September 2009

WETLAND DELINEATION SPECIALIST REPORT

SPECIALIST STUDY

PROPOSED KUSILE RAILWAY: WETLAND DELINEATION SPECIALIST STUDY

Proponent: **Eskom Holdings Limited**

Prepared by: **Zitholele Consulting**

FINAL WETLAND DELINEATION REPORT

Project 12202

PURPOSE OF THIS DOCUMENT

The growing demand for electricity is placing increasing pressure on Eskom's existing power generation and transmission capacity. Eskom is committed to implementing a Sustainable Energy Strategy that complements the policies and strategies of National Government. Eskom aims to improve the reliability of electricity supply to the country, and in particular to provide for the growth in electricity demand in the Gauteng and Mpumalanga provinces. For this reason, Eskom obtained environmental authorisation to construct the new Kusile Power Station between Bronkhorstspruit and Witbank in 2007. Construction of this power station has already commenced.

The new Kusile Power Station requires the delivery of a sorbent to the plant as a reagent in the power generation process. At present it is anticipated that this delivery will be best suited to rail transport. A proposed project to construct a new railway line from the existing Bronkhorstspruit – Emahlahleni railway line to the Kusile Power Station was therefore commissioned.

Eskom's Generation Division appointed Zitholele Consulting (Pty) Ltd, an independent company, to conduct an EIA to evaluate the potential environmental and social impacts of the proposed project.

As part of the environmental process Eskom requested specialist assessments to be undertaken in order to inform the Impact Assessment Phase. This report details the findings the wetland delineation specialist assessment.

Zitholele Consulting have undertaken the aforementioned studies. The purpose of this document is therefore to present the findings from these assessments and to provide impact assessments and mitigation measures for each of the project phases.

TABLE OF CONTENTS

SECTION **PAGE**

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The growing demand for electricity is placing increasing pressure on Eskom's existing power generation and transmission capacity. Eskom is committed to implementing a Sustainable Energy Strategy that complements the policies and strategies of National Government. Eskom aims to improve the reliability of electricity supply to the country, and in particular to provide for the growth in electricity demand in the Gauteng and Mpumalanga provinces. For this reason, Eskom obtained environmental authorisation to construct the new Kusile Power Station between Bronkhorstspruit and Witbank in 2007. Construction of this power station commenced in 2008.

The new Kusile Power Station requires the delivery of sorbent (Limestone most likely) to the plant as a reagent in the power generation process. At present it is anticipated that this delivery will be best suited to rail transport. This project proposes to construct a new railway line from the existing Bronkhorstspruit – Witbank railway line to the Kusile Power Station. At present three route alternatives are being investigated, varying in length from 12 – 18 km, namely (Figure 1-1):

<u>Alternative 1: Kusile – Wilge River interchange shortcut</u>

The Alternative 1 route alignment, which starts at the existing Pretoria-Witbank railway line (A), heads in a south westerly direction and crosses the N4 highway (F). Thereafter the route follows the course of the Wilge River (FB). This route then heads in a south easterly direction and crosses an unnamed tributary of the Wilge River continuing for six kilometres into the Kusile Power Station (BCDE). This route is approximately 12 km in length.

<u>Alternative 2: Kusile - Wilge River interchange</u>

The second alternative follows the same initial alignment as Alternative 1 (AF), but after crossing the N4 highway the alignment continues in a south westerly direction for approximately 4.5 kilometres. Thereafter the route crosses over the Klipfonteinspruit and turns in a south easterly direction for approximately two kilometres. The route then turns south south east for 2.5 kilometres, turns eastward and crosses the Klipfonteinspruit a second time and then turns to run in a northerly direction for three kilometres before meeting up with alternative 1 approximately 3 kilometres from the Kusile Power Station (BGDE). This route is estimated at 18 km in length.

<u>Alternative 3: Kusile – Wilge River interchange shortcut 2</u>

The Alternative 3 route alignment follows the same initial alignment as Alternative 1 (AF) but it crosses the N4 highway 500 metres eastward of the Alternative 1 and 2 crossing (avoiding the farmstead complexes) (FCDE). The alternative rejoins alternative 1 for approximately seven kilometres before entering the Kusile Power Station. This route is very similar to Alternative 1, with some minor deviations 12.2 km.

