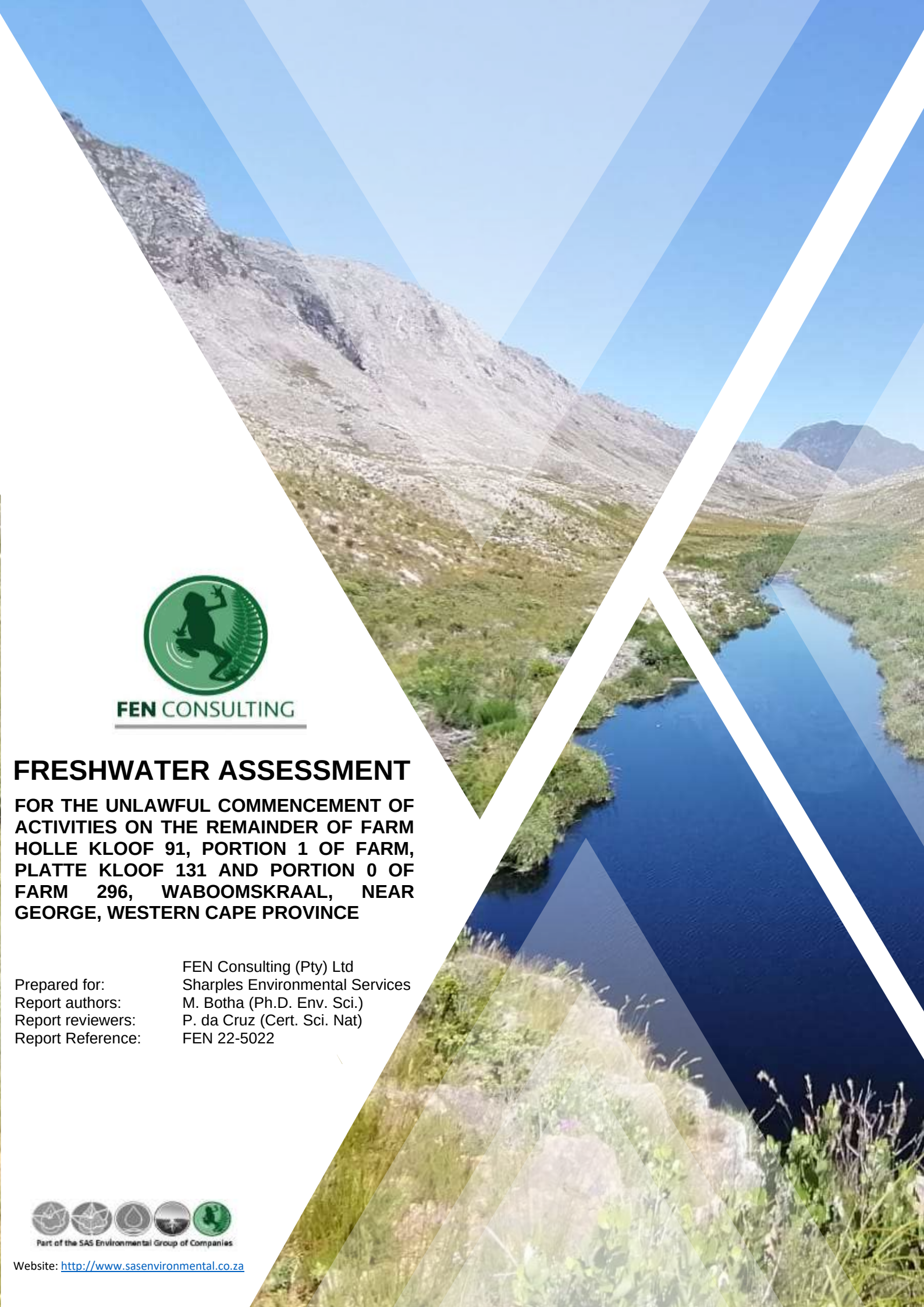

FEN CONSULTING

FRESHWATER ASSESSMENT

FOR THE UNLAWFUL COMMENCEMENT OF ACTIVITIES ON THE REMAINDER OF FARM HOLLE KLOOF 91, PORTION 1 OF FARM, PLATTE KLOOF 131 AND PORTION 0 OF FARM 296, WABOOMSKRAAL, NEAR GEORGE, WESTERN CAPE PROVINCE

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EXECUTIVE SUMMARY

Unlawful commencement of activities (upgrading of a section of an existing road and clearing of a platform) occurred on portion 1 of the Farm Platte Kloof 131 and the remainder of Farm Holle Kloof 91 near George (hereafter collectively referred to as the 'study area'). In November 2021, a significant rainfall event occurred in the catchment area which resulted in the erosion of the partially upgraded road. A large erosion gully formed along the southern boundary of the access road, which ultimately resulted in the sedimentation of the downgradient Kleinbos River, located east of the study area. It is proposed to rehabilitate the erosion gully along the road through the addition of various stormwater cut-off berms and by infilling the extent of the gully that diverted from the road with rip-rap. The Kleinbos River was determined to be in a moderately modified ecological condition. No significant sediment deposition in the active channel of the river was noted. Sediment deposition was noted along the western embankment (within the non-marginal zone of the system). An additional section of road to the north on portion 0 of farm 296, which is in a poor state, will likely be upgraded at a later stage.

Based on the application of the DWS Risk Assessment and the NEMA impact assessment, the initial access road upgrading and the subsequent erosion thereof was determined to have a 'Moderate' risk/ 'Medium low' impact to the river. It is however acknowledged that the duration of the impact of the initial access road upgrading was short as no significant sediment deposition is currently noticeable in the active channel of the river. However, sediment deposition was still evident on the embankment of the river and this sediment will, over time, migrate to the river systems. Should the erosion gully not be rehabilitated, further erosion of the gully, and thus additional long-term sedimentation of the river is expected. It is considered imperative that the erosion gully be rehabilitated (infilled) to prevent ongoing erosion of the gully and subsequent sedimentation of the Kleinbos River. The planned activities to upgrade the additional section of road was determined to have a 'Moderate' risk/ 'Low' impact to the river according to the DWS Risk Assessment and NEMA impact assessment. It is essential that any additional upgrading activities of the remainder of the road to the north must be carried out with the necessary erosion prevention mechanisms in place. Ongoing erosion will result in exacerbated sedimentation of the river active channel as well as change the geomorphological characteristics of the river. As such, should the recommended mitigation measures (as provided in this report) be implemented and the erosion gully and Kleinbos River be monitored until suitable vegetation cover has established, the impacts from the initial access road upgrading can be deemed reversible with limited significant cumulative and latent impacts expected provided that the source of sedimentation is stopped at the source through the proposed rehabilitation measures.

MANAGEMENT SUMMARY

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Section 24G rectification and Environmental Authorisation (EA) processes in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended for the unlawful commencement of activities (upgrading of a section of an existing road and clearing of a platform) and the proposed future upgrading of an additional section of the access road on portion 1 of the Farm Platte Kloof 131, the remainder of Farm Holle Kloof 91 and portion 0 of Farm 296 near George, Western Cape Province (hereafter collectively referred to as the 'study area'). A 500 m "investigation area" around the study area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. The landowner commenced with construction activities in July 2021, which was limited to the partial upgrade of the access road and clearing of a platform area, however construction was ceased on 11 November 2021. On 22 November 2021 a significant rainfall event occurred in the catchment area which resulted in the erosion of the partially upgraded road. A large erosion gully was established along the southern

boundary of the access road, which ultimately resulted in the sedimentation of the downgradient Kleinbos River, located east of the study area. It is proposed to rehabilitate the erosion gully along the road through the addition of various stormwater cut-off berms and by infilling the extent of the gully that diverted from the road with rip-rap. An additional section of road to the north on portion 0 of farm 296, which is in a poor state, will likely be upgraded at a later stage. In this regard, it is considered imperative that erosion prevention measures and appropriate stormwater management are implemented during construction to prevent repetition of events caused by the initial road upgrading activities.

The purpose of this report is to define the ecology of the freshwater ecosystems associated with the study area in terms of the natural freshwater ecosystem characteristics, including mapping, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES). The Department of Water and Sanitation (DWS) Risk Assessment Matrix and an impact assessment was applied to determine the retrospective significance of the impacts associated with the unlawful activities.

During the field verification, undertaken in April and September 2022, no freshwater ecosystems were identified to be traversed by the study area. As such, the study area can be considered of low aquatic biodiversity sensitivity although cognisance must be given to the position of the road in the landscape in relation to more sensitive drainage features. The Kleinbos River is located within the investigation area. This river was identified to be the only freshwater ecosystem impacted by the erosion gully that formed as a result of the road development, and which may potentially be impacted by further upgrading activities. The detailed results of the field assessment are contained in Section 5 of this report and summarised in the table below.

Table A: Summary of the results of the Kleinbos River

Watercourse	Present Ecological State (PES)	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
Kleinbos River	B/C (moderately modified)	very low to moderately high (indicator dependent)	Moderate	REC: Category B/C (Maintain) BAS: Category B/C (Moderately modified) RMO: Maintain
Extent of modification	**Reversible** Rehabilitation of the erosion gully will ensure that no further sedimentation o the Kleinbos River occurs. Together with revegetation of all disturbance footprints, the modification/impacts to the Kleinbos River can be reversed.			

Following the assessment of the freshwater ecosystems, the DWS Risk Assessment Matrix and the impact assessment (applied in the context of the NEMA-related assessment) was applied to determine the impact of the erosion gully to the Kleinbos River and to ascertain the significance of possible impacts which may occur as a result of the proposed rehabilitation and further construction activities.

The results of the risk and impact assessment are presented in Section 7 of this report, of which a summary is provided below.

Table B: Summary of the DWS Risk Assessment and Impact Assessment outcomes.

Activity	DWS Risk Assessment (Mitigated)	Impact Assessment	
		Un-mitigated	Mitigated
Construction Phase (**retrospective**)			
- Site access, clearing and preparation for civil works in the study area, outside the 100 m GN509 ZoR of the Kleinbos River.	**Moderate**	**Medium - Low**	**-**
Ongoing construction Phase			
- Continuation of access road construction & building infrastructure in the study area, outside the 100 m GN509 ZoR of the Kleinbos River.	**Low**	**Low**	**Very Low**

Activity	DWS Risk Assessment (Mitigated)	Impact Assessment	
		Un-mitigated	Mitigated
- Infilling of the erosion gully along the access road and the section thereof in the 100 m GN509 ZoR of the Kleinbos River and the furrow	**Low**	**Low**	**Very Low**
- Rehabilitation of the erosion gully between the furrow and the river	**Low**	**Low**	**Very Low**
- Upgrading of access road within the 32 m NEMA ZoR	**Moderate**	**Low**	**Very Low**
Operational Phase			
- Operation of the access road and stormwater management systems installed along the road	**Low**	**Low**	**Very Low**

Based on the application of the DWS Risk Assessment and the impact assessment, the initial access road upgrading and the subsequent erosion thereof (due to the lack of stormwater management infrastructure), which forms part of the Section 24G rectification, was determined to have exerted a 'Moderate' risk/ 'Medium low' impact to the river. It is acknowledged that the duration of the impacts associated with past events was short as no significant sediment deposition is currently noticeable in the active channel of the river. However, sediment deposition was still evident on the channel banks of the river and this sediment will, over time, be transported downstream. Should the erosion gully not be rehabilitated, further erosion of the gully, and thus additional long-term sedimentation of the river is expected to occur. It is considered imperative that the erosion gully be rehabilitated (infilled) to prevent ongoing erosion of the gully and subsequent sedimentation of the Kleinbos River.

The planned activities to upgrade the additional section of road, which forms part of the application for Environmental Authorisation (EA), was determined to have a 'Moderate' risk/ 'Low' impact to the river according to the DWS Risk Assessment and impact assessment. It is essential that any additional upgrading activities of the remainder of the road to the north must be carried out with the necessary erosion prevention mechanisms in place. Ongoing erosion will result in exacerbated sedimentation of the river active channel as well as changing the geomorphological characteristics of the river. It's the opinion of the freshwater specialist that transverse gabion stabilising walls must be installed in the gully to further stabilise the gully at strategic intervals. By allowing approximately 30 cm of the gabion wall to protrude above the ground surface, siltation and sediment deposition will be encouraged on the upgradient side of each structure, thus reducing flow velocity and intensity and the potential of downgradient erosion. Any future upgrading of the remainder of the access road to the north must also implement measures to prevent further erosion within the study site such as the installation of silt traps (such as hessian curtains or hay bales) perpendicular to the slope to prevent any sediment run-off from entering the downgradient Kleinbos River. Appropriate stormwater management must also be implemented throughout the construction process, e.g., the implementation of swales within the stormwater runoff furrows next to the road.

Should the recommended mitigation measures (as provided in this report) be implemented and the erosion gully and Kleinbos River be monitored until suitable vegetation cover has become established, the impacts from the initial access road upgrading can be reversed with limited significant cumulative and latent impacts expected provided that the source of sedimentation is stopped at the source through the proposed rehabilitation measures.

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirements	Section in report/Notes
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover Page and Annexure G.
2.2	Description of the preferred development site , including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 4 and 5
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 4: Table 1
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 4: Table 1
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 4: Table 1
2.3	Identify any alternative development footprints within the preferred development site which would be of a “low” sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	NA
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 7: Table 5
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Yes, with implementation of the proposed mitigation measures
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.) and d. Assessment of the risks associated with water use/s and related activities.	Section 5: Table 2
2.4.4	How will the development impact on the functionality of the aquatic feature including:	Section 5: Table 3

	a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of 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. 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 soil, etc).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 5: Table 3
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 5: Table 3
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	N/A
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Annexure G
3.2	A signed statement of independence by the specialist.	Annexure G
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 5
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Section 3, Annexure C and Annexure D
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 1.3
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 7: Table 5
3.7	Additional environmental impacts expected from the proposed development.	Section 7: Table 5
3.8	Any direct, indirect and cumulative impacts of the proposed development on site.	Section 7.2
3.9	The degree to which impacts and risks can be mitigated.	Section 7
3.10	The degree to which impacts and risks can be reversed.	Section 7
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 7
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 6
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 7: Table 5
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	Section 7 and 8
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 8
3.16	Any conditions to which this statement is subjected.	Section 8

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soil).
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soil with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perennial:	Flows all year round.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act No. 36 of 1998) a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake 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.
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soil, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
m	Meter
MAP	Mean Annual Precipitation
MC	Management Classes
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NBA	National Biodiversity Assessment
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NWCS	National Wetland Classification System
PEMC	Present Ecological Management Class
PES	Present Ecological State
REC	Recommended Ecological Category
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRC	Water Research Commission

1 INTRODUCTION

1.1 *Background*

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Section 24G rectification in terms of the National Environmental Management (NEMA) Act, 1998 (Act No. 107 of 1998) for the unlawful upgrading of a section of an existing road and clearing of a platform. Also under consideration was the proposed future upgrading of an additional section of the access road as part of the Environmental Authorisation (EA) application in terms of NEMA. Activities occurred on portion 1 of the Farm Platte Kloof 131, the remainder of Farm Holle Kloof 91 and portion 0 of Farm 296 near George, Western Cape Province (hereafter collectively referred to as the 'study area') (Figure 1 and 2). Refer to Section 2 for a detailed project description.

To identify all freshwater ecosystems that have been potentially impacted by the unlawful activities within the study area as well as those which may be impacted by the additional upgrading and use of the road, a 500 m "zone of investigation" around the study area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500 m zone of investigation around study area - will hereinafter be referred to as the "investigation area".

