

**WETLAND SENSITIVITY, FUNCTION AND PES ASSESSMENT
IN THE VICINITY OF THE PROPOSED DEVELOPMENT OF
KLERKSOORD X25 & X26, PRETORIA, GAUTENG**

PREPARED FOR:

LEAP ENVIRONMENTAL CONSULTANTS

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1. INTRODUCTION & TERMS OF REFERENCE

Scientific Aquatic Services was appointed by LEAP Environmental Consultants to conduct a wetland Present Ecological State (PES), ecoservices and sensitivity assessment in the vicinity of a proposed development on Portions 146 and 147 and the Remainder of Portions 145, 160 and 164 of the farm Witfontein 301 JR, known as Klerksoord x25 & x26.

The purpose of this report is to determine the overall sensitivity of the wetland system occurring on the study area, as well as the sensitivities of individual sections thereof, based on the results of the delineation by Taka Echo and Land Rehab CC. This information should aid the developer in the planning of the proposed development, since construction within this area may prove difficult in some areas, and will impinge on wetland habitat, which is generally regarded as sensitive.

In order to manage wetland features and understand the environmental importance and sensitivity thereof, it is essential to define the Present Ecological State (PES) of the system, understand the functioning of the system and the ecological and socio-cultural services that the systems provide. Once these aspects have been considered, the Recommended Ecological Category (REC) of each section of the wetland can be defined and objectives can be formulated to meet these requirements. Based on these findings, the wetland can be divided into areas of varying sensitivity which could guide the proponent as to which areas are, potentially developable, without severely affecting the ecology and function of the system. It must however be noted that development within any wetland or water course requires licensing in terms of Section 21 (c) and (i) of the National Water Act (Act 36 of 1998).



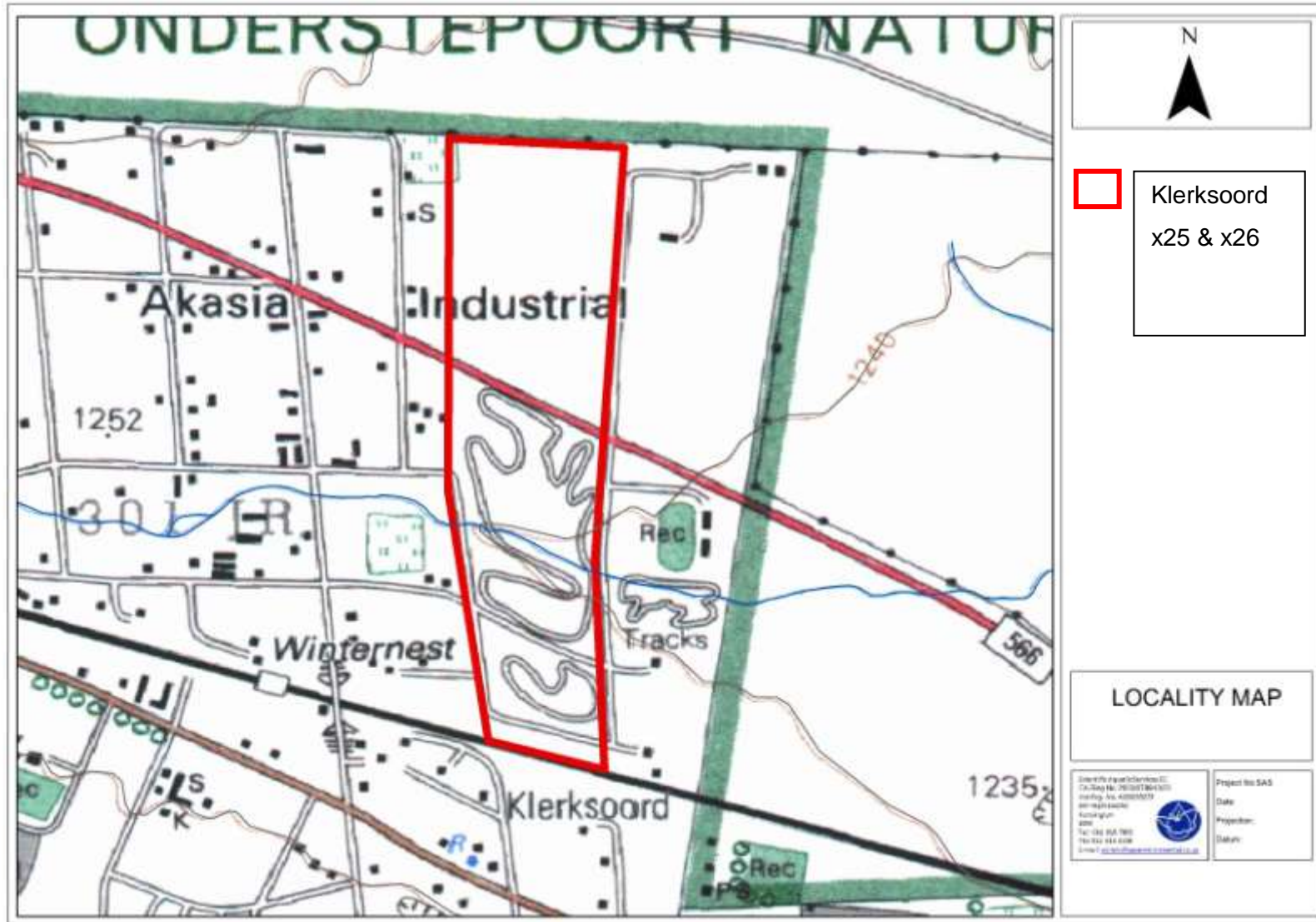


Figure 1: Locality map depicting the proposed development with surrounding areas.



1.1 Assumptions and Limitations

- The wetland assessment is confined to the proposed development site as well as the immediate adjacent areas of relevance and does not include the neighbouring and adjacent properties, although the general surroundings were considered in the desktop assessment of the subject property.
- The wetland assessment is based on the findings of Taka Echo and Land Rehab CC in the document entitled 'Platinum Park Wetland Survey and Delineation Report' in which the wetland resources on the subject property were delineated. No searching for any additional wetland resources was undertaken.
- The wetland sensitivity assessment as presented in this report is regarded as a best estimate of the wetland sensitivity boundaries based on the site condition present at the time of the assessment and limitations in the accuracy of the assessment due to disturbances created by dumping, topographic alteration and wood collection are deemed possible.
- The season in which the assessment took place (Winter 2011) means that some aspects, some of which may have been important, could have been missed due to seasonal variation in vegetation growth and ecological functioning of the system.

