

- b) Waste material of any description, including receptacles, scrap, rubble and tyres will be removed entirely from the mining area and disposed of at a recognised landfill facility. It will not be permitted to be buried or burned on the site.
- c) Internal access tracks, not required by the landowner, shall be obliterated by breaking the surface crust and scarifying the area to a depth of 250 mm, whichever is the shallower, and then be covered with stockpiled topsoil.
- d) The borrow pits will be kept in a neat and tidy condition at all times.

6.9.1.7 Additional measures

- a) No construction equipment, vehicles or unauthorised personnel shall be allowed onto areas that have been finished off.
- b) Only persons or equipment required for the preparation of areas, application of fertiliser and spreading of top material shall be allowed to operate on these areas.
- c) Permanent, stock-proof fencing shall be erected/reinstated adjacent to farm land and alongside the road.
- d) The access gate shall remain locked and a key shall be provided to the farmer for future use.

6.9.2 End Use


After rehabilitation of the borrow pits, these areas will probably be natural accumulation areas for runoff from the surrounding areas and become small dams in the long-term. These areas may also be transformed into artificial wetlands if reeds, sedges and other water tolerant grasses are planted.

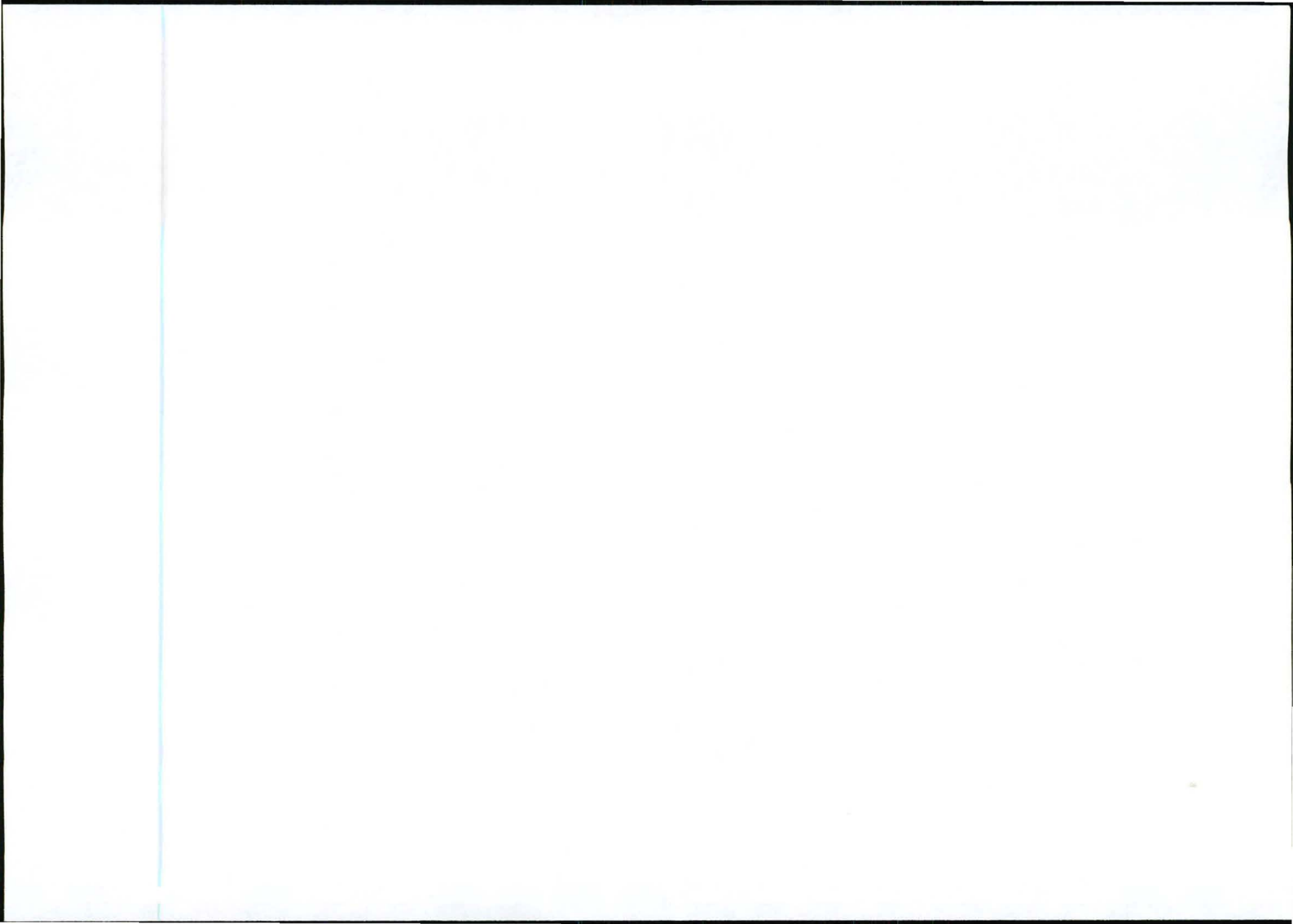
6.9.3 Closure

When the holder of the mining permit intends closing down the mining operations, an environmental risk report shall accompany the application for closure.

6.10 Safety and Security

It is noted that this EMP is not a Health & Safety Plan. It is the Contractor's responsibility to ensure that a Health & Safety Plan, as per the requirements of the Occupational Health & Safety Act, is prepared prior to any physical work occurring on the site. Safety in terms of labourers on site is discussed in section 6.8. In general, the Contractor shall maintain the borrow pits such 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 mining site.





7 References

Berliner, D.D. & Desmet, P. (2007). *Eastern Cape Biodiversity Conservation Plan Technical Report*. Department of Water Affairs and Forestry Project No 2005-012, Pretoria.

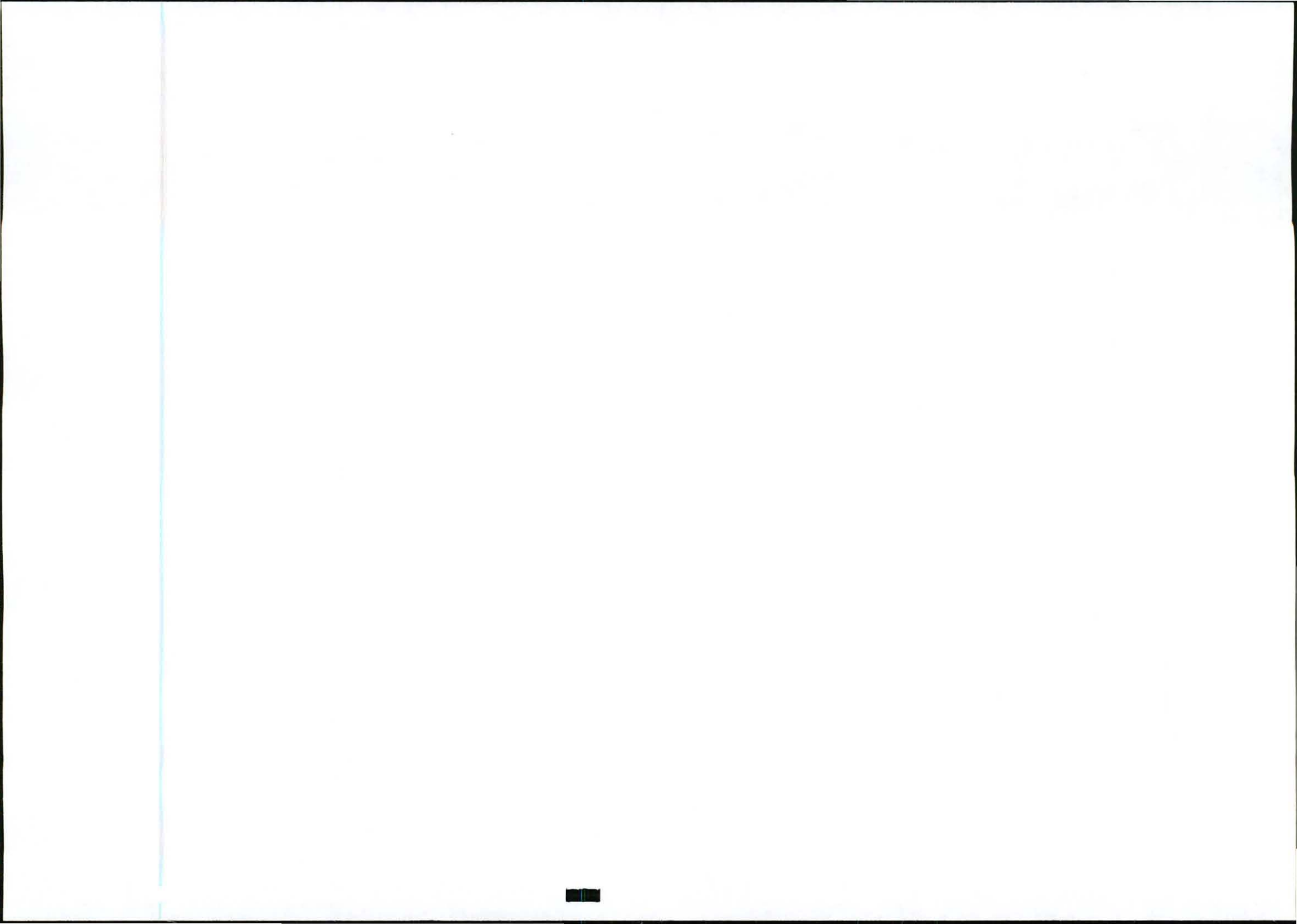
Golding, J. (2002). *Workshop Proceedings: Revision of the national list of protected trees as per section 12, National Forests Act of 1998*. Roodeplaat. Pretoria.

Standard Environmental Management Plan. (2004). Department of Minerals and Energy. Release Version (1.3.1) 01 May 2004.

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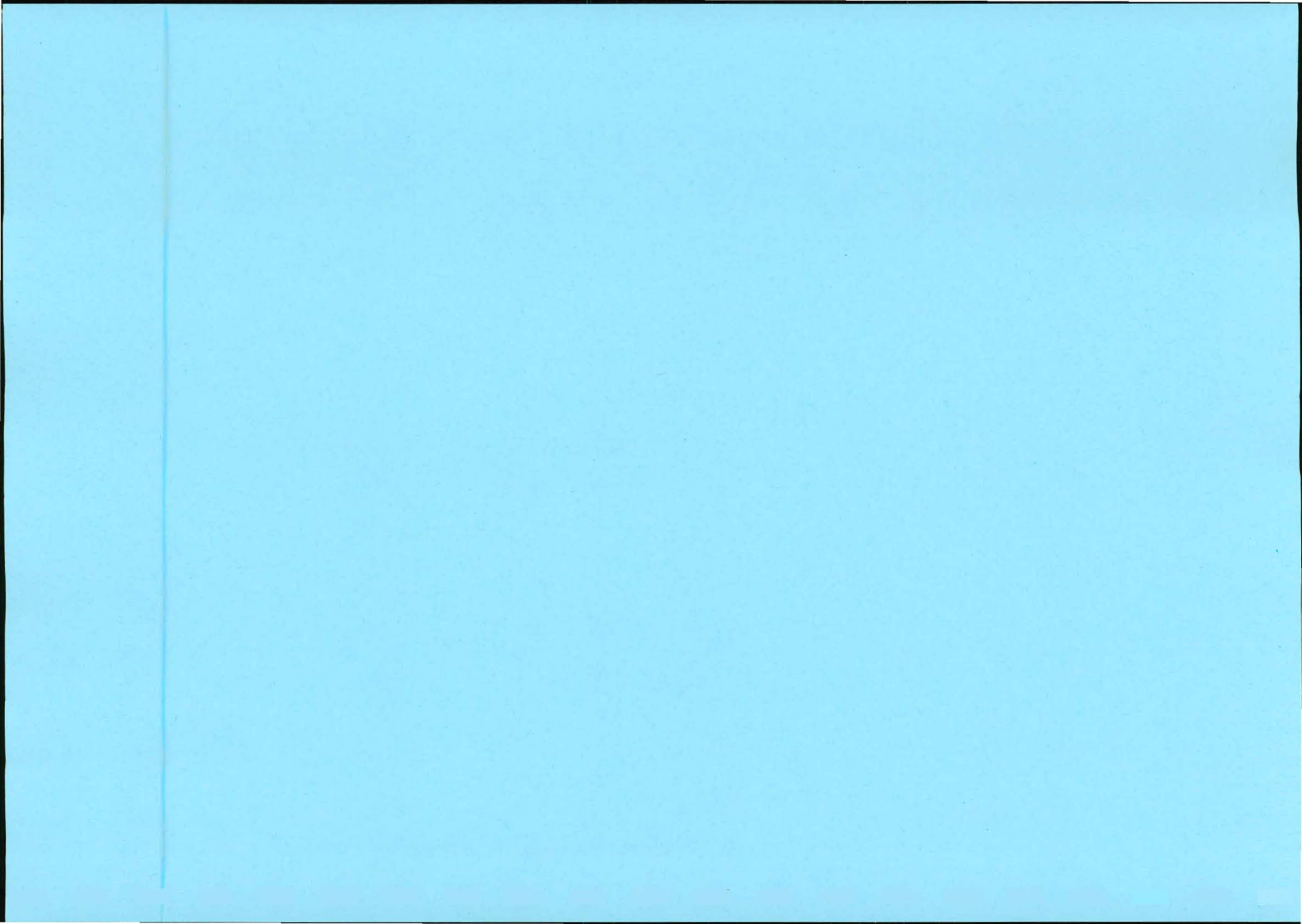
Toerien, D., & Hill, R. (1989). *Geological Survey: The Geology of the Port Elizabeth Area*. Pretoria: Government Printer.

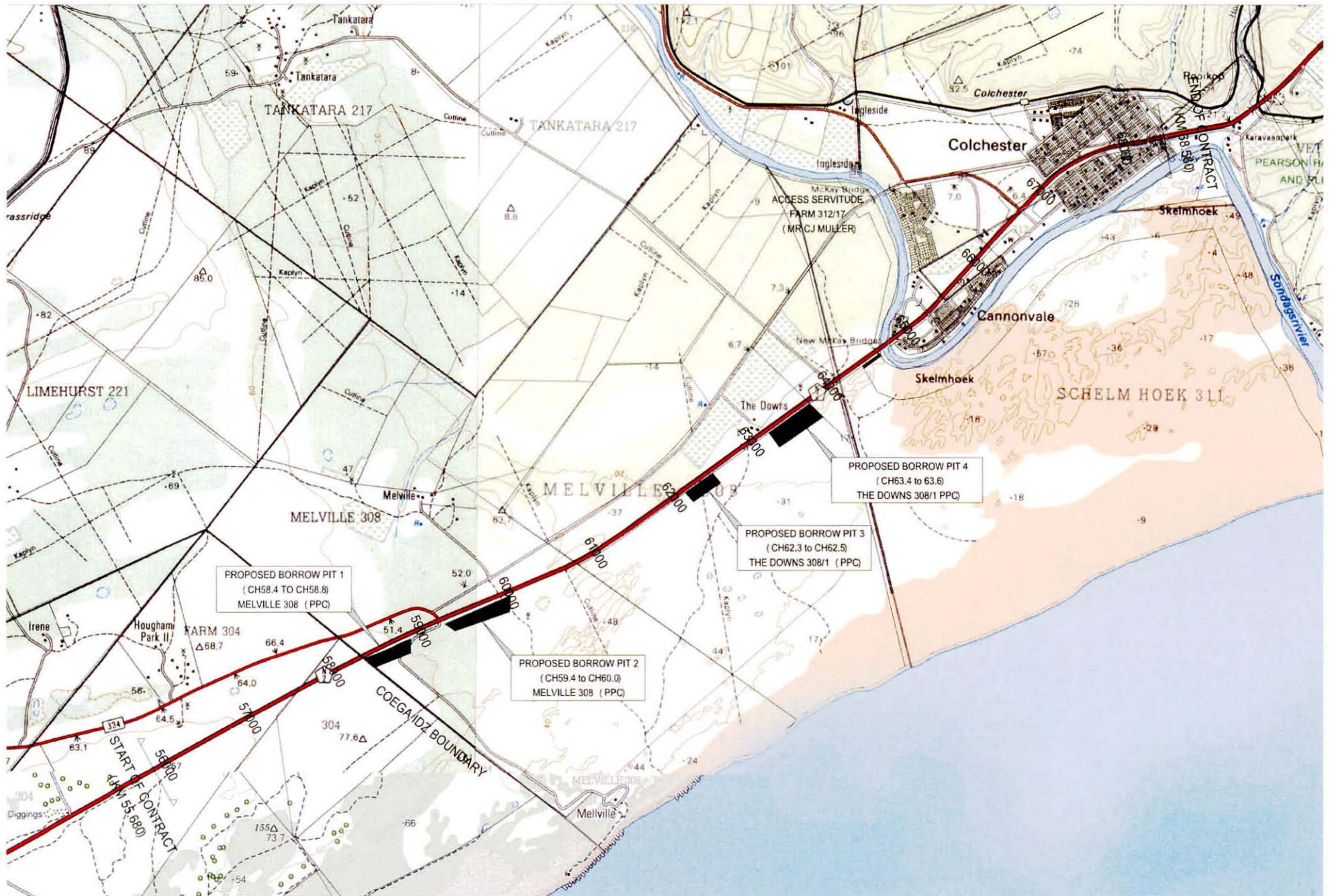




Appendices

Appendix A – Site Locality Plans





PROPOSED BORROW PIT 4
(CH63.4 to CH63.6)
THE DOWNS 308/1 (PPC)

PROPOSED BORROW PIT 3
(CH62.3 to CH62.5)
THE DOWNS 308/1 (PPC)

PROPOSED BORROW PIT 1
(CH58.4 to CH58.8)
MELVILLE 308 (PPC)

PROPOSED BORROW PIT 2
(CH59.4 to CH60.0)
MELVILLE 308 (PPC)

Colchester

Cannonvale

Skelmhoek

MELVILLE 308

MELVILLE 308

SHELM HOEK 311

TANKATARA 217

TANKATARA 217

LIMEHURST 221

FARM 304

COEGAIZD BOUNDARY

NO.	DATE	REVISION

aurecon
Cape Town

Auricon Centre Century Falls
Century Boulevard, Century City, 7641
Tel: +27 21 528 8400
Email: CapeTown@aurecongroup.com

Semenya Furumele Consulting

PO Box 4856
Century, 6048
Tel: +27 21 843 3534
Email: semeniya@sfco.co.za

NO.	DATE	REVISION

THE SOUTH AFRICAN NATIONAL ROADS AGENCY

SOUTHERN REGION

1000000000

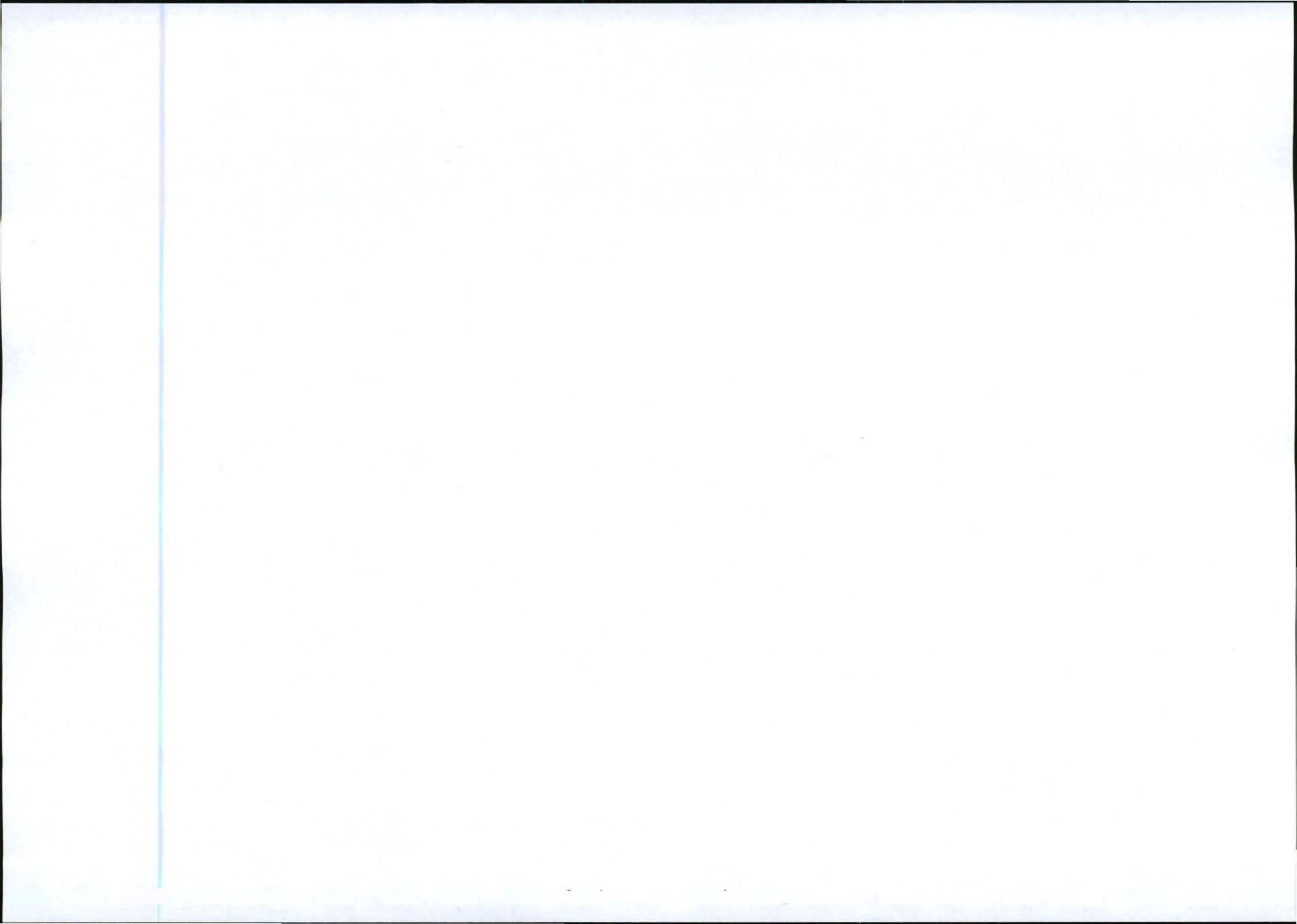
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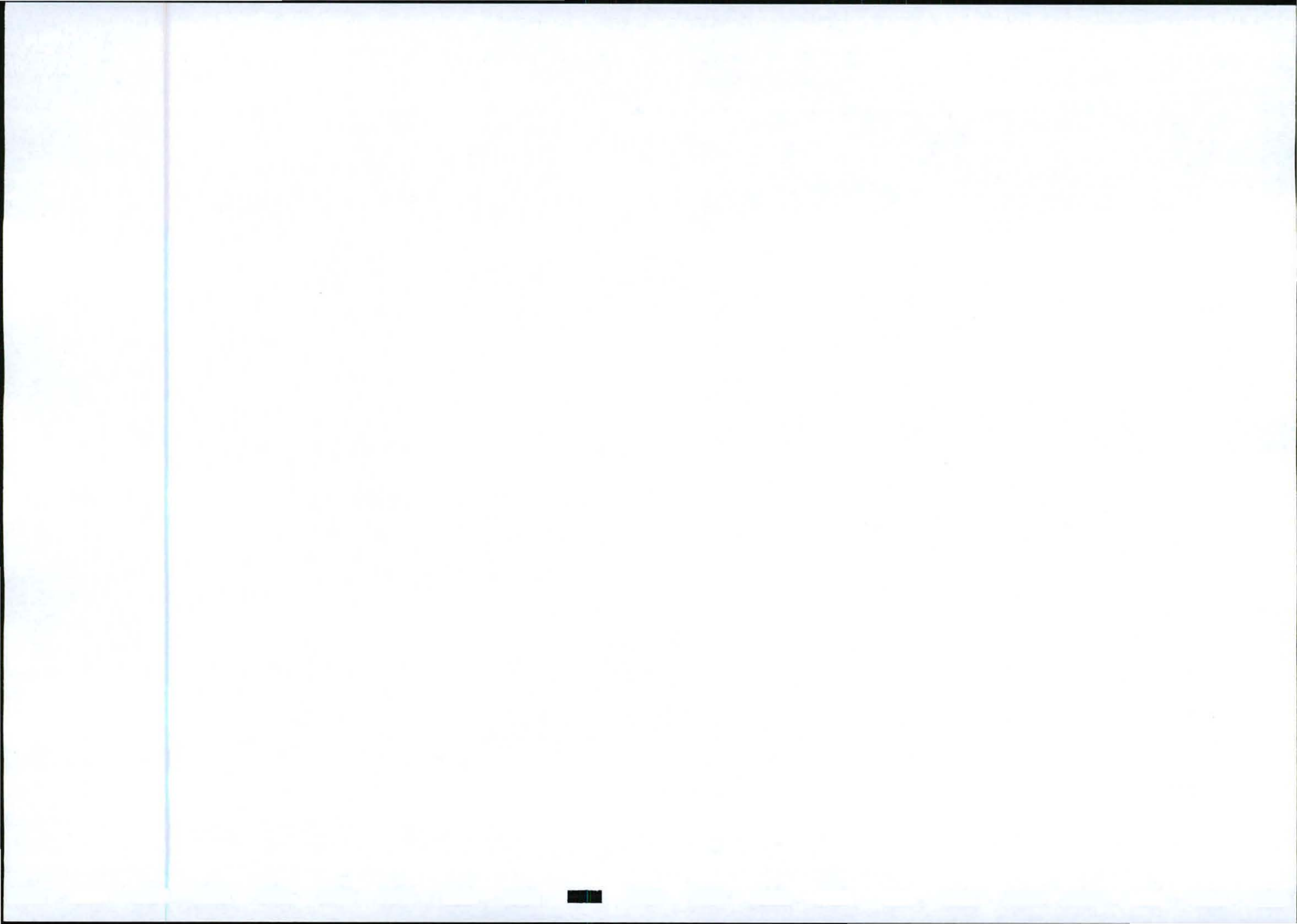
NATIONAL ROUTE 2 SECTION 11:
COEGA TO COLCHESTER: REHABILITATION AND UPGRADING

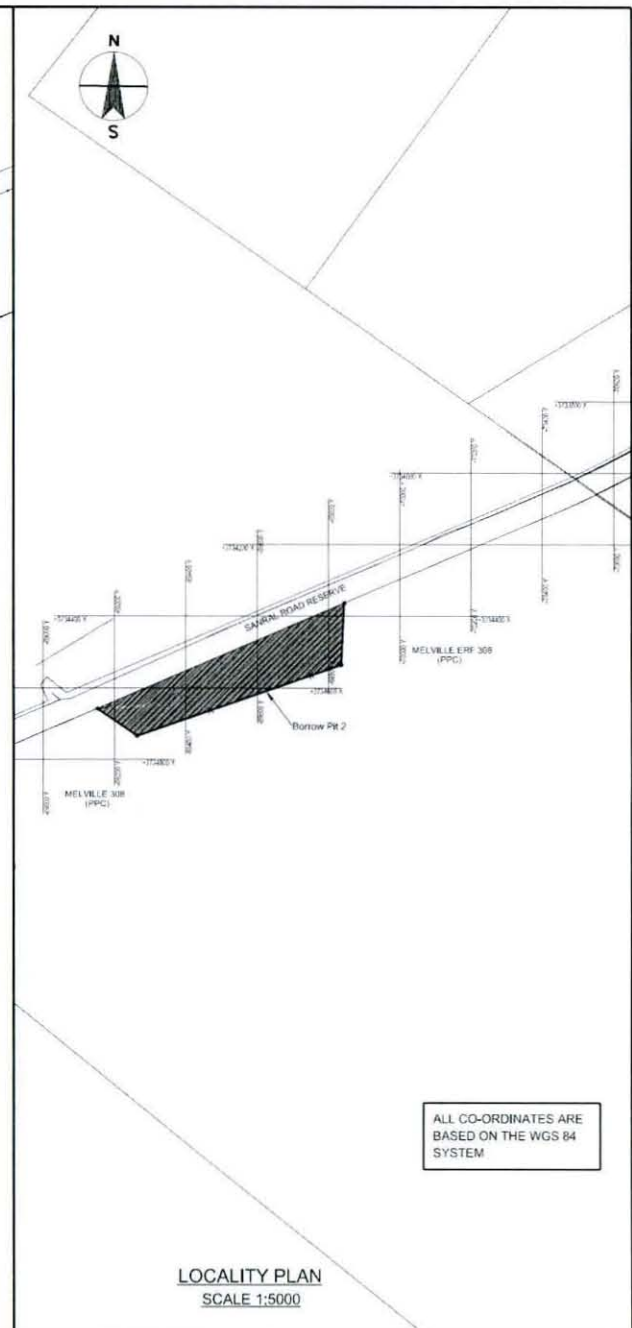
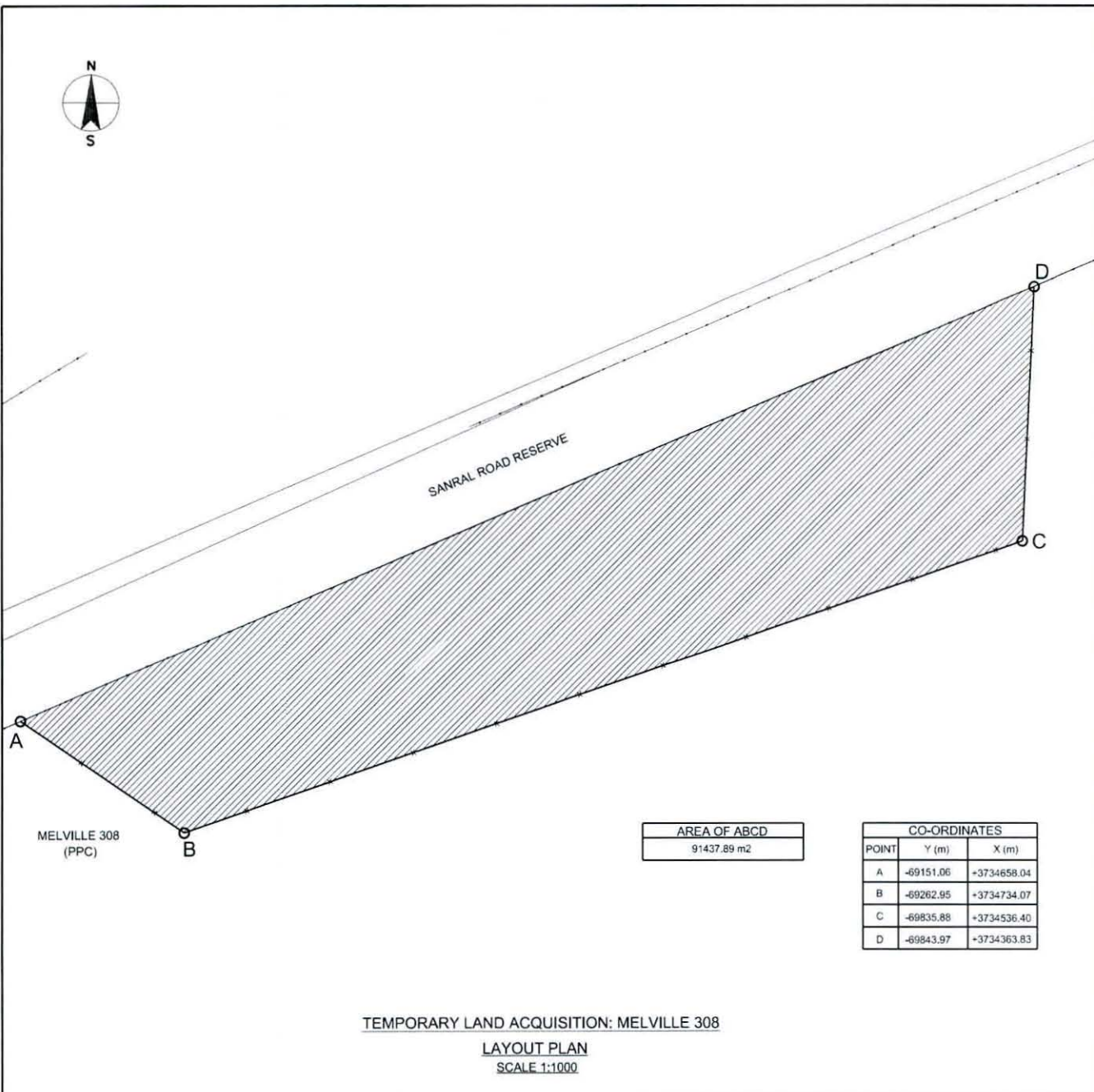
KEY PLAN

