



the dme

Department:
Minerals and Energy
REPUBLIC OF SOUTH AFRICA

DME 12

Private Bag X6076, Port Elizabeth 6000,
Tel: (041) 396 3900
Fax: (041) 396 3946
Cnr. Diaz and Mount Roads
Mount Croix
Port Elizabeth, 6001

Enquiries: D.A. Watkins
E-mail: deidre.watkins@dme.gov.za

Reference:
Date:

(EC)30/5/1/3/3/2/1(0366)EM
18 August 2009

South African Heritage Resources Agency
P.O. Box 759
EAST LONDON
5200

Case ID: 2407

ATTENTION: MR. T. LUNGILE

Sir

**CONSULTATION IN TERMS OF SECTION 40 OF THE MPRDA OF 2002:
ENVIRONMENTAL MANAGEMENT PLAN (EMP); 2 BORROW PITS ON THE
MNGCOZO ACCESS ROAD, CHRIS HANI DISTRICT MUNICIPALITY, EASTERN
CAPE**

1. Attached herewith, please find a copy of a EMP received from Engcobo Local Municipality, for your comments.
2. Please forward any written comments or requirements your department may have in this regard, to this office not later than **10 October 2009**. Failure to do so, will lead to the assumption that your department has no objection(s) or comments with regard to the said document.
3. Consultation in this regard has also been initiated with other relevant State Departments.
4. Please use the reference number (EC) 30/5/1/3/3/2/1(0366) EM in all future correspondence.

Yours faithfully

Alforda
**REGIONAL MANAGER
EASTERN CAPE**



MINGCOZO ACCESS ROAD

PROJ. NO: C204 (COSEC)
CLIENT: EMGCOBO MUNICIPALITY
DISTRICT MUNICIPALITY: CHRIS HANI
CONSULTANT: COSEC

APPLICATION FOR

- **EXCEMPTION IN TERMS OF ARTICLE 106 OF THE MINERALS & PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT 28 OF 2002)**
- **MINING PERMIT IN TERMS OF ARTICLE 27 OF THE MINERALS & PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT 28 OF 2002)**

Application received in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)
EASTERN CAPE REGION

1 1 AUG 2009
S. LURWENGU
S. Lurwengu
DEPARTMENT OF MINERALS AND ENERGY

REGIONAL MANAGER
MINERALS AND ENERGY
EASTERN CAPE REGION
PRIVATE BAG 7 PRIVAATSAK X6076

2009-08-11

PORT ELIZABETH, 6000
STREEKBESTUURDER
MINERALE EN ENERGIE
OOS-KAAPSTREEK

31 JULY 2009

D/2009/08/11/001
Ec 30/5/1/3/2/0366 MP

1910

1910

BOPITE ENGINEERING GEOLOGISTS CC

P. O. BOX 22727
PORT ELIZABETH
6000

CK 96 6444023

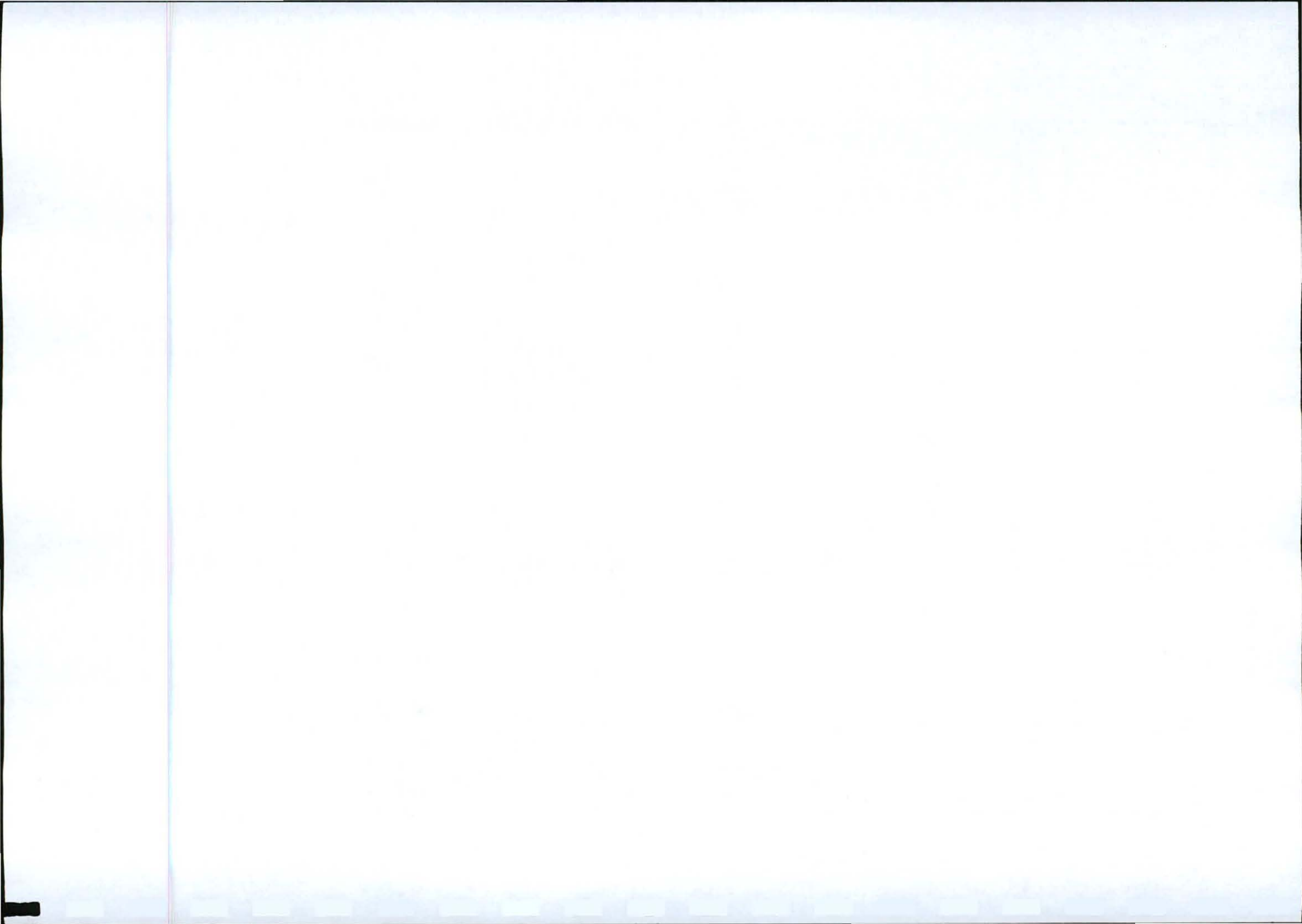
TEL: (041) 776 1171
FAX: (041) 776 1171
CELL: 082 572 9159

2500
8400
6000

**AN ENVIRONMENTAL
MANAGEMENT PROGRAMME
FOR THE ROAD MAINTENANCE
PROGRAMME IN THE
ENGCOBO AREA OF THE
EASTERN CAPE PROVINCE.**

November 2003

Report No. BEG/03312



SYNOPSIS

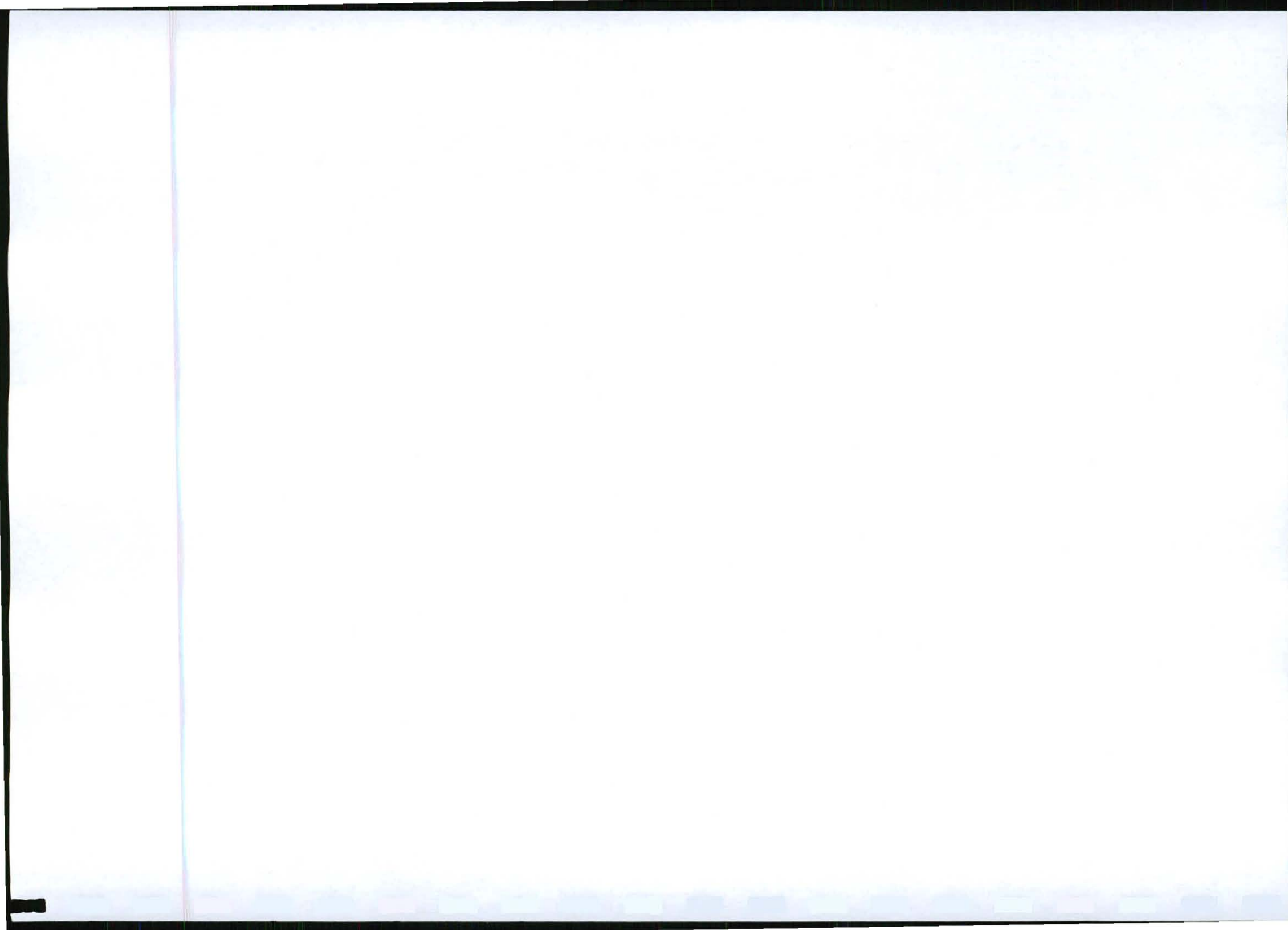
An Environmental Management Programme Report (EMPR) for re-commissioning of existing borrow pits has been undertaken along various roads in the Chris Hani region (Engcobo Local Municipality), in the north-eastern part of the Eastern Cape Province. This project forms part of the proposed road maintenance and reconstruction programme commissioned by the Province of the Eastern Cape Department of Roads and Public Works (Project No PTB5-02/03-1898). Approximately 310 km of gravel road and 27 km of surfaced road are to be rehabilitated over a period of about 5 years as part of this project.

The EMPR investigation is aimed at assessing the environmental implications pertaining to the proposed re-use of some of the existing borrow pits, including the environmental impact and management programme associated with additional material removal. Post quarrying rehabilitation and decommissioning of the borrow pits is also addressed. A thorough environmental impact assessment is not deemed necessary for borrow pit re-commissioning by the Department of Economic Affairs, Environment, and Tourism. All of the borrow pits are already existing scars, and were previously utilised for road building and reconstruction purposes.

Significant issues associated with borrow pit re-commissioning include the direction of additional material removal, a broad mining plan, and rehabilitation recommendations once material has been successfully removed. EMPR regulations require that only newly quarried areas be rehabilitated, although existing scars will be softened where possible during additional material removal. It is also recommended that rehabilitation procedures enable certain borrow pit depressions to be utilised for drinking water holes and earth dams for domestic livestock purposes. These depressions should, however, not be too deep as they have the potential to be regarded as a safety risk for small children.

The investigation revealed that many of the natural environments at the quarry sites in the study area are neither pristine nor unique. Alien vegetation communities occur in places, and previous quarrying activities have extensively disturbed and destroyed natural habitats.

Future borrow pit operations should generally occur parallel to contour and / or away from existing drainage channels, where applicable. Borrow pit material should also be removed in pre-determined phases. During each mining phase, topsoil and overburden must be removed and separately stockpiled. The underlying target material will be exploited, and on completion, each phase must be adequately rehabilitated.



The existing borrow pits covered during this investigation represent already extensively disturbed areas due to past quarrying activities. Additionally, the areas required to fulfill the road maintenance programme requirements are relatively small, resulting in marginal increases in surface area of destroyed habitat at each borrow pit. The disturbance to quarry scar footprints can also be kept to a minimum by material removal from the floor of the various workings. The newly quarried areas would also be subject to stringent rehabilitation techniques, which would improve the environmental aesthetics of the previously un-rehabilitated borrow pits.

It is, therefore, recommended in this EMPR that authorisation for the re-commissioning of the existing borrow pits be granted in terms of the Minerals Act (Act 50 of 1991). The EMP conditions recommended for each working should, however, become conditions of authorisation.

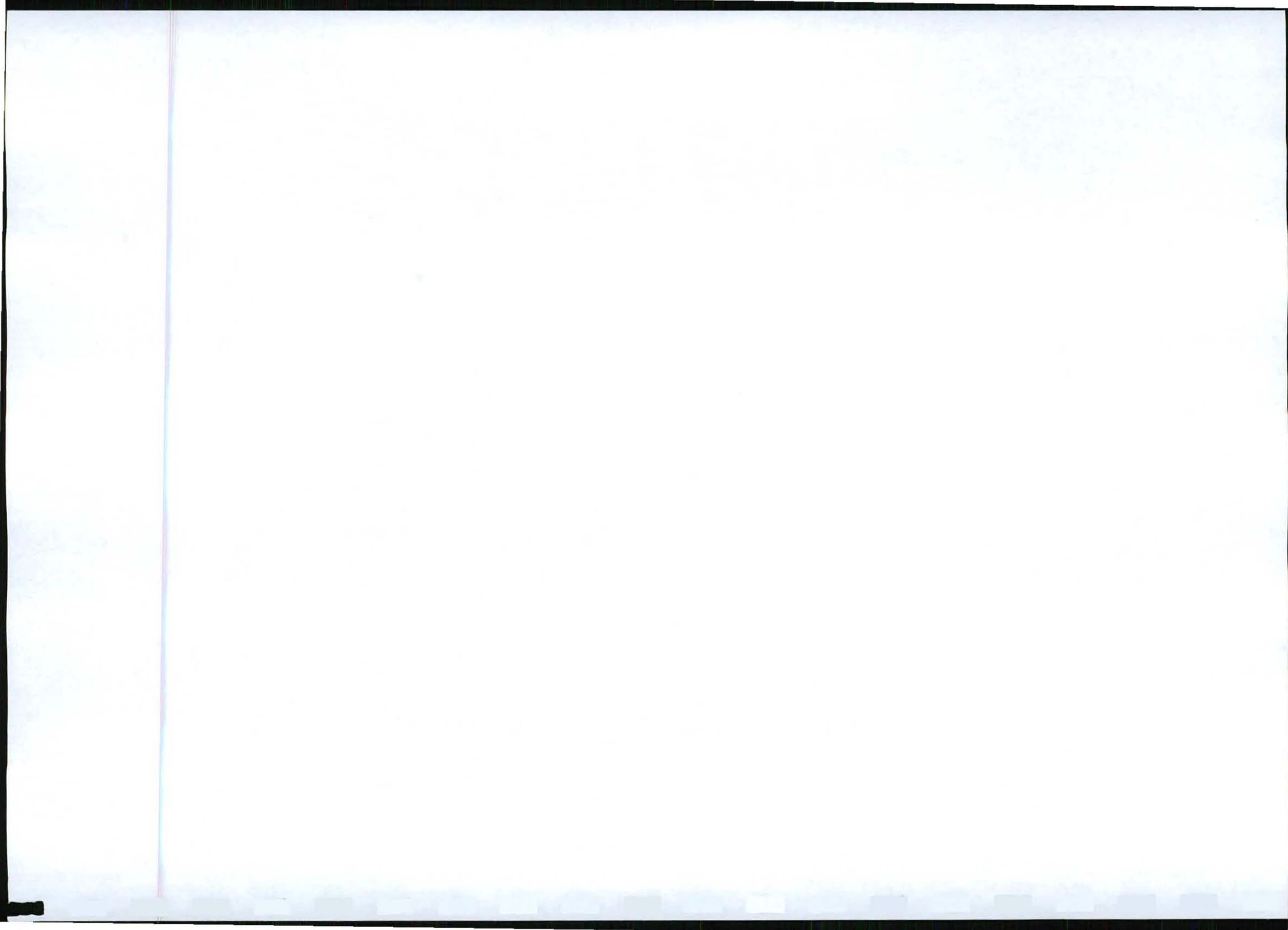
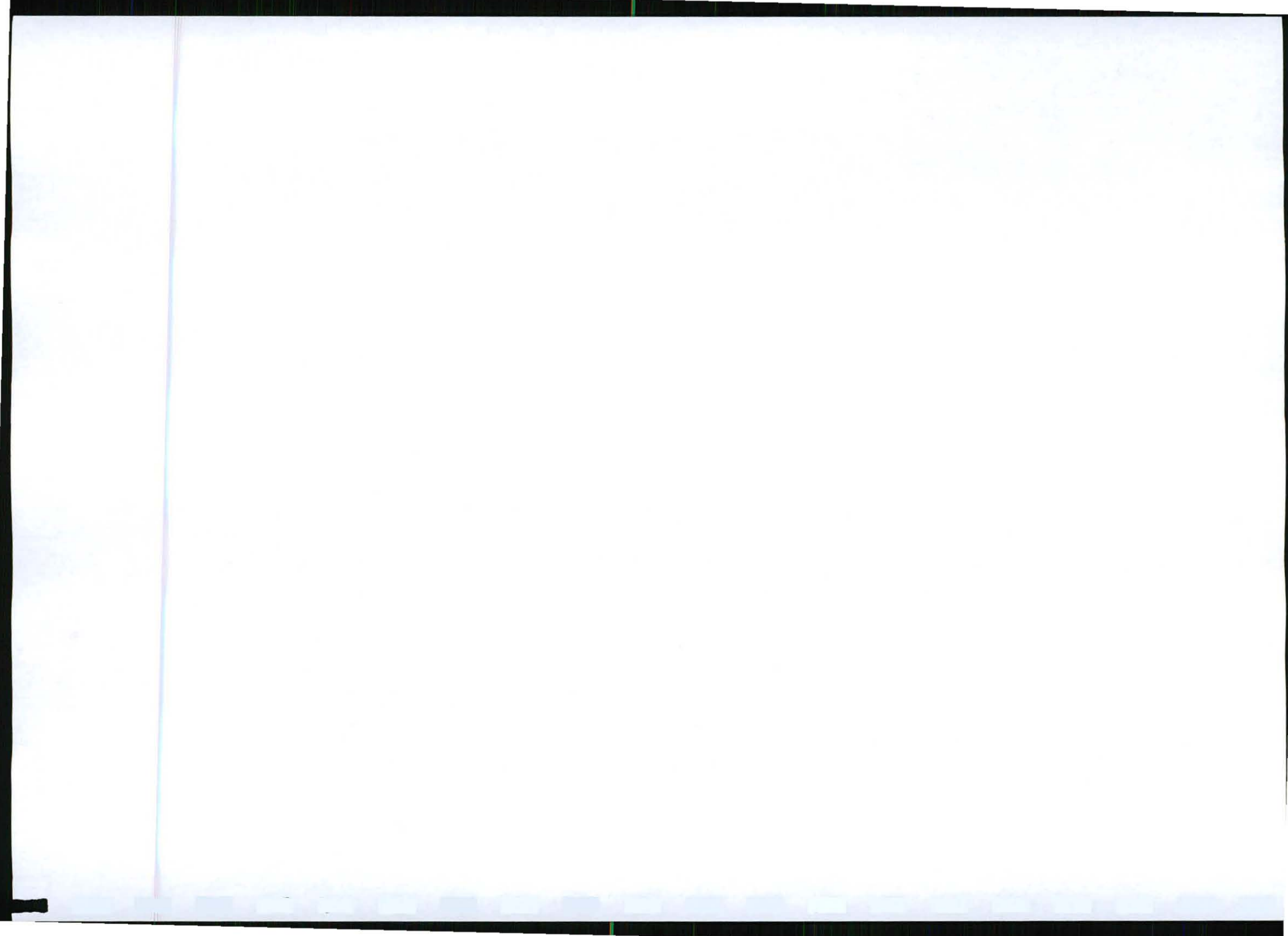
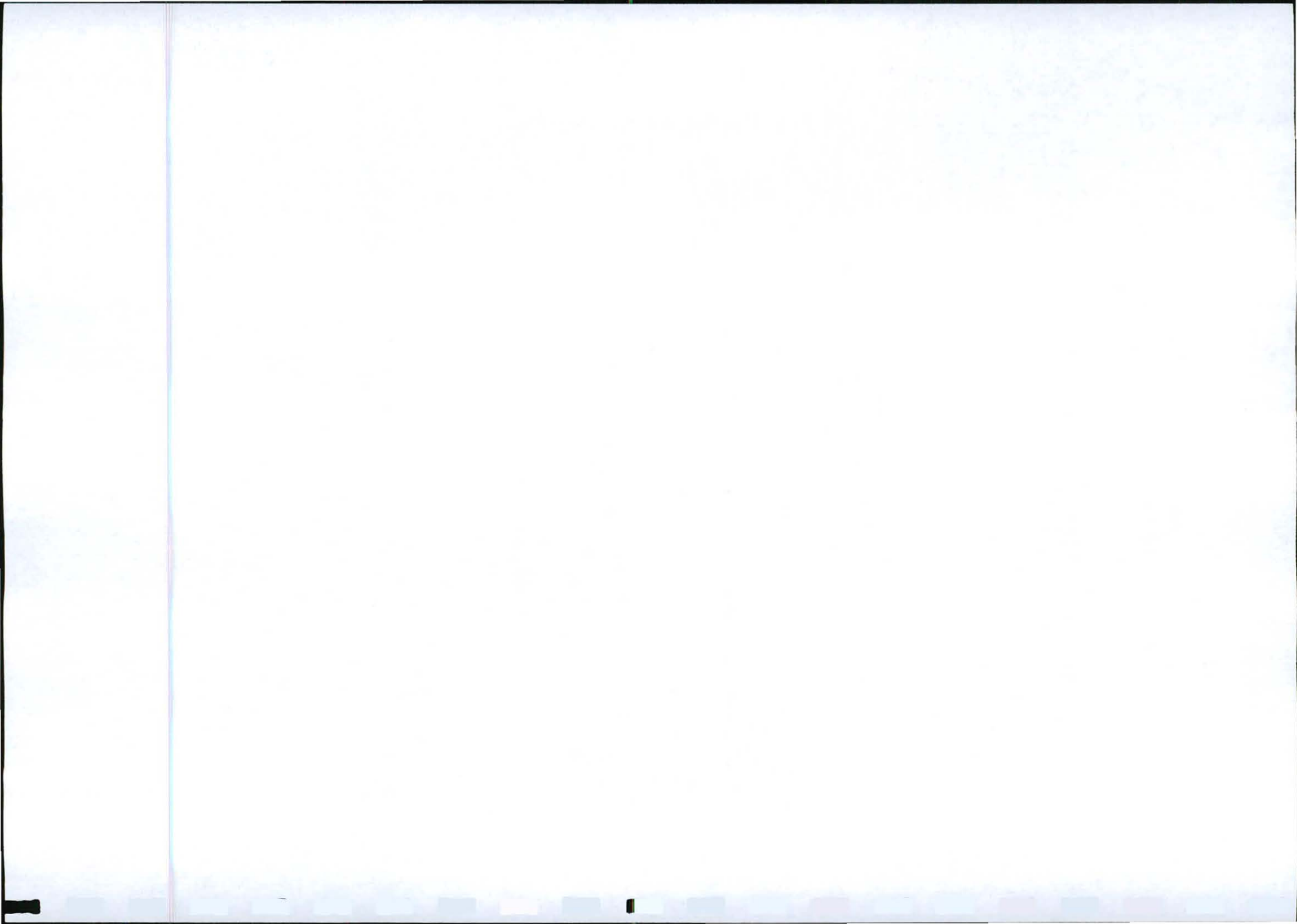


TABLE OF CONTENTS

1.	<u>INTRODUCTION.</u>	1
1.1	TERMS OF REFERENCE.	1
1.2	OBJECTIVES OF THE INVESTIGATION.	1
1.3	LOCATION.	2
1.4	BORROW PIT BACKGROUND.	2
1.4.1	PROPOSED BORROW PITS.	2
1.4.2	MATERIAL STOCKPILING.	3
1.4.3	ACCESS.	4
1.5	AVAILABLE INFORMATION.	4
2.	<u>SITE DESCRIPTION.</u>	6
2.1	TOPOGRAPHY AND DRAINAGE.	6
2.2	CLIMATE.	6
2.3	HYDROLOGY.	7
2.4	LAND USE.	8
4.	<u>INVESTIGATION PROCEDURE.</u>	9
4.1	DESK STUDY.	9
4.2	FIELD INVESTIGATION.	9
5.	<u>GEOLOGY.</u>	10
5.1	REGIONAL GEOLOGY.	10
5.1.1	KATBERG FORMATION.	10
5.1.2	BURGERSDORP FORMATION.	11
5.1.3	MOLTENO FORMATION.	11
5.1.4	DOLERITE.	11
6.	<u>ENVIRONMENTAL CONSIDERATIONS.</u>	12
6.1	ARCHAEOLOGICAL AND CULTURAL SITES.	12
6.2	FAUNA AND FLORA.	12
6.2.1	FLORA.	12
6.2.2	FISH.	13
6.2.3	REPTILES AND AMPHIBIANS.	14
6.2.4	MAMMALS	14
6.2.5	BIRDS.	15

