PEGASUS - UMFOLOZI 400 kV TRANSMISSION LINE
PEDOLOGY REPORT

APPENDIX S

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Prepared for:
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EXECUTIVE SUMMARY

Kay Environmental Services (KES) was approached by PROCON Environmental technologies to undertake a pedological study of the proposed Pegasus – Umfolozi 400 kV transmission line.

Eskom's Transmission Group is proposing to construct a 400 kV transmission line between Pegasus-Substation and the Umfolozi Substation in Kwazulu-Natal. To comply with regulatory requirements of the Environmental Conservation Act (Act 73 of 1989 and associated regulations), and to apply internationally acknowledged best management practice in its activities, Eskom Transmission Group have undertaken this Environmental Impact Assessment (EIA) process.

The aim of this study is to:

- Describe the geology and soils of the study area.
- Identify areas of sensitivity to erosion.
- Identify areas where the local water resource (ground and surface) may be affected by construction activities.
- Recommend mitigation measures to reduce the potential impacts generated by the components of the proposed project.

This report is primarily comprised of a desktop study and 1 day helicopter flight of the corridor. The primary sources of information were the Institute of Soil, Water and Climate maps and land-type memoirs, Department of Agriculture and Environment Kwazulu-Natal and Eskom.

From sections FG-3 to DG-22 the rock type is dominated by Arenite, some shale and dolerite are also present in the landscape. From DG-22 to BD-38 the rock type varies from Arenite, Dolerite, Greenstone, Shale and Tillite. From sections BD-38 to DE-55 the landscape is dominated by Granite with small inclusions of Tillite, also present in the landscape are Basalt, Quartizite and Tillite.

From section FG-3 toFG-7 the soils varies from Plinthic Catena: Upland duplex and Margalitic soil rare (Ba dystrophic and/or mesotrophic; red soils widespread to Glenrosa and/or Mispah (Fb Lime rare or absent in the entire landscape). These soils are located on flat to rolling hill surface with low erosive potential. The soils from sections FGH-8 to BCDEF-28 are dominated by duplex soils that are highly erosive Plinthic Catena: Upland Duplex and/or Margalitic soils common. The rest of the study area soils are dominated by the Glenrosa and/or Mispah form (others may occur) Fb lime rare or absent in upland soils but generally present in low-lying soils.

The environmental impacts of the construction and operational phase would be particularly sensitive to the management and sensible planning. These impacts include soil erosion and soil pollution.

The issues and activities connected to the construction and operational phase that could cause soil erosion includes:

- Clearing of vegetation for the installation of the transmission towers.
- Clearing of areas for campsites.
- Construction of access roads.

The areas between sections DG-22 to BD-36 are the most sensitive and critical areas along the entire route. These soils are highly susceptible to erosion and in fact some of the most severe examples of sheet and gully erosion in South Africa are found in this part of the Tugela basin. Evidence of gully, water and wind erosion is present in the landscape.

Construction and operational activities should be carefully monitored to ensure compliance with the EMP. The EMP should limit construction activities to those that are acceptable in preventing environmental damage. No scarring of such areas would be allowed and proper rehabilitation would ensure recovery without any problems. Erosion prevention measures should be taken right from inception of the construction process.

The proposed transmission line will have very little impact on the soil within the study corridor. However there are some sensitive areas mapped within the study corridor especially section DG-22 to BD-36 where the terrain shows extensive evidence of gully and sheet erosion. Special attention needs to be giving to this area during the construction and operation of the proposed transmission line.

Some of the soils within the study area have a high erosive index because of their position on the landscape. These soils are susceptible to water erosion. Also contributing to this is the lack of or current bad land management.

TABLES OF CONTENTS **Page**

Figures

1 INTRODUCTION

Eskom's Transmission Group is proposing to construct a 400 kV transmission line between Pegasus Substation and Umfolozi Substation in Kwazulu-Natal. To comply with regulatory requirements of the Environmental Conservation Act (Act 73 of 1989 and associated regulations), and to apply internationally acknowledged best management practice in its activities, Eskom Transmission Group have undertaken this Environmental Impact Assessment (EIA) process.

An Environmental Impact Assessment has recently been completed for a Transmission line between Umfolozi Sub-station (near Ulundi) and the Athene Sub-station at Empangeni. Notwithstanding this additional line, recently proposed industrial developments in the Richards Bay area will result in a greater demand being placed on the electricity grid. Therefore, a new 400 kV Transmission line between Pegasus Sub-station (near Dundee) and the Umfolozi Sub-station (near Ulundi) is being proposed to address this increased demand.

2 BACKGROUND AND BRIEF

Richard Bay and its surrounds continue to show significant growth as an industrial centre in South Africa. Eskom Transmission regularly reviews the predictions on energy demand growth and developments could place greater stress on the existing electricity network. To support this growth demand, Eskom Transmission has decided to both improve the reliability of the existing network and upgrade its capacity. To achieve these objectives, additional Transmission lines are required.

The aim of this study is to:

- Describe the geology and soils of the study.
- Identify areas of sensitivity to erosion.
- Identify areas where the local water resource (ground and surface) may be affected by construction activities.
- Recommend mitigation measures to reduce the potential impacts generated by the components of the proposed project.

