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ASSESSMENT OF AGRICULTURAL IMPACT ON THE PROPOSED CONSTRUCTION OF A 400KV 250KM BUROTHO-NZHELELE POWERLINES IN THE LIMPOPO PROVINCE

Submitted

To

NZUMBULULO HERITAGE SOLUTIONS

PREPARED BY

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EXECUTIVE SUMMARY

Project justification

A vibrant agricultural sector contributes significantly to sustainable use of natural resources and economic growth in a country. However, to remain competitive and economically viable in a globalised integrated world, agricultural development in a country will have to run concurrently with sustainable utilization and management of its resource, amidst the demand of the same resources for other developmental projects.

Competing demands are currently placed on available land as a result of local economic development programmes. Agricultural land is a valuable resource and must be used responsibility. To minimize loss of high potential and prime agricultural lands that may result from non-agricultural development projects, it is imperative to assess the impact of such projects on critical resources at the site.

Project background

Preliminary studies by Eskom Holdings identified three powerline routes namely Route 1 (Western Corridor); Route 2 (Eastern Corridor) and Route 3 (Central Corridor) which needs to be investigated in order to select the best route in terms of impact on agriculture. Construction of the powerline will link Burotho substation located south in Ga-Malebana in Mokopane to Bokmakierie substation in Nzhelele in the Limpopo Province. In line with the above-stated issues, JODEMS Agri Pioneers CC, Limpopo Province was mandated by Nzumbululo Heritage Solutions to assess the agricultural potential impacts of the proposed routes and select the corridor that will result in minimal impact on agricultural productivity. This assessment is essential as it will contribute to meeting the requirements of the *National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) in* compliance with *Regulation 387 of 21 April 2006, promulgated in terms of Section 24 (5) of NEMA. It will also address some aspects of the Subdivision of the Agricultural Land Act No. 70 of 1970.*

Methodology

To facilitate the studies, JODEMS Agri Pioneers focused on the following key aspects:

- Review of project background,
- Review of land-use practices on the land through which the corridors will traverse,
- Evaluation of the agro-ecology of the study area viz., climate, geology, land types, current soil fertility, water resources, topography, vegetation on the farm,
- Determine of infrastructure profile of the study area,
- Application of the criteria for assessing agricultural potential and
- Recommendations on the best powerline route.

Findings

The studies revealed the following:

- The three powerline corridors traverse an area which would be classified as high potential due to the presence of irrigated farms. However, on relative terms, the eastern corridors traverses more irrigated fields than the western and central corridors and there is also the presence of wetland across this corridor. Hence, to avoid significant disturbance, the eastern corridor will be the one to avoid.
- The dominant landtype where the three corridors area separated is Bd51 and to the southern portion, there is a localised patch of landtype Ae277. The three powerline corridors traverse approximately similar landtypes within the study area.

- The three powerline corridors traverse fairly similar land capability class which is the low to moderate class. There is however localised pockets of moderate to high capability class within the corridors which is found in more concentration under the eastern corridor. Considering the extent of agricultural potential impact, the construction of powerline along the western and central corridors will have a significantly less impact than that of the eastern corridor.
- The three powerline corridors experiences relatively similar geology to a large extent except some localised patched in the southern and northern portions.
- The three powerline corridors have similar water resources class and are affected similarly by annual precipitation. The precipitation received at the study area is relatively low and supplementary water supply through irrigation will be required if successful crop production is to take place. The study area has the potential for irrigation development
- The three powerline corridors traverse similar and dominant vegetation type, the Makhado Sweet Bushveld. In addition to this, the eastern corridor experiences a significant patch of the Polokwane Plateau Bushveld to the south. The quality of the grass under the Makhado Sweet Bushveld in term of feeding is generally low whereas that of the Polokwane Plateau Bushveld is high. On relatively terms, avoiding the eastern corridor will result in minimal disturbance of the quality of grass compared to that of the western and central corridors.

Conclusions

By definition of parameters of land as stipulated by the Subdivision of Agricultural Land Act, No. 70 of 1970 and the Amended Regulation of Conservation of Agricultural Resources Act No. 43 of 1983 and Part 1 of the Regulation of Conservation of Agricultural Resources Act 43 of 1983), the land occurring under the three corridors at the project sites consists of combination of areas classified as high and low potential for agriculture for the following reasons:

- The high potential soils are the results of the presence of important soil forms such as Hutton, Avalon and Bainsvlei with depths exceeding 750mm. The remaining soil forms under the powerlines are not classified as high potential.
- The three powerline corridors traverse approximately similar landtypes and land capability within the study area. The eastern corridor however has relatively higher land capability and must be avoided.
- The water resources in the study area do not differ among the three corridors and there is a potential for the development of irrigations systems for each of the three routes. This renders the corridors high agriculture potential area according to the classification of potential agricultural land. However, on relative terms, the western corridors traverses more irrigated fields than the western and eastern corridors and hence will be the one to avoid.
- The three powerline corridors traverse similar and dominant vegetation type, the Makhado Sweet Bushveld. In addition to this, the eastern corridor experiences a significant patch of the Polokwane Plateau Bushveld to the south. The quality of the grass under the Makhado Sweet Bushveld in term of feeding is generally low whereas that of the Polokwane Plateau Bushveld is high. On relatively terms, avoiding the eastern corridor will result in minimal disturbance of the quality of grass compared to that of the western and central corridors.

Recommendation

All things being equal, and based on the findings and information gathered from the study area, the western corridor is recommended based on potential impact on agriculture.

1.0 INTRODUCTION

1.1. Project Background

Preliminary studies by Eskom Holdings identified three powerline routes namely Route 1 (Western Corridor); Route 2 (Eastern Corridor) and Route 3 (Central Corridor) and which needs to be investigated in order to select the best route in terms of impact on agriculture. Construction of the powerline will link Burotho substation located south in Ga-Malebana in Mokopane to Bokmakierie substation in Nzhelele in the Limpopo Province. The total distance between the two substations is approximately 196. 3km. This study specifically focuses on the potential impact on agricultural productivity as a result of the construction of the proposed powerline.

1.2. Study justification

A vibrant agricultural sector contributes significantly to sustainable use of natural resources and economic growth in a country. However, to remain competitive and economically viable in a globalised integrated world, agricultural development will have to run concurrently with sustainable utilization and management of its resource, amidst the demand of the same resources for other developmental projects in the province. Both agricultural and industrial development entails numerous trade-offs in relation to sustainable resource utilization.

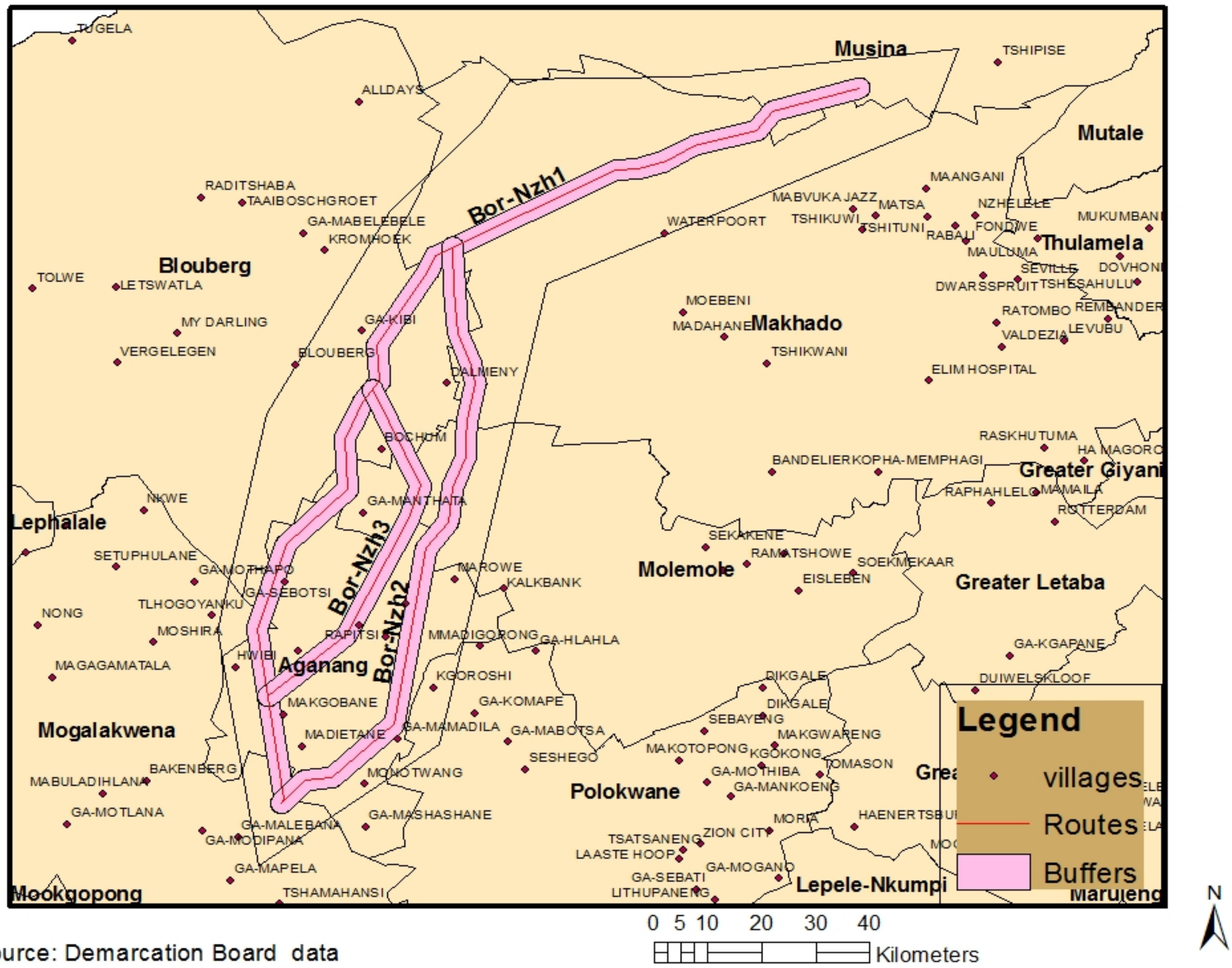
The greater part of the Limpopo Province is semi-arid and has limited arable land for food production. In addition, competing demands are currently placed on available land as a result of local economic development programmes. These demands include: landuse for urbanization, agriculture, mining, growth in the industrial and the manufacturing sector, human settlement and demographics, transportation network, and protected areas for conservation. The high increase in human population as result of immigration from countries north of South Africa is further placing considerable pressure on land resource in the province. Notably, the demand for energy by the ever-growing consuming public constitutes a significant pressure on natural resources in recent years. This challenge has compelled ESKOM to increase its capacity to provide affordable electricity to newly developing areas within South Africa.