The purpose of this report is to define the ecology of the freshwater ecosystems associated with the study area in terms of the natural freshwater ecosystem characteristics, including mapping of the freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES) of the freshwater ecosystems. It is a further objective of the study to provide detailed information to guide and define appropriate rehabilitation and ongoing management in the vicinity of the freshwater ecosystems to ensure the ongoing functioning, such that local and regional conservation requirements and the provision of ecological services in the local area are supported, whilst considering the need for sustainable economic development. This report, after consideration and a description of the ecological integrity of the freshwater ecosystems associated with the study area, must also guide the relevant authorities by means of a reasoned opinion, as to the significance of the impact of the unlawful activities from a freshwater ecosystem management perspective and must guide the requirements for the rehabilitation of the roadway edges and the erosion gully that formed as a result of the roadway development.

1.2 *Structure of this report*

This report investigates the impact significance of the unlawful activities, as explained in Section 2 below, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as well as the National Water Act, 1998 (Act No. 36 of 1998) (NWA) by means of the DWS Risk Assessment Matrix. The following structure is applicable to this report:

Section 1: Introduction
Provides an introduction, the structure of this report and the assumptions and limitations.

Section 2: Project Description
Provides the location of the study area as well as a brief summary of the activities associated with the unlawful activities.

Section 3: Assessment Approach

Provides the relevant methodology and definitions applicable to this report, a description of the sensitivity mapping and the risk assessment approach.

Section 4: Desktop Assessment Results

Reports on the findings from the relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA], 2011 database; the DWS Resource Quality Information System (RQIS) PES/ EIS, 2014 database and Western Cape Biodiversity Spatial Plan (2017) was undertaken to aid in defining the PES and EIS of the freshwater ecosystems.

Section 5: Site Based Freshwater Ecosystem Assessment Results

This section reports the following:

- A description and delineation of all freshwater ecosystems associated with the study area according to "Department of Water Affairs and Forestry (DWAF)[1] (2008): A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". All features are mapped according to their ecological sensitivity;
- Delineation of all freshwater ecosystems (using desktop methods) within 500 m of the study area in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to activities as stipulated in Section 21 (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998);
- The classification of the freshwater ecosystems according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The EIS of the freshwater ecosystems according to the method described by Rountree and Kotze, (2013);
- The services provided by the freshwater ecosystems associated with the study area were assessed according to the method of Kotze et al. (2009);
- The PES of the freshwater ecosystems according to the resource directed measures guideline as advocated by MacFarlane *et al.* (2008); and
- The allocation of a suitable Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) to the freshwater ecosystems based on the results obtained from the PES, Ecoservices and EIS assessments.

Section 6: Legislative Requirements

Provides the applicable legislative requirements based on the findings from Section 5 and indicates any applicable zones of regulation that may trigger various enviro-legal authorisation requirements.

Section 7: Risk and Impact Assessment

Provides the outcomes from the DWS Risk Assessment Matrix and a NEMA Impact Assessment which assessed the impacts from the unlawful activities as well as highlights all potential impacts from the proposed rehabilitation activities and future road upgrading activities that may affect the freshwater ecosystems. Management and mitigation measures are provided which should be implemented during the various development activities (construction and operational phases) to assist in minimising the impact on the receiving environment. The anticipated cumulative impacts and reversibility/irreplaceable loss that the unlawful activities may have on the freshwater ecosystems is expanded upon in this section.

Section 8: Conclusion

Summarises the key findings and recommendations based on the risk assessment outcomes and legislative requirements.

[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA). At present, the Department is known as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

1.3 *Assumptions and Limitations*

- The determination of the wetland or riparian zone boundaries is confined to the freshwater ecosystems associated with the study area and is based on two site visits undertaken in April and September 2022. All freshwater ecosystems identified within the investigation area were delineated in fulfilment of GN509 of the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods including the use of topographic maps, historical and current digital satellite imagery, and historical aerial photographs. The delineations of freshwater ecosystems outside the study area must not be utilised for any purpose, other than planning for the study area. Any areas that may have additionally been mapped will require field-based delineation and ground-truthing as directed by applicable legislation and best practice methods;
- As the partial upgrade of the access road and clearing of the platform already occurred, detailed information pertaining to the initial construction activities is unknown. As such, the construction phase for the road upgrading activities that already took place is assessed retrospectively based on the assumed approach to construction at that time and based on an assumed level of mitigation;
- The pre-impact characteristics of the Kleinbos River and the river's associated riparian zone are unknown. The ecological assessment as presented in this report is based on the assumed ecological condition of the river before impact, in relation to what the current ecological condition is and the impact there was;
- The geomorphological processes and sediment balance of the Kleinbos River are inferred based on the observations made during the site assessment after the impact had occurred. Some misinterpretation of the pre-impact characteristics is possible; however, the analyses is considered sufficiently accurate to allow decision making and further rehabilitation planning to take place;
- Global Positioning System (GPS) technology is inherently somewhat inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. However, the delineations as provided in this report are deemed accurate enough to fulfil the environmental authorisation requirements as well as the implementation of the mitigation measures provided;
- Freshwater ecosystems and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the freshwater ecosystem has been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of riparian and wetland ecology.

2 PROJECT DESCRIPTION

The landowner of portion 1 of the Farm Platte Kloof 131 took ownership of this property in January 2021, which is located along the northern foot slope of the Outeniqua Mountain Range (Figure 1 and 2). This property is accessed from the Divisional Road (DR) 1645 via the remainder of Farm Holle Kloof 91.

Proposed development on the property is limited to a small lifestyle farm (small scale farming), which will entail a residential unit, access road, shed, green houses, fruit trees and vegetable gardens. This will also entail removal of alien and invasive plant species from the property. Use will be made of an existing gravel road, which is in a poor condition, which will be upgraded to provide access to the residential unit. The landowner commenced with unlawful construction activities in July 2021, which were limited to the partial upgrade of a section of the access road and clearing of a platform area

(collectively referred to as the 'study area'), however construction ceased on 11 November 2021. On 22 November 2021 a significant rainfall event occurred in the catchment area which resulted in the erosion of the partially upgraded road. A large erosion gully formed along the southern boundary of the access road, which ultimately resulted in the sedimentation of the downgradient landscape with the eroded sediment ultimately being deposited within the Kleinbos River, located east of the study area and within the investigation area. A need for rehabilitation was identified. The civil engineering drawings as presented in Figures 3 and 4 depict the remediation actions required to rehabilitate the erosion gully along the road through the addition of various stormwater cut-off berms, by infilling the extent of the gully that diverted from the road with rip-rap[2] (Figure 4). It's the opinion of the freshwater specialist that transverse gabion stabilising walls also be installed in the gully to further stabilise the gully at strategic intervals.

As the upgrading of an existing road and clearing of the platform constitute activities contained within the EIA Listing Notices (related to the EIA Regulations of 2014, as amended in 2017) that were unlawfully commenced, a Section 24G rectification process, inclusive of an impact assessment is required for the retrospective authorisation of the development. This will also require the landowner to rectify any impacts to the freshwater ecosystems, specifically the erosion gully and subsequent sedimentation.

An additional section of the access road on portion 0 of Farm 296 will also be upgraded at a later stage, as part of an application for Environmental Authorisation (EA). The need was identified to implement preventive measures to curb erosion with any further upgrading activities of the access roads.

[2] Fill material will comprise a mixture of combined 2/3 rip-rap (durable angular rock material) and 1/3 soil

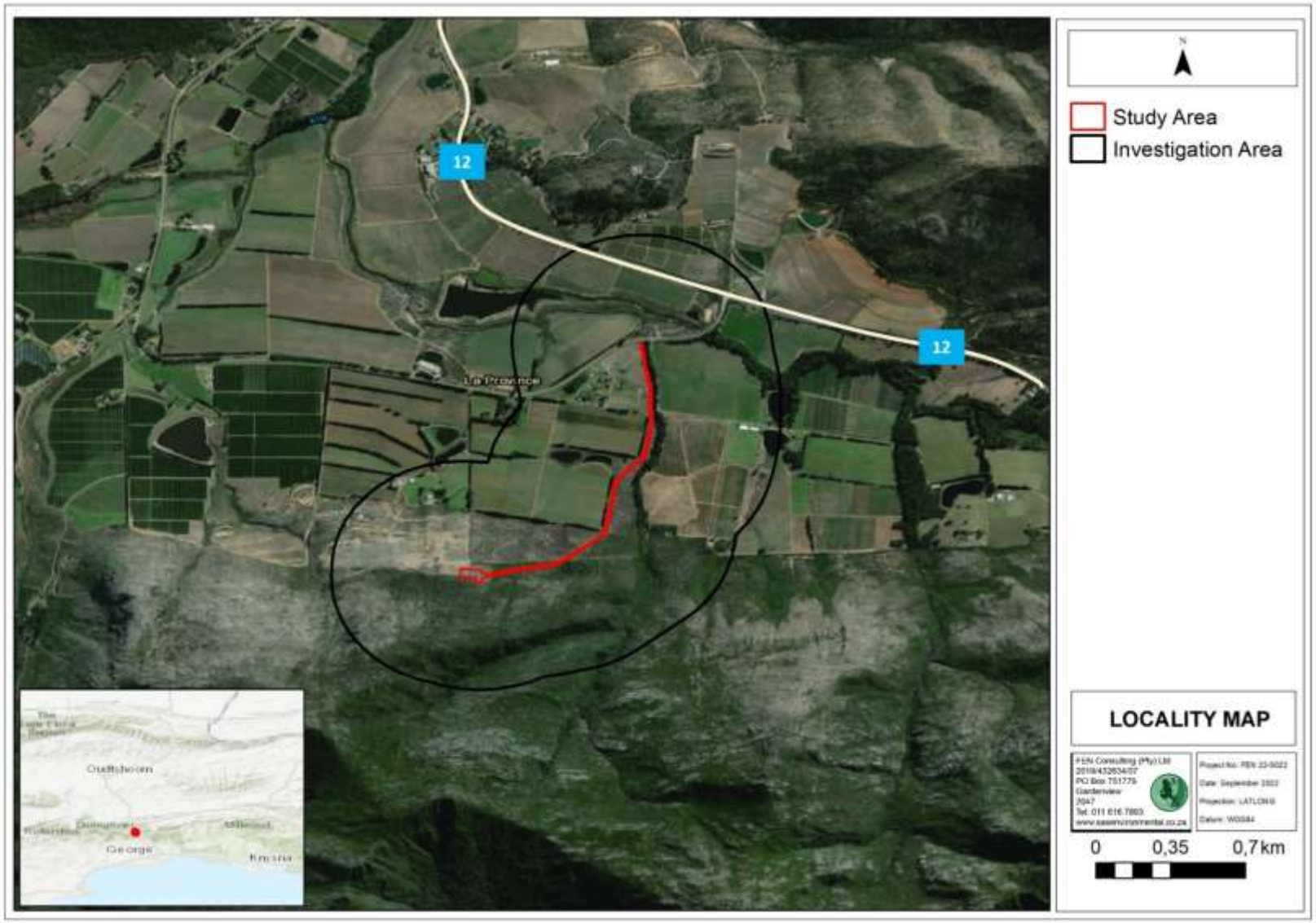


Figure 1: A digital satellite image depicting the location of the study and investigation areas in relation to the surrounding area.

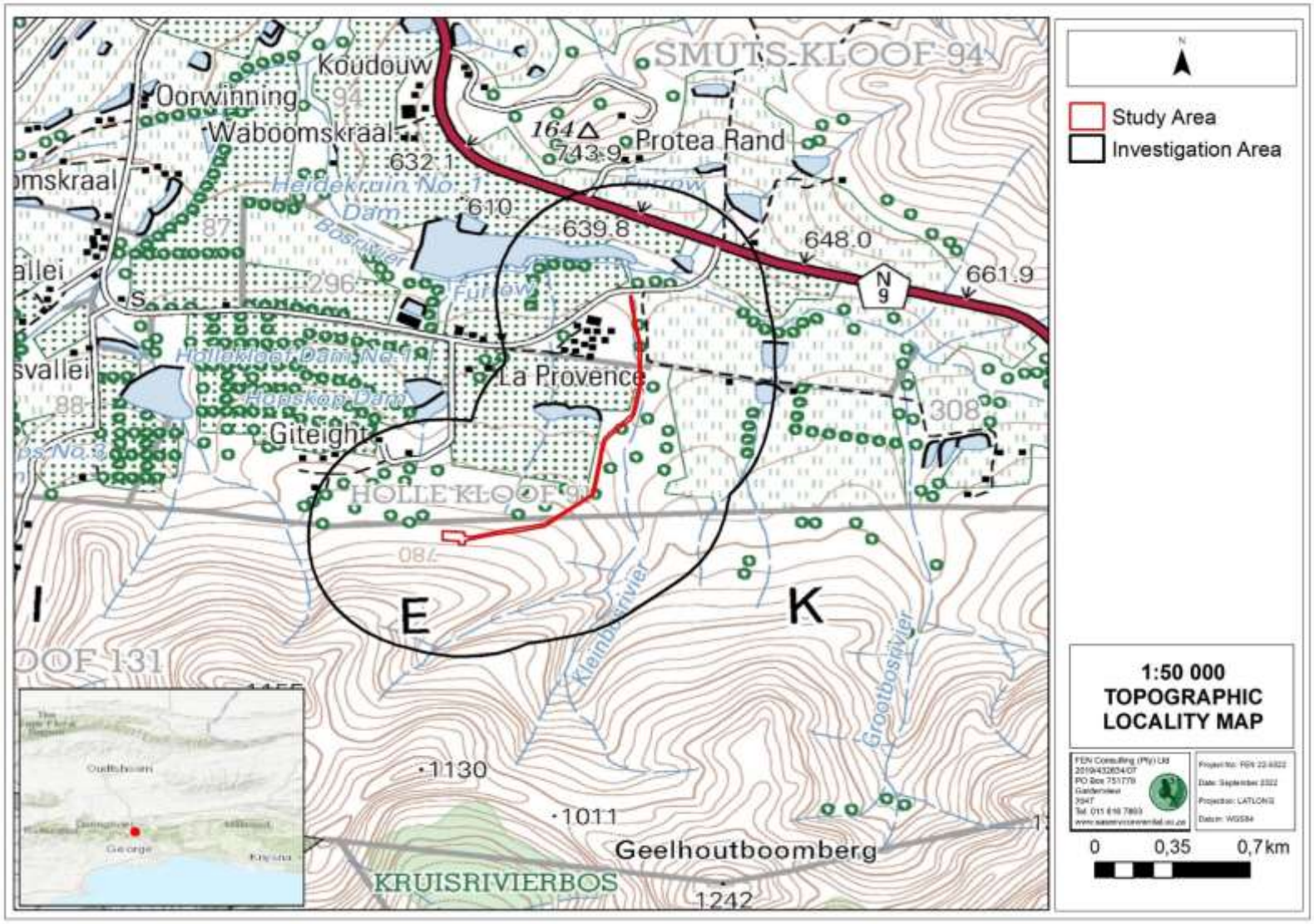


Figure 2: The study and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding area.

Figure 3: Proposed remediation actions for the erosion gully (donga – green and red) along the access road (yellow), as provided by DMS Consulting Structural Engineering (March 2022). Note that stormwater cut-off berms will be installed in the erosion gully section along the southern portion of the road (green). The gully will be infilled for the section it diverts from the road (red) toward the Kleinbos River.

