18.12"S 23°28'28.24"E	
OT9	Ongers		
GPS		30°35'44.15"S 23°27'12.19"E	
WOR5	Ongers		
GPS		30°34'49.92"S 23°25'2.32"E	

Site Label	River System	Upstream	Downstream
OT10	Ongers		
GPS	30°33'32.82"S 23°22'3.66"E		
OT11	Ongers		
GPS	30°33'8.20"S 23°21'5.79"E		
OT12	Ongers		
GPS	30°32'59.40"S 23°20'41.49"E		

Site Label	River System	Upstream	Downstream
WOR6	Ongers		
GPS	30°32'22.02"S 23°19'9.17"E		
Ongers Western Limb	Ongers		
GPS	30°33'51.87"S 23°19'48.11"E		
OT13	Ongers		
GPS	30°31'23.11"S 23°16'56.24"E		

Site Label	River System	Upstream	Downstream
Ongers Eastern Limb	Ongers		
GPS	30°31'1.59"S 23°15'51.52"E		
OT14	Ongers		
GPS	30°30'37.06"S 23°15'11.30"E		
WOR7	Ongers	No Access	
GPS	30°30'13.93"S 23°14'10.33"E		
WSR1	Sand		
GPS	30°23'12.67"S 23° 2'0.66"E		

Site Label	River System	Upstream	Downstream
Sand Eastern Limb	Sand		
GPS	30°22'45.39"S 23° 1'2.44"E		
Sand Western Limb	Sand		
GPS	30°22'12.42"S 23° 0'4.57"E		
WSR2	Sand		
GPS	30°21'46.78"S 22°59'16.30"E		

Site Label	River System	Upstream	Downstream
ST1	Sand		
GPS	30°20'36.86"S 22°57'7.93"E		
ST2	Sand		
GPS	30°19'16.05"S 22°54'23.77"E		
ST3	Sand		
GPS	30°19'2.20"S 22°54'1.14"E		

Site Label	River System	Upstream	Downstream
WSR3	Sand		
GPS	30°18'22.31"S 22°52'36.22"E		
WSR4	Sand		
GPS	30°18'0.22"S 22°51'55.75"E		
ST4	Sand		
GPS	30°17'14.49"S 22°50'27.07"E		

Site Label	River System	Upstream	Downstream
WSR5	Sand		
GPS	30°17'20.67"S 22°50'12.99"E		
ST5	Sand		
GPS	30°16'54.65"S 22°49'49.51"E		
ST6	Sand		
GPS	30°16'39.75"S 22°49'18.56"E		

Site Label	River System	Upstream	Downstream
ST7	Sand		
GPS	30°16'24.87"S 22°48'50.80"E		
ST8	Sand		
GPS	30°15'37.68"S 22°47'17.98"E		
ST9	Sand		
GPS	30°15'27.78"S 22°46'56.87"E		

Site Label	River System	Upstream	Downstream
ST10	Sand		
GPS	30°14'56.45"S 22°45'57.60"E		
ST11	Sand		
GPS	30°14'50.52"S 22°45'42.69"E		
ST12	Sand		
GPS	30°14'45.53"S 22°45'31.44"E		

Site Label	River System	Upstream	Downstream
ST13	Sand		
GPS	30°14'18.55"S 22°44'39.28"E		
WSR6	Sand		
GPS	30°13'40.36"S 22°43'55.34"E		
ST14	Sand		
GPS	30°13'46.64"S 22°43'36.25"E		

Site Label	River System	Upstream	Downstream
WSR7	Sand		
GPS	30°13'29.24"S 22°43'2.15"E		
ST15	Sand		
GPS	30°13'17.33"S 22°42'28.11"E		
WSR8	Sand		
GPS	30°12'30.72"S 22°41'7.50"E		

Site Label	River System	Upstream	Downstream
WSR9	Sand		
GPS		30°11'15.32"S 22°38'40.69"E	
WSR10	Sand		
GPS		30°10'58.29"S 22°37'32.10"E	
WSR11	Sand		
GPS		30°10'24.60"S 22°36'58.46"E	

Site Label	River System	Upstream	Downstream
WSD1	Sand		
GPS	30° 9'49.67"S 22°35'42.99"E		
ST16	Sand		
GPS	30° 9'5.25"S 22°34'43.05"E		
WSD2	Sand		
GPS	30° 8'54.23"S 22°33'24.65"E		

Site Label	River System	Upstream	Downstream
ST17	Sand		
GPS	30° 8'19.78"S 22°33'23.90"E		
WDD1	De Hoek		
GPS	30° 7'5.58"S 22°31'27.87"E		
DT1	De Hoek		
GPS	30° 5'51.94"S 22°28'21.65"E		

Site Label	River System	Upstream	Downstream
DT2	De Hoek		
GPS		30° 5'40.41"S 22°27'57.73"E	
DT3	De Hoek		
GPS		30° 5'23.13"S 22°27'22.77"E	
DT4	De Hoek		
GPS		30° 5'9.46"S 22°26'58.18"E	

Site Label	River System	Upstream	Downstream
DT5	De Hoek		
GPS		30° 5'2.44"S 22°26'41.37"E	
DT6	De Hoek		
GPS		30° 4'52.11"S 22°26'22.71"E	
DT7	De Hoek		
GPS		30° 4'19.25"S 22°25'16.97"E	

Site Label	River System	Upstream	Downstream
DT8	De Hoek		
GPS	30° 3'42.52"S 22°24'3.86"E		
DT9	De Hoek		
GPS	30° 3'20.21"S 22°23'21.87"E		
DT10	De Hoek		
GPS	30° 3'10.35"S 22°23'2.38"E		

Site Label	River System	Upstream	Downstream
DT11	De Hoek		
GPS		30° 1'55.56"S 22°21'3.36"E	
DT12	De Hoek		
GPS		30° 1'22.05"S 22°20'14.44"E	