The construction of the proposed Borotho-Nzhelele powerline to meet energy needs will impact significantly on some agricultural lands. To minimize loss of prime agricultural lands that may result from powerline construction, it is imperative to assess the impact of such projects on critical resources. Three powerline routes have been proposed and the one with minimal impact is to be recommended, hence the requirement for the present study.

1.3. Project location

The three proposed route corridors are presented in the locality map below:

Locality map of the investigated area



Source: Demarcation Board data

The Western (Route 1) and Eastern (Route 2) corridors commenced separately from a common power substation on farm Noord Baraband 774LR which is located in the Mogalakwena Local Municipality in south western portion of the study area and continues in the north-eastern direction until Blouberg where the two routes merge on farm Oog van brakrivier 426 MS. From this farm, only a single route continues through Makhado Municipality until the final destination in Nzhelele in the Vhembe District. The total distance traverse by the eastern corridor is 120.1km. The Central corridor (Route 3) on the other hand emanates from route 1 at Makgobane around Aganang and merges again with route 1 around Blouberg. The distance traversed by the proposed Central corridor is about 69.1 km. The estimated total distance for the routes is 250km.

2.0. PROJECT OBJECTIVES

2.1 Main objective

The main objective of the study is to assess the agricultural impact as a result of a construction of a powerline at the proposed site of study and select the site with the least impact.

2.2 Specific objective

The specific objective is to select from three proposed corridors, western, eastern and central, the corridor that will result in the minimum impact with regard agricultural productivity.

3.0 METHODOLOGY

Assessment of agricultural potential of the study area was based on a combination of desktop studies to amass general information and then through helicopter survey, site visit for status quo assessment, and also the validation of generated information from the desktop studies.

3.1 General information

Pertinent information on the study area was obtained through a combination background information review, public database and literature as well as GIS information. The information amassed includes the following:

i. Definition of parameters of land as stipulated by the Subdivision of Agricultural Land Act, No. 70 of 1970 and the Amended Regulation of Conservation of Agricultural Resources Act No. 43 of 1983.
ii. Classification of high potential agricultural land in South Africa compiled by the Agricultural Research Council (Schoeman, 2004) for the National Department of Agriculture.
iii. Geophysical features of the site using Geographical Information System and walkover survey.
iv. Moisture availability class, determined through seasonal rainfall and fraction of the potential evapo-transpiration (ARC, 2002).

3.2 Site visit

The project site was traversed by a helicopter flight, vehicle and on foot to document the following:

i. Current landuse of the project site.
ii. Soil characteristics, vegetation profile, water resources, terrain type and infrastructural profile.

    The classification of soils at the project site was based on Landtype description and the Binomial System for South Africa. This classifies soils into forms and families based on the diagnostic horizon of the soil profile. A soil auger was used to assess soil depths at pre-determined distances during the walk-over survey on the property.
iii. Other agro-ecological factors prevailing in the area including surface water.

3.3 Determination of Agricultural potential

3.3.1 National assessment criteria

The amount of suitable agricultural lands for plant and livestock production in South Africa is dwindling and this trend needs to be halted and reversed. Interventions that will retain high potential and prime lands as much as possible are required for sustainable agricultural production for future generations. South Africa is generally dominated by shallow soils which are predominantly sandy. This poses a severe inherent limitation to crop production. The poor quality of the soil in South Africa is primarily due to the influence of the parent material from which they were formed. According to Laker (2005), South Africa has only 13 % (approximately 14 million ha) arable land, of which only 3 % is considered to be high potential. Inferring from the international requirement of about 0.4 ha arable land to feed an individual person, South Africa could produce enough food to feed only 35 million people on the available 14 million hectares of arable land. In line with this goal, the Department of Agriculture has developed a set of criteria to define and preserve potential and prime areas for agricultural development in South Africa, as listed below:

- By definition, based on Part 1 of the Regulation of Conservation of Agricultural Resources Act 43 of 1983, an agricultural land in the Limpopo Province and specifically around the project site is considered high potential if the land:
  i. is under permanent irrigation, or
  ii. can be classified into one of the following soil forms; Avalon, Bainsvlei, Bloemdal, Clovelly, Glencoe, Hutton, Oakleaf, Pinedene, Shortlands and Tukulu with a minimum soil depth is 750 mm and topsoil clay content of 10-35.

High potential here means prime or unique. Prime refers to the best available land, mainly from the national perspective, suited to and capable of consistently producing acceptable yields of a wide range of crops (food, feed, forage, fibre and oilseeds), with acceptable expenditure of energy and economic resources and minimal damage to the environment. Unique agricultural land means land that is or can be used for producing specific high value crops.

Permanent irrigation refers to the availability for, and regular artificial application of water to the soil for the benefit of growing crops. The application may be seasonal.

3.3.2 Additional assessment criteria from provincial department

In addition to the necessary legislations relating to land classification in terms of its potential in South Africa, the assessment of agricultural potential at the project site took into consideration the following requirements from the Department of Agriculture, Conservation and Environment (Limpopo Province):

- Soil assessment
- Land capability for producing specific crop types according to the soil and climate,
- Possible yields,
- Irrigation potential
- Water availability
- Surrounding developments and activities
- Current status of the land and landuse options

4.0 AGRO-ECOLOGICAL CHARACTERISATION

4.1 Current landuse

The proposed locations for the Powerlines occur mainly in rural landscape comprising largely the natural vegetation, rural settlement areas and agricultural lands Fig. 1).

Fig. 1. Landuse traversed by the proposed powerline routes (A: Natural veld; B: Settlement area; C: Commercial farming area; D: Smallholder dryland farming area, close to a settlement site).

The current landuse along three proposed corridors and their potential impact on agricultural productivity are presented in table 1 below:

Landuse

Table 1. Landuse use under the proposed corridors and their possible impact on agricultural productivity.

Corridor	Landuse	Potential impact
Western (Route 1)	There are established villages in excess of 6 along the corridor up to the point of convergence with the western corridor. Farms with pivot irrigation system covering a distance in excess of 30km occur under this corridor.	The presence of irrigation systems renders the area high potential for agriculture according to the national land potential classification system.
Central (Route 3)	There are 4 villages along this corridor before merging with the eastern corridor. Farmlands with pivot and linear irrigation systems covering an area of up to 34km.	The presence of irrigation systems renders the area high potential for agriculture according to the national land potential classification system.
Eastern (Route 2)	There are 4 established villages before converging with the eastern corridor. Extensive amount of farmlands with irrigations systems stretching up to 75km occur along the corridor. Some of the farms are inactive at the moment. There is also a wetland across the path of this corridor.	The presence of irrigation systems renders the area high potential for agriculture according to the national land potential classification system. The high amount of irrigated agriculture will result in a relatively more impact from the development at this corridor relative to the western and central corridors.