3 STUDY APPROACH

This report is primarily comprised of a desktop study and limited 1-day helicopter site reconnaissance inspection. The primary sources of information are the Institute of Soil, Water and Climate (ISWC), Map from Department of Agriculture and Environment (Kwazulu-Natal), and geological maps purchase from map office.

The approach to this study was to review all soil land-type maps, geological maps, Maps printed from the Environmental Impact Assessment software and topographical maps (1: 50,000).

A site reconnaissance was conducted to identify sensitive and critical areas. Special attention should be given to area along the Nqutu district (DG-22 to BD-36), because of the erosive nature of the soils in the area.

4 STUDY AREA

The new transmission line is approximately 80 km from Pegasus Sub-station (near Dundee) and the Umfolozi Sub-station (near Ulundi). The pedology for the route was reviewed. Critical and/or sensitive areas along the corridor were identified and mitigation factors area discussed.

4.1 GEOLOGY

From sections FG-3 to DG-22 the rock type is dominated by Arenite, some shale and dolerite are also present in the lanfdspace. From DG-22 to BD-38 the rock type varies from Arenite, Dolerite, Greenstone, Shale and Tillite. From sections BD-38 to DE-55 the landspace is dominated by Granite with small inclusions of Tillite, also present in the landspace are Basalt, Quartizite and Tillite.

4.2 SOILS

From section FG-3 toFG-7 the soils varies from Plinthic Catena: Upland duplex and Margalitic soil rare (Ba dystrophic and/or mesotrophic; red soils widespread to Glenrosa and/or Mispah (Fb Lime rare or absent in the entire landscape). These soils are located on flat to rolling hill surface with low erosive potential. The soils from sections DFGH-8 to BCDEF-28 are dominated by duplex soils that are highly erosive Plinthic Catena: Upland Duplex and/or Margalitic soils common. The rest of the study area soils are dominated by the Glenrosa and/or Mispah form (others may occur) Fb lime rare or absent in upland soils but generally present in low-lying soils.

The areas between sections DG-22 to BD-36 are the most sensitive and critical areas along the entire route. These soils are highly susceptible to erosion and in fact some of the most severe examples of sheet and gully erosion in South Africa are found in this part of the Tugela basin. Evidence of gully, water and wind erosion is present in the landscape.

All the soils of this mapping unit are characterised by a duplex morphology: relatively coarse-textured topsoil overlies, with an abrupt transition, a relatively clayey B-horizon in which structure is either prismatic (Estcourt form) or blocky (Kroostad form). Duplex soils occupy, extensively, the middle and lower slope positions of pedimented landscapes.

The rest of the study area soils are dominated by the Glenrosa and/or Mispah form (others may occur) Fa lime rare or absent in the landscape and Fb lime rare or absent in upland soils but generally present in low-lying soils. These soils have a low to high erosive factor.

5 IDENTIFICATION OF RISK SOURCES

This section presents the various biophysical impacts that may result from the construction, operations and decommissioning of the transmission line. The biophysical impacts are discussed in terms of the various project stages and the activities connected to each stage. The project stages include construction and maintenance.

5.1 CONSTRUCTION AND DECOMMISSIONING

The environmental impacts of the construction phase would be particularly sensitive to the management and sensible planning. These impacts include soil erosion and soil pollution.

The issues and activities connected to the construction and operational phase that could cause soil erosion includes:

- Clearing of vegetation for the installation of the transmission towers.
- Clearing of areas for campsites.
- Constructions of access roads.

5.2 OPERATIONS

The environmental impacts of the operational phase would be particularly sensitive to the management and sensible planning. These impacts include soil erosion and soil pollution.

- Lack of maintenance of access road could cause and exacerbate soil erosion.
- Bad rehabilitation practices.

Construction Phase
Summary of soil land-type with potential risk

Table 2

Land-type	**Land-type Description**	**Erosion Hazard**	**Potential Risk**
Ba	Plinthic catena: upland duplex and margalitic soils rare	Low to High	**Low**
Ca	Plinthic catena: upland duplex and margalitic soil common	High	High
Fa	Glenrosa and/or Mispah form (other soil may occur)	Low to medium	Medium
Fb	Glenrosa and/or Mispah form (other soil may occur)	Low to medium	Medium
Ib	Miscellaneous land class	High	Low

Summary of potential risk of each activity per description area
Table 3

Activity	Impact	Magnitude of impact	**Duration of impact**
Clearing of vegetation for installation of foundation and towers	• Soil erosion • Loss of arable land • Loss of wetland related soils	• High • High • High	• Medium to long term • Medium to long term • Medium to long term
Construction of access roads	• Soil erosion • Soil pollution • Loss of arable land • Wetland related soils • Water Quality	• High • High • High • High • High	• Medium to long term • Long term • Short to long term • Medium to long term • Medium to long term
Clearing for campsite	• Soil erosion • Soil pollution	• High • High	• Medium to long term • Long term

5.3 Criteria against which expected impacts are evaluated

Nature of the impact	**Description of impact**
Extent of the impact	Describe whether the impact will be : local extending only as far as the development site; or limited to the site and immediate surroundings; or will have an impact on the region, or will have an impact on a national scale or across international borders
Duration of the impact	• Short term (0-5 years) • Medium term (5-15 years) • Long term (f16-30 years) • Permanent
Intensity	The specialist should establish whether the impact is destructive or benign and should be qualified as low, medium or high. The specialist study must attempt to quantify the magnitude of the impacts and outline the rationale used.
Probability of occurrence	• Improbable, where the possibility of the impact to materialise is very low • Probable, where there is a distinct possibility that the impact will occur • Highly probable, where it is most likely that the impact will occur • Definite, where the impact will definitely occur
Status of the impact	The specialist should determine whether the impacts are negative, positive or neutral ("cost – benefit" analysis). The impacts are to be assessed in terms of their effect on the project and the environment. For example, an impact that is positive for the proposed development may be negative for the environment. It is important that this distinction is made in the analysis.
Accumulative impact	Consideration must be given to the extent of any accumulative impact that may occur due to the proposed development. Such impacts must be evaluated with an assessment of similar developments already in the environment. Such impacts will be either positive or negative, and will be graded as being of negligible, low, medium or high impact.

