WETLAND ASSESSMENT

PES, EIS, REC

PROPOSED DEVELOPMENT OF THE NEW MONTROSE INTERCHANGE, MPUMALANGA, SOUTH AFRICA

Proponent:

SANRAL
SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg.No.1998/009584/30

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Prism EMS | P.O. Box 1401, Wilgeheuwel, Johannesburg, 1736 | Tel: 087 985 0951 | E-Mail: prism@prismems.co.za

APPROVAL PAGE

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Document Compilation	**Mr. D. Botha** (M.A. Env.Man.) (PHED) Wetland Specialist | Pr.Sci.Nat.		**2020/02** **2020/03 – Update 1** **2020/11 – Update 2**
Field Assessment	**Mr. D. Botha** (M.A. Env.Man.) (PHED) Wetland Specialist | Pr.Sci.Nat.		**2019/10** **2020/01**
	Mr. A.E. van Wyk (B.Sc. Env. &Bio. Sci.) Ecologist		**2019/10** **2020/01**
Document Review	**Mr. P. Singh** (M.Sc. Aquatic Health) Aquatic Specialist | Pr.Sci.Nat.		**2020/02** **2020/03** **2020/11**
Document Signoff	**Mr. D. Botha** (M.A. Env.Man.) (PHED) Wetland Specialist | Pr.Sci.Nat.		**2020/11/05**

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Amendments on Document

Date	Report Reference Number		Description of Amendment
13/03/2020	21935_WPES_D1	21935_WPES_1	Update plans
05/11/2020	21935_WPES_1	21935_WPES_2	Update plans Finalise Report

DECLARATION OF INDEPENDENCE

Specialist Name	Mr. D. Botha
Declaration of Independence	I declare, as a specialist appointed in terms of the National Environmental Management Act (Act No 108 of 1998) and the associated 2014 Environmental Impact Assessment (EIA) Regulations, that: • I act as the independent specialist in this application; • I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant; • I declare that there are no circumstances that may compromise my objectivity in performing such work; • I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity; • I will comply with the Act, Regulations and all other applicable legislation; • I have no, and will not engage in, conflicting interests in the undertaking of the activity; • I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; • All the particulars furnished by me in this form are true and correct; and • I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.
Signature	
Date	2020/11/05

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EXECUTIVE SUMMARY

Prism Environmental Management Services was requested by **TracN4 on behalf of the applicant, South African National Roads Agency (SANRAL),** to undertake a wetland assessment to delineate the wetland and to determine the Present Ecological State (PES), the Ecological Importance and Sensitivity (EIS) and the Recommended Ecological Classification (REC) for the proposed upgrade of **the Montrose Interchange at the Schoemanskloof R539 and N4 intersection.** This, specifically to inform the Environmental Impact Assessment (EIA) and Water Use License Application (WULA) for the said intersection upgrade.

The proposed development is located at the existing T-junction of the National N4 Toll Route between eMgwenya (Waterval Boven) and Mbombela (Nelspruit) with the alternative R539 Route (Schoemanskloof Road), Mpumalanga. (*here after referred to as the study site/s*). The study sites measure approximately 50ha over approximately 2,6km. The study site is located in quaternary catchments X21E and X21K in the Inkomati-Usuthu Management Area (WMA 3). The study area falls within the Savanna Biome (Biome 07), and the Northern Escarpment Mountains Level-1 Ecoregion (Ecoregion 10) as well as a small section in the North Eastern Highlands Level-1 Ecoregion (Ecoregion 4) (Kleynhans *et al.*, 2005).

The field investigations concluded that no natural wetland unit could be recorded as per the DWAF, 2005 guidelines and that three drainage areas could be affected by the proposed development.

These naturally occurring drainages are not streams, as they do not have the morphological structure, nor the duration of water retention or links to the adjacent aquatic zones, such as floodplains or riparian wetlands. They are simply temporary drainage lines acting as temporary flow paths during rainfall events. They also resemble the adjacent terrestrial zones.

The drainage lines recorded were assessed and the following results were attained:

- The drainage lines attained a moderate overall PES (Present Ecological State)
  - The drainage lines are all largely natural with few moderate modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. They can all be classified as falling into the category B/C. The trajectory of change will remain stable over the next five years should no activity take place and no intervention in terms of rehabilitation is implemented.
- The drainage lines attained a Moderate Ecological Importance and Sensitivity (EIS) score.
  - An assessment based on the principles of the ecological importance and sensitivity assessment were conducted according to the guidelines as discussed by DWAF (1999). It was found that the drainage lines are considered ecologically important and sensitive on local scale. The biodiversity of these drainage lines is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers. The drainage lines were classified to fall in the moderate class: EIS = C.

- The drainage lines Recommended Ecological Classification (REC) classification was rated as:

  The drainage lines will be impacted by the proposed development activities. This impact will be localised and at the transitional point leading from the development and infrastructure installations into the drainage lines. It will in all likelihood regress slightly in terms of its current Ecological Category if not managed in specific during the construction period. Stormwater management for the site is required in specific the construction phase. This will mitigate the impact on the drainage lines. Rehabilitation of the impacts and maintenance of the system will further mitigate the impacts and could improve the sustainability of the system. It is thus rated that the Recommended Ecological Category (REC) will fall into:
    - Category C

Concluded from the results presented in this document, the construction activities will in all likelihood impact on the drainage lines but can be mitigated to satisfactory standards if all mitigatory actions are implemented with due care. It is key to preserve water quality and supply to the downstream aquatic resources.

The rehabilitation of the drainage lines is vital to recover some ecological function. The resource drivers must be enhanced as part of the rehabilitation of the affected areas. In respect of the construction phase, it is important to ensure that the required erosion protection measures linked to the drainage lines intersection sections be carefully designed and installed.

The project can be supported, should all the mitigation measures be implemented and monitored against to ensure compliance and protection of the aquatic resource.

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1 INTRODUCTION

Prism Environmental Management Services was requested by **TracN4 on behalf of the applicant, South African National Roads Agency (SANRAL),** to undertake a wetland assessment to delineate the wetland and to determine the Present Ecological State (PES), the Ecological Importance and Sensitivity (EIS) and the Recommended Ecological Classification (REC) for the proposed upgrade of **the Montrose Interchange at the Schoemanskloof R539 and N4 intersection.** This, specifically to inform the Environmental Impact Assessment (EIA) and Water Use License Application (WULA) for the said intersection upgrade.

1.1 Project Description

The **South African National Roads Agency (SANRAL)** is proposing to upgrade the Schoemanskloof R539 Route with additional passing lanes and lengthening of some existing ones and introducing a road interchange at the existing T-junction of the National N4 Toll Route between eMgwenya (Waterval Boven) and Mbombela (Nelspruit) with the alternative R539 Route, Mpumalanga.

As part of continual upgrading of this road corridor between Pretoria in the west and Maputo, Mozambique in the east; a need has arisen to introduce such improvements to:

- Improve traffic flow speeds
- Safety of motorists.

Currently, a high number of road accidents are experienced at (and in close proximity) to this existing T-junction which can be attributed to a few factors such as confusion at the right turn made (east to west flow) by motorists to the Schoemanskloof Road, vehicles colliding with stationery vehicles waiting to turn right (east to west flow), blind rise just before the T-junction for motorists travelling on the N4 from west to east and a blind rise and sharp corner currently posing a hazard to motorists travelling on the Schoemanskloof Road R539 after taking the T-junction right turn (east – west flow).

SANRAL has appointed an implementing agent and concessionaire for the National N4 Toll Route existing between Pretoria and Maputo known as "Trans African Concessions" (TracN4) – a concessionaire established during the mid-90's specifically for the management of the N4 corridor between South Africa and Mozambique. TracN4, as SANRAL's implementing agent ultimately needs to ensure compliance with all conditions of environmental licenses, permits and similar authorisations as custodians of the N4 road on behalf of SANRAL.

1.1.1 Study Site Location

The proposed development is located at the existing T-junction of the National N4 Toll Route between eMgwenya (Waterval Boven) and Mbombela (Nelspruit) with the alternative R539 Route (Schoemanskloof Road), Mpumalanga. (*here after referred to as the study site/s*) (Figure 1.2) (Figure 1.3). The study sites measure approximately 50ha over approximately 2,6km. The study site is located in quaternary catchments X21E and X21K in the Inkomati-Usuthu Management Area (WMA 3), (Figure 1.4). The study area falls within the Savanna Biome (Biome 07), and the Northern Escarpment Mountains Level-1 Ecoregion (Ecoregion 10) as well as a small section in the North Eastern Highlands Level-1 Ecoregion (Ecoregion 4) (Kleynhans *et al.*, 2005) (Figure 1.5).

1.2 Scope and Purpose

The aim of this study was to undertake a wetland assessment to delineate the wetland and to determine the Present Ecological State (PES), the Ecological Importance and Sensitivity (EIS) and the Recommended Ecological Classification (REC) for the proposed development. This, specifically to inform the Environmental Impact Assessment (EIA) and Water Use License Application (WULA) for the said development.

1.3 Overview of Specialist

Prism EMS has conducted the required wetland specialist assessment and delineation of the wetlands on site to inform the Environmental Impact Assessment (EIA) and Water Use License Application (WULA). The team under lead of Mr. D. Botha has conducted the assessment. The details of the team are tabularised in Table 1-1.

Table 1-1: Details of Specialist

Specialist	Mr. D. Botha – Wetland Specialist
Company:	Prism EMS
Qualifications:	M.A. Environmental Management B.A. Hons. Geography & Environmental Management, B.A. Humanities Post Higher Education Diploma Wetland and Wetland Delineation *(DWAF Accredited Short Course)* Soil Classification and Wetland Delineation – Short Course – *Terrasoil Science* Tools for Wetland Assessment – *Rhodes University* SASS5 Aquatic Biomonitoring Training – *Department of Water Affairs, Ground Truth* Wetland Plant Taxonomy – *Water Research Commission* Hydropedology and Wetland Functioning – *Water Business Academy / Terra Soil Science*
Experience:	17 Years
Affiliation/ Registration	South African Council for Natural Scientific Professions (SACNASP) registered Scientist | Pr.Sci.Nat. (119979) Registered Member of Environmental Assessment Practitioners Association of South Africa (Pr.EAP)(2019/1209) Member of the International Association for Impact Assessors (IAIAsa) (1653) Member of the Gauteng Wetland Forum Member of the South African Wetland Society
Address:	No 17 Coldstream Office Park, Coldstream Street, Little Falls
Tel:	087 985 0951

Fax:	086 601 4800
Email:	dewet@prismems.co.za

Designation	Name	Qualification	Professional Registration	Role
Specialist Team				
Ecologist	A.E. van Wyk	B.Sc. Environmental and Biological Sciences B.Sc. Hons. Environmental and Biological Sciences (in progress) 5 Years' Experience	Cand.Sci.Nat	Field Assistant
Aquatic Specialist	Mr. P. Singh	MSc Aquatic Health (Cum Laude) BSc.Hons (Biodiversity & Conservation) BSc (Bot & Zoo) Rand Water Water Purification of Drinking Water – *Rand Water Vereeniging* Ecotoxicity Test Methods and Validation - *Golder Associates Research Laboratory* 7 Years' Experience	Pr. Sci. Nat. (116822)	Peer Review

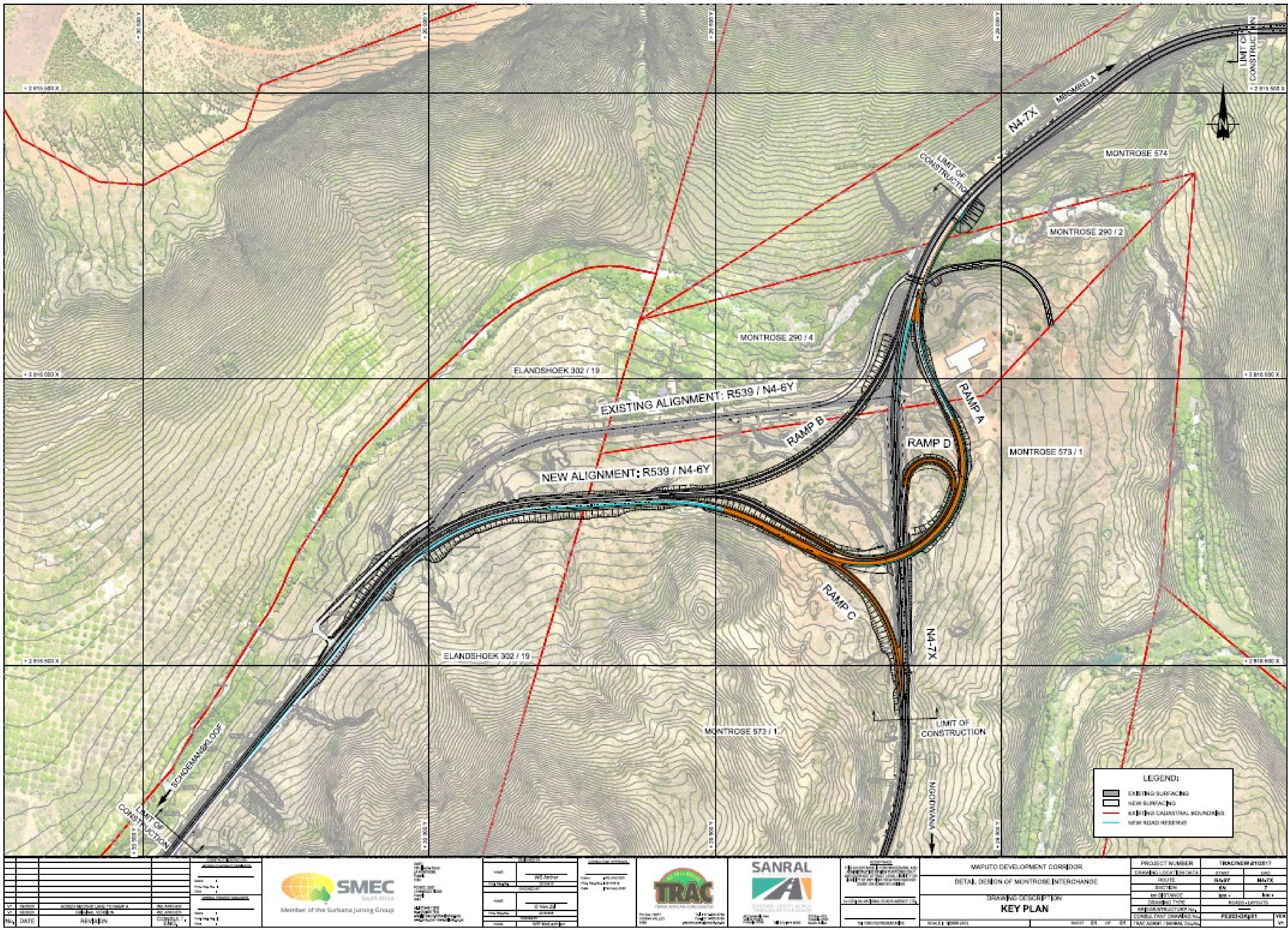

Figure 1.1: Proposed Layout.

