

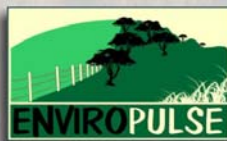
**ZEUS SUBSTATION
ECOLOGICAL ASSESSMENT
EMP REPORT**



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**ZEUS SUBSTATION EXPANSION – ECOLOGICAL REPORT:
EMP FOR THE CONSTRUCTIVE- AND OPERATIONAL PHASES**

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ZEUS SUBSTATION EXPANSION – ECOLOGICAL REPORT:

EMP FOR THE CONSTRUCTIVE- AND OPERATIONAL PHASES

1. INTRODUCTION

The following ecological information is available for the area in the vicinity of Zeus substation:

Land Type Ea (includes one or more of: Vertic, Melanic, Red structured diagnostic horizons).

Acocks' Veld Type: Themeda veld or Turf Highveld.

Low & Rebelo Veld Type: Moist Clay Highveld Grassland.

Although none of this veld type is formally conserved, the grassland has high grazing value if not disturbed (ploughed). Undisturbed and well managed areas should be dominated by Red Grass Themeda triandra.

Soils are very high in clay and very erodable.

- The location of construction camps needs to be identified before any construction commences to ensure that sensitive grassland areas are not directly impacted.
- These soils should be properly drained, covered with topsoil and rehabilitated after disturbance.
- Specific grassland rehabilitation standards need to be followed immediately after disturbance to ensure that the Red Grass character is not lost. This would need a site visit and report with specific recommendations.
- A pre-agreed construction method therefore needs to be followed.

The purpose of this study is therefore to provide ecological information and recommendations including rehabilitation of disturbed grassland areas for both the construction and operational phases.

2. METHODOLOGY

Stratification of survey sites was based on ecological units represented by the variation shown from the topography, vegetation and the soils on the development area.

Soils were evaluated using a hand soil auger. The soil classification was carried out according to the Taxonomic System for South Africa (Macvicar, 1991).

Dominant herbaceous vegetation at the survey site was recorded together with veld condition and photos of the terrain. Veld condition was subjectively assessed.

A total of 6 survey sites were selected.

Photos of the terrain were taken at soil auger sites (See with appended site reports). The position of the survey sites were marked on a map of the study area (See appended map).

3. RESULTS

3.1 SOILS AND VEGETATION

Soils are of high clay content on the flat crest area south of the substation. The Sterkspruit soil form is dominant closer to the present substation in the northeast. In this area 250 mm deep sandy clay Orthic topsoil is underlain by clay prismatic subsoil. Rocky dolerite areas intrude the crest at isolated areas. Immediately adjacent to the rocky areas the sandy clay topsoil is underlain by clay lithocutanic rock, the subsoil partly weathered to a depth of 300 mm (Glenrosa form). Further away from the rocky areas the topsoil is underlain by a 450 mm deep clay pedocutanic horizon and a deeper saprolite layer (Swartland form).

On the present southwestern corner, next to the security fence, the soil is moist and clayey (represented by the Sepane soil form). Wetland conditions extend 180 m into the area from the west. Hydromorphic soils are present on the valley bottom. A small dam is present within this wetland.

On the crests of the southwestern part of the development area the soils are very sensitive. Vertic black clay soils are present (Arcadia form) in the southwestern corner and underlay the newly constructed road. The crest-midslope ecotone is rocky and shallow dolerite outcrops are present (Mispah soil form). To the east of the rocky outcrop the soils are partly weathered and lithocutanic clays 300 mm deep. The midslope between the rocky outcrop and the wetland is underlain by Swartland soils.

Vegetation is typically pristine *Themeda triandra* grassland. The area has not been ploughed and is therefore representative of Acocks' Themeda veld or Turf Highveld (Veld Type 52) or of the Low & Rebelo Veld Type: Moist Clay Highveld Grassland (Veld Type 35). This grassland is generally in a well managed condition, but a mosaic of well managed grassland and patches dominated by tall *Hyparrhenia hirta* (Thatching Grass) *Eragrostis plana* (Taaipol) and *Cynodon dactylon* (Coach Grass/Kweek) is observed. This *H. hirta* / *E. plana* / *C. dactylon* dominated grassland patches occur mostly under the power lines where the grassland is mowed (and where fire is not the main management tool to reduce the grass fuel load). In the centre of the crest and towards the west on the midslope ecotone organic material accumulated to possibly more than 5 tons/ha posing high fault risk if uncontrolled fire burn in this area.