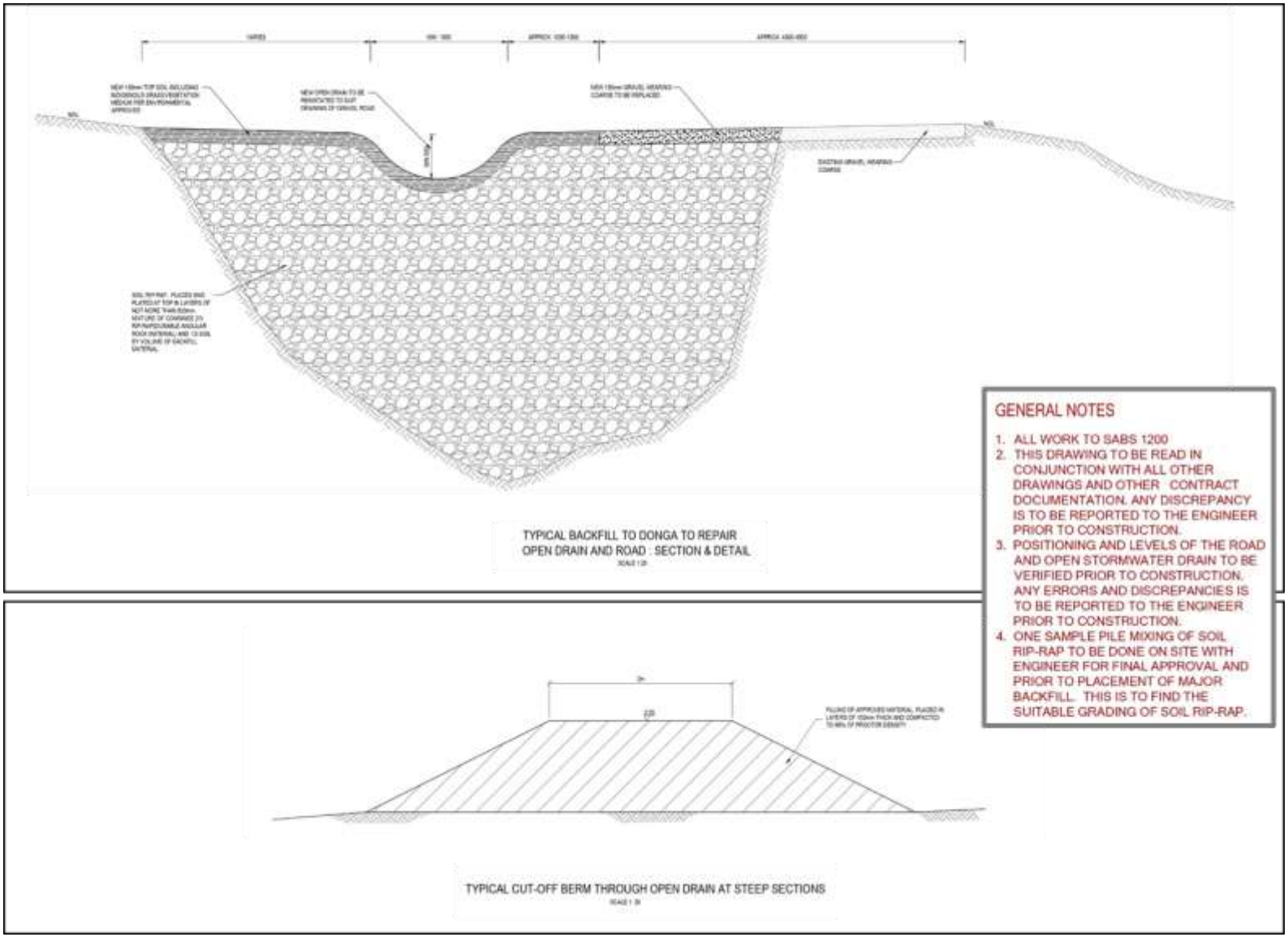


Figure 4: Erosion gully back fill (top) and cut-off berm (bottom) details as provided by DMS Consulting Structural Engineering (March 2022).

3 ASSESSMENT APPROACH

3.1 *Freshwater Ecosystem Verification*

As part of this assessment, the following definitions, as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

Watercourse means-

(a) A river or spring;
(b) A natural channel in which water flows regularly or intermittently;
(c) A wetland, lake or dam into which, or from which water flows; and
(d) Any collection of water, which the Minister may, by notice of the Gazette, declare a watercourse.

It should be noted that in this report "freshwater ecosystem" is used and carries the same meaning as "watercourse" as defined by the NWA.

Wetland habitat is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Riparian habitat includes the physical structure and associated vegetation of areas associated with a watercourse which are commonly characterised by alluvial soil, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas**.**

The freshwater ecosystem delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soil;
- Vegetation adapted to saturated soil; and
- The presence of alluvial soil in stream systems.

Site assessments were undertaken in April and September 2022, during which the presence of any freshwater ecosystem characteristics as defined by DWAF (2008) or wetlands and riparian habitats as defined by the National Water Act, 1998 (Act No. 36 of 1998) were noted (please refer to Sections 4 and 5 of this report). In addition to the delineation process, a detailed assessment of the delineated freshwater ecosystems was undertaken, at which time factors affecting the integrity of the freshwater ecosystems were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the freshwater ecosystems. A detailed explanation of the methods of assessment undertaken is provided in **Annexure C** of this report.

3.2 *Sensitivity Mapping*

All freshwater ecosystems associated with the study area were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map presented in Section 6 should guide the management of the unlawful activities.

3.3 *Risk and Impact Assessment and Recommendations*

Following the completion of the assessment, the DWS Risk Assessment (as promulgated in GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) and impact assessment (in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) was conducted (please refer to **Annexure D** for the method of approach) and recommendations were developed to address and mitigate impacts associated with the unlawful activities. The detailed mitigation measures are outlined in Section 7 of this report, while the general management measures which are considered best practice mitigation applicable to this project, are outlined in **Annexure F.**

4 DESKTOP ASSESSMENT RESULTS

4.1 *National and Provincial Datasets*

The following section contains data accessed as part of the desktop assessment and presented as a "dashboard-style" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for integration of results by the reader. Where required, further discussion and interpretation are provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics associated with the unlawful activities at the scale required to inform the environmental authorisation and/or water use authorisation processes. Given these limitations, this information is considered useful as background information to the study and is important in legislative contextualisation of risk and impact. The information was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. It must, however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision-making process.

Table 1: Desktop data (from desktop databases only) relating to the characteristics of the associated with the study area.

Aquatic ecoregion and sub-regions in which the study area is located	
Ecoregion	South Eastern Coastal Belt
Catchment	Gourits
Quaternary Catchment	J35B
WMA	Gouritz
subWMA	Olifants
Dominant characteristics of the South Western Coastal Belt Ecoregion Level II (20.02) (Kleynhans *et al.*, 2007)	
Level II Code	20.02
Dominant primary terrain morphology	Closed hills, moderate and high relief, Plains, moderate relief.
Dominant primary vegetation types	Mountain fynbos, Afromontane forest, dune thicket, grassy fynbos, south and south-west coast renosterveld
Altitude (m a.m.s.l)	0 - 1300
MAP (mm)	500 - 800
The coefficient of Variation (% of MAP)	<20 - 30
Rainfall concentration index	<15
Rainfall seasonality	All year
Mean annual temp. (°C)	14 - 18
Winter temperature (July)	6 - 18
Summer temperature (Feb)	14 - 28
Median annual simulated runoff (mm)	80 - >250

Detail National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 7)
According to the NBA 2018: SAIIAE no wetlands or rivers are located in the study area. A natural unchanneled valley bottom wetland is indicated within the north eastern portion of the investigation area. This unchanneled valley bottom wetland is indicated as being affected by roads and is thus considered to be in a largely to seriously modified ecological condition (Class D, E or F). This unchanneled valley bottom wetland is indicated as critically endangered according to the ecosystem threat status (ETS) and poorly protected according to the ecosystem protection level (EPL). No rivers are indicated within the investigation area.

National web based environmental screening tool (2020)	
The screening tool is intended for pre-screening of sensitivities in the landscape to be assessed within the EIA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	The study area is located in an area considered of very high aquatic biodiversity sensitivity. This is due to the study area located within a strategic water source area, and due to the presence of rivers and aquatic CBAs. According to the Strategic Water Source Area Database (2017), the study area is situated within the Outeniqua Surface Water Area.

Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPACODE	The study area is located within a sub-quaternary catchment considered of importance as an upstream management area, which are sub-quaternary catchments in which human activities needs to be managed to prevent degradation of downstream river FEPAs and FSAs (FEPA CODE = 4).
NFEPA Wetlands (Figure 5)	According to the NFEPA database, no wetlands are associated with the study area. Two unchanneled valley bottom wetlands are identified by this dataset to be located in the investigation area. The wetland to the east is classified as a natural wetland and is considered to be in a moderately modified ecological condition (Class C). The wetland to the north is classified as an artificial wetland and was verified as an artificial impoundment during the site assessment. An artificial channelled valley bottom wetland is indicated in the north-west of the investigation area and is indicated to be in a heavily to critically modified ecological condition (Class Z3). This artificial channelled valley bottom wetland was verified as an artificial impoundment based on the available digital satellite imagery.
Wetland Vegetation Type	The study area and investigation area are situated within Eastern Fynbos-Renosterveld Sandstone Fynbos (Least Threatened) Wetland Vegetation Type. The threat status is provided by Mbona *et al.* (2015).
NFEPA Rivers (Figure 5)	As per the NFEPA database, no rivers are associated with the study area or the investigation area.

Importance of the study area according to the Western Cape Biodiversity Spatial Plan (2017) (Figure 6)
According to the Western Cape Biodiversity Spatial Plan (2017), a small area outside the eastern boundary of the study area is classified as a Critical Biodiversity Area (CBA) 1 of aquatic ecological importance. CBAs are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure, in this case specifically for riverine environments. The northern portion of the study area traverses areas classified as an Ecological Support Area (ESA) 1 of aquatic importance while the southern portion of the study and investigation areas are located within areas classified as ESA 1 of terrestrial importance. ESAs are important in supporting the functioning of CBAs and are often vital for delivering ecosystem services. These areas are classified as ESA 1, which are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. Areas along the northern and north eastern and north western boundary of the investigation areas are classified as ESA 2, which are areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas (PAs) or CBAs and are often vital for delivering ecosystem services.

CBA = Critical Biodiversity Area; CESA = Critical Ecological Support Area; CR = Critically Endangered; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; EN = Endangered; m.a.m.s.l = Metres above mean sea level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Area; OESA = Other Ecological Support Area; PES = Present Ecological State; WMA = Water Management Area.

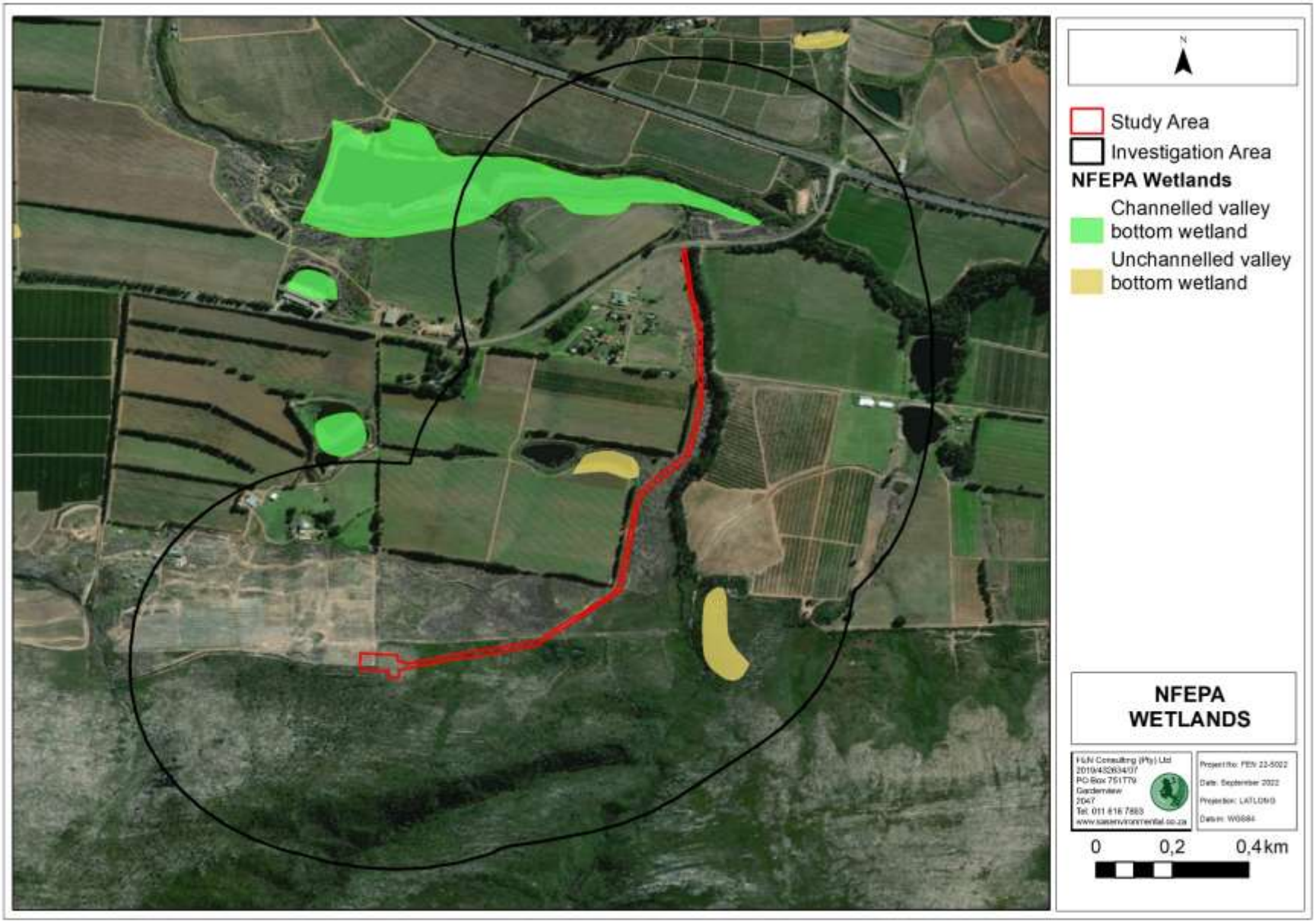


Figure 5: Wetlands associated with the study and investigation areas according to the NFEPA database (2011).