6 IMPACT DESCRIPTION AND ASSESSMENT

Routes: A, and B section FG-5 to EH-14 on both the Northern and Southern line		
Theme	**Clearing of vegetation for installation of foundation and towers**	
Nature of Impact	***Soil Erosion***	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommissioning	Operation
Extent of impact	Local	NA
Duration of impact	Short term	NA
Intensity	Low to high	NA
Probability of Occurrence	Probable	NA
Status of impact	Negative	NA
Accumulative Impact	Low	NA
Level of Significance	High	NA
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • During construction of the proposed transmission line areas with fertile soil present this should removed and stored.	
Level of significance after mitigation	Low	
EMP requirements	• During construction site preparation, vegetation removal and the erection of buildings must happen simultaneously, to ensure that no large tracts of land are left exposed at any point in time. Vegetation clearance should be kept to the dry season. • Catch water drains or berms must be constructed above embankments and cuttings to prevent run-off from flowing down and	

	across the slopes. This is especially important while slopes are still bare. For optimum control of soil erosion on embankments and cuttings, vegetation must be established. • All topsoil removed from an area during site preparation and construction must be stockpiled for use during rehabilitation. The rehabilitation of the site must occur immediately after construction phase, and should not be left until the end of the project. • Erosion must be monitored in the section of the transmission line • EMP to control construction to ensure that the best method is used.	

Discussion

These sections of the proposed transmission line on both sides of the route have a low erosion rating. There is a need for careful planning during construction along these sections to minimise the erosion. The environment along the Northern section of the study area is more pristine than the Southern section of the study. The Southern line is preferred for this section of the proposed line.

Routes: A, B, C and D section EH-14 to DG-22 and BD-36 to BC-41 both Northern and Southern lines		
Theme	**Clearing of vegetation for installation of foundation and towers**	
Nature of Impact	***Soil Erosion***	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommission	Operation
Extent of impact	Regional	NA
Duration of impact	Long term	NA
Intensity	High	NA
Probability of Occurrence	Highly probable	NA
Status of impact	Negative	NA
Accumulative Impact	Negative	NA
Level of Significance	High	NA
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • During construction of the proposed transmission line areas with fertile soil present this should removed and stored.	
Level of significance after mitigation	Low	Low
EMP requirements	• During construction site preparation, vegetation removal and the erection of buildings must happen simultaneously, to ensure that no large tracts of land are left exposed at any point in time. Vegetation clearance should be kept to the dry season. • Catch water drains or berms must be constructed above embankments and cuttings to prevent run-off from flowing down and across the slopes. This is especially important while slopes are still bare. For optimum control	

	of soil erosion on embankments and cuttings, vegetation must be established. • All topsoil removed from an area during site preparation and construction must be stockpiled for use during rehabilitation. The rehabilitation of the site must occur immediately after construction phase, and should not be left until the end of the project.	
Discussion Erosion occurs along these sections of the proposed line on both sides of the study area but limited, most of the erosion along these sections occur at river crossings this will affect the water quality in the river. Because of the sediment load eroding into the river. The southern route is preferred because the northern route has more pristine land along the study area.		

Routes: A and B section DG-22 to BD-36 on both the Northern and Southern line		
Theme	**Clearing of vegetation for installation of foundation and towers**	
Nature of Impact	***Soil Erosion***	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommission	Operation
Extent of impact	Regional	NA
Duration of impact	Long term	NA
Intensity	High	NA
Probability of Occurrence	Definite	NA
Status of impact	Negative	NA
Accumulative Impact	Negative	NA
Level of Significance	High	NA
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • Clearing of vegetation should be kept to a minimum. • If possible construction should happen without vegetation removal. • Avoid pristine area.	
Level of significance after mitigation	Moderate	
EMP requirements	• The rehabilitation of donga will be necessary in this area. • Erosion control will be necessary in this section of the proposed transmission line. • Erosion must be monitored in the section of the transmission line • EMP to control construction to ensure that the best method is used.	

Discussion

This section of the proposed transmission line is the most sensitive and critical area to be crossed by the line. These soils are highly susceptible to erosion and in fact some of the most severe example of sheet and gully South Africa are found in this part. Construction activities will either disturb the vegetation cover or breach the protective topsoil is likely to result in severe soil loss. During the helicopter reconnaissance of the study areas it was acknowledge that majority of the erosion occurs on the southern section of the proposed line. The southern route is favoured because of this reason the northern section shows some erosion but not as extensive as the southern line and the northern line has more pristine land with little human contact. Due to the sensitive nature of this area it is not advised that the northern section be considered.

