FLORAL, FAUNAL, WETLAND AND AQUATIC ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED COMMISSIEKRAAL COLLIERY, KWAZULU-NATAL PROVINCE

Prepared for

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Section D - Wetland Assessment

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1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to provide floral, faunal, wetland and aquatic ecological scoping level input as part of the Environmental Assessment (EIA) and authorisation process for a proposed greenfields coal mine (near Wakkerstroom), 45km east of Paulpietersburg, and 28km north east of Utrecht in the KwaZulu-Natal Province of South Africa.

The entire subject property and its immediate surrounds can be broadly defined as agricultural land where rural settlements and agricultural activities dominate the landscape. This report, after consideration and description of the ecological integrity of the property, must guide proponent and authorities, by means of recommendations, as to the viability of the proposed mining development through consideration of the ecological aspects present on the subject property with specific focus on Ecological Importance and Sensitivity and the Present Ecological State (EIS) and (PES). This scoping report will also highlight future methods of assessment that will be utilised to assess the subject property during the EIA phase of the development.

1.2 Scope

Specific outcomes in terms of the wetland assessment will be:

- To define the Present Ecological State (PES) of each wetland system within the subject property;
- To determine the functioning of each system and the environmental and socio-cultural services that the systems provide;
- To advocate a Recommended Ecological Category (REC) for each wetland feature; and
- To delineate all wetlands or riparian zones occurring within the assessment site.

1.3 Legislation

The following legal framework was considered during this assessment:

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

- National Water Act (Act No. 36 of 1998)
- Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
- The Constitution of South Africa Act of 1996 (Act No. 108 of 1996)
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
- The Protected Areas Act (Act 57 of 2003) (In conjunction with the National Environmental Management: Biodiversity Act (Act No. 10 of 2004))
- Convention on Biological Diversity (1995)
- World Summit for Sustainable Development (2002)
- KwaZulu-Natal Nature Conservation Management Act (Act No 5 of 1999)

2 WETLAND ASSESSMENT METHODOLOGY

2.1 Desktop Study

Wetland specific information resources taken into consideration during the desktop assessment of the subject property included:

- National Freshwater Ecosystem Priority Areas (NFEPAs), 2011
  - NFEPA water management area (WMA)
  - NFEPA wetlands/ National wetlands map
  - Wetland and estuary FEPA
  - FEPA (sub)WMA % area
  - Sub water catchment area FEPAs
  - Water management area FEPAs
  - Fish sanctuaries
  - Wetland ecosystem types
- The Kwa-Zulu Natal Freshwater Systematic Conservation Plan (2007) was consulted to ascertain the presence of any freshwater resources earmarked for protection or already protected in relation to the subject property.

2.2 Classification System for Wetlands and other Aquatic Ecosystems in South Africa

All wetland features encountered within the subject property were assessed using the Classification System for Wetlands (hereafter referred to as the 'Classification System') and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013).

A summary of Levels 1 to 4 of the Classification System for Inland Systems are presented in Table 1 and 2 below.

Table 1: Classification structure for Inland Systems, up to Level 3.

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

Table 2: Hydrogeomorphic (HGM) Units for Inland Systems, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

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

2.3 Inland systems

For the purposes of the Classification System, Inland Systems are defined as an aquatic ecosystem that have no existing connection to the ocean[1] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically.

It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

2.3.1 Level 1: Ecoregions

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

2.3.2 Level 2: NFEPA Wet Veg Groups

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina and Rutherford, 2006) groups vegetation types across the country according to Biomes, which are then divided into Bioregions – composite spatial terrestrial units defined on the basis of similar biotic and physical features and processes at the regional scale (Mucina and Rutherford, 2006).

To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups, and it is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

[1] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

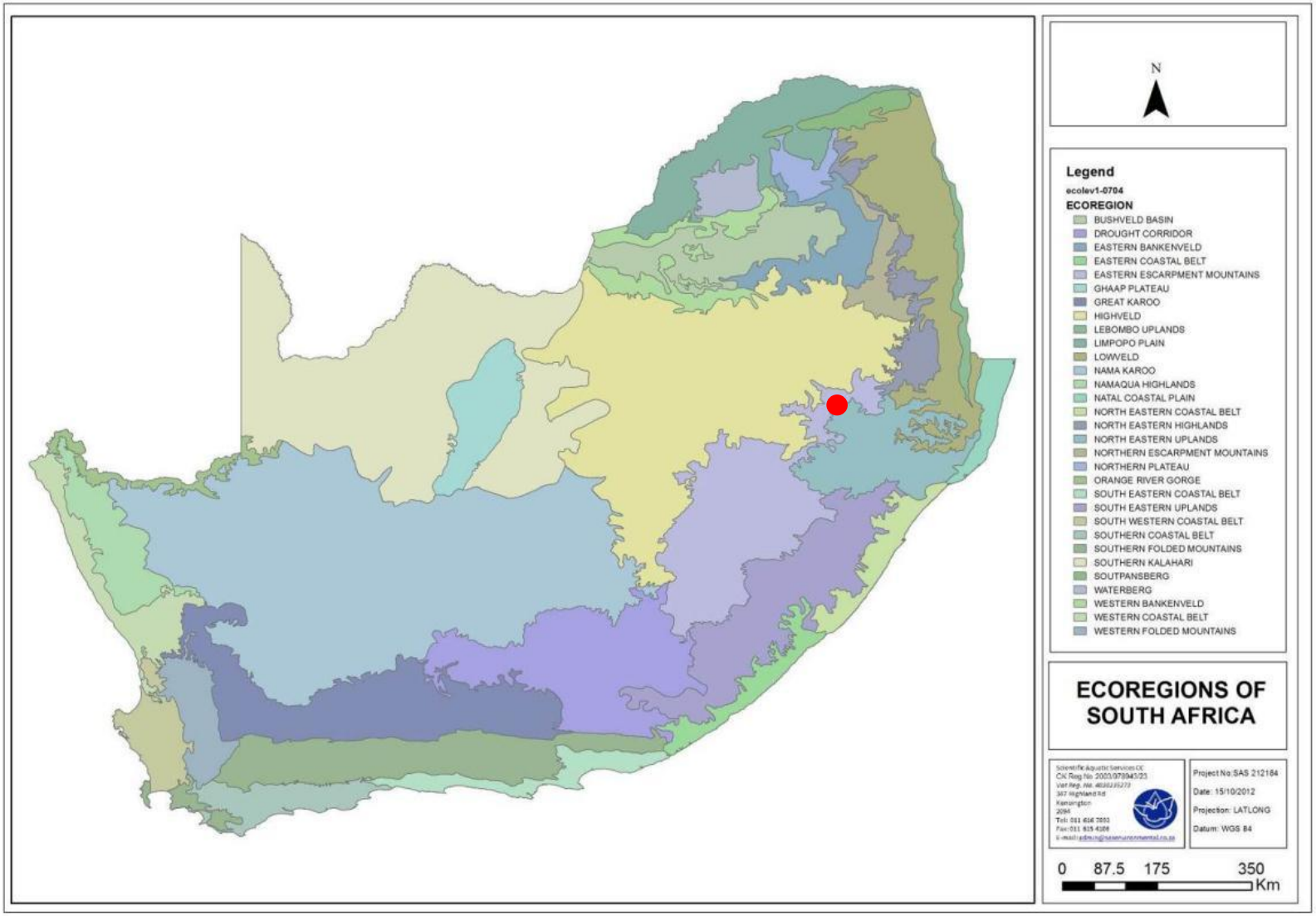

Figure 1: Map of Level 1 Aquatic Ecoregions of South Africa (approximate location of subject property indicated in red).

At Level 3 of the Classification System for Inland Systems, a distinction is made between four Landscape Units (Table 1) on the basis of the landscape setting (i.e. topographical position) within which a Hydrogeomorphic (HGM) Unit is situated, as follows (Ollis *et al.,* 2013):

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

2.3.3 Level 4: Hydrogeomorphic Units

Eight primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table 2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

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

Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

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

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever changing landscape. The primary purpose of this assessment is to evaluate the ecophysical health of wetlands, and in so doing promote their conservation and wise management.

At Level 4B of the classification system, certain of the primary HGM Units can further be divided into sub-categories on the basis of longitudinal geomorphological zonation or localised landform, as follows:

- Channels (including their banks) are divided into six primary longitudinal zones and three zones associated with a rejuvenated longitudinal profile, according to the geomorphological zonation scheme of Rowntree & Wadeson (2000). The sub-categories are *Mountain Headwater Stream, Mountain Stream, Transitional River, Upper Foothill River, Lower Foothill River,* and *Lowland River* (i.e. the primary zones); and *Rejuvenated Bedrock Fall, Rejuvenated Foothill River,* and *Upland Floodplain River* (i.e. the zones associated with a rejuvenated long profile).
- Channelled and unchannelled valley-bottom wetlands are divided into '*valley-bottom flats'* and *'valley-bottom depressions'*.
- Floodplain wetlands are divided into *'floodplain depressions'* and *'floodplain flats'*.

2.4 Wet-Ecoservices (2009)

"The importance of a water resource, in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class" (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was

undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

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

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

Table 3: Classes for determining the likely extent to which a benefit is being supplied.

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

2.5 WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever changing landscape. The primary purpose

of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation

Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment

Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems in Section 2.5.

Quantification of Present State of a wetland

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of the impact of individual activities and then separately assessing the *intensity* of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores, and Present State categories are provided in Table 4.

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Table 4: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (Table 5).

Table 5: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland

Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

2.6 Ecological Importance and Sensitivity (EIS)

The method used for the EIS determination was adapted from the method as provided by DWA (1999) for wetlands. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed.

A series of determinants for the EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 6 below.

Table 6: Descriptions of the EIS Categories.

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

2.7 Recommended Ecological Category (REC)

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

The REC (Table 7) was determined based on the results obtained from the PES, reference conditions and EIS of the resource (sections above), and is followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

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

Table 7: Description of REC classes.