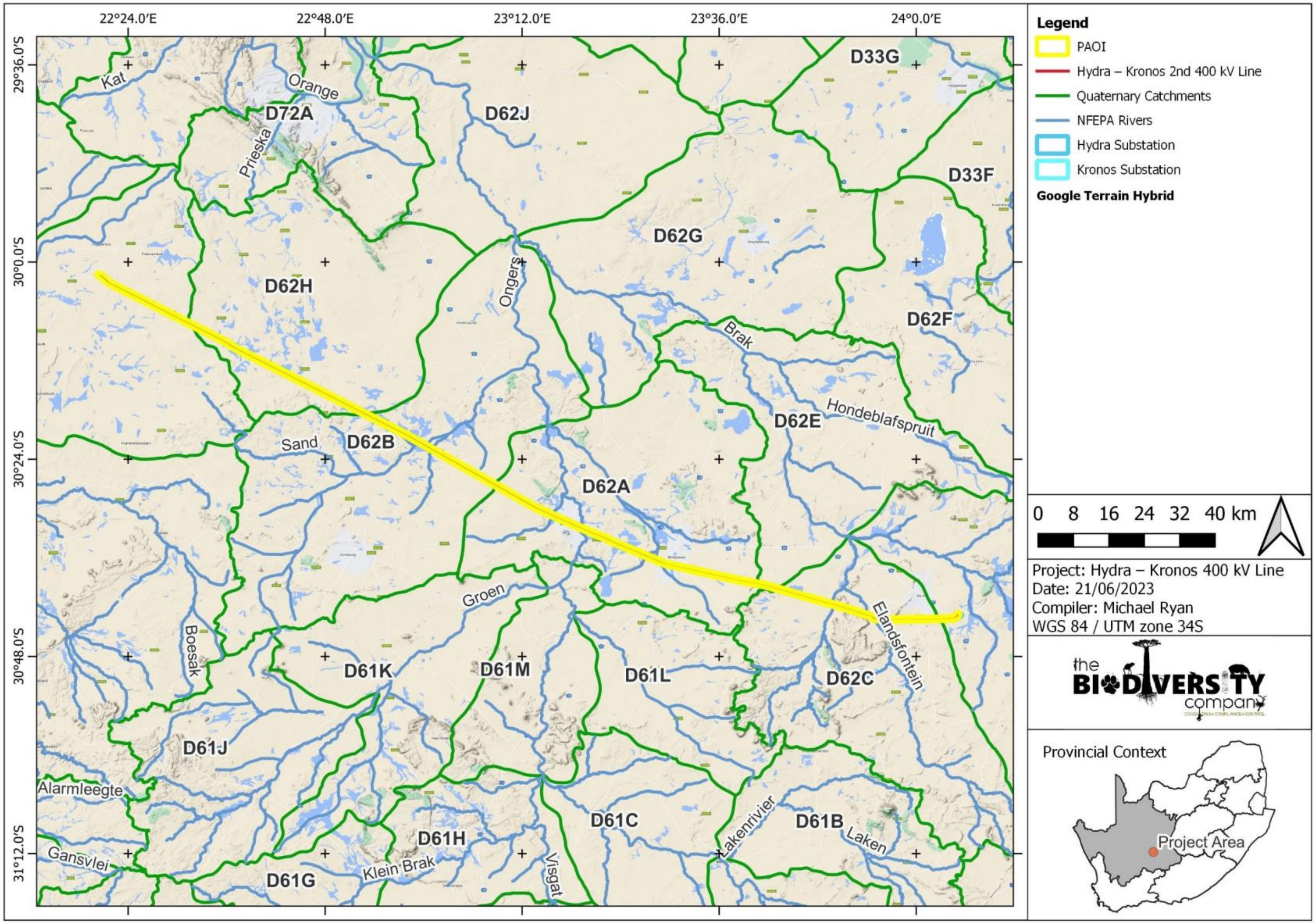

Figure 4-1: Hydrological context of the project area

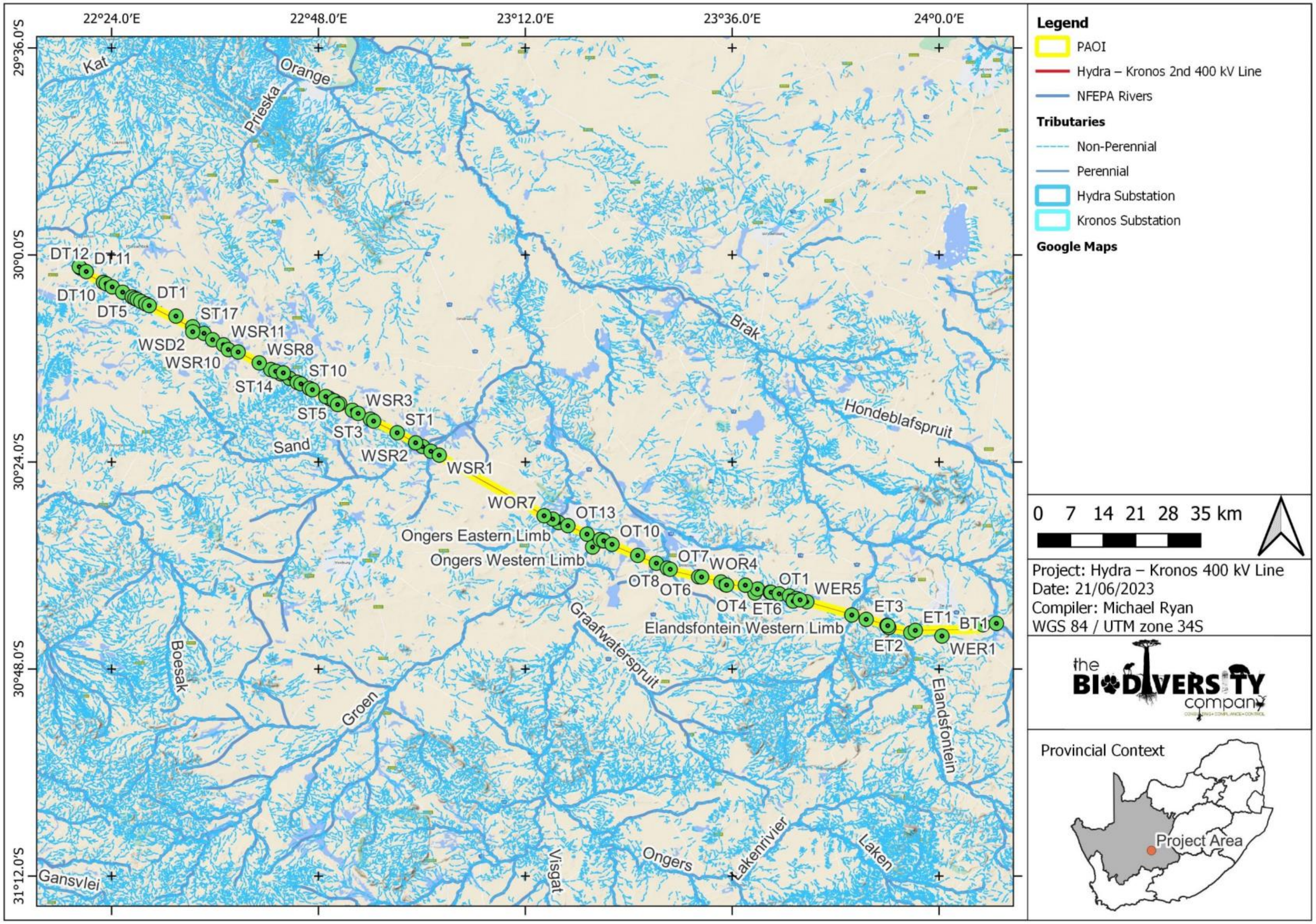

Figure 4-2: Selected sampling sites for the assessment

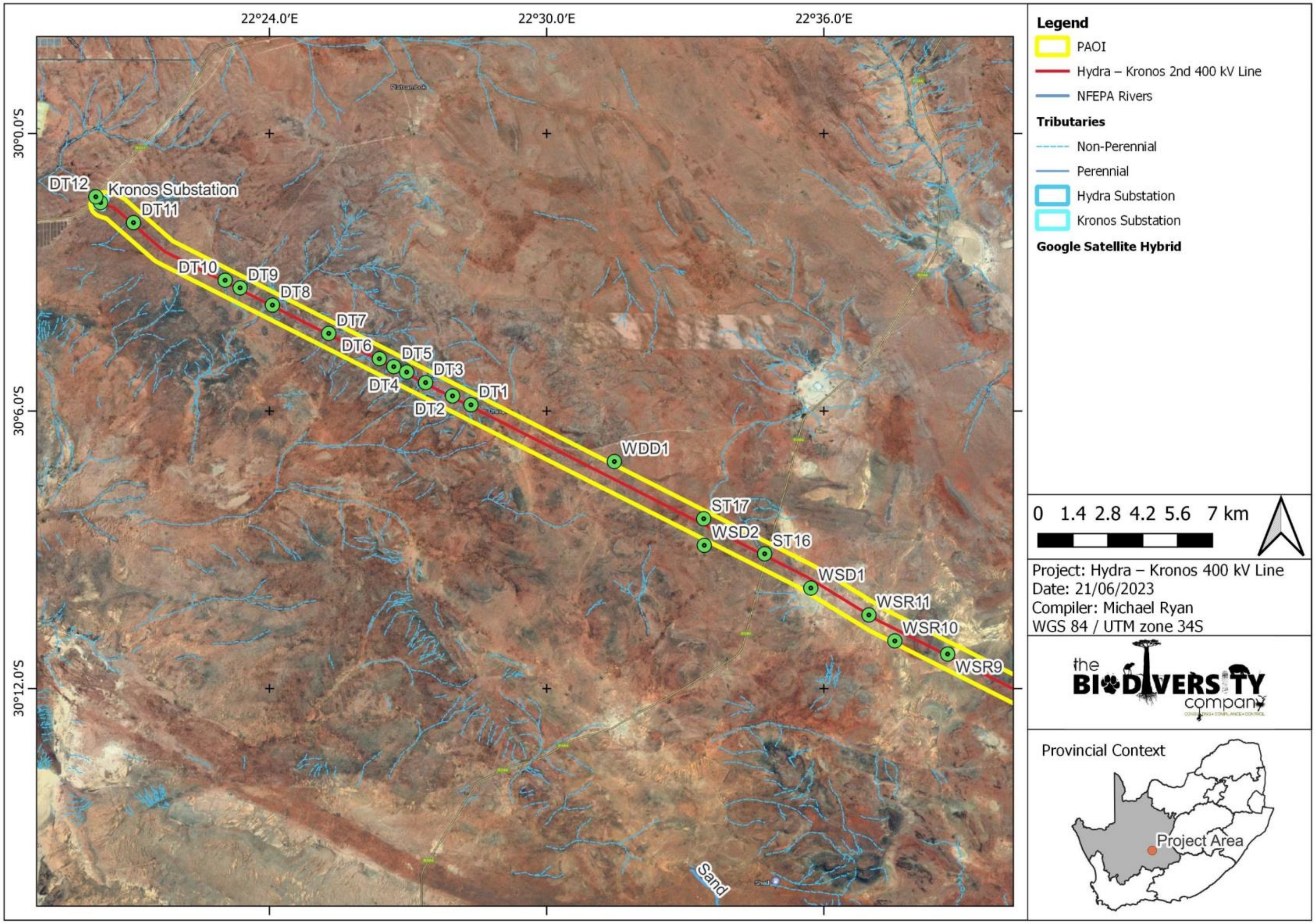

Figure 4-3: Zoomed in view of the selected sampling sites for the assessment

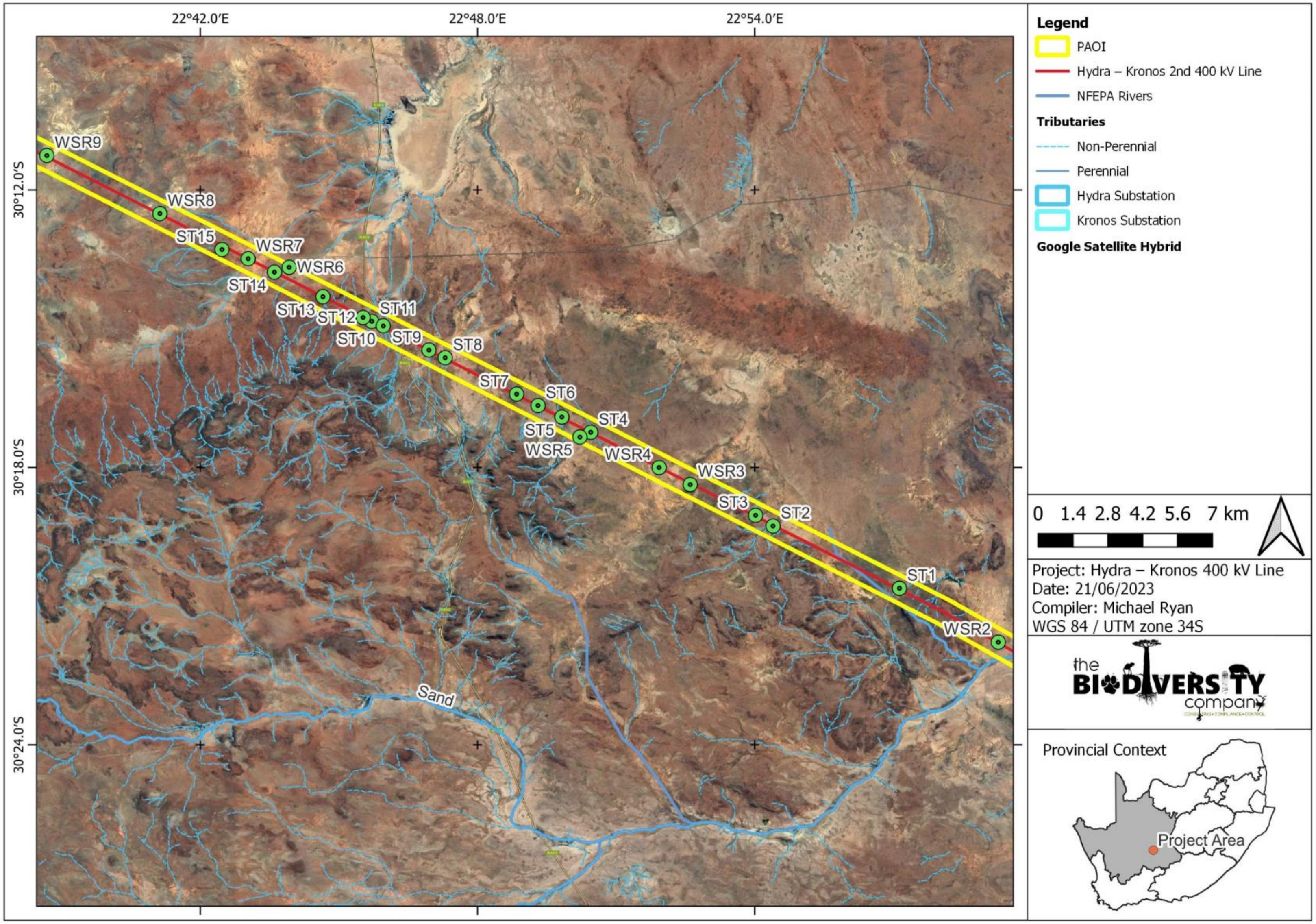

Figure 4-4: Zoomed in view of the selected sampling sites for the assessment

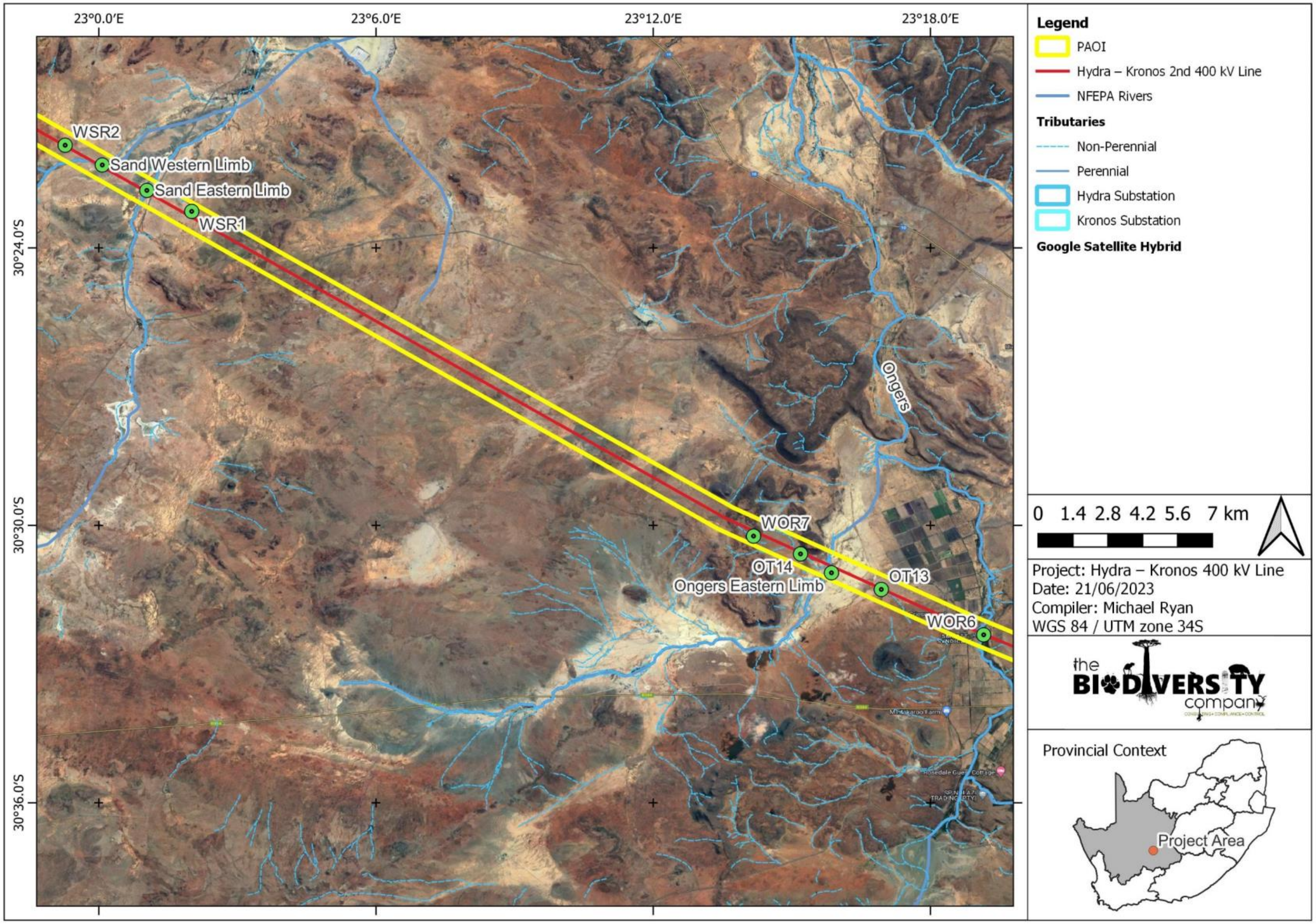

Figure 4-5: Zoomed in view of the selected sampling sites for the assessment

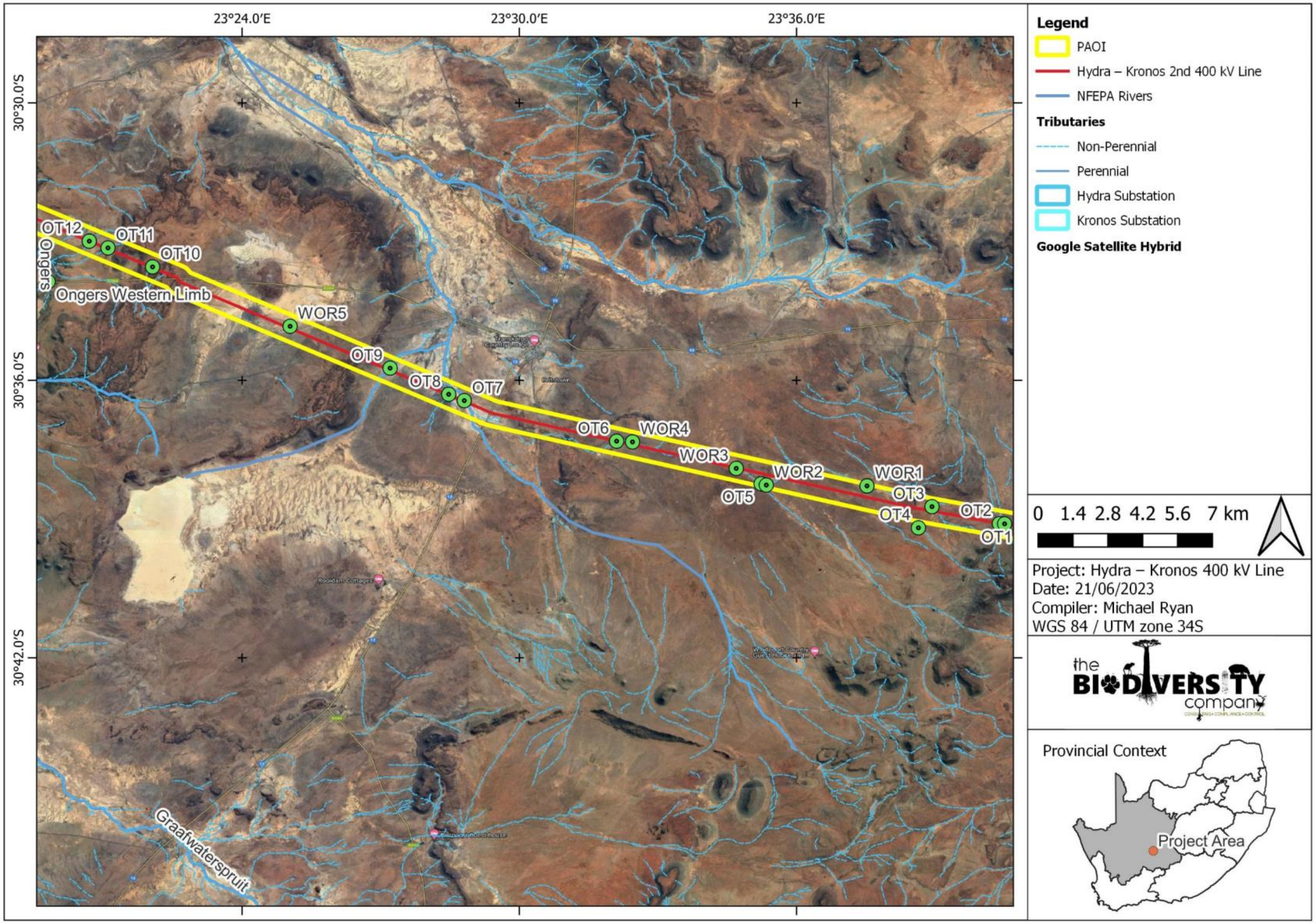

Figure 4-6: Zoomed in view of the selected sampling sites for the assessment

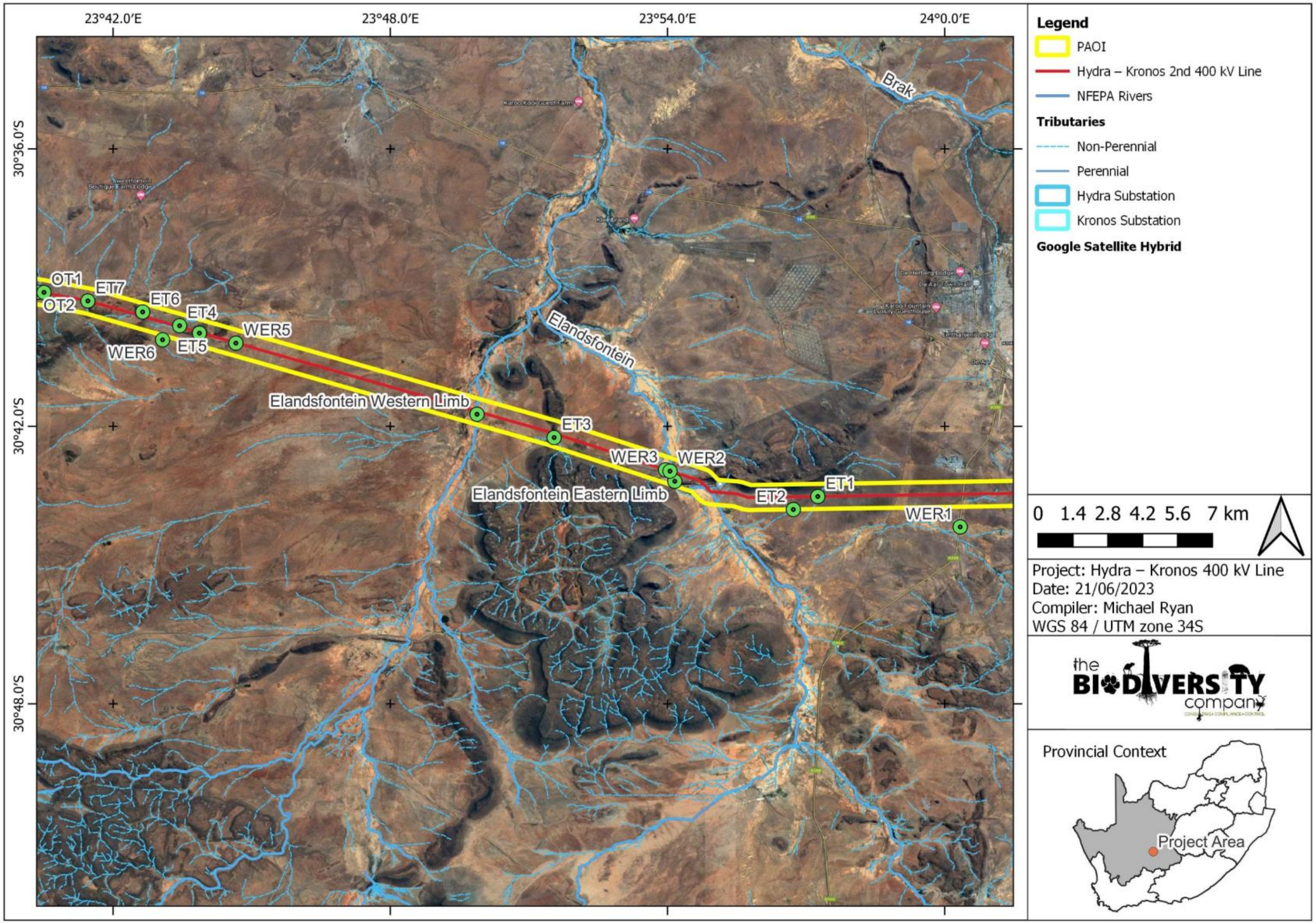

Figure 4-7: Zoomed in view of the selected sampling sites for the assessment

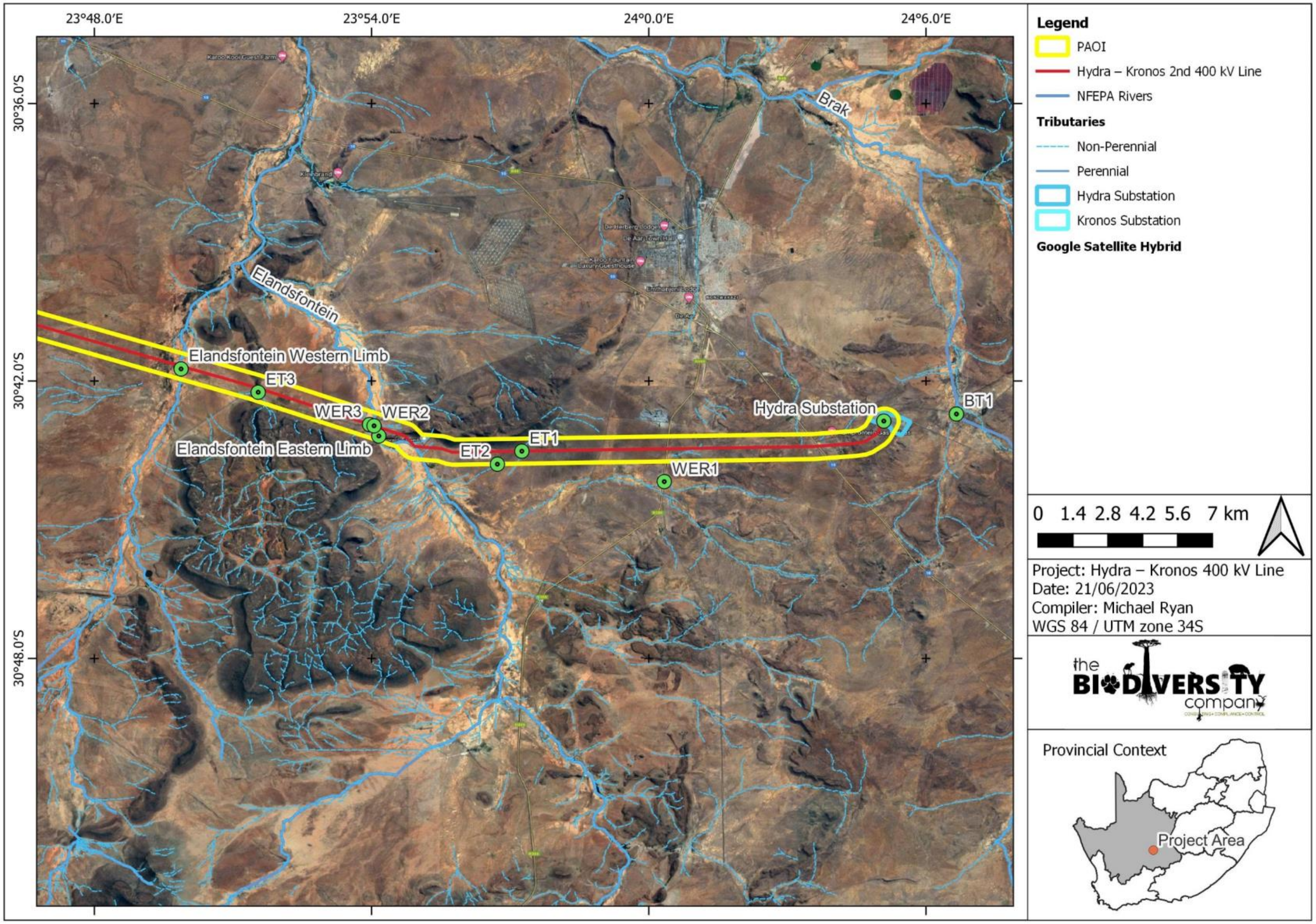

Figure 4-8: Zoomed in view of the selected sampling sites for the assessment

5 Methodology

5.1 Aquatic Assessment

A single low flow survey was conducted from the 5th to 9th of June 2023. Standard methods were used to establish the baseline conditions of the considered river reaches. Details pertaining to the specific methodologies applied are provided in the relevant sections below.

