Tubatse Strengthening Phase 1 – Senakangwedi B Integration Project, Steelpoort, Limpopo Province.

Wetland Draft EIA Report

October 2014

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Declaration of Independence

I, **Antoinette Bootsma**, in my capacity as principal specialist for Limosella Consulting, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member; and
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.

2014.10.31

Antoinette Bootsma (PrSciNat) | Date

Ecologist/Botanist

SACNASP Reg. No. 400222-09

Indemnity

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as information available at the time of study. Therefore the author reserves the right to modify aspects of the report, including the recommendations, if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although the author exercised due care and diligence in rendering services and preparing documents, she accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document.

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EXECUTIVE SUMMARY

Limosella Consulting was appointed by Nsovo Consulting to undertake the wetland scoping assessment in order to determine whether the proposed activities will have an impact on wetland areas with regard to the following:

- Establish new Senakangwedi B substation (1 x 800MVA, 400/275kV and 2X500, 400/132kV) to the south of existing Senakangwedi substation.
- Loop in and out of Senakangwedi B the existing Arnot – Merensky 400kV line.
- Construction of Tubatse – Senakangwedi B 400kV line.
- Construction of Senakangwedi – Senakangwedi B 275kV line.
- 4 x 132kV feeder bays.
- 2 x 275kV feeder bays (Senakangwedi and Senakangwedi B).
- 3 x 400kV feeder bays.

The study area is located south-east of the town of Steelpoort in Limpopo Province. The R555 road forms the western extent of the study area. The proposed substation 1 is located farthest south and is bordered by a regional road as well as a smaller dirt road with approximate coordinates 24°55'6.32"S and 30° 6'36.40"E. The proposed substation 2 is located farthest west and is also directly bordered by a regional road with approximate central coordinates 24°53'45.91"S and 30° 4'39.73"E. The proposed substation 3 is located farthest east and is only accessible via small dirt roads. Approximate central coordinates of substation 3 are 24°52'50.55"S and 30° 8'50.41"E (Figure 1). The proposed powerlines will run in a loop from the existing Tubatse substation to one of the proposed substations and the final route will depend on the chosen substation, but the general route will loop from the Tubatse substation south-east towards one of the proposed substations and then northwards towards the existing line adjacent the R555.

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

- Indicate which alternative substation is likely to have the least impact.
- Indicate the best suited route for the proposed Eskom line within the given 2 km corridor.
- Identify the outer edge of the wetland/riparian area.
- Classify the wetland.
- Recommend suitable buffer zones.
- Indicate possible impacts to the wetland.
- Recommend mitigation measures in order to limit the impact of the proposed development on the wetland or riparian areas.

Two (2) perennial riparian areas were recorded, namely the Steelpoort River and the Dwars River. These riparian areas are linked to numerous smaller tributaries. The majority of the tributaries are temporary (ephemeral or episodic) streams with only a few being perennial. Numerous artificial dams were also recorded throughout the study area and especially in the mining areas. Both proposed substation 1 and proposed substation 3 have small areas of temporary streams located on the site. Proposed substation 3 is also located adjacent to a nature reserve as well as not having adequate access roads and is thus not the preferred substation site. Substation 1, as well as having a small temporary stream located on the study site 1, is also within 500 m of the perennial Dwars River and is therefore also not preferred. Substation 2 is located directly adjacent a regional road and no riparian or wetland conditions occur on this site. Although a small temporary stream is located south of the study site, proposed substation 2 is preferred in terms of wetland/riparian ecology.

Wetland conditions are associated with numerous of the perennial rivers and temporary streams recorded in the region of the study area. The current proposed routes cross perennial rivers or temporary streams a total of 37 times. It is important to note that this figure is for all the routes combined. It is likely that when a route is chosen that the amount of crossings will be less. The suggested substation coordinates and areas of concern are summarised below:

Area	Approximate Coordinates	Preference
Alternative Substation 1	The approximate central coordinates for this wetland are 26°34'37.75"S and 27°48'23.41"E.	Second Preferred Substation
Alternative Substation 2	The approximate central coordinates for this wetland are 26°34'59.62"S and 27°48'23.18"E.	**Preferred Substation**
Alternative Substation 3	The approximate central coordinates for this wetland are 26°36'22.39"S and 27°48'36.96"E.	Least Preferred Substation
Area of concern 1	The approximate central coordinates for this section is 24°53'57.78"S and 30° 4'39.79"E.	Move section of powerline 50 m south
Area of concern 2	The approximate central coordinates for this area is 24°54'10.10"S and 30° 5'18.23"E.	Move section of powerline **100 m south**
Area of concern 3	The approximate central coordinates for this area is 24°53'16.24"S and 30° 8'39.94"E.	Move section of powerline **200 m north-west**
Area of concern 4	The approximate central coordinates of this section is 24°52'28.78"S and 30° 8'33.87"E.	Move section of powerline **10 -100 m south**
Area of concern 5	The approximate central coordinates of this section is 24°52'28.78"S and 30° 8'33.87"E.	Move section of powerline **40 m south**

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1 INTRODUCTION

Limosella Consulting was appointed by Nsovo Consulting to undertake the wetland scoping assessment in order to determine whether the proposed activities will have an impact on wetland areas with regard to the following:

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- 2 x 275kV feeder bays (Senakangwedi and Senakangwedi B).
- 3 x 400kV feeder bays.

A site visit was conducted on the 27th of March 2014.

1.1 Locality of the Study Site

The study area is located south-east of the town of Steelpoort in Limpopo Province. The R555 road forms the western extent of the study area. The proposed substation 1 is located farthest south and is bordered by a regional road as well as a smaller dirt road with approximate coordinates 24°55'6.32"S and 30° 6'36.40"E. The proposed substation 2 is located farthest west and is also directly bordered by a regional road with approximate central coordinates 24°53'45.91"S and 30° 4'39.73"E. The proposed substation 3 is located farthest east and is only accessible via small dirt roads. Approximate central coordinates of substation 3 are 24°52'50.55"S and 30° 8'50.41"E (Figure 1). The proposed powerlines will run in a loop from the existing Tubatse substation to one of the proposed substations and the final route will depend on the chosen substation but the general route will loop from the Tubatse substation south-east towards one of the proposed substations and then northwards towards the existing line adjacent the R555.

1.2 Terms of Reference

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

- Indicate which alternative substation is likely to have the least impact.
- Indicate best suited route for the proposed Eskom line within the giver 2 km corridor.
- Identify the outer edge of the wetland/riparian area.
- Classify the wetland.
- Recommend suitable buffer zones.
- Indicate possible impacts on the wetland.

- Recommend mitigation measures in order to limit the impact of the proposed development on the wetland or riparian areas.

1.3 Assumptions and Limitations

The Garmin Montana 650 used for wetland and riparian delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side. Sensitive environmental areas identified on a strategic scale should be seen as integral to the planning phase of the proposed development but cannot inform the fine scale placement of, for example, pylons. Furthermore, it is important to note that, during the course of converting spatial data to final drawings, several steps in the process may affect the accuracy of areas delineated in the current report. It is therefore suggested that the no-go areas identified in the current report be pegged in the field in collaboration with a surveyor for precise boundaries. The scale at which maps and drawings are presented in the current report may become distorted should they be reproduced by for example photocopying and printing. It is important to note that the map of the delineated wetlands and/or riparian areas is not a stand-alone document and must be read in conjunction with tables in this report.

Furthermore, the assessment of wetlands is based on environmental indicators such as vegetation, that are subjected to seasonal variation as well as factors such as fire. Although background information was gathered, the information provided in this report was mainly derived from what was observed on the study site at the time of the field survey. A Red Data scan, fauna and flora, and aquatic assessments were not included in the current study. Description of the depth of the regional water table and geohydrological processes falls outside the scope of the current assessment.

Although a site visit was conducted, the current phase of the project predominantly reflects wetland and riparian areas identified during a desktop study to determine likely problem areas along the proposed lines and to indicate where possible a shift within a 2 km corridor as provided by Eskom. Based on information gathered during the site visit and aerial imagery the alternative substation sites were considered and the substation likely to have the least impact on wetlands/riparian areas was chosen. A follow-up detailed site visit should be conducted once the final routes have been established to determine the Present Ecological State (PES) and the Ecological Categories (EC) of the wetlands and riparian areas.

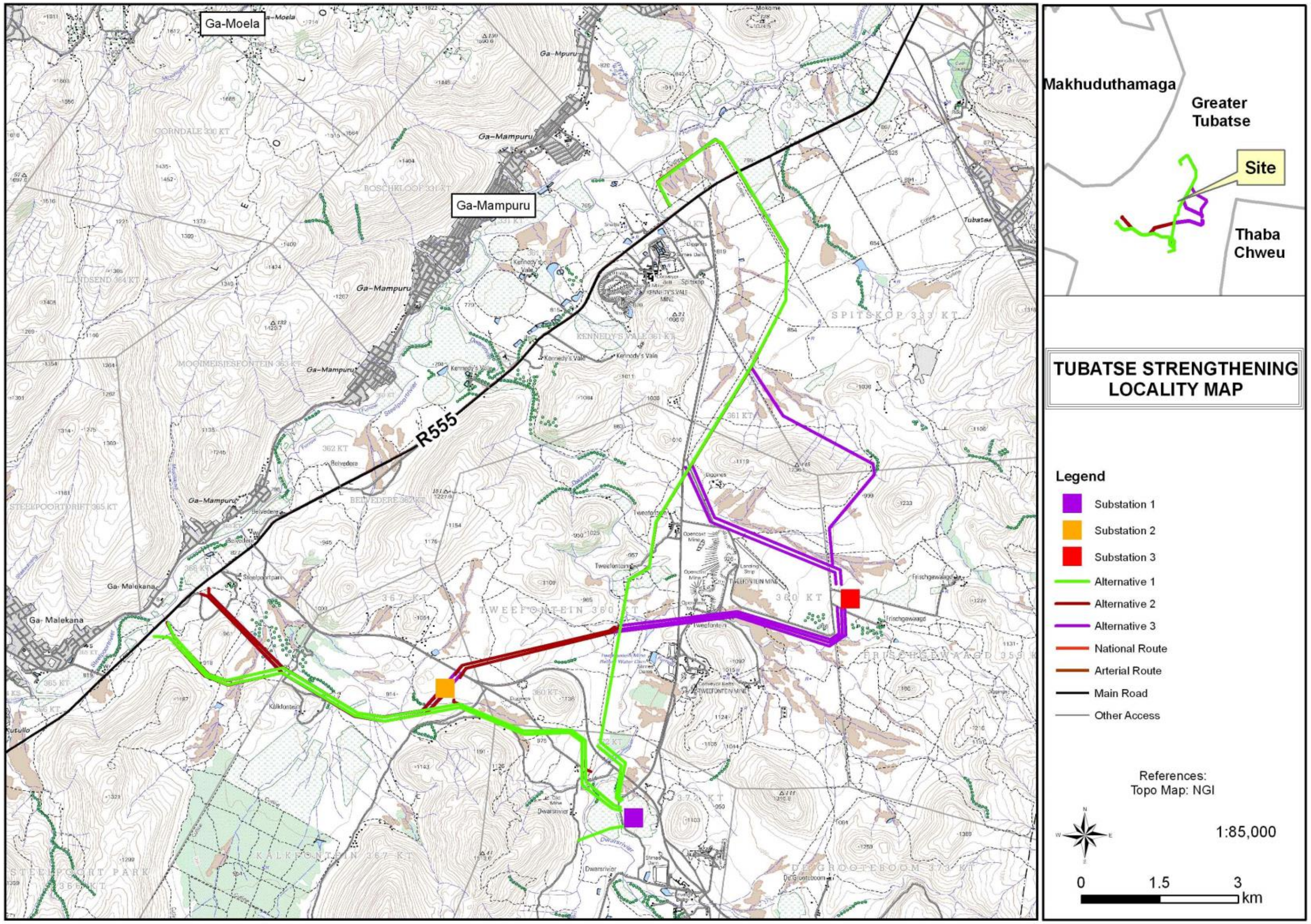

Figure 1: **Locality of the proposed Tubatse substations and powerlines.**

1.4 Definitions and Legal Framework

This section outlines the definitions, key legislative requirements and guiding principles of the wetland study and the Water Use Authorisation process.

The National Water Act, 1998 (Act No. 36 of 1998) [NWA] provides for Constitutional water demands including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State and are regulated by the Department of Water Affairs (DWA). The NWA sets out a range of water use related principles that are to be applied by DWA when taking decisions that significantly affect a water resource. The NWA defines a water resource as including a watercourse, surface water, estuary or aquifer. A watercourse includes a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake, pan or dam, into which or from which water flows; any collection of water that the Minister may declare to be a watercourse; and were relevant its beds and banks.