1.2 Legislative requirements

National Water Act (Act no. 36 of 1998)

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

National Environmental Management Act (Act no. 107 of 1998)

- The National Environmental Management Act and the associated Regulations (No R. 544, No R. 545 and No R.546) as amended in June 2010, 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 process or the EIA process depending on the scale of the impact.



2. WETLAND ASSESSMENT METHODOLOGY

2.1 South African Wetland Assessment Classification System

All wetland and riparian features encountered within the study area were assessed using the *South African Wetland Classification System* as ascribed within the *Resource Directed Measures for Protection of Water Resources* (1999). This was done in order to define the Recommended Ecological Category (REC) of the wetland features. The methodology followed is illustrated in the figure below, followed by a detailed discussion of each section.

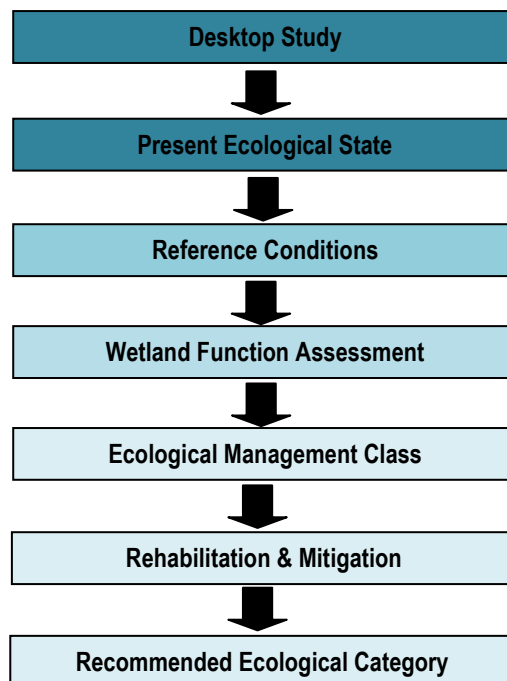


Figure 2: Wetland determination flow chart.

2.2 Ecoregion

When assessing the ecology of any area (aquatic or terrestrial), it is important to know which ecoregion the study area is located within. This knowledge allows for improved interpretation of data, since reference information and representative species lists are often available on this level of assessment to guide the assessment.



2.3 *Ecstatus*

Studies undertaken by the Institute for Water Quality Studies assessed all quaternary catchments as part of the Resource Directed Measures for Protection of Water Resources. In these assessments, the Ecological Importance and Sensitivity (EIS), Present Ecological Management Class (PEMC) and Desired Ecological Management Class (DEMC) were defined, and serve as a useful guideline in determining the importance and sensitivity of aquatic ecosystems prior to assessment, or as part of a desktop assessment.

Water resources are generally classified according to the degree of modification or level of impairment. The classes used by the South African River Health Program (RHP) are presented in the table below and will be used as the basis of classification of the systems in this field, and desktop study.

Table 1: Classification of river health assessment classes in line with the RHP

Class	Description
A	Unmodified, natural.
B	Largely natural, with few modifications.
C	Moderately modified.
D	Largely modified.
E	Extensively modified.
F	Critically modified.



2.4 Present Ecological State

A site visit was undertaken in order to identify all natural characteristics of the wetland features within the study area, followed by characterisation of all wetland systems using the flow chart with definitions as stipulated below.

Water surface – This is found in all systems and includes all water surfaces with a vegetative cover of less than 30%.

Non-vegetated – Includes surfaces with less than 30% surface area cover of vegetation other than pioneer species. Common examples include rocky shores along Marine coastlines, Marine and Estuarine mud, and sand flats, exposed shores on the margins of lakes and dams, and riverine sand bars.

Reef – Includes ridge-like or mound-like structures formed by the colonization and growth of sedentary invertebrates.

Aquatic Bed – Includes habitats dominated by plants that growing principally on or below the water surface for most of the growing season in most years. These habitats are usually found in water less than 2meter deep. They represent a diverse group of plant communities that require surface water for optimal growth and reproduction.

Emergent – Characterised by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years, usually maintaining the same appearance form one year to another. Perennial species tend to dominant Emergent Habitats. Areas that are dominated by pioneer species, which become established during periods of low water, are not Emergent Wetlands and should be classified as Non-vegetated.

Scrub-Shrub – Includes areas dominated by woody vegetation less than 6 meter tall. It is characterised by true shrubs, young trees, and trees or shrubs that are small or stunted as a result of environmental conditions. Such communities may represent a successional stage leading to forested Wetland, or they may be relatively stable.

Forested – This class is characterised by woody vegetation that is taller than 6 meter. These habitats normally possess an overstorey of trees, an understorey of young trees or shrubs, and herbaceous layer.