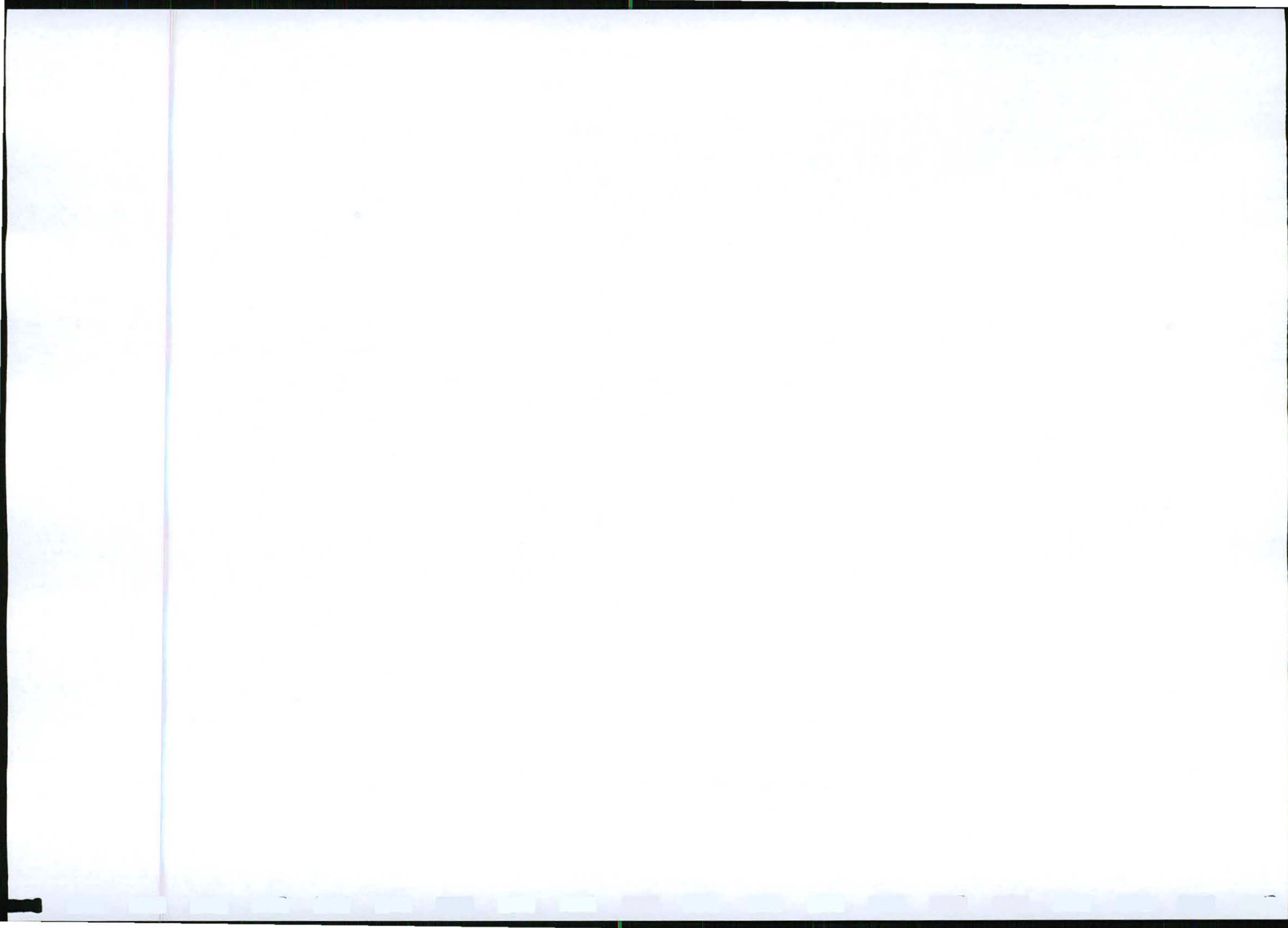


7.	<u>ENVIRONMENTAL ASSESSMENT OF BORROW PITS (VOLUME 2).</u> . . .	16
7.1	BORROW PIT NUMBERS.	16
7.2	BORROW PIT ANALYSIS.	16
8.	<u>ENVIRONMENTAL MANAGEMENT PROGRAMME.</u>	17
8.1	DEVELOPMENT OF PITS.	17
8.2	VISUAL ASPECTS.	18
8.3	FAUNA AND FLORA.	18
8.4	SOIL ASPECTS.	19
8.5	WATER ASPECTS.	20
8.6	AFFECTED PARTIES.	20
8.7	FINANCIAL PROVISION FOR REHABILITATION.	21
8.8	ENVIRONMENTAL MANAGEMENT.	22
8.9	REHABILITATION STRATEGIES.	23
8.10	RESPONSIBILITIES.	24
8.11	GENERAL CONDITIONS IN RESPECT OF THE PROJECT.	24
9.	<u>ENGINEERING GEOLOGICAL EVALUATION.</u>	26
10.	<u>PROJECT OVERVIEW.</u>	27
11.	<u>CONCLUSIONS AND RECOMMENDATIONS.</u>	28
12.	<u>REPORT PROVISIONS.</u>	29
13.	<u>REFERENCES AND BIBLIOGRAPHY.</u>	30

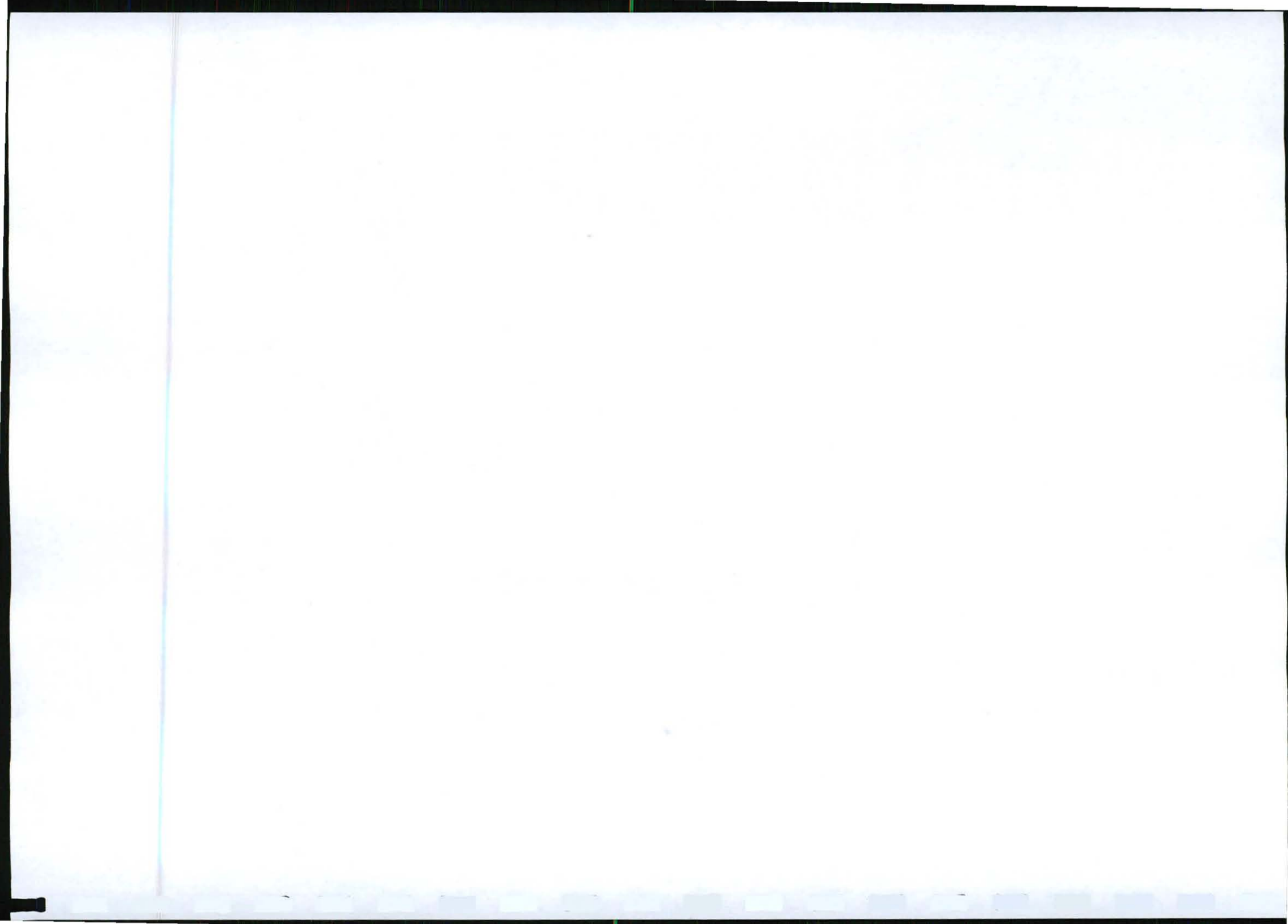


FIGURES

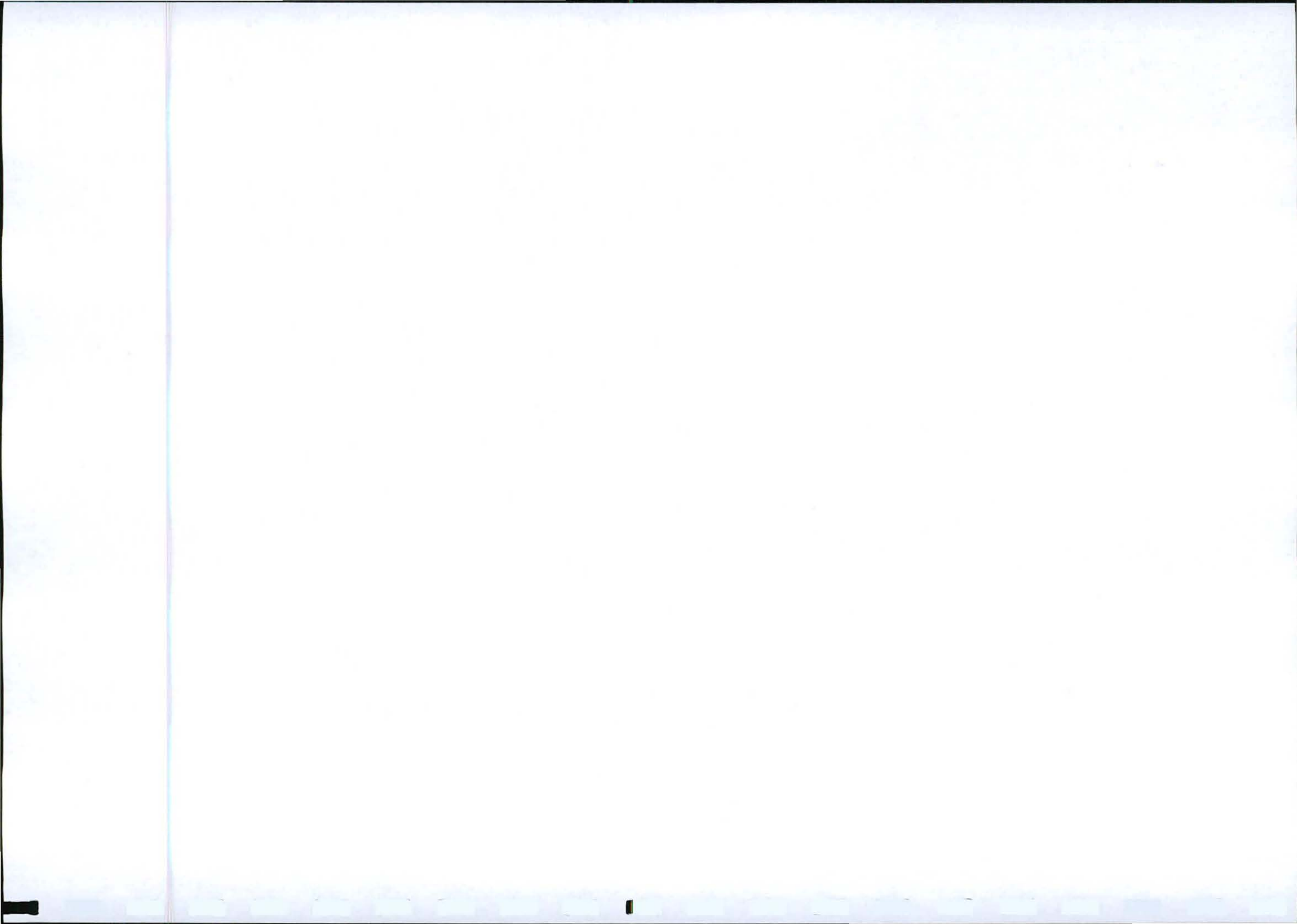
- FIGURE 1: ENGCOBO ROAD MAINTENANCE PROGRAMME: General Locality Map.
- FIGURE 2: ENGCOBO ROAD MAINTENANCE PROGRAMME: Borrow Pit Locality Map.
- FIGURE 3: ENGCOBO ROAD MAINTENANCE PROGRAMME: Geological Map.
- FIGURE 4: ENGCOBO ROAD MAINTENANCE PROGRAMME: MR00715 Borrow Pit 715/1 at Stake Value km 1.2 (LHS). Sketch Map.
- FIGURE 5: ENGCOBO ROAD MAINTENANCE PROGRAMME: MR00715 Borrow Pit 715/2 at Stake Value km 7.7 (RHS). Sketch Map.
- FIGURE 6: ENGCOBO ROAD MAINTENANCE PROGRAMME: MR00715 Borrow Pit 715/3 at Stake Value km 9.7 (RHS). Sketch Map.
- FIGURE 7: ENGCOBO ROAD MAINTENANCE PROGRAMME: MR00715 Borrow Pit 715/4 at Stake Value km 19.8 (RHS). Sketch Map.
- FIGURE 8: ENGCOBO ROAD MAINTENANCE PROGRAMME: MR00715 Borrow Pit 715/5 at Stake Value km 24.3 (LHS). Sketch Map.
- FIGURE 9: ENGCOBO ROAD MAINTENANCE PROGRAMME: MR00715 Borrow Pit 715/8 at Stake Value km 32.1 (RHS). Sketch Map.
- FIGURE 10: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08034 Borrow Pit 8034/2 at Stake Value km 5.6 (RHS). Sketch Map.
- FIGURE 11: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08034 Borrow Pit 8034/3 at Stake Value km 11.0 (LHS). Sketch Map.
- FIGURE 12: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08035 Borrow Pit 8035/0 at Stake Value km 0.0 (RHS). Sketch Map.
- FIGURE 13: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08036 Borrow Pit 8036/1 at Stake Value km 5.1 (RHS). Sketch Map.
- FIGURE 14: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08036 Borrow Pit 8036/3 at Stake Value km 13.1 (RHS). Sketch Map.
- FIGURE 15: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08036 Borrow Pit 8036/5 at Stake Value km 18.9 (LHS). Sketch Map.
- FIGURE 16: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08225 Borrow Pit 8225/1 at Stake Value km 7.4 (RHS). Sketch Map.
- FIGURE 17: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08225 Borrow Pit 8225/2 at Stake Value km 13.3 (LHS). Sketch Map.
- FIGURE 18: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08225 Borrow Pit 8225/3 at Stake Value km 13.5 (RHS). Sketch Map.
- FIGURE 19: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08225 Borrow Pit 8225/4 at Stake Value km 20.8 (RHS). Sketch Map.
- FIGURE 20: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08226 Borrow Pit 8226/1 at Stake Value km 3.2 (RHS). Sketch Map.
- FIGURE 21: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08227 Borrow Pit 8227/1 at Stake Value km 1.5 (RHS). Sketch Map.



- FIGURE 22: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/1 at Stake Value km 1.1 (LHS). Sketch Map.
- FIGURE 23: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8227/2 at Stake Value km 1.3 (LHS). Sketch Map.
- FIGURE 24: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/3 at Stake Value km 3.6 (LHS). Sketch Map.
- FIGURE 25: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/4 at Stake Value km 4.5 (LHS). Sketch Map.
- FIGURE 26: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/5 at Stake Value km 5.5 (LHS). Sketch Map.
- FIGURE 27: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/7 at Stake Value km 13.8 (LHS). Sketch Map.
- FIGURE 28: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/8 at Stake Value km 17.5 (RHS). Sketch Map.
- FIGURE 29: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/10 at Stake Value km 22.6 (RHS). Sketch Map.
- FIGURE 30: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08229 Borrow Pit 8229/11 at Stake Value km 24.9 (RHS). Sketch Map.
- FIGURE 31: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08230 Borrow Pit 8230/2 at Stake Value km 5.7 (LHS). Sketch Map.
- FIGURE 32: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08231 Borrow Pit 8231/1 at Stake Value km 2.1 (RHS). Sketch Map.
- FIGURE 33: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/1 at Stake Value km 0.9 (RHS). Sketch Map.
- FIGURE 34: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/2 at Stake Value km 5.2 (LHS). Sketch Map.
- FIGURE 35: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/3 at Stake Value km 8.3 (LHS). Sketch Map.
- FIGURE 36: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/5 at Stake Value km 15.1 (LHS). Sketch Map.
- FIGURE 37: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/7 at Stake Value km 18.2 (LHS). Sketch Map.
- FIGURE 38: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/8 at Stake Value km 20.8 (RHS). Sketch Map.
- FIGURE 39: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/9 at Stake Value km 23.8 (RHS). Sketch Map.
- FIGURE 40: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08232 Borrow Pit 8232/11 at Stake Value km 32.3 (LHS). Sketch Map.
- FIGURE 41: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08234 Borrow Pit 8234/1 at Stake Value km 3.4 (LHS). Sketch Map.
- FIGURE 42: ENGCOBO ROAD MAINTENANCE PROGRAMME: DR08234 Borrow Pit 8234/2 at Stake Value km 3.4 (LHS). Sketch Map.

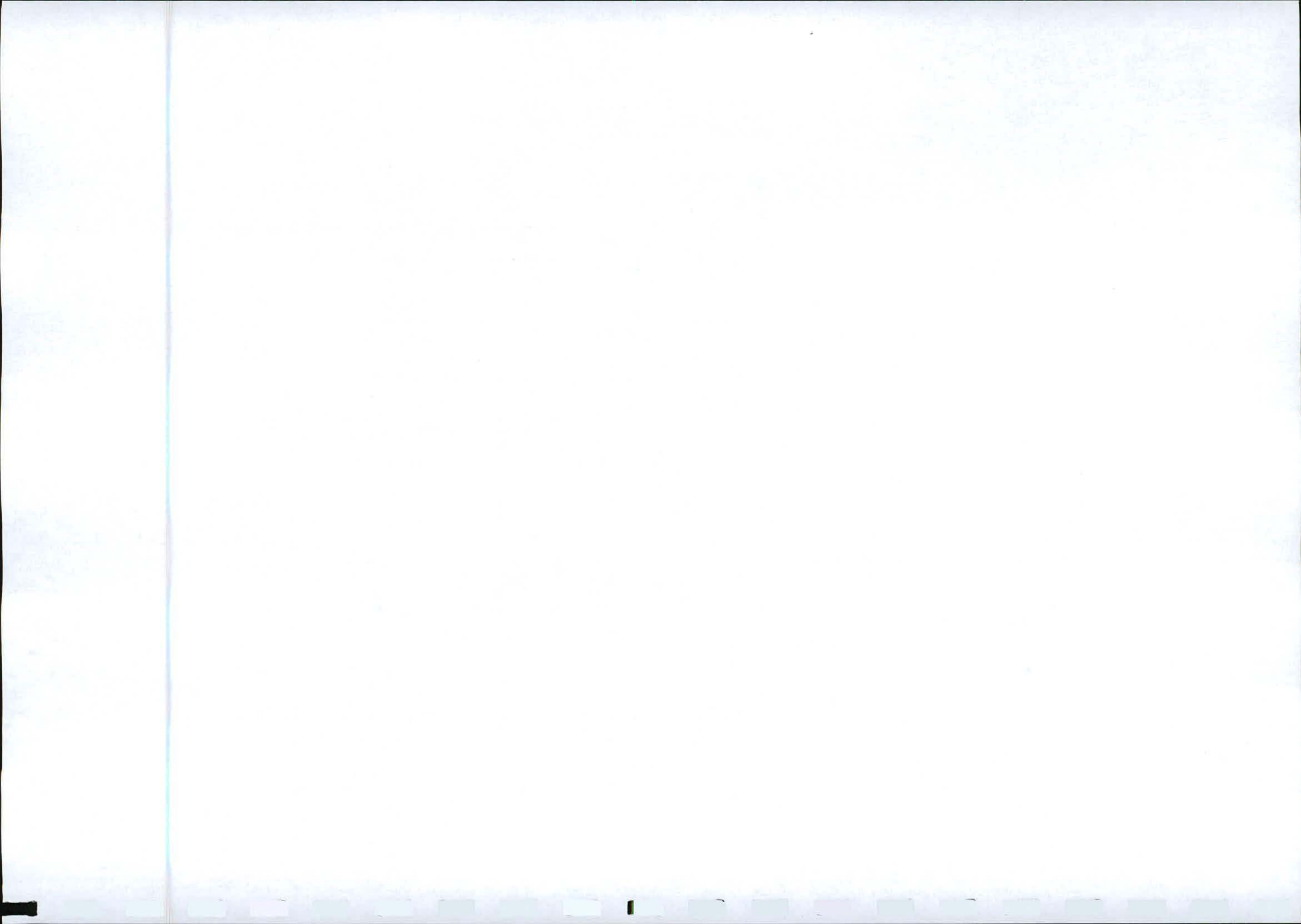


- FIGURE 43: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08258 Borrow Pit 8258/1 at Stake Value km 1,0 (RHS). Sketch Map.
- FIGURE 44: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08259 Borrow Pit 8259/1 at Stake Value km 2,6 (LHS). Sketch Map.
- FIGURE 45: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08260 Borrow Pit 8260/1 at Stake Value km 2,6 (LHS). Sketch Map.
- FIGURE 46: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08266 Borrow Pit 8266/3 at Stake Value km 11,3 (RHS). Sketch Map.
- FIGURE 47: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08266 Borrow Pit 8266/6 at Stake Value km 14,3 (LHS). Sketch Map.
- FIGURE 48: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08266 Borrow Pit 8266/5 at Stake Value km 18,5 (LHS). Sketch Map.
- FIGURE 49: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08270 Borrow Pit 8270/2 at Stake Value km 3,3 (LHS). Sketch Map.
- FIGURE 50: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08270 Borrow Pit 8270/4 at Stake Value km 9,8 (RHS). Sketch Map.
- FIGURE 51: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08270 Borrow Pit 8270/5 at Stake Value km 12,2 (RHS). Sketch Map.
- FIGURE 52: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08272 Borrow Pit 8272/1 at Stake Value km 5,0 (LHS). Sketch Map.
- FIGURE 53: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08273 Borrow Pit 8273/1 at Stake Value km 0,4 (RHS). Sketch Map.
- FIGURE 54: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08273 Borrow Pit 8273/2 at Stake Value km 6,3 (RHS). Sketch Map.
- FIGURE 55: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08273 Borrow Pit 8273/3 at Stake Value km 10,8 (RHS). Sketch Map.
- FIGURE 56: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08274 Borrow Pit 8274/1 at Stake Value km 2,9 (LHS).
- FIGURE 57: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08444 Borrow Pit 8444/1 at Stake Value km 4,4 (LHS).
- FIGURE 58: ENGCOCO ROAD MAINTENANCE PROGRAMME: DR08504 Borrow Pit 8504/1 at Stake Value km 6,8 (RHS).



PHOTOGRAPHS

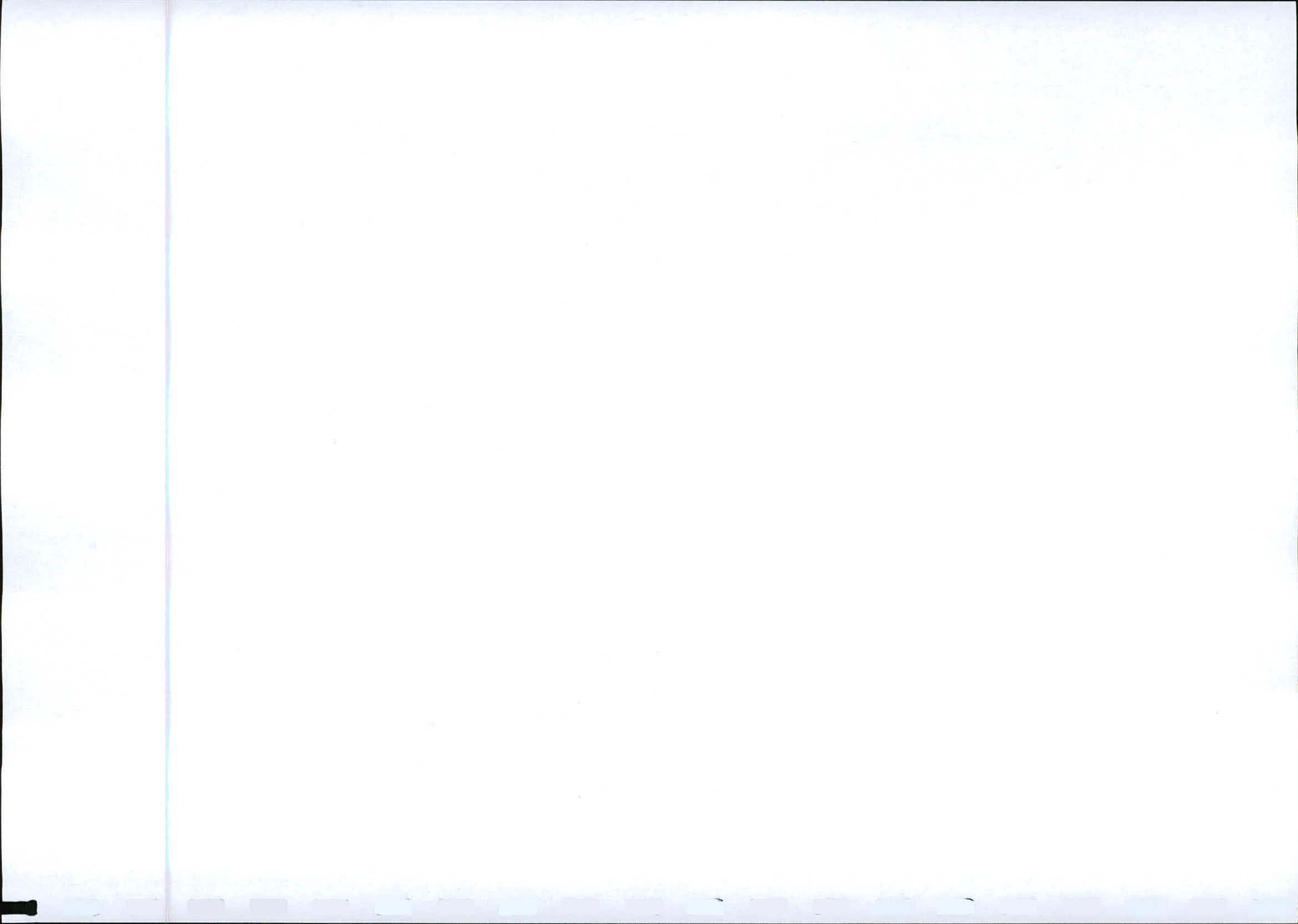
- PHOTO 1: Typical landscape in the high-lying northern part of the study area.
- PHOTO 2: The All Saints Road Camp in the central-background.
- PHOTO 3: Afromontane Forest in the northern part of the study area.
- PHOTO 4: The road cuts through Afromontane Forest in remote areas.
- PHOTO 5: Erosion within drainage systems in the lower-lying areas.
- PHOTO 6: A north-westerly view of Borrow Pit 715/1 at Stake Value km 1.2 (LHS).
- PHOTO 7: A south-westerly view of Borrow Pit 715/2 at Stake Value km 7.7 (RHS).
- PHOTO 8: A westerly view of Borrow Pit 715/3 at Stake Value km 9.7 (RHS).
- PHOTO 9: A view of the north-easterly part of Borrow Pit 715/3 at Stake Value km 9.7 (RHS), showing erosion scours in a rehabilitated slope.
- PHOTO 10: A south-easterly view of Borrow Pit 715/4 at Stake Value km 19.8 (RHS).
- PHOTO 11: A westerly view of Borrow Pit 715/5 at Stake Value km 24.3 (LHS).
- PHOTO 12: A north-easterly view of Borrow Pit 715/8 at Stake Value km 32.1 (RHS).
- PHOTO 13: A north-easterly view of Borrow Pit 8034/2 at Stake Value km 5.6 (RHS).
- PHOTO 14: A south-easterly view of Borrow Pit 8034/3 at Stake Value km 11.0 (LHS).
- PHOTO 15: A northerly view of Borrow Pit 8035/0 at Stake Value km 0.0 (RHS).
- PHOTO 16: A southerly view of Borrow Pit 8036/1 at Stake Value km 5.1 (RHS).
- PHOTO 17: A north-westerly view of Borrow Pit 8036/3 at Stake Value km 13.1 (RHS).
- PHOTO 18: An easterly view of Borrow Pit 8036/5 at Stake Value km 18.9 (LHS).
- PHOTO 19: A south-easterly view of Borrow Pit 8225/1 at Stake Value km 7.4 (RHS).
- PHOTO 20: A north-easterly view of Borrow Pit 8225/2 at Stake Value km 13.3 (LHS).
- PHOTO 21: A south-westerly view of Borrow Pit 8225/3 at Stake Value km 13.5 (LHS).
- PHOTO 22: A south-easterly view of Borrow Pit 8225/4 at Stake Value km 20.8 (RHS).
- PHOTO 23: A north-easterly view of Borrow Pit 8224/1 at Stake Value km 3.2 (RHS). Borrow Pit 8224/1 was encountered along the DR08226 roadway.
- PHOTO 24: An easterly view of Borrow Pit 8227/1 at Stake Value km 1.5 (RHS).
- PHOTO 25: A south-westerly view of Borrow Pit 8229/1 at Stake Value km 1.1 (LHS).
- PHOTO 26: A northerly view of Borrow Pit 8229/2 at Stake Value km 1.3 (LHS).
- PHOTO 27: A north-westerly view of Borrow Pit 8229/3 at Stake Value km 3.6 (LHS).
- PHOTO 28: A north-westerly view of Borrow Pit 8229/4 at Stake Value km 4.5 (LHS).
- PHOTO 29: A westerly view of Borrow Pit 8229/5 at Stake Value km 5.5 (LHS).
- PHOTO 30: A south-westerly view of Borrow Pit 8229/7 at Stake Value km 13.8 (LHS).
- PHOTO 31: An easterly view of Borrow Pit 8229/8 at Stake Value km 17.5 (RHS).
- PHOTO 32: A south-easterly view of Borrow Pit 8229/10 at Stake Value km 22.6 (RHS).
- PHOTO 33: A south-easterly view of Borrow Pit 8229/11 at Stake Value km 24.9 (RHS).
- PHOTO 34: A north-westerly view of Borrow Pit 8230/2 at Stake Value km 5.7 (LHS).
- PHOTO 35: A north-easterly view of Borrow Pit 8231/1 at Stake Value km 2.1 (RHS).
- PHOTO 36: A north-easterly view of Borrow Pit 8232/1 at Stake Value km 0.9 (RHS).
- PHOTO 37: A south-westerly view of Borrow Pit 8232/2 at Stake Value km 5.2 (LHS).