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

2.8 Wetland Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act (1998) 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 wetland zone delineation took place, according to the method presented in the Department of Water Affairs and Forestry (DWAF, 2005) document "A practical field procedure for identification and delineation of wetlands and riparian areas. An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

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

- The presence of wetland vegetation species; and
- The presence of a redoxymorphic soil feature, which are morphological signatures that appear in soils with prolonged periods of saturation.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008).

Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

3 AQUATIC ECOLOGICAL CHARACTERISTICS OF THE SUBJECT PROPERTY

3.1 Ecoregions

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

The subject property falls within the *Eastern Escarpment Mountains Aquatic Ecoregion* and is located within the W42A quaternary catchment. Figure 2 below indicates the aquatic ecoregions and quaternary catchment of the subject property.

Table 8: Summary of the ecological status of the Eastern Escarpment Mountains Ecoregion.

MAIN ATTRIBUTES	EASTERN ESCARPMENT MOUNTAINS
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Low Relief (limited) Lowlands; Hills and Mountains: Moderate and High Relief; Open Hills; Lowlands; Mountains: Moderate to High Relief; **Closed Hills; Mountains: Moderate and High Relief**
Vegetation types (dominant types in bold) (Primary)	South Eastern Mountain Grassland; **AltiMountain Grassland; AfroMountain Grassland;** Moist Upland Grassland; North Eastern Mountain Grassland; **Moist**

MAIN ATTRIBUTES	EASTERN ESCARPMENT MOUNTAINS
	Cold Highveld Grassland; Moist Cool Highveld Grassland; Moist Sandy Highveld Grassland; Dry Sandy Highveld Grassland Natal Central Bushveld (limited); Patches Afromontane Forest
Altitude (m a.m.s.l) (modifying)	1100-3100; 3100-3500 limited
MAP (mm) (Secondary)	400 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 35
Rainfall concentration index	30 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	<8 to 18
Mean daily max. temp. (°C): February	<10 to 28
Mean daily max. temp. (°C): July	<10 to 22
Mean daily min. temp. (°C): February	<6 to 16
Mean daily min temp. (°C): July	<-2 to 4
Median annual simulated runoff (mm) for quaternary catchment	10 to >250

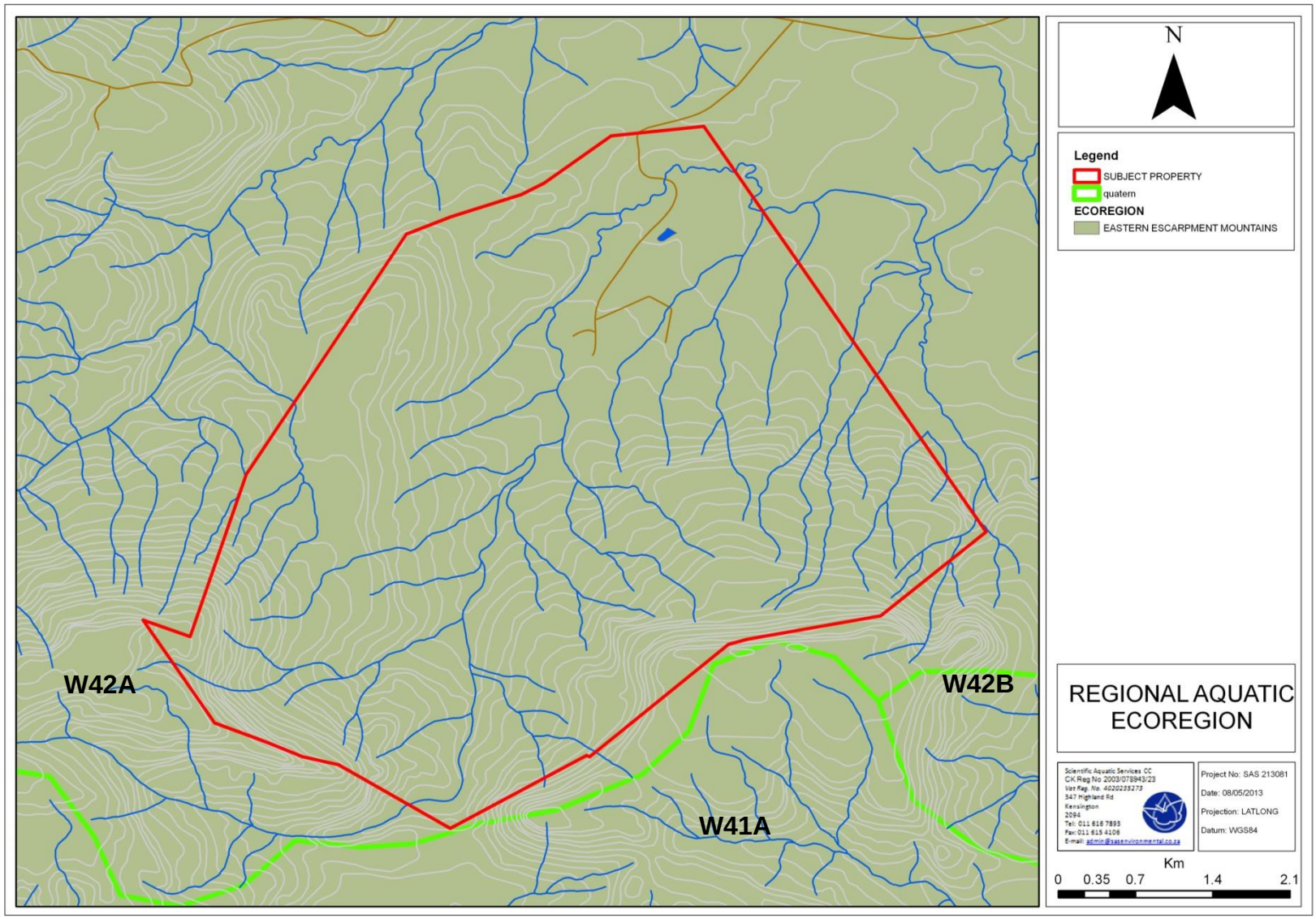

Figure 2: Ecoregions associated with the subject property (Mucina and Rutherford, 2006)

3.2 Ecostatus

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 desktop study, as well as future field studies.

Table 9: 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.

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 three catchments of concern in order to define the EIS, PEMC and DEMC. The results of the assessment are summarised in the table below.

Table 10: Criteria and attributes assessed during the determination of the PES.

Catchment	Resource	EIS	PESC	DEMC
W42A	Pongolo	High	CLASS A	B: Sensitive systems

W42A

According to the ecological importance classification for the quaternary catchment, the system can be classified as a *Sensitive System* which, in its present state, can be considered a Class A (unmodified, natural) stream.

The points below summarise the impacts on the aquatic resources in the quaternary catchment W42A (Kleynhans 1999):

- Impacts as a result of bed modification within the system are considered very low.
- Marginal flow modifications occur within the quaternary catchment.

- Impacts on the system as a result of the introduced aquatic biota are low with special mention of Trout Species.
- Impact due to inundation is very low.
- Riparian zones and stream bank conditions are considered to be marginally impacted.
- Impact as a result of water quality modification is very low.

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 high diversity of habitat types which include rapids, riffles, mountain torrents and mountain riffles.
- The quaternary catchment has a very low importance in terms of conservation and natural areas.
- Fish species within the system, with special mention of *Chiloglanis anoterus* (Rock Catlet) and *Chiloglanis emarginatus* (Pongolo Suckermouth) have a high intolerance to flow and flow related water quality changes.
- The quaternary catchment is regarded as having a very high importance for rare and endangered species conservation with special mention of *Chiloglanis emarginatus* (Pongolo Suckermouth).
- The quaternary catchment is considered of high importance in terms of provision of migration routes with special mention of migration routes for bird species at high altitudes.
- The quaternary catchment has a high importance in terms of providing refugia for aquatic community members.
- The quaternary catchment can be considered to have a high sensitivity to changes in water quality and a very high sensitivity to changes in water flow.
- The quaternary catchment is of high importance in terms of species richness.
- The quaternary catchment is of no importance in terms of endemic and isolated species.

3.3 General Importance of the Subject Property with regard to the National Freshwater Ecosystem Priority Areas (2011) Database

The SANBI Wetland Inventory (2006) and National Freshwater Ecosystem Priority Areas (NFEPA) (2011), databases was consulted to define the aquatic ecology of the wetland or river systems close to or within the subject property that may be of ecological importance. Aspects applicable to the subject property and surroundings are discussed below:

- The subject property falls within the Usuthu to Mhlathuze Water Management Area (WMA). Each Water Management Area is divided into several sub-Water Management Areas (subWMA), where catchment or watershed is defined as a topographically defined area which is drained by a stream or river network. The Sub-Water management unit indicated for the subject property is the Pongola sub-WMA.
- The western border of the subject property falls within a Fish Fresh Water Ecosystem Priority Area (FISHFEPA) (Figure 3). River FEPAs achieve biodiversity targets for river ecosystems and threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.
- The remainder of the subject property falls within a Fish Support Area (FSA) (Figure 3) which is regarded important in terms of a fish sanctuary for threatened fish species.
- The Pandana River runs through the centre of the subject property from the south to the north.
- The Pandana River is a perennial river classified as a Class A (unmodified, natural) river. It is not free flowing and is not classified as a flagship river.
- The subject property contains three wetland features as listed by the NFEPA database (2011). A large, natural bench wetland feature is located in the west of the subject property, a small, natural slope wetland feature is located in the south of the subject property and a small, artificial valley floor wetland feature is located in the north of the subject property (Figure 4).
- The conditions of the wetlands within the subject property are depicted in Figure 5 below and includes:
    - Category AB (Wetlands in a natural or good condition - percentage natural land cover >75%). This category includes the large bench wetland to the west of the subject property as well as the small slope wetland to the south of the subject property.
    - Category Z3 (Wetlands in a critically modified condition – percentage natural land cover <25%). This category includes the small valley floor wetland to the north of the subject property.
- The wetlands within the subject property were ranked according to general importance depicted in Figure 6 below.
    - Rank 2 – Wetlands within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional biodiversity importance with valid reasons documented or as containing wetlands that are

good, intact examples from which to choose. Includes the large bench wetland to the west of the subject property.

