Wetland assessment for the proposed upgrade of the Qhozo (access) Road and construction of crossing structures

uThukela District, KwaZulu-Natal

January 2019

CLIENT

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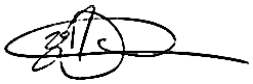
Report Name	**Wetland assessment for the proposed upgrade of the Qhozo (access) Road and construction of crossing structures**	
Reference	**Qhozo Road**	
Submitted to	**Isolendalo Environmental Consulting**	
Wetland Fieldwork/ Reporting	**Ndumiso Dlamini (Pr Sci Nat, 116579)**	
Report Reviewer	**Andrew Husted (Pr Sci Nat, 400213/11)**	

DECLARATION

The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

EXECUTIVE SUMMARY

GN R982	Appendix 6 (n): Specialist Opinion
Considering the conclusions made from the findings, it is the opinion of the specialist that the Qhozo Road project, including the construction of six causeway structures, may be favourably considered provided all mitigation measures and recommendations are strictly adhered to and included as conditions to any environmental authorisation.	

The Biodiversity Company was commissioned to conduct a wetland assessment, as part of the environmental authorisation process and Water Use Licence Application (WULA) for the proposed upgrade of the Qhozo (access) Road and the construction of six (6) causeway structures in the Kokwane A/A (ward 05) area near Bergville within the uThukela District, KwaZulu-Natal.

A site visit was conducted during the week of 24th January 2019, this would constitute a wet season survey.

There were no wetland areas identified in the project area. Several drainage lines were identified in the project area. There were initially five (5) watercourse crossing points; however, a 6th watercourse crossing was identified during the field investigation.

These drainage systems are ephemeral (A Section) and contain storm water and form part of a first order and sometime second order streams of rivers. These drainage lines are almost never (or very seldom) in connection with a zone of saturation and they consequently never have base flows.

A 30m buffer zone is required around drainage lines as per the provincial guidelines.

Risk Assessment

The proposed project is for the upgrade of the Qhozo Road and the construction of six causeway structures. The causeway structures will be constructed within the boundaries of the drainage lines, which, as a result, will be directly impacted on. As this project entails the upgrade of infrastructure and the construction of new infrastructure, impacts associated with the area are potentially moderate to low, based on the current onsite crossings. Modifications to the wetland habitat is likely to occur during construction. The project will entail the cutting, reshaping, and change in hydrodynamics of the watercourses. This has the potential to increase erosion and sedimentation of downstream habitats due to surface runoff during the wet season.

The risk assessment identified several risks as a result of the proposed project. A large number of the risks have been rated as Moderate risks (without mitigation). These Moderate risks are anticipated as the proposed project will be for the upgrade of the road and the construction of the causeway structures and will lead to the direct physical disturbance of the drainage lines. Due to the nature of the project the physical disturbance of the watercourse areas cannot be avoided.

The Moderate risks identified for the construction phase of the project are associated with changes in drainage from the watercourses through channelling or compaction. The increase bare/impervious areas will increase the sediment loads carried down slope into downstream

watercourse areas. The moderate risks associated with the construction phase were re-adjusted to Low ratings with the anticipation that all the prescribed mitigation measures will be implemented.

Moderate risks (pre-mitigation) were also identified for the operational phase of the project. This is largely a result of the longevity of the project and the potential for erosion within the watercourse habitat. No aspects are considered to pose a Moderate risk with the implementation of mitigation measures.

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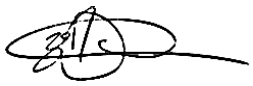
DECLARATION

I, Ndumiso Dlamini declare that:

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



Ndumiso Dlamini

Wetland Specialist

The Biodiversity Company

28 January 2019

1 Introduction

The Biodiversity Company was commissioned to conduct a wetland assessment, as part of the environmental authorisation process and Water Use Licence Application (WULA) for the proposed upgrade of the Qhozo (access) Road and the construction of six (6) causeway structures in the Kokwane A/A (ward 05) area near Bergville within the uThukela District, KwaZulu-Natal.

A site visit was conducted during the week of 24th January 2019, this would constitute a wet season survey.

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

1.1 Objectives

The aim of the assessment is to provide information to guide the proposed project with respect to the current state of the associated wetlands in the area of study. This was achieved through the following:

- The delineation and assessment of wetlands within 500m of the project area;
- A risk assessment for the proposed development; and
- The prescription of mitigation measures and recommendations for identified risks.