The NWA defines a wetland 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.” In addition to water at or near the surface, other distinguishing indicators of wetlands include hydromorphic soils and vegetation adapted to or tolerant of saturated soils (DWA, 2005).

Riparian habitat often times perform the important ecological and hydrological functions, some similar to those performed by wetlands (DWA, 2005). Riparian habitat is also the accepted indicator used to delineate the extent of a river’s footprint (DWAF, 2005). It is defined by the NWA as follows: “Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas”.

Water uses for which authorisation must be obtained from DWA are indicated in Section 21 of the NWA. Section 21 (c) and (i) is applicable to any activity related to a wetland:
Section 21(c): Impeding or diverting the flow of water in a watercourse; and
Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

Authorisations related to wetlands are regulated by Government Notices R.1198 and R.1199 of 18 December 2009. GN 1198 and 1199 of 2009 grants General Authorisation (GA) for the above water uses on certain conditions:
GN R.1198: Any activity in a wetland for the rehabilitation of a wetland for conservation purposes.
GN R.1199: Any activity more than 500 m from the boundary of a wetland.

These regulations also stipulate that these water uses must the registered with the responsible authority. Any activity that is not related to the rehabilitation of a wetland and which takes place within 500 m of a wetland are excluded from a GA under either of these regulations. Wetlands situated within 500 m of proposed activities should be regarded as sensitive features potentially affected by the proposed development (GN 1199). Such an activity requires a Water Use Licence (WUL) from the relevant authority.

In addition to the above, the proponent must also comply with the provisions of the following relevant national legislation, conventions and regulations applicable to wetlands and riparian zones:

- Convention on Wetlands of International Importance - the Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP).
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA].

- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- National Environment Management Protected Areas Act, 2003 (Act No. 57 of 2003).
- Regulations GN R.543, R.544 and R.545 of 2010, promulgated under NEMA.
- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983).
- Regulations and Guidelines on Water Use under the NWA.
- South African Water Quality Guidelines under the NWA.
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 287 of 2002).

1.5 Description of the Receiving Environment

A review of available literature and spatial data formed the basis of a characterisation of the biophysical environment in its theoretically undisturbed state and consequently an analysis of the degree of impact to the ecology of the study site in its current state.

Quaternary Catchment

The study site falls within Quaternary Catchment B41J, B41H and a small area is located in B41G. The existing Tubatse substation and associated proposed powerline infrastructure is located in quaternary catchment B41J. Proposed substations 2 and 3 and the proposed infrastructure is located in quaternary catchment B41H. The proposed substation 1 as well as a short part of the proposed powerline is located in the B41G catchment. The Mean Annual Precipitation (MAP) to Potential Evapotranspiration (PET) is summarised in the table below (Table 1):

Table 1: Quaternary catchment of the study site in relation to the Mean Annual Precipitation (MAP) to Potential Evapotranspiration (PET).

Catchment	MAP-PET
B41H	0.29
B41J	0.26
B41G	0.33

The MAP – PET scores are low and thus consequently, wetlands in these areas are sensitive to changes in regional hydrology, particularly where their catchment becomes transformed and the water available to sustain them becomes redirected.

Geology and Soil

The proposed lines are divided between two types of geology namely Gabbro and Norite. Gabbro refers to a large group of dark, coarse-grained, intrusive mafic igneous rocks chemically equivalent to basalt. The rocks are plutonic, formed when molten magma is trapped beneath the Earth's surface and cools into a crystalline mass (*King H*, 2014).

The proposed lines are located on numerous soil types as per Figure 2 and summarised in Table 2.

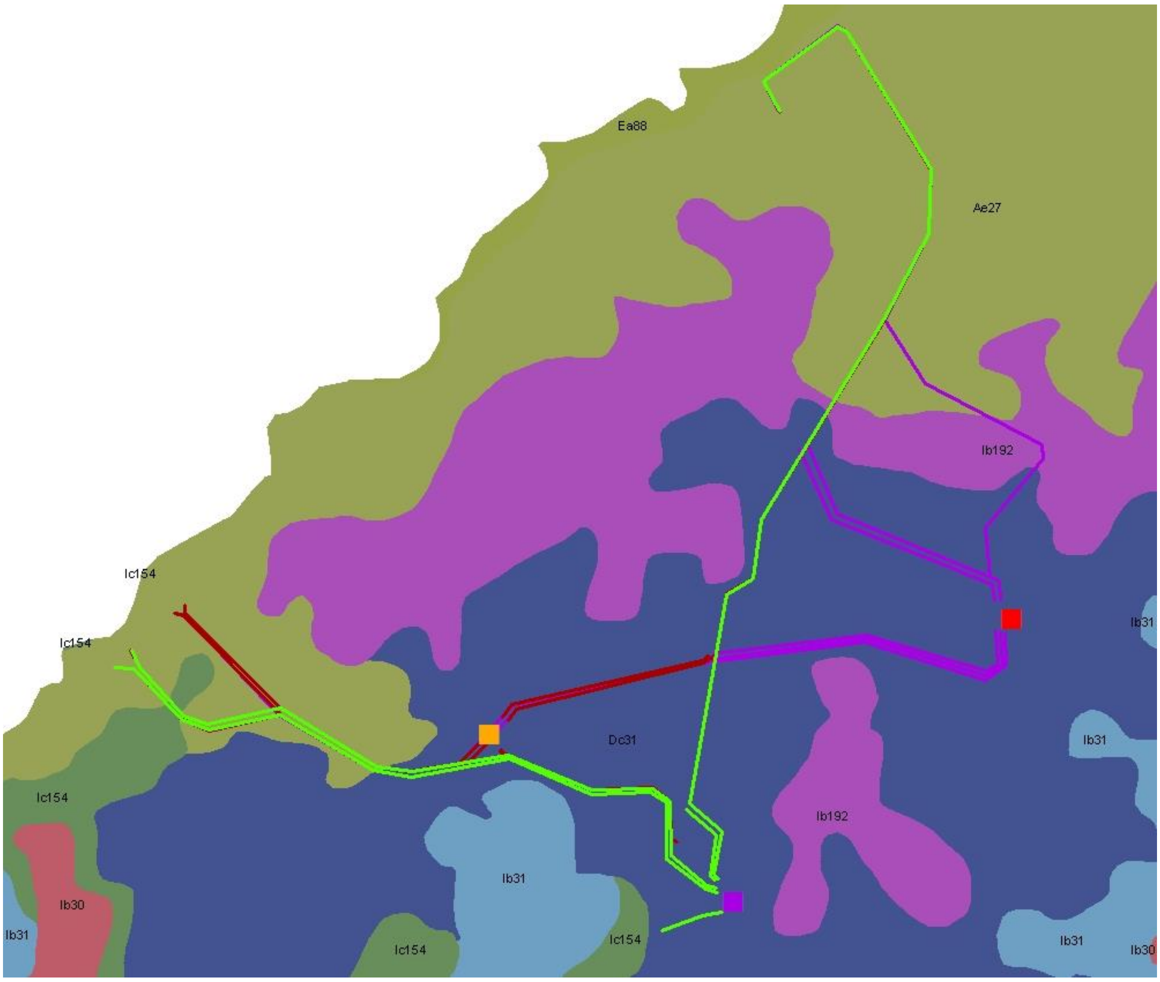

Figure 2: Soil types along the proposed routes and at the proposed substation locality (Excerpt from the national soil map)

Table 2: Land types in relation to the proposed line.

Soil Type (ARC, 2013)	Soil Description	Geology Description
Ae27	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes).	Ferrogabbro and ferrodiorite of the Upper zone, Rustenburg Layered Suite, Bushveld Complex.
Dc31	Soils Are Prismacutanic and/or Pedocutanic with diagnostic horizons dominant; In addition, one or more of the vertic, melanic, red structured diagnostic horizons.	Unknown
Ea88	One or more of: vertic, melanic, red structured diagnostic horizons, undifferentiated.	Norite, pyroxenite and anorthosite of the Dwarsrivier Subsuite; gabbro and norite of the Dsjate Subsuite; Bushveld Complex.
Ib192	Miscellaneous land classes, rocky areas with miscellaneous soils.	Transvaal Sequence. Norite, pyroxenite and andesite of the Dwars River Subsuite; bronzitite, harzburgite and norite of the Croydon Subsuite; hornfels of the Vermont Formation.
Ic154	Miscellaneous land classes, very rocky with little or no soils.	Rustenburg Layered Suite; gabbro and norite of the Dsjate Subsuite and norite, pyroxenite and anorthosite of the Dwarsrivier Subsuite. Also granodiorite.

Vegetation

The study area falls within the Savanna Biome of South Africa (Mucina and Rutherford, 2006). A biome is made up of various vegetation types, based largely on soil, topography and climate variations within the biomes. The study area is situated within the Sehukhune Plains Bushveld and Sekhukhune Mountain Bushveld vegetation type (Figure 3).

Sekhukhune Plains Bushveld extends from Burgersfort and the lower basin of the Steelpoort River in the south, northwards through the plains of the Motse River basin to Jobskop and Legwareng (south of the Strydpoort Mountains). It continues up the basin of the Olifants River to around Tswaing and the valleys of the Lepellane and Mohlaletsi Rivers. It is characterised by mainly semi-arid plains and open valleys between chains of hills and small mountains running parallel to the escarpment. Predominantly short, open to closed thornveld occurs with an abundance of *Aloe* species and other succulents.

This vegetation type is considered to be Vulnerable with nearly 2% statutorily conserved in Potlake, Bewaarkloof and Wolkberg Caves Nature Reserves. Approximately 25% of this area has been transformed and is mainly under dry-land subsistence cultivation. A small area is under pressure from chrome and platinum mining activities and the associated urbanisation. Depending on commodities, this threat could increase in the future. There is a high level of degradation of much of the remaining vegetation by unsustainable harvesting and utilisation. Erosion is widespread at usually high to very high levels with donga formation. Alien *Agave* species, *Caesalpinia decapetala, Lantana camara, Melia azedarach, Nicotiana glauca, Opuntia* species, *Verbesina encelioides* and *Xanthium strumarium* are widespread but scattered (Mucina and Rutherford, 2006).

The southern section of the proposed line and substations occur on the Sekhukhune Mountain Bushveld vegetatation type. This vegetation unit is characterised by dry micro-phyllous plants (e.g. *Acacia* species) and broad-leaved savanna on hills and mountain slopes (Mucina & Rutherford, 2006). Sekhukhune Mountain Bushveld includes a number of biogeographically important plant taxa as well as plants endemic to this vegetation unit (i.e. these plants only occur within the Sekhukhune Mountain Bushveld). This vegetation unit is not considered to be threatened although mining activities, cultivation and urbanisation have already transformed a minimum of 15% of the current extent of Sekhukhune Mountain Bushveld.

Hydrology

Surface water spatial layers including the National Freshwater Ecosystems Priority Areas (NFEPA) Wetland Types for South Africa (SANBI, 2010), reflected that the proposed powerline crosses and runs parallel to a number of perennial and non-perennial rivers. The proposed substations are also located close to the non-perennial streams and rivers. The main rivers associated with the study area is the Steelpoort River and the Dwars River, the rest of the non-perennial streams/drainage lines/tributaries are associated with these rivers (Figure 3).

Conservation Plan (C-Plan)

The C-plan reflects various areas along and within 500 m of the line classified as highly significant, although the majority of the proposed lines are located on areas of least concern. Proposed substation 1 is located on an area with no natural habitat remaining. Proposed substation 2 and 3 is located on areas of least concern (Figure 4).