- Rank 5 – Wetlands within a subquaternary catchment identified by experts at the regional review workshops as containing impacted Working for Wetlands sites. Includes the small slope wetland to the south of the subject property
- Rank 6 – All other wetlands (no importance). Includes the artificial valley floor wetland to the north of the subject property.

- No wetlands within the subject property are considered important with regards to the conservation of biodiversity.
  - Expertid = 0; No importance.
- The large bench wetland feature in the west of the subject property (Figure 7) is shown to have sightings of or breeding areas for cranes (1 = importance indicated).
- The large bench wetland feature to the west of the subject property is indicated as a FEPA Wetland. Wetland FEPAS currently in a good ecological condition should be managed to maintain this condition.
- No RAMSAR wetlands are located within or close to the subject property.
- No wetlands are indicated to fall within 500m of an IUCN threatened frog point locality.

The large bench wetland feature in the west of the subject property is considered to be of high importance with regards to the conservation of biodiversity. This feature is a natural feature which is in a good or natural condition. It has been listed as a wetland within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional biodiversity importance with valid reasons documented or as containing wetlands that are good, intact examples from which to choose. This feature is also regarded as important with regards to the conservation of crane species and is listed a FEPA wetland which should be managed in order to maintain its good ecological condition. The small slope wetland feature to the south of the subject property is also considered of some conservation importance due to its natural condition and due to its listing as a Working for Wetlands site.

3.4 The Kwa-Zulu Natal Freshwater Systematic Conservation Plan (2007)

The Kwa-Zulu Natal Freshwater Systematic Conservation Plan (2007) was consulted in order to determine whether any freshwater conservation areas will be affected by the proposed mining development. According to the database, the subject property falls within a freshwater

catchment earmarked for conservation (Figure 10). Areas earmarked for conservation are optimal biodiversity areas required to meet biodiversity targets.

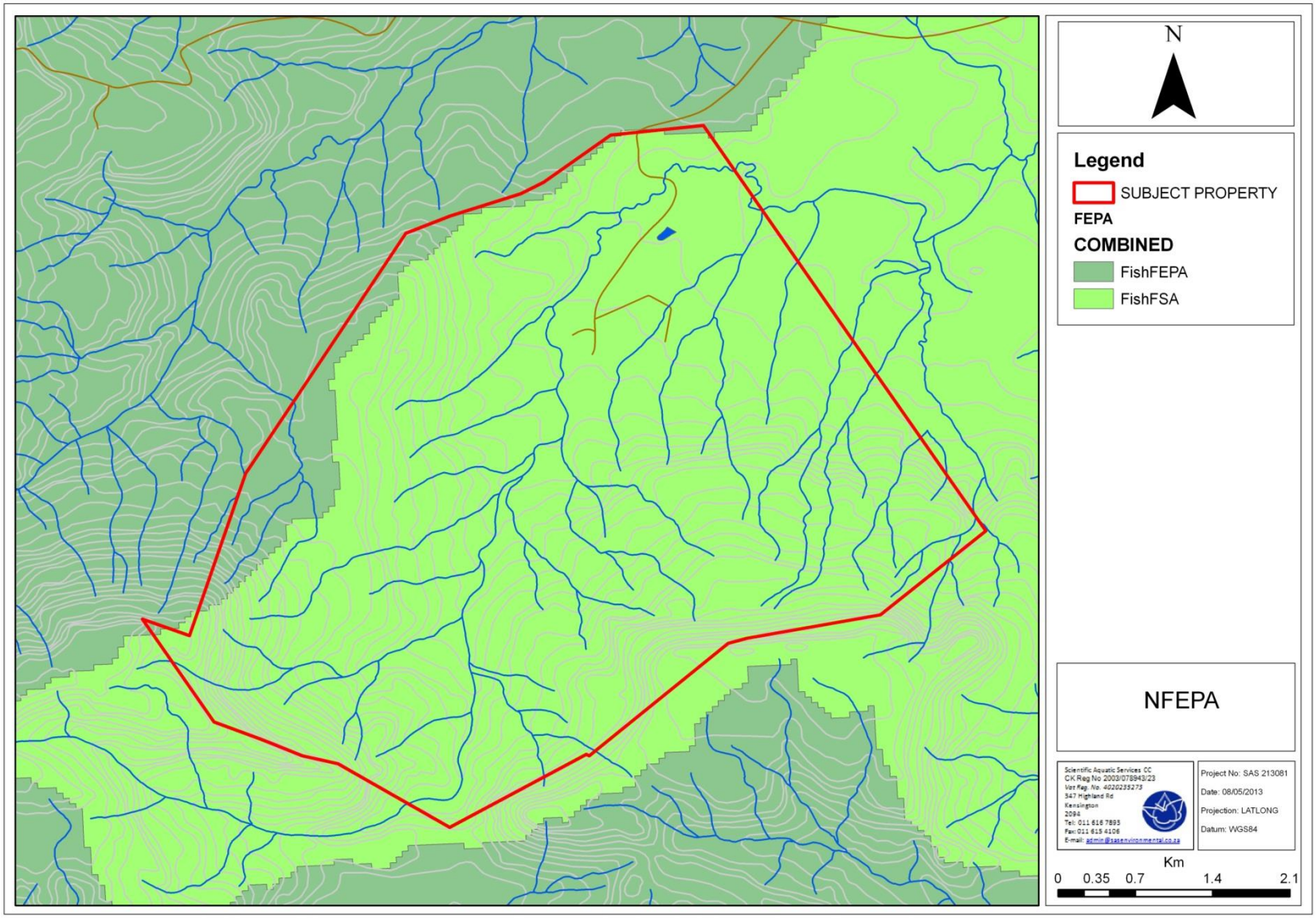

Figure 3: Fish FEPAs and Fish FSAs associated with the subject property.

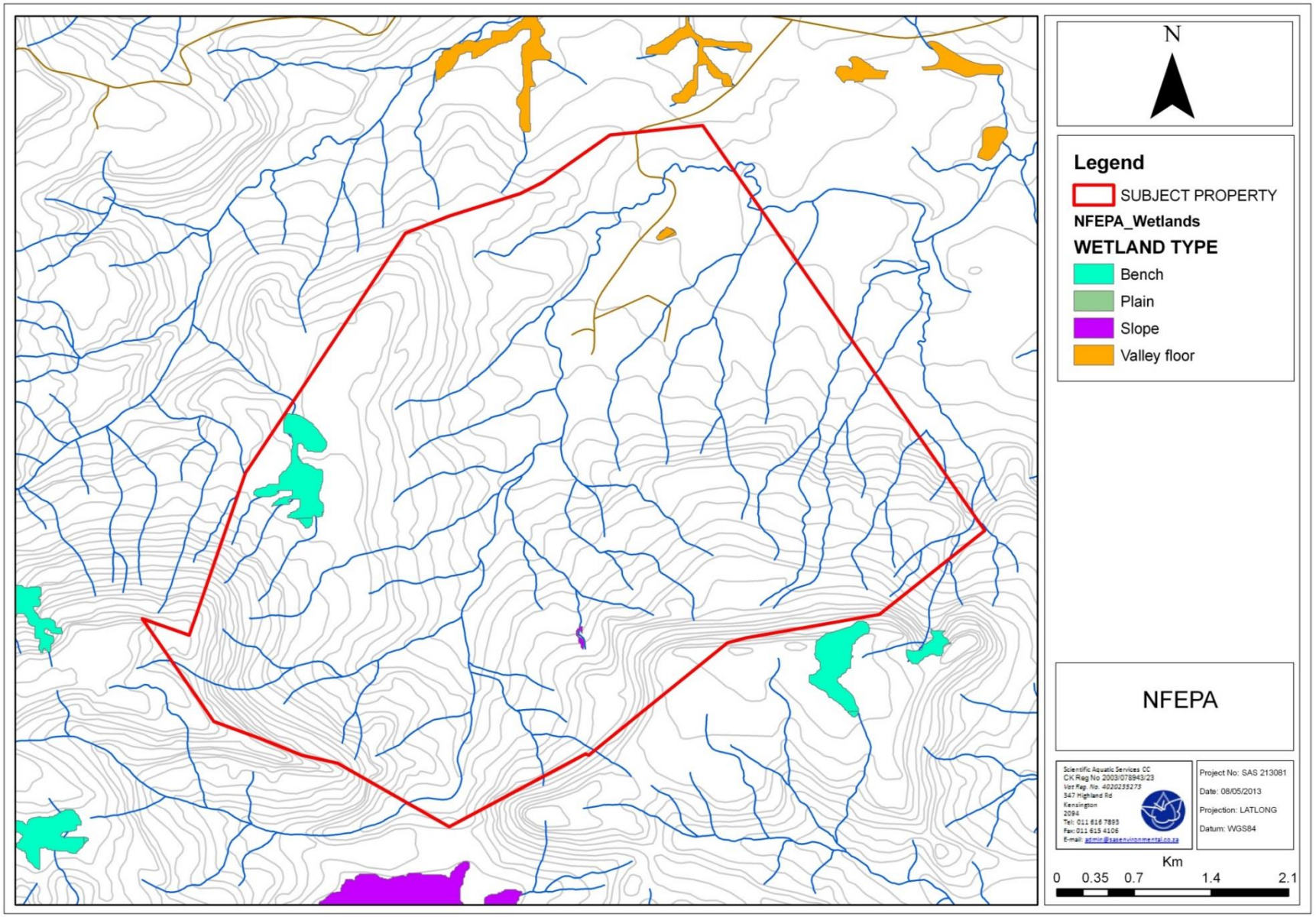

Figure 4: Wetland conditions as defined by the NFEPA wetland map.

