October 2009

SOIL AND AGRICULTURAL POTENTIAL SPECIALIST REPORT

SPECIALIST STUDY

PROPOSED KUSILE RAILWAY: SOIL AND AGRICULTURAL POTENTIAL SPECIALIST STUDIES

Proponent: **Eskom Holdings Limited**

Prepared by: **Zitholele Consulting**

FINAL SOIL AND AGRICULTURAL POTENTIAL 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 soil and agricultural potential specialist assessments.

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 elements.

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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.

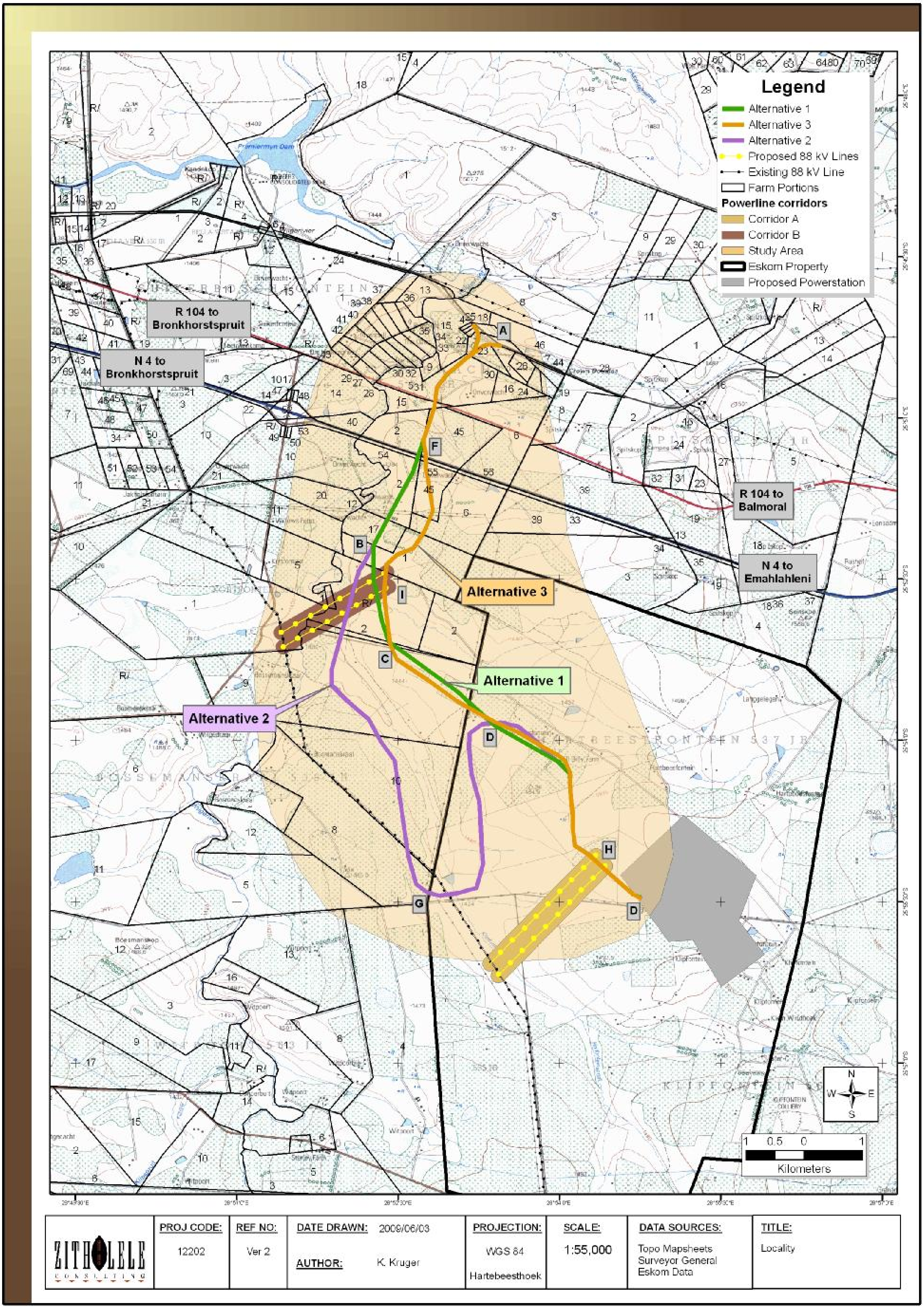

Figure 1-1: Proposed route alternatives for the railway line.

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 Soils and Agricultural Potential assessment.

1.3 STUDY APPROACH

Zitholele Consulting undertook the aforementioned specialist studies during several site visits conducted from the 23rd – 30th March, the 6th – 9th July 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 soil characteristics were sampled.

1.4 PROJECT PERSONNEL

The following project personnel was 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;
- Soils were mapped according to the South African taxonomic system; 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 20 km radius around the study area.

2.1 SOILS

2.1.1 Data Collection

The site visit was conducted in July 2009. Soils were augered at 150m intervals along the proposed railway line routes using a 150 mm bucket auger, up to refusal or 1.2 m. Soils were identified according to Soil Classification; a taxonomic system for South Africa (Memoirs on the Natural Resources of South Africa, no. 15, 1991). The following soil characteristics were documented:

- Soil horizons;
- Soil colour;
- Soil depth;
- Soil texture (Field determination);
- Wetness;
- Occurrence of concretions or rocks; and
- Underlying material (if possible).

2.1.2 Regional Description

The soils in the region are mostly derived from the geology of the region namely, predominantly shale (Silverton formation), sandstone conglomerate (Wilgerivier formation), siltstone (Dwyka formation) or diabase intrusions which feature prominently in the area. The soils are generally shallow with a yellow-brown colour.

2.1.3 Site Description

During the site visit large quantities of soil forms were identified. The soils forms were grouped into management units and are described in detail in the sections below and Figure 2-2 illustrates the location of the soil types. The land capability (agricultural potential) of the abovementioned soil form is described in more detail in Section 2.3.

