PROPOSED CONSTRUCTION OF ±7KM 132KV POWER LINE FROM MAKONDE SANARI POWERLINE AT TSWERA TO NEW MUTSHIKILI SUBSTATION AT THENGWE WITHIN THULAMELA LOCAL MUNICIPALITY OF VHEMBE DISTRICT, LIMPOPO PROVINCE

Agricultural Impact Assessment Report

Submitted to

DIGES Group, Midrand

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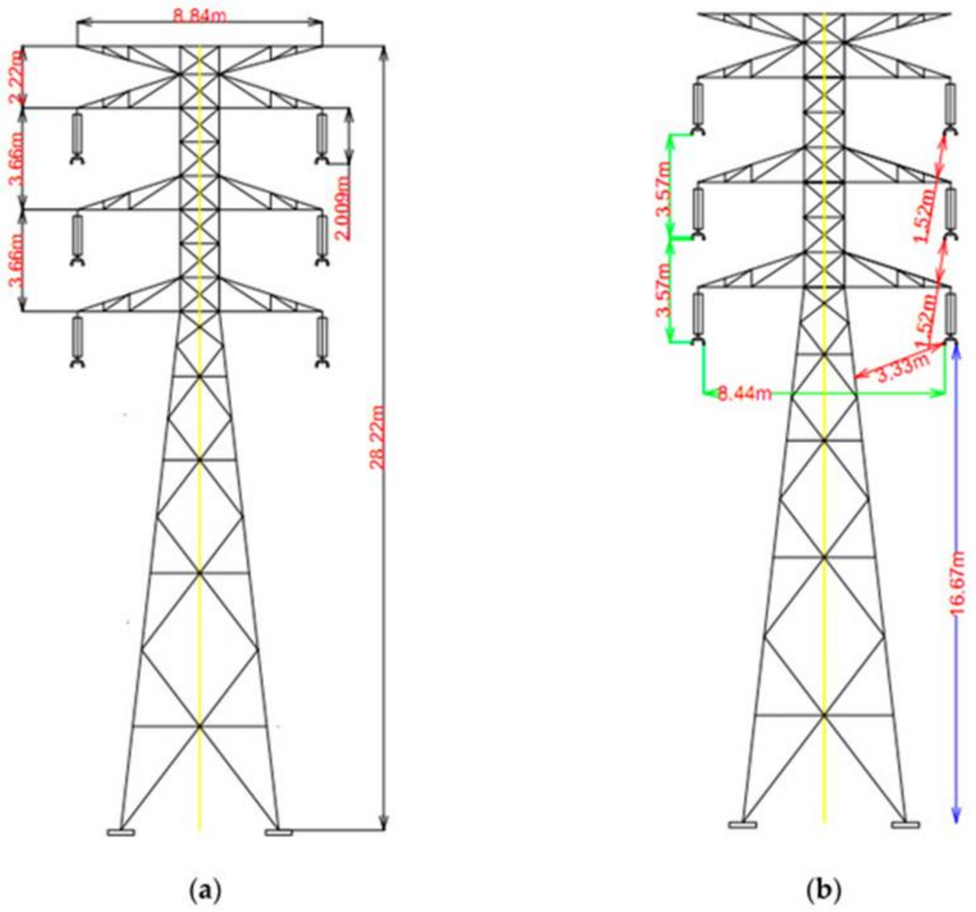

Energy is vital for food production and agricultural activities.

Contents

1. Executive Summary

Eskom has embarked on a journey to ensure that all communities have enough power or Electricity across all corners of South Africa. Electricity powerlines are essential to modern infrastructure, providing a reliable energy source for various sectors. However, installing powerlines can positively and negatively impact agriculture, a sector crucial for global food production and economic stability. There are adverse effects of installing and erecting new structures of electricity powerlines on agriculture. Installing electricity powerlines in agricultural areas can significantly affect farming practices, crop yields, and the agricultural landscape. While powerlines bring numerous benefits, such as increased access to electricity and technological advancements, they also pose challenges, such as land use restrictions, potential health risks, and visual impacts. It is crucial to evaluate these impacts to ensure sustainable agricultural development.

Electricity substations also play a crucial role in the distribution of electrical power, ensuring a reliable supply to meet the growing demands of modern society. However, the installation of these substations can have significant impacts on the agricultural sector. Therefore, the effects of electricity substation installation on agriculture must be explored, including positive and negative aspects. Installing electricity substations near agricultural areas can, directly and indirectly, impact farming practices, crop yields, and overall agricultural productivity. While the availability of electricity can enhance agricultural operations, the potential adverse effects on soil quality, crop growth, and land use patterns must also be considered.

1.1. Main Objective

The main objective of the assessment was to evaluate the impact of the construction of the Eskom powerline from Tswera to Thengwe newly proposed Mutshikili distribution substation on agricultural activities within two proposed alternative corridors in the Makwilidza or Maheni villages and to recommend the corridor with minimal impact for implementation.

1.2. The General Impacts of Powerlines and Installation on Agricultural Activities

1.2.1. Impacts on Land Use Restrictions:

The installation of powerlines often requires the acquisition of land, leading to land use restrictions for farmers. This can affect the available agricultural land, reducing the area for cultivation and potentially affecting crop rotation practices. Additionally, powerline corridors may restrict the use of tall crops or hinder the movement of large machinery, further impacting farming operations. Example: Farmers may need help in expanding their agricultural activities due to the presence of powerlines, limiting their ability to diversify crops or adopt new farming techniques. This can hinder their ability to adapt to changing market demands.

1.2.2. Land Fragmentation:

The allocation of land for electricity substations can result in the fragmentation of agricultural land, leading to reduced farm sizes and increased transportation costs. Example: In some cases, installing substations requires acquiring agricultural land, leading to smaller farm sizes and increased distances between fields, which can hinder efficient farming practices.

1.2.3. Soil Degradation:

The construction and operation of electricity substations and powerlines may lead to soil compaction, disturbance, and erosion, affecting soil fertility and nutrient availability. Example: Heavy machinery used during installation can compact the soil, reducing its ability to retain water and nutrients, ultimately impacting crop growth and yield.

1.2.4. Visual Impacts:

Powerlines can visually impact the agricultural landscape, altering its aesthetic appeal. The presence of towering structures and overhead cables may disrupt the natural beauty of the surroundings, potentially affecting tourism and the overall perception of the area. This visual impact can also influence property values and the willingness of farmers to invest in their land.
Example: Scenic rural areas, known for their picturesque landscapes, may experience a decline in attractiveness due to the installation of powerlines. This can adversely affect local economies that rely on tourism and recreational activities.

1.2.5. Potential Health Risks:

Concerns exist about the potential health risks associated with living or working near powerlines. Electromagnetic fields (EMFs) generated by powerlines have been debated, with some studies suggesting a possible link to health issues such as cancer. Although the scientific consensus remains inconclusive, these concerns can create anxiety among farmers and nearby residents.
Example: Farmers and their families may experience increased stress levels and health concerns due to the perceived risks of living near powerlines. This can have indirect effects on agricultural productivity and overall well-being.

1.3. Potential Benefits to the Farmers

1.3.1. Increased Access to Electricity:

One of the primary advantages of powerlines installation in agricultural areas is increased access to electricity. This enables farmers to utilise modern machinery, such as irrigation systems, automated equipment, and climate control systems, improving efficiency and productivity. Access to electricity also facilitates advanced technologies like precision farming, which optimises resource utilisation and reduces environmental impact.

Example: Farmers can employ electric-powered machinery, such as tractors and harvesters, to enhance productivity and reduce manual labour. This results in higher crop yields and economic growth within the agricultural sector.

1.3.2. Enhanced Irrigation Systems:

Electricity substations provide a reliable power source for irrigation systems, enabling farmers to water their crops efficiently. This leads to improved water management, increased crop yields, and reduced water wastage.

Example: In regions where electricity substations have been installed, farmers have reported significant improvements in crop productivity due to the availability of electricity-powered irrigation systems.