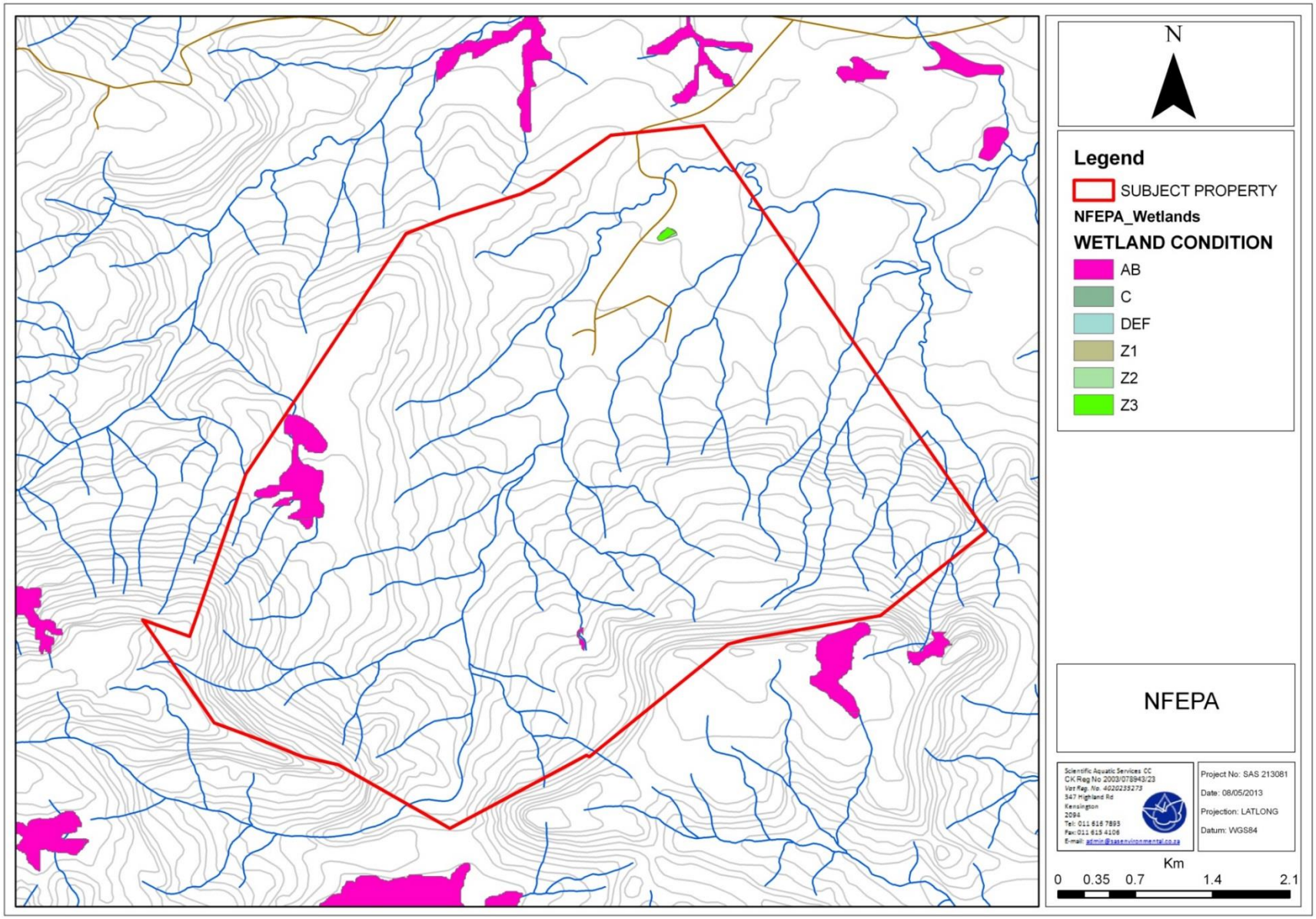

Figure 5: Wetland conditions as defined by the NFEPA wetland map.

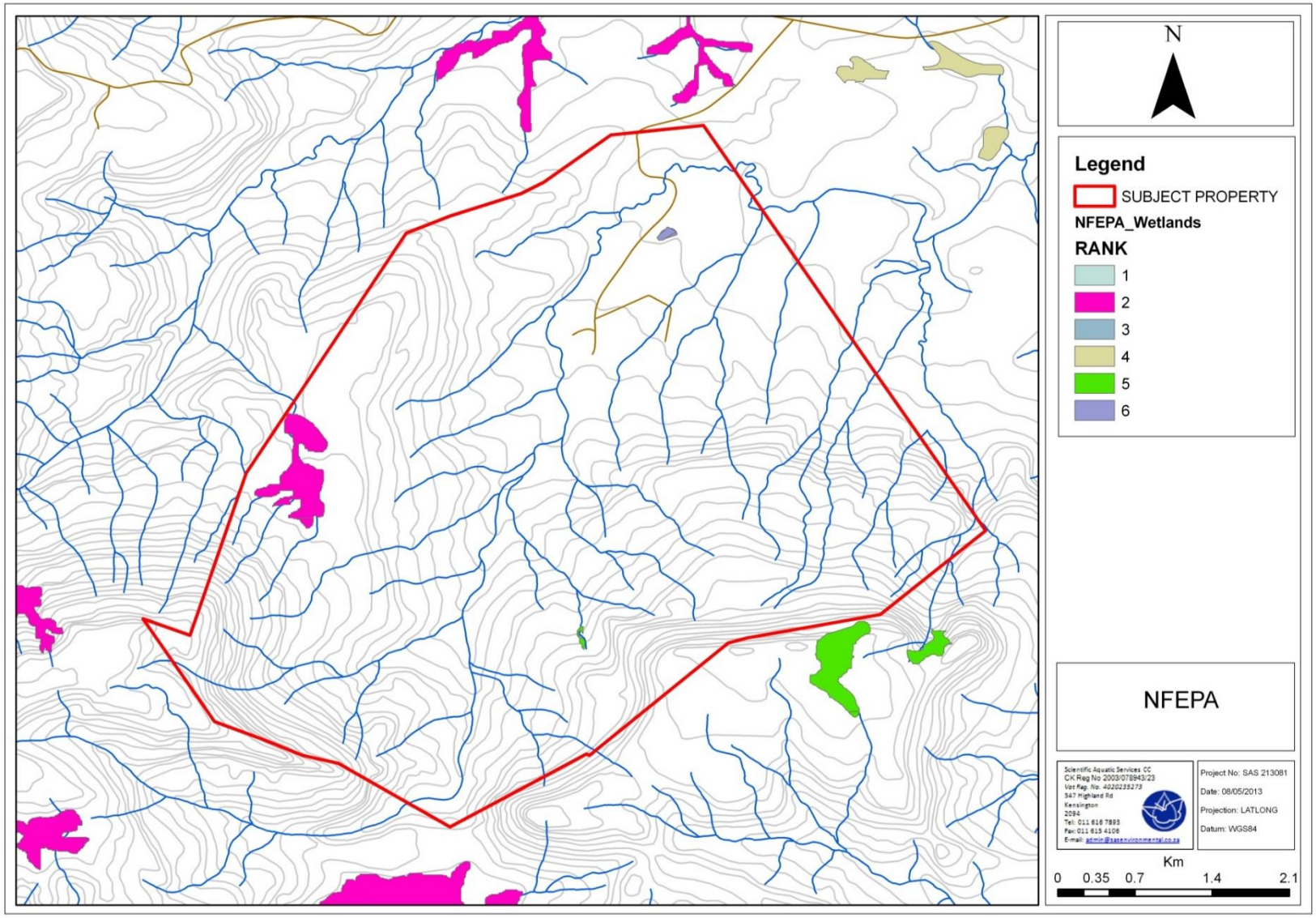

Figure 6: Ranks according to general importance.

