December 2013

ZITHOLELE CONSULTING PTY LTD

Vaalbank 88Kv Basic Assessment - Wetlands

Submitted to:
Zitholele Consulting (Pty) Ltd.

Report Number: 1302719-12577-2

REPORT

Executive Summary

The wetlands within the 500 m study area surrounding the proposed powerline route corridor exist within a landscape currently dominated by agricultural (cultivation, grazing) and mining activities and these land uses have had an influence on the current extent and condition of the wetlands. In this context, the majority of wetlands within the study area were found to be Moderately Modified (C), primarily due to the influence of cultivation and grazing on the vegetation diversity, berming and damming of flows within the agricultural areas, exotic vegetation and weed encroachment, and the influence of linear features such as roads and access tracks on the hydrology of the wetlands. An unchannelled valley bottom wetland in the eastern part of the study area was assessed as being in a Largely Natural (B) state. The results of the Ecological Importance and Sensitivity assessment indicate that all of the wetlands within the study area are of Moderate (C) ecological importance due to the their functionality and the potential to support rare and unique species.

The proposed powerline and switching station project is expected to have a number of impacts on the wetlands within the study area. The most significant potential impacts identified include the loss of natural wetland habitat, Red Data species and biodiversity within and adjacent to the footprint of the proposed works, and interruption in hydrology which may result in erosion and/or desiccation of the wetlands.

It is recommended that the management and mitigation measures provided in this report be included in the proposed project's official EMP and that these measures are assessed for efficacy during all phases of the project and adapted accordingly to ensure minimal disturbance of the study area's wetlands and water resources.

It is important to remember that wetlands are merely a reflection of water movement through the landscape and cannot be effectively managed and maintained in isolation. Activities that occur within a wetland's catchment, but which do not directly impact upon the wetland can still have significantly negative impacts on the hydrology supporting these systems. In recognition of this fact, it is now a requirement that any activities that take place within 500 meters of a wetland is subject to authorisation under Section 21 of the National Water Act (Act 36, 1998). In order to facilitate this process, a 500 meter buffer has been included around all wetlands delineated, and any activity that occurs within this buffer that will impact upon the wetlands will require submission of a Water Use License Application.

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1.0 INTRODUCTION

Golder Associates Africa Pty Ltd (Golder) was appointed by Zitholele Consulting (Pty) Ltd to provide a wetland delineation and assessment for the site of proposed infrastructure associated with the Vaalbank - Makalu 88kV Powerline and Switching Station.

Golder Associates subcontracted Wetland Consulting Services (Pty) Ltd to conduct a wetland survey and assessment within the study area. This report presents the results of the wetland delineation and assessment of wetlands located within 500 m either side of the proposed power line (hereafter referred to as the study area – refer to Figure 1). Possible negative impacts resulting from the proposed project are identified and assessed, and recommendations for management and monitoring of the wetlands in question are put forward.

2.0 OBJECTIVES

The objectives of the wetland study are to:

- Delineate and map wetland and riparian areas within the study area (desktop);
- Conduct a field investigation to ground-truth the presence and extent of wetland and riparian areas within the study area;
- Classify wetlands according to HGM (SANBI, 2009);
- Undertake a functional assessment of any wetland and riparian systems on site (WET-EcoServices);
- Determine the Present Ecological State (PES) and Ecological Importance and Sensitivity of any wetlands on site using the VEGRAI methodology for riparian areas and the Wetland Index of Habitat Integrity and WET-Health methodologies as applicable;
- Broadly identify and assess potential impacts of the proposed project on wetland flora, fauna and ecosystem function; and
- Provide management and monitoring recommendations to mitigate identified negative impacts.

3.0 APPROACH

3.1 Wetland Delineation and Classification

Topographic maps (1:50 000), black and white orthophotos (1:10 000) and geo-referenced Google Earth images were used to generate digital base maps of the study area. A desktop delineation of suspected wetlands was undertaken by identifying wetness signatures from the digital base maps, using ArcGis 9.1. Areas identified as potential wetlands were further investigated in the field.

Wetlands were delineated according to the delineation procedure as set out by the "*A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas*" document, as published by DWAF (2005). The study area was sub-divided into transects and the soil profile was examined for signs of wetness within 50 cm of the surface using a hand augur along each transect. The wetland boundaries were then determined based on the positions of augured holes that showed signs of wetness as well as the presence or absence of hydrophilic vegetation. In accordance with the above methodology, the following key indicators were used to identify and classify the wetlands:

- Soil hydromorphy: the presence of grey and orange mottles indicating periods of alternating anaerobic and aerobic conditions. An important limit is the depth at which hydromorphic conditions occur. Wetlands are considered to be the result of an interaction between soil, water and vegetation, and the 50cm depth limit represents the rooting zone of herbaceous wetland vegetation. Hydromorphic characteristics within the top 50cm of the soil profile therefore indicate the presence of wetland habitat.

- Vegetation: Certain plant species are good indicators of the temporary, seasonal and permanent wetland zones and terrestrial habitat.
  - The original delineation fieldwork took place at the beginning of the dry season, with the vegetation already beginning to die off, hindering detailed species identification. However, the density of vegetation growth was also found to be an effective indicator of the respective wetland zones. Additional wetland plant species were recorded in HGM units within the study area during a site visit undertaken in Jan 2014.
- Topography is a good wetland indicator, particularly when delineating floodplain and channelled valley-bottom systems where the shape of the land indicates the likely extent of peak-flows.

Identified wetlands were classified according to their hydro-geomorphic determinants based on the system proposed by Brinson (1993), as modified for use in South Africa by Marneweck and Batchelor (2002) and subsequently revised by Kotze *et. al.* (2004) and SANBI (2009). Notes were made on the levels of degradation in the wetlands based on field experience and a general understanding of the types of systems present.

3.2 Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

A PES and EIS analysis was conducted for every hydro-geomorphic wetland unit identified and delineated within the study area, in order to establish a baseline of the current state of the wetlands, and to provide an indication of the conservation value and sensitivity of the wetlands.

For each identified wetland unit, the scoring system as described in DWAF (1999) was applied for the determination of the PES and EIS. The results of the assessments are reflected in the placement of each wetland unit into a category based on the assessment scores. A description of the PES and EIS categories are provided in Tables 1 and 2 respectively

Table 1: Description of the PES categories

Mean*	Category	Explanation
Within generally acceptable range		
>4	A	*Unmodified, or* approximates natural condition
>3 and ≤ 4	B	Largely natural with few modifications, but with some loss of natural habitats
>2.5 and ≤ 3	C	Moderately modified, but with some loss of natural habitats
≤ 2.5 and >1.5	D	Largely modified. A large loss of natural habitat and basic ecosystem function has occurred.
Outside generally acceptable range		
>0 and ≤1.5	E	Seriously modified. The losses of natural habitat and ecosystem functions are extensive
0	F	Critically modified. Modification has reached a critical level and the system has been modified completely with almost complete loss of natural habitat.

Table 2: Description of EIS categories

Ecological Importance and Sensitivity categories	Range of Median	Recommended Ecological Management Class
Very high	>3 and ≤ 4	A

Floodplains that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.		
High	>2 and ≤ 3	B
Floodplains that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.		
Moderate	>1 and ≤ 2	C
Floodplains that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.		
Low/marginal	>0 and ≤ 1	D
Floodplains that are not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.		

3.3 Functional Assessment

A functional assessment, of the wetlands within the study area, was undertaken using the level 2 assessment as described in "Wet-EcoServices" (Kotze, Marneweck, Batchelor, Lindley and Collins, 2009). This method provides a scoring system for establishing wetland ecosystem services. It enables relative comparisons of systems based on a logical framework that measures the likelihood that a wetland is able to perform certain functions.

4.0 STUDY AREA

4.1 Location

The proposed project is situated near the town of Sasolburg, in the northern portion of the Free State Province. The study area is located south east of the main New Vaal Colliery complex, approximately 3 km west of Sasolburg (Figure 1).

