WETLAND IMPACT ASSESSMENT

Proposed upgrade of Thokoza Access Road located within the uMsinga Local Municipality, KwaZulu-Natal

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MALACHITE
ECOLOGICAL SERVICES

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EXECUTIVE SUMMARY

Malachite Ecological Services was appointed by Isolendalo Environmental Consulting (Pty) Ltd to undertake a Wetland Impact Assessment for the proposed upgrade of Thokoza Access Road located within the uMsinga Local Municipality.

The terms of reference for the study were as follows:

- Delineate wetland systems along Thokoza Access Road, as well as a 500m assessment buffer according to the Department of Water Affairs and Forestry[1] "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Classify the identified wetland habitats in accordance with the latest approach; 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).
- Determine the Present Ecological State score (PES) and Functional Integrity of any identified wetlands using the WET-Health and Wet-EcoServices approach.
- Determine the Ecological Importance and Sensitivity (EIS) of the identified wetlands.
  Identify current and possible negative future impacts on any identified wetlands and watercourses from the upgrade of the access road. Recommend mitigation measures to lessen these impacts on wetlands/watercourses delineated within the study site and the implementation of suitable rehabilitation measures, should this be required

Based on the current identification of the four wetland indicators, one HGM unit was delineated within the assessment area. This was classified as a Seep system that flows in a southerly direction for approximately 1.5km from the road before forming a watercourse which is a tributary of the Mazabeko River.

The Seep was assessed with regards to its health according to the Wet-Health methodology and was classified as Largely Modified (PES Category D). There have been a number of changes to the catchment and wetland system. These include the development of rural nodes including road infrastructure, housing, subsistence agriculture and livestock grazing. Cultivation of the entire Seep

[1] Department of Water Affairs and Forestry (DWAF) is now named the Department of Water and Sanitation (DWS).

system has taken place, both historically and currently. These changes have resulted in an increase in hardened surfaces within the catchment, as well as a decrease in basal cover, facilitating the formation of erosion gullies within the wetland system. Impacts such as reduced basal cover provide favourable conditions for the encroachment of invasive alien plant species within and adjacent to the wetland system. Invasive vegetation was noted during the investigation however, this was limited and largely confined to the edges of erosion gullies and areas of elevated disturbance. Species recording included *Cirsium vulgare* and *Tagetes minuta.*

Ecosystem goods and services were calculated for the Seep wetland. Scores received ranged from Low to Moderate for all ecosystem service resources. The Seep system received moderate scores for natural ecosystem services associated with flood attenuation, sediment trapping; and filtration (i.e. phosphate, nitrate and toxicant trapping). As this Seep is utilised for cultivation it received high scores for the provision of natural resources as well as the use of the wetland for the cultivation of food. This use of the wetland has resulted in a decline in the health of the system.

An Ecological Importance and Sensitivity (EIS) assessment was undertaken to rank the identified water resources in terms of provision of goods and services or valuable ecosystem functions which benefit people; biodiversity support and ecological value as well as the reliance of subsistence users (especially basic human needs uses). The EIS scores for the Seep were Low. This is largely due to the location of this system within a rural settlement area. The wetland system is utilised for livestock grazing (decreasing the basal cover) and subsistence cultivation, leading to a decrease in basal cover and an increase in the disturbance within the wetland. This lowers the use of the area by faunal species due to suboptimal conditions. This further limits the opportunity for this system to contribute to the maintenance of biodiversity within the larger catchment.

Any development activity in a natural system will have an impact on the surrounding environment. In order to address these impacts, the implementation of a site-specific mitigation measures that are aimed at reinstating favourable hydrological conditions and allow for the regeneration of the functional integrity of the watercourses along the road route are required.

Identified negative impacts associated with this project include:

- Soil erosion; sedimentation and further degradation of the Seep system, which will have knock-on impacts downstream of the road;
- The loss of wetland area as the road is widened;
- Pollution potential of the Seep as a result of construction related activities as well as future operational impacts with regards to polluted runoff from the hardened road surface; and
- Encroachment of invasive alien species into the wetland from the disturbance to the vegetation communities.

Positive impacts are also associated with the proposed development and include the long-term improvement in the control of surface run-off entering the Seep from the road through the upgrade of stormwater control structures along the road. Currently stormwater runoff from the existing road has contributed to the formation of erosion gullies within the Seep and this must be addressed during the construction phase of the road.

The Risk Assessment for the proposed project as per the General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21 (c) and (i) (Notice 509 of 2016) was undertaken. Impacts associated with the proposed project received Low Risk Scores with impacts to the water resources being small and easily managed. Several general and specific measures are proposed to mitigate these impacts on the water resources.

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1. INTRODUCTION AND BACKGROUND

PROJECT BACKGROUND AND LOCALITY

Malachite Ecological Services was appointed by Isolendalo Environmental Consulting (Pty) Ltd to undertake a Wetland Impact Assessment for the proposed upgrade of Thokoza Access Road, located approximately 7.7km north-east of Pomeroy within the uMsinga Local Municipality (Figure 1). The municipality covers an area of approximately 2500 km^2. The site is further situated within the 2830DC quarter degree square, in the south western portion of the uMzinyathi District Municipality. The municipal area is largely rural in nature, comprising 69% Ingonyama Trust land, as well as commercial farmlands and natural tracts of land.

The existing gravel road is approximately 2.8km in length starting at 28°31'54.91" S; 30°30'36.13" E and ending at 28°31'40.26" S; 30°31'6.52" E. Limited details pertaining to the design and construction approach were available, as such, the details in this report focus on the delineation of water resources and possible mitigation measures to protect the surrounding environment.

The degraded nature of existing roads as well as inadequate stormwater management is an issue that has been highlighted in the uMsinga Integrated Development Plan (IDP). Further to this the IDP states that:

> *" Road upgrading and road maintenance is a priority for the municipality and forms the municipality's capital projects"*

PHOTOGRAPH 1: THOKOZA ACCESS ROAD UPGRADE PROJECT

The road upgrade project is likely to impact water resources and as such, the nature and extent of these issues must be assessed. The primary aim of the study is therefore to provide a description of the current ecological integrity and impacts pertaining to any wetland systems occurring within the vicinity of Thokoza Access Road as well as within a 500m assessment buffer area. Furthermore, appropriate management recommendations and rehabilitation measures to mitigate any identified impacts on the delineated wetland systems are provided.

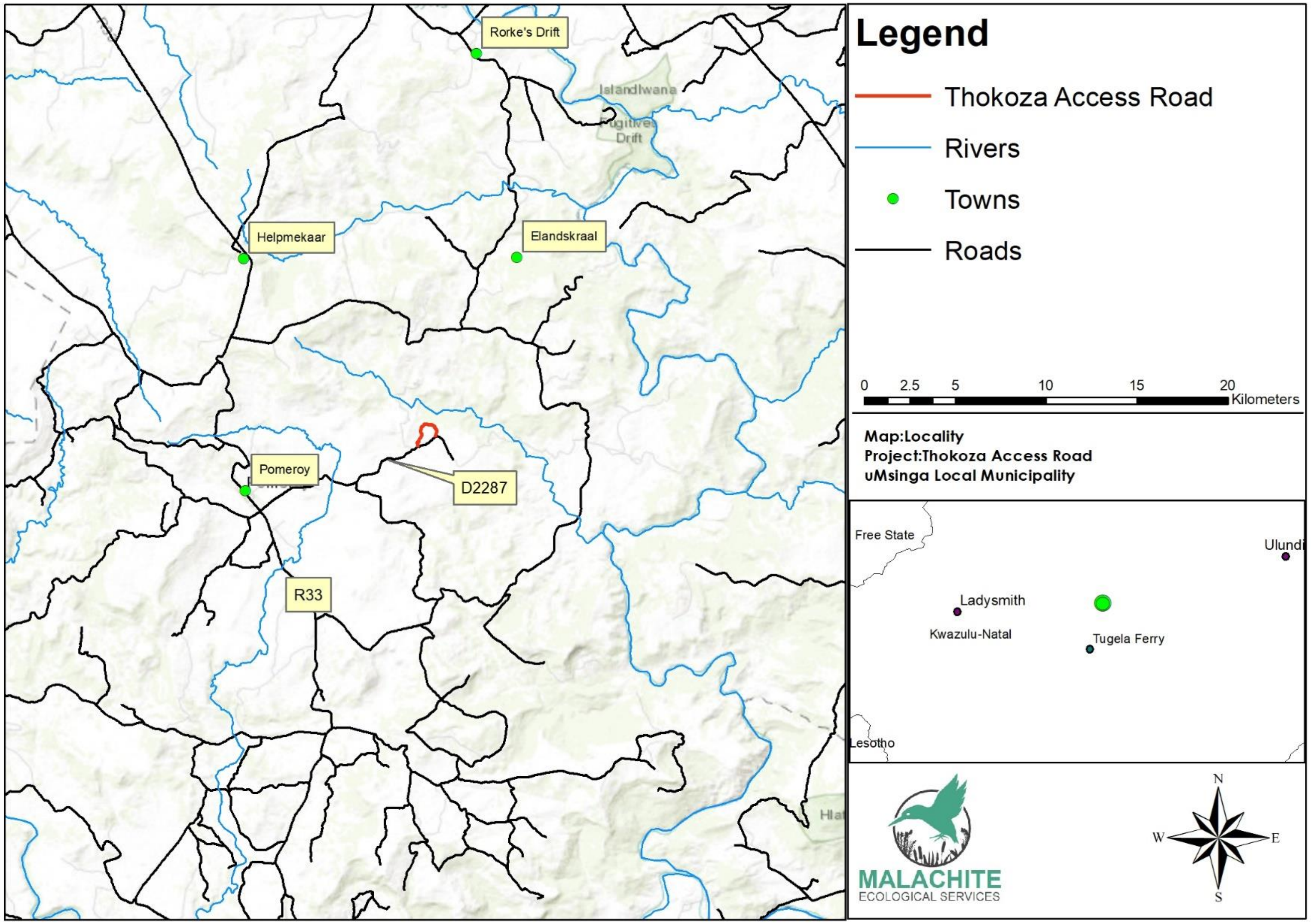

FIGURE 1: SITE LOCALITY OF THOKOZA ACCESS ROAD

SCOPE OF THE ASSESSMENT

The terms of reference for the current study were therefore as follows:

- Delineate wetland systems along Thokoza Access Road upgrade route, as well as a 500m assessment buffer according to the Department of Water Affairs and Forestry[2] "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Classify the identified wetland habitats in accordance with the latest approach; 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).
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Typically, surface water attributed to wetland systems, rivers and riparian habitats comprise an important component of natural landscapes. These systems are often characterised by high levels of biodiversity and fulfil various ecosystems functions. As a result, these systems are protected under various pieces of legislation including; the National Water Act, 1998 (Act No. 36 of 1998) and the National Environmental Management Act, 1998 (Act No. 107 of 1998).

ASSUMPTIONS AND LIMITATIONS

It is difficult to apply pure scientific methods within a natural environment without limitations or assumptions. The following apply to this study:

i. The findings, results, observations, conclusions and recommendations provided in this report are based on the authors' best scientific and professional knowledge as well as available information regarding the perceived impacts on the water resources.
ii. Water resource boundaries are essentially based on GPS coordinate waypoints taken onsite of indicator features. The accuracy of the GPS device therefore affects the accuracy of the maps produced. A hand-

[2] Department of Water Affairs and Forestry (DWAF) is now named the Department of Water and Sanitation (DWS).

held Garmin eTrex 30x was used to delineate the water resources and this has an accuracy of 3-6m.

iii. The assessment of the wetland health, functional integrity and ecological importance and sensitivity was based on a one day field investigation conducted on the 16th July 2018. Once-off assessments such as this may potentially miss certain ecological information, thus limiting accuracy, detail and confidence.

iv. The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological issues arising from the field survey and based on the assessor's working knowledge and experience with similar assessments. No project details on the road upgrade were provided for this project.

2. METHODOLOGY

ASSESSMENT TECHNIQUES AND TOOLS

The techniques and tools utilised for this assessment can be divided into baseline data and field investigations. Baseline data was utilised during the desktop component to determine the biophysical context of the site as well as National and Provincial legislation that governs the proposed activity.