5.1.1 Water Quality

Water quality was measured in situ using a handheld calibrated Extech® DO700 multi-meter. The constituents considered that were measured included: pH, conductivity (µS/cm), water temperature (°C) and Dissolved Oxygen (DO) in mg/l.

5.1.2 Aquatic Habitat Integrity

The Intermediate Habitat Assessment Index (IHIA) as described in the Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999 was used to define the ecological status of all NFEPA river reaches. The reaches within the project area experience uniform influences with similar geomorphological processes. As a result, many river systems were grouped together.

The IHIA model will be used to assess the integrity of the habitats from a riparian and in-stream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale which are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

This model compares current conditions with reference conditions that are expected to have been present. Specification of the reference condition follows an impact based approach where the intensity and extent of anthropogenic changes are used to interpret the impact on the habitat integrity of the system. To accomplish this, information on abiotic changes that can potentially influence river habitat integrity are obtained from surveys or available data sources. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology and physico-chemical conditions and how these changes would impact on the natural riverine habitats. The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 5-1 and Table 5-2 respectively.

Table 5-1: Criteria used in the assessment of habitat integrity (Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in the duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.

Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Water quality modification	Originates from point and diffuse point sources. Measured directly or alternatively agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also, a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochtonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the riverbank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 5-2: Descriptions used for the ratings of the various habitat criteria

Impact Category	Description	Score
None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	1-5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.	6-10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	11-15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	16-20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21-25

5.1.3 Riparian Habitat Delineation

The riparian delineation was completed according to DWAF (2005a; Figure 5-1). Typical riparian cross sections and structures are provided in. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Contour data obtained from topography spatial data was also utilised to support the infield assessment.

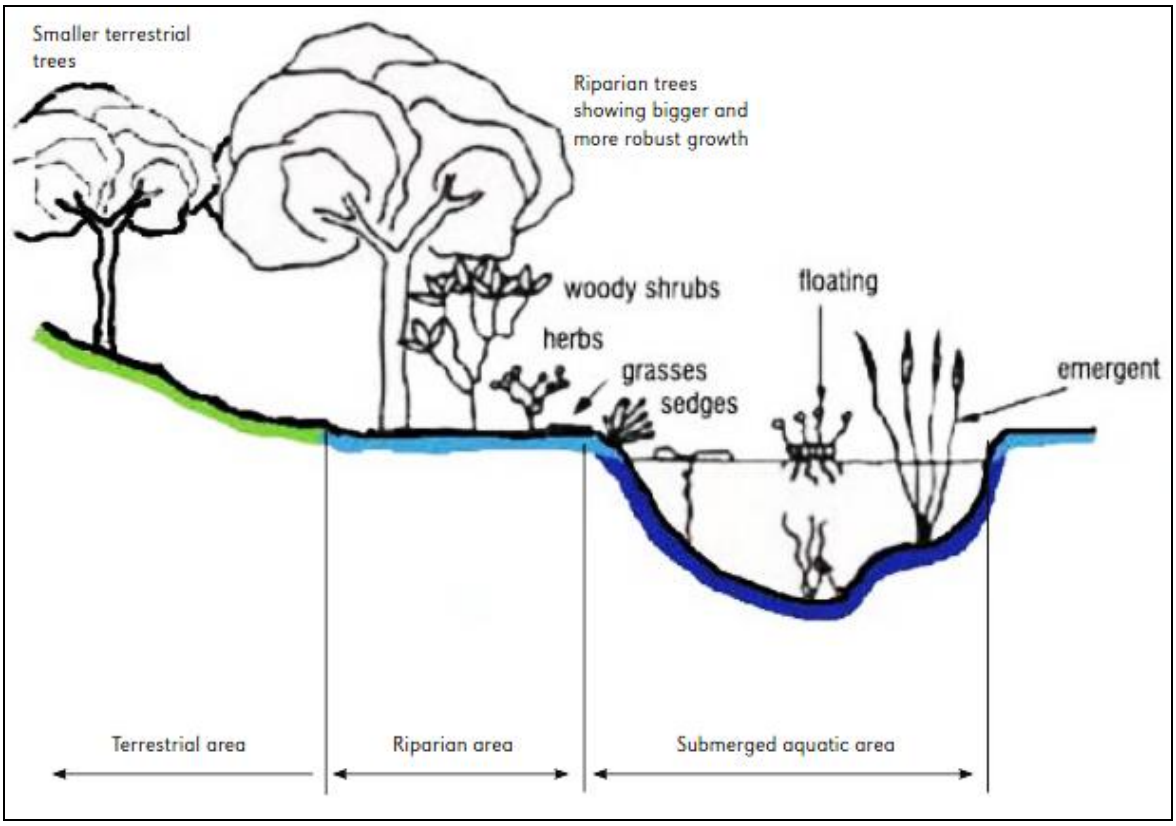

Figure 5-1: Riparian Habitat Delineations (DWAF, 2005)

5.1.4 Aquatic Macroinvertebrate Assessment

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al.,* 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al.,* 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

5.1.4.1 Invertebrate Habitat

The invertebrate habitat at the site was assessed using the South African Scoring System version 5 (SASS5) biotope rating assessment as applied in Tate and Husted (2015). A rating system of 0 to 5 was applied, 0 being not available. The weightings for lowland rivers (slope class F) were used to categorize biotope ratings (Rowntree et al. 2000; Rowntree & Ziervogel, 1999).

5.1.4.2 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g.

Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the "Aquatic Invertebrates of South African Rivers" Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made to family level (Thirion *et al.,* 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002).

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Nama Karoo – Lower Ecoregion (Figure 3). The project area falls within the Nama Karoo – Lower Ecoregion. This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database.

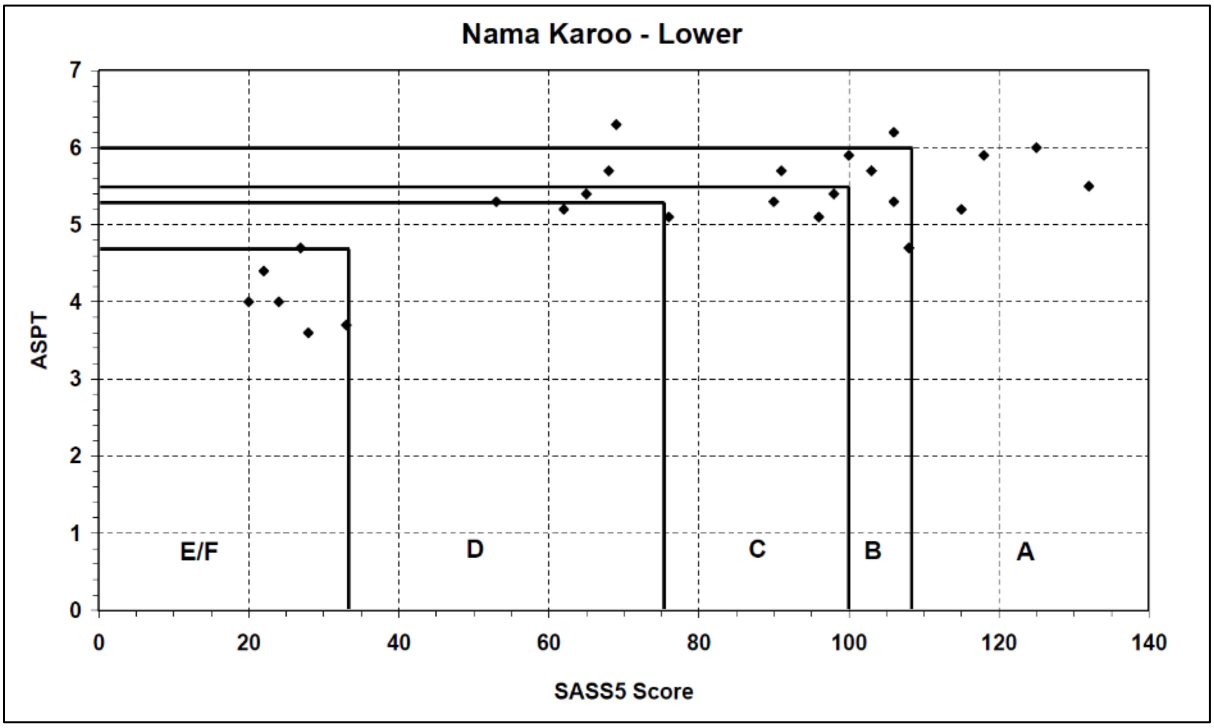

Figure 5-2: Biological Bands for the Nama Karoo – Lower Ecoregion, calculated using percentiles

5.2 Fish Community

Fish were sampled through electroshocking. All fish were identified in the field and released at the point of capture, in order not to cross fish populations. Fish species were identified using the guide Freshwater Fishes of Southern Africa (Skelton, 2001). The identified fish species were compared to those expected to be present for the quaternary catchment. The expected fish species list for the reach was developed from a literature survey to compare to the sampled species at site. Different fish species represent different sensitivities to water chemistry, habitat and flow (Kleynhans *et al*., 2007 and Skelton 2001). Due to the non-perennial nature of the watercourses, sampling was habitat dependent.

5.3 Risk Assessment

The risk assessment will be completed in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in

Section 21(c) or Section 21(i) (GN 509 of 2016). The significance of the impact is calculated according to Table 5-3.

Table 5-3: Significance ratings matrix

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

6 Limitations and Assumptions and Knowledge Gaps

The following aspects were considered as limitations of the assessment:

- It is assumed that the client has provided the specialist with all available data and information surrounding the project at the time of writing;
- It is assumed that all of this information is relevant and accurate;
- A single season aquatic ecology survey was completed for this assessment. Thus, temporal trends were not investigated;
- Due to the rapid nature of the assessment and the survey methods applied, fish diversity and abundance was likely to be underestimated;
- Access to site WOR7 was not possible due to the terrain. The site was however likely dry with a similar geomorphology to the surrounding systems however this could not be confirmed;
- No alternatives were provided for this assessment; and
- This report only considers the linear activity of the transmission line and substation upgrades.

7 Key Legislative Requirements

7.1 National Water Act (NWA, 1998)

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

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

A watercourse means:

- A river or spring;

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

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

7.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in December 2014 as amended on 11 June 2021, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

8 Desktop Assessment

8.1 National Freshwater Ecosystem Priority Areas (NFEPA)

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach to the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998). This directly applies to the National Water Act, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al.,* 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (NEM:BA) (Act 10 of 2004), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al*., 2011).

The project area traverses multiple sub-quaternary catchments as presented in Figure 8-1 and Figure 8-2. These include 4544, 4767, 4662, 4951, 5070, 5081, 5105, 5118, 5082, 5138, 5205, 5235, 5306, 5332, 5339, 5344, 5419 and 5422 Sub-quaternary catchments. The 4767, 4662, 4951, 5070, 5081, 5105, 5082, 5138, 5205, 5235, 5306 and 5339 sub-quaternary catchments have no attached sensitivities. The 4544 and 5118 sub-quaternary catchments are considered River NFEPA while the 5332, 5419 and 5422 sub-quaternary catchments are considered Upstream Management Areas (UMA) which contain wetland NFEPA's as presented in Table 8-1. Care should be taken to avoid degradation to the project area to avoid placing stress on the Sensitive Areas within the project area.

Table 8-1: List of Sub-quaternary catchments of the project area

Catchment	Associated Sensitivity
4544	FEPA: River ecosystem type: Ephemeral - Nama Karoo - Lower foothill FEPA: River ecosystem type: Ephemeral - Nama Karoo - Lowland river FEPA: River ecosystem type: Ephemeral - Nama Karoo - Upper foothill
4767	N/A
4662	N/A
4951	N/A
5070	N/A
5081	N/A
5105	N/A
5118	FEPA: Number of wetland clusters: 2 WetCluster FEPAs FEPA: River ecosystem type: Ephemeral - Nama Karoo - Lower foothill FEPA: Wetland ecosystem type: Upper Nama Karoo - Channeled valley-bottom wetland FEPA: Wetland ecosystem type: Upper Nama Karoo - Flat FEPA: Wetland ecosystem type: Upper Nama Karoo - Unchannelled valley-bottom wetland
5082	N/A
5138	N/A
5205	N/A
5235	N/A
5306	N/A
5332	FEPA: Number of wetland clusters: 1 WetCluster FEPA FEPA: Wetland ecosystem type: Upper Nama Karoo - Channeled valley-bottom wetland FEPA: Wetland ecosystem type: Upper Nama Karoo - Depression FEPA: Wetland ecosystem type: Upper Nama Karoo - Unchannelled valley-bottom wetland
5339	N/A
5344	N/A
5419	FEPA: Wetland ecosystem type: Upper Nama Karoo - Channeled valley-bottom wetland FEPA: Wetland ecosystem type: Upper Nama Karoo - Unchannelled valley-bottom wetland
5422	FEPA: Number of wetland clusters: 3 WetCluster FEPAs FEPA: Wetland ecosystem type: Upper Nama Karoo - Channeled valley-bottom wetland FEPA: Wetland ecosystem type: Upper Nama Karoo - Unchannelled valley-bottom wetland

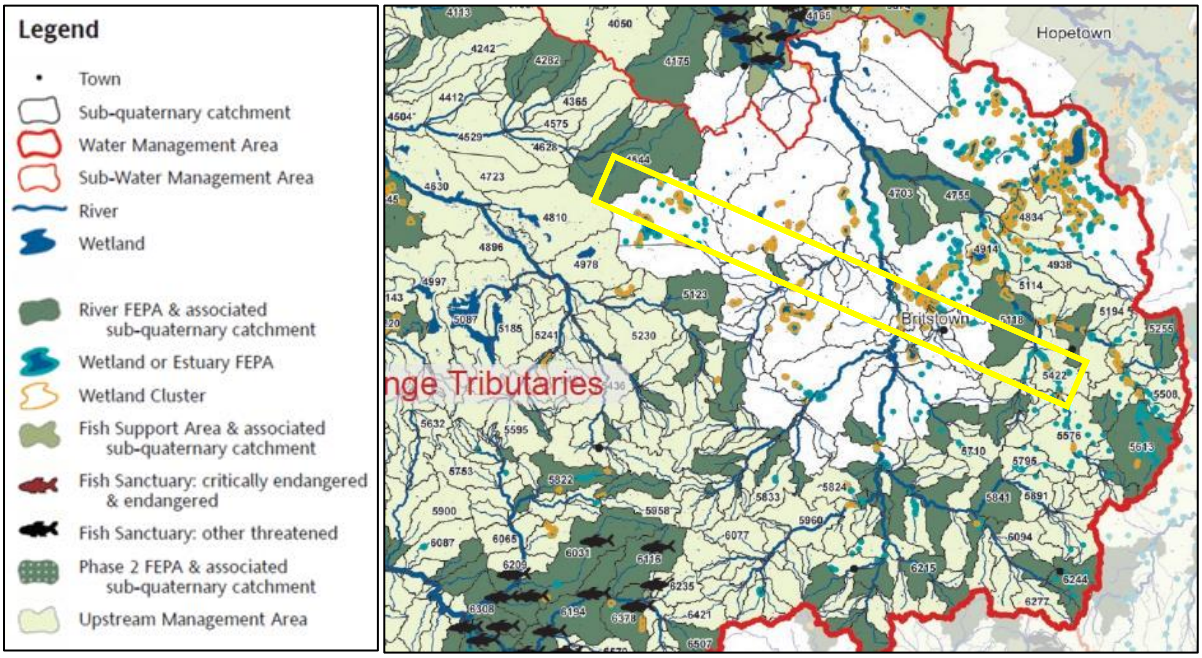

Figure 8-1: Map illustrating fish and river FEPAs for the project area, the project area is represented by the yellow square (Nel et al., 2011)