The management units are broken up into:

- Deep Soils;
- Clay Soils;

- Rocky Soils;
- Transitional Soils; and
- Disturbed Soils.

Rocky Soils

The rocky soils are generally shallow and that overlie an impeding layer such as hard rock or weathering saprolite. These soils are not suitable for cultivation and in most cases are only usable as light grazing. The main soil forms found in rocky soils were Mispah and Glenrosa, each form is described below.

Mispah soil form

The Mispah soil form is characterised by an Orthic A – horizon overlying hard rock. Mispah soil is horizontally orientated, hard, fractured sediments which do not have distinct vertical channels containing soil material. There is usually a red or yellow-brown apedal horizon with very low organic matter content. Please refer to Figure 2-1 for an illustration of a typical Mispah soil form.

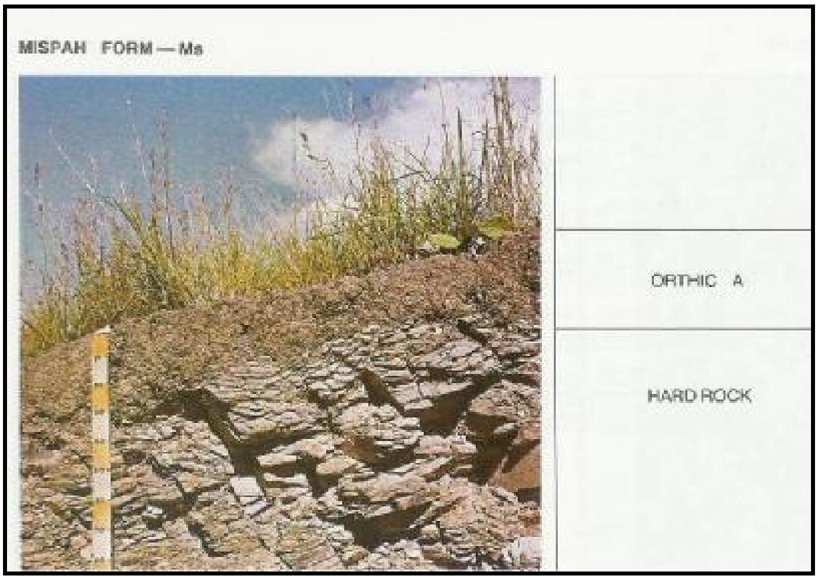

Figure 2-1: Mispah soil form (Soil Classification, 1991).

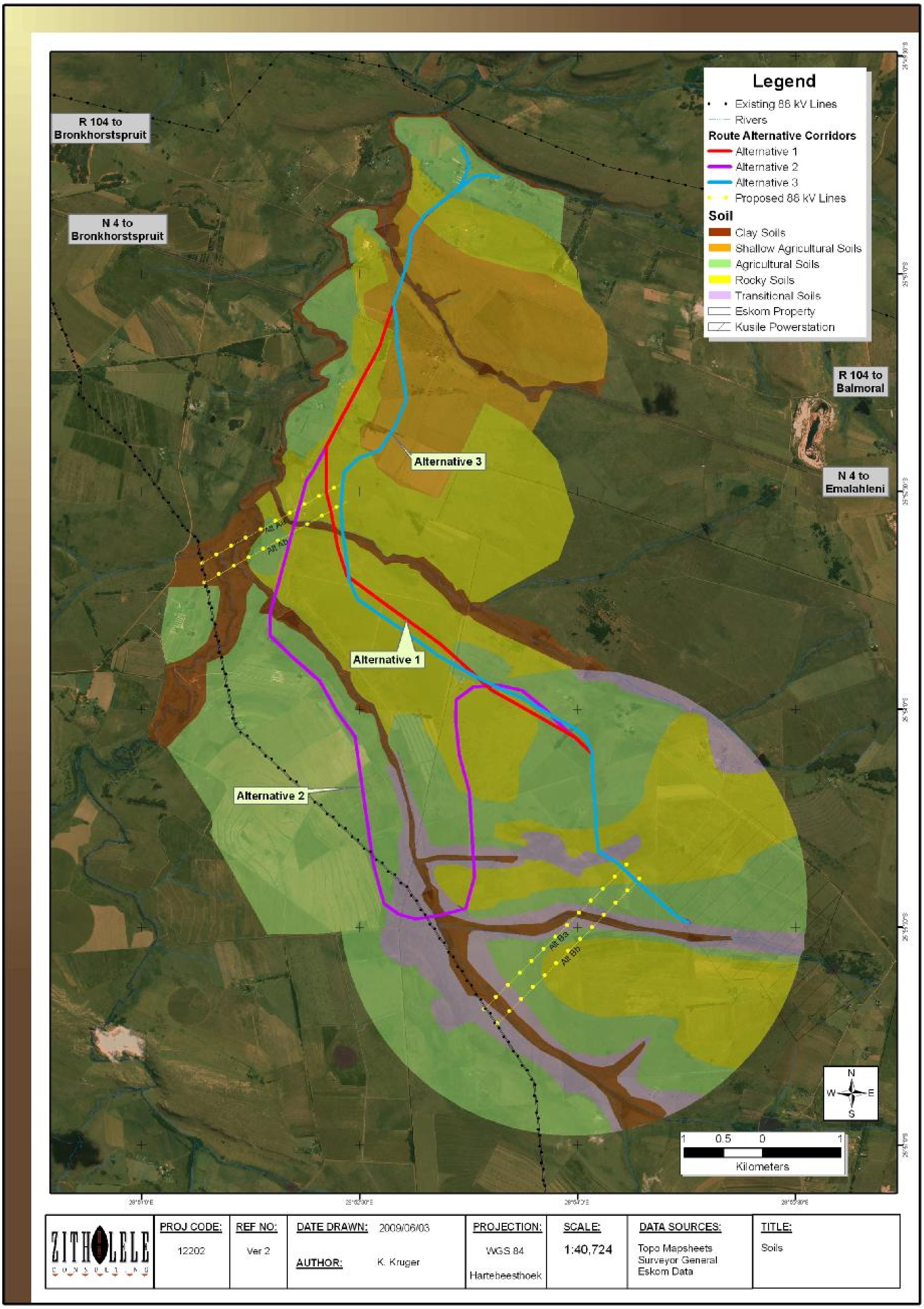

Figure 2-2: Soil Type Map

Glenrosa Soil Form

The Glenrosa soil form is a combination of an Orthic A horizon overlying a lithocutanic B horizon as indicated in Figure 2-3 below. A lithocutanic B has several characteristics that separate it from other horizons, namely:

- It merges into the underlying weathering rock;
- Has a general organisation in respect of colour, structure or consistency that has distinct affinities with the underlying parent rock;
- Has cutanic character expressed usually as tongues or prominent colour variations caused by residual soil formation and illuviation resulting in localization of one or more of clay, iron and manganese oxides;
- Lacks a laterally continues horizon which would qualify as either a diagnostic podzol B, neocarbonate B, pedocutanic B, pedocutanic B, hardpan carbonate or dorbank; and
- If the horizon shows signs of wetness, then more than 25% by volume has saprolitic character.

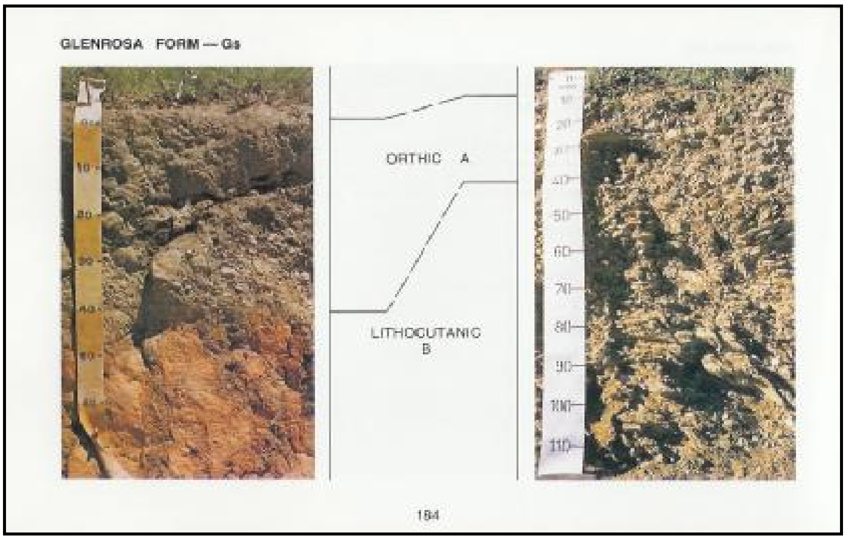

Figure 2-3: Glenrosa Soil Form (Soil Classification, 1991)

<u>Agricultural Soils</u>

The agricultural soils found on site support an industry of commercial maize production. These soils include Clovelly and Avalon. These soils have deep yellow-brown B-horizons with minimal structure. These soils drain well and provide excellent to moderate cultivation opportunities. Each of the soils is described in detail below.

Clovelly Soil Form

Clovelly soils can be identified as an apedal "yellow" B-horizon as indicated in Figure 2-4 below. These soils along with Hutton soils are the main agricultural soil found within South Africa, due to the deep, well-drained nature of these soils. The soils are found on the valley slopes of the site.

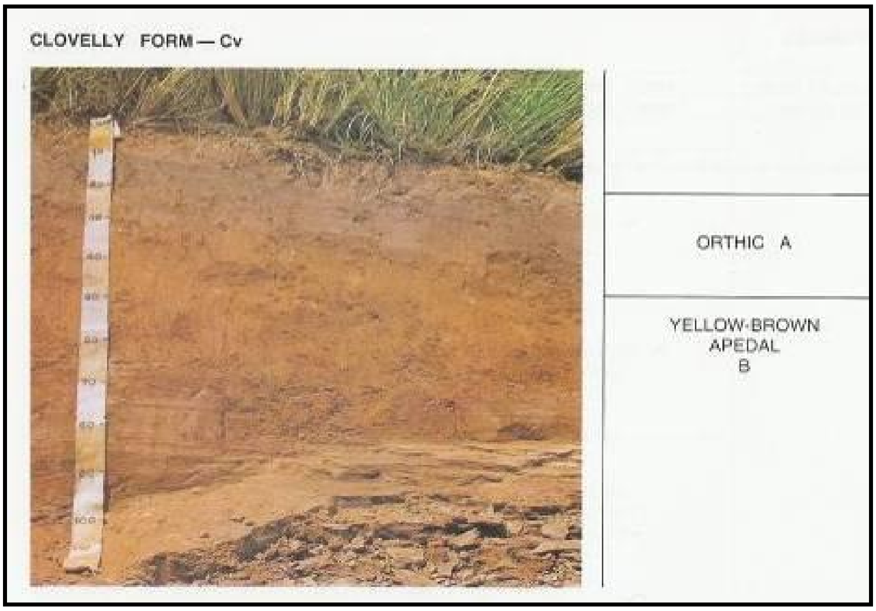

Figure 2-4: Clovelly soil form (Soil Classification, 1991)

Avalon Soil Form

The Avalon soil form is characterised by the occurrence of a yellow-brown apedal B-horizon over a soft plinthic B – horizon (See Figure 2-5). The yellow-brown apedal horizon is the same as described for the Clovelly soil form and the plinthic horizon has the following characteristics:

- Has undergone localised accumulation of iron and manganese oxides under conditions of a fluctuating water table with clear red-brown, yellow-brown or black strains in more than 10% of the horizon;
- Has grey colours of gleying in or directly underneath the horizon; and
- Does not qualify as a diagnostic soft carbonate horizon.