Routes: B, C and D section BC-41 to DE-55 on both the Northern and Southern line		
Theme	**Clearing of vegetation for installation of foundation and towers**	
Nature of Impact	***Soil Erosion***	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommission	Operation
Extent of impact	Regional	NA
Duration of impact	Long term	NA
Intensity	High	NA
Probability of Occurrence	Probable	NA
Status of impact	Negative	NA
Accumulative Impact	Negative	NA
Level of Significance	High	NA
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • Clearing of vegetation should be kept to a minimum. • Avoid pristine area	
Level of significance after mitigation	Low	
EMP requirements	• EMP to control construction to ensure that the best method is used. • EMP to control construction to ensure the best possible method is used. Soil erosion should however not be a major problem due to the slopes and soil conditions over most of the line route. In mountainous areas alternative methods of construction could prevent erosion.	

Discussion

This section of the proposed transmission line has a low erosion hazard. Both the southern and northern the routes are preferred along this section. It's being discussed that the proposed transmission line might jump from the preferred Southern line to the Northern section. This is acceptable. Although the erosion hazard rating is low but the care should be taken to minimise vegetation removal.

Routes: A, B, C and D		
Theme	**Clearing of vegetation for installation of foundation and towers**	
Nature of Impact	**Loss of arable soils**	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommissioning	Operation
Extent of impact	Local	Local
Duration of impact	Short term	Permanent
Intensity	Medium	Medium
Probability of Occurrence	Probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	Medium	Medium
Level of Significance	Low	Low
Mitigation measures	• All topsoil removed from an area during site preparation and construction must be stockpiled for use during rehabilitation. The rehabilitation of the site must occur immediately after construction phase, and should not be left until the end of the project. • In all areas disturbed by construction activities, the topsoil must be removed and stockpiled close to the site for use during rehabilitation. This may involve separating the 0 and A Horizon, depending on the nature of the soil profile. • Reviewing pylon structure design to accommodate farmers need to work the arable land available.	NA
Level of significance after mitigation	Low	**Low**
EMP requirements	• For more site specific mitigation measures refer to Eskom's Environmental Management	

	Plan Report (EMPR) to the construction Phase of this project. • Clearly mark guide ropes	

Discussion

The land, climate and soil types in the study area lend itself to extensive farming and grazing for cattle and sheep. The soil within the study area could not be considered as arable soils. Because of two major limitations arable utilisation usually amount to misuse. Firstly, duplex soils are found mainly in the dry sub-region of the interior Basin where effective rainfall is marginal or sub-marginal for cropping, and where drought is a hazard. Although it is possible, in occasional good season, to produce of maize. Secondly, on account of their morphological and chemical properties, and because of the instability of the landscape in which they occur here, the duplex soils are highly erodible, cultivation introduces a severe risk of soil loss. Only in limited areas are arable soils prevalent these are section FG-5 to FH-7 and area around the town of Nqutu district. Many old cultivated fields are observed in the study area where crops were grown previously.

Routes: A, B, C and D		
Theme	**Clearing of vegetation for installation of foundation and towers**	
Nature of Impact	**Loss of Wetland related soils**	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction and Decommissioning	Operation
Extent of impact	Regional	Regional
Duration of impact	Long – term	Medium
Intensity	High	High
Probability of Occurrence	Highly probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	High	High
Level of Significance	High	High
Mitigation measures	• Wetland area should be avoided at all cost during the installation of towers	NA
Level of significance after mitigation	Medium	**Medium**
EMP requirements	• Wetlands should be avoided in planning access roads for construction. • Any damage to wetlands must be rehabilitated before the site is abandoned. • Self-supporting tower should be installed in wetland area and pans. • No dumping of refuses and waste around wetlands. • While working in an area efforts should made to reduce compaction of soil. • Temporary road crossing wetland should not be compacted and must be remove after construction is finished. For more site specific mitigation measures refer to	• Annual Inspections and rehabilitation to be conducted.

	Eskom's Environmental Management Plan Report (EMPR) to the construction Phase of this project.	

Discussion

Wetlands are highly sensitive habitats being home to a group of highly specialized species, particularly bird species. More than 50% of KwaZulu-Natal's wetlands have been lost over the past 3 decades through draining, damming and road construction. Gaining access to construct this proposed powerline has the potential to impact heavily the wetlands in this study area. These wetlands must be avoided, as it is unacceptable to route roads through wetlands. All routes are assessed together as wetlands are equally common all along the length of all the route options. Wetlands impacts at one point in the catchment very often influence the wetlands further down in the catchment, particularly through erosion and siltation. Wetlands must at all costs be avoided when planning the access roads for the construction teams.

Routes: A and B section FG-5 to EH-14 on both the Northern and Southern line		
Theme	**Construction of access roads**	
Nature of Impact	*Soil Erosion*	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction	Operation
Extent of impact	Local	Local
Duration of impact	Long-term	Long-term
Intensity	Low	Low
Probability of Occurrence	Probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	Negative	Negative
Level of Significance	Low	Low
Mitigation measures	• During construction of access road track based vehicle should be used especially in wetland surroundings. • Compaction should minimised • Any foreign material used to maintain the temporary road must be remove after construction, unless used to improve the road and for erosion control	• All rehabilitation and re-vegetation programmes must be monitored. • Existing access road should be used were ever possible.
Level of significance after mitigation	Low	Low
EMP requirements	• During construction site preparation, vegetation removal and the erection of buildings must happen simultaneously, to ensure that no large tracts of land are left exposed at any point in time. Vegetation clearance should be kept to the dry season.	• All access roads must be maintained and storm water drainage system implemented. • Vegetation removal must be kept to a minimum.