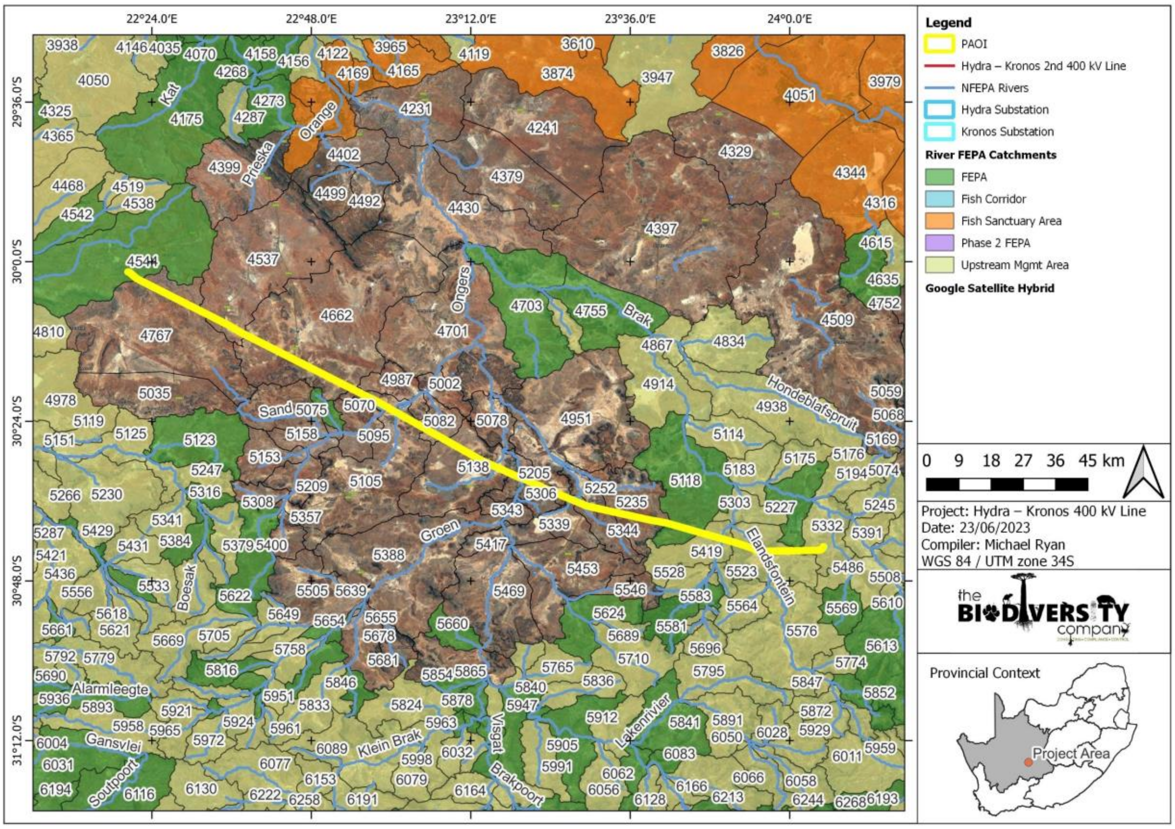

Figure 8-2: Layout of the proposed development area in relation to the riverine National Freshwater Priority Areas

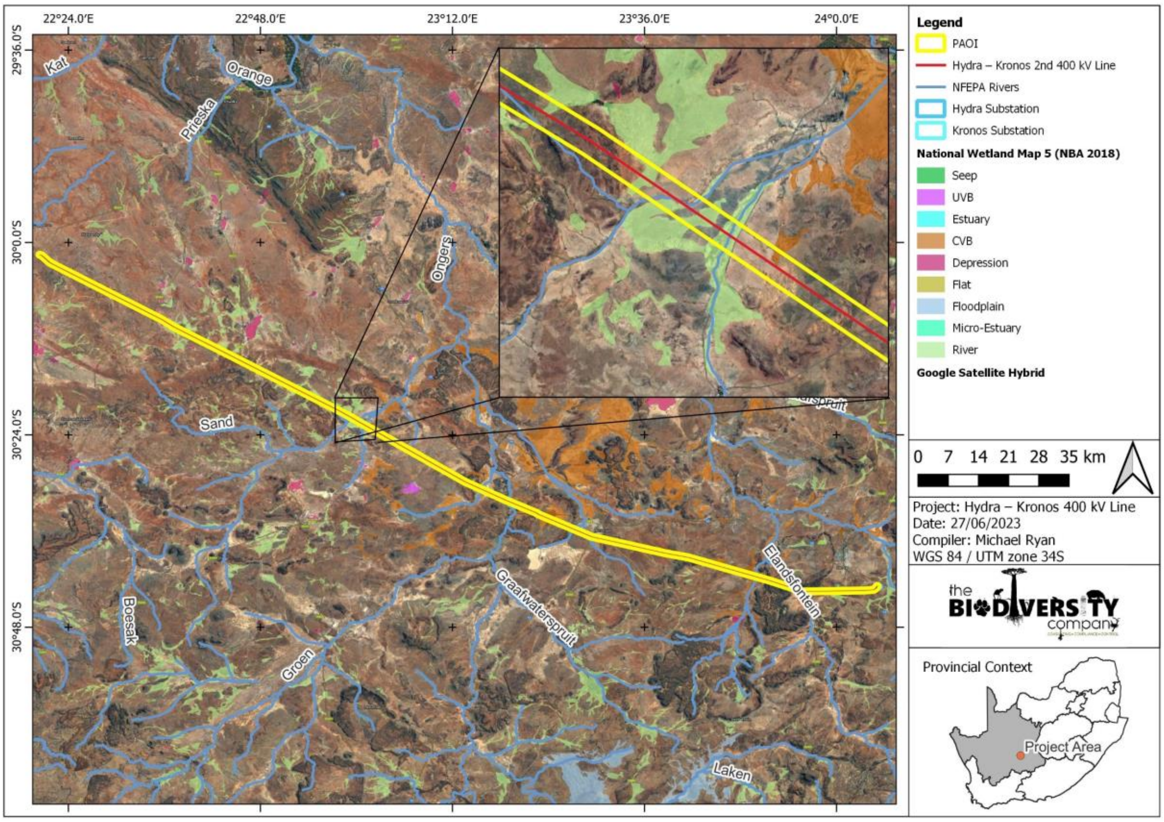

Figure 8-3: NFEPA wetlands present within the project area

8.2 Status of sub-quaternary reaches

Desktop information for the Sub-Quaternary Reaches (SQR's) were obtained from DWS, 2014. The transmission line crosses multiple watercourses of which eleven are considered SQRs. All other watercourses form part of the drainage networks of these eleven SQR's (Table 8-2). The desktop PES category of the eleven reaches', range from category C (moderately modified) to a class D (largely modified), with most systems not assessed due to its ephemeral nature. The modification status of these reaches are a result of impacts to instream habitat, wetland and riparian zone continuity, flow modifications and potential impacts on physico-chemical conditions (water quality).

Table 8-2: Summary of the Present Ecological State of the SQRs associated with the transmission line (DWS, 2014)

SQR Importance and Sensitivity	Score
D62C-05422 (Elandsfontein River)	
River Type	Non-Perennial
Present Ecological Status	Moderately Modified (class C)
Ecological Importance	Moderate
Ecological Sensitivity	Low
Default Ecological Category	C
D62C-05419 (Elandsfontein River)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Low
Ecological Sensitivity	Moderate
Default Ecological Category	N/A
D62A-05344 (Unnamed)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Moderate
Ecological Sensitivity	Moderate
Default Ecological Category	N/A
D62A-05339 (Unnamed)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Low
Ecological Sensitivity	Moderate
Default Ecological Category	N/A
D62A-05205 (Ongers River)	
River Type	Non-Perennial
Present Ecological Status	Largely Modified (class D)
Ecological Importance	Low
Ecological Sensitivity	Low
Default Ecological Category	D
D62A-05138 (Ongers River)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Moderate
Ecological Sensitivity	Moderate
Default Ecological Category	N/A

D62B-05105 (Sand River)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Low
Ecological Sensitivity	Moderate
Default Ecological Category	N/A
D62B-05081 (Sand River)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Low
Ecological Sensitivity	Low
Default Ecological Category	N/A
D62B-05070 (Sand River)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Low
Ecological Sensitivity	N/A
Default Ecological Category	N/A
D62D-05391 (Brak)	
River Type	Non-Perennial
Present Ecological Status	Moderately Modified (class C)
Ecological Importance	Moderate
Ecological Sensitivity	Low
Default Ecological Category	C
D54G-04542 (Unnamed River)	
River Type	Episodic
Present Ecological Status	N/A
Ecological Importance	Low
Ecological Sensitivity	N/A
Default Ecological Category	N/A

8.3 Strategic Transmission Corridors (EGI)

On the 16 February 2018 minister Edna Molewa published Government Notice No. 113 in Government Gazette No. 41445 which identified five (5) strategic transmission corridors/ Electricity Grid Infrastructure (EGI) important for the planning of electricity transmission and distribution infrastructure as well as procedure to be followed when applying for environmental authorisation for electricity transmission and distribution expansion when occurring in these corridors. A map illustrating the five Gazetted EGI Corridors is presented in Figure 8-4.

On the 29th of April 2021, Minister Barbara Dallas Creecy published Government Notice No. 383 in Government Gazette No. 44504, which expanded the eastern and western transmission corridors and gave notice of the applicability of the application procedures identified in Government Notice No. 113, to these expanded corridors. More information on this can be obtained from https://egis.environment.gov.za/egi.

A power generations location within these corridors' places priority on these projects as they comprise part of the distribution infrastructure planning for the country. Figure 8-5 indicates that the PAOI overlaps with the Central EGI corridor.

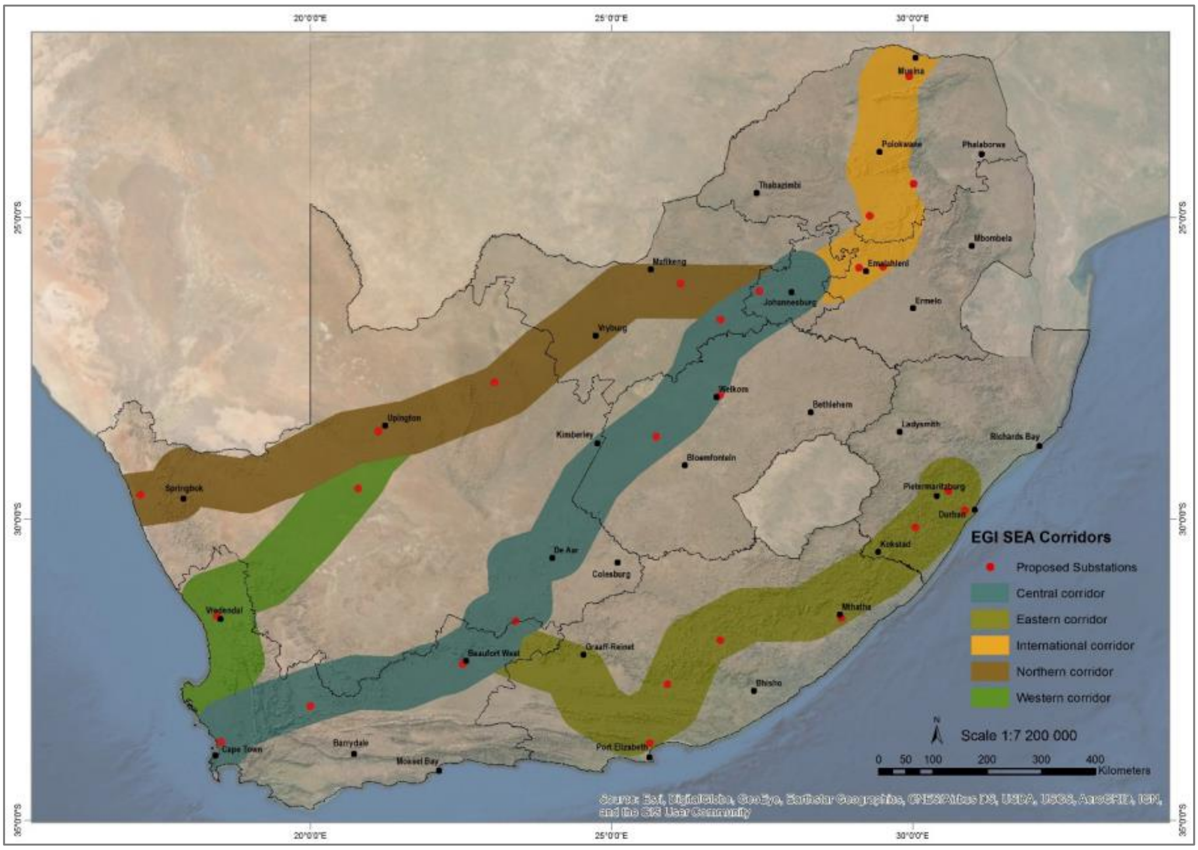

Figure 8-4 The five strategic transmission corridors (DEFF, 2019)

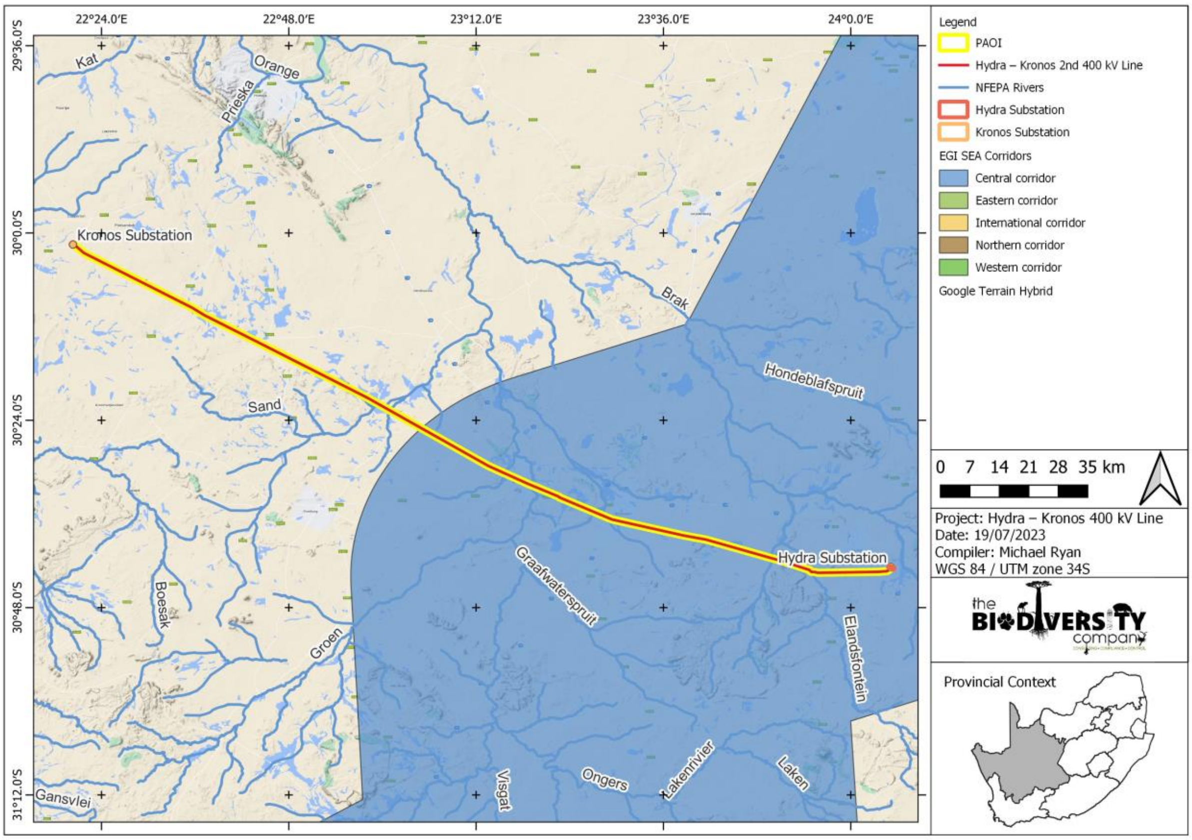

Figure 8-5 The project area in relation to the strategic transmission corridors

8.4 Renewable Energy Development Zones (REDZ)

On 16 February 2018, Minister Edna Molewa published Government Notice No. 114 in Government Gazette No. 41445 which identified eight (8) Renewable Energy Development Zones (REDZ) important for the development of large-scale wind and solar photovoltaic facilities. The Government Notice included procedure to be followed when applying for environmental authorisation for large scale wind and solar photovoltaic energy facilities when occurring in these REDZs.

On 26 February 2021, Minister Barbara Dallas Creecy, published Government Notice No. 142, 144 and 145 in Government Gazette No. 44191 which identified three (3) additional REDZs for implementation as well as the procedures to be followed when applying for environmental authorisation for electricity transmission or distribution infrastructure or large scale wind and solar photovoltaic energy facilities in these REDZs.

The REDZs were identified through the undertaking of 2 Strategic Environmental Assessments, the first being finalised in 2015 and the second being finalised in 2019. More information on this can be obtained from https://egis.environment.gov.za/redz.

Figure 8-6 indicates that the PAOI does not fall within any REDZ.