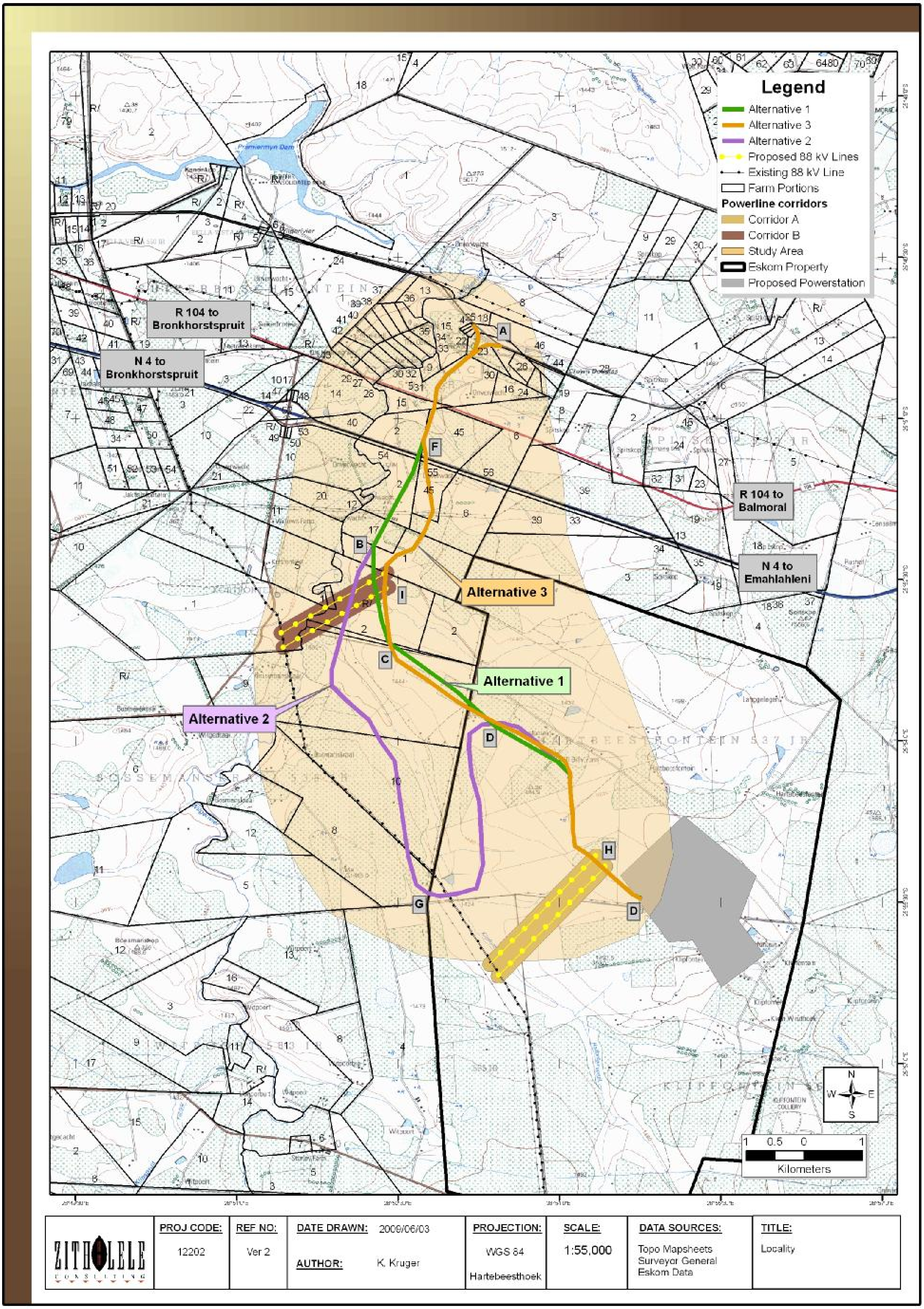


Figure 1-1: Proposed route alternatives for the railway line.

Power Line Alternatives

In order to power the railway line, two 88 kV power lines will be connected to two substations adjacent to the proposed railway line. This line will feed from the existing 88 kV power lines in the area and the potential placements are shown as Corridors A and B that link into the railway lines at points H and I in the Figure above. Each of the corridors requires one power line which will connect to one substation, depending on the route selected.

1.2 STUDY SCOPE

Eskom's Generation Division has appointed Zitholele Consulting (Pty) Ltd, an independent company, to conduct an EIA to evaluate the potential environmental and social impacts of the proposed project. As part of the environmental impact assessment for the aforementioned project it is required that certain biophysical specialist investigations are undertaken. Zitholele Consulting was appointed to undertake the following biophysical specialist studies:

- Wetlands and Surface Water;
- Topography and Visual Impact;
- Soils;
- Agricultural Potential; and
- Terrestrial Ecology.

This report details the findings of the wetland delineation assessment.

1.3 STUDY APPROACH

Zitholele Consulting undertook the aforementioned specialist studies during several site visits conducted from the 23rd – 30th March and 1st – 4th September 2009. The wide spread of site visits during the year were undertaken to obtain a maximum cover of the seasonal variations. The study area encompasses the area within a 500 m radius of the proposed railway line alternatives. Transects were walked on either side of the proposed railway line alternatives in which vegetation, soil and wetland characteristics were sampled.

1.4 PROJECT PERSONNEL

The following project personnel were involved in the compilation of this report.

<u>Konrad Kruger, BSc Hons (Geog)</u>

Mr. Konrad Kruger graduated from the University of Pretoria with a BSc Honours in Geography in 2003. He has been involved in a variety of environmental projects in the last three years and has become specialised in undertaking specialist studies, mapping and environmental consulting. He has undertaken GIS mapping for mining, residential as well as industrial developments. He is also an experienced land ecologist and will provide expertise for this project in terms of soil surveys, land capability assessments and mapping. He is currently in the process of acquiring his MSc in Geography (Landscape Ecology) from the University of Pretoria.

1.5 ASSUMPTIONS AND LIMITATIONS

The following assumptions were made during the assessment:

- The information regarding the routes provided by Eskom is accurate;
- Ecological and wetland assessments have to be undertaken during the summer months; and
- A corridor width of 500 m was used for each alternative route.

2 BIOPHYSICAL RECEIVING ENVIRONMENT

This section details the receiving environment at the project location. For the context of this report the regional environment refers to a 50 km radius around the study area.

Although the aim of this report is to detail the vegetation, wetlands and, soil and land capability component of the receiving environment; certain additional factors have been included, as they provide perspective to the soil and vegetation study. These include geology, topography, climate, surface water and land use.

2.1 TOPOGRAPHY

2.1.1 Data Collection

The topography data was obtained from the Surveyor General's 1:50 000 toposheet data for the region, namely 2528DD. Contours were combined from the topographical mapsheets to form a combined contours layer. Using the Arcview GIS software the contour information was used to develop a digital elevation model of the region as shown in Figure 2-1 below.

2.1.2 Regional Description

The topography of the region is gently undulating to moderately undulating landscape of the Highveld plateau. Some small scattered wetlands and pans occur in the area, rocky outcrops and ridges also form part of significant landscape features in the area. Altitude ranges between 1 360 – 1 600 metres above mean sea level (mamsl). Figure 2-1 provides an illustration of the topography of the site, while Figure 2-2 shows the ridges found on site. With regards to ridges, all the routes avoid the ridges found on site, but it should be noted that in various places the routes do come in close proximity to ridges.

2.2 SURFACE WATER

2.2.1 Data Collection

The surface water data was obtained from the WR90 database from the Water Research Council. The data used included catchments, river alignments and river names. In addition water body data was obtained from the CSIR land cover database (1990) to illustrate water bodies and wetlands. This data was supplemented with site observations during the various site visits.