2 Key Legislative Requirements

2.1 National Water Act (Act No. 36 of 1998)

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

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

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem, and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS.

For the purposes of this project, a wetland area is defined according to the NWA (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”.

Wetlands have one or more of the following attributes to meet the NWA wetland definition (DWAF, 2005):

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

2.2 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in December 2014, 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.

3 Project Area

The project is for the upgrade of the Qhozo Road and the construction of six causeway structures in Kokwane A/A (ward 05) area within the uThukela District, KwaZulu-Natal. The project site is located close to the Woodstock Dam, approximately 40 km west of the Bergville centre in the KwaZulu-Natal Province (Figure 1). The local area within the proximity of the project site is low density housing and gravel road infrastructure.

The project is located within the V11E and V11B Quaternary Catchments within the Pongola - Mtamvuna Water Management Area (WMA 4) (NWA, 2016). It must be noted that the section of the WMA the project is situated within was previously known as the Thukela Water Management Area.

The portion of the WMA that the project lies mainly within the province of Kwazulu-Natal, the catchment is mainly composed of tributaries draining from the Drakensberg. Characterized by mountain streams in the upper reaches. Rainfall is concentrated along the mountains with a mean annual precipitation rate of 600 to 1500mm. Main impacts associated with the system are forestry and agriculture, Newcastle is the main area of industrial activity within the catchment. (StatsSA, 2010).