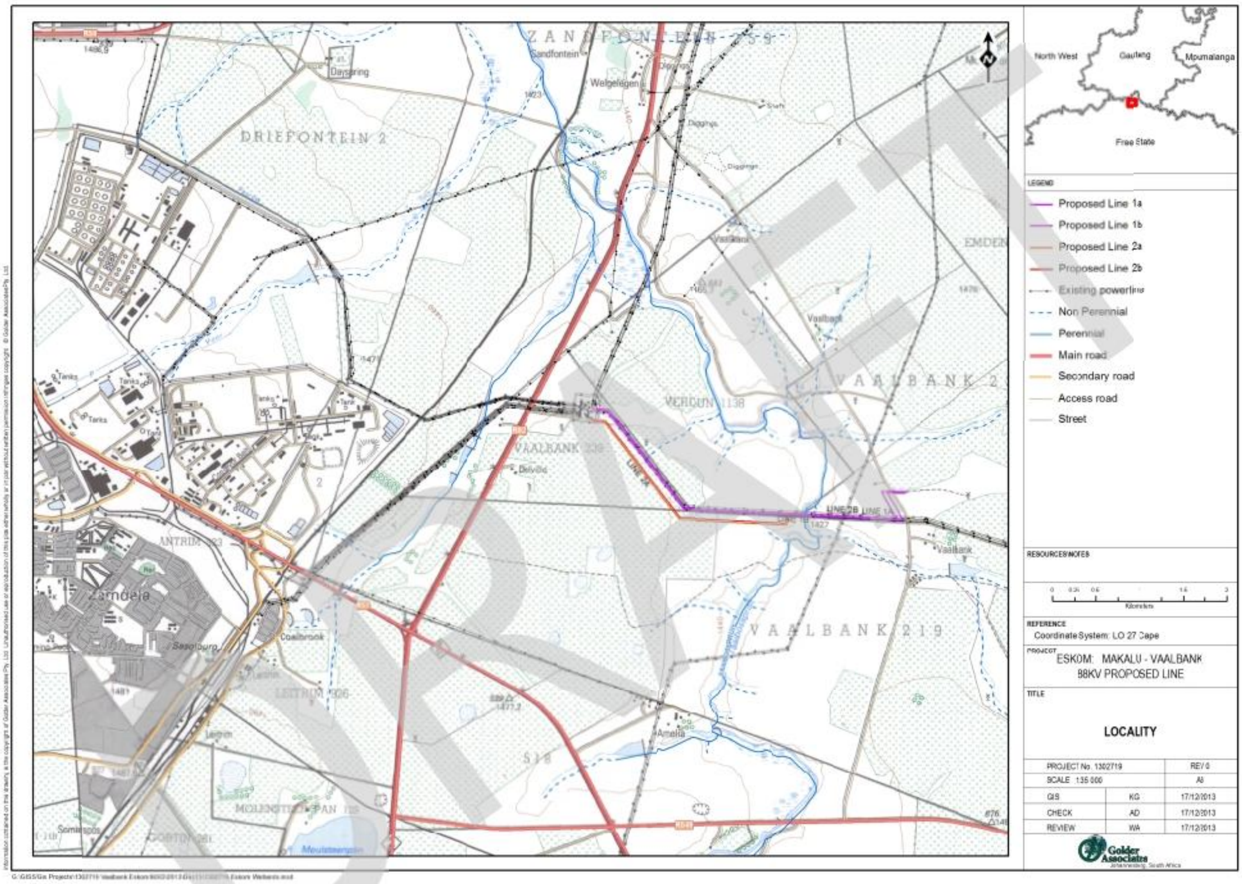

Figure 1: Proposed power line options in local context

4.2 Catchment information

The study area is situated within quaternary catchments C22G and C22K (Figure 2) in the Vaal River catchment in the Upper Vaal Water Management Area (WMA8). Runoff characteristics of the three catchments are provided in Table 3 below.

Table 3: Quaternary catchment characteristics for the study area (Middleton, Midgley, and Pitman, 1990).

Quaternary Catchment	Area (Hectares)	Mean Annual Precipitation (mm)	Mean Annual Runoff (mm)	MAR as a % of MAP
C22G	75500	612.83	19.9	3.25
C22K	39380	644.37	23.6	3.7

4.3 Geology

The underlying lithology are characteristic of the area and include recent alluvium with underlying mudstone, sandstones and shale of the Volksrust Formation, and Vryheid Formation of the Permian age Ecca Group (Figure 3). The study area is underlain by dolerite (Jd) and Sandstone, Shale, Coalbeds (Pv).

4.4 Vegetation

Vegetation within the Study Area (Figure 4) consists of Central Free State Grassland (Mucina & Rutherford, 2006). It is described as short grassland dominated by *Themeda triandra* occurring on undulating plains. Degraded areas tend to become dominated by *Eragrostis curvula* and *E. chloromelas* and are prone to *Acacia karroo* encroachment. This grassland type is considered Vulnerable due to very limited statutory conservation and extensive transformation as a result of cultivation and dam building. No serious infestation by exotic flora has been observed in this vegetation type, but encroachment of dwarf Karroo shrubs becomes a problem in the degraded southern parts of this vegetation unit (Mucina & Rutherford, 2006).