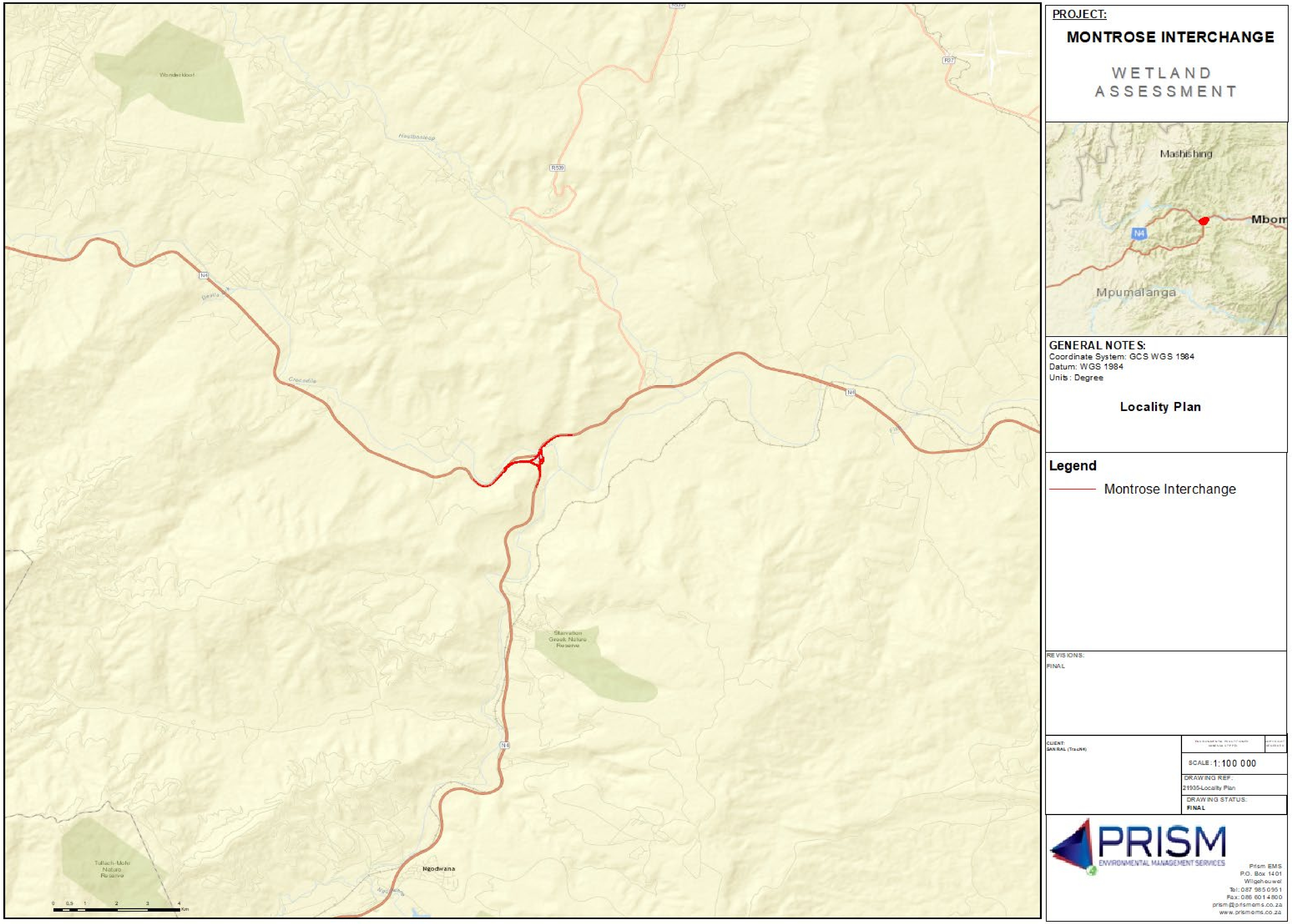

Figure 1.2: Locality Plan.

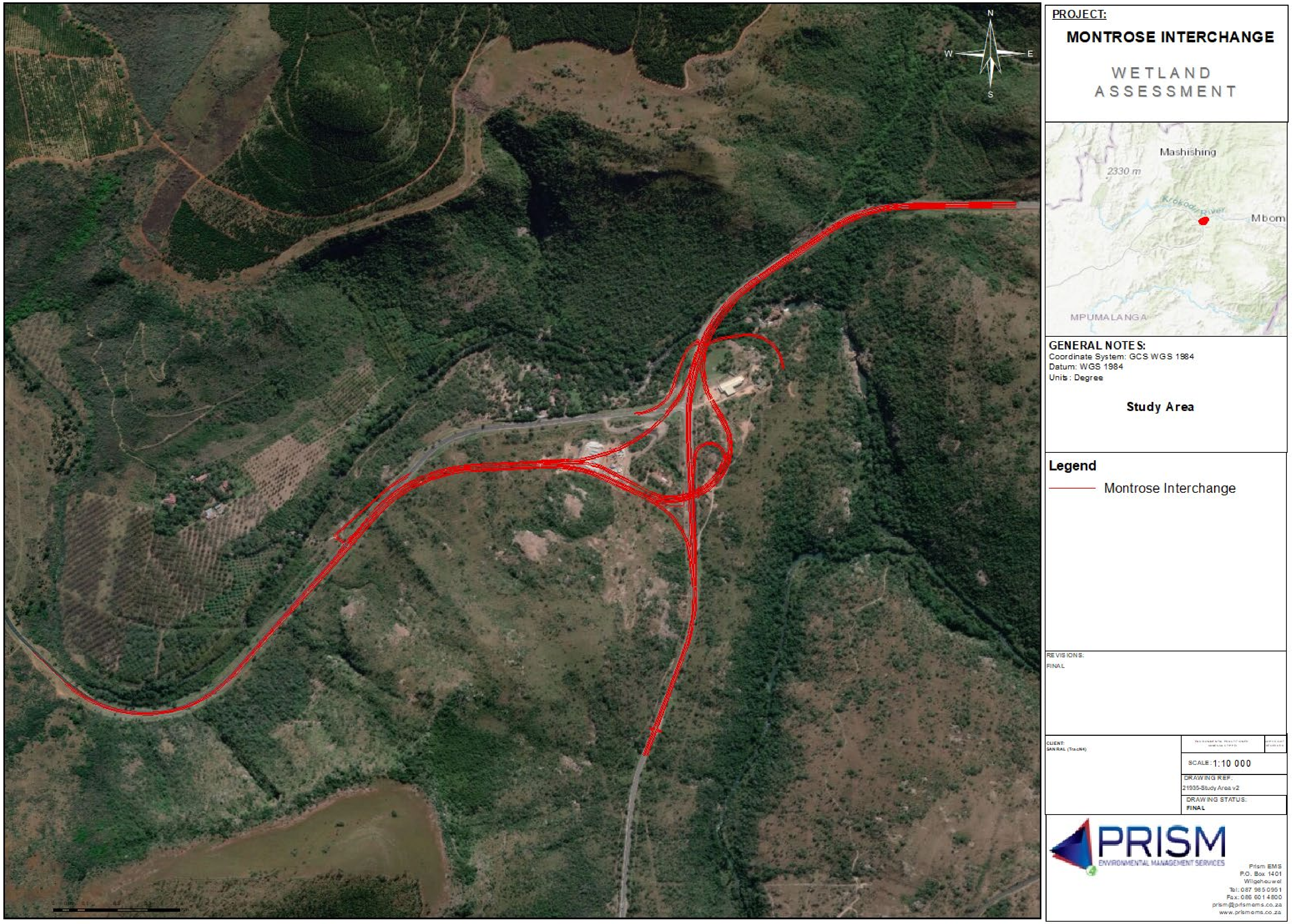

Figure 1.3: Map of the survey area.

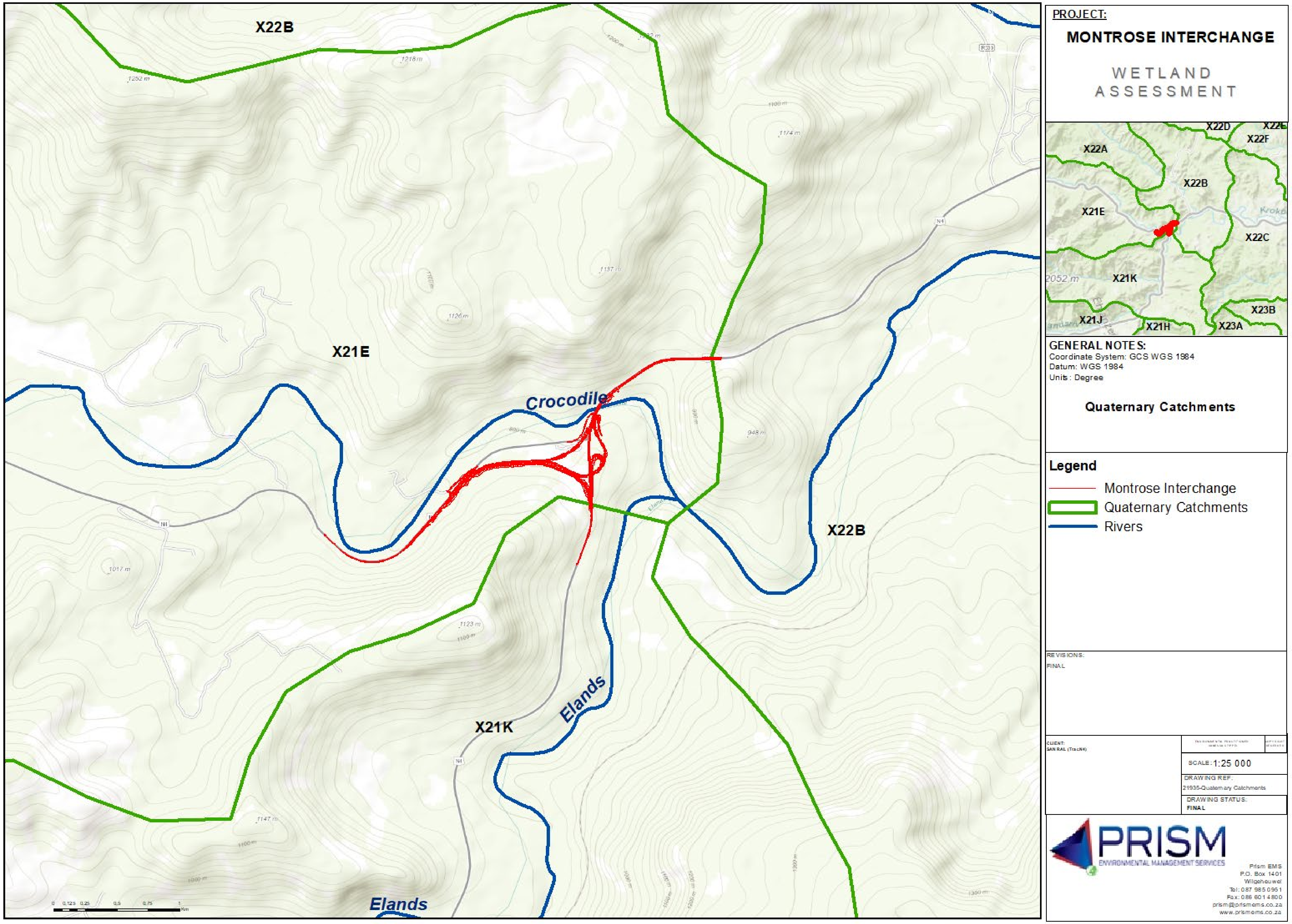

Figure 1.4: Map of the Catchment Areas.