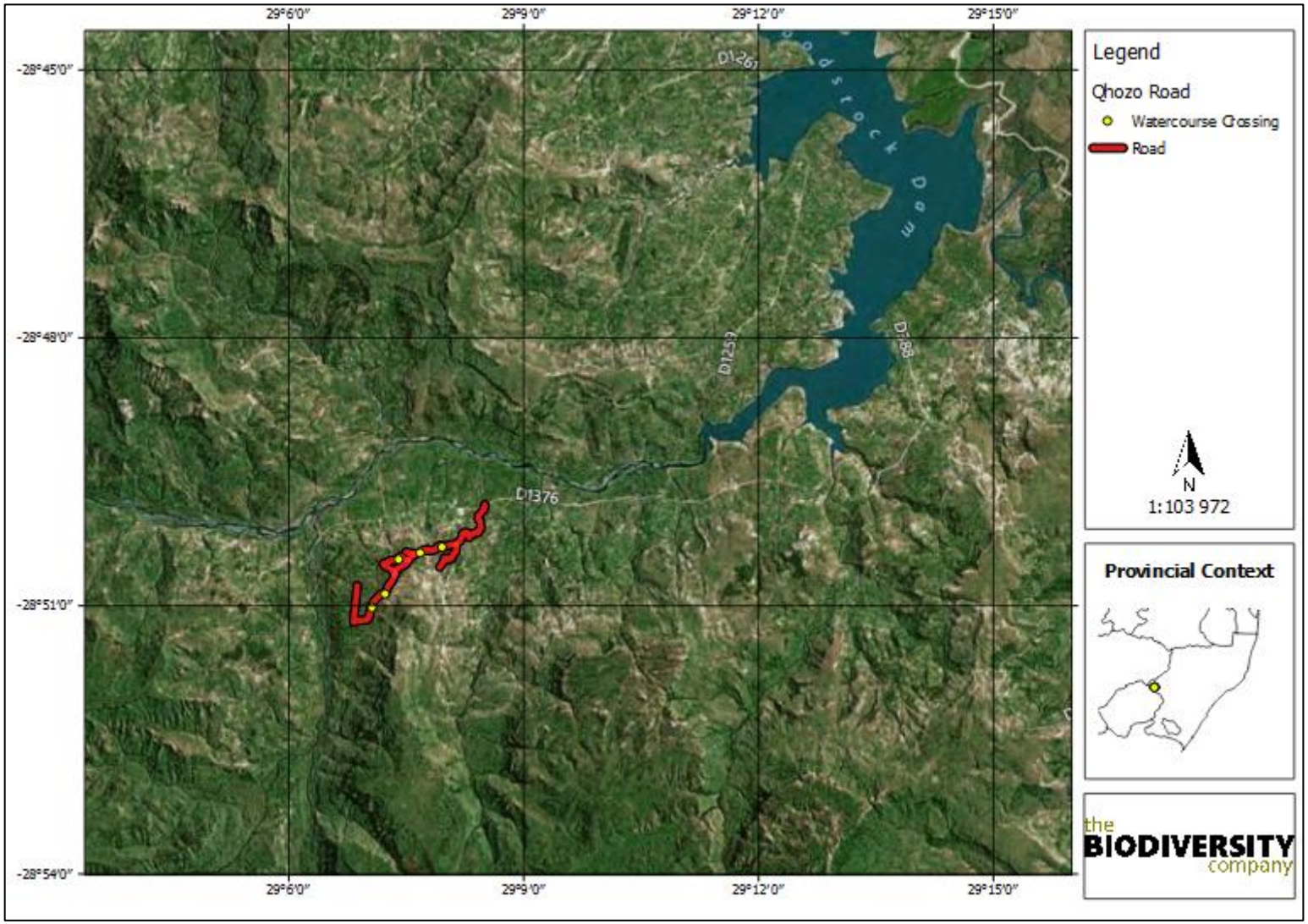


Figure 1: Local layout of the road and causeway upgrades

4 Limitations

The following aspects were considered as limitations;

- The wetland assessment was based on the results of a single survey only, and information provided should be interpreted accordingly;
- Only wetlands that were likely to be impacted by proposed development activities were assessed in the field. Wetlands located within a 500m radius of the sites but not in a position within the landscape to be measurably affected by the developments were not considered as part of this assessment;
- Field assessment were completed to assess as much of the site as possible with focus on the proposed directly impacted and downstream areas; and
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side.

5 Methodology

5.1 Desktop Assessment

The following information sources were considered for the desktop assessment;

- Aerial imagery (Google Earth Pro);
- Department of Water and Sanitation (DWS, 2018);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- The National Freshwater Ecosystem Priority Areas (Nel et al., 2011); and
- Contour data (5m).

5.2 Wetland Assessment

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and also then includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

5.2.1 Delineation

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.

- The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);

- The 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 hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

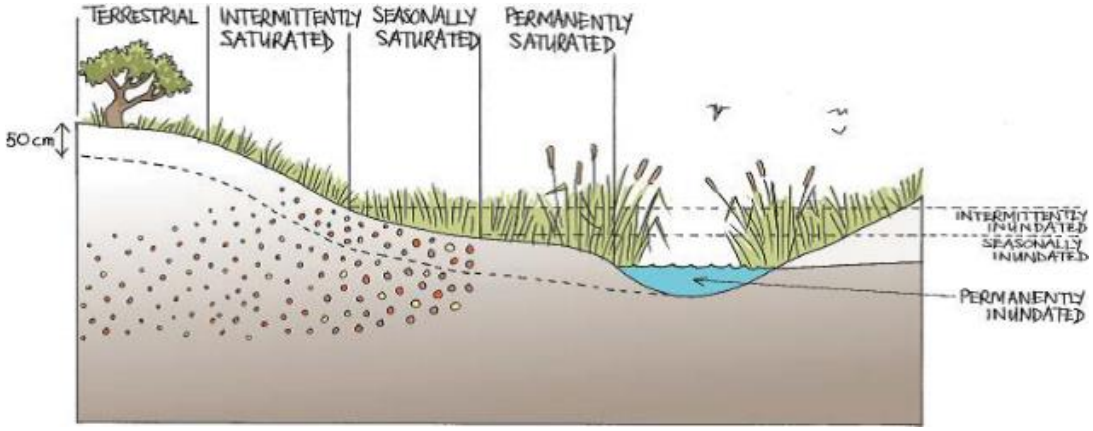


Figure 2: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al., 2013)

5.2.2 Present Ecological Status (PES)

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 1.

Table 1: The PES categories (Macfarlane, et al., 2009)

Impact Category	Description	Impact Score Range	Present State Category
None	**Unmodified, natural**	**0 to 0.9**	**A**
Small	**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.	**1.0 to 1.9**	**B**
Moderate	**Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	**2.0 to 3.9**	**C**
Large	**Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.	**4.0 to 5.9**	**D**
Serious	**Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	**6.0 to 7.9**	**E**
Critical	**Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	**8.0 to 10**	**F**

5.2.3 Ecosystem Services

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (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 services are provided (Table 2).