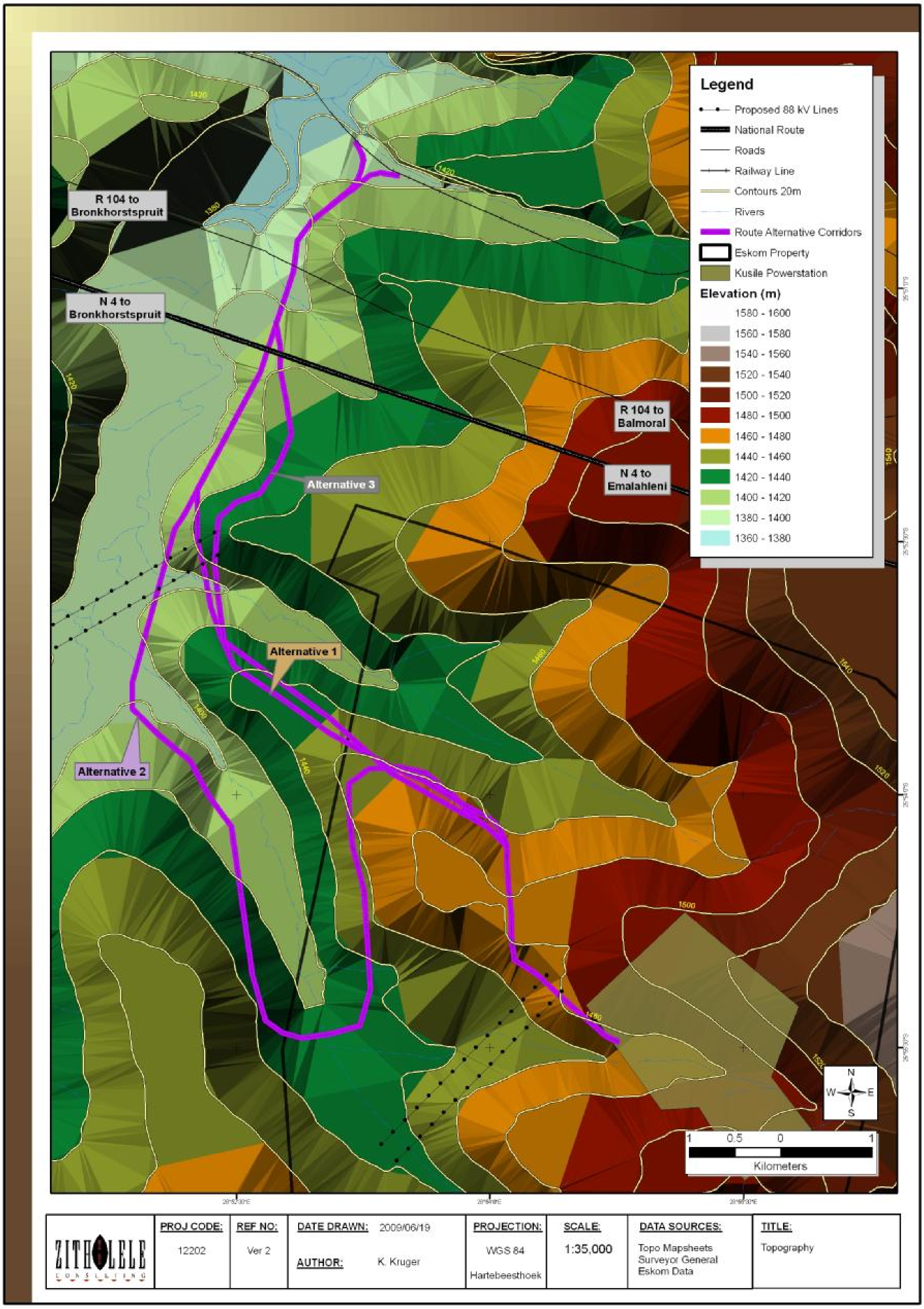


Figure 2-1: Topography of the site

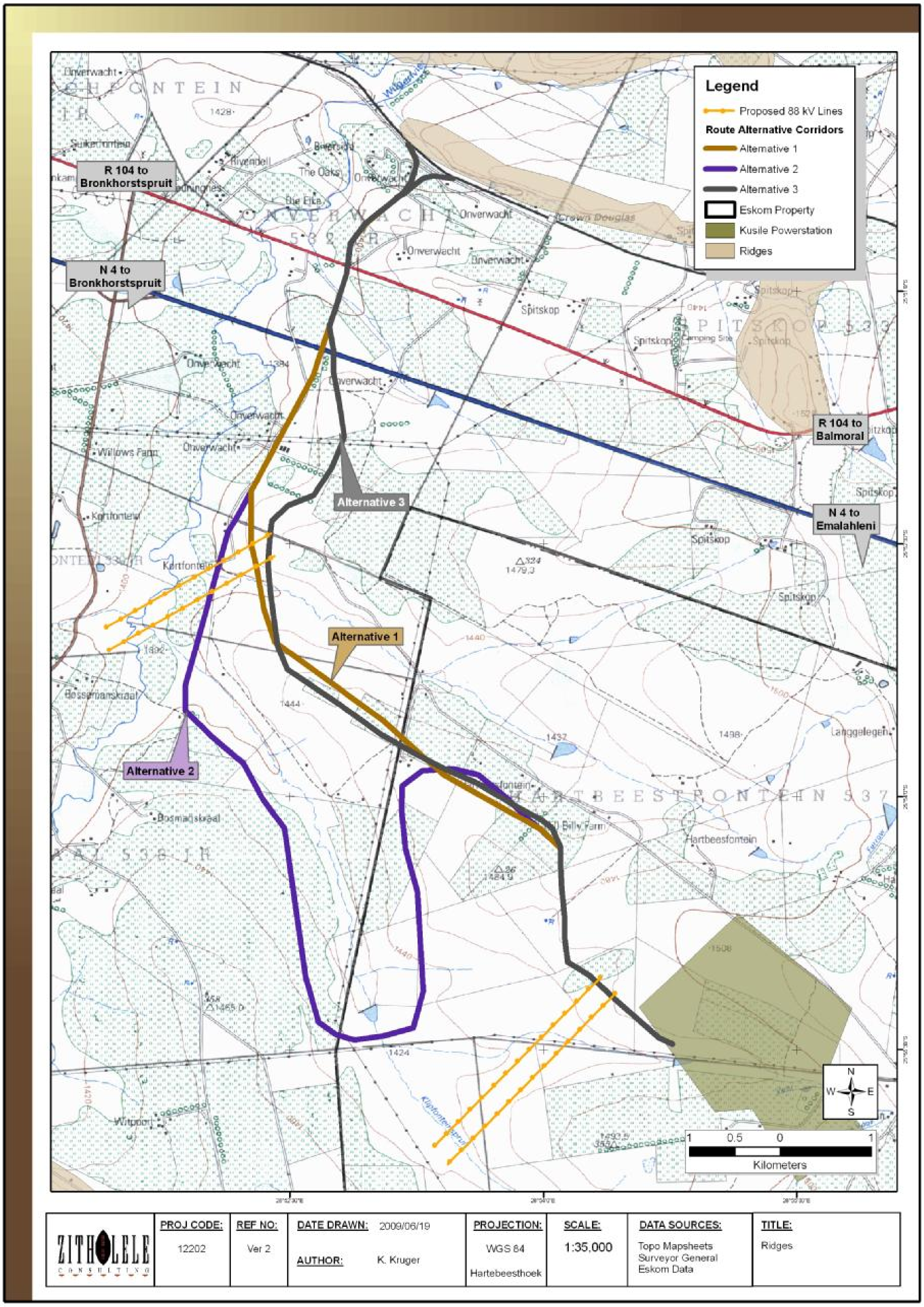


Figure 2-2: Ridges found on site

2.2.2 Site Description

The main drainage feature of the area is the Wilge River which drains northwards. Several tributaries are also found on site including the Klipfonteinspruit and several unnamed streams. In addition to the streams several dams can also be found on site as illustrated in Figure 2-3 and Figure 2-4. The streams and their associated dams support a number of faunal and floral species uniquely adapted to these aquatic ecosystems and therefore all surface water bodies are earmarked as sensitive features and should be avoided as far as possible.