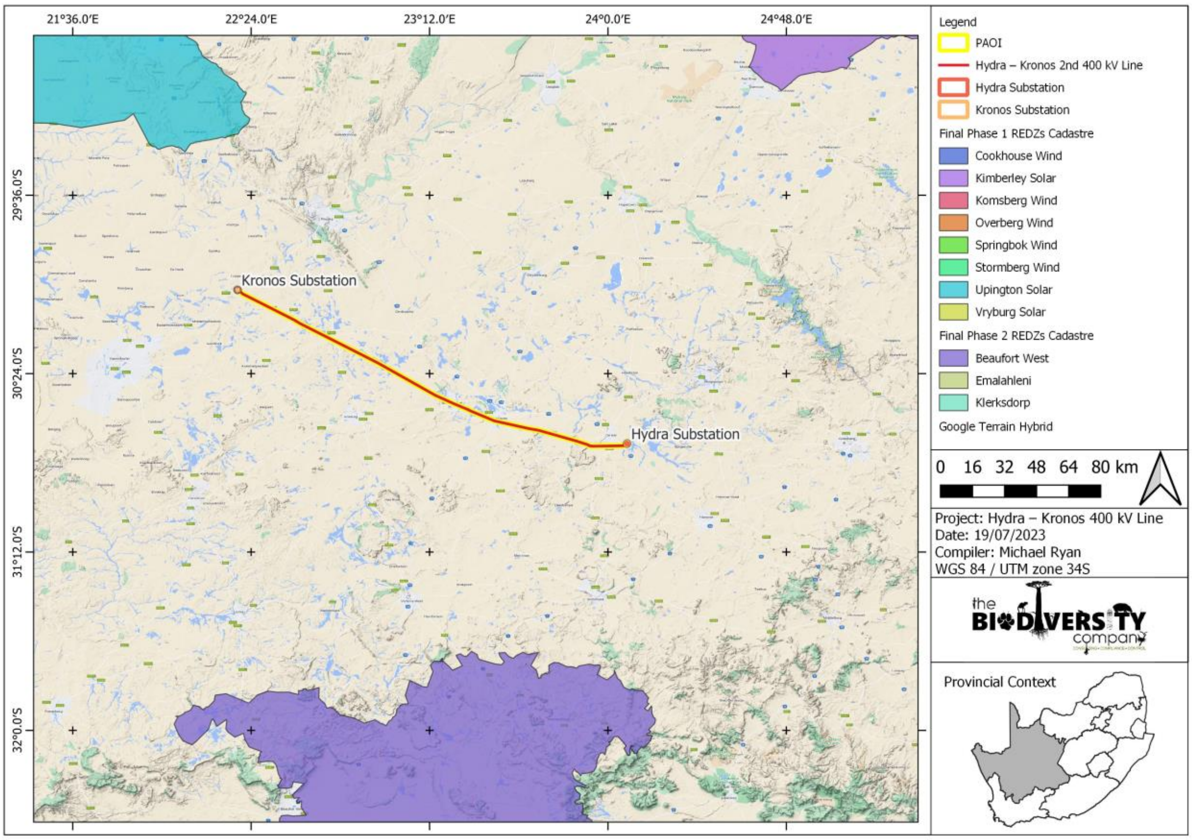

Figure 8-6 The project area in relation to the Renewable Energy Development Zones

8.4.1 Strategic Water Source Areas

Strategic Water Source Areas are areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. The areas supplying ≥ 50% of South Africa's water supply (which were represented by areas with a mean annual runoff of ≥ 135 mm/year) represent national Strategic Water Source Areas (SANBI, 2021). According to the most recent shapefile of the Surface Water Strategic Water Source Areas (SWSAs) of South Africa, Lesotho and Swaziland, the project area is not located within the SWSAs for surface water. The POAI is however associated with a groundwater SWSA's in the east, under the Brak River in the form of the De Aar Region SWSA. This area is considered sensitive as a recharge area for underground aquifers, with care to be taken where considering modification to natural habitat.

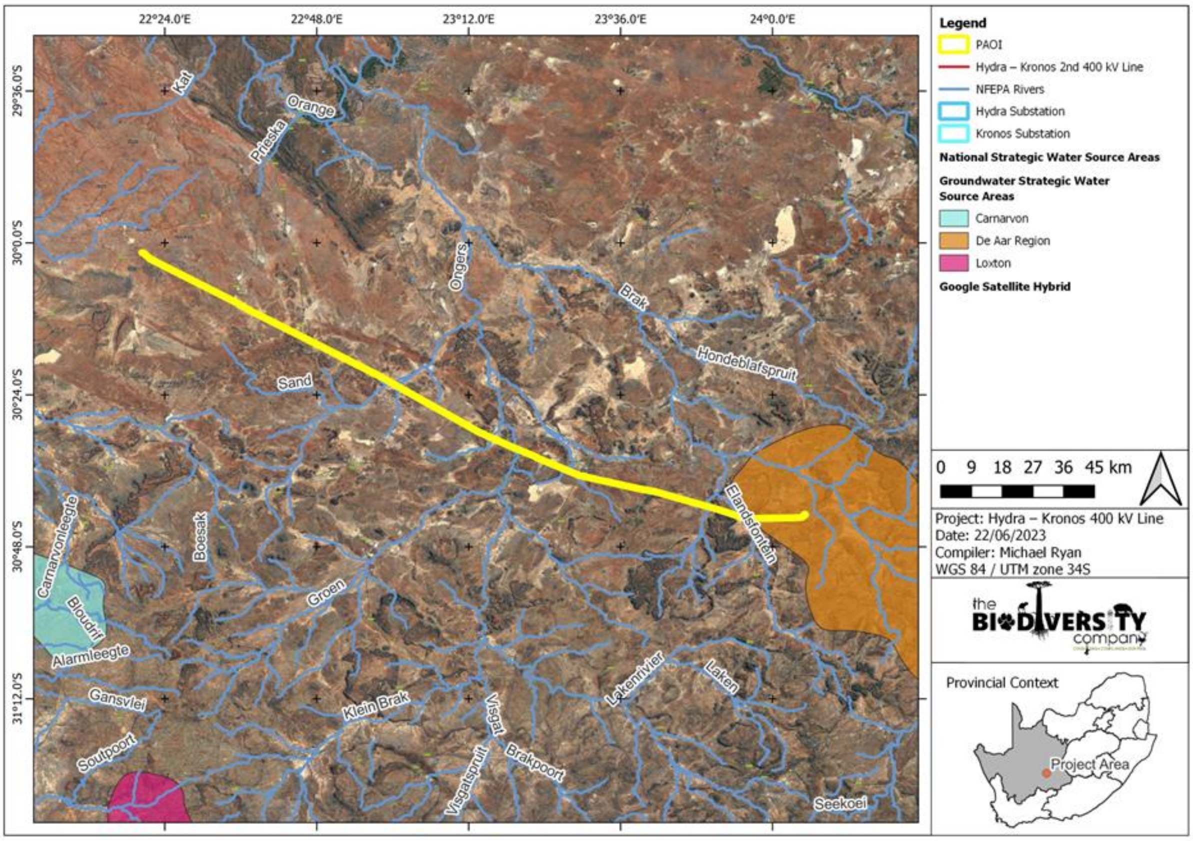

Figure 8-7: Strategic Water Source Areas for the project area

8.4.2 Freshwater Critical Biodiversity Area

The Northern Cape Biodiversity Spatial Plan (CBA) Map for freshwater biodiversity (SANBI, 2016) was considered for the project area. It was drafted by the Northern Cape Department of Environment and Nature Conservation to identify the Critical Biodiversity Areas which were undertaken using a Systematic Conservation Planning approach. Due to the extensive area covered by the linear PAOI, it traverses multiple different categories indicating differing sensitivities. The majority of the transmission line is located within Other Natural Areas (ONA), with the eastern section of the PAOI located within an Ecological Support Area (ESA). The NFEPA rivers which the PAOI crosses are considered Critical Biodiversity Areas (One or Two) (Figure 8-8).

ONA are all remaining natural areas not included in the CBA or ESA categories and are still subject to the usual authorisation procedures, e.g., EIA's and still require a site visit to ensure the absence of important biodiversity features before any environmental authorisation in terms of NEMA is given. ESAs are terrestrial and aquatic areas of the landscape that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas. (DENC, 2008). CBAs are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI, 2017).

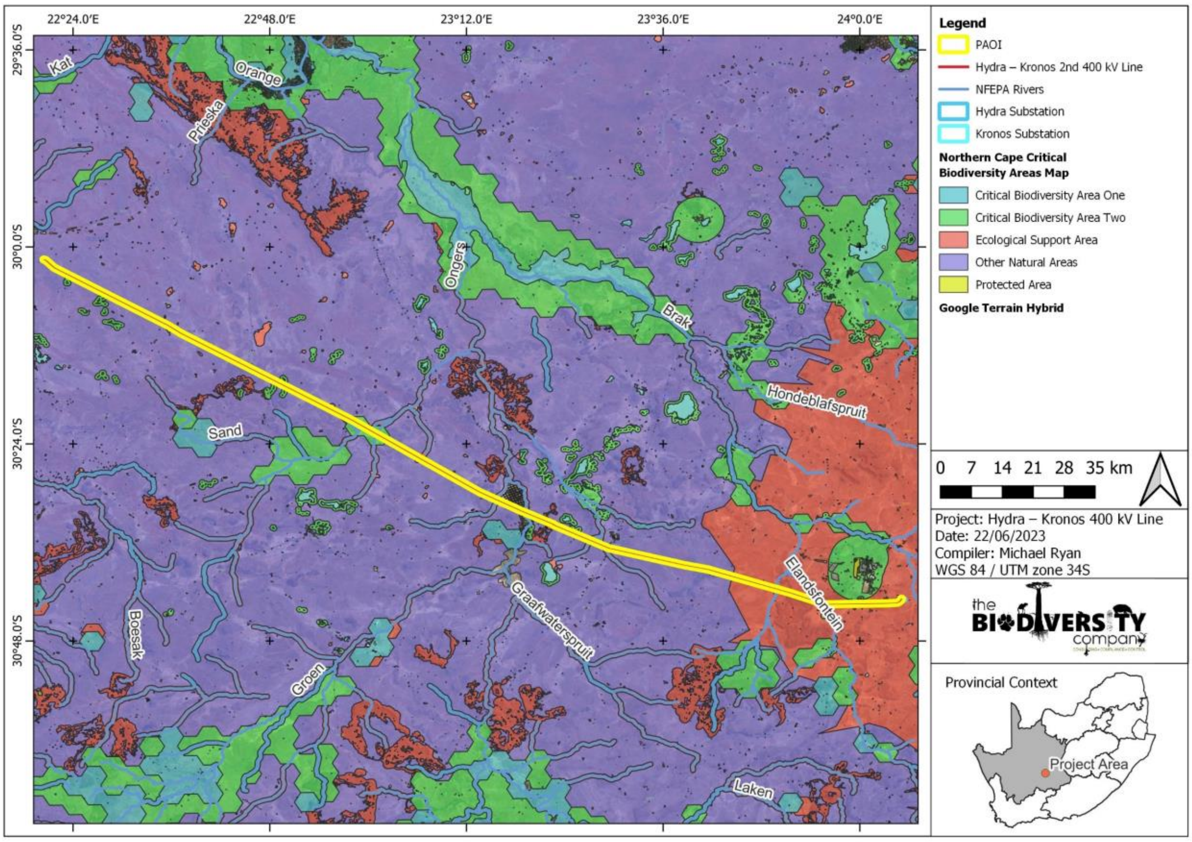

Figure 8-8: Illustration of the Freshwater Critical Biodiversity Areas within the project area (SANBI, 2008)

8.4.3 Ecosystem Threat Status

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Van Deventer, *et al*., 2019).

Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Van Deventer, *et al*., 2019). The Ecosystem Threat

Status (ETS) of each river assessed was based on the extent to which the system had been modified from its natural condition (SANBI, 2018). According to the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) released with the National Biodiversity Assessment (NBA) of rivers, the rivers which were superimposed on the aquatic ecosystem threat status (Figure 5 3) indicate that the proposed infrastructure crosses multiple watercourses which are considered *Endangered* ecosystems, bar the Ongers River system which is considered a *Least Threatened* ecosystem (Figure 5 3).

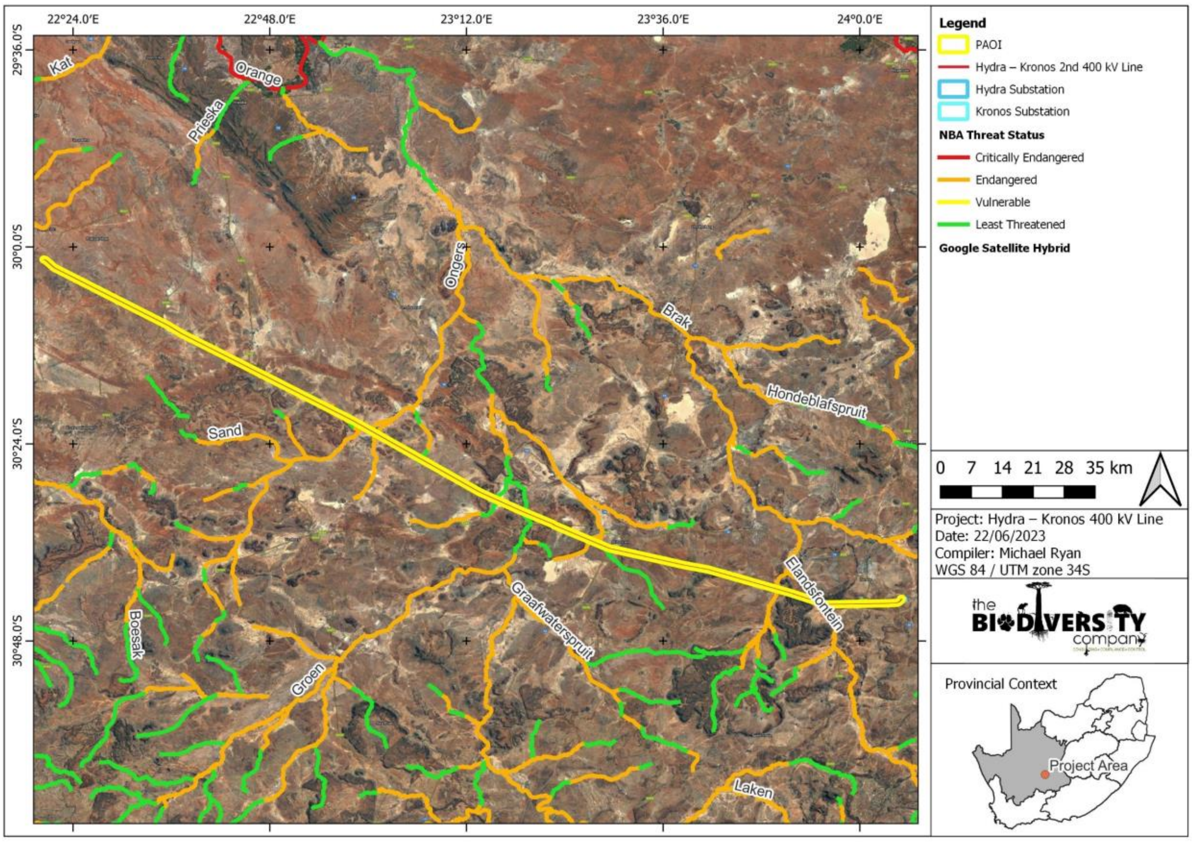

Figure 8-9: Illustration of the Ecosystem Threat Status of the project area (SANBI, 2018)

8.4.4 Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Van Deventer, *et al*., 2019). The Ecosystem Protection Level (EPL) of each river assessed was based on the extent (expressed as a percentage) to which the system has their biodiversity target located within protected areas and are in a natural or near-natural ecological condition. Rivers in protected areas need to be in good condition (A or B ecological category) to be considered as protected. Well protected rivers have 100% located within protected areas, while moderately protected and poorly protected river ecosystem types have at least 50% and 5% of their biodiversity target in protected areas, respectively. Not protected rivers form less than 5% (SANBI, 2018).