PROJECT NUMBER	NPA R02A-16-0005/1	
DRAWING COLLECTION DATA	START	END
ROUTE	11	11
SECTION	11	11
DRAWING OR DETAIL	ROADS - GENERAL PLANS	
DRAWING TYPE	GENERAL STRUCTURE PLAN	
CONTRACT DRAWING NO.	11	11
SHEET NO.	11	11

SCALE: 1:20,000 SHEET 11 OF 11







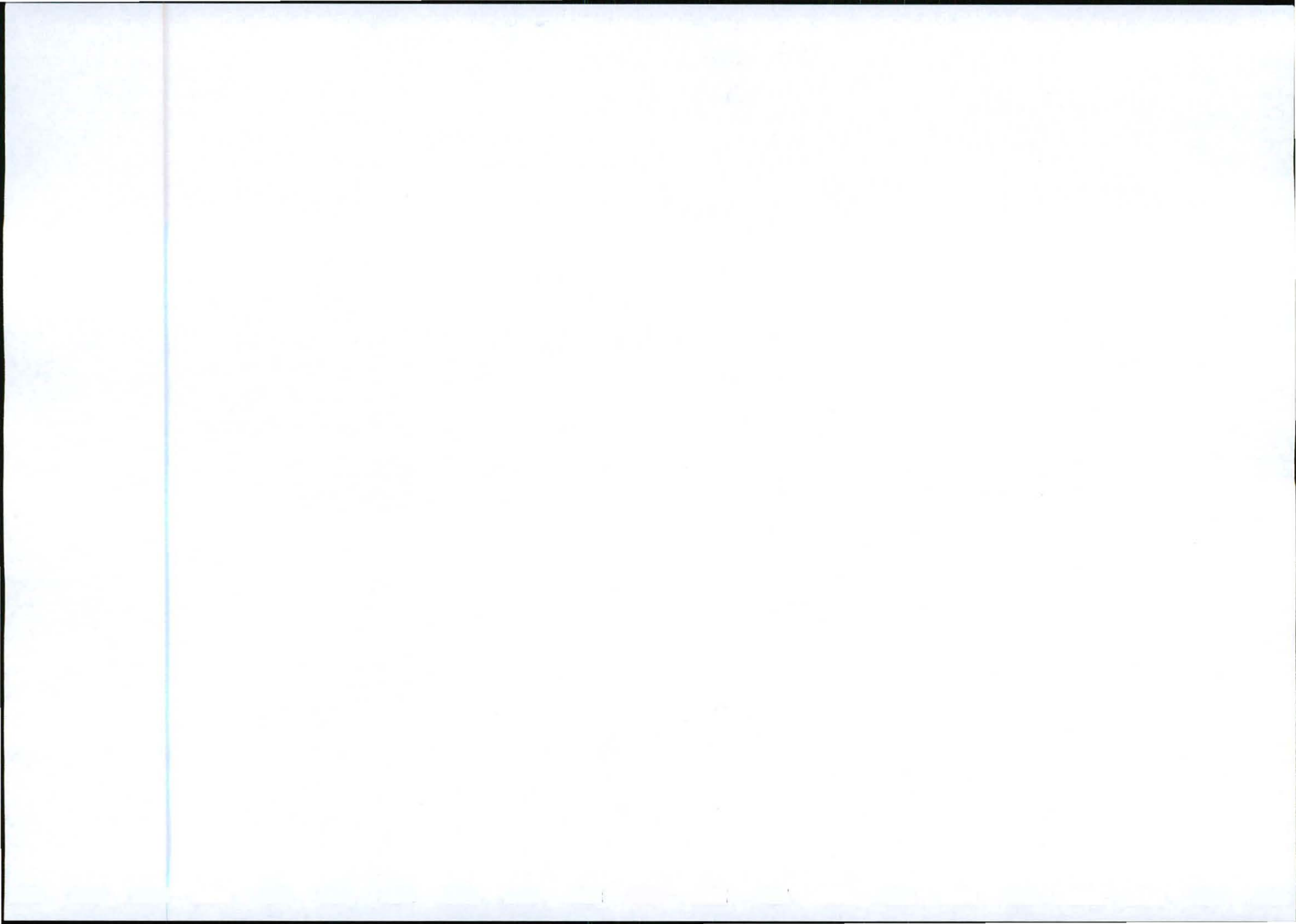
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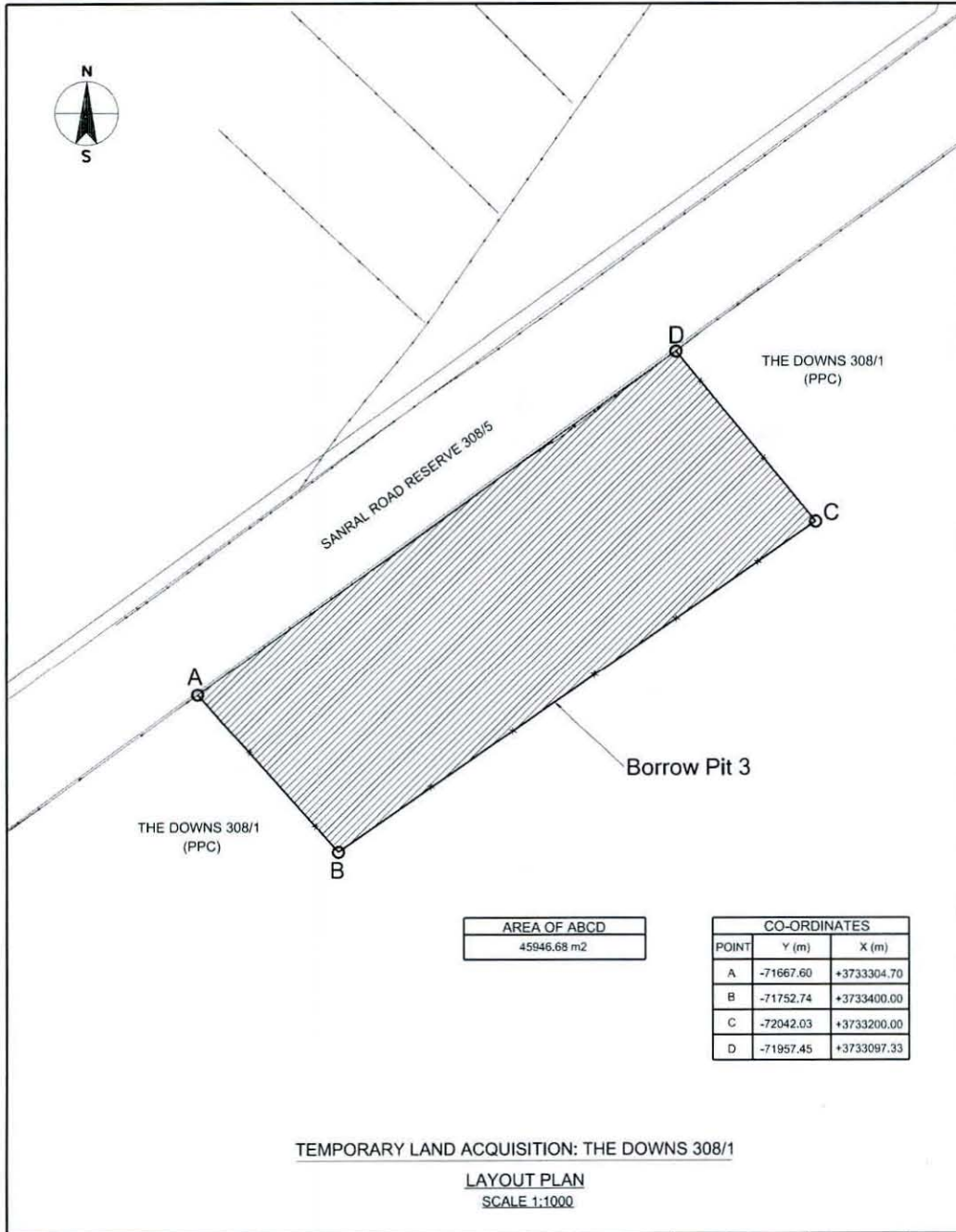
CO-ORDINATES		
POINT	Y (m)	X (m)
A	-69151.06	+3734658.04
B	-69262.95	+3734734.07
C	-69835.88	+3734536.40
D	-69843.97	+3734363.83

TEMPORARY LAND ACQUISITION: MELVILLE 308
 LAYOUT PLAN
 SCALE 1:1000

LOCALITY PLAN
 SCALE 1:5000

<p>aurecon Cape Town</p> <p>Aurecon: Century Falls, Century Boulevard, Century City, 1441 Cape Town Tel: +27 21 526 9500 Fax: +27 21 526 9450 Email: CapeTown@aurecongroup.com</p>	<p>Semenya Furumele Consulting</p> <p>PO Box 8556, Century City, 1441 Cape Town Tel: +27 21 843 8351 Fax: +27 21 843 8354 Email: admin@sfco.co.za</p>	<p>PROJECT NO. N. 10000/10</p> <p>PROJ. REG. NO. N. 10000/10</p> <p>DATE: 11/08/2010</p>	<p>CLIENT: SANDKOR</p> <p>PROJECT: NATIONAL ROUTE 2 SECTION 11: SOUTHWERKE IS TO COLCHESTER: REHABILITATION</p> <p>PROJECT AREA: BORROW PIT 2</p>	<p>SCALE: 1:1000</p> <p>DATE: 11/08/2010</p>	<p>PROJECT DESCRIPTION</p> <p>NATIONAL ROUTE 2 SECTION 11: SOUTHWERKE IS TO COLCHESTER: REHABILITATION</p> <p>TEMPORARY EXPROPRIATION DIAGRAM</p> <p>BORROW PIT 2: MELVILLE FARM 308</p>	<p>PROJECT NUMBER: NTA N2011/11/2005/1</p> <p>DRAWING NO. 11</p> <p>SECTION: 11</p> <p>DATE: 11/08/2010</p> <p>SCALE: 1:1000</p> <p>CONSULTANT: Aurecon</p> <p>DESIGNER: Aurecon</p> <p>CHECKER: Aurecon</p> <p>DATE: 11/08/2010</p>
		<p>DATE: 11/08/2010</p> <p>REVISION:</p>	<p>SCALE: 1:1000</p> <p>DATE: 11/08/2010</p>	<p>SCALE: 1:1000</p> <p>DATE: 11/08/2010</p>	<p>SCALE: 1:1000</p> <p>DATE: 11/08/2010</p>	<p>SCALE: 1:1000</p> <p>DATE: 11/08/2010</p>

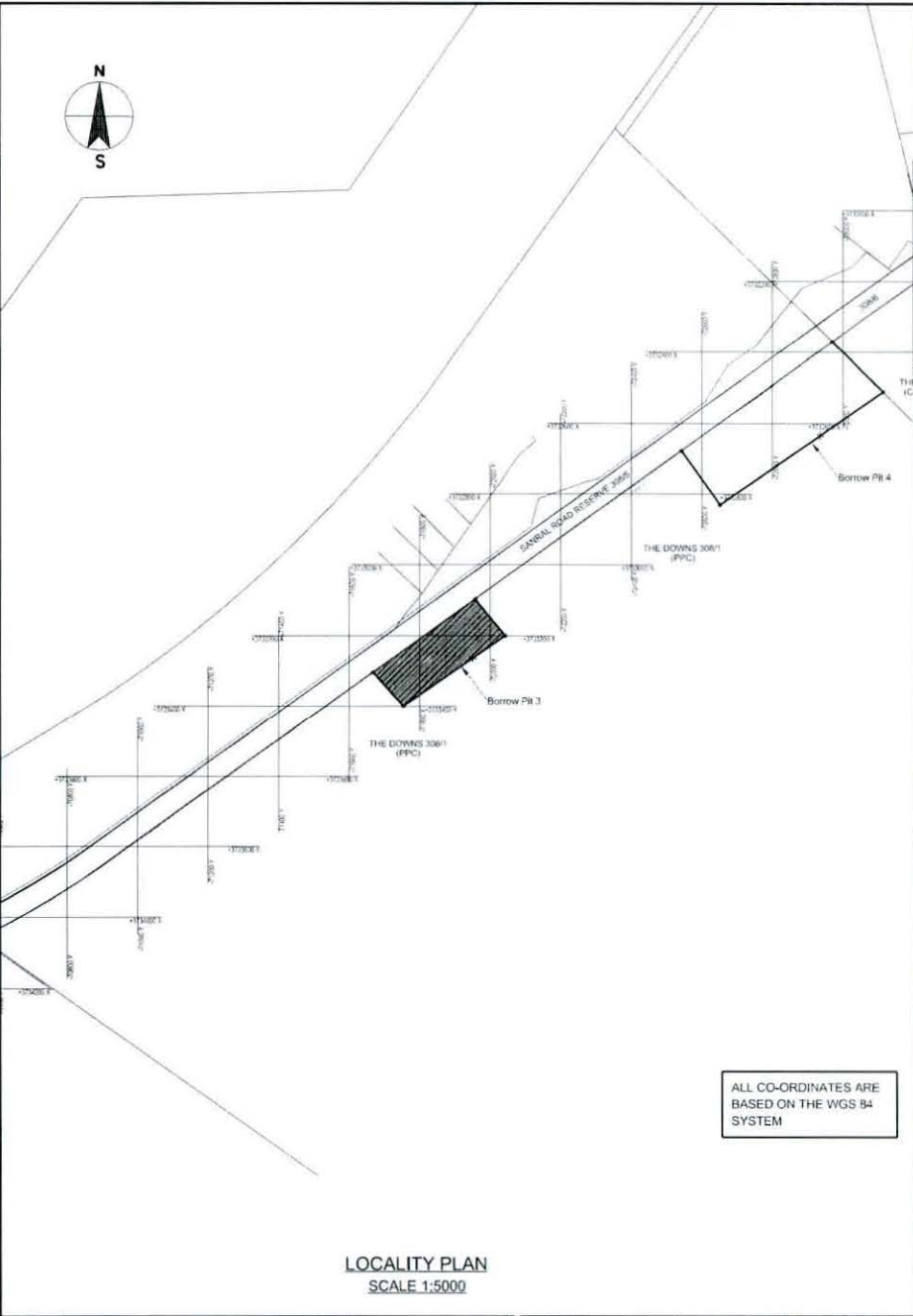




AREA OF ABCD
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CO-ORDINATES		
POINT	Y (m)	X (m)
A	-71667.60	+3733304.70
B	-71752.74	+3733400.00
C	-72042.03	+3733200.00
D	-71957.45	+3733097.33

TEMPORARY LAND ACQUISITION: THE DOWNS 308/1
LAYOUT PLAN
SCALE 1:1000



ALL CO-ORDINATES ARE BASED ON THE WGS 84 SYSTEM

LOCALITY PLAN
SCALE 1:5000

No.	DATE	REVISION

aurecon
Cape Town
Aurecon Centre, Century Falls
Century Boulevard, Century City, 7441
Email: CapeTown@af.aureconcorp.com
Fax: +27 21 526 8500
Tel: +27 21 526 9400

Semenya Furumele Consulting
PO Box 8958
Caulston, 6246
Email: ssm@sfco.co.za
Fax: +27 21 643 6551
Tel: +27 21 643 6554

NO.	DATE	REVISION

HEAD OFFICE
124 Main Road
Durbanville, 7801
Tel: 021 426 9000

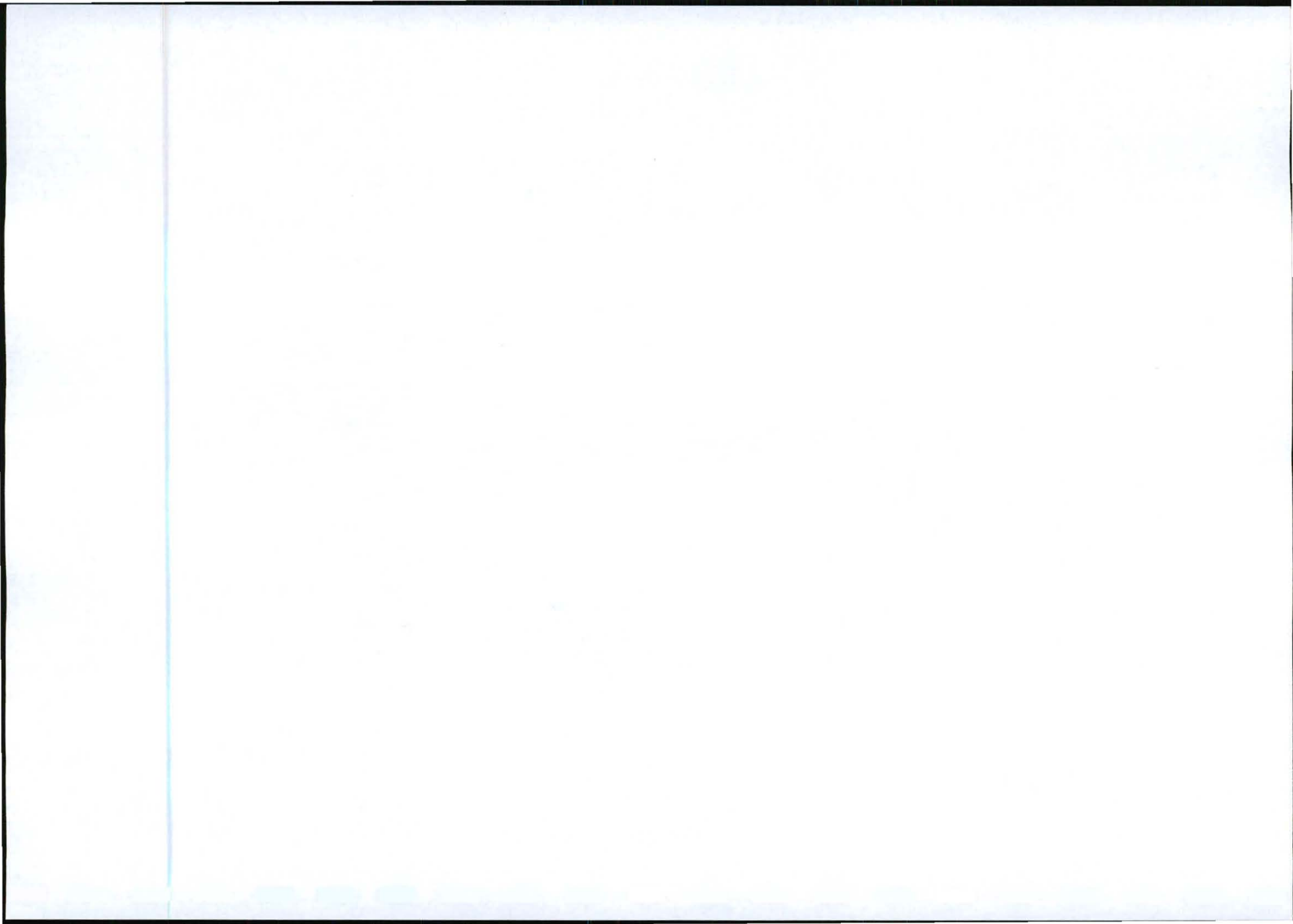


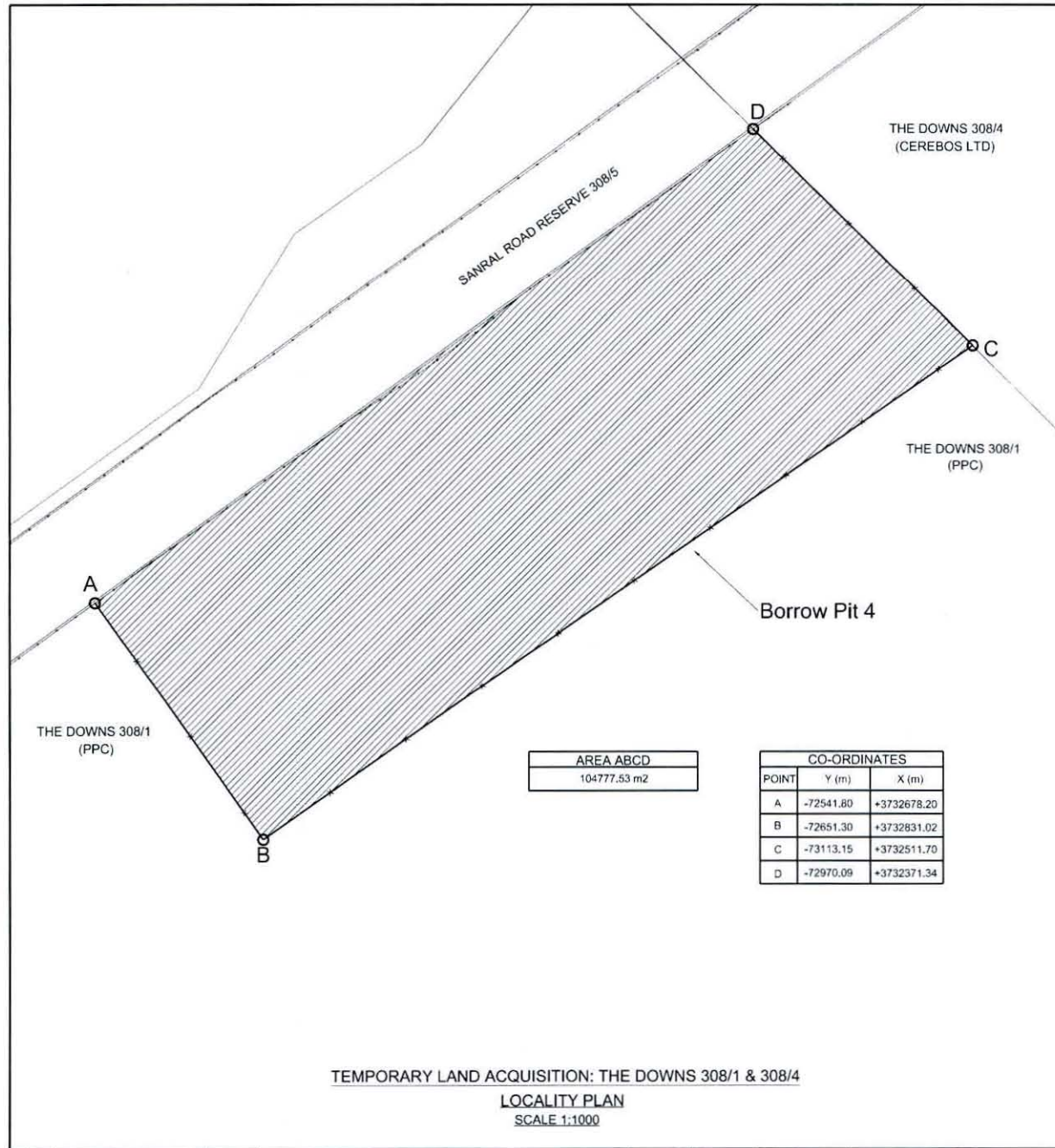
PO Box 2726
Cape Town
Tel: 021 426 9000

PROJECT DESCRIPTION
NATIONAL ROUTE 2 SECTION 15:
SOUTHWERKE 115 TO COLCHESTER: REHABILITATION

TEMPORARY EXPROPRIATION DIAGRAM
BORROW PIT 3 : THE DOWNS 308/1

PROJECT NUMBER	NRA ALLOCATION

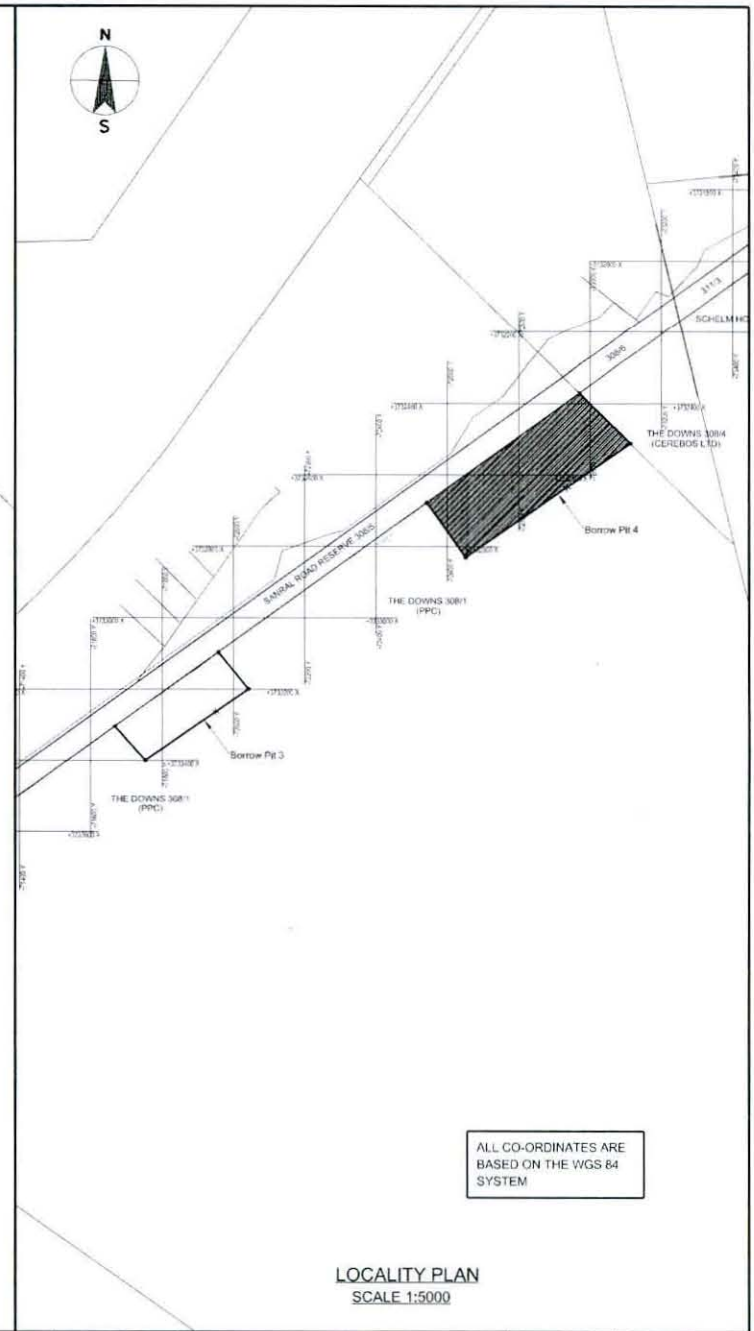




AREA ABCD	
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CO-ORDINATES		
POINT	Y (m)	X (m)
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B	-72651.30	+3732831.02
C	-73113.15	+3732511.70
D	-72970.09	+3732371.34

TEMPORARY LAND ACQUISITION: THE DOWNS 308/1 & 308/4
 LOCALITY PLAN
 SCALE 1:1000



ALL CO-ORDINATES ARE BASED ON THE WGS 84 SYSTEM

LOCALITY PLAN
 SCALE 1:5000

No.	DATE	REVISION

aurecon
 Cape Town
 Aurecon Centre, Century Falls
 Century Boulevard, Century City, 7441
 Email: CapeTown@aureconpros.com

Semenya Furumele Consulting
 PO Box 6956
 Century City, 7441
 Email: admin@sfcc.co.za

DATE	BY	REVISION

DATE	BY	REVISION

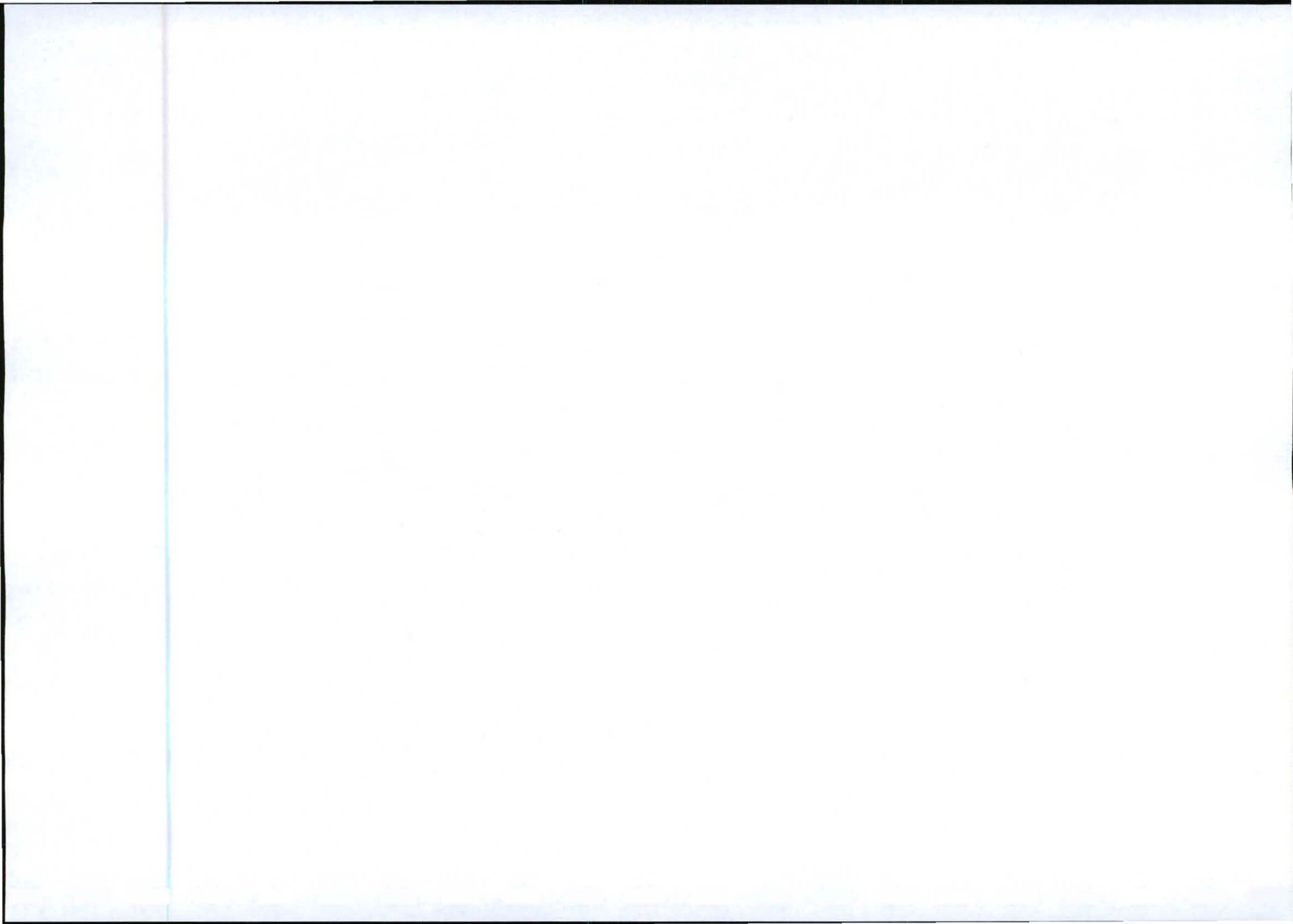
HEAD OFFICE
 1204 Park Street
 Market Square
 Cape Town
 PO Box 411
 Market Square
 Cape Town
 Tel: 021-406 0000