Figure 2-3: Dams and wetlands within the streams on site (Klipfonteinspruit).

From Figure 2-4 above, it is clear that all the alternatives cross a stream or river at some point. Table 2-1 below provides an indication of the number of river crossings per alternative. From the table it is evident that Alternatives 1 and 3 have the least crossings, while Alternatives 2 has 5 crossings.

Table 2-1: Number of stream crossings per alternative

Alternative	Number of Stream Crossings
Alternative 1	2 x tributaries
Alternative 2	3 x tributaries and the Klipfonteinspruit twice (5 crossings)
Alternative 3	2 x tributaries

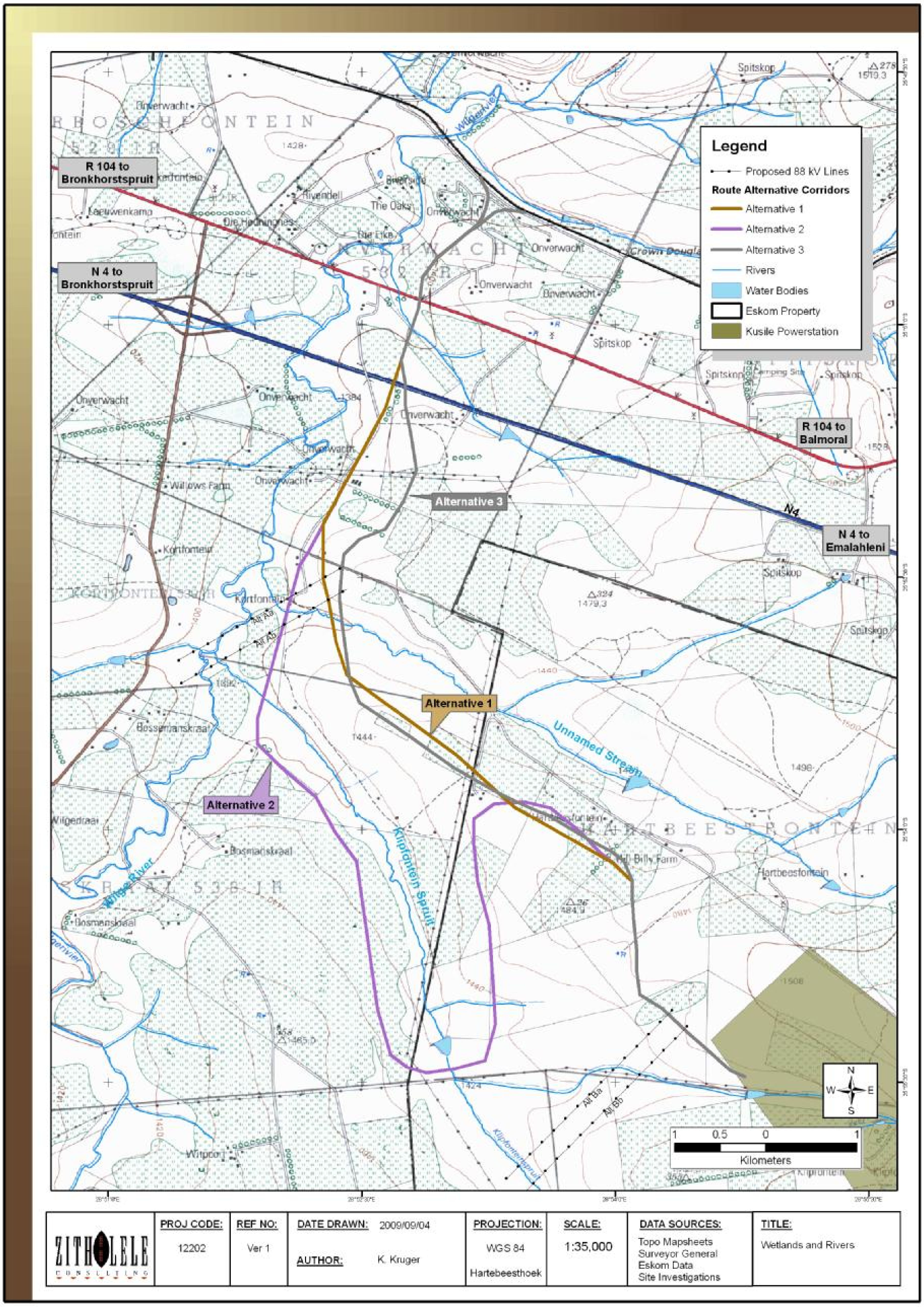


Figure 2-4: Surface water and drainage features

2.3 WETLAND DELINEATION

2.3.1 Data Collection and Methodology

Riparian Zones vs. Wetlands

Wetlands

The riparian zone and wetlands were delineated according to the Department of Water Affairs (DWA, previously known as the Department of Water Affairs and Forestry -DWAF) guideline, 2003: A practical guideline procedure for the identification and delineation of wetlands and riparian zones. According to the DWA guidelines *a wetland* is defined by the National Water Act as:

"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near 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 the guidelines indicate that wetlands must have one or more of the following attributes:

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

During the site investigation the following indicators of potential wetlands were identified:

- Terrain unit indicator;
- Soil form indicator;
- Soil wetness indicator; and
- Vegetation indicator.

Riparian Areas

According to the DWA guidelines *a riparian area* is defined by the National Water Act as:

"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"

The difference between Riparian Areas and Wetlands

According to the DWA guidelines the difference between a wetland and a riparian area is:

"Many riparian areas display wetland indicators and should be classified as wetlands. However, other riparian areas are not saturated long enough or often enough to develop wetland characteristics, but also perform a number of important functions, which need to be safeguarded… Riparian areas commonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments."

2.3.2 Delineation

The site was investigated for the occurrence / presence of wetlands and riparian areas, using the methodology described above and described in more detail in the DWA guidelines.

<u>Terrain Unit Indicator</u>

The terrain on site varies from 1 360 mamsl to 1 600 mamsl as illustrated in Figure 2-1. From Figure 2-1 it can be seen that the site is located in an area of undulating hills with the dominant terrain units on site being the midslope, footslope and valley bottom units. According to the DWA guidelines the valley bottom is the terrain unit where wetlands are most likely to occur, but the occurrence of wetlands is not excluded from any of the other terrain units.