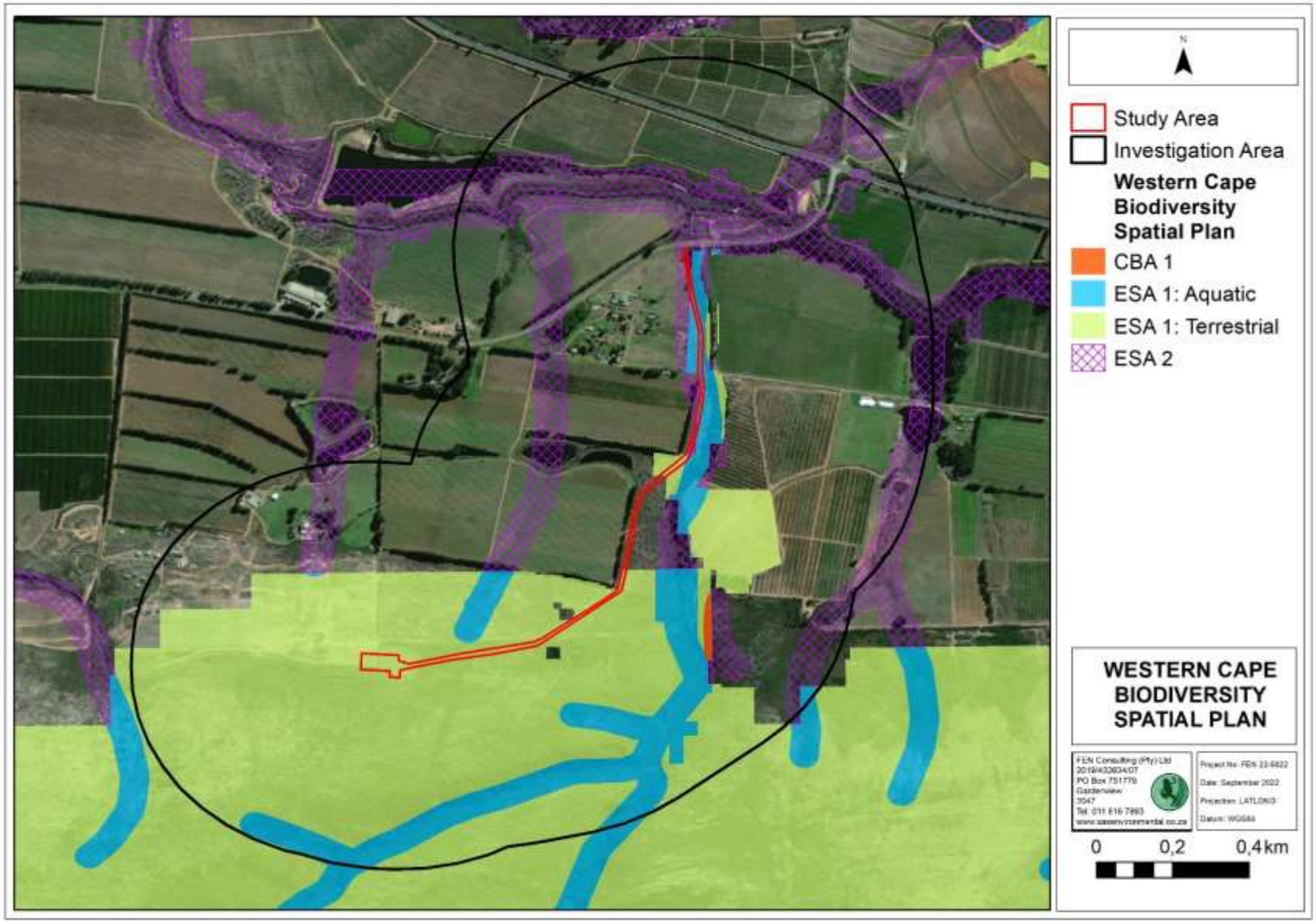


Figure 6: Areas of biodiversity importance associated with the study and investigation areas, as per the Western Cape Biodiversity Spatial Plan (2017).

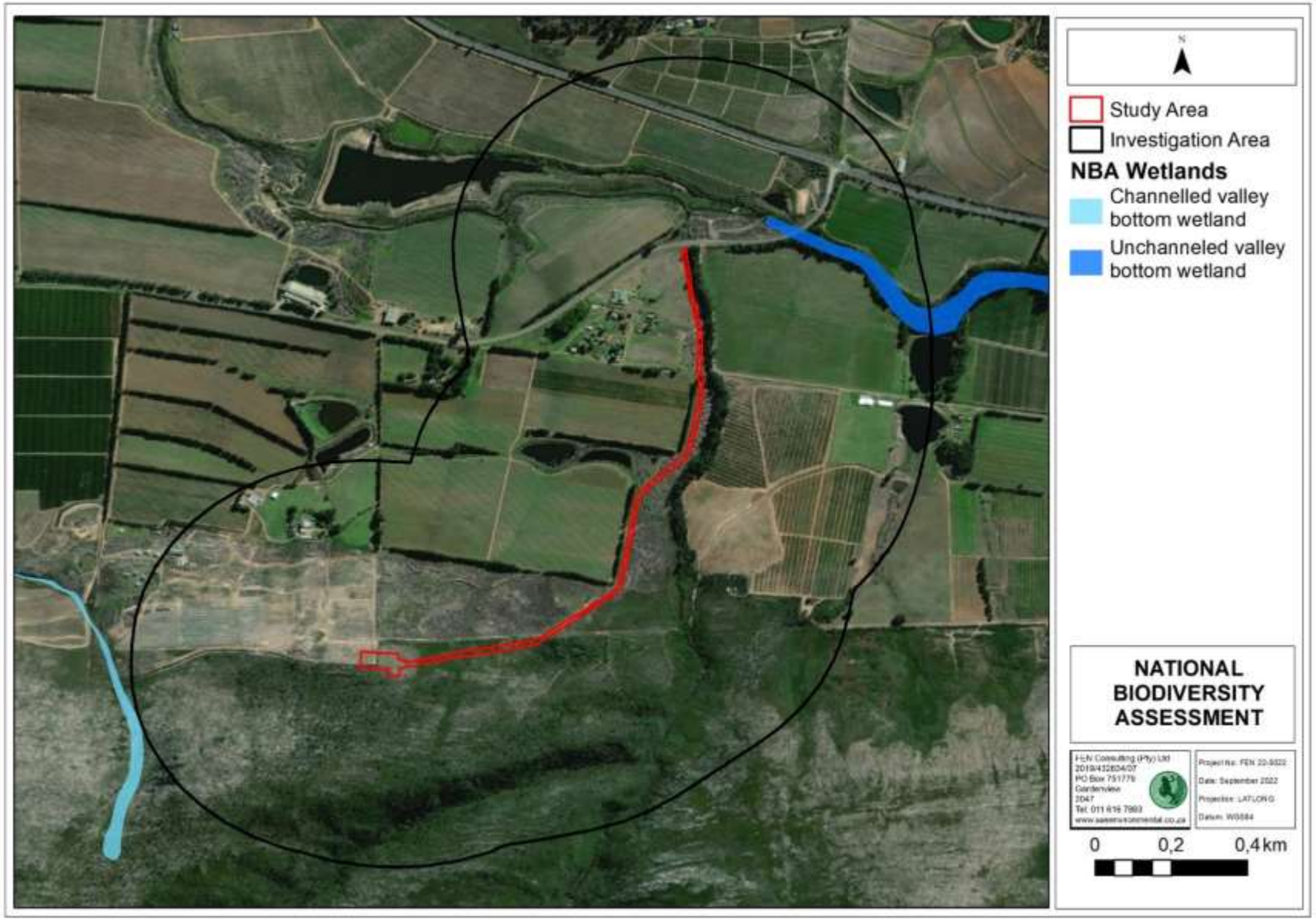


Figure 7: Hydrogeomorphic (HGM) units associated with the investigation area according to the National Biodiversity Assessment (NBA, 2018).

5 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

5.1 *Desktop assessment of historical vs. most recent imagery*

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national wetland databases (as outlined in Section 4 of this report) were used to identify points of interest in the surrounding area at a desktop level. Based on the historical photograph (Figure 8), only one area within the study area displayed digital signatures that correspond with a freshwater ecosystem. In this regard, specific mention is made to the following:

- Linear features: since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with freshwater ecosystems: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often show as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with freshwater ecosystem vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

On review of the historical photograph dating back to 1942 (Figure 8), the study area and the general surrounds are in a natural condition with no obvious anthropogenic changes to the landscape. The Kleinbos River is located to the east of the study area, with freshwater ecosystem signatures noted to the north, which can be interpreted as small drainage lines.

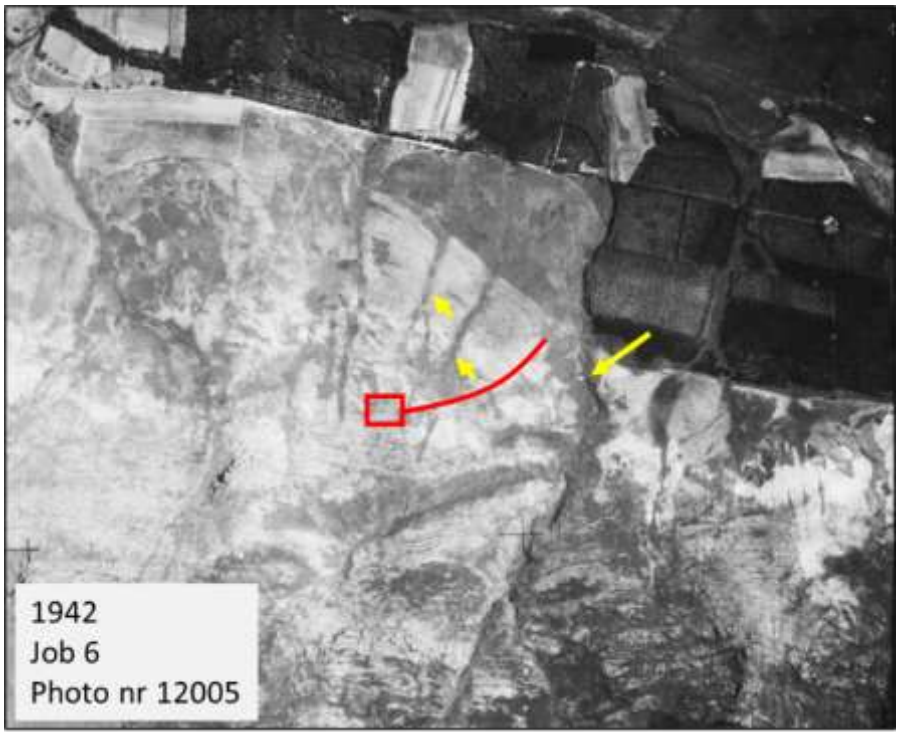


Figure 8: Historical photograph of the approximate locality of the study area (location of the study area indicated in red). The yellow arrows depict signatures that may potentially represent freshwater ecosystems.

When compared to the satellite imagery from April 2021 (prior to construction activities and the significant rainfall event, Figure 9 - top) and January 2022 (after the rainfall event, Figure 9 - bottom), the general surrounding area has been transformed as linear features (informal roads, fire breaks) and changes to the vegetation composition are evident. A cultivated area is also visible, with signatures of the drainage lines that are less prominent (Figure 9, yellow arrows), which can most likely be prescribed to the presence of furrows (Figure 9, blue lines) diverting runoff into artificial impoundments and/or the Kleinbos River, in an effort to avoid flooding of the downgradient cultivated area, and the overall changes to the catchment specifically relating to vegetation clearing. In the January 2022 imagery, an erosion gully (pink arrows) is noticeable along and diverting from the newly constructed road, which connects to the Kleinbos River.

Based on the analysis of the historical photograph and digital satellite imagery, no freshwater ecosystems are directly traversed by the study area. The erosion gully that formed along the access road connects to the Kleinbos River and as such, it is expected that some sedimentation of the river occurred after the rainfall event. Considering this, the Kleinbos River was considered the main freshwater ecosystem to investigate during the site assessment. Additionally, the downgradient area where signatures of potential drainage lines were observed were also considered of interest to investigate.

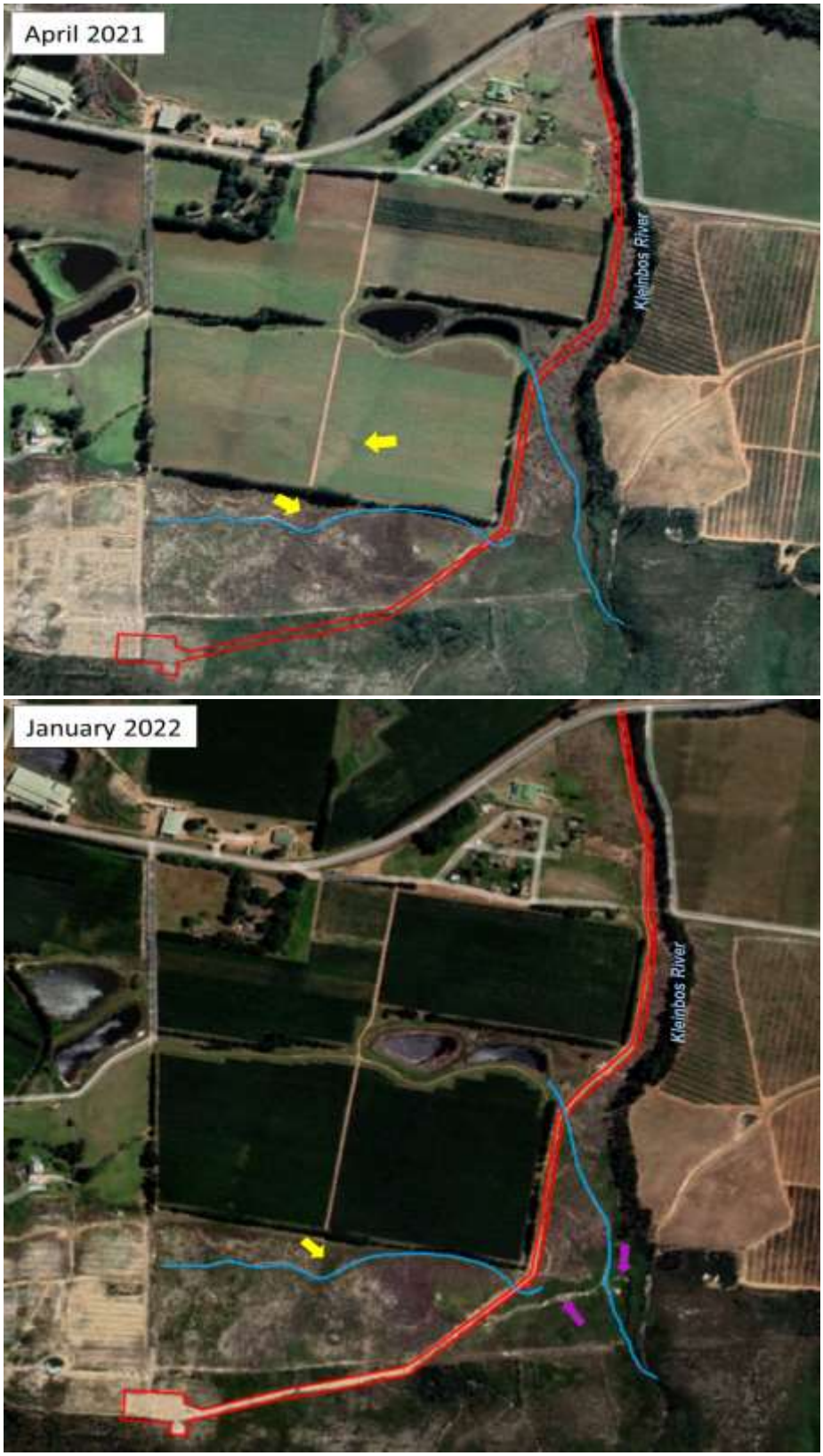


Figure 9: Digital satellite imagery depicting the locality of the study area (red outline) prior to the construction activities (2021) and after (2022). Furrows (blue lines) drain surface runoff and water from the Kleinbos River. Faint signatures (yellow arrows) associated with potential small drainage lines are evident in the vicinity of the study area. An erosion gully (pink arrows) is noticeable, diverting away from the access road to the Kleinbos River.

5.2 *Field verification outcome*

During the field verification, undertaken in April and September 2022, no freshwater ecosystems were identified to be traversed by the study area. As such, the study area can be considered of low aquatic biodiversity sensitivity although cognisance must be given to the position of the road in the landscape in relation to more sensitive drainage features. The Kleinbos River, located approximately 200 m east of the partially upgraded road, was identified to be the only freshwater ecosystem impacted by the erosion gully that formed as a result of the road development.