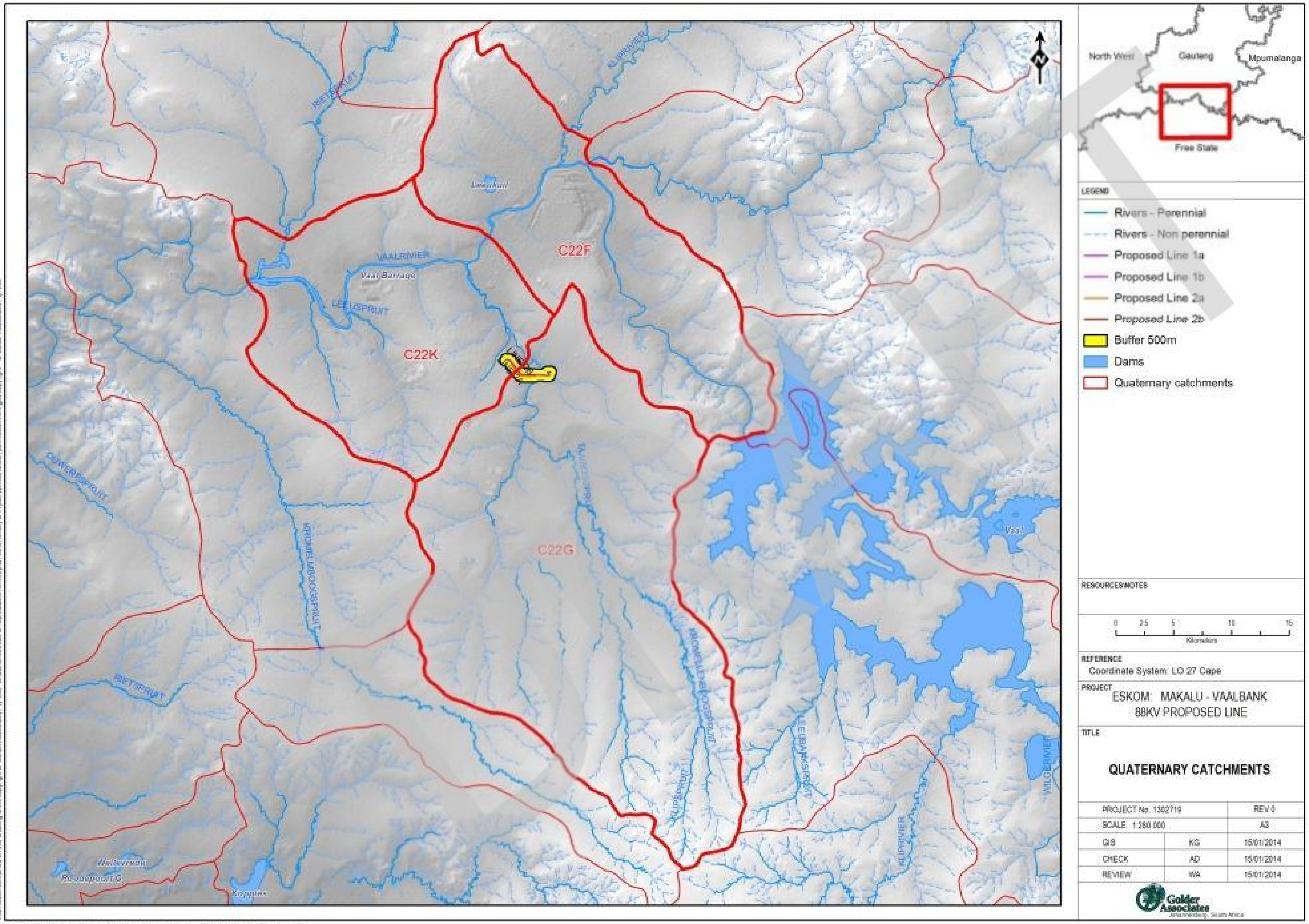

Figure 2: Quaternary catchments surrounding the study area

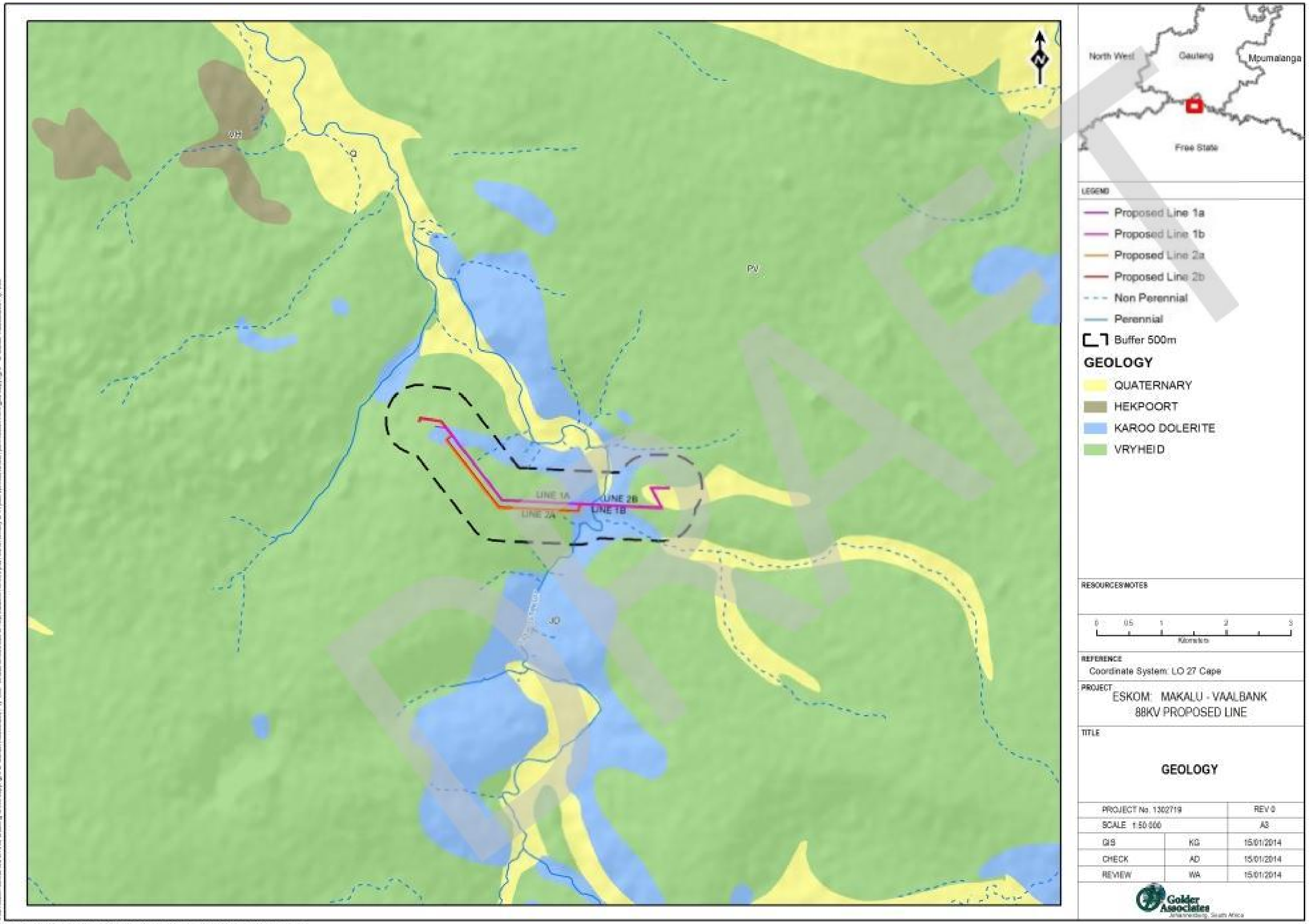

Figure 3: Underlying geology of the study area

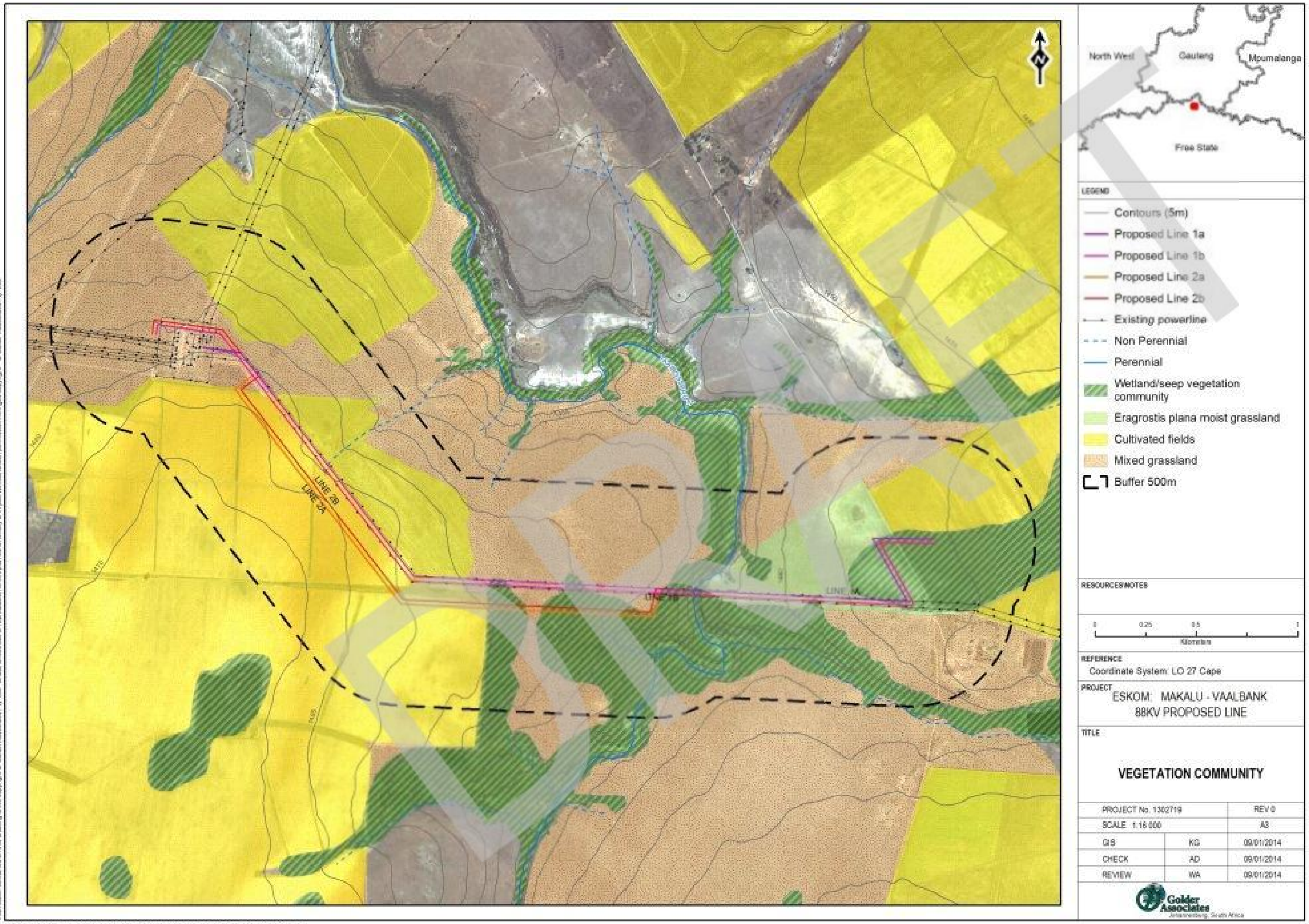

Figure 4: Vegetation communities recorded in study area in relation to proposed powerline

5.0 WETLAND DELINEATION

5.1 Wetland Classification

In the South African context, a wetland is defined 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*' (National Water Act, Act 36 of 1998).