<u>Soil Form Indicator</u>

The site is located on a slope that drains towards the Klipfonteinspruit, and eventually to the Wilge River. Water enters the soils profile and then flows through the profile down-slope. This action of water movement through the slope typifies the soils of the largest part of the site (eluvial and plinthic soils). Closer to the stream (within the valley bottom terrain unit) the soils gradually deepen due to the down-slope transport of soil (colluvium). In addition these soils have gradually higher percentages of clays that over time have been washed down-slope and accumulate at the valley bottom where the slope angle reduces. The detailed soil mapping exercise was limited to the footslope and valley bottom area in order to delineate the wetland / riparian zones.

During a four day site visit the soils on site were identified. Of the soils identified on site the Katspruit soil form is indicative of the permanent wetland zone, while the Wasbank and Longlands soil forms are indicative of the temporary wetland zone. There is also a possibility that the Avalon soil form can be indicative of the temporary zone.

<u>Soil Wetness Indicator</u>

The soils on site were subjected to a soil wetness assessment. If soils showed signs of wetness within 50 cm of the soil surface, it was classified as a hydromorphic soil and divided into the following groups:

Temporary Zone

- Minimal grey matrix (<10%);
- Few high chroma mottles; and
- Short periods of saturation.

Seasonal Zone

- Grey matrix (>10%);
- Many low chroma mottles present; and
- Significant periods of wetness (>3 months / annum).

Permanent Zone

- Prominent grey matrix;
- Few to no high chroma mottles;
- Wetness all year round; and
- Sulphuric odour.

The Katspruit, Wasbank and Longlands soil forms have signs of wetness within the top 50 cm of the soil profile. The Avalon soil form however did not have any signs of wetness. The Katspruit soil form was classified as the permanent zone, while the Wasbank and Longlands were classified as the temporary and seasonal zone.

<u>Vegetation Indicator</u>

The wetland vegetation units on site are described below. The vegetation found in the moist grassland and the seepage zone vegetation units both have species present to indicate the presence of wetlands.

***Eragrostis plana* Moist Grassland (Moist Grassland)**

The *Eragrostis plana* Grassland is well represented occurring mainly in high rainfall parts. This grassland type is a moist grassland, usually restricted to flat plains or bottomlands, mostly on moist, deep, clayey and poorly drained, seasonally wet soils, adjacent to wetlands , seasonal as well as perennial rivers. These habitats are often fairly unstable due to seasonal flooding and drying, which, together with frequent overgrazing, cause degradation of the vegetation (Bezuidenhout & Bredenkamp 1990).

Eragrostis plana is conspicuous, often dominant member of this grassland type. *Paspalum dilatatum*, and the rhizomatous *Cynodon dactylon*, often presents in degraded sites, are also diagnostic, as well as the forbs *Crabbea acaulis, Berkheya radula, B. pinnatifida and Trifolium africanum.* Grass species such as *Eragrostis curvula, Themeda triandra, Setaria sphacelata and Digitaria eriantha* are often abundantly present, and may be locally dominant, while forbs are generally quite rare (Coetzee et al. 1995; Bredenkamp & Brown 2003).

Figure 2-5: Eragrostis Plana Moist Grassland.

Seepage areas and wetland communities

Seepage areas are seasonally wet areas that occur in sandy areas where water seeps into lowlying drainage lines after rains. These areas are usually covered by hygrophytes such as sedges and reeds. The dominant sedge in the study area is *Juncus rigidus*. Sometimes bulrush (*Typha capensis*) and reeds (*Phragmites australis*) also occur.

Wetlands are of a more permanent nature and occur in low-lying areas such as tributaries of streams and rivers. Here hydrophytes can be found. Typical plants are the Orange River Lily (*Crinum bulbispermum*), bulrush (*Typha capensis*) and reeds (*Phragmites australis*), sedges of the *Cyperus, Fuirena and Scirpus* genera also occur).

Figure 2-6: Seepage Area.

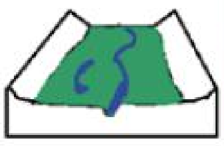
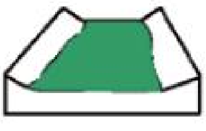
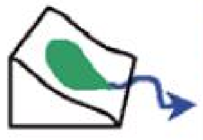
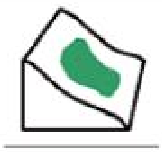
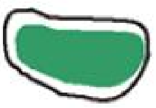
<u>Delineated Wetlands and Buffer Zones</u>

According to the methodology that was followed for delineation of wetlands by DWA, there are wetlands present on site. It should however be noted that several of the so-called wetlands could also be classified as riparian zones as they follow the drainage path of the non-perennial streams on site. All the area's identified above perform critical ecosystem functions and also provide habitat for sensitive species. It is suggested that a 50m buffer be placed from the edge of the temporary zone in order to sufficiently protect the wetlands and riparian zones. Figure 2-7 below illustrates the various wetland zones as well as the buffer placed along the edge of the temporary zone.

2.3.3 Classification of Wetlands

The classification of the wetlands in the study area into different wetland types was based on the WET-EcoServices technique (Kotze *et al*, 2007). The WET-EcoServices technique identifies seven main types of wetland based on hydro-geomorphic characteristics (Table 2-2).

Table 2-2: Wetland types based on hydro-geomorphic characteristics (Kotze *et al*, 2007).

Hydrogeomorphic types		Description	Source of water maintaining the wetland[1] Surface	Source of water maintaining the wetland[1] Sub-surface
Floodplain		Valley bottom areas with a well defined stream channel, gently sloped and characterized 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.	***	*
Valley bottom with a channel		Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized 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.	***	*/ ***
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized 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 linked to a stream channel		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.	*	***
Isolated Hillslope seepage		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.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important output in all of the above settings

Water source: * Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on the local circumstances

*/ *** Contribution may be small or important depending on the local circumstances.

Wetland

Using the methodology above the following wetland types were identified on site as shown below in Figure 2-7:

- VB Valley Bottom;
- VBC Valley Bottom with a channel;
- HS Hillslope Seepage Wetland; and
- HSW Hillslope Seepage linked to stream.

2.3.4 Wetland Integrity

The Present Ecological Status (PES) Method (DWA 2005) was used to establish the integrity of the wetlands in the study area and was based on the modified Habitat Integrity approach developed by Kleynhans (1996, 1999 In DWA 2005). The delineated wetland units (as described under section 3.2.1.) were used as the basis to divide the wetlands into different segments to increase the resolution of the integrity assessment.

Table 2-3 shows the criteria for assessing the habitat integrity of palustrine wetlands along with Table 2-4 describing the allocation of scores to attributes and the rating of confidence levels associated with each score. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 2-3: Habitat integrity assessment criteria for palustrine wetlands (DWA, 2005).

Criteria and Attributes	Relevance
Hydrologic	
Flow Modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floralistic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water Quality	
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Hydraulic/Geomorphic	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduce or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.