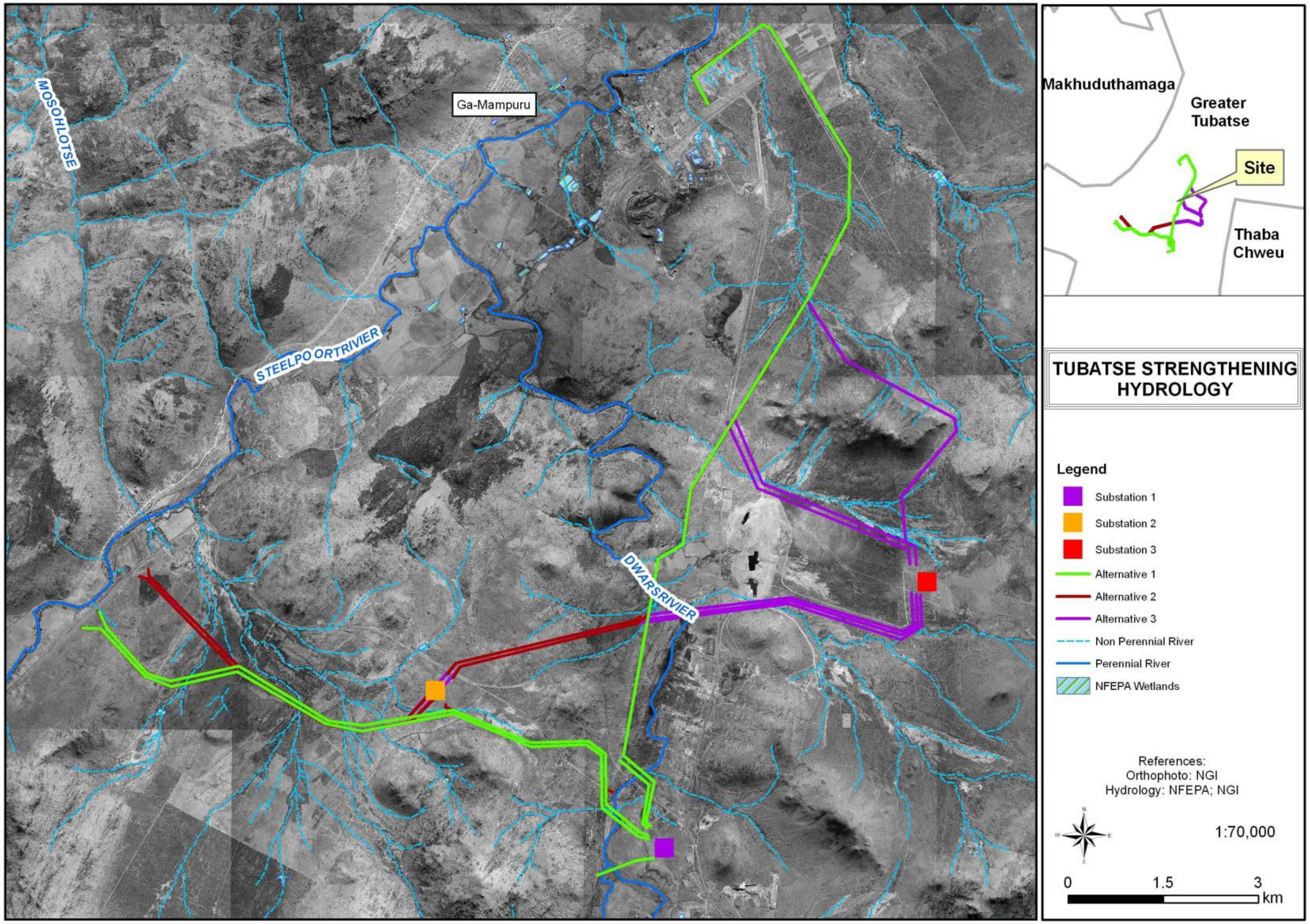

Figure 3: Wetlands and Riparian areas within 500m of the proposed activities, as per the National Freshwater Ecosystem Priority Areas layer

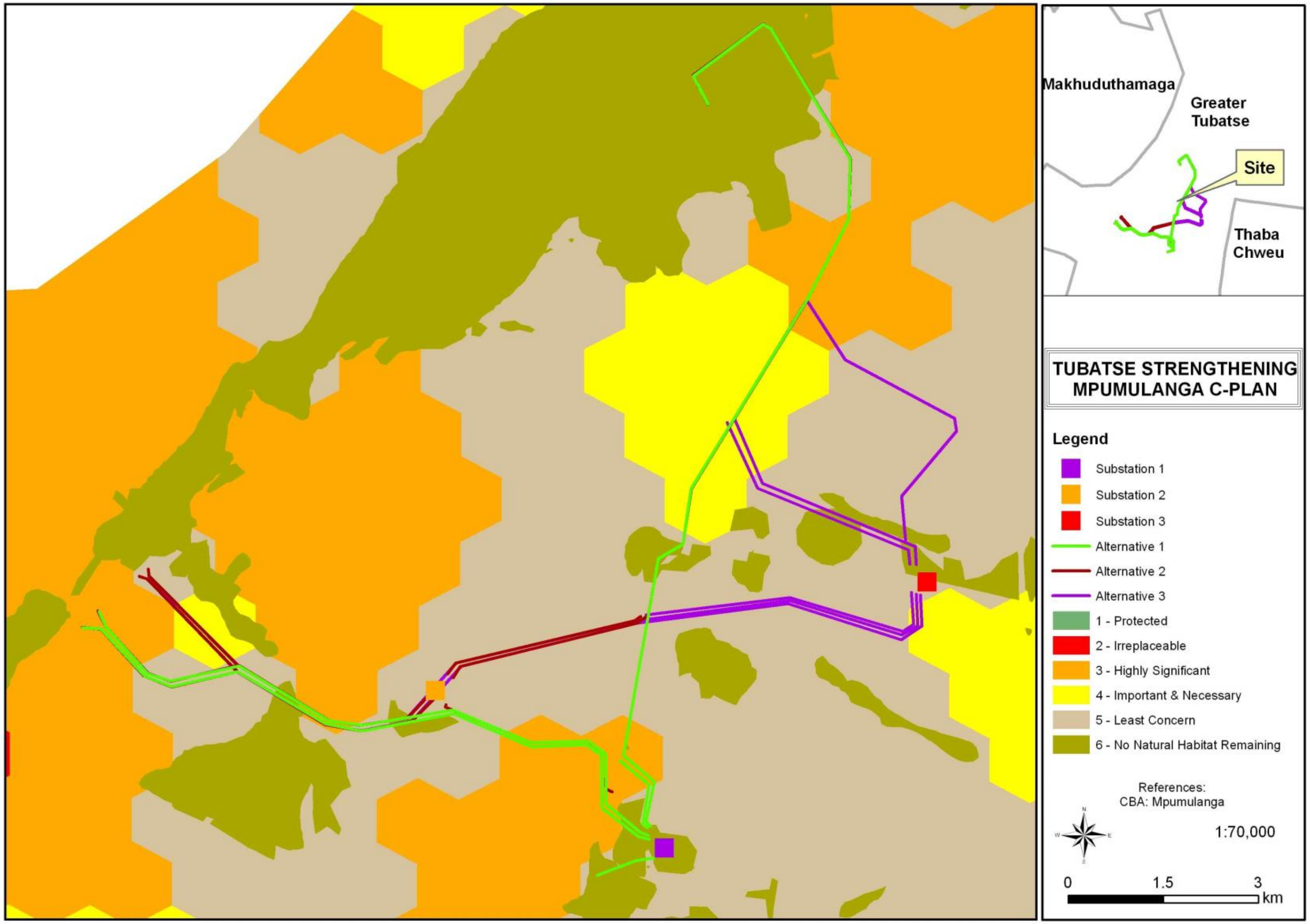

Figure 4: Conservation plan in relation to the existing line and the proposed development.

2 METHODOLOGY

The delineation method documented by the Department of Water affairs and Forestry in their document "Updated manual for identification and delineation of wetlands and riparian areas" (DWAF, 2008), and the Minimum Requirements for Biodiversity Assessments (GDACE, 2009) as well as the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al,* 2013) were followed throughout the field survey. These guidelines describe the use of indicators to determine the outer edge of the wetland and riparian areas such as soil and vegetation forms as well as the terrain unit indicator.

A hand held Garmin Montana 650 was used to capture GPS co-ordinates in the field. 1:50 000 cadastral maps and available GIS data were used as reference material for the mapping of the preliminary watercourse boundaries. These were converted to digital image backdrops and delineation lines and boundaries were imposed accordingly after the field survey.

2.1 Wetland and Riparian Delineation

Wetlands are identified based on the following characteristic attributes (DWAF, 2008) (Figure 5):

- The presence of plants adapted to or tolerant of saturated soils (hydrophytes);
- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation; and
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing within 50 cm of the soil surface.

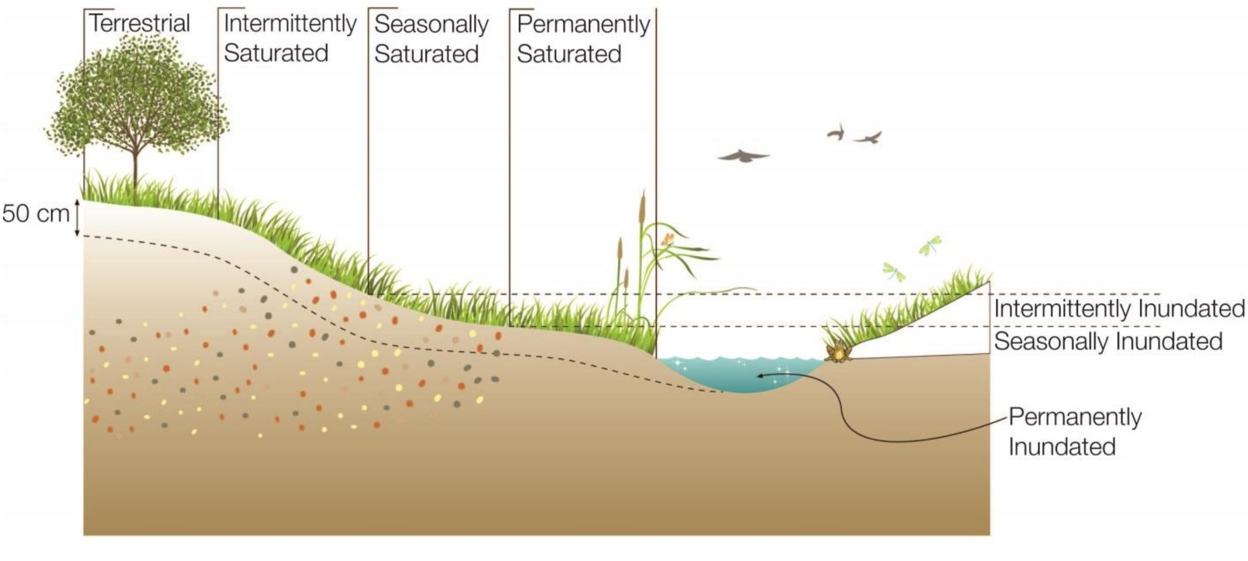

Figure 5: Typical cross section of a wetland (Ollis *et al*, 2013).

Riparian habitat is classified primarily by identifying riparian vegetation along the edge of the macro stream channel. The macro stream channel is defined as the outer bank of a compound channel (Figure 6) and should not be confused with the active river bank. The macro channel bank often represents a dramatic change in the energy with which water passes through the system. Rich alluvial soils deposit nutrients making the riparian area a highly productive zone. This causes a very distinct change in vegetation structure and composition along the edges of the riparian area (DWAF, 2008). The marginal zone has also been referred to as active features or wet bank (Van Niekerk and Heritage, 1993). It includes the area from the water level at low flow, if present to those features that are hydrologically activated for the greater part of the Year (WRC Report No TT 333/08 April, 2008). The non-marginal zone is the combination of the upper and lower zones (Figure 6).