The project area was superimposed on the ecosystem protection level map to assess the protection status of aquatic ecosystems associated with the development (Figure 8-10). This indicates that the aquatic ecosystems associated with the project area are rated as *not protected.*

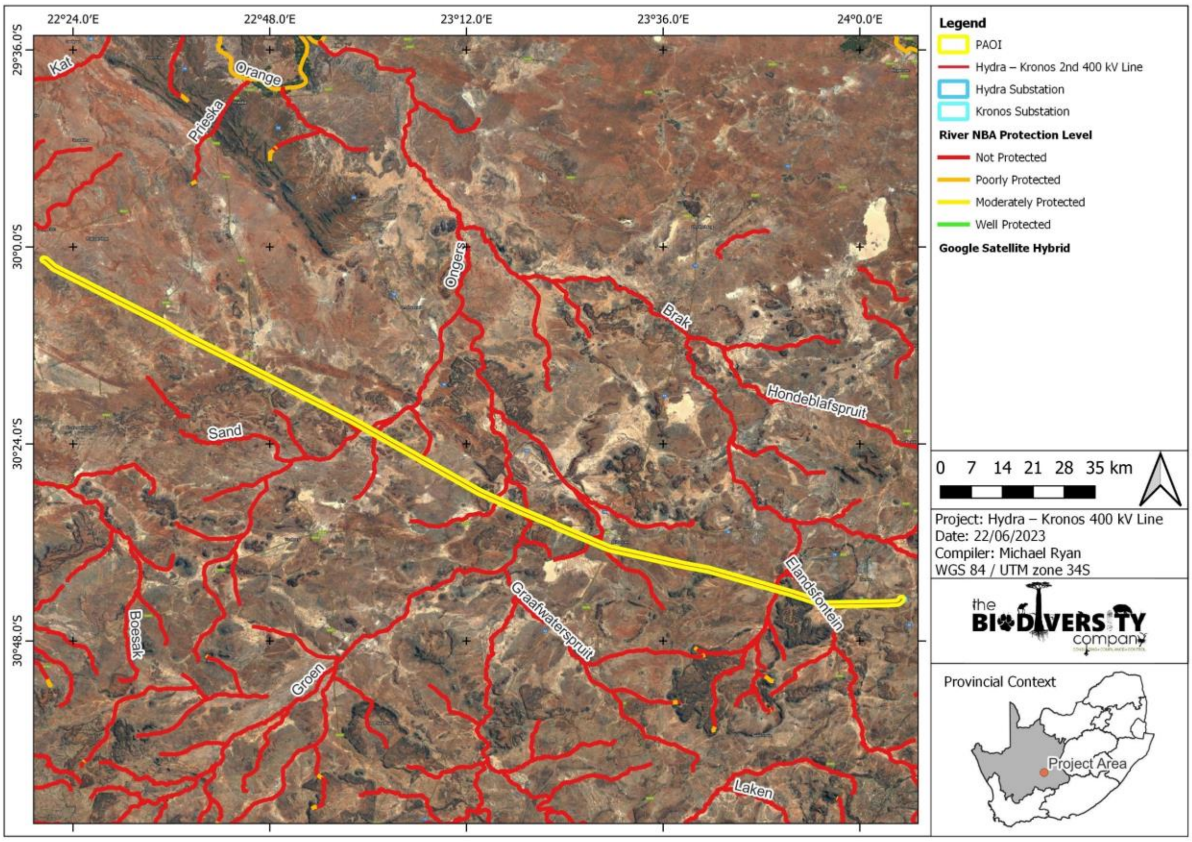

Figure 8-10: Illustration of the Ecosystem Protection Level of the project area (NBA, 2018)

8.4.5 Spatially Sensitive Mapping

This approach has also taken cognisance of the recently published Government Notice 320 in terms of NEMA dated March 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation” (DWS, 2020). The National Web Based Environmental Screening Tool (NWBEST) has characterised the aquatic sensitivity of the watercourses within the project area as “very high” - requiring an assessment (Figure 5 1). The PAOI is extensive due to the linear footprint of the transmission line which therefore traverses a multitude of aquatic systems which are considered sensitive for different reasons. These systems sensitivities include CBAs (Figure 8-8), ESAs (Figure 8-8), River NFEPA’s (Figure 8-2 and Figure 8-1), Wetland NFEPAs (Figure 8-3), Strategic Water Source Area’s (Figure 8-7) as well as being freshwater ecosystem priority areas (quinary catchments - Figure 8-9 and Figure 8-10). These areas are considered sensitive to modification and result in the “very high” associated sensitivity of the PAOI. The freshwater ecology of the immediate project area and further downstream areas are considered sensitive to disturbance from a hydrological and biological perspective. This will include all watercourses within the project area which are considered sensitive due to their relatively small spatial scale when compared to terrestrial habitat with a large demand for the ecosystem services which they provide.

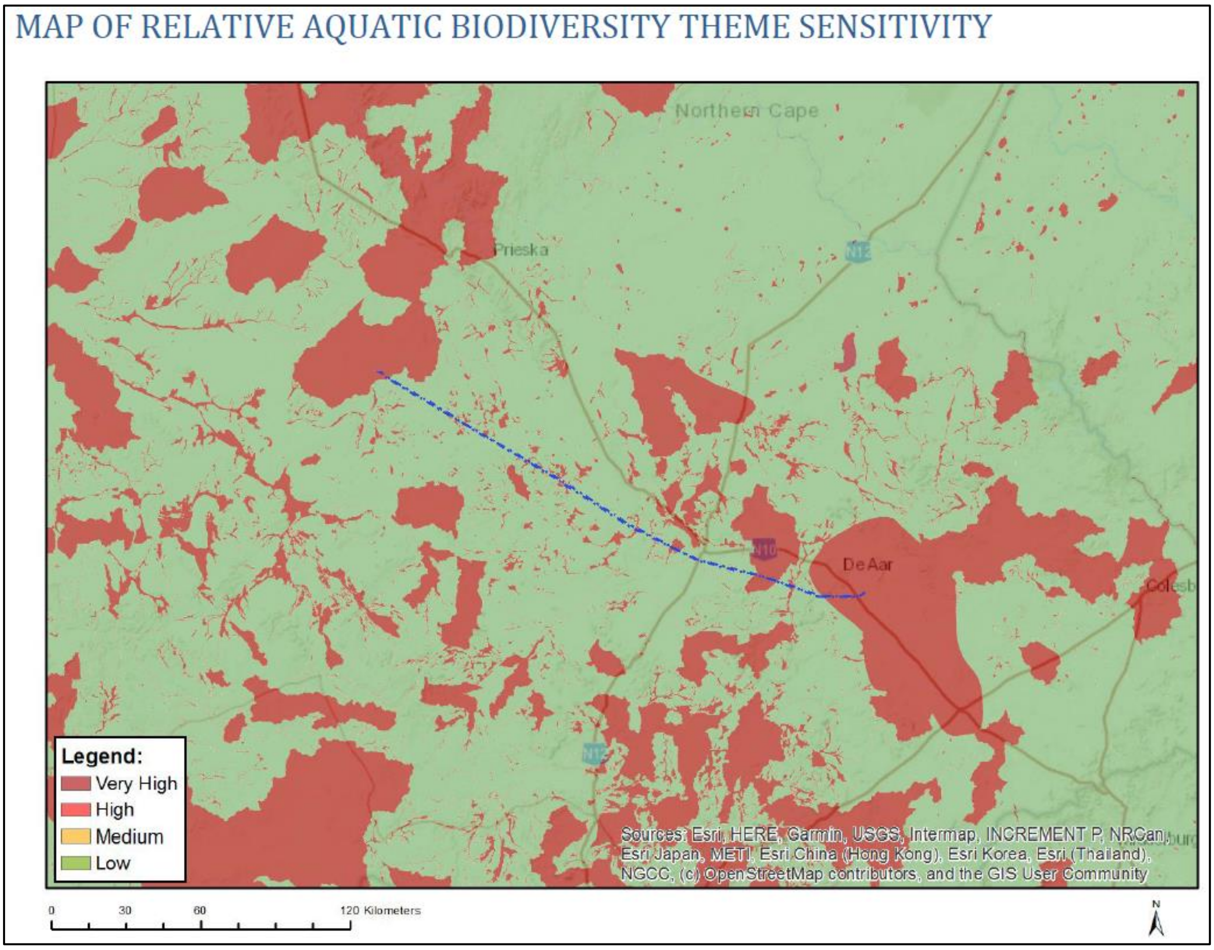

Figure 8-11: Aquatic Biodiversity Combined Sensitivity (National Web based Environmental Screening Tool)

8.5 Expected Fish Species

An expected species list was generated from DWS (2014), and Skelton (2011) for the D62D-05391(Brak River), D62A-05205 (Ongers River) and D62C-05422 (Elandsfontein River), which are the non perennial river systems which may only contain water and flow during the wet season. All other river systems are considered ephemeral, and no fish species are expected in these systems.

A total of 2 fish species are expected to occur in the rivers of the project area which are presented in Table 8-3. The conservational status of fish species was assessed against the IUCN database 2022 (IUCN, 2022).

The expected species are generated on a reach basis, and the occurrence of all species in the system is unlikely as different species are specialists of different habitats which are present along a reach. The multiple SQR's are varied in habitat and flow. As a result, the expected fish species list for the respective river systems includes only two different fish species which are expected in low numbers during the wet season which fish migrate upstream into these systems from the Orange River system.

Table 8-3: Expected fish species

D62D-05391(Brak River)	D62A-05205 (Ongers River)	D62C-05422 (Elandsfontein River)	Common Name	IUCN Status (2023)
Enteromius anoplus	*Enteromius anoplus*	*Enteromius anoplus*	Chubbyhead Barb	LC
Labeo umbratus	x	x	Moggel	LC

LC - Least Concern, NT – Near Threatened, VU – Vulnerable; x - not expected

9 Results and Discussion

9.1.1 *In situ* Water Quality

In situ water quality analysis was conducted during the study at all accessible watercourses within the project area which contained water. This included rivers, tributaries and drainage lines as well as dams. Results have been compared to limits stipulated in the Target Water Quality Range (TWQR) for aquatic ecosystems (DWS, 1996). The results of the June 2023 assessment are presented in Table 9-1 with sites ordered in a downstream direction.

Table 9-1: In situ surface water quality results (June 2023)

Site	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)	Temperature (°C)
TWQR*	6.5-9*	-	-	80 % - 120 % of saturation	5-30*
Elandsfontein					
Elandsfontein Eastern Limb	8.72	1 073	11.3	110.7	14.1
ET2	9.1	442	10.8	94	15.3
ET4	7.41	53.1	10.1	88.8	9.8
ET5	7.75	51.5	11.0	99.5	10.2

*TWQR – Target Water Quality Range; Levels exceeding guideline levels are indicated in red; Elevated levels in yellow

In situ water quality for the project area indicates natural conditions for the watercourses of the project area, as all recorded parameters conform with TWQR. Due to the scale of the project area and multitude of sampling sites considered across multiple river systems the potential for modification within the project area increases. The dry conditions (river systems considered either ephemeral or non-perennial) naturally mitigates the potential footprint of potential modification as it cannot be carried throughout a system due to the lack of flow. The dry conditions were observed with only four of the sites sampled containing surface water which were a result of a rainfall event which occurred the week before. This is observed specifically by ET4 and ET5 which have neutral pH and low dissolved solids as measured by electrical conductivity. The Elandsfontein Eastern Limb crosses through agricultural land with cattle observed to be making use of the watercourse which accounts for the elevated dissolved solids in the system. This is also suspected to have increased due to lack of flow compounded by salt enrichment resulting from evaporation.

The recorded parameters assessed within *in-situ* water quality indicate conditions which would not hinder aquatic life in these systems, however this assessment is not considered robust enough to make this statement on a larger scale as chemical analysis is required to further understand the physiochemical conditions in the reach. Furthermore, the surface water is expected to completely evaporate within a week, with water quality within these systems extremely dynamic seasonally and therefore not a robust test for instream ecological integrity for the region. Due to the ephemeral conditions of the majority of systems within the PAOI, habitat integrity should be the focus in efforts of ecological conservation.

9.1.2 Habitat Integrity Assessment

The IHIA for the rivers in the project area was completed by grouping the river systems together with similar geomorphology and anthropogenic influences. As a result, two separate IHIAs were completed, one for ephemeral systems and a second for the non-perennial systems of the project area. These were grouped according to the classifications given by the desktop PES in section 8.2, with characteristics confirmed during the survey. This was completed as described in the IHIA methodology component of this study. The special framework of which constitutes a up to a 5 km reach of any system which would potentially be affected by the proposed transmission line was considered as opposed to the entire watercourse from source to confluence. The results thereof are shown in Table 9-2.

Table 9-2: Intermediate Habitat Integrity Assessment for the watercourses of the project area

Criterion	Impact Score	Weighted Score	Impact Score	Weighted Score
Watercourse type	Ephemeral		Non-Perennial	
		Instream		
Water abstraction	0	0	11	6.16
Flow modification	6	3.12	8	4.16
Bed modification	5	2.6	7	3.64
Channel modification	7	3.64	7	3.64
Water quality	4	2.24	4	2.24
Inundation	2	0.8	6	2.4
Exotic macrophytes	0	0	0	0
Exotic fauna	0	0	4	1.28
Solid waste disposal	0	0	0	0
Total Instream Score	**87.6**		**76.48**	
Instream Category	**B**		**C**	
		Riparian		
Indigenous vegetation removal	4	2.08	6	3.12
Exotic vegetation encroachment	11	5.28	8	3.84
Bank erosion	12	6.72	8	4.48
Channel modification	8	3.84	10	4.8
Water abstraction	2	1.04	9	4.68
Inundation	2	0.88	8	3.52
Flow modification	5	2.4	6	2.88
Water quality	3	1.56	7	3.64
Total Riparian Score	**76.2**		**69.04**	
Riparian Category	**C**		**C**	

The results of the instream habitat assessment for the ephemeral systems indicates a largely natural state (class B) while the instream habitat assessment for the non-perennial systems indicates a moderately modified state (class C). The riparian habitat assessment indicates a moderately modified state (class C) for both the ephemeral and non-perennial systems. The influences on the systems of the project area are low with non-perennial rivers only having a larger circle of influence due to extended period of flowing water during the wet season having the potential to move modification throughout the system where it remains localized in the ephemeral systems. These systems have a lack of habitat and continuity for invertebrates and fish which result from ephemeral upper catchment reaches in flat arid areas combined with instream dams and abstraction for surrounding centre pivots as well as anti-erosion berms. Channel degradation from crossings and braiding of channels with severe erosion has occurred as well as likely loss of baseflow downstream of the chain-of-dams has occurred. Despite this the riparian/wetland zone continuity is largely natural with some berms present however dryer systems do experience bush encroachment as well as some alien vegetation establishment. Further some influences on water quality include agriculture runoff, homesteads and urban areas as well as influence from inundation from dams and siltation from upstream erosion. Erosion in the catchment in ephemeral systems are severe due to dry condition where there is little vegetation for soil continuity in flooding events where large volumes of water occur in short time frames with immense force for the movement of sediments.

9.1.3 Riparian Habitat – Watercourse Extent

The project area traverses through five vegetation types namely the Northern Upper Karoo (NKu3), Upper Karoo Hardeveld (NKu2), Eastern Upper Karoo (NKu4),Bushmanland Arid Grassland (NKb3) and Bushmanland Basin Shrubland (NKb6) from east to west. The Northern Upper Karoo (NKu3) vegetation type is the dominant vegetation type covering 75.53% of the PAOI. The Northern Upper Karoo (NKu3) vegetation type is distributed throughout the Northern Cape and Free State Provinces. It is localized to the Northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east at altitudes between 1 000–1 500 m. The vegetation is comprised of shrubland dominated by dwarf karoo shrubs, grasses and *Acacia mellifera subsp. detinens* and some other low trees (especially on sandy soils in the northern parts and vicinity of the Orange River). These shrublands are distributed along flat to gently sloping, isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford, 2006).

Important Taxa (Mucina & Rutherford, 2006):

Small Trees: *Acacia mellifera* subsp. *detinens*, *Boscia albitrunca*.

Tall Shrubs: *Lycium cinereum* (d), *L. horridum*, *L. oxycarpum*, *L. schizocalyx*, *Rhigozum trichotomum*.

Low Shrubs: *Chrysocoma ciliata* (d), *Gnidia polycephala* (d), *Pentzia calcarea* (d), *P. globosa* (d), *P. incana* (d), *P. spinescens* (d), *Rosenia humilis* (d), *Amphiglossa triflora*, *Aptosimum marlothii*, *A. spinescens*, *Asparagus glaucus*, *Barleria rigida*, *Berkheya annectens*, *Eriocephalus ericoides* subsp. *ericoides*, *E. glandulosus*, *E. spinescens*, *Euryops asparagoides*. *Felicia muricata*, *Helichrysum lucilioides*, *Hermannia spinosa*, *Leucas capensis*, *Limeum aethiopicum*, *Melolobium candicans*, *Microloma armatum*, *Osteospermum leptolobum*, *O. spinescens*, *Pegolettia retrofracta*, *Pentzia lanata*, *Phyllanthus maderaspatensis*, *Plinthus karooicus*, *Pteronia glauca*, *P. sordida*, *Selago geniculata*, *S. saxatilis*, *Tetragonia arbuscula*, *Zygophyllum lichtensteinianum*.

Succulent Shrubs: *Hertia pallens*, *Salsola calluna*, *S. glabrescens*, *S. rabieana*, *S. tuberculata*, *Zygophyllum flexuosum*. Semiparasitic

Shrub: *Thesium hystrix* (d), Herbs: *Chamaesyce inaequilatera*, *Convolvulus sagittatus*, *Dicoma carpensis*, *Gazania krebsiana*, *Hermannia comosa*, *Indigofera alternans*, *Lessertia pauciflora*, *Radyera urens*, *Sesamum capense*, *Sutera pinnatifida*, *Tribulus terrestris*, *Vahlia capensis*.

Succulent Herb: *Psilocaulon coriarium*.

Geophytic Herb: *Moraea pallida.*

Graminoids: *Aristida adscensionis* (d), *A. congesta* (d), *A. diffusa* (d), *Enneapogon desvauxii* (d), *Eragrostis lehmanniana* (d), *E. obtusa* (d), *E. truncata* (d), *Sporobolus fimbriatus* (d), *Stipagrostis obtusa* (d), *Eragrostis bicolor*, *E. porosa*, *Fingerhuthia africana*, *Heteropogon contortus*, *Stipagrostis ciliata*, *Themeda triandra*, *Tragus berteronianus*, *T. koelerioides*, *T. racemosus*.

Vegetation within the riparian areas was composed of succulent herbs and shrubs as mentioned above. Due to the ephemeral and non-perennial nature of the river systems observed throughout the project area, surface flow is diminished for extended periods of the year. This results in a lack of hydrophilic species present within the riparian areas of the watercourses as terrestrial vegetation encroaches the active water channel. The only sections of a watercourse which presented vegetation characteristic of riparian areas were at sections where the channel contained infrastructure to store water such as a dam or weir. This was observed at the Elandsfontein Eastern Limb where some *Cyprus sp*. were observed (Figure 9-1). Another section of the same river as observed at the Elandsfontein Western Limb was found to contain no hydrophilic species with terrestrial overgrowth observed to have occurred (Figure 9-2).