Discussion
This section of the proposed transmission has a low erosion rating. Although the erosion rating is low the activities involved in the construction of access road could course erosion. Utilisation of existing access road is a must. Avoid pristine area

Routes: A, B, C and D section EH-14 to DG-22 and BD-36 to BC-41 both Northern and Southern lines		
Theme	**Construction of access roads**	
Nature of Impact	***Soil Erosion***	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction and Decommissioning	Operation
Extent of impact	Local	Local
Duration of impact	Medium	Medium
Intensity	High	High
Probability of Occurrence	Probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	Negative	Negative
Level of Significance	High	High
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • During construction of the proposed transmission line areas with fertile soil present this should removed and stored.	• All rehabilitation and re-vegetation programmes must be monitored. • Existing access road should be used were ever possible.
Level of significance after mitigation	Low	Low
EMP requirements	• EMP to control construction to ensure that the best method is used. • During construction site preparation, vegetation removal and the erection of buildings must happen simultaneously, to ensure that no large tracts of land are left exposed at any point in time. Vegetation clearance should be kept to the dry season.	• All access roads must be maintained and storm water drainage system implemented. • Vegetation removal must be kept to a minimum. • Burning along the entire route should be avoided if possible. Burning will leave the topsoil exposed, which increases the chances of soil erosion. If possible, the veld along the entire route should be cut mechanically to prevent soil exposure.

Discussion

Their is evidence of soil erosion along this section of the line on both sides of the study area, most of the erosion along this section occurs at river crossings this will affect the water quality in the river. Because of the sediment load eroding into the river. The southern route is preferred because the northern route has more pristine land along the study area. Utilisation of existing access road is a must. Avoid pristine area.

Routes: A and B section DG-22 to BD-36 on both the Northern and Southern line		
Theme	**Construction of access roads**	
Nature of Impact	***Soil Erosion***	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction	Operation
Extent of impact	High	Low
Duration of impact	Long-term	Long Term
Intensity	High	Low
Probability of Occurrence	Definite	Highly Probable
Status of impact	Negative	Negative
Level of Significance	High	High
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • Clearing of vegetation should be kept to a minimum.	• The rehabilitation of donga will be necessary in this area. • Erosion control will be necessary in this section of the proposed transmission line.
Level of significance after mitigation	Medium	Medium to High
EMP requirements	• The rehabilitation of donga will be necessary in this area. • Erosion control will be necessary in this section of the proposed transmission line. • Erosion must be monitored in the section of the transmission line • EMP to control construction to ensure that the best method is used.	• All access roads must be maintained and storm water drainage system implemented. • Vegetation removal must be kept to a minimum. • All rehabilitation and re-vegetation programmes must be regularly checked and monitored with reseeding of any bare soil patches. • Burning along the entire route should be avoided if possible. Burning will leave the topsoil exposed, which increases the chances of soil erosion. If possible, the veld along the

		entire route should be cut mechanically to prevent soil exposure. • Erosion should be monitored during the maintenance of the proposed transmission line.

Discussion

This section of the proposed transmission line is the most sensitive and critical area to be crossed by the proposed line. These soils are highly susceptible to erosion and in fact some of the most severe example of sheet and gully South Africa are found in this part. Construction activities will either disturb the vegetation cover or breach the protective topsoil is likely to result in severe soil loss. During the helicopter reconnaissance of the study areas it was acknowledge that majority of the erosion occurs on the southern section of the proposed line. The southern route is favoured because of this reason the northern section shows some erosion but not as extensive as the southern line and the northern line has more pristine land with little human contact. Although soil erosion is very extensive in some areas along the proposed transmission line route due to bad management practice or neglects Eskom should look at improving the land practices along this route because this will help slow down a lot of the erosion currently taking place.

Routes: B, C and D section BC-41 to DE-55 on both the Northern and Southern line		
Theme	**Construction of access roads**	
Nature of Impact	***Soil Erosion***	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction and Decommission	Operation
Extent of impact	Local	Local
Duration of impact	Long-term	Long-term
Intensity	High	**High**
Probability of Occurrence	Probable	**Probable**
Status of impact	Negative	**Negative**
Accumulative Impact	Negative	**Negative**
Level of Significance	High	**High**
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • Clearing of vegetation should be kept to a minimum. • Avoid pristine area	
Level of significance after mitigation	Low	Low
EMP requirements	• EMP to control construction to ensure that the best method is used. • Soil erosion should however not be a major problem due to the slopes and soil conditions over most of the line route. In mountainous areas alternative methods of construction could prevent erosion.	• All access roads must be maintained and storm water drainage system implemented. • Vegetation removal must be kept to a minimum. • Burning along the entire route should be avoided if possible. Burning will leave the topsoil exposed, which increases the chances of soil erosion. If possible, the veld along the entire route should be cut mechanically to prevent soil exposure.

Discussion

This section of the proposed transmission line has a low erosion hazard. Both the southern and northern the routes are preferred along this section. It's being discussed that the proposed transmission line might jump from the preferred Southern line to the Northern section. This is acceptable. Although the erosion hazard rating is low but the care should be taken to minimise vegetation removal and the access road must maintained with storm water drainage system installed along access road located in hilly and mountainous area.