BASELINE DATA

The desktop study conducted involved the examination of aerial photography, Geographical Information System (GIS) databases including the National Freshwater Ecosystem Priority Areas (NFEPA). The study made use of the following data sources:

- Google Earth™ satellite imagery was used at the desktop level.
- Relief dataset from the Surveyor General was used to calculate slope and the desktop mapping of water resources.
- The National Freshwater Ecosystem Priority Areas were used in determining any priority wetlands.
- Geology dataset was obtained from AGIS[3] and the Council for Geoscience.
- Vegetation type dataset from Mucina & Rutherford (2006) was used in determining the vegetation type of the study area.
- Terrestrial and aquatic habitats were identified and analysed by making use of the KwaZulu-Natal Biodiversity Sector Plan.
- Terrestrial ecosystems within South Africa are governed by legislation and these legislative requirements were consulted including:
  - National Environment Management: Biodiversity Act No. 10 of 2004.
  - Conservation of Agricultural Resources Act No. 43 of 1983.
  - Chapter 11 of the Nature Conservation Ordinance (No. 15 of 1974).
  - Terrestrial Threatened Ecosystems (Government Notice 1002. (Gazetted on 9 December 2011).
  - GN R 704 published in terms of the National Water Act (Act 36 of 1998) on 4 June 1999.

SITE INVESTIGATION

- In field data collection was taken on 16th July 2018. This included the delineation of wetland and watercourse systems, topographical setting, soil sampling techniques, identification of current land use, existing impacts

[3] Land type information was obtained from the Department of Agriculture's Global Information Service (AGIS) January 2014 – www.agis.agric.za

and dominant vegetation units present. This data was used in conjunction with the wetland delineation process to not only determine the functionality of individual wetlands but also understand their connectivity within the larger study area.

WETLAND DEFINITION & DELINEATION TECHNIQUE

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act as:

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

Furthermore, the Ramsar Convention defines wetlands as:

> *"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6m"*

These habitats are found where the topography and geological parameters impede the flow of water through the catchment, resulting in the soil profiles of these habitats becoming temporarily, seasonally or permanently wet. Further to this, wetlands occur in areas where groundwater or surface water discharges to the surface forming seeps and springs. Soil wetness and vegetation indicators change as the gradient of wetness changes (Figure 2).

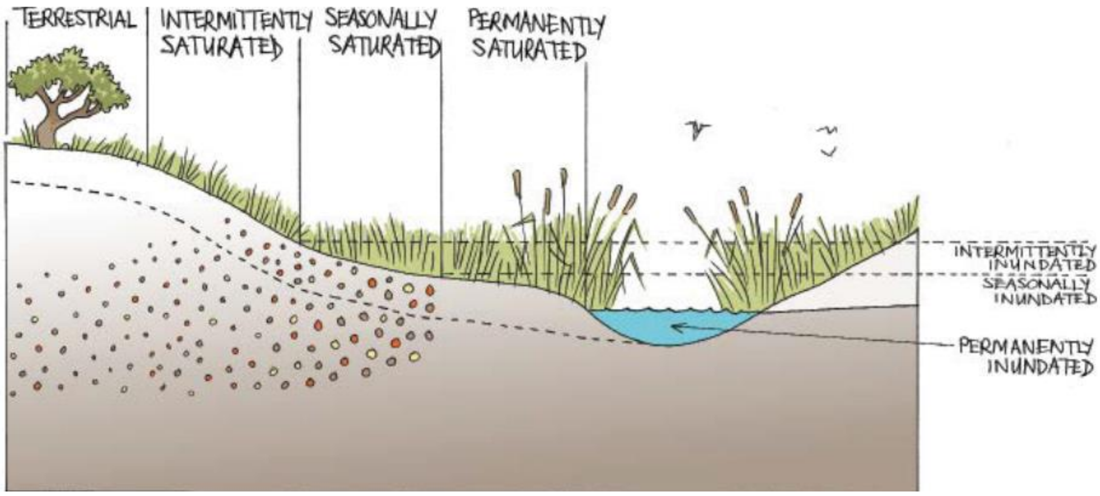

FIGURE 2: INCREASING SOIL WETNESS ZONES IDENTIFIED WITHIN VARIOUS WETLAND SYSTEMS

Based on definition presented in the National Water Act, three vital concepts govern the presence of a wetland namely:

i. Hydrology- Land inundated by water or displays saturated soils when these soils are biologically active (the growth season).
ii. Hydric soils- Soils that have been depleted of oxygen through reduction resulting in the presence of redoximorphic features.
iii. Hydrophytic vegetation- Plant species that are adapted to growing in saturated soils and subsequent anaerobic conditions (hydrophytes).

The conservation of wetland systems is vital as these habitats provide numerous functions that benefit not only biodiversity but provide an array of ecosystem services. These services are further divided into direct and indirect and are detailed in Table 1.

TABLE 1: DIRECT AND INDIRECT BENEFITS OF WETLAND SYSTEMS (KOTZE ET AL. 2005)

WETLAND GOODS AND SERVICES	
DIRECT	**INDIRECT**
Hydrological Water purification Flood reduction Erosion control Groundwater discharge	*Socio-economic* Socio-cultural significance Tourism and recreation Education and Research
Biodiversity conservation	Water supply
Chemical cycling	Provision of harvestable resources

The study site was assessed with regards to the determination of the presence of wetland and watercourse areas according to the procedure described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas –Edition 1' (DWAF, 2005).

WETLAND HEALTH AND FUNCTIONAL INTEGRITY ASSESSMENT TECHNIQUES

A Level 2 Wet-Health Assessment to determine the Present Ecological State as well as a Level 2 Wet-EcoServices Assessment to determine the Functional Integrity of the identified wetland unit was carried out. Further to this, the Ecological Importance and Sensitivity of the wetland unit was determined.

Detailed methodology for the wetland delineation, health, provision of ecosystem goods and services (functional integrity), ecological importance and sensitivity is given in Appendix B.

Assessment of Impact Significance

Significance scoring both assesses and predicts the significance of environmental impacts through evaluation of the following factors; probability of the impact; duration of the impact; extent of the impact; and magnitude of the impact. The significance of environmental impacts is then assessed taking into account any proposed mitigations. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required[4]. Each of the above impact factors have been used to assess each potential impact using ranking scales.

Unknown parameters are given the highest score (5) as significance scoring follows the Precautionary Principle. The Precautionary Principle is based on the following statement:

> *'When the information available to an evaluator is uncertain as to whether or not the impact of a proposed development on the environment will be adverse, the evaluator must accept as a matter of precaution, that the impact will be detrimental. It is a test to determine the acceptability of a proposed development. It enables the evaluator to determine whether enough information is available to ensure that a reliable decision can be made.'*

Table 2: Significance scoring used for each potential impact

Probability	Duration
1 - very improbable 2 - improbable 3 - probable 4 - highly probable 5 - definite	1 - very short duration (0-1years) 2- short duration (2-5 years) 3 - medium term (5-15 years) 4 - long term (>15 years) 5 - permanent/unknown
Extent	**Magnitude**
1 - limited to the site 2 - limited to the local area 3 - limited to the region 4 - national 5 - international	2 – minor 4 – low 6 – moderate 8 – high 10 – very high

The following formula was used to calculate impact significance:

Impact Significance: (Magnitude + Duration + Extent) x Probability

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[4] *Impact scores given "with mitigation" are based on the assumption that the mitigation measures recommended in this assessment are implemented correctly and rehabilitation of the site is undertaken. Failure to implement mitigation measures during and after construction will keep the impact at an unacceptably high level.*

The formula gives a maximum value of 100 points which are translated into 1 of 3 impact significance categories; Low, Moderate and High as per Table 3.

TABLE 3: IMPACT SIGNIFICANCE RATINGS

SIGNIFICANCE POINTS	SIGNIFICANCE RATING
0 - 30 points	Low environmental significance
31 - 59 points	Moderate environmental significance
60 -100 points	High environmental significance

The impact assessment is discussed in more detail in Section 7.

RATIONALE FOR THE ASSESSMENT

South Africa comprises a region of high biodiversity with high levels of endemism (Bates et al., 2014). According to the National Environmental Management: Biodiversity Act (NEMBA) (Act no.10 of 2004), biodiversity is defined as:

"the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems"

An ecosystem is a complex, self-sustaining natural system centred on the interaction between the structural components of the system (biotic and abiotic). Effective conservation of wetlands and associated biodiversity is paramount for the provision of ecosystem services. The degradation of the ecological integrity of wetland systems has a direct negative impact on the system's ability to provide these essential ecosystem goods and services.

Wetlands are particularly susceptible to anthropogenic activities and are threatened throughout South Africa (Figure 3). Wetland degradation is associated with agricultural (ploughing, drainage, alteration of flow regimes and nutrient enrichment), mining (effluent and industrial discharges), and urban activities (desiccation, channelization and loss of wetland systems).

As a result, wetland conservation requires a holistic approach in order to integrate the activity and the receiving environment in a sustainable and progressive way. This includes the incorporation of the natural system into the layout and design of the development.

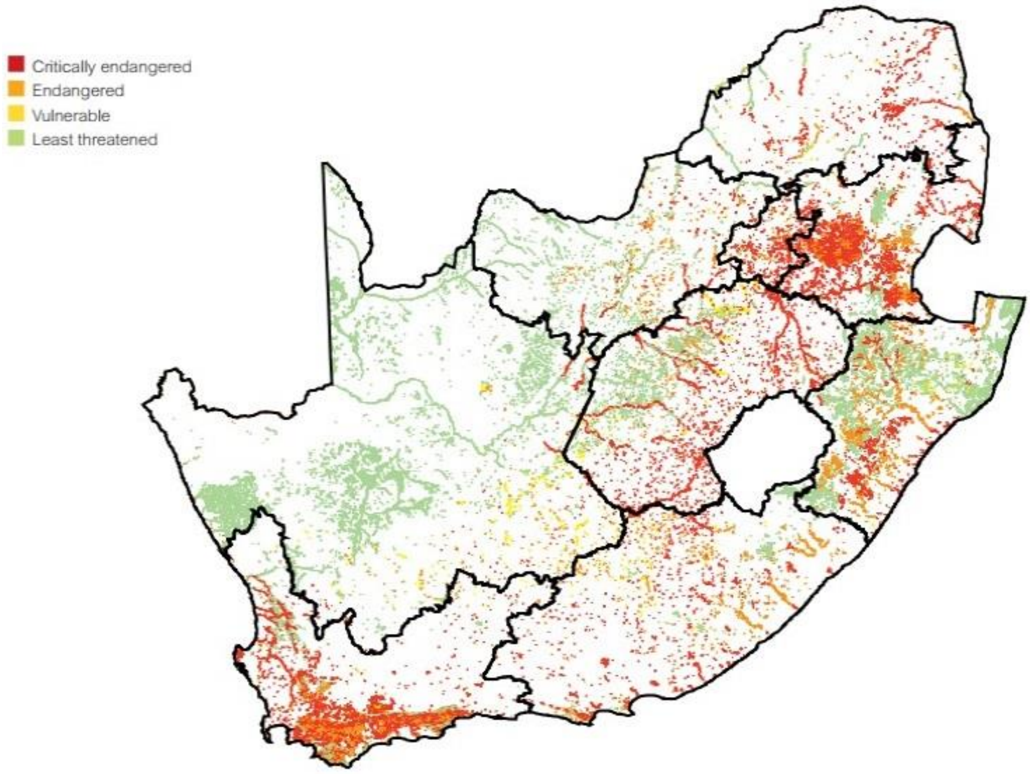


FIGURE 3: THREAT STATUS OF WETLAND ECOSYSTEMS (SANBI, 2013)

3. BASELINE BIOPHYSICAL DESCRIPTION

The study area is characterised by a summer rainfall pattern with limited rainfall events in the winter months. The mean annual precipitation is approximately 651mm (Table 4). The mean monthly minimum and maximum temperatures for the area are 4.3°C to 24.6°C respectively (Table 5) (Mucina & Rutherford, 2006; Camp, 1999).

This area of KZN falls into Climatic Capability Class C7. As indicated in the table below 65 % of the rainfall is precipitated over a 120 day window between November and February. Although winters are not severe, a few days of severe frosts are encountered.

TABLE 4: MEAN ANNUAL RAINFALL FOR THE AREA

	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
MEAN ANNUAL RAINFALL	105	120	85	73	39	16	8	10	17	31	62	84

TABLE 5: TEMPERATURES AND EVAPORATION FOR THE AREA

	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
MEAN TEMP (°C)	19	23	23	22	19	16	13	13	15	18	20	21
MAX TEMP (°C)	26	30	29	28	26	24	22	22	24	26	26	27
MIN TEMP (°C)	12	17	17	16	12	8	5	5	7	10	13	14

GEOLOGY AND TOPOGRAPHY

The geological characteristics of an area influences the topography, vegetation community's and faunal assemblages present. The geology of the larger study area is characterised by the formations associated with the Karoo Supergroup. Dominant rock types of these formations include sandy shales and mudstone, as well as areas of granite and diamctite (Mucina & Rutherford, 2006) (Figure 4).