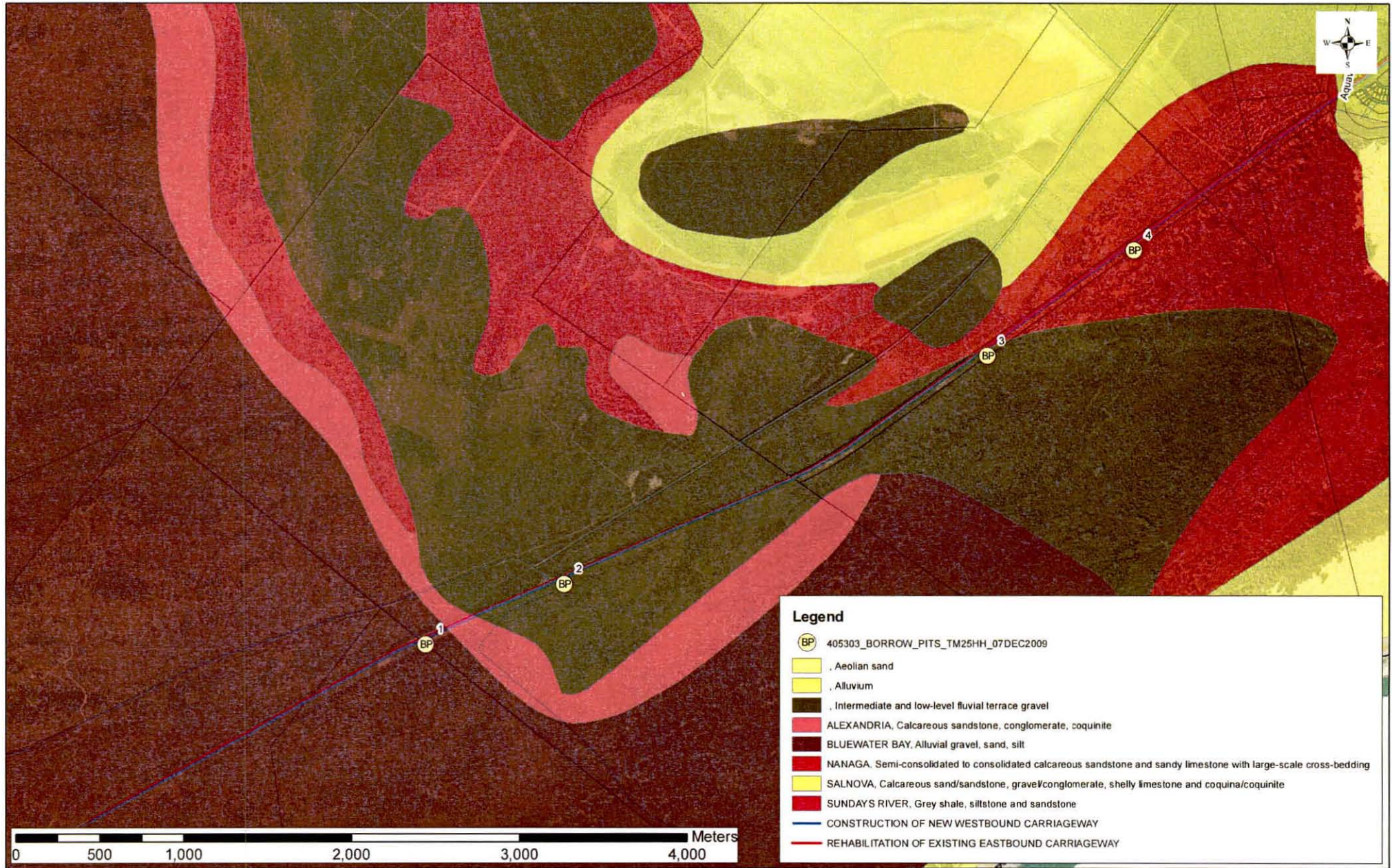


SOUTH AFRICAN NATIONAL ROADS AGENCY
 NATIONAL ROUTE 2 SECTION 11: SOUTHWERKE 1'S TO COLCHESTER: REHABILITATION
 TEMPORARY EXPROPRIATION DIAGRAM BORROW PIT 4: THE DOWNS FARM 308/1

PROJECT NUMBER	NRA NO: 211/2015/1

PROJECT NUMBER	NRA NO: 211/2015/1





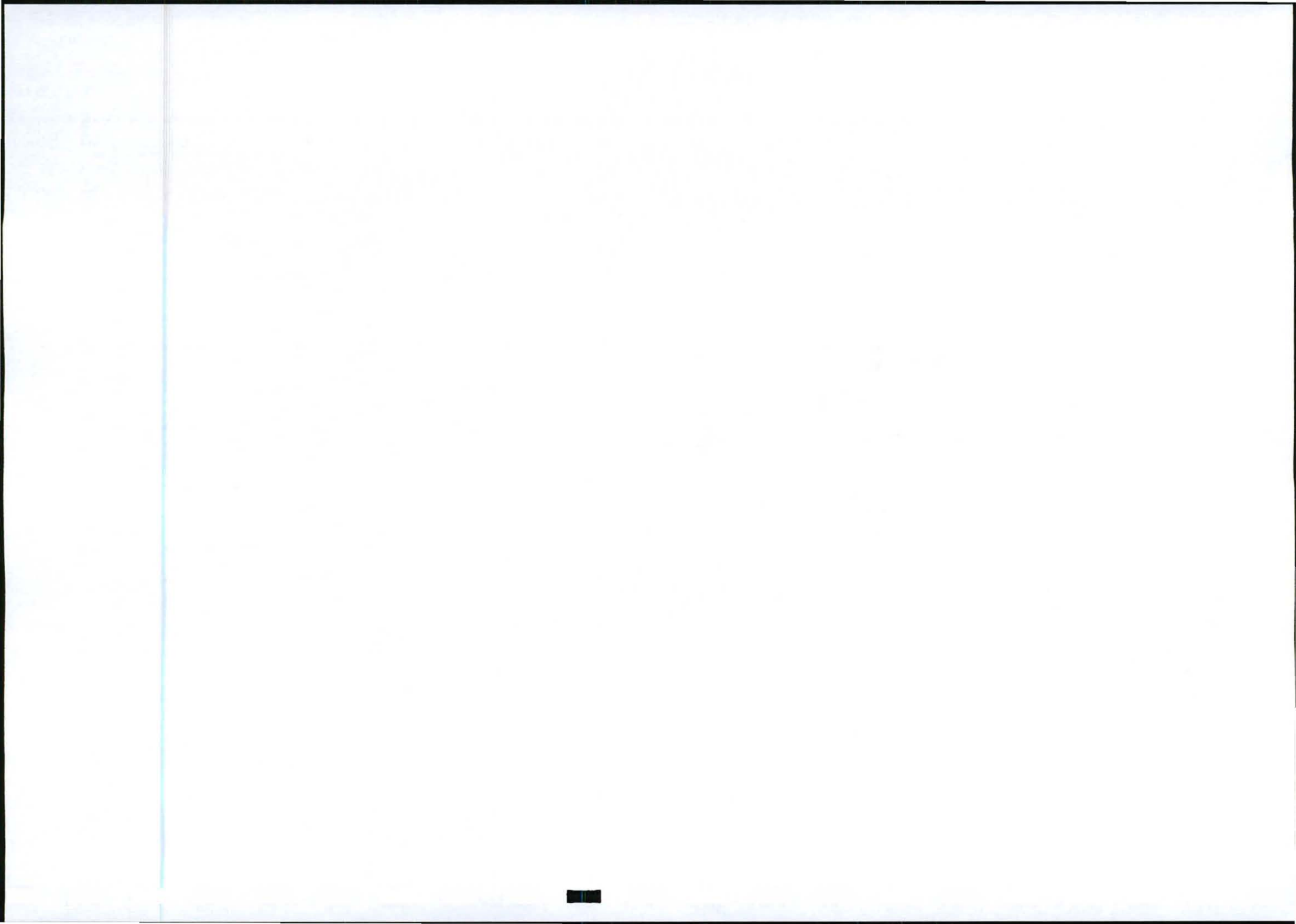
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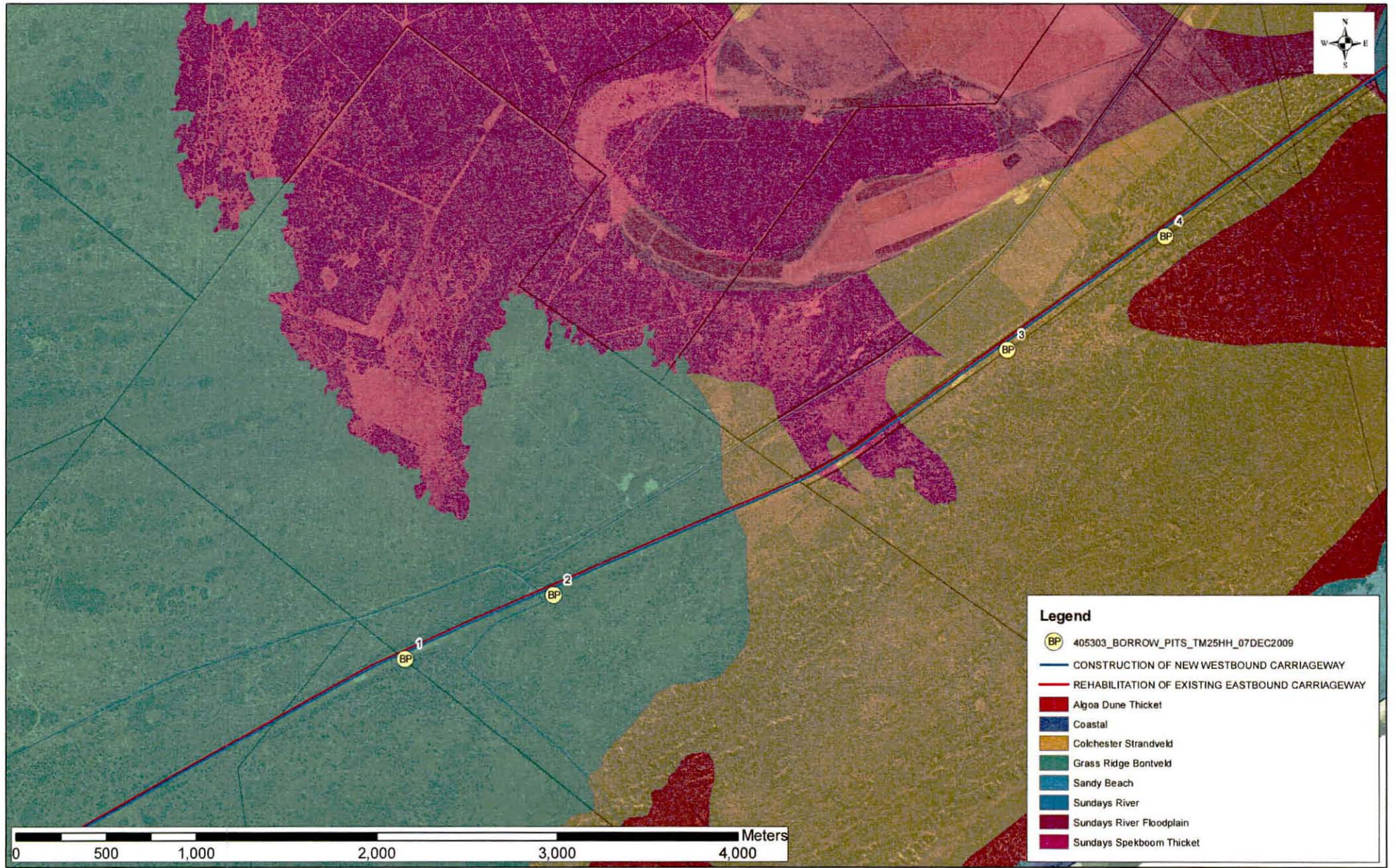
- BP 405303_BORROW_PITS_TM25HH_07DEC2009
- Aeolian sand
- Alluvium
- Intermediate and low-level fluvial terrace gravel
- ALEXANDRIA, Calcareous sandstone, conglomerate, coquinite
- BLUEWATER BAY, Alluvial gravel, sand, silt
- NANAGA, Semi-consolidated to consolidated calcareous sandstone and sandy limestone with large-scale cross-bedding
- SALNOVA, Calcareous sand/sandstone, gravel/conglomerate, shelly limestone and coquina/coquinite
- SUNDAYS RIVER, Grey shale, siltstone and sandstone
- CONSTRUCTION OF NEW WESTBOUND CARRIAGEWAY
- REHABILITATION OF EXISTING EASTBOUND CARRIAGEWAY

Project No.	Datum
405303	HH94
	Projection
	TM
	Central Meridian/Zone
	LO25

N2 COEGA TO COLCHESTER EIA
GEOLOGY

Date:	Scale:
25/09/2009	1:21,538
Compiled by	Fig No:
VANE	011





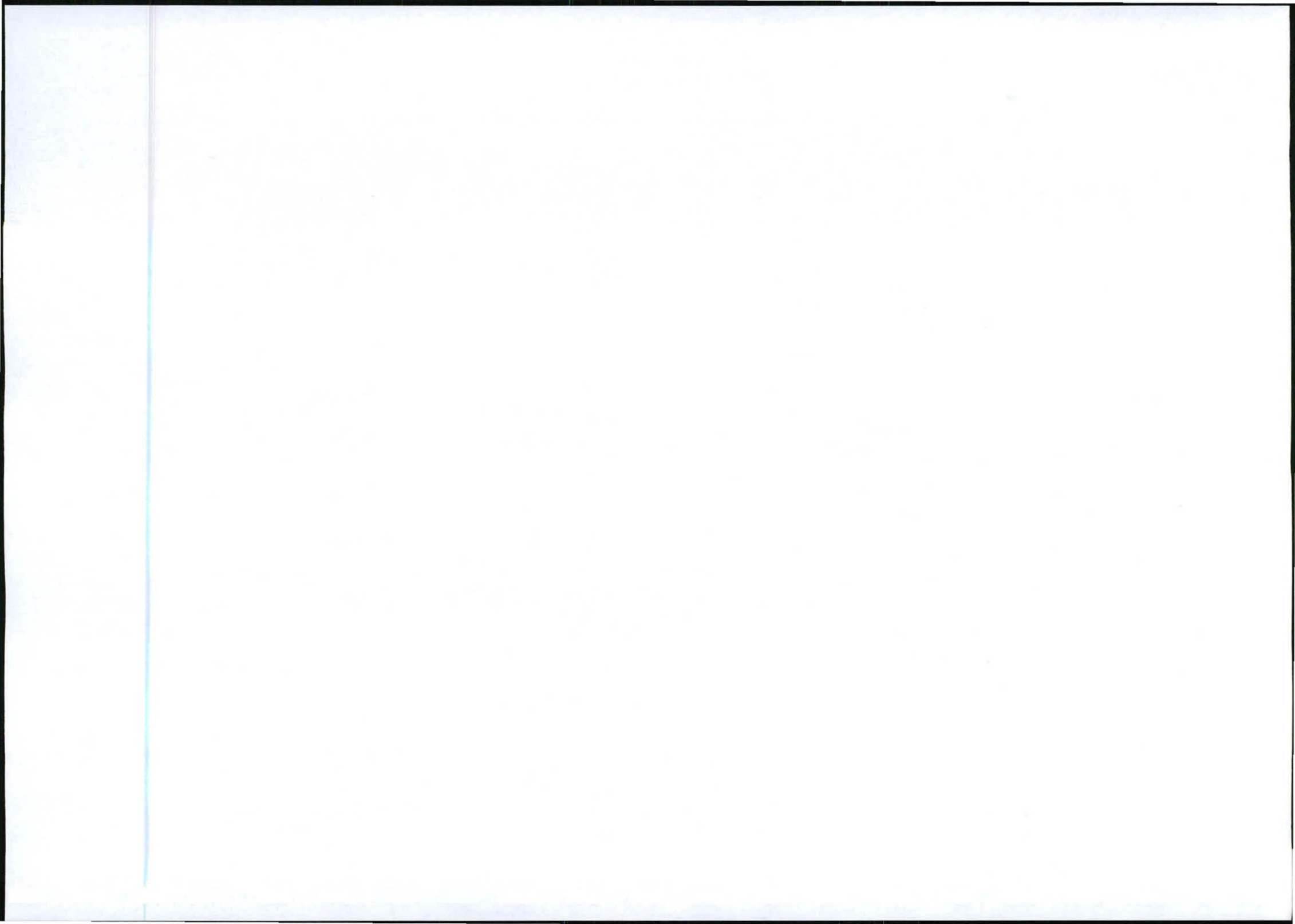
Legend

- BP 405303_BORROW_PITS_TM25HH_07DEC2009
- CONSTRUCTION OF NEW WESTBOUND CARRIAGEWAY
- REHABILITATION OF EXISTING EASTBOUND CARRIAGEWAY
- Algoa Dune Thicket
- Coastal
- Colchester Strandveld
- Grass Ridge Bontveld
- Sandy Beach
- Sundays River
- Sundays River Floodplain
- Sundays Spekboom Thicket

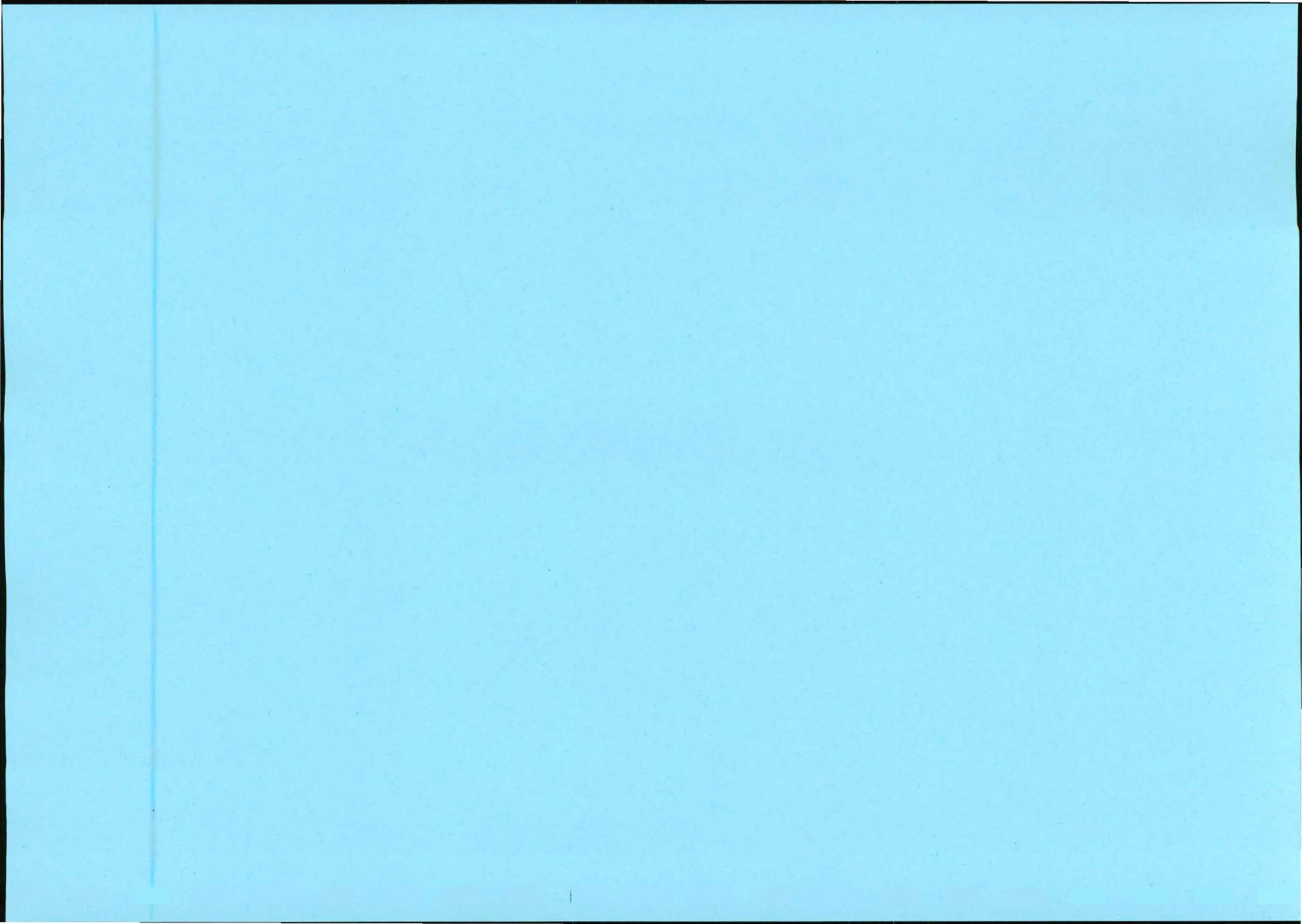
Project No:	Datum:
405303	HH94
	Projection:
	TM
	Central Meridian/Zone:
	LO25

N2 COEGA TO COLCHESTER EIA
VEGETATION

Date:	Scale:
10/12/2009	1:20,000
Compiled by:	Fig No:
VANE	012



Appendix B – Borrow Pit Layouts



Appendix C – Photographs





Figure C-1: Berm adjacent to the existing road at borrow pit 1



Figure C-2: Disturbed vegetation at borrow pit 1



Figure C-3: Recently burnt vegetation at borrow pit 1



Figure C-4: Vegetation at borrow pit 1 showing high alien infestation



Figure C-5: Vegetation at borrow pit 2



Figure C-6: Borrow pit 2



Figure C-7: Vegetated berm adjacent to the existing road at borrow pit 2



Figure C-8: Vegetated berm adjacent to the existing road at borrow pit 2



Figure C-9: Vegetation and small sand dune at borrow pit 3



Figure C-10: Open area at borrow pit 3

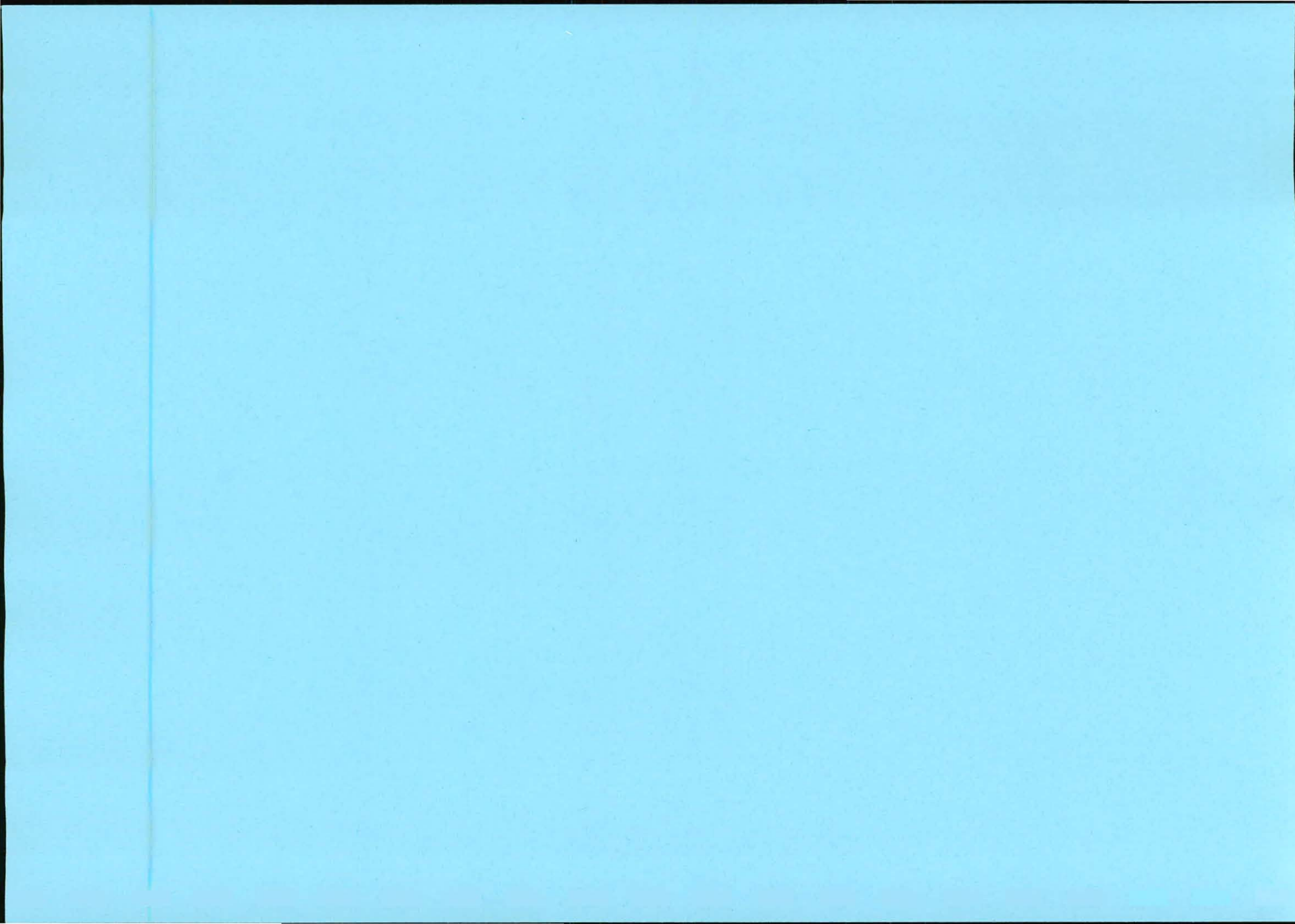


Figure C-11: Vegetation and tracks from livestock at borrow pit 4



Figure C-12: Open area at borrow pit 4

Appendix D – Proof of Landowner’s Consultation



PPC
CEMENT



Pretoria Portland Cement Company Limited
PPC Building Barlow Park Extension
180 Katherine Street Sandton Johannesburg
PO Box 787416 Sandton 2146 South Africa

Tel 00 27 (0) 11 386 9000
Fax 00 27 (0) 11 386 9001
www.ppc.co.za

Reg No 1892/000657/06

22 February 2010

Aurecon Centre,
Century Falls,
Century Boulevard,
Cape Town

Attention Ms R Du Plooy

Dear Ms Du Plooy,

**PROJECT BRA.N.002-110-2005/1 : NATIONAL ROUTE 2 SECTION 11 : COEGA TO COLCHESTER :
CONFIRMATION OF WILLINGNESS TO ENTER INTO A SERVICE LEVEL AGREEMENT**

We refer to previous communications in regard to the above.

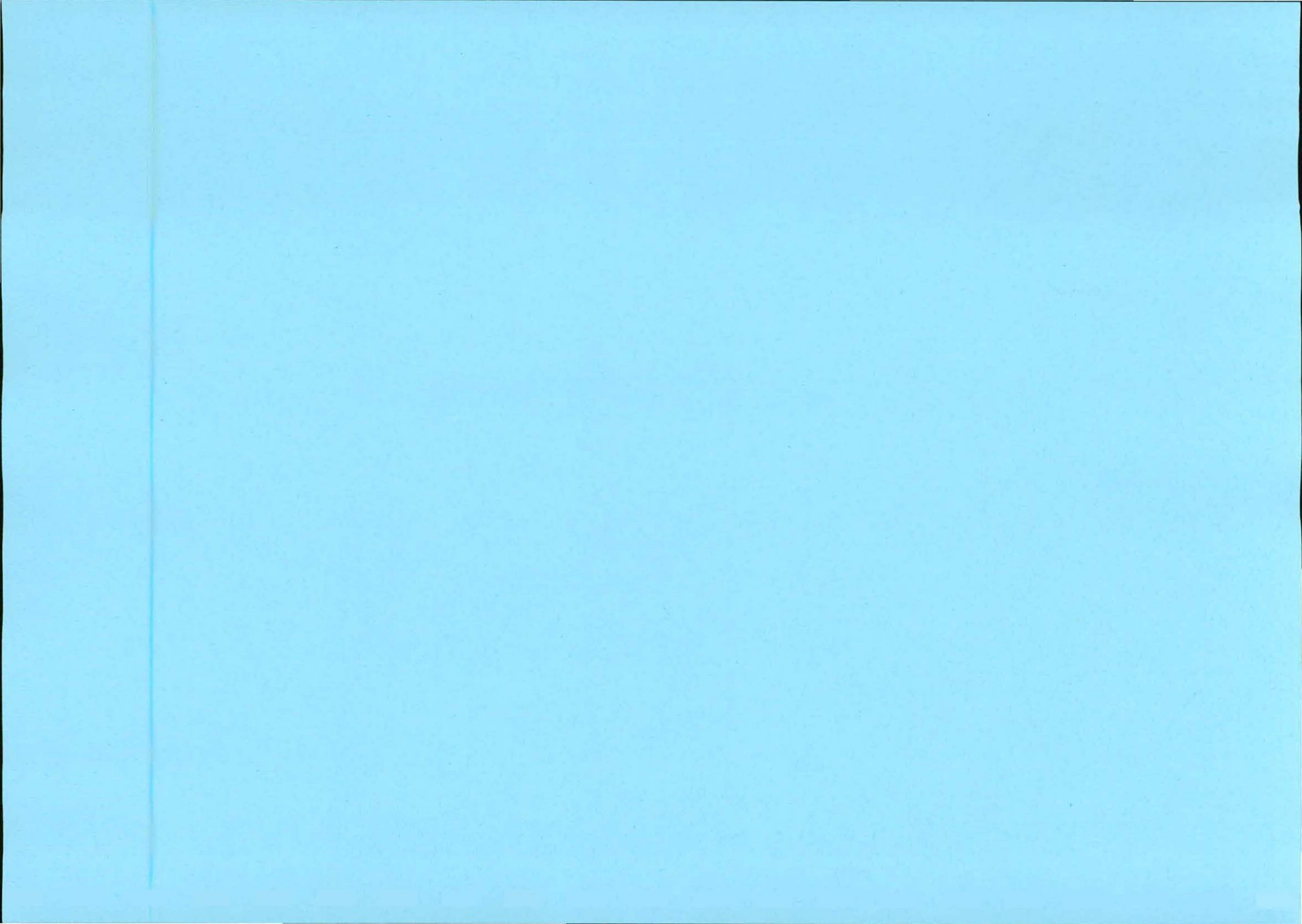
I have been instructed to confirm that PPC has no fundamental objections to the proposed borrow pits on its properties situated on the farms Melville 308 and 308/1. This is however subject to the successful conclusion of a service level agreement that adequately addresses PPC's concerns revolving around the funding for- and completion to its satisfaction of the rehabilitation of the borrow pits.

Yours faithfully

Paul Maré
General Manager
Legal Services



Appendix E – Heritage Impact Assessment Report



A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED UPGRADING OF THE N2 HIGHWAY BETWEEN COEGA AND COLCHESTER AS WELL AS THE CONSTRUCTION OF THE NEW SUNDAYS RIVER BRIDGE, AND FOUR BORROW PITS, NELSON MANDELA METROPOLITAN MUNICIPALITY, PORT ELIZABETH, EASTERN CAPE PROVINCE

Prepared for: SRK Consulting
P.O. Box 21842
Port Elizabeth
6000
Tel: 041 509 4800
Fax: 041 509 4850
Contact person: Karissa Nel
Email: KNel@srk.co.za

Compiled by: Dr Johan Binneman and Ms Celeste Booth
Contact person: Ms Celeste Booth
Department of Archaeology
Albany Museum
Somerset Street
Grahamstown
6139
Tel: (046) 622 2312
Fax: (046) 622 2398
J.Binneman@ru.ac.za
celeste.booth@ru.ac.za

January 2010

TABLE OF CONTENTS

EXECUTIVE SUMMARY..... 2
PROJECT INFORMATION 3
BRIEF ARCHAEOLOGICAL BACKGROUND 4
DESCRIPTION OF THE PROPERTY..... 7
ARCHAEOLOGICAL INVESTIGATION 7
RECOMMENDATIONS 14
GENERAL REMARKS AND CONDITIONS 15
APPENDIX 1 16
MAPS 17

A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED UPGRADING OF THE N2 HIGHWAY BETWEEN COEGA AND COLCHESTER AS WELL AS THE CONSTRUCTION OF THE NEW SUNDAYS RIVER BRIDGE, AND FOUR BORROW PITS, NELSON MANDELA METROPOLITAN MUNICIPALITY, PORT ELIZABETH, EASTERN CAPE PROVINCE

Dr Johan Binneman and Ms Celeste Booth*
 Contact person: Ms Celeste Booth
 Department of Archaeology
 Albany Museum
 Somerset Street
 Grahamstown
 6139
 Tel: (046) 622 2312
 Fax: (046) 622 2398
 J.Binneman@ru.ac.za
 celeste.booth@ru.ac.za

Note: This report follows the minimum standard guidelines required by the South African Heritage Resources Agency (SAHRA) for compiling a Phase 1 Archaeological Impact Assessment (AIA).