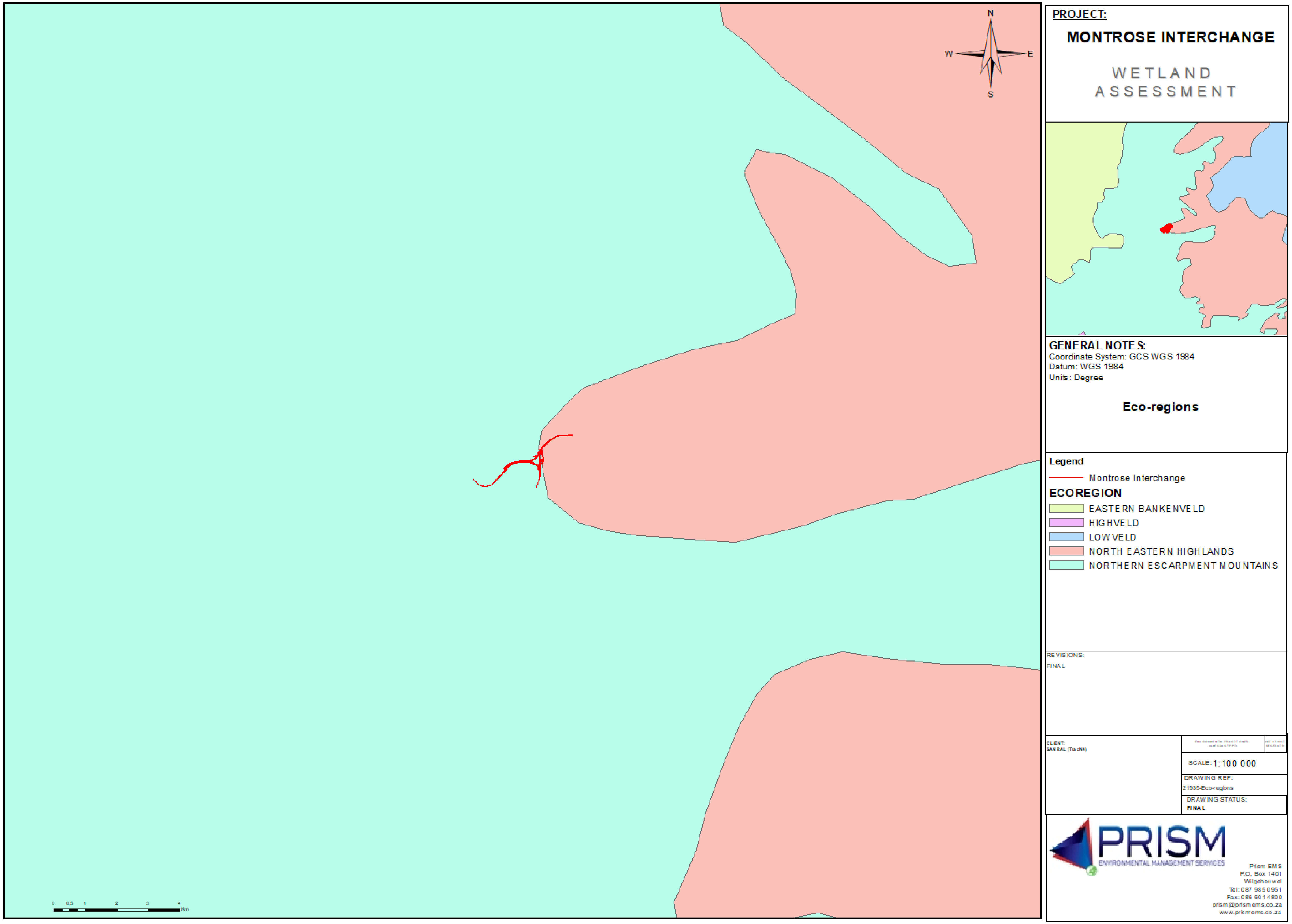

Figure 1.5: Map of the study sites Eco-Regions (DWAF; 2005).

2 REPORT OUTLINE

Appendix 6 of GN 982 of 4 December 2014 provides the requirements for specialist reports undertaken as part of the environmental authorisation process. In line with this, Table 2-1 provides an overview of Appendix 6 together with information on how these requirements have been met.

Table 2-1. Specialist Report Requirements.

Requirement from Appendix 6 of GN 982 of 4 December 2014	Chapter
(a) Details of - (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Chapter 1.3
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	*Declaration of Independence*
(c) Indication of the scope of, and the purpose for which, the report was prepared	Chapter 1.2
(d) Date and season of the site investigation and the relevance of the season to the outcome of the assessment	Chapter 4.1
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process	Chapter 4.
(f) Specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Chapter 6
(g) Identification of any areas to be avoided, including buffers	Chapter 6
(h) Map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Chapter 6
(I) Description of any assumptions made and any uncertainties or gaps in knowledge	Chapter 5
(j) Description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment	Chapter 6 Chapter7 Chapter 8
(k) Mitigation measures for inclusion in the EMPr	Chapter 8
(l) Conditions for inclusion in the environmental authorisation	Chapter 8
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Chapter 8
(n) Reasoned opinion - (i) as to whether the proposed activity or portions thereof should be authorised; and	Chapter 8

Requirement from Appendix 6 of GN 982 of 4 December 2014	Chapter
(ii)if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	
(o) Description of any consultation process that was undertaken during the course of preparing the specialist report	Chapter 4.7
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) Any other information requested by the competent authority	N/A

3 LEGISLATION AND GUIDELINES

The generic term 'wetland' is used worldwide and includes specific ecosystems such as bogs, coastal lakes, estuaries, fens, floodplains, mangroves, marshes, mires, moors, pans, peatlands, seeps, sloughs, springs, swamps, vlei and wet meadows (Mays, 1996; DWAF, 2005). Regardless of the local name given to wetlands, the driving force of all wetlands is the interplay between land and water, and the consequent characteristics that reflect both (Cowan, 1999). Any part of the landscape where water accumulates for long enough and often enough to influence the plants, animals and soils occurring in that area, is referred to as a wetland (DWAF, 2005). Wetlands comprise approximately 6% (8.5 km^2 x 103) of the world's land surface and are found in every climate from the tropics to the frozen tundra (Mays, 1996).

Several definitions for wetland and wetland areas exist. Two of the most common wetland definitions used in South Africa is the National Water Act (NWA) (Act 36 of 1998) and the Ramsar definition are provided below:

National Water Act, Act No 36 of 1998:

> *"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."*

South Africa, being a contracting party to Ramsar, also uses the definition accepted by the convention. Article 1.1 of the convention defines wetlands as (Cowan, 1999; Koester, 1989):

> *"Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters*."

Wetlands are defined as those areas that have water on the surface or within the root zone for long enough periods throughout the year to allow for the development of anaerobic conditions. These conditions create unique soil conditions (hydric soils) and support vegetation adapted to these flood conditions.

Hydric soils develop a grey or sometimes greenish or blue-grey colour, as a result of the chemical reduction of iron (gleying). Hydric soils that are seasonally flooded are characterised by the formation of mottles, which are relatively insoluble, enabling them to remain in the soil long after it has been drained. Consequently, it is possible to identify wetland areas on the basis of soil colour, using a standard colour chart, as matrix hue and chroma decrease, while mottle hue and chroma initially increase and then decrease the more saturated the soils become Table 3-1.

Table 3-1: Relationship between degree of wetness (wetland zone), soil-physiochemistry and vegetation (Kotze *et al*., 1994).

Degree of wetness			
	Temporary	**Seasonal**	**Permanent / Semi-permanent**
Soil Depth (0cm – 10cm)	Matrix chroma: 1-3 Few / no mottles Low / intermediate OM Non-sulphuric	Matrix chroma: 0-2 Many mottles Intermediate OM Seldom sulphuric	Matrix chroma: 0-1 Few / no mottles High OM Often sulphuric
Soil Depth (40cm – 50cm)	Few / many mottles Matrix chroma: 0-2	Many mottles Matrix chroma: 0-2	No / few mottles Matrix chroma: 0-1
Vegetation	Predominantly grass species	Predominantly sedges and grasses	Predominantly reeds and sedges

Vegetation distribution within wetlands is related to the flooding regime. Terrestrial plants are not tolerant of flooding within the root zone for periods long enough to cause anaerobic conditions, and are thus found on drier soil conditions. The distribution of wetland plants is related to their tolerance of different flooding conditions, and their distribution within a system can be used as an indication of the wetness of an area.

Typically, indicators of soil wetness based on soil morphology correspond closely with vegetation distribution, since hydrology affects soils and vegetation in systematic and predictable ways. However, in systems where the hydrological regime has been modified due to human activities, vegetation distribution will not vary systematically with soil morphology. The response of vegetation to alteration of hydrological conditions is rapid (months / years), whereas the response of soil morphology to such alteration is slow (centuries). Therefore, lowering of the water table or reduction of surface flows, may lead to rapid establishment of terrestrial vegetation, whereas the soil morphology will retain indicators of wetness for a lengthy period. Soil morphology forms the basis of wetland delineation nationally, following international protocols, mainly because it provides a long-term indication of the "natural" hydrological regime. However, soil morphology cannot be considered to necessarily reflect the current hydrological conditions of the site where the hydrological regime has been altered, and in such circumstances vegetation provides the best indication of the distribution of wetlands as it best reflects current hydrological conditions (Figure 3.1).

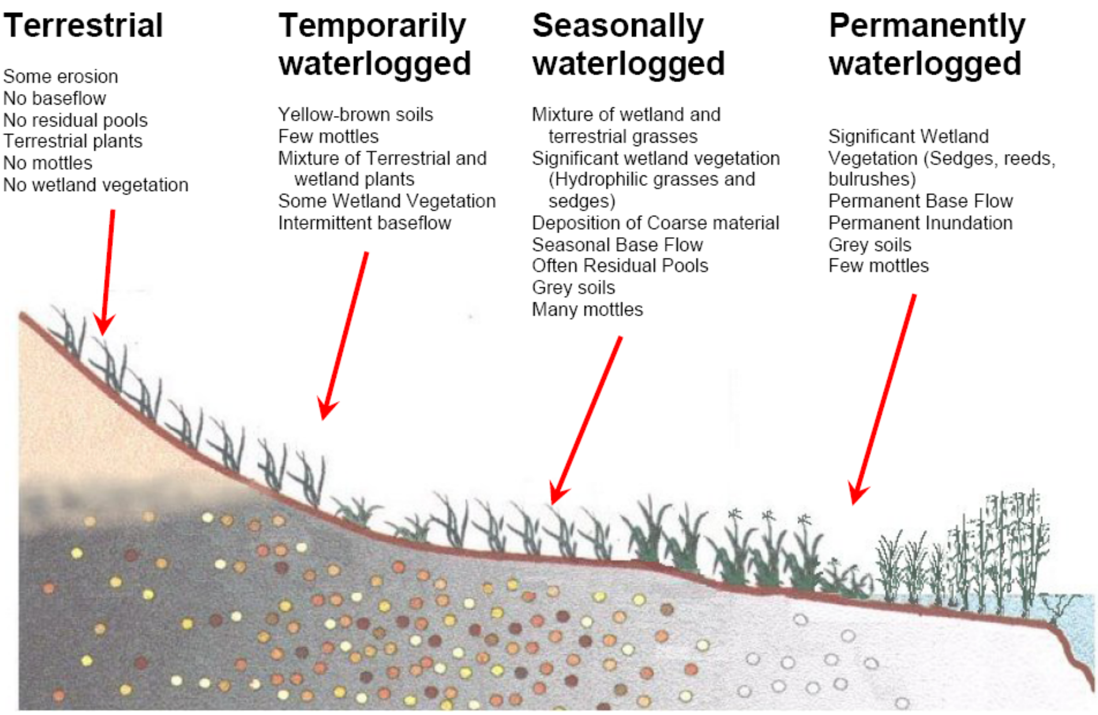

Figure 3.1: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change along a gradient of decreasing wetness, from the middle to the edge of the wetland. (Reproduced by Sivest from Kotze (1996), DWAF Guidelines).

Wetland vegetation is adapted to shallow water table conditions. Due to water availability and rich alluvial soils, wetland areas are usually very productive. Tree growth rate is high and the vegetation under the trees is usually lush and includes a wide variety of shrubs, grasses and wildflowers.

The term 'watercourse' (also water course, water-course) is uncommon as a noun in the field of aquatic science. The norm is to refer to streams and rivers as types of lotic [*flowing as opposed to standing (lentic) water*] aquatic environments. Additionally, it is recognized that lakes, reservoirs and wetlands may form part of the longitudinal continuum between the source(s) of a river, and its final point of discharge. Furthermore, that the stream environment embodies a range of characteristics that define it as such, inter alia the shape and form of the channel bed and banks (hydromophological characteristics), the hydrological regime, as well as the zonation of plant types and tiers that extend from the channel edge to the upland (Harding; 2015).

In the South African legal context the term 'watercourse' has been adopted as a collective synonym for springs, rivers, wetlands, lakes and dams.

National Water Act, Act No 36 of 1998 defines a watercourse as follows:
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 in the Gazette, declare to be a watercourse
and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA definitions of watercourses and wetlands are equally stated in the National Environmental Management Act (NEMA).