Criteria and Attributes	Relevance
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, etc.
Total	
Mean	

Table 2-4: Scoring guidelines and relative confidence scores for the habitat integrity assessment for palustrine wetlands (DWA, 2005).

Scoring Guidelines per Attribute	
Natural/Unmodified	5
Largely Natural	4
Moderately Modified	3
Largely Modified	2
Seriously Modified	1
Critically Modified	0
Relative Confidence of Scores:	
Very High Confidence	4
High Confidence	3
Moderate Confidence	2
Marginal/Low Confidence	1

Table 6 provides guidelines for the determination of the Present Ecological Status Category (PESC), based on the mean score determined for Table 2-5. This approach is based on the assumption that extensive degradation of any of the wetland attributes may determine the PESC (DWA, 2005).

Table 2-5: Category's assigned to the scores achieved in the wetland habitat assessment (DWA, 2005).

Category	Mean Score	Category Description
Within generally acceptable range		
A	>4	Unmodified or approximated natural condition.
B	>3 and <=4	Largely natural with few modifications, but with some loss of natural habitats.
C	>2 and <=3	Moderately modified, but with some loss of natural habitats.

Category	Mean Score	Category Description
D	2	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
Outside generally acceptable range		
E	>0 and <2	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
F	0	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

Ecosystem Services Supplied by Wetlands

The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et* al (2009). A Level 2 assessment was undertaken which examines and rates the following services:

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

The characteristics were scored according to the following general levels of services provided:

Table 2-6: Level of service ratings.

Score	Services Rating
0	Low
1	Moderately Low
2	Intermediate
3	Moderately High
4	High

The different wetland units (as delineated under section 2.5) were used as the basis for the level 2 assessment. The assessment was further focussed on those wetland units within the segments of likely impact associated with the different proposed site layouts. The relative importance of the different units, in relation to one another and between the three alternative railway alignments, were then evaluated by summing the number of services regarded as high (scoring levels higher than intermediate). The wetland units with the highest number of important functions were then delineated to facilitate decision making as shown in Figure 2-8. This map indicates that only one area can be deemed pristine with a high integrity rating. This area is only crossed by Alternative 2.

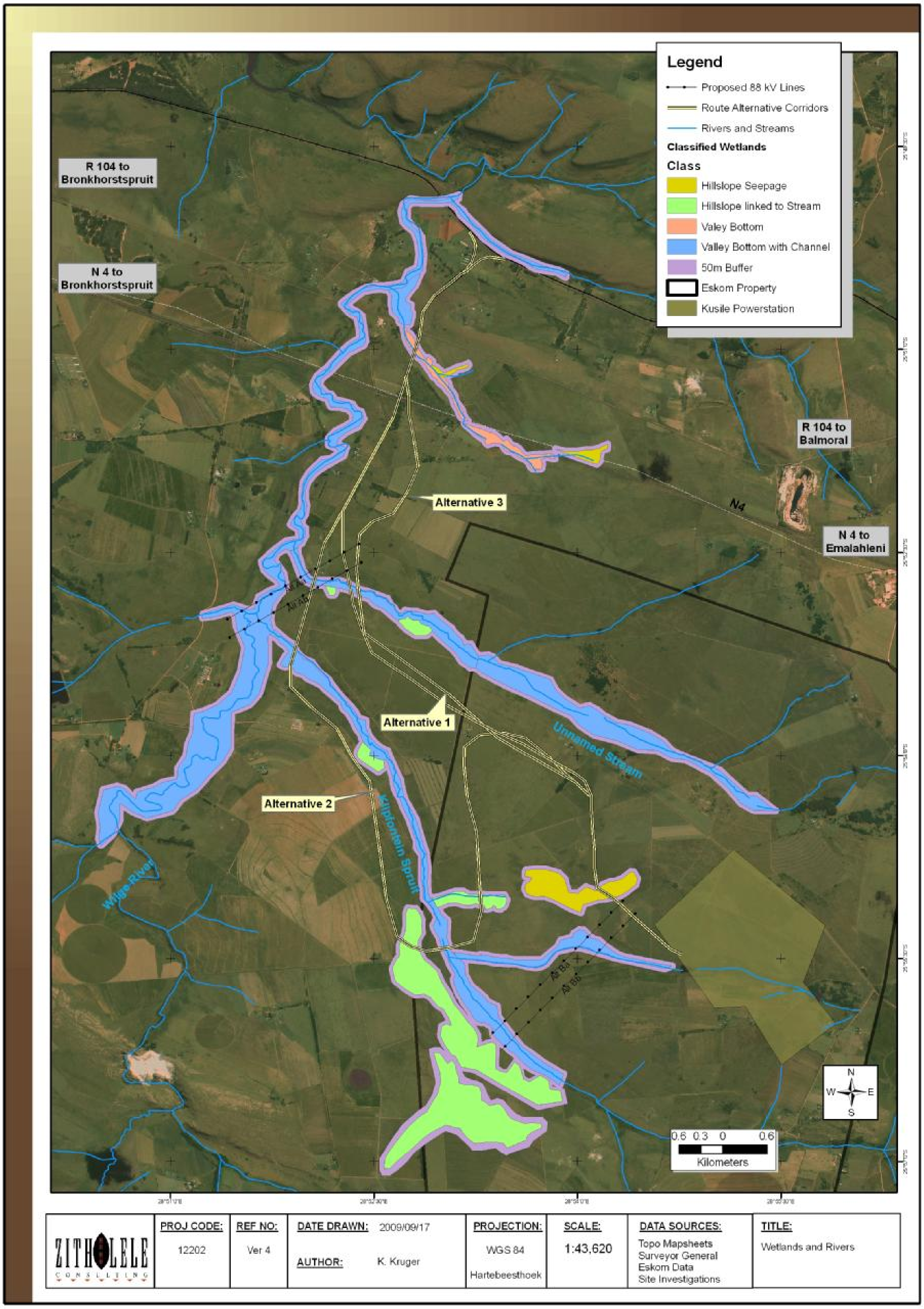


Figure 2-7: Wetlands Delineated and Classified.