1.3.3. Mechanization and Automation:

The presence of electricity substations facilitates the adoption of modern agricultural machinery and equipment, leading to increased efficiency and reduced labour requirements.

Example: With the installation of electricity substations, farmers can utilise electric-powered machinery such as tractors, harvesters, and milking machines, resulting in higher productivity and reduced physical strain.

1.4. Rationale for agricultural impact assessment.

Both corridors 1 and 2, as indicated in Figure 1 for this project, comprise mainly agricultural land, with only a tiny percentage comprising roads and other public infrastructure and rivers. The purpose of this report is to compute and compare the agricultural value of the two sites with each other to assist with the final decision on the selection of a specific site for the new distribution substation and the 132kv powerline connecting from Sanari – Makonde Powerline. The second objective is to compute the impact or loss in agricultural production if all the land is withdrawn from agricultural production for the duration of the powerline and substation construction.

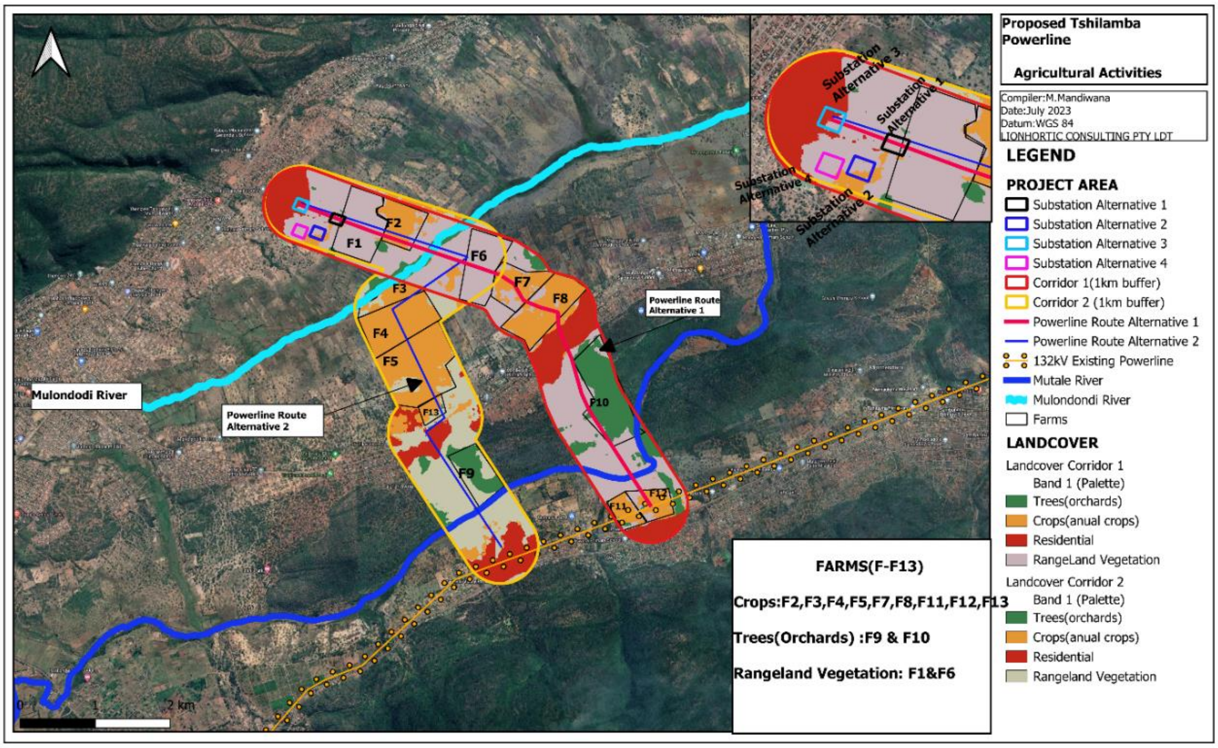

Figure 1: The proposed corridors and powerlines together with substations locations alternatives.

2. Methodology

2.1. The Proposed Corridors Location

The area where the proposed powerlines and substations will be constructed falls under the Thengwe Tribal authority under the chieftaincy of Thovhele Vudzitshena Nethengwe. The Title deed of the whole area falls under the chief and not individual farmers. Farmers only hold the certificate of ownership provided to them by the chief. The area is dominated by rainfed agriculture, which is primarily communal, and informal information is available regarding farm practices.

The area also covers the two villages, Makwilidza and Maheni, both of which are under the chieftaincy of Nethengwe, while the other area is under chief Netswera. The Corridors pass through four villages: Makwilidza, Thengwe, Maheni and Tswera, as depicted in Figure 1. The areas of the suggested corridors are dominated by communal or smallholder farmers. Since this is a rural area where farming is the primary source of income and food security for most families, it is crucial to evaluate the impacts of the new powerlines for both corridors. Significant impacts will be experienced during the period at which the construction will begin and during the entire construction period of this new powerline. The removal of fences will cause the impacts unless a different method of pylons transportation is used, such as helicopters and the creation of access roads which will temper agricultural activities.

Water is a constraint for expanding current agricultural production, as is the impact of agricultural activities such as irrigation on available water resources. Apart from the apparent disturbance caused by the land clearing for Pylons Installation, other infrastructures situated in the farms will be affected. Since land is a limited resource, the demand for land will coincide with economic development and population growth. Economic and population growth has as one of its consequences the demand for and increased competition for land from different sectors. The computation of a cost-benefit analysis to determine the benefit of new developments to society is, therefore, one of the essential elements of an Agricultural Impact Assessment (AIA). In most cases, agriculture must give way to other developments, especially when developments are regarded as national interest. The climate of an area is Semi-arid, with sandy soils dominating the area. There is also sand mining activity on the site nearby due to the availability of sand in the foothills of the mountains.

2.2. Assessment Process

Assessment of soil potential and land capability of the proposed routes was based on a combination of desktop studies to amass general information and then through site visits for status quo assessment. The value of agricultural production is determined by the combination of several factors that are interrelated to each other. The area is regarded as one of the areas in the Mutale region with the highest agricultural potential because of the combination of high-potential soil, climate, and proximity to the local markets.

- Analysis of the sensitivity reports
- Agricultural production, *among other things,* depends on the following factors: Soil potential; Climate; Topography; Vegetation; Water supply, i.e., irrigation potential.
- Availability and distance from infrastructure such as roads, input suppliers etc.
- Availability of markets for products produced on the land.
- Security of the area
- Sustainability of current production methods

2.3. The methodology used to obtain and analyse the agricultural data was as follows:

- On-site inspection to obtain a general picture of the region.
- Information regarding land ownership with the assistance of the royal council
- Obtain information regarding agriculture in the region using satellite imagery to determine land use patterns.
- Obtain gross margin data for crops in the region.
- Obtain farm-level data from individual farmers through questionnaires.
- Compute annual agricultural value per ha.

- Compare the two sites with each other.

2.4. Site visit

The project site was traversed largely by a vehicle and by walking into the farms with the assistance of the chief's right-hand man in May and June 2023 to document the following:
a) Current and emerging agricultural activities of the project site.
b) Soil characteristics, water resources and farm infrastructural profile.
The classification of soils at the project site was based on Landtype description and the Binomial System for South Africa.

2.4.1. Spatial Analysis

A fieldwork, visit, and desktop assessment of farms associated with the powerlines was undertaken. The following baseline and background information was researched and used to understand the study area: Arc GIS was used together with Google Earth software to get the area demarcation of farms based on the available contour and topographic data, and detailed aerial imagery was applied to the proposed powerline corridors to indicate the potential extent of the agricultural farms present. Thorough in-field verification of these systems took place during May and June 2023.