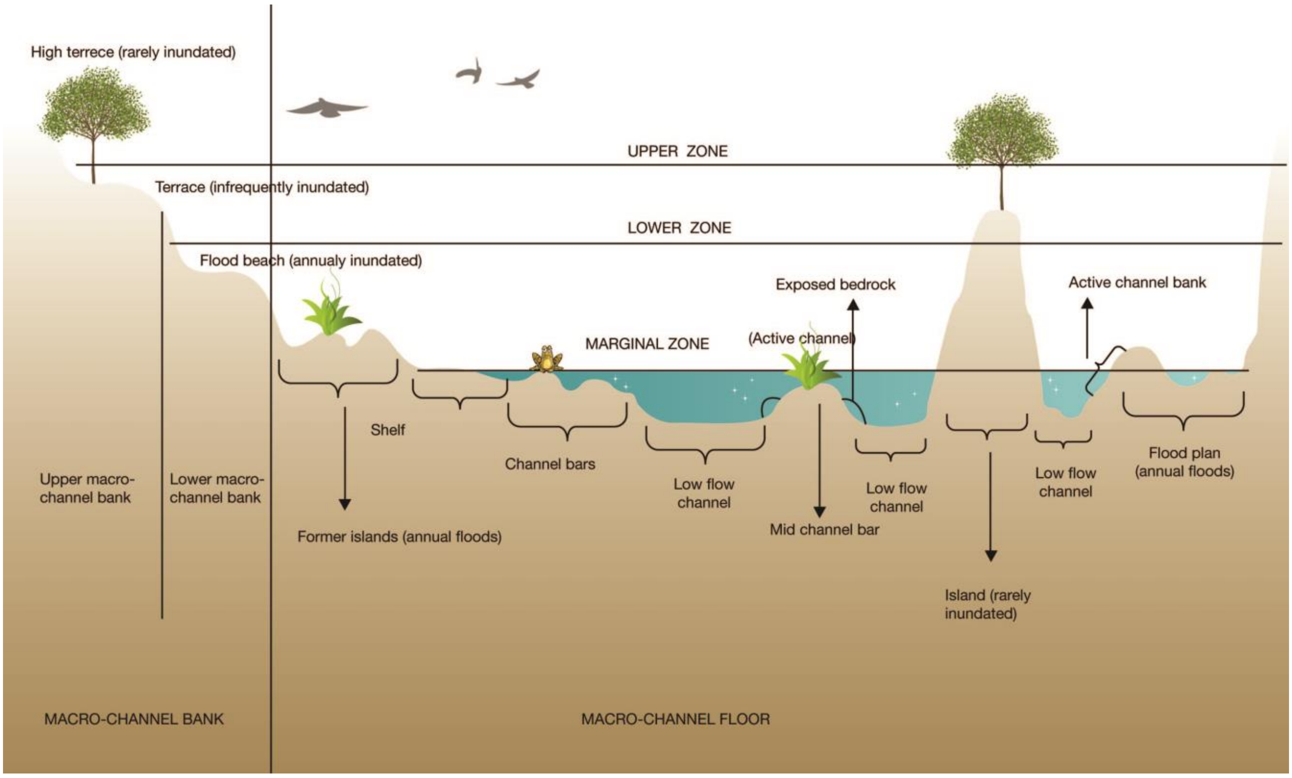

Figure 6: Schematic diagram illustrating an example of where the 3 zones would be placed relative to geomorphic diversity (Kleynhans *et al*, 2007)

2.2 Wetland Classification and Delineation

The classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification (SANBI, 2009). The current wetland study follows the same approach by classifying wetlands in terms of a functional unit in line with a level three category recognised in the classification system proposed in SANBI (2009). HGM units take into consideration factors that determine the nature of water movement into, through and out of the wetland system. In general HGM units encompass three key elements (Kotze *et al,* 2005):

- Geomorphic setting - This refers to the landform, its position in the landscape and how it evolved (e.g. through the deposition of river borne sediment);
- Water source - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and
- Hydrodynamics - This refers to how water moves through the wetland.

The study area was divided into two main different catchments, as well as a small area located in a third catchment. The watercourses associated with these catchments are the Steelpoort River which flows from a south-western to a north-eastern direction through the main catchment areas (B41J and B41H). The other significant river is the Dwars River which is associated with the B41 H catchment. These rivers have numerous smaller streams that flow into the rivers. These streams (Riparian areas) can persist in the form of perennial or temporary streams (Figure 7 & 8). Furthermore some of the rivers as well as temporary and perennial streams often have one or more wetland types that is associated with the stream. The most common wetland type associated with streams is seepage wetlands. Where the water velocity slows in river unchannelled – and channelled valley bottom wetlands can often form. The different types of wetlands and riparian areas discussed in this report are described below:

Riparian Areas:

A riparian area is characterised by linear fluvial, eroded landforms which carry channelized flow on a permanent, seasonal or ephemeral/episodic basis (Figure 7). The river channel flows within a confined valley (gorge) or within an incised macro-channel. The "river" includes both the active channel (the portion which carries the water) as well as the riparian zone (DWAF, 2008).

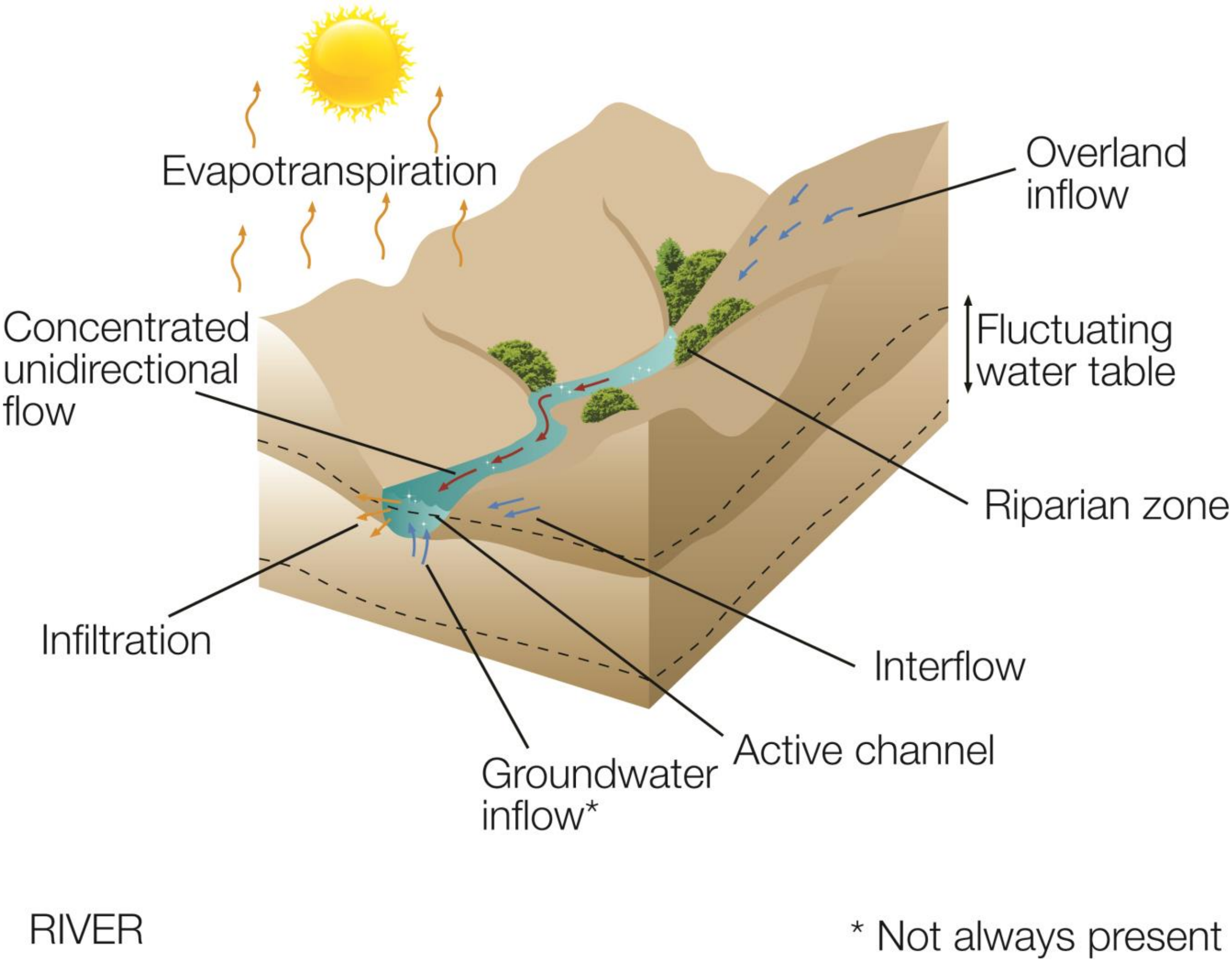

Figure 7: Conceptual illustration of a river (Ollis *et al*, 2013).

Riparian areas can be grouped into different categories based on their inundation period per year. Perennial rivers are rivers with continuous surface water flow, intermittent rivers are rivers where surface flow disappears but some surface flow remains, temporary rivers are rivers where surface flow disappears for most of the channel (Figure 7). Two types of temporary rivers are recognized, namely "ephemeral" rivers that flow for less time than they are dry and support a series of pools in parts of the channel, and "episodic" rivers that only flow in response to extreme rainfall events, usually high in their catchments (Seaman *et al,* 2010). The rivers recorded on site are classified as ephemeral rivers/streams due to the presence of pools as well as being dry for the majority of the year.

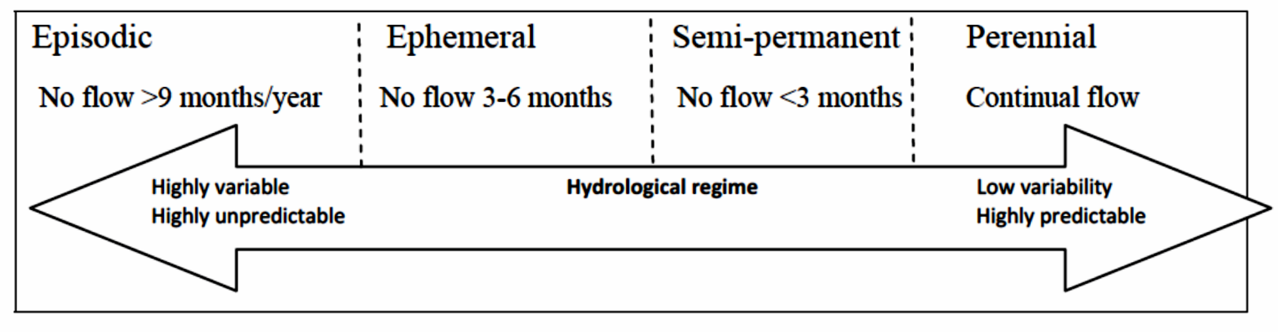

Figure 8: The four categories associated with rivers and the hydrological continuum. Dashed lines indicate that boundaries are not fixed, but only an indication (Seaman *et al*, 2010).

<u>Seepage Wetland:</u>

Seepage wetlands are the most common type of wetland (in number), but probably also the most overlooked. These wetlands can be located on the mid- and footslopes of hillsides; either as isolated systems or connected to downslope valley bottom wetlands (Figure 9). They may also occur fringing depressional pans. Seepages occur where springs are decanting into the soil profile near the surface, causing hydric conditions to develop; or where through flow in the soil profile is forced close to the surface due to impervious layers (Frey, 1999).

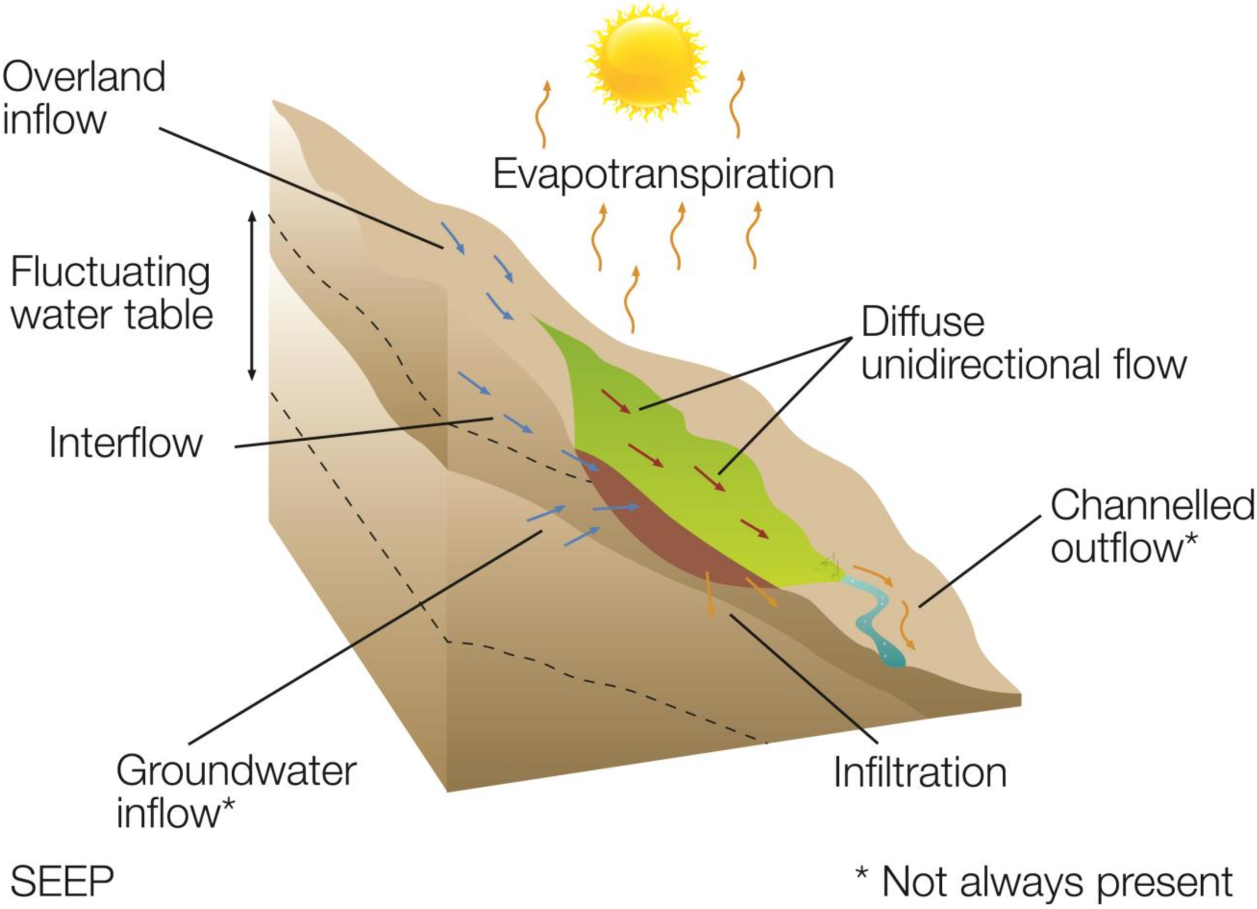

Figure 9: A schematic representation of the processes characteristic of Seepage Wetlands (Ollis *et al*, 2013).