Routes: A, B, C and D		
Theme	**Construction of access roads**	
Nature of Impact	**Loss of arable soils**	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommissioning	Operation
Extent of impact	Local	Local
Duration of impact	Short term	Permanent
Intensity	Medium	Medium
Probability of Occurrence	Probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	Medium	Medium
Level of Significance	Low	Low
Mitigation measures	• All topsoil removed from an area during site preparation and construction must be stockpiled for use during rehabilitation. The rehabilitation of the site must occur immediately after construction phase, and should not be left until the end of the project. • In all areas disturbed by construction activities, the topsoil must be removed and stockpiled close to the site for use during rehabilitation. This may involve separating the 0 and A Horizon, depending on the nature of the soil profile.	NA
Level of significance after mitigation	Low	Low
EMP requirements	• For more site specific mitigation measures refer to Eskom's Environmental Management Plan Report (EMPR) to the construction Phase of this project.	

Discussion

The land, climate and soil types in the study area lend itself to extensive farming and grazing for cattle and sheep. Only in limited areas are the soils arable. Many old cultivated fields are observed in the study area where crops were grown previously. Crops grown are mainly maize where the fields are ploughed, harrowed and planted mechanically. Harvesting takes place manually. Standard farming equipment should not be excessively affected by the line.

Routes: A, B, C and D		
Theme	**Construction of access roads**	
Nature of Impact	**Soil Pollution (creosote)**	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommissioning	Operation
Extent of impact	Local	Local
Duration of impact	Short –term	Long term
Intensity	Medium	Medium
Probability of Occurrence	Probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	Medium	Medium
Level of Significance	Low	Low
Mitigation measures	• No faulty vehicles should be used during clearing. • Dress the poles with polymer sleeves • No maintenance of construction vehicle along riverbank and any accidental spill of petroleum and/or hazardous waste should be reported to DWAF	Same as construction
Level of significance after mitigation	Low	Low
EMP requirements	• For more site specific mitigation measures refer to Eskom's Environmental Management Plan Report (EMPR) to the construction Phase of this project. • Dress the poles with polymer sleeves	**Same as construction**

Discussion

The used of faulty or leaky vehicles is not permitted during construction and operation of the line. During to the high infiltration rate and shallow soils in the study area, any pollution will have an adverse effect on the surrounding environment. Maintenance of vehicles should conducted in designated areas. Creosote poles pose a threat of leaching into the soil poisoning the soil and flora growing in close proximity. Using polymer sleeves will drastically reduce the potential for leakage. Creosote drip traps are to be set up in the material storage area to prevent pollution in the material yard.

Routes: A, B, C and D		
Theme	**Clearing of vegetation for installation of foundation and towers**	
Nature of Impact	**Loss of Wetland related soils**	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction and Decommissioning	Operation
Extent of impact	Regional	Regional
Duration of impact	Long – term	Medium
Intensity	High	High
Probability of Occurrence	Highly probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	High	High
Level of Significance	High	High
Mitigation measures	• Wetland area should be avoided at all cost during the installation of towers	NA
Level of significance after mitigation	Medium	Medium
EMP requirements	• Wetlands should be avoided in planning access roads for construction. • Any damage to wetlands must be rehabilitated before the site is abandoned. • Self-supporting tower should be installed in wetland area and pans. • No dumping of refuses and waste around wetlands. • While working in an area efforts should made to reduce compaction of soil. • For more site specific mitigation measures refer to Eskom's Environmental Management Plan Report (EMPR) to the construction Phase of this project.	• Annual Inspections and rehabilitation to be conducted.

Discussion Wetlands are highly sensitive habitats being home to a group of highly specialized species, particularly bird species. More than 50% of KwaZulu-Natal's wetlands have been lost over the past 3 decades through draining, damming and road construction. Gaining access to construct this proposed powerline has the potential to impact heavily the wetlands in this study area. These wetlands must be avoided, as it is unacceptable to route roads through wetlands. All routes are assessed together as wetlands are equally common all along the length of all the route options. Wetlands impacts at one point in the catchment very often influence the wetlands further down in the catchment, particularly through erosion and siltation. Wetlands must at all costs be avoided when planning the access roads for the construction teams.		

Routes: A, B, C and D		
Theme	**Construction of Access Road**	
Nature of Impact	**Water Quality**	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction and Decommissioning	Operation
Extent of impact	Local	Local
Duration of impact	Short – term	Permanent
Intensity	Medium	Medium
Probability of Occurrence	Highly probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	Medium	Medium
Level of Significance	Medium	Low
Mitigation measures	• Good rehabilitation practice • Energy dissipating engineering	NA
Level of significance after mitigation	Medium	Low
EMP requirements	• Rehabilitate any construction activity, slow surface water movement down. • Access road should not be constructed next to river and streams. • For more site specific mitigation measures refer to Eskom's Environmental Management Plan Report (EMPR) to the construction Phase of this project.	• Annual Inspections and rehabilitation to be conducted.

Discussion

The soils in the study area have high clay content that makes the soils easily eroded. The clay particles are carried by the run-off and storm water into the streams and later in the rivers. The clay particles make the water turbid reducing the potential for aquatic plant material thus reducing the possible biodiversity in the local rivers and further down stream. Silt carried away by run-off water silts up the streams decreasing the depth of the streams reducing the potential carrying capacity for bio-diversity as clearly seen at F13.