The definition of a watercourse expressed in the National Water Act contains a statement that lacks specificity, viz. 'a natural channel or depression in which water flows regularly or intermittently'. As defined and if not placed in context, the aforementioned statement could simplistically imply that any topographical 'channel' or 'depression' that conveys surface water could be deemed a watercourse. It is contended here that the definition intends to refer to geomorphological features that are more substantial than mere drainages, ie that it refers to streams inclusive of their associated biophysical attributes. An examination of international legislation and case law confirms this hypothesis (Harding; 2015).

3.2 EIA Applicable Legislation

3.2.1 National Environmental Management Act (Act No. 107 of 1998) (NEMA)

The proposed development triggers a number of activities in terms of NEMA. These are listed in Table 3-2.

Table 3-2: Listed Activities in terms of NEMA

Government Notice Number	Activity and Listing Number	Description
GN 983 of 4 December 2014	Activity 9, Listing Notice 1	The development of infrastructure exceeding 1 000 m in length for the bulk transportation of storm water
GN 983 of 4 December 2014	Activity 12, Listing Notice 1	The development of infrastructure or structures with a physical footprint of 100 m2 or more; where such development occurs. within 32 m of a watercourse…
GN 983 of 4 December 2014	Activity 19, Listing Notice 1	The infilling or depositing of any material of more than 10 m3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 m3 from a watercourse…
GN 983 of 4 December 2014	Activity 56, Listing Notice 1	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km…
GN 984 of 4 December 2014	Activity 27, Listing Notice 1	The development of a road with a reserve wider than 30 m…
GN 985 of 4 December 2014	Activity 4, Listing Notice 3	The development of a road wider than 4 metres with a reserve less than 13,5 metres.
GN 985 of 4 December 2014	Activity 12, Listing Notice 3	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan
GN 985 of 4 December 2014	Activity 14, Listing Notice 3	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan
GN 985 of 4 December 2014	Activity 18, Listing Notice 3	The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometre, outside urban areas in a protected area identified in terms of NEMPAA… and sensitive areas…
GN 985 of 4 December 2014	Activity 23, Listing Notice 3	The expansion of… a bridge where the bridge is expanded by 10 m2 or more in size…; infrastructure or structures where the physical footprint is expanded by 10 square metres or more… where such development occurs within a watercourse… within 32 metres of a watercourse, measured from the edge of the watercourse… outside urban areas in a protected area identified in terms of NEMPAA… and sensitive areas…

3.3 WULA Applicable Legislation

3.3.1 National Water Act (Act No 36 of 1998) (NWA)

The NWA is the primary regulatory legislation; controlling and managing the use of water resources as well as the pollution thereof and is implemented and enforced by the Department of Human Settlements, Water and Sanitation (DHSWS[1]). Section 21 of the NWA lists water uses that must be licensed unless it is listed in the schedule (existing lawful use) and/or is permissible under a general authorisation, or if a responsible authority waives the need for a Water Use Licence.

The following listed water uses that require a Water Use License according to Section 21 of the NWA are triggered for the proposed project:

- Section 21(a): taking water from a water resource
- Section 21(c): impeding or diverting the flow of water in a watercourse
- Section 21 (i): altering the bed, banks, course or characteristics of a watercourse.

A Water Use Licence Application (WULA) will be undertaken.

[1] Previously referred to as the Department of Water and Sanitation (DWS)

4 METHODOLOGY

4.1 Wetland Assessment

4.1.1 Desktop Assessment

A preliminary delineation of the Wetland boundary was undertaken using aerial photograph interpretation. Historical records and reports were consulted. The Department of Human Settlements, Water and Sanitation (DHSWS) database was also consulted to obtain historical data for the study area. The National Wetland Map version 5 (NWM5) as presented by South African National Biodiversity Institute (SANBI) was also scrutinised (Van Deventer *et al*, 2019). Historical data and official approvals were also consulted during the assessment.

4.1.2 Field Investigation

The field investigations were undertaken during **October 2019 and January 2020** to assess and corroborate the delineated Wetland zones present on the survey area.

The field procedure for the wetland delineation was conducted according to the Guidelines for delineating the boundaries of a wetland set out by the Department of Water Affairs and Forestry (DWAF 2005/8). Due to the transitional nature of wetland boundaries, the different wetland zones are often not clearly apparent. However, the wetland edge can be determined accurately. The delineations are based on scientifically defensible criteria and are aimed at providing a tool to facilitate the decision-making process regarding the assessment of the significance of impacts that may be associated with the proposed developments.

The wetlands were delineated by considering the following wetland indicators (DWAF 2005/8):

- Terrain unit indicator helps identifying those parts of the landscape where wetlands are most likely to occur. Wetlands occupy characteristic positions in the landscape and can occur on the following terrain units: crest, midslope, footslope, and valley bottom;
- Soil wetness indicator identifies the morphological signatures developed in the soil profile as a result of prolonged and frequent saturation; and
- The vegetation indicator identifies hydrophytic vegetation associated with frequently saturated soils.

The following procedure was followed during the delineation of the wetland boundaries and zones:

- A desktop delineation of the larger wetland area was undertaken using satellite imagery of the study site;
- Areas for verification were identified; and
- Identified areas were then assessed in the field with boundaries being recorded using a GPS.

4.1.3 Mapping

Mapping of the wetland boundaries was done by computerised processing utilising GPS tools and GIS modelling.

4.2 Wetland Classification

SANBI's "Further development of a proposed National Classification System for South Africa" was used to verify the classification of the wetlands within the study area (SANBI, 2009). The wetlands were classified up to level four, which includes the system, regional setting, landscape unit and hydrogeomorphic unit.

Table 4-1: Wetland classification level 1 - 4.

Level 1: System	Level 2: Regional setting	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit			
Connectivity to open ocean	**Ecoregion**	**Landscape setting**	**HGM type**	**Longitudinal zonation / landform**	**Drainage - outflow**	**Drainage - inflow**
			A	**B**	**C**	**D**
INLAND	DWAF Level 1 Ecoregions	SLOPE	Channel (river)	Mountain headwater stream	Not applicable	Not applicable
				Mountain stream	Not applicable	Not applicable
				Transitional river	Not applicable	Not applicable
				Rejuvenated bedrock fall	Not applicable	Not applicable
			Hillslope seep	Not applicable	With channel inflow	Not applicable
					Without channel inflow	Not applicable
			Depression	Not applicable	Exorheic	With channel inflow
						Without channel inflow
					Endorheic	With channel inflow
						Without channel inflow
					dammed	With channel inflow
						Without channel inflow
		VALLEY FLOOR	Channel (river)	Mountain stream	Not applicable	Not applicable
				Transitional river	Not applicable	Not applicable
				Rejuvenated bedrock fall	Not applicable	Not applicable
				Upper foothill river	Not applicable	Not applicable
				Lower foothill river	Not applicable	Not applicable
				Lowland river	Not applicable	Not applicable
				Rejuvenated foothill river	Not applicable	Not applicable
				Upland floodplain river	Not applicable	Not applicable
				Valley-bottom depression	Not applicable	Not applicable

Level 1: System	Level 2: Regional setting	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit			
			Channelled valley-bottom wetland	Valley-bottom flat	Not applicable	Not applicable
			Unchannelled valley-bottom wetland	Valley-bottom depression	Not applicable	Not applicable
				Valley-bottom flat	Not applicable	Not applicable
			Floodplain wetland	Floodplain depression	Not applicable	Not applicable
				Floodplain flat	Not applicable	Not applicable
			Depression	Not applicable	Exorheic	With channel inflow
						Without channel inflow
					Endorheic	With channel inflow
						Without channel inflow
					dammed	With channel inflow
						Without channel inflow
			Valleyhead seep	Not applicable	Not applicable	Not applicable
		PLAIN	Channel (river)	Lowland river	Not applicable	Not applicable
				Upland floodplain river	Not applicable	Not applicable
			Floodplain wetland	Floodplain depression	Not applicable	Not applicable
				Floodplain flat	Not applicable	Not applicable
			Unchannelled valley-bottom wetland	Valley-bottom depression	Not applicable	Not applicable
				Valley-bottom flat	Not applicable	Not applicable
			Depression	Not applicable	Exorheic	With channel inflow
						Without channel inflow
					Endorheic	With channel inflow
						Without channel inflow
			Flat	Not applicable	Not applicable	Not applicable
		BENCH (Hilltop/saddle/shelf)	Depression	Not applicable	Exorheic	With channel inflow
						Without channel inflow
					Endorheic	With channel inflow
						Without channel inflow
			Flat	Not applicable	Not applicable	Not applicable

The Hydrogeomorphic wetland units identified will be describe individually as per Marneweck and Batchelor (Marneweck & Batchelor; 2002).

4.3 Present Ecological Status (PES) assessment

WET-Health assists in assessing the health of wetlands using indicators based on geomorphology, hydrology and vegetation. WET-Health is tailored specifically for South African conditions and has wide application, including assessing the Present Ecological State of a wetland for purposes of Ecological Reserve determination in terms of the National Water Act, and for environmental impact assessments WET-Health (Macfarlane *et al*, 2008). A level 1 wetland assessment was undertaken to determine the PES of the wetland system.

The PES assessment is concluded by following a 5 step process:

1. Divide the wetland into HGM units
2. Assess hydrological health of the wetland
3. Assess geomorphological health
4. Assess vegetation health of the wetland
5. Represent the health scores for the overall wetland

Table 4-2: Outline of steps involved in the Level 1 assessment (Macfarlane *et al*, 2008).

Step 1	**Divide the wetland into HGM units**
↓	
Step 2	**Assess hydrological health of the wetland**
• Step 2A	Evaluate changes to water input characteristics from the catchment
• Step 2B	Evaluate changes to water distribution and retention patterns with the wetland
• Step 2C	Determine the hydrological State of the wetland based on integrating scores from individual HGM Units
• Step 2D	Determine the overall Present Hydrological State of the wetland based on integrating scores from individual HGM Units
• Step 2E	Assess the anticipated trajectory of change of the wetland hydrology
↓	
Step 3	**Assess geomorphological health**
• Step 3A	Determine the Present Geomorphic State of the Individual HGM units
• Step 3B	Determine the overall Present Geomorphic State of the wetland based on integrating scores from individual HGM Units
• Step 3C	Assess the anticipated trajectory of change of the geomorphology of the overall wetland
↓	
Step 4	**Assess vegetation health of the wetland**
• Step 4A	Familiarisation with the general structure and composition of wetland vegetation in the area
• Step 4B	Identify and estimate the extent of disturbance classes
• Step 4C	Assess the changes to vegetation composition in each class, and integrate these for the overall HGM Unit
• Step 4D	Determine the overall Present Vegetation State based on integrating scores from individual HGM Units
• Step 4E	Assess the anticipated trajectory of change of wetland vegetation
↓	
Step 5	**Represent the health scores for the overall wetland**

The Present Ecological State (PES) categories are given in Table 4-3.

Table 4-3: PES categories (Macfarlane *et al*, 2008).

Description of Ecological Category	Combined impact score	PES Category
Unmodified / Natural	0-0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

The determination of the probable Trajectory of Change of the wetland is also evaluated. This is rated and presented as indicated in Table 4-4.

Table 4-4: Trajectory of Change classes, scores and symbols used to represent anticipated changes to wetland integrity (Macfarlane *et al*, 2008).

Trajectory class	Description	Change score	Class Range	Symbol
Improve markedly	Condition is likely to improve substantially over the next five years	2	1.1 to 2.0	↑↑
Improve	Condition is likely to improve over the next 5 years	1	0.3 to 1.0	↑
Remain stable	Condition is likely to remain stable over the next 5 years	0	-0.2 to +0.2	→
Deterioration slight	Condition is likely to deteriorate slightly over the next 5 years	-1	-0.3 to -1.0	↓
Deterioration substantial	Condition is likely to deteriorate substantially over the next 5 years	-2	-1.1 to -2.0	↓↓

4.4 Wetland Ecological Importance and Sensitivity (EIS)

The ecological importance and sensitivity assessment were conducted according to the guidelines as discussed by DWAF (1999). DWAF defines "ecological importance" of a water resource as an expression of its importance to the maintenance of ecological diversity and function on local and wider scales. "Ecological sensitivity", according to DWAF (1999), refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The Ecological Importance and Sensitivity (EIS) analysis provides a guideline for the determination of the Ecological Management Class (EMC).

In the method outlined by DWAF (1999) a series of determinants for EIS are assessed for the wetlands on a scale of 0 to 4 (Table 4-5), where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to determine the EIS and EMC of the wetland unit (Table 4-6).

Table 4-5: Score sheet for the determination of ecological importance and sensitivity (DWAF, 1999).

Determinant	Score	Confidence
Primary determinants		
Rare and endangered species		
Species / taxon richness		
Diversity of Habitat types or features		
Migration route / breeding and feeding site for wetland species		
Sensitivity to changes in the natural hydrological regime		
Sensitivity to water quality changes		
Flood storage, energy dissipation and particulate / element removal		
Modifying determinants		
Protected status		
Ecological integrity		

Score guideline: 4 = Very High; 3 = High; 2 = Moderate; 1 = Marginal / Low; 0 = None. Confidence rating: 4 = Very High Confidence; 3 = High Confidence; 2 = Moderate Confidence; 1 = Marginal / Low Confidence.

Table 4-6: Ecological Importance and Sensitivity (EIS) categories and the interpretation of median scores for biotic and habitat determinants (DWAF, 1999).