Table 2: Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

5.2.4 Ecological Importance and Sensitivity (EIS)

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3.

Table 3: Description of EIS categories.

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

5.3 Buffer Determination

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane, *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity.

5.4 Risk Assessment

The risk assessment was conducted in accordance with the DWS risk-based water use authorisation approach and delegation guidelines. The significance of the impact is calculated according to Table 4.

Table 4: Significance ratings matrix

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

6 Results and Discussion

6.1 Desktop Assessment

6.1.1 Desktop Soils and Vegetation

According to the land type database (Land Type Survey Staff, 1972 - 2006) the proposed project falls within the Ab208 and Ab2107 land types. The land type is dominated by red-yellow apedal soils that are freely drained and red soils that may be either dystrophic or mesotrophic. The land type characteristics are described in Table 5.

Table 5: Land type Characteristics

Land type	Characteristics
Ab 208	Red-yellow apedal, freely drained soils; Red, dystrophic and/or mesotrophic
Ab 210	

The proposed project is situated within the Northern KwaZulu-Natal Moist Grassland and Drakensburg Foothill Moist Grassland vegetation units. The distribution of the vegetation unit is restricted to the KwaZulu-Natal Province. The vegetation unit is found in altitudes that range from 920m – 1440m above sea level (Mucina & Rutherford, 2006).

The conservation status for the Northern KwaZulu-Natal Moist Grassland is considered Vulnerable with close to 25% of the vegetation unit lost through transformation. The Drakensburg Foothill Moist Grassland vegetation unit conservation status is considered Least concern with approximately 30% of the unit lost through transformation. The vegetation units are transformed for cultivation, by urban sprawl and construction of dams. Most of the area is used for subsistence farming (Mucina & Rutherford, 2006).

6.1.2 Wetland NFEPAs

There were no NFEPA wetland areas identified within 500m of the proposed project area.

6.2 Wetland Assessment

There were no wetland areas identified in the project area. Several drainage lines were identified in the project area as presented in Table 6 and Figure 3. There were initially five (5) watercourse crossing points; however, a 6th watercourse crossing was identified during the field investigation.

These drainage systems are ephemeral (A Section) and contain storm water and form part of a first order and sometime second order streams of rivers. These drainage lines are almost never (or very seldom) in connection with a zone of saturation and they consequently never have base flows (DWAF, 2005).

