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AMCOAL COLLIERY AND INDUSTRIAL OPERATIONS LIMITED

THE ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

FOR

LANDAU COLLIERY

A SECTION OF SOUTH AFRICAN COAL ESTATES

Report for the Schoongezicht

No 4 Seam Minipit

An Addendum to the Report for Landau Colliery

Dated November 1993

LANDAU COLLIERY

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SCHOONGEZICHT NO.4 SEAM MINIPIT

JULY 1994

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A. EXECUTIVE SUMMARY

This application for a minipit mining operation arises from an increase in the demand for export coal through the Richards Bay Coal Terminal (RBCT) in which Amcoal has a share. The development of this minipit will allow Amcoal to participate in sourcing its share of the demand which will be beneficial to the country in terms of foreign exchange and employment opportunities.

Landau Colliery has been granted a temporary mining authorization by the Department of Mineral and Energy Affairs - Regional Director, Witbank in terms of a letter dated 14 January 1993, reference OT 5/52/95, to mine on Schoongezicht 308 JS, RE. This Environmental Managment Programme Report (EMPR) sets out Amcoal's commitment to integrated environmental management for the exploitation of coal reserves by open cut mining on the farm Schoongezicht 308JS, RE and is submitted as an addendum to the Landau Colliery EMPR.

Mining of the minipit will be carried out by a contractor who will deliver the crushed coal to either the Klipfontein (old Landau III) plant or the Navigation plant by road haulage. Minipit mining will be carried out using conventional bowl scraper and shovel and truck operations. The two coal processing plants with their associated discard disposal facilities are described in the Kleinkopje Colliery and Landau Colliery EMPR's respectively.

Development of the minipit will be such that it will not impact adversely on the present clean and dirty water systems as described in the Landau Colliery EMPR for the Navigation plant. After closure, ground-water emanating from the minipit will not be allowed to decant into the Schoongezichtspruit, but will be pumped from wells in the spoils to the Navigation plant for process water.

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PART 1: **BRIEF PROJECT DESCRIPTION**

1.1 NAME AND ADDRESS OF MINE, MINE OWNER, MINE MANAGER AND RESPONSIBLE HEAD OFFICE PERSON

All communications should in the first instance be directed to;

Postal: The Mine Manager:

Landau Colliery
P O Box 78
Clewer
1036

Telefax: (0135) 902074
Telephone: (0135) 902066

Thereafter the Consulting Engineer who may be contacted at:

Postal: Coal II
Amcoal Colliery & Industrial Operations Ltd.
P O Box 61587
MARSHALLTOWN
2107

Telefax No.: (011) 638 2645
Telegraph: Anmercosa
Telephone: (011) 638 9111

The company registration number of the mine is:

Reg NO. 01/06730/06

The location of the minipit mine is shown on Figure 1.1.1.

1.2 NAME AND ADDRESS OF THE MINERAL RIGHTS HOLDER

The mineral rights are held by:

Amcoal Colliery and Industrial Operations Limited

Postal Address: P O Box 61587
Marshalltown
2107

Physical Address: 44 Main Street
Johannesburg
2000

In the application for mining authorization dated 18th December 1992, plans and schedules detailing the areas over which coal rights are held for Landau Colliery where submitted to the Regional Director - Eastern Transvaal Region.

A temporary mining authorization for Landau Colliery has been granted until issuing of a Mining Authorization in terms of letter dated 14th January 1993 reference OT 5/5/2/95.

Figure 1.2.1 shows the location of coal reserves held by the company whilst Figure 1.2.2 shows the coal reserves for the Schoongezicht area.

1.3 NAME AND ADDRESS OF THE HOLDER OF THE MINING AUTHORIZATION

The Manager
Landau Colliery
P O Box 78
CLEWER
1036

1.4 NAME AND ADDRESS OF THE OWNER OF THE LAND AND THE TITLE DEED DESCRIPTION

Amcoal Colliery and Industrial Operations Ltd.

Postal Address: P O Box 61587
Marshalltown
2107

Physical Address: 44 Main Street
Johannesburg
2000

1.5 REGIONAL SETTING

1.5.1 The Schoongezicht No 4 Seam minipit mine is situated in the Witbank magisterial district and is served by the Highveld Regional Services Council.

1.5.2 The minipit mine is situated 6km southwest of Witbank.

1.5.3 Figure 1.2.1 shows the location of the minipit mine and Navigation plant in relation to Witbank and also infrastructure serving the area.

1.5.4 Infrastructure services shown on Figure 1.5.1 are covered by servitudes over properties they traverse. Details of these servitudes can be made available if required.

1.5.5 The minipit is situated on the farm Schoongezicht 308 JS, Remaining Extent.The surface rights and the coal rights are owned by Acoils (Figure 1.2.2).

1.5.6 The minipit and Navigation plant are situated in the Olifants River Catchment number 210.

1.6 DESCRIPTION OF THE PROJECT

1.6.1 The mineral to be mined is a bituminous coal.

1.6.2 The minipit mine will extract some 1.4 million tons of bituminous coal per annum. The coal will be road hauled to the Navigation and Klipfontein plants to produce a steam coal product at the rate of up to 1.0 million tons per year.

1.6.3 The economic reserves total 3.7 million run of mine tons which will yield some 2.6 million tons of steam coal.

1.6.4 This EMPR covers only the Schoongezicht No. 4 Seam minipit. The mining method to be employed will involve a combination of truck and shovel fleet, bowl-scraper fleet and bulldozers. Contractors will be used for all phases of mining, primary coal crushing and road hauling to the plants.

1.6.5 At full output the mine will produce between 0.75 and 1.0 million tons per year of steam coal from between 1.1 to 1.4 million tons per year of raw coal.

1.6.6 The project's life is approximately 3.5 years.

PART 2: **DESCRIPTION OF THE PRE-MINING ENVIRONMENT**

2.1 GEOLOGY

2.1.1(a) Geological description

The regional geology of the Schoongezicht coal deposit is shown on the 1:250 000 Geological Survey series, Pretoria Sheet, No 2528. The coal occurs in the Vryheid Formation of the Ecca Group which overlies a thin layer of Dwyka Group shales and tillites. The Ecca and Dwyka sedimentary rocks were deposited in glacial valleys unconformably overlying Waterberg Group quartzites and sandstones.

A thin veneer of Dwyka sedimentary rocks are present, but they are generally not thick enough to prevent the propagation of the irregular pre-Karoo topography into the overlying Vryheid Formation.

The Vryheid Formation attains a maximum thickness of 140m. Up to six coal seams are present, of which four have economic potential. The preservation of the coal seams is a function of pre-Karoo topography, sedimentary processes and present-day erosion.

Figure 2.1.1 comprises four geological logs of the minipit area. The boreholes reflected are SAC 2273, SAC 2283, SAC 2289, SAC 2300 and their locations are shown on Figure 2.1.2. Three geological cross sections of the minipit are shown on Figure 2.1.3. The location of the cross sections is shown on Figure 2.1.4.

2.1.1(b) Overburden characteristics

The overburden is comprised of soil, weathered sandstone and fresh sandstone.

Zone 1

The orange brown soil from the A and B horizons was analysed and found to have acidic tendencies.

Zone 2

Zone 2 is comprised of C horizon material and intact highly weathered carbonaceous sandstone. The sandstone will contaminate the water with aluminium, iron, calcium, potassium, magnesium, manganese and acidity.

2.1.1(c) Acid-base characteristics of the spoil

Selected borehole samples of the various unweathered lithological components of the overburden were submitted to the Institute for Ground Water Studies (IGWS) for acid-base potential analysis. The material was ground to 80% less than 200μ and water circulated through the sample to simulate salt generation. Although the use of powdered samples is not representative of spoil fragments that occur within the opencast areas, this is the current accepted procedure used to predict water quality generated from opencast mine spoils.

The initial and oxidised pH-values and the Net Neutralization Potential (NNP) for the samples were measured. The NNP of the sample is a measure of the overall base potential of the spoils after allowance has been made to neutralize the acidic components of the spoils. NNP is measured in the equivalent kilograms of $CaCO_3$ per ton of spoil required to neutralize the spoils, with negative values indicating overall acidic conditions and positive values indicating overall basic conditions.

The laboratory results only provide a framework for evaluating the effect of spoils on the ground water in the field. The results can be influenced by such factors as the size of spoils particles, the formation of preferential pathways through the spoil material, the distribution of pyrite and neutralising components within the spoil fragments and the placement of coal discards.

Two options are available for evaluating whether a mine is potentially acid or not. The first option is to assume that the spoil material approximates a closed system. Although this represents the maximum acid potential in terms of carbonate consumption, it is probably a realistic approximation in view of the long-term projected behaviour of the spoil environment. The second alternative involves the concept of a threshold value for the NNP of an open system. Studies have shown that a mine with a NNP threshold value of greater than 30kg $CaCO_3$/ton of spoil will produce alkaline drainage. The IGWS predicts that the minipit will behave as a semi-closed system.

Out of the seven samples submitted, six samples indicated acidic tendencies, as is indicated by the drop in the pH after oxidation (Table 2.1.1) and also the negative NNP values. The heavy metals that are likely to be leached from the rock are indicated in Table 2.1.1. The heavy metals include A1, Co, Fe, Mn and Zn. Small amounts of Cd, Cu and Ni will also be released.

TABLE 2.1.1 ELEMENTS RELEASED DURING COMPLETE OXIDATION OF SPOILS FOR THE EASTERN AND WESTERN PITS (AT FINAL PH-VALUE)

The sample concentrations are weighted according to the respective volumes occurring in the pit. The results indicate that on closure of the pit the water emanating from the spoils will be acidic.

Weighted Number	Al mg/g	B mg/g	Ba mg/g	Ca mg/g	Cd mg/g	Co mg/g	Cu mg/g	Fe mg/g
	0.286	0.000	0.005	0.089	0.000	0.001	0.0028	0.163

Weighted Number	K mg/g	Mg mg/g	Mn mg/g	Na mg/g	Ni mg/g	Sr mg/g	Zn mg/g	S mg/g
	0.189	0.038	0.010	0.040	0.002	0.002	0.002	0.267

Weighted Number	Initial pH	Final pH	NNP Open System Kg $CaCO_3$/t	NNP Closed System Kg $CaCO_3$/t
	6.3	3.8	0.616	-0.218

2.1.2 Presence of dykes, sills and faults

Rare diabase intrusions in the pre-Karoo Waterberg Group have been regionally mapped, but no regional faulting has been detected.

The No. 1 Seam and No. 2 Seam have been partially mined by underground methods. Examination of the underground plans show the seams to be relatively undisturbed and it is therefore unlikely that the overlying 4 Seam has been affected.

Two North, South trending dykes are expected to be intersected in the Western minipit and are shown on figure 4.1.4.