<u>Unchanneled valley bottom wetland:</u>

Unchannelled valley bottom wetlands are described as a linear fluvial, net depositional valley bottom surfaces which do not have a channel. The valley floor is a depositional environment composed of fluvial or colluvial deposited sediment. These systems tend to be found in the upper catchment areas, or at tributary junctions where the sediment from the tributary smothers the main drainage line (Figure 10) (Kotze, 1999).

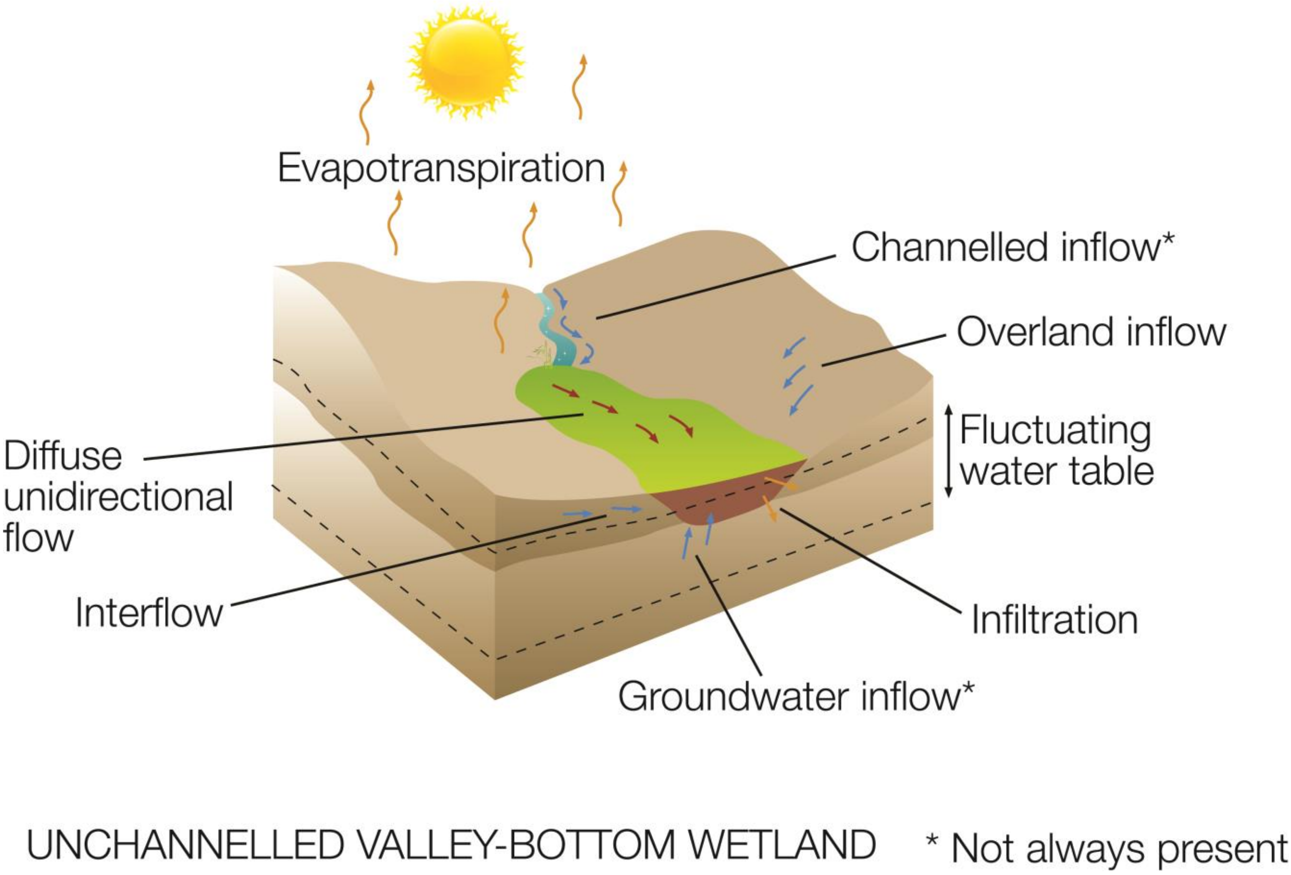

Figure 10: A schematic representation of the processes characteristic of unchannelled valley bottom wetlands (Ollis *et al*, 2013).

<u>Channelled valley bottom wetland:</u>

Linear fluvial, net depositional valley bottom surfaces which have a straight channel with flow on a permanent or seasonal basis. Episodic flow is thought to be unlikely in this wetland setting. The straight channel tends to flow parallel with the direction of the valley (i.e. there is no meandering), and no ox-bows or cut-off meanders are present in these wetland systems. The valley floor is, however, a depositional environment such that the channel flows through fluvially-deposited sediment. These systems tend to be found in the upper catchment areas.

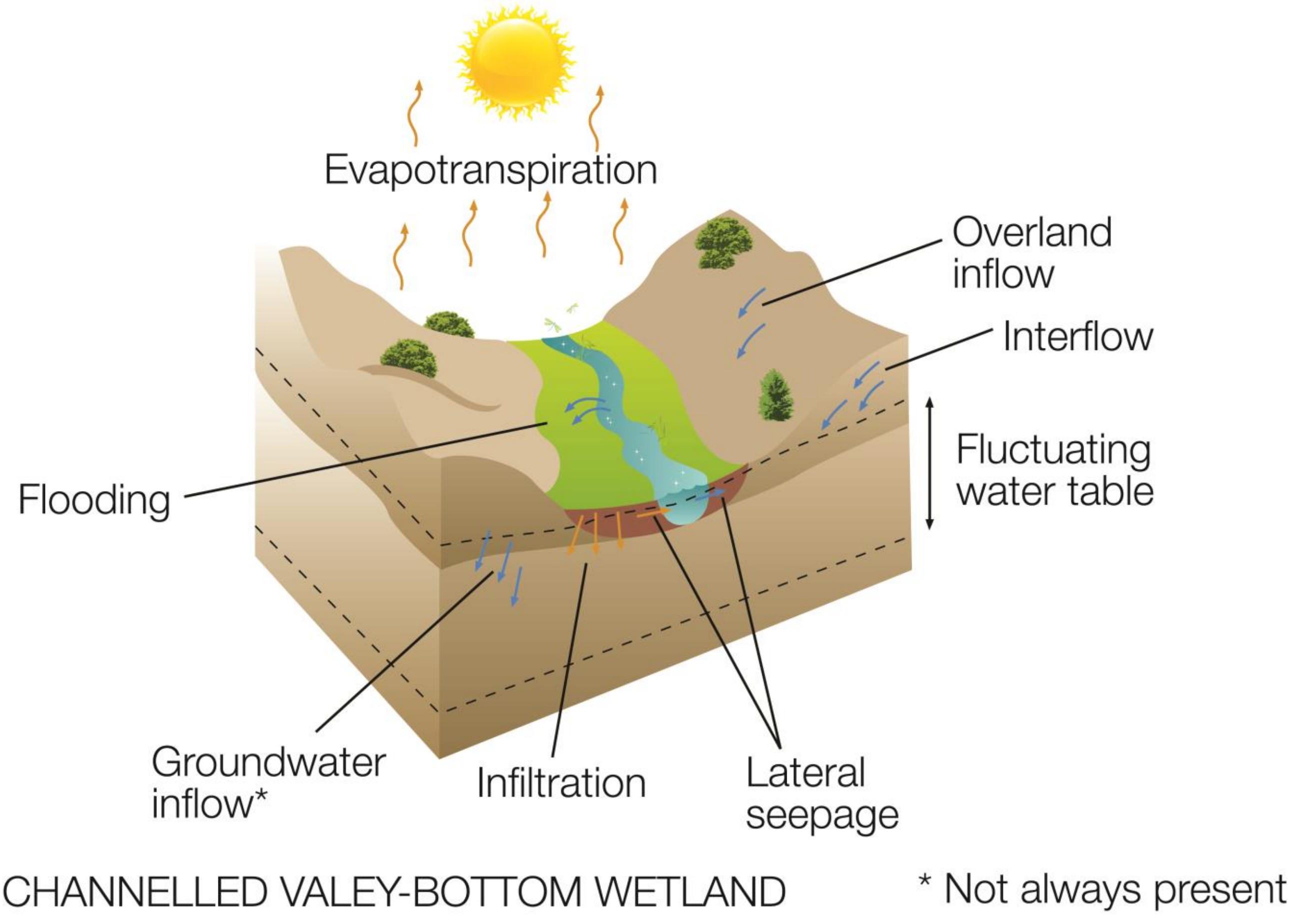

Figure 11: A schematic representation of the processes characteristic of channelled valley bottom wetlands (Ollis *et al*, 2013).

Some areas along the proposed line resemble wetlands due to the presence of some wetland features such as hydrophytic vegetation, however many of these areas are artificial or described as "difficult sites". These areas and the approach are described in the table below (Table 3):

Table 3: List of types of sites that are difficult to delineate. (N.Jobs, 2009).

Type of "difficult site"	Approach
Some or all, wetland indicators are present but is a non-natural wetland (e.g some dams, road islands)	• Decide on the relative permanence of the change and whether the area can now be said to be functioning as a wetland. • Time field observations during the wet season, when natural hydrology is at its peak, to help to differentiate between naturally-occurring versus human-induced wetland. • Decide appropriate policy/management i.e. can certain land uses be allowed due to "low" wetland functional value, or does the wetland perform key functions despite being artificial.
Indicators of soil wetness are present but no longer a	• Look for evidence of ditches, canals, dikes, berms, or subsurface drainage tiles. • Decide whether or not the area is currently functioning as a wetland.

functioning wetland (e.g. wetland has been drained)	
Indicators of soil wetness are present but no longer a functioning wetland (e.g. relic / historical wetland)	• Decide whether indicators were formed in the distant past when conditions were wetter than the area today. • Obtain the assistance of an experienced soil scientist.
Some, or all, wetland indicators are absent at certain times of year (e.g. annual vegetation or seasonal saturation)	• Thoroughly document soil and landscape conditions, develop rationale for considering the area to be a wetland. • Recommend that the site be revisited in the wet season.
Some, or all, wetland indicators are absent due to human disturbance (e.g. vegetation has been cleared, wetland has been ploughed or filled)	• Thoroughly document landscape conditions and any remnant vegetation, soil, hydrology indicators, develop rationale for considering the area to be wetland. • Certain cases (illegal fill) may justify that the fill be removed and the wetland rehabilitated.

2.3 Buffer Zones

A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted (DWAF, 2005). A development has several impacts on the surrounding environment and on a wetland. The development changes habitats, the ecological environment, infiltration rate, amount of runoff and runoff intensity of the site, and therefore the water regime of the entire site. An increased volume of stormwater runoff, peak discharges, and frequency and severity of flooding is therefore often characteristic of transformed catchments. The buffer zone identified in this report serves to highlight an ecologically sensitive area in which activities should be conducted with this sensitivity in mind.

Buffer zones have been shown to perform a wide range of functions and have therefore been widely proposed as a standard measure to protect water resources and their associated biodiversity. These include (i) maintaining basic hydrological processes; (ii) reducing impacts on water resources from upstream activities and adjoining landuses; (iii) providing habitat for various aspects of biodiversity. A brief description of each of the functions and associated services is outlined in Table 4 below.