- PHOTO 38: A south-easterly view of Borrow Pit 8232/3 at Stake Value km 8.3 (LHS).
- PHOTO 39: A southerly view of Borrow Pit 8232/5 at Stake Value km 15.1 (LHS).
- PHOTO 40: A south-easterly view of Borrow Pit 8232/7 at Stake Value km 18.2 (LHS).
- PHOTO 41: A northerly view of Borrow Pit 8232/8 at Stake Value km 20.8 (LHS).
- PHOTO 42: A north-easterly view of Borrow Pit 8232/9 at Stake Value km 23.8 (RHS).
- PHOTO 43: A westerly view of Borrow Pit 8232/11 at Stake Value km 32.3 (LHS).
- PHOTO 44: A southerly view of Borrow Pit 8234/1 at Stake Value km 3.4 (LHS).
- PHOTO 45: A south-easterly view of Borrow Pit 8234/2 at Stake Value km 3.4 (LHS).
- PHOTO 46: A south-easterly view of Borrow Pit 8258/1 at Stake Value km 1.0 (RHS).
- PHOTO 47: A southerly view of Borrow Pit 8259/1 at Stake Value km 2.6 (LHS).
- PHOTO 48: A south-easterly view of Borrow Pit 8260/1 at Stake Value km 2.6 (LHS).
- PHOTO 49: A north-westerly view of Borrow Pit 8266/3 at Stake Value km 11.3 (RHS).
- PHOTO 50: An easterly view of Borrow Pit 8266/6 at Stake Value km 14.3 (LHS).
- PHOTO 51: An easterly view of Borrow Pit 8266/5 at Stake Value km 18.5 (LHS).
- PHOTO 52: A south-easterly view of Borrow Pit 8270/2 at Stake Value km 3.3 (LHS).
- PHOTO 53: A westerly view of Borrow Pit 8270/4 at Stake Value km 9.8 (RHS).
- PHOTO 54: A south-westerly view of Borrow Pit 8270/5 at Stake Value km 12.2 (RHS).
- PHOTO 55: A northerly view of Borrow Pit 8272/1 at Stake Value km 5.0 (LHS).
- PHOTO 56: A south-easterly view of Borrow Pit 8273/1 at Stake Value km 0.4 (RHS).
- PHOTO 57: An easterly view of Borrow Pit 8273/1 at Stake Value km 6.3 (RHS).
- PHOTO 58: A south-easterly view of Borrow Pit 8273/3 at Stake Value km 10.8 (RHS).
- PHOTO 59: A south-easterly view of Borrow Pit 8274/1 at Stake Value km 2.9 (LHS).
- PHOTO 60: An easterly view of Borrow Pit 8504/1 at Stake Value km 6.8 (RHS).
- PHOTO 61: A south-easterly view of Borrow Pit 8444/1 at Stake Value km 4.4 (LHS).

APPENDICES

- APPENDIX 1: ENGOBO ROAD MAINTENANCE PROGRAMME: Photographs.
- APPENDIX 2: ENGOBO ROAD MAINTENANCE PROGRAMME: Figures.
- APPENDIX 3: ENGOBO ROAD MAINTENANCE PROGRAMME: Additional Correspondence.



AN ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE ROAD MAINTENANCE PROGRAMME IN THE ENGCOBO AREA OF THE EASTERN CAPE PROVINCE.

1. INTRODUCTION.

1.1 TERMS OF REFERENCE.

This Environmental Management Programme Report (EMPR) has been prepared for some of the existing borrow pits along various gravel standard roads in the Chris Hani region (Engcobo Local Municipality), in the north-eastern part of the Eastern Cape Province. Approximately 310 km of gravel road and 27 km of surfaced road are to be rehabilitated over a period of about 5 years as part of this project, which has been commissioned by the Province of the Eastern Cape Department of Roads and Public Works. The EMPR investigation was conducted as per legislation stipulated under the Minerals Act No. 50 of 1991, as required by the Department of Minerals and Energy.

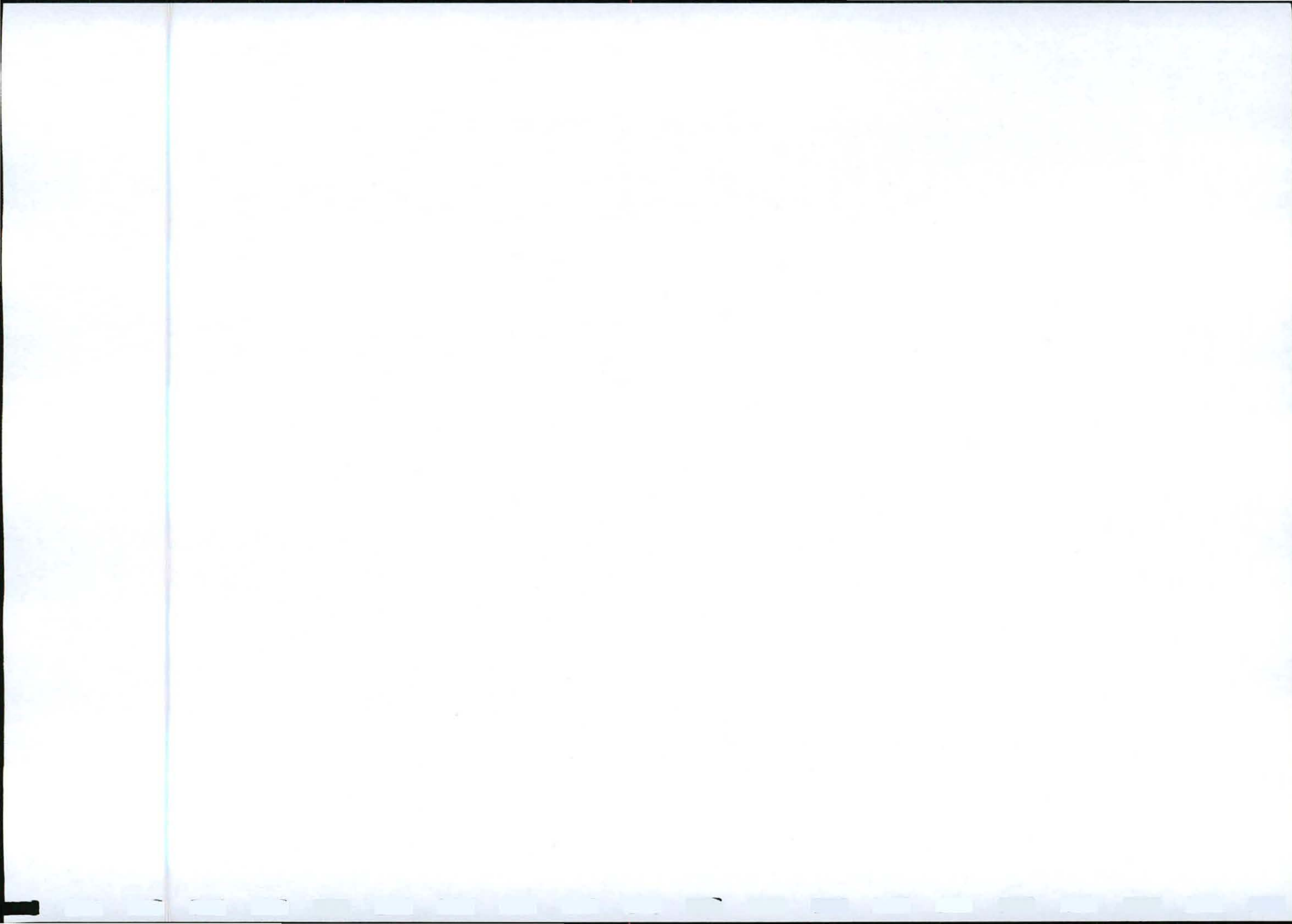
A materials investigation has already been completed in many of the existing borrow pits. This investigation comprised the sampling of bedrock material from the various existing borrow pits, and determining their potential suitability for the proposed road maintenance programme.

The EMPR investigation was conducted at the request of Mr Anton Westerberg of Engineering Advice and Services Consulting Engineers (Port Elizabeth), as per letter of appointment dated 30 November 2002. The reconnaissance site visit was undertaken between Monday 16 September 2002 and Wednesday 18 September 2002, and the field investigation was conducted between Wednesday 6 August 2003 and Sunday 10 August 2003. The investigation was carried out in accordance with accepted EMPR norms and standards.

1.2 OBJECTIVES OF THE INVESTIGATION.

The objectives of the investigation for each of the existing borrow pits, were to:

- a) Meet the requirements and directives of the Minerals Act (Act No. 50 of 1991), and the regulations promulgated under that act, as specified by the Department of Mineral and Energy.



b) Motivate the feasibility of the proposed borrow pit activity, bearing the prevailing baseline environmental factors in mind.

c) Provide a functional management programme for the effective mining of target material within an environmentally acceptable ambit, including decommissioning and rehabilitation of the post-mining scars (both past and future) in the area.

d) Ensure that the environmental principles advocated in the National Environmental Management Act (NEMA), No 107 of 1998, are adhered to during borrow pit re-commissioning, rehabilitation, and decommissioning.

1.3 LOCATION.

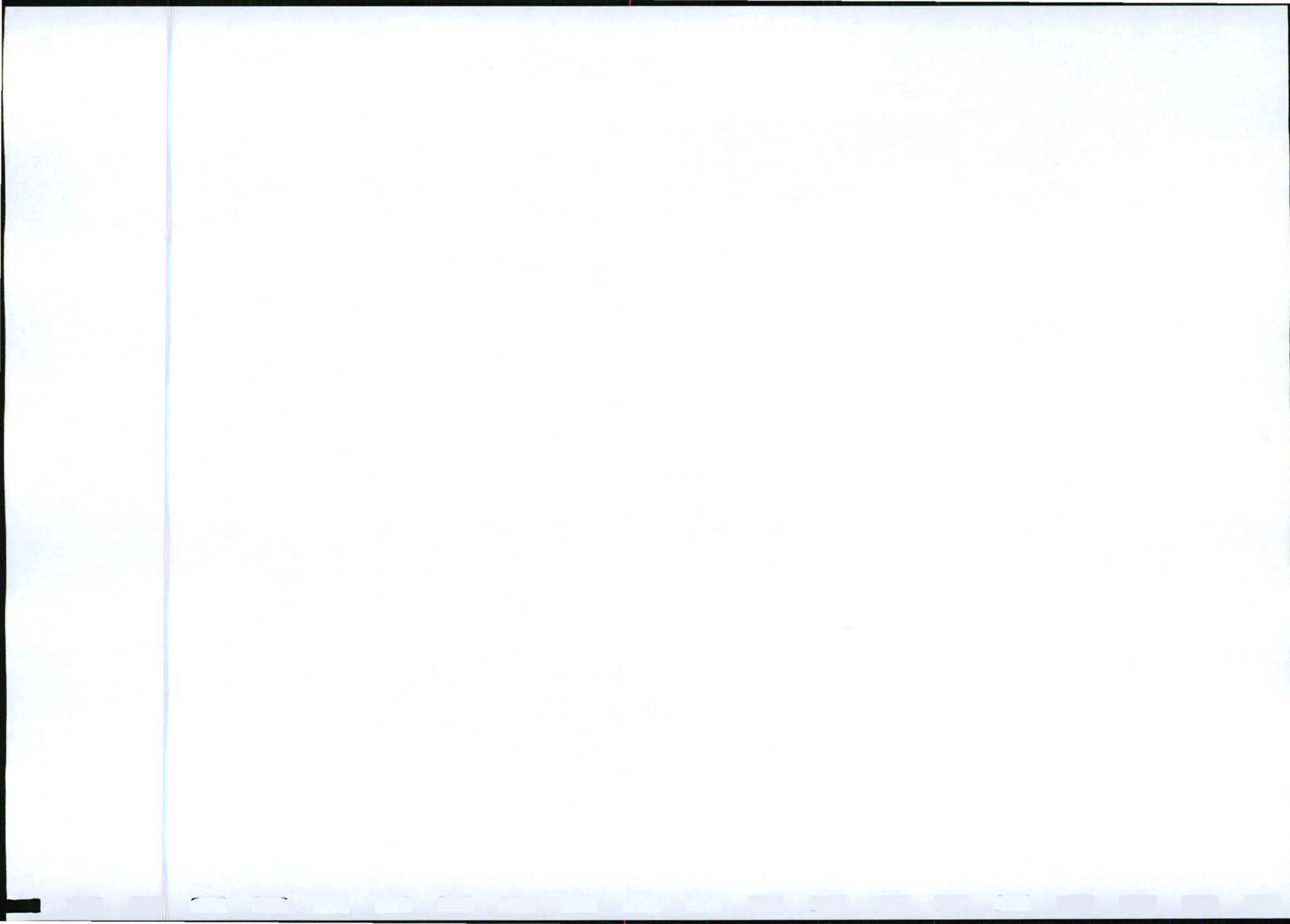
The Chris Hani District is located on the southern flanks of the Drakensberg Mountains between the Kannaskop Peak (1581 metres above mean sea-level) to the north, Gqogqora Peak (1099 mamsl) to the south, Kunomadamba Peak (1671 mamsl) to the west, and Kwe-Nduli-Epakati Peak (1600 mamsl) to the east. The study area covers an area of about 1 000 km², and includes the town of Engcobo and the All Saints village. Numerous rural settlements are also scattered throughout the study area.

Engcobo is situated about 60 km south of Elliot, about 225 km north-east of Queenstown, and 80 km west of Umtata, in the north-eastern part of the Eastern Cape Province. The roads and borrow pits covered by this investigation are scattered randomly throughout the study area. The borrow pit positions and their corresponding Stake Values are indicated on Figure 2, whilst the positions of the borrow pits in relation to the roads are also indicated in the individual borrow pit sketch maps (Figures 5 to 60 in Appendix 2).

1.4 BORROW PIT BACKGROUND.

1.4.1 PROPOSED BORROW PITS.

During the initial reconnaissance site visit numerous existing borrow pits were identified along the various gravel standard and surfaced roads within the Chris Hani District. Initial indicators suggested that road surfaces constructed with weathered dolerite produced good quality surfaces in the short term due to good compaction values and the lack of oversize in surface wearing course. Climatic conditions, however, encourages the break-down of this material over time, and the completed road surfaces show signs of distress over a relatively short period of time.



Gravel roads constructed with sandstone and mudstone, on the other hand, need to be more carefully constructed as harder material needs to be well sorted to reduce the percentage of oversize material within the road surface. An already completed roadway, however, appears to have a much longer lifespan and shows less signs of distress over time when compared to that of a dolerite constructed road surface.

This was confirmed by the results of the materials investigation. Much of the EMPR field work was, therefore, carried out on residual mudstone and sandstone borrow pits, although occasional dolerite borrow pits were subjected to investigation where no potentially suitable alternative existed.

This EMPR covers existing borrow pits, which are potentially suitable to provide gravel wearing course, subgrade fill or culvert backfill for road rehabilitation purposes. In most cases it will be necessary to extend existing workings to extract the required quantity and quality of material.

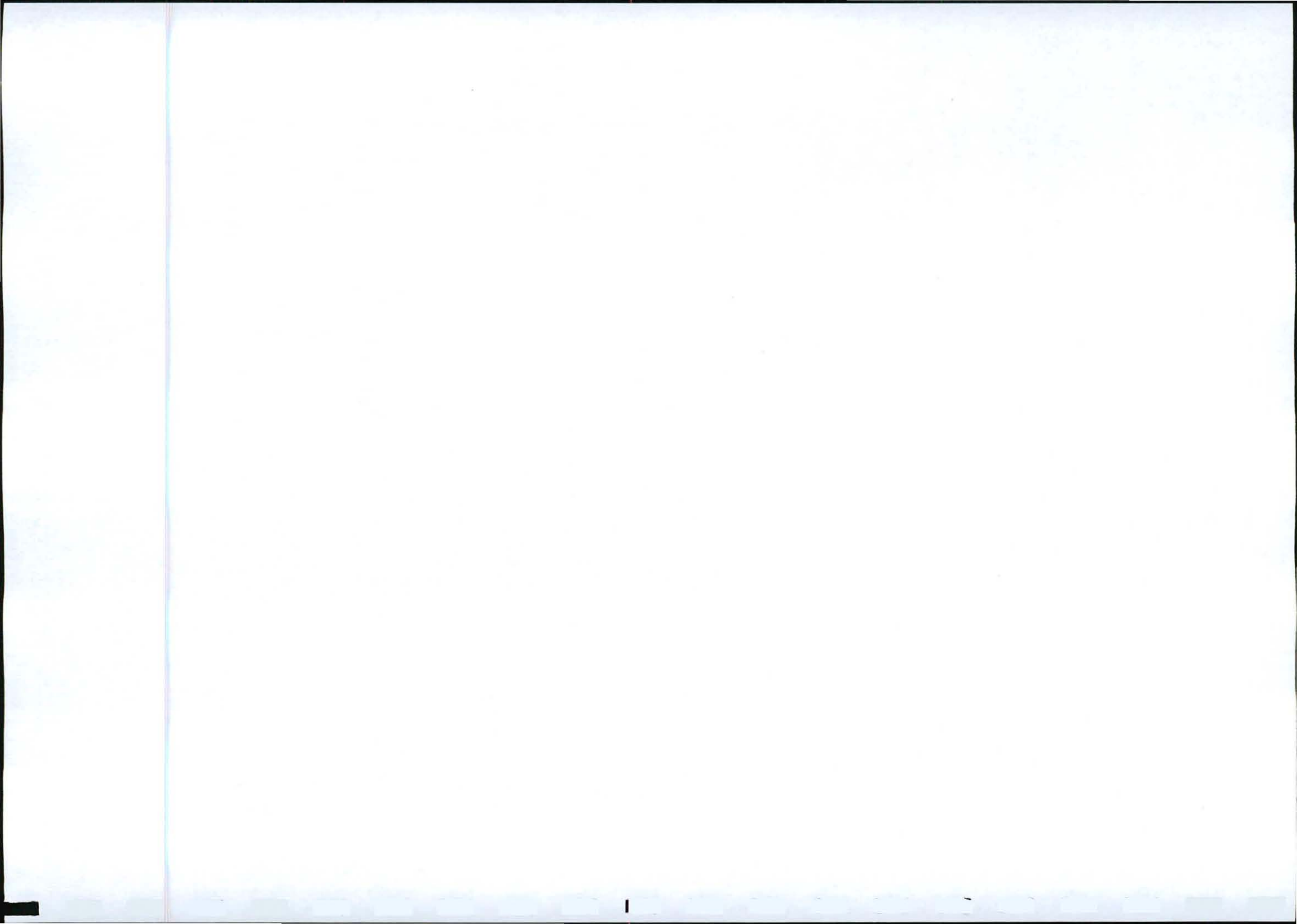
There is very little material stockpiled in most of the existing borrow pits, and extraction of material will generally be by excavating directly from the face or floor of the pits. Where stockpiles do exist, most of the material has slaked rendering it unsuitable for road rehabilitation purposes. The quantity of material to be extracted from each pit is not yet known, and will depend on the requirements and priorities for maintenance as the contract proceeds. Approximately 310 km of gravel road and 27 km of surfaced road are to be rehabilitated over a period of about 5 years as part of this project.

The duration of operation of the borrow pits will be very short, a matter of weeks in any one pit. The borrow pits will remain open after the end of the contract for continued use for road maintenance programmes.

Other than minor reinstatement of existing accesses to the pits off the roads, no buildings or infrastructure will be required at the borrow pits.

1.4.2 MATERIAL STOCKPILING.

Material from the borrow pits will generally be transported directly to the roads and processed *in situ*. Loading of material onto trucks and pre-stockpiling will generally be carried out by an excavator at each borrow pit.



1.4.3 ACCESS.

Many of the borrow pits are immediately adjacent to the roads, so no access routes are necessary. A few pits are, however, located away from the roads, and have constructed tracks leading to them. These access routes are frequently run-down due to lack of use and may have to receive attention in places. Fences and gates exist at some of the borrow pits, and may have to be re-constructed at some pits to facilitate material removal. All work relating to access routes, fences and gates must be cleared with the relevant land users prior to borrow pit re-commissioning.

1.5 AVAILABLE INFORMATION.

a) Topographical maps 3127 DA CALA, 3127 DB ENGCOBO, 3127 DD NOBOKWE, 3128 AC XUKA DRIFT, 3128 AD UMNGA FLATS, 3128 CA ALL SAINTS, 3128 CB BAZIYA, 3128 CC MJANYANA and 3128 CD CLARKEBURY, all on a scale of 1:50 000.

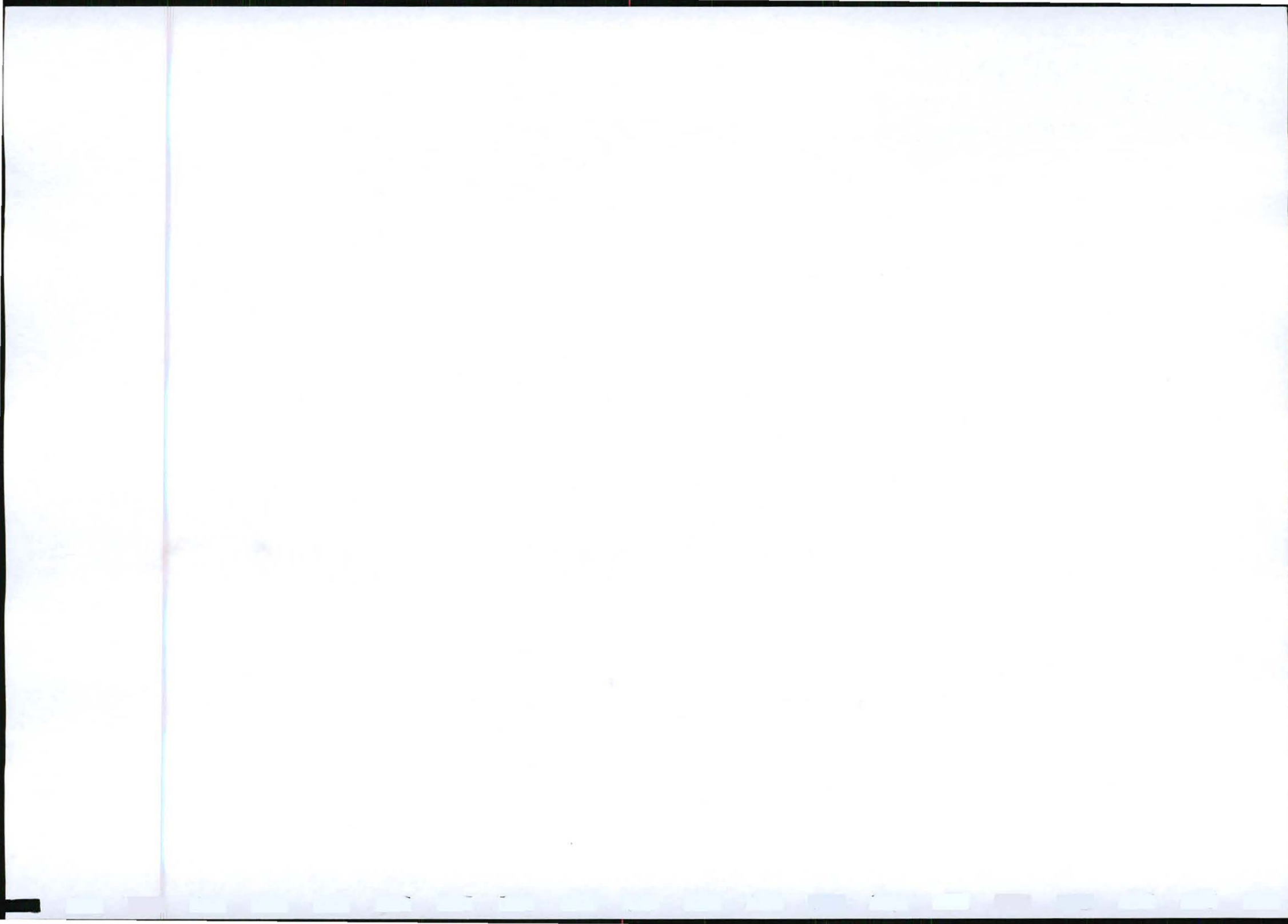
b) Topographical maps 3126 QUEENSTOWN and 3128 UMTATA, both on a scale of 1:250 000.

c) Geological maps 3126 QUEENSTOWN and 3128 UMTATA, both produced by the Geological Survey (Council for Geoscience) on a scale of 1:250 000.

d) Copy of an area plan entitled, "Chris Hani Region - Engcobo Local Municipality. Area-Wide Road Maintenance. Initial Road Assessment". This plan (drawing number 307-T-01) was produced by Engineering Advice and Services Consulting Engineers on an original scale of 1:200 000, for the Department of Public Works.

e) Copy of an area plan entitled, "Chris Hani Region - Engcobo Local Municipality. Area-Wide Road Maintenance". This plan (drawing number 307-Fig 08) was produced by Engineering Advice and Services Consulting Engineers on an original scale of 1:125 000, for the Department of Public Works.

f) Copy of a borrow pit locality plan entitled, "Project No. PTB5 - 02/03 - 1898. Chris Hani Region - Engcobo Local Municipality. Proposed Maintenance & Reconstruction Programme - Year 1". This plan (drawing number Year1-A2) was produced by Engineering Advice and Services Consulting Engineers on an original scale of 1:200 000, for the Department of Public Works.



g) A copy of a report entitled, "An Engineering Geological Investigation for a New Cemetery at Ugie, in the Eastern Cape Province. This report was completed in 1997 for Engeocon.