EXECUTIVE SUMMARY

Purpose of the Study

The purpose of the study was to conduct a phase 1 archaeological impact assessment (AIA) for the proposed upgrading of the N2 highway situated between Coega and Colchester, as well as the construction of the new Sundays River Bridge, and 4 borrow pits, Nelson Mandela Bay Municipality, Port Elizabeth, Eastern Cape Province.

Brief Summary of Findings

The area proposed for the upgrading of the N2 highway between Coega and Colchester as well as the construction of the new Sundays River Bridge lies on the southern side of the existing N2 highway and is approximately 12.5 km in extent. In addition, four borrow pits are also proposed along the southern side parallel to the existing N2 highway (see Maps 1 and 2), these borrow pits will provide the material required for the road upgrade and the construction of the new Sundays River Bridge. Most of the proposed area, 20 m parallel along the existing N2 highway, has been heavily disturbed by footpaths; the construction of a fence that stretches for the extent of the proposed area surveyed, and the construction of road signs, underground drain, sewage and water pipes. This area has also previously been bulldozed and disturbed by routine road maintenance activities. Moving closer to the town of Colchester the area is more developed with houses, a petrol station and a

shopping centre. In other areas, vegetation cover such as grass and low bushes is dense and impenetrable.

No archaeological remains were documented and no archaeological sites were observed along the route surveyed. It is highly unlikely that there would be any archaeological sites and materials present. The proposed area for development is rated as having low local cultural significance. Development may proceed as planned.

Recommendations

The area is of a low cultural sensitivity and development may proceed as planned, although the following recommendation must be considered:

1. The extent of the area proposed for the upgrade of the N2 highway, construction of the new Sundays River Bridge and the four proposed borrow pits has been highly disturbed, therefore, it is unlikely that any archaeological sites/remains, and human remains would be uncovered during construction. However, if concentrations of archaeological heritage material and human remains are uncovered during construction, all work must immediately cease and be reported to the Albany Museum and/or the South African Heritage Resources Agency (SAHRA) so that systematic and professional investigation/excavation can be undertaken.

PROJECT INFORMATION

The phase 1 archaeological impact assessment (AIA) is a section of the required environmental impact assessment (EIA) study.

The proposed upgrading of the N2 between Colchester and Coega as well as the construction of the new Sundays River Bridge will greatly improve the quality of the road. The proposed four borrow pits will provide the material required for the upgrading of the road and the construction of the new Sundays River Bridge.

Developer:

The South African National Roads Agency Ltd (SANRAL)
 P.O.Box 27230
 Greenacres
 6057
 Tel: 041 398 3200
 Fax: 041 398 3222

Consultant:

SRK Consulting
 P.O. Box 21842
 Port Elizabeth
 6000
 Tel: 041 509 4800
 Fax: 041 509 4850
 Email: KNel@srk.co.za
 Contact person: Karissa Nel

Terms of Reference

To conduct a survey of possible archaeological heritage sites and remains within the area of the proposed upgrading of the N2 highway between Coega and Colchester as well as the construction of the new Sundays River Bridge, and four borrow pits, Nelson Mandela Metropolitan Municipality, Port Elizabeth, Eastern Cape Province. The survey was conducted to establish the range and importance of the exposed and *in situ* archaeological heritage features, the potential impact of the development and, to make recommendations to minimize possible damage to these sites.

Legislative requirements

Parts of section 35(4) of the National Heritage Resources Act 25 of 1999 apply:

35 (4) *No person may, without a permit issued by the responsible heritage resources authority—*

(a) *destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;*

(b) *destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;*

(d) *bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.*

BRIEF ARCHAEOLOGICAL BACKGROUND

Literature review

Early Stone Age (ESA) (approximately 250 000 - 1 million years old) stone tools are found throughout the area. Large handaxes were reported from Coega Kop and were also collected from the banks and gravels of the Coega River and between the N2 national road and the Cerebos salt works (Albany Museum collections). One of South Africa's most important Earlier Stone Age finds and excavations (Deacon 1970) was conducted a few kilometres west of the surveyed area, at Amanzi Springs. In a series of spring deposits a large number of stone tools were found *in situ* to a depth of 3-4 metres. Wood and seed material preserved in the spring deposits, possibly dating to between 250 000 to 800 000 years old.

Middle Stone Age (MSA) (125 000 - 30 000 years ago) and Later Stone Age (LSA) (30 000 years ago to historical times) stone tools are also found in the gravels and along the banks of the Coega River. These stone artefacts, like the Earlier Stone Age handaxes are in secondary context with no other associated archaeological material.

Occurrences of fossil bone remains and Middle Stone Age stone tools were also reported south of Coega Kop (Gess 1969). During excavations the remains were found in the surface limestone, but the bulk of the bone remains were found some 1-1,5

metres below the surface. The excavations exposed a large number and variety of bones, teeth and horn corns strongly suggesting that they were deposited there by humans. The bone remains included warthog, leopard, hyena, rhinoceros and ten different antelope species. A radiocarbon date of greater than 37 000 years was obtained for the site.

Shell middens and the remains of at least 12 clay pots were reported by Rudner (1968) west of the Coega River Mouth. A large number of shell middens were also situated east of Coega River Mouth. Several of the middens were sampled and excavated just before the harbour was constructed. Many middens, ceramic pot sherds (from Later Stone Age Khoekoen pastoralist origin - last 2 000 years) and other archaeological material, are situated between the Coega and Sunday's River Mouths. These remains date mainly of Holocene Later Stone Age (last 8 000 years). Human remains have also been found in the dunes along the coast.

Two well eroded fragments of Willow pattern porcelain fragments were recovered from near the Coega River Mouth (before the harbour was constructed), which may have washed-up from a nearby nineteenth century shipwreck. Bennie (2002) has reported on several ships that floundered between the mouth of the Coega and Zwartkops River, between 1817 and 1880. There is also evidence of wreck material just off the Island of Jahleel.

The Coega (or Koega) River was first mentioned by historical travellers in 1752 (Theal 1896). The name Coega is of Khoekhoen origin and means literally 'seacow' or hippopotamus (Nienaber & Raper 1977). In November 1776, Anders Sparrman (1785) found a community of Cochoqua Khoekhoen (remnants of the Cochoqua who had fled the Cape after their defeat in the second Khoekhoen-Dutch War one hundred years previously), living on the Coega River. They were caring for the stock of a Dutch burgher. Nearby was a group of Gonaqua Khoekhoen, led by a captain named Tadi, who were also tending to the stock of a Dutch farmer. The nearby Coega Kop is shown on maps dating back to 1834 (Port Elizabeth Museum) and is reported to have been used as a navigation beacon by sailing ships wishing to enter Port Elizabeth harbour in the past. The 'kop' which has been quarried since the 1920s by SA Railways and Harbours for the development of the Port Elizabeth Harbour (Skead 1993) is likely to disappear soon with intensive quarrying.

The salt pan behind Coega Kop (not the present locality of the salt works at the river estuary) was being mined for its salt as early as 1820. However, this salt pan is likely to have been destroyed with developments in the area. A map of 1851 which indicated that the original road between Port Elizabeth and Grahamstown closely followed the present National road across the Coega River, also revealed the presence of a 'Junction Post' on the crossing. While Coetzee's (1995) definitive book on the forts of the Eastern Cape failed to indicate the presence of this military post, it is likely to represent one of Cradock/Somerset's temporary earthen fortifications established between 1812 and 1819 to protect the eastern frontier. This post, in all likelihood, no longer exists.

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Previous investigations

Several archaeological investigations were conducted in the general vicinity, near or on the property. During the 1990s several investigations were conducted along the coast and adjacent inland areas (Binneman 1994; Binneman and Webley 1996, 1997). In 1996 all important archaeological features east of the Coega River Mouth were removed by systematic excavations. Recently more investigations were conducted along the coast and shifting dune system (Kaplan 2007; Webley 2007).

Museum/University databases and collections

The Albany Museum in Grahamstown houses collections and information from the region.

Relevant impact assessments

- Binneman, J. 1999. *Coega Industrial Development Zone: cultural sensitivity Phase 2 Report*. Report prepared for Coega IDZ. Albany Museum Grahamstown.
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DESCRIPTION OF THE PROPERTY

Area surveyed

Location data

The area for the proposed upgrading of the N2 is situated south and parallel to the existing N2 highway between Coega and Colchester, approximately 12.5 km in extent (see Maps 1 and 2). The existing N2 highway lies between 3 km and 5 km from the coast and is therefore within the sensitive coastal archaeology area. The construction of the new Sundays River Bridge is also a part of the upgrade of the N2 highway. The proposed four borrow pits (see Maps 1 and 2) will provide the materials for the upgrade of the N2 highway and the construction of the new Sunday River Bridge. Various GPS readings were taken using a Garmin Plus II (see Methodology below).

Map

1:50 000 - 3325DA Addo, 3325DB Colchester and 3325CD & 3425AB Uitenhage

ARCHAEOLOGICAL INVESTIGATION

Methodology

The survey was conducted by two people, simultaneously from a vehicle and on foot. The existing N2 highway was followed and spot checks were conducted every few metres for the proposed area of upgrade of the road. The Sundays River area and nearby dunes were investigated for any signs of freshwater and marine shellfish middens. The areas proposed for the four borrow pits were individually surveyed and photographed.

Firstly, the areas for the four proposed borrow pits will be described; they form part of the proposed upgrade of the N2 highway between Coega and Colchester. Secondly, various GPS points were taken they have been plotted on Map 2 and each surrounding area will be described.

PROPOSED BORROW PIT 1(BP 1): 33° 44' 11.88"S; 24° 44' 41.52"E

The area proposed for BP 1 is situated on the farm Melville 308, slightly south and running parallel to the existing N2 highway. A farm entrance road turning south off the existing N2 highway separates BP 1 and BP 2. BP 1 is situated on the western side of this farm entrance road and will about 400 m in extent. The area is covered by low grass vegetation and low shrubs, calcretes are exposed in places. The area has been disturbed by the construction of the fence that extends about 20 m to the south of the N2 highway and runs parallel to the road for the extent of the proposed area for upgrade; road signs and accident protection barricades; and the construction of the farm road (Figs 1-2).

The area was investigated for possible archaeological remains and sites. No archaeological remains or sites were observed within the area proposed for BP 1.



Fig. 1. Western area proposed for BP 1. Low grass and shrub cover and exposed calcrete.

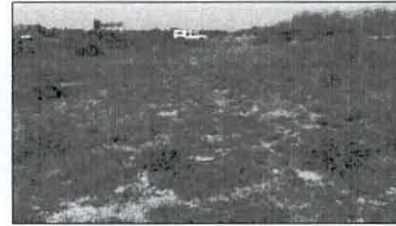


Fig. 2. Eastern area proposed for BP 1. Road signs, the fence and the farm road is visible.

PROPOSED BORROW PIT 2 (BP 2): 33° 44'9.9"S; 25° 44'46.68E

The area proposed for BP 2 is situated a few metres on the eastern side of the farm entrance road on the farm Melville 308. The area is situated adjacent to the existing N2 highway and the extent of BP 2 is approximately 600 m. The area has been disturbed by the construction of road signs and the farm boundary fence. Pieces of old tar road and piles of calcrete have been dumped in the area, most probably during road routine maintenance having been carried out in the area. The area is covered by low grass vegetation and low bushes and trees (Figs 3-4).

The area was investigated for possible archaeological remains and sites. No archaeological remains or sites were observed within the area proposed for BP 2.

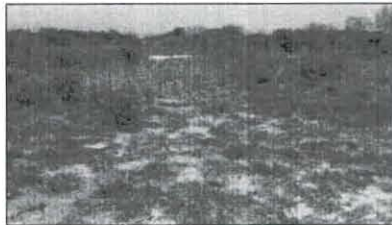


Fig. 3. Low grass and bush cover.



Fig. 4. Piles of calcrete and pieces of old tar road.

PROPOSED BORROW PIT 3 (BP 3): 33° 43'3.66"S; 25° 46'58.2"E

The area proposed for BP 3 is situated on the farm The Downs 308/1 adjacent to the existing N2 highway and will be approximately 300 m in extent running parallel to the N2 highway. The area comprised mainly of dense thicket vegetation and archaeological visibility was low owing to the vegetation being impenetrable. However, it is unlikely that any archaeological remains will be uncovered during construction. The area has previously been disturbed due to the construction of the

accident prevention barricade and the construction of the existing N2 highway. A small cross was observed during the survey, situated next to the road within the area proposed for BP 3, most probably in memory of a person who may have been killed in an accident within the area. The dates 13.10.1982-30.12.2007 were inscribed on the cross, however, no name could be observed. It is unsure how regularly the 'cross' is visited; although some grave goods have previously been placed in front of the cross (Figs 5-6).

The area was investigated for possible archaeological remains and sites. No archaeological remains or sites were observed within the area proposed for BP 3.



Fig. 5. Dense thicket vegetation cover and the accident prevention barricade facing to the west.



Fig. 6. The cross situated within the proposed BP 3 area.

PROPOSED BORROW PIT 4 (BP 4): 33° 42'54.72"S; 25° 47'14.40"E

The area proposed for BP 4 is situated on the farm The Downs 308/1 and 308/4 adjacent to the existing N2 highway and will be approximately 300 m running parallel to the existing N2 highway. The area is covered by dense thicket vegetation making archaeological visibility difficult. An area 10 x 10 m seems to have been cleared and may be part of a test pit. The area has previously been disturbed by the construction of the existing N2 (Figs 7-8).

The area was investigated for possible archaeological remains and sites. No archaeological remains or sites were observed within the area proposed for BP 3.



Fig. 7. Area cleared for a possible test pit.



Fig. 8. Dense thicket vegetation cover facing towards the east.

GPS 1: 33° 44' 55.62"S; 25° 42' 58.02"E

The contract for the upgrade of the N2 highway begins 2 km within the Coega IDZ Boundary along the recently constructed dual roadway. The area is covered by open low grass cover and is disturbed owing to area having previously been cleared for the construction of the new dual roadway leading into the Coega IDZ and Port Elizabeth (Figs 9-10).

The area was investigated for possible archaeological remains and sites, but none were observed within the area surveyed.

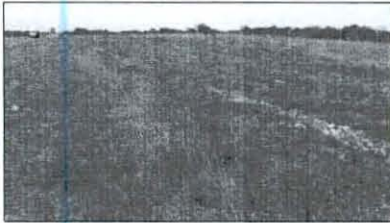


Fig. 9. Area cleared for roadworks, facing east.

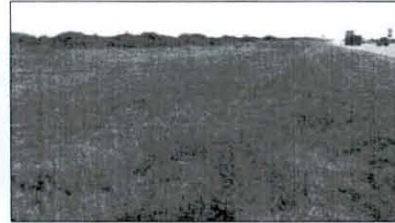


Fig. 10. Area cleared for roadworks, facing west.

GPS 2: 33° 43' 31.14"S; 25° 46' 12.66"E

An exposed calcrete area has been heavily disturbed by bulldozing and has possibly been used as a dumping area for roadworks (Figs 11-12). Some of calcrete area seems to have been tarred. The exposed area was investigated for possibly archaeological remains, however, none were observed. Calcretes occasionally contain concentrations of stone tools and fossilized bone. The developer must be aware of this situation and if, during developed, concentrations of stone tools and fossilized bones are uncovered, this must be reported to the South African Heritage Agency (SAHRA) and work must immediately cease.



Fig. 11. Exposed calcrete area south of the existing N2 highway.

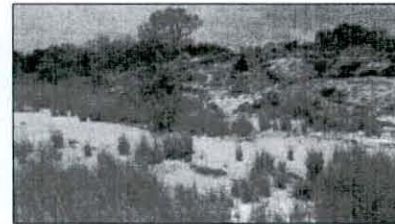


Fig. 12. Area has been disturbed by bulldozing and used as a dumping are for roadworks.

GPS 3: 33° 42' 37.92"S; 25° 47' 40.32"E

A mobile dune area lies about 10 m south of the existing N2 highway directly west and next to the Sundays River Bridge. A fence demarcates the boundary of the dune and the area proposed for the upgrading of the N2 highway and construction of the new Sundays River Bridge (Figs 13-14). The dune area was investigated for possible archaeological remains, sites and shell middens. The river bank area was investigated for any possible freshwater shell middens. The area between the existing N2 highway and the fence has in the past been disturbed by construction of the accident prevention barricade and road signs.

The area was investigated for possible archaeological remains and sites, but none were observed within the area surveyed.



Fig. 13. Eastern view of the mobile dune area west of the Sundays River Bridge.



Fig. 14. Area disturbed by erection of the fence and construction of the barricade and road signs.

GPS 4: 33° 42' 29.52"S; 25° 47' 54.18"E

The area is covered by dense thicket vegetation. Sand dunes can be observed in the distance approximately 300 m from the existing N2 highway. A suburban area is situated between the existing N2 highway and the sand dunes. The area has been disturbed by the construction of the existing N2 highway and a bridge that crosses the existing N2 highway (Figs 15-16).

The area was investigated for possible archaeological remains and sites, but none were observed within the area surveyed.



Fig. 15. Dense vegetation facing west.



Fig. 16. Distance of the dunes and the position of the suburban area from the existing N2 highway. The bridge crossing over the N2 highway is also visible.

GPS 5: 33° 42' 14.10S; 25° 48' 12.78E

The area is covered by dense thicket vegetation making archaeological visibility difficult. However, it is unlikely that archaeological remains will be found *in situ* within the area owing to disturbance caused by the construction of the existing N2 highway. The suburban area of Cannonville situated about 100 m from the existing N2 highway (Figs 17-18).

The area was investigated for possible archaeological remains and sites, but none were observed within the area surveyed.

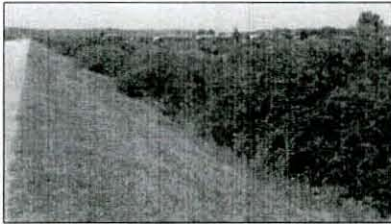


Fig. 17. View of proposed area facing east.

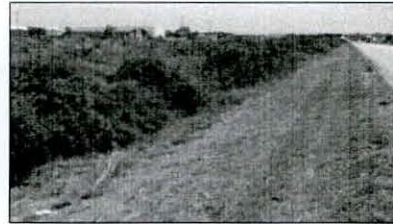


Fig. 18. View of proposed area facing west.

GPS 6: 33° 41' 51.48"S; 25° 48' 37.92"E

The area marks the Cannonville intersection with the Cannonville road leading south from the existing N2 highway. The area is relatively open low grass vegetation next to the roads becoming more densely thicket vegetation the further from the road. The area proposed for the N2 upgrade has been disturbed by the construction of the existing roads, fences, road signs and footpaths (Figs 19-20).

The area was investigated for possible archaeological remains and sites, but none were observed within the area surveyed.

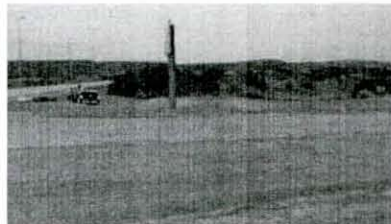


Fig. 19. The Cannonville road leading south off the existing N2 highway facing east.



Fig. 20. Low grass and dense thicket vegetation facing west.

GPS 7: 33° 41' 51.48"S; 25° 49' 24.54"E

The proposed area for the N2 road upgrade has been heavily disturbed by the construction of the existing N2 highway, bus stop and the erection of the chevron sign poles and a fence 20 m south of the existing N2 highway. The proposed area is covered in low grass vegetation. The area 50-100 m south of the existing N2 highway is the developed suburban area of Colchester.

The area was investigated for possible archaeological remains and sites, but none were observed within the area surveyed.



Fig. 21. View of the bus stop, chevron sign poles and Colchester facing east.



Fig. 22. View of the low grass vegetation and lamp poles facing west.

GPS 8: 33° 41' 25.98"S; 25° 49' 35.10"E

The end of the contract for the proposed N2 road upgrade finishes at the Colchester Petrol Station. The area between the bus stop and the petrol station has been heavily disturbed by the construction of the petrol station and a shopping centre. Lamp poles and chevron sign poles have also been erected (Figs 23-24).

The area was investigated for possible archaeological remains and sites, but none were observed within the area surveyed.



Fig. 23-24. View of the petrol station, lamp posts and chevron sign posts facing west.



RECOMMENDATIONS

The area has been rated as having low local cultural significance, although the following recommendations must be considered:

1. In the unlikely event that any concentrations of archaeological material are exposed during construction, all work in that area should stop and it should be reported immediately to the nearest museum/archaeologist or to the South African Heritage Resources Agency so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to remove/collect such material (See appendix 1 for a list of possible archaeological sites that maybe found in the area).
2. Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.

GENERAL REMARKS AND CONDITIONS

Note: This report is a phase 1 archaeological heritage impact assessment/investigation only and does not include or exempt other required heritage impact assessments (see below).

The National Heritage Resources Act (Act No. 25 of 1999, section 35) requires a full Heritage Impact Assessment (HIA) in order that all heritage resources, that is, all places or objects of aesthetics, architectural, historic, scientific, social, spiritual linguistic or technological value or significance are protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60 years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects.

It must be emphasized that the conclusions and recommendations expressed in this archaeological heritage sensitivity investigation are based on the visibility of archaeological sites/features and may not therefore, reflect the true state of affairs. Many sites/features may be covered by soil and vegetation and will only be located once this has been removed. In the event of such finds being uncovered, (such as during any phase of construction work), archaeologists must be informed immediately so that they can investigate the importance of the sites and excavate or collect material before it is destroyed. The onus is on the developer to ensure that this agreement is honoured in accordance with the National Heritage Act No. 25 of 1999.

It must also be clear that Archaeological Specialist Reports (ASRs) will be assessed by the relevant heritage resources authority. The final decision rests with the heritage resources authority, which should grant a permit or a formal letter of permission for the destruction of any cultural sites.

APPENDIX 1: IDENTIFICATION OF ARCHAEOLOGICAL FEATURES AND MATERIAL FROM INLAND AREAS: guidelines and procedures for developers

1. Human skeletal material

Human remains, whether the complete remains of an individual buried during the past, or scattered human remains resulting from disturbance of the grave, should be reported. In general the remains are buried in a flexed position on their sides, but are also found buried in a sitting position with a flat stone capping and developers are requested to be on the alert for this.

2. Freshwater mussel middens

Freshwater mussels are found in the muddy banks of rivers and streams and were collected by people in the past as a food resource. Freshwater mussel shell middens are accumulations of mussel shell and are usually found close to rivers and streams. These shell middens frequently contain stone tools, pottery, bone, and occasionally human remains. Shell middens may be of various sizes and depths, but an accumulation which exceeds 1 m² in extent, should be reported to an archaeologist.

3. Fossil bone

Fossil bones or any other concentrations of bones, whether fossilized or not, should be reported.

4. Stone artefacts

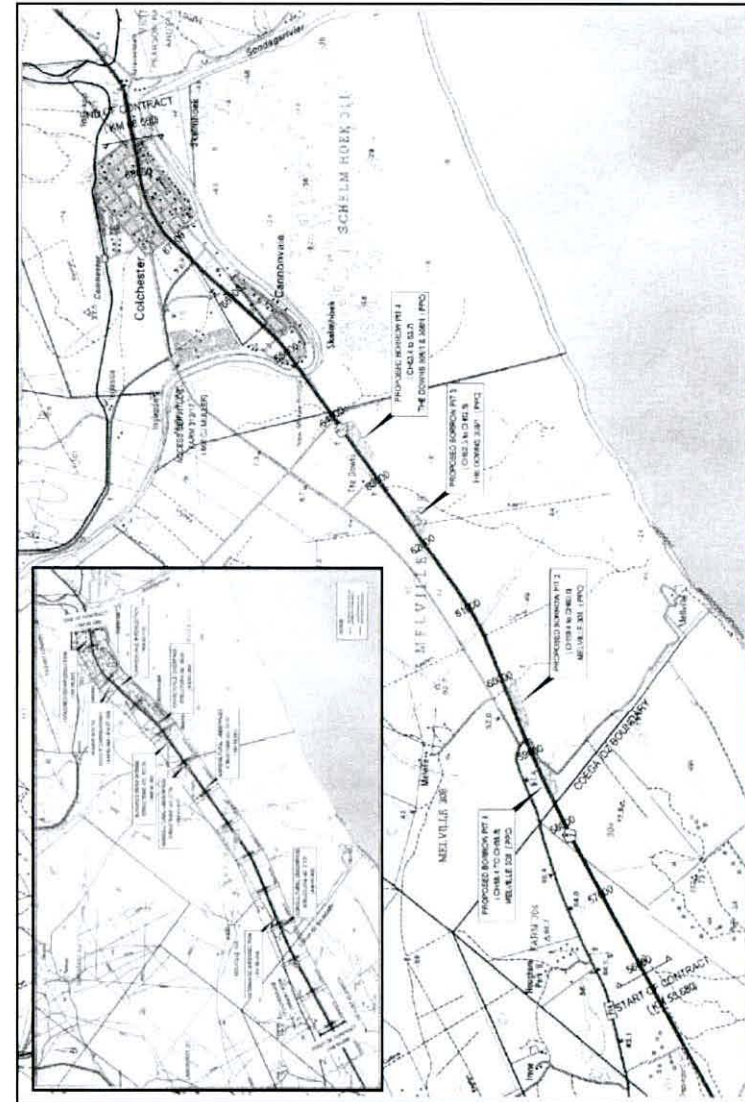
These are difficult for the layman to identify. However, large accumulations of flaked stones which do not appear to have been distributed naturally should be reported. If the stone tools are associated with bone remains, development should be halted immediately and archaeologists notified.

5. Stone features and platforms

They come in different forms and sizes, but are easy to identify. The most common are an accumulation of roughly circular fire cracked stones tightly spaced and filled in with charcoal and marine shell. They are usually 1-2 metres in diameter and may represent cooking platforms. Others may resemble circular single row cobble stone markers. These are different sizes and may be the remains of wind breaks or cooking shelters.

6. Historical artefacts or features

These are easy to identified and include foundations of buildings or other construction features and items from domestic and military activities.

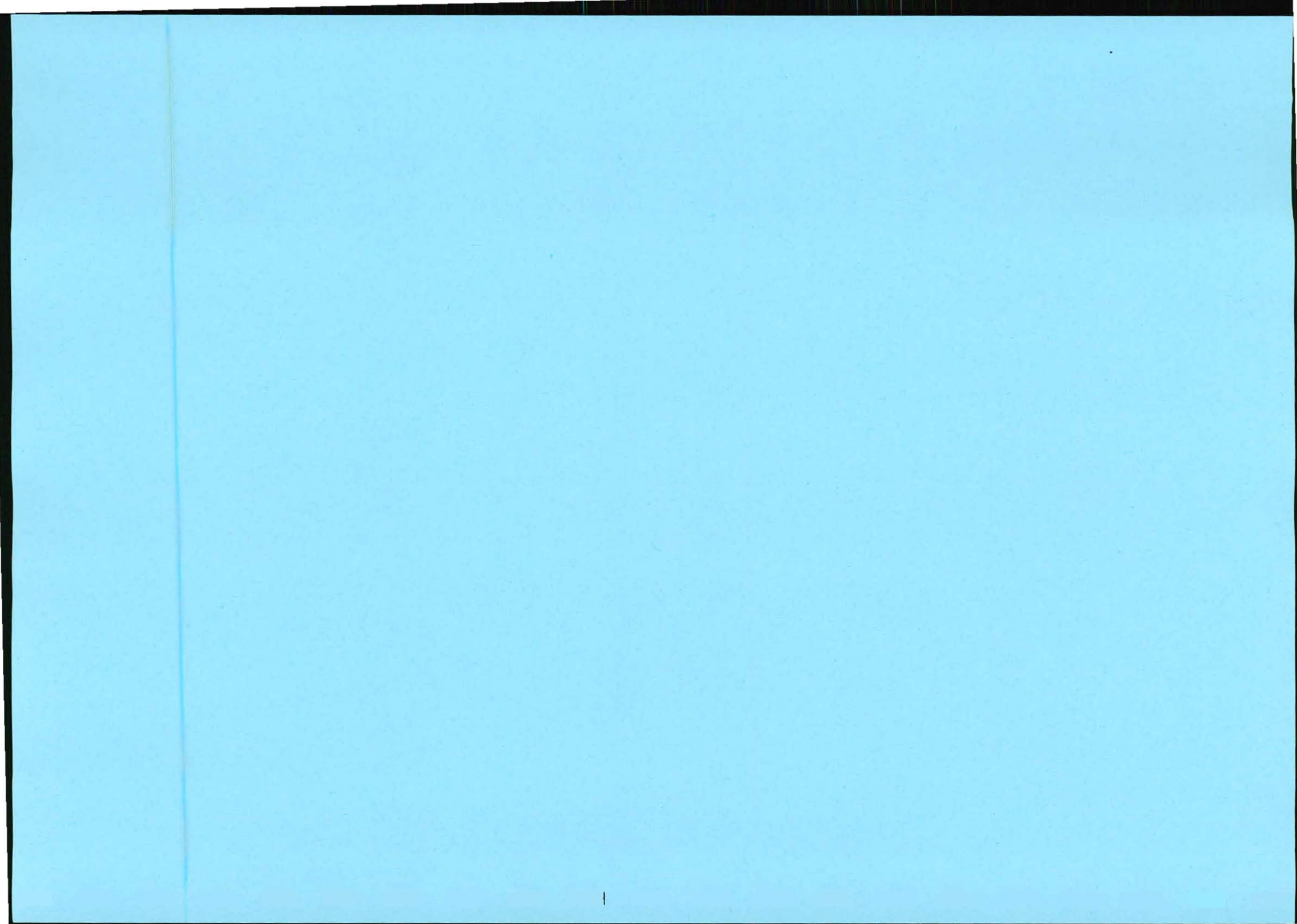


Map 1. 1:50 000 maps indicating the extent of the proposed upgrade of the N2 road and the four proposed borrow pits (maps courtesy of SRK Consulting)



Map 2. Aerial view of the proposed area for the N2 road upgrade and the four proposed borrow pits, GPS plotted.

Appendix F – Vegetation Impact Assessment Report



**Vegetation Investigation for proposed
Coega - Colchester N2 road upgrade**

Client

SRK Consulting
Port Elizabeth
Project Ref: 405303



Author

Jamie Pote
Postnet Suite 177, Private bag X0002,
The Fig Tree, Port Elizabeth, 6033
Email: jamiepote@aerosat.co.za
Cell: 083 743 9353, Fax: 0866 503 506

25 January 2010

Indemnity and conditions relating to this project

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and the author reserves the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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Author

The author (Mr. Jamie Pote) has a BSc honours degree in Botany and Environmental Science, specialising in Ecology, Rehabilitation and Invasive Alien Plant management with 3 years part-time and 5 years full-time experience in southern Africa across a broad spectrum of habitats and operations (mining, residential and resort developments, conservation projects, service provision including power-lines, roads and pipelines), conducting Biophysical Assessments and compiling Environmental Management Plans.