The methodology used to identify agricultural impacts included the following activities:

- Identification of all the fields within the proposed project site
- Spatial data sourcing (vegetation types and land use activities) and land cover classification

2.4.2. Description of the Site based on the environmental setting.

A picturesque landscape of mountains and rolling hills surround the region. The Soutpansberg mountain range (refer to Figure 2), which runs along the northern part of the site, offers stunning views and is home to unique flora and fauna. The site area experiences a subtropical climate with hot summers and mild winters. High temperatures and occasional rainfall characterise summers, while winters are generally dry and cooler.

2.4.3. Land Types

Thengwe area is characterized by vast stretches of lush savannah, with tall grasses and scattered trees, creating a picturesque landscape. The region features gentle, rolling hills that add a sense of tranquillity and charm to the surroundings. Thengwe area is home to dense woodlands, with a variety of indigenous trees and vegetation, providing shade and shelter for various wildlife species. The landscape of Thengwe includes rocky outcrops and boulders, adding a rugged and unique element to the land. Thengwe, Maheni and Makwilidza areas are blessed with riverine forests, lining the banks of rivers and streams, creating a lush and vibrant ecosystem. Thengwe area encompasses wetlands, with marshes, swamps, and seasonal floodplains, supporting a diverse range of aquatic plants. The region also features expansive open grasslands, providing ample grazing opportunities for herbivores and offering breathtaking views of the horizon. Thengwe area is part of the bushveld biome, characterised by a mix of grassy plains, shrubs, and scattered trees, creating a unique and diverse habitat. Agricultural Fields: In certain parts of Thengwe, you can find agricultural fields where crops are cultivated, adding a touch of human intervention to the natural beauty of the area.

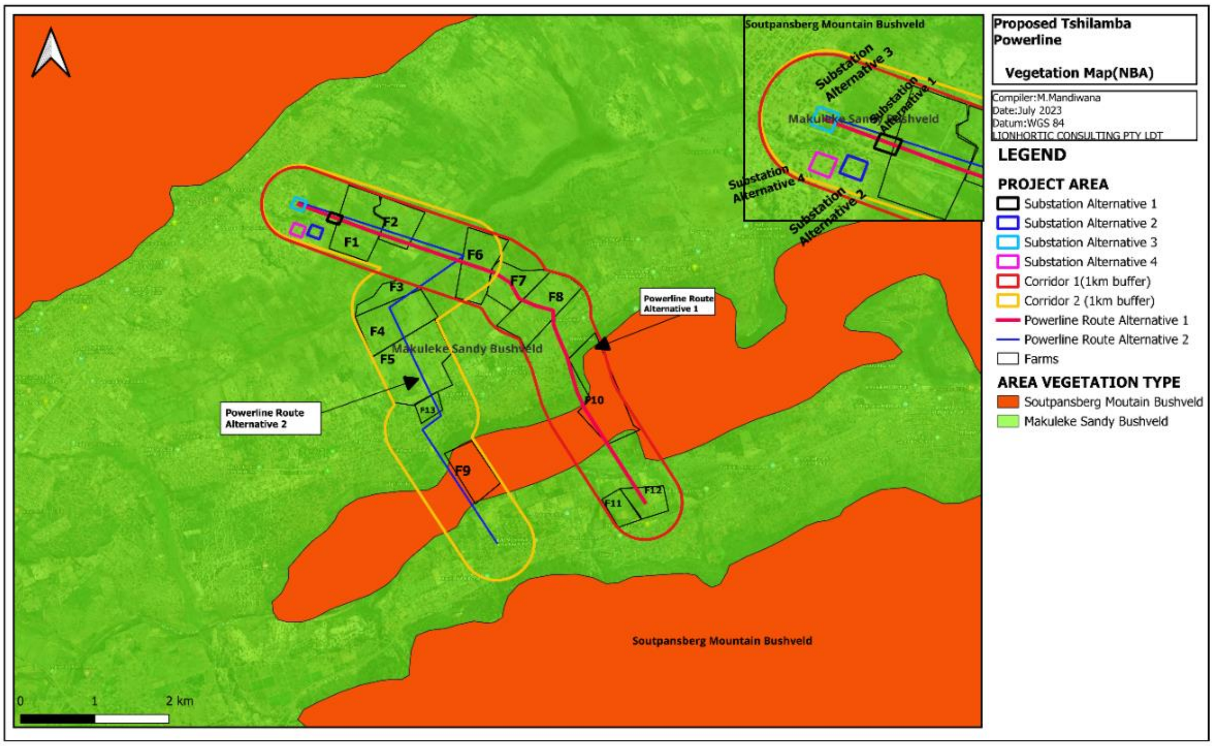

Figure 2: Environmental setting, Vegetation and Climate description covering the proposed corridors.

As per land cover classification, the site's environment consists of extensive orchards, residential areas, and rangeland vegetation. The rangeland vegetation within the site includes low grassland and open woodland—two alternative powerline routes pass through Mutale River, located south of the site. The site is a rural village, and the community largely relies on subsistence farming and small-scale businesses for their livelihoods. Traditional huts, communal areas, and a close-knit community characterise the village.

2.5. Rainfall, Water Resources for Irrigation and Livestock

The project site is situated in a summer rainfall region. In the Limpopo Province, the most important determinant of agricultural productivity is water availability during crop growth. Long-term precipitation records indicate that the proposed site for the powerline corridors could receive a mean annual rainfall of 650 to 1300 mm. The project site is, thus, located in a generally dry to medium rainfall environment. Most of the annual precipitation is expected to fall from October to March. The Mulondodi and Mutale rivers are the major suppliers of irrigation water around the farms, even though there needs to be a proper irrigation scheme. Under the moisture availability classification, the area falls under class 3, as depicted by the Vegetation status Map in Figure 2, which is interpreted as conducive for rainfed arable agriculture. With the expected annual rainfall of 780 mm, the area should be able to support satisfactory rainfed agriculture provided soil conditions and other factors such as topography, extent, and infrastructure are not limiting.

2.6. Approach to the Assessment of Cumulative Impacts

The assessment of cumulative impacts on a study area is complex; especially if many of the impacts occur on a much wider scale than the site being assessed and evaluated. It is often difficult to determine at which point the accumulation of many small impacts reaches the point of an undesired or unintended cumulative impact that should be avoided or mitigated. There are often factors which are uncertain when potential cumulative impacts are identified.
The general methodology which is used for the assessment of cumulative impacts comprised the following:

- Identifying the critical cause-and-impact relationships between the proposed activity and the environmental resources.
- A determination of the magnitude and significance of cumulative impacts; and
- The modification, or addition, of alternatives to avoid, minimize or mitigate significant cumulative impacts.

3. Results and analysis

The data needed to compute and verify agricultural potential are grouped into:

- Soil potential, land use and farming system.
- Infrastructure.
- Potential yields.
- Distance from markets.

It is important to note that this section does not deal with the socio-economic impact such as labour etc.

3.1. Soil Description and Potential and land use

Thengwe area is known for its sandy soil, which is well-draining and allows for good aeration. This type of soil is often found in drier regions and is suitable for certain crops and plants that can tolerate low moisture levels. Some parts of Thengwe have clay soil, which tends to be heavy and retains moisture well. This type of soil can be fertile but may require proper management to prevent waterlogging and improve drainage. Thengwe area also has pockets of loamy soil as depicted in Figure 3, which is a balanced combination of sand, silt, and clay. Loamy soil is highly fertile, retains moisture, and provides good drainage, making it ideal for a wide range of crops and plants. In certain areas, Thengwe has rocky soil, characterized by a high concentration of rocks and stones. This type of soil can be challenging for agriculture but may support hardy plants that can adapt to rocky conditions.