2.2 CLIMATE

2.2.1 Regional climate

The average summer temperature range is from 12 degrees Celsius (°C) to 29°C with an average temperature of 20°C. The winter temperature varies from -3°C to 20°C with an average temperature of 9°C, the first frost being experienced in May and the last in August. The prevailing winds are from the northwest with an average wind speed of 2.9 metres per second. The climate of the area is one of summer rainfall with an average Mean Annual Precipitation (MAP) of 690mm per annum. There is normally one rainfall event of over 40mm annually.

2.2.2 Mean monthly and annual rainfall

Table 2.2.1 shows the monthly and annual rainfall recorded at the Kromdraai opencast mine since 1982 when records commenced.

TABLE 2.2.1 - MONTHLY AND ANNUAL RAINFALL AT KROMDRAAI LIMING PLANT (mm/MONTH AND mm/YEAR)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1982	38	52	132	14	0	0	11	0	4	85	89	30	555
1983	186	36	90	31	15	21	23	38	3	83	251	89	866
1984	121	115	86	7	0	20	15	6	14	112	71	82	649
1985	78	171	89	0	17	0	0	0	49	83	65	94	646
1986	119	66	54	22	0	7	0	1	0	91	195	121	676
1987	143	36	187	17	3	0	0	41	86	65	217	123	918
1988	76	63	52	18	0	12	4	0	6	120	84	97	532
1989	76	151	95	29	11	49	0	5	2	52	179	124	773
1990	39	77	104	89	8	20	4	0	7	34	82	202	666
1991	189	153	158	4	2	28	0	0	6	69	45	97	751
1992	70	93	51	9	0	0	0	1	1	69	88	62	544
AVERAGE	112	92	100	22	5	14	5	8	16	78	124	111	689

Table 2.2.2 shows the number of days in each month since 1986 with measurable precipitation.

TABLE 2.2.2 - MONTHLY AND ANNUAL DAYS OF RAINFALL AT KROMDRAAI LIMING PLANT (mm/MONTH AND mm/YEAR)

MONTH	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	AVERAGE
Mar	6	12	8	6	9	15	5	9
Apr	7	4	3	7	7	1	4	5
May	-	1	-	3	3	1	-	1
Jun	2	-	4	4	-	4	-	2
Jul	-	-	2	-	1	-	-	< 1
Aug	1	4	-	1	-	-	2	1
Sept	-	10	6	1	2	2	1	3
Oct	6	8	11	6	6	5	10	7
Nov	12	18	13	11	11	10	7	12
Dec	13	12	12	12	15	10	10	12
Jan	13	7	8	9	13	11	10	10
Feb	8	6	11	10	9	8	13	9
Total	68	82	78	70	76	67	62	72

2.2.3 Maximum rainfall intensities per month

The storm event figures for the Schoongezicht/Navigation area has not been recorded.

Table 2.2.3 shows the rainfall records available from the Witbank Municipality.

TABLE 2.2.3 - AVERAGE RAINFALL AND 24 HOUR STORM EVENTS RECORDED BY THE WITBANK MUNICIPALITY FOR THE PERIOD MAY 1956 TO JANUARY 1992

MONTH	AVERAGE	Max. in 24 hrs	
		(mm)	Date
Jan	132	76	81.01.23
Feb	83	94	84.02.26
Mar	81	88	91.03.17
Apr	48	66	60.04.23
May	14	30	56.05.10
Jun	9	54	89.06.04
Jul	9	28	57.07.02
Aug	8	24	87.08.25
Sep	30	51	81.09.10
Oct	82	77	58.10.21
Nov	123	61	83.11.20
Dec	104	62	89.12.23

2.2.4 Mean monthly maximum and minimum temperatures

The nearest weather stations at which these data have been recorded are Carolina and Bethal. These figures are not believed to represent climatic conditions in the Witbank region and have therefore not been included, but will be made available on request.

2.2.5 Mean monthly wind direction and speed

The nearest weather stations at which these data have been recorded are Carolina and Bethal. These figures are not believed to represent climatic conditions in the Witbank region and have therefore not been included, but will be made available on request.

2.2.6 Mean monthly evaporation

The mean monthly evaporation for Witbank Dam is presented in Table 2.2.4

TABLE 2.2.4 - MEAN MONTHLY EVAPORATION AT WITBANK DAM FOR THE PERIOD MARCH 1963 TO SEPTEMBER 1989 (SYMONS TANK) (mm/MONTH).

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
170	165	174	178	144	136	100	81	68	74	100	136

2.2.7 Incidence of extreme weather conditions

There are no suitable records of extreme weather conditions, however if required these may be extracted from the records of the nearest weather station.

2.3 TOPOGRAPHY

The topography of the area is illustrated on the Government topocadastral maps numbered 2529 CC and 2529 CA on a scale of 1:50 000. Also available are orthophoto plans to a scale of 1:100 000 with surface contour intervals of 5 metres. The most recent aerial survey of the area was carried out in 1991.

Figure 2.1.4 shows in detail the pre-mining topography of the Schoongezicht minipit. The surface lies at between 1 504 and 1 531 metres above mean sea level (mamsl) dipping gently to the north and towards the Schoongezichtspruit.

The stormwater run-off is towards the Schoongezichtspruit which flows into the Brugspruit.

The topography has been disturbed by surface structures such as power lines, a railway line, shafts and graves. Also present is a buried pipeline for pumping acid water from the Schoongezicht dam to the Navigation plant.

2.4 SOIL

Red Earth, a forestry soil consultancy, were commissioned to report on the soil depth, soil classification and land capability of the area (see Supplementary Report No 1). Figure 2.4.1 shows the pre-mining soil types mapped.

The soil cover for the area surveyed consists of an association typical of the Eastern Highveld. The pattern is made up of a variation of red, yellow, brown, hydromorphic and shallow soils.

The relative abundance of the five main soil types is shown in Table 2.4.1.

TABLE 2.4.1 - DISTRIBUTION OF SOIL TYPES

Soil type	Area (ha)	% of Total
Red apedal soils	41.3	34.0
Yellow-brown apedal soils	58.6	48.4
Hydromorphic soils	7.5	6.2
Shallow soils	7.6	6.2
Exposed rock/hard plinthite	6.4	5.2
Total	121.4	100.0

2.5 PRE-MINING LAND CAPABILITY

The area to be disturbed is some 75 hectares in size, inclusive of the crushing area, contractor's site and haul roads. The mining area, including the land 100m outside the mining perimeter was surveyed to ensure proper coverage. The Chamber of Mine's rehabilitation guidelines were used in the determination of land capability classes. The land capability classes for the East Pit, West Pit and surrounds are shown in Table 2.5.1. Information extracted from Supplementary Report No 1.

TABLE 2.5.1 - PRE-MINING LAND CAPABILITY

Land Capability	Location	Total	
		ha	% of Area
Wetland	East Pit	0	0.0
	West Pit	1.0	0.8
	Surrounds	3.2	2.5
Arable	East Pit	8.4	6.8
	West Pit	17.8	15.5
	Surrounds	32.4	26.6
Grazing	East Pit	3.5	2.8
	West Pit	29.7	24.5
	Surrounds	19.0	15.6
Wilderness	East Pit	2.5	2.0
	West Pit	3.0	2.3
	Surrounds	0.9	0.6
Total East Pit		14.4	11.6
Total West Pit		51.5	43.1
Total Surrounds		55.5	45.3
Total		121.4	100.0

Figure 2.5.1 shows the pre-mining capability distribution.

2.6 LAND USE

2.6.1 Pre-mining land use

Prior to commencement of mining the land was used for grazing and arable purposes. It should be pointed out that the actual use of the land differs from the surveyed potential and use capability, in that grazing areas have been utilised for arable purposes and visa versa. This anomaly appears to be due to practical limitations of using agricultural equipment in the low lying areas of the Schoongezichtspruit.

2.6.2 Historical agricultural production

Historically the East Pit and its surrounds were used for grazing purposes. The West Pit was mainly used for arable purposes. Thirty five hectares of the possible forty two hectares to be mined in the West Pit were used as arable ground.

2.6.3 Evidence of misuse

Agricultural misuse has been observed and is described in section 2.6.1.

2.6.4 Existing structures (prior to development of the project)

Existing structures on the mining area are:

- Inclined shaft
- Ventilation shafts
- Dwellings
- Railway line
- Pipe line (water)
- Dam
- Graves
- Power lines
- Foundations of old contractor site.

2.7 NATURAL VEGETATION/PLANT LIFE

A pre-mining vegetation survey of the area to be disturbed by mining operations was conducted by the Amcoal Environmental Services (AES) Department (See Supplementary Report No. 2).

Approximately 50% of this area is currently planted to maize. The remaining natural vegetation is the Eastern variation of Bankenveld, but is degraded and dominated by the grasses *Hyparrhenia hirta* and *Aristida diffusa*.

Within the mini pit area, five plant communities (excluding the land under maize) were recognised (See Figure 2.7.1).

Community A - *Hyparrhenia hirta* dominated grassland.
Community B - Disturbed *Hyparrhenia hirta* grassland.
Community C - *Aristida diffusa* dominated grassland.
Community D - *Mesophytic* community.
Community E - Sandstone community.

Species present within the area currently planted to maize are *Cynodan dactylon*, *Verbena braziliensis*, *Ipomoea purpurea*, *Bidens formosa*, *Bidens pilosa* and *Tagetes minuta*.

The species composition of the natural vegetation within the minipit area is poor, with the grassland dominated by species of low grazing value. The natural vegetation within this area is, however, stable and provides a high basal cover, exceeding 15%. Results of a pre-mining survey showed that no endangered or rare plant species occurred on the site (see Supplementary Report No 2).

2.8 ANIMAL LIFE

An animal life survey of the area to be disturbed by mining operations was conducted by the Amcoal Environmental Services (AES) department (see supplementary report No. 2).

The Schoongezicht No 4 Seam minipit falls within the natural distribution range of a variety of wild life species which are not endangered and which would be affected only in the short term by the mining operation. Nine species of birds were observed during the survey. No mammals were observed during the survey period, but mole hills and droppings of Common Duiker were evident. No South African Red Data bird or mammal species were found in the area during the pre-mining survey. However Supplementary Report No 2 indicates the possibility of Grass Owl, African Wild Cat and Striped Weasel occurring. Should any of these species be found during mining operations steps will be taken to have them relocated.

2.9 SURFACE WATER

2.9.1 Surface water quantity

2.9.1(a) Measured data

The mine has no measured flow data for the immediate mining area. However a weir has been commissioned downstream of the pit on the Schoongezichtspruit with continuous monitoring equipment measuring pH, conductivity and flow. Results from the weirs' equipment has been unreliable and new equipment is currently being installed. Data from this station will be submitted annually with the Landau Colliery returns.

2.9.1(b) Modelled data

Estimates of surface water quantities were obtained using various models. The WRSM90 computer model was used to simulate monthly run-off and the Rational Method was used to model design run-off. The effect of the mining window was modelled using parameters obtained from personal communication with Professors F D I Hodgson and N F G Rethman.