These soils are found between lower down the slopes than the Clovelly soils and indicate the start of the soils with clay accumulation.

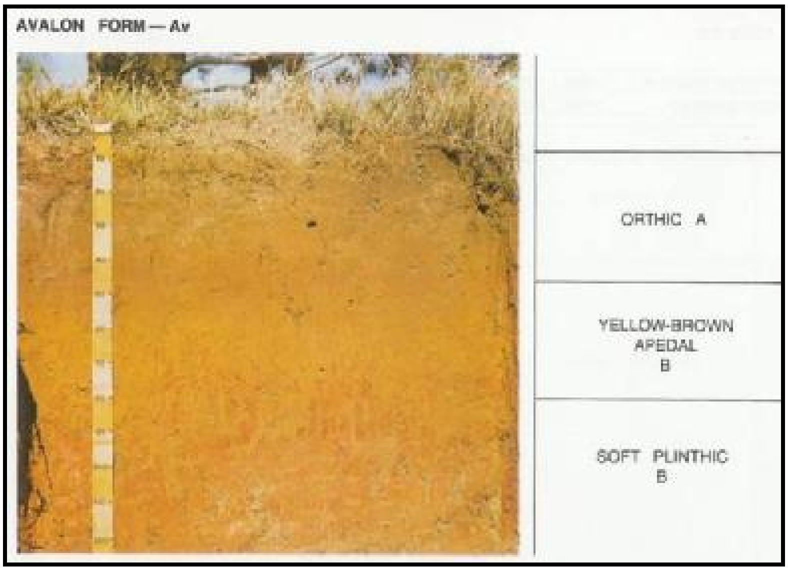

Figure 2-5: Avalon Soil Form (Soil Classification, 1991)

Transitional Soils

The transitional soil management unit comprises the soils found between clay soils and the agricultural soils. These soils often have signs of clay accumulation or water movement in the lower horizons. These soils are usually indicative of seasonal or temporary wetland conditions. The main soil forms found in transitional soils were Kroonstad, Wasbank, Longlands and Westleigh, each form is described below.

Kroonstad Soil Form

The Kroonstad soil form is most commonly found in areas of semi-permanent wetness. The soil is made up of an Orthic A horizon over a diagnostic E-horizon over a G-horizon, as indicated in Figure 2-6 below. The G-horizon has several unique diagnostic criteria as a horizon, namely:

- It is saturated with water for long periods unless drained;
- Is dominated by grey, low chroma matrix colours, often with blue or green tints, with or without mottling;
- Has not undergone marked removal of colloid matter, usually accumulation of colloid matter has taken place in the horizon;
- Has a consistency at least one grade firmer than that of the overlying horizon;
- Lacks saprolitic character; and
- Lacks plinthic character.

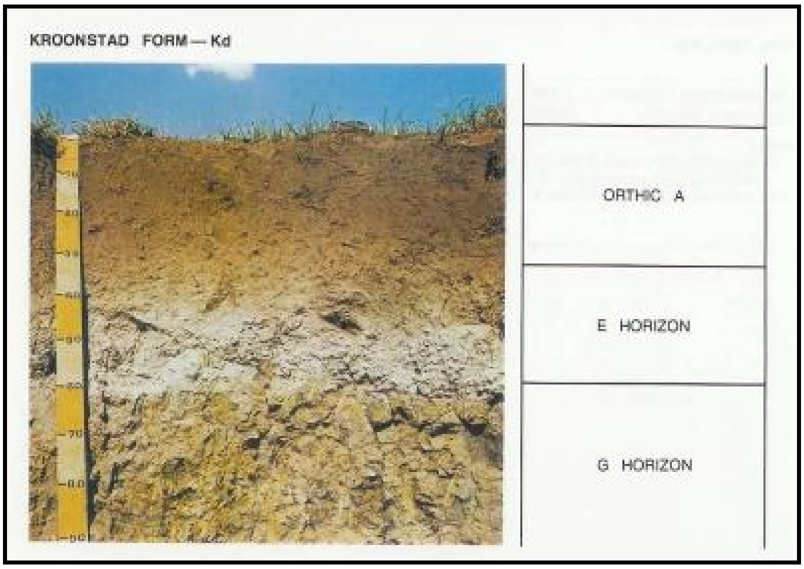

Figure 2-6: Kroonstad Soil Form (Soil Classification, 1991)

Longlands Soil Forms

The Longlands soil forms are all typified by an eluvial (E) horizon over a soft plinthic horizon (as described above). The E-horizon is a horizon that has been washed clean by excessive water movement through the horizon and the plinthic horizon as undergone local accumulation of colloidal matter (refer photo below). Please refer to Figure 2-7 and Figure 2-8 for an illustration of the soil form.