Table 4: Generic functions of buffer zones relevant to the study site (adapted from Macfarlane *et al*, 2010)

Primary Role	Buffer Functions
Maintaining basic aquatic processes, services and values.	• Groundwater recharge: Seasonal flooding into wetland areas allows infiltration to the water table and replenishment of groundwater. This groundwater will often discharge during the dry season providing the base flow for streams, rivers, and wetlands.
Reducing impacts from upstream activities and adjoining land uses	• Sediment removal: Surface roughness provided by vegetation, or litter, reduces the velocity of overland flow, enhancing settling of particles. Buffer zones can

Primary Role	Buffer Functions
	therefore act as effective sediment traps, removing sediment from runoff water from adjoining lands thus reducing the sediment load of surface waters. • Removal of toxics: Buffer zones can remove toxic pollutants, such hydrocarbons that would otherwise affect the quality of water resources and thus their suitability for aquatic biota and for human use. • Nutrient removal: Wetland vegetation and vegetation in terrestrial buffer zones may significantly reduce the amount of nutrients (N & P), entering a water body reducing the potential for excessive outbreaks of microalgae that can have an adverse effect on both freshwater and estuarine environments. • Removal of pathogens: By slowing water contaminated with faecal material, buffer zones encourage deposition of pathogens, which soon die when exposed to the elements.

Despite limitations, buffer zones are well suited to perform functions such as sediment trapping, erosion control and nutrient retention which can significantly reduce the impact of activities taking place adjacent to water resources. Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts of land uses / activities planned adjacent to water resources. These must however be considered in conjunction with other mitigation measures.

Local government policies require that protective buffer zones be calculated from the outer edge of the temporary zone of a wetland (KZN DAEA, 2002; CoCT, 2008; GDACE, 2009). Although research is underway to provide further guidance on appropriate defensible buffer zones, there is no current standard other than the generic recommendation of 30m for wetlands inside the urban edge and 50 m outside the urban edge (GDARD, 2012). The current report suggests that a generic 30 m buffer zone be applied to the outer edge of the wetlands in the urban edge and 50 m buffer zone be applied to the outer edge of the wetlands outside of the urban edge. As for riparian areas a 32 m buffer zone should be applied from the outer edge of the riparian area within the urban edge and a 100 m buffer zone should be applied to the edge of the riparian area outside of the urban edge. An understanding of the origin of water that results in the wetland/riparian conditions should ideally form the basis of refining this generic buffer zone through an analysis of empirical data.

3 RESULTS

Although a site visit was conducted, the current phase of the project predominantly reflects wetland and riparian areas identified during a desktop study to determine likely problem areas along the proposed lines and to indicate where possible a shift within a 2 km corridor as provided by Eskom. Based on information gathered during the site visit and aerial imagery the alternative substation sites were considered and the substation likely to have the least impact on wetlands/riparian areas was chosen. A follow-up detailed site visit should be conducted once the final routes have been established to determine the Present Ecological State (PES) and the Ecological Categories (EC) of the wetlands and riparian areas.

3.1 Land Use and Land Cover

The studied area is dominated by mines and mining activities. Agricultural and livestock farming is also prevalent throughout the area. Small towns are scattered throughout the study area and surroundings although the majority of the area remains natural. The area is characterised by mountainous areas with various small streams and drainage lines. Only one regional road, the R555 is located within the study area. One smaller road as well as numerous dirt roads are located throughout the study area.

3.2 Wetland Classification and Delineation

Two (2) perennial riparian areas were recorded; namely the Steelpoort River and the Dwars River. These riparian areas are linked to numerous smaller tributaries. The majority of the tributaries are temporary (ephemeral or episodic) streams with only a few being perennial. Numerous artificial dams were also recorded throughout the study area and especially in the mining areas. Both proposed substation 1 and proposed substation 3 have small areas of temporary streams located on the site. Proposed substation 3 is also located adjacent to a nature reserve as well as not having adequate access roads and is thus not the preferred substation site. Substation 1 as well as having a small temporary stream located on the study site is also within 500 m of the perennial Dwars River and is therefore also not preferred. Substation 2 is located directly adjacent a regional road and no riparian or wetland conditions occur on the proposed site, this substation is therefore the preferred substation alternative. A small temporary stream is located south of the study site. Wetland conditions are associated with many of the perennial rivers and temporary streams.

The current proposed routes cross perennial rivers or temporary streams a total of 37 times (Figure 12). It is important to note that this figure is for all the routes combined. It is likely that when a route is chosen that the amount of crossings will be less.

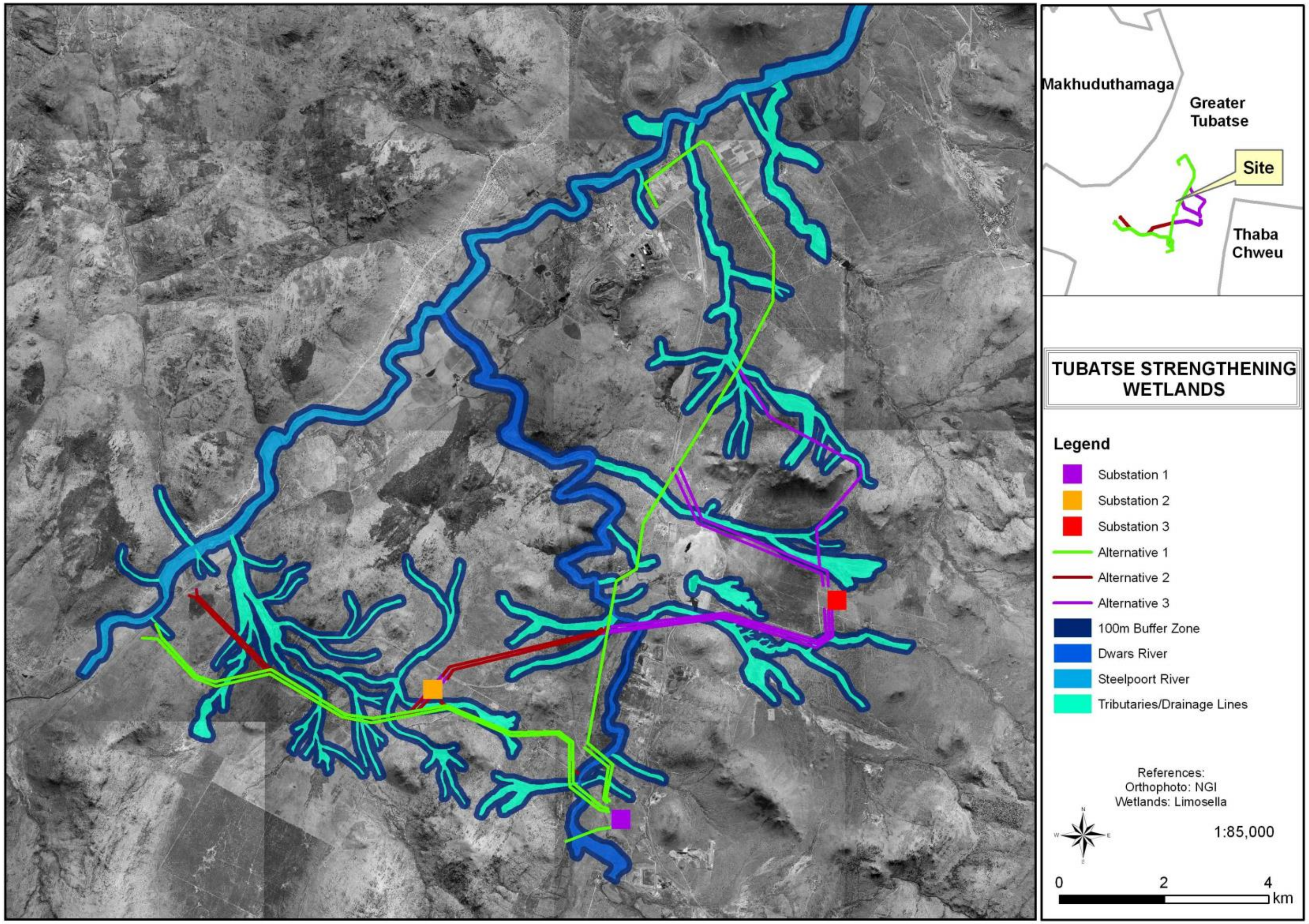

Figure 12: Wetland sensitivity areas delineated together with associated buffer zones.

Areas of concern:

From a wetland/riparian point of view, a few areas of concern were noticed. These areas include powerline turns within the riparian area (perennial and temporary) as well as sections that do not cross riparian areas (perennial and temporary) directly but runs parallel within a riparian area (perennial and temporary) (Figure 13). Five areas of concern were noticed, these are numbered 1-5 and each is described below and summarised in Table 5

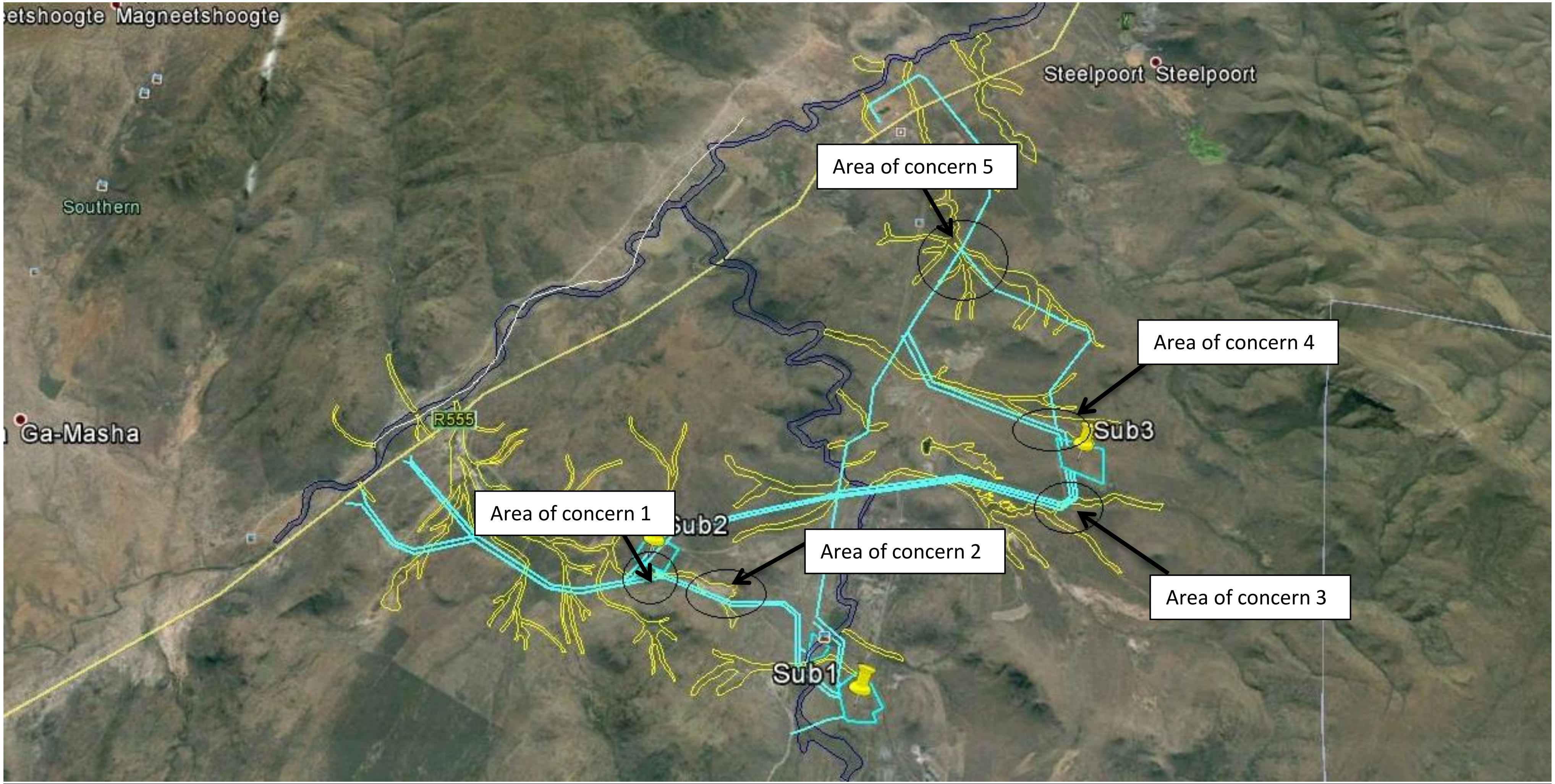

Figure 13: Areas of concerned (Circled) numbered 1-5.

Area of concern 1:

This area is located directly south of proposed substation 2. The proposed route runs parallel and within a temporary stream for approximately 720 m as well as making a small bend within the stream (Figure 14). It is suggested that the route moves approximately 50 m south. The approximate central coordinates for this section is 24°53'57.78"S and 30° 4'39.79"E.