Messrs Stewart Scott Inc. prepared a hydrological study for the Navigation/Schoongezicht areas using the WRSM90 model (see Supplementary Report No 8 of the Landau Colliery EMPR). The same model parameters and data bases were used for simulations carried out by the mine's staff for the present water reticulation on the property. The Ogies weather station rainfall database for the period 1912 to 1989 was used to model surface water run-off. Run-off volumes were generated for the undisturbed, present mining and closure scenarios. The mining window model was used for the open pit in the mining scenario and subsequently integrated with the WRSM90 model.

2.9.1.1 Catchments

The mining area straddles the Schoongezichtspruit which flows into the Brugspruit as shown on Figure 1.2.1 These steams form part of the Olifants River catchment, catchment No. 210, as shown in Figures 2.9.1 and 2.9.2.

2.9.1.2 Calculated mean annual run-off

Mean annual run-off is affected by the physical nature of the topography, which in the case of Schoongezicht, falls into two categories namely "undisturbed" and "mined by opencast methods".

Table 2.9.1 shows the estimated percentage breakdown of the disposal of mean annual precipitation for undisturbed areas and areas mined by opencast.

TABLE 2.9.1 - ESTIMATED PERCENTAGE BREAKDOWN OF THE DISPOSAL OF MEAN ANNUAL PRECIPITATION

NATURE OF TOPOGRAPHY	CATEGORY	PERCENTAGE
Undisturbed	- Evaporation - Run-off - Ground water	83% 7% 10%
Mined by opencast	- Evaporation - Run-off - Ground water	80% 10% 10%

The consultants, Stewart Scott Inc., assumed a lower crop co-efficient for rehabilitated areas as compared to virgin areas. This assumption results in an enhanced run-off volume simulation for rehabilitated areas. However, during mining the biomass of rehabilitated areas is greater than that for virgin areas. In the long term the rehabilitated areas are expected to revert to natural veld conditions with lower evaporation. Due to the compaction of top soil by mining machinery rehabilitated soil will have a lower field capacity. Field capacity is the amount of water remaining in the soil horizon after free drainage has occurred. Once field capacity is reached, run-off should theoretically occur. Therefore, when the precipitation event occurs, less precipitation will be required to attain field capacity. Since less precipitation is required to attain field capacity for rehabilitated areas, run-off will occur more frequently as compared to virgin areas. The parameters in Table 2.9.1 will require validation and are being investigated by Amcoal in order to calibrate the model (Refer to Kleinkopje Colliery EMPR).

The surface water model for the minipit catchment and the ground water model has been integrated to provide an overall model to estimate the water balance. Pump test data for the high wall of the pit has allowed for a fairly accurate estimate of groundwater flow into the pit to be made (see section 2.10.5). The evaporative and run-off components of the mining window (Table 2.9.2) were calculated manually for the end of each fiscal year. The resultant in-pit water generated is shown in Tables 2.9.3 and 2.9.4. The extent of mining for each fiscal year is shown in Figure 4.1.4. A cross-section of the mining window is shown on Figure 4.1.5 which has been used to calculate the in-pit water generation.

TABLE 2.9.2 - ESTIMATED PERCENTAGE BREAKDOWN OF THE DISPOSAL OF MEAN ANNUAL PRECIPITATION FOR THE MINING WINDOW

MINING WINDOW SUB-SECTION	CATEGORY	PERCENTAGE
1. Topsoil (virgin)	- Evaporation - Run-off - Ground water	83% 7% pump test data 10%
2. Topsoil removed	- Evaporation - Run-off - Ground water	40% 50% pump test data 0%
3. Pit	- Evaporation 1 326mm x 15% area - Precipitation 700mm x 100% area	
4. Spoils	- Evaporation - Run-off - Infiltration	65% 5% 30%
5. Levelled	- Evaporation - Run-off - Infiltration	75% 5% 20%
6. Topsoil (levelled)	- Evaporation - Run-off - Infiltration	78% 12% 10%
7. Vegetated	- Evaporation - Run-off - Infiltration	80% 10% 10%

TABLE 2.9.3 - WESTERN PIT MINING WINDOW SURFACE WATER AND HIGHWALL GROUND WATER VOLUMES

F1994

CUTS		J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
	Precip % MAP	17	13	12	3	1	2	1	2	4	13	18	16	102
	Highwall ground water	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	113388
	Nett rainfall to pit													
11	Virgin	28775	21410	19697	5652	1884	3083	1713	3083	6337	21410	31173	27062	171279
1	Prestrip	2837	2111	1942	557	186	304	169	304	625	2111	3073	2668	16887
1	Pit precipitation	3152	2345	2157	619	206	338	188	338	694	2345	3414	2964	18760
1	Pit evaporation	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-5232
1	Spoils	948	704	647	186	62	101	56	101	208	704	1024	889	5628
1	Levelled spoils	630	469	431	124	41	68	38	68	139	469	683	593	3753
1	Topsoil levelled	315	235	216	62	21	34	19	34	69	235	341	296	1877
1	Vegetated	315	235	216	62	21	34	19	34	69	235	341	296	1877
Total	m^3	45983	36520	34320	16275	11434	12975	11214	12975	17156	36520	49064	43782	328218
	l/s	17	14	13	6	4	5	4	5	7	14	19	17	10.2

F1995

CUTS		J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
	Precip % MAP	17	13	12	3	1	2	1	2	4	13	18	16	102
	Highwall ground water	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	113388
	Nett rainfall to pit													
2	Virgin	5232	3893	3581	1028	343	561	311	561	1152	3893	5668	4920	31143
1	Prestrip	2837	2111	1942	557	186	304	169	304	625	2111	3073	2668	16887
1	Pit precipitation	3152	2345	2157	619	206	338	188	338	694	2345	3414	2964	18760
1	Pit evaporation	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-5232
1	Spoils	948	704	647	186	62	101	56	101	208	704	1024	889	5628
1	Levelled spoils	630	469	431	124	41	68	38	68	139	469	683	593	5630
1	Topsoil levelled	315	235	216	62	21	34	19	34	69	235	341	296	1877
10	Vegetated	3152	2345	2157	619	206	338	188	338	694	2345	3414	2964	18760
Total	m^3	25278	21114	20146	12208	10078	10756	9982	10756	12595	21114	26632	24308	204965
	l/s	10	8	8	5	4	4	4	4	5	8	10	9	6.6

F1996

CUTS		J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
	Precip % MAP	17	13	12	3	1	2	1	2	4	13	18	16	102
	Highwall ground water	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	113388
	Nett rainfall to pit													
0	Virgin	0	0	0	0	0	0	0	0	0	0	0	0	0
1	Prestrip	2837	2111	1942	557	186	304	169	304	625	2111	3073	2668	16887
1	Pit precipitation	3152	2345	2157	619	206	338	188	338	694	2345	3414	2964	18760
1	Pit evaporation	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-436	-5232
1	Spoils	948	704	647	186	62	101	56	101	208	704	1024	889	5628
1	Levelled spoils	630	469	431	124	41	68	38	68	139	469	683	593	5630
1	Topsoil levelled	315	235	216	62	21	34	19	34	69	235	341	296	1877
12	Vegetated	3782	2814	2589	743	248	405	225	405	833	2814	4097	3557	22512
Total	m^3	20675	17690	16996	11304	9777	10263	9708	10263	11582	17690	21847	19981	177576
	l/s	8	7	6	4	4	4	4	4	4	7	8	8	5.7

TABLE 2.9.4 - EASTERN PIT MINING WINDOW SURFACE WATER AND HIGHWALL GROUND WATER VOLUMES

F1994

CUTS		J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
	Precip % MAP	17	13	12	3	1	2	1	2	4	13	18	16	102
	Highwall ground water	7052	7052	7052	7052	7052	7052	7052	7052	7052	7052	7052	7052	84624
	Nett rainfall to pit													
0.00	Virgin	7809	5810	5345	1534	511	837	465	837	1720	5810	8459	7344	46481
	Prestrip	2117	1575	1449	416	139	227	126	227	466	1575	2293	1991	12601
	Pit precipitation	2352	1750	1610	462	154	252	140	252	518	1750	2548	2212	14000
	Pit evaporation	-325	-325	-325	-325	-325	-325	-325	-325	-325	-325	-325	-325	-3900
	Spoils	706	525	483	139	46	76	42	76	155	525	764	664	4201
	Levelled spoils	470	350	322	92	31	50	28	50	104	350	510	442	3628
	Topsoil levelled	235	175	161	46	15	25	14	25	52	175	255	221	1399
	Vegetated	235	175	161	46	15	25	14	25	52	175	255	221	1399
Total	m^3	20650	17087	16258	9462	7638	8218	7555	8218	9793	17087	21811	19822	163599
	l/s	8	6	6	4	3	3	3	3	4	6	8	8	5.17

F1995

CUTS		J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
	Precip % MAP	17	13	12	3	1	2	1	2	4	13	18	16	102
	Highwall ground water	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	9449	113388
	Nett rainfall to pit													
0	Virgin	0	0	0	0	0	0	0	0	0	0	0	0	0
1	Prestrip	2117	1575	1449	416	139	227	126	227	1575	1575	2293	1991	12601
1	Pit precipitation	2352	1750	1610	462	154	252	140	252	1750	1750	2548	2212	14000
1	Pit evaporation	-325	-325	-325	-325	-325	-325	-325	-325	-325	-325	-325	-325	-3900
1	Spoils	706	525	483	139	46	76	42	76	525	525	764	664	4201
1	Levelled spoils	470	350	322	92	31	50	28	50	350	350	510	442	3628
1	Topsoil levelled	235	175	161	46	15	25	14	25	175	175	255	221	1399
5	Vegetated	1176	875	805	231	77	126	70	126	875	875	1274	1106	7000
Total	m^3	16180	14374	13954	10510	9586	9880	9544	9880	10678	14375	16768	15760	151488
	l/s	6	5	5	4	4	4	4	4	4	5	6	6	4.75

Table 2.9.5 shows the resultant integrated affected water volumes generated by the minipit during operation and after closure. During operation the affected water will be pumped to the Navigation plant to be used as process water at the rate of between 7500 and 49000 m^3/month. After closure, water generated in the spoils is estimated to be between 19600 and 24700 m^3/month. This water will be pumped to the Navigation plant for process water.

TABLE 2.9.5 - ESTIMATED QUANTITIES OF AFFECTED WATER FOR THE POST OPERATIONAL PHASE

POST MINING - EAST AND WEST PITS COMBINED

	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
m^3	24261	22996	22702	20292	19645	19851	19615	19851	20409	22996	24672	23967	261257
l/s	9	9	9	8	7	8	7	8	8	9	9	9	8.5

2.9.1.3 Normal dry weather flow

Table 2.9.6 shows the dry weather flows for the Schoongezichtspruit in the mining area.