Along the riverbanks and floodplains, Thengwe features alluvial soil, which is rich in nutrients and highly fertile. Alluvial soil is formed by the deposition of sediment carried by rivers, making it ideal for agriculture. Thengwe area is known for its red soil, which is often rich in iron oxide. This type of soil can be fertile and is commonly found in tropical regions, supporting a variety of crops and vegetation. Some parts of Thengwe have sandy loam soil, which is a combination of sand and loam. This type of soil offers good drainage, retains moisture, and is suitable for a wide range of crops. In certain areas, Thengwe has gravelly soil, characterized by a high concentration of gravel and coarse particles. This type of soil may have limited water-holding capacity but can support plants that are adapted to well-drained conditions. Thengwe area may have acidic soil, with a low pH level. Acidic soil can pose challenges for certain crops but can be managed through proper soil amendments and selection of acid-tolerant plants. Alkaline Soil: In some parts of Thengwe, alkaline soil may be present, with a high pH level. Alkaline soil can affect nutrient availability to plants but can be managed through soil amendments and appropriate plant selection.

The study area consists of areas having low soil depths and low land capability classes. Most soils are not suitable for arable agriculture but suitable for forestry or grazing, intermediate suitability for arable agriculture, or poor suitability for arable agriculture. Based on the on-site inspection, satellite imagery, and data from individual farmers, it is shown in Table 1 that 45% of the land at Corridor 1 is cultivated for dry land purposes compared to 55% of Corridor 2. However, much of this area is restricted by shallow rock emanating from a rock outcrop, bedrock, or stiff clays. The Sandy soil makes it difficult for most farmers to cultivate the land, so most farms resemble abandonment.

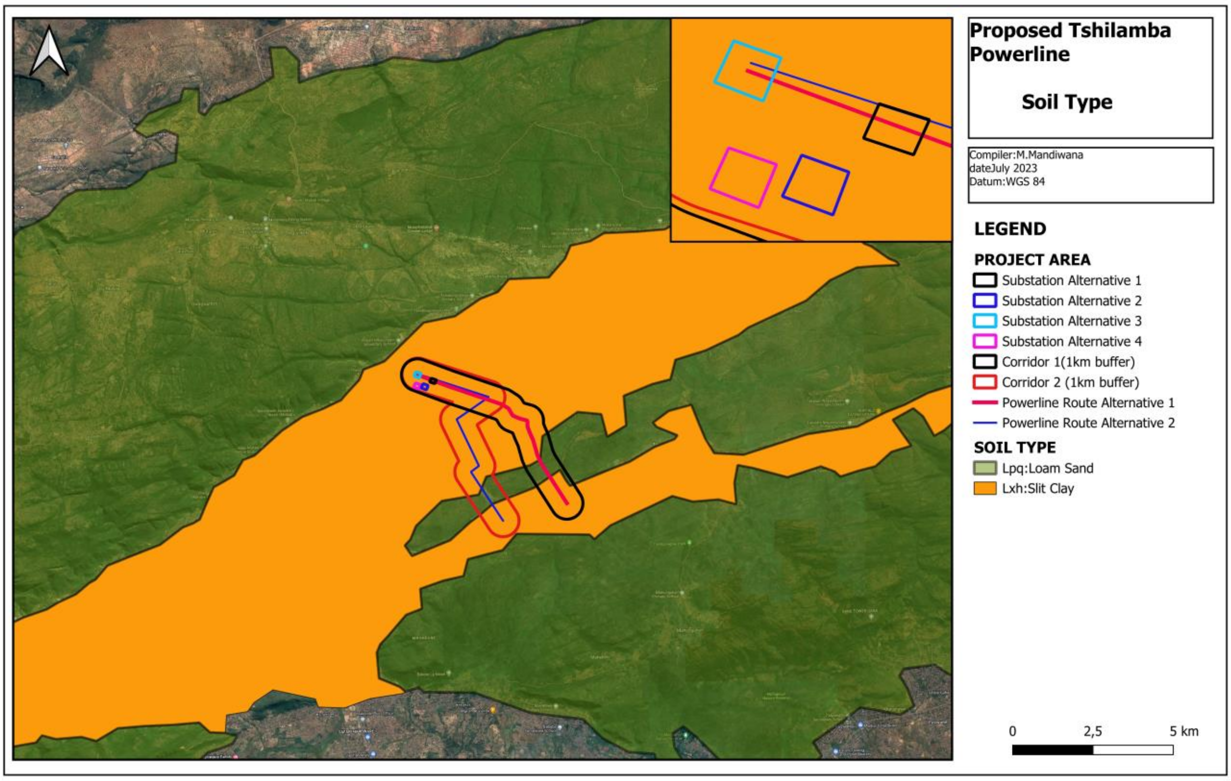

Figure 3: Soil classification map for the proposed corridor section

Most soils are sandy loam on the top horizon and silt clay underneath it. Although farmers at both corridors indicated a more significant percentage of their land as high potential (45 % compared to 55 % for corridor 2), land cultivated for cash crops does not correspond with their perception of land potential due to most of the farms not being cultivated for more than seven years and some even more than ten years as there are no irrigation systems available in the area.

Table 1: Comparison of data between corridor one and corridor two (%)

	Corridor 1 (makwilidza)	Corridor 2 (maheni)
High Potential Soil	45	55
Land Cultivated	50	90
Irrigation Land	5	13
Natural Grazing	18	27
Pastures	6	12
Orchards	10	18
Dry Land Agriculture	80	65

The land use patterns shown in Table 1 show that more smallholder crop farm activities are taking place at both alternative corridors. The exception is one farmer at corridor 1 Near the Substation with an intensive piggery and a chicken under closed quarters. The two powerline routes traverse similar land types and other geographical features. All things are equal and based on the findings and information gathered from the study area.

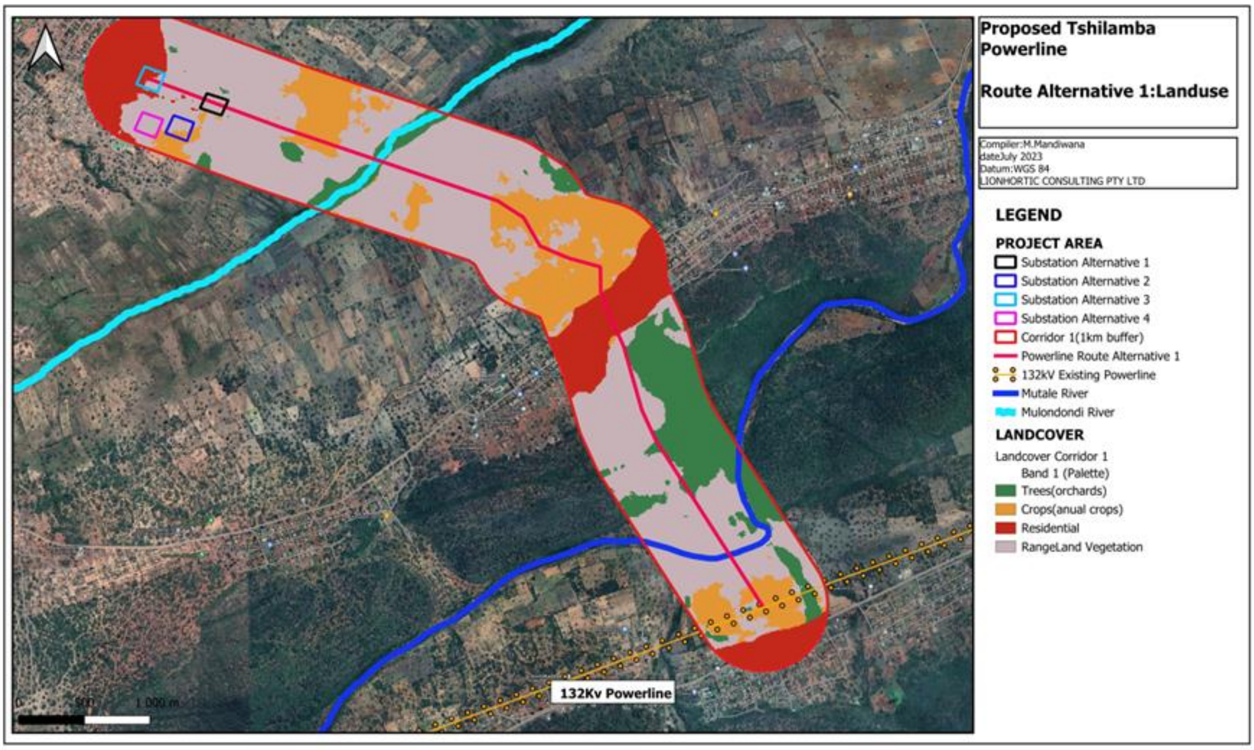

Figure 4: Land use under proposed corridor1 with all agricultural and other environmental activities.