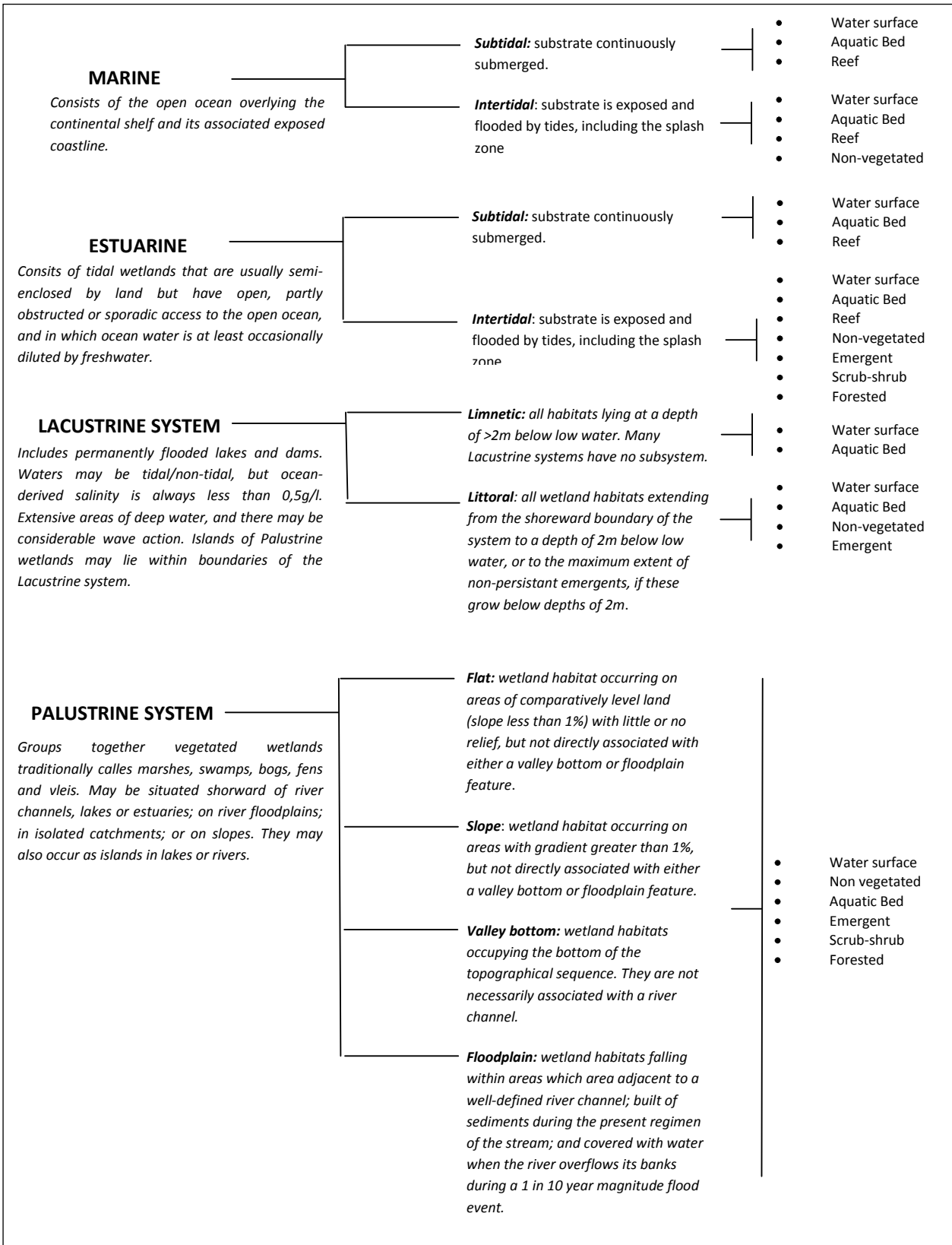


Figure 3: Wetland system characterisation.



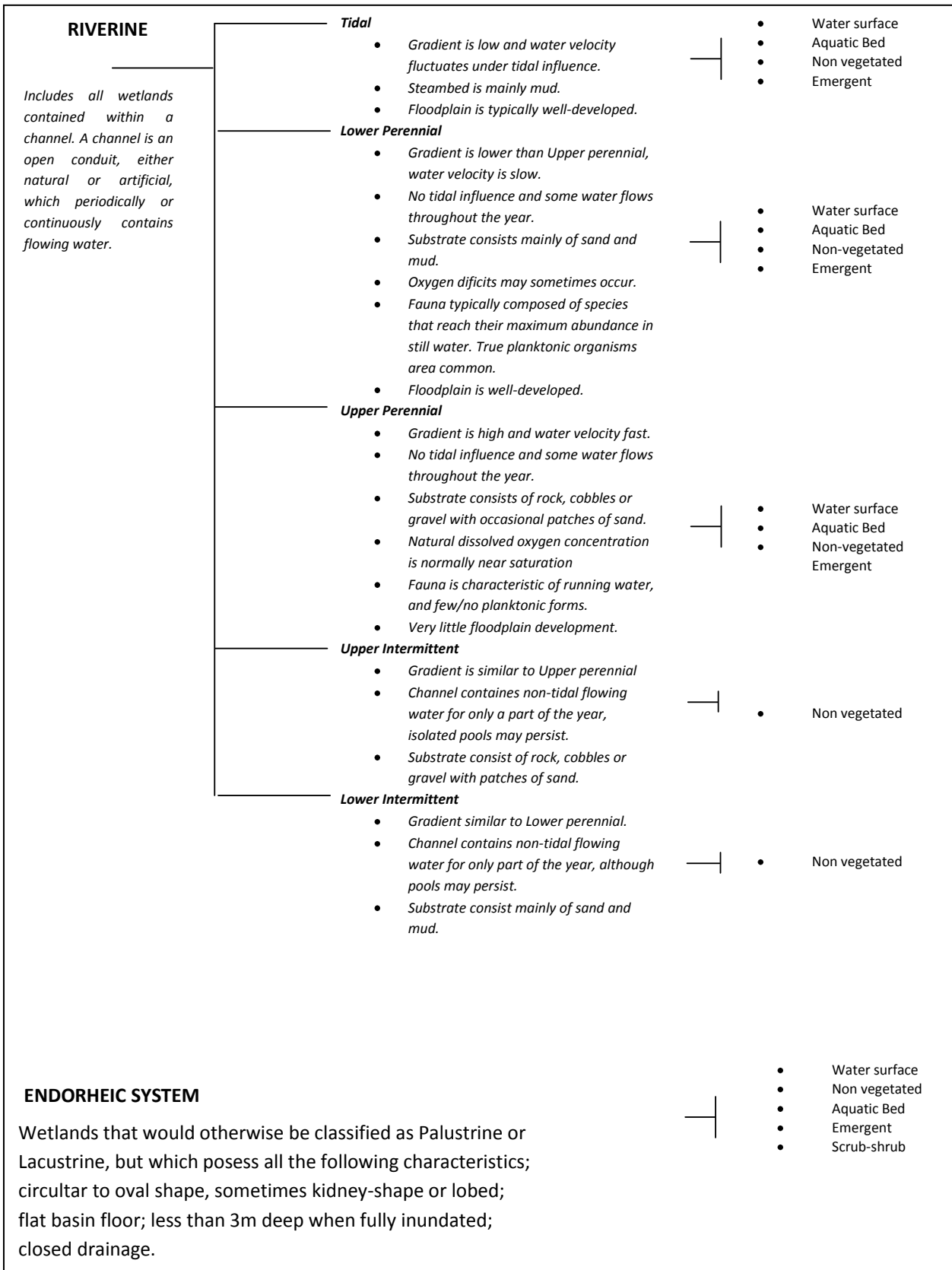


Figure 4: Wetland system characterisation¹ (continued).

Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999 [Appendix W1]¹



After wetland systems have been classified according to the characteristics stipulated above it is important to determine any modifying aspects that may have altered the natural ecological state of the wetland system. *Resource Directed Measures (RDM)* (Dini, J; Cowan, G. & Goodman, P. First Draft: DWAF, Version 1.0, 1999) identifies three groups of modifiers: Water Regime Modifiers, Water Chemistry Modifiers, and Artificial Modifiers. A desktop study as well as the field assessment was used in order to determine any of these modifiers present at the subject property.

All the information gathered above as well as hydrology-, hydraulic/geomorphic-, biological criteria and water quality were then used to assign a Present Ecological Status (PES) for the wetland features. The table below lists the attributes as well as criteria assessed during the PES assessment.

Table 2: Criteria and attributes assessed during the determination of the PES.

Criteria and attributes	
Hydrological	Hydraulic/Geomorphic
Flow modification	Canalisation
Permanent Inundation	Topographic Alteration
Water Quality	Biota
Water Quality Modification	Terrestrial Encroachment
Sediment load modification	Indigenous Vegetation Removal
	Invasive plant encroachment
	Alien fauna
	Overutilisation of biota

Each of the attributes were given a score according to ecological state observed during the site visit, as well as a confidence score to indicate areas of uncertainty (table below).

Table 3: Scoring guidelines.

Scoring guidelines		Relative confidence score	
Natural, unmodified	5	Very high	4
Largely natural	4	High	3
Moderately modified	3	Moderate	2
Largely modified	2	Low	1
Seriously modified	1		
Critically modified	0		



A mean score for all attributes were then calculated and the final score was then used in the Present Ecological Status category determination as indicated in the table below.

Table 4: Present Ecological Status Category descriptions²

Score	Class	Description
>4	A	Unmodified, natural
>3 and ≤4	B	Largely natural with few modifications
>2 and ≤3	C	Moderately modified
2	D	Largely modified
>0 and <2	E	Seriously modified
0	F	Critically modified

2.5 Reference Conditions

“Reference conditions refer to the natural un-impacted condition of the wetland feature prior to changes due to human settlement, utilisation of the wetland feature and its resources.”³ To determine, accurate reference conditions the historical geomorphology (terrain unit, landform, substrate type, substrate erodibility, sediment dynamics), hydrology (water source, saturation zones, extent, period and depth of inundation, flow volumes) and biological attributes (vegetation communities and zonation, faunal communities, occurrence of threatened species) were determined. The reference conditions were then used as a “bench-mark” to determine an appropriate EMC class.

2.6 Wetland function assessment

“The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class”.⁴ The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2005). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation

² Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources*, 1999 [Table G2].

³ Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources*, 1999 [Appendix W3].

⁴ Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources*, 1999



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

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

Table 5: Classes for determining the likely extent to which a benefit is being supplied.

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

2.7 Ecological Management Class

“A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability, but carries a higher risk of ecosystem failure.”⁵

⁵ Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources 1999*



The Ecological Management Class (EMC) was determined based on the results obtained from the PES, reference conditions and Ecological Importance and Sensitivity of the resource (sections above). Followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired EMC.

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

Table 6: Description of EMC classes.

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

2.8 Wetland sensitivity determination

For the purposes of this investigation, a wetland habitat is defined in the National Water Act (1998) as including the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

Riparian and wetland zones can be divided into three zones (DWAF 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant part of the rainy season and the temporary zone surrounds the seasonal zone and is only saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The object of this study was to identify zones of varying ecological and functional importance. It was deemed highly likely that the wetland sensitivities would correlate with wetland zonation to some degree, as wetter areas within wetlands are generally less disturbed due to lower levels of past human activity in these areas and therefore close attention was given to identifying the different wetland zones within the feature.



3. RESULTS OF INVESTIGATION

3.1 *South African Wetland Assessment Classification System*

According to Taka Echo and Land Rehab CC, two wetlands have been identified on the study area (Figure 5). The wetlands occupy approximately 5% of the total study area. These wetlands have been identified as seepage wetlands, are situated on a footslope and feed into a formalised canal. According to Taka Echo and Land Rehab CC. both wetlands show signs of being permanently wet wetlands. Their soil sample shows low mottling content with anaerobic characteristics and predominantly fine textures poorly drained gleyed soil. Both wetlands have similar hydrological characteristics with their hydrology being dependent on the sub-surface flow that is generated by the immediate catchment.

Plants such as *Typha capensis*, *Imperata cylindrica* and the alien species *Arundo donax*, occur within the wetland boundaries, with is indicative of a permanent or semi-permanent wetland.

At the time of the assessment by SAS in September 2011, no permanent water, apart from that within the canalised stream, was present within the delineated wetland area. This may be due to the delayed rainy season and is considered to be natural seasonal variation.