TABLE 2.9.6 - UNAFFECTED MEAN ANNUAL RUN-OFF (MAR) FOR THE PITS

	F1994	F1995	F1996	F1997 Onwards
WESTERN PIT MAR m^3	18 200	20 020	21 840	21 840
EASTERN PIT MAR m^3	12 600	12 600	12 600	15 120
TOTAL MAR m^3	30 800	32 620	34 440	36 960

2.9.1.4 Flood peaks and volumes

Design peak discharge can be calculated using any of the following methods:

* modelling
  - parametric - SCS-SA
  - semi-parametric (Rational Method)
  - empirical - unit hydrograph, and

* data manipulation (raw weir data) eg.
  - Pearson Type III distribution
  - 1 parameter lognormal distribution
  - 2 parameter lognormal distribution

As no actual data is available for the Schoongezicht/Navigation area, peak discharge volumes are estimated by modelling. The Department of Water Affairs and Forestry (DWAF) requested that the Rational Method, a conservative method, be used for the calculation of the 1:50 year flood. The resultant peak discharge down the Schoongezichtspruit through the minipit area was calculated to be 347 m^3/s. The outline of the 1:50 year flood level is shown in Figure 4.1.4.

2.9.2 Surface water quality

Table 2.9.7 sets out the pre-mining surface water quantity data measured in the mining area before mining. The locations of the sampling points are shown in Figure 2.9.3.

TABLE 2.9.7 - PRE-MINING SURFACE WATER QUANTITY

MEASUREMENT POINT	pH	EC (mS/m)	ESTIMATED FLOW (l/s)
A	2,7	255	20
B	5,2	22	15
C	2,7	260	20

2.9.3 Drainage density of area to be disturbed

The measured drainage density of area to be disturbed is 1.9.

2.9.4 Surface water use

In terms of the Landau Colliery EMPR, surface water is divided into affected and unaffected water and is illustrated in Figure 2.9.3. The affected water is captured in the Schoongezicht pollution control dam and pumped to the Navigation plant for process water. The unaffected water is channelled into the Schoongezichtspruit below the pollution control dam for consumption by riparian right users.

Figure 4.1.2 illustrates how the affected water from the minipit will be integrated into the Navigation plant process water system.

Landau Colliery has committed to submitting a study on surface water use by July 1995 which will incorporate the whole of the Schoongezicht and Navigation areas.

2.9.5 Water authority

The water authority for the area of mining is the DWAF.

2.9.6 Wetlands

As shown in Figure 2.5.1, approximately 1 hectare of the wetland will be disturbed by the mining operation.

2.10 GROUND WATER

2.10.1 Depth of water table

Two pump test holes, shown as D and E in Figure 2.9.3, indicate the water table level in the minipit area to be 2.0m and 1.7m respectively.

2.10.2 Water boreholes and springs

No water boreholes are present on the mining area.

A clean water spring yielding approximately 15 litre/second is present, and its location is shown as B on Figure 2.9.3.

2.10.3 Ground-water quality

The water quality of the spring has a pH of 5.2 and a conductivity of 22 mS/m.

2.10.4 Ground-water use

The spring is used to water live stock.

2.10.5 Ground-water zone

Pump tests were done on the boreholes D and E indicated on Figure 2.9.3. The purpose of the pump test on the western embankment of the spruit was to determine the yield, transmissivity and storativity of the rock to enable groundwater ingress from the highwall to be calculated. Similar parameters were calculated for the eastern embankment with the purpose of evaluating the ingress of water from the wetland into the pit, since the pits floor elevation is lower than that of the wetland. Both tests illustrated that although the storativity is relatively high, the transmissivity is low, resulting in minimum ingress of water from the stream into the pit. As it is planned to keep the water level in the mined out pit below the level of the spruit there will be no flow of water towards the spruit.

The Theis pumping tests for the two boreholes are shown on Figures 2.10.1 and 2.10.2.

2.10.6 River diversion

No river or streams will be diverted. The Schoongezichtspruit will remain intact between the West Pit and the East Pit.

2.11 AIR QUALITY

C J Els, in his 1990 report titled "Strategies for dealing with the Eastern Transvaal Highveld Acidic Deposition Situation" has prepared an estimate of the sulphur dioxide emissions in the Eastern Transvaal Highveld, which is summarised in Table 2.11.1.

TABLE 2.11.1 - MAJOR SOURCES OF AIR POLLUTION IN THE EASTERN TRANSVAAL HIGHVELD

Source	Sulphur Dioxide Mass (ton/yr)	Emissions Percentage (%)
Power Stations	1 110 585	91.20
Brickworks	2 634	0.22
Ferro-alloy Works	1 557	0.13
Steelworks/Foundries	78	< 0.01
Saw Mills	499	0.04
Paper and Pulp Mills	79	< 0.01
Petrochemical Plants	7 019	0.58
Domestic/Municipal Combustion	36 984	3.04
Coal Dumps	54 390	4.47
Other	3 903	0.32
TOTAL	1 217 728	100.00

The results were derived from data made available by the Department of National Health and Population Development based on an air pollution survey carried out in 1985. Where no samples for a particular industry were available, the pollution results given in the table are estimates using emission factors from American industries.

From Table 2.11.1 it is noted that burning coal dumps contribute some 4.5% of sulphur dioxide to the atmospheric pollution load, i.e. very little compared to power generation plants which contribute 91%. Coal discard recovery and disposal techniques now applied in the region have improved to the extent that a reduction in sulphur dioxide pollution from dumps can be expected in future years.

Investigations on fallout dust has shown that it settles exponentially with distance from the source. Except during exceptional thunderstorm activity, fallout dust will not have measurable impacts beyond 3km from the source, based on long term measurements on gold mine tailings. The assessment of air quality for a particular mining operation therefore needs to be site specific, taking into account the land use in a 3km radius around the boundaries of the operation.

Historically, the Witbank district was predominantly a maize cultivation area. Soil cultivation itself has led to large exposed areas of soil on a seasonal basis, with ploughing, harvesting, and burning of agricultural residues being major dust producing activities.

Two single bucket collectors have been installed near the Schoongezicht No 4 Seam minipit. The monitoring of the air quality around the minipit will be integrated into the existing dust monitoring programme for Landau Colliery.

Figure 2.11.1 shows the location of currently installed dust monitoring points. Also shown are the locations of the two additional monitoring points (A and B) that have been installed to monitor dust emission from the minipit. Results from these points will be submitted with the annual returns from Landau Colliery.

2.12 NOISE

The mining operation is remote from residential areas and at this stage a noise survey is not envisaged.

2.13 SITES OF ARCHAEOLOGICAL AND CULTURAL INTEREST

No known sites have been identified.

2.14 SENSITIVE LANDSCAPES

No sensitive landscapes are present.

2.15 VISUAL ASPECTS

Visual impact of the pit will be minimal as it lies in a valley and is barely visible from public roads.

2.16 REGIONAL SOCIO-ECONOMIC STRUCTURE

This is reported in the Landau Colliery EMPR.

The minipit mine will provide employment for some 110 people.

2.17 INTERESTED AND AFFECTED PARTIES

This is reported on in the Landau Colliery EMPR.

The agricultural lease agreement with a local farmer is in the process of being amended to cater for the exclusion of the area to be mined from the existing lease.

PART 3: MOTIVATION FOR THE PROJECT

3.1 BENEFITS OF THE PROJECT

The project will place up to 1.0 million tons per year of steam coal onto the export market which will earn foreign exchange for the country. This project is the fore-runner to an expansion of the export market currently under investigation by Amcoal

As the project will utilise existing plant capacity at Klipfontein and Navigation, capital expenditure will be minimal. It is estimated that less than R3.0 million will be spent.

The incremental labour to be employed will be some 110 people.

3.2 CONSIDERATION OF PROJECT ALTERNATIVES

As plant capacity and infrastructure was available at the SACE complex only coal reserves in the immediate vicinity of the two plants were considered. The selected minipit proved to be the only viable option for contractor mining and road hauling of the coal.

Schoongezicht No. 4 Seam minipit lies within an area of future large scale opencast mining and the minipit's environmental impacts will be integrated into future plans when large scale mining takes place.

PART 4: DETAILED DESCRIPTION OF THE PROJECT

4.1 SURFACE INFRASTRUCTURE

No permanent surface infrastructure will be constructed. The contractor will set up a site office, workshop and primary crushing plant which will be removed on completion of mining.

Use will be made of Landau and Kleinkopje Collieries' plant and infrastructure which are described in their respective EMPR's.

Figure 4.1.1 shows the location of surface infrastructure for the minipit.

4.1.1 Roads, railways and powerlines

The major infrastructure network is shown on Figure 1.5.1.

4.1.2 Solid waste management facilities

Industrial and domestic waste facilities are described in the Landau Colliery EMPR.

Mine residue will be disposed of at the Navigation plant Blaauwkrans disposal site and the Klipfontein Colliery plant disposal site. These sites are described respectively in the Landau Colliery and Kleinkopje Colliery EMPR's.

4.1.3 Water pollution management facilities

Use will be made of the Navigation sewage plant which is described in the Landau Colliery EMPR.

Pollution for the minipit will link into the system described in the Landau Colliery EMPR which is shown on Figure 2.9.3. The pollution control system for the minipit is shown on Figure 4.1.2.

A new Erichsen dam will be constructed below the Schoonie clean water dam and clean water channel. Manhole wells will be placed in the spoils at the lowest No 4 Seam floor elevations to collect affected water which will be pumped to the Erichsen dam. These wells will keep the pit water level some 3 meters below the decant point thus preventing decant and contamination of the clean water system.

The Erichsen Dam will also receive water from the Schoonie acid water dam. Water from the Erichsen dam will be pumped to the Navigation plant for use as process water.

A second pipeline will be constructed from the Erichsen dam to the Navigation dam to cater for the additional water volume. This system will also allow for increasing pumping volumes of acid water from the Schoonie pollution control dam.

A detailed integrated water balance will be submitted in the July 1995 report which will be based on current investigations.

As the minipit will not encroach on the 1 in 50 year flood level line there will be no risk of flood waters entering the mining area and becoming affected for flood returns periods of less than 1 in 50 years.

4.1.4 Potable water

Potable water will be obtained from the Witbank Municipality.

4.1.5 Process water

Water for dust suppression in the pit will be obtained from the dirty water system.

4.1.6 Mineral processing plant

Raw coal from the minipit will be processed at the Navigation and Klipfontein plants which are shown on Figure 4.1.3.

4.1.7 Workshops, administration and other buildings

No permanent buildings will be erected.

4.1.8 Housing, recreation

Amcoal employees associated with the minipit will utilise the existing facilities of S A C E. Labour employed by the contractor will be the responsibility of the contractor.