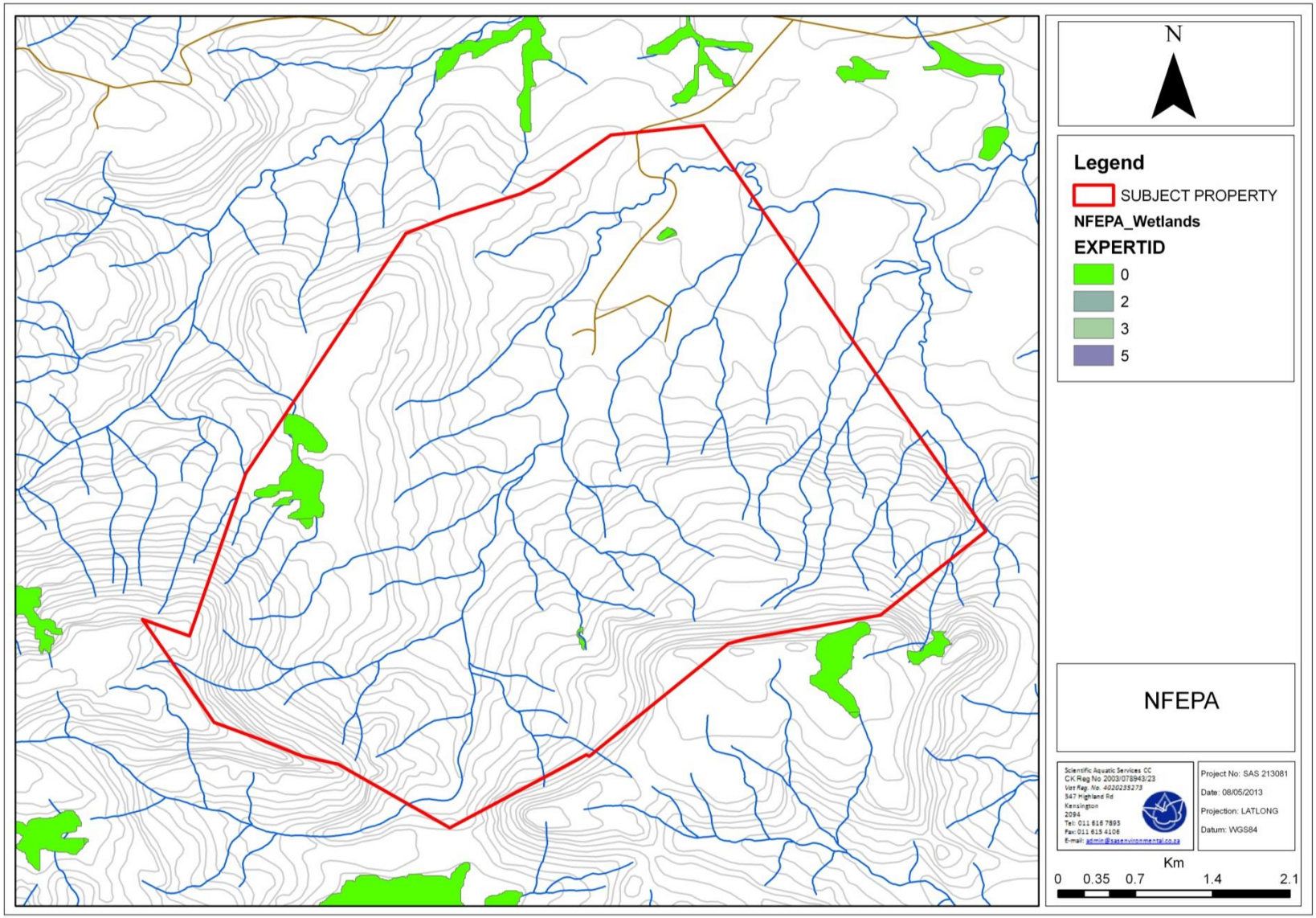

Figure 7: Wetlands indicated to be of importance towards biodiversity conservation (0 = no importance indicated).

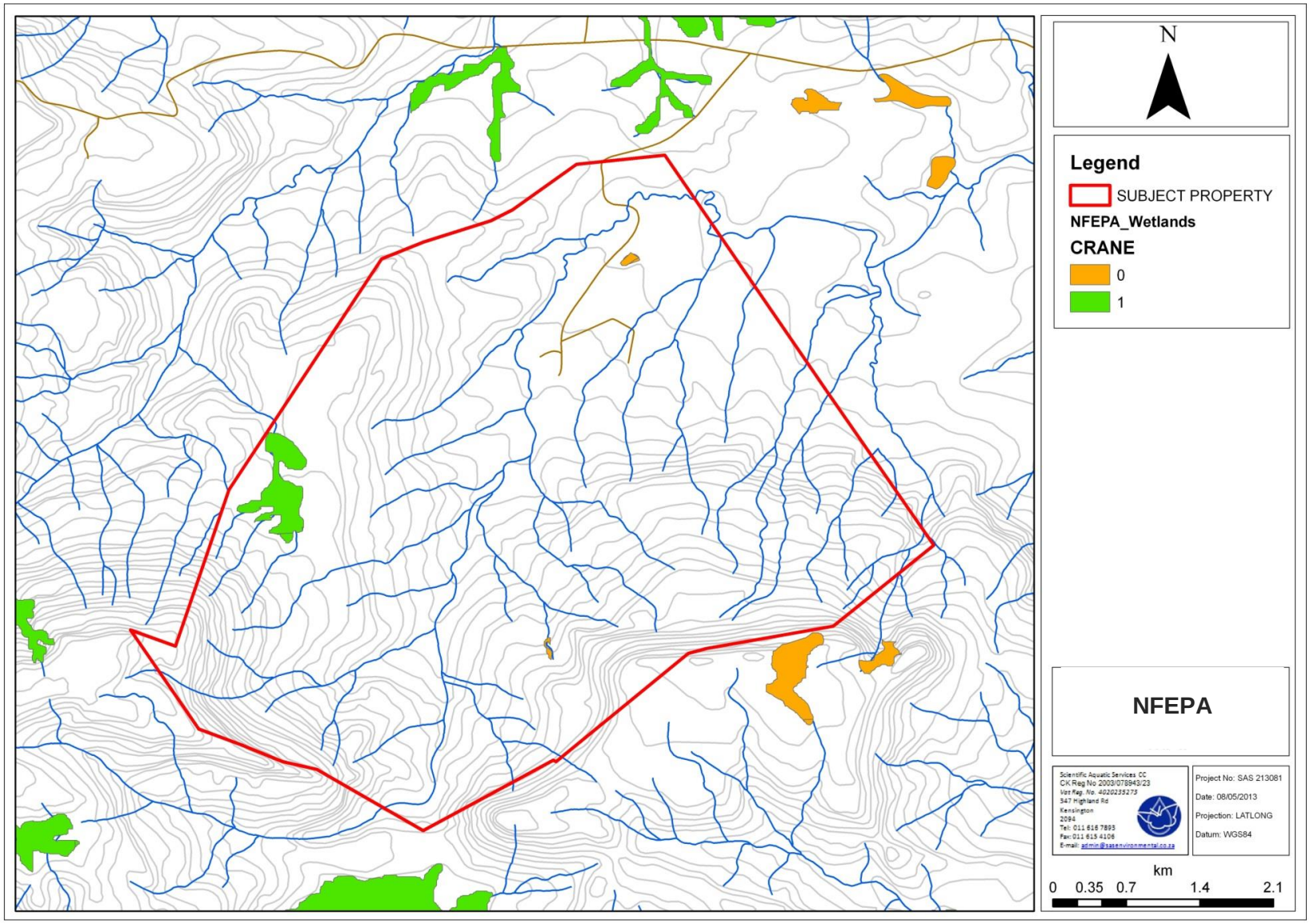

Figure 8: Wetlands indicated to be of importance towards crane conservation (1 = importance indicated).

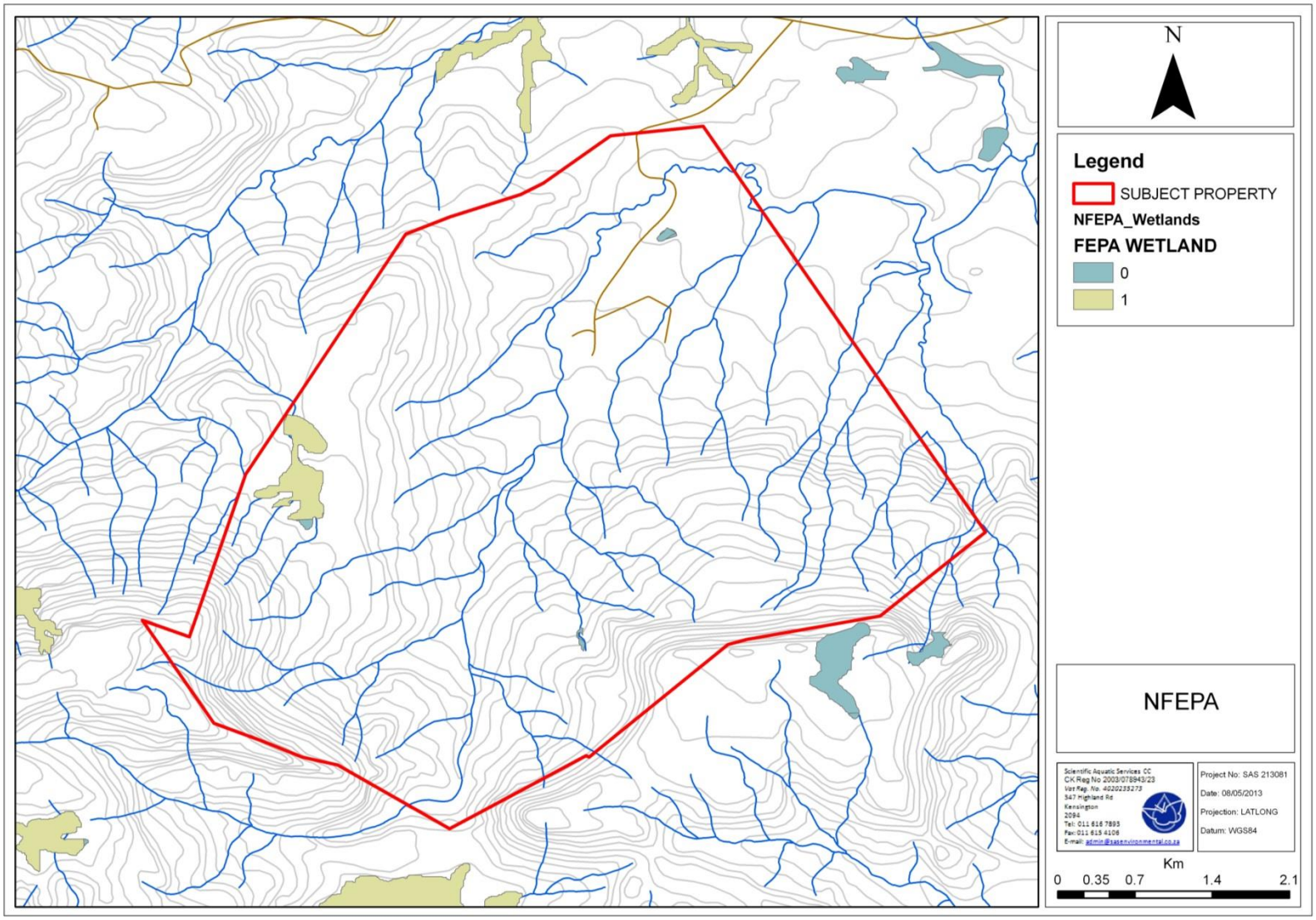

Figure 9: FEPA wetlands located within the subject property boundary (1= FEPA wetland).