3.2 TABLE RESULTS

Survey point	GPS S	GPS E	Terrain Unit	Slope (1= 0-5; 2=5-15. 3=>15 °)	Soil Form	Soil Texture (Sa = Sandy; Lm = Loamy; Cl = Clay)			Soil depth (mm)			Sensitivity (1 =Not Sensitive & 5 = Very sensitive)	Grass cover (cm)	Dominant Species	Distance to wetland	Comments
1	26.69589	29.08652	Midslope / Valley Bottom	5-15	Sepane	SaCl	Cl	Cl	250	1000	1000+	5	3.0	<i>Eragrostis plana / Digitaria tricholaenoides</i>	60m to wetland	Overgrazed
2	26.69808	29.086102	Midslope	5-15	Swartland	SaCl	Cl	n/a	250	250-450	450+	5	4.8	<i>Themeda triandra</i>	120m to wetland/ 190m to small dam/ 230m to farm dam	Well Managed
3	26.69923	29.08621	Crest	0-5	Arcadia	Cl	n/a	n/a	200	n/a	n/a	5	1.8	<i>Themeda triandra</i>	250m to wetland/ 330m to farm dam	Well Managed
4	26.69941	29.09079	Crest	0-5	Sterkspruit	SaCl	Cl	n/a	100	600	n/a	5	1.6	<i>Themeda triandra</i>	500m to wetland/ 700m to farm dam	Well Managed
5	26.69663	29.09217	Crest	0-5	Sterkspruit	SaCl	Cl	n/a	100	600	n/a	4	2.8	<i>Themeda triandra</i>	580m to wetland/ 780m to farm dam	Well Managed to slightly degraded
6	26.69947	29.09800	Crest	0-5	Glenrosa	SaCl	Cl	n/a	100	300	n/a	4	1.8	<i>Themeda triandra</i>	330m to wetland/ 490m to farm dam	Well Managed

3.3 DISCUSSION AND RECOMMENDATIONS

The impact of the development on the vegetation is envisaged to be high. Most of the area is pristine grassland dominated by Red Grass. The shallow rocky outcrops may also be the habitat of threatened plant species, for dolerite on the Highveld is often associated with Red Data species (including some bird species). However, as this report reflects vegetation from a winter survey a follow-up survey(s) is/are proposed during the wet seasons (for October/January).

Soils are high in clay, with the extreme of >55% clay on the topsoil in the southwestern part of the study area. Clay of > 50% underlay the topsoil of the flatter area on the crest. Sufficient provision should be made with construction on these areas to take into account the movement of clay as result of its swelling / shrinking between dry and wet seasons.

The wetland area on the western side of the study area extends up to 180m eastwards into the development area. A distance of 100 should be left between the boundary of the wetland and the immediate area where it will be developed. Hydromorphic soils and wet clays a pose significant challenge with development in such areas. However, wetland areas are protected by law and development should ensure that the wetland character and function remains intact. The small dam inside the wetland area may attract water birds in the area and it should be taken into account with sufficient provision of bird-guard application on the towers above.

CONSTRUCTION AND OPERATIONAL PHASES

3.3.1 CONSTRUCTION PHASE

Construction camp:

The construction camp may be located anywhere except within 100m from the wetland areas. Any permanent structures (if applicable) need to take into account the high clay. A dry toilet system is recommended due to the poor drainage. Green water discharge should be monitored and controlled. The following points should be taken into account in the location of a construction camp at Zeus:

- A farm dam is situated in close proximity west of the study area.
- A new road is currently in construction south and adjacent to the study area.

Water point:

There is a farm dam in the area adjacent to the development site (330m from survey point 3), presently used to provide water to the cattle grazing in the area. The quantity of water required or available for both cattle and human consumption was not investigated in this study.

Access road:

The access road should preferably on the southeast, branching northwest from the existing access road to substation. Sufficient provision should be made for water drainage away from the road. Clay should be removed to the depth of saprolite and be replaced with suitable road-filling material.