Routes: A, B, C and D		
Theme	**Clearing for campsite**	
Nature of Impact	***Soil Erosion***	
Legal requirements	Conservation of Agricultural Resources Act (No 43 of 1983), Environmental conservation Act (No 73 of 1989)	
Stage	Construction	Operation
Extent of impact	High	Low
Duration of impact	Long-term	Long Term
Intensity	High	Low
Probability of Occurrence	Highly Probable	Highly Probable
Status of impact	Negative	Negative
Level of Significance	High	High
Mitigation measures	• Construction to be done in dry season. • Work from top of slope downward. • Clearing of vegetation should be kept to a minimum.	• The rehabilitation of donga will be necessary in this area. • Erosion control will be necessary in this section of the proposed transmission line.
Level of significance after mitigation	Low to Medium	Low to Medium
EMP requirements	• All topsoil removed from an area during site preparation and construction must be stockpiled for use during rehabilitation. The rehabilitation of the site must occur immediately after construction phase, and should not be left until the end of the project. • Construction camps should not be sited on steep slopes or near wetland, as this will increase soil erosion. It is advisable to locate construction camps near watershed in order to minimise run-off and erosion. Re-vegetation will prevent erosion after closure. • The rehabilitation of donga will be necessary	• Vegetation removal must be kept to a minimum. • All rehabilitation and re-vegetation programmes must be regularly checked and monitored with reseeding of any bare soil patches. • Burning along the entire route should be avoided if possible. Burning will leave the topsoil exposed, which increases the chances of soil erosion. If possible, the veld along the entire route should be cut mechanically to prevent soil exposure. • Erosion should be monitored during the

	in this area. • Erosion control will be necessary in this section of the proposed transmission line. • Erosion must be monitored in the section of the transmission line • EMP to control construction to ensure that the best method is used. • No maintenance of construction vehicle along riverbank and any accidental spill of petroleum and/or hazardous waste should be reported to DWAF immediately.	maintenance of the proposed transmission line.

Discussion

This section of the proposed transmission line is the most sensitive and critical area to be crossed by the proposed line. These soils are highly susceptible to erosion and in fact some of the most severe example of sheet and gully South Africa are found in this part. Construction activities will either disturb the vegetation cover or breach the protective topsoil is likely to result in severe soil loss. During the helicopter reconnaissance of the study areas it was acknowledge that majority of the erosion occurs on the southern section of the proposed line. The southern route is favoured because of this reason the northern section shows some erosion but not as extensive as the southern line and the northern line has more pristine land with little human contact. Although soil erosion is very extensive in some areas along the proposed transmission line route due to bad management practice or neglects Eskom should look at improving the land practices along this route because this will help slow down a lot of the erosion currently taking place.

Routes: A, B, C and D		
Theme	**Clearing for campsite**	
Nature of Impact	***Soil Pollution (creosote)***	
Legal requirements	**Conservation of Agriculture Resources Act (No. 43 of 1983)**	
Stage	Construction and Decommissioning	Operation
Extent of impact	Local	Local
Duration of impact	Short –term	Long term
Intensity	Medium	Medium
Probability of Occurrence	Probable	Probable
Status of impact	Negative	Negative
Accumulative Impact	Medium	Medium
Level of Significance	Low	Low
Mitigation measures	• No faulty vehicles should be used during clearing. • Dress the poles with polymer sleeves • No maintenance of construction vehicle along riverbank and any accidental spill of petroleum and/or hazardous waste should be reported to DWAF	Same as construction
Level of significance after mitigation	Low	Low
EMP requirements	• For more site specific mitigation measures refer to Eskom's Environmental Management Plan Report (EMPR) to the construction Phase of this project. • Dress the poles with polymer sleeves	

Discussion

The used of faulty or leaky vehicles is not permitted during construction and operation of the line. During to the high infiltration rate and shallow soils in the study area, any pollution will have an adverse effect on the surrounding environment. Maintenance of vehicles should conducted in designated areas. Creosote poles pose a threat of leaching into the soil poisoning the soil and flora growing in close proximity. Using polymer sleeves will drastically reduce the potential for leakage. Creosote drip traps are to be set up in the material storage area to prevent pollution in the material yard.

6.2 SUMMARY TABLE

ISSUE	DESCRIPTION	ENVIRONMENTAL IMPACT	IMPACT AFTER MITIGATION	EMP REQUIRE MENTS
Soil Erosion	• Vegetation clearance for installation of towers • Loss of arable land • Loss of wetland related soils	Overall significance rating = High. **Discussion:** *The soil types of the study area, the natural vegetation, the land-use practices and the impact of the line makes this rating to be high.* *The proposed transmission line will be crossing very sensitive and critical area. These soils are highly susceptible to erosion and in fact some of the most severe example of sheet and gully South Africa are found in this part. Construction activities will either disturb the vegetation cover or breach the protective topsoil is likely to result in severe soil loss.* *(DG-22 to BD-36 on both the Northern and Southern line warrant special attention).* *The other sections have a low to medium erosion rating but could become high rating if proper mitigation is not followed.*	Overall significance rating = low to Medium **Discussion:** *Mitigation will help improve and maybe reduce soil erosion along the study area. But due to the high erosive nature of the soils and bad or lack of land management within the study area construction will have an impact on the soils. Engineering actions to slow the movement of the run-off water down reduce the potential soil loss.*	√