Soils within the uMsinga Local Municipality are characterised by limited pedological development, soils with a plinthic criteria as well as soils with a podzolic characteristic (uMsinga SDF, 2016).

The topographical nature of the municipal area is comprised of deep gorge systems (associated with the Buffalo and Tugela Rivers). Primary land uses within the area are associated with livestock farming, subsistence agriculture and rural nodes.

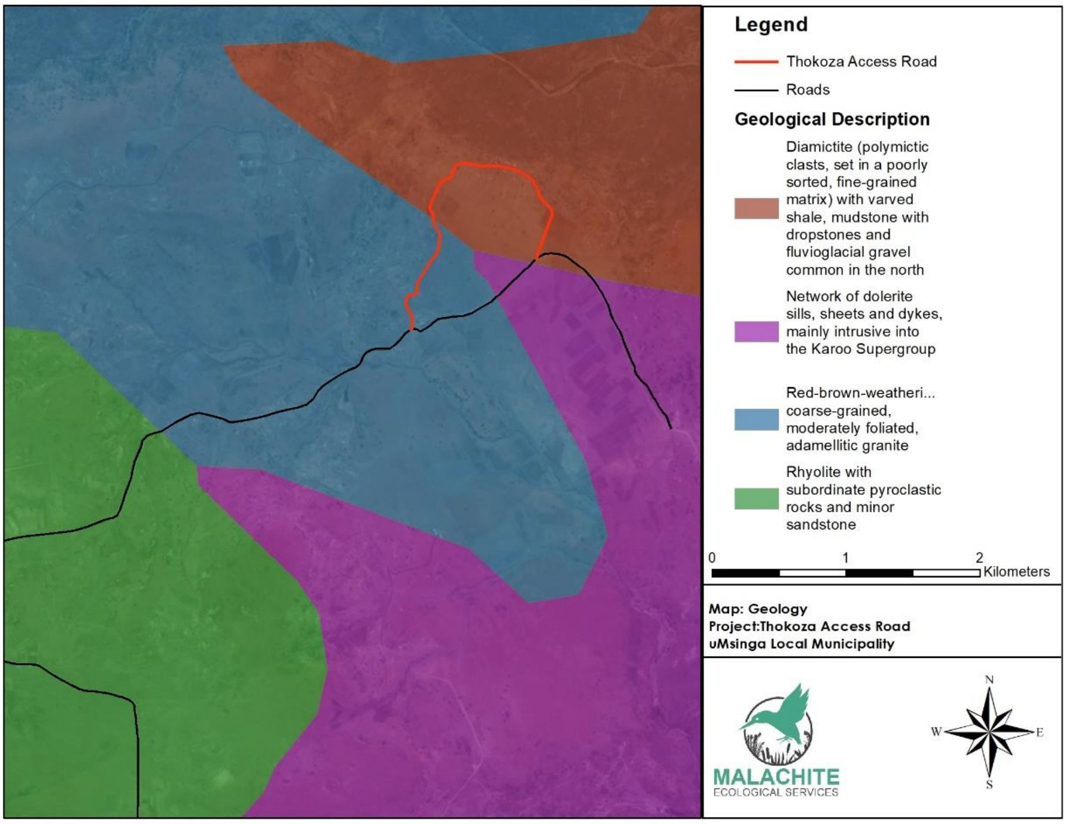


FIGURE 4: GEOLOGY OF THE STUDY SITE

REGIONAL VEGETATION STRUCTURE AND COMPOSITION

The project area is located within the Savanna Biome. The access route traverses through Highveld Alluvial vegetation and lies on the boundary of KwaZulu-Natal Highland Thornveld and Thukela Valley Bushveld vegetation types (Figure 5). Highveld Alluvial vegetation was the dominant vegetation unit associated with the road upgrade route. All three vegetation units are discussed in greater detail below based on *The Vegetation Map of South Africa* (Mucina & Rutherford, 2006).

<u>Highveld Alluvial Vegetation (Aza 5)</u>

This vegetation unit is distributed within alluvial drainage lines and floodplains along rivers embedded within the Grassland and Savannah Biomes. It is characterised by relatively flat topography supporting riparian thickets and seasonally flooded grasslands. This vegetation type is considered Least Threatened (Mucina & Rutherford, 2006). More than 25% has been transformed by cultivation and the construction of dams. Due to the elevated nutrient status and of the soils and high water availability, highveld alluvia are prone to invasion by pioneer problem and alien species. Commonly noted species include *Schinus molle*, *Melia azedarach*, *Morus alba*, *Argemone ochroleuca* and *Verbena bonariensis*. Further to this, the undergrowth of the alluvial riparian thickets and the accompanying grasslands are prone to overgrazing. Approximately 10% of this vegetation unit is statutorily conserved in several reserves and protected areas.

<u>Thukela Valley Bushveld (SVs 1)</u>
This vegetation unit is distributed within the central Thukela River basin upstream of Jameson's Drift, past Tugela Ferry to the southeast portion of Ladysmith. It also occurs within valleys systems of several major tributaries (lower Mooi, Bushmans, Buffels and Sundays Rivers). This vegetation unit is largely associated with rocky rugged slopes and terraces comprise of short-medium height deciduous trees and shrubs. Commonly noted species include *Vachellia tortilis*, *V. nilotica* subsp *Kraussiana* and *V. natalitia*. Prominent evergreen species include *Olea europaea* subsp. *africana*, *Boscia albitrunca* and *Euclea crispa*. Succulent plants are largely characterised by *Euphorbia* and *Aloe* species occurring on shallow and eroded soils as well as on the valley floor. The main topographical unit associated with this vegetation type is undulating slopes and ridgelines (Mucina & Rutherford, 2006).

This vegetation type is considered Least Threatened and is statutorily conserved in the Weenen Game Reserve. SVs1 has undergone considerable degradation over large portions of its distributional range. In the many eroded areas, prolonged continuous overgrazing has resulted in the complete loss of the grass cover. In many instances ground cover only exists under *Vachellia tortilis* trees where their root systems retain soil, the trees act as nutrient pumps and provide shade (Camp 1999e).

<u>KwaZulu-Natal Highland Thornveld (Gs 6)</u>
This vegetation unit is distributed within the central-northern regions of KwaZulu-Natal, where it occurs on both dry valleys and moist upland. This vegetation unit is largely associated with Hilly, undulating landscapes and broad valleys supporting tall tussock grassland usually dominated by *Hyparrhenia hirta*, with occasional savannoid woodlands with scattered *Vachellia sieberiana var. woodii* and in small pockets also with *V. karroo* and *V. nilotica* subs. *Kraussiana*. The main topographical unit associated with this vegetation type is undulating slopes and ridgelines (Mucina & Rutherford, 2006).

Gs 6 is classified as Least Threatened and is statutorily conserved within the Spoinkop, Weenen, Ntinini, Moor Park and Tugela Drift Nature Reserve. It is predicted that more than 16% has been transformed due to cultivation, urban sprawl and the construction of dams. Alien invasive species including *Opuntia*, *Eucalyptus*, *Populus*, *Acacia* and *Melia* are altering the functionality of various portions of this habitat. However, arguably the greatest threat to the remaining natural areas of this habitat unit is bush encroachment.

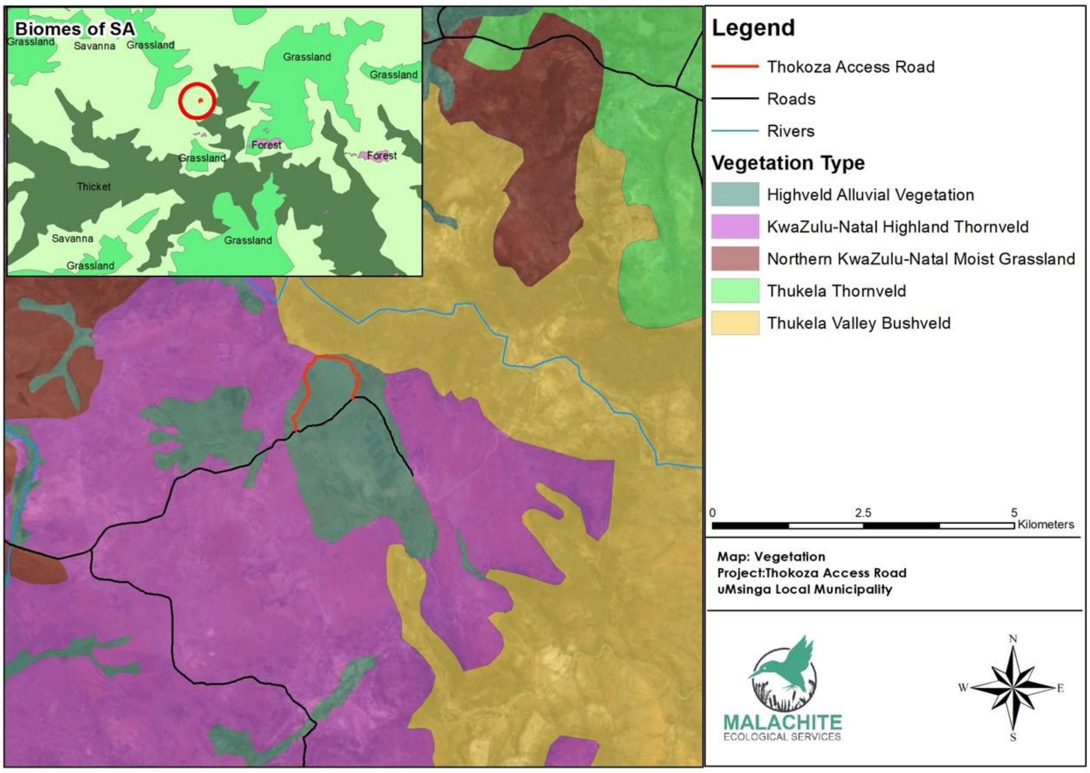


FIGURE 5: REGIONAL VEGETATION ASSOCIATED WITH THE STUDY SITE

BIODIVERSITY

The ecological integrity and connectivity of an area play a vital role in determining the floral and faunal species composition. The biodiversity of a particular area is focused on the interaction between living and non-living organisms. The ability of a habitat to effectively regulate the ecosystem processes will allow for the provision of important ecosystem services. These include provision of clean water, climate regulation and carbon sequestration (Driver *et al*. 2012).

The uMsinga Local Municipality has tracks of unprotected, intact vegetation units. As such an efficient biodiversity management system is imperative to the continue conservation of these sites and the ability to achieve/maintain conservation targets.

The present impacts on biodiversity and threats to terrestrial ecosystems within the larger area include:

i. Habitat loss due rural sprawl, agricultural expansion and rural settlements.
ii. Untransformed vegetation units (bushveld dominated slopes) within the municipality are susceptible to over-grazing, invasive plant infestation (*Acacia mearnsii* and *Caesalpinia decapetala*) as well as inappropriate burning techniques.
iii. Overgrazing was also noted on river banks often resulting in the decline in riparian systems.
iv. Loss of endemic plant species through overharvesting, overgrazing and through extensive sheet and donga erosion.
v. Encroachment of succulent *Euphorbia pseudocactus*.
vi. Sites of Conservation Value are threatened by rural human settlements.
vii. Loss of sensitive sites due to mismanagement/ lack of appropriate protection.
viii. Lack of biodiversity information within tribal areas.

This combination of factors has resulted in habitat transformation and subsequent reduction in suitable habitats for floral and faunal species. These impacts have had a direct negative impact on biodiversity within the larger project area.

PROVINCIAL CONSERVATION PLANNING

Loss of biodiversity results in ecosystem degradation and subsequent loss of important ecological services. Anthropogenic developments are a driving force that exerts pressure on the natural habitat and biological diversity.

Sensitivity of the area was assessed through the interrogation of biodiversity databases. The Provincial Biodiversity Sector Plan is a conservation plan introduced and implemented by Ezemvelo KZN Wildlife. Ezemvelo KZN Wildlife is the Nature Conservation Agency within the province whose core disciplines include biodiversity conservation, sustainable use of natural resources, the creation and management of partnerships with stakeholders and communities and the provision of affordable eco-tourism destinations within the Province (uThukela District Municipality Biodiversity Sector Plan). The primary aim of this conservation plan is to ensure that representative biodiversity samples are conserved to ensure that subsequent conservation targets are achieved. Areas within the province are categorised based on the sites ecological sensitivity, biological functioning and conservation significance. Classification of sites within this plan makes reference to the following:

- Optimal CBA: Areas identified through systematic conservation planning which represent the optimal/best localities out of a larger selection of available planning units that are optimally located to meet conservation targets.