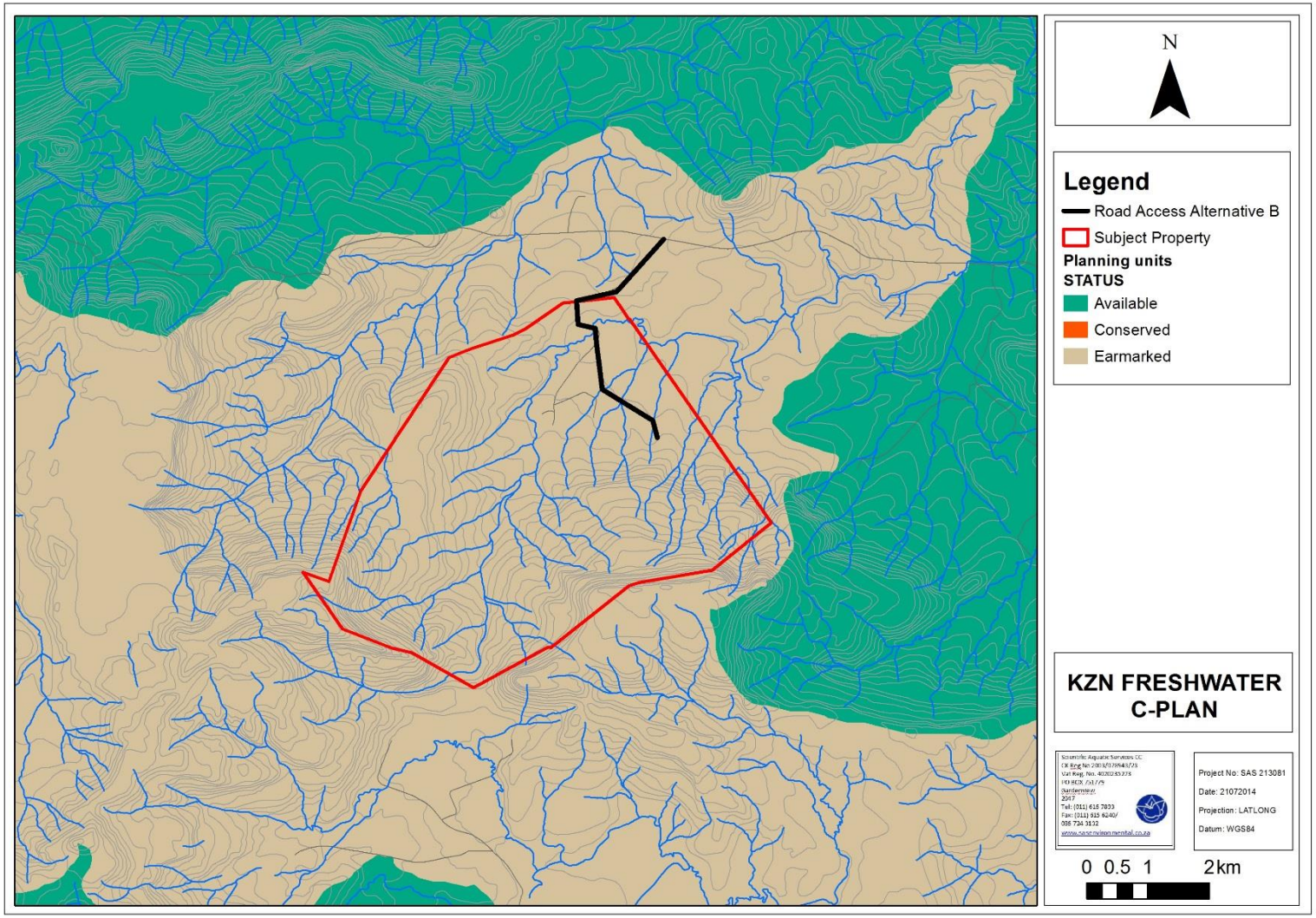

Figure 10: Importance according to the KZN Freshwater Conservation Plan

4 RESULTS

4.1 Wetland System Characterisation

The wetland features identified during the assessment of the subject property was categorised according to the classification system as described in Section 2.3 of this report. The results of the wetland system characterisation are illustrated in the table below.

Table 11: SANBI National Wetland Classification for wetland areas present within the subject property.

Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit
Inland: An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	**Ecoregion:** The subject property falls within the Eastern Escarpment Mountains Ecoregion **NFEPA WetVeg Groups** ➢ Mesic Highveld Grassland Group5 and 8	**Valley Floor:** The typically gently sloping, lowest surface of a valley	**Lower Foothill River:** Lower-gradient, mixed-bed alluvial channel with sand and gravel dominating the bed and may be locally bedrock controlled; reach types typically include pool riffle or pool-rapid, with sand bars common in pools; pools are of significantly greater extent than rapids or riffles. Characteristic gradient is 0.001–0.005.
Inland: An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	**Ecoregion:** The subject property falls within the Eastern Escarpment Mountains Ecoregion **NFEPA WetVeg Groups** Mesic Highveld Grassland Group5 and 8	**Channel (river, including the banks):** an open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies.	**Transitional River:** moderately steep stream dominated by bedrock and boulders; reach types include plain-bed, pool-riffle or pool-rapid; usually in confined or semi-confined valley. Characteristic gradient is 0.02–0.039.
Inland: An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	**Ecoregion:** The subject property falls within the Eastern Escarpment Mountains Ecoregion **NFEPA WetVeg Groups** Mesic Highveld Grassland Group5 and 8	**Valley floor:** The typically gently sloping, lowest surface of a valley	**Channelled valley bottom wetland:** A valley bottom wetland with a river channel running through it.
Inland: An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	**Ecoregion:** The subject property falls within the Eastern Escarpment Mountains Ecoregion **NFEPA WetVeg Group:** Mesic Highveld Grassland Group 5 and 8	**Bench:** Bench (hilltop/saddle/shelf): an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on	**Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat

Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit
		two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope on one side and a down-slope on the other side in the same direction)	

The wetlands were classified as Inland systems falling within the Eastern Escarpment Mountains Ecoregion and within the Mesic Highveld Grassland Groups 5 and 8 wetland vegetation groups. The bench wetlands are situated in the higher altitude areas, while the Pandana River is characterised as a lower foothill river. Several smaller tributaries to the Pandana River, especially in the higher altitude areas, were classified as transitional rivers. In the lower lying areas where the gradient was more gentle, several channelled valley bottom wetlands were encountered.

Overall, the systems consisted of permanent, seasonal and temporary zones, which were identified primarily by means of soil wetness indicators and indicators of phorolyses as indicated by mottling of soils. Soil types with gleyed soils and lower chroma soils were extensively used to define the wetland boundary with a relatively clear contact between high chroma terrestrial soils and low chroma wetland soils evident along most of the length of the wetland features. The figures below present representative photographs of the wetlands in the subject property.

Figure 11: Wetlands encountered in the subject property. Note trampling by cattle on the right.

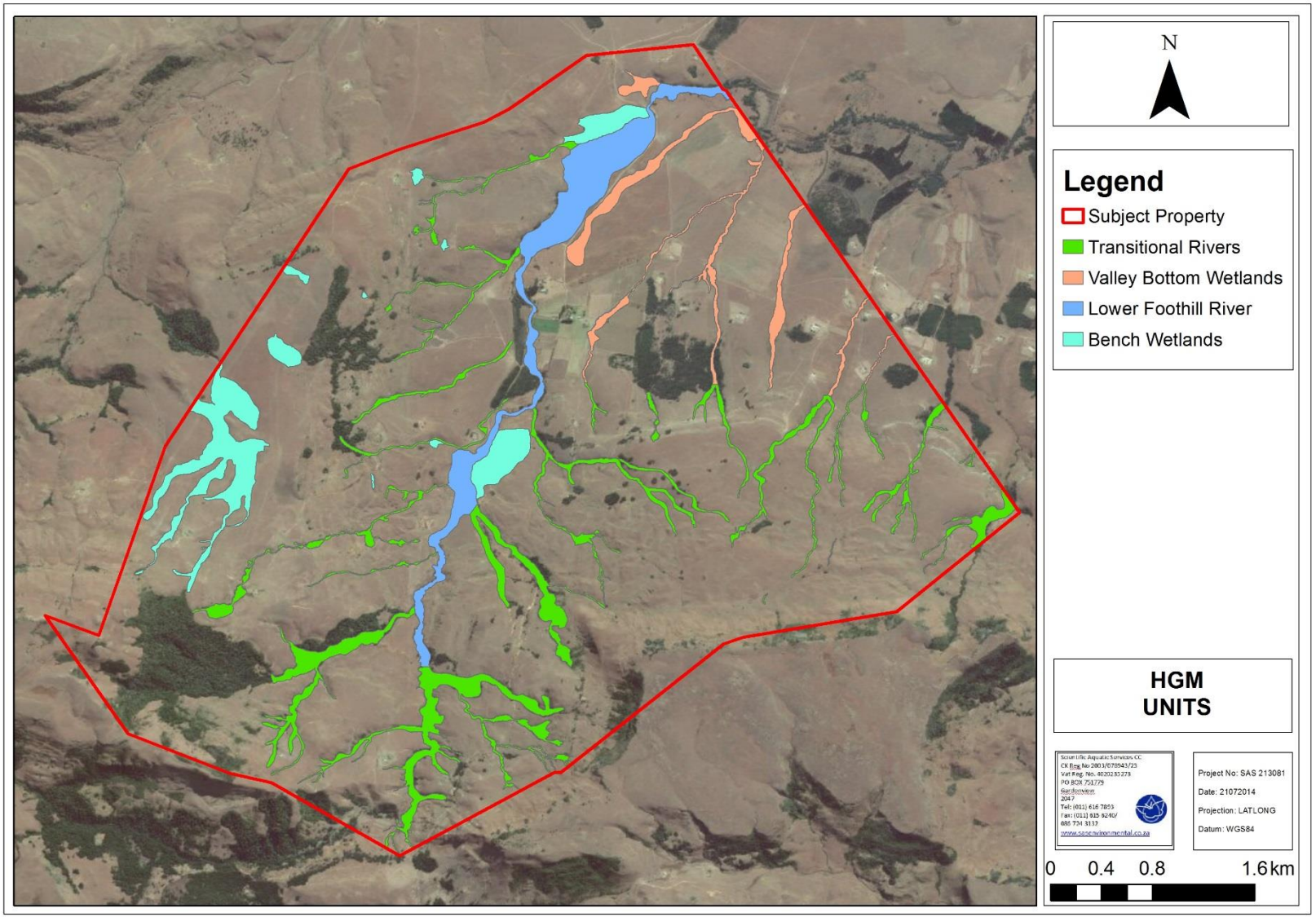

Figure 12: Map of the wetland features within the subject property.