4.1.9 Transport

The coal road hauling routes are shown on Figure 4.1.3. Coal will be road hauled by contractor vehicles from the minipit to the Klipfontein and Navigation plants along these routes.

4.1.10 Water balance diagram

The estimated water volumes generated and disposed of by the minipit are shown in Tables 2.9.3 to 2.9.6.

4.1.11 Disturbance of water courses

Mining will be limited to outside of the 1 in 50 year flood line thus leaving the Schoongezichtspruit intact.

4.1.12 Storm-water

Two storm-water diversion channels will be constructed along the eastern and western perimeters of the minipit as shown on Figure 4.1.2. This will reduce infiltration into the mined area and maximise clean water flow into the clean water system.

4.2 CONSTRUCTION PHASE

The construction phase will take some three months with the following activities:

- Geological drilling programme and technical investigations.
- Establish pollution control measures.
- Develop boxcut.
- Erect temporary crushing plant.

4.3 OPERATIONAL PHASE

4.3.1 Soil utilisation guide

The object with soil utilisation is to restore, as far as practicable, the land to the pre-mining arable and grazing capabilities.

Wherever possible, stripped topsoil will be transported to the nearest available area of levelled and graded spoils and deposited in its final position. Stockpiling of topsoil will be kept to a minimum.

Depths of topsoil have been described in Section 2.4.

4.3.2 Mine surface layout

4.3.2.1 Access to workings

Access to the minipit workings will be via a network of private haul roads off provincial roads linking the mining area with the Navigation and Klipfontein plants (Figure 4.1.3).

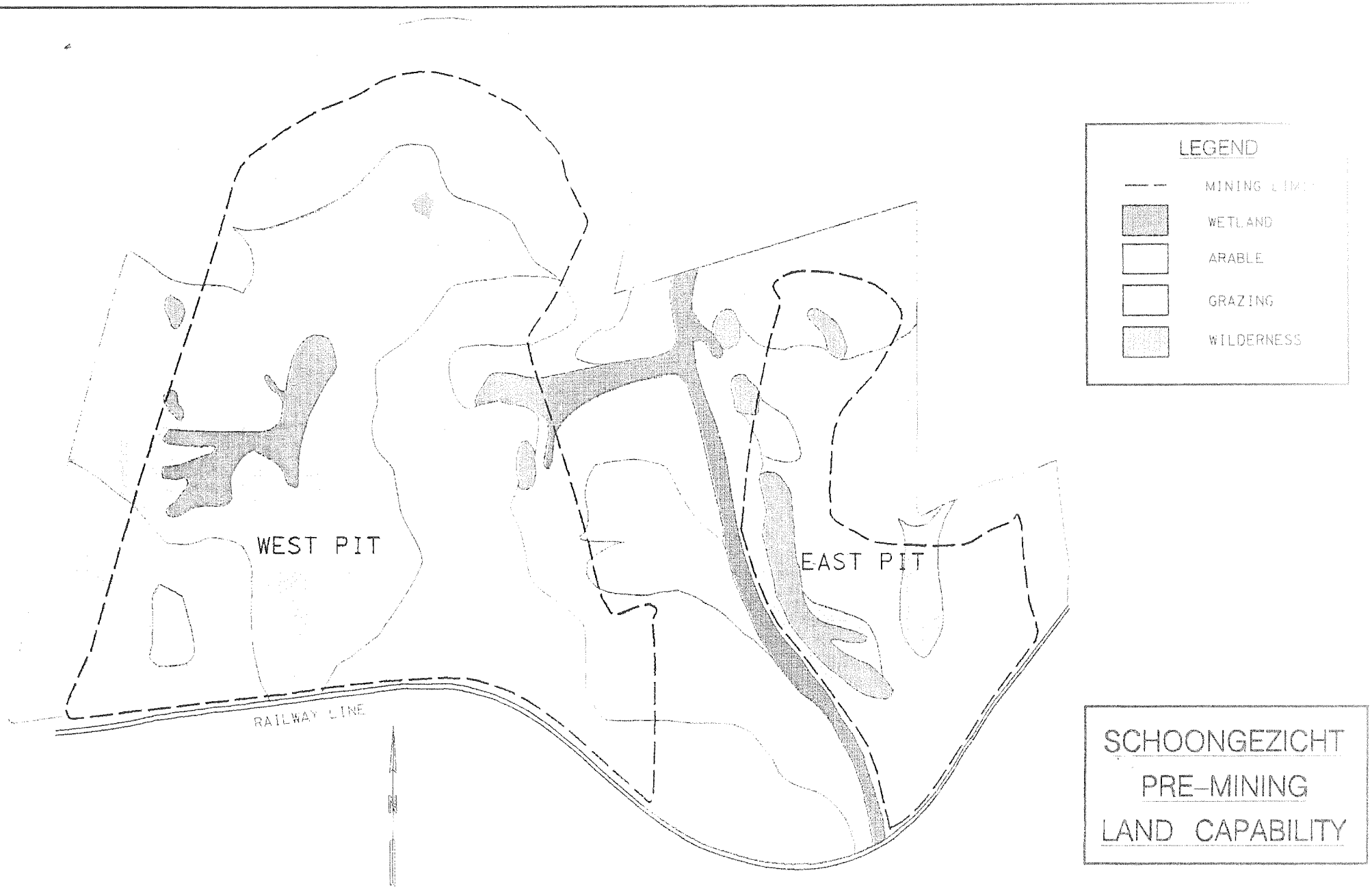
4.3.2.2 Structures affected by blasting vibrations

The contractors will erect temporary facilities to accommodate their operational back-up functions which will not be affected by blasting vibration. At the end of the minipit's life these facilities will be removed.

Structures that may be affected by blasting operations are:

- Eskom overhead lines
- Spoornet railway line

The location of the structures are shown in Figure 4.1.4.



SCHOONGEZICHT
PRE-MINING
LAND CAPABILITY

FIGURE 2.5.1.