The downgradient area, north of the partially upgraded road, was also investigated considering faint digital signatures noted in the historical photograph (Figure 8). Although a small valley was noted, no distinct freshwater ecosystem signatures were identified in this area (Figure 9). Considering the slope of this area it is acknowledged that surface water runoff would flow into this small valley but is not retained in the landscape for a sufficient period to encourage the establishment of a floral community that relies on an increased abundance of water within the effective rooting zone. As this water is collected in the downgradient furrow, no flow drains further towards the downgradient area. As such, the feature in this valley does not meet the definitions of a freshwater ecosystem from an ecological perspective (as defined by the National Water Act, 1998 (Act No. 36 of 1998)) and therefore does not require any further assessment.

Figure 10: The area downgradient investigated for freshwater ecosystem characteristics, of which none was noted. The relatively steep slope (Top left) allows surface flow into the downgradient furrow. (Bottom left) view of the downgradient area taken from the access road.

A large erosion gully was noted along the southern side of the partially upgraded access road (Figure 11. The significant flooding event in November 2021 caused the erosion gully to divert from the partially upgraded road towards the downgradient Kleinbos River (Figure 11). The gully breached an existing furrow, which resulted in sediment deposition along the western bank of the river as well as conveying sediment into the active channel of the river (Figure 11).

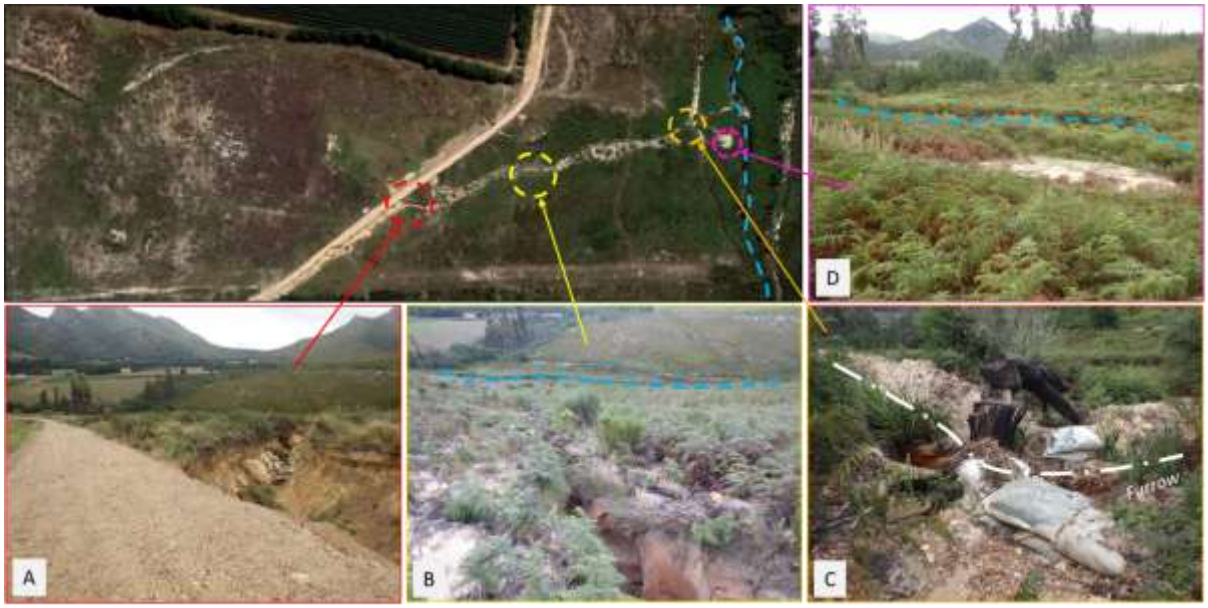


Figure 11: (A) diversion of the erosion gully from the partially upgraded road. (B) Erosion gully relative to the downstream Kleinbos River (blue dashed line). (C) the erosion gully breached an existing furrow (white dashed line), resulting in the deposition of sediment along the river embankment (D).

Figure 12: The northern section of the gravel road connecting to the tarred road on Portion 0 of Farm 296 (yellow line and arrow). This section displays fewer signs of erosion. It is however evident that some erosion has occurred in areas where alien vegetation has been removed, as well as in the stormwater furrows next to the road (pink arrows).

Investigation of the remaining portion of gravel road which has not yet been upgraded revealed less evidence of erosion, except for some areas next to the road where alien vegetation has been removed, and in the stormwater furrows next to the road. However, this road section runs within close approximation to the river (±5 m in some areas), which needs to be considered when assessing the potential impacts of future upgrading activities.

The delineated extent of the Kleinbos River relative to the study area is presented in Figure 12.

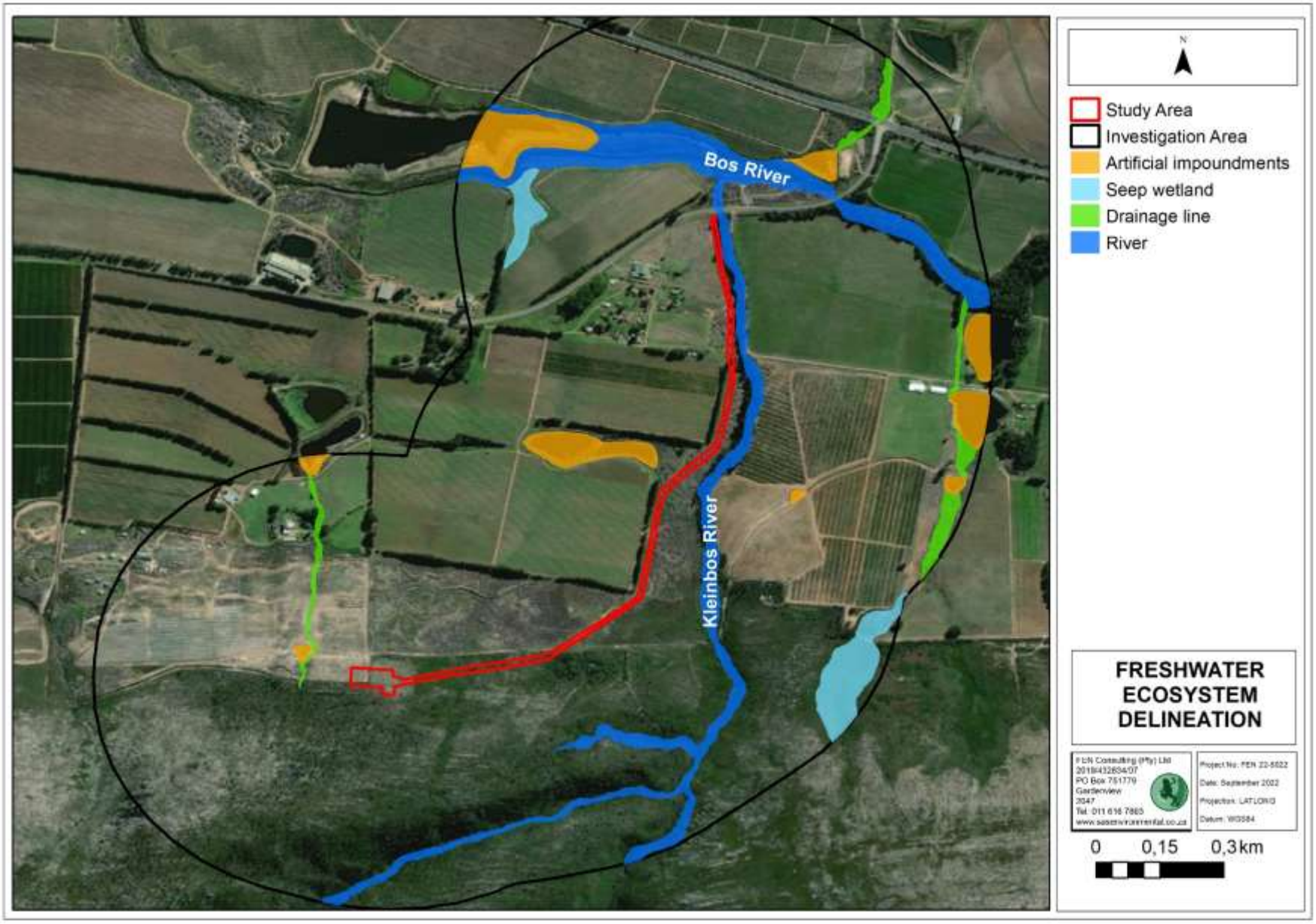


Figure 13: Delineation of the freshwater ecosystems located in the investigation area relative to the study area.

5.3 *Freshwater ecosystem delineation*

The outer boundary of the Kleinbos River was delineated according to the guidelines advocated by DWAF (2008) taking into consideration soil characteristics as defined by Job (2009). The delineation as presented in this report is regarded as a best estimate based on the site conditions present at the time of assessment. During the field assessment, the following indicators were used to determine the boundary of the Kleinbos River:

- **Topography/elevation** was used to determine in which parts of the landscape the identified freshwater ecosystems was most likely to occur. The identified Kleinbos River is located in the valley floor position, which is the lowest area east of the study area (Figure 10).

Figure 14: The elevation profile of the study area and the position of the Kleinbos River.

- Vegetation associated with riparian areas: the identification of riparian areas relies heavily on vegetative indicators. Using vegetation (Figure 11), the outer boundary of a riparian area can be defined as the point where a distinctive change occurs:
  - in species composition relative to the adjacent terrestrial area; and
  - in the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the vigour, density, size, structure and/or numbers of individual plants.

Figure 15: Overview of the vegetation component of the Kleinbos River.

- **The presence of alluvial soil:** The presence of alluvial soil was used as an indicator of riparian zones, as defined by the National Water Act, 1998 (Act No. 36 of 1998). The occurrence of alluvial deposited material adjacent to the active channel is a good indicator of the riparian zone of a riparian freshwater ecosystem. Alluvial soil is soil derived from materials deposited by flowing water, especially in the valley bottom position. Riparian areas often, but not always, have alluvial soil. While the presence of alluvial soil cannot always be used as a primary indicator to delineate riparian freshwater ecosystems accurately, it can be used to confirm the topographical and vegetative indicators. Unlike wetland areas, riparian zones are usually not saturated for a long enough period of time for redoximorphic features to develop. This is

because riparian freshwater ecosystems are mainly driven by longitudinal flow, originating from its local catchment which flows through the freshwater ecosystem and does not reside in the riparian freshwater ecosystem as with wetlands. The active channel of the Kleinbos River consists of a cobble bed with alluvial soil deposited in shallow pools.

Figure 16: The active channel of the river consists mainly a cobble bed with small shallow pools.

5.4 *Freshwater ecosystem classification & assessment*

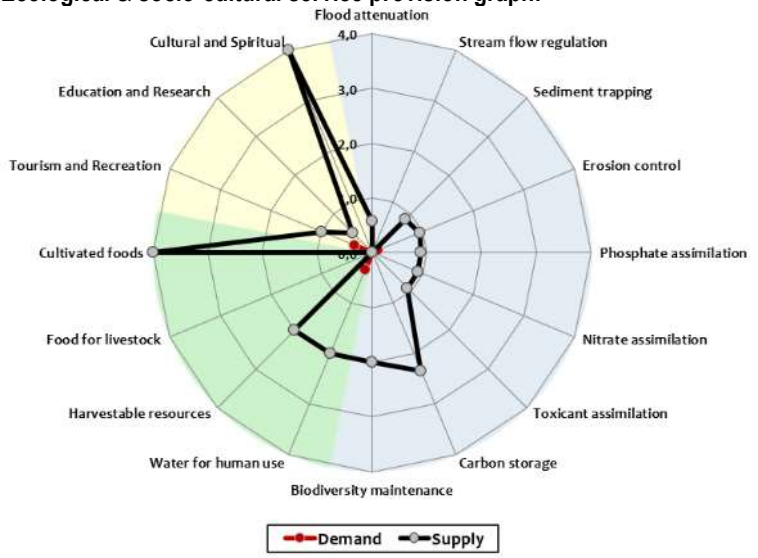
The freshwater ecosystems as described above were classified according to the Classification System outlined in Annexure C of this report as an Inland System, located within the South Eastern Coastal Belt Ecoregion wetland vegetation type. Table 2 below presents the classification from level 3 to 4 of the 'Classification System of Wetlands and other Aquatic Ecosystems' (Ollis *et al*, 2013).

Table 2: Classification of the freshwater ecosystems located in the investigation area.

Watercourse	Level 3: Landscape Unit	Level 4: Hydrogeomorphic (HGM) Type
Kleinbos River	Valley floor—the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	**River:** A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit.

Table 3 below provide a summary of the field verification findings in terms of relevant aspects (hydrology, geomorphology and vegetation components) associated with the Kleinbos River. The details pertaining to the methodology used to assess the Kleinbos River is contained in **Annexure C.**

Table 3: Summary of results of Kleinbos River located east of the study area.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td colspan="2"> 
Figure 17: Representative photographs of the Kleinbos River. (Left) Red dashed line indicates the flow path that transported the sediment into the river. (Right) Blue lines indicate direction of flow. Not the steep western embankment of the river (on the right side of the photograph).</td></tr>
<tr><td>IHI Discussion</td><td>IHI Category: B/C (moderately modified)
The river is considered to be largely natural in its upper reaches, with modifications noted within the assessed reach of the river. This largely pertains to the furrows created to convey water from the river to artificial impoundments and the invasion of alien plant species in the lower reach. As the erosion gully did breach the furrow, sediment deposition was noted along the western bank of the river as well as a flow path into the river. Despite this, no significant sediment disposition was noted in the assessed reach.</td><td>Ecoservice provision</td><td>Ecoservice Provisioning: very low to moderately high (indicator dependent)
The Kleinbos River and surrounding area is considered to have the characteristics to supply ideal conditions for the cultivation of food. Considering that the catchment is largely protected as part of the Garden Route Biosphere Reserve, the demand for such cultivation activities is considered reduced. The furrows allow for abstraction of water (moderate supply). The organic soils associated with the river contribute to carbon storage and host a diversity of plant species that provide habitat for a variety of species. Due to the low density of agricultural developments in the catchment and the reliance of humans on the ecosystem services provided by this river, most ecosystem services as considered to be of low demand and thus of very low importance.</td></tr>
<tr><td>EIS discussion</td><td colspan="3">EIS Category: Moderate
This river is considered of moderate ecological importance on a landscape scale, primarily due to the diversity of habitat types provided by the river and the connectivity thereof to downstream freshwater ecosystems. Considering the overall ecological state of the wetland, it can be considered sensitive to changes in the landscape, as can be witnessed from the recent significant rainfall event, relating to the erodibility of the soil in the catchment.</td></tr>
<tr><td>REC Category, BAS and RMO</td><td colspan="3">REC: Category B/C (Maintain)
BAS: Category B/C (Moderately modified)
RMO: Maintain
The outcome of the RMO indicates that the PES of the river must be maintained at a category of B/C (moderately modified). It is therefore critical that the erosion gully be rectified to avoid ongoing erosion and subsequent sedimentation of die Kleinbos River.</td></tr>
</table>