Wetland types are differentiated based on their hydro-geomorphic (HGM) characteristics i.e. on the position of the wetland in the landscape, as well as the way in which surface water and/or ground water moves into, through and out of the wetland systems. Six different HGM types are currently defined by DWAF guidance (Kotze et al., 2007); these are illustrated described in Table 3.

Table 3: Wetland hydrogeomorphic (HGM) types (Kotze et al., 2007)

Hydrogeomorphic type	Description
Floodplain	Valley bottom areas with a well-defined stream channel, gently sloped and characterised by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes
Channelled valley bottom	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterised by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes
Unchannelled valley bottom	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes
Hillslope seepage with channelled outflow	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. 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
Hillslope seepage without channelled outflow	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel
Depression (includes pans)	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.

The findings of the wetland delineations are provided in Figure 5 and Figure 6 and indicate the wetland classification applied. The following wetland types were identified within the 500m study area:

- Unchannelled Valley Bottom Wetlands;
- Hillslope Seepage Wetlands (with channelled outflow);
- Hillslope Seepage Wetlands (without channelled outflow); and
- Channel (Taaibosspruit).

The wetlands identified within the study area form part of the Taaibosspruit or its tributaries, or are expected to contribute towards the Taibosspruit through subsurface flows (hillslope seepages without channelled outflow).

Wetland vegetation observed in untransformed areas and which was of particular use in delineating the wetland boundaries included:

- Temporary zone - *Andropogon appendiculatus, Imperata cylindrica, Setaria sphacelata, Arundanella nepallensis, Aristida junciformis, Helichrysum aureonitens*;
- Seasonal zone - Sedges, *Fiurena pubescens, Eliocharis dregeana, Leersia hexandra, Arundanella nepallensis, Hermathria altissima, Ranunculus multifidus*; and
- Permanent zone - Sedges, *Phragmites australis, Leersia hexandra, Typha capensis, Cyperus latifolius, Juncus effusus, Schoenoplectus brachyceras*.

Both *Themeda triandra* and *Hyperthelia dissoluta* were commonly indicators of terrestrial habitat, with the former covering extensive areas of uncultivated clay soils along the Taaibosspruit.