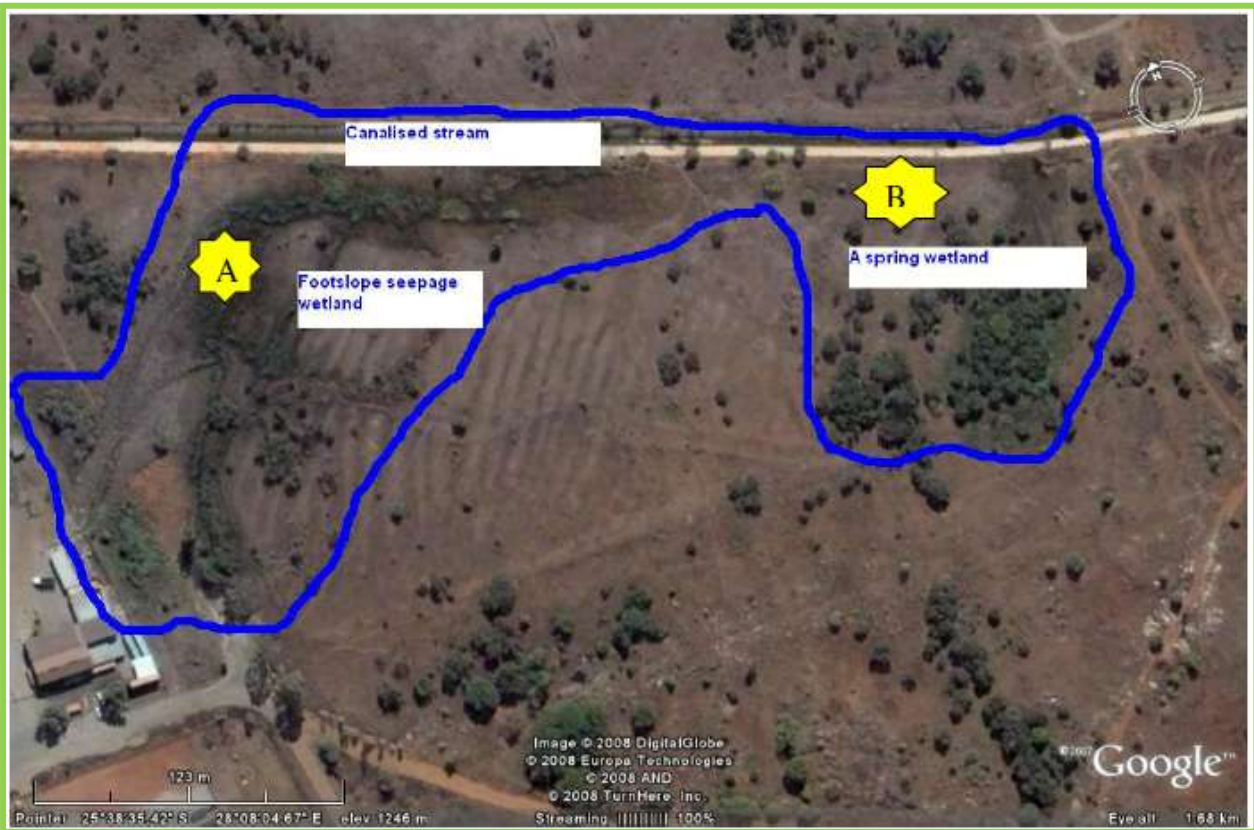


Figure 5: The location of wetlands on the study area as delineated by Taka Echo and Land Rehab CC, 2011.



Figure 6: General photograph of the wetland area, indicating obligate wetland species, such as *Imperata cylindrica*.



3.3.1 Ecoregion and Ecstatus

The study area falls within the Bushveld Basin Ecoregion, and also falls within the A23E quaternary catchment (Figure 7).

Studies undertaken by the Institute for Water Quality Studies assessed all quaternary catchments as part of the *Resource Directed Measures for Protection of Water Resources*. In these assessments, the Ecological Importance and Sensitivity (EIS), Present Ecological Management Class (PEMC) and Desired Ecological Management Class (DEMC) were defined, and serve as a useful guideline in determining the importance and sensitivity of aquatic ecosystems prior to assessment, or as part of a desktop assessment. This database was searched for the quaternary catchment of concern (A23E) in order to define the EIS, PEMC and DEMC. The findings are based on a study undertaken by Kleynhans (1999) as part of “A procedure for the determination of the ecological reserve for the purpose of the national water balance model for South African rivers”. The results of the assessment are summarised in the table below.

Table 7: Summary of the ecological status of quaternary catchment A23E based on Kleynhans 1999

Catchment	Resource	EISC	PESC	DEMC
A23E	Apies River	Moderate	CLASS C (Class D based on desktop certainty)	Class C: Moderately sensitive systems

The points below summarise the impacts on the aquatic resources in this quaternary catchment:

- The aquatic resources within this quaternary catchment have been slightly affected by bed modification due to algal growth in the catchment.
- Significant flow modifications have taken place.
- Some impacts from the introduced fish species *Gambusia affinis* and *Cyprinus carpio* are likely to affect the aquatic community.
- Some impacts from the introduced plant species *Eichhornia crassipes* are likely to affect the aquatic community.
- A significant impact from inundation is evident.
- Riparian zones and stream bank conditions are considered to be highly impacted due to alien vegetation encroachment and canalisation.
- Eutrophication is deemed likely to affect the catchment to a moderate degree.



In terms of ecological functions, importance and sensitivity, the following points summarise the conditions in this catchment:

- The riverine systems in this catchment have a relatively low diversity of habitat types, limiting the ecological sensitivity and importance of the resources in the area.
- The site has a low importance in terms of conservation.
- The riverine resources have a moderate sensitivity to flow requirements, with the species *Labeobarbus marequensis* and *Labeobarbus polylepis* being dependent on flow as part of their biology, specifically for breeding purposes.
- The area has moderate importance in terms of migration of aquatic species.
- The area is insignificant in terms of rare and endemic species conservation.
- The ecology of the area is considered to be moderately sensitive to changes in water quality.
- The area has a moderate importance as a source of refugia for aquatic species.
- The catchment can be considered to be moderately sensitive to changes in water quality.
- The catchment has a moderate importance in terms of species richness in the area.
- The catchment has a low importance in terms of endemic species and isolated populations.