Table 6: The identified drainage lines at the watercourse crossing points

Watercourse Crossing	Upstream	Downstream
WC 1		
WC 2		
WC 3		

Watercourse Crossing	Upstream	Downstream
WC 4		
WC 5		
WC 6		

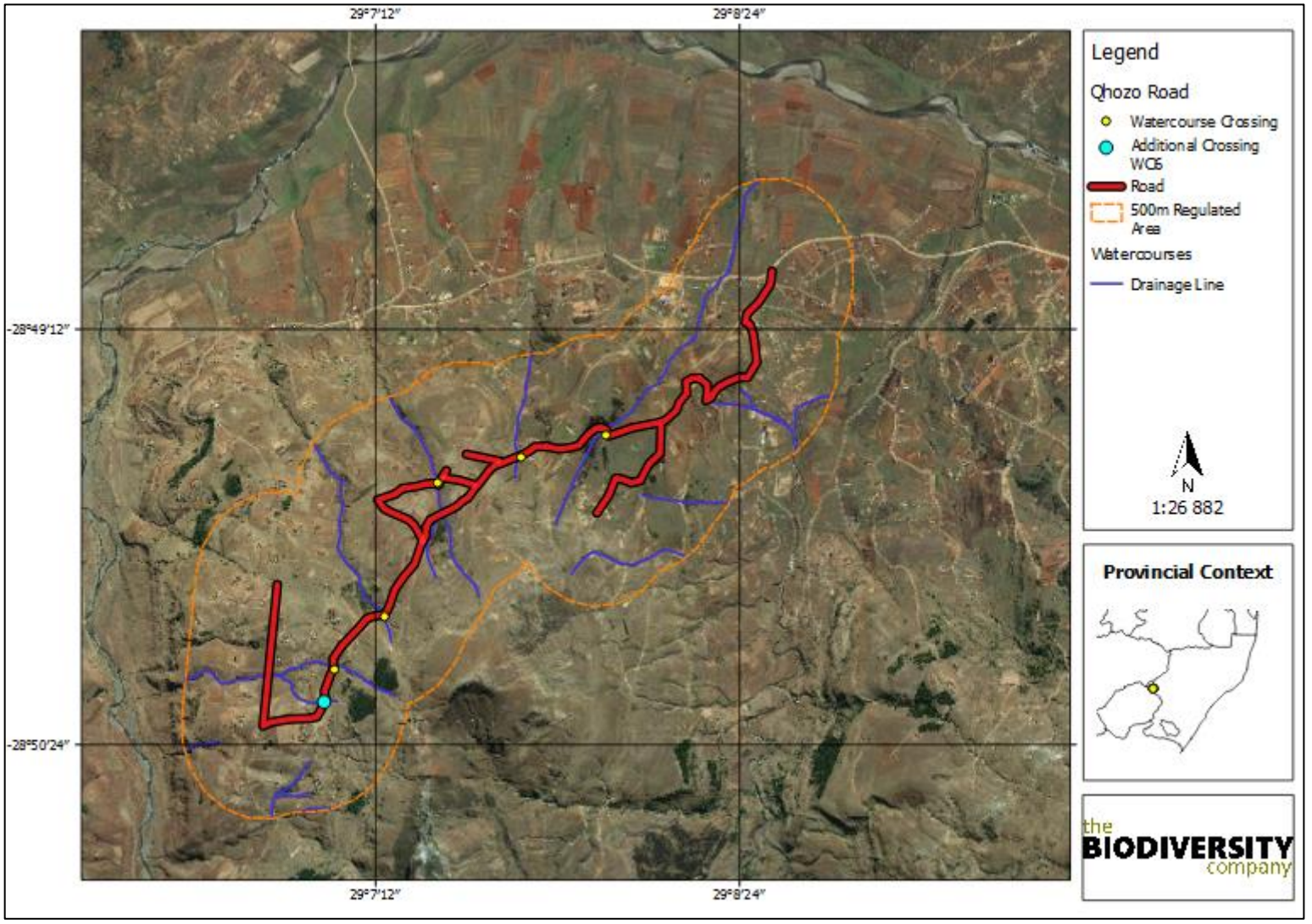


Figure 3: The delineated watercourses within 500m WULA of the assessment area

6.2.1 Buffer Zones

No wetland areas were identified for the project area and as such, a buffer zone could not be determined. A 30m buffer zone is required around drainage lines as per the Ezemvelo Guidelines.

7 Risk Assessment

The proposed project is for the Qhozo (access) Road and the construction of six causeway structures. The causeway structures will be constructed within the boundaries of the drainage lines, which, as a result, will be directly impacted on. As this project entails the upgrade of infrastructure and the construction of new infrastructure, impacts associated with the area are potentially moderate to low, based on the current onsite crossings (Figure 4). Modifications to the watercourses (drainage lines) is likely to occur during construction. The project will entail the cutting, reshaping, and change in hydrodynamics of the watercourses. This has the potential to increase erosion and sedimentation of downstream habitats due to surface runoff during the wet season.

Figure 4: One of the crossings (WC 1) and the current road

Findings from the DWS aspect and impact register / risk assessment are provided in Table 7, Table 9 and Table 10.

Table 7: Potential risk posed by the upgrade

Ndumiso Dlamini	Pr Sci Nat	116579
Activity	**Impact**	**Aspect**
Excavating and levelling of culverts and roads to surveyed levels	Alteration to flow volumes	Channelling of flow from road embankment.
		Removal of watercourse areas (reshaping road contours).
		Compaction from operation of heavy machinery in watercourse areas.
	Alteration of patterns of flows (increased flood peaks)	Channelling of flow from road embankment.
		Removal of watercourse areas (reshaping road contours).
		Increased impermeable surfaces from cleared area.
		Compaction from operation of heavy machinery in watercourse areas.
	Increase in sediment inputs & turbidity	Channelling of seepage from road embankment.
		Removal of watercourse areas (reshaping road contours).
		Increased impermeable surfaces from cleared area.
		Compaction from operation of heavy machinery in watercourse areas.
	Inputs of toxic organic contaminants	Hydrocarbon spills from working machinery
		Waste and ablution facilities
	Loss of watercourse habitat	Removal of watercourse areas (reshaping road contours).
	Loss of watercourse functionality	Channelling of flow from road embankment.
		Removal of watercourse areas (reshaping road contours).
		Compaction from operation of heavy machinery in watercourse areas.
		Hydrocarbon spills from working machinery