Freshwater ecosystem characteristics:	
This river originates from the Outeniqua Mountain Range, north of the study area and is driven by surface and subsurface flows originating from the mountainous areas. The upstream reach of the river and beyond the investigation area is hydrologically intact. Some interruption to the hydrological integrity of the river is noted due to the taking of water via furrows. Despite this, no significant changes to the hydrological regime of the assessed reach were observed, nor were any other biota stresses noted. Due to the locality of the assessed reach of the river being in the upper part of the catchment and in consideration that water is coming from the surrounding mountainous area, the water is of good quality. The geomorphology of the upstream reach of the river system (located in the hillslope position) is considered to be largely natural due to no apparent anthropogenic disturbances. Erosion of the active channel was noted; however, it cannot be discerned if this erosion was caused by the influx of sediment during the significant rainfall event (and subsequent scouring of the river channel) or if erosion of the channel occurred previously. Nonetheless, no obvious sediment deposition was noted within the assessed reach of the river, indicating that either the sediment was transported downstream into the Kleinbos River Dam (located approximately 1 km downstream of the sediment entry point) or the volume of sediment into the river can be regarded as negligible, with the majority thereof deposited along the western embankment of the river. In either case the significance of impact from sedimentation is considered limited and transient. The river hosts a diversity of indigenous fynbos species associated with both wetland and terrestrial ecosystems. As land uses changed along the river (most notably the downstream reach) invasion of large alien trees (*Acacia mearnsi*i and *Pinus* species) became significant. The system is listed as an Ecological Support Area (ESA) in accordance with the Western Cape Biodiversity Spatial Plan database (2017). In terms of ecoservice provision the system likely provides suitable habitat for various faunal species and can be considered an important migratory corridor in the landscape.	
Extent of modification anticipated	**Reversible** Rehabilitation of the erosion gully will ensure that no further sedimentation o the Kleinbos River occurs. Together with revegetation of all disturbance footprints, the modifications to the Kleinbos River can be reversed.
Impact Significance and Business Case:	**Moderate** Based on the application of the DWS Risk Assessment and an impact assessment, the initial access road upgrading and the subsequent erosion thereof (due to the lack of stormwater management infrastructure) resulting in an erosion gully and consequently the sedimentation of the Kleinbos River, was determined to have a 'Moderate' risk/ 'Medium low' impact to the river. It is acknowledged that the duration of this impact was short as no significant sediment deposition is currently noticeable in the active channel of the river. However, sediment deposition was still evident on the embankment of the river and this sediment will, over time, migrate to the river systems~~.~~. Should the erosion gully not be rehabilitated, further erosion of the gully, and thus additional long-term sedimentation of the river is expected. The rehabilitation of the erosion gully will pose a 'Low' risk/impact significance, should the recommended mitigation measures be implemented, with specific mention of installing drift/sediment fences in the erosion gully during infilling to prevent any sediment laden runoff from entering the downgradient Kleinbos River. The further upgrading activities associated with the additional section of road to the north was also determined to have a ''Moderate' risk/ 'Medium low' impact to the river, mostly considering the close approximation of this section of road to the river. With proper instalment of erosion prevention and stormwater management measures, impacts can be considered to be low.

All comprehensive results calculated are available in **Appendix D.**

6 LEGISLATIVE REQUIREMENTS

The following legislative requirements were considered during the assessment. A detailed description of these legislative requirements is presented in **Annexure B** of this report:

- The Constitution of the Republic of South Africa, 1996[3];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on freshwater ecosystems arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted, however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

The definition and motivation for a regulated zone of activity for the protection of the assessed freshwater ecosystems can be summarised as follows:

Table 4: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998).	**Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as: • the outer edge of the 1:100 year floodline and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • **in the absence of a determined 1:100 year floodline or riparian area the area within 100 m from the edge of a watercourse** where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • **a 500 metre radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation**.
Listed activities in terms of the National	**Activity 14** of Listing Notice 3 of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) states that:

[3] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it not the acts amending it are allocated act numbers.

Regulatory authorisation required	Zone of applicability
Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended.	*The development of:* *(xii) Infrastructure or structures with a physical footprint of 10 square meters or more.* *Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) **If no development setback has been adopted, within 32 meters of a watercourse**, measured from the edge of a watercourse.* *(f) In Western Cape:* *i. Outside urban areas, in:* *aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *bb) National Protected Area Expansion Strategy Focus areas;* *cc) World Heritage Sites;* *dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *ee) Sites or areas listed in terms of an International Convention;* *ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *gg) Core areas in biosphere reserves.* **Activity 19** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states "*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse".*

A 100m Zone of Regulation (ZoR) in terms of the National Water Act, 1998 (Act No. 36 of 1998) and a 32 m ZoR in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) was applied to the Kleinbos River.

Although the unlawfully commenced activities (upgrading of the gravel road and clearing of the platform) are not located in the regulated zones of the Kleinbos River, rehabilitation of the erosion gully which is located up to the edge of the Kleinbos River is required. Also, the remainder of the gravel road to the north which has not yet been upgraded falls within the NEMA 32m ZoR (although probably not within the 1:100 year floodline), which may need to be considered before commencement of road upgrading activities.

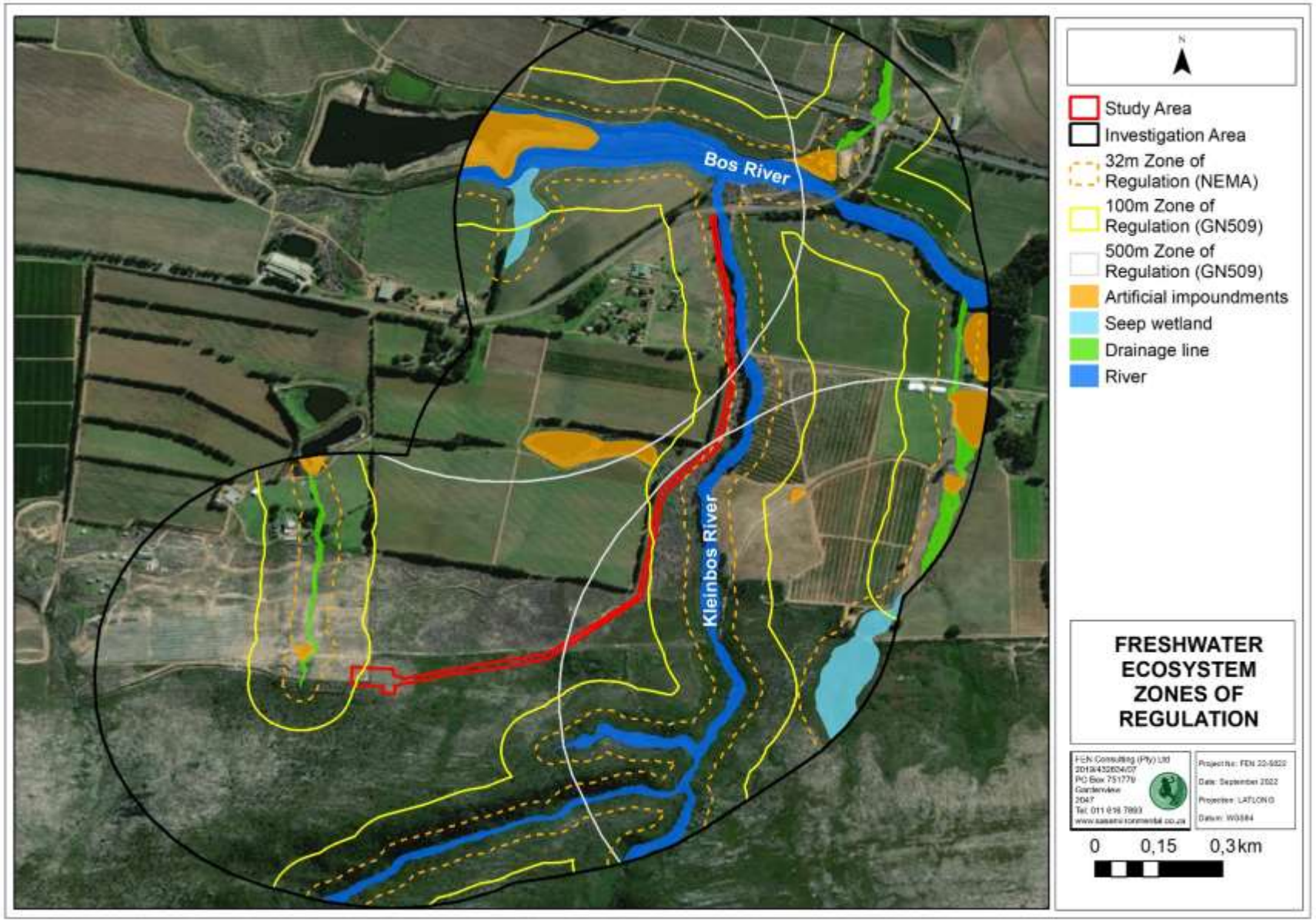


Figure 18: **The NEMA and GN509 zones of regulation associated with the freshwater ecosystems within the investigation area.**

7 RISK ASSESSMENT AND IMPACT ASSESSMENT

7.1 *DWS Risk Assessment*

Following the assessment of the Kleinbos River east of the study area, the DWS specified Risk Assessment Matrix (as promulgated in GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)) was applied as part of the section 24G rectification of unlawful commencement of activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended, since the upgrading of the road and clearing of the platform were likely undertaken with little to no mitigatory measures in place. The points below summarise the considerations undertaken:

- The risk significance of the following was determined:
  - Upgrading of the access road (retrospectively);
    - As the access road has been partially upgraded and the platform cleared, the activities associated with the construction phase have already occurred. Thus, the risk significance was assessed based on the observed and perceived level of mitigation at that time. This part of the risk assessment is thus applied retrospectively in support of the section 24G rectification process;
  - Finishing the construction of the access road, including the installation of stormwater cut-off berms). It is acknowledged that these activities are located outside the 100 m GN509 and 32 m NEMA ZoR of the Kleinbos River; considering the indirect impacts that previously occurred to the Kleinbos River, these activities were assessed;
  - Infilling of the erosion gully located within the 100 m GN509 ZoR (Figure 19). As per the engineering drawings provided by DMS Consulting Structural Engineering (Figure 3) only a section of the erosion gully will be infilled with rip-rap. It is considered imperative that a further downgradient section (the extent of the erosion gully within the 100m GN509 ZoR) also be infilled to ensure that future surface runoff doesn't further erode the gully and to avoid latent impacts to the Kleinbos River. The DWS Risk Assessment was thus applied assuming that the full extent of the erosion gully in the 100m GN509 ZoR is infilled;

Figure 19: The length of erosion gully proposed to be infilled with rip-rap, as per the engineering drawing (Figure 3) relative to the Kleinbos River and the 100m GN509 ZoR.

- In addition to the infilling of the erosion gully along the road and within the 100 m GN509 ZoR, it's the opinion of the freshwater specialist that transverse gabion stabilising walls must also be installed in the gully to further stabilise the gully at strategic intervals. By allowing approximately 30 cm of the gabion wall to protrude above the ground surface, siltation and sediment deposition will be encouraged on the upgradient side of each structure, thus reducing flow velocity and intensity and the potential of downgradient erosion. Over time silt and sediment collected in the landscape will become vegetated (natural reclamation) and the gabions will not be evident in the landscape. Figure 20 provides a schematic diagram of the gabion wall above the partially rip-rap filled gully. It is recommended that a gabion wall be installed in the gully at 30 m intervals.

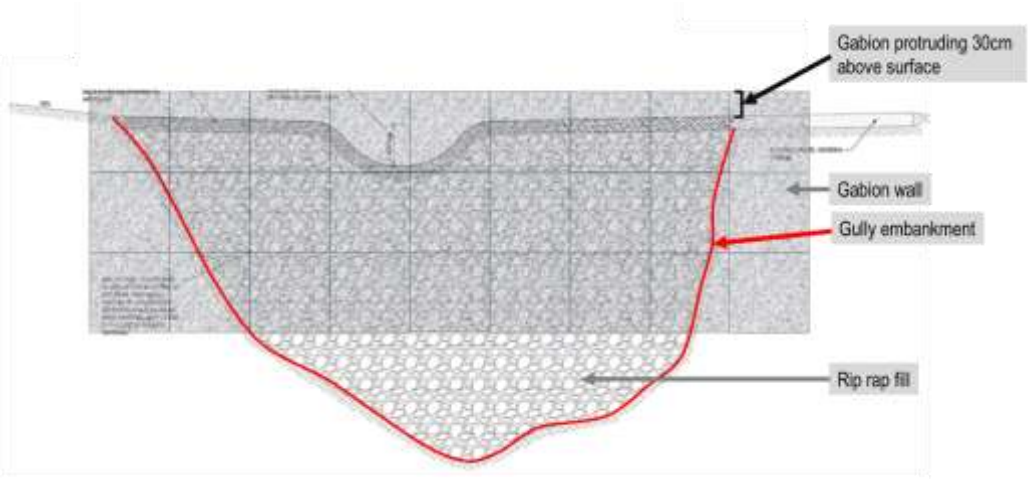


Figure 20: Schematic[4] suggesting the installation of transverse gabion walls in the erosion gully.

- Rehabilitation of the erosion gully between the furrow and the Kleinbos River (Figure 21). This includes infilling the shallow erosion gully/flow path with the deposited sediment located on the western embankment of the river and revegetating all disturbed areas with suitable indigenous vegetation.

Figure 21: Area to be rehabilitated by infilling the shallow gully/flow path with the deposited sediment and revegetating the area.

[4] Schematic for illustration purposes only. A suitably qualified professional must design this type of structure.

- Upgrading the access road within the 32 m NEMA ZoR. Due to the close approximation of this portion of road to the river, it is imperative that erosion control measures be implemented during construction activities. Silt traps must be installed (such as hessian curtains or hay bales) perpendicular to the slope to prevent any sediment run-off from entering the downgradient Kleinbos River. Also, appropriate stormwater management must be implemented, e.g. adding swales within the stormwater runoff furrow next to the road.

- The result of the operational phase assessment as provided in this report presents the perceived impact significance post-mitigation, and mitigation measures to be implemented during the continued operation of the access road specifically;
- In applying the DWS Risk Assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al.* (2013) would be followed, i.e. the impacts would be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- Most impacts are considered easily detectable; however, impacts such as surface and/or groundwater contamination would entail specific monitoring to ascertain the occurrence and severity of impacts; and
- While the operation and maintenance of the access road will be a permanent activity, the construction thereof and the additional rehabilitation activities are envisioned to take no more than a few months. However, the frequency of the impacts may be daily during this time.

7.1.1 Risk Assessment Discussion

The following potential ecological risks to the Kleinbos River were considered as part of this assessment:

- Loss of freshwater ecosystem habitat and ecological structure resulting in impacts to biota;
- Changes to the socio-cultural and service provision;
- Impacts on the hydrology and sediment balance of the river;
- Impacts on water quality.

The results of the risk assessment are summarised in Table 5 below, including key mitigation measures for each activity that must be implemented.

Table 5: Summary of the results of the DWS risk assessment applied to the Kleinbos River located east of the study area.

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented	Reversibility of Impact
1	Construction Phase (retrospective)	Site access, clearing and preparation for civil works in the study area, outside the 100 m GN509 ZoR of the Kleinbos River.	× Removal of vegetation within the study area; × Compaction of road.	× Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; × Decreased ecoservice provision; × Concentrated stormwater runoff from the road/platform.	4.5	8.5	9	76.5	M	No mitigation possible for the construction phase since the construction has already occurred. The risk significance was thus assessed based on the assumed approach to construction at that time and based on an assumed level of mitigation.	Fully Reversible
2	Construction phase (ongoing)	Continuation of access road construction & building infrastructure in the study area, outside the 100 m GN509 ZoR of the Kleinbos River.	× Installation of stormwater cut-off drains along the road; × General road upgrading activities.	× Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; and × Decreased ecoservice provision	1	3	4	12	L	It is acknowledged that these activities are located outside the 100m GN509 ZoR of the Kleinbos River, however, considering the previous impacts that occurred to the Kleinbos River due to the construction of the road, this activity was included. x Drift fences must be installed (such as hessian curtains) in the erosion gully, at intervals and downgradient of where the stormwater cut-off drains will be installed, to prevent any sediment run-off from entering the downgradient Kleinbos River. x General good housekeeping control measures (Appendix F) must be adhered to.	