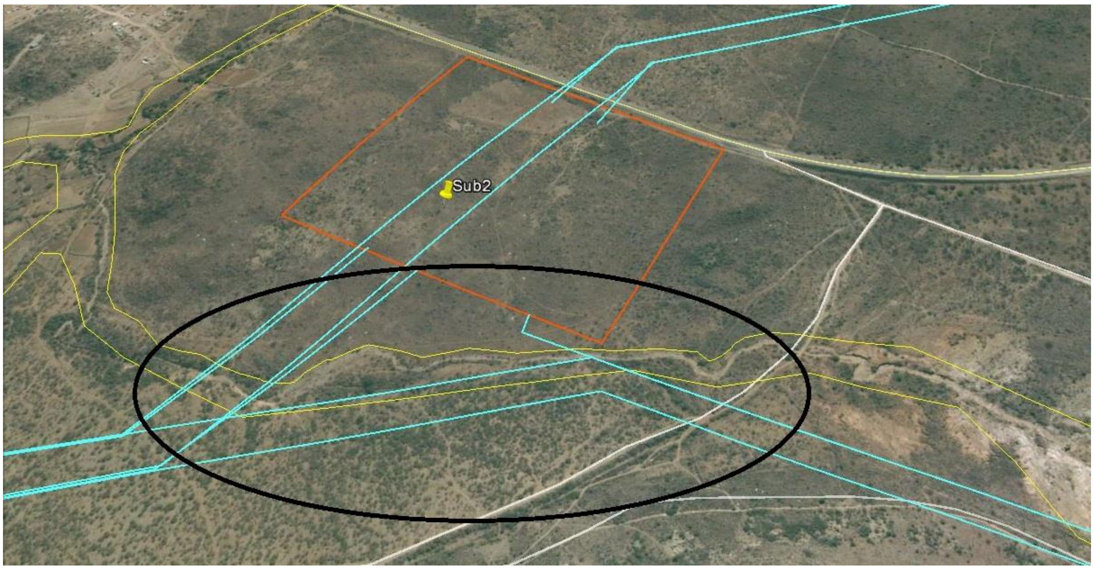

Figure 14: Area of concern 1 indicated by the black circle. The temporary stream is indicated by the yellow, the proposed line by blue, and the proposed substation 2 by orange.

Area of concern 2:

This area is located east of the proposed substation 2. The proposed line is located within a temporary stream area as well as drainage area (Figure 15). The area is currently heavily eroded any infrastructure located within this area is likely to increase erosion. The proposed line is located within this temporary stream for approximately 500 m. It is suggested that the proposed line moves approximately 100 m south. The approximate central coordinates for this area are 24°54'10.10"S and 30° 5'18.23"E.

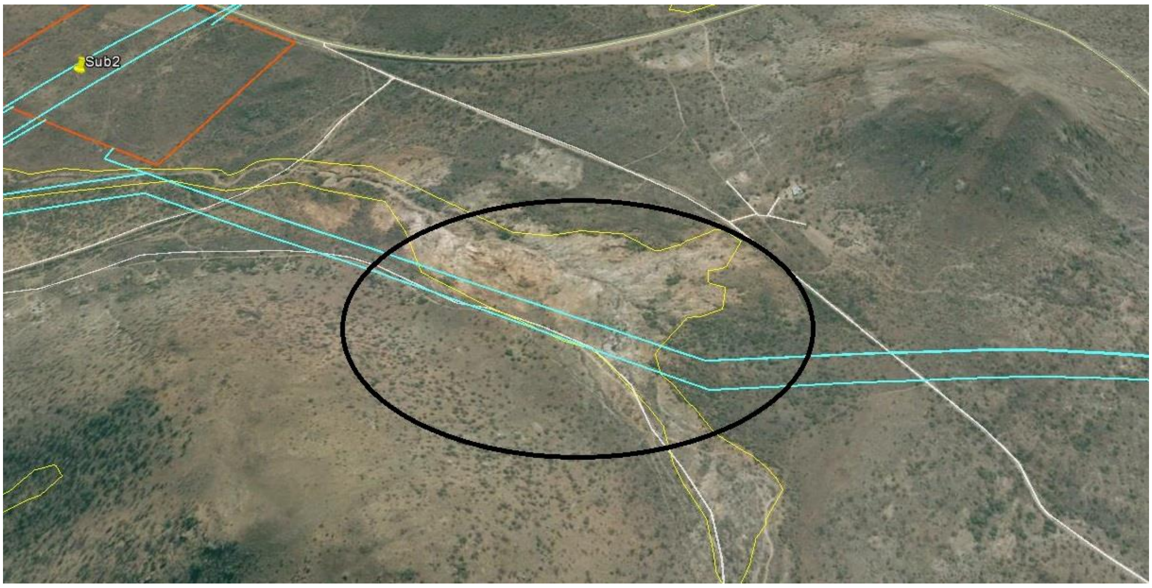

Figure 15: Area of concern 2 indicated by the black circle. The temporary stream is indicated by the yellow, the proposed line by blue, and the proposed substation 2 by orange.

<u>Area of concern 3:</u>

This area is located south of proposed substation 3. The proposed line runs parallel and within with a temporary stream for approximately 360 m (Figure 16). Two bends are also located within this area. It is suggested that the line within the stream move 200 m north-west. The approximate central coordinates for this area are 24°53'16.24"S and 30° 8'39.94"E.

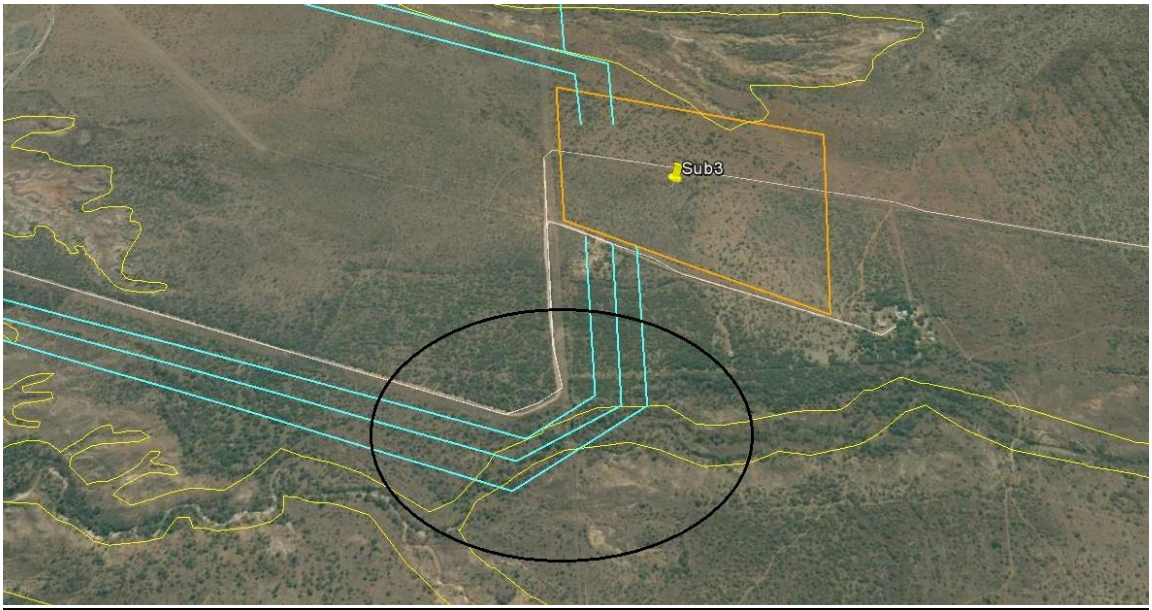

Figure 16: Area of concern 3 indicated by the black circle. The temporary stream is indicated by the yellow, the proposed line by blue, and the proposed substation 3 by orange.

<u>Area of concern 4:</u>

This area is located north of the proposed substation 3. The area is located on the boundary of a temporary stream and runs parallel with the stream (Figure 17). It is suggested that this section moves approximately 10-100 m south. The approximate central coordinates of this section is 24°52'28.78"S and 30° 8'33.87"E.

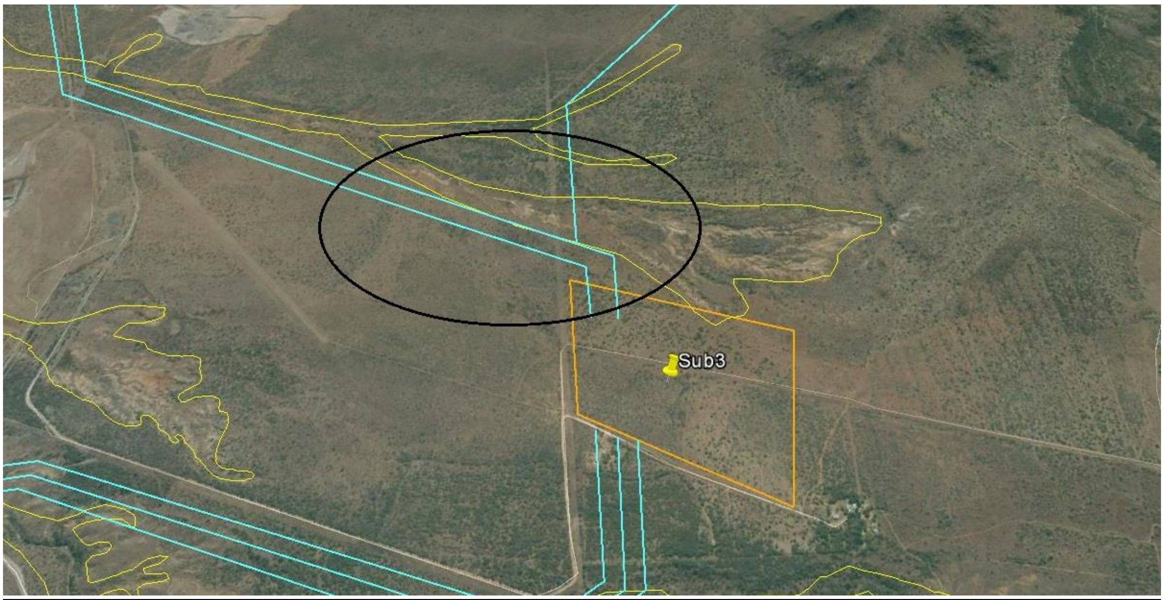

Figure 17: Area of concern 4 indicated by the black circle. The temporary stream is indicated by the yellow, the proposed line by blue, and the proposed substation 3 by orange.

Area of concern 5:

This area is located south east of the existing Tubatse substation and North West of the proposed substation 3 (Figure 18). This area is where one of the proposed lines joins up with another. The area where the lines are proposed to join is located within a temporary stream. It is suggested that the connection moves approximately 40 m south in order to fall outside of the stream area. The approximate central coordinates for the connections are 24°50'27.06"S and 30° 7'48.99"E.

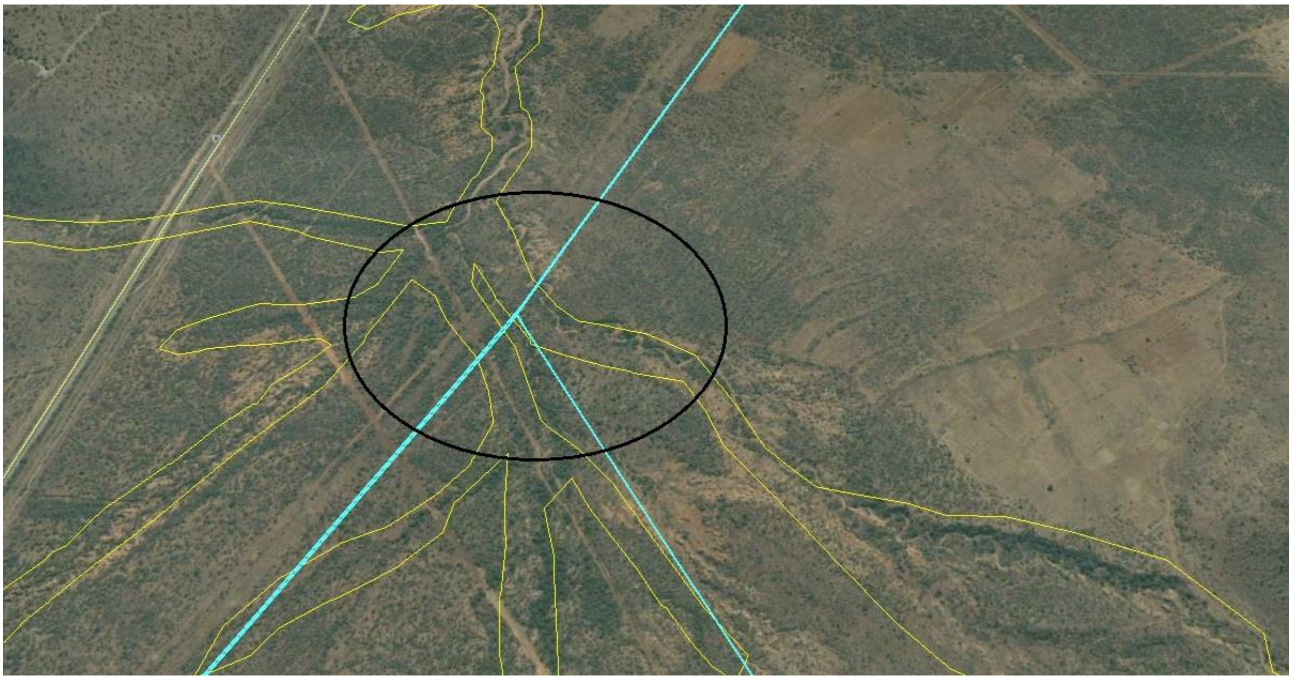

Figure 18: Area of concern 5 indicated by the black circle. The temporary stream is indicated by the yellow, the proposed line by blue.