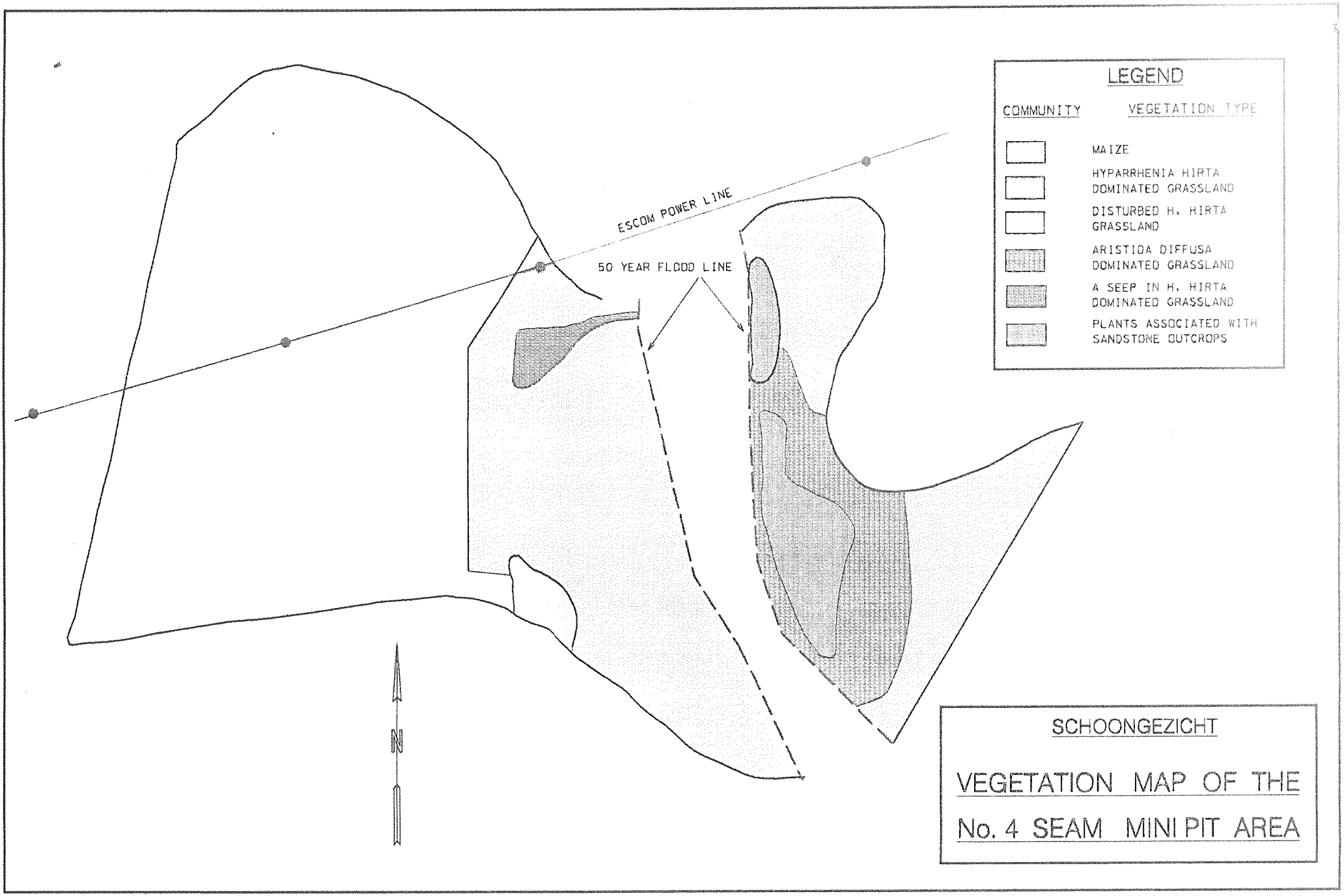
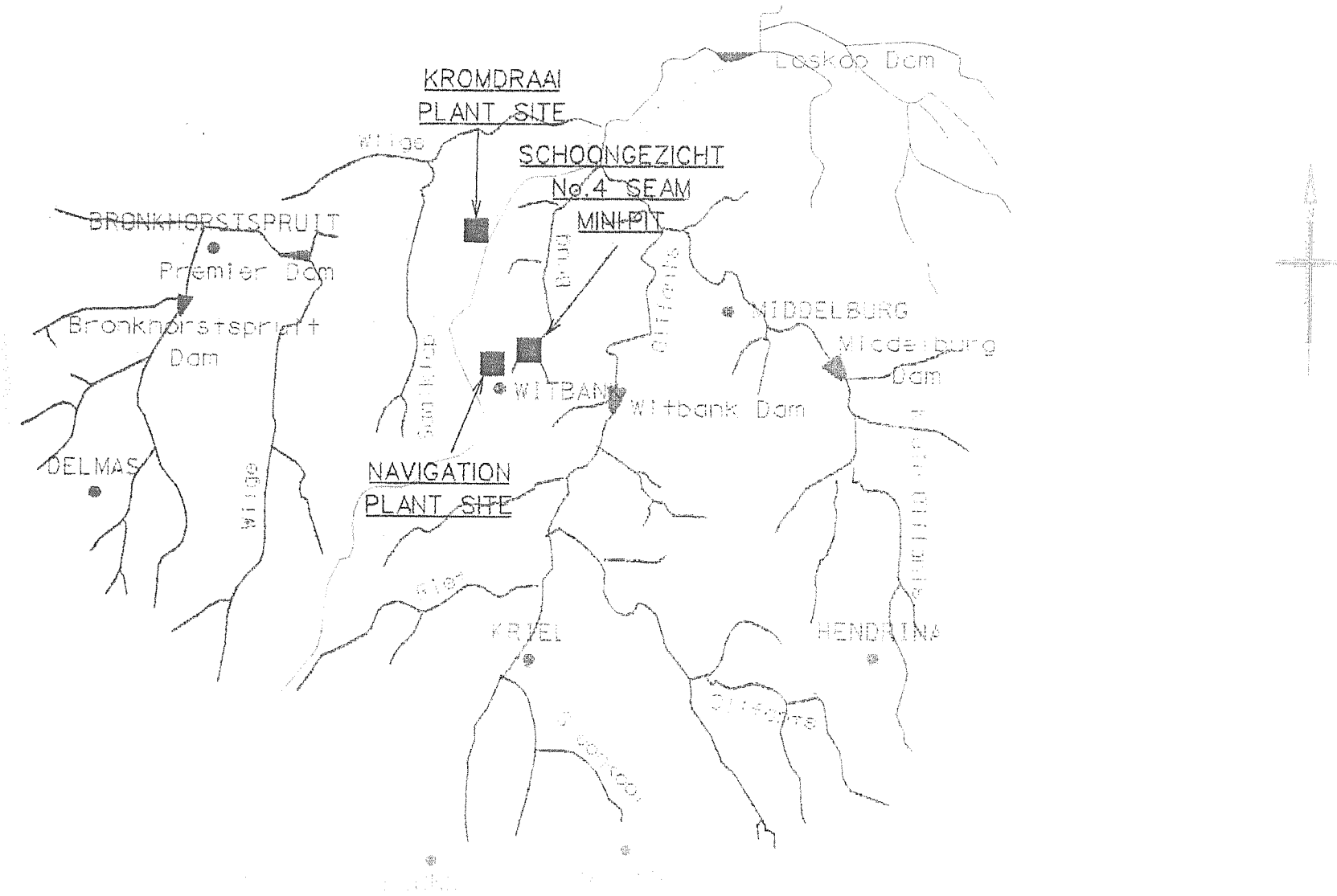
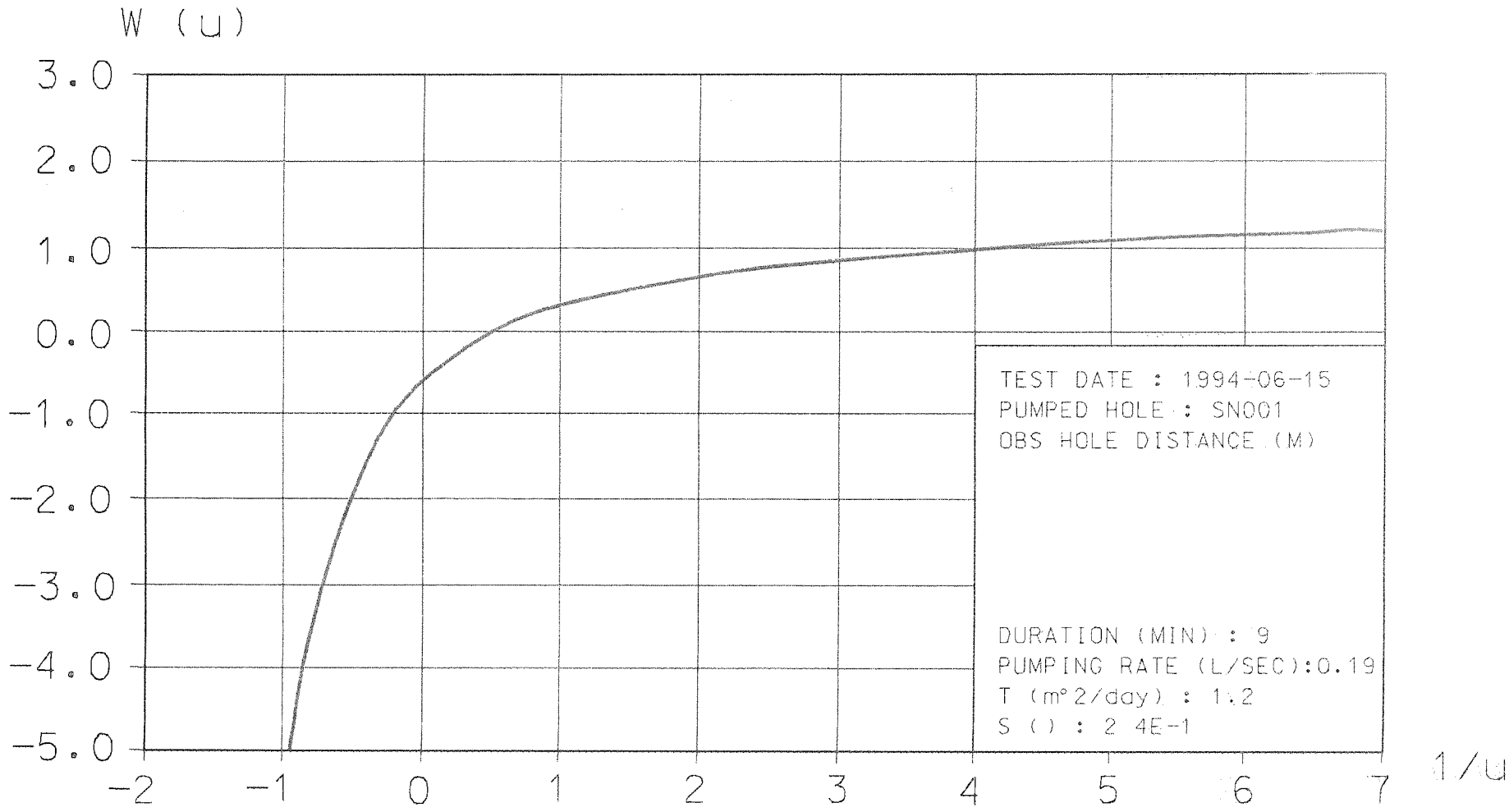

LEGEND
COMMUNITY
VEGETATION TYPE
MAIZE
HYPARRHENIA HIRTA DOMINATED GRASSLAND
DISTURBED H. HIRTA GRASSLAND
ARISTIDA DIFFUSA DOMINATED GRASSLAND
A SEEP IN H. HIRTA DOMINATED GRASSLAND
PLANTS ASSOCIATED WITH SANDSTONE OUTCROPS
ESCOM POWER LINE
50 YEAR FLOOD LINE
N
SCHOONGEZICHT
VEGETATION MAP OF THE
No. 4 SEAM MINI PIT AREA