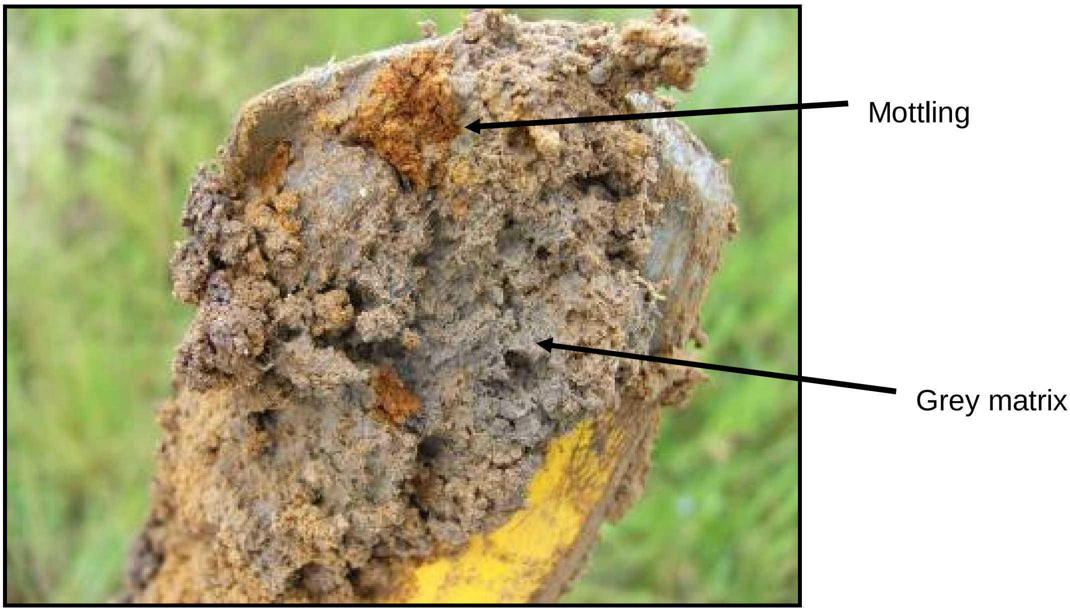

Figure 2-7: Soft plinthic B-horizon.

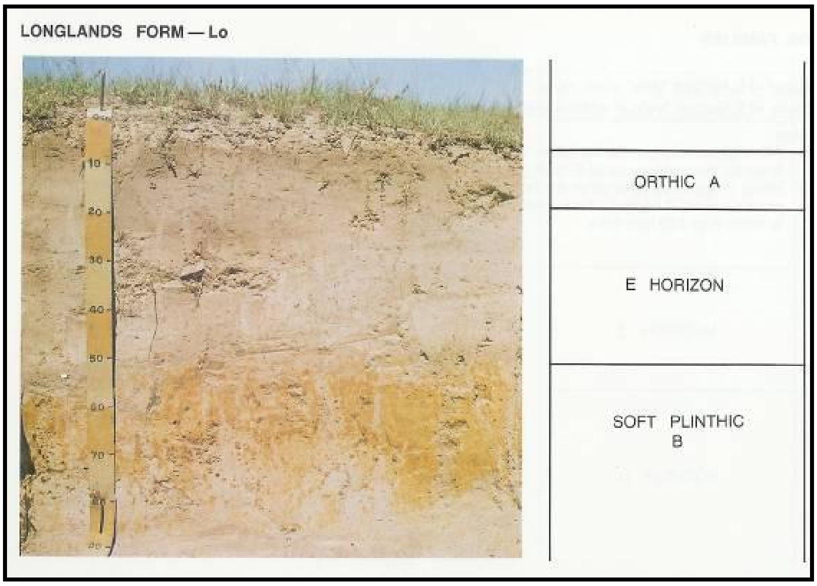

Figure 2-8: Longlands Soil Form (Soil Classification, 1991)

Wasbank Soil Form

The Wasbank soil form is found in close proximity to the Longlands soil form and is typified by an Orthic A-horizon over an E-horizon (as described above) over a Hard Plinthic B-horizon. The Hard Plinthic B-horizon develops when a Soft Plinthic horizon is subjected to a prolonged dry period and the accumulated colloidal matter hardens, almost irreversibly. The Wasbank soil form is illustrated in Figure 2-9 below.

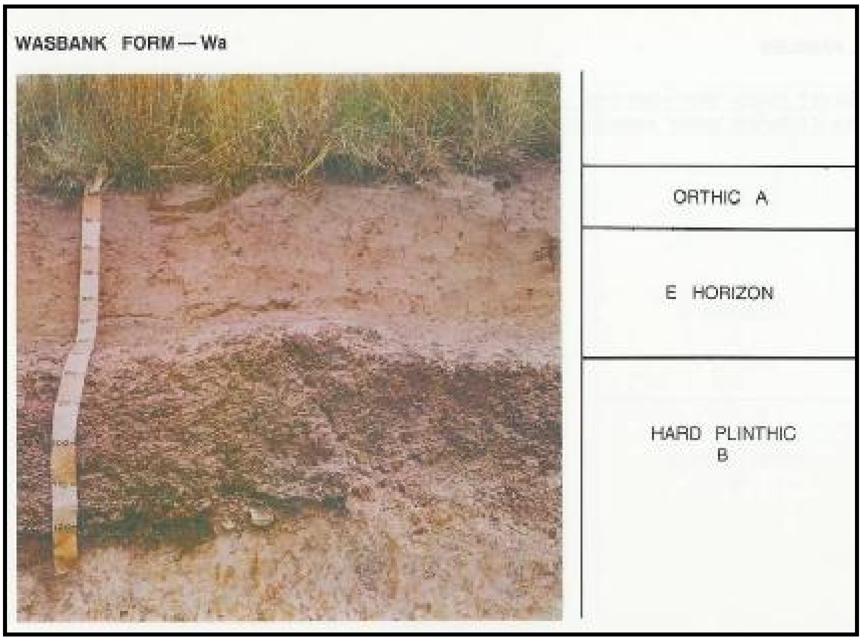

Figure 2-9: Wasbank Soil Form (Soil Classification, 1991)

Westleigh Soil Forms

Westleigh soils are characterised by an orthic A-horizon over a soft plinthic B-horizon and is found in areas between good agricultural soils and clay soils and the movement of water determines the characteristics of the soil.

Figure 2-10: Westleigh Soil Form (Soil Classification 1991)

Clay Soils

The clay soil management unit is found in areas where clays have accumulated to such an extent that the majority of the soil matrix is made up of clay particles. These soils are usually indicative of seasonal or permanent wetland conditions. The main soil forms found in clay soils were Katspruit and Willowbrook, each form is described below. These soils are saturated with water and must be noted to be unstable for construction and are sensitive.