Land use under Proposed Corridor 2 shows a long path with farming activities being affected, as depicted in Figure 5. The two alternative powerline corridors consist of fields named F1 to F13 on the map. The main agricultural activity within the site is subsistence farming for annual crops.

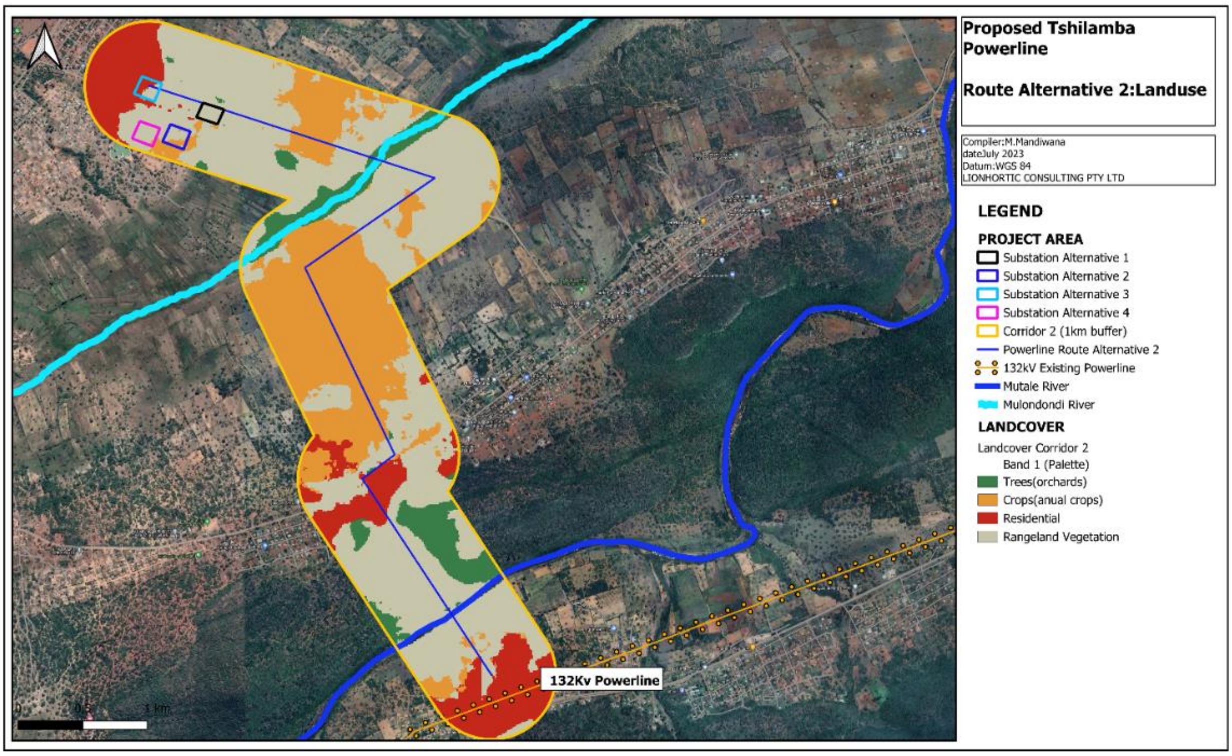

Figure 5: The description of alternative corridor 2 with its powerline and indication of the agricultural and other environmental activities.

It is anticipated that the construction phase will have impacts ranging from low to medium and that implementing the recommended mitigation measures will reduce these impacts. No additional impacts are anticipated for the operational phase of the development. Most agricultural activities are in the valley, and the low-lying area is demarcated closer to the water sources, the Mulondodi and Mutale Rivers.

The assessment of site capability for agricultural through local soil and climatic conditions revealed that the proposed area of development falls predominantly within the Medium to moderate capability class with localised pockets of permanently transformed small scale farms. By comparison, corridor 2 traverses slightly more moderate to high lands relative to route 1. At the point of interception of the two routes, the land capability is predominantly moderate. The area preferred for Mutshikili substation is situated largely on low to moderate lands whereas at the alternative substation sites, land capability could be described as moderate to high.

Table1: Sensitivity indicator for the powerlines and substations alternatives

Sites	Very High	High	Medium	Low
Corridor 1		X		
Corridor 2		X		
Substation 1		X		
Substation 2		X		
Substation 3			X	
Substation 4		X		

Based on the sensitivity report. There is high sensitivity on agricultural activities over the proposed corridors. But even though the sensitivity is very high on the map the reality on the ground shows a different picture about the area. The sensitivity report was verified by the specialist and indeed it is clear that most of the proposed area for the powerlines are a showing a high risk for agricultural activities (Table 1 and 2). But the risk can be minimised by constructing the powerline on corridor 1

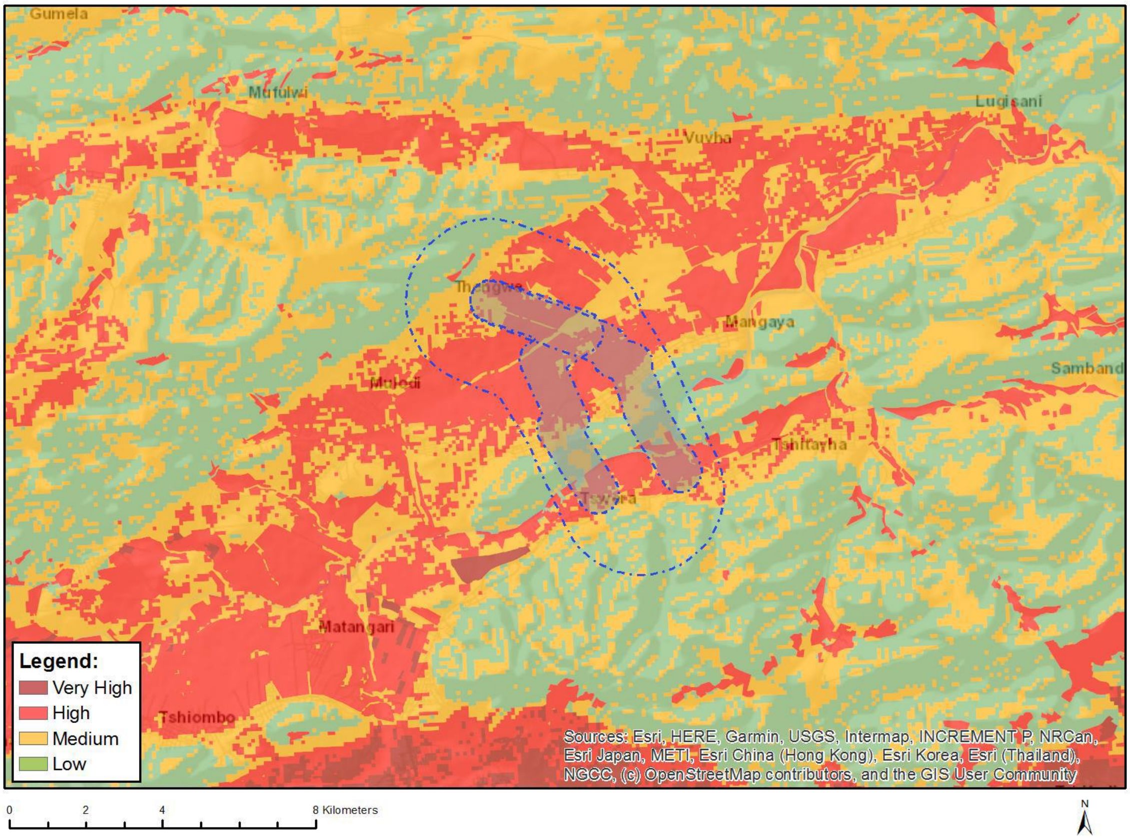

Figure 6: Map of relative agriculture theme sensitivity for the powerline corridors

The Sensitivity report summary for Agriculture based on the features, there are those which resembles High land Capability and Moderate to High in terms of features which will be affected during the construction phase of the powerline.