- Irreplaceable CBA: Areas that are critical for meeting conservation targets and thresholds and are required to ensure the persistence of viable populations of species and the functionality of ecosystems. Therefore, the site has an irreplaceable conservation value with no alternative sites available.

Interrogation of the KZN Biodiversity Sector Plan indicated that Thokoza Road project area is not classified as either Critical Biodiversity Area or Ecological Support Area.

TERRESTRIAL THREATENED ECOSYSTEMS

The South African National Biodiversity Institute (SANBI) in collaboration with the DEAT and DWAF focused on the identification of threatened ecosystems within South Africa. The primary focus of this listing process was to reduce the rate of ecosystem and species loss and to preserve areas with high conservation value. As specified within Government Notice 1002 (gazetted on 9 December 2011) the criteria used to identify threatened terrestrial ecosystems include the following aspects:

- A1-Irreversible loss of natural habitat.
- A2-Ecosystem degradation and loss of integrity.
- B-Rate of loss of natural habitat.
- C- Limited extent and imminent threat.
- D1- Threatened plant species associations.
- D2- Threatened animal species associations.
- E- Fragmentation.
- F- Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan.

NB. Due to data constraints A2 and C have been applied to forests but no other vegetation types. Furthermore, Criteria B, D2 and E are dormant as thresholds have not been set due to a lack of a workable criterion.

The National Environmental Management: Biodiversity Act (Act 1 0 of 2004) provides for listing of threatened or protected ecosystems in the following categories:

- Critically Endangered (CR) ecosystems: This refers to ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation.
- Endangered (EN) ecosystems: This refers to ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems.
- Vulnerable (VU) ecosystems: This refers to ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems.
- Protected Ecosystems: This refers to ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable.

According to the 'Schedule of Threatened Terrestrial Ecosystems in South Africa' (promulgated under NEMBA, Government Notice 1002 of 2011), the project area is not located within a Listed Ecosystem.

CATCHMENT CHARACTERISTICS AND WATERCOURSES

The project area is situated within the V33D quaternary catchment (within the North-eastern Uplands Ecoregion). As of September 2016, the original 19 Water Management Areas (WMA) have been amalgamated into 9 Water Management Areas. In terms of WMAs, the project area is located within the Pongola-Mtamvuna WMA which incorporates the original Usuthu to Mhlatuze WMA, the Thukela WMA and the Mvoti to Umzimkulu WMA.

The Buffels River is the major river within the quaternary catchment, while the Mazabeko and Sampofu Rivers flow to the north (600m) and west (3.7km) of the site respectively. These are the dominant water courses within the study area. Further to these systems, there are numerous non-perennial watercourses which bisect the larger project (Figure 6).

Land use within the V33D quaternary catchment consists largely open tracts of land with low density rural housing and associated subsistence agriculture. Commercial plantations are present in limited portions of the quaternary catchment and extend into the adjacent catchments. Open tracts of land are largely classified as 'Degraded Bushveld' and 'Degraded Grassland'. This is predominantly due to large-scale sheet and gully erosion as a result of; land clearance, agricultural practices including livestock overgrazing and quarrying of stone and sand (uMsinga SDF, 2016). Despite these impacts, vegetation associated with steep valley systems surrounding the project area were intact and displayed elevated ecological integrity and functionality. This included a high density of *Aloe*, *Euphorbia* and other succulent species.

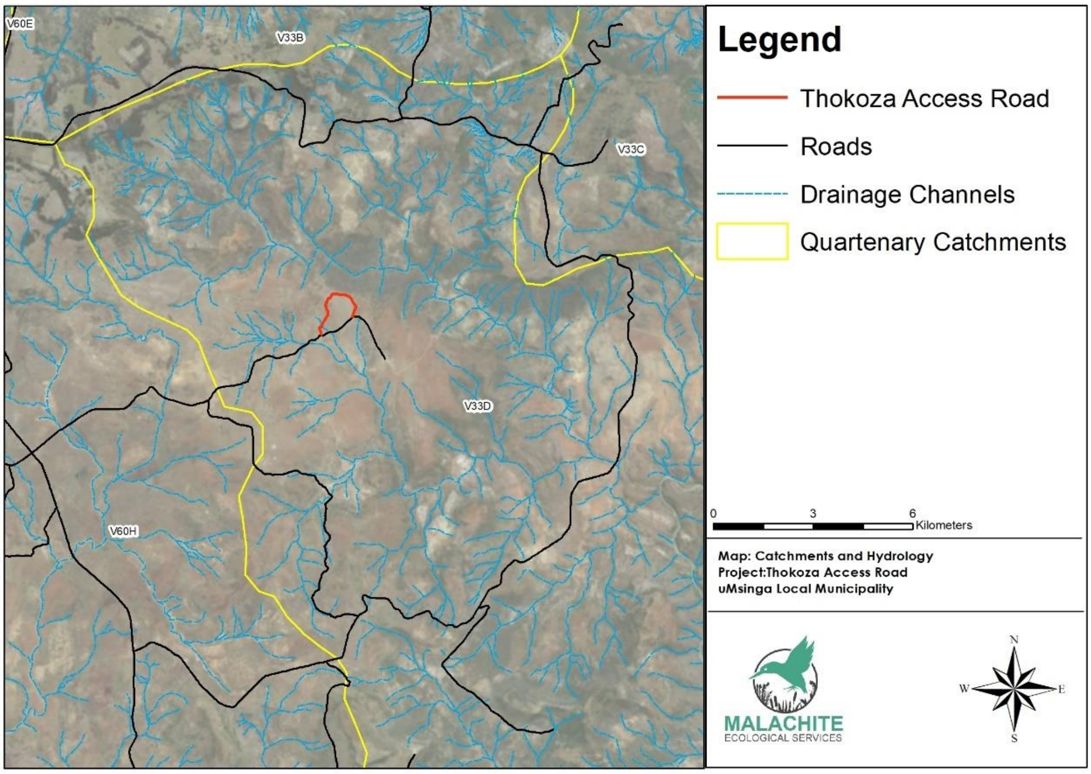


FIGURE 6: QUATERNARY CATCHMENT LOCATION AND RIVER SYSTEMS

The Thokoza Road traverses through scattered rural settlements and associated agricultural activities, interspersed with tracts of open degraded grasslands with scattered woody vegetation (primarily *Vachellia sieberiana* var. *woodii*). The road is situated on a gently sloping plateau.

NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS (NFEPA)

South Africa's freshwater ecosystems are diverse and these ecosystems refer to all inland water bodies (fresh or saline) including rivers, lakes, wetlands, sub-surface waters and estuaries (Nel et al., 2011). More than half of the country's freshwater ecosystems are considered threatened with the taxa associated with these habitats also displaying high levels of threat (fishes, molluscs, dragonflies, crabs and vascular plants). These statistics emphasise the need to protect and conserve the remaining freshwater ecosystems.

The NFEPA project was developed to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs (Driver et al., 2011). NFEPA further supports the implementation of the National Water Act, the Biodiversity Act and the Protected Areas Act.

As discussed in the regional vegetation component, vegetation in South Africa has been categorised into special units based on biotic factors, physical features and assemblages. In a similar way the NFEPA wetland vegetation groups have further categorised vegetation units associated with water resources. These vegetation groups were derived from grouping the 438 vegetation units into 133 wetland vegetation groups. The site is situated within the Sub-Escarpment Grassland Group 2 wetland ecosystem type. This ecosystem type is listed as Least Threatened.

An examination of the NFEPA database was undertaken. Three FEPA wetland systems were identified within the project area (Figure 7). These are classified as a Channelled Valley Bottom wetland, Valleyhead Seep and Flat wetland system. These wetlands are classified as FEPA wetlands due to their largely natural condition (PES A/B).

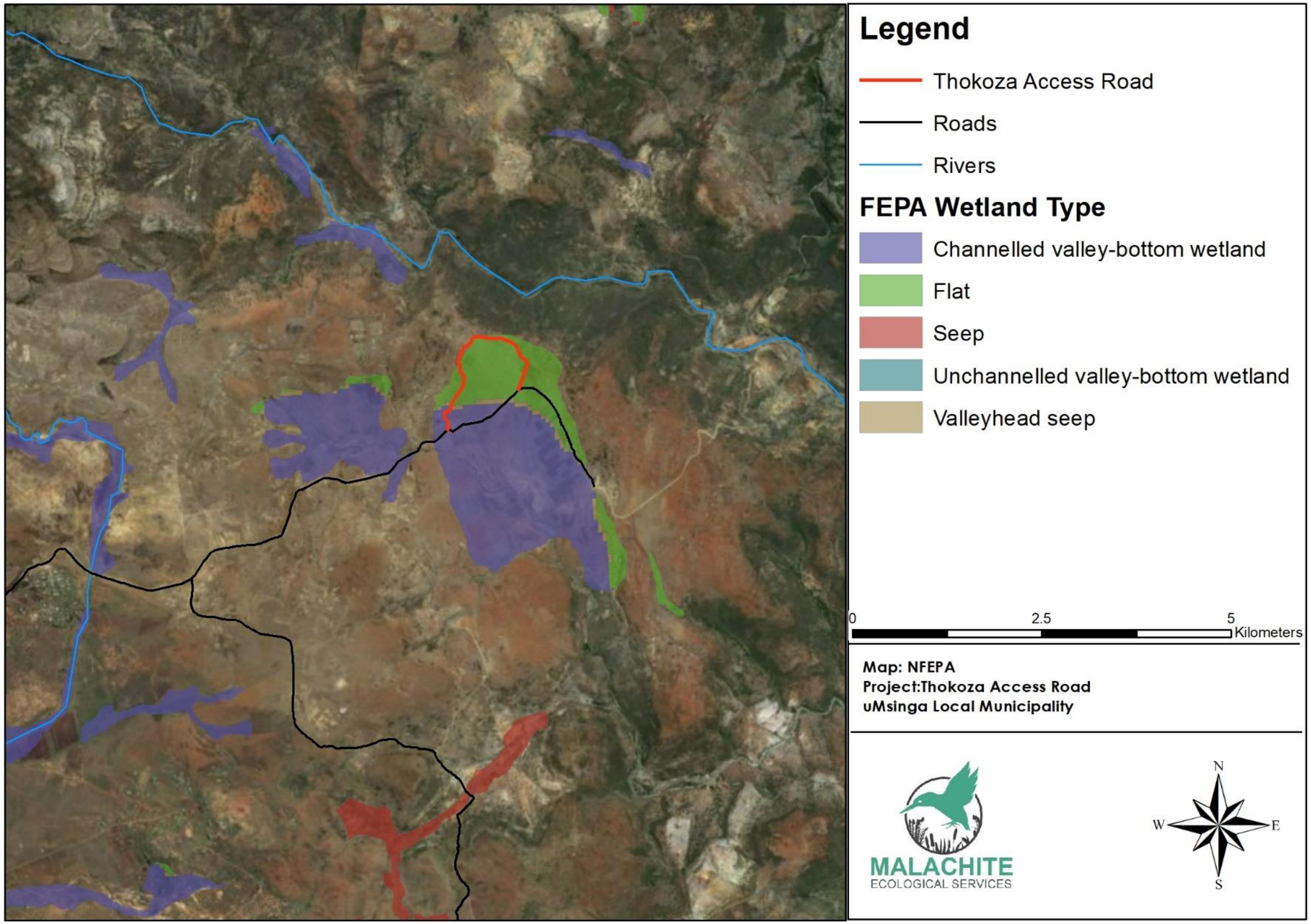


FIGURE 7: FEPA WETLANDS IDENTIFIED ALONG THE THOKOZA ACCESS ROAD

4. ASSESSMENT RESULTS

WETLAND DELINEATION

The South African classification system categorises wetland systems based on the characteristics of different Hydrogeomorphic (HGM) Units. An HGM unit is a recognisable physiographic wetland-unit based on the geomorphic setting, water source of the wetland and the water flow patterns (Macfarlane et al., 2008). There are five broad recognised wetland systems based on the abovementioned system and these are depicted in Figure 8. The classification of these wetlands is then further refined as per the 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).