4.2 Wetland Function Assessment

Wetland function and service provision were assessed for the wetland features within the subject property. The average scores for the assessed systems are presented in the following table along with the radar plot in the figure that follows the table.

Table 12: The wetland function and service provision for the wetland features.

Ecosystem service	Transitional Rivers	Bench Wetlands	Lower Foothill River	Valley Bottom Wetlands
Flood attenuation	2.4	2.2	2.5	2.9
Streamflow regulation	2.4	2.2	2.5	2.9
Sediment trapping	2	2.8	2.4	2.6
Phosphate assimilation	1.8	2	2.3	2.4
Nitrate assimilation	1.8	2	2.3	2.4
Toxicant assimilation	1.8	2	2.3	2.4
Erosion control	2.8	2.4	2.1	2.3
Carbon Storage	1.6	3	2.2	3
Biodiversity maintenance	3.5	3.5	3.5	3.5
Water Supply	2.3	2.3	2.3	2.3
Harvestable resources	1.9	1.5	1.8	1.6
Cultivated foods	1.4	1.4	2.2	2.2
Cultural value	1	1	1	1
Tourism and recreation	1.1	1.1	1.2	1.2
Education and research	1.8	1.8	1.7	1.6
SUM	**29.6**	**31.2**	**32.3**	**34.3**
Average score	**2.0**	**2.1**	**2.2**	**2.3**

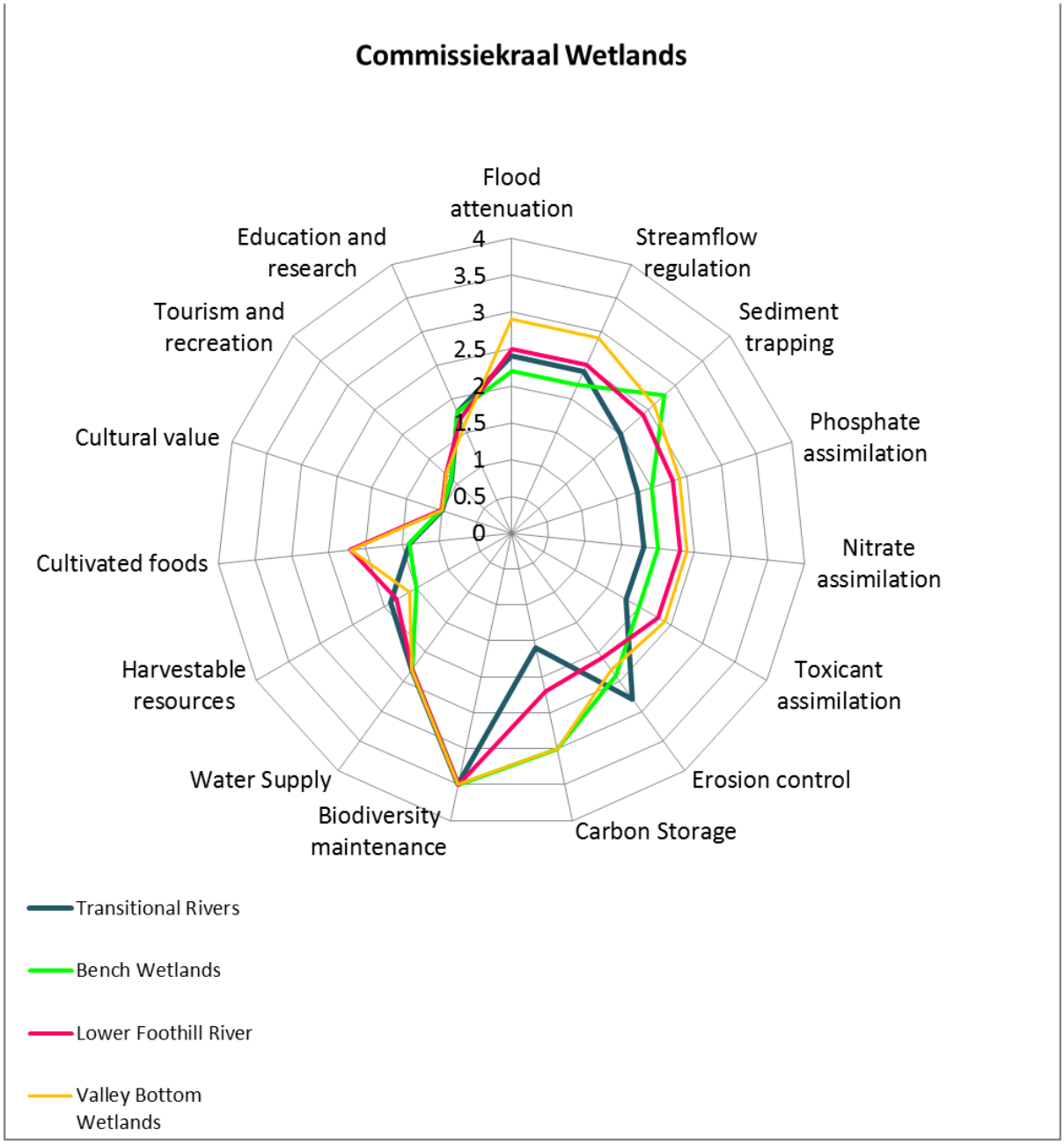

Figure 13: Radar plot of wetland services provided.

In summary, the lower foothill river obtained an overall ecological service provision score of 2.2, the bench wetlands obtained a score of 2.1, the valley bottom wetlands obtained a score of 2.3 and the transitional rivers obtained a score of 2.0, which places the wetlands in a moderately high class of ecological service provision.

From the results of the assessment, it is evident that the majority of the wetland features important in terms of flood attenuation, streamflow regulation and nutrient assimilation as they are situated in an agricultural area. Furthermore, the systems play the most important role in terms of biodiversity maintenance, as several protected floral and faunal species are

associated with the wetlands (refer to Section B and C of the baseline reports). As the systems are situated in the upper catchment of the Pongolo River which is an important river in terms of water supply for agricultural areas, they are also important in terms of water supply.

In summary, it is clear that the various wetland systems within the subject property provide moderately high levels of ecological and socio-cultural services, and impacts associated with proposed mining (especially decant of polluted water) are likely to significantly affect these systems, especially in terms of the importance of the system with regard to agricultural areas downstream.

4.3 WET-Health Assessment

The wetlands were classified as Inland systems falling within the Eastern Escarpment Mountains Ecoregion and within the Mesic Highveld Grassland 5 and 8 vegetation groups. The wetland systems were assessed according to the WET-Health methodology described in Section 2.5.

Three modules were assessed namely hydrology, geomorphology and vegetation. Each HGM unit was assessed separately, after which the sum of the individual area weighted scores for each HGM unit was taken as the final score of each module considered representative of the wetland feature as a whole. A summary of the results is provided in the tables below.

4.3.1 Transitional Rivers

Table 13: Summary of the overall health of the Transitional River features based on impact score and change score.

Hydrology		Geomorphology		Vegetation	
Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
B	→	A	→	B	↓

The overall score for the wetland system that aggregates the scores for the assessed three modules, namely hydrology, geomorphology and vegetation, was calculated using the formula[2] as provided by the WET-Health methodology. The overall score calculated was 1.4, falling within Category B (Largely natural with few modifications).

[2] ((Hydrology score) x 3 + (geomorphology score) x2 + (vegetation score) x 2))/ 7 = PES

The present hydrological state of the HGM unit calculated a score that falls within Category B (Largely natural with few modifications). Any deviation from a Category B in the future is considered unlikely, provided that the current land use is continued. Erosion and consequent deposition and changes in runoff intensity is considered marginal within the wetland system, as a result the calculated score falls within the present geomorphic Category A (Unmodified/natural) with indications of the system continuing along this trend. The present vegetation state is considered to fall within Category B (Largely natural with few modifications). Vegetation composition has been slightly altered but introduced alien and/or ruderal species are still clearly less abundant than characteristic indigenous wetland species, however a decrease in the vegetation condition is likely as alien floral invasion is likely to increase.

4.3.2 Bench Wetlands

Table 14: Summary of the overall health of the Bench Wetland features based on impact score and change score.

Hydrology		Geomorphology		Vegetation	
Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
B	→	A	→	B	↓

The overall score for the bench wetland system that aggregates the scores for the assessed three modules, namely hydrology, geomorphology and vegetation, was calculated using the formula[3] as provided by the WET-Health methodology. The overall score calculated was 1.4, falling within Category B (Largely natural with few modifications).

The present hydrological state of the HGM unit calculated a score that falls within Category B (Largely natural with few modifications). Any deviation from a Category B in the future is considered unlikely, especially in the higher altitude areas, provided that the current land use is continued. Erosion and consequent deposition and changes in runoff intensity is considered marginal due to limited trampling by cattle recorded, as a result the calculated score falls within the present geomorphic Category A (Unmodified/natural) with indications of the system continuing along this trend.

The present vegetation state is considered to fall within Category B (Largely natural with few modifications). Vegetation composition has been slightly altered by the invasion of alien floral species, most notably *Acacia mearnsii,* however, these species are still clearly less abundant

[3] ((Hydrology score) x 3 + (geomorphology score) x2 + (vegetation score) x 2))/ 7 = PES

than characteristic indigenous wetland species. A decrease in the vegetation condition is likely as alien floral invasion is likely to increase.

4.3.3 Lower Foothill River

Table 15: Summary of the overall health of the Lower Foothill River feature based on impact score and change score.

Hydrology		Geomorphology		Vegetation	
Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
C	→	B	→	D	↓

The overall score for the lower foothill river system that aggregates the scores for the assessed three modules, namely hydrology, geomorphology and vegetation, was calculated using the formula[4] as provided by the WET-Health methodology. The overall score calculated was 2.8, falling within Category C (A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact).