Summary of landuse

The three powerline corridors traverse an area which would be classified as high potential due to the presence of centre pivot and linear irrigations system according to the national land potential classification system. However, on relative terms, the eastern corridors traverses more irrigated fields than the western and central corridors and there is also the presence of wetland across this corridor. Hence, to avoid significant disturbance, the eastern corridor will be the one to avoid.

4.2 Soil distribution

4.2.1 Landtypes

Different landtypes occur at the three proposed powerline corridors with the dominant one being **Bd51** in the southern portion where the three routes are separated (Fig. 2). The dominant one in the north-eastern part of the single corridor is **Ae277** and at the tail end of the route, close to the Nzhelele, the dominant type is **Ah89**. Landtypes **Fc731** and **Bc48** occur in localised but significant portions whereas landtypes **Ia** and **Db** are highly localised and insignificant along the routes (Memoirs of the Agricultural Natural Resources of South Africa).

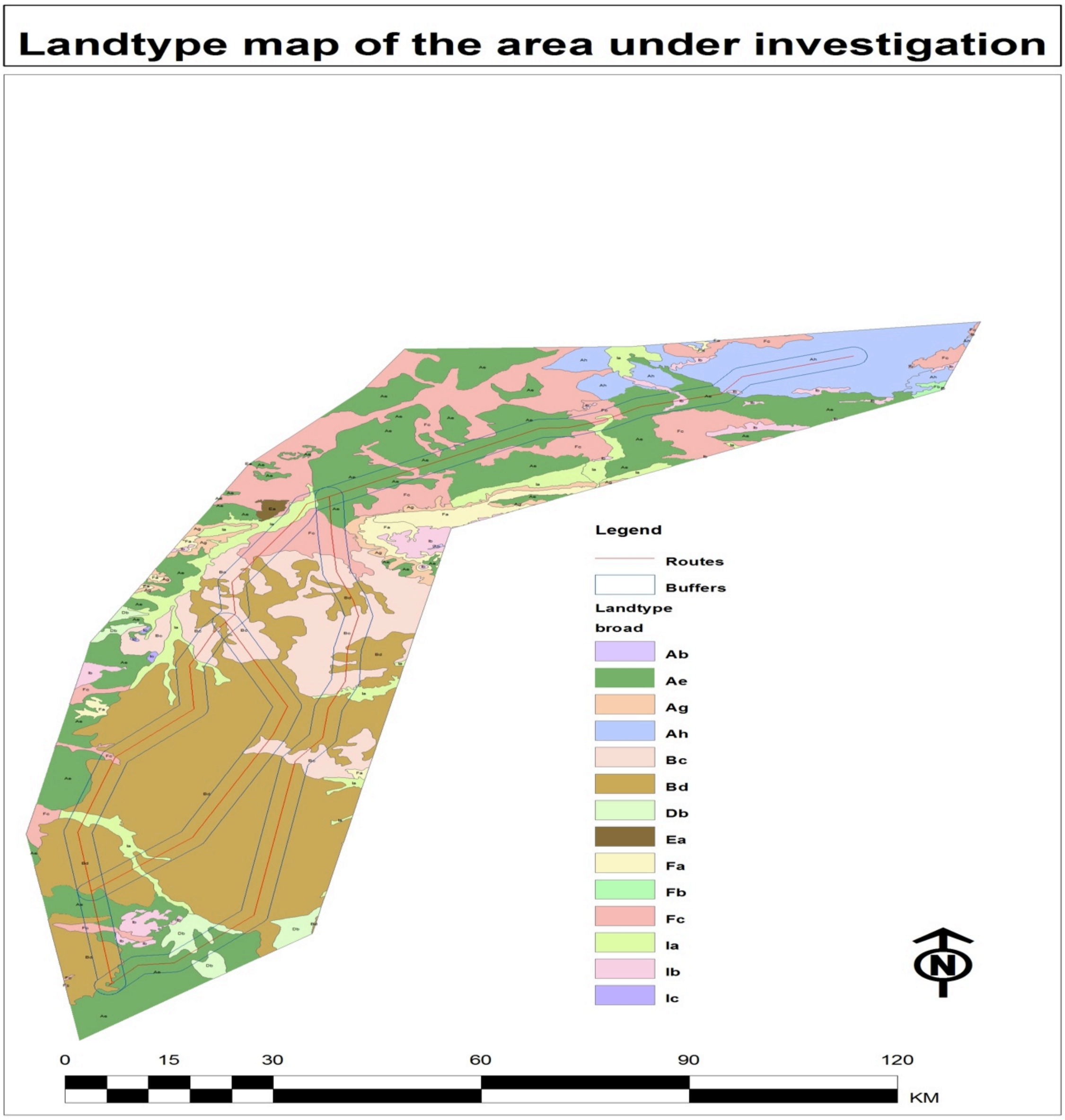


Fig. 2. Landtypes under the proposed corridors.

The characteristics of the landtypes within the proposed corridors are presented in table 2 below:

Table. 2. Landtype characteristics under the proposed corridors for the powerlines.

Landtype Bd51

Corridor	Soil form	Characteristics	Classification as potential soil form	
			Yes	**No**
Western (Route 1)	Hutton, Bainsvlei, Avalon & Longlands	The Hutton, Bainsvlei and Avalon are considered high potential whereas Longlands is low potential. They are high potential, deep and well drained soils. The topsoil clay content varies between 12 & 20%. This landtype constitutes approximately 75% of the landtypes along the route before merging with corridor 3. ***The probable impact on agriculture is high.***	x	
Central (Route 3)	Hutton, Bainsvlei, Avalon & Longlands	The Hutton, Bainsvlei and Avalon are considered high potential whereas Longlands is low potential. They are high potential, deep and well drained soils. The topsoil clay content varies between 12 & 20%. This landtype constitutes approximately 60% of the landtypes along the route from Burotho before corridors 1 and 3 merge. ***The probable impact on agriculture is significant but relatively lower than that of corridors 1 and 3.***	x	
Eastern (Route 2)	Hutton, Bainsvlei, Avalon & Longlands	The Hutton, Bainsvlei and Avalon are considered high potential whereas Longlands is low potential. They are high potential, deep and well drained soils. The topsoil clay content varies between 12 & 20%. This landtype constitutes approximately 70% of the landtypes along the route before merging with corridor 1. ***The probable impact on agriculture is high but slightly less than that of corridor 1.***	x	

Landtype Ae277

Corridor	Soil form	Characteristics	Classification as potential soil form	
			Yes	No
Western corridor (Route 1)	Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly	Only Hutton and Clovelly are considered high potential but the shallow depth reduces this potential. The soils are generally shallow, less than 300mm. They are land with larger portion of red to yellow apedal soils which covers more than 10% of the area. This landtype constitutes approximately 15% of the landtypes along the route before merging with corridor 3. ***The probable impact on agriculture is low.***		x
Central corridor (Route 3)	Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly	Only Hutton and Clovelly are considered high potential but the shallow depth reduces this potential. The soils are generally shallow, less than 300mm. They are land with larger portion of red to yellow apedal soils which covers more than 10% of the area. This landtype constitutes less than 5% of the landtypes along the route from Burotho before corridors 1 and 3 merge. ***The probable impact on agriculture is very low.***		X
Eastern corridor (Route 2)	Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly	Only Hutton and Clovelly are considered high potential but the shallow depth reduces this potential. The soils are generally shallow, less than 300mm. They are land with larger portion of red to yellow apedal soils which covers more than 10% of the area. This landtype constitutes approximately 22% of the landtypes along the route before merging with corridor 1. ***The probable impact on agriculture is low.***		X

Landtype Bc48

Corridor	Soil form	Characteristics	Classification as potential soil form	
			Yes	No
Western (Route 1)	Hutton, Bainsvlei, Avalon & Longlands	The Hutton, Bainsvlei and Avalon are considered high potential whereas Longlands is low potential. They are high potential, deep and well drained soils. The topsoil clay content varies between 12 and 20%. This landtype constitutes approximately 20% of the landtypes along the route before merging with corridor 3. ***The probable impact on agriculture is high.***	x	
Central (Route 3)	Hutton, Bainsvlei, Avalon & Longlands	The Hutton, Bainsvlei and Avalon are considered high potential whereas Longlands is low potential. The high potential soils are deep well drained soils. The topsoil clay content varies between 12 & 20%. This landtype constitutes approximately 10% of the landtypes along the route from Burotho before corridors 1 and 3 merge. ***The probable impact on agriculture is significant but relatively lower than that of corridors 1 and 3.***	x	
Eastern (Route 2)	Hutton, Bainsvlei, Avalon & Longlands	The Hutton, Bainsvlei and Avalon are considered high potential whereas Longlands is low potential. The high potential soils are deep well drained soils. The topsoil clay content varies between 12 & 20%. This landtype constitutes approximately 31% of the landtypes along the route before merging with corridor 1. ***The probable impact on agriculture is relatively higher than that of corridor 1.***	x	