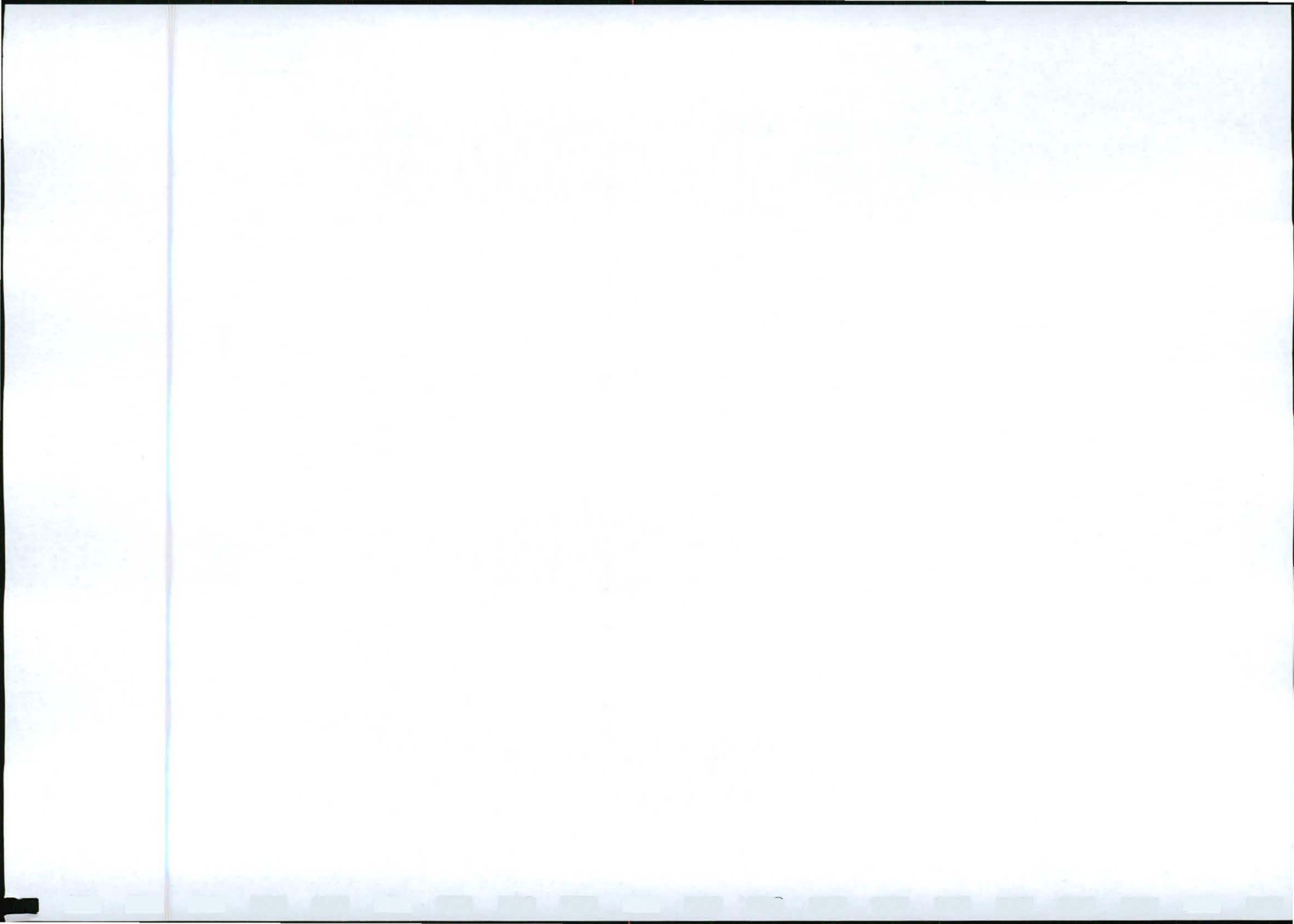
h) Copy of report entitled, "An Engineering Geological Investigation for New Housing Development at Ibeka, Butterworth, in the Eastern Cape Province". This report (number BEG/098036) was completed during January 1998 by Bopite Engineering Geologists CC for Grinaker Housing (Eastern Cape).

i) Copy of a report entitled, "An Engineering Geological Appraisal of the Greater Ugie Area for Integrated Development Plan Purposes". This report (number G0056) was completed by Blue Horizon Consulting during December 1998 for Urban Dynamics (Port Elizabeth).

j) Copy of report entitled, "An Engineering Geological Investigation for the Proposed Low Cost Housing Project at Idutywa, in the Eastern Cape Province". This report (number BEG/00202) was completed during October 2000 by Bopite Engineering Geologists CC for Megacom Housing (Pty) Ltd.

k) Copy of a report entitled, "An Environmental Management Programme of Re-commissioning of Eight Borrow Pits along Gravel Road DR344 near Butterworth, in the Transkei". This report (number BEG/02264) was completed by Bopite Engineering Geologists CC during September 2002 for Kwezi V3 Consulting Engineers (Port Elizabeth).

l) Copy of a report entitled, "An Engineering Geological Investigation for Housing Development and Latrine (VIP) Instillation at MacKay's Nek, near Lady Frere, in the Eastern Cape Province". This report (number BEG/02304) was completed by Bopite Engineering Geologists CC during February 2003 for Ninham Shand Consulting Engineers (East London).



2. SITE DESCRIPTION.

2.1 TOPOGRAPHY AND DRAINAGE.

The Chris Hani Region is located at the foot of the southern Drakensberg Mountain escarpment. Numerous north to south orientated ridges and spurs occur in the northern part of the study area, whilst fairly gentle wide-open plains characterise the southern parts. The northern part of the study area is, therefore, characterised by steeper slopes and mountain passes, whilst the southern areas are blanketed by a more gentle surface topography.

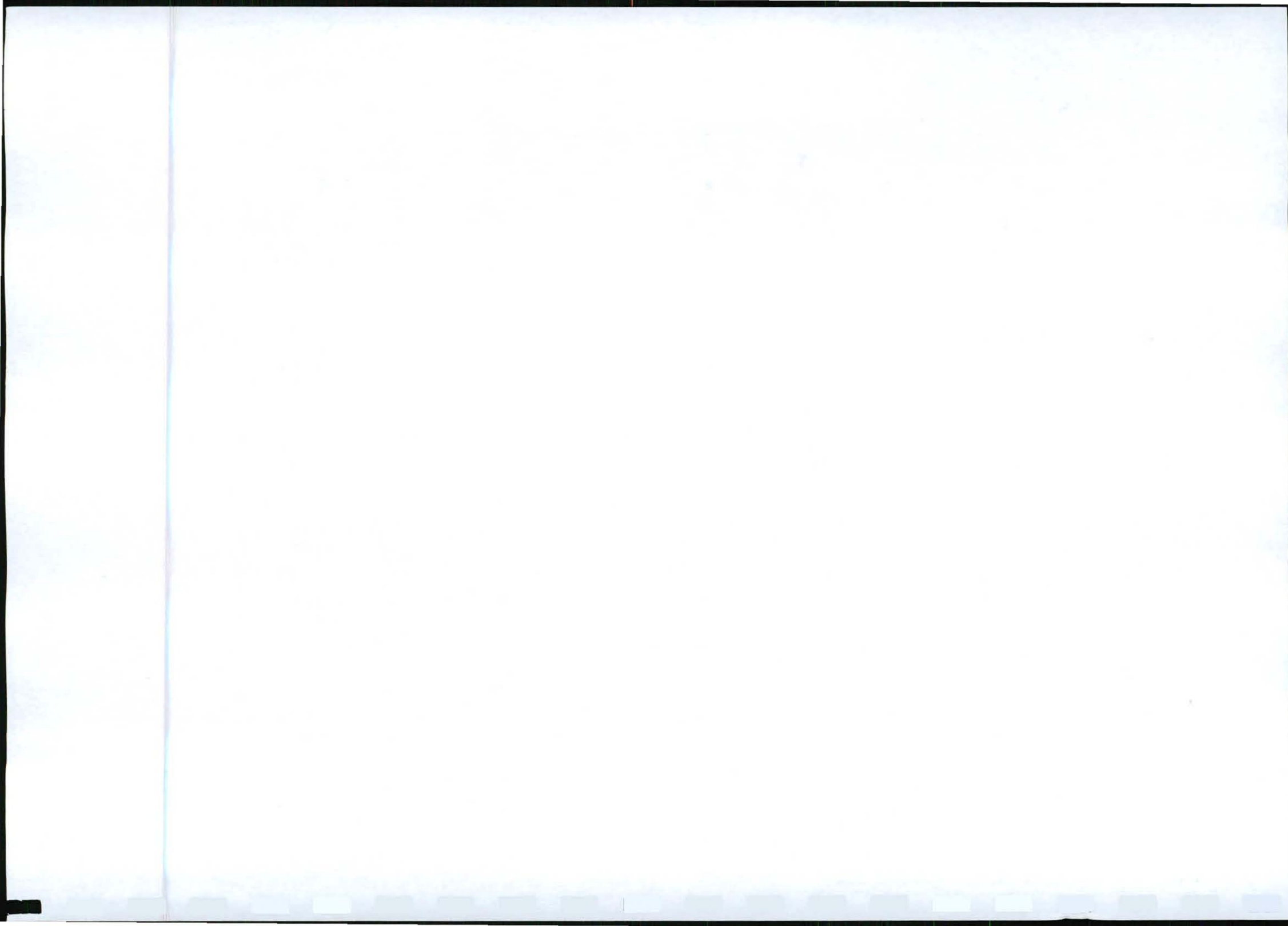
Significant mountain peaks in the region include the Kunomadamba Peak to the west (1671 metres above mean sea-level), Kannaskop to the north (1581 mamsl), Kwa-Nduli-Epakati Peak (1600 mamsl) and Mount Ross (1530 mamsl) to the east, and Gqogqora Peak (1099 mamsl) to the south (Figure 1).

The perennial Mbashe River to the east of Engcobo is the most significant drainage system within the Chris Hani Region. Numerous other perennial and ephemeral river systems occur in the study area, most of which flow in a southerly and south-easterly direction. Most of these drainage systems and their tributaries are traversed by the Chris Hani Region road network, via culverts, causeways and bridges.

2.2 CLIMATE.

The Eastern Cape Province straddles a transition between three major climatic regions. Spring and autumn rainfall occurs in the western part of the coastal region, summer rainfall in the eastern region, and a combined effect with cold fronts and little or no rainfall in the interior regions. The climate in the study area is classed as sub-tropical according to the Köppens Climatic Classification system (Kopke, 1998). This implies that temperatures of between 10°C and 22°C occur throughout the year, and precipitation occurs mostly during the summer months.

According to the South African Weather Bureau (WB42, 1988), fairly harsh climatic conditions prevail in the Engcobo region. Rainfall varies between 600 mm and 650 mm per annum, with a precipitation maximum during the summer months (November to March). The mean annual run-off generated in the Engcobo area is about 50 to 100 mm per annum. The surface run-off in the region is, therefore, only about 10% to 15% of the annual precipitation.



It is worth noting that most of the run-off generated across the study area is "virgin". Developed run-off would only be generated from the limited buildings (schools, mission and houses) and road network.

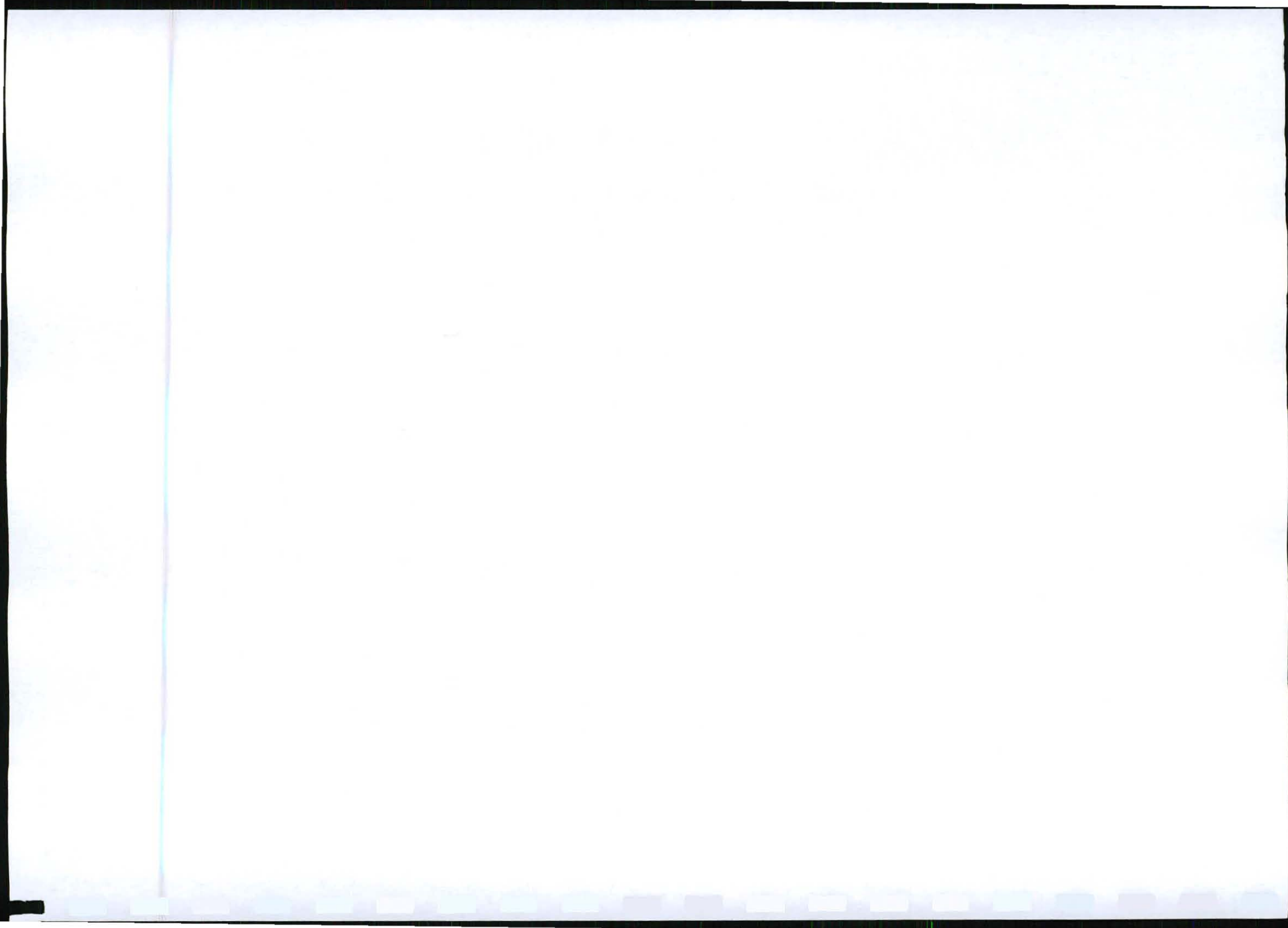
Summer (January) temperatures vary from an average maximum of about 27 °C to an average minimum of about 14 °C, whilst winter (July) maximums and minimums are about 17 °C and 4 °C, respectively. The maximum rainfall experienced in the region over a 24 hour period was at the Cala Police Station on 13 January 1958, when 232 mm fell. Statistically, thunder generally occurs in the region for about 34 days per year, fog for about 6 days per year, hail for about 3 days per year, and snow for a single day per year. The mean annual evaporation value for the Engcobo area is between about 1400 mm to 1500 mm per annum.

The dominant wind directions are from the north-west and south-east, with a minor westerly and easterly component also occurring. Calm conditions are experienced for about 18 % (66 days) of the year. Weinert's climatic N number is approximately 3,3 implying that chemical weathering dominates over mechanical weathering. The weathering profile and residual soil cover thicken down gradient, especially in the southern part of the study area where more gentle topography prevails. Basic crystalline rocks such as dolerite also decompose to produce smectitic clay minerals, especially in areas of impeded drainage. It is worth noting that the study area falls to the south of the Drakensberg footprint that requires local determination of climatic N-values.

The Thornwaite Index for this area is about 0, which separates the dry and wet climates. A negative Thornwaite index represents a water deficit, whilst a positive Thornwaite index a moisture surplus. The Thornwaite index generally becomes positive along the coast towards the east, and negative inland.

2.3 HYDROLOGY.

No borrow pits recommended in this EMPR occur in any feature representing a natural drainage course along either of the investigated roads. Some borrow pits do, however, occur on sloping land that feeds surface drainage down gradient towards drainage channels. Where such a scenario occurs, downslope earth walls should be constructed to collect surface run-off within the borrow pit scar. These artificial run-off collectors frequently serve as watering holes for domestic livestock in the region.



The trough collecting surface run-off should, however, not be too deep to represent a safety hazard to small children who may drown when swimming unsupervised. The down gradient berm must, therefore, just ensure that downslope siltation of drainage channels is avoided as far as possible under normal weather conditions.

Poor rehabilitation techniques during past quarrying operations have, however, revealed many steep slopes along the edges of the borrow pits and water holes, with limited access for animals. This situation should be rectified as far as possible once borrow pit rehabilitation and decommissioning takes place.

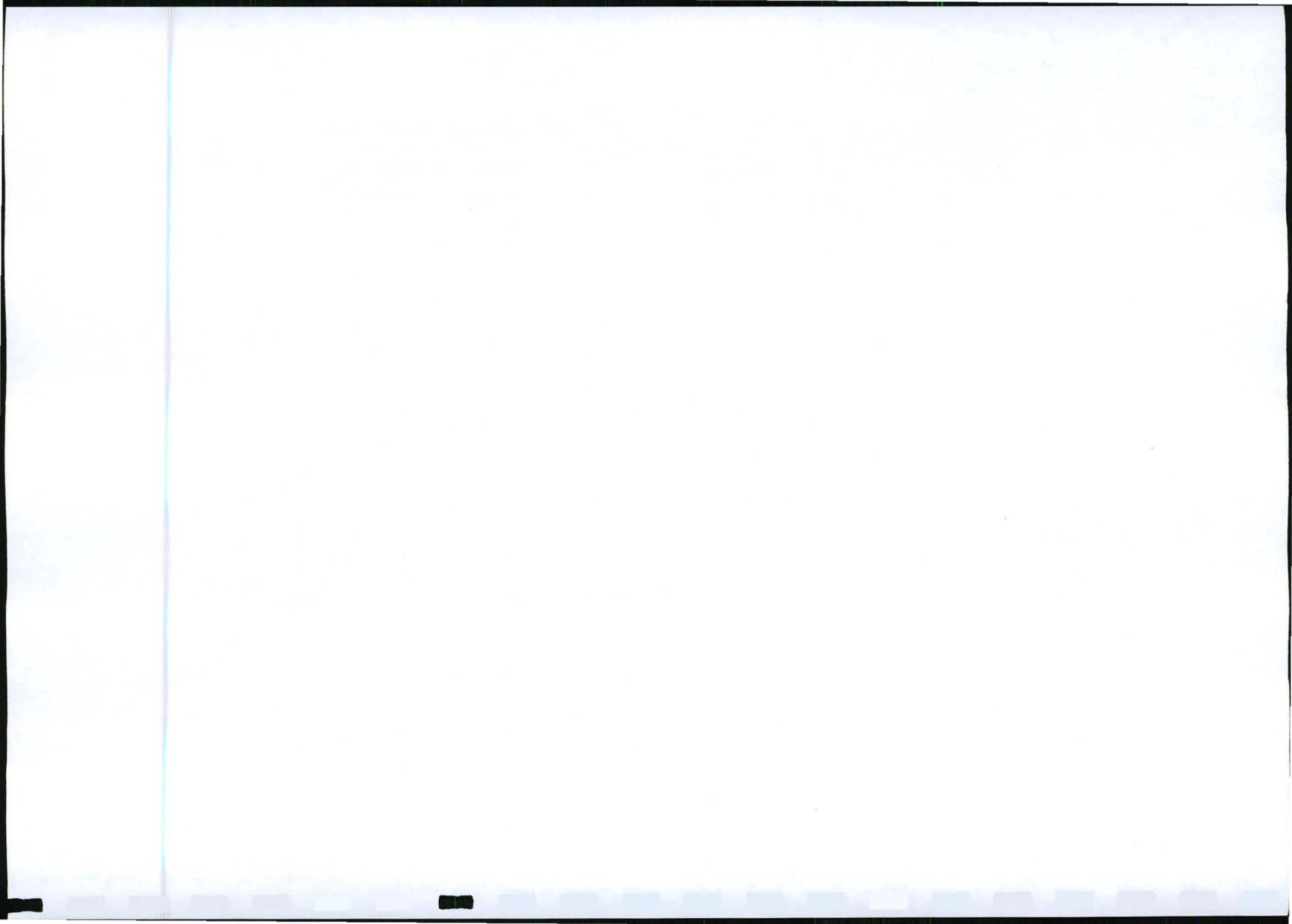
Where drainage features are located nearby to an existing borrow pit, and when operations of such borrow pits is carried out during the wet season, some sediment may be washed into these features. This is likely to be a short-term problem affecting only a few of the sites.

Some springs also occur in the floor of some existing borrow pits. These springs are an important source of drinking water to local inhabitants, and must in no way be negatively impacted upon by future quarrying operations. Where present, the spring seepage point and outflow channel should be enclosed by a berm to protect fresh water flow from additional siltation and potential blocking of the source. Details in this regard are outlined in the various borrow pit sketches where natural springs were identified.

2.4 LAND USE.

Most of the gravel and surface roads in the Engcobo area, including borrow pit access routes, traverse tribal land that belongs to the state. Many of the larger roads are public routes servicing larger communities, whilst some of the smaller roads are specifically constructed as a feeder to the smaller settlements. Grazing by domestic livestock takes place around most of the borrow pits identified along these two roads. Several of the borrow pits collect water during the wet season and act as watering holes for the livestock. Many of these pits still hold water during the drier months as well.

Any draining of borrow pits to provide water for road construction purposes, or for access for plant, must be negotiated with local communities before action is taken.



4. INVESTIGATION PROCEDURE.

4.1 **DESK STUDY.**

The investigation commenced with a desk study of all available information sources. This study gave an indication of the general geology to be expected, as well as an indication of prevailing fauna and flora along each roadway. Potential environmental issues such as drainage channel proximity and future mining directions were also identified.

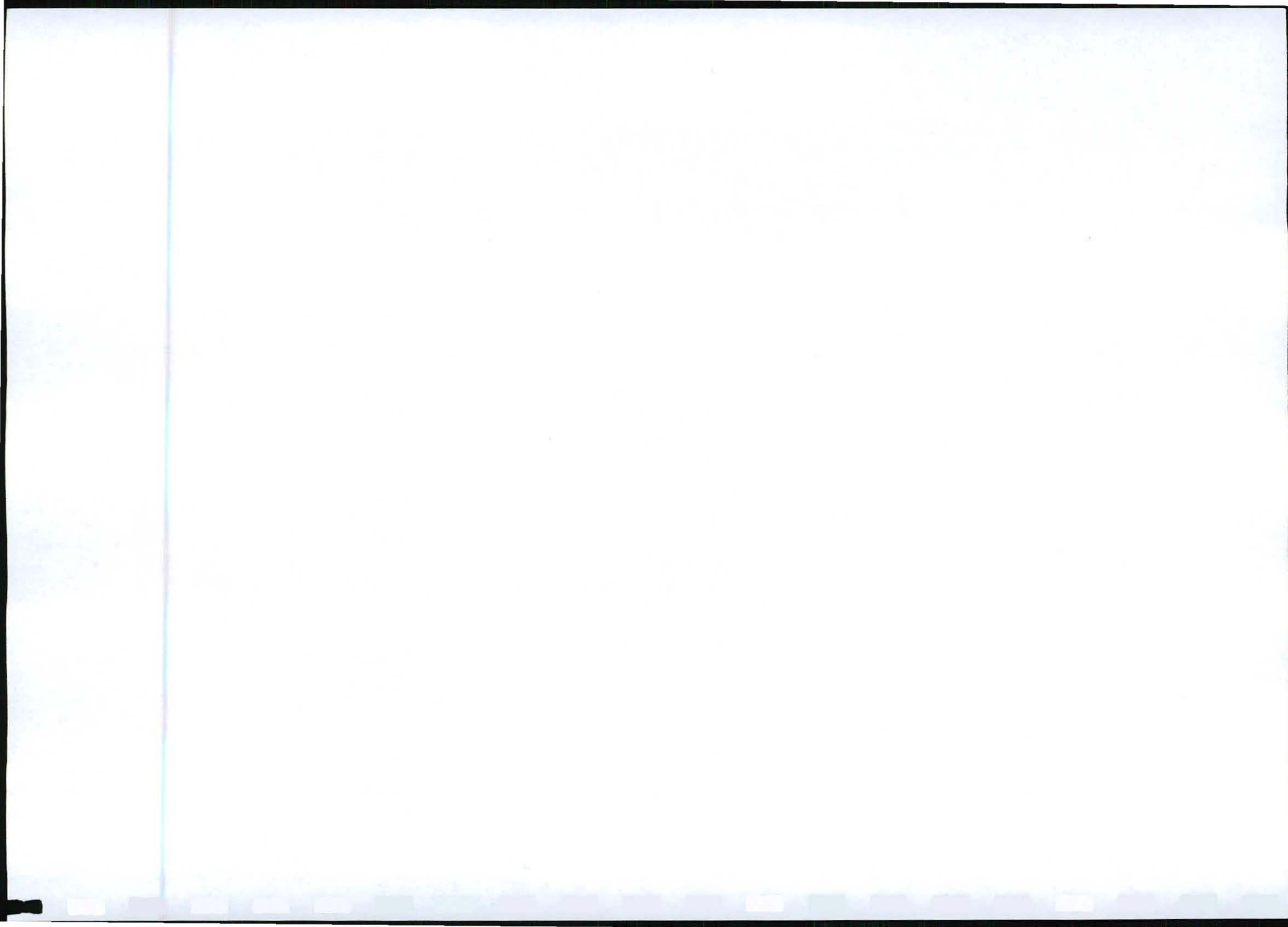
The desk study revealed the Engcobo district is underlain by sedimentary rocks of the Katberg, Burgersdorp and Molteno Formations of the Karoo Supergroup. Intrusive igneous dolerite occurs throughout the study area as both narrow dykes and sills. Fairly wide alluvial floodplains also characterise the river banks of the larger drainage systems in the district.

The Engcobo area falls within the north-western fringes of the Maputoland-Pondoland Region (MPR) floristic unit, which stretches from the Kei River to the south-west, up to Xai-Xai north of Maputo in Mozambique. The vegetation of the region comprises grassland, forest, bushveld, and thicket. The South-Eastern Mountain Grassland (Low and Rebelo Veld Type 44) would probably be the dominant vegetation community in most of the study area, with fragments of Afromontane Forest (Low and Rebelo Veld Type 2) in the higher-lying north-western and northern areas.

Some of these vegetation communities need to be protected, and negative impacts on natural vegetation need to be kept within environmentally acceptable levels. The conservation status of the Afromontane Forest, for example, dictates that this vegetation type should not be disturbed in any way, and that all roadways through such veld types be kept as narrow as possible. It is worth noting, however, that natural vegetation is usually highly altered by agricultural practises in parts of the Transkei, especially where grassland occurs in close proximity to rural villages. Clearing of forests has also resulted in small isolated forest patches occurring in the steepest slopes in the region.

4.2 **FIELD INVESTIGATION.**

The information obtained from the desk study was checked during the field-work stages of the investigation. An initial site reconnaissance was followed by more detailed field investigations, when specific information was collected on bedrock conditions at each borrow pit, and vegetation types and faunal populations in the area. Normal faunal and avifaunal trends associated with plant communities were also noted.



A social investigation whereby affected landowners were identified and contacted regarding the proposed road building projects and borrow pit re-commissioning was not carried out, as the land belongs to the state, who also commissioned this road reconstruction program. Local villagers who approached us during the field investigations were, nevertheless, accommodated, and the scope of the investigation was explained to them where possible.

This aspect of the investigation has also been addressed in Chapter 8.