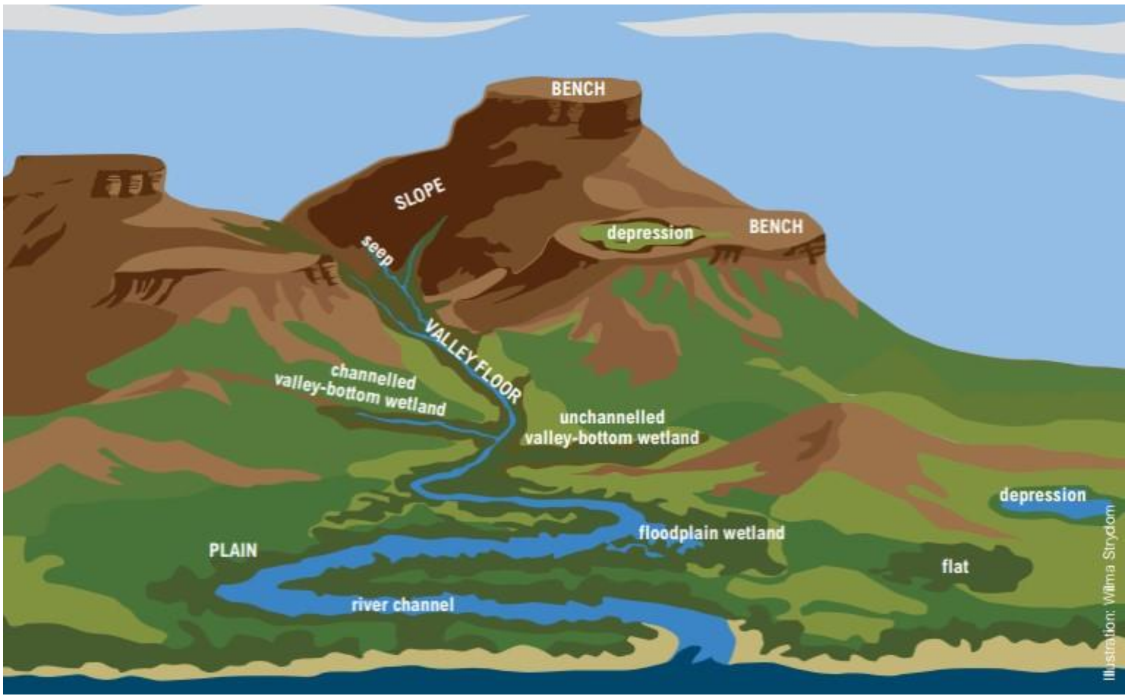
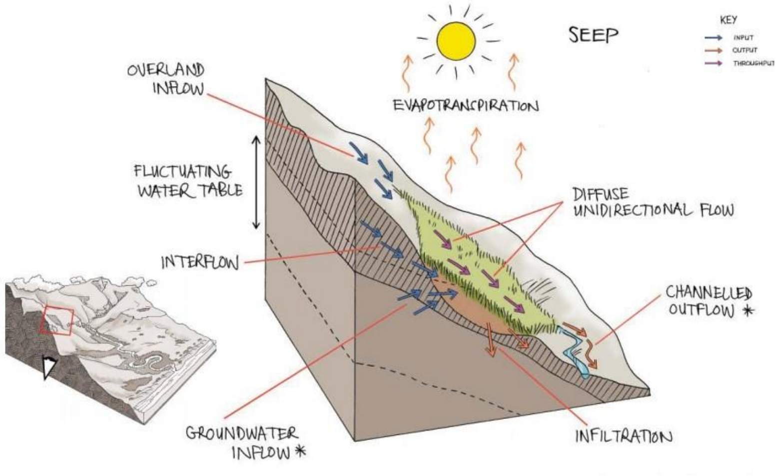


FIGURE 8: DIAGRAMMATIC REPRESENTATION OF COMMON WETLAND SYSTEMS IDENTIFIED IN SOUTHERN AFRICA

Based on the current identification of the four wetland indicators, one HGM unit was delineated within the assessment area (Figure 9). This was classified as a Seep system that flows in a southerly direction for approximately 1.5km from the road before forming a watercourse which is a tributary of the Mazabeko River.

Seepage wetlands are characterised by their association with topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to seep down-slope as subsurface interflow. Water movement through the Seep is primarily attributed to interflow, with diffuse overland flow often being significant during and after rainfall events (Kotze et al., 2008; Ollis et al., 2013). Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.



The wetland delineation was conducted based on the dominant indicators, including soil type (i.e. Soil Form and the presence of hydric characteristics); vegetation; and topographic position within a landscape. These are discussed in more detail within the assessment results.

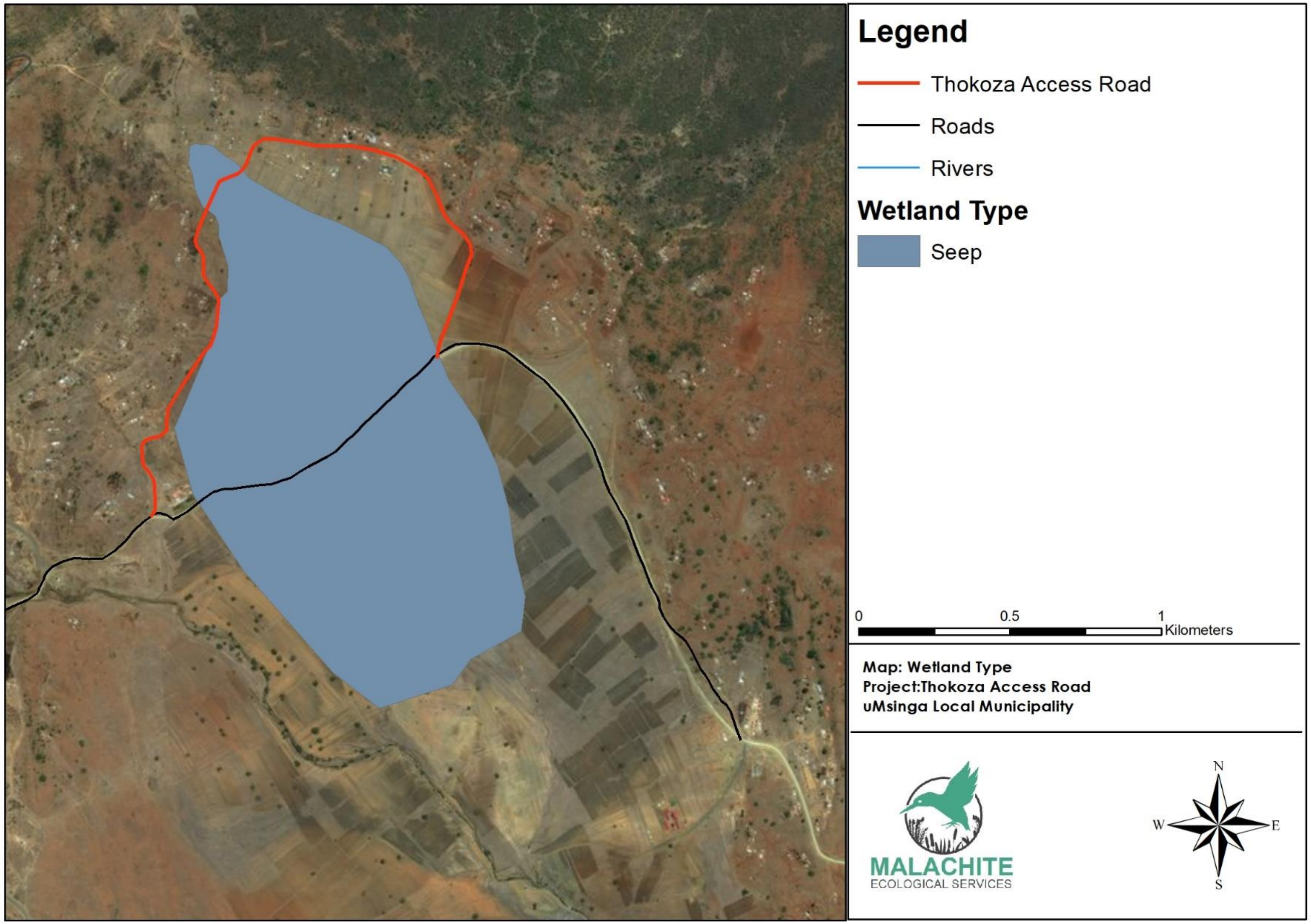


FIGURE 9: DELINEATION OF WETLANDS ALONG THE THOKOZA ACCESS ROAD AND WITHIN THE 500M ASSESSMENT BUFFER

SOIL WETNESS AND SOIL FORM INDICATOR

Soil samples were taken within the study site. These samples were examined for the presence of hydric (wetland) characteristics. Hydric soils are defined as those that typically show characteristics (redoximorphic features) resulting from prolonged and repeated saturation. Redoximorphic features include the presence of mottling (i.e. bright insoluble iron compounds); a gleyed matrix; and/or Manganese (Mn)/Iron (Fe) concretions (Photograph 2).

The presence of redoximorphic features are the most important indicator of wetland occurrence, as these soil wetness indicators remain in wetland soils, even if they are degraded or desiccated (DWAF, 2005). It is important to note that the presence or absence of redoximorphic features within the upper 500mm of the soil profile alone is sufficient to identify the soil as being hydric, or non-hydric (Collins, 2005). The type of soil is an important indicator of wetland systems as it affects the hydrological dynamics of the system as well as the vegetation composition and the biological functions that the system can perform.

PHOTOGRAPH 2: EXAMPLES OF HYDRIC CHARACTERISTICS USED AS INDICATORS FOR WETLAND CONDITIONS

Further to the identification of hydric properties, it is important to take into account the Soil Form. The type of soil (or the Soil Form) has a significant influence on the formation and functioning of a wetland system, including the way in which water enters and flows through a wetland (Ollis et al., 2013). The South African Soil Taxonomy (Soil Classification Working Group, 1991) refers to soil water regimes in the definition of three diagnostic horizons namely the E, G and soft plinthic B horizons (Jennings et al., 2008).

Soil sampling was undertaken along the existing Thokoza Access Road as well as within a 500m assessment buffer. Both hydric and terrestrial soils were identified within the areas sampled. Hydric soils were classified as the sandy loam Pinedene and Tukulu soil forms and these were identified within the Seep system. Terrestrial soils were dominated by the structureless Clovelly and Oakleaf forms and the shallow Mispah form.

Both the Pinedene and Tukulu soils lack structure within the soil profile. The Pinedene and Clovelly soils are characterised by a yellow-brown apedal soil horizon which is formed through weathering in well drained environments that produce coatings of iron oxide on soil particles that give rise to the yellow colouring. Within the Seep system, the formation of the Pinedene soil differs to the Clovelly soil in the formation of an underlying gleyic horizon which is formed by saturated conditions. This layer displays low chroma colours as well as mottling (Soil Classification Working group, 2018).

The Tukulu and Oakleaf soil forms are characterised by a weakly structured B horizon formed by colluvial (gravitational) movement material on foot-slopes of hilly areas. Again, the Tukulu, which is identified within the Seep, differs from the Oakleaf form by the presence of the gleyic horizon, which forms under saturated conditions (Soil Classification Working group, 2018).

Soils identified within the site are displayed in Table 6.

Table 6: Soils identified within the sampling area

<table>
<tr><th colspan="2">Soil Form and Defining Horizons</th><th>Defining Soil colour</th><th>Soil Texture</th><th>Zone of wetness</th><th>Observations</th><th>Photograph</th></tr>
<tr><td colspan="7">Hydric Soil</td></tr>
<tr><td rowspan="3">Pinedene</td><td>Orthic A</td><td rowspan="3">10YR 4/4 (Dark yellowish brown)</td><td rowspan="3">Clay loam</td><td rowspan="3">Temporary and Seasonal</td><td rowspan="3">Identified in the southern portion of the Seep system. Luvic in nature (increase in clay percentage with depth)</td><td rowspan="3"></td></tr>
<tr><td>Yellow Brown Apedal</td></tr>
<tr><td>Gleyic</td></tr>
</table>

<table>
<tr><th colspan="2">Soil Form and Defining Horizons</th><th>Defining Soil Colour</th><th>Soil Texture</th><th>Zone of Wetness</th><th>Observations</th><th>Photograph</th></tr>
<tr><td rowspan="3">Tukulu</td><td>Orthic A</td><td rowspan="3">10YR 2/1 (Black)</td><td rowspan="3">Clay Loam</td><td rowspan="3">Temporary and Seasonal</td><td rowspan="3">Identified within the Seep system and structureless in nature. Hydric properties in the form of mottling.</td><td rowspan="3"></td></tr>
<tr><td>Neocutanic</td></tr>
<tr><td>Gleyic horizon</td></tr>
<tr><td colspan="7">Terrestrial Soil</td></tr>
<tr><td rowspan="3">Clovelly</td><td>Orthic A</td><td rowspan="3">5YR 5/4 ((Yellowish Brown)</td><td rowspan="3">Sandy Clay Loam</td><td rowspan="3">None</td><td rowspan="3">Identified along the road, outside of the wetland systems. No hydric properties identified.</td><td rowspan="3"></td></tr>
<tr><td>Yellow Brown Apedal</td></tr>
<tr><td>Lithic</td></tr>
</table>

Soil Form and Defining Horizons		Defining Soil Colour	Soil Texture	Zone of Wetness	Observations	Photograph
Oakleaf	Orthic A Neocutanic B	10YR 2/2 (Very Dark Brown)	Sandy Loam	None	Identified on the surrounding hillslopes outside of the wetland systems.	
Mispah	Orthic A Hard Rock	10YR ¾ (Dark Yellowish Brown)	Sandy	None	Identified on the surrounding hillslopes outside of the wetland systems. Shallow in nature. Hard rock characterised by Sandstone	

VEGETATION INDICATOR

According to DWAF (2005), vegetation is regarded as a key component to be used in the delineation procedure for wetlands as distinct changes in vegetation assemblages can be noted when moving through wetland systems, from the permanent zone to the temporary zone. Vegetation also forms a central part of the wetland definition in the National Water Act (Act 36 of 1998).