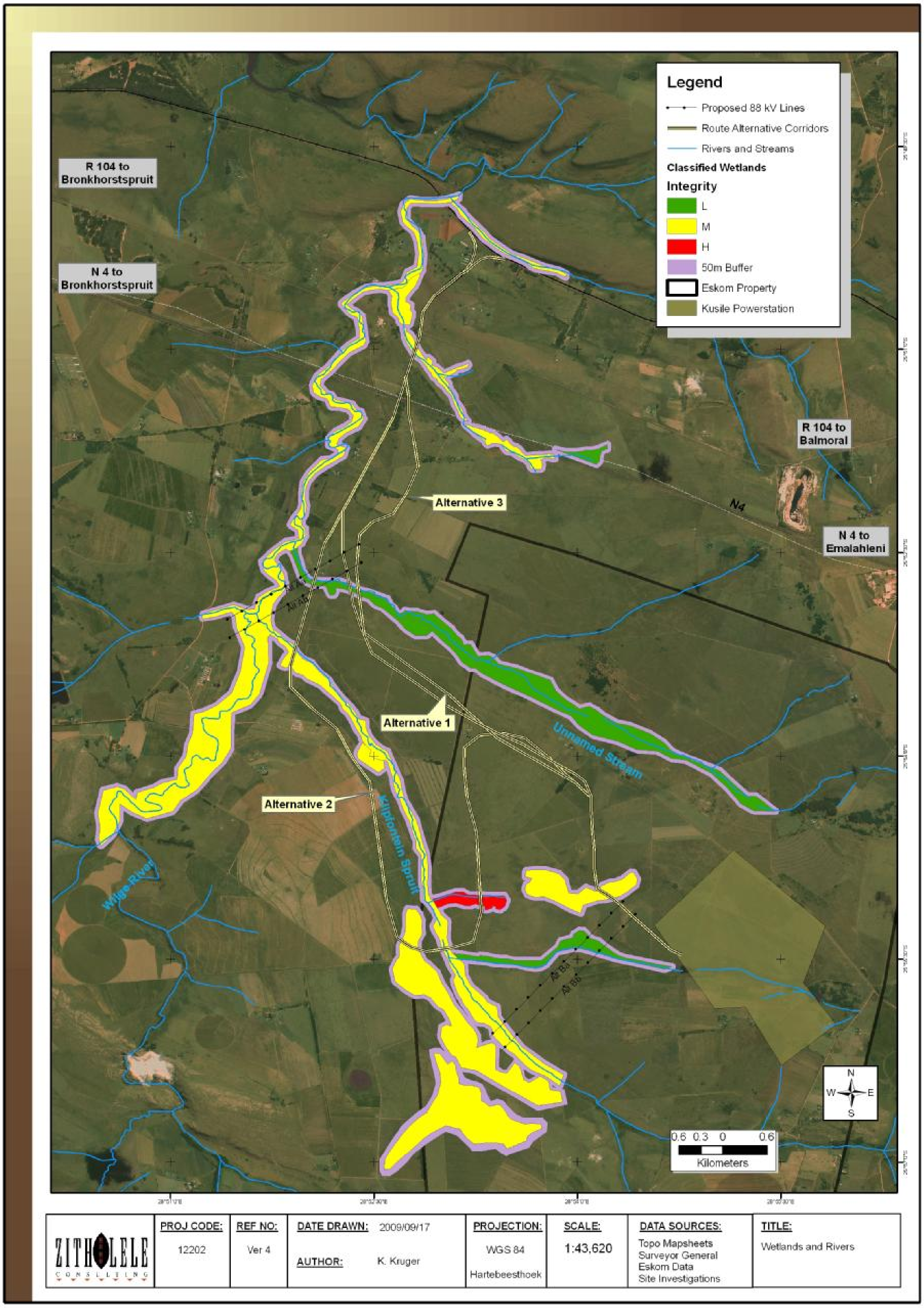


Figure 2-8: Wetland Integrity.

3 IMPACT ASSESSMENT METHODOLOGY

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology was utilised so that a wide rage of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 3-1.

Table 3-1: Quantitative rating and equivalent descriptors for the impact assessment criteria

Rating	Significance	Extent Scale	Temporal Scale
1	VERY LOW	*Isolated sites / proposed site*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

3.1 SIGNIFICANCE ASSESSMENT

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1 000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in Table 3-2 below.

Table 3-2 : Description of the significance rating scale

Rating		Description
5	Very high	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	High	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	Moderate	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	Very low	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity are needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	No impact	There is no impact at all - not even a very low impact on a party or system.

3.2 SPATIAL SCALE

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in Table 3-3.

Table 3-3 : Description of the significance rating scale

Rating		Description
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 5 km from the proposed study area.
2	Study Area	The impact will affect an area not exceeding the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the power line alignments.

3.3 DURATION SCALE

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 3-4.

Table 3-4: Description of the temporal rating scale

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of plant.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

3.4 DEGREE OF PROBABILITY

Probability or likelihood of an impact occurring will be described as shown in Table 3-5 below.

Table 3-5 : Description of the degree of probability of an impact occurring

Rating	Description
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

3.5 DEGREE OF CERTAINTY

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in Table 3-6. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 3-6 : Description of the degree of certainty rating scale

Rating	Description
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.
Don't know	The consultant cannot, or is unwilling, to make an assessment given available information.

3.6 QUANTITATIVE DESCRIPTION OF IMPACTS

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\textbf{\textit{Impact Risk}} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

Table 3-7 : Example of Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
	LOW	*Local*	Medium-term	*Could Happen*	
Impact to air	**2**	***3***	**3**	**3**	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to five classes as described in the table below.

Table 3-8 : Impact Risk Classes

Rating	Impact Class	Description
0.1 – 1.0	**1**	**Very Low**
1.1 – 2.0	**2**	**Low**
2.1 – 3.0	**3**	**Moderate**
3.1 – 4.0	**4**	**High**
4.1 – 5.0	**5**	**Very High**

Therefore with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

3.7 CUMULATIVE IMPACTS

It is a requirement that the impact assessments take cognisance of cumulative impacts. In fulfilment of this requirement the impact assessment will take cognisance of any existing impact sustained by the operations, any mitigation measures already in place, any additional impact to environment through continued and proposed future activities, and the residual impact after mitigation measures.

It is important to note that cumulative impacts at the national or provincial level will not be considered in this assessment, as the total quantification of external companies on resources is not possible at the project level due to the lack of information and research documenting the effects of existing activities. Such cumulative impacts that may occur across industry boundaries can also only be effectively addressed at Provincial and National Government levels.

Using the criteria as described above an example of how the cumulative impact assessment will be done is shown below:

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Initial / Existing Impact (I-IA)	**2**	**2**	**2**	*1*	0.4
Additional Impact (A-IA)	**1**	***2***	**1**	*1*	0.3
Cumulative Impact (C-IA)	**3**	***4***	**2**	*1*	0.6
Residual Impact after mitigation (R-IA)	**2**	***1***	**2**	*1*	0.3

As indicated in the example above the Additional Impact Assessment (A-IA) is the amount that the impact assessment for each criterion will increase. Thus if the initial impact will not increase, as shown for temporal scale in the example above the A-IA will be 0, however, where the impact will increase by two orders of magnitude from 2 to 4 as in the spatial scale the A-IA is 2. The Cumulative Impact Assessment (C-IA) is thus the sum of the Initial Impact Assessment (I-IA) and the A-IA for each of the assessment criteria.

