



CONTRACT Nr. 4600025648

**GEOTECHNICAL CONSULTING SERVICES
DISTRIBUTION WESTERN REGION**

**GEOTECHNICAL INVESTIGATION REPORT
PROPOSED BITOU SUBSTATION**

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TERMS OF REFERENCE

Element Consulting Engineers have been appointed by Eskom Holdings Limited, Distribution Western Region, to provide Geotechnical Consulting Services, PSC Number 4600025648.

In terms of this contract, Task Order Nr 4500819127 was issued for the geotechnical investigation of site of the proposed Bitou Substation. A copy of the Task Order is attached to this report in Appendix A.

The scope of the works ordered include the following:

- Investigate the stability of the steep hill behind the proposed site at the intersection of the R340 & the N2 National Road.
- Investigate the sub-soil conditions on the proposed site for suitability for building the substation

1. LOCATION

The location of the proposed Bitou Substation is north east of the intersection of National Road N2 and Provincial Road R340. The location is illustrated on the Locality Plan included in Appendix B of this report.

2. GEOTECHNICAL INVESTIGATION

2.1 Method followed

A visual inspection was done of the cliff behind the site in order to comment on its stability. The visual inspection was based on the following:

- General geology of the cliff;
- Evidence of rock-falls or mud-slides.

Furthermore, three test pits were made on the proposed platform by using TLB type hydraulic excavator. The purpose of these test pits is to comment on the suitability of the platform for foundation of the substation structures. Soil samples were taken from the pit bottoms for testing in a laboratory. Tests performed include the following:

- Grading
- Modified Aashto Densities
- Californian Bearing Capacities (CBR)

2.2 General Findings

The geology of the cliff behind the proposed substation consists of stable Enon Conglomerate. Although the fine material between the pebbles is weathered, it is stable and can not be easily removed with a geological hammer. The pebbles are well interlocked and bound together by finer sandy gravel. The general geology of the cliff face can be seen in on the photos included in Appendix C.

The bottom of the cliff is overgrown by thick indigenous vegetation consisting of large trees and shrubs (Cape holly *Ilex mitis*, Forest elder *Nuxia floribunda*, and others).

Although some evidence was found of rock-falls, the scars on the cliff face left by the rock-falls seemed fairly old. This was checked with the provincial roads authority in Outshoorn, who confirmed that they had not experienced any serious rock-falls in the past.

Some loose rocks were found at the foot of the cliff, but it was evident that the rock-falls were stopped by the thick vegetation along the bottom of the cliff.

The flat platform between the bottom of the cliff and the road is overgrown by large Black Wattle trees. This is where the test pits were made. The soil on the platform consists of well graded hard sandy gravel. Excavation by the TLB was stopped at 500 mm depth due to the hard nature of the material.

2.3 Results

The detail soil profile logs of the test pits are given in Appendix D of this report. The results from the laboratory tests are given in Appendix E.

The laboratory test results are summarised in the table below:

Indicator	Value	
	Test Pit 1	Test Pit 2
Plasticity Index (PI) (%)	5	SP
Liquid Limit (LL) (%)	17	SP
In situ CBR (%)	52	74
% of sample passing 0.075 mm sieve	6.7	8.1

The values in the table confirm that the in situ material of the platform of the proposed substation is of high quality. The bearing capacity of the soil is exceptionally high and the fact that the grading is very coarse is an indication that the foundation condition of the platform is good.

2.4 Conclusions

Due to the stable nature of the cliff face and the evidently low risk of rock-falls, this site is found well suited for the proposed Bitou substation. This comment is further enhanced by the good foundation material found on the platform where the substation is to be located.

3. RECOMMENDATIONS ON CONSTRUCTION

3.1 Site accessibility

Special permission for a site access point will have to be given by the provincial road authorities. Access is normally not given within 600m from the nearest intersection. However, the low frequency of site visits for maintenance of the sub-station might persuade the road authority to allow the access. Special traffic accommodation measures will however be necessary during construction when a lot of activity will take place.

3.4 Retaining structure

It is proposed that a free standing retaining wall be built along the bottom of the cliff to serve as catch-wall for falling rocks. Furthermore, it is important that the natural vegetation along the foot of the cliff not be disturbed during construction, as this serves as a natural retainer.

In addition to the catch-wall, it is recommended that the face of the cliff be covered by a PVC coated wired mesh, anchored with rock nails, to prevent rocks from falling.

Design of both the catch-wall and wired mesh falls outside of the scope of this report.

J M Marais Pr Eng

Director: Special Projects

20 June 2008

APPENDIX A: COPY OF TASK ORDER

APPENDIX B: LOCALITY PLAN

APPENDIX C: PHOTOS OF CLIFF FACE

APPENDIX D: TEST PIT LOGS

APPENDIX E: LABORATORY TEST RESULTS