Katspruit Soil Form

The Katspruit soil form is most commonly found in areas of semi-permanent wetness. The soil is made up of an Orthic A-horizon over a diagnostic G-horizon and is indicated in Figure 2-11 below. The G-horizon has several unique diagnostic criteria as a horizon, namely:

- It is saturated with water for long periods unless drained;
- Is dominated by grey, low chroma matrix colours, often with blue or green tints, with or without mottling;
- Has not undergone marked removal of colloid matter, usually accumulation of colloid matter has taken place in the horizon;

- Has a consistency at least one grade firmer than that of the overlying horizon;
- Lacks saprolitic character; and
- Lacks plinthic character.

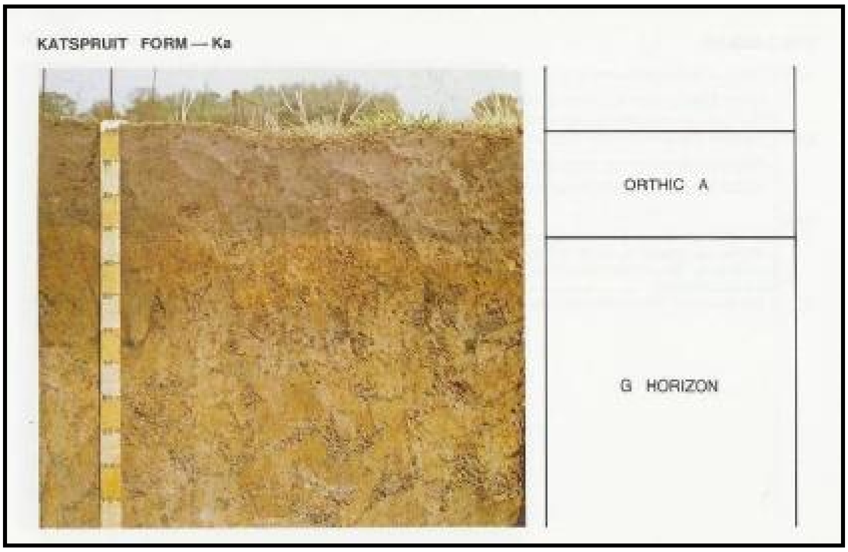

Figure 2-11: Katspruit Soil form (Soil Classification, 1991)

Willowbrook Soil Form

Willowbrook soils are characterised by Melanic A-horizon over a G-horizon. The G-horizon is invariably firm or very firm and its characteristics are described above. The Melanic horizon has several unique diagnostic criteria as a horizon, namely:

- Has dark colours in the dry state.
- Lack slickensides that are diagnostic of vertic horizons.
- Has less organic carbon than required for diagnostic organic O horizon.
- Has structure that is strong enough so that the major part of the horizon is not both massive and hard or very hard when dry.

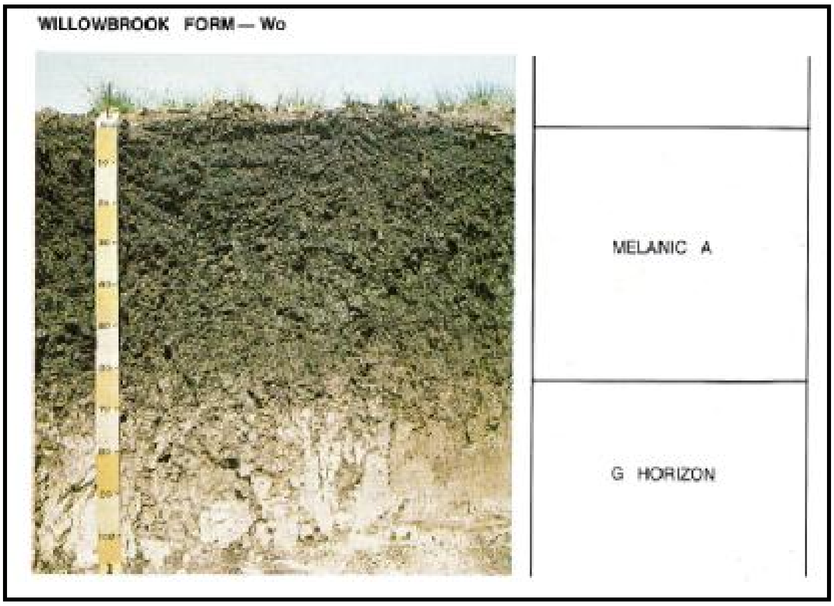

Figure 2-12: Willowbrook Soil Form (Soil Classification 1991)

2.2 AGRICULTURAL POTENTIAL (LAND CAPABILITY)

2.2.1 Data Collection

A literature review was conducted in order to obtain any relevant information concerning the area, including information from the Environmental Potential Atlas (ENPAT), Weather Bureau and Department of Agriculture. Results from the soil study were taken into account when determining the agricultural potential also known as the land capability of the site. The land capability assessment methodology as outlined by the National Department of Agriculture was used to assess the soil's capability to support agriculture on site.

2.2.2 Regional Description

The regional land capability is mostly class II soils with few limitations. This is evident in the large number of cultivated lands found in the region. In the areas where the soil is too shallow or too wet to cultivate, livestock are grazed.

2.2.3 Site Description

According to the land capability methodology, the potential for a soil to be utilised for agriculture is based on a wide number of factors. These are listed in the table below along with a short description of each factor.

Table 2-1: Agricultural Potential criteria

Criteria	Description
Rock Complex	If a soil type has prevalent rocks in the upper sections of the soil it is a limiting factor to the soil's agricultural potential
Flooding Risk	The risk of flooding is determined by the closeness of the soil to water sources.
Erosion Risk	The erosion risk of a soil is determined by combining the wind and water erosion potentials.
Slope	The slope of the site could potentially limit the agricultural use thereof.
Texture	The texture of the soil can limits its use by being too sandy or too clayey.
Depth	The effective depth of a soil is critical for the rooting zone for agricultural crops.
Drainage	The capability of a soil to drain water is important as most grain crops do not tolerate submergence in water.
Mechanical Limitations	Mechanical limitations are any factors that could prevent the soil from being tilled or ploughed.
pH	The pH of the soil is important when considering soil nutrients and hence fertility.
Soil Capability	This section highlights the soil type's capability to sustain agriculture.
Climate Class	The climate class highlights the prevalent climatic conditions that could influence the agricultural use of a site.
Land Capability / Agricultural Potential	The land capability or agricultural potential rating for a site combines the soil capability and the climate class to arrive at the sites potential to support agriculture.