In both cases the I-IA and A-IA are assessed without taking into account any form of mitigation measures. As such the C-IA is also a worst case scenario assessment where no mitigation measures have been implemented. Thus a Residual Impact Assessment (R-IA) is also made which takes into account the C-IA with mitigation measures. The latter is the most probable case scenario, and for the purpose of this report is considered to be the final state Impact Assessment.

3.8 NOTATION OF IMPACTS

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

- Significance or magnitude- IN CAPITALS
- Temporal Scale – in underline
- Probability – *in italics and underlined*.
- Degree of certainty - **in bold**
- Spatial Extent Scale – *in italics*

4 IMPACT ASSESSMENT

The Impact Assessment will highlight and describe the impact to the environment following the abovementioned methodology and will assess the Surface Water and Wetlands components:

The impact assessment was undertaken for the construction, operational and decommissioning phases of the project. The impact of each line/route alternative was also assessed separately, however, where the impact was not significantly different, only one impact assessment was undertaken. The railway line will constitute a single railway line with a single overhead line and an access road (Figure 4-1). According to the design team at Kwezi V3 the impact footprint for such a railway line would be approximitaly 50 m depending on the cut/fill required.

Figure 4-1: Example of what the railway line would look like

4.1 SURFACE WATER AND WETLANDS

4.1.1 Initial Impact

The initial impacts on surface water and wetlands are mostly located around the Kusile power station. A number of dams have been constructed in the water courses, but this appears not to have affected the downstream aquatic environment. With the site is currently undegoing major construction works with the potential to contaminate the surface water through hydrocarbon and dust pollution. In addition the study area is criss-crossed with roads and their associated bridges over the rivers and streams. The construction at the Kusile power station is creating large amounts of dust and this is entering the aquatic system through runoff. The streams to the west of the power station construction site have notibly increased in turbidity over the recent months. This is rated as a **Moderate** impacts as shown in Table 4-1 below.

4.1.2 Additional Impact

The additional impact if the railway line will be most evident at the river and wetland crossings along the route. Alternatives 1 and 3 cross over 2 streams and 1 wetland area, while Alternative 2 crossed over 4 streams and 2 wetland areas. The river and stream crossings will be done by building bridges over the larger features and culverts over the drainage lines. The footings of these structures will be placed within the buffer zones of the surface water features and this impact cannot be avoided. The construction vehicles have a potential to enter the rivers or wetlands and cause damage to the integrity of the systems by destroying vegetation, polluting the water system, increasing turbidity in the water system and the chasing the natural fauna away. This is rated as a **Moderate** impact.

During the operational phase the structures constructed will remain within the buffer zones of the surface water features. These structures will initially alter the banks of the rivers and streams and could alter the flow during storm flow events. Therefore the impacts assessed during the construction phase will persist in terms of the structures on site but the vehicles will not be present. This impact is rated as a **Moderate** impact as shown in Table 4-1.

4.1.3 Cumulative Impact

The cumulative impact of the proposed railway line along with the existing impacts in the area will cumulatively remain a **High** impact as rated in the table below.

4.1.4 Mitigation Measures

- Demarcated areas where waste can be safely contained and stored on a temporary basis during the construction phase should be provided at the hard park;
- When adequate volumes (not more than 1 month) have accumulated all waste is to be removed from site and disposed of at a licensed facility;
- Waste is not to be buried on site;
- Hydro-carbons should be stored in a bunded storage area;
- All hazardous materials *inter alia* paints, turpentine and thinners must be stored appropriately to prevent these contaminants from entering the environment;
- Spill-sorb or similar type product must be used to absorb hydrocarbon spills in the event that such spills should occur;
- Care must be taken to ensure that in removing vegetation adequate erosion control measures are implemented;

- No construction vehicles or activities will be allowed to work within 50 m of any of the streams or wetlands on site, unless this cannot be avoided, then it should only occur under supervision of the ECO;
- Demarcate the no-go areas with tape and ensure that the demarcation remains in place for the duration of the construction works; and
- Use existing river crossings where possible.

4.1.5 Residual Impact

The residual impact if the above mitigation measures are implemented, especially the adherence to the buffer zones could reduce the impact significance and also the probability of the impact. If successfully implemented the impact could be reduced to a **Moderate** impact during the construction and operational phases.

During the closure phase the railway line bridges and structures will be removed, and the initial decommissioning activities will be similar to those during the construction phase, but one the closure and rehabilitation is complete the impact will be a positive one.

Table 4-1: Impact Rating Matrix for Surface Water and Wetlands

Construction phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Initial	Low	Isolated Sites	Long Term	Is happening	**2.3 Moderate**
Additional	Very High	Isolated sites	Long Term	Will happen	**3.3 – High**
Cumulative	Very High	Isolated sites	Long Term	Will happen	**3.3 – High**
Residual	High	Isolated sites	Long Term	Very Likely	**2.4 - Moderate**
Operational Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Additional	High	Isolated sites	Long Term	Will happen	**3 – Moderate**
Cumulative	High	Isolated sites	Long Term	Will happen	**3 – Moderate**
Residual	High	Isolated sites	Long Term	Very Likely	**2.4 - Moderate**
Closure and Rehabilitation Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Residual	High	Isolated sites	Long Term	Very Likely	**2.4 - Moderate**

5 CONCLUSION

In conclusion the proponent proposes to construct and operate a railway line in order to connect the Kusile Power Station to the existing Bronkhorstspruit – Emahlahleni railway line in order to deliver Limestone to the Power Station.

Zitholele Consulting was appointed to investigate the biophysical aspects and Stakeholder sensitivities of the proposed routes. The aspects investigated include topography, surface water and wetlands.

It was found that the major areas of concern were the surface water crossings and habitat fragmentation. Most of the elements analysed indicate that the impacts from Alternative 2 will be larger than the other 2 alternatives as shown in Table 5-1 below.

Table 5-1: Summary of impacts per alternative

Impact	Alt 1	Alt 2	Alt 3
Topography	Moderate	Moderate but more cut and fill required	Moderate
Surface Water and wetlands	Moderate – 2 stream and 1 wetland crossing	High - 4 streams and 2 wetland crossings	Moderate – 2 stream and 1 wetland crossing

Alternative 2 is 8 km longer than the other two alternatives and also crosses more streams and the associated riparian and wetland habitat. It is therefore suggested that either Alternative 1 or 3 be used for the railway line rather that Alternative 2. On the basis of the criteria evaluated there is no difference between Alternative 1 and 3 and either can be utilised.

ZITHOLELE CONSULTING (PTY) LTD

Konrad Kruger Jacqui Hex