Landtype Fc731

Corridor	Soil form	Characteristics	Classification as potential soil form	
			Yes	No
Western corridor (Route 1)	Glenrosa and/or Mispah Forms	These are soils with shallow depth limited by hard rock. This landtype constitutes approximately 15% of the landtypes along the route before merging with corridor 3. ***The probable impact on agriculture is very low.***		X
Central corridor (Route 3)	Glenrosa and/or Mispah Forms	This landtype does not occur under the central corridor.		X
Eastern corridor (Route 2)	Glenrosa and/or Mispah Forms	These are soils with shallow depth limited by hard rock. This landtype constitutes approximately 10% of the landtypes along the route before merging with corridor 1. ***The probable impact on agriculture is very low.***		X

Single corridor

Landtype	Soil form	Characteristics	Classification as potential soil form	
			Yes	No
Ah89	Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly	Only Hutton and Clovelly are considered high potential but the shallow reduces this potential.		X
Ae277	Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly	Only Hutton and Clovelly are considered high potential but the shallow depth reduces this potential. The soils are generally shallow, less than 300mm. They are land with larger portion of red to yellow apedal soils which covers more than 10% of the area. This landtype constitutes approximately 15% of the landtypes along the route before merging with corridor 3. ***The probable impact on agriculture is low.***		X
Fc731	Glenrosa and/or Mispah Forms	These are soils with shallow depth limited by hard rock. This landtype constitutes approximately 10% of the landtypes along the route before merging with corridor 1. ***The probable impact on agriculture is very low.***		X

Summary of landtype impact

The dominant landtype where the three corridors area separated is Bd51 and to the southern portion, there is a localised patch of landtype Ae277. The three powerline corridors traverse approximately similar landtypes within the study area.

4.2.2 Land capability

The land capability under the different powerline corridors is presented in figure 3 below:

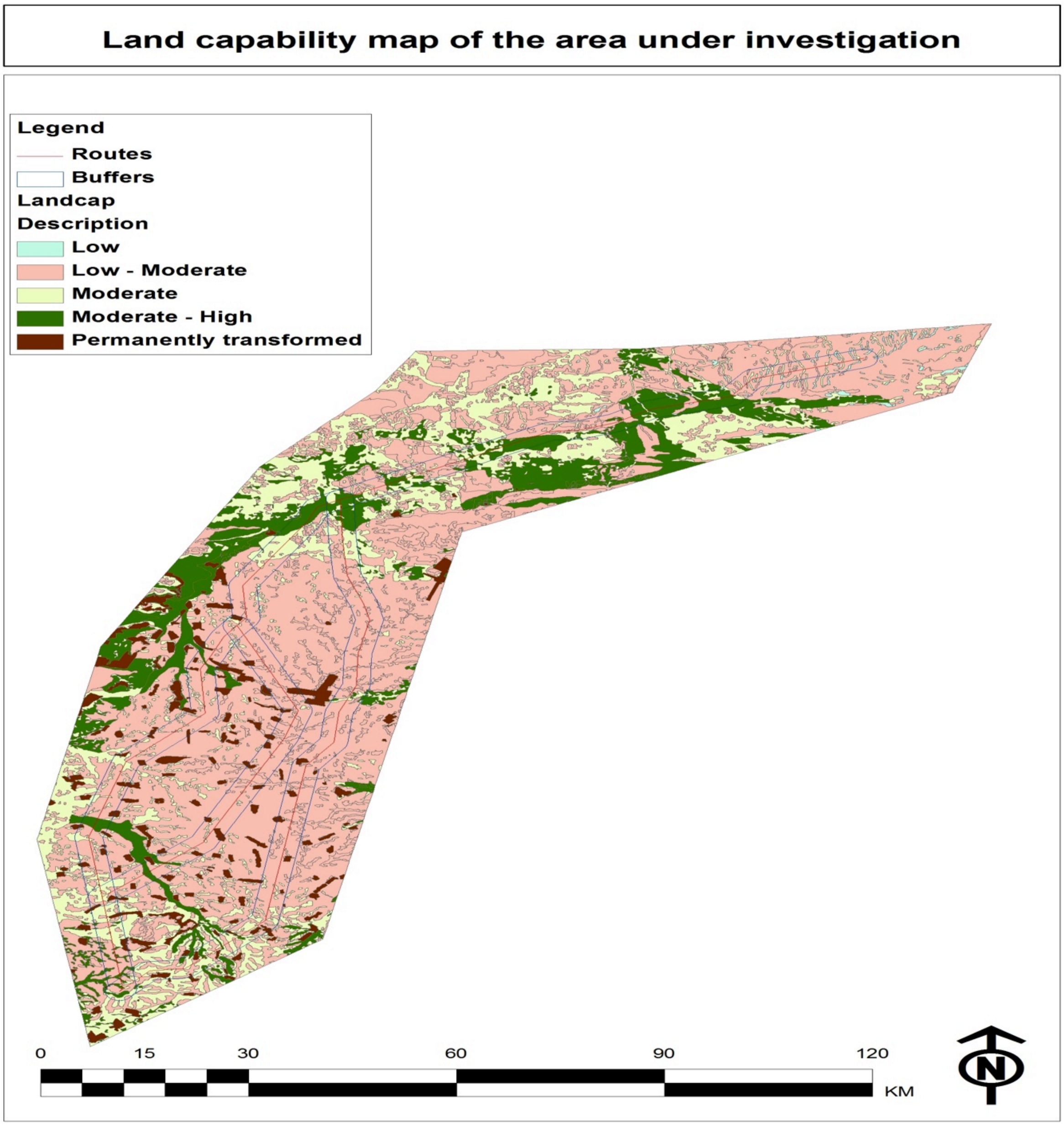


Fig. 3. Land capability under the three proposed corridors.

The assessment of site capability for agricultural through local soil and climatic conditions revealed that the proposed area of development falls predominantly within the low to moderate capability class with localised pockets of moderate and moderate to high capability. By comparison, the western corridor traverses an area of which over 95% is classified as low to moderate capability and approximately 3.5% as moderate to high capability. The low to moderate class is in excess of 96% under the central corridor with approximately 2% as moderate to high class under this corridor. The central corridor traverses an area which is classified largely as low to moderate. The eastern corridor traverses an area with over 90% low to moderate class and approximately 9% of moderate to high class. The moderate to high class land occurs close to the point where it intersects with the eastern corridor. This area also coincides with high concentration of irrigated arable farming.

Summary of land capability

The three powerline corridors traverse fairly similar land capability class which is the low to moderate class. There is however localised pockets of moderate to high capability class within the corridors which is found in more concentration under the eastern corridor. Considering the extent of agricultural potential impact, the construction of powerline along the western and central corridors will have a significantly less impact than that of the eastern corridor.