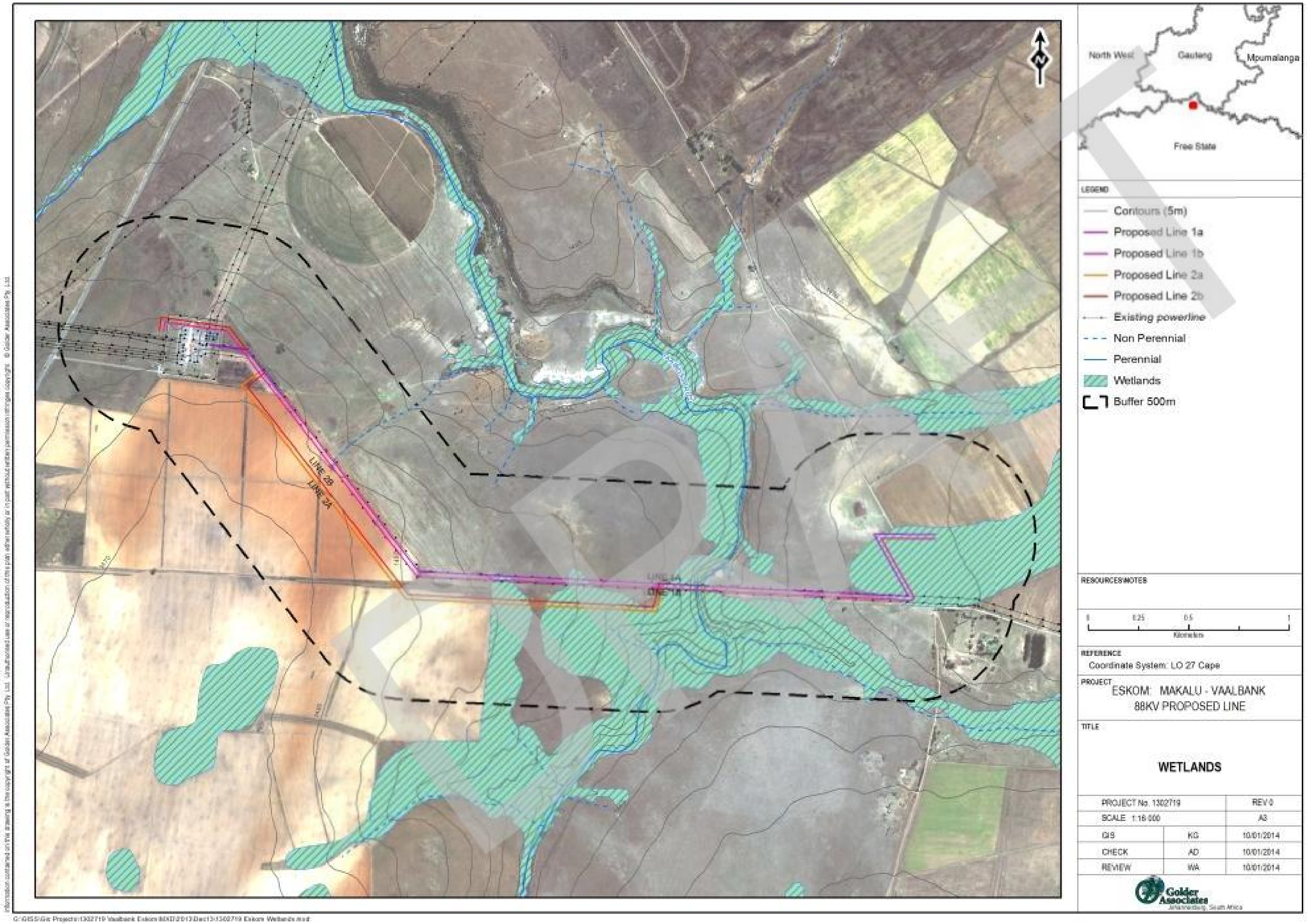

Figure 5: Wetlands in relation to proposed powerline

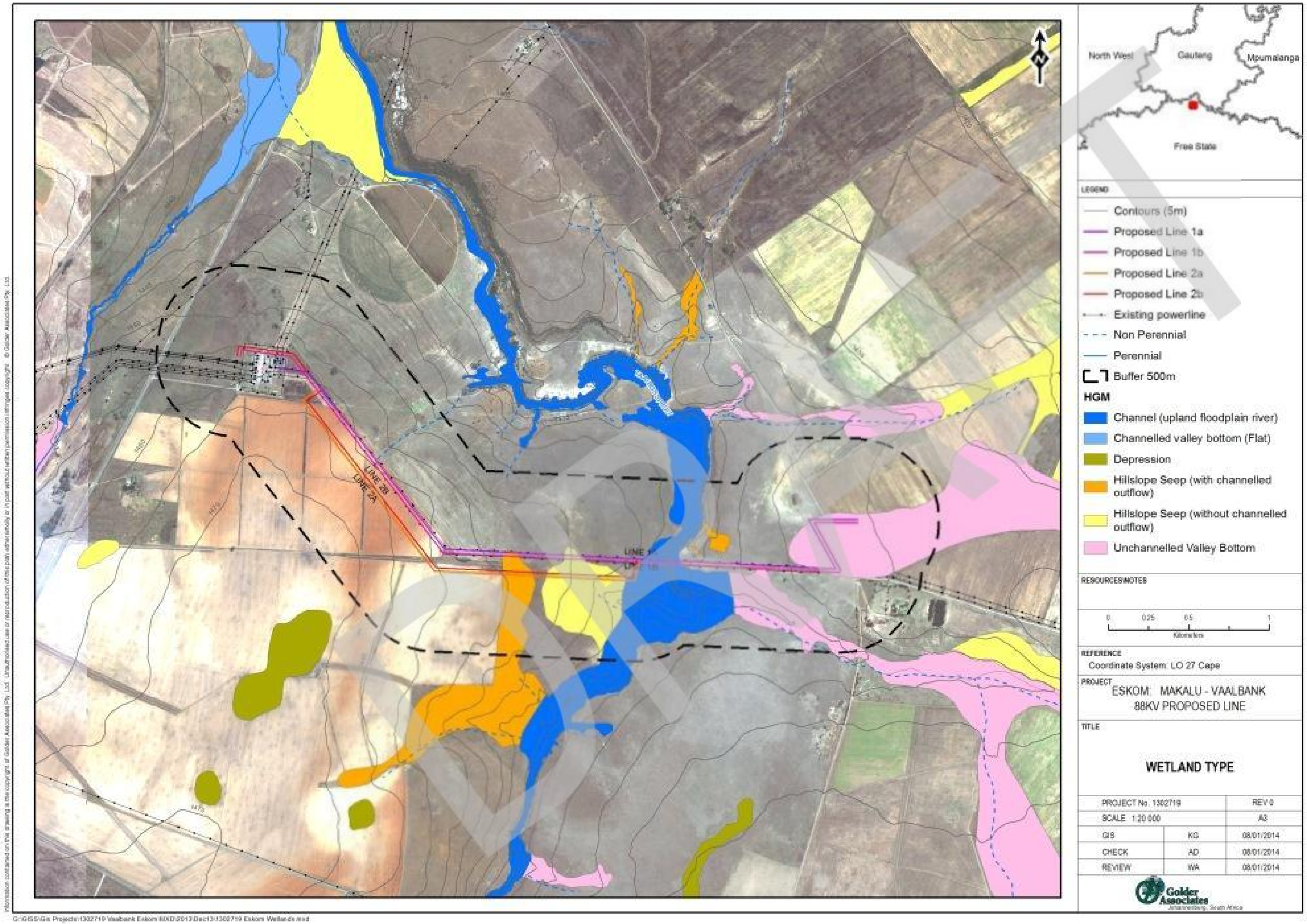

Figure 6: Wetland HGM units within the study area

5.2 Wetlands occurring within the study area

5.2.1 Hillslope Seepage Wetlands

Both seepage wetlands connected directly to the stream channel, and isolated seepage wetlands were encountered, though it is highly likely that all the hillslope seepage wetlands are connected to the stream network via subsurface flows. These wetlands were temporary to seasonal in nature and characterised by yellowish grey to grey, imperfectly drained, sandy, soils underlain by soft plinthite or gleyed clay (Soil types: Kroonstad and Longlands).

The sandy soils on site have typically been exploited for cultivation and therefore vegetation could not always be used as a reliable indicator of wetland conditions. In such cases soil wetness indicators were used as the primary tool in identifying the wetland boundaries (Figure 7). Within these areas, in order to be classified as wetlands, the E-horizon needed to be highly bleached, indicating strong eluviation. The topsoil generally had a Munsell colour of 10YR 5/6, and the relevant E-horizon had a value of 7 and a chroma of 1 or 2. E-horizons with these characteristics were associated with changes in vegetation. The E-horizon had to be within the top 35-40cm of the soil profile. Those E-horizons found below this depth generally had a higher chroma (were less bleached), and were associated with terrestrial vegetation. In areas where natural vegetation was present *Andropogon appendiculatus* and *Imperata cylindrica* were found to be reliable indicators of a wetland E-horizon.

Figure 7: Hydromorphic soils observed within wetlands on site

Grass owls (*Tyto capensis*), listed as Vulnerable in South Africa, were flushed on three occasions during the survey of the large hillslope seepage wetland to the west of the Taaibosspruit just before its confluence with the Vaal River; approximately 8 km northwest of the study area. Although it was not observed during the 2014 site visit, the areas of rank vegetation associated with natural seasonal wetlands within the study area provide suitable habitat for this species.

5.2.2 Valley Bottom Wetlands

Two valley bottom wetlands are present in the eastern part of the study area; these are both unchannelled valley bottoms.

The soils within these wetlands were found to be shallow, greyish brown to grey, poorly drained, clay loam to clay soils (Soil types: Katspruit, Sepane-Katspruit) and shallow, poorly drained, black clay soils with shrink and expand properties (Soil types: Willowbrook, Rensburg). These systems, as a consequence of the characteristically clay soils tend to be seasonal to permanent in nature, as the relatively impermeable clays form an aquitard preventing further infiltration and thereby maintain saturation at the soil surface for extended periods. The vegetation observed within the valley bottom wetlands indicates that most of these systems are predominantly temporary-seasonal, with very limited areas of permanent saturation.

Of interest is the large unchannelled valley bottom wetland occurring in the eastern part of the study area which is characterised by a very gentle, almost flat terrain and typical clay soils. As a result of the terrain, precipitation and runoff entering the wetland are likely to remain within the clay soils for long periods. Outflow from this wetland is likely to be dominated by evapo-transpiration and some surface runoff during high flow periods. It is also possible that flows are moving off the adjacent hillslope seepage wetlands and at the contact zone with the unchannelled valley bottom, flows are moving beneath the clay layer present at the surface and moving through the landscape at a deeper level within the soil profile. Vegetation within the wetland was dominated by *Eragrostis plana*, which although often occurring in wet habitats, is a facultative wetland species at best and is not always a reliable indicator of wetland conditions. *Juncus* sp. and *Kyllinga* sp. occurred along the interface between this system and the adjacent hillslope seeps, but do not extend far into the valley bottom wetland. It appears that subsurface flows from the hillslope seeps, surface runoff and precipitation accumulate within this area due to the nature of the soils and the terrain, but do not remain for long enough to encourage the establishment of plant species typical of seasonally to permanently saturated conditions.

6.0 WETLAND ASSESSMENT

6.1 Functional Assessment

The nature of the functions that the wetlands perform and the services they provide were assessed using the Wet Ecoservices tool. For the purposes of the assessment, the wetlands were grouped according to their HGM type and the landuse setting in which they occur (i.e.: cultivated, livestock grazing-intensive, natural/livestock grazing-limited) as these factors determine the potential functions provided by the wetlands and the opportunities available to perform certain functions and services.

In summary, the findings of the assessments indicate that the hillslope seeps and unchannelled valley bottom wetlands provide effective streamflow regulation, phosphate- and nitrate trapping, sediment trapping, erosion control and toxicant removal. Those hillslope seepage wetlands that have not been cultivated and which are used for limited livestock or wildlife grazing only are also expected to be valuable due to the biodiversity maintenance service that they perform. Human benefits provided by these wetlands include the provision of a water source, natural resources and cultivated foods.

Under natural conditions, the Taaibospruit floodplain would be expected to provide some measure of flood attenuation and sediment trapping, particularly during flood events when water overtops its banks, however, the moderate levels of channel incision evident within the Taaibosspruit and its smaller channelised tributaries have reduced these wetlands ability to attenuate flows. As the Taaibospruit system represents the only open water habitat within the study area, it also plays an important role in supporting aquatic biodiversity and provision of a source of water to the inhabitants (both human and livestock/wildlife) of the area. The linear nature of both valley bottom wetlands and floodplains within the landscape and their connectivity to the larger drainage system provides the opportunity for these wetlands to play an important role as an ecological corridor allowing the movement and migration of fauna and flora between remaining natural areas within the landscape. Although modified in certain respects, the wetlands still provides a natural refuge for biodiversity.