5. **GEOLOGY.**

5.1 **REGIONAL GEOLOGY.**

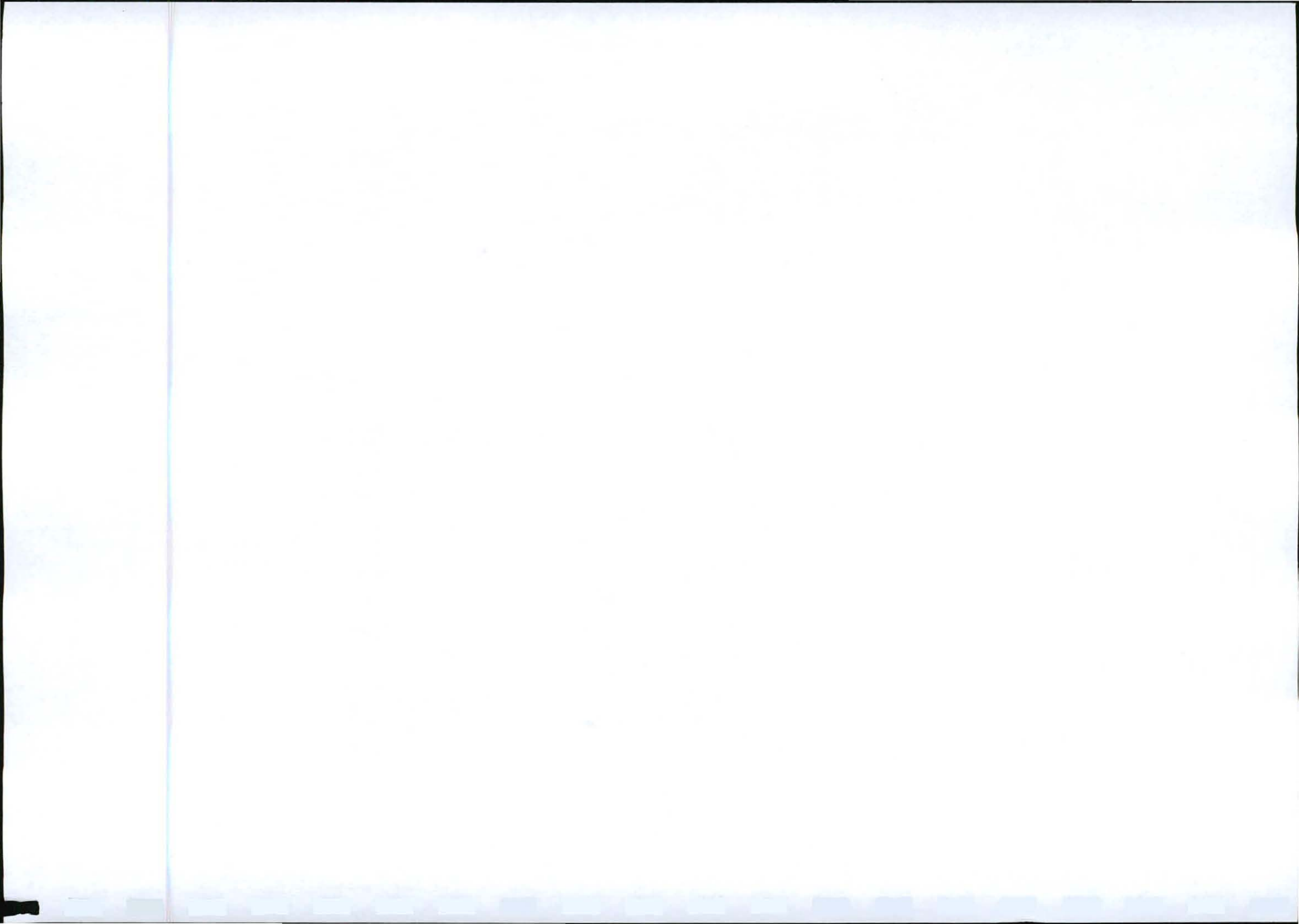
According to the 1:250 000 geological maps (3126 QUEENSTOWN and 3128 UMTATA) published by the Geological Survey of South Africa, the Engcobo area is underlain by sedimentary rocks of the Katberg, Burgersdorp and Molteno Formations of the Karoo Supergroup. These lithologies generally dip gently towards the north-east in the western part of the study, and towards the north-west in the eastern part of the study area.

The Karoo Supergroup rocks have been intruded by igneous dolerite (both near vertical dykes and near horizontal sills) throughout the study area. Fairly wide alluvial floodplains have also been mapped along the banks of the larger drainage channels in the region.

5.1.1 **KATBERG FORMATION.**

The Katberg Formation of the Traka Subgroup, Beaufort Group, of the Karoo Supergroup, has been mapped in the south-eastern and eastern parts of the study area. This formation generally comprises relatively arenaceous fine to medium grained sandstone, with sub-ordinate red and greenish-grey mudrock (shale and / or mudstone). The Katberg Formation attains a maximum thickness of about 900 metres, thinning towards the north. Terrestrial vertebrate fossils and plant remains have been found in Katberg Formation sediments.

The Katberg Formation is conformably overlain by the Burgersdorp Formation in the study area.



5.1.2 **BURGERSDORP FORMATION.**

The Burgersdorp Formation also forms part of the Traka Subgroup, Beaufort Group, of the Karoo Supergroup, and generally comprises red and greenish-grey mudrock and sub-ordinate fine-grained sandstone. This formation is mapped throughout most of the study area, and attains a thickness of about 950 metres in the south (i.e. the study area), thinning rapidly towards the north. Burgersdorp Formation sediments have revealed both vertebrate fossil and plant remains to date, and are conformably overlain by the Molteno Formation in the study area.

5.1.3 **MOLTENO FORMATION.**

The Molteno Formation of the Karoo Supergroup is mapped in the extreme north-western and northern parts of the study area, and is generally characterised by high-lying topography. This formation usually comprises alternating fine to coarse grained sandstone (pebbly in places), olive mudstone, and dark grey shale. The shale frequently reveals locally abundant plant remains.

Coal seams and thin conglomerate are known to occur within the Molteno Formation sediments, which attains thicknesses of between about 450 to 600 metres.

5.1.4 **DOLERITE.**

Dolerite intrusion along zones of weakness in sedimentary rocks characterised the end of the Karoo era between 150 and 190 million years ago. The present dolerite outcrops are remnants of this massive igneous suite. The magma forming the dolerite sills and dykes will have had an effect on the surrounding sedimentary rocks. Thermal metamorphic changes such as mudstone to hornfels is common in the region. This metamorphic aureole is, however, usually only about one tenth the thickness of the doleritic intrusion.



6. ENVIRONMENTAL CONSIDERATIONS.

6.1 ARCHAEOLOGICAL AND CULTURAL SITES.

No archeological sites are known to exist along any of the roads or in the vicinity of the identified borrow pits in the study area. There are no major buildings near any of the borrow pits. None of the borrow pits would, therefore, interfere with the cultural history of the areas covered by this project.

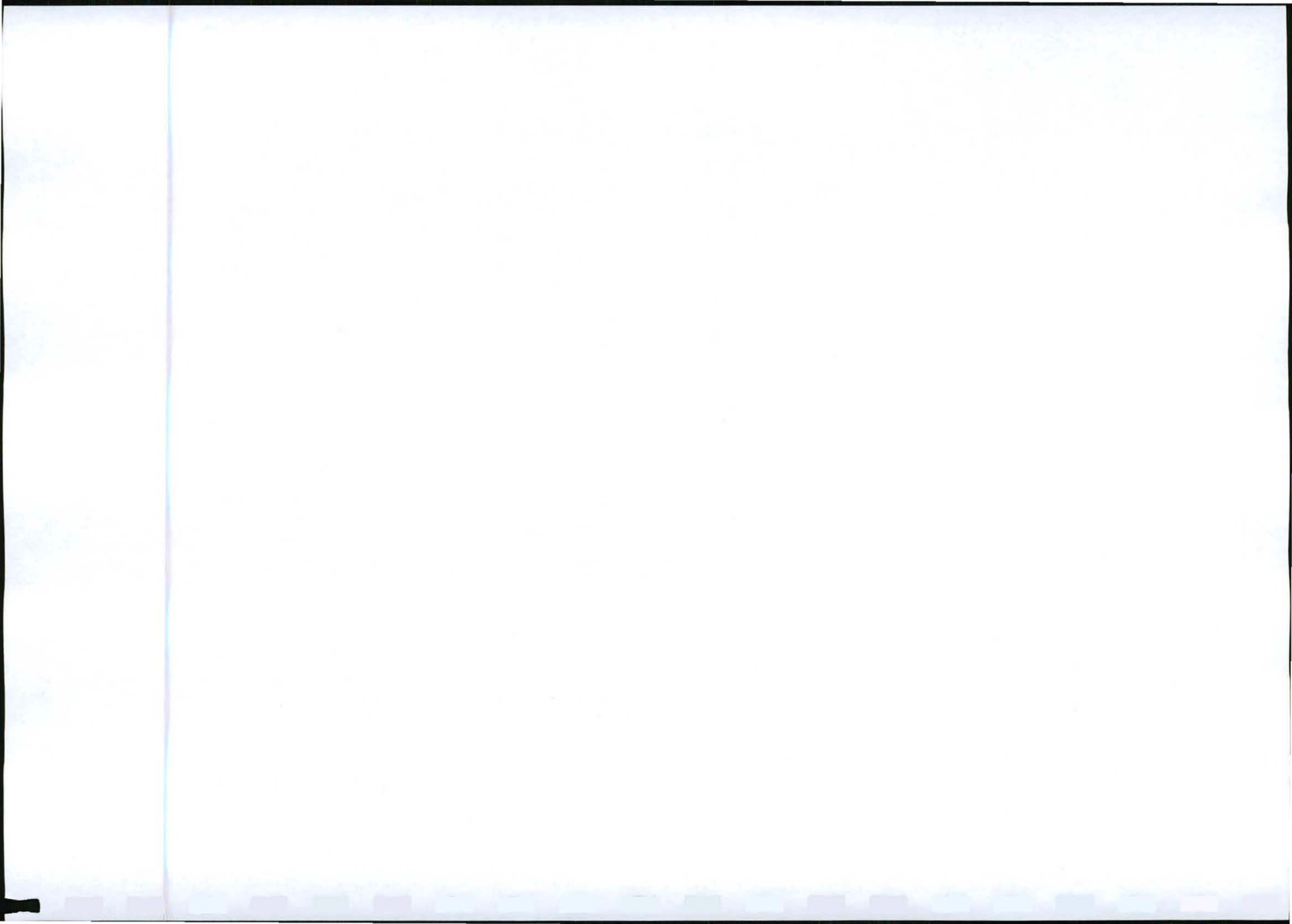
6.2 FAUNA AND FLORA.

6.2.1 FLORA.

The Engcobo area falls within the north-western outskirts of the Maputoland-Pondoland Region (MPR) floristic unit, which stretches from the Kei River to the south-west up to Xai-Xai north of Maputo in Mozambique, and inland up to the foot of the Drakensberg mountains. The vegetation of the region generally includes grassland, forest, bushveld, and thicket.

Natural vegetation in the Engcobo area is fairly disturbed, and the South-Eastern Mountain Grassland (Low and Rebelo Veld Type 44) would probably be the dominant vegetation community throughout most of the study area. This vegetation unit corresponds to Acock's Eastern Province Grassland (Acock's Veld Type 68). The South-eastern Mountain Grassland is typically characterised by *Themeda triandra* (Red Grass) and *Eragrostis chloromelas* (Love grass) species, and is classed as False Grassveld where it is suspected that the climax form of this vegetation community is temperate scrub-forest.

The sweet to mixed grassveld is important stock land owing to suitable winter grazing. However, selective grazing can convert it to sourveld or result in the invasion of karroid or Fynbos elements. Such infestations can lead to the development of Sub-arid Thorn Bushveld (Low and Rebelo Veld Type 15), or False Thornveld of the Eastern Cape (Acock's Veld Type 21), as is the case in the moderate to steeper areas. *Acacia karroo* (Sweet Thorn) and *Acacia mearnsii* (Black Wattle) were noted in these areas during the field investigation. Under conditions of excessive grazing pressure, the thorn tree invasion may be very dense and rapid soil erosion could result.



The South-eastern Mountain Grassland is poorly conserved, with only about 0.33 % of this grassland biome conserved nationally. It is well protected in the Mountain Zebra National Park near Cradock. Most of the borrow pits identified within the Engcobo area occur within the South-Eastern Mountain Grassland veld type.

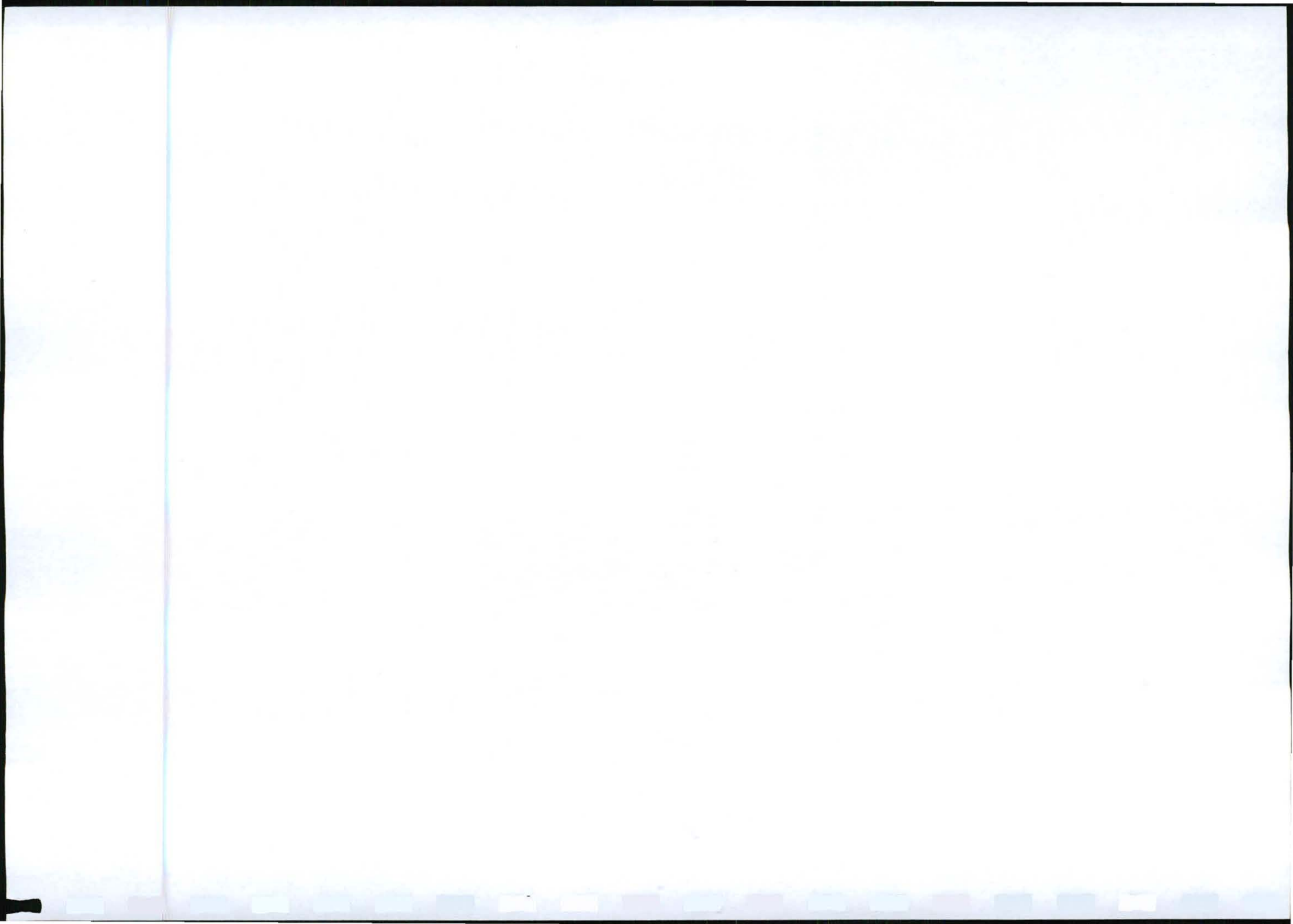
The steeper areas in the high-lying northern parts of the study area are generally characterised by isolated patches of Afromontane Forest (Low and Rebelo Veld Type 2). This vegetation community is more common along south-facing ridges and ravines where moisture is higher and the maximum effect of the south-westerly and south-easterly driven rains is apparent. As is evident from the way the forest is confined to kloofs and gullies, water is the key limiting factor. However, Afromontane Forest would certainly spread into both grasslands and Fynbos were it not for fires.

Forest trees are continually exploited for timber although specific species are usually selected. Likewise, other species are selected for muti and, in more populated areas, firewood. Afromontane areas are well conserved in a number of areas in South Africa, and many stands are safe from exploitation by their isolation in remote areas. Plantations of Pine and Blue-gum threaten the water supply to the indigenous forests in many regions.

The removal of certain alien plant species is required under Section 29 of the CARA Regulations (Conservation of Agricultural Resources Act, No 43 of 1983), which can result in exposed soil and encourage soil erosion under certain conditions. The removal of alien vegetation where possible near borrow pits should still be seen as a positive environmental impact, however.

6.2.2 FISH.

No fish species are expected in the borrow pits as they do not occur within any drainage channels in the study area. A small chance does exist, however, that introduced species may exist in some of the borrow pit areas where surface run-off has dammed as drinking water features for domestic livestock. All work in borrow pits containing water must, therefore, ensure that a link to surrounding drainage channels does not exist. It is important that introduced fish species do not enter natural drainage channels in the region. This is not, however, considered an important environmental issue associated with the re-commissioning of the borrow pits for this project.



6.2.3 REPTILES AND AMPHIBIANS.

The herpetofauna of South Africa are very diverse as 140 taxa occur, of which 93 are listed in the South African Red Data Book: Reptiles and Amphibians (1988). About 31 species are restricted (endemic) to the Eastern Cape Province. Both the Nile Crocodile (*Crocodylus niloticus*) and the African Rock Python (*Python sebae natalensis*) have been exterminated from the Eastern Cape Province. The Nile Crocodile has been extinct in the region for the last 150 years, whilst the last known African Rock Python was killed in the Bathurst area during 1927.

The only listed Reptile and Amphibian Red Data Book species that could occur in the study area is the Yellowbellied House Snake (*Lamprophis fuscus*). This species is listed as rare, which means that it occurs in small population groups which are not presently endangered or vulnerable. Preliminary evidence suggests that the numbers of these species is low, however.

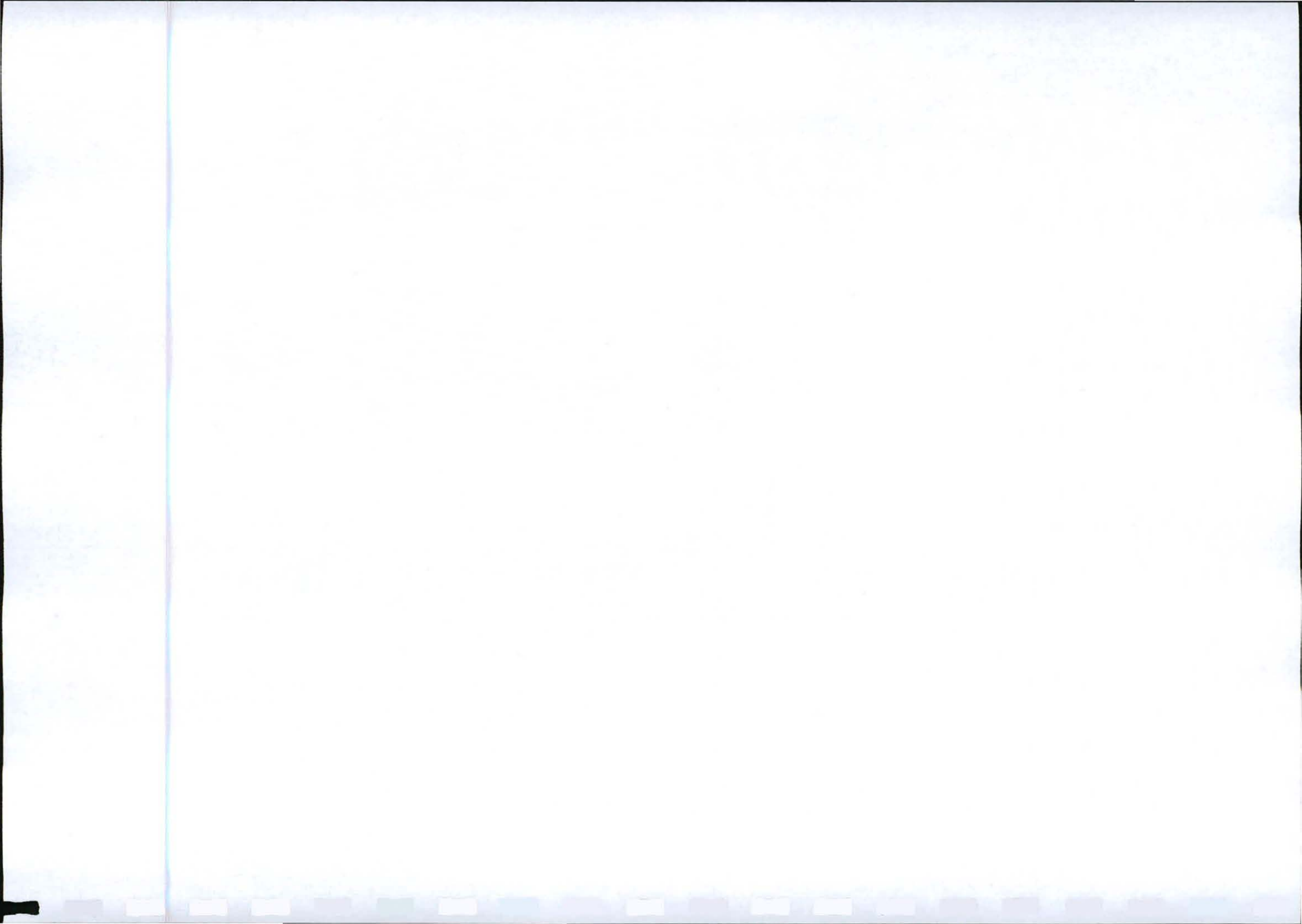
South Africa has been spared the scourge of introduced reptiles and amphibians. A number of commensal geckos have occasionally been introduced into the Eastern Cape from adjacent regions, however.

It should be noted that The Cape Nature and Environmental Ordinance (No 19 of 1974) prohibits any person from hunting wild animals, or removing them from land of which he is not the owner, unless he has the owner's written permission.

Eastern Cape reptiles and amphibians are classed as Schedule II (protected wildlife) animals. Thus, all tortoises (including water terrapin), frogs, toads, lizards and non-poisonous snakes are protected species. None may be hunted or kept without a permit. Although poisonous snakes appear neglected, as wild animals they still cannot be kept, killed, or transported without a permit.

6.2.4 MAMMALS

Of the 292 terrestrial mammal species in Southern Africa, 128 occur in the Eastern Cape Province. Most of the larger species occur in game reserves, and only the smaller wild mammals could occur in the study area. Mammals that have become extinct in the Eastern Cape Province include the Quagga and Blue Antelope.



Species listed as vulnerable in the South African Red Data Book: Terrestrial Mammals (1986), where the study area is included in their range, include the White-tailed Mouse (*Mystromys albicaudatus*), Honey Badger (*Mellivora capensis capensis*), African Wild Cat (*Felis lybica cafra*), and Antbear (*Orycteropus afer afer*). Vulnerable refers to taxa that may move into the endangered category if the causal factors continue operating.

Rare species listed in this region include the South African Hedgehog (*Atelerix frontalis*), Samango Monkey (*Cercopithecus mitis labiatus*), Spectacled Dormouse (*Graphiurus ocularis*), African Striped Weasel (*Poecilogle albinucha albinucha*), Aardwolf (*Proteles cristatus cristatus*), Cerval (*Felis serval serval*), Small Spotted Cat (*Felis nigripes*), Leopard (*Panthera pardus melanotica*), Tree Dassie (*Dendrohyrax arboreus arboreus*), and Blue Duiker (*Philantomba monticola monticola*).

Rare species are considered to be small populations which are not at present endangered or vulnerable, but which are at risk.

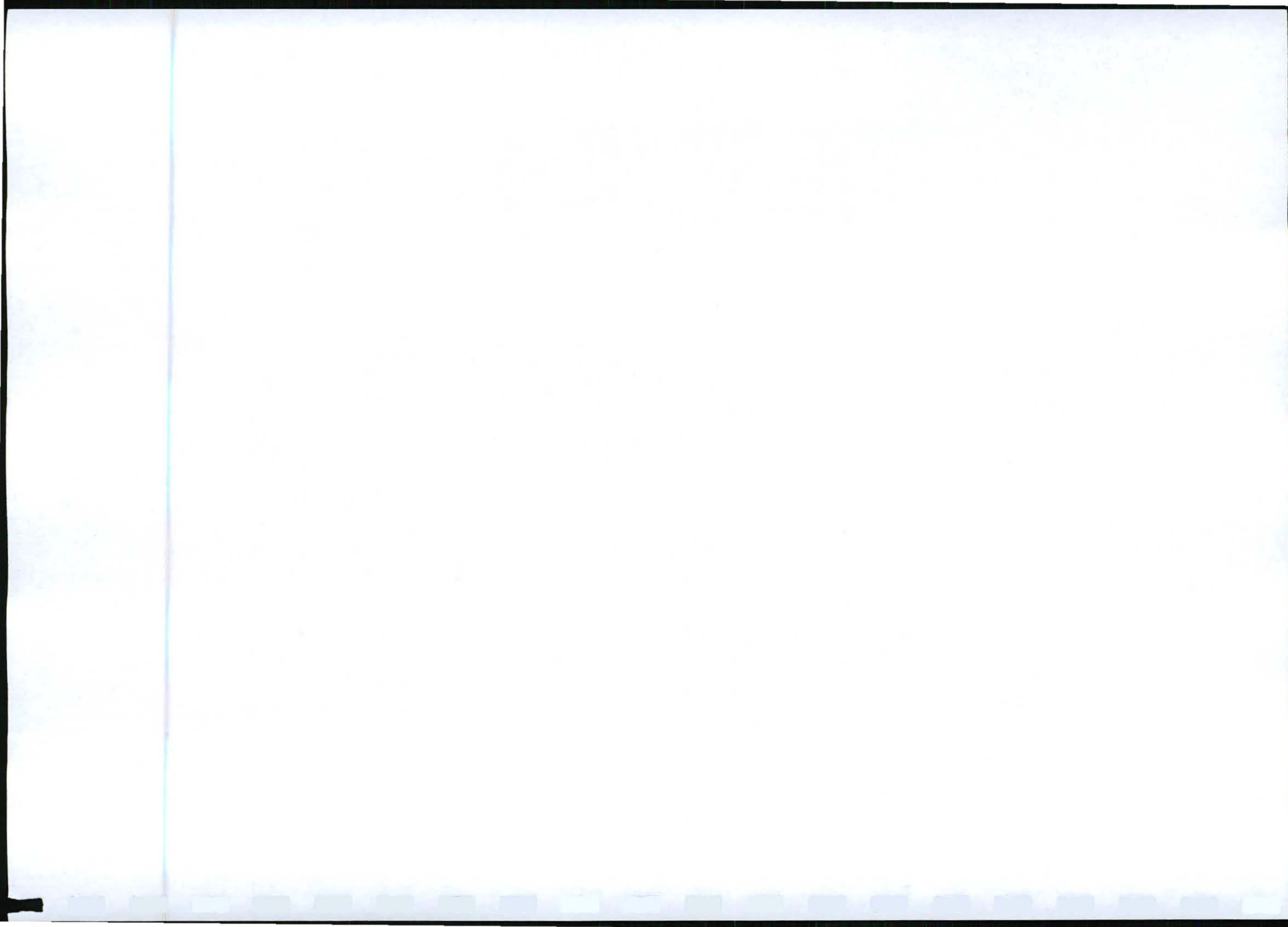
Other more common mammals occurring in the region include Vervet monkeys (*Cercopithecus pygerythrus*), Caracal lynx (*Felis caracal*), and hedgehogs (*Erinaceous frontalis*). No wild mammals were identified in the study area during the field investigation, however.