Range of Median	EIS Category	Category Description	Ecological Management Class
>3 and ≤4	**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. They play a major role in moderating the quantity and quality of water of major rivers.	**A**
>2 and ≤3	**High**	Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water in major rivers.	**B**
>1 and ≤2	**Moderate**	Wetlands that are to be considered ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	**C**
>0 and ≤1	**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. They play an insignificant role in moderating the quantity and quality of water of major rivers.	**D**

4.5 Recommended Ecological Category (REC)

"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." (DWAF, 1999).

The Recommended Ecological Category (REC) is determined based on the results obtained from the Present Ecological State (PES), reference conditions and Ecological Importance and Sensitivity (EIS) of the aquatic resource. This is then followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

A system may receive the same class for the PES, as the REC if the system is deemed to be 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 to enhance the PES of the riparian system (Table 4-7).

Table 4-7: Recommended Ecological Category (REC) classes.

Class (% of total)	Description
A	Unmodified, natural.
B	Largely natural with few modifications.
C	Moderately modified.
D	Largely modified.

4.6 Impact Assessment Methodology

As standardized impact assessment methodology was utilized to determine the impacts associated with the proposed installation. A summary of this methodology is provided below.

The **significance** of an impact is defined as the combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The nature and type of impact may be direct or indirect and may also be positive or negative, refer to Table 4-8: below for the specific definitions.

Table 4-8: Nature and type of impact.

	Nature and Type of Impact:		
IMPACT	**Direct**	Impacts that are caused directly by the activity and generally occur at the same time and place as the activity	✓/✗
	Indirect	Indirect or induced changes that may occur as a result of the activity. These include all impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity	✓/✗
	Cumulative	Those impacts associated with the activity which add to, or interact synergistically with existing impacts of past or existing activities, and include direct or indirect impacts which accumulate over time and space	✓/✗
	Positive	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will benefit significantly, and includes neutral impacts (those that are not considered to be negative	✓
	Negative	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will be comprised	✗

Table 4-9 presents the defined criteria used to determine the **consequence** of the impact occurring which incorporates the extent, duration and intensity (severity) of the impact.

Table 4-9: Consequence of the Impact occurring.

CONSEQUENCE	**Extent of Impact:**	
	Site	Impact is limited to the site and immediate surroundings, within the study site boundary or property (immobile impacts)
	Neighbouring	Impact extends across the site boundary to adjacent properties (mobile impacts)
	Local	Impact occurs within a 5km radius of the site
	Regional	Impact occurs within a provincial boundary
	National	Impact occurs across one or more provincial boundaries
	Duration of Impact:	
	Incidental	The impact will cease almost immediately (within weeks) if the activity is stopped, or may occur during isolated or sporadic incidences
	Short-term	The impact is limited to the construction phase, or the impact will cease within 1 - 2 years if the activity is stopped
	Medium-term	The impact will cease within 5 years if the activity is stopped
	Long-term	The impact will cease after the operational life of the activity, either by natural processes or by human intervention
	Permanent	Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient
	Intensity or Severity of Impact:	
	Low	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are not affected
	Low-Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are modified insignificantly
	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are altered
	Medium-High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes are severely altered
	High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will permanently cease

The probability of the impact occurring is the likelihood of the impacts actually occurring, and is determined based on the classification provided in Table 4-10.

Table 4-10: Probability and confidence of impact prediction.

PROBABILITY	**Probability of Potential Impact Occurrence:**	
	Improbable	The possibility of the impact materialising is very low either because of design or historic experience
	Possible	The possibility of the impact materialising is low either because of design or historic experience
	Likely	There is a possibility that the impact will occur
	Highly Likely	There is a distinct possibility that the impact will occur
	Definite	The impact will occur regardless of any prevention measures

The significance of the impact is determined by considering the consequence and probability without taking into account any mitigation or management measures and is then ranked according to the ratings listed in Table 4-11.

Table 4-11: Significance rating of the impact.

	Significance Ratings:	
SIGNIFICANCE	**Low**	Neither environmental nor social and cultural receptors will be adversely affected by the impact. Management measures are usually not provided for low impacts
	Low-Medium	Management measures are usually encouraged to ensure that the impacts remain of Low-Medium significance. Management measures may be proposed to ensure that the significance ranking remains low-medium
	Medium	Natural, cultural and/or social functions and processes are altered by the activities, and management measures must be provided to reduce the significance rating
	Medium-High	Natural, cultural and/or social functions and processes are altered significantly by the activities, although management measures may still be feasible
	High	Natural, cultural, and/or social functions and processes are adversely affected by the activities. The precautionary approach will be adopted for all high significant impacts and all possible measures must be taken to reduce the impact

The level of confidence associated with the impact prediction is also considered as low, medium or high (Table 4-12:).

Table 4-12: Level of confidence of the impact prediction.

	Level of Confidence in the Impact Prediction:	
CONFIDENCE	**Low**	Less than 40% sure of impact prediction due to gaps in specialist knowledge and/or availability of information
	Medium	Between 40 and 70% sure of impact prediction due to limited specialist knowledge and/or availability of information
	High	Greater than 70% sure of impact prediction due to outcome of specialist knowledge and/or availability of information

Once significance rating has been determined for each impact, management and mitigation measures must be determined for all impacts that have a significance ranking of Medium and higher in order to attempt to reduce the level of significance that the impact may reflect.

The EIA Regulations, 2014 specifically require a description is provided of the degree to which these impacts:

- can be reversed;
- may cause irreplaceable loss of resources; and
- can be avoided, managed or mitigated.

Based on the proposed mitigation measures, the mitigation efficiency is also determined (Table 4-13) whereby the initial significance is re-evaluated and ranked again to effect a significance that incorporates the mitigation based on its effectiveness. The overall significance is then re-ranked and a final significance rating is determined.

Table 4-13: Mitigation efficiency.

MITIGATION EFFICIENCY	Mitigation Efficiency		
	None	Not applicable	
	Very Low	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact. Positive impacts will remain the same	
	Low	Where the significance rating reduces by one level, after mitigation	
	Medium	Where the significance rating reduces by two levels, after mitigation	
	High	Where the significance rating reduces by three levels, after mitigation	
	Very High	Where the significance rating reduces by more than three levels, after mitigation	

The reversibility is directly proportional to the "Loss of Resource" where no loss of resource is experienced, the impact is completely reversible; where a substantial "Loss of resource" is experienced there is a medium degree of reversibility; and an irreversible impact relates to a complete loss of resources, i.e. irreplaceable (Table 4-14).

Table 4-14: Degree of reversibility and loss of resources.

DEGREE REVERSABILITY & LOSS OF RESOURCES	Loss of Resources:		
	No Loss	No loss of social, cultural and/or ecological resource(s) are experienced. Positive impacts will not experience resource loss	
	Partial	The activity results in an insignificant or partial loss of social, cultural and/or ecological resource(s)	
	Substantial	The activity results in a significant loss of social, cultural and/or ecological resource(s)	
	Irreplaceable	The activity results in the complete and irreplaceable social, cultural and/or ecological loss of resource(s)	
	Reversibility:		
	Irreversible	Impacts on natural, cultural and/or social functions and processes are irreversible to the pre-impacted state in such a way that the application of resources will not cause any degree of reversibility	
	Medium Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if less than 50% resources are applied	
	High Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if more than 50% resources are applied	
	Reversible	Impacts on natural, cultural and/or social functions and processes are fully reversible to the pre-impacted state if adequate resources are applied	

4.7 Consultation Process

Consultation as part of the overall environmental authorization process is being undertaken by Prism EMS (EAP). Prism EMS, wetland specialist consulted with:

- The EAP
- Department of Human Settlements, Water and Sanitation (DHSWS)
- The Professional Team

5 ASSUMPTIONS, GAPS AND LIMITATIONS

The study was limited to a snapshot view during a few site visits. The field investigations were undertaken during October 2019 and January 2020 to assess and confirm the delineated Wetland zones present on the survey area. Weather conditions during the survey were favourable for recordings. The delineations were recorded by hand held GPS.

It must be noted that, during the process of converting spatial data to final output drawings, several steps are followed that may affect the accuracy of areas delineated. Due care has been taken to preserve accuracy. Printing or other forms of reproduction may also distort the scale indicated in maps. It is therefore suggested that the wetland areas identified in this report be pegged in the field in collaboration with the surveyor for precise boundaries.

It is unlikely that more surveys would alter the outcome of this study radically.

6 RESULTS AND FINDINGS

6.1 Wetland Delineation

6.1.1 Desktop Assessment

During the desktop investigation, three (3) possible area where wetlands or drainage lines could occur was identified on or in close proximity to the study site that would be affected by the proposed development activities.

The National Wetland Map version 5 (NWM5) as presented by SANBI (Van Deventer *et al.,* 2019) as well the NFEPA Wetlands layer was also scrutinised and one wetland area was identified (refer to Figure 6.3) on or in close proximity to the study site that could be affected by the proposed activities. These wetlands as indicated by the NWM5 and NFEPA wetland layers were further investigated on site.

6.1.2 Field Assessment

The field investigations were undertaken during October 2019 and January 2020 to assess and confirm the possible Wetland and Drainage lines present on the survey area.

The field investigations concluded that no natural wetland unit could be recorded as per the DWAF, 2005 guidelines and that three drainage areas could be affected by the proposed development (Figure 6.4).

These naturally occurring drainages are not streams, as they do not have the morphological structure, nor the duration of water retention or links to the adjacent aquatic zones, such as floodplains or riparian wetlands. They are simply temporary drainage lines acting as temporary flow paths during rainfall events. They also resemble the adjacent terrestrial zones.

6.1.2.1 Wetland Indicators

6.1.2.1.1 Terrain Unit Indicator

Terrain unit indicator helps identify those parts of the landscape where wetlands and drainage lines are most likely to occur. Wetlands occupy characteristic positions in the landscape and can occur on the following terrain units:

- crest,
- midslope,
- footslope, and
- valley bottom.

No wetlands were recorded in the study area. The study area presented rivers and drainage lines. Refer to the Aquatic Resource Baseline Assessment (21935_B_AQUA_2) as a separate report investigating the impacts on the Rivers in the study area.

Refer to Table 6-1 and section 4.2 Wetland Classification for the classification of the terrain unit.

Table 6-1: Wetland Classification

Level 1: System	**Level 2: Regional setting**	**Level 3: Landscape unit**	**Level 4: Hydrogeomorphic (HGM) unit**	
Connectivity to open ocean	**Ecoregion**	**Landscape setting**	**HGM type**	**Longitudinal zonation / landform**
			A	**B**
INLAND	Northern Escarpment Mountains (Ecoregion 10) as well as a small section in the North Eastern Highlands (Ecoregion 4)	SLOPE	N/A – *Drainage lines recorded*	N/A

6.1.2.1.2 Soil Form and Soil Wetness Indicator

Soil erodibility in hydrologically transformed environments contributes to the difficulties to precisely determining wetland boundaries. This investigation focussed on the delineation of the wetland features based on soil hydro-morphology and landscape hydrology as observed in the catchment and on the site.

Soils were found to be of a low clay content in general. Mostly sandy soils were present especially in the top 150mm. Typical soils observed (Figure 6.1). No clear wetland soil characteristics were observed. It was observed that interflow and sub-lateral flow patterns do occur and is linked to sheet flow from the catchment and drainage lines. This is typical to the topography of the area.

These naturally occurring drainages are not streams, as they do not have the morphological structure, nor the duration of water retention or links to the adjacent terrestrial zone, such as floodplains or riparian wetlands. They are simply temporary drainage lines acting as temporary flow paths.

Figure 6.1: Soil observed.

6.1.2.1.3 Vegetation Indicator

Upon the assessment of the area, the vegetation components were assessed and recorded. Dominant species were characterised as either wetland species or terrestrial species. No representative hydrophytic vegetation species were observed. Predominantly grass, sedge and tree species were recorded. This unit was predominantly utilised to assess the site conditions related to wetland and drainage units.

Figure 6.2: Vegetation observed linked to the drainage lines

6.1.3 Mapping

Figure 6.3 indicates the National Wetland Map version 5 (NWM5) as presented by SANBI (Van Deventer *et al.,* 2019) and NFEPA Wetlands (Nel; 2011). NWM5 indicates no wetland recorded in close proximity to the site, but the NFEPA Wetlands Layer indicate one wetland to the west of the study site.

Figure 6.4 serves to conceptually present flow accumulation in the system as modelled by use of Geographic Information System (GIS).

Figure 6.5 serves to conceptually present quantitative flow in the system as modelled by use of Geographic Information System (GIS).

Figure 6.6 serves to conceptually present the location of the drainage lines that could be affected by the proposed development activities on the site.

The drainage lines indicated in Figure 6.6 are recorded and presented to further assist with management of stormwater and surface water flow over the landscape.

Figure 6.7 presents the conservation buffer zones that are applicable and should be considered during the development to ensure appropriate mitigation and management of the activities.

A 32m buffer was applied to the drainage lines that is in line with the National Environmental Management Act (NEMA) listed activities and the biodiversity and mapping requirements. The conservation buffer should be utilised as the control area and will be adequate to assist with management and mitigation during the construction and operation phase.

Also, refer to the associated digital files presenting the drainage boundaries to allow for further planning of the layout of the proposed activity.