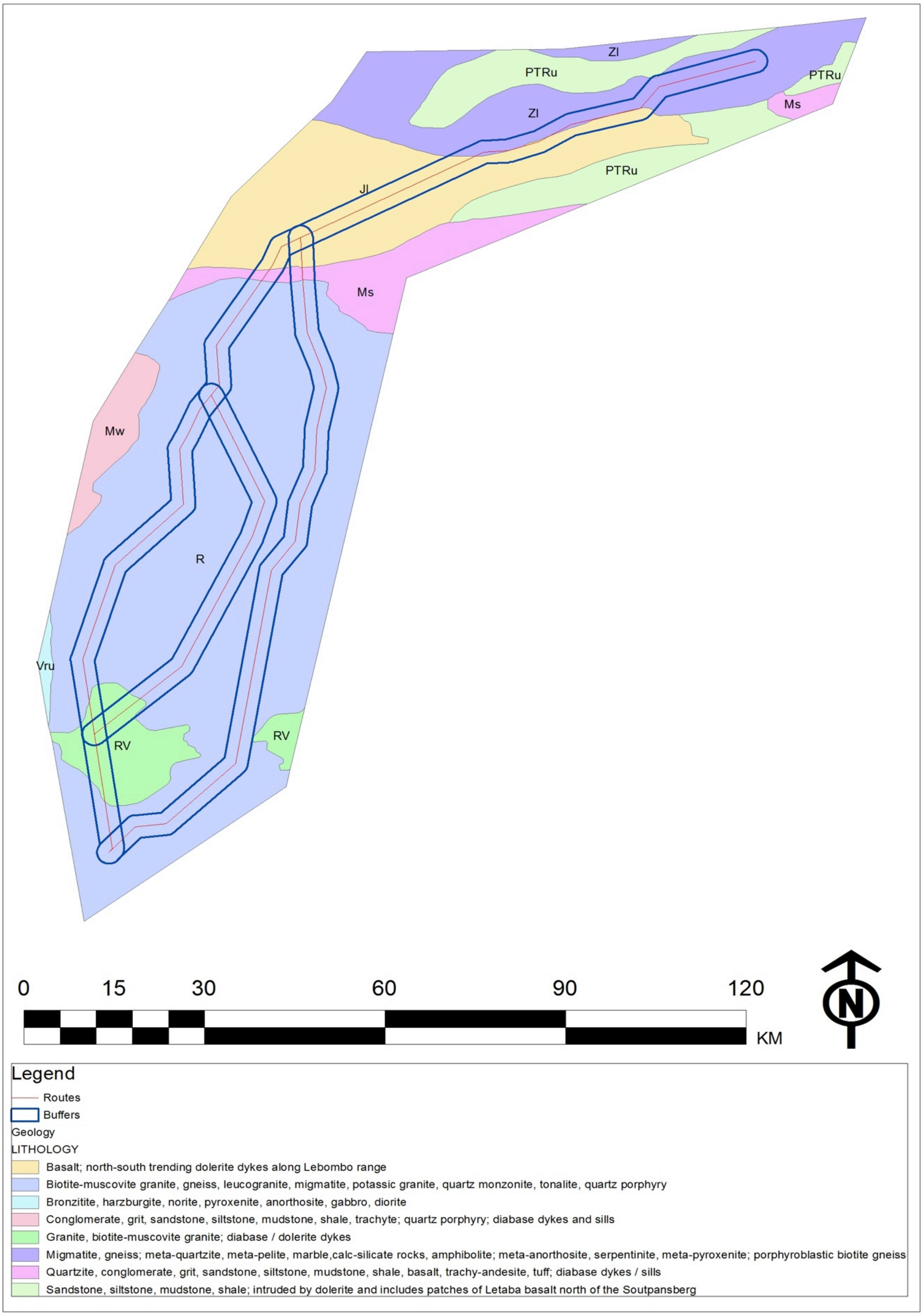
4.2.3 Geology

The geology of the different powerline corridors is presented in figure 4. The geology is of the study area is fairly similar under the three corridors. The dominant geology is described as Biotite-muscovite granite, gneiss, leucogranite, migmatite, potassic granite, quartz monzonite, tonolite, quartz porphyry and a localised patch of granite, Biotite-muscovite granite, diabase/derolite dykes at the south under the western and central corridors. Quartzite, conglomerate, grit, sandstone, siltstone mudstone, shale, basalt, trachy-andesite, tuff, daibase dykes / sills occur in highly localised band across the western and eastern corridors. There two predominant geology of the single corridor, namely basalt, north-south trending delorite dykesalong Lebombo range and then migmatite, gneiss,meta-quartzite, meta-pelite, marble, calc silicate rocks, amphobilite, meta-anorthosite, serpentinite, meta-pyroxenite, porphyroblastic biotite gneiss.

Summary of geology impact

The three powerline corridors experiences relatively similar geology to a large extent except some localised patched in the southern and northern portions.

Geology map of the area under investigation



4.3 Precipitation

The project site is situated in a summer rainfall region. In the Limpopo Province, the most important determinant of agricultural productivity is the availability of water during crop growth. Long-term precipitation records indicate that the sites could receive a mean annual precipitation (rainfall and fog) range of 129-534 mm (Fig. 4). Over 90% of the site accommodating the three proposed corridors experiences between 129 - 426 mm. The project site is thus dry and could not sustain significant agricultural productivity without supplementary irrigation. The single corridor route after the amalgamation of the three corridors experiences even a smaller annual precipitation of up to 426. A large proportion of the annual precipitation is expected to fall from October to March.

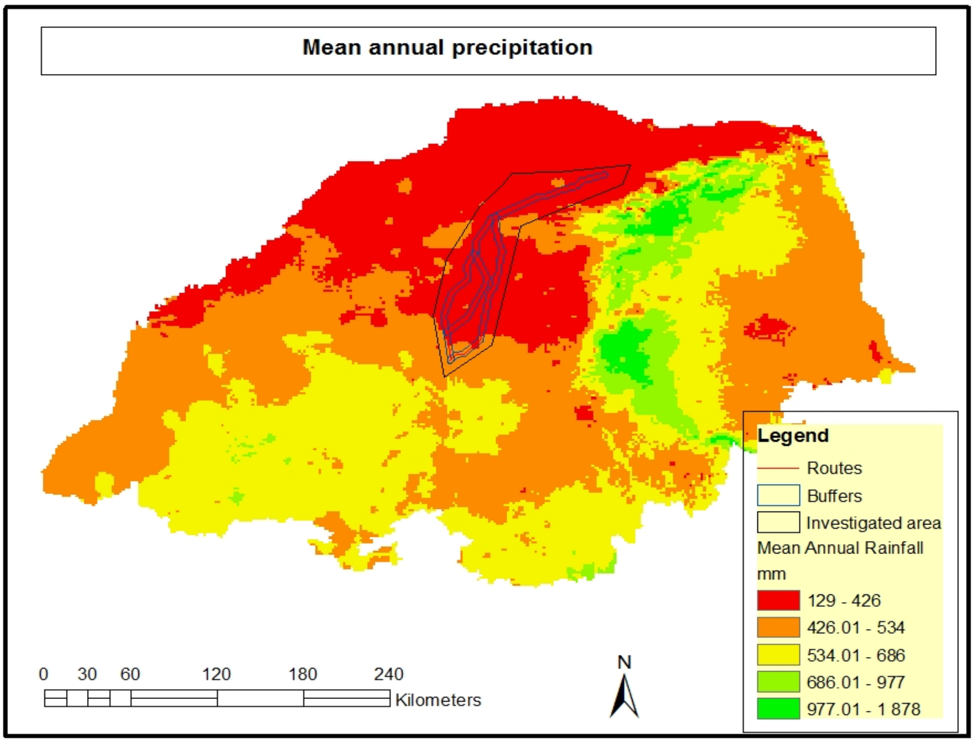


Fig. 4. Long-term mean annual precipitation expected at the project sites.

Summary of precipitation impact

The three powerline corridors will be affected by annual precipitation to the same extent. The precipitation received at the study area is relatively low and supplementary water supply through irrigation will be required if successful crop production is to take place.

4.4 Moisture availability class

Under the moisture availability classification (Fig. 5), the proposed project site falls under varied moisture classes, ranging largely from Class 4 to Class 5 in the northern part and predominantly class 3 in the south.