The soils identified in Section 2.2 above were classified according to the methodology proposed by the Agricultural Research Council – Institute for Soil, Climate and Water (2002). The criteria mentioned above were evaluated in the table below. The site is made up of two main land capability classes, namely class II and III – cultivation and class VI – grazing. The class II and III soils are suitable for cultivation and can be used for a range of agricultural applications. The class VI soils have continuing limitations that cannot be corrected; in this case rock complexes, flood hazard, stoniness, and a shallow rooting zone constitute these limitations. Figure 2-13 illustrates the various land capability units on site.

Table 2-2: Land Capability of the soils within the study site

Soil	Agricultural	Transitional	Rocky	Clay
% on Site	37.4 % (2088 ha)	10,3 % (575 ha)	43.9 % (2446 ha)	8.4 % (468 ha)
Rock Complex	None	None	Yes	None
Flooding Risk	No	Moderate	No	Very Limiting
Erosion Risk	Low	High	High	Very Low
Slope %	3.9	3.7	4.0	0.5
Texture	Loam	Loam	Loam	Clay

Soil	Agricultural	Transitional	Rocky	Clay
Effective Depth	> 100 cm	> 60 cm	< 60 cm	< 60 cm
Drainage	Good drainage	Imperfect	Good drainage	Poorly drained
Mech Limitations	None	None	Rocks	None
pH	> 5.5	> 5.5	> 5.5	> 5.5
Soil Capability	Class II	Class III	VI	VI
Climate Class	Mild	Mild	Mild	Mild
Land Capability	Class II – Arable Land	Class III – Moderately Arable Land	Class VI – Moderately Grazing Land	Class VI – Moderately Grazing Land

No limitation	Low	Moderate	High	Very Limiting

As shown in the table above, the bulk of the site comprises agricultural and rocky soils. With regards to the various alternatives that are investigated for the proposed project, the length of route is given below for each soil unit.

Table 2-3: Agricultural Impact per route

Route	Agricultural	Transitional	Rocky	Clay
Alternative 1	33 %	1.4 %	64.5 %	1.1 %
Alternative 2	41.7 %	9.6 %	45.3 %	3.4 %
Alternative 3	32.2 %	1.4 %	65.3 %	1.1 %

From the table above it is clear that Alternative 1 and 3 have very similar impacts, which was expected considering the similarity between the alignment of the two routes. Alternative 2 does have a higher impact on agricultural soils and also higher on clay and transitional soils. In addition Alternative 2 is the longer (± 7 km) than the other alternatives, it also represents the longest impact and should on this basis not be considered.

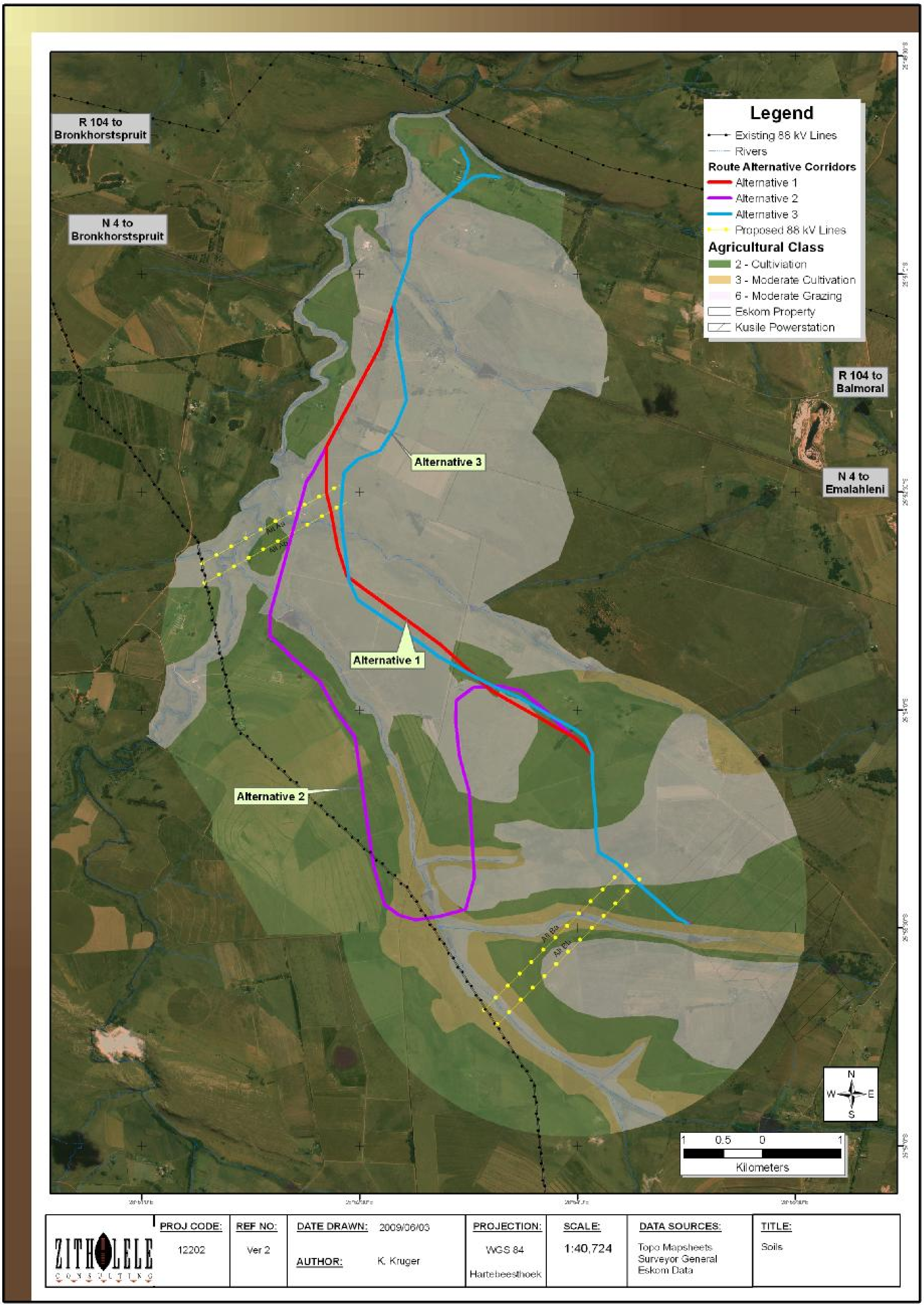

Figure 2-13: Agricultural Potential Map

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:

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

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**	<u>*1*</u>	0.4
Additional Impact (A-IA)	**1**	***2***	<u>**1**</u>	<u>*1*</u>	0.3
Cumulative Impact (C-IA)	**3**	***4***	<u>**2**</u>	<u>*1*</u>	0.6
Residual Impact after mitigation (R-IA)	**2**	***1***	<u>**2**</u>	<u>*1*</u>	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 – <u>in underline</u>
- Probability – <u>*in italics and underlined*</u>.
- 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 following components:

- Topography; and
- Soils and Agricultural Potential

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 SOILS AND AGRICULTURAL POTENTIAL

4.1.1 Initial Impact

As mentioned above, the site is presently being developed into the Kusile Power Station. The section of soils that will be crossed by the power line alternatives are presently not impacted by the construction of the power station, but in the near future the construction of the power plant will extend westward. Other existing impacts are the existing power line pylon footings and cultivation of soils for mainly maize and fodder. The soils underneath the Kusile Power Station site will become sterile and cannot be used for the land capability that the soils possess. This impact is rated as a HIGH negative impact that occurs on *isolated sites* and will remain for the long term. The impact ***has already occurred*** and is therefore rated as a **High impact.**

4.1.2 Additional Impact

The additional impacts to soils and agricultural potential during construction of the railway line include the clearing of vegetation in the railway servitude, compaction and levelling of the soil, covering of the soil by the ballast stones and the construction of the access road and power line adjacent to the railway line. The clearing of the soil could potentially results in erosion as the vegetation is removed, exposing the soil to the elements. Furthermore the construction vehicles have the potential to compact the soil by their movements or pollute the soil by spilling hydrocarbons. Both of these impacts significantly reduce the agricultural potential of soils. The placing of the ballast on the soil creates a long term impact that renders the underlying soil sterile and useless in terms of agriculture. Furthermore the establishment of a linear impact like a railway line will divide the farmland and in several places, farms are divided in half, and neither half can operate as an economic unit, therefore rendering a larger area not suitable to agriculture (in this specific cases – grazing land for livestock).

The impacts described above are similar for all the alternatives, but due to the fact that Alternative 2 is significantly longer in length (8 km) than the other two alternatives, it is recommended that the impact be minimised by selecting one of the shorter routes.

The additional impact to soils and agricultural potential during the construction phase is a HIGH negative impact occurring *study area* and acting in the long term. This impact *will occur* and as such is rated as a **High** impact.

During the operational phase the impacts described above will remain, but the construction vehicles will be replaced with the potential for spillage from the train. Therefore the impact is rated the same as above.

During the rehabilitation and closure phase the ballast will be removed along with the rest of the railway line infrastructure. With proper rehabilitation the soils could be re-established as an agricultural resource. The rehabilitation will be a major positive impact rated as a **High** positive impact as indicated in Table 4-1.

4.1.3 Cumulative Impact

The cumulative impact during the construction phase remains as assessed above as the impact stretches over the study site. Therefore the impact remains a **High** impact. The same is applicable for the closure phase.

4.1.4 Mitigation Measures

- Ensure that all machinery on site is in a good working order;
- Limit all activities to the proposed railway line servitude;
- Ensure that adequate storm water control measures are in place to prevent erosion;
- Avoid placement of ballast on the clay soils;
- Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling area in the hard park;
- Oil-contaminated soils are to be removed to a contained storage area and bio-remediated or disposed of at a licensed facility;
- If soils are excavated for the cut operations, ensure that the soil is utilised elsewhere for rehabilitation/road building/fill purposes; and
- Ensure that soil is stockpiled in such a way as to prevent erosion from storm water.

4.1.5 Residual Impact

The residual impact with the successful implementation of the mitigation measures mentioned above will be slightly less significant as the probability reduces slightly. Therefore the rating reduces to **Moderate.** This is relevant for both the construction and operational phases.

Table 4-1: Impact Rating Matrix for Soils and agricultural potential

Construction phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Initial	High	Isolated sites	Long Term	Is Occurring	**3 - Moderate**
Additional	High	Study site	Long Term	Will occur	**3.3 - High**
Cumulative	High	Study site	Long Term	Will occur	**3.3 - High**
Residual	High	Study site	Long Term	Very Likely	**2.7 - Moderate**
Operational Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Additional	High	Study site	Long Term	Will occur	**3.3 - High**
Cumulative	High	Study site	Long Term	Will occur	**3.3 - High**
Residual	High	Study site	Long Term	Very Likely	**2.7 - Moderate**
Closure and Rehabilitation Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Residual	High	Isolated sites	Long Term	Will occur	**3 - 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, soils and agricultural potential.

It was found that the major areas of concern were the loss and fragmentation of agricultural land. 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
Soils	Moderate	Moderate but longer route and therefore more impact	Moderate
Agricultural Potential	Moderate	Moderate but longer route and therefore more impact	Moderate

Alternative 2 is 8 km longer than the other two alternatives and also crosses more streams and the associated riparian and wetland habitat. This line also traverses the longest section of agricultural land. 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

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