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Limitations of the study

- Botanical surveys based upon a limited sampling time period, may not reflect the actual species composition of the site due to seasonal variations in flowering times.

Definitions and terminology used in this report:

- **Annual:** Completing the cycle from seed to death in one year or season.
- **Biennial:** Completing the cycle from seed to death in two years or seasons.
- **Boundary:** Landscape patches have a boundary between them which can be defined or fuzzy (Sanderson and Harris 2000). The zone composed of the edges of adjacent ecosystems is the boundary.
- **Composition:** refers to the number of patch types (see below) represented on a landscape, and their relative abundance.
- **Connectivity:** relates to how intact patches of indigenous vegetation are (i.e. it is the opposite of fragmentation).
- **Corridors:** have important functions as strips of a particular type of landscape differing from adjacent land on both sides. habitat, ecosystems or undeveloped areas that physically connect habitat patches. Smaller, intervening patches of surviving habitat can also serve as "stepping stones" that link fragmented ecosystems by ensuring that certain ecological processes are maintained within and between groups of habitat fragments.
- **Disturbance:** an event that significantly alters the pattern of variation in the structure or function of a system, while fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. Disturbance is generally considered a natural process.
- **ECO/ESO:** Environmental Site/Control Officer – person responsible for the Day-to-Day Environmental Management on-site during construction.
- **Ecotone:** the transitional zone between two communities
- **Edge:** the portion of an ecosystem near its perimeter, where influences of the adjacent patches can cause an environmental difference between the interior of the patch and its edge. **Emergent trees:** Trees that grow above the top of the canopy
- **Endemic:** a plant or animal species, or a vegetation type, which is naturally restricted to a particular defined region. It is often confused with indigenous, which means 'native, occurring naturally in a defined area'.
- **Exotic:** Non-indigenous; introduced from elsewhere, may also be a *weed* or *invasive* species.
- **Fragmentation:** causes land transformation, an important current process in landscapes as more and more development occurs.
- **Function:** refers to how each element in the landscape interacts based on its life cycle events.
- **Habitat:** the home of a plant or animal species. Generally those features of an area inhabited by animal or plant which are essential to its survival.
- **Heterogeneity:** A landscape with structure and pattern implies that it has spatial heterogeneity or the uneven, non-random distribution of objects across the landscape.
- **Indigenous:** Native; naturally occurring.
- **Invasive:** a non-indigenous plant or animal species that adversely affect the habitats it invades economically, environmentally or ecologically.
- **Matrix:** the "background ecological system" of a landscape with a high degree of connectivity.
- include assigning stewardship or protected area status to remaining conservation-worthy land or making a financial bequest for purposes of biodiversity conservation.
- **Patch:** a term fundamental to landscape ecology, is defined as a relatively homogeneous area that differs from its surroundings.
- **Pattern:** is the term for the contents and internal order of a heterogeneous area of land.
- **Refuge:** a location of an isolated or relict population of a once widespread animal or plant species
- **Rill:** A very small stream of water
- **Riparian:** pertaining to, situated on or associated with a river bank.
- **River corridors:** River corridors perform a number of ecological functions such as modulating streamflow, storing water, removing harmful materials from water, and providing habitat for aquatic and terrestrial plants and animals. These corridors also have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species densities, and rates of biological productivity than most other landscape elements. Rivers provide for migration and exchange between inland and coastal biotas.
- **Shrub:** A woody plant that produces no trunk but branches from the base.
- **Under-story:** the area of a forest which grows in the shade of the canopy.
- **Structure:** is determined by the composition, the configuration, and the proportion of different patches across the landscape.
- **Transformation** in ecology, transformation refers to adverse changes to biodiversity, typically habitats or ecosystems, through processes such as cultivation, forestry, drainage of wetlands, urban development or invasion by alien plants or animals. Transformation results in habitat fragmentation - the breaking up of a continuous habitat, ecosystem, or land-use type into smaller fragments.
- **Tributary/Drainage line:** A small stream or river flowing into a larger one.
- **Weed:** an indigenous or non-indigenous plant that grows and reproduces aggressively, usually a ruderal pioneer of disturbed areas. Weeds may be unwanted because they are unsightly, or they limit the growth of other plants by blocking light or using up nutrients from the soil. They also can harbour and spread plant pathogens.

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1 Background

Jamie Pote was sub-contracted by SRK Consulting to undertake a botanical investigation to identify and compile a list of Species of Special Concern and provide vegetation management recommendations for borrow pits and sensitive dune vegetation during January 2010.

2 Terms of Reference

The TOR for this botanical investigation studies are to:

1. Conduct a site visit will be along the proposed road route: Coega to Colchester;
2. Compile list of Species of Special Concern, including GPS coordinates (to be provided as shapefile);
3. Compile short mitigation report for Species of Special Concern and sensitive areas.
4. Recommended dune vegetation management plan for sensitive Dune areas west of the Sundays River;
5. Compile Vegetation management recommendation report for borrow pits, including pre-mining recommendations, plant rescue and post-mining rehabilitation plan for inclusion into EMP.
6. Recommend appropriate mitigatory measures, if applicable, to reduce the impact of the proposed activities upon the protected flora of the area and provide relevant input for EMP.
7. Identify any gaps in knowledge that can be translated to so called 'red-flags' or risks for the development if necessary and identify potential additional study requirements if necessary (i.e. mobile dune system in close proximity).

3 Protection status and legislation and Species of Special Concern

3.1 Indigenous flora

All plant species were identified, where possible, to species level. Initial investigations indicate that a number of indigenous species having protection status under the various relevant legislations occur (Table 3.1).

3.2 Flora relocation and management plan

The vegetation of the proposed road and associated borrow pits has been transformed by historical agricultural practices, roads servitude clearing and mining activities. These activities appear to have included vegetation clearing and livestock grazing. The remnants of the original vegetation present along the edge of the proposed site has been severely degraded, and is not expected to be ecologically functional. The road servitude is in general flat with dunes present towards the eastern extent and due to historical clearing species of special concern are present, but scarce. Maps and photos of site in Appendix 1 and 2.

Plant species identified for which permits will be required in terms of the Provincial Nature Conservation Ordinance No. 19 of 1974 (PNCO), the National Forests Act of 1998 (NFA), and those classified as threatened or near threatened according to IUCN 2002 (Golding, 2002) are listed in Table 1. Protected species will be removed from the designated construction areas and relocated to designated relocation area. Plant search and rescue should be conducted within the areas where

construction/ vegetation clearing activities are to occur. Permits for the protected flora must be obtained from the respective departments timeously:

- Department of Water Affairs and Forestry (DWAF) for NFA permits: Mr Thabo Nokoyo; Department of Water Affairs and Forestry; Port Elizabeth; Tel: (041)586 4884; Fax: (041) 586 0379; Email: NokoyoT@dwaf.gov.za;
- Department of Economic Development and Environmental Affairs (DEDEA) for PNCO permits: Alan Southwood; Private Bag X5001; Greenacres; Port Elizabeth; 6057; Tel: (041) 508 5800; Fax: (041) 585 1964/585 1958; Email: alan.southwood@deae.ecape.gov.za.

3.2.1 Transplantation/relocation procedure:

- The construction footprint must be clearly demarcated (fenced) and no construction related access allowed before species of special concern have been removed;
- The EO/ECO and a suitably qualified botanist must survey the entire site for plant species of special concern and mark the ground with bio-degradable paint or with pegs for later translocation; Alternatively, *Linda Redfern (Landscape & Environmental Services)* can be contacted to remove SSC to the CDC nursery for temporary/permanent storage. A clearance certificate will be issued after clearing and the rescued material can either be utilised in other areas for rehabilitation and/or returned after construction for on-site revegetation:
 - Contact details: Linda Redfern, Landscape & Environmental Services; 19 Amsterdam Hoek, Swartkops 6210, Port Elizabeth; Tel: (041) 466 1694; Mobile: (082) 960 2099; Fax: (041) 467 2856; Email: redlin@absamail.co.za;
- The soil around the base of the plants should be loosened using a pick and spade and the plants removed making every effort to keep the root mass intact. These can be placed in sacks for transportation across the site for succulents. Tree species should be transplanted directly into bags, with every effort made to keep the root mass intact;
- The removed plants should either be stored in a temporary nursery or replanted into a designated relocation area, where similar soil conditions are present.
- Once replanted, plants should be lightly watered once a week for a month and then once every 2 weeks for 2 months thereafter or until such time as determined by the ECO/engineer that they have become established.
- Topsoil may only be removed from the construction footprint and used for rehabilitation of the site once all these species of special concern have been removed.
- A follow-up visit should be conducted by the botanist once relocation is complete to assess the success and a follow-up report submitted to DEDEA.
- Once construction has been completed and site, species suited for rehabilitation can be utilised and species of special concern replanted or left in relocation area.

Table 3.1: Species having protection status under PNCO, NFA or IUCN occurring within the site.

Botanical Name*	Status**	Family	Regional Distribution/Endemism*	Community	Distribution within the site
<i>Aloe africana</i>	PNCO	Asphodelaceae	EC endemic, widespread	Bontveld	Widespread, in thicket clumps and scattered through Bontveld
<i>Aristea anceps</i>	PNCO	Iridaceae	EC endemic, widespread	Bontveld Matrix/ Disturbed	Scattered on edge of thicket clumps and throughout Bontveld
<i>Asclepias sp.</i>	PNCO	Apocynaceae	unconfirmed	Thicket clumps	Isolated individuals
<i>Bergeranthus addoensis</i>	PNCO, IUCN (NT)	Mesembryanthemaceae	EC, Uitenhage, Endemic	Calcrete	Usually scattered in outcrops, presence not confirmed and unlikely and but possible
<i>Baophone disticha</i>	PNCO	Amaryllidaceae	Southern Africa, East Africa	All	Widespread and somewhat common in matrix
<i>Carpobrotus edulis</i>	PNCO	Mesembryanthemaceae	EC, WC, Widespread	All, disturbed	Widespread
<i>Corpuscularia lehmannii</i>	PNCO, Endemic	Mesembryanthemaceae	PE, Uitenhage, Endemic	Calcrete	Bontveld outcrops and matrix
<i>Crassula perforata</i>	PNCO	Crassulaceae	EC, WC, KZN	Bontveld, calcrete	Widespread, in thicket clumps
<i>Cyrtanthus spiralis</i>	PNCO, IUCN (En), Endemic	Amaryllidaceae	EC endemic	Bontveld, calcrete	Few isolated specimens in outcrops, only visible during flowering period (Summer)
<i>Delosperma calycinum</i>	PNCO	Mesembryanthemaceae	EC Endemic	Bontveld, calcrete	Scattered in thicket, may be present
<i>Delosperma sp.</i>	PNCO	Mesembryanthemaceae	Unconfirmed	Bontveld, calcrete	Widespread in outcrops, may be present
<i>Drosanthemum sp.</i>	PNCO	Mesembryanthemaceae	Unconfirmed	Bontveld, calcrete	Widespread in outcrops
<i>Euryops ericifolius</i>	IUCN (VU), Endemic	Asteraceae	PE, Sundays River	Bontveld, calcrete	Few isolated specimens in outcrops, may be present
<i>Gasteria bicolor</i>	PNCO	Asphodelaceae	Widespread	Thicket	Widespread, in thicket clumps, may be present
<i>Glottiphyllum longum</i>	PNCO	Mesembryanthemaceae	EC, WC, Karoo	Bontveld	Common in thicket in the area, likely to be present
<i>Haemanthus coccineus</i>	PNCO	Amaryllidaceae	EC, WC, Namibia, Widespread	Calcrete	Scattered in Bontveld, may be present

<i>Lampranthus sp.</i>	PNCO	Mesembryanthemaceae	Unconfirmed	Bontveld	Outcrops and mosaic
<i>Pentaschistis pallida</i>	IUCN (LC)	Poaceae	EC to Namaqualand	Calcrete	Occasionally present in calcrete outcrops
<i>Pittosporum viridiflorum</i>	NFA		Widespread	Thicket	Present in thicket clumps
<i>Rhombophyllum rhomboideum</i>	PNCO, IUCN (NT)	Mesembryanthemaceae	EC endemic, PE, Graaff-Reinet	Calcrete	Scattered individuals in vicinity of calcrete outcrops, may be present
<i>Sansevieria hyacinthoides</i>	PNCO	Dracaenaceae	Widespread	Thicket, disturbed	Present in thicket clumps and along road verges
<i>Schotia afra</i>	NFA	Fabaceae	Widespread	Thicket	Present in thicket clumps
<i>Sideroxylon inerme</i>	NFA	Sapotaceae	Widespread	Thicket	Present in thicket clumps and on dunes
<i>Sutera polyantha</i>	IUCN (LC)	Scrophulariaceae	EC, WC	Bontveld	Thicket and Bontveld Matrix
<i>Syncarpha recurvata</i>		Asteraceae		Bontveld, Calcrete	
<i>Trichodiadema bulbosum</i>	PNCO	Mesembryanthemaceae	EC, Endemic, PE area	Calcrete	Common in calcrete outcrops within the Coega area

* PNCO Protected by the Provincial Nature Conservation Ordinance (see Appendix 2 for applicable legislation); NFA Protected by the National Forests Act of 1998 (see Appendix 2 for applicable legislation); IUCN Classified as threatened or near threatened according to IUCN 2002 (Golding, 2002).

3.3 Alien Invasive Plant species

A number of declared alien invasive plant species are present within the site (Table 3.2) although they tend to occur in light infestations or as individual plants. Infestations do however appear localised and can be relatively easily removed as per the requirements of the Conservation of Agricultural Resources Act 43 of 1983 and methods of their removal and treatment should be undertaken according to the Working for Water Guidelines.

Table 3.2: Alien Invasive plants present within the property

Botanical Name	Family	Common Name	Category	Removal procedure
<i>Acacia cyclops</i>	Fabaceae	Rooikranz	CARA 2	Chop trees and remove brushwood
<i>Acacia saligna</i>	Fabaceae	Port Jackson	CARA	Chop trees and remove brushwood
<i>Opuntia ficus-indica</i>	Cactaceae	Prickly Pear	CARA 1	Chop and remove plant material
<i>Opuntia aurantiaca</i>	Cactaceae	Jointed Cactus	CARA 1	Chop and remove plant material

4 Environmental Management Plan Guidelines

The proposed widening of the west of the Sundays River will require the temporary removal of portion of a dune during road construction and a retaining wall (Figure 4.1 and Figure 4.2), followed by subsequent replacement of the sand, re-profiling of the dune and revegetation. Maps and photos of site in Appendix 1 and 2.

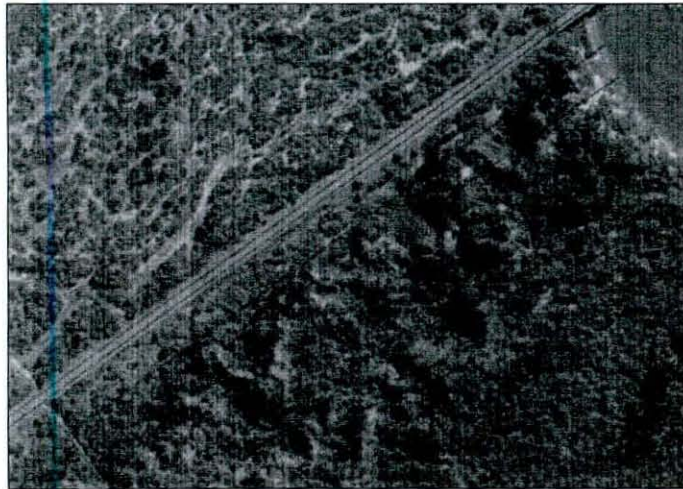


Figure 4.1: Aerial Photograph overlain with DEM, indicating sensitive vegetated dune field adjacent to Sundays River crossing. (A) indicates road servitude edge and (B) proposed areas where dune to be removed and replaced after construction of retaining wall.

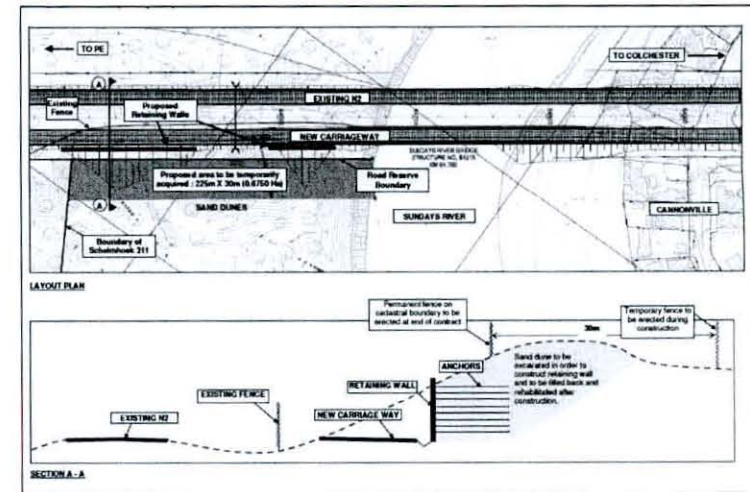


Figure 4.2: Figure illustrating proposed road route and temporary removal of dune for retaining wall construction.

4.1 Introduction

A number of issues pertinent to dune processes need to be considered that may be affected by the proposed road construction. These will require on-site management during the construction and operational phases of the proposed activity.

4.2 Coastal Dune Vegetation (sensu Lubke et al., 2000)

The major factor controlling the distribution of plants is climate. Regional temperatures and rainfall are the most important factors accounting for the distribution of the different species and families over the whole region and the assembling of plants into recognizable vegetation types such as dune fynbos, dune thicket. Other factors such as geology and geomorphology, dune geomorphology and soils are more important on a local scale and will determine whether, for example, dune fynbos or dune thicket is found in a particular environment. The abundance of species within various coastal habitats is controlled by local habitat conditions. Only a few species of hardy pioneer plants will be found on sand dunes or rocky cliffs. These species may have special morphological or physiological features enabling them to germinate and grow under adverse conditions. Two major gradients are defined: a moisture gradient from dry through 'normal' to moist or wet conditions, and a salinity gradient from freshwater to marine conditions. Because of the effect of salt spray there is an accumulation of salts in some habitats.

Coastal Dune vegetation tends to be highly sensitive and a number of important physical and ecological processes occur. Together with sandy beaches, dunes form a buffer zone and link between the marine system and the truly terrestrial stabilized land surfaces. The dynamics and ecology of coastal dune systems are inadequately understood and this has led to problems in coastal zone planning and management in South Africa and many other parts of the world. Dunes in the Eastern Cape are mainly transversely orientated with respect to the wind direction, the steep side or slipface facing downwind. Vegetation is continually invading open sands and the plants form sand

traps which modify the shape and form of the dunes. Pioneer plants form characteristic foredune hummocks as their creeping rhizomes or stems stabilize the mobile sand. The hummock dunes may develop on the driftline, forming embryo dunes, often just above the berm or parallel beach ridge hummocks, especially common on accreting shorelines, which are building up as sand is deposited. Their form and morphology are often dependant on the type of pioneer plants stabilizing the sand. Hummock dunes may also develop in the moister dune slacks: low lying ground between dunes or behind the fore dunes where the groundwater is near the surface. As a result of a disturbance, such as trampling or fire, or changes in topography, these parabolic dunes may form a blowout into the vegetation. A number of studies in the Eastern Cape dune fields have shown that because of predominantly westerly winds, there is a net movement of dunes from west to east

4.2.1 Pioneer communities of coastal dunes

The common pioneer of fore dunes is *Scaevola plumieri*, which is a succulent-leaved shrub with tough stems which ramify through the drifting sands and help to bind the dunes. *Arctotheca populifolia* and *Gazania rigens* var. *uniflora* are two members of the daisy family (Asteraceae) which stabilize sand and form hummock dunes. Many of the pioneer species are locally very common probably due to the sporadic distribution of seeds or propagules in these changing dune conditions.

A much greater variety of species is found in the protected environments behind the dunes in the dune slacks or hollows. Where standing water is common, *Scirpus nodosus* and *Juncus kraussii* are common pioneers, whereas *Sporobolus virginicus* and fore dune pioneers such as *Arctotheca populifolia* are common in drier slacks. Species of salt-marshes or of freshwater vleis are found in these habitats, depending upon whether the water of the wet slacks is saline or fresh.

On the rear dunes, *Ehrharta villosa* is the common pioneer. Only a few of the fore dune pioneers occur in this region as they appear to require moving sand and possibly also salt spray. A great variety of shrubs is found in bush clumps or bush pockets on the rear dunes, notably *Passerina rigida*, *Stoebe plumosa* and *Myrica cordifolia*. Some attractive herbs occur in open drift sands, for example, *Senecio elegans*, *Zaluzianskya maritima* and *Felicia echinata*.

4.2.2 Dune scrub or thicket

Often there are no longer pioneer dune communities on the vast dune sands and the vegetation that is encountered as one moves away from the shore is dune thicket. Along the margin of the scrub the dominant shrubs vary from region to region, but generally include *Chrysanthemoides monilifera*, *Rhus crenata*, *Maytenus procumbens* and *Passerina rigida*. Creepers are common in the dune margin, for example, *Solanum americanum*, *Rhoicissus digitata* and *Cynanchum natalitium*.

4.3 Dune Processes

In the coastal area development, too little attention has been paid to the mobile Driftsands and recreational beaches. Beaches are not static, sterile, permanent features, but are highly mobile and constantly changing. Storms at sea, floods, and constantly changing sand movement patterns can make major alterations to the shape and size of the beach. The trend until recently has been to build too close to the sea, and then to spend vast amounts of money attempting to stabilise the dunes and prevent sand movement. Development should be planned in such a way that it takes into account the natural movement of sand, so that protective devices are not necessary.

4.3.1 Short-term dune evolution processes

Dunes are dynamic landforms that respond to changing conditions along the coast, usually brought about by the varying weather. Coastal dunes accumulate sand blown inland from the beaches in front of them by onshore winds (accretion). They lose sand by either wind removal (deflation) or marine erosion caused mainly by waves (Figure 4.3).

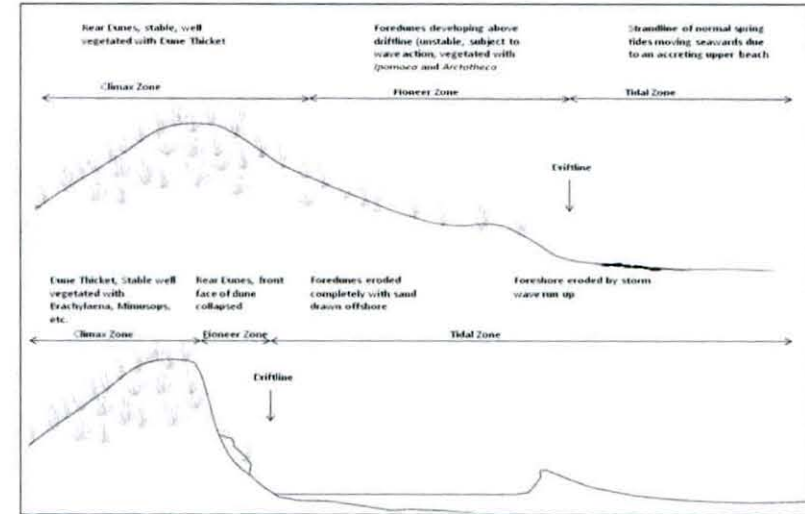


Figure 4.3: Cross-section of an accreting (top) and eroding (bottom) dune system. The dunes present along the road servitude are prone to wind erosion but NOT wave erosion.

The main concerns about dunes usually arise when it is perceived that the erosion processes have removed more sand than the accretion processes can replace over time scales of months or a few years and this erosion threatens developed areas, infrastructure, commercial interests or important natural assets. Problems can also arise when accretion dominates, because the excess of sand blows inland affecting agriculture, blocking roads or even inundating built up areas. Natural erosion or accretion of undeveloped dune systems is not normally considered to be a problem, but rather an integral part of geomorphological evolution. A brief description of the accretion and erosion processes is set out below.

4.3.2 Dune Accretion

The basic requirements for the formation of coastal dunes are:

- a supply of sand over a wide drying foreshore
- a backshore area of low relief
- predominant onshore winds for at least part of the year.

Dunes usually begin to form at the crest of a beach, with wind-blown sand accumulating around small objects such as clumps of seaweed, driftwood or other debris cast up along the strand line. Once formed, the low hills of loose sand are colonised by salt-tolerant, pioneer plants that both increase the resistance of the surface layer of sand to wind erosion and reduce the wind speeds over the surface. The embryo dunes or foredunes will continue growing, unless they are destroyed by wave action at high tide levels.

The rate of dune vegetation growth depends on the climatic conditions, with growth in some regions being inhibited by low rainfall and extreme temperatures.

Ideal conditions for the transport of sand from a beach to the dunes occur after constructive (i.e. low height, long period) waves have deposited sand on the upper beach and inter-tidal foreshore. At low tide the sand dries and onshore winds can carry substantial volumes of sand onto the dunes. The transport of sand is diminished if the sand is wet due to rain or ground water drainage and can be prevented entirely if winds are too weak to mobilise the grains or are blowing offshore.

The vertical growth of dunes can be curtailed by one of three factors, namely:

- The dune reaches a height where the vegetation is no longer able to protect the dune surface from wind erosion.
- New foredunes intercept a large proportion of the wind-blown sand, preventing the further growth vegetated dunes. This situation occurs on prograding coasts, and may result in the formation of many dune ridges over the years.
- Damage is caused to the dune vegetation by human influences (trampling, groundwater extraction, farming, construction, etc.) or by animal grazing/burrowing, hence diminishing the capacity of vegetation to trap and retain further sand.

4.3.3 Erosion

There are two main types of Dune Erosion, namely:

- Surface erosion by wind action (deflation), which may have some influence on the dunes present within the site;
- Marine erosion of the toe and seaward face of the dunes (*not applicable in this instance*).

The former can and does occur naturally, following disease or damage to vegetation caused, for example, by drought, lack of nutrients or over-grazing by rabbits. However, the onset and subsequent problems of deflation are often worsened by human activities. Typical causes include excessive trampling, driving vehicles over dunes, the removal of sand for building materials or agricultural use, excessive extraction of ground water, allowing excessive grazing by farm animals and construction activities that may destabilise the dunes. If the vegetation is seriously damaged, it no longer acts to stabilise the sand and wind action will rapidly remove the exposed loose sand, forming a blow out (Figure 4.4). Once initiated, a blow out can spread rapidly and large areas of dunes can be affected, to the extent that blown sand becomes a major nuisance further inland. There are numerous methods of repairing blow-outs, including fencing, installing boardwalks, protection of the eroded dune surface by thatching and transplanting dune stabilising grasses (usually exotic and invasive).

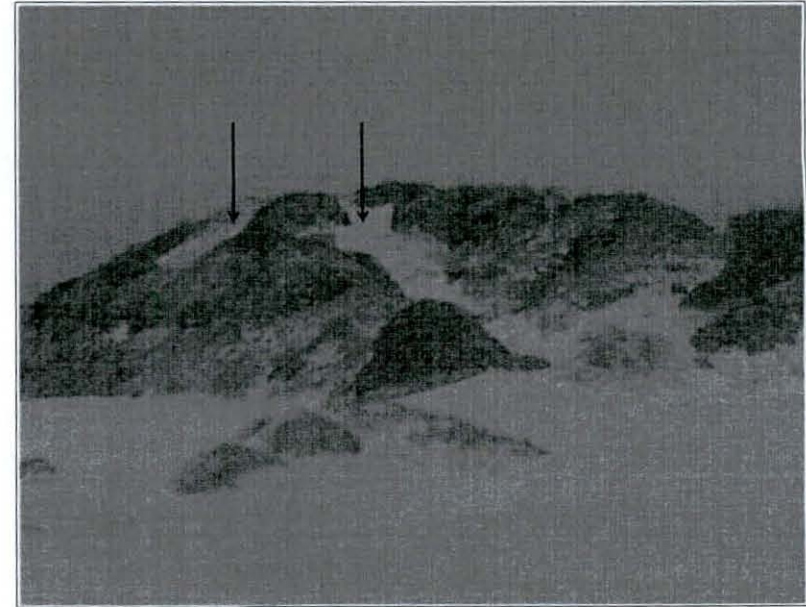


Figure 4.4: Example of a dune blowout. As the name implies such features are formed by wind scour rather than wave attack. The dune present adjacent to the Sundays River and road reserve will be susceptible to dune blowouts after roads construction has been completed.

4.4 Human Impacts and Influences

Dune systems are under threat from development, including building and road construction, and policy for such development is lacking. A number of human influences have impacts on sandy beach functioning:

- Any factors, including coastal developments, which modify sediment transport.
- Trampling of dune vegetation where human access is not strictly controlled.
- Invasive plants may alter dune ecosystems through stabilization.
- Extraction of groundwater and subsequent infiltration of seawater into the water table influences dune vegetation.
- Beach mining has adverse effects where this is undertaken.
- Pollution, recreational activities and localized impacts are less damaging to the intertidal zone than to dune systems and fast recovery is usually evident.
- Off-road vehicles on the back beach and in the dunes can have a major impact.
- Predicted sea level rises.

4.5 Additional processes and issues

4.5.1 Loss of dune sands with possible long term slumping and loss of vegetation cover

An extensive dune system surrounds the site, areas of which are vegetated. The vegetated dunes that will be affected also tend to have a sparse vegetation cover with mobile sands present, particularly on the northern and eastern slopes (adjacent to the Sundays River). Long term wind erosion processes may result in a decrease in the stability of the dune system.

4.5.2 Disturbance to dune along estuary riparian zone and saltmarsh interface

The dunes about the Sundays River along the western bank adjacent to the site, with a narrow saltmarsh is present on the eastern bank. Steep slopes adjacent to the river bank are likely to persist in the long run, which may lead to erosion along the eastern edge as a result of river induced erosion.

- Exotic alien plant species must be removed and controlled within the areas impacted upon by the activity;
- Disturbances to the river banks and saltmarsh areas must be monitored and signage should be appropriately sited informing users of their sensitivity;
- Care should be taken during removal of dune sands from this area during pre-construction and post-construction replacement, and re-profiling of the dune system should be undertaken so as to minimise potential future erosion (i.e. slopes should be kept as gentle as reasonably possible);
- Additional stabilisation, especially on the corner, between the river interface and road interface is likely to be necessary to minimise future slumping.

4.5.3 Dune thicket may become susceptible due to erosion and loss of vegetation cover due to erosion and drying out

According to Tinley (1985) two distinct sand characteristics occur in dune fields. Bare dune sands, yellow in colour, absorb all rain and consequently there is no surface runoff. Grey sands, stained by humus and covered with woody vegetation, have a water repellent layer near the surface, beneath the litter, causing a massive surface runoff when heavy rains follow a dry period (Tinley 1985).

- Any informal pathways must be closed off and rehabilitated to prevent further deterioration;
- Stormwater runoff from upslope dunes, paths and other artificial surfaces must be managed adequately to prevent erosion from occurring, especially along any retaining walls;
- Alien invasive species (*Acacia cyclops*) must be removed timeously to minimise any long-term negative effects on indigenous vegetation and a long term management plan implemented;
- Areas cleared of invasive species or otherwise disturbed during construction activities must be adequately stabilized and revegetated using appropriate indigenous species.