6.2.5 BIRDS.

Past records indicate that about 500 bird species occur in the Eastern Cape Province, of which about 300 species breed, including 20 species currently listed as rare or endangered in the South African Red Data Book: Birds.

Of the 500 species in the region, only the European Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), and Feral Pigeon (*Colomba livia*) occur as exotic species in the study area. The major factor determining current bird distribution in the region is man's modification of the habitat. This is especially applicable where overgrazing has taken place.

Habitat destruction due to quarrying operations and anthropological pressures from informal farming activities, have reduced the value of parts of the study area from an avifaunal point of view.



7. ENVIRONMENTAL ASSESSMENT OF BORROW PITS.

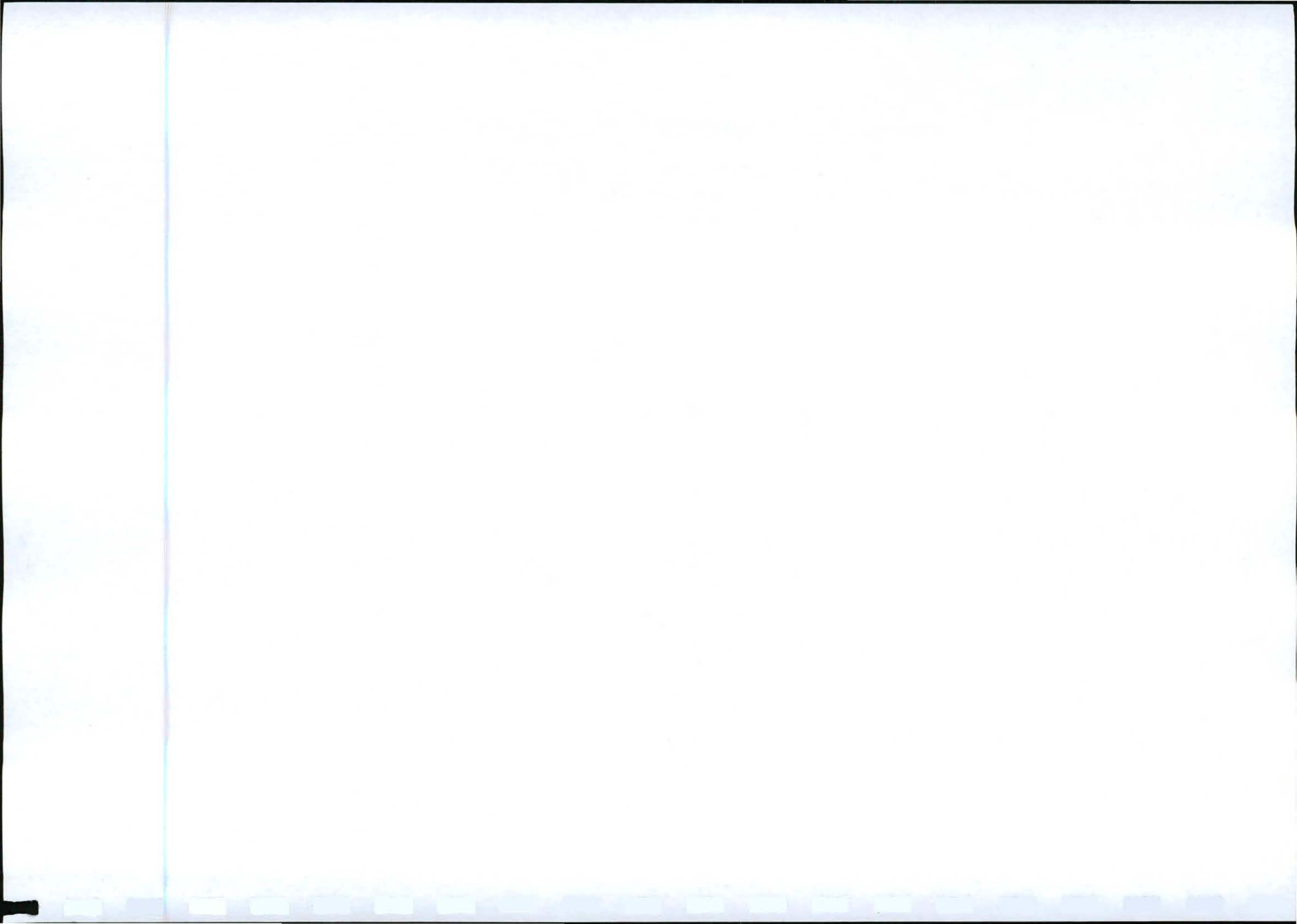
7.1 BORROW PIT NUMBERS.

The numbering of the borrow pits generally follows the sequential numbering given to the workings during the already completed materials investigation. The borrow pits are also indicated with a prefix that refers to the various route's designated road number.

7.2 BORROW PIT ANALYSIS.

All of the borrow pits described in the report have been visited, measured, inspected, sampled, and photographed. This section of the report (Appendix 2) contains a fairly detailed analysis of each borrow pit, along with borrow pit sketch diagrams and general soil profiles. Reference is also made to prevailing topographical features, including proposed future quarrying directions and schematic cross-sections.

Photographs of each borrow pit are included at the end of this report (Appendix 1). It should be noted that the rehabilitation of the various roads requires a relatively small amount of road building gravel. Existing borrow pit excavations will, therefore, be enlarged by a very small amount where necessary.



8. ENVIRONMENTAL MANAGEMENT PROGRAMME.

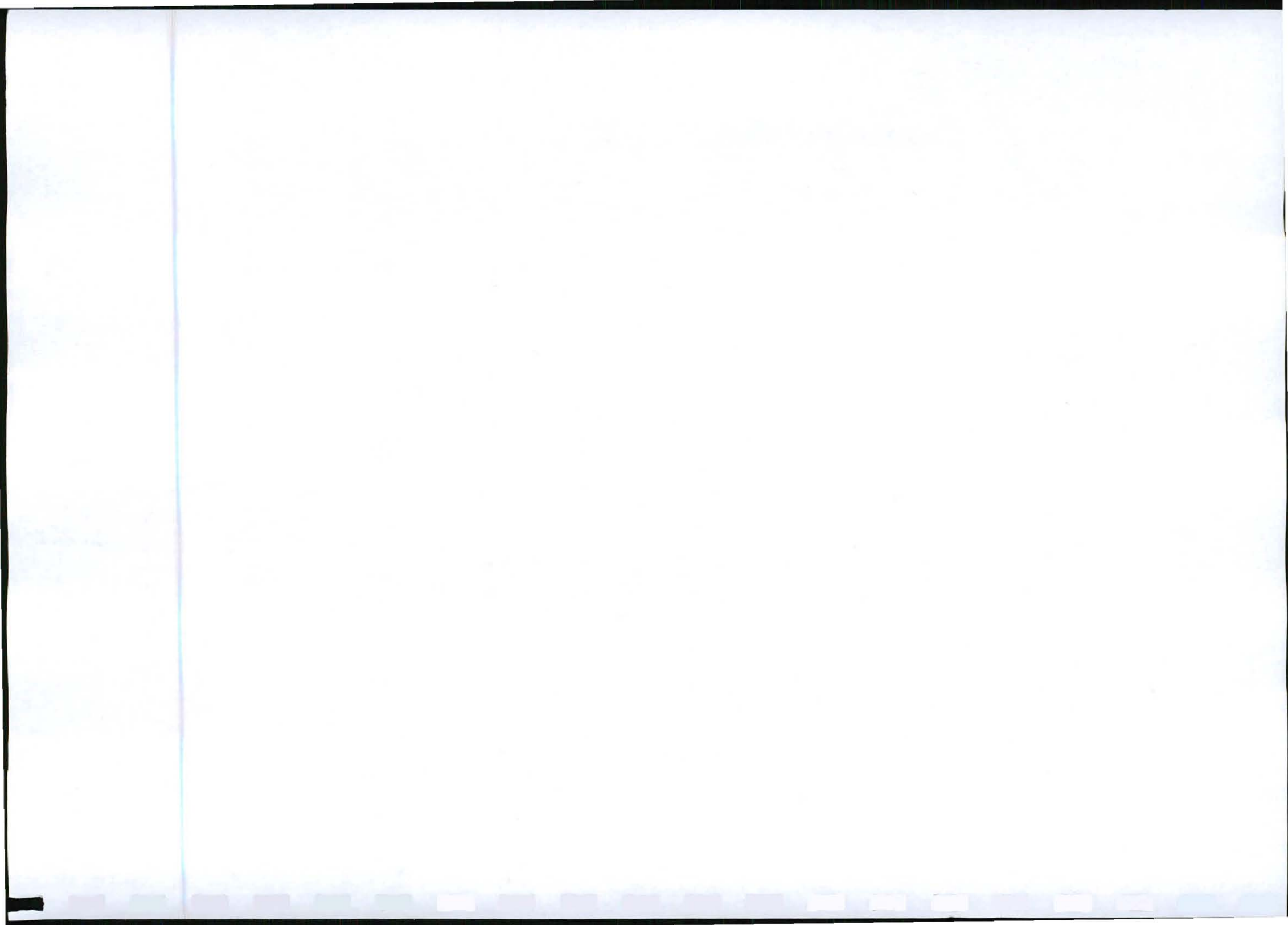
General EMP conditions that should be imposed in respect of re-commissioned borrow pits within the Engcobo area are categorised and discussed as follows:

- Development of Pits
- Visual Aspects.
- Fauna and Flora
- Soil Aspects
- Water Aspects
- Affected Parties
- Financial Provision for Rehabilitation
- Environmental Management
- Rehabilitation Strategies
- Responsibilities
- General Conditions in Respect of the Project.

8.1 DEVELOPMENT OF PITS.

The re-commissioned borrow pits shall be developed according to the following criteria:

- New slopes and embankments shall be at 1:3 (18°) slopes. Re-worked existing sloped should be softened as much as possible, with gradients of about 1:3 also recommended.
- Excavations should follow the contour lines.
- The excavation will not be left in any way to deteriorate into any illegal dumping site. A permit must be obtained from the Department of Water Affairs and Forestry should the excavation be utilised for the dumping of solid waste.
- No blasting shall be permitted without the permission from the Principal Inspector of Mines.
- Watering to minimise the effect of dust generation should be carried out as frequently as necessary. Noise should also be kept within reason.
- The access roads to the various borrow pits shall be rehabilitated upon completion of the project.
- All material in and around the excavation, including piled up gravel, oversized rocks, must be levelled and where appropriate, covered with topsoil.
- No chemical pollution shall be allowed to contaminate the soils, and any plant found to be attributing to such a scenario must be removed from the site and repaired. Vehicle repairs may not take place on site.



8.2 VISUAL ASPECTS.

Many existing borrow pits have been excavated adjacent to the road reserve, and are highly visible to the general public and road users. This unfortunate situation needs to be remedied as much as possible, bearing in mind that legislation can only enforce new excavations to be rehabilitated. Sensitive and controlled excavation techniques can, nevertheless, contribute towards an environmental improvement to existing borrow pits.

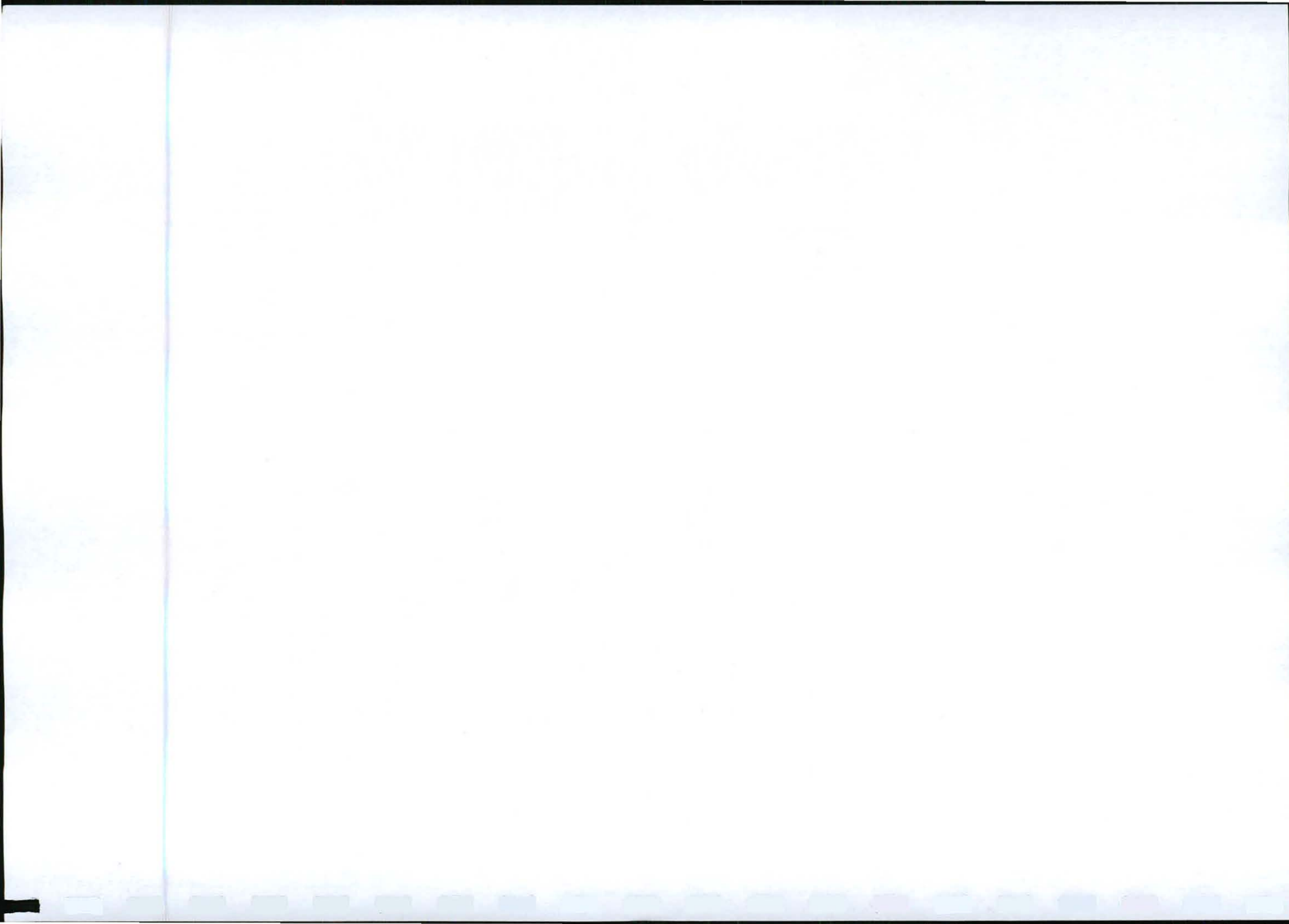
The following points should be borne in mind from a visual perspective to borrow pit excavation:

- Rehabilitation will be restricted to new excavation areas, however should additional funding become available, the existing disturbed areas will also have to be rehabilitated.
- Seed mix shall be established to blend with the surrounding environment and must have local watering requirements. Existing seed banks in carefully controlled topsoil stock piles are usually sufficient for this criteria.
- The exposure of soil through the removal of vegetation before commencement of excavations will be limited to that which is essential.
- After closure, breaking the surface crust, erecting earth embankments to prevent erosion, and germination of adapted vegetation will obliterate roads, unless the landowner requests that the roads be retained for his personal use.
- The remains of huts and other temporary buildings that have been erected at the borrow pits must be demolished and removed.
- Care will be taken that all rehabilitated land will merge with the immediate environment and that any negative visual impacts will be rectified to the satisfaction of the Department of Economic Affairs, Environment, and Tourism.

8.3 FAUNA AND FLORA.

The fauna and flora occurring in the study area have already been addressed in Chapter 6 of this report. The protection of these species and how they will be impacted upon by the proposed borrow pit excavation activity, is addressed in this chapter:

- No workers will be allowed to collect any plant or snare any animal.
- Grass and vegetation of the immediate environment, or adapted grass / vegetation will be re-established. Advice in this regard can be obtained from the Directorate: Nature Conservation, and re-establishment will be carried out in consultation with the landowner / land user.

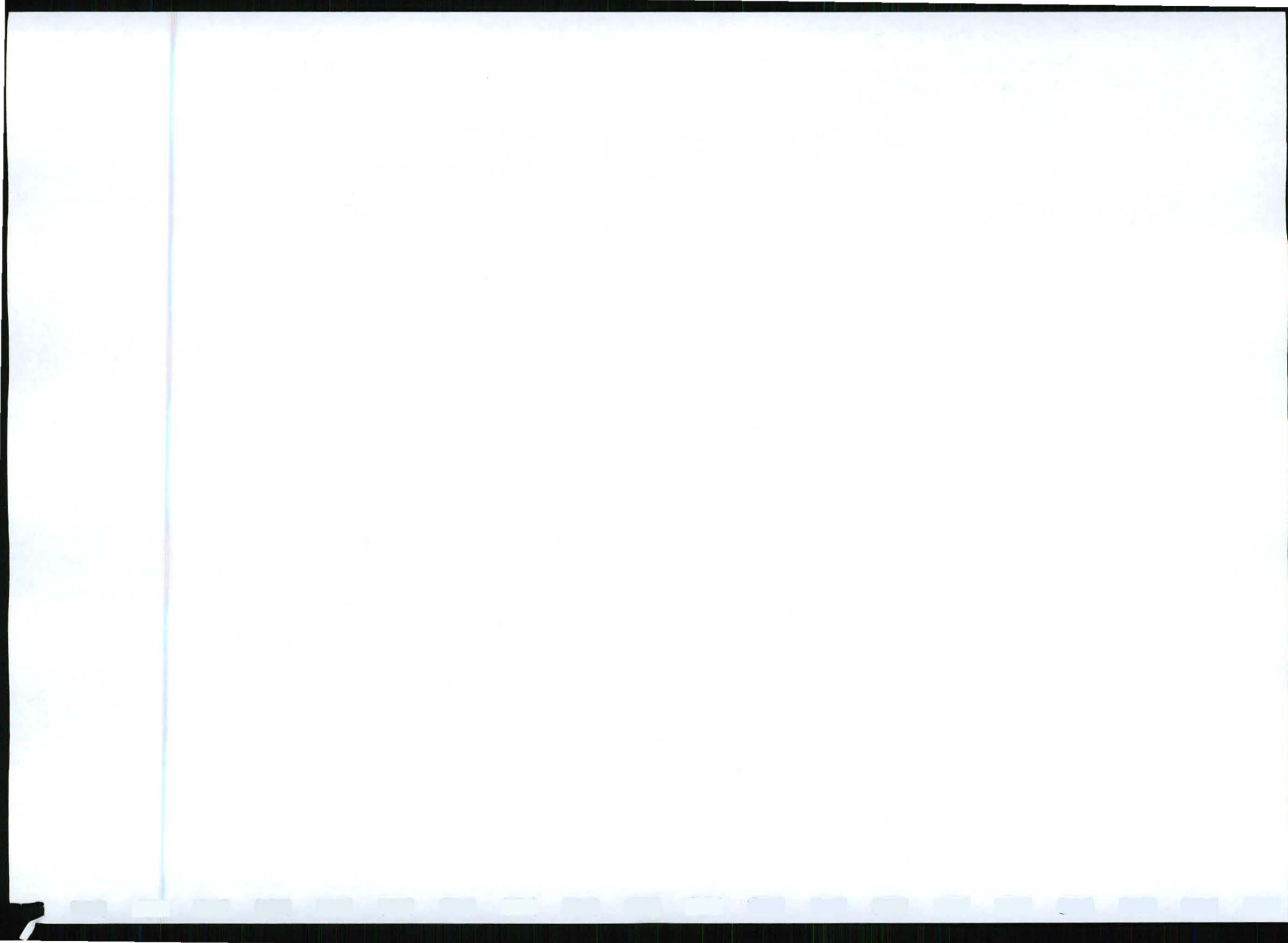


- All animal life, vegetation, and firewood will remain the property of the land owner / land user, and will not be disturbed, moved, or used excessively.
- Cognisance is to be made of the potential for endangered species that may occur in the area. It is considered unlikely, however, that these species will be affected by the re-commissioning of the borrow pits in the study area.

8.4 SOIL ASPECTS.

The topsoil layer at most of the borrow pits comprises a 200 mm to 800 mm thick layer of soil with gravel and roots. Soil profiles for all of the investigated borrow pits are discussed under each borrow pit header in Chapter 7 of this report. The soil in the area is frequently dispersive (prone to erosion), especially where vegetation disruption has occurred. Grass cover has however, prevented large scale scour from taking place, which helps minimise the formation of large erosion. EMP criteria relating to the soil overlying the borrow pits, are as follows:

- The topsoil and overburden will be removed and stockpiled for use in the rehabilitation process. Topsoil means the surface layer of soil which provides a suitable environment for the germination of seeds. Topsoil must be stored separately in a suitable place so that it can be placed on the exposed subsoil as soon as the mining of the excavation has been completed, and its slopes have been finished off to the acceptable gradient.
- The topsoil will be stored in such a way and in such a place that it will not cause damming up of water or washaways. Piles of topsoil must also not be allowed to wash away itself. Stockpiles of topsoil should not exceed a height of about 2 metres, and if left stored for longer than 6 months will be upgraded before replacement. Piles may also be protected against erosion and weeds by means of hydro-seeding.
- The overburden is that layer of soil immediately beneath the topsoil, and must also be removed and stored separately from the topsoil.
- Cognisance must be made of any sensitive landscapes that may occur in the area.



8.5 WATER ASPECTS.

The majority of the borrow pits in the study area are located on the crests or on the slopes of the hillsides, implying that no large concentrations of stormwater are likely to occur in or nearby the excavations. Where drainage features are located nearby, and when operation of borrow pits is to be carried out during the wet season, some sediment may be washed into these features. This is likely to be a short-term problem affecting only a few borrow pits.

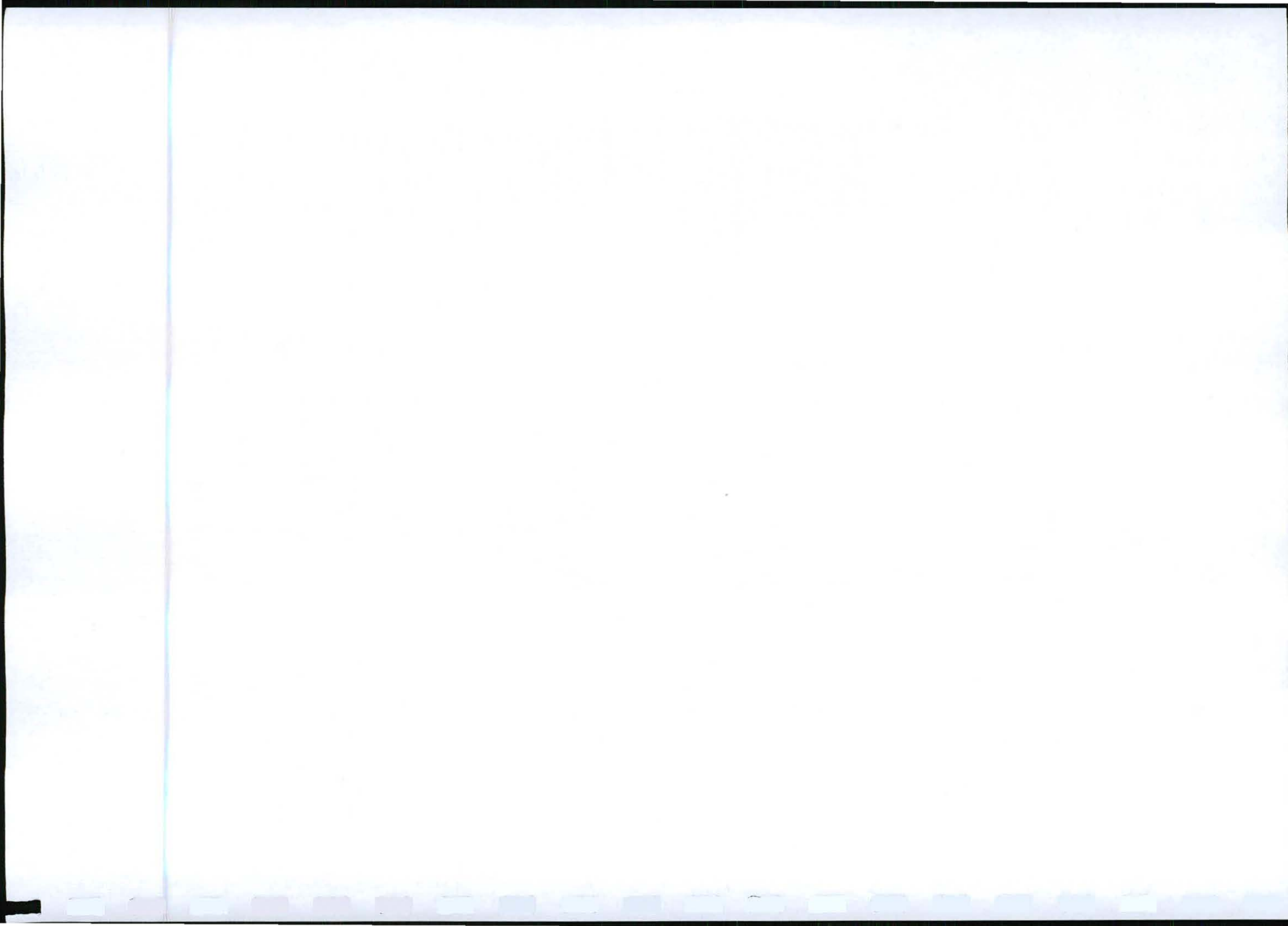
EMP aspects to be borne in mind include the following:

- Before a borrow pit is opened or expanded, it will be established how the area drains and how the drainage will be changed by the excavation or re-development thereof.
- Rehabilitation of the quarry will be planned and completed in such a way that the run-off water will not cause erosion. This especially important bearing the dispersive nature of the soil in the region.
- Where a depression in the ground exists where water can gather, attention will be given to the outflow of water to prevent concentration of run-off and thus prevent erosion.
- To prevent soil pollution, precautionary measures must be taken in the handling of grease and petroleum polluted liquids.
- Visual inspections will be carried out on a regular basis with regard to the stability of water control structures, and erosion and siltation.
- No drainage features will be affected by silt emanating from the excavation.
- Borrow pits will be located in such a way that fountains and other ground water structures are not affected.