FIGURE 2.7.1



STREAMS & CATCHMENTS OF THE UPPER OLIFANTS RIVER

FIGURE 2.9.1



THEIS PUMPING TEST

FIGURE 2.10.2

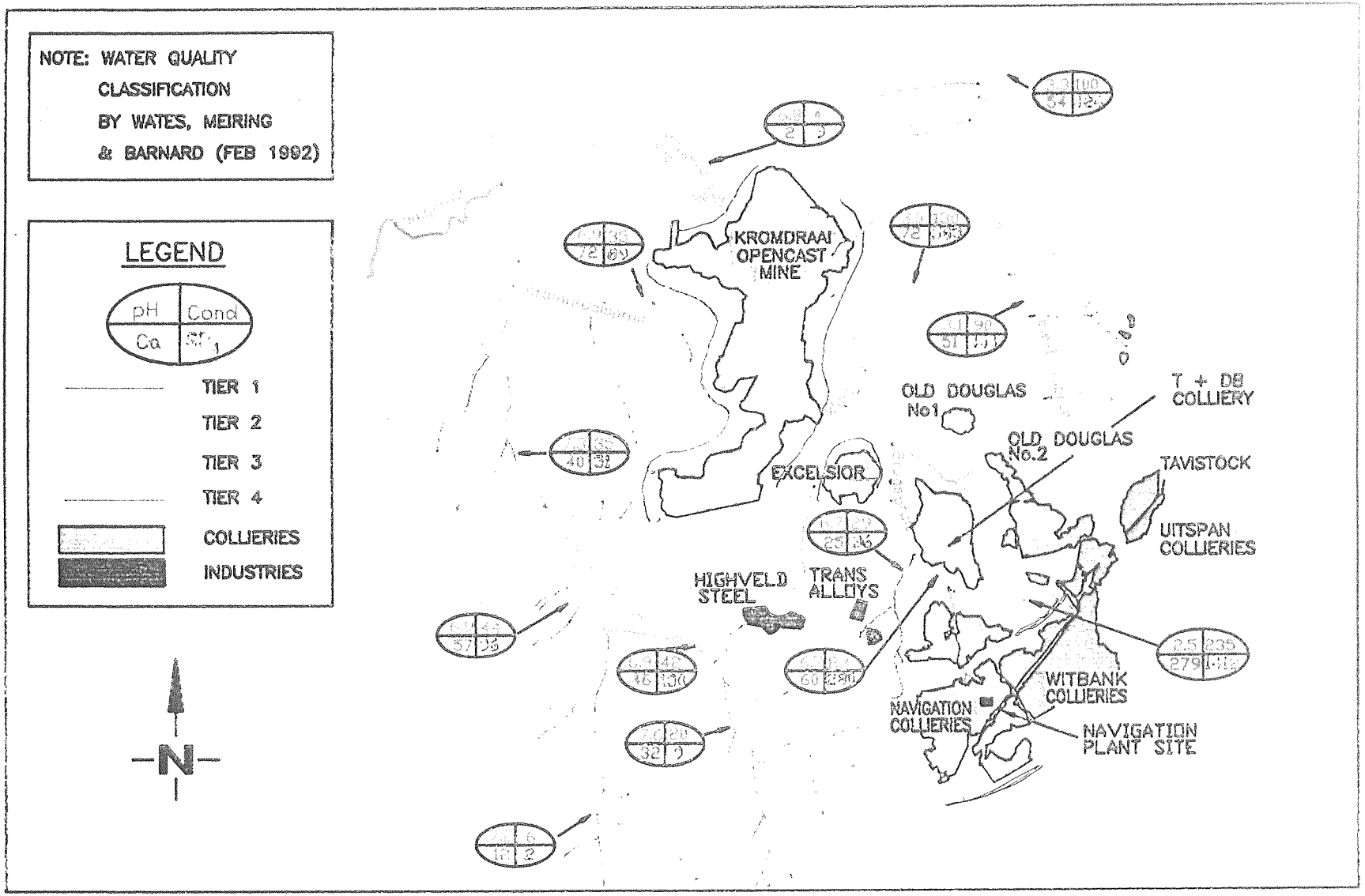


FIGURE 2.9.2. WATER QUALITY IN THE KROMDRAAI AREA

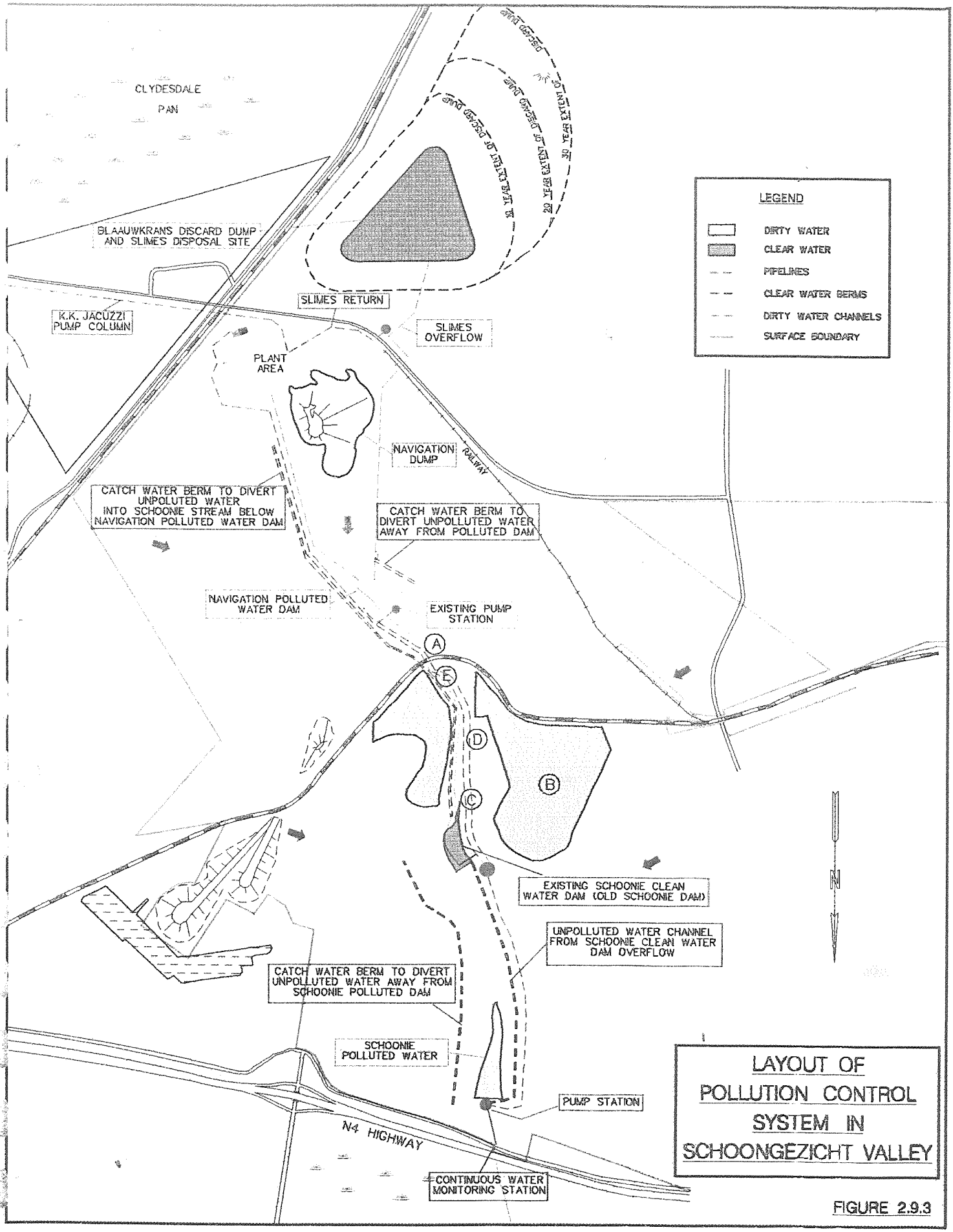
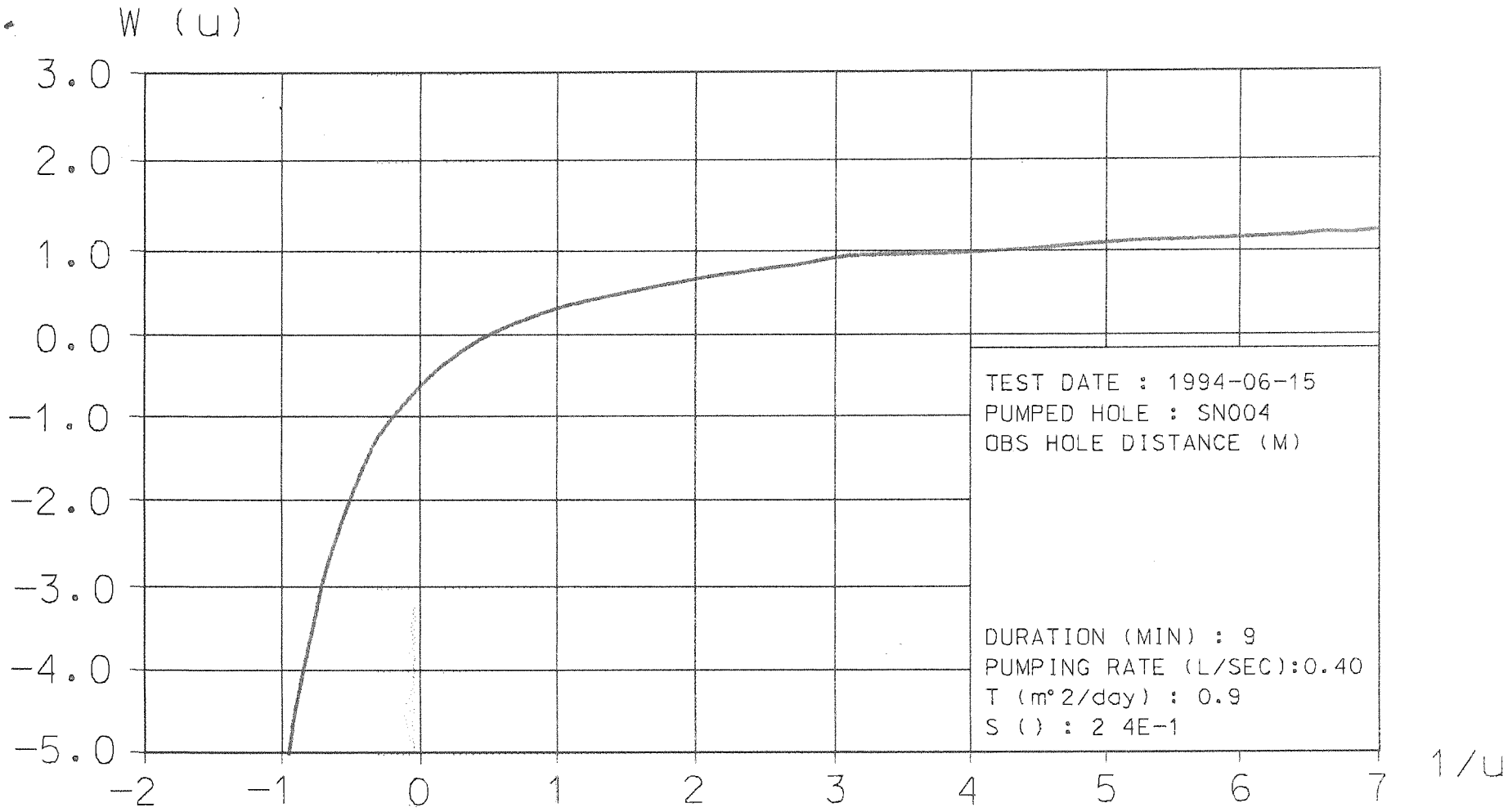

CLYDESDALE
PAN
BLAAUWKRANS DISCARD DUMP AND SLIMES DISPOSAL SITE
SLIMES RETURN
SLIMES OVERFLOW
K.K. JACUZZI PUMP COLUMN
PLANT AREA
NAVIGATION DUMP
RAILWAY
CATCH WATER BERM TO DIVERT UNPOLLUTED WATER INTO SCHOONIE STREAM BELOW NAVIGATION POLLUTED WATER DAM
CATCH WATER BERM TO DIVERT UNPOLLUTED WATER AWAY FROM POLLUTED DAM
NAVIGATION POLLUTED WATER DAM
EXISTING PUMP STATION
A
E
D
B
C
EXISTING SCHOONIE CLEAN WATER DAM (OLD SCHOONIE DAM)
UNPOLLUTED WATER CHANNEL FROM SCHOONIE CLEAN WATER DAM OVERFLOW
CATCH WATER BERM TO DIVERT UNPOLLUTED WATER AWAY FROM SCHOONIE POLLUTED DAM
SCHOONIE POLLUTED WATER
PUMP STATION
N4 HIGHWAY
CONTINUOUS WATER MONITORING STATION
LEGEND
DIRTY WATER
CLEAR WATER
PIPELINES
CLEAR WATER BERMS
DIRTY WATER CHANNELS
SURFACE BOUNDARY
N
LAYOUT OF POLLUTION CONTROL SYSTEM IN SCHOONGEZICHT VALLEY