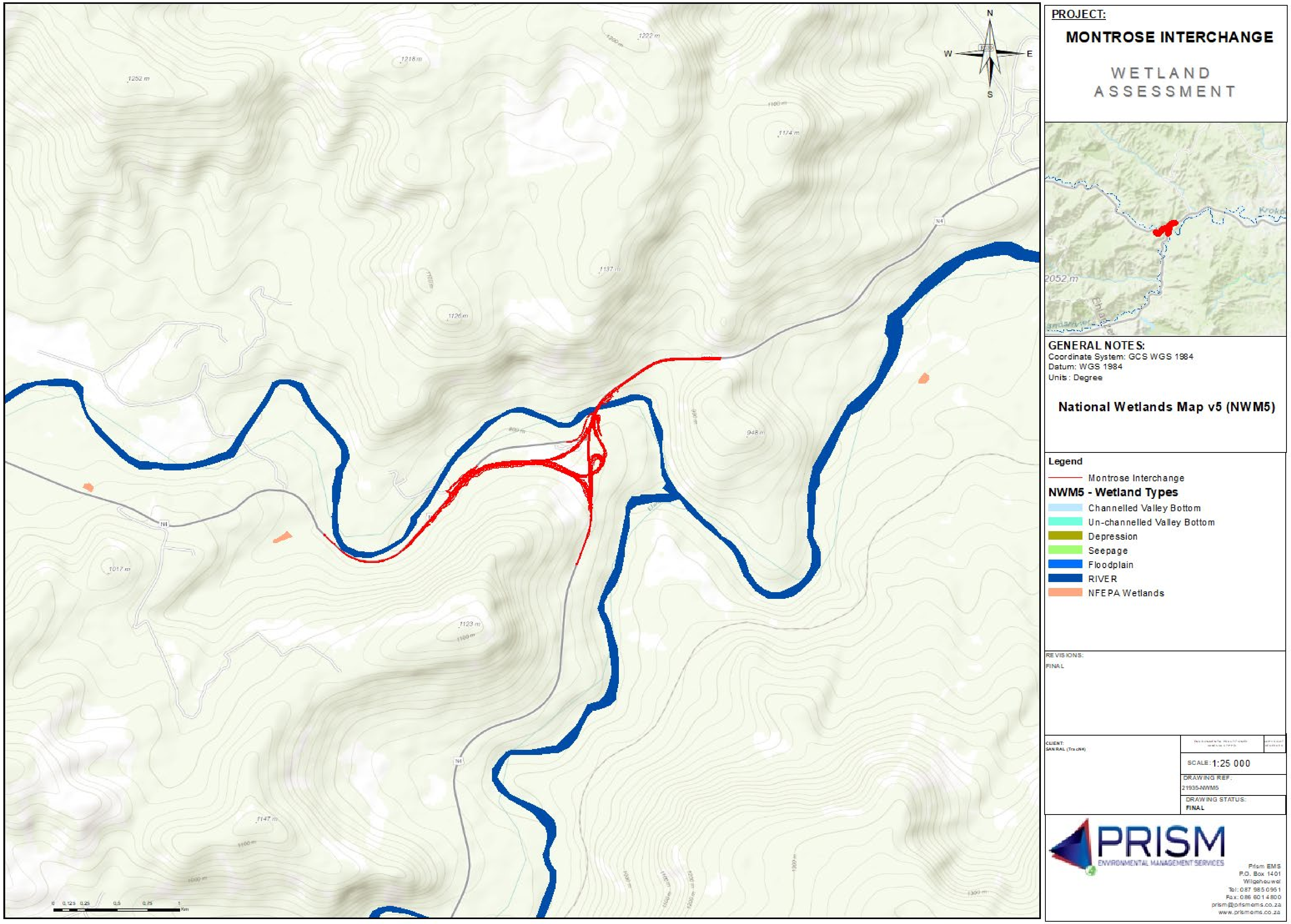

Figure 6.3: National Wetland Map version 5 (NWM5) (Van Deventer *et al.*, 2019) & NFEPA Wetlands (Nel, 2011).