6.2 Present Ecological State (PES)

The wetlands within the study area exist within a landscape currently dominated by agricultural (cultivation, grazing) and mining activities and these land-uses have had an influence on the current extent and condition of the wetlands within the study area.

Within the study area, the wetlands and their catchments are either currently cultivated, or have been historically; and this disturbance has had an influence on the vegetation composition, geomorphology and hydrology of the wetlands.

The majority of the wetlands within the study area were found to be *Moderately Modified* (C), primarily due to the influence of cultivation and grazing on the vegetation diversity, berming and damming of flows within agricultural areas, exotic vegetation and weed encroachment, and the influence of linear activities such as tracks and roads on the hydrology of the wetlands. The large unchannelled valley bottom wetland occurring in the eastern part of the study area was found to be *Largely Natural with few Modifications* (B). The results of the Present Ecological State (PES) assessments are displayed in Figure 8 below.

Some of the impacts encountered within the wetlands and their catchments during the site visits included:

- Cultivation (annual crops) resulting in total loss of the wetland vegetation, disturbance of the upper soil profile and increased surface runoff;
- Livestock and wildlife grazing of varying intensity leading to wetland vegetation degradation and reduced species diversity;
- Farm dams causing flow impoundment and concentration and changing the wetness regimes across the wetlands;
- Dirt road crossings leading to flow concentration and erosion;
- Exotic vegetation and weed encroachment within wetlands that have been previously cultivated or disturbed causing reduced diversity and richness of the natural vegetation community;
- Trenches and berms placed to drain certain wetlands or restrict the extent of flooding across the wetlands (with the purpose of maximising cultivatable land) leading to a reduction in the natural extent of the wetlands affected;
- Head-cut erosion within seepage wetlands caused by increased surface runoff, reduced vegetation cover and flow concentration; and
- Changes in landuse within the catchment leading to channel erosion within the Taaibosspruit and its larger tributaries due to increases in the volume and velocity of flows received.

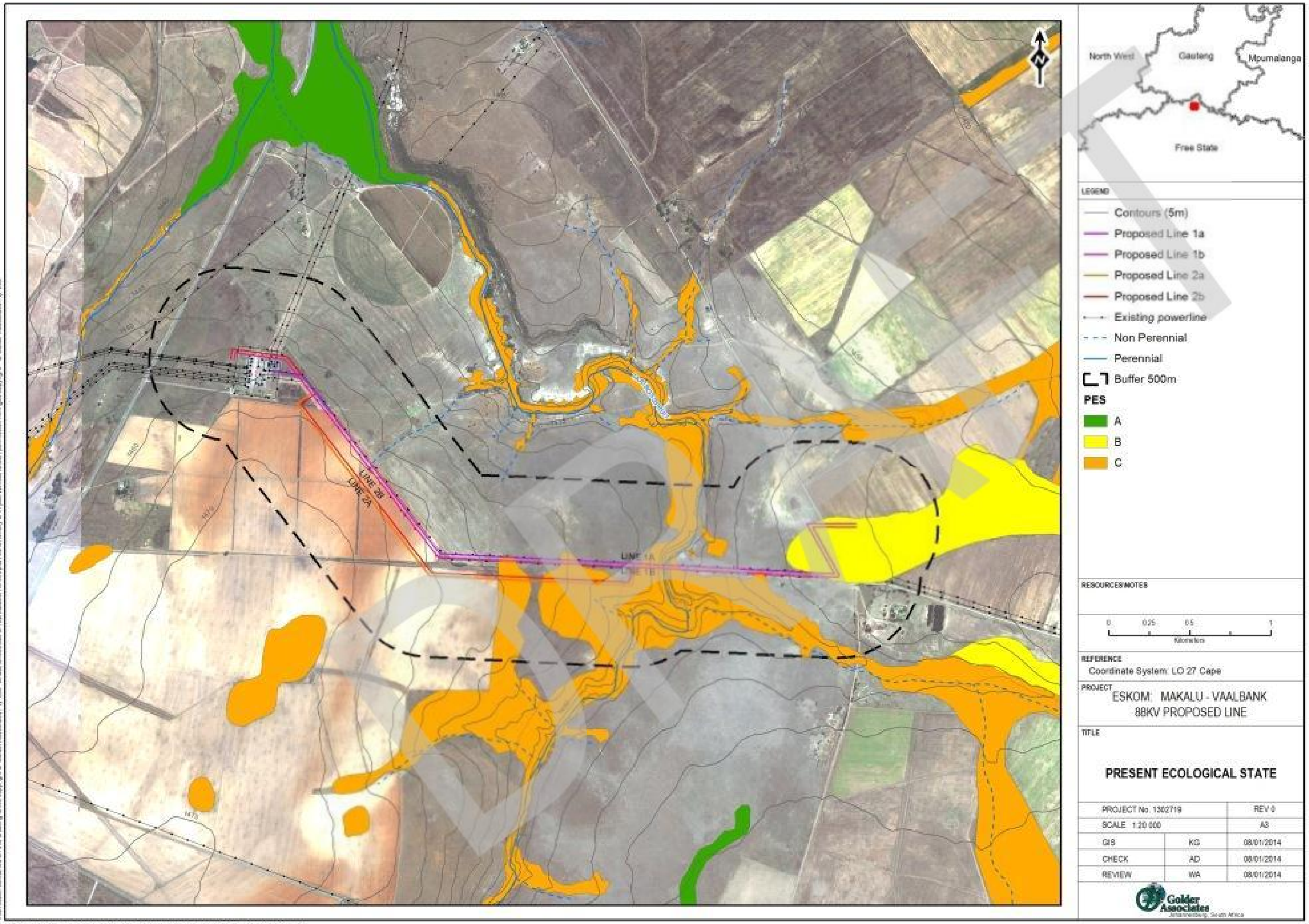

Figure 8: Present Ecological State (PES) of the wetlands

6.3 Ecological Importance and Sensitivity (EIS)

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology (DWAF, 1999a) to evaluate a wetland in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits.

"Ecological importance" of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. "Ecological sensitivity" refers to the system's ability to resist disturbances and its capability to recover from disturbance once it has occurred.

Although the majority of the wetlands within the study area have been moderately modified due to impacts either within the wetlands themselves or within their catchments, the systems still maintain a moderate to high level of functionality both in terms of their contribution towards flood attenuation, flow regulation, and water quality improvement, amongst others.

In terms of the wetlands' support of important biodiversity, according to the findings of the terrestrial ecology assessment (Golder, 2014 - Report Number: 1302719-12577-1) the study area has the potential to support 11 Red Data and protected plant species, 13 Red Data mammal species (of which two are strongly associated with wetland and river habitats - Sloggett's vlei rat, Spotted necked otter), 45 Red Data bird species (of which two have been recorded approximately 8 km north of the study area – Secretarybird, Grass owl; and one approx. 2 km southeast of the study area - Lesser kestrel), four Red Data and protected herpetofauna species, and three Red Data arachnid species. Given the extensive conversion to agriculture within the study area, it is unlikely that many of these species are present; however, it does suggest that suitable habitat still remains to support a diverse biodiversity consisting of a number of Red Data species. In addition, four Red Data/protected plant species were recorded in hillslope seep wetland habitat within the study area – *Hypoxis hemerocallidea*, *Hypoxis acuminata* and *Eucomis autumnalis*. Though many of the Red data species potentially occurring are not specifically wetland, aquatic or semi-aquatic in habit, the wetlands provide areas of relatively natural habitat within a mosaic of cultivation practices and the valley bottom, floodplain and river systems provide linear corridors linking remaining areas of natural habitat, and as such, are expected to be utilised for breeding, feeding or migration by a wide range of species.