The present hydrological state of the HGM unit obtained a score that falls within Category C (Moderately modified), as several crossings, cattle paths and runoff from surrounding homesteads have likely altered the hydrological regime, although any deviation from a Category C in the future is considered unlikely, provided that the current land use is continued. Few signs of incision or other geomorphological impacts were recorded, as a result the calculated score falls within the present geomorphic Category B (Largely natural) with indications of the system continuing along this trend.

The vegetation component falls within Class D (Largely modified), as a result of severe encroachment by *Acacia mearnsii,* which has, in some areas, completely replaced the indigenous wetland species. A decrease in the vegetation condition is likely as alien floral invasion is likely to increase.

[4] ((Hydrology score) x 3 + (geomorphology score) x2 + (vegetation score) x 2))/ 7 = PES

4.3.4 Valley Bottom Wetlands

Table 16: Summary of the overall health of the Valley Bottom Wetland features based on impact score and change score.

Hydrology		Geomorphology		Vegetation	
Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
C	→	B	→	C	↓

The overall score for the valley bottom wetlands that aggregates the scores for the assessed three modules, namely hydrology, geomorphology and vegetation, was calculated using the formula[5] as provided by the WET-Health methodology. The overall score calculated was 2.6, falling within Category C (A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact).

The present hydrological state of the HGM unit obtained a score that falls within Category C (Moderately modified), as an earth dam, crossing structures and runoff from surrounding homesteads have likely altered the hydrological regime with any significant deviation from a Category C in the future unlikely, provided that the current land use is continued. No significant geomorphological impacts were recorded, as a result the calculated score falls within the present geomorphic Category B (Largely natural) with indications of the system continuing along this trend.

The vegetation component falls within Class C (Moderately modified), as a result of edge effects from agricultural activities, cattle grazing and encroachment by alien floral species. A decrease in the vegetation condition is likely, should current land use practices continue.

4.4 Ecological Importance and Sensitivity Assessment

The Wetland EIS determination method was applied according to the protocol of DWAF (1999). The aim of the application of this method is to clearly define the importance of each system. The wetland EIS was defined for the various wetland features identified within the subject property.

[5] ((Hydrology score) x 3 + (geomorphology score) x2 + (vegetation score) x 2))/ 7 = PES

Table 17: Score sheet for determining the EIS of the wetland systems.

Determinant	Transitional Rivers	Bench Wetlands	Lower Foothill River	Valley Bottom Wetlands	Confidence
PRIMARY DETERMINANTS					
1. Rare & Endangered Species	3	4	3	3	4
2. Populations of Unique Species	3	3	3	2	4
3. Species/taxon Richness	3	3	2	2	4
4. Diversity of Habitat Types or Features	2	2	2	2	4
5. Migration route/breeding and feeding site for wetland species	3	4	3	3	4
6. PES as determined by WET-Health assessment	4	4	3	3	4
7. Importance in terms of function and service provision	3	3	3	3	4
MODIFYING DETERMINANTS					
8. Protected Status according to NFEPA Wetveg	4	4	4	4	4
9. Ecological Integrity	4	4	2	2	4
TOTAL	29	30	25	24	
MEAN	3.22	3.33	2.78	2.67	
OVERALL EIS	**A**	**A**	**B**	**B**	

Based on the findings of the study it is evident that from a wetland point of view, the Transitional Rivers and Bench Wetlands fall within Class A systems, indicating a very high EIS. The Lower Foothill Rivers and Valley Bottom Wetlands obtained a high EIS score (Class B). Thus, it is evident that the wetland systems within the subject property are of high to very high sensitivity, and any impacts due to mining are likely to be highly significant both regionally and locally. In this regard, specific mention is made of possible dewatering of surface water systems and also possible decant of polluted water, which are likely to decrease the EIS of the wetlands during the life of mine and post-closure.

4.5 Recommended Ecological Category

According to the resource directed measures for protection of water resources[6] a wetland or river may receive the same class for the PES as the REC if the habitat is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as to enhance the PES of the feature. The results obtained from the assessments indicate relatively low levels of transformation on all levels of ecology. It is therefore recommended that the features be assigned the same REC as the PES Class calculated. The EIS and REC values are presented in the table below. It is evident that the wetland systems within the subject property are of high

[6] DWA and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources 1999*

to very high sensitivity, and any impacts due to mining are likely to be highly significant both regionally and locally. In this regard, specific mention is made of possible dewatering of surface water systems and also possible decant of polluted water, which are likely to provide a significant challenge to maintain the REC of the wetlands during the life of mine and post-closure.

Table 18: Assigned REC Classes.

Feature	Wetland PES Classes	EIS Class	REC Class
Transitional Rivers	B	A	B
Bench Wetlands	B	A	B
Lower Foothill River	C	B	C
Valley Bottom Wetlands	C	B	C

4.6 Legislative requirements and Buffer Allocations

The wetland EIS was utilised to determine the sensitivity of the various wetland systems. From the figure below, the Class A EIS systems are considered to be of very high sensitivity, while the Class B EIS systems are considered to be of high sensitivity. Legislative requirements were used to determine the extent of buffer zone required for all wetland types. The wetlands associated with the subject property are defined as watercourses. If any activities are to take place within 100 meters or the 1:100 year flood lines exemption terms of Regulation GN 704 of the NWA, 1998 (act no. 36 of 1998) needs to be obtained. Section 21 of the NWA (Act 36 of 1998) as well as General Notice no. 1199 of 2009 as it relates to the NWA will also apply and therefore a Water Use License will be required. A 32m buffer is indicated around all features which will require authorisation in terms of the National Environmental Management Act (NEMA) 107 of 1998 if any activities are to take place within the buffer zone.

After the assessment it can be concluded that the wetland resources are of significant importance in terms of function and service provision with special mention of biodiversity. The wetland resources associated with the subject property are largely intact and are therefore important in terms of biodiversity value as they provide habitat and migratory corridors for a diversity of faunal and floral species. The wetland resources also have significant downstream importance for biodiversity maintenance and other basic ecosystem services as it is situated in the upper catchment of the Pongolo River system, and any detrimental impact on these systems will be of high significance, both locally and downstream.

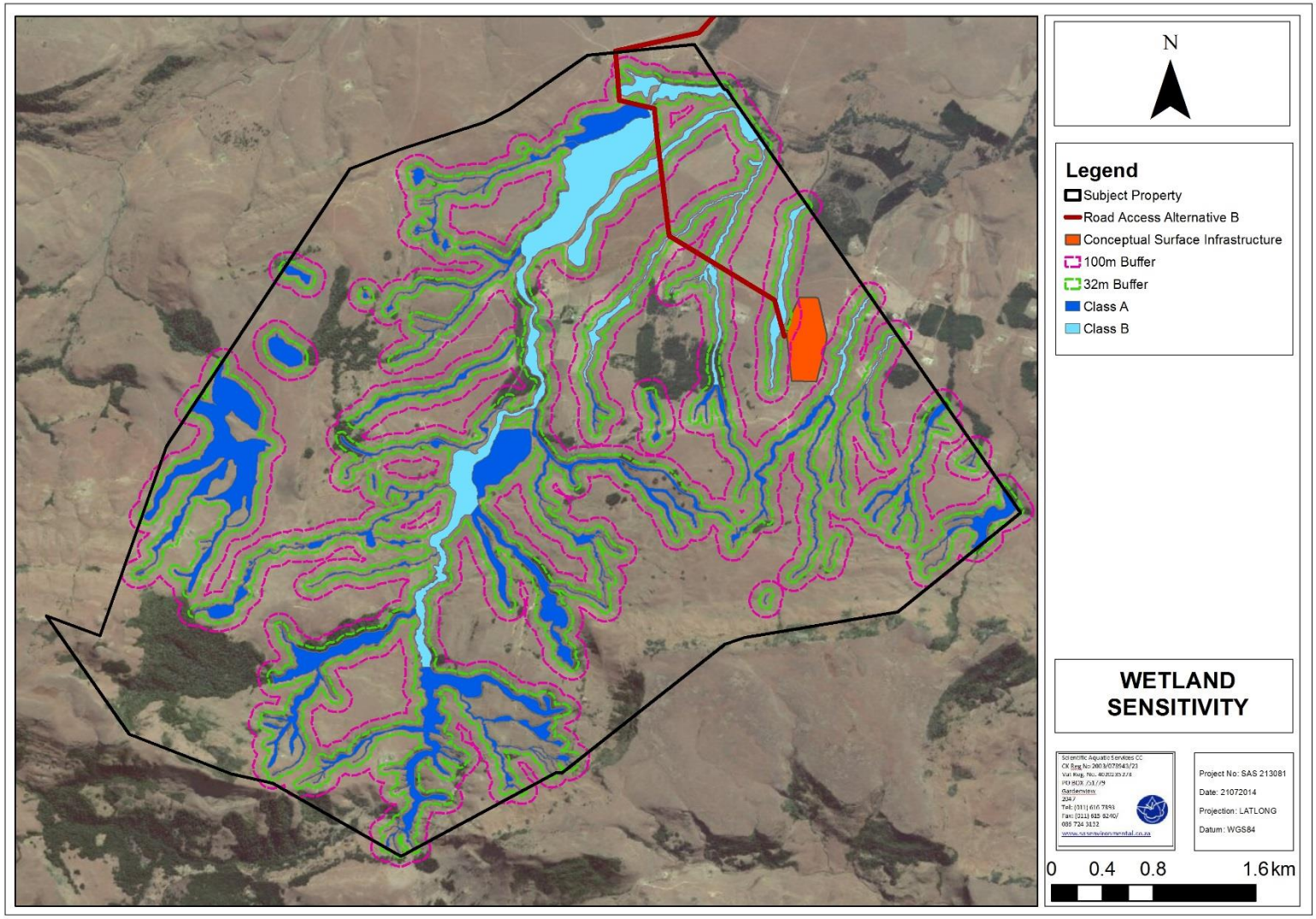

Figure 14: Conceptual representation of the wetland features present within the subject property with associated buffers.

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