Table 5: The approximate coordinates of the substation alternatives and areas of concern located on or near the proposed lines.

Area	Approximate Coordinates
Alternative Substation 1	The approximate central coordinates for this wetland are 26°34'37.75"S and 27°48'23.41"E.
Alternative Substation 2	The approximate central coordinates for this wetland are 26°34'59.62"S and 27°48'23.18"E.
Alternative Substation 3	The approximate central coordinates for this wetland are 26°36'22.39"S and 27°48'36.96"E.
Area of concern 1	The approximate central coordinates for this section is 24°53'57.78"S and 30° 4'39.79"E.
Area of concern 2	The approximate central coordinates for this area is 24°54'10.10"S and 30° 5'18.23"E.
Area of concern 3	The approximate central coordinates for this area is 24°53'16.24"S and 30° 8'39.94"E.
Area of concern 4	The approximate central coordinates of this section is 24°52'28.78"S and 30° 8'33.87"E.
Area of concern 5	The approximate central coordinates of this section is 24°52'28.78"S and 30° 8'33.87"E.
Potential Impacts related to construction activities	
• Increasing the invasion of exotic vegetation. • Degradation of wetland/riparian vegetation. • Water quality changes such as reducing the wetland's/riparian area's ability to dilute pollutants. • Increased sediment entering the wetland/riparian area. • Hydrological changes in the groundwater table. • Erosion associated with pylon footprint.	

3.3 Impacts and Mitigation

A development has several impacts on the surrounding environment and particularly on a wetland. The development changes habitats, the ecological environment, infiltration rates, amount of runoff and runoff intensity of stormwater run-off, and therefore the hydrological regime of the site. Site specific mitigation measures should be included in an Environmental Management Plan.

The proposed construction of the new power lines and substation is likely to have some impacts on the wetlands/riparian areas described in this report. Generic suggested primary management procedures are summarised in Table 6.

Table 6: Impacts and suggested management procedures relevant to the proposed development (modified from Macfarlane *et al*, 2010)

Threat / Impact	Source of the threat	Primary Management Procedure
Changing the quantity and fluctuation properties of the watercourse.	*Construction:* • Development within water resources e.g. tower footprint within wetland area or riparian area, thereby diverting or impeding flow • Lack of adequate rehabilitation resulting in invasion by woody invasive plants *Operational:* • Vehicles driving in / through watercourses Damage to vegetated areas	• No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only a pylon footprint and no access roads can be considered. This is subjected to authorization by means of a water use license. • Construction in and around watercourses must be restricted to the dryer winter months. • A temporary fence or demarcation must be erected around the works area to prevent access to sensitive environs. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the tower/pylon • Prevent pedestrian and vehicular access into the wetland and buffer areas as well as riparian areas. • NO vehicle access is allowed within watercourses, not even to pull the electricity cables through • Access roads and bridges should span the wetland area, without impacting on the permanent or seasonal zones • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Management of on-site water use and prevent stormwater or contaminated water directly entering the watercourse • Management of point discharges • Planning of construction site must include eventual rehabilitation / restoration of indigenous vegetative cover • Alien plant eradication and follow-up control activities prior to construction, to prevent spread into disturbed soils, as well as follow-up control during construction • The amount of vegetation removed should be limited to the least amount possible. • Rehabilitation plans must be submitted and approved for rehabilitation of damage during construction and that plan must be implemented immediately upon completion of construction.
Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount)	Construction: • Earthwork activities to construct towers. • Clearing of surface vegetation will expose the soils, which in rainy events would wash	• Construction in and around watercourses must be restricted to the dryer winter months. • A temporary fence or demarcation must be erected around the works area to prevent water runoff and erosion of the disturbed or heaped soils into wetland areas.

Threat / Impact	Source of the threat	Primary Management Procedure
	down into wetlands, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface • Disturbance of slopes through creation of roads and tracks • Changes in runoff characteristics • Erosion (e.g. gully formation, bank collapse) *Operational:* • Vehicles impacting on surface vegetation	• Access roads and bridges should span the wetland area, without impacting on the permanent or seasonal zones. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005). • A vegetation rehabilitation plan should be implemented. Grassland can be removed as sods and stored within transformed vegetation. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other or within sensitive environs. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks. • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. • Rehabilitation plans must be submitted and approved for rehabilitation of damage during construction and that plan must be implemented immediately upon completion of construction. • Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. • Delay the re-introduction of livestock (where applicable) to all rehabilitation areas until an acceptable level of re-vegetation has been reached. • During the construction phase measures must be put in place to control the flow of excess water so that it does not impact on the surface vegetation. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • Runoff from roads must be managed to avoid erosion and pollution problems. • Implementation of best management practices • Source-directed controls • Buffer zones to trap sediments

Threat / Impact	Source of the threat	Primary Management Procedure
		• Active rehabilitation
Alteration of water quality – toxic contaminants (including toxic metal ions (e.g. copper, lead, zinc) and hydrocarbons.	Construction: • Runoff from road surfaces • Runoff from cultivated lands • Discharge of solvents, and other industrial chemicals *Operational:* • Runoff from road surfaces • Discharge of solvents, and other industrial chemicals	• After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. • Ensure that maintenance work does not take place haphazardly, but, according to a fixed plan, from one area to the other. • Maintenance of construction vehicles • Control of waste discharges • Guidelines for implementing Clean Technologies • Maintenance of buffer zones to trap sediments with associated toxins
Changing the physical structure within a water resource (habitat)	Construction: • Encroachment to achieve maximum commercial returns • Deposition of wind-blown sand • Loss of fringing vegetation and erosion • Alteration in natural fire regimes *Operational:* Loss of vegetation	• Other than approved and authorized structure, no other development or maintenance infrastructure is allowed within the delineated wetland and riparian areas or their associated buffer zones. • Demarcate the wetlands and riparian areas and buffer zones to limit disturbance, clearly mark these areas as no-go areas • Linear developments (e.g. roads) should span the watercourse • Weed control in buffer zone • Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed. • Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance of the powerline and take immediate corrective action where invasive species are observed to establish.

4 CONCLUSION

Two (2) perennial riparian areas were recorded, namely the Steelpoort River and the Dwars River. These riparian areas are linked to numerous smaller tributaries. The majority of the tributaries are temporary (ephemeral or episodic) streams with only a few being perennial. Numerous artificial dams were also recorded throughout the study area and especially in the mining areas. Both proposed substation 1 and proposed substation 3 have small areas of temporary streams located on the site. Proposed substation 3 is also located adjacent to a nature reserve as well as not having adequate access roads and is thus not the preferred substation site. Substation 1 as well as having a small temporary stream located on the study site is also located within 500 m of the perennial Dwars River and is therefore also not preferred. Substation 2 is located directly adjacent a regional road and no riparian or wetland conditions occur on the proposed site and is therefore the preferred substation. A small temporary stream is located south of the study site. Wetland conditions are associated with numerous perennial rivers and temporary streams.

The current proposed routes cross perennial rivers or temporary streams a total of 37 times. It is important to note that this figure is for all the routes combined. It is likely that when a route is chosen that the amount of crossings will be less.

From a wetland/riparian point of view, a few areas of concern were noticed. These areas includes powerline turns within the riparian area (perennial and temporary) as well as sections that do not cross riparian areas (perennial and temporary) directly but run parallel within a riparian area (perennial and temporary) these areas are summarised in the table below (Table 6)

Table 7: Summary of the preference and current impacts associated with the proposed substations and areas of concern with regards to wetland/riparian sensitivity.

Area	Approximate Coordinates	Preference
Alternative Substation 1	The approximate central coordinates for this wetland are 26°34'37.75"S and 27°48'23.41"E.	Second Preferred Substation
Alternative Substation 2	The approximate central coordinates for this wetland are 26°34'59.62"S and 27°48'23.18"E.	**Preferred Substation**
Alternative Substation 3	The approximate central coordinates for this wetland are 26°36'22.39"S and 27°48'36.96"E.	Least Preferred Substation
Area of concern 1	The approximate central coordinates for this section is 24°53'57.78"S and 30° 4'39.79"E.	Move section of powerline 50 m south
Area of concern 2	The approximate central coordinates for this area is 24°54'10.10"S and 30° 5'18.23"E.	Move section of powerline **100 m south**
Area of concern 3	The approximate central coordinates for this area is 24°53'16.24"S and 30° 8'39.94"E.	Move section of powerline **200 m north-west**
Area of concern 4	The approximate central coordinates of this section is 24°52'28.78"S and 30° 8'33.87"E.	Move section of powerline **10 -100 m south**
Area of concern 5	The approximate central coordinates of this section is 24°52'28.78"S and 30° 8'33.87"E.	Move section of powerline **40 m south**

In order to limit the impact on the hydrology of the area, the current assessment finds that a minimum buffer of 30 m from the edge of the wetland boundaries should be respected as well as a minimum buffer of 32 m for riparian areas in the urban areas while a minimum buffer of 50 m from the edge of the wetland boundaries as well as a minimum buffer of 100 m for riparian areas outside of the urban areas should be respected.

Powerline infrastructure should ideally be excluded from these sensitive areas. However, linear developments such as the proposed powerline are rarely able to avoid crossing any watercourses whatsoever. Where alternatives have been investigated and watercourse crossings have been shown to be necessary it is important that appropriate mitigation measures are put into place and carefully monitored to ensure minimal impact to regional hydrology. In the case of the proposed powerline mitigation should focus on:

- Rehabilitation / restoration of indigenous vegetative cover.
- Management of point discharges during construction activities.
- Alien plant control.
- Implementation of best management practices regarding stormwater and earthworks.
- Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone during construction activities.

- Implementation of appropriate stormwater management around the excavation to prevent the ingress of run-off into the excavation.
- Prevention of erosion, and where necessary rehabilitation of eroded areas.

The impact assessment found that the greatest impact that the construction of the power line is likely to have on the assessed watercourses is the change in the amount of sediment entering the water resources and associated change in turbidity (increasing or decreasing the amount) during construction. The study area is located in a semi-arid region and erosion due to sudden high rainfall events is thus likely. Erosion should thus be controlled and minimised where the proposed activities comes close to a watercourse. Activities like these are likely to increase the invasion of exotic plants. Mitigation measures as set out in this report should be strictly adhered to. Furthermore, it must be noted that if construction of access roads or other construction activities within the 1:100 year floodline or the wetland area (whichever is the greatest) is unavoidable, an application for a Water Use License will be likely (DWA, 2010).

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APPENDIX A: GLOSSARY OF TERMS

Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area
Hydrophyte	any plant that grows in water or on a substratum that is at least periodically deficient in oxygen as a result of soil saturation or flooding; plants typically found in wet habitats
Hydromorphic soil	soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils)
Seepage	A type of wetland occurring on slopes, usually characterised by diffuse (i.e. unchannelled, and often subsurface) flows
Sedges	Grass-like plants belonging to the family Cyperaceae, sometimes referred to as nutgrasses. Papyrus is a member of this family.
Soil profile	the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons (Soil Classification Working Group, 1991)
Wetland:	"*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 delineation	the determination and marking of the boundary of a wetland on a map using the DWAF (2005) methodology. This assessment includes identification of suggested buffer zones and is usually done in conjunction with a wetland functional assessment. The impact of the proposed development, together with appropriate mitigation measures are included in impact assessment tables