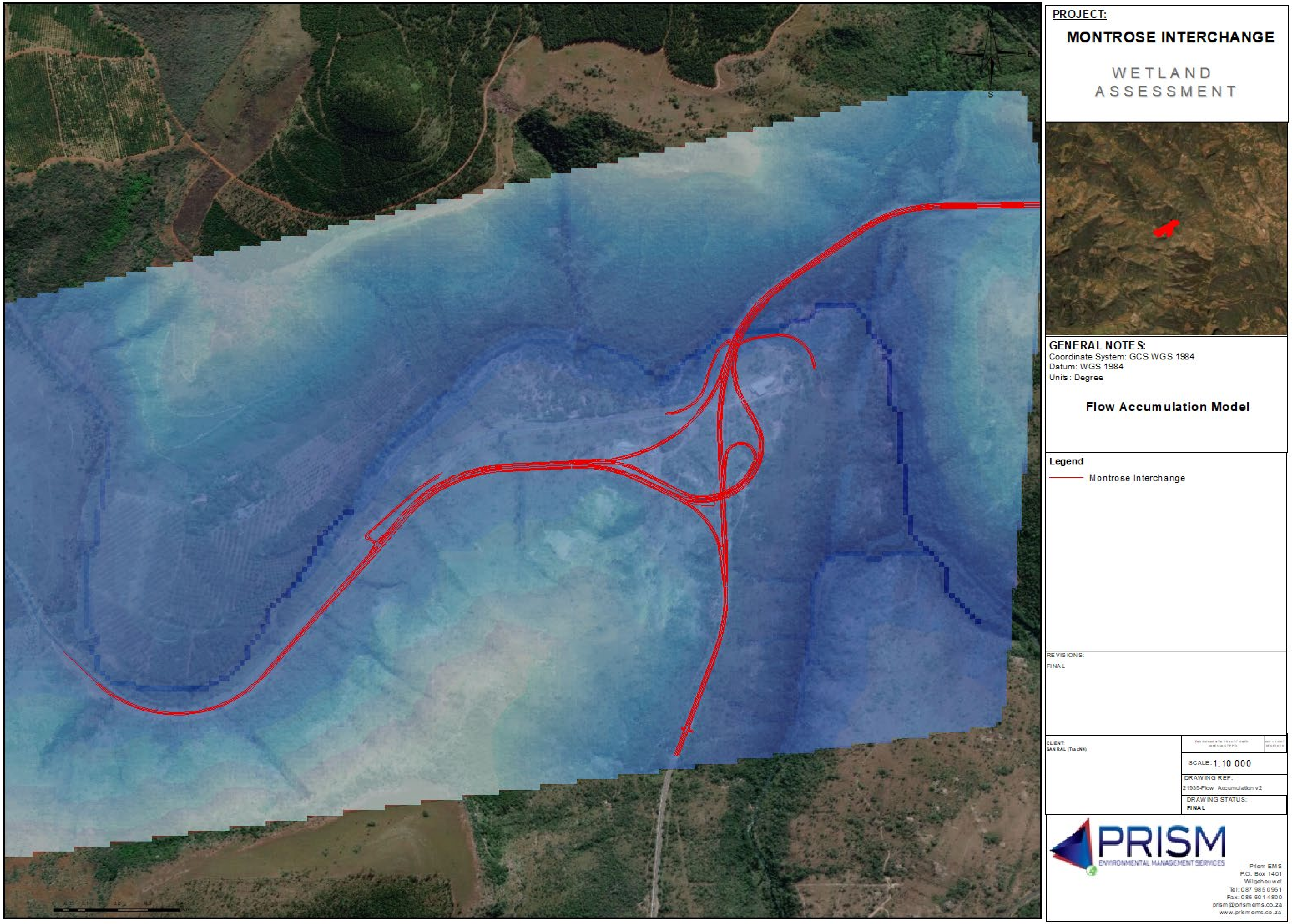

Figure 6.4: Flow Accumulation Model

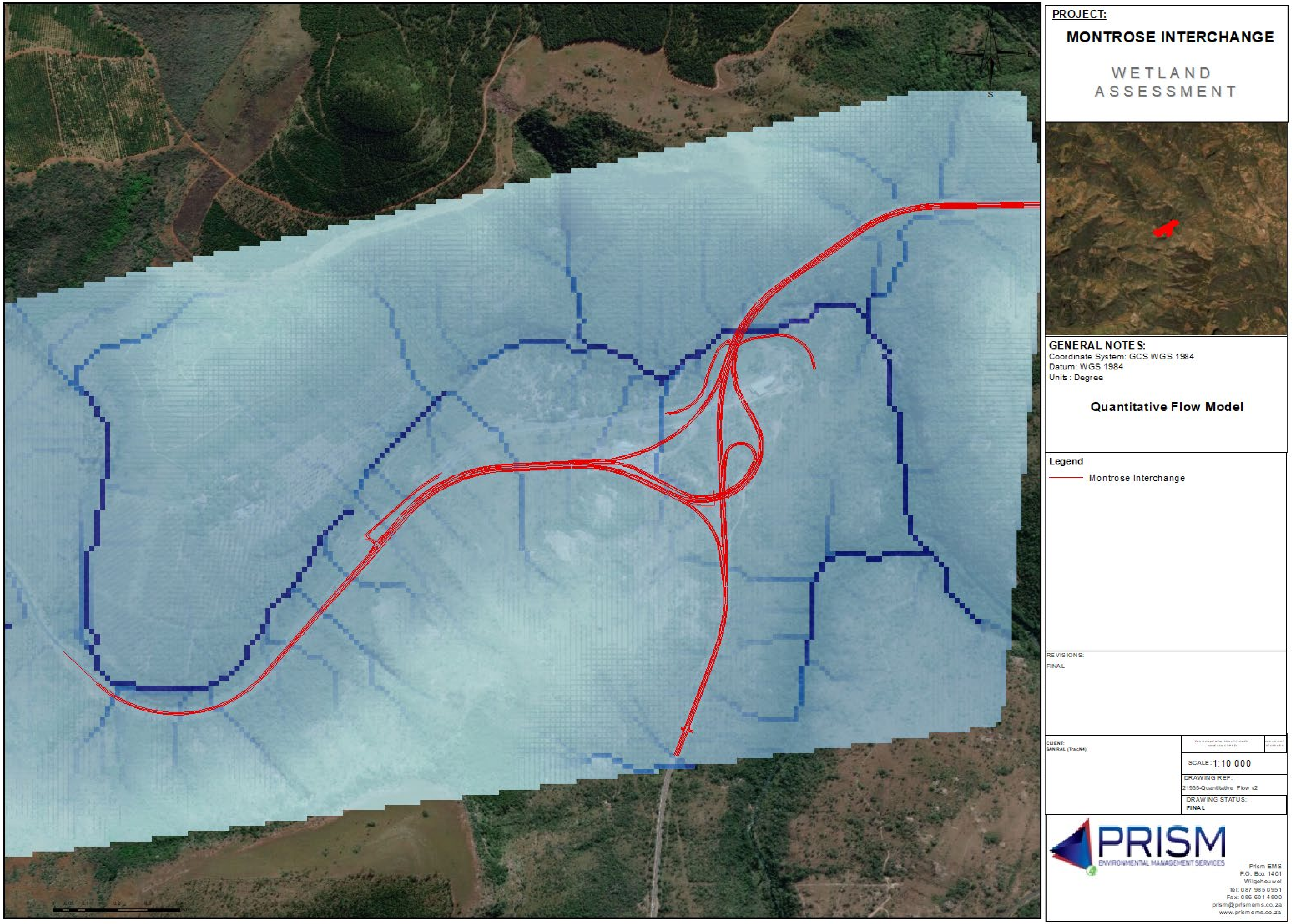

Figure 6.5: Quantitative Flow Model

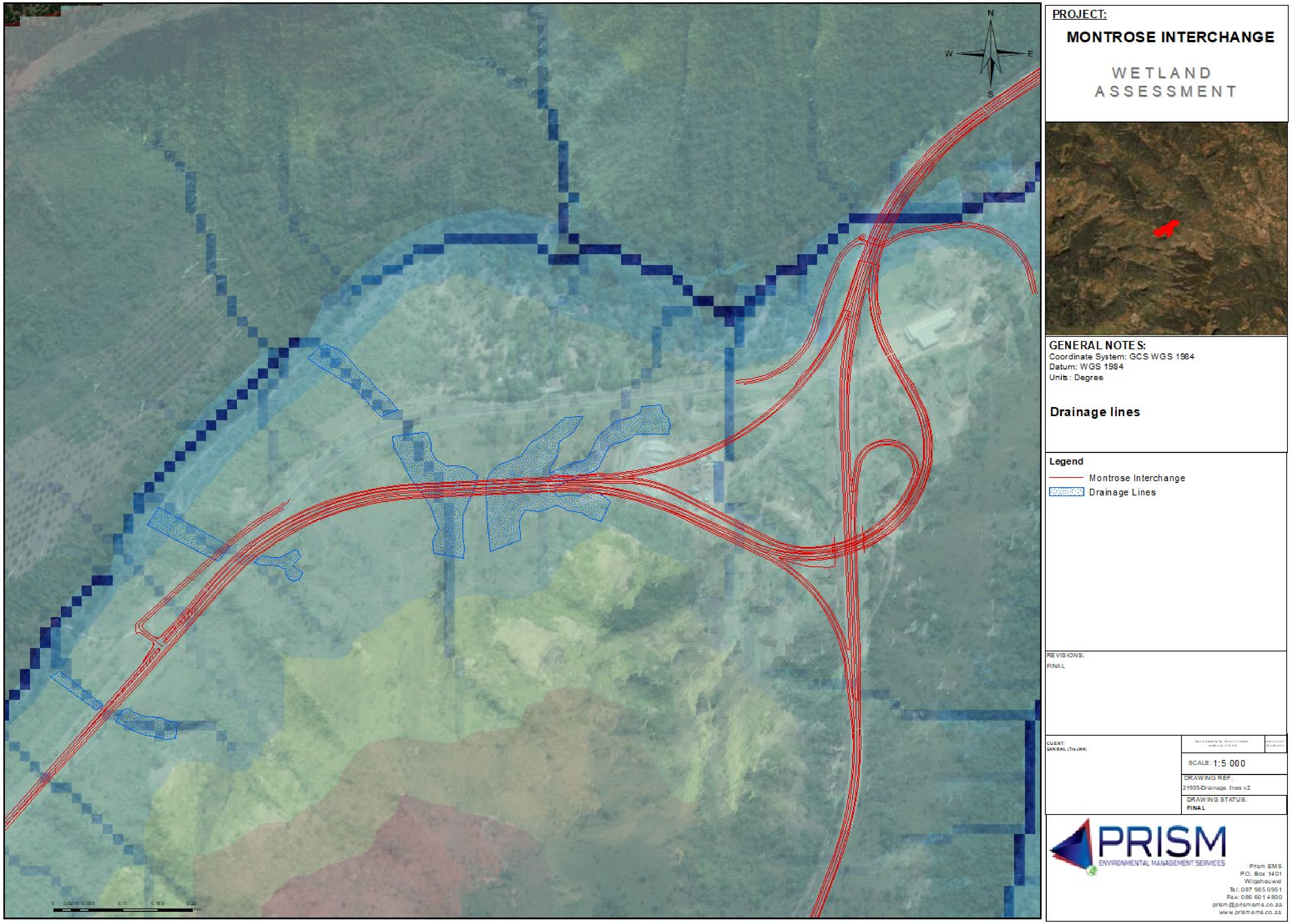

Figure 6.6: Drainage Line Delineation

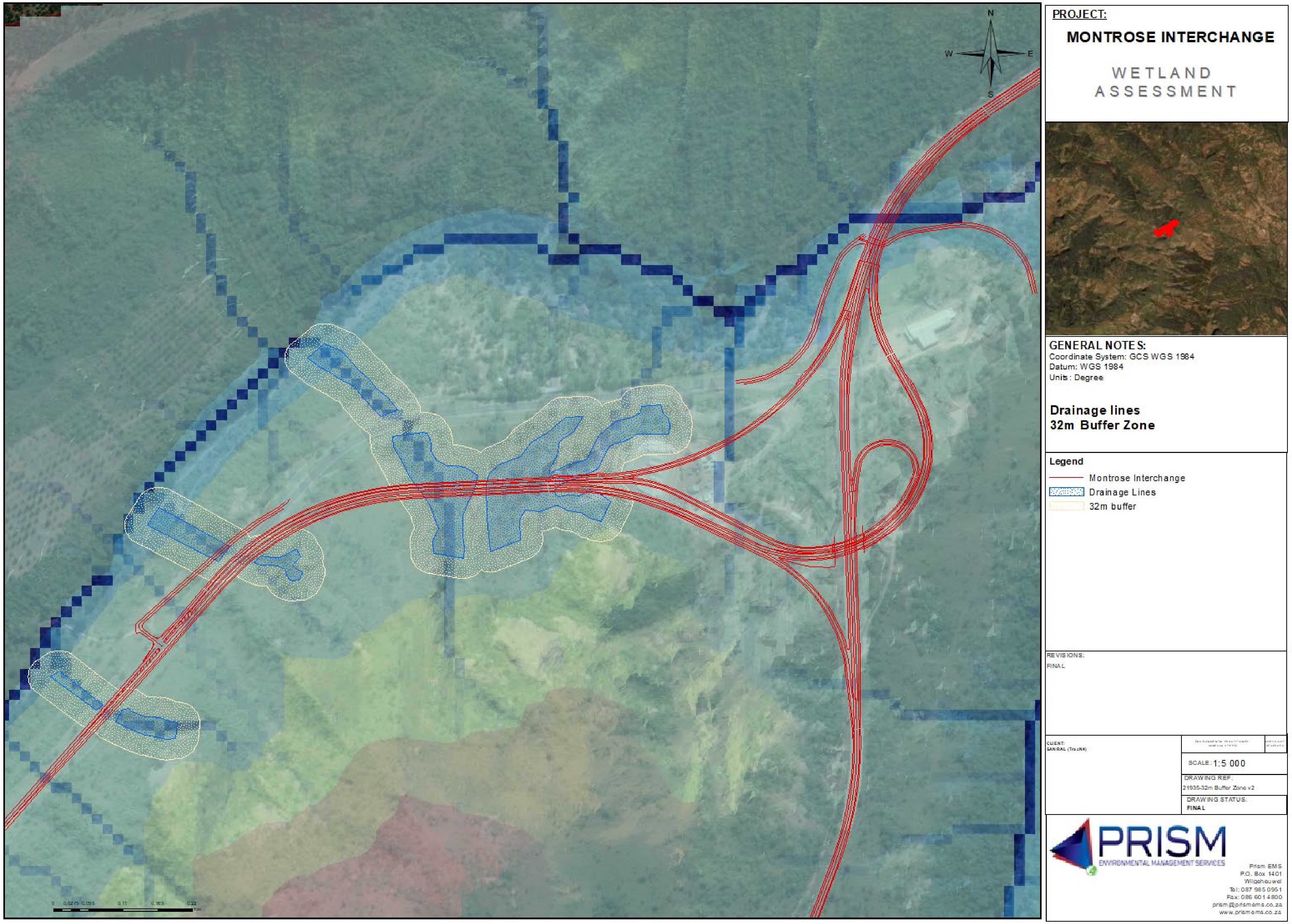

Figure 6.7: Buffer Zones.

6.2 Wetland Classification

SANBI's classification for wetlands are used to classify the wetland units within the study area (SANBI, 2009). The units were classified up to level four, which includes the system, regional setting, landscape unit and Hydrogeomorphic (HGM) unit. Figure 6.8 conceptually present the HGM units (Marneweck and Batchelor, 2002).

Three drainage lines were identified during the field investigation.

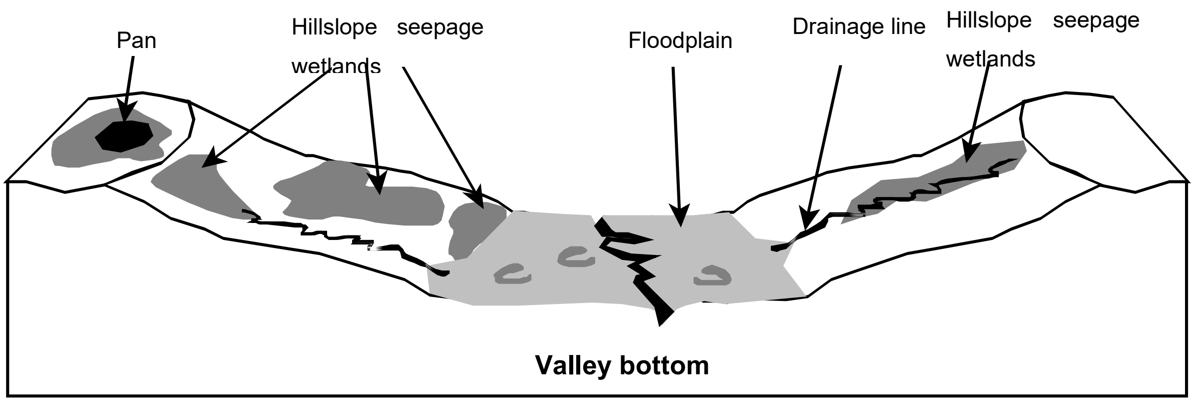

Figure 6.8: Wetland hydrogeomorphic (HGM) classification (Marneweck and Batchelor, 2002).

6.2.1 Drainage Lines

Three drainage lines, representative of overland inflow, were identified in the study area. Figure 6.9 diagrammatically illustrates the HGM unit.

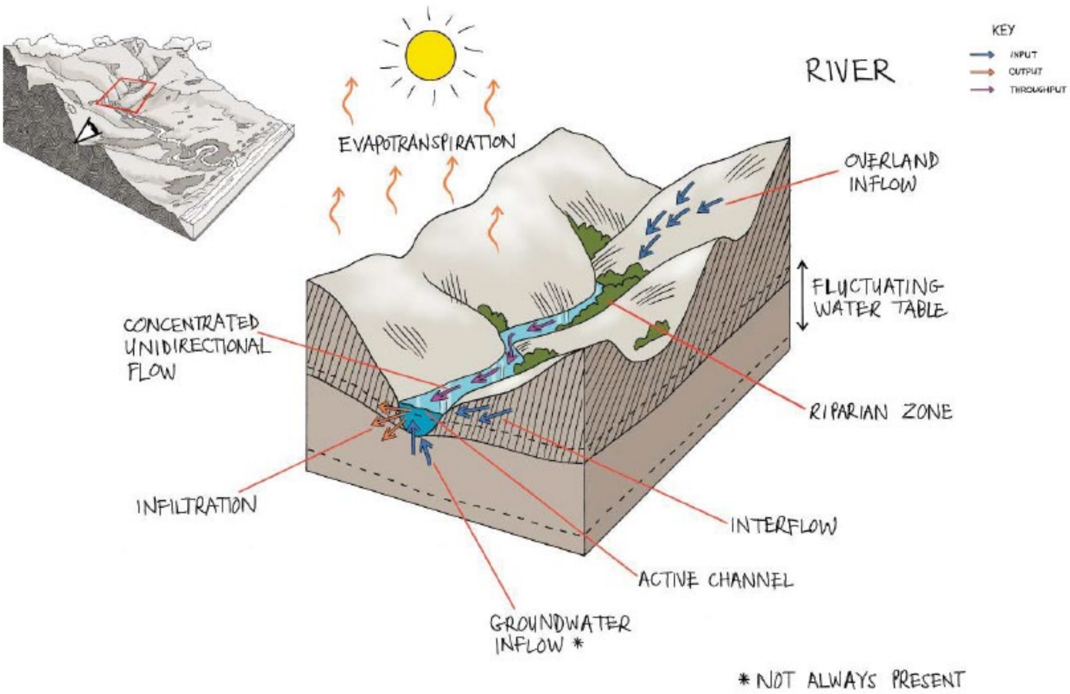

Figure 6.9: Overland flow linked to Rivers (SANBI; 2013)

6.3 Present Ecological Status (PES)

An assessment based on the principles of the level 1 WET-health wetland assessment was undertaken to determine the PES of the drainage lines.

The drainage lines are all largely natural with few moderate modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. They can all be classified as falling into the category B/C. The trajectory of change will remain stable over the next five years should no activity take place and no intervention in terms of rehabilitation is implemented.

6.4 Ecological Importance and Sensitivity (EIS)

The ecological importance and sensitivity assessment were conducted according to the guidelines as discussed by DWAF (1999). DWAF defines "ecological importance" of a water resource as an expression of its importance to the maintenance of ecological diversity and function on local and wider scales. "Ecological sensitivity", according to DWAF (1999), refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The Ecological Importance and Sensitivity (EIS) analysis provides a guideline for the determination of the Ecological Management Class (EMC).

An assessment based on the principles of the ecological importance and sensitivity assessment were conducted according to the guidelines as discussed by DWAF (1999). It was found that the drainage lines are considered ecologically important and sensitive on local scale. The biodiversity of these drainage lines is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers. The drainage lines were classified to fall in the moderate class: EIS = C.

6.5 Recommended Ecological Category (REC)

The Recommended Ecological Category (REC) is determined based on the results obtained from the Present Ecological State (PES), reference conditions and Ecological Importance and Sensitivity (EIS) of the aquatic resource. This is then followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

The drainage lines will be impacted by the proposed development activities. This impact will be localised and at the transitional point leading from the development and infrastructure installations into the drainage lines. It will in all likelihood regress slightly in terms of its current Ecological Category if not managed in specific during the construction period. Stormwater management for the site is required in specific the construction phase. This will mitigate the impact on the drainage lines. Rehabilitation of the impacts and maintenance of the system will further mitigate the impacts and could improve the sustainability of the system. It is thus rated that the Recommended Ecological Category (REC) will fall into:

- Category C (Table 6-2).

Table 6-2:: REC

Class (% of total)	Description
C	Moderately modified.