Figure 9-1: Elandsfontein Eastern Limb riparian areas

Figure 9-2: Elandsfontein Western Limb riparian areas

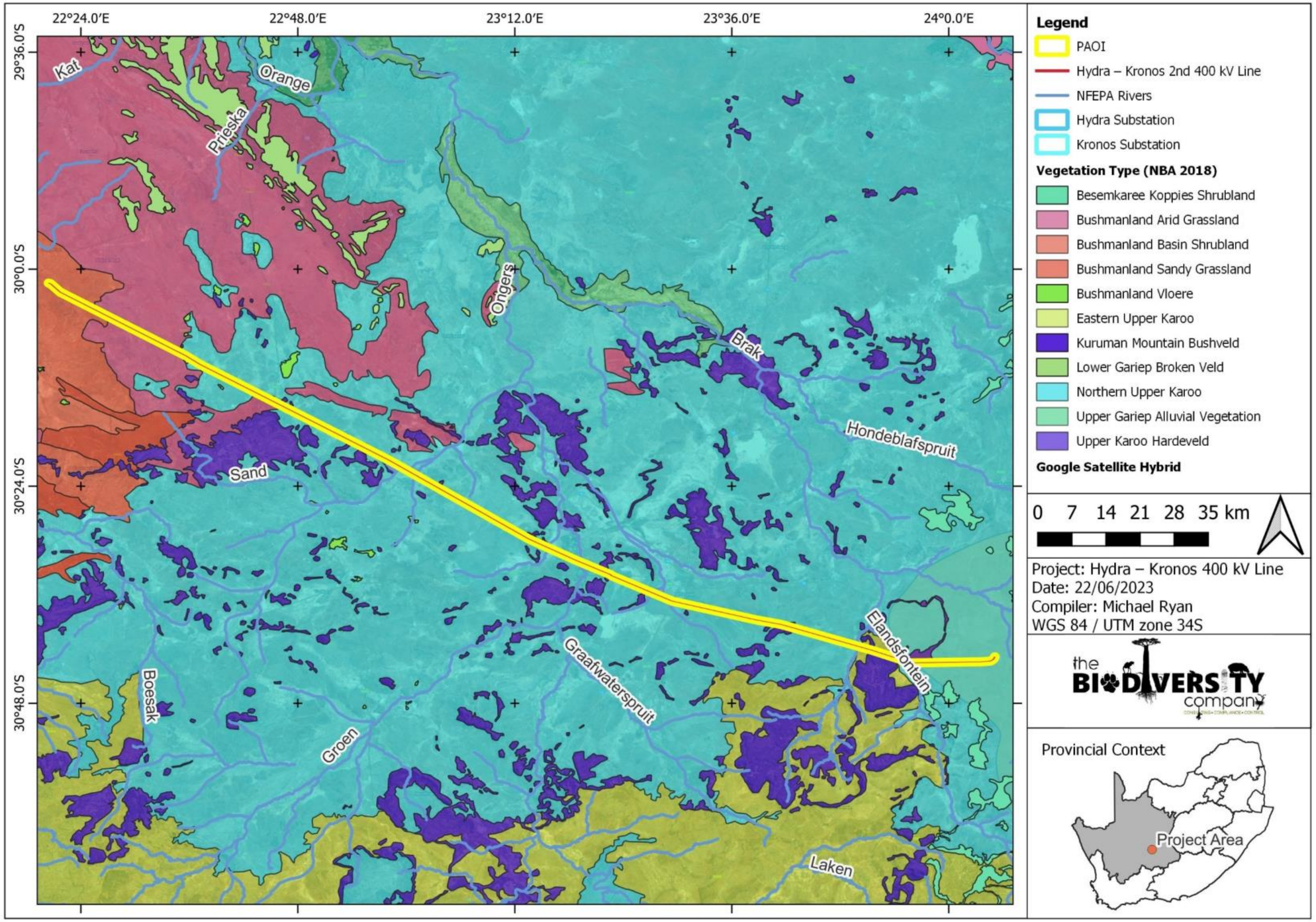

Figure 9-3: The vegetation type of the project area

9.2 Buffer zones

According to the buffer guidelines the maximum required buffer should be applied to a system (Macfarlane, *et al*., 2014). Riparian areas have high conservation value and can be considered most important part of a watershed for a wide range of values and resources. They provide important habitat for a large volume of wildlife and often forage for domestic animals. The vegetation they contain are an important part of the water balance for the hydrological cycle through evapotranspiration. They are crucial for riverbank stability and in preventing erosion within the channel (Elmore and Beschta, 1987). This is especially true for ephemeral systems where due to dry nature of the system, the habitat provided by vegetation within the riparian area are the only existing aspect of the watercourse until thunderstorm events. Due to the scale of the project, main stem rivers classified as NFEPA scale rivers are given a 30m buffer (Chase *et al.* 1995, Desbonnet *et al*. 1994, McMillan, 2000 and Fisher *et al*. 2000). The smaller systems which are considered either tributaries or drainage lines were assigned an 18 m buffer according to Dosskey (2000) to protect this habitat type. The wetland systems were assigned a 15 m buffer as per Cooke (1992) recommendation – with Graham and de Winnaar, 2009 and Desbonnet *et al*. (1994) using the same buffer widths in wetter climates. The delineated riparian areas and associated buffer zones are considered **no go** areas for any infrastructure such as pillars or towers for the transmission powerline. It is however understood that the line will invariably cross systems which is unavoidable but associated infrastructure should be located outside the riparian buffers in accordance with the precautionary principle. The delineation of the watercourse extents riparian zone observed in the study area are presented in Figure 9-4.

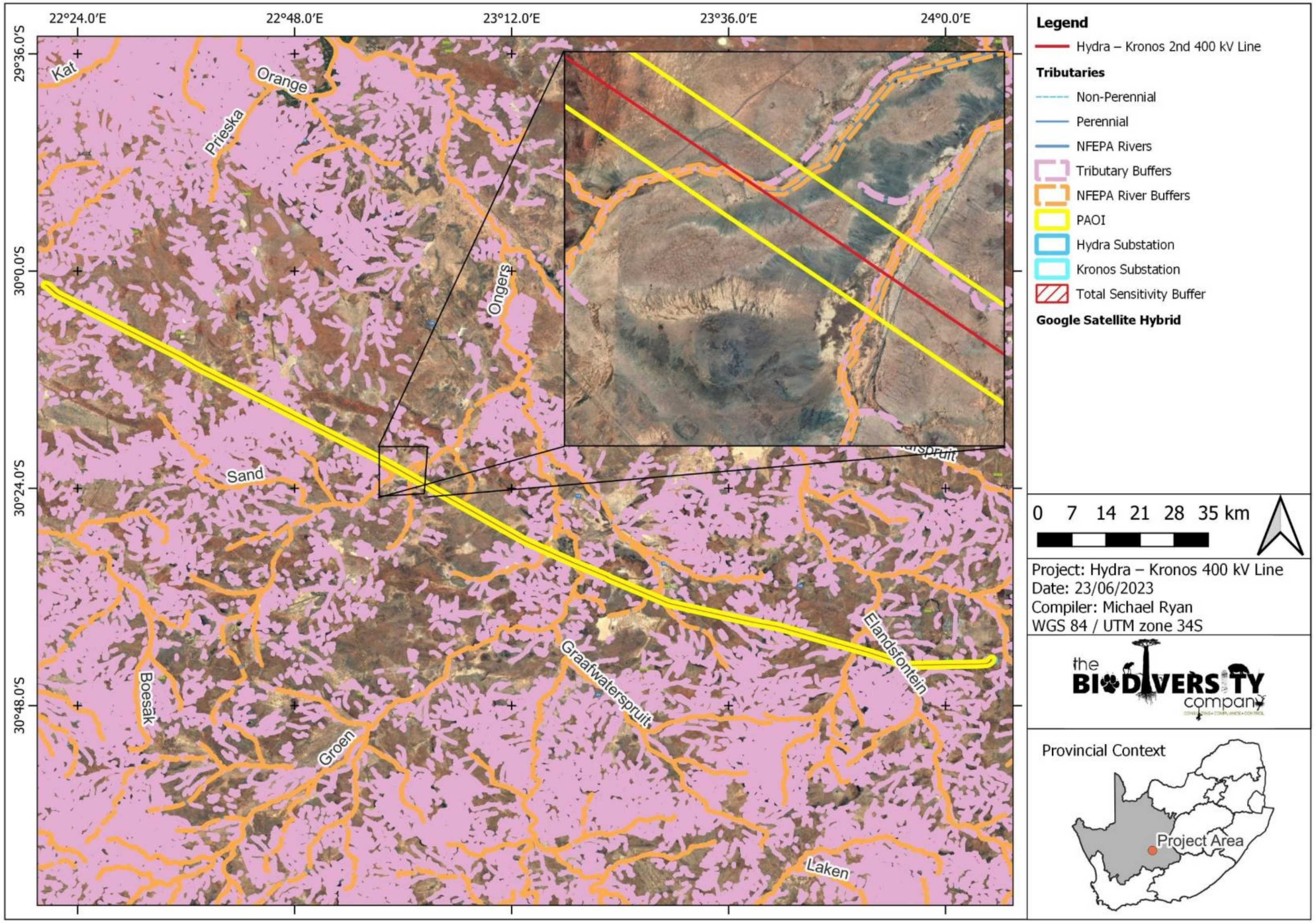

Figure 9-4: Riparian delineation and associated buffer of the watercourses associated with the project area

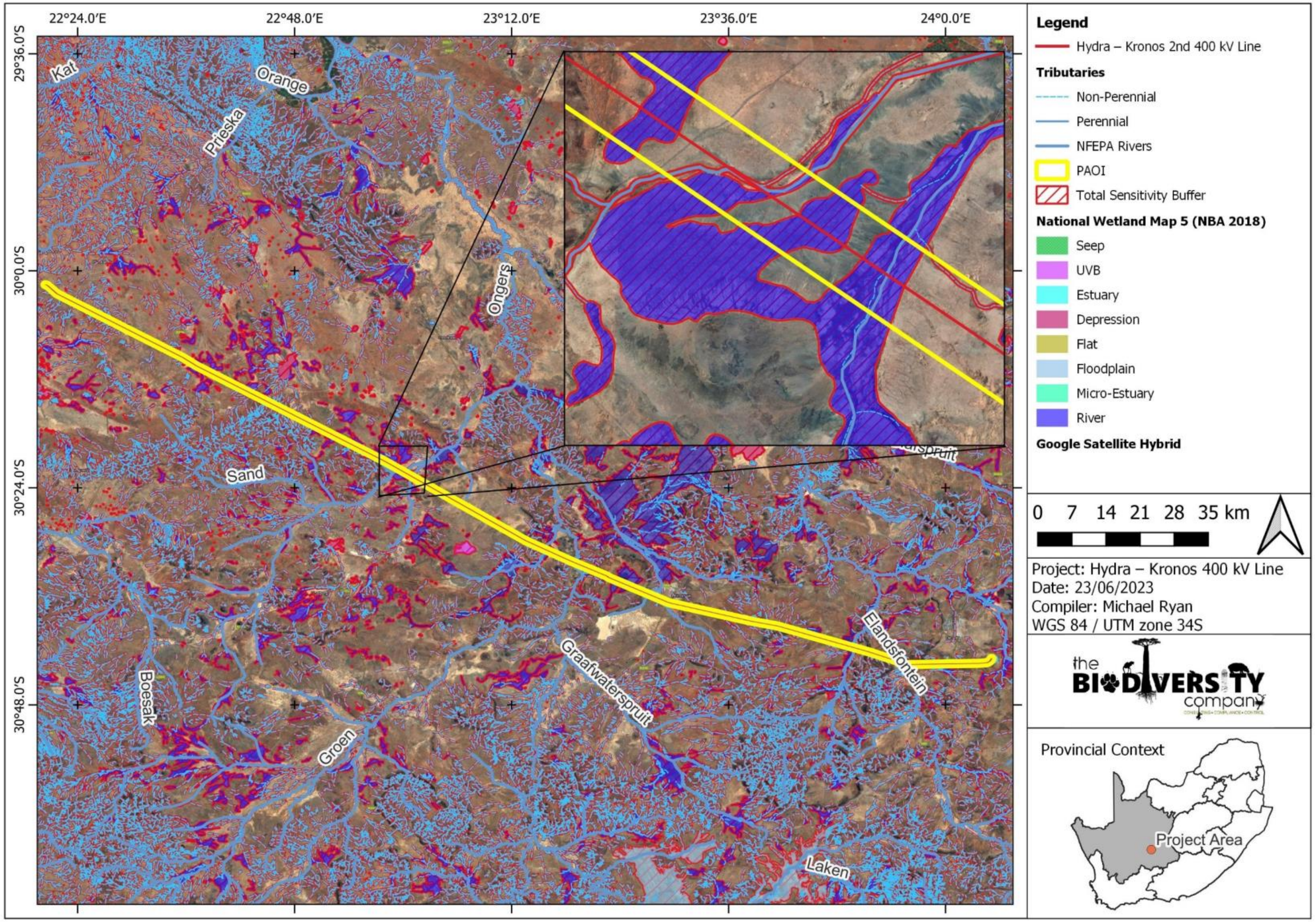

Figure 9-5: Total Sensitivity and associated buffer of the watercourses associated with the project area

9.2.1 Aquatic Macroinvertebrate Assessment

9.2.1.1 Macroinvertebrate Habitat

Biological assessments were completed at representative sites in the considered river reach. The results of the biotope assessment are provided below (Table 9-3).

Table 9-3: Biotope availability at the sites (Rating 0-5)

Biotope	Weighting (Upper Foothills)	Elandsfontein Eastern Limb
Stones in current	20	0
Stones out of current	10	2
Bedrock	5	3
Aquatic Vegetation	0.5	0
Marginal Vegetation In Current	2	0
Marginal Vegetation Out Of Current	2	3
Gravel	3.5	0
Sand	1	0
Mud	0.5	3
Biotope Score		11
Weighted Biotope Score (%)		19
Biotope Category (Tate and Husted, 2015)		F

The habitat availability within the project area represents poor (class F) conditions. This resulted from the watercourse presenting as only a shallow pool surrounding a weir where the riverbed was dominated by bedrock which has a poor infiltration rate. This resulted in no present in current habitat. Further marginal vegetation was comprised of few different species such as sedges in isolated patches which presented uniform habitat. The only present substrate above the bedrock was mud at a uniform depth. The habitat assessment indicates that biotope results within the reach indicate that the habitat availability would be a limiting factor for the diversity of macroinvertebrate communities within the sampled river.

9.2.1.2 South African Scoring System

SASS5 methodologies were applied to all suitable watercourses with water within the project area. This included one site across six river systems. The aquatic macroinvertebrate results for the survey are presented in Table 9-4.

Table 9-4: Macroinvertebrate assessment results recorded during the survey (June 2023)

Site	SASS Score	No. of Taxa	ASPT*	Category (Dallas, 2007)**
		Elandsfontein		
Elandsfontein Eastern Limb	14	4	3.5	E/F

*ASPT: Average score per taxon; ** Nama Karoo – Lower Ecoregion

The SASS5 assessment results generated a SASS score of a category E/F for the Elandsfontein Eastern Limb (Dallas, 2007) which indicates seriously modified conditions within the reach. Despite these results, the data is not considered representative for the nature of the system as the surface flow observed represented a rainfall event which occurred the previous week which fell outside the wet season and the channel is suspected to dry up within a week of the rainfall event. This was observed as only 4 taxa were sampled within the reach. The observed taxa included Oligochaeta, Dytiscidae, Gyrinidae and Lymnaeidae – all in their juvenile life stage. The channel therefore does not have enough time with surface flow for macroinvertebrate communities to establish. Therefore, the resultant category does not indicate modification rather the non-perennial nature of the system.

9.2.2 Fish Communities

Due to the lack of surface flow and connectivity with perennial systems observed in with all watercourses sampled, no fish were sampled during the June 2023 survey.

10 Impact / Risk Assessment

The proposed Hydra – Kronos 2nd 400 kV Transmission Line is intended to cross a plethora of rivers, tributaries and drainage lines. The powerline will not be buried underground requiring terrain and watercourses to be unearthed, rather will be placed along multiple single circuit angle steel towers which can be easily placed outside of the buffers of the riparian areas and therefore the potential risks to these watercourses are expected to be low. Multiple watercourses are dry and therefore the potential for impacts in river systems to spread downstream is also low, with impacts being localized. There is an existing service road along the existing transmission line and therefore this aspect of the development will not be required for the proposed project. The last aspect is the laydown yards and the substations which will be constructed and are all located outside of the delineated buffer zones. Furthermore, the proposed line will be aligned along the existing transmission line. It is however noted that in the survey, some electrical pylons of the existing transmission line were constructed within the watercourse, however their footprint is considered minimal as small platforms are constructed for each leg of a pylon (Figure 10-1). Constructing any pylons within a watercourse should be avoided as far as possible. As a result, the largest risks are anticipated during construction with negligible effects during the operation of the substations and transmission lines.

Figure 10-1: Concrete platform used to stabilise the electrical pylons

The impact assessment considered both direct, indirect and cumulative impacts to the water resources. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the study (Figure 10-2). Risks which are assigned to the decommissioning phase of the transmission line are considered the same as during the construction phase, just with the activity reversed. In accordance with the mitigation hierarchy, the preferred mitigatory measure is to first avoid impacts by considering options in project location, siting, scale, layout, technology and phasing. If avoidance isn't possible, associated risks should be minimised. In instances where impacts are unavoidable, rehabilitation will be required. Findings from the impact assessment are provided in Table 10-1. Findings from the DWS risk assessment are provided in Table 10-2 and Table 10-3.