ISSUE	DESCRIPTION	ENVIRONMENTAL IMPACT	IMPACT AFTER MITIGATION	EMP REQUIRE MENTS
Construction of Access	• Soil erosion • Soil pollution • Loss of arable land • Wetland related soils • Water Quality	**Overall significance rating = High** **Discussion:** *The proposed line will not have a significant impact on the soils but the construction of access road and maintenance of the road will have a significant impact of the environment.*	Overall significance rating = Low to Medium **Discussion:** *Using existing access routes will minimise the need to disturb new area for road construction. Apply proper rehabilitation techniques at the time of construction will minimise soil loss. Rehabilitation is very critical within the study area without rehabilitation the erosion will definitely be a problem.*	√
Clearing for campsite	• Soil erosion • Soil pollution	Overall significance rating = High **Discussion:** *The soil types of the study area, the natural vegetation, the land-use practices and the impact of the line makes this rating to be high.* *The proposed transmission line will be crossing very sensitive and critical area. These soils are highly susceptible to erosion and in fact some of the most severe example of sheet and gully South Africa are found in this part. Construction activities will either disturb the vegetation cover or breach the*	Overall significance rating = Low to Medium **Discussion:** *Mitigation will help improve and maybe reduce soil erosion along the study area. But due to the high erosive nature of the soils and bad or lack of land management within the study area construction will have an impact on the soils. Engineering actions to slow the movement of the run-off water down reduce the potential soil loss.*	√

ISSUE	DESCRIPTION	ENVIRONMENTAL IMPACT	IMPACT AFTER MITIGATION	EMP REQUIRE MENTS
		protective topsoil is likely to result in severe soil loss. *(DG-22 to BD-36 on both the Northern and Southern line warrant special attention).*		

7.0 Generic management and mitigation measures

Objectives:

- To reduce the erosion potential when soils are denuded of vegetation or otherwise disturbed.
- To maximise the use of suitable topsoil for rehabilitation.
- Control and suitable dispersion of runoff on slopes.
- Minimise the potential for soil pollution.

7.1 MITIGATION

- During construction site preparation, vegetation removal and the erection of buildings must happen simultaneously, to ensure that no large tracts of land are left exposed at any point in time. Vegetation clearance should be kept to the dry season.

- Construction camps should not be sited on steep slopes or near wetland, as this will increase soil erosion. It is advisable to locate construction camps near watershed in order to minimise run-off and erosion. Re-vegetation will prevent erosion after closure.

- Catch water drains or berms must be constructed above embankments and cuttings to prevent run-off from flowing down and across the slopes. This is especially important while slopes are still bare. For optimum control of soil erosion on embankments and cuttings, vegetation must be established.

- All topsoil removed from an area during site preparation and construction must be stockpiled for use during rehabilitation. The rehabilitation of the site must occur immediately after construction phase, and should not be left until the end of the project.

- Construction activities should be carefully monitored to ensure compliance with the EMP. The EMP should limit construction activities to those that are acceptable in preventing environmental damage. No scarring of such areas would be allowed and proper rehabilitation would ensure recovery without any problems. Erosion prevention measures should be taken right from inception of the construction process.

7.2 MAINTENANCE

Objective:

- To ensure that rehabilitation measures are effective.

Mitigation:

- All rehabilitation and re-vegetation programmes must be regularly checked and monitored with reseeding of any bare soil patches.

- Burning along the entire route should be avoided if possible. Burning will leave the topsoil exposed, which increases the changes of soil erosion. If possible, the veld along the entire route should be cut mechanically to prevent soil exposure. Although soil erosion is very extensive in some areas along the proposed transmission line route due to bad management practice or neglects Eskom should look at improving the land practices along this route because this will help slow down a lot of the erosion currently taking place.

7.3 Rehabilitation of fertile soil

In all areas disturbed by construction activities, the topsoil must be removed and stockpiled close to the site for use during rehabilitation. This may involve separating the 0 and A Horizon, depending on the nature of the soil profile.

In cases where these horizons are separated, the material must be stored in different stockpiles. This material should not be stockpiled in natural drainage channels, even during the dry season, as this will leave it exposed to the processes of water erosion. Stockpiles should be placed in areas where they are not susceptible to wind erosion.

For more site specific mitigation measures refer to Eskom's Environmental Management Plan Report (EMPR) to the construction Phase of this project**.**

8. ALTERNATIVES

No alternative study corridor was looked at because the study area encompasses a 10-km wide (5-km either side of the Northern and Southern line) corridor from Pegasus to Umfolozi. Although alternative routes are proposed within the study area corridor the effect on this alternative will be the same as the route for the preferred line. The southern route is the most preferred route

9 DISCUSSION

The proposed transmission line will have very little impact on the soil within the study corridor. However there are some sensitive areas mapped within the study corridor especially sections DG-22 to BD-36 the terrain shows extensive evidence of gully and sheet erosion. Special attention needs to be giving to this area during the construction of the proposed transmission line.

Some of the soils within the study area have a high erosive index because of shallow soil cover. These soils are susceptible to water and wind erosion. Also contributing to this is the lack of or current bad land management in the area due to overgrazing or lack of land management in the areas.

10. REFERENCES

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