4.6 Dune vegetation management plan

4.6.1 Site preparation and clearing and temporary stabilisation

- The construction footprint should be clearly demarcated using chevron tape (no construction related access allowed before species of special concern have been removed);
- The EO/ECO and a suitably qualified botanist must survey the entire area for plant species of special concern and mark the ground with bio-degradable paint or with pegs for later translocation;
- Where necessary, Permits must be obtained from DWAF for tree species protected i.t.o. the NFA;
- Where possible, small trees and shrubs can be transplanted into potting bags, making every effort to keep the root mass intact, and stored temporarily for later use during revegetation of the dune. These bags should be watered on a regular basis during temporary storage;
- Topsoil may only be removed from the construction footprint for use in rehabilitation of the site once all these species of special concern and other plants deemed suitable for replanting, have been removed;
- Remaining brushwood should also be removed from site and stored for later re-application of brushwood and mulch. No seed-bearing material of *Acacia cyclops* should be utilised;
- Although difficult to undertake in the dune sands present on site, all reasonable efforts should be made to strip the 'topsoil' layer from the dunes and stored in a temporary area. The 'topsoil' layer can be identified as that portion of the soil containing grey organic matter and root mass and would most likely constitute approximately the top 10 cm of the soil. In addition, every effort should be made to discard or sieve topsoil containing high densities of *Acacia cyclops* seed;
- No construction vehicle traffic should be allowed outside of the demarcated work areas;
- Once topsoil has been removed and stored appropriately, temporary removal of the dune sands should commence. This sand should be temporarily stored and appropriate measures implemented to prevent erosion and highly mobile sand from being blown away;
- After removal of sand, measures must be implemented to minimise erosion of the surface sands during the construction period. Low fences can be constructed using shade cloth along the surface at appropriate intervals and brushwood can be applied between fences to minimise sand erosion and to further trap wind-blown sands. During heavy winds, spraying of the surface with fresh-water may be necessary;

4.6.2 Post construction stabilising and revegetation

- Once road construction activities within the dunes have been completed, temporarily stored sand can be replaced, the final dune surface re-profiled and topsoil replaced. Suitable topsoil from surrounding areas (where removed for road construction) may also be required to supplement topsoil;
- The dune surface should be re-profiled so that slopes are never steeper than 1:3 and flatter, if possible. It may be necessary to lower the overall dune height, where deemed necessary to reduce the slope gradient;
- The top-soiled surface should be left fairly rough to enhance seedling establishment, reduce water run-off and increase infiltration.

- Anti erosion fences should be constructed at regular intervals along the dune surface as deemed appropriate by the appointed ECO and engineer; These should be sited so that maximum protection is obtained from the prevailing winds;
- Brushwood should be applied to the dune surface between wind-protection fences, as well as against fences to act as sand traps. In addition it is recommended that brushwood removed during road servitude construction also be stored and used. A wood-chip mulch can also be applied to the topsoil layer to reduce erosion;
- Revegetation can then commence using appropriate species (see Table 4.1); Grasses should be planted in rows of plugs parallel to the dune slope in small furrows, which will act as a sand trap and reduce erosion should heavy rains occur and during irrigation;
- Under no circumstances should non-indigenous grasses such as **Marram** (*Ammophila arenaria*) or **Vetiver** (*Chrysopogon zizanioides*) be utilised to stabilise the dune surface, as, although successful, they are invasive and would most likely spread to surrounding sensitive dune areas and result in long-term negative effects within the local dune system as a whole;
- Small shrubs and trees (as per Table 4.1) should be planted at regular intervals along the dune slope in holes 1 m x 1 m x 1 m, which have been filled with a weed-free soil, humus rich;
- Once replanted, plants should be well watered on a weekly basis (or more regularly) as deemed necessary by the ECO and/or engineer for a period of at least 4 - 6 months until they have become established. Watering frequency can be decreased as deemed appropriate by the ECO/engineer once plants are established but after-care should continue for 2 year period to ensure maximum survival is obtained;
- Weak or dead plants should be replaced timeously as necessary;

Table 4.1: Recommended plant species for use in dune stabilisation/revegetation.

Botanical Name	Family	Common name	Growth Form/Use
<i>Azima tetraacantha</i>	Salvadoraceae	Needle-bush	Spinescent Shrub
<i>Brachylaena bicolor</i>	Asteraceae	Coast Silver Oak	Small tree
<i>Canthium spinosum</i>	Rubiaceae		Shrub/Small tree
<i>Carissa bispinosa</i>	Apocynaceae		Shrub
<i>Carpobrotus deliciosus</i>	Mesembryanthemaceae	Sour fig	Succulent groundcover
<i>Chrysanthemoides monilifera</i>	Asteraceae	Bitou	Shrub
<i>Cotyledon velutina</i>	Crassulaceae		Succulent Shrub
<i>Cynodon dactylon</i>	Poaceae	Couch Grass	Grass
<i>Ehrharta villosa</i>	Poaceae		Grass
<i>Euclea natalensis</i>	Ebenaceae		Tree
<i>Euclea racemosa</i>	Ebenaceae	Sea Guarri	Small tree
<i>Grewia occidentalis</i>	Tiliaceae		Small tree
<i>Maytenus procumbens</i>	Celastraceae		Small tree
<i>Mystroxydon aethiopicum</i>	Celastraceae		Tree
<i>Olea exasperata</i>	Oleaceae		Small tree
<i>Panicum deustum</i>	Poaceae		Grass (shade)
<i>Pterocelastrus tricuspidatus</i>	Celastraceae		Tree
<i>Rhamnus prinoides</i>	Rhamnaceae		Shrub
<i>Rhus crenata</i>	Anacardiaceae	Nana berry	Shrub
<i>Scutia myrtina</i>	Rhamnaceae		Shrub/Small tree
<i>Sideroxylon inerme</i>	Sapotaceae	White Milkwood	Small - large tree
<i>Stenotaphrum secundatum</i>	Poaceae	Buffalo Turf Grass	Grass
<i>Zygophyllum morganiana</i>	Zygophyllaceae		Shrub/Small tree

4.6.3 Operation management and monitoring

- A monitoring plan must be implemented by the ECO in conjunction with the engineer for a suitable time-period after revegetation commences until it is deemed that the vegetation has become effectively established, due to the susceptible nature of the dune substrate;
- Since the dune will be susceptible to drying out and sand movement it is likely that follow-up work will be required in the long term using the above revegetation approach.

4.6.4 Comments, Red flags and alternatives

- An alternative to the above procedure would be to apply a deeper fertile topsoil layer over the mobile sands, and grasses sown using a hydro-mulching technique together with the use of a biodegradable netting/matting (made from jute, sisal, coir or similar material) or a geofabric, geogrid or nylon fabric. The long-term persistence of this method is however uncertain as erosion of soil beneath the matting and potential drying out could result in failure of the technique in the long-term;
- Stabilisation of mobile dune sands can be difficult and long-term follow up may be necessary;
- The preferred procedure, using a retaining wall, could result in long-term issues resulting from a build-up of sand above the retaining wall and subsequent wind-borne sands spilling over the top of the wall and/or damage to the wall. The alternative, without using a retaining wall could result in a more effective solution as it would minimise the risk of wind-borne sand building up and spilling over the retaining wall and a 'hedge' shrubs/small trees could be planted adjacent to the road to trap wind-borne sand. Periodic removal of this accumulated sand may be required to prevent migration of the dune into the road reserve.

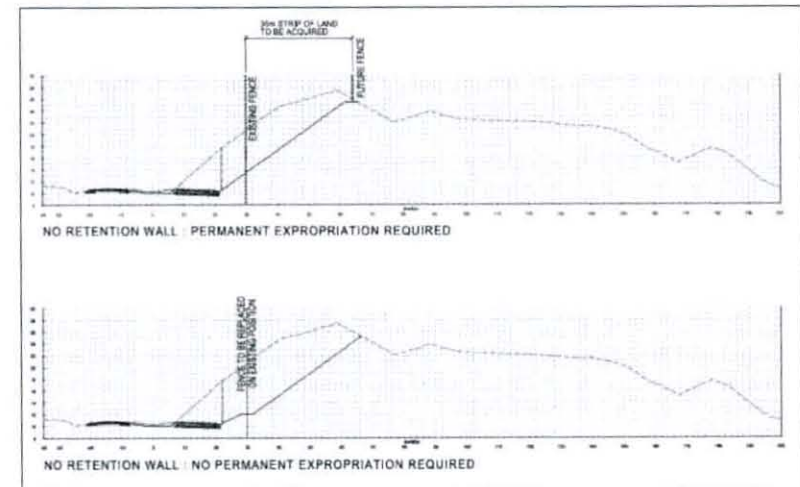


Figure 4.5: Alternative approaches without a retention wall.

4.7 Mining vegetation management plan

4.7.1 Borrow Pit descriptions

Maps and photos of borrow pits in Appendix 1 and 2.

Borrow Pit 1

Bedrock overlain by mobile sand dunes, vegetated with typical dune thicket tree and shrub species. Interclump vegetation of a dune fynbos nature with grasses and sedges.

Borrow Pit 2

Bedrock overlain by mobile sand dunes, vegetated with typical dune thicket tree and shrub species. Interclump vegetation of a dune fynbos nature with grasses and sedges.

Borrow Pit 3

Nanaga formation soils overlain with exposed calcrete outcropping in parts. Somewhat degraded with patches of disturbed outcrops present. Vegetation typically composed of small thicket clumps and grasses, herbs and shrubs in interclump areas with outcrops commonly having succulent species.

Borrow Pit 4

Nanaga formation soils overlain with exposed calcrete outcropping in parts. Old borrow pit present with dense infestation of *Acacia cyclops* and degradation of soil structure as a result of recent fire. Intact outcrop vegetation patchy and typically with grasses succulent species and some herbaceous cover.

4.7.2 Rehabilitation Objective

The overall objective of the rehabilitation plan is to minimize adverse environmental impacts associated with the mining activities whilst maximizing the future utilization of the property. The idea, therefore, is to leave the mined out quarry in a conditions that reduces many of the negative impacts associated with a mined out area. Significant aspects to be borne in mind in this regard is visibility of the mining scar, revegetation of the mining footprint and stability and environmental risk in an old mine environment. The immediate area of the working must also be free of alien vegetation.

The proposed mining and rehabilitation procedures have been formulated to optimise the extraction of raw material while creating stable borrow pit sides that will not present an unreasonable safety risk once borrow pit closure has been approved. The overall revegetation plan will, therefore, be as follows:

- Confining the mining footprint to an area as small as possible;
- Ameliorate the aesthetic impact of the site and integrating the borrow pit into the existing landscape, using natural rounded contouring;
- Stabilise disturbed soil and rock faces;
- Minimize surface erosion and consequent siltation of natural water course located on site;
- Control wind-blown dust problems;
- Re-topsoiling and vegetating all disturbed areas and enhancing the physical properties of the soil, re-establishing nutrient cycling and thus re-establish a stable ecological system.

- Use indigenous trees and/or the retention/construction of a small bench between the road and the borrow pit around the perimeter of the borrow pit to mask borrow pit scars in the long-term. Borrow pit 3 has a small vegetated dune along boundary between the road and the pit which could be retained/replaced as a visual buffer.

4.7.3 Site preparation (pre mining)

Flora Plant relocation and vegetation clearing

- The construction footprint must be clearly demarcated using chevron tape (no construction related access allowed before species of special concern have been removed).
- The EO/ECO and a suitably qualified botanist must survey the entire proposed site for plant species of special concern and mark the ground with bio-degradable paint or with pegs for later translocation.
- Where necessary, Permits must be obtained from DWAF for tree species protected i.t.o. the NFA and from DEDEA for species protected i.t.o. the PNCO;
- The soil around the base of the plants should be loosened using a pick and spade and the plants removed making every effort to keep the root mass intact. These can be placed in sacks for transportation across the site.
- The removed plants should either be temporarily stored in an designated relocation area for later use during revegetation and/or permanently planted in adjacent areas having the same soil type as from where they are removed.
- Once replanted, plants should be lightly watered once a week for a month and then once every 2 weeks for 2 months thereafter until they have become established, or deemed established as per recommendation of the ECO/engineer (rainfall dependant).
- A follow-up visit should be conducted by the botanist once relocation is complete to assess the success and a follow-up report submitted to DME.
- Stripped vegetation (excluding exotic invasive species) should also be temporarily stored during mining operation for later use to stabilise slopes.
- Topsoil may only be removed from the site once all these species of special concern have been removed. Topsoil should be stored in designated storage areas as per borrow pit layout plan and adequately stabilised against wind and water erosion.
- No construction vehicle traffic should be allowed outside the demarcated work areas.

Topsoil and Subsoil removal

- Topsoil ($\pm 10 -20$ cm) overburden must be stripped separately from the area to be mined. The topsoil and subsoil removed from the initial cut must be stockpiled separately and only used in rehabilitation work towards the end of the mining operation. The vegetative cover that had been stripped with the thin topsoil layer will provide organic matter to the relayed material and ensure that the seed store contained in the topsoil is not diminished.
- Topsoil from adjacent road clearing can also be stored to supplement topsoil from mining area where topsoil is deemed to be inadequate by the ECO/engineer.

Mining phase

- Every effort must be made to avoid unnecessary disturbance of the natural vegetation outside of the fenced off borrow pit footprint during operations.

4.7.4 Post mining

Topsoil and Subsoil replacement

- Stripped overburden must be backfilled into the worked out areas and used to recreate slopes (maximum slope gradient of 1:3) to obtain the required drainage for water runoff.
- Reseeding may be required should the stockpiles stand for too long (greater than 6 months) and be considered barren from a seed bank point of view. Stockpiles should ideally be stored for no longer than 6 months.
- The topsoil and overburden must be keyed into the re-profiled surfaces to ensure that they are not eroded or washed away.
- Stripped topsoil must be spread over the re-profiled areas to an adequate depth to encourage plant re-growth.
- Sorted brushwood (i.e. without alien material) should be overlain on slopes in conjunction with use of a biodegradable netting/matting (made from jute, sisal, coir or similar material) or a geofabric, geogrid or nylon fabric as deemed necessary by the ECO/engineer.
- Brushwood collected during surrounding bush clearing activities can be utilised to minimise erosion.
- The top-soiled surface should be left fairly rough to enhance seedling establishment, reduce water run-off and increase infiltration.
- Latent impacts may be monitored by the Department of Minerals and after borrow pit operations cease before a final mine closure certificate can be granted by the DME.

Drainage and Erosion Control

To control the drainage and erosion at site the following procedures will need to be adopted:

- Areas where mining is completed should be rehabilitated immediately.
- Areas to be disturbed in future mining operations will be kept as small as possible (i.e. conducting the mining operations in phases), thereby limiting the scale of erosion.
- Borrow pit slopes should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scour (maximum 1:3 gradient).
- Diversion channels should be constructed ahead of the open cuts as well as above emplacement areas and stockpiles to intercept clean run-off and divert it around disturbed areas into the natural drainage system downstream of the borrow pits.
- All existing mined areas will be revegetated to control erosion and sedimentation.
- Central borrow pit areas are likely to become water traps in the long-term and the rehabilitation procedure should aim to complement this - i.e. the use of locally occurring water tolerant grasses, sedges and reeds would be recommended.
- Existing vegetation must be retained as far as possible to minimize erosion problems.
- Runnels, erosion channels or wash-aways developing after rehabilitation shall be backfilled and consolidated and the areas restored to a proper stable condition.

Revegetation

- No seeding of replaced topsoil should be required, unless topsoil has been stored for a period longer than 12 months. Once replaced, the topsoil will be left to revegetate naturally unless the process does not occur unaided or if significant topsoil erosion occurs.
- The prepared surfaces should be irrigated regularly for the initial 30 day period and monitored for natural re-growth. If necessary, planting or seeding shall be undertaken if natural vegetation did not begin to establish after 30 - 60 days (specialist guidance shall be sought to determine the exact requirements).
- Should the initial approach be deemed insufficient, the problem areas should be seeded with suitable grass species to provide an initial ground cover and stabilize the soil surface. *Melinis repens* and *Themeda triandra* are species that can work in this regard and can either be collected on site (using a mower or by hand) or purchased from a relevant local seed supplier.
- Possible trees to utilize for reducing visual impact could include: *Aloe africana*, *Hippobromus pauciflorus*, *Olea europaea*, *Pappea capensis*, *Brachylaena discolor*, *Ptaeroxylon obliquum*, *Schotia latifolia* and *Plumbago auriculata*. Individual trees (excluding *Aloe* spp.) must be planted in square holes at least 1 m x 1 m x 1 m in size, filled with a suitable soil/compost mix, which can be imported from off site to maximize growth rates.
- No alien species shall be planted at any time in this area.

5 Potential Flora related Impacts and recommended Mitigation Measures

Table 5.1 provides a list of potential flora related impacts and recommended mitigation measures.

Table 5.1: Recommended Impact mitigation procedures.

Impact Description	Proposed mitigation actions
Dune related Impacts	
Loss of dune sands with possible long term slumping and loss of vegetation cover	<ul style="list-style-type: none"> • Re-profiled dunes must be adequately stabilised and vegetated to minimise slumping risk; • Follow-up revegetation may be required should vegetation loss occur.
Disturbance to dune along estuary riparian zone and saltmarsh interface	<ul style="list-style-type: none"> • Dunes along Sundays River bank must be adequately stabilised and profiled to minimise slumping and erosion.
Dune thicket may become susceptible due to erosion and loss of vegetation cover due to erosion and drying out	<ul style="list-style-type: none"> • Initial revegetation procedures on dune areas will need to be adequate; • Long-term monitoring will be required and follow-up replanting undertaken where necessary.
Species of Special Concern	
Loss of protected flora may occur within road reserve and borrow pit footprints	<ul style="list-style-type: none"> • Relevant DWAF and DEDEA permits should be obtained from authorities for removal of protected flora; • Protected flora within degraded road reserve tend to be

Impact Description	Proposed mitigation actions
Loss of localised endemic species may occur within road reserve and borrow pit footprints	<ul style="list-style-type: none"> cosmopolitan in nature and of insignificant concern; Where possible relocation of protected flora should be undertaken, either to similar adjacent habitat or replanted into areas during rehabilitation. Habitat in road reserve tends to be degraded and endemic species present of nominal concern; Plant search and rescue must be undertaken timeously <i>before</i> any clearing and/or construction activities commence; All reasonable efforts should be undertaken to rescue and relocate localised endemic species especially <i>Trichodiadema bulbosum</i>, <i>Syncarpha recurvata</i>, <i>Pentaschistis pallida</i>, <i>Rhombophyllum rhomboideum</i>, <i>Euryops ericifolius</i>, <i>Delosperma calycinum</i>, <i>Cyrtanthus spiralis</i> and <i>Bergeranthus addoensis</i>; Should it be present, seed must be collected from any endemic flora, where relocation is not feasible.

6 Conclusions

- Where possible, protected species should be avoided, or permits obtained as required by the relevant legislation discussed above. It is advised that removed plants be translocated for use during rehabilitation and landscaping activities where necessary.

6.1 Road reserve

- Although a number of protected flora are present within the road reserve, those species present tend to have a cosmopolitan distribution and the areas where they do occur tend to be highly disturbed.

6.2 Dunes

- Areas of the dunes that are showing signs of loss of vegetation cover after rehabilitation should be stabilised timeously to prevent the formation of blow-outs and minimise the potential for slumping in the long-term.
- Whilst the highly sensitive climax dune vegetation communities should ideally be avoided, this report has sought to provide some guidelines to re-establish vegetation on the dunes once road construction has been completed since disturbance is unavoidable;
- Under no circumstances should non-indigenous grasses such as **Marram** (*Ammophila arenaria*) or **Vetiver** (*Chrysopogon zizanioides*) be utilised to stabilise the dune surface, as, although successful, they are invasive and would most likely spread to surrounding sensitive dune areas and result in long-term negative effects within the local dune system as a whole;

6.3 Borrow pits

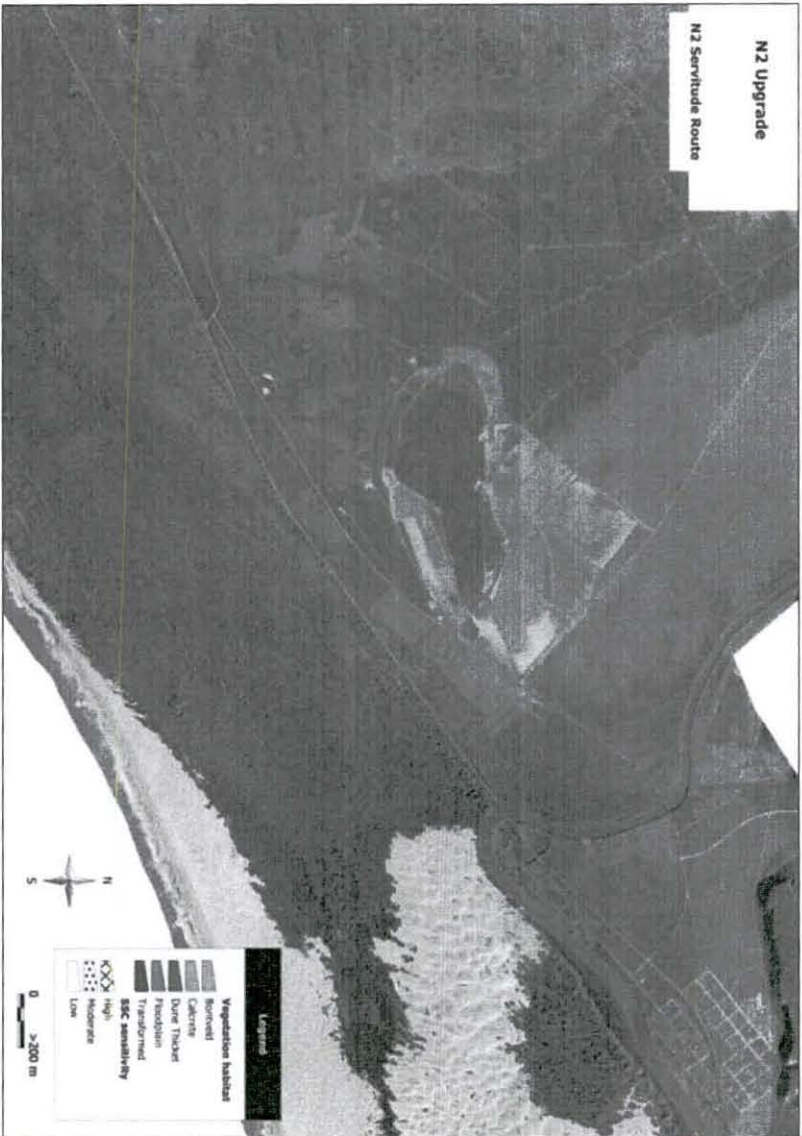
- Although a number of species of special concern including protected flora and endemic species with localised distribution are present within the proposed borrow pit sites, most of those species present tend to have a wide distribution or where they are localised endemics, the areas where they do occur tend to either be highly disturbed or of limited conservation value within the greater context of the region.

Borrow Pit	Vegetation and Flora
BP 1	Bontveld with some Calcrete outcropping; Highly degraded from mining activities on calcrete and dense alien invasion (<i>Acacia cyclops</i> and <i>Acacia saligna</i>) with substantial subsequent loss or original habitat
BP 2	Bontveld with some Calcrete outcropping. Heavy alien invasion and substantial subsequent loss or original habitat
BP 3	Vegetated dunes with Dune Thicket on slopes with dune fynbos in dune slumps
BP 4	Vegetated dunes with Dune Thicket. Moderately dense alien infestation

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8 Appendix 1: Maps



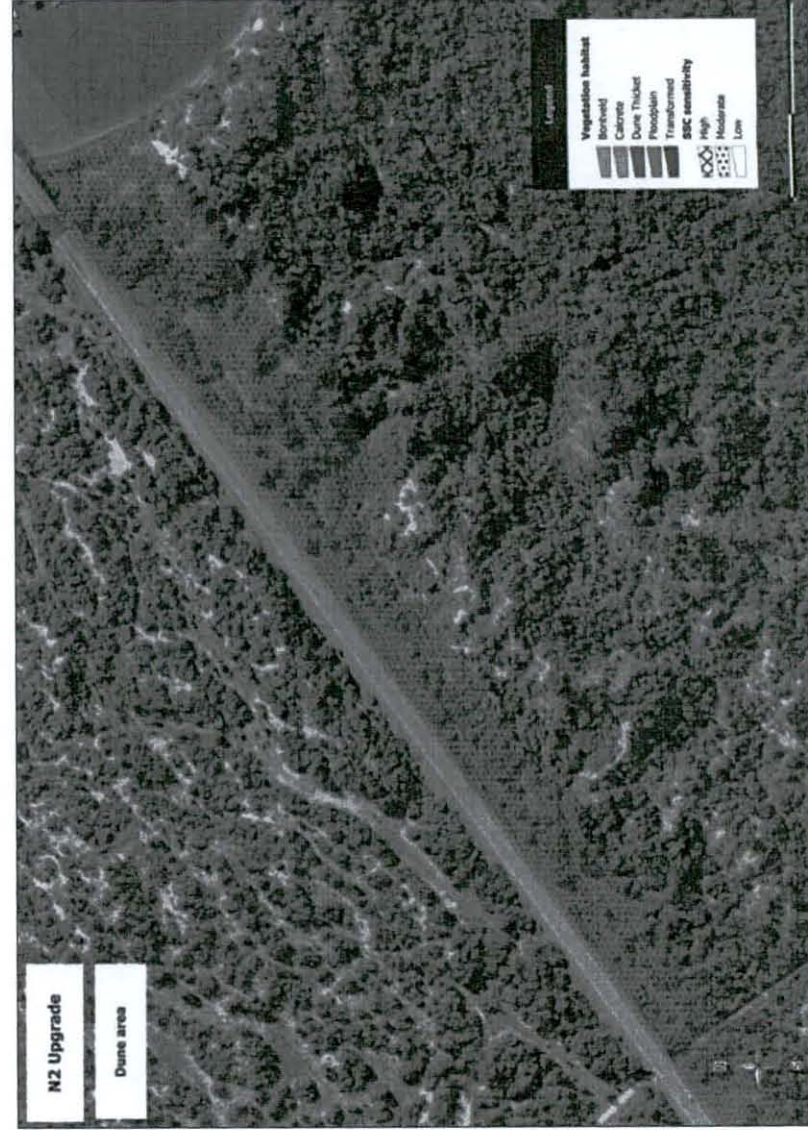
Map 1: Road reserve habitats (Western Section).



Map 2: Road reserve habitats (Central Section)



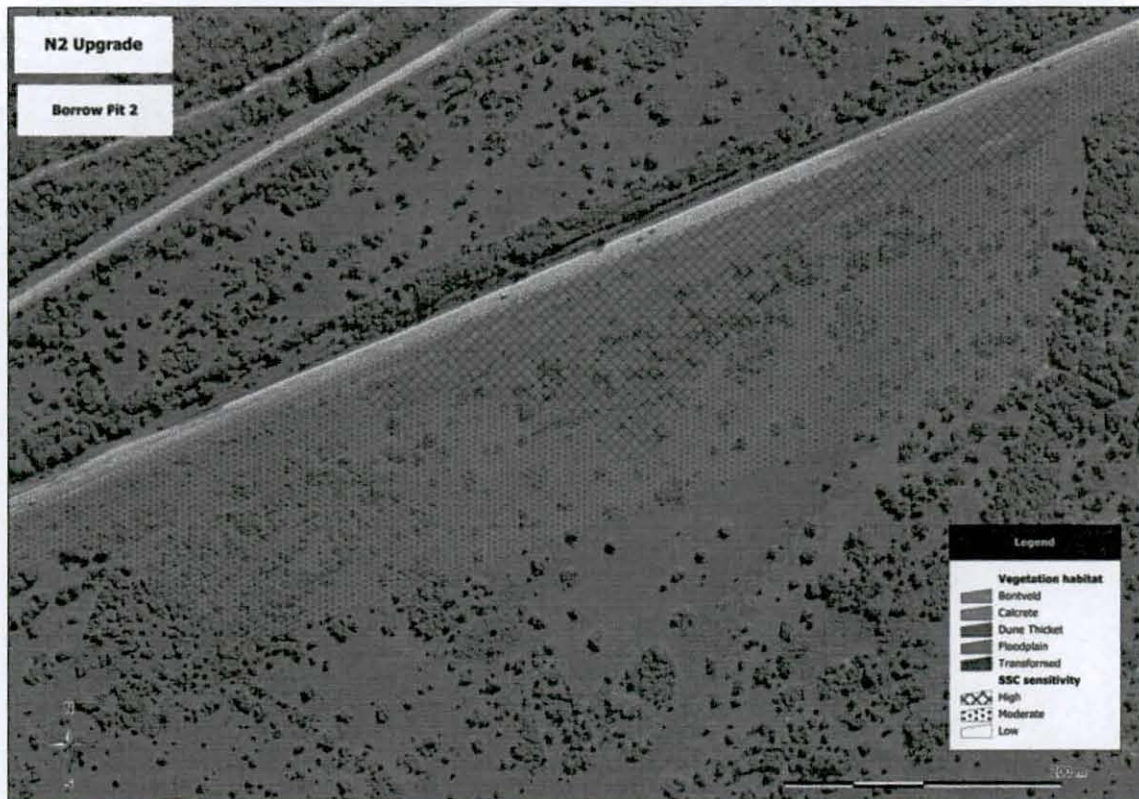
Map 3: Road reserve habitats (Eastern Section):



Map 4: Proposed widening adjacent to Sundays River into dune.



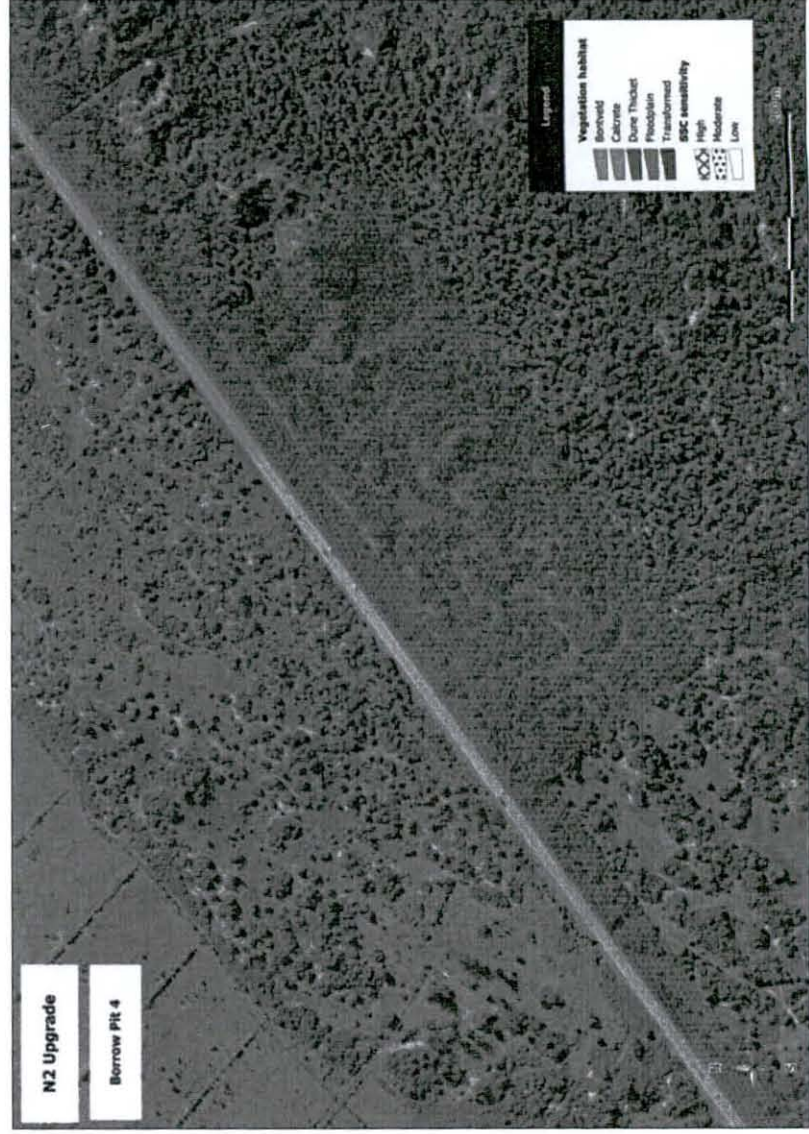
Map 5: Borrow Pit 1 vegetation habitat.