Construction of culverts and stormwater management systems	Alteration to flow volumes	Channelling of flow from road embankment.
		Compaction from operation of heavy machinery in watercourse areas.
	Alteration of patterns of flows (increased flood peaks)	Channelling of flow from road embankment.
		Increased impermeable surfaces from cleared area.
		Compaction from operation of heavy machinery in watercourse areas.
	Increase in sediment inputs & turbidity	Channelling of flow from road embankment.
		Increased impermeable surfaces from cleared area.
		Compaction from operation of heavy machinery in watercourse areas.
	Inputs of toxic organic contaminants	Hydrocarbon spills from working machinery
		Waste and ablution facilities
	Loss of watercourse functionality	Channelling of flow from road embankment.
		Removal of watercourse areas (reshaping road contours).
		Compaction from operation of heavy machinery in watercourse areas.
		Hydrocarbon spills from working machinery
Construction of stormwater management systems	Alteration to flow volumes	Channelling of flow from road embankment.
		Compaction from operation of heavy machinery in watercourse areas.
	Alteration of patterns of flows (increased flood peaks)	Channelling of flow from road embankment.
		Compaction from operation of heavy machinery in watercourse areas.
	Increase in sediment inputs & turbidity	Channelling of flow from road embankment.
		Increased impermeable surfaces from cleared area.
		Compaction from operation of heavy machinery in watercourse areas.

	Inputs of toxic organic contaminants	Hydrocarbon spills from working machinery
		Waste and ablution facilities
	Loss of watercourse functionality	Channelling of flow from road embankment.
		Compaction from operation of heavy machinery in watercourse areas.
		Hydrocarbon spills from working machinery
Operation of the causeways	Alteration to flow volumes	Channelling of flow from road embankment.
	Alteration of patterns of flows (increased flood peaks)	Channelling of flow from road embankment.
	Increase in sediment inputs & turbidity	Channelling of flow from road embankment.
		Increased impermeable surfaces from cleared area.
	Inputs of toxic organic contaminants	Hydrocarbon spills from everyday traffic
	Loss of watercourse functionality	Channelling of flow from road embankment.

Table 8: DWS Risk Impact Matrix for the proposed project

Activity	Severity								
	Impact	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase									
Excavating and levelling of causeways to surveyed levels	Alteration to flow volumes	3	2	3	2	2.5	1	2	5.5
	Alteration of patterns of flows (increased flood peaks)	3	2	2	1	2	2	2	6
	Increase in sediment inputs & turbidity	1	3	3	3	2.5	2	2	6.5
	Inputs of toxic organic contaminants	1	4	3	3	2.75	1	2	5.75
	Loss of watercourse habitat	3	2	3	3	2.75	1	2	5.75
	Loss of watercourse functionality	3	2	2	3	2.5	2	2	6.5
Construction of roads and causeways	Alteration to flow volumes	3	2	3	2	2.5	1	2	5.5
	Alteration of patterns of flows (increased flood peaks)	3	2	2	1	2	2	2	6
	Increase in sediment inputs & turbidity	1	3	3	3	2.5	2	2	6.5
	Inputs of toxic organic contaminants	1	4	3	3	2.75	1	2	5.75
	Loss of watercourse functionality	3	2	2	3	2.5	2	2	6.5
Construction of stormwater management systems	Alteration to flow volumes	3	2	3	2	2.5	1	2	5.5
	Alteration of patterns of flows (increased flood peaks)	3	2	2	1	2	2	2	6
	Increase in sediment inputs & turbidity	1	3	3	3	2.5	2	2	6.5
	Inputs of toxic organic contaminants	1	4	3	3	2.75	1	2	5.75
	Loss of watercourse functionality	3	2	2	3	2.5	2	2	6.5
Operational Phase									