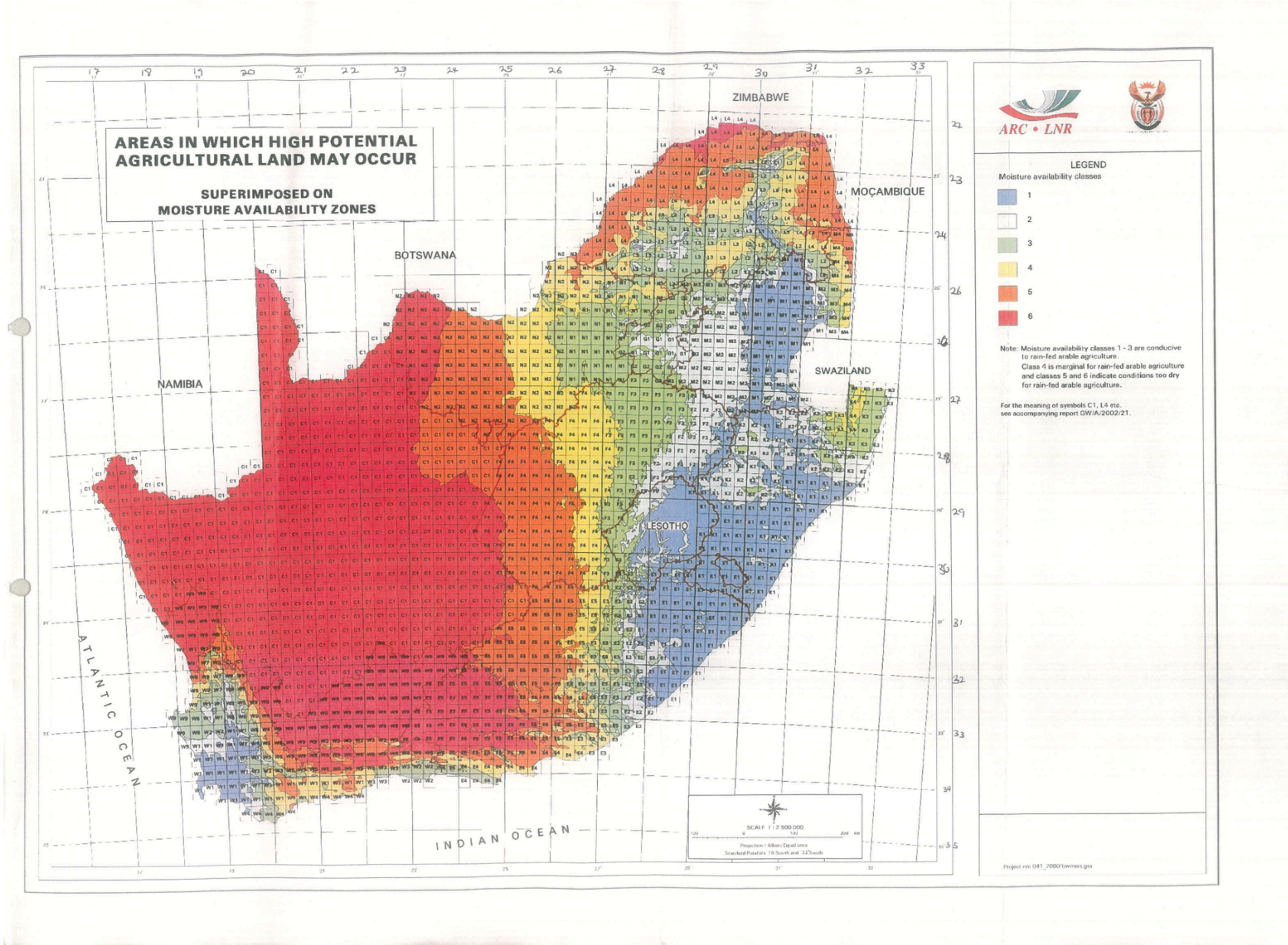


Fig 5. Moisture availability class at the project site.

Class 4 is interpreted as marginal for rainfed arable agriculture whereas class 5 is considered too dry for rainfed arable agriculture. Class 3 on the other hand is interpreted as conducive for rainfed arable agriculture (ARC, 2002). The potential impacts of the three proposed routes are presented in table 3 below:

Table 3. Potential impact of the proposed routes on rainfed arable agriculture based on moisture availability class.

Corridor (Route)	Moisture availability class	Comments
Western	3, 4 and 5	The southern part of the western corridor predominantly falls under moisture class 3 with localised pockets of class 4 whereas the northern part falls under classes 4 and 5 with highly localised pockets of class 3. Some level of rainfed agriculture is feasible at the southern section of this corridor but not in the northern section.
Central	3 and 4	The eastern corridor occurs largely under class 3 with pockets of class 4. Rainfed agriculture is feasible under this route.
Eastern	3, 4 and 5	The eastern corridor cuts across moisture classes 3, 4 and 5. Rainfed arable farming is feasible under this corridor. The significantly higher proportion of classes 4 and 5 will result in less impact following the construction of the eastern corridor.
Single route	4 and 5	Marginal or too dry for rainfed arable farming.

Summary of moisture class impact

The three powerline corridors experiences relatively similar water classes. Rainfed agriculture will generally be marginal.

4.5 Topography

The assessment of slope class in an area is an important determinant in the evaluation of land for crop production. Slope influences the use of mechanical traction and together with soil textural classes, influences the rate of soil erosion. Field topography can also have a direct effect on crop growth and yield by redirecting soil water availability. Indirectly, it also has an effect on the distribution of such chemical and physical properties as organic matter content, base saturation, soil temperature, and particle size distribution (Franzmeier et al., 1969; Stone et al., 1985; Jiang, and Thelen, 2004).

The topography of the selected corridors is largely flat across the proposed routes with slope not exceeding 10%. The terrain will not limit mechanical traction across all the three corridors

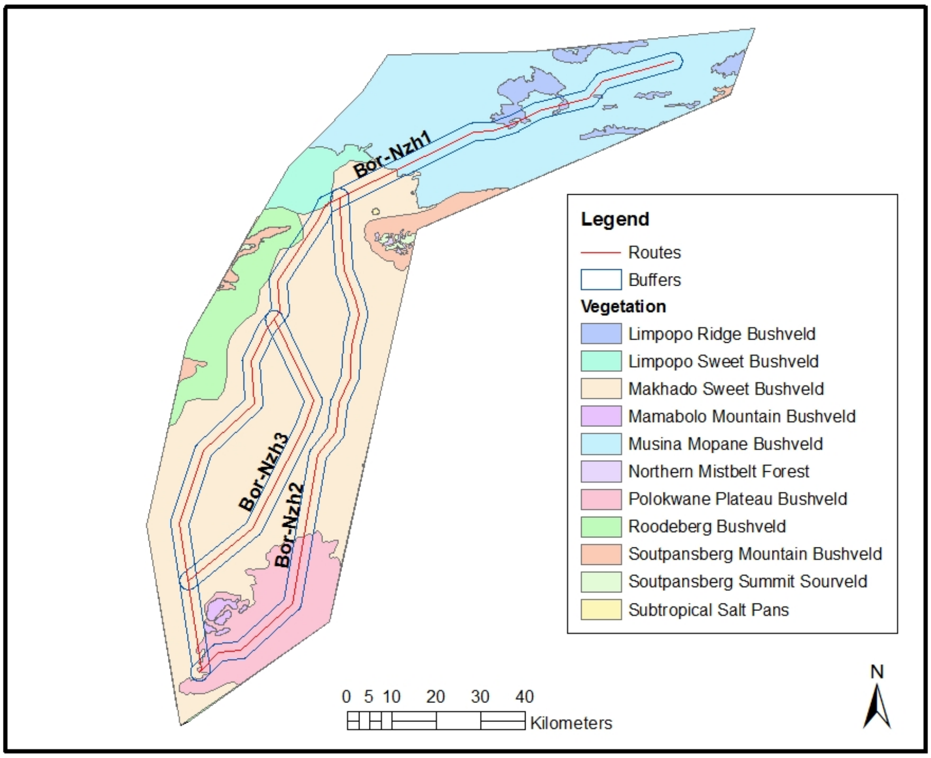
Summary of slope impact

The slope is conducive for mechanical traction under all three powerline corridors.

4.6 Vegetation

The proposed corridors traverse an area characterised a mixture of natural and disturbed vegetation with the disturbance resulting primarily from farming and settlement. The natural vegetation consists of a dominant Makhado Sweet veld with a significant portion of the Polokwane Plateau Bushveld in the southern to central portion of the study area where the corridors merge into one route (Mucina & Rutherford, 2006). The dominant vegetation within the single corridor in the northern portion of the study area is the Musina Mopane Bushveld with localised pockets of Limpopo Ridge Bushveld and a patch of Makhado Sweet Bushveld at the southern tip of the single corridor (Fig 6).

Vegetation map of the area



Source: Department of Environmental Affairs EMPAT data

Fig. 6. Vegetation classes at the project site.

With the exception of the southern portion of the eastern corridor which has a significant patch of Polokwane Plateau Bushveld, all three corridors traverse a single vegetation type, the Makhado Sweet Bushveld.

Makhado Sweet Bushveld

The plant species of *Makhado Sweet Bushveld* is presented in Table 4.

Table 4. A list of plant species under the Makhado Sweet Bushveld.

Grass, sedges and reed species	**Forb species**	**Tree/Shrubs**
Anthephora pubescens (d)↑	*Chamaecrista absus*	***Small trees:***
Aristida stipitata subsp. *graciliflora* (d)	*Corbichonia decumbens*	*Acacia erubescens* (d)
Cenchrus ciliaris (d)	*Geigeria acaulis*	*Acacia gerrardii* (d)
Enneapogon scopiarius (d)	*Harpagophytum procumbens* subsp. *transvaalense*	*Acacia mellifera subsp. detinens* (d)
Brachiaria nigropedata	*Heliotropium steudneri*	*Acacia rehmanniana (d)*
Eragrostis trichophora	*Hemizygia elliottii*	*Boscia albitrunca* (d)
Panicum coloratum	*Hermbstaedtia odorata*	*Combretum apiculatum* (d)
Panicum maximum	*Leucas sexdentata*	*Acacia tortilis* subsp. *heteracantha*
Schmidtia pappophoroides	*Osteospermum muricatum*	*Terminalia sericea*
Urochloa mosambicensis	*Tephrosia purpurea* subsp. *leptostachya*	
		***Tall shrubs*:**
		Commiphora pyracanthoides
		Dichrostachys cinerea
		Grewia flava
		Hibiscus calyphyllus
		Lycium shawii
		Rhigozum obovatum
		Low shrubs:
		Barleria lancifolia
		Hirpicium bechuanense
		Indigofera poliotes
		Melhania rehmannii
		Pechuel-Loeschea leubnitziae

↑: ***(d) – Dominant species***

The extent of palatability of the grasses is an important determinant of livestock productivity in an area. The palatability of the dominant grass species under the Makhado Sweet Bushveld is presented in Table 5. Approximately 75% of the dominant grass species in Makhado Sweet Bushveld is of low palatability for livestock production.