Rehabilitation:

Care should be taken not to disturb the topsoil for any disturbance of the topsoil cause permanent loss of the *Themeda triandra*-dominated grassland character. Preventative measures include the insurance that sunlight always falls directly on the grass layer. Building material should not be allowed to be placed on the grass in such a way as to deprive it from sunlight. Areas that are already disturbed where Coach Grass or Weeping Love Grass or Taaipol dominates should be selected instead. Mowing of the grassland will also cause permanent loss of Red Grass, especially when the mowed material is not immediately removed. Mowing of the grassland under the power lines is not recommended but controlled burning is recommended instead (Chris Austin from Environet can be contacted for a fire management course – Cell 083 459 0504).

In the even where it is inevitable that an area with Red Grass dominating will be disturbed the sod with topsoil should be removed to a depth of 250mm to 300mm and be kept moist (so that the roots are in contact with shallow water) in open areas where sunlight can shine on the Red Grass. Red Grass can also be planted in plug form, which is an expensive exercise, but it should prove to be successful. Grass cover after rehabilitation should be as close as possible (or better) than the norm for this veld type. A realistic target would be to restore grass tuft distance to a minimum of 3cm. Planting of Red Grass plugs are recommended above sowing, but depending on the size of area that would need restoration, sowing can be considered. Coach Grass (*Cynodon dactylon*) seed is recommended for sowing and not *Eragrostis curvula* due to the high fire risk that result in the long term if the latter species is chosen.

3.3.2 OPERATIONAL PHASE

Grassland monitoring at areas where it was disturbed (and rehabilitated afterwards) through the construction phase would need to be done yearly for the first three years. Grass cover and composition needs to be evaluated.

Grass fuel load or volume of grass also needs to be monitored on a regular basis. If no grazing occurs the grass would need to be burned at levels exceeding 3000 kg/ha. A disk pasture meter is recommended as a rapid method to establish grass volume. Burning should be preferably at nighttime to minimize fire risk.

4. CONCLUSION

The ecological impact envisaged is high on most parts, but higher on lower lying areas close to the wetland system on the west of the study area. The largest impact envisaged is the disturbance of topsoil dominated by Red Grass. Specific recommendations include the removal of topsoil with Red Grass intact and to prevent any cover on Red Grass dominated grassland during construction. Mitigations on midslope or wetland ecotone areas are necessary to allow natural underground seepage towards the drainage lines. If it requires construction to be closer than 100m to the wetland the ecological impact would be higher. It is recommended, as a safe ecological alternative, that the construction plan then includes an extension to areas further east instead.

5. REFERENCES

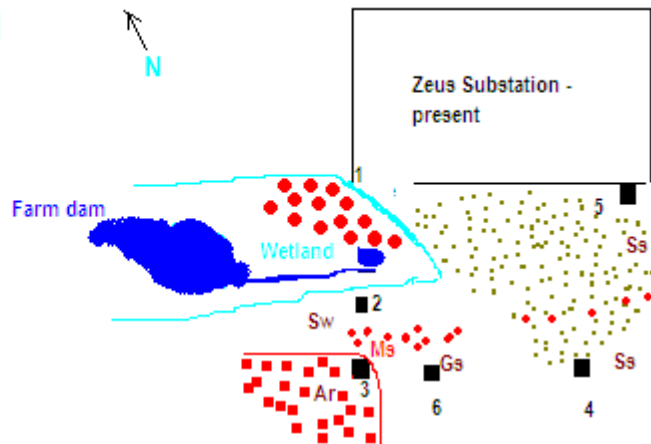
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

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6. APPENDIX A – MAP OF SUBSTATION AND CONSTRUCTION AREA


ZEUS SUBSTATION EXPANSION




LEGEND

-  Arcadia soil form - Vertic topsoil very sensitive (clay% too high for safe construction, unless sufficient provision is made)
-  Mispah soil form - Rocky dolerite outcrops may be suitable habitat for threatened plant species
-  Sterkspruit soil form - Clay subsoils problematic for construction, unless special provision is made as with Arcadia soils - swelling/shrinking of clay results in unstable foundations
-  Hydromorphic soils, including Sepane soil form - problematic due to wet subsoils and high clay