Table 2: Description of features based on the sensitivity report specifically for preferred powerline corridor and alternative.

Sensitivity	Features
High	Land capability;09. Moderate-High/10. Moderate-High
High	Subsistence Farming; Land capability;09. Moderate-High/10. Moderate-High
High	Subsistence Farming; Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
High	Subsistence Farming; Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate

The Sensitivity report for substations shows that two sites have very high to high sensitivity regarding agriculture and that is Site 1 and 4. The Medium risk alternative site is Site 2 and 3. The Substation sites are all located in low capability soils and the area is dominated by sandy

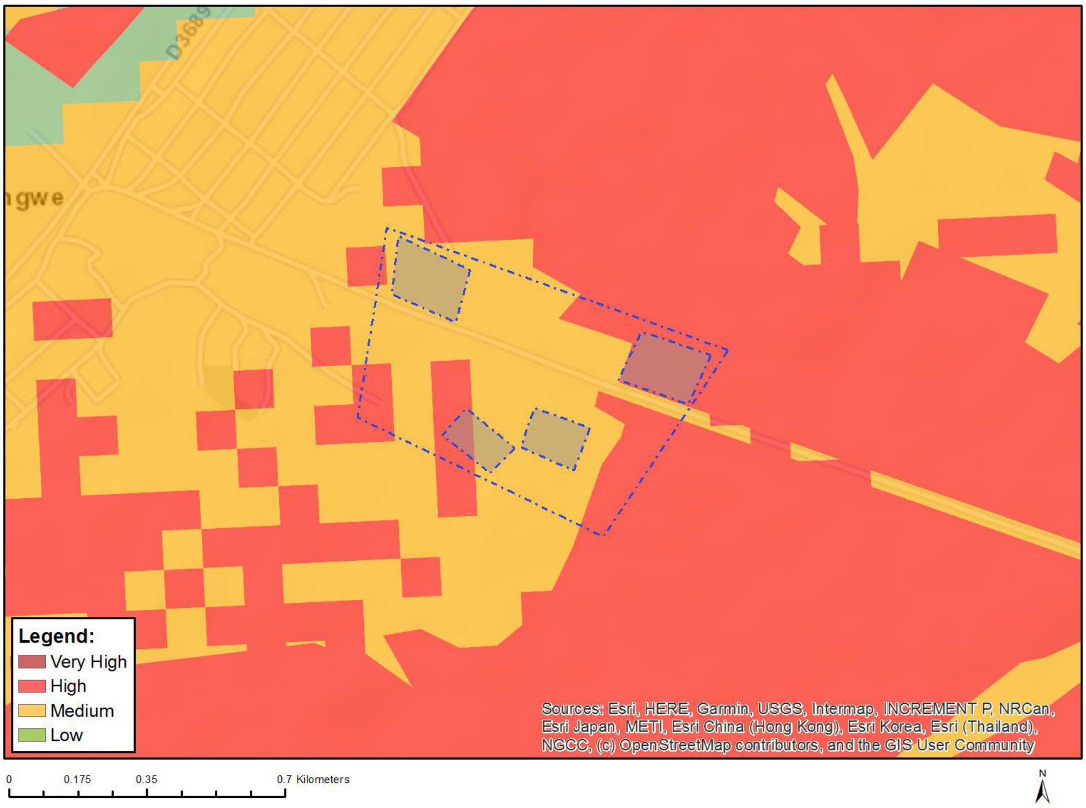

Figure 7: Map of relative agriculture theme sensitivity for substation alternative sites

The features which will be affected the most by the construction of the substation in alternative 1 and 2 is the subsistence farming. One of the problems noticed by the specialist during site visit is the structures which emerged after the sensitivity report was generated. Those structures are making the preferred area to become very high risk.

Table 3: Sensitivity report on land capability and the agricultural or small holder farms

Sensitivity	Features
High	Land capability;09. Moderate-High/10. Moderate-High
High	Subsistence Farming; Land capability;09. Moderate-High/10. Moderate-High
High	Subsistence Farming; Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate

Land capability refers to the capability of producing common cultivated crops and pasture plants without deteriorating over a long period of time. The land capability under the different powerline routes is presented in figure 6 below.

Table 4. Land use uses the proposed corridors with alternatives and their possible impact on agricultural productivity.

Corridor	Land Use	Potential Impact	Extent of Impact		
			Low	Medium	High
Corridor 1	Traverses essentially smallholder farms for about 3.64 km and vacant unspecified lands for about 2.08 km. Beyond this, it continues for approximately 2.0 km across cultivated lands.	The route will affect cultivated and subsistence farming, settlement, and naturally vegetated areas.	X		
Corridor 2	Corridor 2 traverses the peripheries of farms unspecified lands for	The route will affect cultivated and subsistence farming, settlement,		X	X

	about 5.26 km and 2 km across hill and Vacant land. It continues for 4 km through subsistence farms and settlement areas. Relative to corridor 1, the impact on the settlement and subsistence farms is higher.	naturally vegetated, and conservation areas to a higher extent.			

3.2. Infrastructure

Most farms within the designated areas are not equipped with structures or infrastructures, but they are mostly fenced. However, the data clearly show that farms at Corridor 1 are much more built up and equipped with modern infrastructure than the site of Corridor 2. This is expected to consider as the farming systems of crop farming and fruit Farming in Corridor 1 and Corridor 2. Both corridors have farms which comprise farm dwellings and sheds, with livestock handling facilities on one farm and one irrigation system. Corridor 2 boasts three farmhouses and other well-maintained infrastructure such as irrigation pumps and systems, sheds, animal handling facilities, a fully equipped piggery with heating systems and a feedlot.

3.3. Potential yields

The difference between corridors 1 and 2 regarding yields is very similar under dryland conditions. Farmers at both corridors have indicated their average yields for the past three years as between 3.5 and 5 tons per ha. However, farmers who irrigated their crops reported average yields of about 10 tons for the past three years. Farmers also reported different carrying capacities for natural grazing, with farmers for both corridors indicating that they need three ha per livestock unit (LSU). Based on the data obtained regarding crop and animal yields, it seems it will take much work to conclude on the site as no measurements or proper record is available. The number of Farms and classification based on field surveys conducted and farm visit and gathering of the data from the royal council is depicted in Table 5. Table 5 depicts the number of farms on either side of the Zoutpansperg Mountain range, which the powerlines will cross from Tswera to Thengwe.

Table 5: The number of farms affected when the powerline is constructed in one of the corridors.

Agricultural Activities	Corridor 1 (Number of Farms)	Corridor 2 (Number of Farms)
Mango Orchards	2	2
Citrus Orchards	1	1
Cattle Farms (Grazing	3	10
Crop Farms	28	36
Total Number of Farms	34 (397 ha)	49 (442 ha)

The specialist has no objections to the project from the agricultural Impacts on Corridor 1 from a soil potential standpoint. The position of the pylons based on corridor one will result in fewer farming activities being disturbed, as depicted in Figure 6. The suggested positions of the pylons are based on the 263m distance between them, as it is the standard for the terrain were both corridors are passing through.