Hydrophytic vegetation are plant species that are adapted to growing in permanently or temporarily water-logged conditions (elevated water conditions in wetland soils). This is further subdivided into species that are obligate and facultative wetland species (Table 7). The composition of a plant community is determined by the complex interactions between climate, soil type, position in the landscape and competition between plant species.

Wetland plant species perform a variety of functions including:

- Maintaining water quality by filtering out nutrients and sediments.
- Providing food, shelter and breeding habitat for both aquatic and terrestrial fauna.
- Preventing erosion.

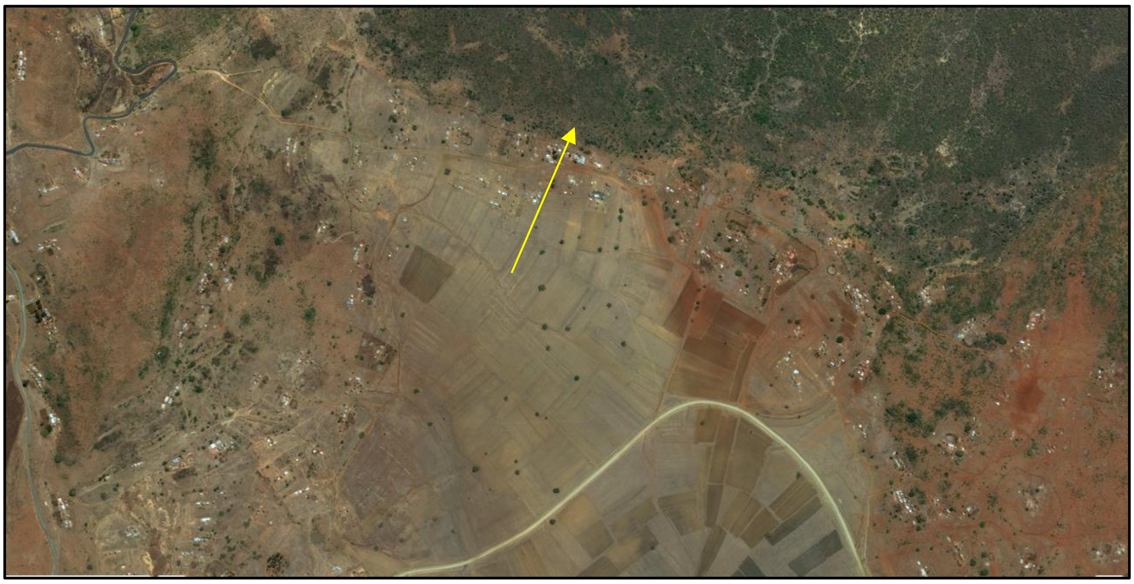
TABLE 7: THE CLASSIFICATION OF PLANTS ACCORDING TO OCCURRENCE IN WETLANDS (DWAF, 2008)

VEGETATION COMPONENTS	DESCRIPTION
Obligate wetland species	Almost always grow in wetlands (> 99% of occurrences)
Facultative wetland species	Usually grow in wetlands (67-99% of occurrences) but occasionally are found in non-wetland areas
Facultative species	Are equally likely to grow in wetlands and non-wetland areas (34- 66% of occurrences)
Facultative dry-land species	Usually grow in non-wetland areas but sometimes grow in wetlands (1- 34% of occurrences)

These wetland "indicator" species assist in the identification of wetland systems and associated boundaries. However, using vegetation as a primary wetland indicator requires undisturbed conditions (DWAF, 2005). The alteration of habitat and associated floral communities has a detrimental impact on the ability to confidently rely on vegetation as wetland indicators. In these instances, it makes scientific sense to utilise a combination of terrain and soil characteristics in determining wetland boundaries around transformed areas.

Variations in wetland systems also have an impact on vegetation communities through the topographical setting. The topographic position of plant communities is believed to influence plant distribution through variations in radiant (solar) energy and subsequent variations in soil moisture levels. Therefore, Channelled Valley Bottom wetlands generally provide unique environmental conditions compared to the Seepage system.

No hydrophytic species were noted surrounding the access road route. The vegetation structure of the project area was dominated by degraded grasslands interspersed with *Vachellia sieberiana* var. *woodii*. Grass basal cover was moderate-low with patches of overgrazed and exposed soils. Examination of aerial imagery shows that the grassland communities have been historically cultivated, accounting for the low and altered species diversity. Species noted were dominated by *Hyparrhenia hirta*, *Melinis repens*, *Cymbopogon* spp. and *Eragrostis* spp. The western portion of the project area is characterised by a woody-succulent mosaic as opposed to the secondary grasslands to the east. Common species noted within this mosaic included *Dichrostachys cinerea*, *Vachellia karroo*, *Euphorbia ingens*, *E. tirucalli* and *E. pseudocactus*, *A. spectablis* and *A. arborescens* (Photograph 3). Grass basal cover was higher below these woody trees as opposed to the open grassland areas.



PHOTOGRAPH 3: NOTE THE CHANGE IN THE VEGETATION COMPOSITION FROM DEGRADED GRASSLAND TO BUSHVELD

Livestock overgrazing and historic terracing of the site has impacted the grassland system. Further to this, scattered rural houses and associated subsistence farming has transformed this grassland community (Photograph 4).

Despite these disturbances, limited invasive alien species were noted. These comprised of *Tagetes minuta* (Khaki Weed) and *Cirsium vulgare* (Scottish thistle). *Aloe spectabilis* were noted adjacent to the access road and the rocky outcrop on the western portion of the project area. It is imperative that the *A. spectabilis* plants are not impacted by the proposed development. *A. spectabilis* are located adjacent to the existing road (approximately 17 plants) and must be relocated to suitable habitat, as it is highly likely that the road infrastructure threatens their persistence. This must be conducted by a qualified botanist only once the prescribed permits have been applied for and received by the local conservation authority. No translocation of species are permitted without the necessary permits. Further to this, *Crinum* spp. was also noted within the Seep wetland and must not be impacted by the proposed project as this is also protected by provincial legislation.

PHOTOGRAPH 4: SECONDARY GRASSLAND COMMUNITIES WHICH DOMINATE THE STUDY AREA AND *ALOE SPECTABILIS* ADJACENT TO THE THOKOZA ACCESS ROAD

TERRAIN INDICATOR

The topography of an area is generally a good practical indicator for identifying those parts in the landscape where wetlands are likely to occur. Generally, wetlands occur as a valley bottom unit however, wetlands can also occur on steep to mid slopes where groundwater or surface water discharge is taking place through seeps (DWAF, 2005). In order to classify a wetland system, the localised landscape setting must be taken into consideration through ground-truthing of the study site after initial desktop investigations (Ollis et al., 2014).

The existing Thokoza Road is situated on a plateau area, with the topography dropping steeply to the west and gently to the east. The Seep system has formed on the more gently topography. The road ranges in altitude from 907m to 1010m above sea level.

A hydrological flow prediction model was undertaken within the assessment area, the results are displayed in Figure 10. This model highlights the probability of watercourse areas and associated wetland systems. The area is dominated by a variety of seasonal and ephemeral watercourses, with the Seep system displayed as a seasonal to temporary system and linked to the valley bottom via a drainage network.

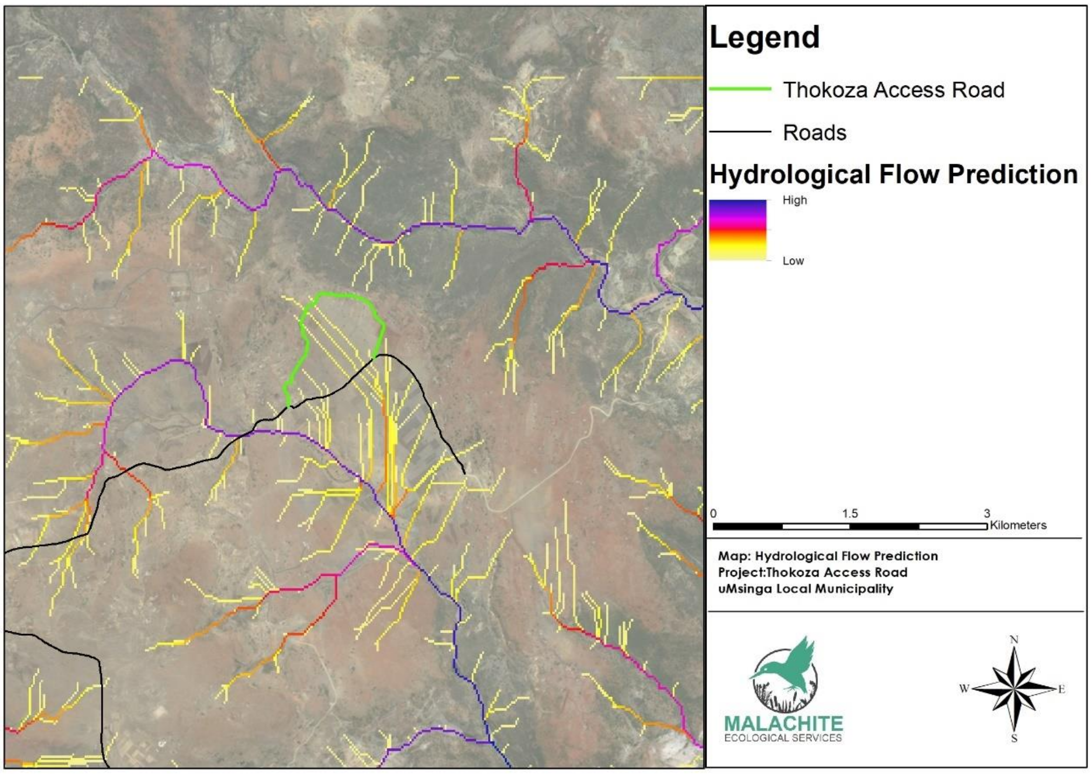


FIGURE 10: HYDROLOGICAL FLOW PREDICTION MODEL OF THE ASSESSMENT AREA

5. WETLAND HEALTH AND FUNCTIONAL ASSESSMENT

PRESENT ECOLOGICAL STATE (PES)

The Seep was assessed with regards to its health according to the Wet-Health methodology[5] and was classified as Largely Modified (PES Category D).

There have been a number of changes to the catchment and wetland system. These include the development of rural nodes including roads, housing, subsistence agriculture and livestock grazing. Cultivation of the entire Seep system has taken place, both historically and currently. These changes have resulted in an increase in hardened surfaces within the catchment, as well as a decrease in basal cover/ This has facilitated the creation of erosion gullies within the wetland system (Photograph 5).

Furthermore, cultivation of wetland systems has negative impacts on the functions of the geomorphology and hydrological processes, often resulting in erosion gully formation over extended periods. The cultivation of wetlands also requires their drainage, leading to the desiccation of hydric soils and a subsequent decline in the health of the wetland system. Decreases in soil bulk density, pH, and soil nutrient storage have been observed in wetland systems converted to cultivation lands. This is also true for the storage of soil organic matter, and available nitrogen and phosphorus, having negative consequences on the vegetation community within the system (Photograph 6).

These impacts facilitate the encroachment of alien invasive species within and adjacent to the wetland. These species were however noted to be limited in their presence and were confined to the edges of the erosion gullies and areas of elevated disturbance. These included*, Cirsium vulgare* and *Tagetes minuta*.

A summary of the PES scores obtained for the field-based delineated system following application of the Wet-Health approach during the present assessment as well as the healthy hectare equivalents is provided in Table 8. The Seep is expected to remain stable or decrease slightly in functional integrity and health over the next five years due largely to continued use of the wetland for agricultural practices, the growth of erosion gullies and the likelihood of development within the area.

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[5] The current size of the delineated wetlands was recorded. It must be noted that this is not the entire size of the wetland but rather the portion of the system delineated within the assessment area.