8.6 AFFECTED PARTIES.

In order to minimise the impact of borrow pit excavation on land users, they must be consulted beforehand with regards to the process and project details. EMP conditions that should be adhered to with regards interested and affected parties, are as follows:

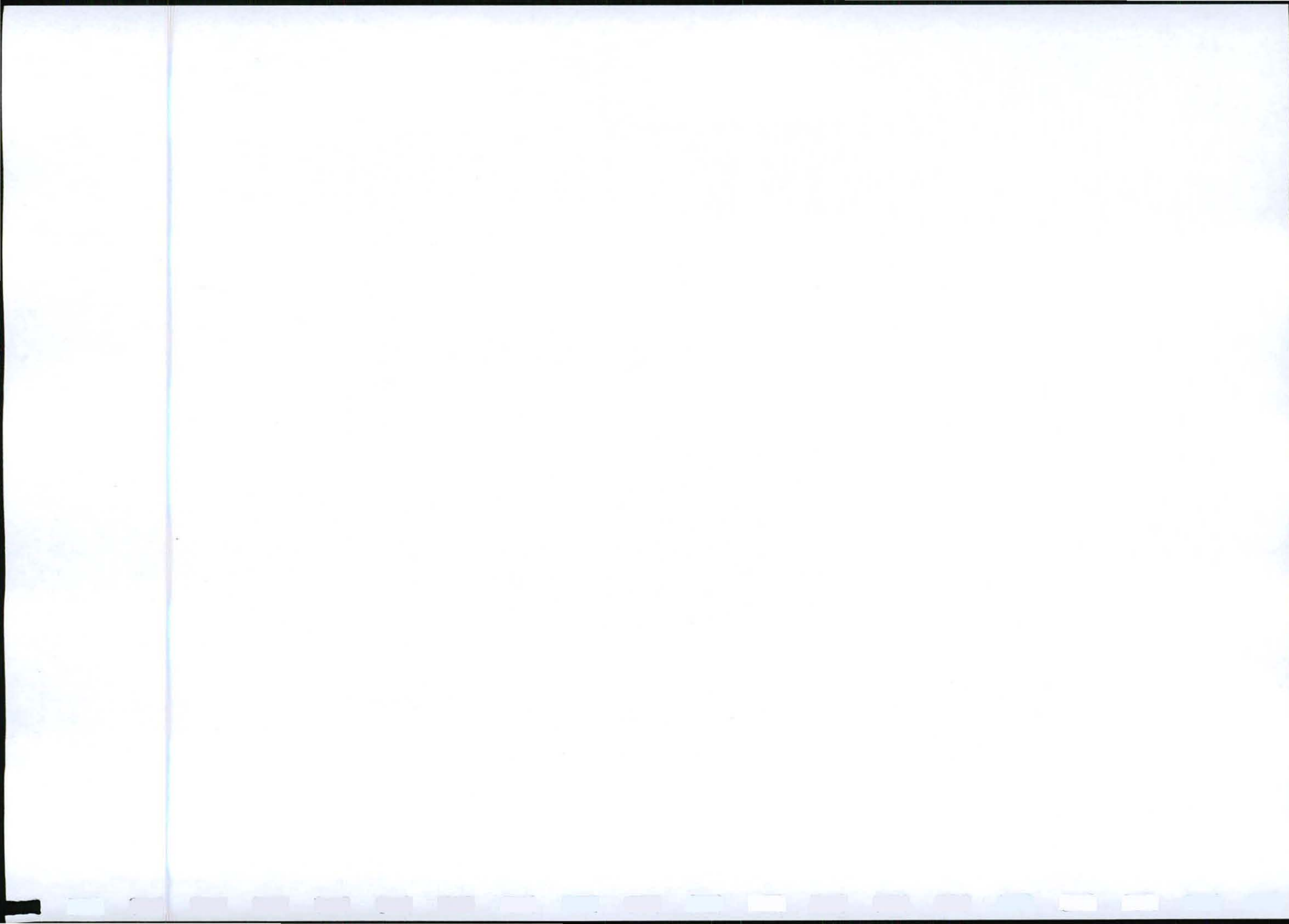
- Access roads will within reason and with the objective of minimising disturbances of the environment, be sensitively selected and carefully established.
- Access roads are to be maintained in satisfactory condition and in such a way that air pollution and erosion are limited.



- Field personnel will not be allowed to move on any other road so as to limit unnecessary disturbances of the surface, natural vegetation, game, birds, plants, or livestock.
- Additional access roads not required by the land user will be rehabilitated to prevent soil erosion.
- Reasonable speeds will be maintained at all times in order to prevent accidents, excessive noise, and dust to prevent injuries to livestock. Gates that may be found open or closed will be left in the same state as they were found subject to the requirements of the land user.
- Accommodation for field personnel will have sufficient kitchen and sanitary facilities. Toiletries will be provided and will be situated in such a way as not to pollute water.
- Natural vegetation will not be disturbed unnecessarily in and around the campsite.
- Biodegradable (decomposable) waste will be burnt in an excavation constructed for this purpose. Non biodegradable (non-decomposable) waste such as glass bottles, plastic bags and waste material will be stored at properly fenced collection points and will be removed periodically.
- These dump sites will be located in consultation with the landowner concerned, and in accordance with the applicable legislation. Precautions will be taken to ensure that loose debris does not spread at the waste site.
- All waste materials will be disposed of in such a way that the pollution of natural water sources and the formation of unpleasant bacterial odours are avoided.
- Campsites will be kept neat and tidy at all times.

8.7 **FINANCIAL PROVISION FOR REHABILITATION.**

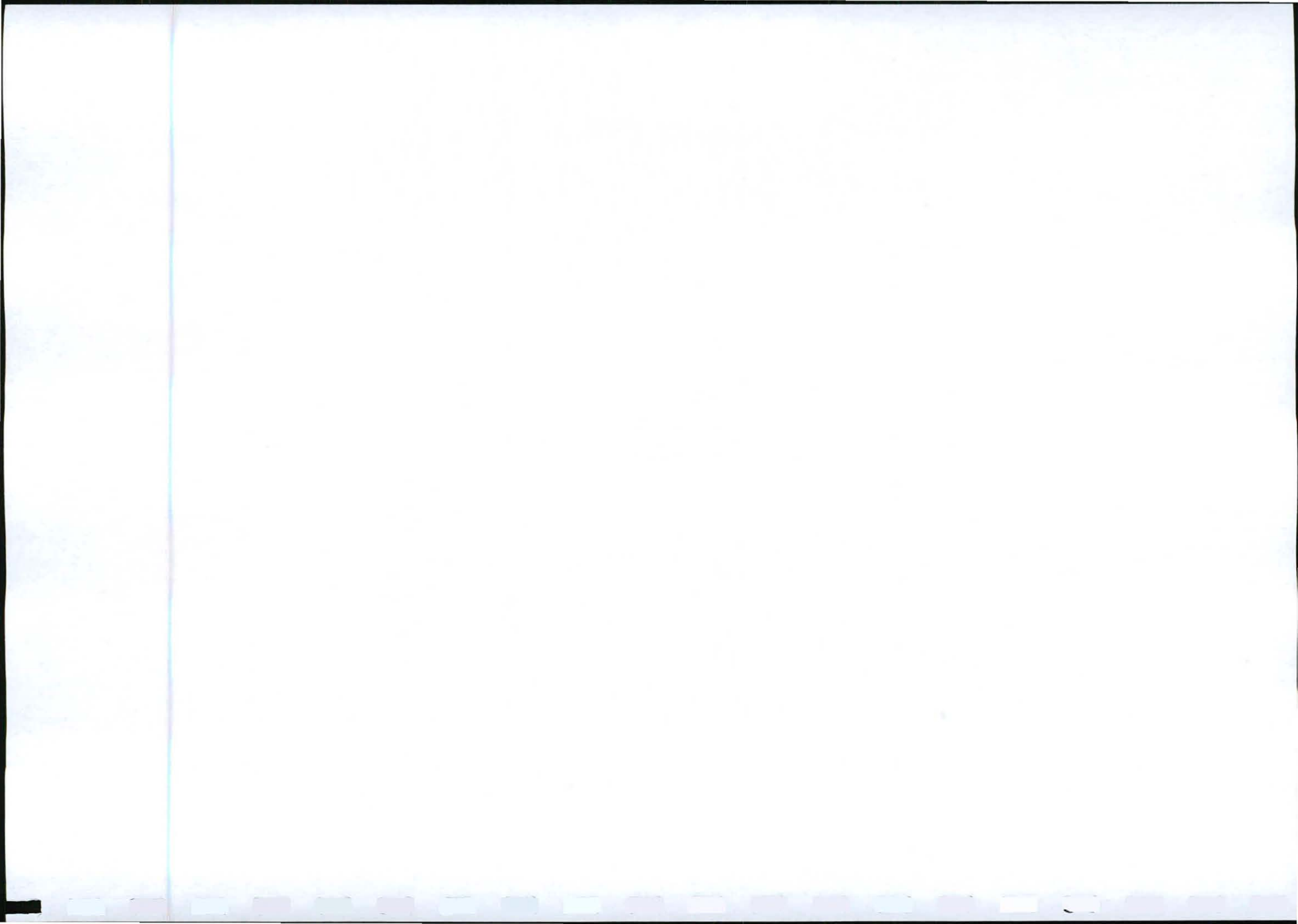
No specific sum will be allocated to ensure the rehabilitation process takes place after the mining process has been completed. The final payment of the retention monies will, however, be held back in the event that the contractor fails to adequately rehabilitate the affected areas. The maintenance period for the borrow pits shall run for a period of six months after completion of the work. This time frame usually runs simultaneously with the road works project.



8.8 ENVIRONMENTAL MANAGEMENT.

The natural environmental conditions occurring in the study area have been addressed in Chapter 6 of this report. Management of these environmental conditions during borrow pit quarrying should bear the following criteria in mind:

- No biodegradable, domestic or commercial waste will be generated in the mining process. No waste may be discarded or allowed to accumulate on site.
- Alien trees and plants should be removed where possible. This includes areas within the confines of the road reserve. Alien plants will be disposed of by burning on the borrow pit site, within the cleared area designated by the land user. The contractors personnel shall monitor disposal until satisfied that burning has ceased, and that all alien vegetation has been completely destroyed. The burnt waste shall form part of the overburden in the rehabilitation process.
- Working hours shall be deemed by the Contractor's normal working hours of 07:00 to 17:00, Mondays to Fridays, excluding public holidays. These conditions can, however, be changed at the Consulting Engineers discretion, after liaison with the land user.
- The Contractor shall be held responsible for reinstatement and maintenance of the surface of the access road to the borrow pit for the duration of the Contract until full rehabilitation has taken place.
- All fences and other structures that have been damaged or interfered with by the Contractor shall be restored to a condition at least equivalent to their original condition.
- Access roads shall be maintained in a satisfactory condition and in such a way that air pollution and erosion are limited.
- Field personnel will not be allowed to move on any other road or track other than the established access road so as to limit unnecessary disturbance of the surface, natural vegetation, game, birds, dust and to prevent injury to livestock and persons.
- Keeping the operational plant in good repair will minimise pollution or contamination of the soil and water. In the event of a fuel spill, the Contractor must take suitable measures to contain the pollution and prevent it from spreading or seeping into the sub-soil. Once the spill has been contained, contaminated material shall be removed and disposed of using methods as specified by the Department of Economic Affairs, Environmental and Tourism.
- Heavy vehicle signs within the specifications of the relevant traffic ordinance shall be erected on both sides of the gravel road. These shall be located approximately 300 metres from the borrow pit entrance, on either side of the access road.

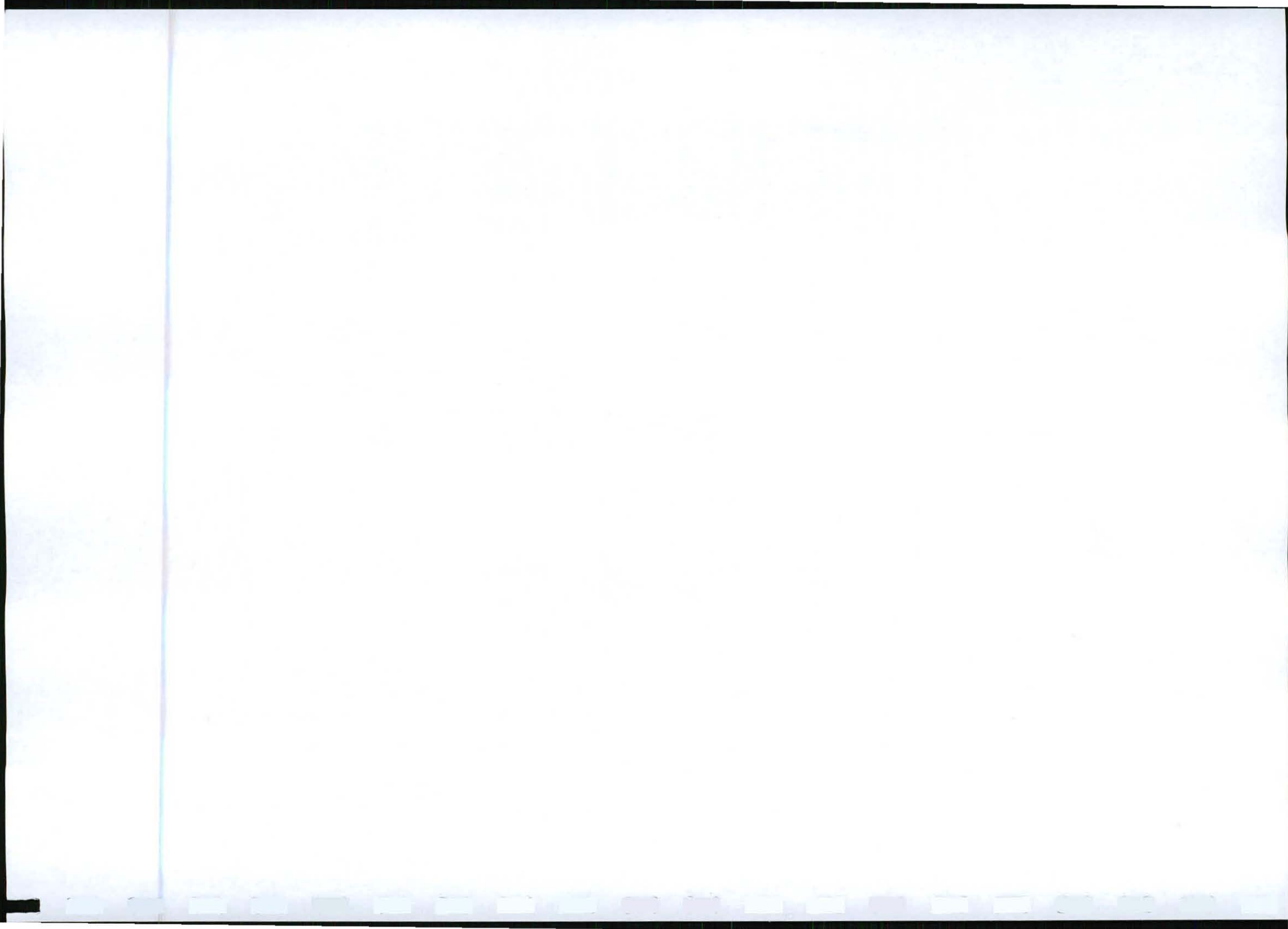


- The appointed Contractor shall be deemed as both the "excavator" and a person competent to inspect "bracing and shoring", as defined and required in terms of the Machinery and Occupational Safety Act. The Contractor shall also maintain the borrow pits so that they do not become a danger to persons or livestock. The Contractor shall at all times observe proper and adequate safety precautions on the site and shall be deemed to be responsible for security of the quarrying site.
- After closure, unless the land user requests that roads be retained for personal use, access roads will be obliterated by breaking the surface crust and erecting earth embankments to prevent erosion, and adapted vegetation will be re-established.
- All structures and buildings erected for the site or quarrying operation will be dismantled and removed. Care will be taken that all rehabilitated land will merge with the immediate environment. Any negative visual impact will be rectified to the satisfaction of the Regional Director of the Department of Minerals and Energy.
- It is the objective of this project, once completed, to decommission the mining operation and apply for a closure certificate (partial closure) in respect of the areas affected by excavations during road reconstruction. In the event sufficient funds are available to effect complete rehabilitation measures, a closure certificate for the whole area (new and existing) will be sought.

8.9 REHABILITATION STRATEGIES.

The Contractor is only responsible for the rehabilitation of new quarrying activity in terms of the Minerals Act, Act No 50, 1991. However, should sufficient funds be available upon completion of the project, then the new and existing scars in the borrow pits should be rehabilitated. Rehabilitation strategies to be borne in mind during the project include the following:

- The Contractor shall be required to carefully remove the flora within the designated area and in a protected and fenced off area. The vegetation shall be replanted in the borrow pit areas in accordance with the Consulting Engineer's instructions.
- Topsoil and overburden shall be stripped and stockpiled separately.
- On completion of quarrying, all unused material, including overburden but excluding topsoil, shall be returned and the sides of the pits shall be graded at 1:3 slopes.
- The topsoil stockpile shall then be spread evenly over the area of the borrow pit to a minimum thickness of 75 mm and, thereafter any access constructed by the Contractor shall be scarified and the area reinstated.



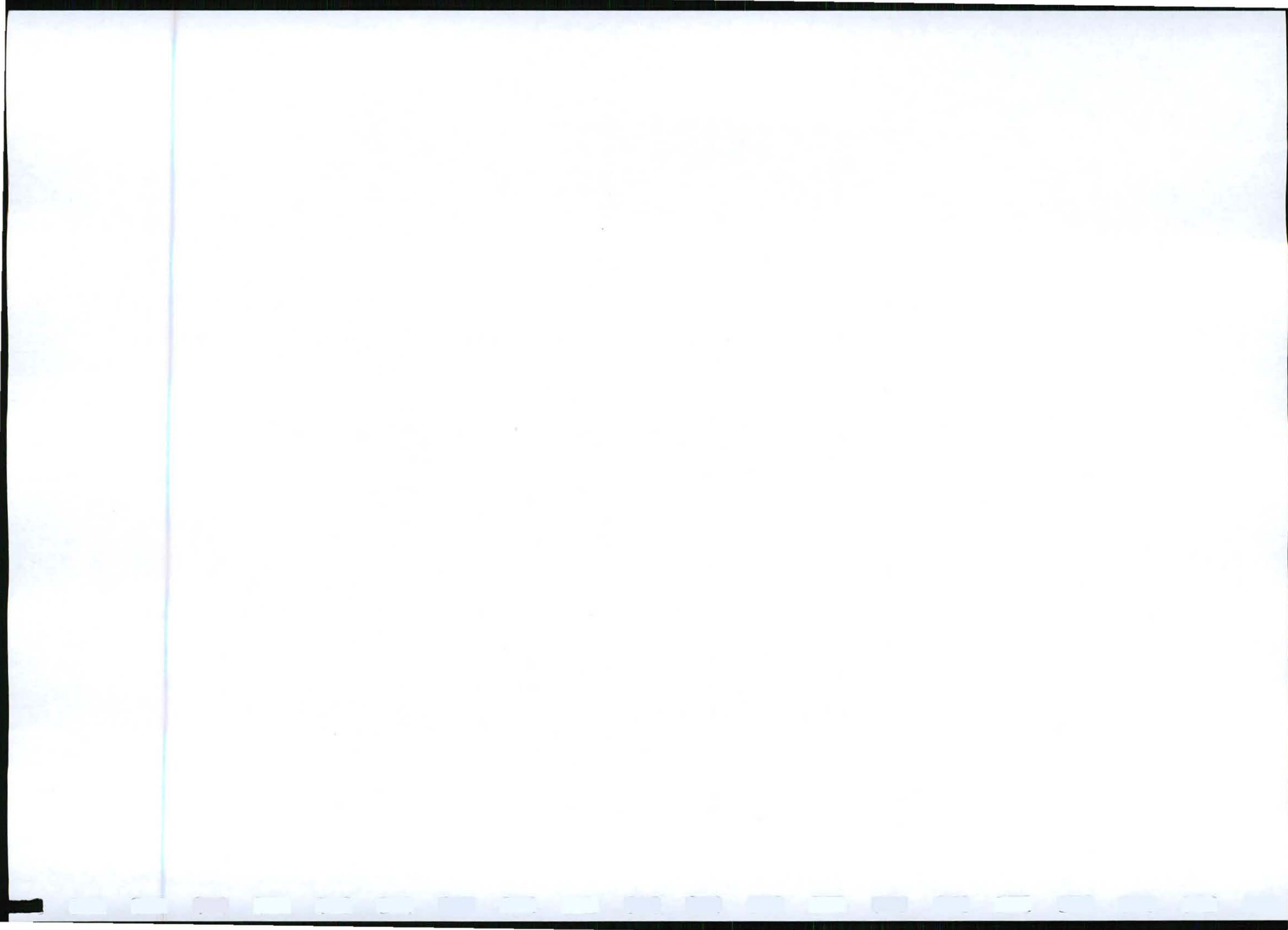
- Grass or removed vegetation shall be reinstated or planted after topsoiling is completed. On completion of the planting, the planted area shall be neatly trimmed and well watered.
- The final surface level shall be free draining and necessary measures must be taken to prevent erosion until such time that the vegetation is sufficient to withstand the elements of nature.
- The junctions from the access road to the target gravel road will only be improved to allow adequate access for construction vehicles with the addition of traffic signs to warn oncoming traffic.
- The topsoil should be sufficient to cover the entire borrow pit area (old and new), however financial constraints will determine the extent of topsoil coverage.
- Where possible, the existing vegetation will be removed and stockpiled for use as coverage to the topsoil as part of the rehabilitation process. Should this be insufficient, grassing will be done with imported vegetation. The rehabilitated land will merge with the immediate environment, and any negative visual impact will be rectified to the satisfaction of the Regional Director of the Department of Minerals and Energy. No alien species shall be planted at any time in this area.
- No fertiliser will be used.
- Watering will be done by watering cart (bowser). No irrigation will be provided.
- Rehabilitation will take place on completion of the quarrying process and shall continue for six months after completion of the project, until a certificate of closure is issued by the Department of Minerals and Energy.

8.10 RESPONSIBILITIES.

The Contractor shall be deemed responsible for the implementation of the Environmental Management. The Consulting Engineer will monitor the Environmental Management Process. This does not, however, relieve the Contractor from his responsibilities. Rehabilitation shall not be the responsibility of the Contractor.

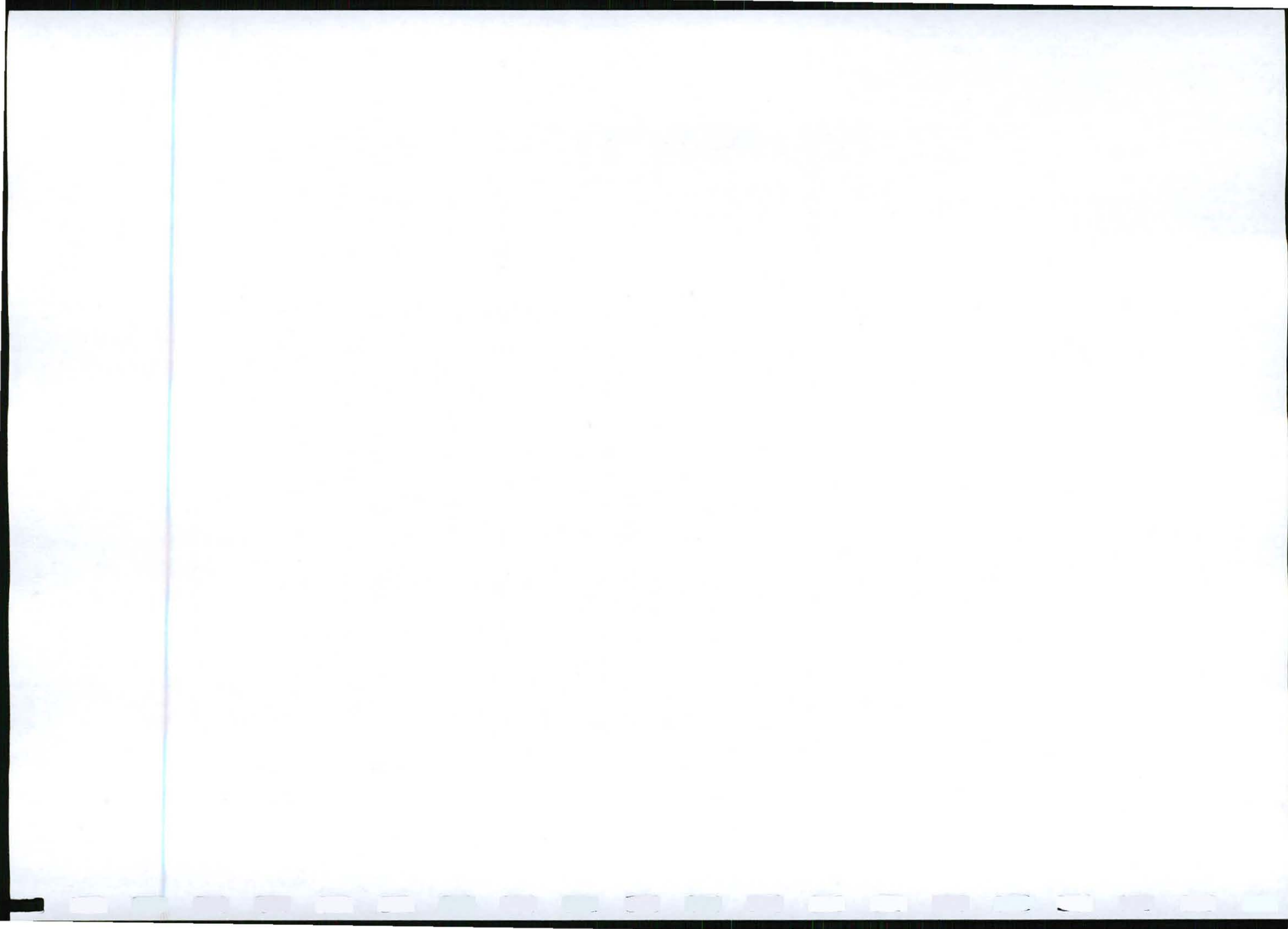
8.11 GENERAL CONDITIONS IN RESPECT OF THE PROJECT.

These are generic conditions which must be fulfilled, as a requirement of the Environmental Conservation Act No 73 of 1989 (Sections 21, 22 and 26). Acceptance of the EMP conditions contained in this chapter must be accepted by the appointed Contractor as per the "Undertaking" document contained in Appendix 3 of this report.



Approval for borrow pit re-commissioning will only be obtained from the Department of Minerals and Energy once this "Undertaking" has been accepted and signed by the appointed Contractor.

- Should it be necessary to store materials and equipment on site for short periods, only previously disturbed areas above the 20 year flood level and within the road reserve must be used for this purpose.
- Any construction camp set up must be clearly demarcated and secured against theft or vandalism and any toxic materials (cement, oil, petrol, diesel etc) must be very strictly controlled and secured. Such a construction camp must be above the 50 year flood level, situated in areas previously disturbed and must be completely rehabilitated on completion of construction activities.
- All areas in the riparian zone resulting from construction activities, must be rehabilitated to prevent erosion and undermining of river banks. Appropriate indigenous plant species must be used to re-establish vegetation cover.
- All "surplus" rocks and other material excavated during construction must be removed from the water course.
- No concrete to be mixed on the soil surface. All concrete mixers to be placed on trays and precautions to be taken against contamination of the soil through spillage of pre-mixed concrete.
- Precautions to be taken against oil spillage from heavy equipment such as compressors and generators, through the use of sand or sawdust (or any other suitable material) filled drip trays. All contaminated material (including soil) to be disposed of at a registered waste site.
- Adequate toilet facilities (e.g. chemical toilet) to be provided for workers on site, and all ablutions to take place in these facilities.
- Scavenger proof containers to be provided on site and strict control over littering to be enforced.
- All waste material, including excess construction material, litter and sewerage to be regularly removed from site and disposed of at a registered waste facility.
- Strict precautions to be taken when making open fires, which must be restricted to the demarcated camp area.
- No wild animals are to be disturbed unnecessarily in any way.
- Detailed designs of causeways are to be provided for comment before commencing construction.
- Only one access road per river or drainage system to be used, if necessary. These access roads are to be clearly demarcated.
- All debris and remains of damaged causeways to be removed from the river bed.



9. **ENGINEERING GEOLOGICAL EVALUATION.**

A materials investigation was carried out on bedrock and stockpiled gravel from many of the existing borrow pits within the Engcobo area prior to the commencement of this EMPR investigation. The findings of this materials investigation are compiled in a report produced by ControLab CC. These findings have not been addressed in this EMPR, as this aspect of the investigation falls outside the scope of work for this EMPR investigation.