Map 6: Borrow Pit 2 vegetation habitat.



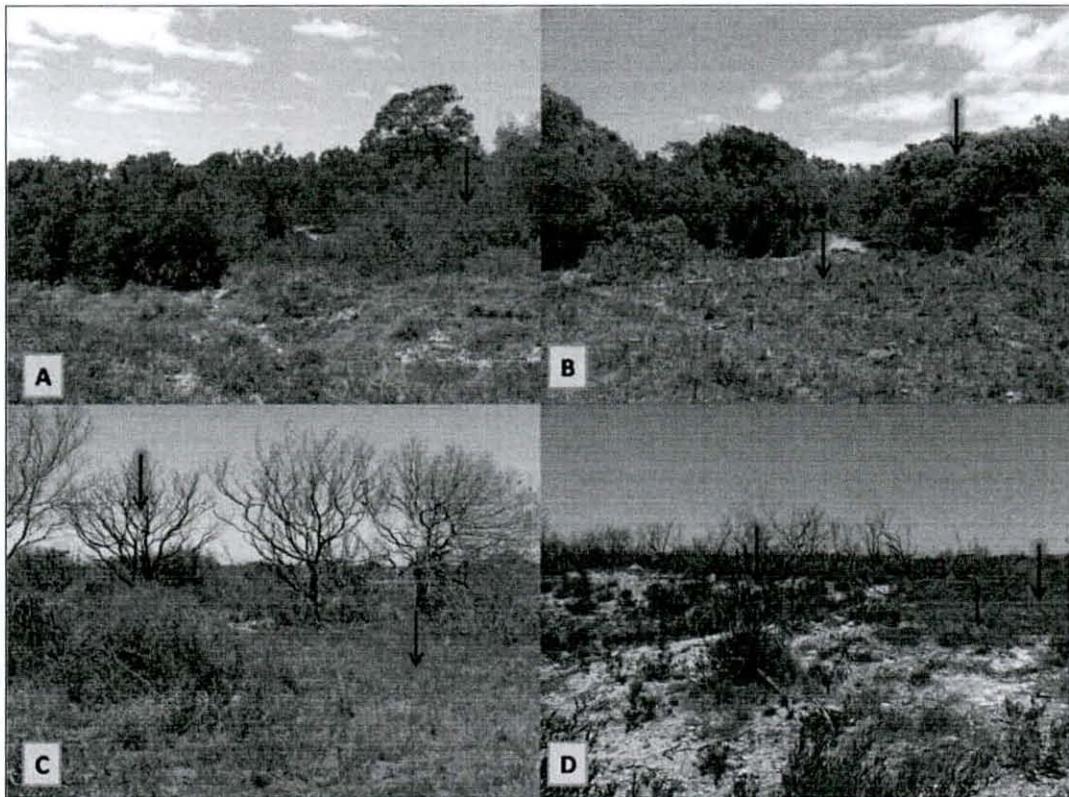
Map 7: Borrow Pit 3 vegetation habitat.



Map 8: Borrow Pit 4 vegetation habitat.

9 Appendix 2: Site Photos

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Photo 1: Borrow Pits:(A) Borrow Pit 4 with dune thicket and dense *Acacia cyclops*; (B) Borrow Pit 3 - Dune Thicket with Dune Fynbos matrix; (C) Borrow Pit 2 - Dense alien invasion with disturbed grassed matrix; (D) Borrow Pit 1 - borrow pit scar, with Alien invasion and some relict Bontveld



Photo 2: Road Servitude Vegetation: (A) Disturbed-grassed areas; (B) Thicket clumps with indigenous and exotic tree species
(C) Disturbed Fynbos-grassed areas in Thicket matrix; (D) exposed Calcrete outcrops.

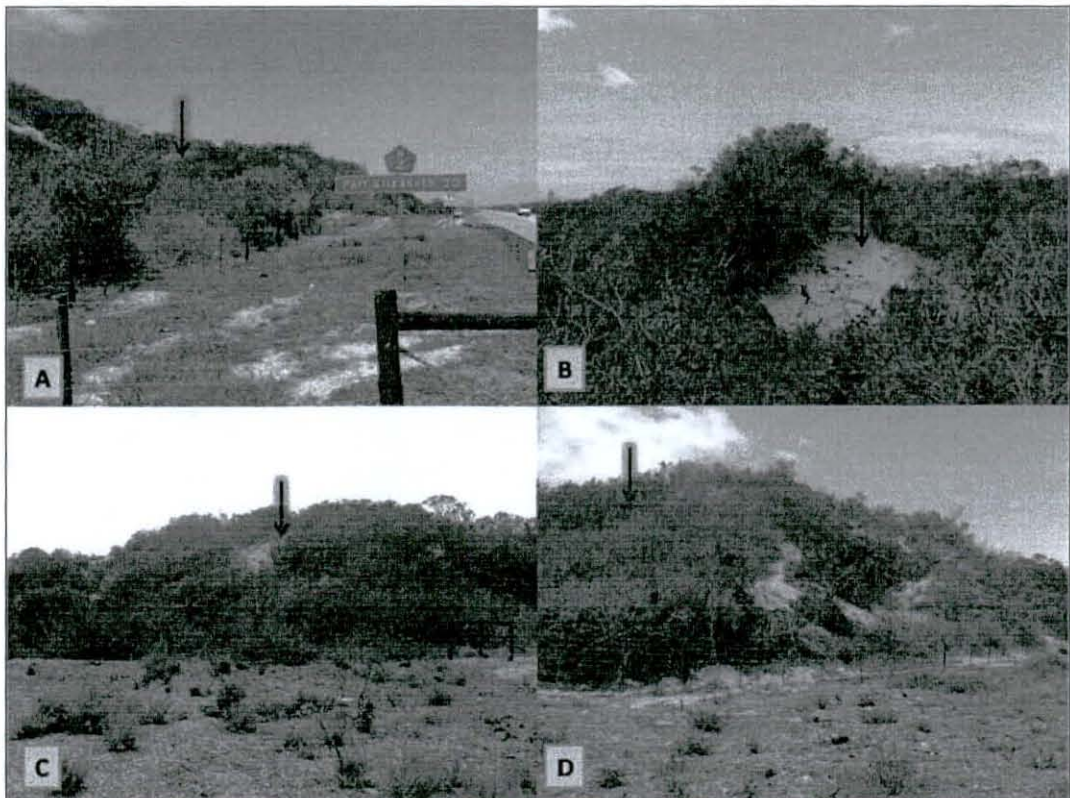


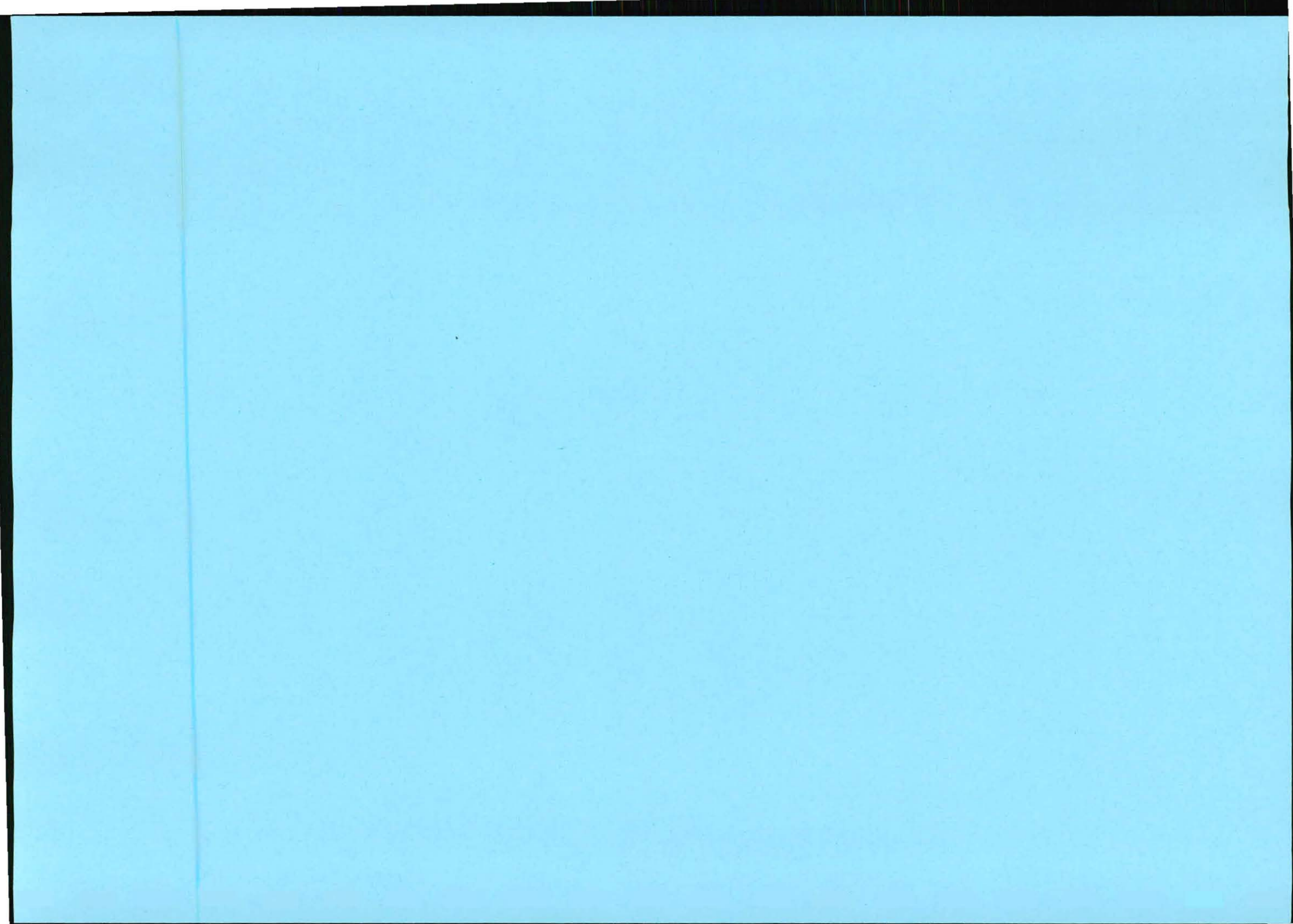
Photo 3: Dune area: (A-C) Sparsely vegetated dunes with exposed sands prone to erosion; (D) Shrub species key stabilisers.



Photo 4: Dune area: (A) Erosion along river bank southwards of proposed activity; (B) Exposed dunes prone to slumping on eastern edge adjacent to rover; (C-D) Exposed base of dunes with inadequate topsoil and vegetation cover.



Appendix G – Impact Rating Table & Rating Methodology



Impact	Description	Mitigation	Extent	Intensity	Duration	Consequence	Consequence	Probability	Probability	Significance	Status	Confidence
Topography	Alteration of topography through excavation of borrow pits and removal of material, and the deposition of material for the proposed road.	Without	1	2	3	6	Medium	3	Definite	Medium	- ve	high
		With	1	1	3	5	Low	2	Probable	Low	- ve	high
Geology	Permanent alteration of geology through the removal of rock material from borrow pits.	Without	1	2	3	6	Medium	3	Definite	Medium	- ve	high
		With	1	1	3	5	Low	3	Definite	Low	- ve	high
Soils	Potential loss of soil from borrow pits due to removal of topsoil and stockpiling for rehabilitation.	Without	1	2	3	6	Medium	2	Probable	Medium	- ve	high
		With	1	1	3	5	Low	1	Possible	Very Low	- ve	high
Vegetation	Small scale loss of endemic vegetation associated with activities (establishment of camp site, removal of overburden, and topsoil stockpiling).	Without	1	2	2	5	Low	3	Definite	Low	- ve	high
		With	1	1	2	4	Very low	2	Probable	Very Low	- ve	high
Vegetation	Loss of protected flora may occur within road reserve.	Without	1	3	3	7	High	2	Probable	High	- ve	high
		With	1	1	1	3	Very low	2	Probable	Very Low	- ve	high
Fauna	Potential small scale loss of fauna, particularly small animals confined to borrow pit sites, resulting from habitat loss. No endangered or protected species.	Without	1	2	1	4	Very low	2	Probable	Very Low	- ve	high
		With	1	1	1	3	Very low	1	Possible	Insignificant	- ve	high
Surface water	Potential increased sediment load in runoff water from borrow pits and road works.	Without	1	2	1	4	Very low	2	Probable	Very Low	- ve	high
		With	1	1	1	3	Very low	2	Probable	Very Low	- ve	high
Ground water	Impacts on ground water are not expected.	Without	1	0	1	2	Not significant	0	Improbable	0		low
		None required	0	0	0	0	Not significant	0	Improbable	0		low
Air quality	Nuisance impact of dust generated from excavating, crushing, stockpiling and road works on traffic on the N2.	Without	1	3	1	5	Low	3	Definite	Low	- ve	low
		With	1	2	1	4	Very low	2	Probable	Very Low	- ve	low
Land capability	No permanent or significant impact on land capability is expected.	Without	1	1	1	3	Very low	2	Probable	Very Low	- ve	high
		With	1	1	1	3	Very low	1	Possible	Insignificant	- ve	high
Noise	Noise impact will be limited as there are no residents nearby the proposed sites.	Without	1	2	1	4	Very low	2	Probable	Very Low	- ve	low
		With	1	1	1	3	Very low	1	Possible	Insignificant	- ve	low
Archeology	No archeological or cultural sites will be affected.	Without	1	0	1	2	Not significant	0	Improbable	0		low
		With	1	0	1	2	Not significant	0	Improbable	0		low
Visual Impacts	Borrow pits should not be visible from the existing road (N2/11) as a berm will be retained/replaced between the road and the proposed borrow pits.	Without	1	3	3	7	High	2	Probable	High	- ve	high
		With	1	2	3	6	Medium	1	Possible	Low	- ve	high
Socio-economic structure	No people directly affected by the mining operations as no residents occur near any of the proposed sites.	Without	1	0	1	2	Not significant	0	Improbable	0		high
		None required	0	0	0	0	Not significant	0	Improbable	0		high
Waste management	Pollution by construction waste could lead to other visual impacts and loss of natural habitat.	Without	1	2	2	5	Low	2	Probable	Low	- ve	high
		With	1	1	1	3	Very low	1	Possible	Insignificant	- ve	high



Impact Rating Methodology

A significance rating is allocated to each potential impact, based on consideration of the probability, intensity, extent, duration and possible mitigation of the potential impact. These terms are explained as follows:

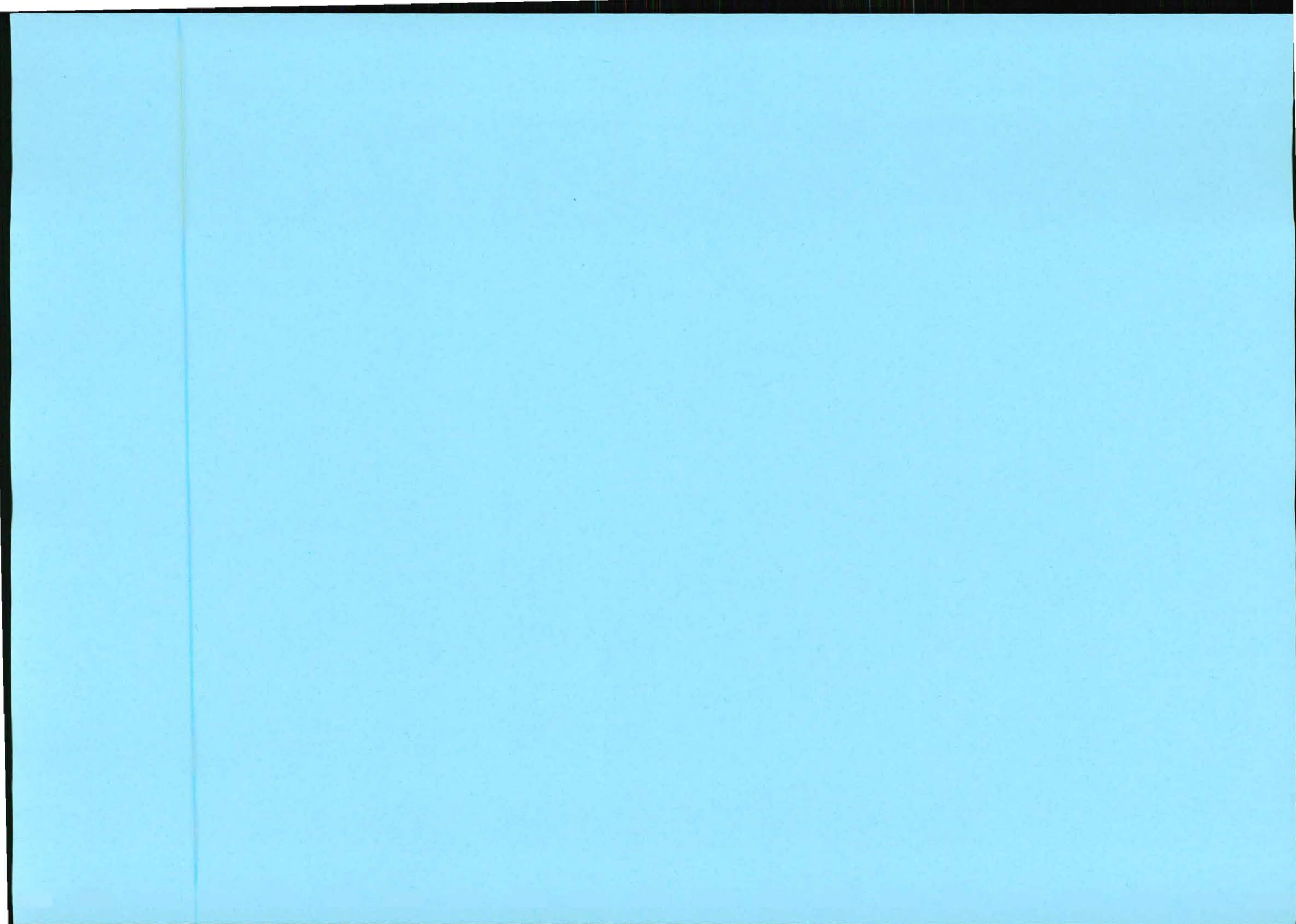
- **Probability:** the likelihood of the impact occurring;
- **Intensity:** the 'severity' of the impact or extent to which ecological and social processes are altered;
- **Extent:** the scale of the impact on a local - national level;
- **Duration:** the length of time the impact will last, which may be anything from several days to the entire lifetime of the development; and
- **Mitigation:** ways in which an impact can be avoided, minimised or managed to reduce its environmental significance.

Each rating is based on observations made during the site visits and on professional judgement. Based on a synthesis of the above criteria, significance of an impact is rated as follows:

- **High significance:** where the impact would influence the decision to authorise the road upgrade regardless of any mitigation measures;
- **Moderate significance:** where the impact should influence the decision to upgrade the road, and where mitigation measures can, and must, be specified to reduce the overall impact; and
- **Low significance:** where the impact would not have any influence on the decision to authorise the upgrading of the road.



Appendix H – Letters Confirming Financial Provision for Rehabilitation





REGISTRATION NO. 1998/009584/06

Southern Region

SANRAL House, Southern Life Gardens, 70 2nd Avenue, Newton Park, Port Elizabeth
P O Box 27230, Greenacres, South Africa, 6057
Tel +27 (0) 41 398 3200 Fax +27 (0) 41 398 3211 / 3222

Reference:	S16/1/4 – N.002-100-2005/1 408856-v1	Fax Number:	+27 (0) 41 398 3222
Date:	27 January 2010	Direct Line:	+27 (0) 41 398 3220
Email:	lorior@nra.co.za	Website:	www.nra.co.za

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infrastructure*

The Regional Manager
Department of Minerals and Energy
Private Bag X6076
PORT ELIZABETH
6000

Attention: Ms. D. Watkins

PROJECT N.002-110-2005/1: UPGRADING OF NATIONAL ROUTE 2, SECTION 11 BETWEEN COEGA AND COLCHESTER : UPGRADING OF NATIONAL ROAD

This letter is submitted in support of the Environmental Management Programme for the development of borrow areas on Farm 308 (Mellville) and Farm 308/1 (The Downs) for the upgrading of approximately 12 km of road being National Route 2, Section 11 between Coega and Colchester (km 56 to km 68). We would like to confirm that this is a South African National Roads Agency Ltd project. The contract for the project has not been awarded as yet.

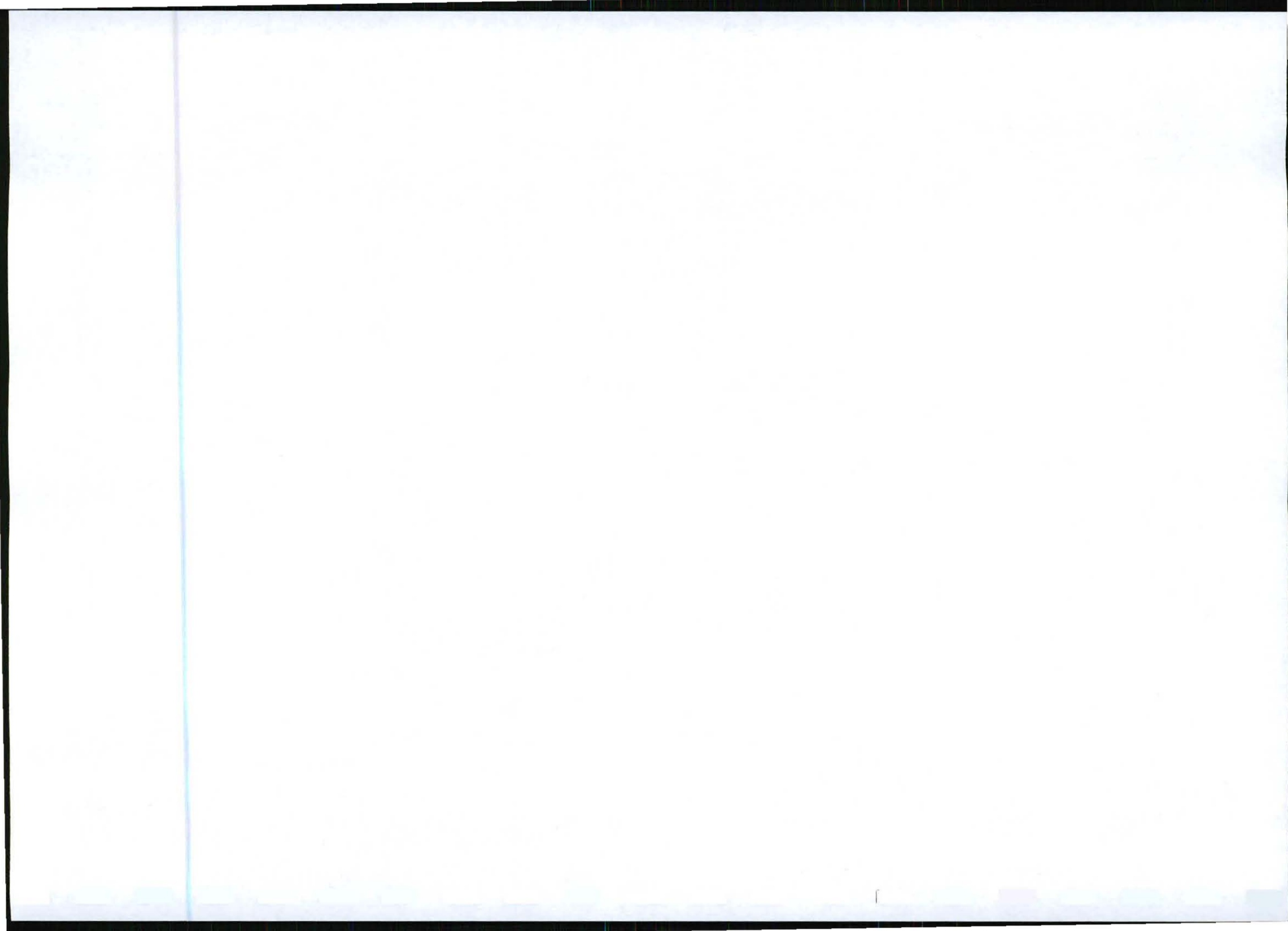
Yours faithfully

M S PETERSON

Regional Manager
South African National Roads Agency Ltd
Southern Region

Head Office: Ditsela Place, 1204 Park Street, Hatfield, Pretoria, 0001
Tel +27 (0) 12 426 6000 Fax +27 (0) 12 362 2101 / 2116 / 2117

Board of Directors: M.L. Ndlovu, (Chairman), N. Alli (CEO), A.Julies, S.D. Macozoma, Ms D.J. Nyamane, Ms
S.N. Mabaso-Konyana, M Noge, Ms L. Mchunu , Prof. F.O. Otieno
Company Secretary: Ms A.A. Mathew





Southern Region

SANRAL House, Southern Life Gardens, 70 2nd Avenue Newton Park, Port Elizabeth
P O Box 27230, Greenacres, South Africa, 6057
Tel +27 (0) 41 398 3200 Fax +27 (0) 41 398 3211 / 3222

Reference:	816/14 – N.002-110-2005/1 408999-v1	Fax Number:	+27 (0) 41 398 3222
Date:	29 January 2010	Direct Line:	+27 (0) 83 283 6140
Email:	lorlor@nra.co.za	Website:	www.nra.co.za

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wealth through
infrastructure*

The Regional Manager
Department of Minerals and Energy
Private Bag X6076
PORT ELIZABETH
6000

Attention: Ms. D. Watkins

PROJECT N.002-110-2005/1: UPGRADING OF NATIONAL ROUTE 2, SECTION 11 BETWEEN COEGA AND COLCHESTER : UPGRADING OF NATIONAL ROAD

With regard to our letter dated 27 January 2010 which confirmed the above to be a SANRAL project we would like to confirm that financial provision for the rehabilitation of the disturbed areas will be made in the tender documentation. This financial provision will be sufficient to rehabilitate the disturbed areas on Farm 308 (Mellville) and Farm 308/1 (The Downs) as contemplated in the Environmental Management Plan that is to be submitted to your office for approval.

We trust that you find the above in order and if you have any questions in this regard please contact the undersigned.

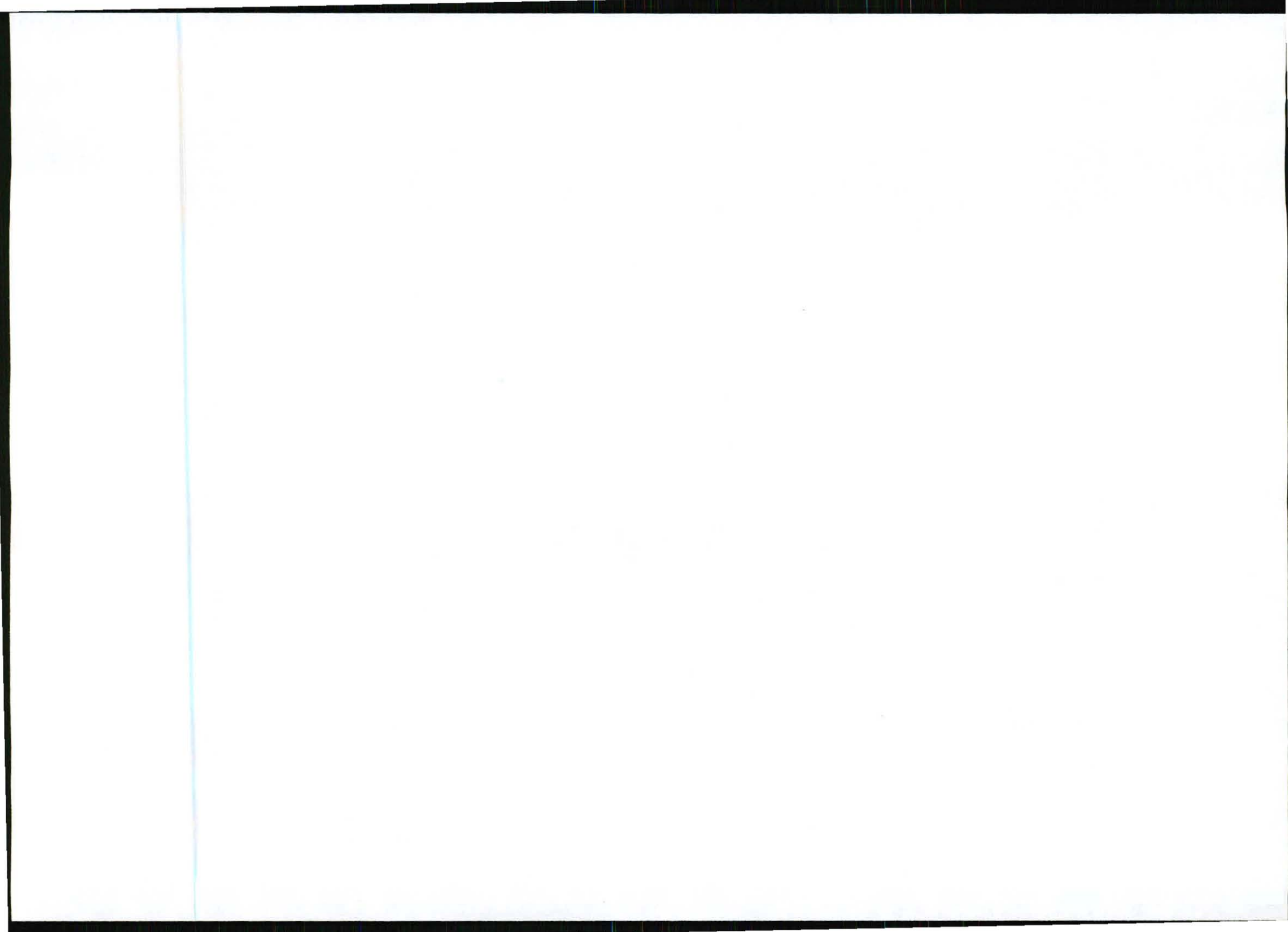
Yours faithfully,

R LORIO

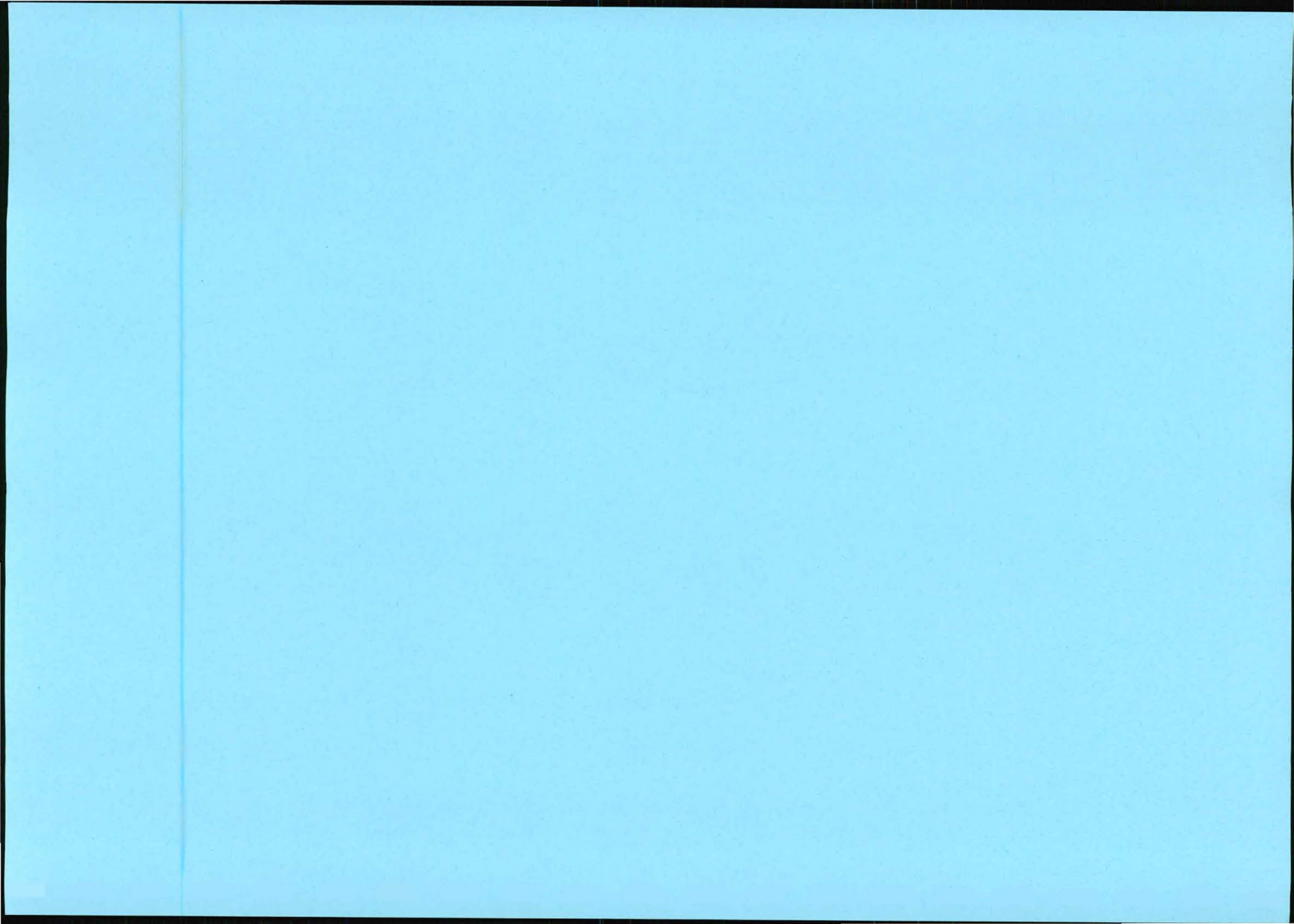
Project Manager
South African National Roads Agency Ltd
Southern Region

Head Office: Ditsela Place, 1204 Park Street, Hatfield, Pretoria, 0001
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Konyana, M Noge, Ms L. Mchunu, Prof. F.O. Orleno
Company Secretary: Ms A.A. Mathew





Appendix I – Undertaking



UNDERTAKING

I, MBULELO SIMON PETERSON

....., the undersigned and duly authorised thereto by
THE SOUTH AFRICAN NATIONAL ROADS AGENCY LIMITED

Company/~~Close Corporation~~/Municipality (Delete that which is not applicable) have studied and understand the contents of this document in its entirety and hereby duly undertake to adhere to the conditions as set out therein.