7. APPENDIX B – SITE REPORTS


Veld Type (Acocks, 1988)		Acocks' Veld Type: Themeda veld or Turf Highveld.
Land Type Description		Land Type Ea (includes one or more of: Vertic, Melanic, Red structured diagnostic horizons).
Site number		Site 1
Latitude (S)		S 26. 69589°
Longitude (E)		E 29. 08650°
Date visited	05/06/2007	
Land terrain Unit	Midslope/Valley Bottom ecotone	
Slope of Terrain (degrees °)	5-15	
Soil form	Sepane	
Soil description	Orthic A underlain by a pedocutanic B on a unspecified material with signs of wetness	
Soil texture A-horizon	35% Clay	
Soil texture B1-horizon	40-45% Clay	
Soil texture B2-horizon	40-45% Clay	
Soil depth A-horizon	250 mm	
Soil subsoil depth of B1/B2-horizon	1000mm/1000mm+	
Soil erodability	High to Very high	Veld Condition = Overgrazed / Disturbed
Dominant Species	<ul style="list-style-type: none"> • <i>Eragrostis plana</i> and <i>Digitaria tricholaenoides</i> 	
Notes	<ul style="list-style-type: none"> • A wetland with a small dam is bordering this site, 0.12 km south. • This site is on an ecotone with the wetland with signs of seepage present. • A larger farm dam is 0.23 km south-west. • 0.4 km south of new road. • This site is on the south-western corner of the safety fence around Zeus. 	
Red Data Plant Species Recorded	None observed	Recommendation <ul style="list-style-type: none"> • Construction at this area would be problematic due to the high clay, the wet soils and the proximity to a wetland.

Veld Type (Acocks, 1988)		Acocks' Veld Type: Themeda veld or Turf Highveld.
Land Type Description		Land Type Ea (includes one or more of: Vertic, Melanic, Red structured diagnostic horizons).
Site number		Site 2
Latitude (S)		S 26.69808°
Longitude (E)		E 26.08610°
Date visited	05/06/2007	
Land terrain Unit	Midslope	
Slope of Terrain (degrees °)	5-15	
Soil form	Swartland	
Soil description	Orthic A underlain by a pedocutanic B on saprolite	
Soil texture A-horizon	35% Clay	
Soil texture B-horizon	40-45% Clay	
Soil depth A-horizon	200 mm	
Soil subsoil depth of B-horizon to limiting layer	450mm	
Soil erodability	High	
Dominant Species	<ul style="list-style-type: none"> • <i>Themeda triandra</i> 	
Notes	<ul style="list-style-type: none"> • This grassland is in a good condition and has a high conservation status. • A wetland with a small dam is bordering this site, 0.12 km away. • A larger farm dam is 0.23 km away. • This site is 0.15 km south of the new road and 0.09 km south from rocky Mispah areas. 	
Red Data Plant Species Recorded	None observed	Recommendation <ul style="list-style-type: none"> • Construction is possible at this site, but mitigations for high clay would need to be implemented. • Rocky areas adjacent to this site may have sensitive plant species – development should not be in close proximity of the rocky areas until a survey in the wet season clarify whether Red Data plants are present or not.

Veld Type (Acocks, 1988)		Acocks' Veld Type: Themeda veld or Turf Highveld.
Land Type Description		Land Type Ea (includes one or more of: Vertic, Melanic, Red structured diagnostic horizons).
Site number		Site 3
Latitude (S)		S 26.69923°
Longitude (E)		E 29.08621°
Date visited	05/06/2007	
Land terrain Unit	Crest	
Slope of Terrain (degrees °)	0-5	
Soil form	Arcadia	
Soil description	Vertic A on unspecified material	
Soil texture A-horizon	>55% Clay	
Soil depth A-horizon	200 mm	
Soil erodability	Very high	
Dominant Species	<ul style="list-style-type: none"> • <i>Themeda triandra</i> 	
Notes	<ul style="list-style-type: none"> • The nearest wetland from this site is 0.25 km north-west. • A larger farm dam is present, 0.33 km north-west. • Grassland in this area have very high grazing value and represents pristine vegetation of this veld type. 	
Red Data Plant Species Recorded	None observed. Disturbance at this area will result in long term loss of <i>Themeda triandra</i>	Recommendation <ul style="list-style-type: none"> • Construction problematic on these clay soils, with ecological risk unless mitigated for. • This area needs maximum protection – sensitive grassland. • Topsoil at this area is significantly higher and needs to be taken into account even with low impact construction activities.