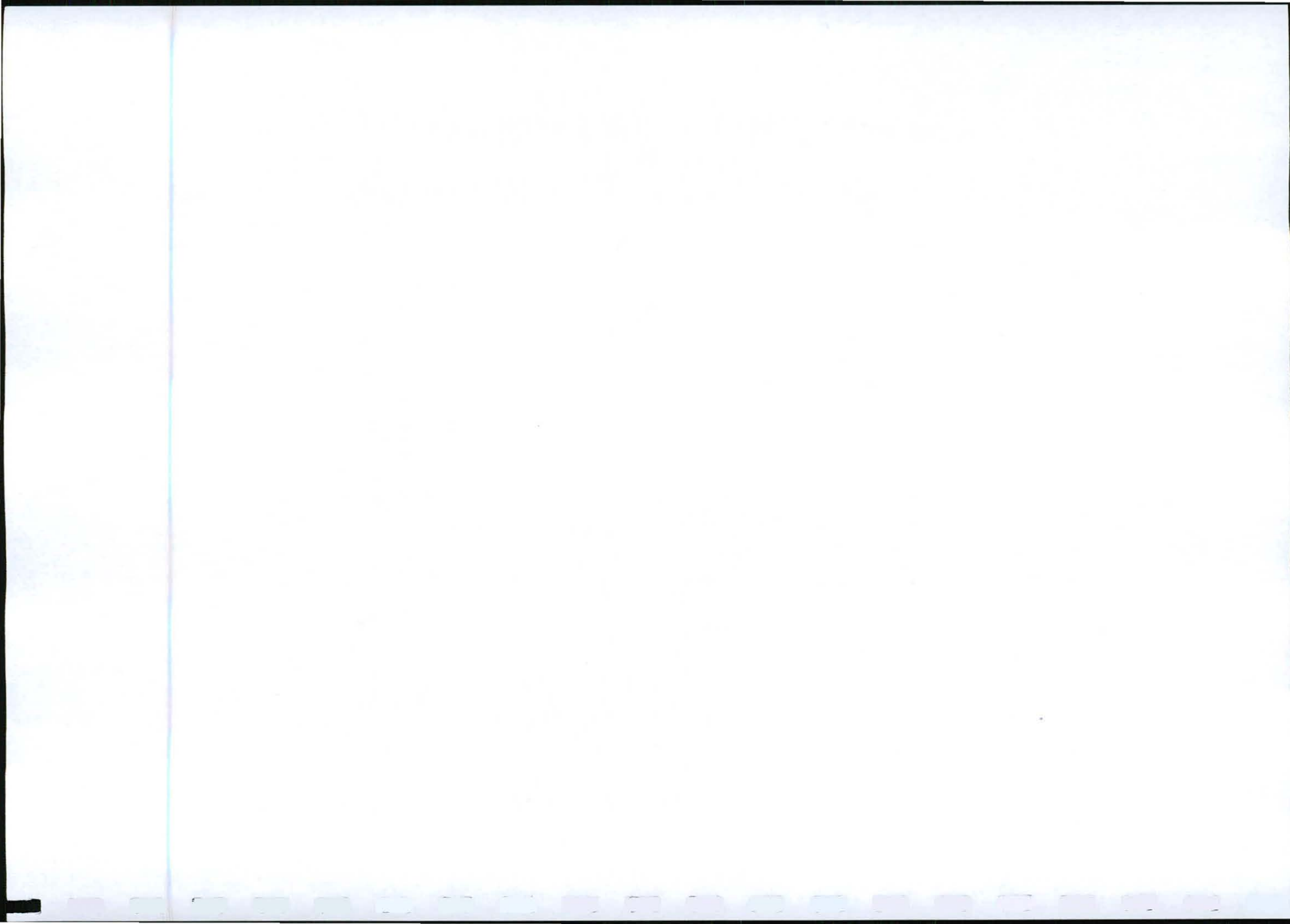
The laboratory results obtained during the materials investigation suggest that some of the naturally occurring material from the existing borrow pits in the Engcobo area may need to be blended and manipulated in order to achieve the most satisfactory results for road reconstruction purposes. The blending procedures should be overseen by a qualified roads engineer.

Adequate crushing and wetting should take place at the borrow pits to ensure that acceptable grading curves are realised. Oversized boulders must be removed from the roadway prior to material compaction. The reworked subbase must also be checked, and any oversized clast should be removed. This will reduce the potential for pothole development, and reduce the stoniness effect on the road surface.

Ravelling, rutting, corrugations, gravel loss, and erosion are all formed by a combination of factors which can be overcome by increasing the number of fines in your layer works (i.e. increased crushing), and attaining a good compaction where interlocking grains are tightly packed.

The direction of transportation of the gravel should be in such a way that the newly constructed road is not trafficked by the construction vehicles. If the road is compacted as per the specified requirements, trafficking by construction vehicles results in more damage to the road (ravelling and potholes) than the benefits gained from further compaction. If the compaction is minimal, however, the passage of the construction traffic may be beneficial. This alternative option is not, however, recommended.

One of the main problems with the reconstruction of unpaved roads is the lack of supervision. Greatly improved unpaved roads would result from close supervision by experienced personnel during the borrow pit working and actual reconstruction and rehabilitation.



10. **PROJECT OVERVIEW.**

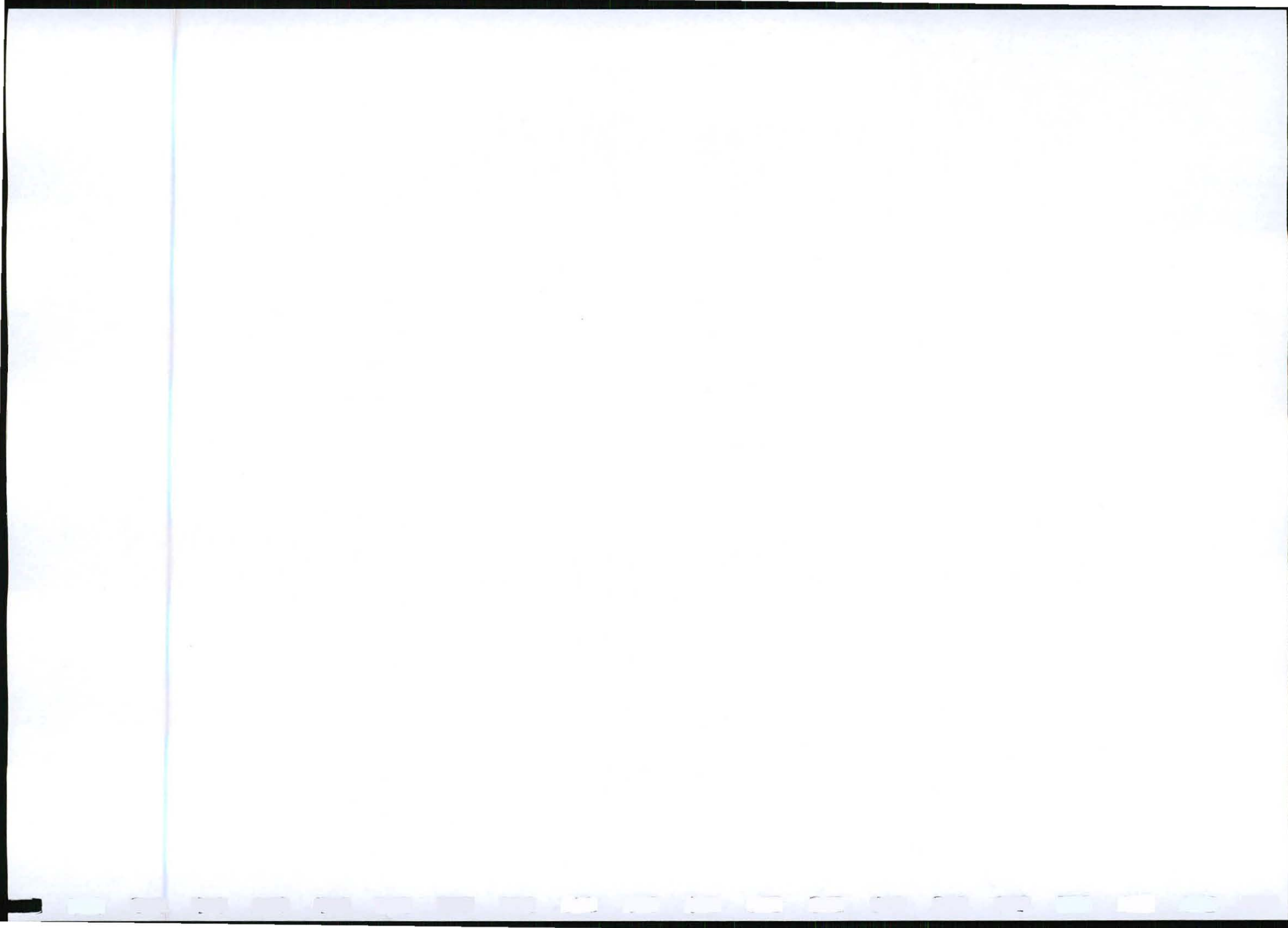
Wear and tear of the various roads in the Engcobo area have resulted in much of the gravel wearing course eroding off the road surface over time. Irregular road maintenance and inclement weather have exacerbated the road condition along many of these routes, which have resulted in a significant deterioration of the road pavement layers.

Approximately 310 km of gravel road and about 27 km of surface road have, therefore, been earmarked for rehabilitation over a period of about 5 years as part of a regional road maintenance programme. A 100 mm thick gravel wearing course will be constructed along the various gravel roadways. Causeways and drainage channel repair will also be carried out along the various roads where necessary.

A thorough desk study and walk-over site inspection was followed by a more detailed field investigation when numerous existing borrow pits were identified as possible sources of road building material in the region. The investigation includes a biophysical analysis, covering the vegetation communities and endangered faunal populations occurring in the area.

Laboratory results obtained during the materials investigation suggest that most of the material occurring in the borrow pits would be suitable for the proposed road repair and reconstruction, although a certain amount of blending may be required to enhance certain road building material requirements.

The EMPR investigation is aimed at assessing the environmental implications pertaining to the re-use of the existing borrow pits, including the environmental impact and management programme associated with material removal. Post quarrying rehabilitation and decommissioning of the borrow pits was also addressed. A thorough environmental impact assessment is not deemed necessary for this project in terms of the Environment Conservation Act (Act 73 of 1989). All of the borrow pits are existing pits, which were previously utilised for road building and reconstruction purposes.



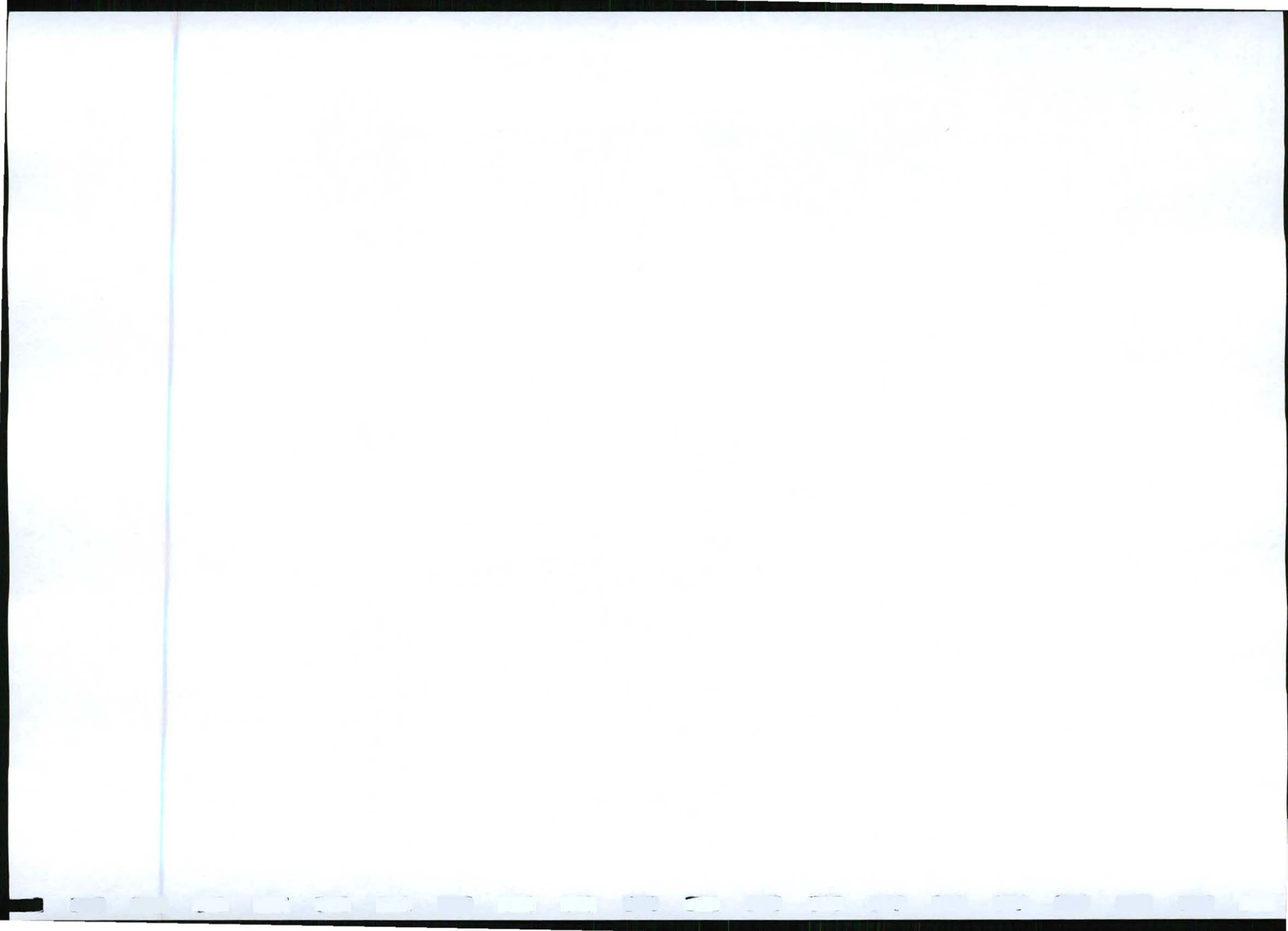
11. CONCLUSIONS AND RECOMMENDATIONS.

The existing borrow pits investigated in the Engcobo area generally appear to be acceptable for road reconstruction purposes. Significant issues associated with borrow pit re-commissioning include the direction of additional material removal, a mining plan, and rehabilitation techniques once material has been successfully removed. EMPR regulations require that only newly quarried areas be rehabilitated, although existing scars will be softened where possible during additional material removal. Some land users have also requested that rehabilitated procedures enable certain borrow pit depressions to be utilised for drinking holes and earth dams for domestic livestock purposes.

The investigation revealed that most of the natural environment in the Engcobo area is neither pristine nor unique. Alien vegetation communities occur in places, and previous quarrying activity have extensively disturbed and destroyed natural habitat. Future borrow pit operations should occur parallel to contours away from existing drainage channels or roads where they occur. Borrow pit material should also be removed in pre-determined phases. During each mining phase, topsoil and overburden must be removed and stockpiled. The underlying target material will be exploited, and on completion, each phase must be rehabilitated.

In essence, the investigated borrow pits represent already extensively disturbed areas due to past quarrying activities. Additionally, the areas required to fulfill the road maintenance programme requirements are relatively small, resulting in marginal increases in surface area of destroyed habitat at each borrow pit. The newly quarried areas would also be subject to stringent rehabilitation techniques, which would improve the environmental aesthetics of the previously un-rehabilitated borrow pits.

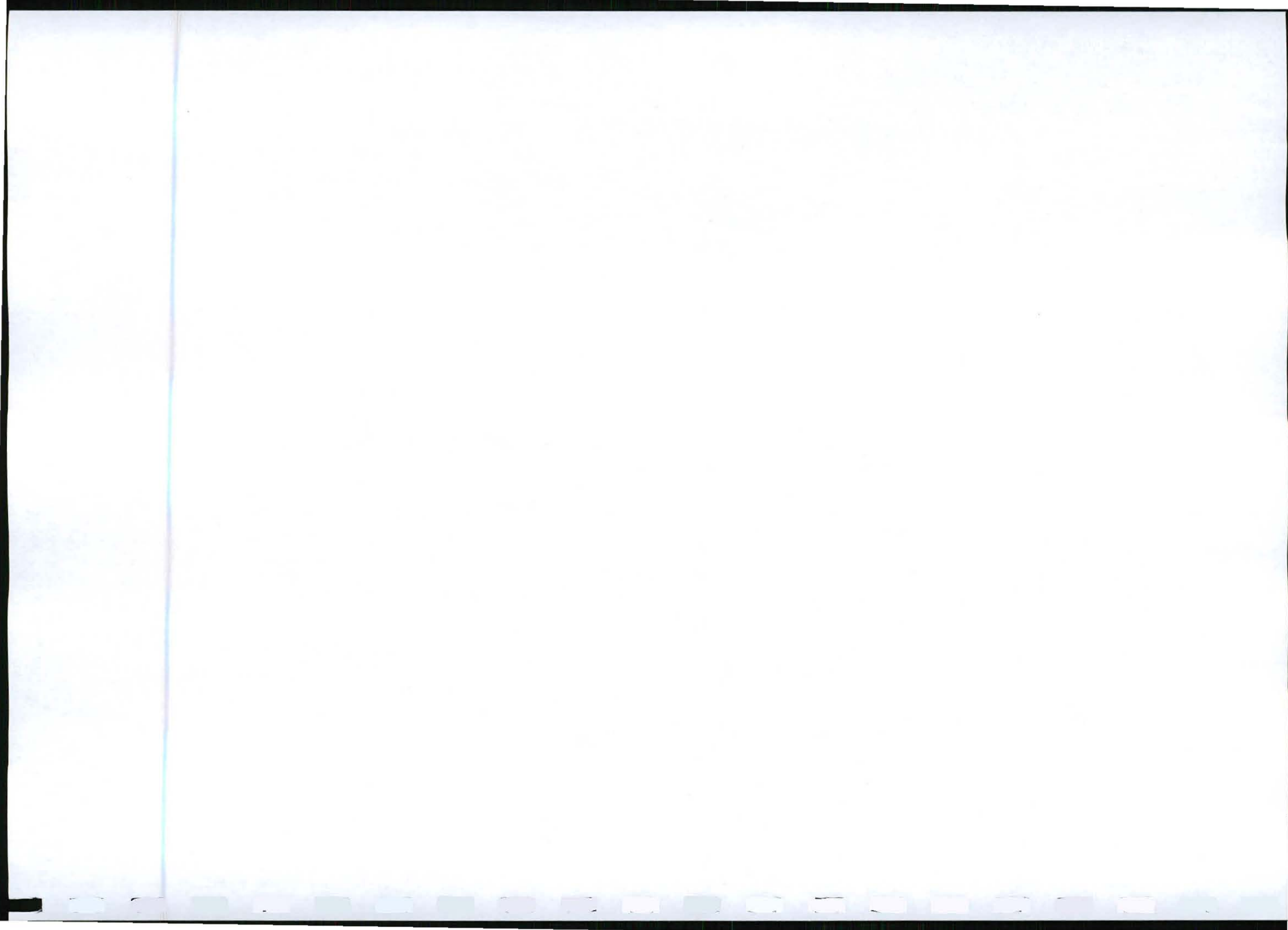
It is recommended, therefore, that authorisation for the re-commissioning of the existing borrow pits be granted in terms of the Minerals Act (Act 50 of 1991). The EMP conditions should, however, become conditions of authorisation.



12. **REPORT PROVISIONS.**

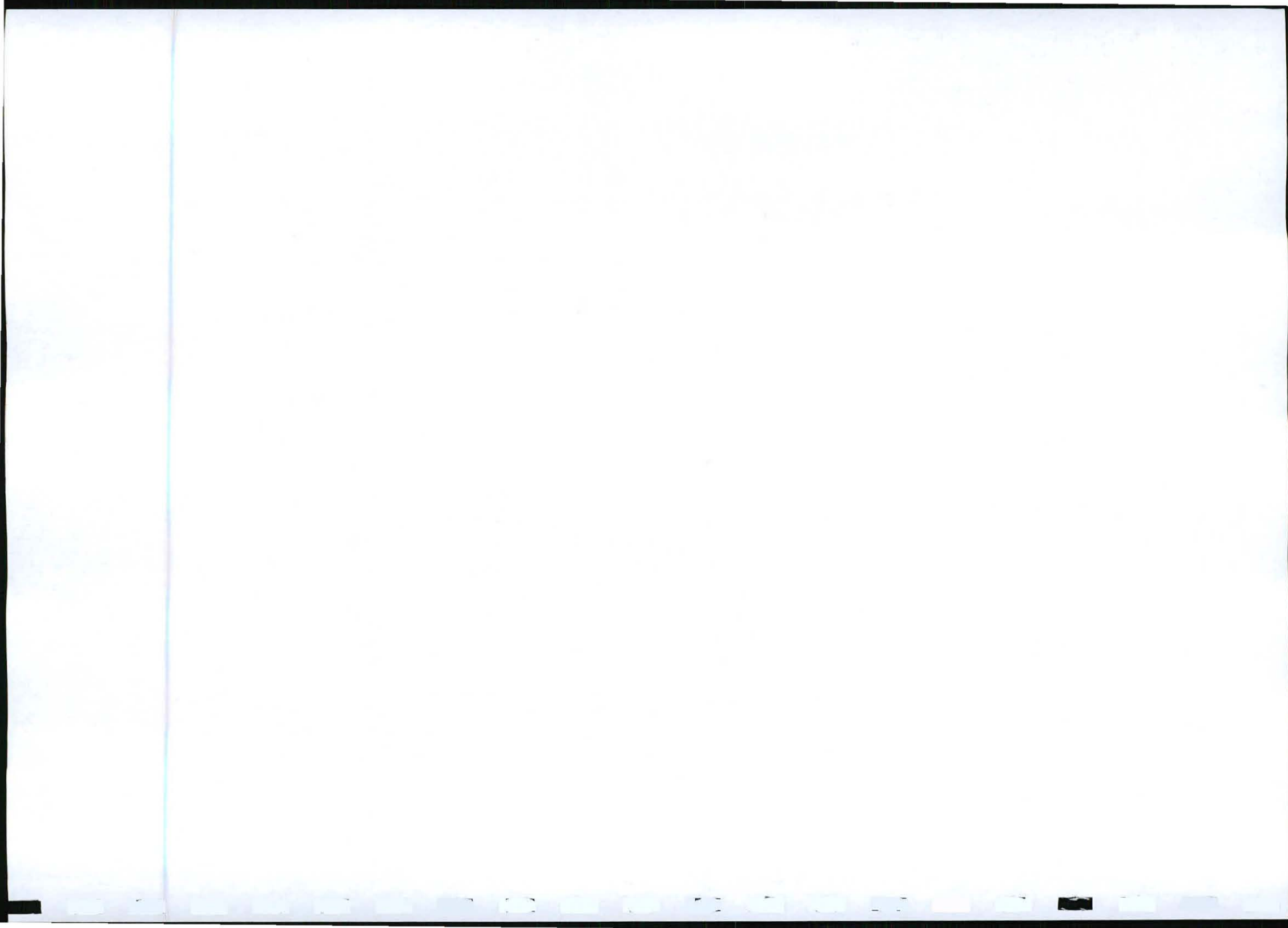
This investigation is aimed at meeting the requirements as laid out by the Department of Minerals and Energy for an EMPR for existing borrow pits in the Engcobo area. The borrow pits were all previously used for road reconstruction purposes, and need to be re-commissioned for similar applications.

Every effort has been made during both the desk study and field-work phases of this investigation to identify the various environmental and management issues associated with this project. We believe that the report is complete in this regard. The investigation was also conducted in a fully independent manner.



13. **REFERENCES AND BIBLIOGRAPHY.**

- 13.1 Acocks, J. P. H. 1988. Veld Types of South Africa. Memoirs of the Botanical Survey of South Africa, No 57. Botanical Research Institute, Department of Agriculture and Water Supply, South Africa.
- 13.2 Brink A. B. A. (1985). Engineering Geology of Southern Africa, Vol. 4. Building Publications, Pretoria.
- 13.3 Bruton, M. N., and Gess, F. W. 1988. Towards and Environmental Plan for the Eastern Cape. Conference proceedings from Rhodes University. Grocott and Sherry, Grahamstown.
- 13.4 Committee for State Road Authorities. 1978. Technical Recommendations for Highways. Volume 2. Geotechnical and Soil Engineering Mapping for Roads and the Storage of Materials Data. pp 33.
- 13.5 Committee for State Road Authorities. 1985. Technical Recommendations for Highways. Volume 14. Guidelines for Road Reconstruction Materials. pp 57.
- 13.6 Committee for State Road Authorities. 1990. Draft Technical Recommendations for Highways. Volume 20. Structural Design, Construction and Maintenance of Unpaved Roads. pp 53.
- 13.7 Department of Environmental Affairs. 1992. Guideline Documentation. Integrated Environmental Management Guideline Series. Vol 1. The Integrated Environmental Procedure., Vol 2. Guidelines for Scoping., Vol 3. Guidelines for Report Scoping., Vol 4. Guidelines for Review., and Vol 5. Checklist of Environmental Characteristics.
- 13.8 Department of Minerals and Energy. 1992. Aide-Mémoire for the Preparation of Environmental Management Programme Reports for Prospecting and Mining. pp 34.
- 13.9 Gledhill, E. 1981. Veldblomme van Oos-Kaapland. The Department of Nature and Environmental Conservation of the Cape Province Administration. Galvin and Sales. Cape Town.
- 13.10 Greyling, T., and Huntley, B. J.. 1984. Directory of southern African conservation areas. South African National Scientific Programmes Report No. 98 Council for Scientific and Industrial Research. Pretoria.



- 13.11 Hartmann, M. O., 1988. The Soils of the Eastern Cape. In: Lubke, R. A., Gess, F. W., and Bruton, M. N. (Eds) A Field Guide to the Eastern Cape Coast. A Wildlife Handbook. Grahamstown Centre of the Wildlife Society of Southern Africa.
- 13.12 Henderson, L., 2001. Alien Weeds and Invasive Plants. Plant Protection Research Institute, Agricultural Research Council, Handbook No 12. Paarl Printers Cape Town.
- 13.13 Low, A. B., and Rebelo, A. T. G., 1998. Vegetation of South Africa, Lesotho and Swaziland. Department of Environmental Affairs and Tourism, Pretoria.
- 13.14 Maclean, G. L., 1985. Robert's Birds of Southern Africa. Trustees of the John Voelcker Bird Book Fund. Cape Town.
- 13.15 Middleton, B. J. and Lorentz, S. A., 1988. Surface Water Resources of the Eastern Cape. In: Bruton, M. N., and Gess, F. W. (Eds). Towards and Environmental Plan for the Eastern Cape. Conference proceedings from Rhodes University. Grocott and Sherry, Grahamstown.
- 13.16 Midgley, D. C., Pitman, W. V., and Middleton, B. J. 1981. Surface Water Resources Of South Africa. Reports 8/81 - 13/81, Hydrological Research Unit, University of Witwatersrand, Johannesburg.
- 13.17 Schulze, B. R. 1947. Classification of Climates of Southern Africa after Koppen and Thornwaite. S. Afr. geog. J. 29:32-42.
- 13.18 Sinclair, I., and Hockey, P. 1996. Sasol : The Larger Illustrated Guide to Birds of Southern Africa. Struik. Cape Town
- 13.19 Smithers, R. H. N., 1986. South African Red Data Book. Terrestrial Mammals. South African National Scientific Programmes Report No. 125 Council for Scientific and Industrial Research. Pretoria.
- 13.20 Soil Classification Working Group (SCWG), 1991. Soil Classification, A Taxonomic System for South Africa. Memoirs on the Agricultural Natural Resources of South Africa, No 15. Department of Agricultural Development, Pretoria.
- 13.21 Stirton, C. H. 1987. Plant Invaders : Beautiful, but Dangerous. The Department of Nature and Environmental Conservation of the Cape Province Administration. Galvin and Sales. Cape Town.