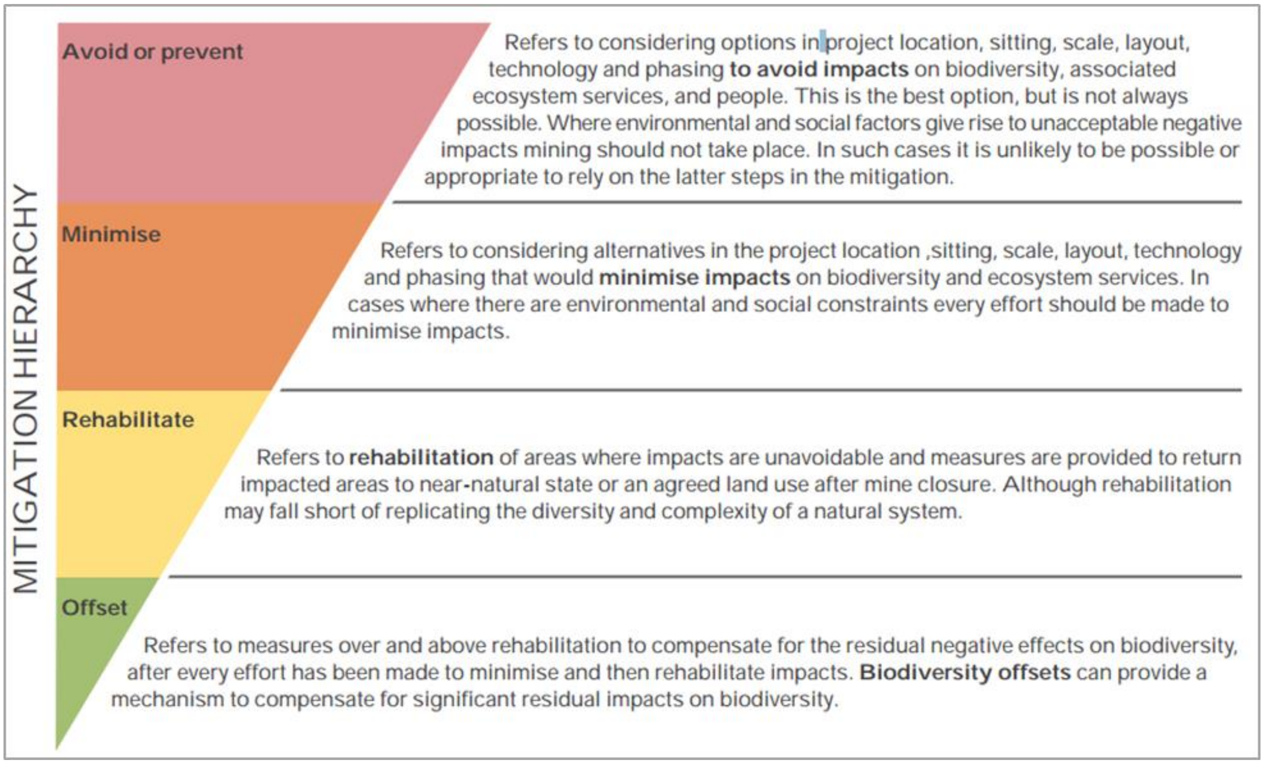

Figure 10-2: The mitigation hierarchy as described by the DEA (2013)

Table 10-1: Potential impacts associated with the project

Prasheen Singh	Pr Sci Nat	116822
Activity	**Aspect**	**Impacts**
Construction of multiple single circuit angle steel towers, substations and roads	• Drainage patterns change • Potential bank alteration of rivers • Removal of embankment vegetation areas • Cutting/reshaping of embankments • Operation of equipment and machinery outside riparian areas. • Soil and building material stockpile management • Domestic and industrial waste • Storage of chemicals, mixes and fuel • Final landscaping and post-construction rehabilitation • Temporary staff ablutions	• Loss of embankments. • Siltation of watercourse. • Erosion of watercourse. • Increase in sediment inputs • Vegetation removal • Loss of seepage areas • Alteration to future flow volumes
Operation of substations and transmission line	• Alteration of surface drainage and runoff • Storm water management • Establishment of alien plants on disturbed areas • Conducting maintenance	• Alteration to flow volumes (impediment) • Alteration of patterns of flows (increased flood peaks) • Solid waste

A variety of risks have been identified for the proposed project. All seven risks associated with this project were determined to be low for the construction phase of the project. This is due to the distance of all construction aspects outside of the delineated buffers combined with the low spatial scale of influence which results from the predominantly dry watercourses. Mitigation measures as well as appropriate rehabilitation have been suggested to further lower the identified risk in the DWS risk matrix (Table 10-2 and Table 10-3).

The operation of the transmission line poses a risk to the identified water resources, with the level of risk determined to be low for all five potential risks. The resultant elevated risks result from the duration which they will occur for, being the lifetime of the activity. The potential for the hanging transmission line or the substation which are located a considerable distance from all watercourse buffers to have any effect on any watercourse is highly improbable.

Due to the low risks assigned to the project by the DWS risk assessment, authorisation under the provisions of the General Authorisation (GA) is deemed appropriate, provided mitigation measures and the recommendations are implemented. This is all on condition that all electrical pylons are installed outside of a delineated watercourse and associated buffer. If a pylon is placed within a watercourse, it is considered a moderate risk. These pylons will then require licencing under a full Water Use License Application (WULA).

Table 10-2: DWS Risk Impact Matrix for the proposed project

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Small scale drainage patterns change	1	0	1	0	0.5	1	2	3.5
Isolated removal of embankment vegetation areas	2	0	3	3	2	1	2	5
Operation of equipment and machinery outside delineated watercourses or buffers	1	1	1	0	0.75	1	2	3.75
Soil and building material stockpile management	1	0	1	0	0.5	1	2	3.5
Domestic and industrial waste	0	1	0	1	0.5	1	2	3.5
Storage of chemicals, mixes and fuel	0	1	0	1	0.5	1	2	3.5
Final landscaping and post-construction rehabilitation	1	0	1	0	0.5	1	2	3.5
Constructed electrical Pylon or laydown yards WITHIN the delineated Sensitive Areas	4	1	4	3	3	2	3	7
Operational Phase								
Alteration of surface drainage and runoff	1	0	1	0	0.5	1	4	5.5
Storm water management	1	0	0	0	0.25	2	4	6.25
Operation of transmission line and substation	1	0	0	0	0.25	2	4	6.25
Establishment of alien plants on disturbed areas	1	0	1	1	0.75	1	2	3.75
Conducting maintenance	0	1	0	0	0.25	1	2	3.25
Constructed electrical Pylon WITHIN the delineated Sensitive Areas	4	1	4	3	3	2	4	9

Table 10-3: DWS Risk Impact Matrix for the proposed project continued

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase								
Small scale drainage patterns change	1	2	5	3	11	38.5	Low	Low
Isolated removal of embankment vegetation areas for select roads	2	3	5	2	7	60	Moderate	Low
Operation of equipment and machinery outside delineated watercourses or buffers	1	3	1	1	6	22.5	Low	Low
Soil and building material stockpile management	1	1	1	1	4	14	Low	Low
Domestic and industrial waste	4	1	1	2	8	28	Low	Low
Storage of chemicals, mixes and fuel	1	1	1	2	5	17.5	Low	Low
Final landscaping and post-construction rehabilitation	1	1	1	1	4	14	Low	Low
Constructed Electrical Pylon or laydown yards WITHIN the delineated Sensitive Areas	5	3	5	3	16	112	Moderate	Moderate
Operational Phase								
Alteration of surface drainage and runoff	1	2	5	1	9	49.5	Low	Low
Storm water management	2	2	1	1	6	37.5	Low	Low
Operation of transmission line and substation	3	2	1	2	8	50	Low	Low
Establishment of alien plants on disturbed areas	2	2	1	2	7	26.25	Low	Low
Conducting maintenance	1	1	1	1	4	13	Low	Low
Constructed electrical Pylon WITHIN the delineated Sensitive Areas	5	3	5	3	16	144	Moderate	Moderate

(*) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

10.1.1 Unplanned Events

The planned activities will have anticipated impacts as discussed; however, unplanned events may occur on any project and may have potential impacts which will need management. Table 10-4 is a summary of the findings of an unplanned event assessment from an ecological perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 10-4 Summary of unplanned events for terrestrial biodiversity

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spills into the surrounding environment	Contamination of habitat as well as water resources associated with spillage.	A spill response kit must be available at all times. The incident must be reported on and if necessary an biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural grassland and wetlands	Appropriate/Adequate fire management plan need to be implemented.

10.2 Mitigation Measures

The prescribed mitigation measures for the project include the following:

10.2.1.1 Transmission line installation specific mitigation measures

- The footprint area of the transmission line must be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- The footprint area must be aligned with the existing road/railway reserves wherever possible. Disturbed areas should be sought as the preferred alignment area;
- The locations of all single circuit angle steel towers which hold the transmission line must be located outside of all delineated watercourses as far as possible. This should be achieved by increasing or decreasing the distances between towers;
- As far as possible all access roads should use existing service road;
- Preferential flow paths should be identified that intersect with the road so that silt traps and fences can be installed to avoid siltation of watercourses; and
- An appropriate stormwater management plan must be developed for all substations or the existing ones updated.

10.2.1.2 General mitigation measures

The following general mitigation measures are provided:

- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- Laydown yards, camps and storage areas must be beyond the aquatic areas delineated watercourse extend and associated buffer zones. Where possible, the construction of the transmission line and substations must take place from the existing road servitudes and not from within the aquatic systems;

- All construction areas should be clearly demarcated
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are cleaned-up and discarded correctly;
- All chemicals and toxicants to be used for the construction must be stored outside any channel system and in a bunded area;
- All machinery and equipment should be inspected regularly for faults and possible leaks; these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the watercourse. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- As far as possible, all building materials used for the substations should be pre-fabricated and transported to site to avoid any risks of contamination to any watercourse:
- No dumping of construction material on-site may take place;
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported; and
- An alien invasive plant management plan needs to be compiled and implemented post construction to control current invaded areas and prevent the growth of invasives on cleared areas.

11 Cumulative Risks

Cumulative impacts are assessed in context of the extent of the proposed project area; other developments in the SQR and Quaternary catchment areas; and general habitat loss and transformation resulting from other activities in the area. The impacts of projects are often assessed by comparing the post-project condition to a pre-existing baseline condition. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for freshwater fauna and flora.

Localised cumulative impacts include the cumulative effects from anthropogenic activities that are close enough (such as nearby farming activities within the area) to potentially cause additive effects on the environment or sensitive receivers. These include disruption of ecological corridors or habitat such as watercourses, impacts to groundwater and surface water quality, and transport of soils and instream habitat smothering impacts.

Long-term cumulative impacts due to the proposed electricity generation and transmission footprint, comprising the wind turbines and solar farms and servitudes in the upper reaches of the watercourses combined with the low density agricultural activities currently present in the upper, reaches of the watercourses (Figure 11-1) has the potential to degrade watercourse habitat across the catchment. The cumulative impact of the project was rated as moderate should the project go ahead and involve the implementation of mitigation.

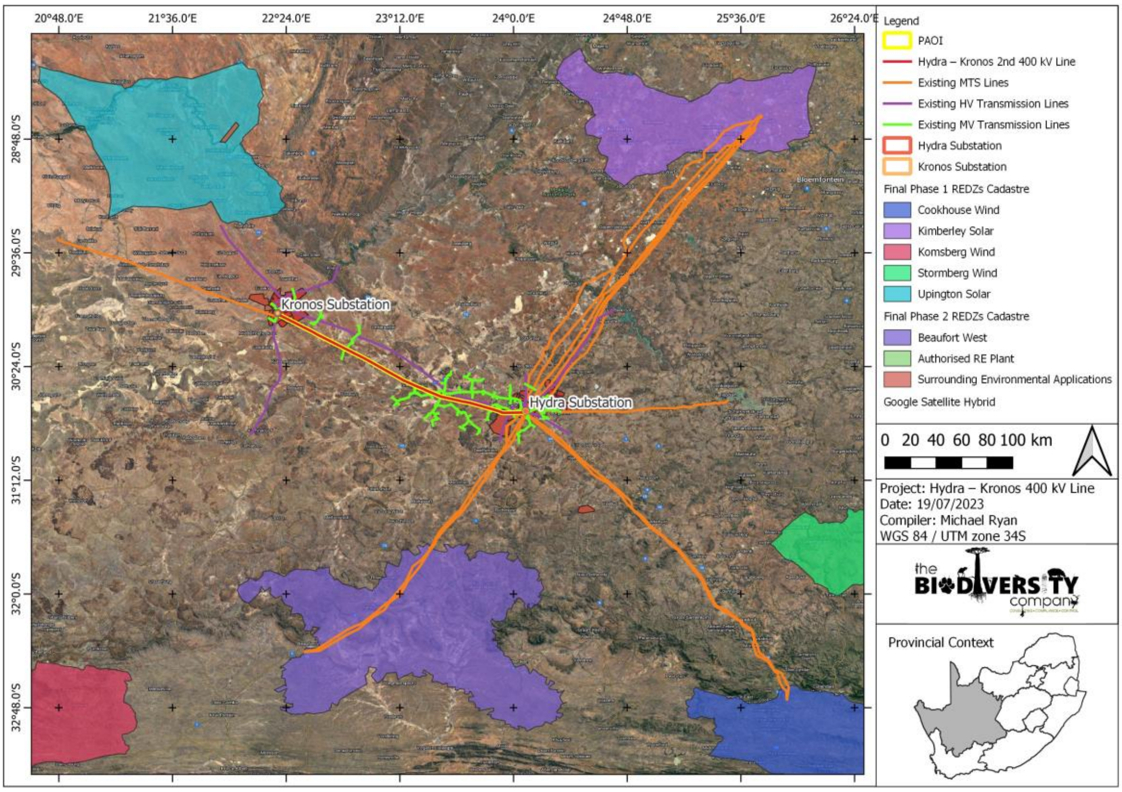

Figure 11-1 Cumulative renewable applications in region

Table 11-1 Cumulative impacts to aquatic ecology associated with the proposed project

Impact Nature: Cumulative loss/ disturbance of habitat and ecological functioning of watercourses in the region		
The development of the proposed infrastructure will contribute to cumulative habitat loss within the local other natural areas and ESAs, watercourses and adjacent habitat together with the potential for increased contaminants and sediment entering the watercourses. The loss/alteration of habitat lowers the buffering capacity of the catchment to water quality impacts, will have negative impacts on the ecological processes of the associated watercourse in the PAOI, with no impacts of significance expected in the region.		
	Overall impact of the proposed project (with mitigation) considered in isolation	**Cumulative impact of the project together with the existing and proposed projects in the area**
Extent	Footprint & surrounding areas (2)	Local area (3)
Duration	Long term (> 15 years) (4)	Long term (> 15 years) (4)
Magnitude	Low and will cause a slight impact on processes (4)	Moderate and will result in processes continuing but in a modified way (6)
Probability	Probable (distinct possibility) (3)	Highly probable (4)
Significance	**Medium (30)**	**Medium (52)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, although this impact cannot be well mitigated as some level of hydrological and habitat modification is unavoidable. Avoidance of watercourse areas will be of highest importance to mitigate impacts.	
Mitigation:		
See section 10.2 of this report.		
Residual Impacts:		
Some level of modification is inevitable due to the nature of the construction and operational activities and cannot be entirely mitigated. The residual impact would be moderate and of long term duration for the life of the project following the implementation of mitigation.		

12 Conclusion

12.1 Aquatics baseline

The National Web Based Environmental Screening Tool (NWBEST) has characterised the aquatic sensitivity of the rivers of the project area as 'Very High' - requiring an assessment. This was confirmed as the watercourses are designated as a Critical Biodiversity Areas or Ecological Support Areas and the remaining terrestrial habitat considered an Other Natural Area. These watercourses are considered Endangered ecosystems, bar the Ongers River system which is considered a Least Threatened ecosystem but remains not protected. The eastern section of the PAOI (Project Area of Influence) is also considered a groundwater Strategic Water Source Areas. Desktop present ecological state of the sub quaternary reaches crossed range from a category C (moderately modified) to a category D (largely modified), with most systems not applicable for assessment due to their ephemeral nature. The baseline survey observed isolated pools of water in certain watercourses (four of the eighty-six sampled systems) the resultant of a rainfall event the previous week and was not representative of the true ecological state of these systems. As a result, the ecological integrity of these systems should be conserved through habitat delineation and conservation. This was achieved through the delineation of the total sensitivities which should be avoided by any aspect of the proposed development, unless authorised by the Competent Authority.

12.2 Risk Assessment

A variety of risks have been identified for the proposed project for both the construction and operational phase. The impacts however are largely mitigated by the transmission line only crossing the watercourses by means of multiple single circuit angle steel towers with towers, substations and laydown yards outside of delineated riparian areas and associated buffers.

12.3 Specialist Recommendation

It is the opinion of the specialists that after a consideration of the current PES of the assessed systems as well as the potential risks which may result from the powerline routes, that the 2nd 400 kV Line is approved as the development of the grid connection infrastructure within the assessed corridors is acceptable, provided all delineated no-go areas are avoided and the recommended mitigations are applied. Therefore, the project poses no fatal flaws to the associated aquatic ecological features and the project qualifies for authorisation under the provisions of the General Authorisation provided that the mitigation measures held within are adhered to. Only the transmission line instillation specific mitigation measures are required to be added to the general EMPr with the remaining general ones already covered.

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