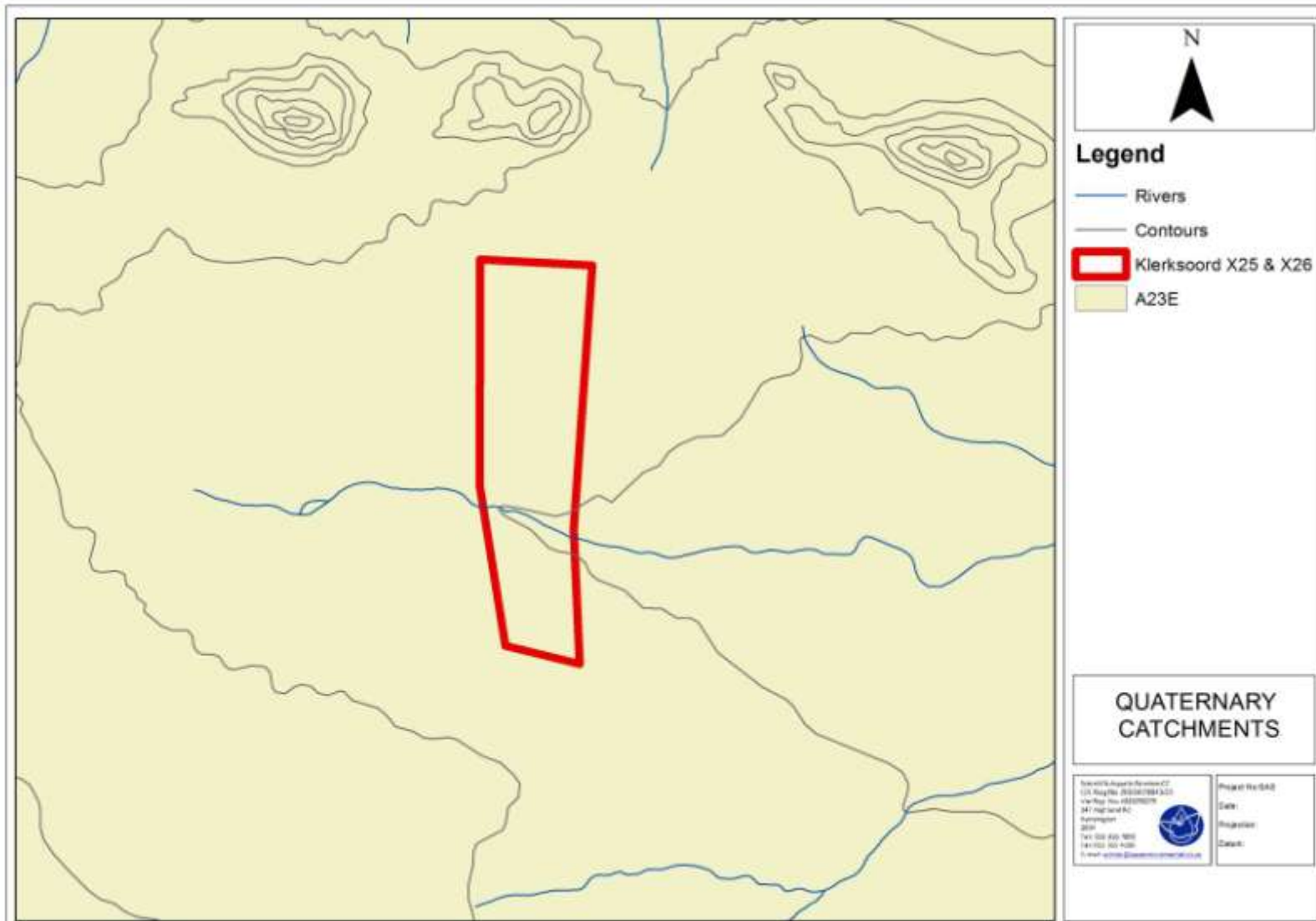


Figure 7: A map of the quaternary catchments of the area.



3.3.2 Wetland System Characterisation

The wetland feature identified during the assessment of the study area was categorised with the use of the Wetland System Characterisation Methodology. The results are illustrated in the figure below.

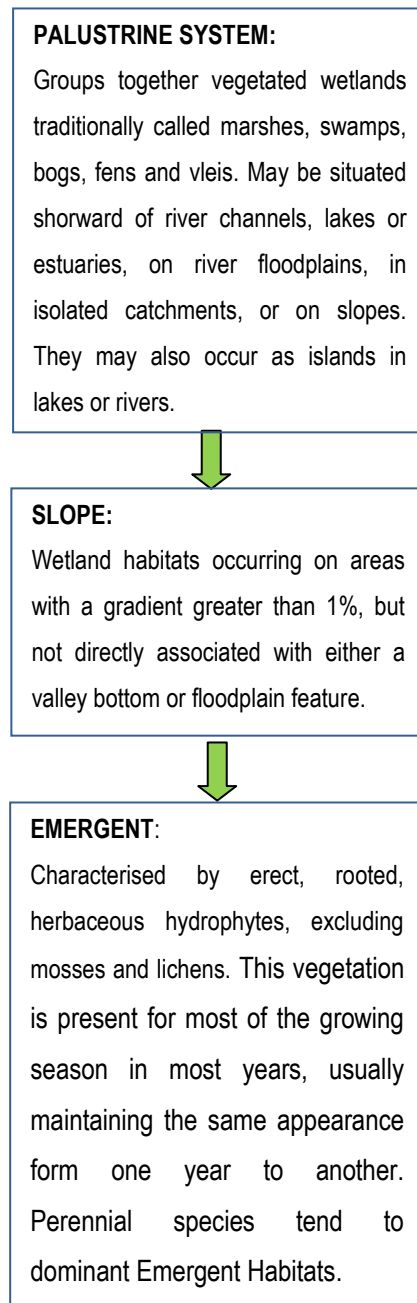


Figure 8: Wetland categorisation for the wetland feature.



3.3.3 Wetland Function Assessment

Through visual observation (including habitat condition assessment, level of disturbance, etc.) disturbance during the site assessment conducted in September 2011, it was evident that wetland ecological condition, functionality and service provision differed throughout the system and that the wetland as delineated by Taka Echo and Land Rehab CC, may be divided into smaller sections/ management units of similar sensitivities. These discrepancies within the wetland system are primarily due to site disturbances such as; bush encroachment (Figure 9), trampling and informal walkways (Figure 10), dumping (Figure 11), past construction activities and related altered topography, burning due to informal fires on the study area (Figure 12) and alien plant invasion, by species such as *Arundo donax*, *Sesbania bispinosa*, *Campuloclinium macrocephalum* and *Tithonia rotundifolia*.



Figure 9: Bush encroachment within the wetland system.



Figure 10: Trampling and informal walkways within the wetland system.



Figure 11: Dumping within the wetland system.



Figure 12: Burning due to informal fires within the wetland system.

Wetland function and service provision were assessed within the study area for each unit of the wetland system deemed to belong in a different sensitivity category. The average scores for each of the management units initially identified are presented in the table and radar plots following below.

Table 8: Wetland functions and service provision.

Ecosystem service	Unit A	Unit B	Unit C
Flood attenuation	0.4	1.2	1.5
Streamflow regulation	0.6	1.2	1.5
Sediment trapping	0.5	0.8	2
Phosphate assimilation	0.5	0.5	0.8
Nitrate assimilation	0.5	0.5	0.8
Toxicant assimilation	0.3	0.3	0.8
Erosion control	0.3	0.6	2
Biodiversity maintenance	0.8	1.3	1.7
Carbon Storage	0.5	0.6	2.6
Water Supply	0.7	0.7	1.3
Harvestable resources	0.8	0.8	0.8
Cultivated foods	0.4	0.4	0.4
Cultural significance	0.3	0.3	0.3
Tourism and recreation	0.0	0.0	0.6
Education and resource	0.8	0.8	0.8
SUM	7.4	10.0	17.9
Average score	0.5	0.7	1.3

From the results of the assessment, it is evident that the overall wetland feature has a low to moderate level of ecological function and service provision. Due to the large number of disturbances related to the site, it is unlikely to harbour populations of RDL faunal and floral species. The wetland does however, provides good habitat for certain faunal species with special mention of avifauna, and as such does deserve some level of conservation. Historical infrastructure development, such as the concrete channel construction and related changes in surface topography, rubble dumping, alien vegetative invasion and bush encroachment also contribute to the transformed nature of the wetland feature.