Operation of the roads and causeways	Alteration to flow volumes	3	2	3	2	2.5	1	4	7.5
	Alteration of patterns of flows (increased flood peaks)	3	2	2	1	2	2	4	8
	Increase in sediment inputs & turbidity	1	2	3	3	2.25	2	2	6.25
	Inputs of toxic organic contaminants	1	3	2	2	2	1	2	5
	Loss of watercourse functionality	4	2	3	3	3	2	3	8

Table 9: DWS Risk Impact Matrix for the proposed project continued

Activity	Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase									
Excavating and levelling of causeways to surveyed levels	Alteration to flow volumes	3	3	5	2	13	71.5	**Moderate***	**Low**
	Alteration of patterns of flows (increased flood peaks)	3	3	5	1	12	72	**Moderate***	**Low**
	Increase in sediment inputs & turbidity	3	3	5	1	12	78	**Moderate***	**Low**
	Inputs of toxic organic contaminants	2	2	5	1	10	57.5	**Moderate***	**Low**
	Loss of watercourse habitat	3	4	5	1	13	74.75	**Moderate***	**Low**
	Loss of watercourse functionality	3	3	5	1	12	78	**Moderate***	**Low**
Construction of roads and causeways	Alteration to flow volumes	3	3	5	2	13	71.5	**Moderate***	**Low**
	Alteration of patterns of flows (increased flood peaks)	3	3	5	1	12	72	**Moderate***	**Low**
	Increase in sediment inputs & turbidity	3	3	5	1	12	78	**Moderate***	**Low**
	Inputs of toxic organic contaminants	2	2	5	1	10	57.5	**Moderate***	**Low**
	Loss of watercourse functionality	3	3	5	1	12	78	**Moderate**	**Low**
Construction of stormwater management systems	Alteration to flow volumes	3	3	5	2	13	71.5	**Moderate***	**Low**
	Alteration of patterns of flows (increased flood peaks)	3	3	5	1	12	72	**Moderate***	**Low**
	Increase in sediment inputs & turbidity	3	3	5	1	12	78	**Moderate***	**Low**
	Inputs of toxic organic contaminants	2	2	5	1	10	57.5	**Moderate***	**Low**

	Loss of watercourse functionality	3	3	5	1	12	78	**Moderate***	**Low**
Operational Phase									
Operation of the roads and causeways	Alteration to flow volumes	3	3	1	2	9	67.5	**Moderate***	**Low**
	Alteration of patterns of flows (increased flood peaks)	3	3	1	1	8	64	**Moderate***	**Low**
	Increase in sediment inputs & turbidity	3	3	1	2	9	56.25	**Moderate***	**Low**
	Inputs of toxic organic contaminants	2	2	1	1	6	30	**Low**	**Low**
	Loss of watercourse functionality	3	3	1	1	8	64	**Moderate***	**Low**

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

The risk assessment identified several risks as a result of the proposed project. A large number of the risks have been rated as Moderate risks (without mitigation). These Moderate risks are anticipated as the proposed project will be for the upgrade of the road and the construction of the causeway structures and will lead to the direct physical disturbance of the drainage lines. Due to the nature of the project the physical disturbance of the watercourse areas cannot be avoided.

The Moderate risks identified for the construction phase of the project are associated with changes in drainage from the watercourses through channelling or compaction. The increase bare/impervious areas will increase the sediment loads carried down slope into downstream watercourse areas. The moderate risks associated with the construction phase were re-adjusted to Low ratings with the anticipation that all the prescribed mitigation measures will be implemented.

Moderate risks (pre-mitigation) were also identified for the operational phase of the project. This is largely a result of the longevity of the project and the potential for erosion within the watercourse habitat. No aspects are considered to pose a Moderate risk with the implementation of mitigation measures.