Veld Type (Acocks, 1988)		Acocks' Veld Type: Themeda veld or Turf Highveld.
Land Type Description		Land Type Ea (includes one or more of: Vertic, Melanic, Red structured diagnostic horizons).
Site number		Site 4
Latitude (S)		S 26.69941°
Longitude (E)		E 29.09079°
Date visited	05/06/2007	
Land terrain Unit	Crest	
Slope of Terrain (degrees °)	0-5	
Soil form	Sterkspruit	
Soil description	Orthic A overlying a pedocutanic B	
Soil texture A-horizon	35% Clay	
Soil texture B-horizon	45-50% Clay	
Soil depth A-horizon	100 mm	
Soil subsoil depth of B-horizon to limiting layer	600mm	
Soil erodability	High	
Dominant Species	<ul style="list-style-type: none"> • <i>Themeda triandra</i> 	
Notes	<ul style="list-style-type: none"> • The nearest wetland from this site is 0.5 km north-west. • A larger farm dam is present, 0.7 km north-west. 	
Red Data Plant Species Recorded	None observed	Recommendation <ul style="list-style-type: none"> • Construction problematic on these clay soils, with ecological risk unless mitigated for.

Veld Type (Acocks, 1988)		Acocks' Veld Type: Themeda veld or Turf Highveld.
Land Type Description		Land Type Ea (includes one or more of: Vertic, Melanic, Red structured diagnostic horizons).
Site number		Site 5
Latitude (S)		S 26.69663°
Longitude (E)		E 29.09217°
Date visited	05/06/2007	
Land terrain Unit	Crest	
Slope of Terrain (degrees °)	0-5	
Soil form	Sterkspruit	
Soil description	Orthic A underlain by a prismaeutanic subsoil	
Soil texture A-horizon	35% Clay	
Soil texture B-horizon	45-50% Clay	
Soil depth A-horizon	100 mm	
Soil subsoil depth of B-horizon to limiting layer	100-600mm	
Soil erodability	High	
Dominant Species	<ul style="list-style-type: none"> • <i>Themeda triandra</i> 	
Notes	<ul style="list-style-type: none"> • The nearest wetland from this site is 0.58 km west. • A larger farm dam is present, 0.78 km west. • Mowing activities under the powerline has resulted in a mosaic of disturbed grassland and well managed veld. This site is representative for most of the crest area at Zeus. 	
Red Data Plant Species Recorded	None observed	Recommendation
		<ul style="list-style-type: none"> • Construction problematic on these clay soils, with ecological risk unless mitigated for. • Burning under the powerline is strongly recommended as an alternative above mowing.

Veld Type (Acocks, 1988)		Acocks' Veld Type: Themeda veld or Turf Highveld.
Land Type Description		Land Type Ea (includes one or more of: Vertic, Melanic, Red structured diagnostic horizons).
Site number		Site 6
Latitude (S)		S 25. 69947°
Longitude (E)		E 26. 08800°
Date visited	05/06/2007	
Land terrain Unit	Crest	
Slope of Terrain (degrees °)	0-5	
Soil form	Glenrosa	
Soil description	Orthic A underlain by a lithocutanic B horizon	
Soil texture A-horizon	35% Clay	
Soil texture B-horizon	35-40% Clay	
Soil depth A-horizon	100 mm	
Subsoil depth to saprolite	300 mm	
Soil erodability	Moderate	Veld Condition = Well Managed
Dominant Species	<ul style="list-style-type: none"> • <i>Themeda triandra</i> 	
Notes	<ul style="list-style-type: none"> • This is valuable grazing land and the grassland is not ploughed and in good condition. • The nearest wetland from this site is 0.33 km away. • A larger farm dam is present, 0.49 km away. 	
Red Data Plant Species Recorded	None observed, but the rocky areas adjacent to this site may be sensitive and needs to be evaluated in the wet season.	Recommendation <ul style="list-style-type: none"> • Construction possible on these soils, but a shallow clay soil overlaying the weathered rock needs to be taken into account. • Clay soils to depth of 300 mm from topsoil needs to be replaced by road filling material when used for heavy vehicles. • These soils are adjacent to rocky Mispah soils and although the soils at this site are suitable for construction it is close enough to rocky areas where construction may impact negatively on sensitive plants.