Management Unit A (Figure 14) was deemed to have both a low ecological/ habitat integrity and functionality, as disturbances in this area were deemed to be very high. Unit B (Figure 15) was deemed to have a low ecological integrity, with moderate functioning, as the wetland in this section provides some level of flood attenuation and streamflow regulation. Unit C (Figure 16) provide moderate functionality in terms of wetland services, and moderate ecological importance and should remain undeveloped. A 30m buffer zone and an ecological corridor to link the two areas of moderate sensitivity in order to protect this management unit should be maintained (Figure 17).



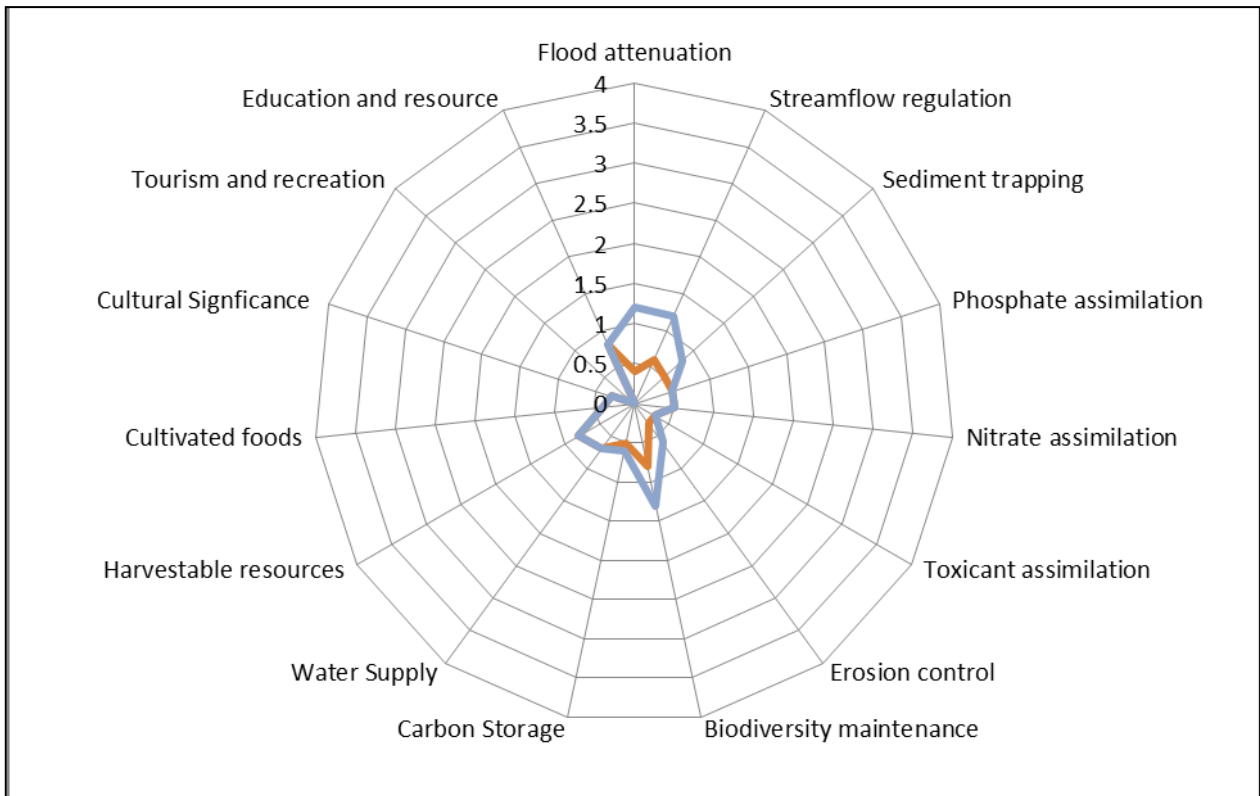


Figure 13: Radar plot of wetland services provided.



Figure 14: Management Unit A.





Figure 15: Management Unit B.



Figure 16: Management Unit C.

3.3.4 Present Ecological State

The result for the criteria and attributes used for the calculation of the PES is stipulated in the table below. The PES was conducted across the entire wetland system.

Table 9: Criteria and Attributes used with the calculation of the PES.

Criteria and Attributes	Score	Confidence
Hydrologic		
Flow modification	3	3
Permanent Inundation	2	3
Water Quality		
Water Quality Modification	2	2
Sediment load modification	2	3
Hydraulic/Geomorphic		
Canalisation	1	3
Topographic Alteration	3	4
Biota		
Terrestrial Encroachment	2	3
Indigenous Vegetation Removal	2	3
Invasive plant encroachment	2	3
Alien fauna	3	4
Over utilisation of biota	3	3
Total	25	
Mean	2	

The mean score was calculated as 2, indicating the PES falls within class D – Largely Modified. This class obtained is mainly due to the impacts on the system arising from land use activities such as topographical alterations, urban infrastructure development, erosion and alien floral invasion.

3.3.5 Ecological Management Class

All results obtained from the South African Wetland Assessment Classification System that were used in the determination of the appropriate EMC class, is indicated in the table below. The results obtained from the wetland assessment indicate relatively high transformation on all levels of ecology and functionality. Therefore, the EMC class deemed appropriate to enhance and maintain current ecology as well as functionality is class D (Largely modified). Recommendations stipulated in this report, if followed, are deemed adequate to reach this goal on a localised scale however, the catchment wide impacts on the drainage system will limit the ability to reach this EMC objective.



Table 10: Summary of results of the South African Assessment Classification System

Name	Type	System Modifiers	PES	Wetland Function Assessment	EMC
Apies	<ul style="list-style-type: none"> • Palustrine • Slope • Emergent 	Topographical, urban development, alien invasion, eutrophication, algal growth.	CLASS D (Largely modified).	Low to moderate level of function and service provision.	CLASS D- (Largely modified).

3.3.6 Wetland delineation and sensitivity mapping

During the assessment, a site walkabout was conducted whereby GPS coordinates were taken where levels of disturbance, function and ecological integrity differed. These areas were mapped as Management Units, based on GPS data and use of digital satellite imagery. These boundaries are illustrated in Figure 17.