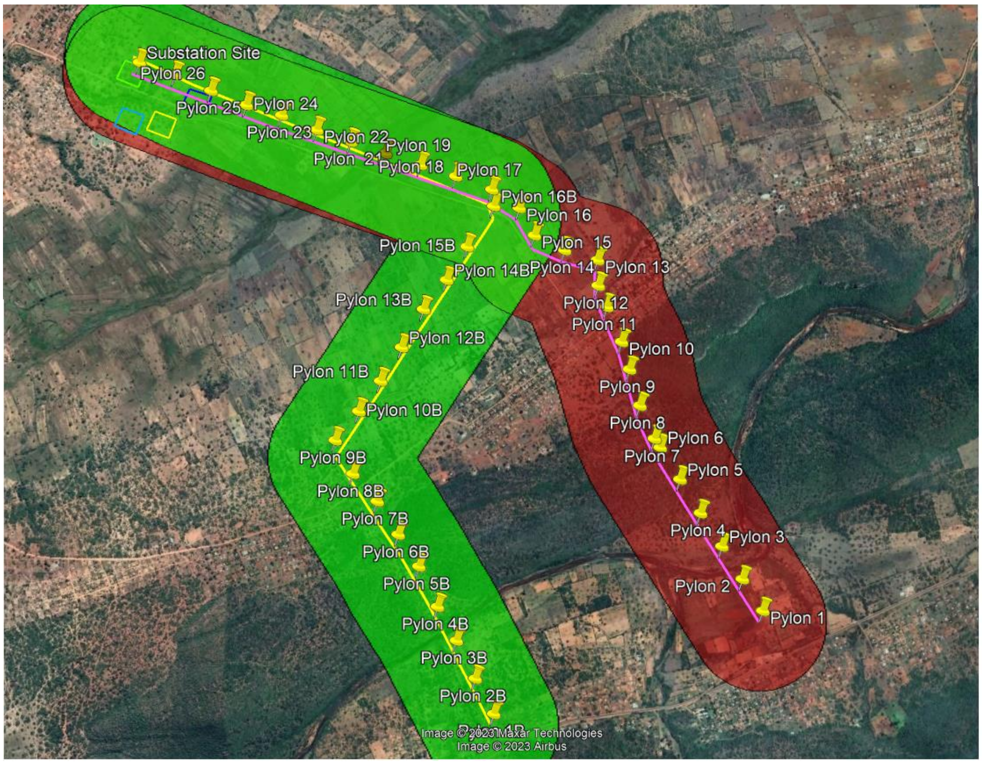

Figure 8: Position of the Pylon over the farms, which will be affected by the permanent structures of the farms.

4. Assessment of Impacts on Agricultural Activities

4.1. Results of Impact Assessment

Most of the area covered by the powerlines for both corridors is in the flat or low-lying areas, as depicted by the elevation map in Figure 9. The low land capability is based on the aridity of the site.As per the results obtained from the screening tool report, the agricultural theme sensitivity was predominantly very high for corridor two compared to corridor 1. It is recommended that an Alternative one be used for the powerline corridor. The area covered by the agricultural activities is of about 2.8 km for corridor 1, while it is approximately 5.6 km if corridor 2 is considered. Therefore, the risk is very high regarding alternative powerline route of corridor 2.

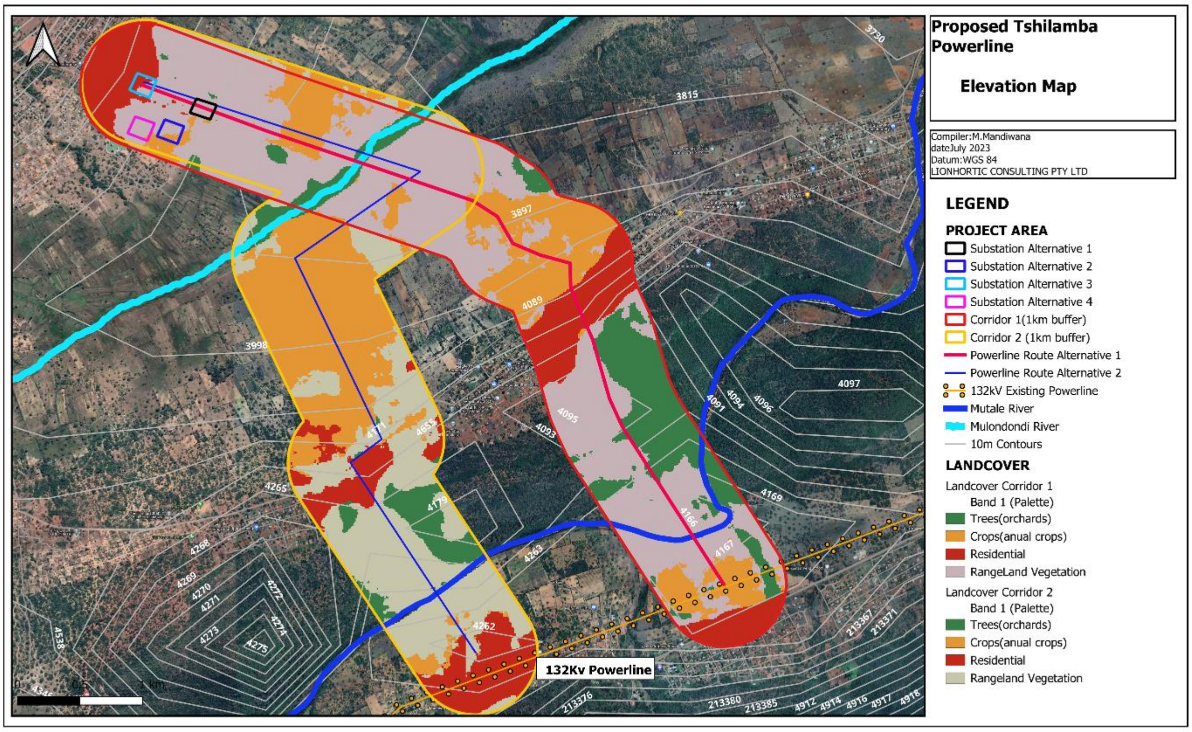

Figure 9: The elevation of both corridors showing the slopes and the activities among the slopes.

4.2. Implications of Project Implementation

Construction Phase Impacts: During the construction phase, construction workers will access the land to prepare the terrain and construct the substations and the base for the pylons. Both potential spills and leaks from construction vehicles and equipment. waste generation on-site can result in soil pollution.

The data analysis and impact assessment indicated that the proposed 132kV powerline based on corridor one is considered an acceptable development within the area of the project assessment zone that was assessed to compile the Agricultural Compliance Report.

It is recommended that substation site three be used as the preferred site, as Alternative one and two have a small area consisting of the Arcadia soil form.

It is anticipated that the construction phase will have impacts ranging from low to medium and that implementing the recommended mitigation measures will reduce these impacts. No additional impacts are anticipated for the operational phase. It is not foreseen that there will be a decommissioning phase. The specialist reasoned that the substation and associated powerline corridor be considered favourably, permitting mitigation measures to prevent soil pollution and minimise impacts on the veld quality of the farm portions that will be affected.

4.3. Land Use and Environmental Impact:

Both corridors, alternatives one and two, pass through crop fields, and rangeland land vegetation with less natural grass and orchards. However, route alternative 2 passes through fields where more crops are grown, which may potentially cause significant disruption in farming operations. As it is indicated in farm named (f3, f4, f5, and f13)

1. Substation alternatives 1, 2, and 4 are located within crop fields and some rangeland vegetation, making them less suitable for the proposed project.
2. Substation alternative 3 is far from the crop fields, which makes it more suitable for the proposed powerline.

Considering the factors above, corridor 1 appears to be the more suitable choice for powerline development in this agricultural area. corridor 1 allows for uninterrupted subsistence farming operations. However, alternative two can be suitable with the following recommendation:

- Moving corridor two powerlines more to the edges of the crop fields to avoid the intensive disruption of farming.

This will ensure that all concerns are addressed, additional local knowledge is incorporated, and a comprehensive decision-making process is followed in addition, the site area is also within the Soutpansberg Mountain Bushveld and Makuleke Sandy Bushveld (Figure 2), which makes the area have less agricultural land. The south side of Route Alternatives 1 and 2 is steep (Figure 8), which makes agricultural activities less due to the chances of soil erosion. There are some areas which were fenced by some villagers who were claiming to be the owners of the site for example the area which is suitable for the substation as depicted in Figure 9.