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented	Reversibility of Impact
3	**Construction phase (ongoing)**	Infilling of the erosion gully along the access road and the section thereof in the 100 m GN509 ZoR of the Kleinbos River and the furrow.	× Importing of fill material (rip-rap and soil); × Stockpiling of material; × Movement of construction personnel; × Vegetation disturbance; × Compaction of soil.	× Potential habitat disturbance and vegetation removal to access the erosion gully; × Soil compaction leading to preferential flow paths that transport sediment laden runoff into the Kleinbos River.	**1.75**	**3.75**	**12**	**45**	**L**	It is considered imperative that a further downgradient section (the full extent of the erosion gully within the 100m GN509 ZoR) also be infilled to ensure that future surface runoff doesn't further erode the gully and to avoid latent impacts to the Kleinbos River. The DWS Risk Assessment was thus applied assuming that the full extent of the erosion gully in the 100m GN509 ZoR will be infilled and that transverse gabion walls be installed in the erosion gully at 30m intervals. x All construction personnel or vehicle movement must be limited to the area between the road and the furrow to avoid the delineated extent of the Kleinbos River; x All stockpiles must not exceed 2 m in height. All exposed soil must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) to prevent erosion and sedimentation of the downgradient river; x Drift fence/sediment traps must be installed in the erosion gully and its embankment to limit any sediment laden runoff from entering the downstream Kleinbos River; x The fill material must be suitably mixed and compacted to ensure stability of the erosion gully and to withstand any concentrated flows to avoid the development of a new gully; x All disturbed areas surrounding the gully and the gully itself must be rehabilitated, and where required, suitable vegetation to be planted to promote reestablishment of vegetation and increase the surface roughness of the disturbance footprint. All rehabilitation activities must be signed off by a suitably qualified freshwater ecologist.	

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented	Reversibility of Impact
4	**Construction phase (ongoing)**	Rehabilitation of the erosion gully between the furrow and the river	× Infilling of the erosion gully with deposited sediment; × Movement of construction personnel within close proximity to the river; × Vegetation disturbance; × Compaction of soil.	× Potential habitat disturbance and vegetation removal to access the erosion gully; × Soil compaction leading to preferential flow paths that transport sediment laden runoff into the Kleinbos River.	**2.5**	**4.5**	**12**	**54**	**L**	x Disturbance areas downgradient of the furrow must be kept as small as possible to avoid impacts to the Kleinbos River and further disturbance of the vegetation in the area along the river; x No construction vehicles/machinery may enter the area below the furrow, and all rehabilitation activities must be undertaken by personnel only; x Deposited sediment may be utilised to infill the erosion gully but no other material downgradient of the furrow may be used for these purposes. Should more material be required, suitable material must be imported; x The entry point of the erosion gully into the active channel of the river must be suitably compacted and sloped to ensure stability. Should it be required the slope can be reinforced by the placement of rip-rap (or in situ rocks from the active channel) along the embankment, but no hard engineering infrastructure may be utilised; x Drift fence/sediment traps must be installed in the erosion gully and its embankment to limit any sediment laden runoff from entering the downstream Kleinbos River; x The fill material must be suitably compacted to ensure stability of the erosion gully and to withstand any concentrated flows to avoid the development of a new gully; x All disturbed areas surrounding the gully and the gully itself must be rehabilitated, and suitable vegetation to be planted to promote reestablishment of vegetation and increase the surface roughness of the disturbance footprint. All rehabilitation activities must be signed off by a suitably qualified freshwater ecologist.	

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented	Reversibility of Impact
5	Construction phase (ongoing)	Upgrading of access road within the 32 m NEMA ZoR	× Removal of vegetation within the study area; × Compaction of road.	× Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; × Decreased ecoservice provision; × Concentrated stormwater runoff from the road.	3	7	9	63	M	x Silt traps must be installed (such as hessian curtains or hay bales) perpendicular to the slope to prevent any sediment run-off from entering the downgradient Kleinbos River. x Appropriate stormwater management must be implemented throughout the construction process, e.g. adding swales within the stormwater runoff furrow next to the road. x General good housekeeping control measures (Appendix F) must be adhered to.	
6	Operational Phase	Operation of the access road and stormwater management systems installed along the road	x Potential dust generation due to usage of road; x Concentrated stormwater runoff from the road.	x Smothering of surrounding vegetation by dust; x Sediment laden runoff into surrounding areas, and eventually into the Kleinbos River; x Proliferation of alien and invasive plant species within the river. x Potential further erosion of the gulley walls, especially at the infilled material-gulley side wall interface	1.75	3.75	11	41.25	L	x Stormwater runoff from the road into the area between the road and the river must be released in a dispersed manner to avoid concentrated flow paths from establishing; x Alien and invasive plant species must be eradicated on an ongoing basis, and monitoring of the establishment of indigenous vegetation associated with the disturbance footprint are recommended. This is to ensure successful rehabilitation and to increase the surface roughness of the 100m GN509 ZoR of the Kleinbos River to ensure successful establishment of vegetation within the disturbance footprints; x The erosion gully footprint must be regularly inspected for erosion or subsidence, specifically after rainfall events. Should erosion be noted, it must be infilled with in situ material and be suitably revegetated.	

Based on the application of the DWS Risk Assessment, the initial access road upgrading and the subsequent erosion thereof (due to the lack of stormwater management infrastructure) resulting in an erosion gully and consequently the sedimentation of the Kleinbos River, was determined to have exerted a 'Medium' risk to the river. It is however acknowledged that the duration of this impact was short as no significant sediment deposition is currently noticeable in the active channel of the river. However, sediment deposition was still evident on the embankment of the river and this sediment will, over time, migrate to the downstream reaches of the river system. Should the erosion gully not be rehabilitated, further erosion of the gully, and thus additional long-term sedimentation of the river is expected.

The rehabilitation of the erosion gully will pose a 'Low' risk significance, should the recommended mitigation measures be implemented, with specific mention of installing drift/sediment fences in the erosion gully during infilling to prevent any sediment laden runoff from entering the downgradient Kleinbos River. Additionally, it's the opinion of the freshwater specialist that that transverse gabion stabilising walls must also be installed in the gully to further stabilise the gully at strategic intervals. By allowing approximately 30 cm of the gabion wall to protrude above the ground surface, siltation and sediment deposition will be encouraged on the upgradient side of each structure, thus reducing flow velocity and intensity and the potential of downgradient erosion.

The upgrading of the northern portion of road which is yet to occur was determined to have a 'Medium' risk to the river. It is considered imperative that erosion control measures be implemented during construction activities. Silt traps must be installed (such as hessian curtains or hay bales) perpendicular to the slope to prevent any sediment run-off from entering the downgradient Kleinbos River. Also, appropriate stormwater management must be implemented throughout the construction process, e.g. adding swales within the stormwater runoff furrow next to the road.

Additional "good practice" mitigation measures applicable to a project of this nature are provided in **Appendix F** of this report.

7.2 *Impact Assessment*

Similar to the application of the DWS Risk Assessment as per Section 7.1, the following impact assessment was applied as part of the section 24G rectification of unlawful activities and Environmental Authorisation (EA) processes in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended. The impact assessment summarises the probability of occurrence and the extent and duration of its impact, together with the degree that the impact can be avoided, mitigated, managed, or reversed and the degree to which the impact can cause irreplaceable loss of resources. These are considered in the assessment outputs which refer to the significance of impacts prior to and post mitigation and thereafter the consequences of impact, and cumulative impacts pre- and post-mitigation.

The results of the impact assessment are summarised in Tables 6 to 8 that follow, including reference to key mitigation measures which are summarised in the DWS Risk Assessment Matrix for each activity, that must be implemented to reduce the impacts of the unlawful activities and the potential impact of the rehabilitation activities.

Table 6: Retrospective impact assessment for the initial upgrading of the access road.

CONSTRUCTION PHASE (RESTROSPECTIVE)								
Activity: Site access, clearing and preparation for civil works in the study area, outside the 100 m GN509 ZoR of the Kleinbos River. **Aspect:** - Removal of vegetation within the study area; - Compaction of road. **Nature of impact:** - Concentrated stormwater runoff resulting in an erosion gully that resulted in the deposition of sediment along and within the Kleinbos River; - Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; - Decreased ecoservice provision.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	5	3	3	2	2	8	7	56 (Medium Low)
MITIGATED	-	-	-	-	-	-	-	-
Applicable mitigation measures: No mitigation possible for the construction phase since the construction has already occurred. The risk significance was thus assessed based on the assumed approach to construction at that time and based on an assumed level of mitigation.								

Table 7: Construction phase impact assessment for the continuation of access road construction.

ONGOING CONSTRUCTION PHASE								
Activity: Continuation of access road construction & building infrastructure in the study area, outside the 100 m GN509 ZoR of the Kleinbos River. **Aspect:** - Installation of stormwater cut-off drains along the road; - General road upgrading activities. **Nature of impact:** - Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; and - Decreased ecoservice provision.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	3	3	2	2	3	6	7	42 (Low)
MITIGATED	1	3	1	1	3	4	5	20 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity as per Table 5								

Table 8: Construction phase impact assessment for the infilling of the erosion gully.

ONGOING CONSTRUCTION PHASE								
Activity: Infilling of the erosion gully along the access road and the section thereof in the 100 m GN509 ZoR of the Kleinbos River and the furrow. **Aspect:** - Importing of fill material (rip-rap and soil); - Installation of transverse gabion walls at 30m intervals in the erosion gully; - Stockpiling of material; - Movement of construction personnel; - Vegetation disturbance; - Compaction of soil. **Nature of impact:** - Potential habitat disturbance and vegetation removal to access the erosion gully; - Soil compaction leading to preferential flow paths that transport sediment laden runoff into the Kleinbos River.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	3	3	3	2	3	6	8	48 (Low)
MITIGATED	1	3	1	1	3	4	5	20 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity as per Table 5								

Table 9: Construction phase impact assessment for the rehabilitation of the erosion gully between the furrow and river.

ONGOING CONSTRUCTION PHASE								
Activity: Rehabilitation of the erosion gully between the furrow and the river **Aspect:** - Infilling of the erosion gully with deposited sediment; - Movement of construction personnel within close proximity to the river; - Vegetation disturbance; - Compaction of soil. **Nature of impact:** - Potential habitat disturbance and vegetation removal to access the erosion gully; - Soil compaction leading to preferential flow paths that transport sediment laden runoff into the Kleinbos River.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	3	3	3	2	3	6	8	48 (Low)
MITIGATED	2	3	1	1	3	5	5	25 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity as per Table 5								

Table 10: Construction phase impact assessment for the continuation of access road construction

ONGOING CONSTRUCTION PHASE								
Activity: Upgrading of access road within the 32 m NEMA ZoR of the Kleinbos River. **Aspect:** - General road upgrading activities. - Removal of vegetation within the study area - Compaction of road. **Nature of impact:** - Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; and - Decreased ecoservice provision. - Concentrated stormwater runoff from the road								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	3	3	3	2	2	6	7	42 (Low)
MITIGATED	2	3	2	1	1	5	4	20 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity as per Table 5								

Table 11: Operational phase impact assessment for the access road.

OPERATIONAL PHASE								
Activity: Operation of the access road and stormwater management systems installed along the road **Aspect:** - Potential dust generation due to usage of road; - Concentrated stormwater runoff from the road. **Nature of impact:** - Smothering of surrounding vegetation by dust; - Sediment laden runoff into surrounding areas, and eventually into the Kleinbos River; - Proliferation of alien and invasive plant species within the river.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	2	3	2	2	5	5	9	45 (Low)
MITIGATED	1	3	1	1	4	4	6	24 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity as per Table 5								

As per the outcome of the DWS Risk Assessment, the retrospective impact of the access road upgrading and the consequent erosion gully and sedimentation, was determined to have has a 'Medium Low' impact to the Kleinbos River. The erosion gully rehabilitation with the recommended mitigation measures is expected to pose an overall 'Low' impact significance to the Kleinbos River. The planned

activities for upgrading the existing road within the 32m NEMA ZoR is expected to have a 'Very Low' impact with the implementation of mitigation measures.

7.3 *Cumulative Impacts*

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Section 7.1 and 7.2 above. Wetlands and riparian areas within the region are under continued threat due to ongoing land use transformation and the invasion of alien and invasive plant species. It is considered imperative that the erosion gully be rehabilitated (infilled) to prevent ongoing erosion of the gully and subsequent sedimentation of the Kleinbos River. Also, it is essential that any additional upgrading activities of the remainder of the road to the north must be carried out with the necessary erosion prevention mechanisms in place. Ongoing erosion will result in exacerbated sedimentation of the river active channel as well as change the geomorphological characteristics of the river. As such, should the recommended mitigation measures (as provided in this report) be implemented and the erosion gully and Kleinbos River be monitored until suitable vegetation cover has established, the impacts from the initial access road upgrading can be deemed reversible with limited significant cumulative and latent impacts and latent impacts expected provided that the source of sedimentation is stopped at the source through the proposed rehabilitation measures.

8 CONCLUSION

FEN Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Section 24G rectification and Environmental Authorisation (EA) processes in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) for the unlawful upgrading of an existing road and clearing of a platform, as well as the proposed future upgrading of an additional section of the access road.

During the field verification, undertaken in April and September 2022, no freshwater ecosystems were identified to be traversed by the study area. The Kleinbos River, located approximately 200 m east of the partially upgraded road, was identified to be the only freshwater ecosystem impacted by the erosion gully. The results of the ecological assessment of the Kleinbos River are discussed in Section 5 of this report is summarised in the table below:

Table 12: Summary of results of the field assessment as discussed in Section 5.

Watercourse	PES	Ecoservices	EIS	REC and RMO
Kleinbos River	B/C (moderately modified)	very low to moderately high (indicator dependent)	Moderate	REC: Category B/C (Maintain) BAS: Category B/C (Moderately modified) RMO: Maintain
Extent of modification	**Reversible** Rehabilitation of the erosion gully will ensure that no further sedimentation o the Kleinbos River occurs. Together with revegetation of all disturbance footprints, the modification stop the Kleinbos River can be reversed.			

Based on the application of the DWS Risk Assessment and an impact assessment, the initial access road upgrading and the subsequent erosion thereof (due to the lack of stormwater management infrastructure) resulting in an erosion gully and consequently the sedimentation of the Kleinbos River, was determined to have a ‘Moderate’ risk/ ‘Medium low’ impact to the river. It is however acknowledged that the duration of this impact was short as no significant sediment deposition is currently noticeable in the active channel of the river. However, sediment deposition was still evident on the embankment of the river and this sediment will, over time, migrate to the river systems. Should the erosion gully not be rehabilitated, further erosion of the gully, and thus additional long-term sedimentation of the river is expected. The upgrading of the northern portion of road which is yet to occur was determined to have a Medium’ risk to the river. It is considered imperative that erosion control measures be implemented during construction activities to prevent repetition of events associated with the initial road upgrading process.

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ANNEXURE A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and FEN CC and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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ANNEXURE B: Legislative Requirements

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
National Water Act , 1998 (Act No. 36 of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in 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 Department of Water and Sanitation (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) & (i). A watercourse is defined as: a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act , 1998 (Act No. 36 of 1998)	In accordance with Government Notice (GN)509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: ➢ The outer edge of the 1:100 year floodline and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➢ In the absence of a determined 1:100 year floodline or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➢ A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.