7.1 Road and causeway construction mitigation measures

The following causeway construction specific mitigation measures are provided:

- The footprint area of the construction should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- All construction activities and access must make use of the existing road;
- Batching plants must be allocated outside of the 30m buffer zones;
- Culverts are to be placed during the dry season;
- Exposed road surfaces awaiting grading must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion of the road;
- Silt traps and fences must be placed in the preferential flow paths along the road to prevent sedimentation of the watercourse;
- Temporary storm water channels should be filled with aggregate and/or logs (branches included) to dissipate flows;
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- It is recommended that the material surrounding and holding the culverts in place include a coarse rock layer that has been specifically incorporated to increase the porosity and permeability to accommodate flooding and very low flows;
- The culverts used in the design should be as large as possible, partially sunken and energy dissipating material must be placed at the discharge area of each culvert to prevent erosion of these areas;

- Large aggregate outsourced or from the project area (if available) can be used for energy dissipation in the channel downstream of the culverts to reduce the likelihood of scouring the river bed and sedimentation of the catchment. It is preferable that larger aggregate be used to avoid flows removing material from the site;
- The use of larger culverts will prevent the build-up of debris by allowing the free movement of debris through the large culverts;
- Culverts should avoid inundation (damming) of upstream areas by facilitating streamflow and catering properly for both low flows and high flows;
- Surface run-off from the roads flowing down the embankments often scours the watercourse on the sides of the culvert causing sedimentation of the channel. This should be catered for with adequate concreted storm water drainage depressions and channels with energy dissipaters that channel these flows into the river in a controlled manner;
- The culvert installations should further take into account the scouring action of high flows and gabion structures or similar should be placed on both sides of the culvert on the embankments both upstream and downstream. This will serve as retention of the soils from scouring around and underneath the culvert structures aiding in the protection of the structure; and
- A suitable storm water plan must be compiled for the road. This plan must attempt to displace and divert storm water from the road and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced with energy dissipaters and flows discharged into the local watercourses.

7.2 General Mitigation Measures

The following general mitigation measures are provided:

- The water resources outside of the specific project site area must be avoided where possible;
- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- Laydown yards, camps and storage areas must be beyond the aquatic areas. Where possible, the construction of the crossings must take place from the existing road and not from within the watercourse and associated buffer;
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- It is preferable that construction takes place during the dry season (as much as possible) to reduce the erosion potential of the exposed surfaces;
- Prevent uncontrolled access of vehicles through the water resources system that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;
- All chemicals and toxicants to be used for the construction must be stored outside the channel system and in a bunded area;

- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the watercourse. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Erosion and sedimentation into the channel must be minimised through the effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed banks;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- Large trees and other debris often collect upstream against the causeways, damming up the channel with risk of flooding and damaging the crossing and its banks. This debris should be cleared routinely with appropriate disposal of the debris. Timber can be sold or donated to local communities;
- No dumping of construction material on-site may take place; and
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

8 Conclusion

There were no wetland areas identified in the project area. Several drainage lines were identified in the project area. There were initially five (5) watercourse crossing points; however, a 6th watercourse crossing was identified during the field investigation.

These drainage systems are ephemeral (A Section) and contain storm water and form part of a first order and sometime second order streams of rivers. These drainage lines are almost never (or very seldom) in connection with a zone of saturation and they consequently never have base flows.

A 30m buffer zone is required around drainage lines as per the provincial guidelines.

Risk Assessment

The proposed project is for the upgrade of Qhozo Access Road and the construction of six causeway structures. The causeway structures will be constructed within the boundaries of

the drainage lines, which, as a result, will be directly impacted on. As this project entails the upgrade of infrastructure and the construction of new infrastructure, impacts associated with the area are potentially moderate to low, based on the current onsite crossings. Modifications to the wetland habitat is likely to occur during construction. The project will entail the cutting, reshaping, and change in hydrodynamics of the watercourses. This has the potential to increase erosion and sedimentation of downstream habitats due to surface runoff during the wet season.

The risk assessment identified several risks as a result of the proposed project. A large number of the risks have been rated as Moderate risks (without mitigation). These Moderate risks are anticipated as the proposed project will be for the upgrade of the road and the construction of the causeway structures and will lead to the direct physical disturbance of the drainage lines. Due to the nature of the project the physical disturbance of the watercourse areas cannot be avoided.

The Moderate risks identified for the construction phase of the project are associated with changes in drainage from the watercourses through channelling or compaction. The increase bare/impervious areas will increase the sediment loads carried down slope into downstream watercourse areas. The moderate risks associated with the construction phase were re-adjusted to Low ratings with the anticipation that all the prescribed mitigation measures will be implemented.

Moderate risks (pre-mitigation) were also identified for the operational phase of the project. This is largely a result of the longevity of the project and the potential for erosion within the watercourse habitat. No aspects are considered to pose a Moderate risk with the implementation of mitigation measures.

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