Table 5. Palatability rating of the main grass species under the Makhado Sweet Bushveld.

Grass species	**Palatability for grazing**		
	Low	**Medium**	**High**
Anthephora pubescens	*x*		
Aristida spp	*x*		
Cenchrus ciliaris			*x*
Enneapogon scopiarius	*x*		

Polokwane Plateau Bushveld

The *Polokwane Plateau Bushveld* occurs only along the western corridor and the species composition is presented in Table 6.

Table 6. Plant species composition of Polokwane Plateau Bushveld.

Grass sedges and reed spp.	**Forb species**	**Tree/Shrubs**
Aristida diffusa (d) *Brachiaria nigropedata* (d) *Digitaria eriantha* subsp. *eriantha* (d) *Eragrostis curvula* (d) *Themeda triandra* (d) *Aristida congesta* *Cymbopogon caesius* *Cynodon dactylon* *Digitaria diagonalis* *Diheteropogon amplectens* *Elionurus muticus* *Eragrostis gummiflua* *E. racemosa* *E. superba* *Eustachys paspaloides* *Panicum maximum* *Pogonarthria squarrosa* *Sporobolus africanus*	*Felicia mossamedensis* *Hermbstaedtia odorata* *Pollichia campestris* *Eulophia petersii* *Hypoxis hemerocallidea* *Aloe greatheadii* var. *greatheadii*	*Acacia caffra* (d) *Acacia permixta* (d) *Acacia rehmanniana* (d) *Acacia karroo* *Acacia tortilis* subsp. *heteracantha* *Combretum molle* *Ormocarpum kirkii* *Ziziphus mucronata* ***Succulent Tree:*** *Aloe marlothii* subsp. *marlothii* ***Tall Shrubs:*** *Acacia hebeclada* subsp. *hebeclada* (d) *Gymnosporia senegalensis* (d) *Combretum hereroense* *Diospyros lycioides* subsp. *sericea* *Euclea crispa* subsp. *crispa* *Heteromorpha arborescens* var. *abyssinica* *Lippia javanica* *Rhus pyroides* var. *pyroides* *Tephrosia rhodesica* *Triumfetta pilosa* var. *tomentosa* ***Low Shrubs:*** *Anthospermum rigidum* subsp. *rigidum* *Gymnosporia glaucophylla* *Hirpicium bechuanense* *Lantana rugosa* *Senecio burchellii*

		Sida rhombifolia *Solanum panduriforme* ***Succulent Shrub:*** *Aloe cryptopoda* Woody Climber: *Asparagus africanus.* Herbaceous Climbers: *Momordica balsamina* *Rubia petiolaris*

↑: (d) - Dominant species

The dominant grass species under the Polokwane Plateau bushveld are *Aristida spp., Brachiaria nigropedata, Digitaria eriantha* subsp. *Eriantha, Eragrostis curvula and Themeda triandra.* The extent of palatability of the species as gazing grass is presented in the table 7.

Table 7. Palatability of the main grass species under the **Polokwane Plateau Bushveld** along the western corridor.

Grass species	**Palatability for grazing**		
	Low	**Medium**	**High**
Aristida spp	*x*		
Brachiaria nigropedata	*x*		
Digitaria eriantha			*x*
Eragrostis curvula		*x*	
Themeda triandra			*x*

Approximately 60% of the dominant grass species in Polokwane Plateau Bushveld is of medium to high palatability for livestock production. Construction of the powerline along this route could cause significant disturbance to the grass quality compared to that of the other corridors.

Musina Mopane Bushveld

The Musina Mopane Bushveld occurs along the single corridor after the merger of the three corridors and the species composition is presented in Table 8.

Table 8. Plant species composition of the Musina Mopane Bushveld.

Grasses species	Herbs and Shrubs	Tree
Grasses: *Aristida adscensionis,* *A. stipitata* subsp. *graciliflora,* *Digitaria eriantha* subsp. *eriantha,* *Enneapogon cenchroides, Panicum maximum,* *Schmidtia pappophoroides,* *Stipagrostis uniplumis;* and	***Succulent herb:*** *Tavaresua barklyi.* ***Tall shrubs:*** *Catophractes alexandri,* *Commiphora pyracanthoides,* *Gardenia resiniflua,* *Grewia bicolor,* *G. villosa,* *Hibiscus calyphyllus,* *H. micranthus;* low shrubs: *Barleria affinis,* *Blepharis diversispina,* *Neuracanthus africanus, Plinthus rehmannii, Ptycholobium contortum;*	**Tall trees** *Adasonia digitata* (d), *Acacia nigrescens* (d), *Sclerocarya birrea* subsp. *Caffra;* ***Small trees:*** *Colophospermum mopane* (d), *Commiphora glandulosa* (d), *C. tenuipetiolata* (d), *Terminalia puriodes* (d), *Acacia Senegal* var. *leiorhachis,* *A. tortilis* subsp. *heteracantha, Boscia albitrunca,* *Combertum apiculatum,* *C. imberbe,* *Cammiphora mollis,* *Ficus abutilifolia,* *F. tettensis,* *Kirkia acuminata,* *Sterculia rogersii,* *Ximenia Americana;*

The quality of grass species under the Musina Mopane Bushveld ranges from low to high quality grasses.

Summary of vegetation impact

The three powerline corridors traverse similar and dominant vegetation type, the Makhado Sweet Bushveld. In addition to this, the eastern corridor experiences a significant patch of the Polokwane Plateau Bushveld to the south. The quality of the grass under the Makhado Sweet Bushveld in term of feeding is generally low whereas that of the Polokwane Plateau Bushveld is high. On relatively terms, avoiding the eastern corridor will result in minimal disturbance of the quality of grass compared to that of the western and central corridors.

4.7 Water Resources

The study area is drained largely by means of surface run-off (sheetwash), and several streams and rivers most of which are non-perennial in nature (Fig..).

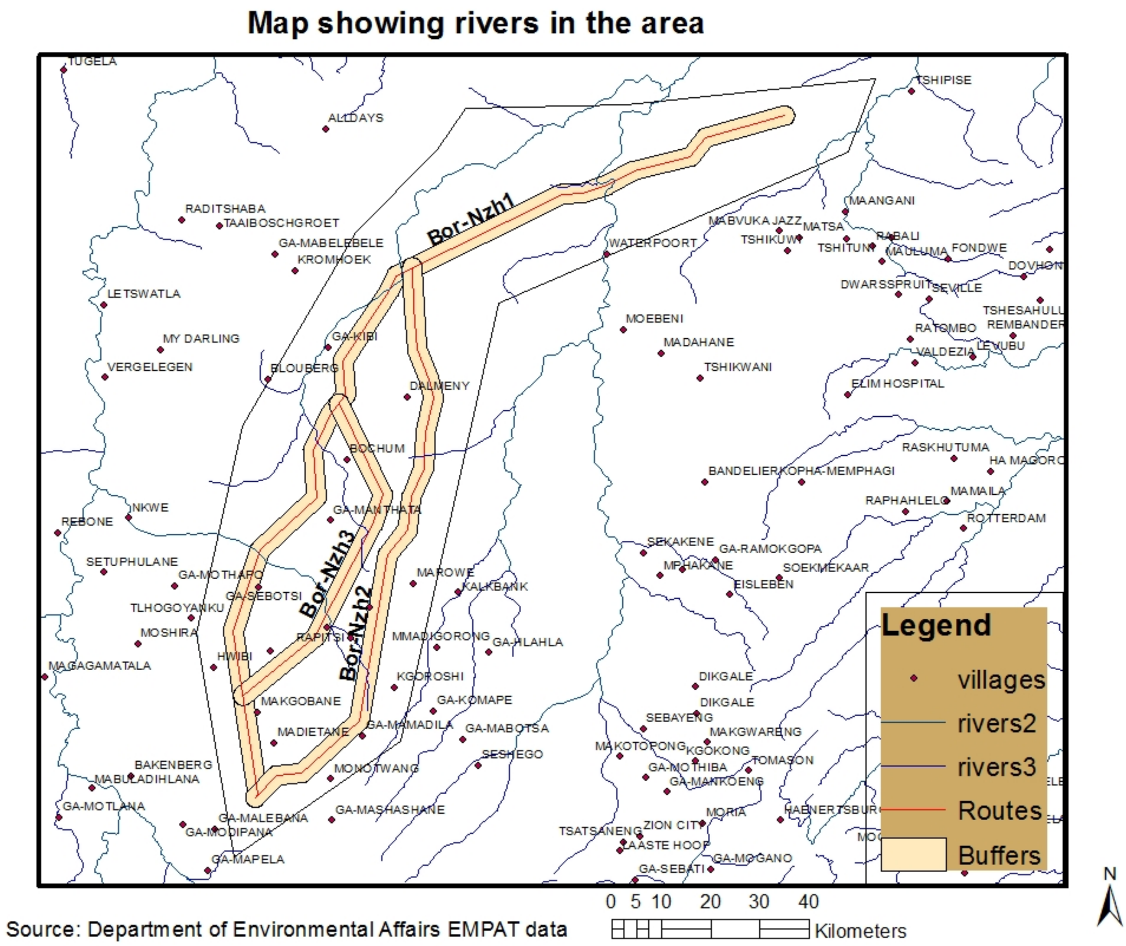


Fig 7. Rivers of the study area

The drainage systems do not differ for the three proposed corridors. The presence of water bodies across the corridors indicates the possibility of the development of irrigation system for agriculture.