TABLE 8: SUMMARY OF PES SCORE

EXTENT DELINEATED (HA)	HYDROLOGY	GEOMORPHOLOGY	VEGETATION	PES SCORE (CATEGORY)	HEALTHY HECTARE EQUIVALENTS
128	6.5	5.2	4.8	D (5.64)	55.80

PHOTOGRAPH 5: THE USE OF THE SEEP FOR HISTORIC AND CURRENT CULTIVATION, AFFECTING THE HEALTH OF THE SYSTEM

PHOTOGRAPH 6: EROSION GULLY NOTED WITHIN THE SEEP SYSTEM

FUNCTIONAL ASSESSMENT (ECOSYSTEM GOODS AND SERVICES)

Ecosystem goods and services were calculated for the Seep. Scores received ranged from Low to Moderate for all ecosystem service resources (Figure 11).

The Seep system received moderate scores for natural ecosystem services associated with flood attenuation, sediment trapping; and filtration (i.e. phosphate, nitrate and toxicant trapping). As this Seep is utilised for cultivation it received high scores for the provision of natural resources as well as the use of the wetland for the cultivation of food. This use of the wetland has resulted in a decline in the health of the system.

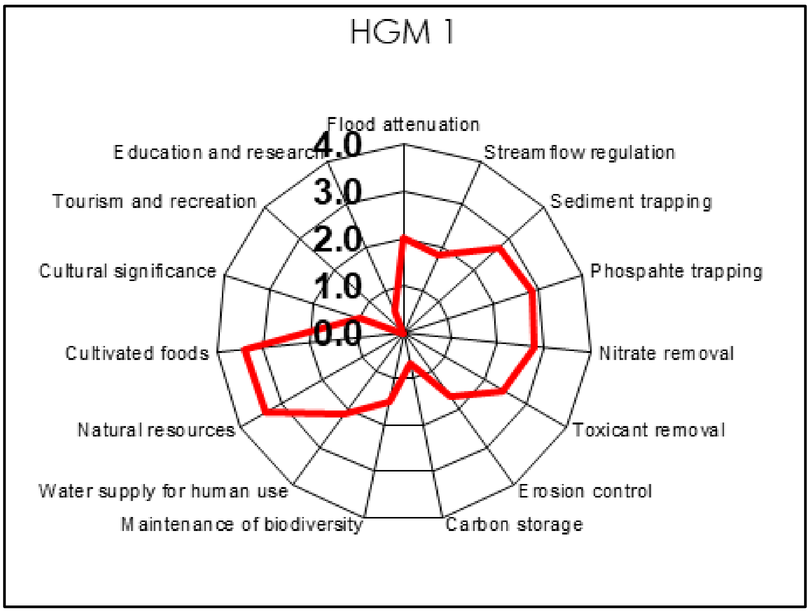


FIGURE 11: GENERAL WET-ECOSERVICES RESULTS FOR THE WETLAND SYSTEMS

ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The EIS score for the Seep system is Low[6] (Table 9). This is largely due to the location of this system within a rural settlement area. The wetland system is utilised for livestock grazing (decreasing the basal cover) and subsistence cultivation, leading to a decrease in basal cover and an increase in the disturbance within the wetland. This lowers the use of the area by faunal species due to the suboptimal conditions. This limits the opportunity for this system to contribute to the maintenance of biodiversity within the larger catchment.

The Seep received a Moderate score with regards to the Hydrological Functional Importance. Despite the modified nature of the system, it still provides ecosystem goods and services to its catchment, including water attenuation within the landscape, the provision of natural resources, filtration, and erosion control.

Furthermore, the system is utilised by the community for the grazing of cattle and the cultivation of subsistence crops, therefore receiving the Moderate Socio-Economic importance scores.

[6] A low score indicates that features about the wetland are regarded as somewhat ecologically important and sensitive at a local scale. The functioning and/or biodiversity features have low-medium sensitivity to anthropogenic disturbances. They typically play a very small role in providing ecological services at the local scale.

TABLE 9: SUMMARY OF THE ECOLOGICAL IMPORTANCE AND SENSITIVITY

HGM UNIT	EIS	SCORE (0-4)	CONFIDENCE (0-5)	CATEGORY
HGM 1 Seep	Ecological Importance and Sensitivity	1.21	3.00	Low
	Hydrological Functional Importance	2.12	3.00	Moderate
	Direct Human Benefits	2.00	3.50	Moderate

6. IMPACT ASSESSMENT AND RECOMENDATIONS

Any development activity in a natural system will have an impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of identified future impacts resulting from the construction of the Thokoza Access Road and provide a description of the recommendations required to limit the identified negative impacts on the receiving environment.

In order to address these impacts, the implementation of a site-specific mitigation measures that are aimed at reinstating favourable hydrological conditions that allow for the regeneration of the functional integrity of the watercourses along the road route.

Identified negative impacts associated with this project include:

- Soil erosion; sedimentation and further degradation of the Seep system, which will have knock-on impacts downstream of the road;
- The loss of wetland area as the road is widened;
- Pollution potential of the Seep as a result of construction related activities as well as future operational impacts with regards to polluted runoff from the hardened road surface; and
- Encroachment of invasive alien species into the wetland from the disturbance to the vegetation communities.

Positive impacts are also associated with the proposed development and include the long-term improvement in the control of surface run-off entering the Seep from the road through the upgrade of stormwater control structures along the road. Currently stormwater runoff from the existing road has contributed to the formation of erosion gullies within the Seep and this must be addressed during the construction phase of the road.

SOIL EROSION, SEDIMENTATION AND DEGRADATION OF WATERCOURSES

IMPACTS ASSOCIATED WITH SOIL EROSION, SEDIMENTATION AND DEGRADATION OF THE WATERCOURSE										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	Without	With	With out	With	With out	With		
Construction Phase										
Further soil erosion as a result of construction	5	3	2	2	2	1	6	4	50 (moderate)	21 (low)
Operational Phase										
Continued soil erosion along the upgraded road	5	3	5	5	2	1	4	2	55 (moderate)	24 (low)

Description of impact

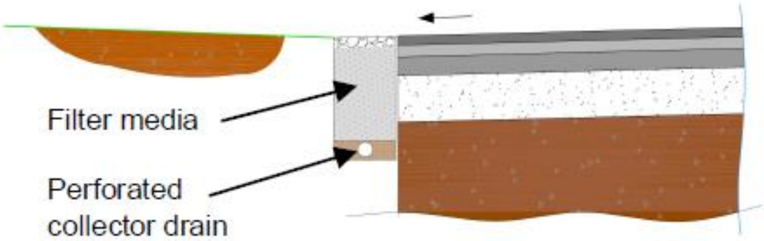
Construction activities (i.e. excavations and vegetation clearing) expose soil to environmental factors including rainfall and wind. The exposure to these factors will result in the continued erosion of soil within the disturbed construction areas. This is particularly so, in areas where soil will be compacted by heavy machinery. The eroded soil will quickly be washed downstream in the erosion gullies situated along the road and being deposited downstream. This will lead to disturbances to the hydrological flow of these systems and the continued formation of erosion gullies.

In the longer-term, sediment movement as a result of inadequately designed roads can lead to excessive erosion along the road.

Mitigation Options

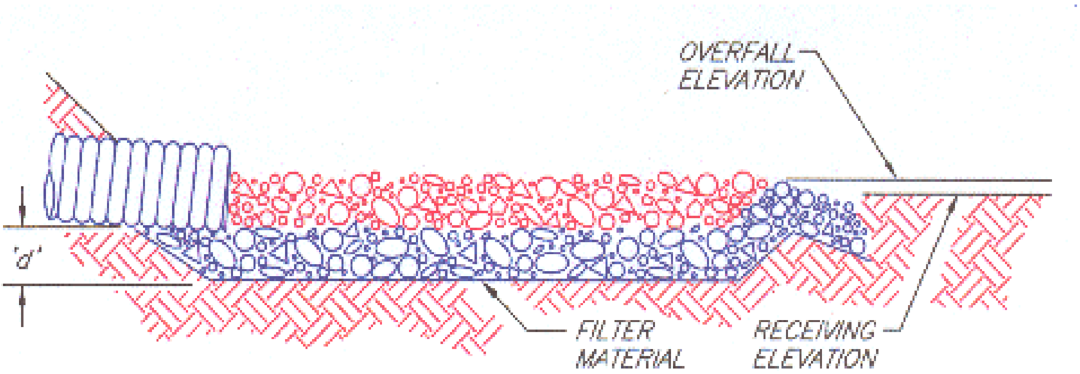
- To counter existing soil erosion along the road care must be taken at the design stage that the correct placement of water directing techniques be designed and specified in a manner that will best mitigate the effects of stormwater runoff.
- The use of sustainable drainage systems (SUDS) must be incorporated into the design of the road and associated drainage systems and include:
    - The use of swales (a shallow vegetated channel to convey road runoff).

- The use of filter drains/infiltration trenches which are roadside trenches filled with permeable media to provide treatment and temporary storage of runoff before infiltration or conveyance to the receiving environment.



- The use of filter strips which are maintained grassed areas of land that are used to manage shallow overland stormwater runoff through several filtration processes in a similar manner to buffer strips.

- Other erosion protection measures can include using energy dissipaters to slow the velocity of water coming from any stormwater pipes (particularly at the erosion gully) as shown below:



- It is important to maintain any SUDS feature that are installed along the road route. Un-maintained SUDS features may eventually fail operationally as a result of sediment build up and the effect this has on vegetation growth. If properly designed and regularly maintained, vegetated swales and other SUDS can last indefinitely and are far more cost effective than the maintenance of hardened or semi-hardened structures.
- The use of SUDS features can also be used to remediate parts of the Seep system. The SUDS will aid in erosion control and the attenuation of water, allowing for the build-up of sediment in the erosion gullies and ultimately the 're-wetting' of this system. This in turn, will promote vegetation growth in this area and help to stabilise the system.

<u>Other mitigation measures relating to the construction phase include</u>:

- No stockpiling of any materials may take place adjacent to the Seep. Erosion control measures must be implemented in areas sensitive to erosion and where erosion has already occurred. These measures include but are not limited to - the use of sand bags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes.
- Topsoil stockpiles must be appropriately protected using for example silt fences or sand bag barriers.
- Do not allow surface water or stormwater to be concentrated, or to flow down slopes without erosion protection measures being in place.
- Vegetation clearing must not be undertaken more than 10 days in advance of the work front. Vegetation clearing must only be undertaken when construction activity is actually underway at this point and such areas must be rehabilitated within 2 weeks of initial clearing occurring. The entire road construction servitude must not be stripped of vegetation prior to commencing construction activities.

- Disturbed sites must be rehabilitated as soon as construction in an area is complete or near complete and not left until the end of the project to be rehabilitated.
- Install sediment barriers across the entire construction right-of-way, to prevent sediment flow into the Seep.
- Erosion protection measures must be installed at stormwater drainage pipes outlets located along the route. This is in addition to velocity control measures.

POLLUTION OF WATER RESOURCES AND SOIL

IMPACTS ASSOCIATED WITH POLLUTION OF WATER RESOURCES AND SOIL										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	With out	With	With out	With	With out	With		
Construction Phase										
Upgrade of road	5	4	2	2	2	1	6	4	50 (moderate)	28 (low)
Operational Phase										
Existence of upgraded road	4	3	5	5	2	1	4	2	44 (moderate)	24 (low)

<u>Description of the impact</u>

Sediment release from a construction site into the receiving environment is one of the most common forms of waterborne pollution. Furthermore, mismanagement of waste and pollutants including hydrocarbons, construction waste and other hazardous chemicals will result in these substances entering and polluting these sensitive environments either directly through surface runoff during rainfall events, or subsurface water movement. The linked nature of the Seep will likely result in pollutants being carried downstream from the construction site.

In addition to this, hardened surfaces are recognised as a source of various pollutants which can originate from a wide variety of sources. The pollutant concentration in road runoff can be highly variable and dependant on a wide variety of factors including location, traffic volumes, extent of dry period before a rainfall event, and nature of the surface. The increase in hardened surfaces as a result of the project will lead to the increase in the flushing of these pollutants into the Seep system during the operational phase of this development.