As a result of these attributes, all of the wetlands within the study area are considered to be of Moderate (C) ecological importance and sensitivity. The findings of the EIS assessment are displayed in Figure 9.

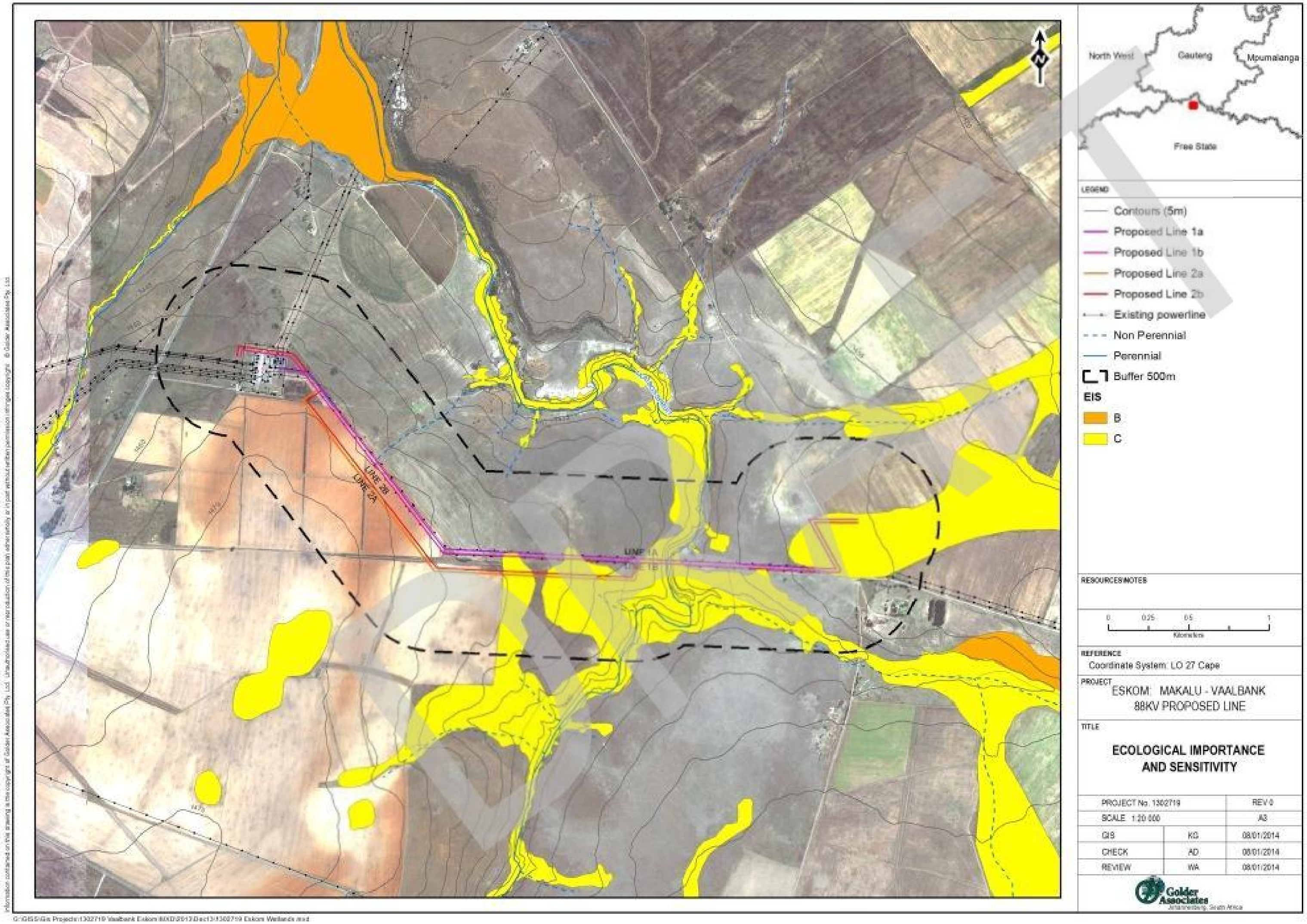

Figure 9: Ecological Importance and Sensitivity (EIS) of wetlands in and around the study area

7.0 IMPACT ASSESSMENT

The potential impacts, of the infrastructure on the surrounding wetland ecosystems, can be divided into impacts that would occur during the construction phase, operational phase and decommissioning/closure phase. The potential impacts are discussed in the following Sections and summarised in Table 4. The impact assessment methodology is described in Appendix A.

7.1 Loss and Disturbance of Wetland Habitat

The routes of the proposed powerlines pass through two temporary to seasonal hillslope seepage wetlands, the channel of the Taaibosspruit and the switching station is located in an area delineated as unchannelled valley bottom. Construction of the powerline and switching station as proposed will lead to the direct loss of wetland habitat due to clearing of wetland vegetation and disturbance of the soil profile.

Mitigation

- Limit the footprint of wetland areas to be excavated or cleared of vegetation;
- Minimise disturbance to wetland habitat outside the construction servitudes by clearly demarcating the construction servitude and limiting all activities to the servitude;
- A suitable rehabilitation programme should be developed and implemented in all disturbed areas post construction.

7.2 Wetland Habitat Fragmentation

The proposed power line routes that cross wetland habitat will lead to the fragmentation and isolation of wetland habitat as a result of vegetation clearing during the construction phase, and the presence of physical barriers, such as the pylon footprints and the switching station once constructed.

Mitigation

- Where possible, the power lines should be aligned with *existing linear* infrastructure or routed through already transformed areas;
- Limit the footprint of wetland areas to be excavated or cleared of vegetation; and
- Where possible, fences and other barriers associated with the power line servitude and switching station should be designed to allow fauna to move across these barriers.

7.3 Interruption in Hydrology

The proposed powerline, switching station and associated infrastructure will cross several wetland HGM units ranging from temporarily to seasonally/permanently saturated. The infrastructure (including pylons) may interrupt surface and/or subsurface flows, leading to flow concentration, change in flow pathways, flow impoundment, increased surface runoff and increased risk of erosion.

Outside of the delineated wetlands, the soils within the study area support a perched water table that, although not shallow enough to directly influence the herbaceous plant community and therefore be considered a wetland, does represent an important water resource that is responsible for sustaining the areas of wetland across the study area. As such, it is important that the movement of water through the landscape, not only within the wetlands, also be maintained. Any activity or infrastructure that impedes or alters the natural subsurface flow in the catchment's soils could have indirect but potentially significant effects on the wetlands.

Mitigation

- The proposed development should aim to maintain connectivity of flows across the full width of the wetlands being crossed. Engineered solutions for allowing seepage water to pass underneath and around the pylon footprints should be investigated for the hillslope seepage crossings, to ensure that water can move unhindered across the servitude;

- In the event that culverts and pipes are used to convey flows at the switching station, they should be designed and constructed in such a way that they do not lead to impoundment and ponding of flows upslope of the crossing, or flow concentration and erosion downslope of the crossing during regular return events;
- Regular monitoring of all stormwater discharge points from the switching station should be employed to check for erosion. Erosion damage should be repaired immediately;
- Stormwater off the switching station access tracks and roads should not be allowed to accumulate into high volume and high velocity flows, rather regular discharge points for small volumes of water should be encouraged;
- Wherever possible, powerline pylons should be placed outside the wetlands, to limit the disturbance of wetland soils and subsurface flows. Where this is not possible, engineering measures need to be employed to ensure diffuse, subsurface flows are maintained across the footprint of the pylons, without the creation of preferential flow pathways;
- Subsurface and surface flows within the wetlands need to be maintained across the power line servitude;
- Soil compaction should be avoided wherever possible to limit changes in subsurface flow characteristics; and
- No pylons or pedestals should be placed in the active channel of a wetland.

7.4 Erosion

Erosion may occur on exposed soils as a consequence of vegetation clearing during construction. Erosion of the wetland soils will lead to habitat deterioration, changes in the natural wetland hydrology, further concentration of flows, lowering of the water table within the wetlands and possible desiccation of areas of the wetlands.