Signed at PORT ELIZABETH this 17 day of MARCH 2010.

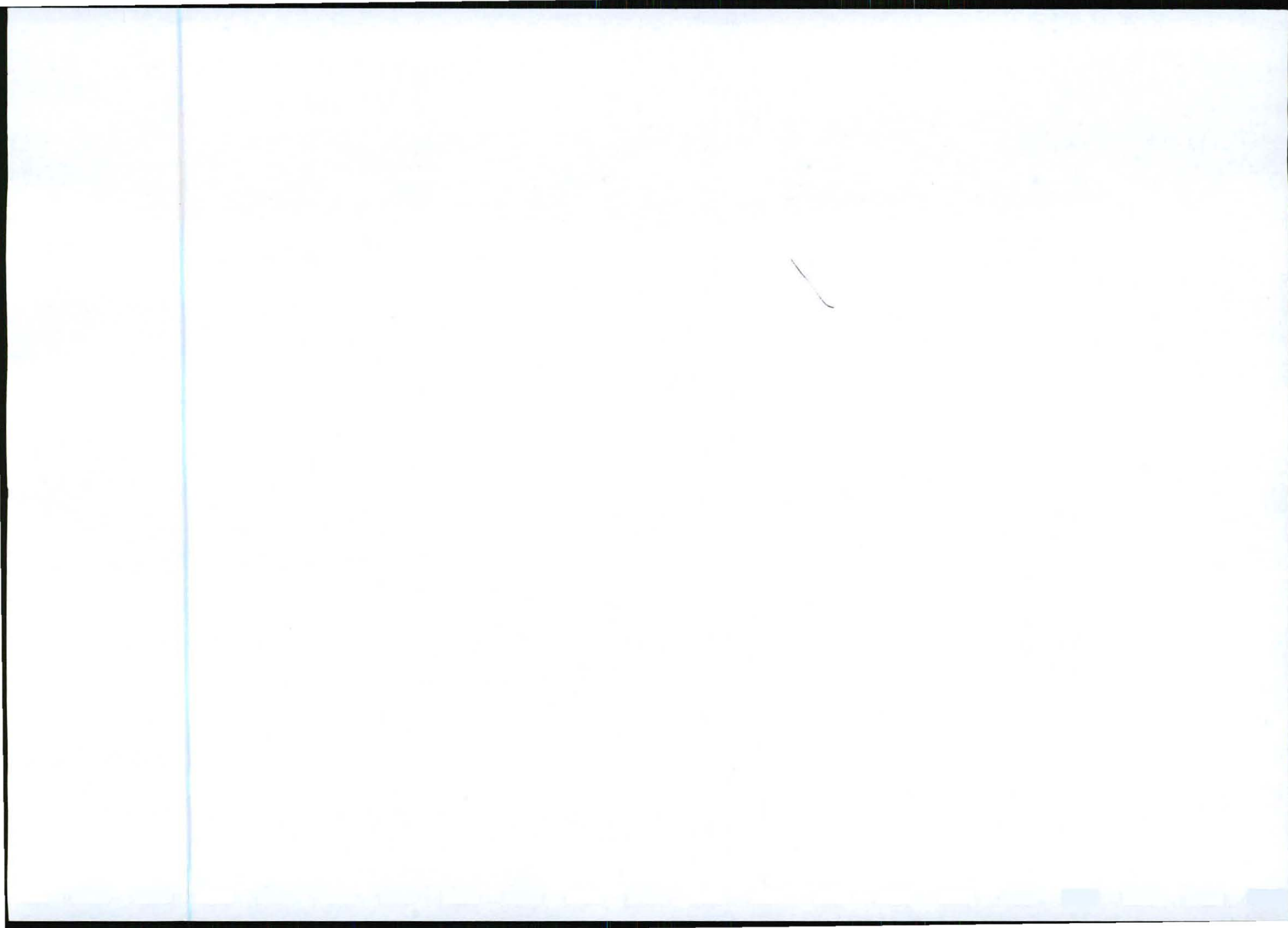


Signature of applicant

REGIONAL MANAGER

Designation

Agency declaration: This document was completed by SRK Consulting on behalf of SANRAL



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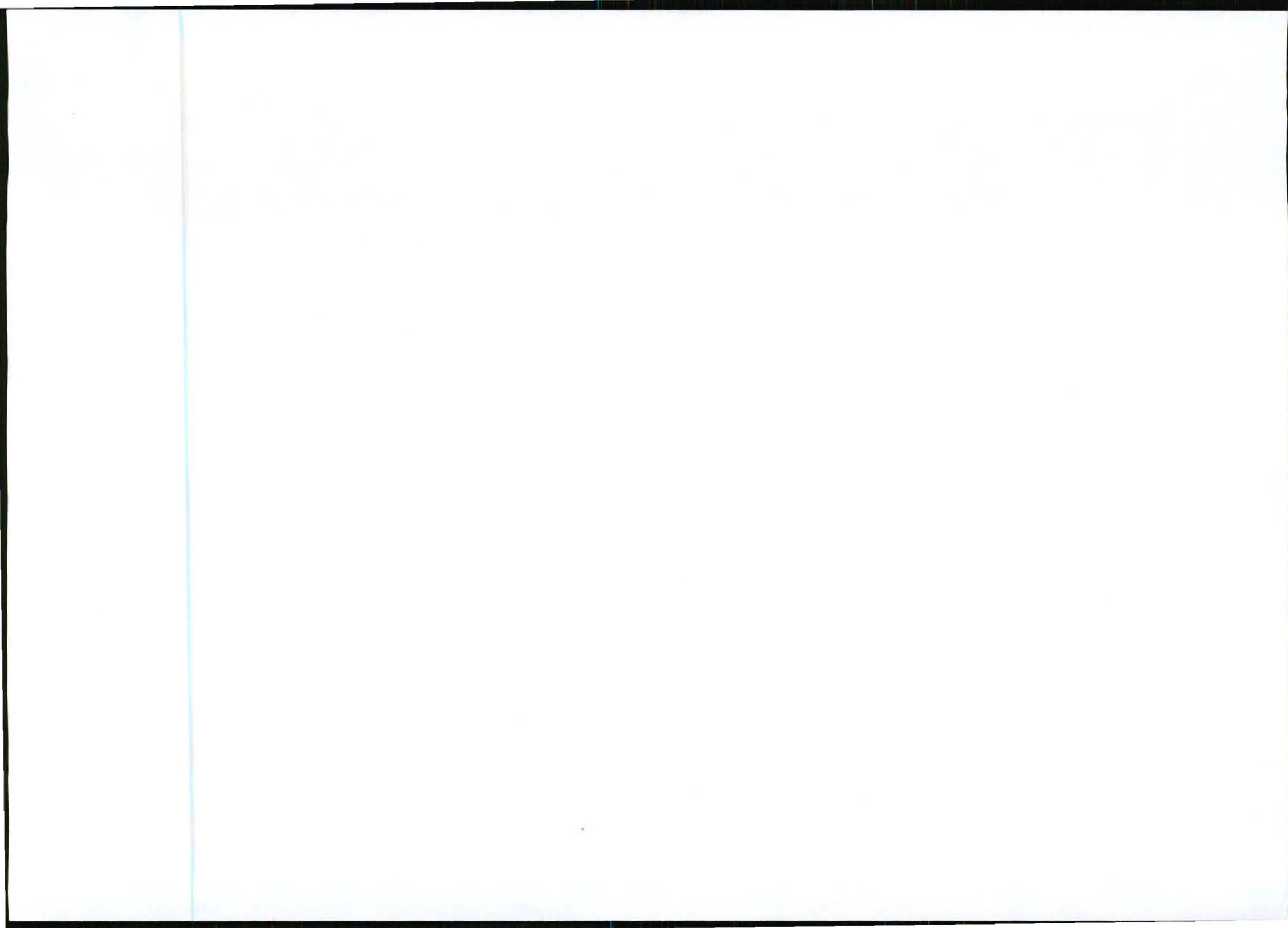
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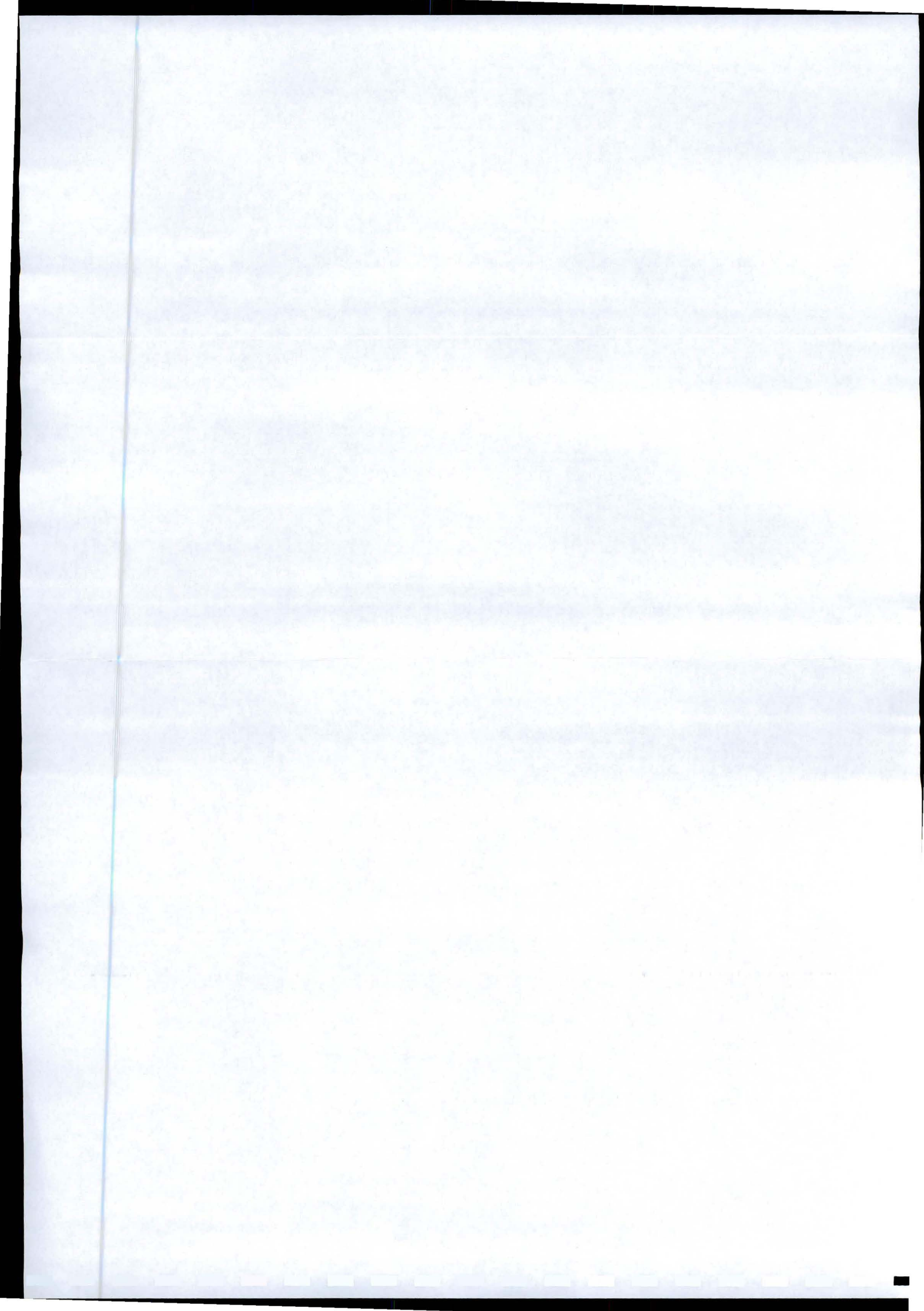
Name/Title	Company	Copy	Date	Authorised by
Regional Manager: Ms. Thandiwe Biyela	Department of Minerals and Energy (DME)	1-7	23 March 2010	R. Gardiner
Mr R. Lorio	SANRAL	8	23 March 2010	R. Gardiner
Mr Paul Maré	PPC	9	23 March 2010	R. Gardiner
Ms R. Du Plooy	Aurecon SA Pty Ltd.	10	23 March 2010	R. Gardiner
SRK Port Elizabeth Library	SRK Consulting	11	23 March 2010	R. Gardiner
SRK Johannesburg Library	SRK Consulting	12	23 March 2010	R. Gardiner

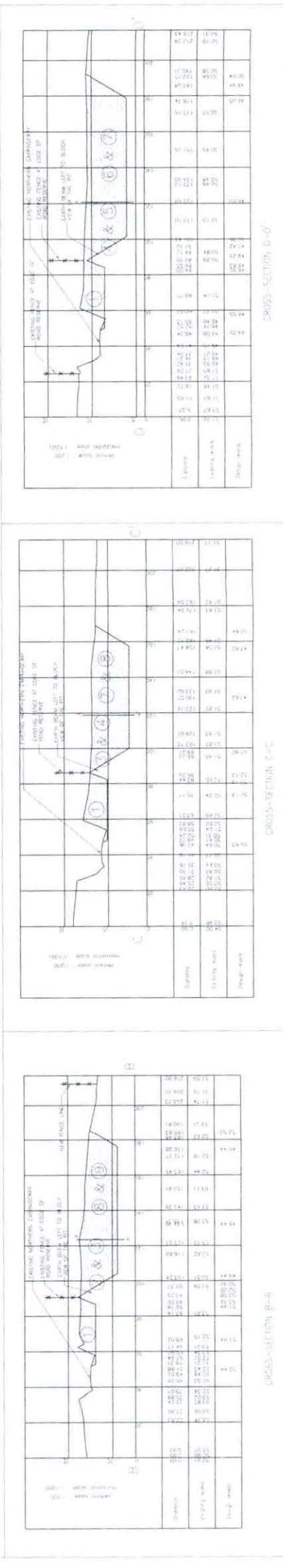
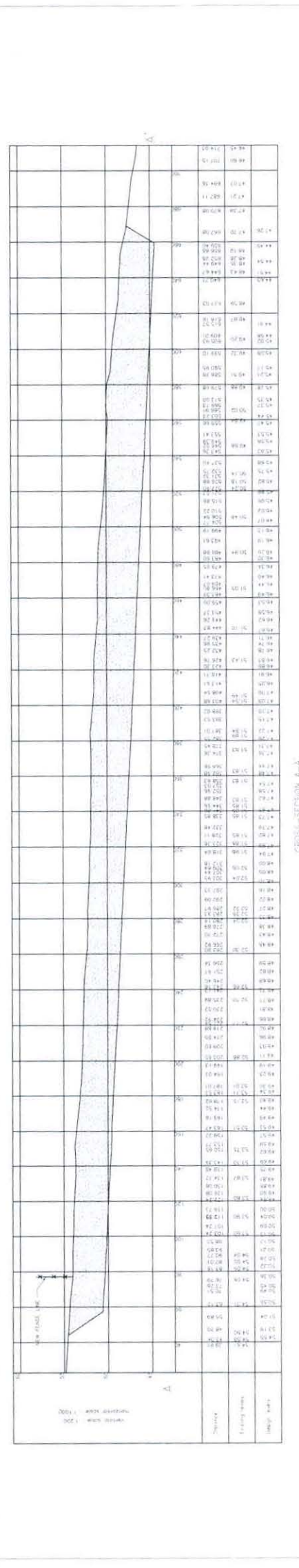
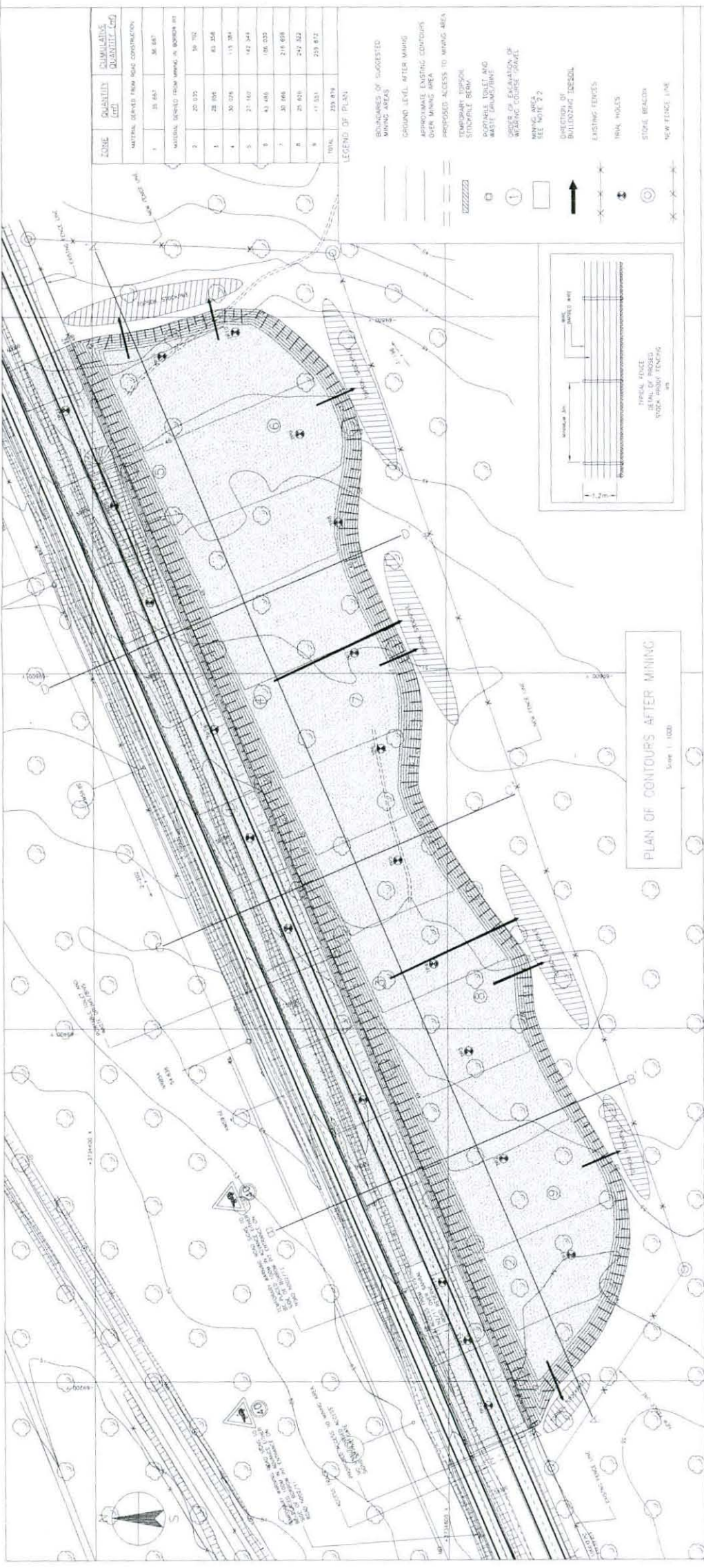
Approval Signature:



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- NOTES:**
1. PREPARATION OF THIS PLAN IS BASED ON THE DATA PROVIDED BY THE CLIENT.
 2. THE CLIENT IS RESPONSIBLE FOR THE ACCURACY OF THE DATA PROVIDED.
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PROJECT DESCRIPTION
NATIONAL ROUTE 3 SECTION 11
SOUTHERNE IS TO COLCHESTER REHABILITATION
BORROW PIT PLAN
Km 99-4 / 0.06 R

PROJECT NUMBER WRA/2022/00021
DATE 11/11/2022
SCALE 1:1000
PROJECT LOCATION DATA SECTION 11
INVESTIGATOR MRC/AS
DESIGNER MRC/AS
CHECKER MRC/AS
APPROVED MRC/AS

THE SOUTH AFRICAN NATIONAL ROADS AGENCY
 100 WATERLOO ROAD, WINDERMERE, JOHANNESBURG, 2013
 TEL: +27 (0)11 400 0000
 FAX: +27 (0)11 400 0001
 EMAIL: info@roads.gov.za

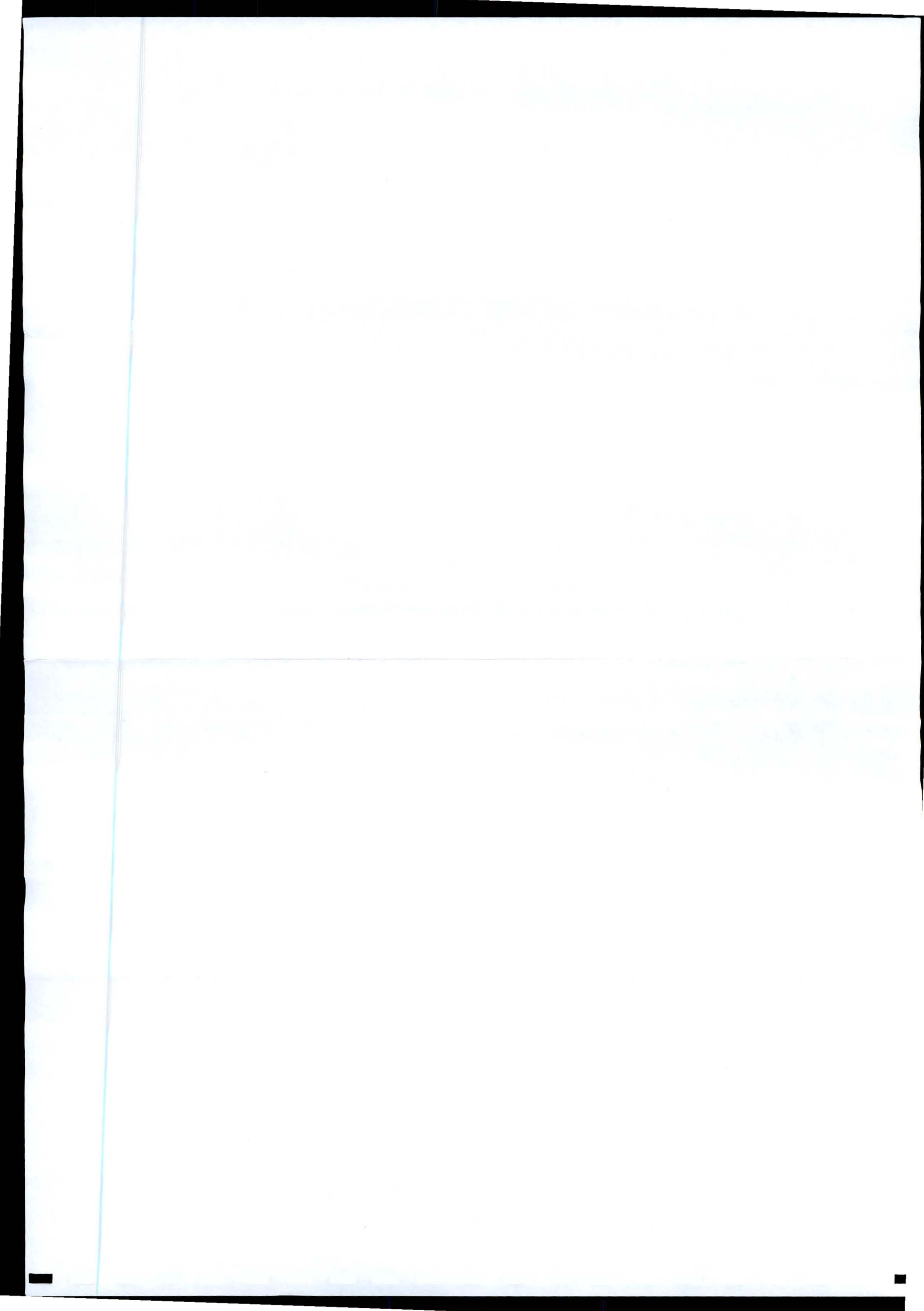
SEMENTA FURUMELE CONSULTING
 PO Box 4868, Ficksburg, 1601
 TEL: +27 (0)11 400 0000
 FAX: +27 (0)11 400 0001
 EMAIL: info@sementa.co.za

aurecon
 Aurecon Centre, Century Falls
 Century Boulevard, Century City, 7411
 Tel: +27 (0)21 252 8400
 Email: aurecon@auriconsouthafrica.com

REVISION
 NO. DATE REVISION BY

DATE 11/11/2022
BY MRC/AS
CHECKED MRC/AS
APPROVED MRC/AS

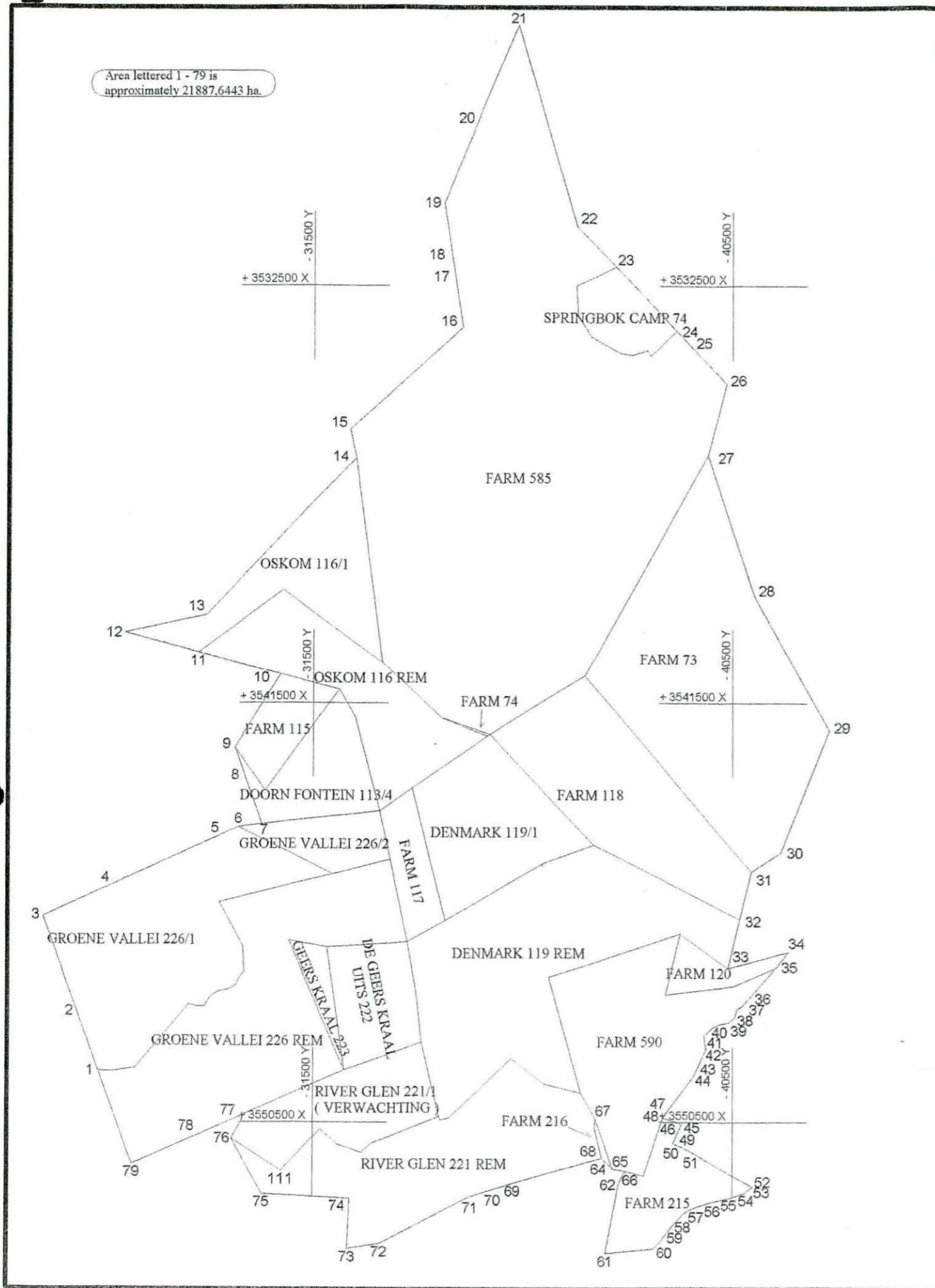
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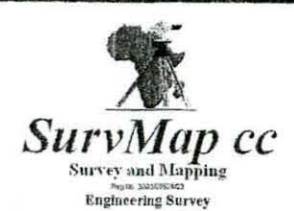
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66	-37894.15	51482.69
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68	-37663.65	51266.52
69	-35787.72	51812.05
70	-35353.01	51842.37
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72	-32818.41	53101.02
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60	-38788.90	53297.33

OFFICIAL PURPOSE
DME REF. No.: EC 30/5/1/1/2(28) PR



SurvMap cc
Survey and Mapping
Engineering Survey

Cell: 082 933 3223
Tel/Fax: 015 296 0267

5 Springbok Street
Fauna Park
POLOKWANE
0699

Prospecting area is approximately 21887,6443 ha in extent,
Sited on farms , 585 , 116 , 115 , 118 , 73 , 113 , 74 , 119 , 120 , 590 , 117 , 226 , 223 , 222 , 221.

Applied for a prospecting permit by,
TASMAN PACIFIC MINERALS Ltd
(112 181 665)

APPLICANT: *D. Woodall*

DATE: *11 November 05*