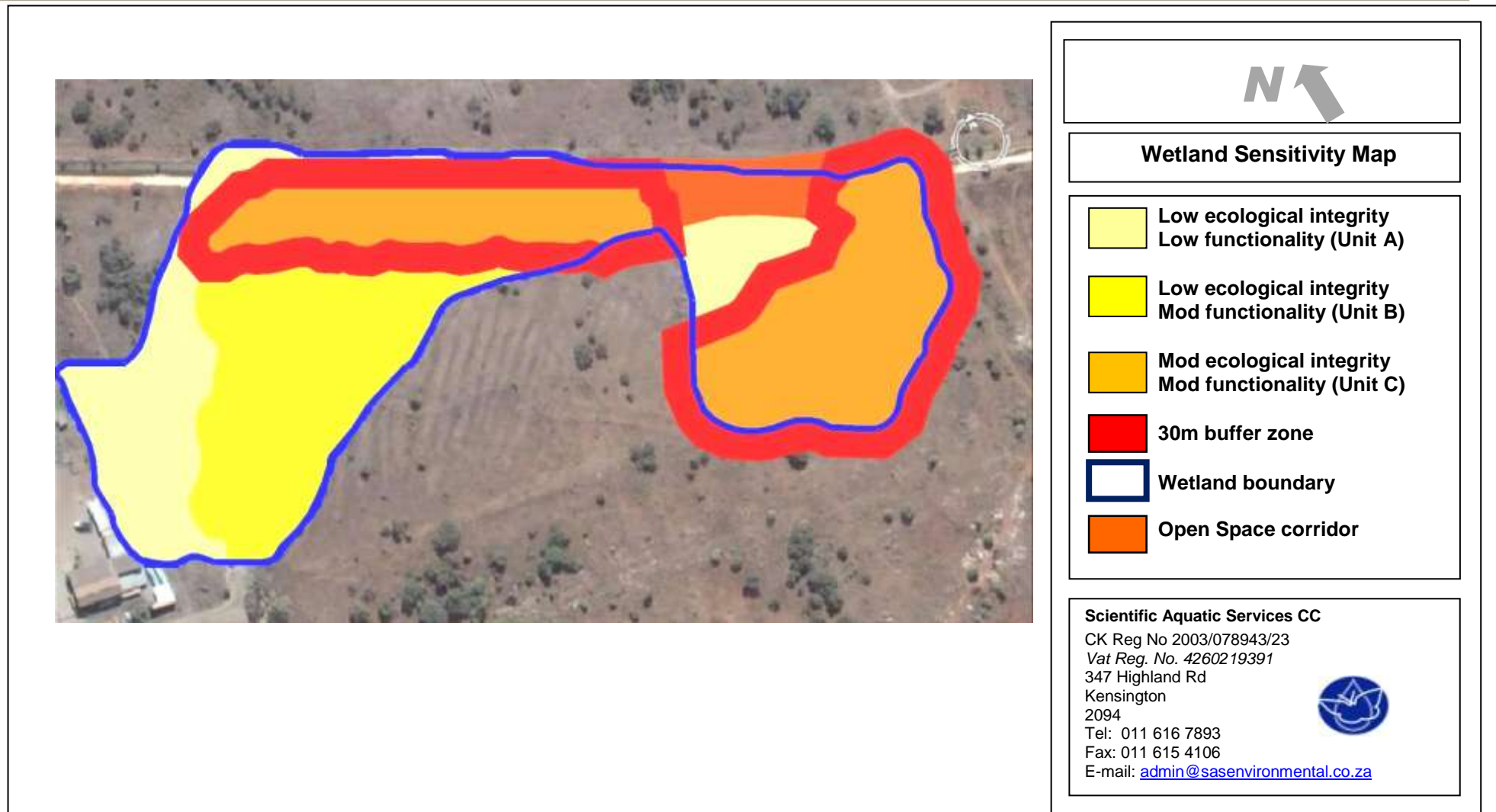


Figure 17: Conceptual wetland aerial map depicting areas of different wetland sensitivities.



4. CONCLUSIONS AND RECOMMENDATIONS

The following general conclusions were drawn on completion of the survey:

- A palustrine, slope, emergent wetland was in the study area.
- The study area falls within the Bushveld Basin Ecoregion, and also falls within the A23E quaternary catchment which is classified as a Class C system (Class D desktop) and is targeted to be managed as a Class D system.
- The wetland function and service provision assessment indicated a low to moderate level of ecological function and service provision within different sections of the wetland.
- The wetland feature's present ecological state was determined to fall within class D – Largely Modified. The ecological management class determined by the *South African Wetland Assessment Classification System* is D – Largely Modified.

From the above assessment, several guidelines for the proposed development design are recommended. The design should ensure that the following criteria are met to ensure the ongoing functioning of the riparian zones in the vicinity of the proposed development:

- Management Unit C has moderate ecological importance and moderate functionality – these areas are not to be developed and should be protected by a 30m buffer zone.
- Management Unit A and B both have low ecological integrity, with Unit A having low functionality and Unit B having moderate functionality. Development may take place within these areas, provided that the relevant authorisations are obtained from the Department of Water Affairs in terms of Section 21 c and i of the National Water Act (Act 36 of 1998).
- An open space corridor is to be implemented as per the Sensitivity Map (Figure 17).
- Stormwater systems must be designed in such a way so as not to impact upon the more sensitive sections of the wetland system.
- Any discharge points must be designed to minimise erosion and discharge energy and to prevent any further impacts on the wetland.
- The duration of impacts on the system should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place, is minimised.
- During the construction phase, no vehicles should be allowed to indiscriminately drive through the more sensitive wetland areas.
- No dumping of waste should take place within sensitive wetland areas and rubble currently on site should be cleared.
- If any spills occur, they should be immediately cleaned up.



- During construction, erosion berms should be installed to prevent gully formation. The following points should serve to guide the placement of erosion berms:
 - Where the track has slope of less than 2%, berms every 50m should be installed.
 - Where the track slopes between 2% and 10%, berms every 25m should be installed.
 - Where the track slopes between 10%-15%, berms every 20m should be installed.
 - Where the track has slope greater than 15%, berms every 10m should be installed.
- In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998 landowners are legally responsible for the control of invasive alien plants on their properties and it is therefore recommended that the declared weed and invader species be removed.
- All areas affected by construction should be rehabilitated upon completion of the construction phase of the development. Areas should be reseeded with indigenous grasses as required.
- For a minimum period of one year after construction, active management of rehabilitated areas should take place to remove any recruited alien vegetation.
- Fires within the wetland areas must be prevented at all times.



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