ANNEXURE C: Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted to determine the ecoregion and ecostatus of the larger aquatic system within which the watercourses and drainage line features present in close proximity of the proposed development are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland feature present in the vicinity of the proposed development.

1.2 *Department of Water and Sanitation (DWS) Resource Quality Information Services Present Ecological State / Ecological Importance and Sensitivity (PES/EIS) Database (2014)*

The PES/EIS database as developed by the DWS RQIS department was utilised to obtain background information on the project area. The PES/EIS database has been made available to consultants since mid-August 2014. The information from this database is based on information at a sub-quaternary catchment reach (subquat reach) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites. The results obtained serve to summarise this information as a background to the conditions of the watercourse traversed by the proposed linear development.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian features encountered within the study area was assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis et. al., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	**LEVEL 2: REGIONAL SETTING**	**LEVEL 3:LANDSCAPE UNIT**
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4:HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems
From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean** (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups
For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et. al.*, 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting
At Level 3 of the classification system for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et. al.*, 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units
Seven primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table C2), on the basis of hydrology and geomorphology (Ollis *et. al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchanneled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates;
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et. al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et. al*., 2009).

3. Wet-Ecoservices (2009)

“The importance of a water resource, in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class” (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table C3: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Riparian Vegetation Response Index (VEGRAI)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: ‘riparian habitat’ includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

The Riparian Vegetation Response Assessment Index (VEGRAI) is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results5. Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

[5] Kleynhans et al, 2007

Table C4: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota & basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota & basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

5. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C5) of the wetland system being assessed.

Table C5: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

6. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C6: Recommended management objectives (RMO) for watercourses based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unnacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A watercourse may receive the same class for the REC as the PES if the watercourse is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C7: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

7. Watercourse Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act, 1998 (Act No. 36 of 1998) as "land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".

The wetland zone delineation took place according to the method presented in the DWAF (2005) document "A practical field procedure for identification and delineation of wetlands and riparian areas.

An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The position in the landscape, which will help identify those parts of the landscape where wetlands are more likely to occur;
- The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
- The presence of wetland vegetation species; and

- The presence of redoxymorphic soil feature, which are morphological signatures that appear in soil with prolonged periods of saturation.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008).
Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soil and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

ANNEXURE D: Risk and Impact Assessment Methodology

DWS Risk Assessment

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[6]. The interaction of an aspect with the environment may result in an impact;
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Frequency of activity** refers to how often the proposed activity will take place;
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor;
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial extent** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[7].

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of

[6] The definition has been aligned with that used in the ISO 14001 Standard.
[7] Some risks/impacts that have low significance will however still require mitigation

information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 (c) and (i) water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table D3: Duration (How long does the aspect impact on the resource quality)

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table D4: Frequency of the activity (How often do you do the specific activity)

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4

Covered	5

Table D8: Rating Classes

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.
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. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[8] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

[8] Mitigation measures should address both positive and negative impacts

Reversibility and/or irreplaceable loss

The following indicates the rationale for the reversibility scoring in relation to the watercourses.

Table D10: Reversibility of impacts on the watercourse

Reversibility Rating:	**Irreversible** (the activity will lead to an impact that is permanent)
	Partially reversible (The impact is reversible to a degree e.g. acceptable revegetation measures can be implemented but the pre-impact species composition and/or diversity may never be attained. Impacts may be partially reversible within a short (during construction), medium (during operation) or long term (following decommissioning) timeframe
	Fully reversible (The impact is fully reversible, within a short, medium or long-term timeframe)

Impact Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[9]. The interaction of an aspect with the environment may result in an impact;
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as freshwater features, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Frequency of activity** refers to how often the proposed activity will take place;
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor;
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial extent** refers to the geographical scale of the impact;
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor;

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the

[9] The definition has been aligned with that used in the ISO 14001 Standard.

likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[10].

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table D11 Criteria for assessing significance of impacts.

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function Largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / linear features affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / linear features affected < 3000m	4

[10] Some risks/impacts that have low significance will however still require mitigation

Entire habitat unit / Entire system/ > 2000ha impacted / linear features affected > 3000m	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table D12: Significance rating matrix.

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table D13: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium-high	76-100	Improve current management	Maintain current management
Medium-low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction; and

- Operation.

- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed;
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

ANNEXURE E: Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the Wet-Health assessment applied to the Kleinbos River

	MRU
INSTREAM IHI	
Base Flows	-1,0
Zero Flows	1,0
Floods	1,0
HYDROLOGY RATING	**1,0**
pH	1,0
Salts	1,0
Nutrients	1,0
Water Temperature	1,0
Water clarity	1,0
Oxygen	1,0
Toxics	1,0
PC RATING	**2,0**
Sediment	3,0
Benthic Growth	1,5
BED RATING	**2,0**
Marginal	1,0
Non-marginal	1,0
BANK RATING	**1,0**
Longitudinal Connectivity	1,0
Lateral Connectivity	1,0
CONNECTIVITY RATING	**1,0**
INSTREAM IHI %	**71,3**
INSTREAM IHI EC	**C**
INSTREAM CONFIDENCE	**3,0**

	MRU
RIPARIAN IHI	
Base Flows	-1,0
Zero Flows	1,0
Moderate Floods	2,0
Large Floods	2,0
HYDROLOGY RATING	**1,6**
Substrate Exposure (marginal)	1,0
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,0
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	2,0
Erosion (non-marginal)	2,0
Physico-Chemical (marginal)	0,5
Physico-Chemical (non-marginal)	1,0
Marginal	2,0
Non-marginal	2,0
BANK STRUCTURE RATING	**2,0**
Longitudinal Connectivity	0,5
Lateral Connectivity	0,5
CONNECTIVITY RATING	**0,5**
RIPARIAN IHI %	**69,5**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**3,0**

Table E2: Presentation of the results of the Socio-cultural and Ecoservice provision provided by the Kleinbos River

		Present State			
ECOSYSTEM SERVICE		**Supply**	**Demand**	**Importance Score**	**Importance**
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,6	0,0	0,0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	0,9	0,0	0,0	Very Low
	Erosion control	0,9	0,1	0,0	Very Low
	Phosphate assimilation	0,9	0,0	0,0	Very Low
	Nitrate assimilation	0,9	0,0	0,0	Very Low
	Toxicant assimilation	0,9	0,0	0,0	Very Low
	Carbon storage	2,3	0,0	0,8	Low
	Biodiversity maintenance	2,0	0,0	0,5	Very Low
PROVISIONING SERVICES	Water for human use	2,0	0,3	0,7	Very Low
	Harvestable resources	2,0	0,0	0,5	Very Low
	Food for livestock	0,0	0,0	0,0	Very Low
	Cultivated foods	4,0	0,0	2,5	Moderately High
CULTURAL SERVICES	Tourism and Recreation	1,0	0,3	0,0	Very Low
	Education and Research	0,5	0,0	0,0	Very Low
	Cultural and Spiritual	4,0	0,0	2,5	Moderately High

Table E3: Presentation of the EIS assessment applied to the Kleinbos River

			Kleinbos River
Ecological Importance and Sensitivity			Score (0-4)
Biodiversity support			**A (average)**
			1,33
Presence of Red Data species			1
Populations of unique species			1
Migration/breeding/feeding sites			2
Landscape scale			**B (average)**
			1,80
Protection status of the wetland			1
Protection status of the vegetation type			1
Regional context of the ecological integrity			2
Size and rarity of the wetland type/s present			2
Diversity of habitat types			3
Sensitivity of the wetland			**C (average)**
			1,00
Sensitivity to changes in floods			1
Sensitivity to changes in low flows/dry season			1
Sensitivity to changes in water quality			1
ECOLOGICAL IMPORTANCE & SENSITIVITY (max of A,B or C)			**B**
Hydro-Functional Importance			**Score (0-4)**
Regulating & supporting benefits	**Flood attenuation**		1
	Streamflow regulation		1
	Water Quality Enhancement	***Sediment trapping***	1
		Phosphate assimilation	1
		Nitrate assimilation	1
		Toxicant assimilation	1
		Erosion control	1
	Carbon storage		3
HYDRO-FUNCTIONAL IMPORTANCE (average score)			1
Direct Human Benefits			**Score (0-4)**
Subsistence benefits	***Water for human use***		3
	Harvestable resources		3
	Cultivated foods		3
Cultural benefits	***Cultural heritage***		0
	Tourism and recreation		0
	Education and research		0
DIRECT HUMAN BENEFITS (average score)			1,50

ANNEXURE F: Risk Analysis and Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecology and biodiversity, will include any activities which take place in close proximity to the proposed activities that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater ecosystem identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into freshwater ecosystems unless absolutely essential and where project activities are located in the freshwater ecosystems. It must be ensured that the freshwater ecosystem habitat is off-limits to construction vehicles and non-essential personnel;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes (if applicable) should avoid freshwater ecosystems and be restricted to existing roads where possible;
- Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Removal of the alien and weed species encountered on the property must take place to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)) Removal of species should take place throughout the construction, operational, and maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species*;* and
  - No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

Soil

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soil;

- No stockpiling of topsoil is to take place within the recommended buffer zone around the freshwater ecosystems (unless specified otherwise), and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the wetland;
- All soil compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble/silt removed from the dam must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed development should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

Risk significance on the freshwater ecosystem ecology of the study area

The table below serves to summarise the anticipated impacts that might occur during the construction and operational phases as well as the mitigation measures that must be implemented to maintain and enhance the ecological integrity of the resource.

Table F1: Risk Assessment outcomes for the unlawful activities.

No.	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat (Geomorph/Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
1	**Construction Phase (retrospective)**	Site access, clearing and preparation for civil works in the study area, outside the 100 m GN509 ZoR of the Kleinbos River.	× Removal of vegetation within the study area; × Compaction of road.	× Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; × Decreased ecoservice provision; × Concentrated stormwater runoff from the road/platform.	5	5	5	3	**4.5**	2	2	**8.5**	1	2	5	1	**9**	**76.5**	**M**
2	**Construction phase (ongoing)**	Continuation of access road construction & building infrastructure in the study area, outside the 100 m GN509 ZoR of the Kleinbos River.	× Installation of stormwater cut-off drains along the road; × General road upgrading activities.	× Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; and × Decreased ecoservice provision	1	1	1	1	**1**	1	1	**3**	1	1	1	1	**4**	**12**	**L**

No.	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
3	**Construction phase (ongoing)**	Infilling of the erosion gully along the access road and the section thereof in the 100 m GN509 ZoR of the Kleinbos River and the furrow.	× Importing of fill material (rip-rap and soil); × Stockpiling of material; × Movement of construction personnel; × Vegetation disturbance; × Compaction of soil.	× Potential habitat disturbance and vegetation removal to access the erosion gully; × Soil compaction leading to preferential flow paths that transport sediment laden runoff into the Kleinbos River.	1	1	3	2	**1.75**	1	1	**3.75**	5	1	5	1	**12**	**45**	**L**

No.	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
4	**Construction phase (ongoing)**	Rehabilitation of the erosion gully between the furrow and the river	× Infilling of the erosion gully with deposited sediment; × Movement of construction personnel within close proximity to the river; × Vegetation disturbance; × Compaction of soil.	× Potential habitat disturbance and vegetation removal to access the erosion gully; × Soil compaction leading to preferential flow paths that transport sediment laden runoff into the Kleinbos River.	1	1	4	4	**2.5**	1	1	**4.5**	5	1	5	1	**12**	**54**	**L**

No.	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
5	**Construction phase (ongoing)**	Upgrading of access road within the 32 m NEMA ZoR	× Removal of vegetation within the study area; × Compaction of road.	× Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; × Decreased ecoservice provision; × Concentrated stormwater runoff from the road.	3	3	3	3	**3**	2	2	**7**	1	2	5	1	**9**	**63**	**M**
6	**Operational Phase**	Operation of the access road and stormwater management systems installed along the road	x Potential dust generation due to usage of road; x Concentrated stormwater runoff from the road.	x Smothering of surrounding vegetation by dust; x Sediment laden runoff into surrounding areas, and eventually into the Kleinbos River; x Proliferation of alien and invasive plant species within the river.	2	2	2	1	**1.75**	1	1	**3.75**	3	2	5	1	**11**	**41.25**	**L**

ANNEXURE G: Details, Expertise and Curriculum Vitae of Specialists

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden MSc. Environmental Management (UJ)

Paul Da Cruz BA (Hons) (Geography and Environmental Studies) (WITS)

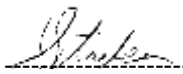
Monique Botha PhD Env. Sci (NWU)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

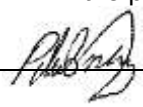
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.



Signature of the Specialist

I, Paul da Cruz, declare that -

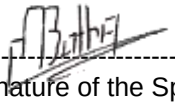
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.



Signature of the Specialist

I, Monique Botha, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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



Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation

4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use License Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF PAUL DA CRUZ

PERSONAL DETAILS

Position in Company	Senior Ecologist
Joined SAS Environmental Group of Companies	2022

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Certificated Scientist at South African Council for Natural Scientific Professions (SACNASP)

Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA)

Member of the South African Wetland Society (SAWS)

EDUCATION

Qualifications

BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand)	1998
BA (Geography) (University of the Witwatersrand)	1997

Short Courses

Taxonomy of Wetland Plants (Water Research Commission)	2017
Advanced Grass Identification (Frits van Outshoorn)	2010
Grass Identification (Frits van Outshoorn),	2009
Soil Form Classification and Wetland Delineation; (TerraSoil Science)	2008

AREAS OF WORK EXPERIENCE

South Africa – All Provinces

Southern Africa – Lesotho, Botswana

DEVELOPMENT SECTORS OF EXPERIENCE

1. Renewable energy (Wind and solar)
2. Linear developments (energy transmission, telecommunication, pipelines, roads, border infrastructure)
3. Nature Conservation and Ecotourism Development
4. Commercial development
5. Residential development
6. Environmental and Development Planning and Strategic Assessment
7. Industrial/chemical; Non-renewable power Generation

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- EIA / BA Applications
- Environmental Authorisation Amendments
- EMPr Compilation
- Environmental Compliance Monitoring (Environmental Auditing)
- Environmental Screening Assessments and Listing Notice 3 Trigger Identification / Mapping
- Strategic Environmental Assessments and Environmental Management Frameworks
- EIA / Specialist Study Peer Review

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Assessments in support of Environmental Screening Assessments, Precinct Planning & SEA
- Wetland Construction (Compliance) Monitoring

Biodiversity Assessments

- Avifaunal Assessments
- Strategic Biodiversity Assessment

Visual Impact Assessment

- Visual Impact Assessments

GIS / Spatial Analysis

- GIS Spatial Analysis and Listing Notice 3 mapping

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF MONIQUE BOTHA

PERSONAL DETAILS

Position in Company	Junior field ecologist
Joined SAS Environmental Group of Companies	2022

MEMBERSHIP IN PROFESSIONAL SOCIETIES

SACNASP Candidate Natural Scientist (Environmental Sciences) **#126160**

EDUCATION

Qualifications

B.Sc. Environmental and Biological Sciences (North-West University)	2010
Hons. B.Sc. Environmental Sciences (North-West University)	2011
M.Sc. Environmental Sciences (North-West University)	2014
Ph.D. Environmental Sciences (North-West University)	2016

Short Courses

Freshwater bio-assessment techniques (North-West University)	2010
River profile analysis (North-West University)	2010
Spatial analysis and Geoprocessing (ESRI Online)	2022

KEY SPECIALIST DISCIPLINES

- Desktop Freshwater Ecosystem (wetland / riparian) Delineation
- Wetland Delineation and Assessment
- Mapping (GIS, Global Mapper)