7 IMPACT ASSESSMENT

	IMPACTS			CONSEQUENCE			PROBABILITY	RANKING WITHOUT MITIGATION	CONFIDENCE	IMPLEMENTATION OF MANAGEMENT MEASURES		RANKING WITH MITIGATION	DEGREE REVERSABILITY & LOSS OF RESOURCE	
	Type	Description	Nature	Extent (A)	Duration (B)	Intensity (C)	Probability (P)	Significance (A + B + C) X P	Confidence	Mitigation and/or Management Measures	Mitigation Effectiveness	Significance	Loss of Resources	Reversibility
CONSTRUCTION PHASE														
Drainage Lines	Indirect	Water quality	Negative	*Neighbouring*	*Short-term*	*Low-Medium*	*Likely*	*Low*	*High*	Stock piling outside the drainage line area, erosion control, stormwater management, dry season construction, silt barriers, filtration.	*High*	*Low*	*No Loss*	*Reversible*
	Direct	Flow Regime	Negative	*Local*	*Short-term*	*Medium*	*Highly Likely*	*Low-Medium*	*High*	Stock piling outside the drainage line area, stormwater management and diversion structures, dry season construction, filtration.	*High*	*Low*	*No Loss*	*Reversible*
	Direct	Habitat	Negative	*Site*	*Medium-term*	*Low-Medium*	*Highly Likely*	*Low-Medium*	*High*	Minimal ingress and egress.	*High*	*Low*	*No Loss*	*Reversible*
	Indirect	Biota	Negative	*Neighbouring*	*Short-term*	*Low*	*Likely*	*Low*	*High*	Stock piling outside the drainage line area, erosion control, stormwater management, dry season construction, silt barriers, filtration.	*High*	*Low*	*No Loss*	*Reversible*
	Direct	Geomorphology	Negative	*Neighbouring*	*Medium-term*	*Low-Medium*	*Highly Likely*	*Low-Medium*	*High*	Stormwater management design and erosion control measures.	*High*	*Low*	*No Loss*	*Reversible*
OPERATIONAL PHASE														
Drainage Lines	Indirect	Water quality	Negative	*Local*	*Incidental*	*Low-Medium*	*Possible*	*Low*	*High*	Rehabilitation of construction impacted area, continuous monitoring. Storm water management. Erosion control. Waste management (litter).	*High*	*Low*	*No Loss*	*Reversible*
	Direct	Flow Regime	Negative	*Neighbouring*	*Permanent*	*Low*	*Likely*	*Low-Medium*	*Medium*	Rehabilitation of construction impacted area, continuous monitoring and maintenance. Storm water management. Design requirements to mitigate impacts.	*High*	*Low*	*No Loss*	*Reversible*
	Direct	Habitat	Negative	*Site*	*Permanent*	*Low*	*Likely*	*Low*	*High*	Rehabilitation of construction impacted area, continuous monitoring, storm water management.	*High*	*Low*	*No Loss*	*Reversible*
	Indirect	Biota	Negative	*Neighbouring*	*Incidental*	*Low-Medium*	*Possible*	*Low*	*High*	Rehabilitation of construction impacted area, continuous monitoring and maintenance. Storm water management. Design requirements to mitigate impacts.	*High*	*Low*	*No Loss*	*Reversible*
	Direct	Geomorphology	Negative	*Site*	*Permanent*	*Low*	*Possible*	*Low*	*High*	Rehabilitation of construction impacted area, continuous monitoring and maintenance. Storm water management. Design requirements to mitigate impacts.	*High*	*Low*	*No Loss*	*Reversible*

8 REASONED OPINION AND RECOMMENDATIONS

The drainage lines are all largely natural with few moderate modifications and impacts by historical and ongoing anthropogenic activities. The Present Ecological Status (PES) for the drainage lines were scored in the mid-high ranges. The Ecological Importance and Sensitivity (EIS) falls in the moderate range and some functionality in respect of biodiversity conservation and play a small role in moderating the quantity and quality of water of major rivers. The Recommended Ecological Category (REC) for the wetlands were categorised as moderate. It will thus require some rehabilitation to enhance the ecological function of the system.

For this reason, it can be supported that the development may go-ahead if the design requirements include measures to preserve the major resource drivers, i.e. flow and water quality. The rehabilitation of the areas is vital to recover some ecological function. The resource drivers must be enhanced as part of the rehabilitation of the affected areas. In respect of the construction phase, it is important to ensure that the required erosion protection measures linked to the crossing sections be carefully designed and installed.

The project can be supported, should all the mitigation measures be implemented and monitored against to ensure compliance.

8.1 Mitigation and Monitoring Requirements

Monitoring programmes can measure the success of mitigation implementations, monitor unforeseen impacts, and can be used as a feedback system to adjust or correct management of the wetlands.

The following are recommended:

- It should be attempted to enhance the current ecological function.
    - Resource drivers should be protected as far as possible.
    - Water quality preservation is key. Silt protection measure to be implemented in consultation with the wetland specialist (ECO).
- Mitigation measures for the proposed development activities should be implemented, managed and monitored according to:
    - The following ecosystem impact assessment conclusions, based on the results of the baseline survey:
        - Runoff from the construction areas may result in contamination of aquatic resources and downstream aquatic habitat;
        - On site storm water management must be implemented.
        - On site filtration must be adopted (hay bales can be used affectively)
    - The following impacts may result in changes to the soil structure:
        - Heavy construction vehicles moving within the drainage line areas;

            - Ingress and Egress must be managed to minimise impacts in respect of compaction of the soils.
            - Single entry and exit points must be established.
            - These areas must be scarified with the contours in mind as part of the rehabilitation plan.
        - Stock piling;
            - Stock piling must be located outside the delineated drainage line and buffer boundaries.
        - Spills from machinery;
            - To be managed as per the Environmental Management Programme (EMPr).
        - The mixing of concrete; and
            - To be managed as per the Environmental Management Programme (EMPr).
    - The following aspects may result in reduction of ecosystem habitat integrity:
        - Dust and sediment runoff from construction activities;
        - Diesel and oil spill from equipment and machinery; and
        - Higher and faster water flow from the site that could cause soil erosion.
    - The following aspects may result in sedimentation of the associated aquatic systems:
        - Sedimentation due to increase runoff and dispensed soil particles and runoff from the affected areas; and
        - Increase in the velocity of the runoff from the exposed soil, due to construction.
    - The proposed activities must be initiated and constructed in such a way to prevent the reduction of natural water flow into the drainage line and downstream which, in essence, is the driving factor in terms of water provision.
        - An approved stormwater management plan must be implemented.
        - Velocity dissipation structures and sheet flow structures (such as reno mattresses) must also be installed to prevent water flowing through culverts to gain velocity and be released uncontrolled.
        - Dispersed flow must be attained post formal structures.
- The drainage line integrity should be improved during the rehabilitation phase. This may entail the following:
    - Removal of alien and invasive plant species during the construction and operational phases.
    - Stabilisation of gullies and drainage lines to prevent erosion.
    - Implementation of topsoil management (stockpiling, topography shaping) and erosion control (berms, geotextiling, silt fences, hay bales and gabion structures).
    - Re-vegetation with indigenous plant species.

9 CONCLUSION

The field investigations concluded that no natural wetland unit could be recorded as per the DWAF, 2005 guidelines and that three drainage areas could be affected by the proposed development.

These naturally occurring drainages are not streams, as they do not have the morphological structure, nor the duration of water retention or links to the adjacent aquatic zones, such as floodplains or riparian wetlands. They are simply temporary drainage lines acting as temporary flow paths. They also resemble the adjacent terrestrial zones.

The drainage lines recorded were assessed and the following results were attained:

- The drainage lines attained a moderate overall PES (Present Ecological State)
  - The drainage lines are all largely natural with few moderate modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. They can all be classified as falling into the category B/C. The trajectory of change will remain stable over the next five years should no activity take place and no intervention in terms of rehabilitation is implemented.
- The drainage lines attained a Moderate Ecological Importance and Sensitivity (EIS) score.
  - An assessment based on the principles of the ecological importance and sensitivity assessment were conducted according to the guidelines as discussed by DWAF (1999). It was found that the drainage lines are considered ecologically important and sensitive on local scale. The biodiversity of these drainage lines is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers. The drainage lines were classified to fall in the moderate class: EIS = C.
- The drainage lines Recommended Ecological Classification (REC) classification was rated as: The drainage lines will be impacted by the proposed development activities. This impact will be localised and at the transitional point leading from the development and infrastructure installations into the drainage lines. It will in all likelihood regress slightly in terms of its current Ecological Category if not managed in specific during the construction period. Stormwater management for the site is required in specific the construction phase. This will mitigate the impact on the drainage lines. Rehabilitation of the impacts and maintenance of the system will further mitigate the impacts and could improve the sustainability of the system. It is thus rated that the Recommended Ecological Category (REC) will fall into:
  - Category C

Concluded from the results presented in this document, the construction activities will in all likelihood impact on the drainage lines but can be mitigated to satisfactory standards if all mitigatory actions are implemented with due care. It is key to preserve water quality and supply to the downstream aquatic resources.

The rehabilitation of the drainage lines is vital to recover some ecological function. The resource drivers must be enhanced as part of the rehabilitation of the affected areas. In respect of the construction phase, it is important to ensure that the required erosion protection measures linked to the drainage lines intersection sections be carefully designed and installed.

The project can be supported, should all the mitigation measures be implemented and monitored against to ensure compliance and protection of the aquatic resource.

10 REFERENCES AND BIBLIOGRAPHY

CARA (Conservation of Agricultural Resources Act – 1983).

Constitution (Act 108 – 1996).

Cowan, J.I. 1999. The development of a national policy and strategy for wetland conservation in South Africa. PhD, University of Pretoria, Faculty of Science.

DEA-SANBI 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report.* South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.

DWAF. 1996. South African Water Quality Guidelines. Volume 7: Aquatic Ecosystems.

DWAF, 1999. *Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems*.

DWAF, 1999. *Version 1.0 of Resource Directed Measures for Protection of Water Resources*.

DWAF, 2003: Final draft: *A practical field procedure for identification and delineation of wetlands and Wetland areas*.

DWAF 2005. *A practical field procedure for identification and delineation of wetlands and wetland areas.* DWAF, Republic of South Africa.

DWAF 2005. *A Level I River Ecoregional Classification System for South Africa, Lesotho and Swaziland.* Department of Water Affairs and Forestry Resource Quality Services. Republic of South Africa.

DWAF 2006. Position paper for the management of the physical and ecological properties of a water resource. Wetlands, watercourses and estuaries. Draft 2. DWAF, Republic of South Africa.

DWAF 2007. *Manual for the assessment of a Wetland Index Habitat Integrity for South African floodplain and channelled valley bottom wetland types.* M. Rountree (ed); C.P. Todd, C.J. Kleynhans, A.L. Batchelor, M.D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. And G.C. Marneweck. Report no. N/0000/00/WEI/0407.

DWAF, 2008. Wetland and Wetland Delineation Course for Consultants – Module 1 course notes. Directorate: Water Abstraction & Instream Use; Sub-directorate: Stream Flow Reduction, Pretoria, South Africa.

Gauteng Department of Agriculture, Conservation and Environment (GDACE), 2005. Gauteng Wetlands Guideline Document. Version 1.4 of 2005. Gauteng Provincial Government.

Harding, W.R. 2015. The Definition of a 'Watercourse': Towards an Interpretive Understanding: The meaning of the term 'natural channel'. https://www.researchgate.net/publication/279676640.

Kleynkans CJ. 1996. A qualitative procedure for the assessment of the habitat integrity status of the Luvuvhu River (Limpopo System, South Africa) Journal of Aquatic Ecosystem Health 5:41-54.

Kleynhans, C. J. (2007). *Fish Response Assessment Index in River Ecoclasification*

Kleynhans C J, Thirion C and Moolman J A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland. [Report]. - Pretoria : Department of Water Affaris and Forestry, 2005.

Koester, V. 1989. The Ramsar Convention on the Conservation of Wetlands. Ramsar Convention Bureau. International Union for Conservation of Nature and Natural Resources (IUCN).

Kotze D.C. 1996. How wet is a wetland? WETLAND-USE booklet 2. Share-Net. Umgeni Valley

Kotze, D.C. and Marneweck, G.C. 1999. *Draft guidelines for delineating the boundaries of a wetland and the zones within a wetland in terms of the South African Water Act.* As part of the development of a protocol for determining the Ecological Reserve for Wetlands in terms of the Water Act Resource Protection and Assessment Policy Implementation Process. Department of Water Affairs and Forestry, South Africa

Kotze, D., Marneweck, G. C., Batchelor, A. L., Lindley, D. S., & Collins, N. B. (2005). *WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands.* Free State: Department of Tourism, Environmental and Economic Affairs

Kotze, D., Marneweck, G. C., Batchelor, A. L., Lindley, D. S., & Collins, N. B. (2008). *WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands.* Water Research Commission. WRC Report TT 339/08. Republic of South Africa.

Low, A.B. & Rebelo, A.G. 1998. (Eds.) *Vegetation of South Africa, Lesotho and Swaziland*. Dept. Environmental Affairs and Tourism, Pretoria

Macfarlane, D. M., Kotze, D. C., Ellery, W. N., Walters, D., Koopman, V., Goodman, P., et al. (2008). *WET-Health: a technique for rapidly assessing wetland health. WRC report TT340/08.* South Africa: WRC

Mays, L.W. 1996. Water Resource Handbook. McGraw-Hill. USA.

McMillan PH. 1998. An Invertebrate Habitat Assessment System (IHAS, version 2) for the Rapid Biological Assessment of Rivers and Streams. A CSIR research project, number ENV-P-I 98132 for the Water Resources Management Programme, CSIR. ii + 44pp.

National Environmental Management Act (NEMA) 1998.

National Water Act (Act 36, 1998).

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H.,Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). *Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.* SANBI.

Ollis, D., Snaddon, K., Job, N., Mbona, N. (2013). *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. SANBI Biodiversity Series 22. USER MANUAL: Inland Systems.*

Van Deventer, H., Van Niekerk, L., Adams, J., Dinala, M., Gangat, R., Lamberth, S., Lotter, M., Mbona, N., MacKay, F., Nel, J., Ramjukadh, C-L., Skowno, A., and Weerts, S. (2019). *National Wetland Map 5 - and improved spatial extent and representation of inland aquatic and estuarine ecosystems in South Africa*. Water SA 46(1) 66–79.