Mitigation Options

- All waste generated during construction is to be disposed of as per an Environmental Management Programme (EMPr) and washing of containers, wheelbarrows, spades, picks or any other equipment that has been contaminated with cement or chemicals within the erosion gullies, or watercourses, must be strictly prohibited.
- Proper management and disposal of construction waste must occur during the upgrade of the road.
- No release of any substance i.e. cements or oil that could be toxic to fauna or faunal habitats; Wet cement and/ or concrete must not be allowed to enter the Seep.
- Portable toilets must be placed outside of a 100m buffer from the wetland system.
- Do not locate the construction camp or any depot for any substance which causes or is likely to cause pollution within a distance of 100m of the Seep.
- Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using proper solid/hazardous waste facilities (not to be disposed of within the natural environment). Any contaminated soil must be removed and the affected area rehabilitated immediately. Consult with a wetland/aquatic specialist if spills occur.

INVASIVE ALIEN SPECIES ENCROACHMENT

IMPACTS ASSOCIATED WITH ALIEN INVASIVE SPECIES										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	With out	With	With out	With	With out	With		
Construction Phase										
Upgrade of the road	3	2	2	2	2	1	6	4	30 (low)	14 (low)
Operational Phase										
Existence of the upgraded road	4	3	5	5	2	1	4	2	44 (moderate)	24 (low)

Description of the impact

Any removal of vegetation within the Seep will lead to further disturbance within the area having a negative impact on the functionality of the already degraded vegetation community. Invasive alien species will further encroach into disturbed areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches (Bromilow, 2010). Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs (Zedler, 2004).

Mitigation Options

- An invasive alien management programme must be incorporated into the Environmental Management Programme.
- Ongoing alien plant control must be undertaken. Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan must be implemented for the clearing/eradication of alien species.
- Construction staff and vehicles must stick to the construction servitude and not be allowed to access sensitive areas.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. This requirement is in fulfilment of the terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004). Areas which have been disturbed will be quickly colonised by invasive alien plant species.

7. RISK MATRIX

The Risk Assessment for the proposed upgrade of the Thokoza Access Road as per the General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21 (c) and (i) (Notice 509 of 2016) was undertaken.

The risk assessment involves the analysis of the risk matrix provided in appendix 1 of this notice and involves the evaluation of the severity of impacts to the flow regime, water quality, habitat, and biota of the water resource. Based on the outcome of the Risk Assessment Matrix, low risk activities will be generally authorised with conditions, while moderate to high risk activities will be required to go through a Water Use Licence Application Process. Water use activities that are authorised in terms of the General authorisations will still need to be registered with the DWS.

It must be borne in mind that when assessing the impact significance following the DWS Risk Assessment Matrix, determination of the significance of the impact assumes that mitigation measures as listed within this report as well as within an Environmental Management Programme for the construction and operational phase of the road project are feasible and will be implemented, and as such does not take into consideration significance before implementation of mitigation measures.

The risk assessment is provided in Appendix C. Impacts associated with the proposed project received Low Risk Scores with impacts to the water resources being small and easily managed

8. CONCLUSION

Based on the current identification of the four wetland indicators, one HGM unit was delineated within the assessment area. This was classified as a Seep system The Seep was assessed with regards to its health according to the Wet-Health methodology and was classified as Largely Modified (PES Category D).

Any development activity in a natural system will have an impact on the surrounding environment. In order to address these impacts, the implementation of a site-specific mitigation measures that are aimed at reinstating favourable hydrological conditions that allow for the regeneration of the functional integrity of the watercourses along the road route.

Identified negative impacts associated with this project include:

- Soil erosion; sedimentation and further degradation of the Seep system, which will have knock-on impacts downstream of the road;
- The loss of wetland area as the road is widened;
- Pollution potential of the Seep as a result of construction related activities as well as future operational impacts with regards to polluted runoff from the hardened road surface; and
- Encroachment of invasive alien species into the wetland from the disturbance to the vegetation communities.

Positive impacts are also associated with the proposed development and include the long-term improvement in the control of surface run-off entering the Seep from the road through the upgrade of stormwater control structures along the road. Currently stormwater runoff from the existing road has contributed to the formation of erosion gullies within the Seep and this must be addressed during the construction phase of the road.

The Risk Assessment for the proposed project as per the General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21 (c) and (i) (Notice 509 of 2016) was undertaken. Impacts associated with the proposed project received Low Risk Scores with impacts to the water resources being small and easily managed. Several general and specific measures are proposed to mitigate these impacts on the water resources.

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10. APPENDICES

APPENDIX A – DECLARATIONS

I **Rowena Harrison,** declare that -

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- 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 National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the NEMA Act, regulations and all other applicable legislation;
- As a registered member of the South African Council for Natural Scientific Professions in terms of the Natural Scientific Professions Act, 2003 (Act No. 27 of 2003), I will undertake my professional duties in accordance with the Code of Conduct of the Council, as well as any other societies of which I am a member; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B-(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:

Date: 27/09/2018

Specialist:	Rowena Harrison for Malachite Specialist Services (Pty) Ltd
Qualification:	MSc Soil Science (UKZN)
E-mail:	rowena@malachitesa.co.za
Professional affiliation(s) (if any)	SACNASP *Pr. Sci.Nat*: 400715/15 IAIAsa (No. 2516)

I **Craig Widdows,** declare that -

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- 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 National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the NEMA Act, regulations and all other applicable legislation;
- As a registered member of the South African Council for Natural Scientific Professions in terms of the Natural Scientific Professions Act, 2003 (Act No. 27 of 2003), I will undertake my professional duties in accordance with the Code of Conduct of the Council, as well as any other societies of which I am a member;
- 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 report are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B-(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:

Date: 27/09/2018

Specialist:	Dr Craig Widdows for Malachite Specialist Services (Pty) Ltd
Qualification:	PhD Ecology (UKZN)
Email:	craig@malachitesa.co.za
Professional affiliation(s) (if any)	SACNASP *Pr. Sci.Nat*: 117852

APPENDIX B – WETLAND AND WATERCOURSE DELINEATION AND ASSESSMENT METHODOLOGY

WETLAND DELINEATION TECHNIQUE

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act as:

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

The study site was assessed with regards to the determination of the presence of wetland areas according to the procedure described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005). This methodology requires the delineator to give consideration to the following four indicators in order to identify wetland areas; to find the outer edge of the wetland zone; and identify the different zones of saturation within the wetland systems identified:

i. Terrain Unit Indicator: helps to identify those parts of the landscape where wetlands are more likely to occur.
ii. Soil Form Indicator: identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
iii. Soil Wetness Indicator: identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation. Signs of wetness are characterised by a variety of aspects including marked variations in the colour of various soil components, known as mottling; a gleyed soil matrix; or the presence of Fe/Mn concretions. It should be noted that the presence of signs of wetness within a soil profile is sufficient to classify an area as a wetland area despite the lack of other indicators.
iv. Vegetation Indicator: identifies hydrophilic vegetation associated with frequently saturated soils.

In assessing whether an area is a wetland, the boundary of a wetland should be considered as the point where the above indicators are no longer present. An understanding of the hydrological processes active within the area is also considered important when undertaking a wetland assessment. Indicators should be 'combined' to determine whether an area is a wetland, to delineate the boundary of that wetland and to assess its level of functionality and health.

ASSESSMENT OF THE WETLAND'S FUNCTIONAL INTEGRITY

Wetlands within the study area serve to improve habitat within and potentially downstream of the study area through the provision of various ecosystem services. These ecosystem services relate to:

- Flood attenuation.
- Streamflow regulation.
- Water purification (including sediment trapping and the assimilation of phosphates, nitrates and toxicants).
- Carbon storage.
- Maintenance of biodiversity.
- Provision of water for human and agricultural use.
- Cultural benefits (including tourism, recreation and cultural heritage).

Wetlands therefore affect the quantity and quality of water within a catchment (Mitsch & Gosselink, 1993). The importance of wetland conservation and sustainable management is directly related to the value of the functions provided by a wetland. An indication of the functions and ecosystem services provided by wetlands is assessed through the WET-EcoServices manual (Kotze et al., 2008) and is based on a number of characteristics that are relevant to the particular benefit provided by the wetland. The tool uses biophysical characteristics of the wetland and the level of disturbance within the wetland and its catchment to estimate the level of supply of ecosystem goods and services. A Level 2 WET-EcoServices assessment was undertaken for the wetlands identified along the power line corridor. A Level 2 assessment is the highest WET-EcoServices assessment that can be undertaken and involves an on-site assessment as well as desktop work.

ASSESSMENT OF THE WETLAND'S PRESENT ECOLOGICAL STATE (PES)

The Present Ecological State (PES) for wetlands which is defined as '*a measure of the extent to which human impacts have caused the wetland to differ from the natural reference condition'* is also an indication of each wetland's ability to contribute to ecosystem services within the study area. This was assessed according to the methods contained in the Level 2 WET-Health: *A technique for rapidly assessing wetland health* (Macfarlane et al., 2009).

This document assesses the health status of a wetland through evaluation of three main factors -

- **Hydrology:** defined as the distribution and movement of water through a wetland and its soils.
- **Geomorphology:** defined as the distribution and retention patterns of sediment within the wetland.
- **Vegetation:** *defined as the vegetation structural and compositional state.*

The WET-Health tool evaluates the extent to which anthropogenic changes have impacted upon the functional integrity or health of a wetland through assessment of the above-mentioned three factors. The deviation from the natural condition is given a rating based on a score of 0-10 with 0 indicating no impact and 10 indicating modifications have reached a critical level. Since hydrology, geomorphology and vegetation are interlinked their scores are then aggregated to obtain an overall PES health score These scores are then used to place the wetland into one of six health classes (A – F; with A representing completely unmodified/natural and F representing severe/complete deviation from natural as depicted in Table 10.

TABLE 10: HEALTH CATEGORIES USED BY WET-HEALTH FOR DESCRIBING THE INTEGRITY OF WETLANDS

DESCRIPTION	IMPACT SCORE	HEALTH CATEGORY
Unmodified, natural.	0 - 1.0	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 - 2.0	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2.1 - 4.0	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4.1 - 6.0	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable	6.1 - 8.0	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	8.1 - 10.0	F

Due to differences in the pattern of water flow through various hydro-geomorphic (HGM) types, the tool requires that the wetland is divided into distinct HGM units at the outset. Ecosystem services for each HGM unit are then assessed separately.

Assessment of Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity (EIS) assessment was determined by utilising a rapid scoring system. The system has been developed to assess the 'Ecological Importance and Sensitivity' of the wetland within the larger landscape; the 'Hydrological Functional Importance' of the wetland; and the 'Direct Human Benefits' obtained from the wetland through either subsistence or cultural practices. The scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze et al. (2008) on the assessment of wetland ecological goods and services from the WET-EcoServices tool. The scores obtained were placed into a category of very low; low; medium; high; and very high as shown:

- Very low: 0 – 1.0
- Low: 1.1 – 2.0
- Medium: 2.1 – 3.0
- High: 3.1 – 4.0
- Very High 4.1 – 5.0

APPENDIX C– RISK MATRIX

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

NAME and REGISTRATION No of SACNASP Professional member: Rowena Harrison Reg. no. 400715/15

Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

					Severity																			
No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes	PES AND EIS OF WATERCOURSE
1	Construction Phase	Construction of road	Clearing vegetation adjacent to existing road	Impacts to hydric soils, Loss of biodiversity & habitat; Loss of vegetation structure; Increase in exposed soil; Disturbance to vegetation communities;	1	2	2	2	1.75	1	2	4.75	3	2	5	1	11	52.25	L	80	As per Section 6 of the report		One Seep system (PES D; EIS Low)
			Construction of road including foundations and compaction of gravel		1	2	2	2	1.75	1	2	4.75	3	2	5	1	11	52.25	L	80			
2	Construction Phase	Construction and installation of stormwater drains		Erosion and sedimentation of Seep; impact to hydrological flow; pollution potential	2	1	1	1	1.25	1	2	4.25	3	2	5	1	11	46.75	L	80	As per Section 6 of the report		One Seep system (PES D; EIS Low)

3	Construction phase	Upgrade of road adjacent to Seep system	Widening of road adjacent to Seep	Removal of vegetation and soils; soil erosion and sedimentation; degradation of adjacent Seep system	**2**	**1**	**1**	**2**	**1.5**	**1**	**2**	**4.5**	**3**	**2**	**5**	**1**	**11**	**49.5**	L	**70**	As per Section 6 of the report		One Seep system (PES D; EIS Low)
			Clearing of vegetation and soil along existing track		1	1	1	1	1	1	4	6	1	2	5	1	**11**	**49.5**	L	70			
4	Operational phase	Maintenance of road	Vegetation clearing along road	Sediment deposition in the Seeps, pollution of water resources	2	2	2	2	2	1	1	4	1	2	5	2	10	40	L	60	As per Section 6 of the report		One Seep system (PES D; EIS Low)
			Rehabilitation of erosion gullies		3	2	2	1	2	1	1	4	1	1	5	1	8	32	L	60			