Figure 10: The current situation of the area demarcated for the substation.

The farm near the areas where the substation is supposed to be built nearby has been adding structures which were not there during the initial phase of the proposed powerlines and substation. The farm has operated more than any other farm in the area. An interview with the farmer was held between the specialist and the farmer Mr Mavhungu as depicted in Figure 9, who indicated that he has no problem with the Substation being built near his farm if there is a service agreement between him and Eskom.

Figure 11:The farm structures situated in the farm near the substation resemble mixed farming.

4.4. Cumulative Impacts

The cumulative impacts will emerge; however, it is crucial to recognize the potential cumulative impacts that this infrastructure development can have on small-scale agriculture. The are various long term various effects that the construction of substations and powerlines can have on small-scale agriculture, including land fragmentation, soil compaction, disruption of irrigation systems, and potential economic losses.

1. Soil Degradation:

Powerline construction often involves the clearing of land, leading to soil disturbance and erosion. The heavy machinery used during construction will compact the soil, reducing its fertility and water-holding capacity. The removal of vegetation will expose the soil to increased erosion risks, especially in areas near Mulondodi and Mutale rivers. Soil degradation can negatively impact crop growth, nutrient availability, and overall productivity. Soil compaction and erosion will significantly reduce crop yields in the short-term during construction phase. The loss of topsoil due to erosion also led to decreased nutrient content, affecting the quality of crops for those who are planting which are few as compared to the farms where there is no production or activity.

2. Soil Compaction:

The heavy machinery used during the construction of substations and powerlines can lead to soil compaction. This compaction reduces soil porosity, limiting water infiltration and root penetration. Consequently, compacted soils have reduced water-holding capacity and nutrient availability, negatively impacting crop growth and productivity. Areas where substations and powerlines will be constructed are anticipated to have a significant increase in soil compaction, leading to decreased crop yields and poor plant health.

3. Disruption of Pollinators:

Powerline construction can disrupt the habitats of pollinators, such as bees and butterflies, which are crucial for crop pollination. The clearing of vegetation and alteration of natural landscapes can limit the availability of food sources and nesting sites for these essential pollinators. Consequently, reduced pollination can lead to decreased crop yields and quality. Areas where powerline construction occurred revealed a decline in pollinator populations, resulting in reduced fruit set and seed production in crops such as fruits.

4. Potential Health Risks for Farmers:

Powerlines emit electromagnetic fields, which have raised concerns about potential health risks for farmers working close to these structures. Prolonged exposure to electromagnetic fields has been associated with various health issues, including increased risk of cancer, neurological disorders, and reproductive problems. Farmers who spend significant time near powerlines may face these health risks, potentially impacting their well-being and ability to sustain agricultural activities. A long-term study conducted on farmers working near powerlines found a higher incidence of certain cancers than those working in areas without powerline infrastructure. This suggests a potential link between prolonged exposure to EMFs and adverse health outcomes. Therefore, caution must be taken and advisory or strict regulations must be considered for the small-scale farmers not to spend too much time under the powerlines. The only advantage about the farmers in Thengwe, Makwilidza and Maheni is that they are mostly seasonal farmers who are only active during the summer months.

5. Land Fragmentation:

The construction of substations and powerlines often requires the acquisition of land, leading to the fragmentation of agricultural plots. This fragmentation can disrupt the continuity of farming operations, making it challenging for small-scale farmers to manage their land effectively. Fragmented plots may result in reduced efficiency, increased transportation costs, and difficulties in implementing crop rotation practices. Substations and powerlines constructed near the farms, will lead to small-scale farmers having difficulties in managing their fragmented plots, resulting in decreased productivity and increased labour requirements.

5. Disruption of Irrigation Systems:

The construction of substations and powerlines may require the installation of underground cables, potentially disrupting existing irrigation systems. This disruption can lead to water shortages or uneven distribution, affecting crop water requirements and overall irrigation efficiency. Small-scale farmers heavily reliant on irrigation may face challenges in maintaining optimal soil moisture levels for their crops. Small-scale farmers in an area where substations and powerlines were constructed reported disruptions in their irrigation systems, resulting in reduced crop yields and increased water stress for their plants.

6. Potential Economic Losses:

The cumulative impacts of substation and powerline construction on small-scale agriculture can result in economic losses. Reduced crop yields, increased labour requirements, and additional costs associated with managing fragmented plots and repairing irrigation systems can significantly impact the financial viability of small-scale farming operations. The economic impacts of substation and powerline construction on small-scale agriculture found that farmers experienced a decline in income due to decreased crop yields and increased production costs.

5. Conclusion:

The construction of substations and powerlines can have cumulative impacts on small-scale agriculture, including land fragmentation, soil compaction, including soil degradation, disruption of pollinators, disruption of irrigation systems, potential economic losses and potential health risks for farmers. To mitigate these impacts, it is crucial to implement measures such as proper land management practices, soil conservation techniques, and coordination between infrastructure developers and farmers to minimize disruptions to irrigation systems. Additionally, raising awareness among farmers about potential health risks and providing guidelines for safe practices can help protect their well-being. By considering these factors, we can ensure the sustainability and resilience of small-scale agricultural practices in the face of infrastructure development.

6. Recommendations

Eskom is a public utility – an organisation tasked with maintaining public service infrastructure, in this case, electricity. Consequently, it has the right to enter your farm at any time to construct, erect, operate, maintain, repair, alter or inspect the structures, works, appliances, conductors, or cables on the land, or to gain access to an adjacent property. This access (easement) to your land can be through a wayleave or a servitude. Before making a final decision, further consultations with field owners, landowners, and relevant authorities are crucial.

References

Soil classification working group. 1991. Soil classification, A Taxonomic System for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development. Pretoria.

Appendix A: Consultations with farmers

General Comment

During the site visit and meeting with the farmers with an assistant of the royal house or Tribal council of Thengwe. The project didn't have any resistance from the communities or farm owners, but it was viewed as an opportunity for servitude and wayleave. The perception that the powerline had to be developed was that there were sudden developments in the farms and people just ensuring that they had fenced their communal demarcated farms and sorting out all sorts of ownership of the land to benefit from the powerline project; therefore, Eskom must be ready to come up with a tangible compensation which will make it easy for the community to accept the project and one main thing which will create smooth pathway for the project is to employ the locals for general labour work during the implementation of the project. Figure 9 depicts the types of activities which are happening on some farms. Most of the farms are abandoned, as mentioned above, and some are active, and the farmers are busy with soil preparations for the next season. One example is the farm owned by Mrs Netshdongololwe from Maheni, as shown in Figure nine during a consultation between her and Dr Tharaga. She was offered the type of Pylons that Eskom uses and what part of the farm may be affected, and a thorough explanation was given to her regarding the powerline and its importance. Her main concern was the narrative which says, "Eskom is going to take our farms", of which explanation was given to Mrs Netshidongololwe that Eskom will not take your farms but will only need access to install the structures and to service them when there is a need.

The overall recommendation is to construct the substation at Alternative 3 and the powerline on Corridor 1.

Figure 12: Evidence of the visits and consultations with farmers whose farms will mostly be affected by the powerline and the types of farming activities and farm structures.

LIST OF FARM OWNERS

1. Livhuwani Nelson Mavhungu (500 m from the preferred substation site)
2. Shumani Nethengwe (Mango Orchard)
3. Ravhudzulo Shonisani (A farm near the river- active but no crops)
4. Nethengwe Mashudu (Periperi Farm- With Drip Irrigation System)
5. George Nethengwe (Abandoned farm)
6. Mr Singo (Planted Moringa Trees)
7. Nancy Netshidongololwe (Farming with Maize and Butternut – only during Summer)
8. Chief Vudzitshena Nethengwe (Livestock Farm)

All the farmers mentioned above have visited their farms and consulted to get their views about the powerline.

IF ANY ENQUIRY ARISES PLEASE CONTACT DR THARAGA ON 0767784293