Mitigation

- Construction should take place in winter;
- Rehabilitate and re-vegetate disturbed areas as soon as possible and monitor for successful establishment of indigenous vegetation;
- Monitor adjacent wetlands for signs of erosion. If observed, corrective measures should be implemented immediately through consultation with a wetland specialist;
- Stormwater discharge points should be protected against erosion; and
- Attenuation facilities should be provided for to ensure flows from regular return events (1:2 year event) do not differ from pre-development flow velocities.

7.5 Loss of Biodiversity and Red Data Species

The proposed powerline and switching station will lead to a direct loss of wetland habitat and vegetation communities within the footprint of the switching station and the pylons, and the subsequent loss of species relying on these habitats. There is the potential that the removal of these habitats could lead to the loss of Red Data species, such as the African Grass Owl, which is a species typical of moist grassland habitat and has been previously observed in hillslope seepage wetland to the west of the Taaibosspruit just before its confluence with the Vaal River (approx. 8km N of the study area). The wetlands that will be affected are considered to be of Moderate Ecological Importance and Sensitivity and therefore play a role in biodiversity support and flow regulation and supply to major watercourses.

Mitigation

- The construction of the switching station and the placement of powerline pylons may disturb/displace African grass owls (or their habitat) in the area. The presence of African grass owl within the study area should be confirmed by a dedicated survey prior to construction or vegetation clearing works. If African grass owl presence is confirmed, the Gauteng Department of Agriculture and Rural Development (GDARD) recommend a buffer of 170m around all confirmed African grass owl sites. However, placement of infrastructure within 170m of the hillslope seepage wetland i.e. within the wetlands catchment, will likely disrupt the hydrology supporting the seepage wetland, resulting in changes to the vegetation of the seepage wetland and the potential loss of suitable habitat for the African grass owl. Should African grass owl presence be confirmed within the study area, it is recommended that an ornithologist be consulted in this regard to provide recommendations on suitable buffer zones etc.;
- All wetland areas not located directly within the footprint of the proposed developments should be fenced off prior to the commencement of construction activities and no construction machinery or any other vehicles should be allowed access to these areas other than along existing roads;
- All mitigation measures as recommended for managing water quality deterioration should be fully implemented; and
- Alien vegetation management should be undertaken during construction.. Surveys for alien species should be done and clearing and control of all invasive species should be undertaken; and
- Develop and implement a Biodiversity Action Plan as required by the Anglo Environment Way as a tool to identify, assess, manage and monitor on an ongoing basis all impacts on biodiversity throughout the mining life cycle.

7.6 Water Quality Deterioration

Water quality deterioration within the wetlands is expected during the construction phase as a consequence of vegetation removal and the increased risk or erosion and sediment transport off exposed soils after rainfall events, and due to accidental spills of potentially hazardous or polluting materials, e.g.: cement , diesel and oil from construction vehicles. During the operational phase, polluted stormwater runoff could discharge into the wetlands. The construction phase impacts to water quality are also anticipated during the closure phase.

Mitigation

- Avoid wetland crossings as far as possible;
- To minimise water quality deterioration during the construction phase, construction activities should be undertaken during the winter months to prevent erosion due to surface run-off following rains;
- Dust suppression will need to be practiced during the construction period;
- Construction servitudes should be kept as narrow as possible and should be clearly demarcated to limit disturbance to the wetlands;
- No storage of potentially hazardous materials should take place on site, e.g. diesel or oil, other than what will be used within the course of a single day;
- Handling of such hazardous materials should only take place outside the wetland areas and drip trays or plastic sheeting should be provided to capture any spills;
- No stockpiling of materials should take place within the wetlands;
- It is strongly recommended that the dirty and clean water pipelines lie above ground to allow easy access for maintenance and to address any leaks or spills that may occur; and
- Apply effective dust management measures.

Table 4: Impact Analysis

Impact	Phase	Impact before mitigation						Impact after mitigation					
		Probability	Scale	Duration	Magnitude	Total	Significance	Probability	Scale	Duration	Magnitude	Total	Significance
Loss and Disturbance of Wetland Habitat	Construction, Operational, Closure	5	1	5	8	70	Moderate	5	1	5	6	60	Moderate
Wetland Habitat Fragmentation	Construction, Operational	5	2	4	6	60	Moderate	4	2	2	2	24	Low
Interruption in Hydrology	Construction, Operational	5	2	5	8	75	Moderate	3	2	4	4	30	Low
Water Quality Deterioration	Construction, Operational, Closure	4	2	2	4	32	Moderate	3	2	2	4	24	Low
Erosion	Construction, Operational, Closure	5	2	4	6	60	Moderate	4	2	2	4	32	Moderate
Loss of Biodiversity and Red Data Species	Construction, Operational, Closure	4	1	5	10	64	Moderate	4	3	5	10	72	Moderate

8.0 CONCLUSION AND RECOMMENDATIONS

The wetlands within the study area exist within a landscape currently dominated by agricultural (cultivation, grazing) and mining activities. These land uses have had an influence on the current extent and condition of the wetlands. Within the 500 m study area surrounding the proposed powerline route corridor, the wetlands and their catchments are either currently cultivated, or have been previously. This disturbance has had an influence on the vegetation composition, geomorphology and hydrology of the wetlands. In this context, the majority of wetlands within the study area were found to be Moderately Modified (C), primarily due to the influence of cultivation and grazing on the vegetation diversity, berming and damming of flows within the agricultural areas, exotic vegetation and weed encroachment, and the influence of linear activities such as roads and railway lines on the hydrology of the wetlands. An unchannelled valley bottom wetland in the eastern part of the study area was assessed as being in a Largely Natural (B) state. The results of the Ecological Importance and Sensitivity assessment indicate that all of the wetlands within the study area are of Moderate (C) ecological importance due to the their functionality and the potential to support rare and unique species.

The proposed powerline and switching station project is expected to have a number of impacts on the wetlands within the study area. The most significant potential impacts identified include the loss of natural wetland habitat, Red Data species and biodiversity within and adjacent to the footprint of the proposed works, and interruption in hydrology which may result in erosion and/or desiccation of the wetlands.

It is recommended that the management and mitigation measures provided in this report be included in the proposed project's official EMP and that these measures are assessed for efficacy during all phases of the project and adapted accordingly to ensure minimal disturbance of the study area's wetlands and water resources.

It is important to remember that wetlands are merely a reflection of water movement through the landscape and cannot be effectively managed and maintained in isolation. Activities that occur within a wetland's catchment, but which do not directly impact upon the wetland can still have significantly negative impacts on the hydrology supporting these systems. In recognition of this fact, it is now a requirement that any activities that take place within 500 meters of a wetland is subject to authorisation under Section 21 of the National Water Act (Act 36, 1998). In order to facilitate this process, a 500 meter buffer has been included around all wetlands delineated (Figure 5), and any activities that occurs within this buffer that will impact upon the wetlands will require submission of a Water Use License Application.

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APPENDIX A

Impact Assessment Methodology

Potential significance of impacts was based on occurrence and severity, which are further sub-divided as follows:

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Magnitude (severity) of impact	Scale / extent of impact

To assess each impact, the following four ranking scales are used:

PROBABILITY	DURATION
5 - Definite/don't know	5 – Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium-term (8-15 years)
2 - Low probability	2 - Short-term (0-7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 – Immediate
0 - None	
SCALE	**MAGNITUDE**
5 - International	10 - Very high/don't know
4 - National	8 – High
3 - Regional	6 – Moderate
2 - Local	4 – Low
1 - Site only	2 – Minor
0 - None	

The significance of the two aspects, occurrence and severity, is assessed using the following formula:

SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 150 significance points (SP). The impact significance points are assigned a rating of high, medium or low with respect to their environmental impact as follows:

SP >75	Indicates **high** environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Indicates **moderate** environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates **low** environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that is likely to result in positive consequences/effects.

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