Summary of water resource impact

The water resources in the study area do not differ among the three corridors and there is a potential for the development of irrigations systems for each of the three routes. This renders the corridors high agriculture potential area according to the classification of potential agricultural land.

5.0 INFRASTRUCTURE

The proposed project site is traverse natural vegetation, villages and smallholder and commercial farmlands. There are accessible roads to the villages and the commercial farm lands but large proportions of the natural areas do not have accessible roads. The commercial farms have their basic farm infrastructure which may be impacted from the construction of the powerline. The western corridor has more commercial farms and is likely to be affected more than the other two corridors.

6.0 AGRO-ENTERPRISE

Agricultural activities at the project site could be classified into crop cultivation and livestock production. The production of crops will include vegetable, field crops, pasture crops, fruit crop and ornamental crop production. The potential for successful agricultural productivity of any given area is a function of several natural or biological factors of the target area, socio-economic conditions as well as prevailing legislations impacting on agriculture in the country.

The main natural factors are: climate; terrain form, and soil type. Biological factors encompass prevailing diseases, pests and selection of plant and animal species to be cultured and their ability to adapt and withstand the growing and developmental conditions prevailing at the particular site. Socio-economic considerations will include factors such as level of education, managerial skills and technical experience of the prospective farmer or group of farmers as well as market availability. The interactive effects of these factors determine the potential of an area for agricultural activity. Of these factors, the management skills are those production and non-production practices that are directly within the control of the farmer. This may include site selection; land or soil preparation; choice of cultivar; planting; fertilization programming; irrigation scheduling; diseases and pest control; crop rotation; harvesting and storage; marketing, etc.

In South Africa, water availability, temperature and soil characteristics are major determinants of agricultural productivity. The arable portion of the project site is dominated by deep Hutton soil form and significant localised pockets of Mispah. The topsoil and subsoil clay percent range from 5 to 40 % of which large proportion is suitable for crop production.

Summary

The proposed project corridors traverse an area that is generally not conducive for rainfed arable farming but has existing irrigated farming systems and also areas with the potential for irrigated farming. The eastern corridor has more irrigated farming systems and hence the maximum disturbance if construction goes along that route.

4.0 SUMMARY AND CONCLUSIONS

By definition of parameters of land as stipulated by the Subdivision of Agricultural Land Act, No. 70 of 1970 and the Amended Regulation of Conservation of Agricultural Resources Act No. 43 of 1983 and Part 1 of the Regulation of Conservation of Agricultural Resources Act 43 of 1983), the land occurring under the three corridors at the project sites consists of combination of areas classified as high and low potential for agriculture for the following reasons:

- The high potential soils are the results of the presence of important soil forms such as Hutton, Avalon and Bainsvlei with depths exceeding 750mm. The remaining soil forms under the powerlines are not classified as high potential.
- The three powerline corridors traverse approximately similar landtypes and land capability within the study area. The eastern corridor however has relatively higher land capability and must be avoided.
- The water resources in the study area do not differ among the three corridors and there is a potential for the development of irrigations systems for each of the three routes. This renders the corridors high agriculture potential area according to the classification of potential agricultural land. However, on relative terms, the western corridors traverses more irrigated fields than the western and eastern corridors and hence will be the one to avoid.
- The three powerline corridors traverse similar and dominant vegetation type, the Makhado Sweet Bushveld. In addition to this, the eastern corridor experiences a significant patch of the Polokwane Plateau Bushveld to the south. The quality of the grass under the Makhado Sweet Bushveld in term of feeding is generally low whereas that of the Polokwane Plateau Bushveld is high. On relatively terms, avoiding the eastern corridor will result in minimal disturbance of the quality of grass compared to that of the western and central corridors.

5.0 RECOMMENDATION

From agricultural point of view, all three corridors fall under area classified as high potential For agriculture due to the presence of specific soil forms, deeper depth and water bodies which offer potential for permanent or seasonal irrigation systems. However on relative terms, the recommended site for development among the three corridors is either the eastern or the central corridor preferably the western corridor for the following reasons:

- The land capability under the eastern corridor is higher than that of the western and the central corridors which is evidenced by significantly more pivot and linear irrigation system this corridor.
- There are relatively more palatable grass species for livestock production along the eastern corridor that the western and the central which may result in maximum disturbance if the construction is to go that route.
- The western corridor traverses slightly less farmlands than the detour through the central corridor. Furthermore, the surrounding landuse on the upper section of the central is dominated more by irrigated farms relative to the western corridor. The western corridor will thus result in less disturbance and interference.

The western corridor is recommended based on potential impact on agriculture. The construction of the Powerline through the western corridor will however need to consider all the other necessary environmental legislations requirements.

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6.0 LIST OF APPENDIX

Farms along the western corridor and the single corridor in the north.

WESTERN CORRIDOR: BOROTHO-NZHELELE ESKOM POWERLINE		
No.	**Farm Name**	**Comments**
1	Noord Baraband 774 LR	Southern substation: Western and eastern corridors emanates from this farm
2	Luxemburg 772 LB	
3	Matalas 591 LS (5%)	Central corridor emanates from the eastern corridor
4	Prague 734 LR	
5	Goedgevonden 732 LR	
6	Schoongelegen 695 LB	
7	Sour Apple Tree 691 LR	
8	Cromford 690 LR	
9	Schaffhausen 689 LR	
10	Ambergate 685 LR	
11	Lucy's Town LR	
12	Rozenkrans 424 LR	
13	Welgelegen 395 LR	
14	Terbrugge 156 LS	
15	Brilliante 155 LS	
16	Overdyk 147 LS	
17	Werden 150 LS	
18	Bochem 145 LS	
19	Schroelen 84 LS	
20	Wuppertoe 83 LS	
21	Solingen 86 LS	
22	Puraspan 87 LS	Central corridor merges with the western corridor
23	Luton 87 LS	
24	Uiksloot 72 LS	
25	Hoogland LS	
26	Amelad 11 LS	
27	Terschelligen 15 LS	
28	Schiermonikog 16 LS	
29	Fraaifontein 447 MS	
30	Rietbokvlei 449 MS	
31	Zuurbult 450 MS	
32	Knopjesdoorn 448 MS	
33	Kaalplaats 451 MS	
34	Kierielager 428 MS	
35	Oog van brakrivier 426 MS	Eastern corridor merges with the western corridor

SINGLE CORRIDOR)		
No.	Farm Name	Comments
1	Oog van brakrivier 426 MS	Eastern corridor merges with the western corridor
2	Sandheuvel 425 MS	
3	Tambotie 422 MS	
4	Leyden 423 MS	
5	Witlaagte 421 MS	
6	Vryheid 417 MS	
7	Ilford 420 MS	
8	Overyssel 418 MS	
9	Vogelstruis 415 MS	
10	Doncaster 414 MS	
11	Danie 416 MS	
12	Duinen 419 MS	
13	Verlooren 409 MS	
14	Omloop 413 MS	
15	Bruno 407 MS	
16	Bosworth 406 MS	
17	Buchan 404 MS	
18	Groningen 405 MS	
19	Ringer 403 MS	
20	Stockport 396 MS	
21	Vervulling 401 MS	
22	Hoogeplaats 399 MS	
23	Barrow 622 MS	
24	Kameelkop 623 MS	
25	Sandsloot 626 MS	
26	Langdraai 627 MS	
27	Diamant 628 MS	
28	Bosjesveld 669 MS	
29	Twyfel 629 MS	
30	Kortdraai 609 MS	
31	Roos 605 MS	
32	Anzac 604 MS	
33	Du plooy 600 MS	
34	Bierman 599 MS	
35	Mellet 603 MS	
36	Toby ? MS	
37	Afstap 609 MS	
38	Bruilof 598 MS	
39	Lina 595 MS	
40	Honeymoon 610 MS	
41	Pylkop 593 MS	
42	Somerville 590 MS	
43	Faure 562 MS	
44	Vrienden 589 MS	
45	Du toit 563 MS	
46	Grootpraat 564 MS	
47	Steenbok 565 MS	
48	Somm MS	
49	Antrobus 586 MS	

50	Groot Endaba 581 MS	
51	Buxton MS	
52	Scott 567 MS	Northern Substation at Nzhelele