FIGURE 2.9.3



THEIS PUMPING TEST

FIGURE 2.10.1

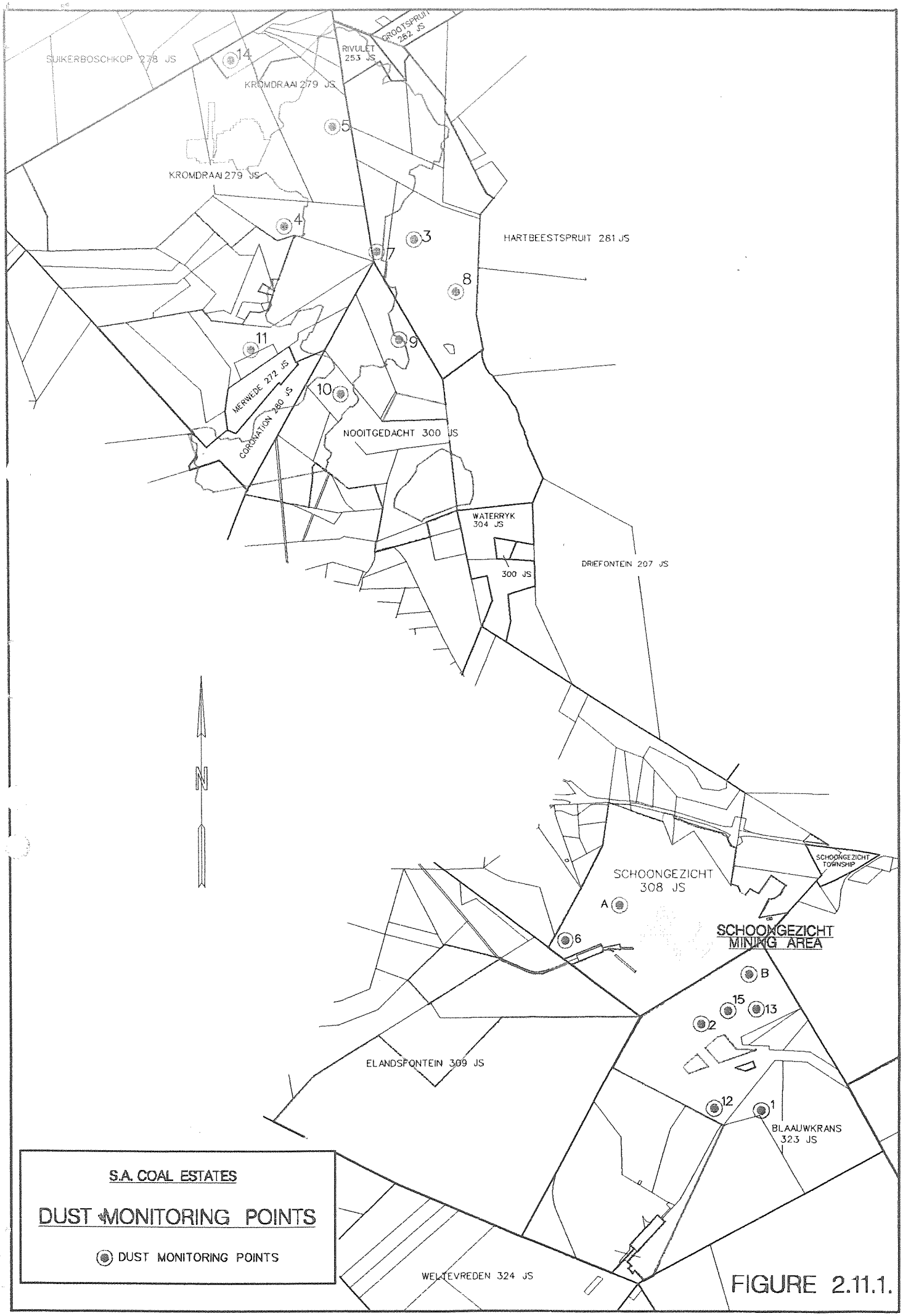
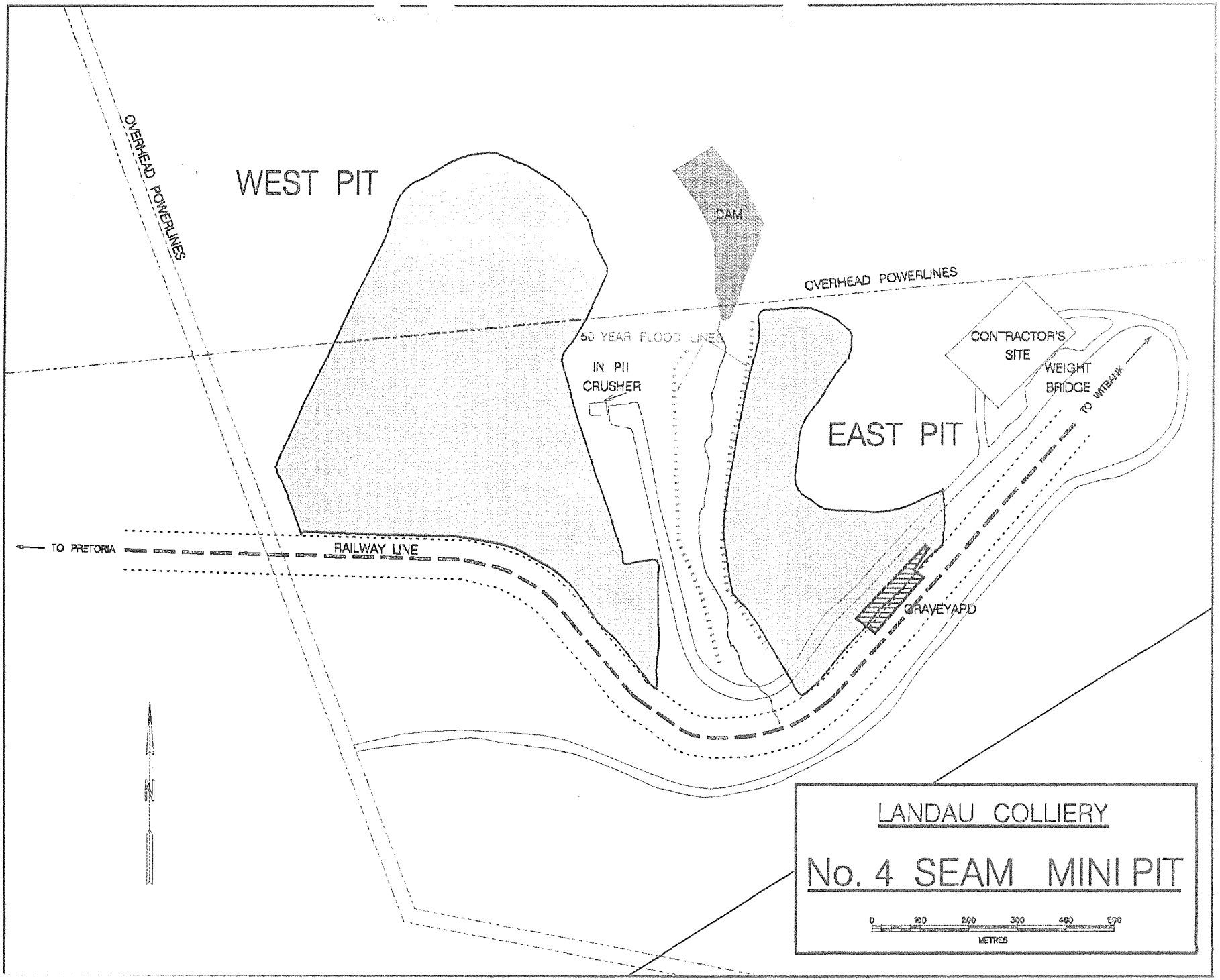
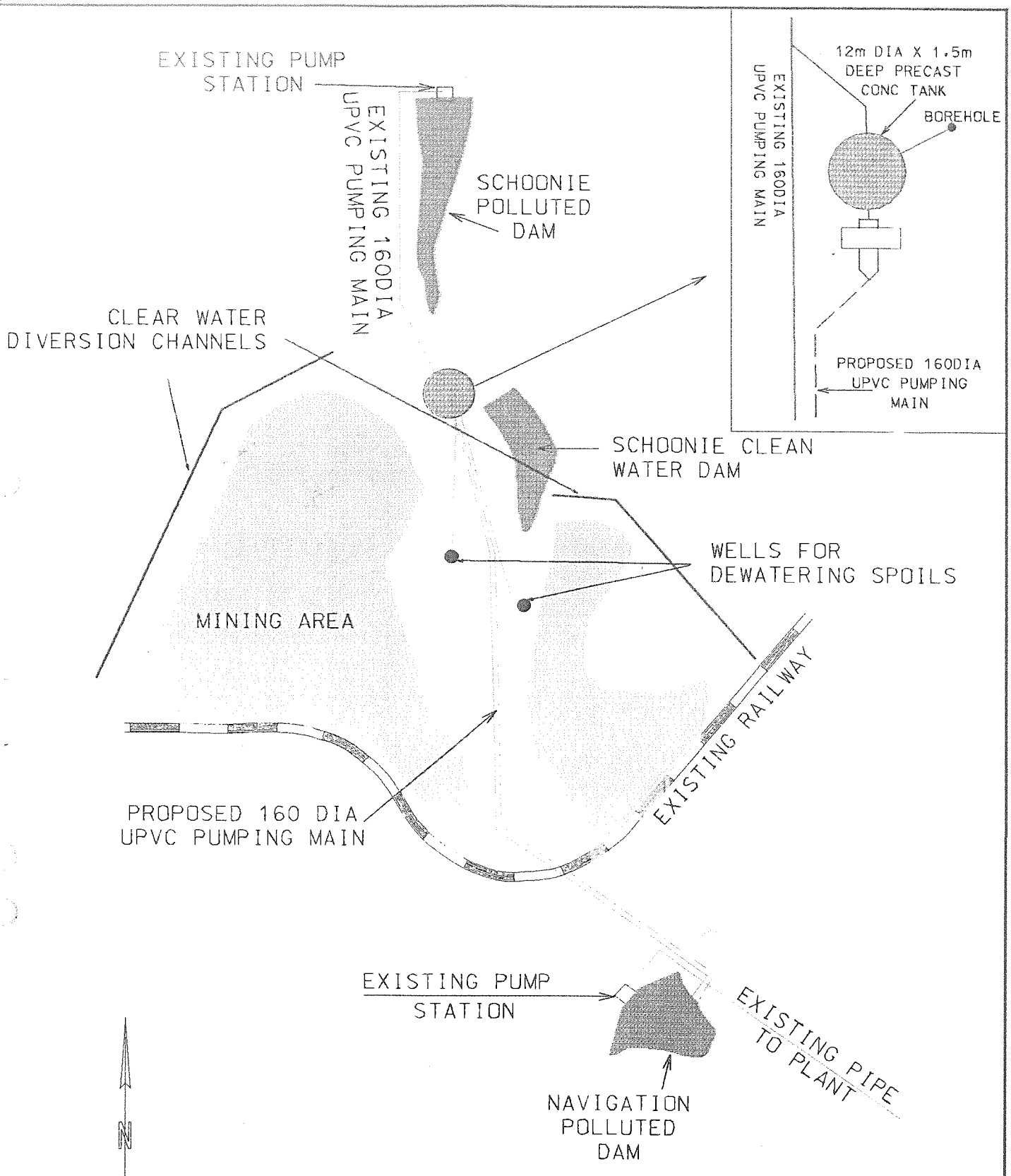

SUIKERBOSCHKOP 278 JS
KROMDRAAI 279 JS
RIVULET 253 JS
GROOTSPRUIT 282 JS
KROMDRAAI 279 JS
HARTBEESTSPRUIT 281 JS
MERWEDE 272 JS
CORONATION 280 JS
NOOITGEDACHT 300 JS
WATERRYK 304 JS
300 JS
DRIEFONTEIN 207 JS
SCHOONGEZICHT 308 JS
SCHOONGEZICHT TOWNSHIP
SCHOONGEZICHT MINING AREA
ELANDSFONTEIN 309 JS
BLAAUWKRANS 323 JS
WELTEVREDEN 324 JS
N
S.A. COAL ESTATES
DUST MONITORING POINTS
DUST MONITORING POINTS

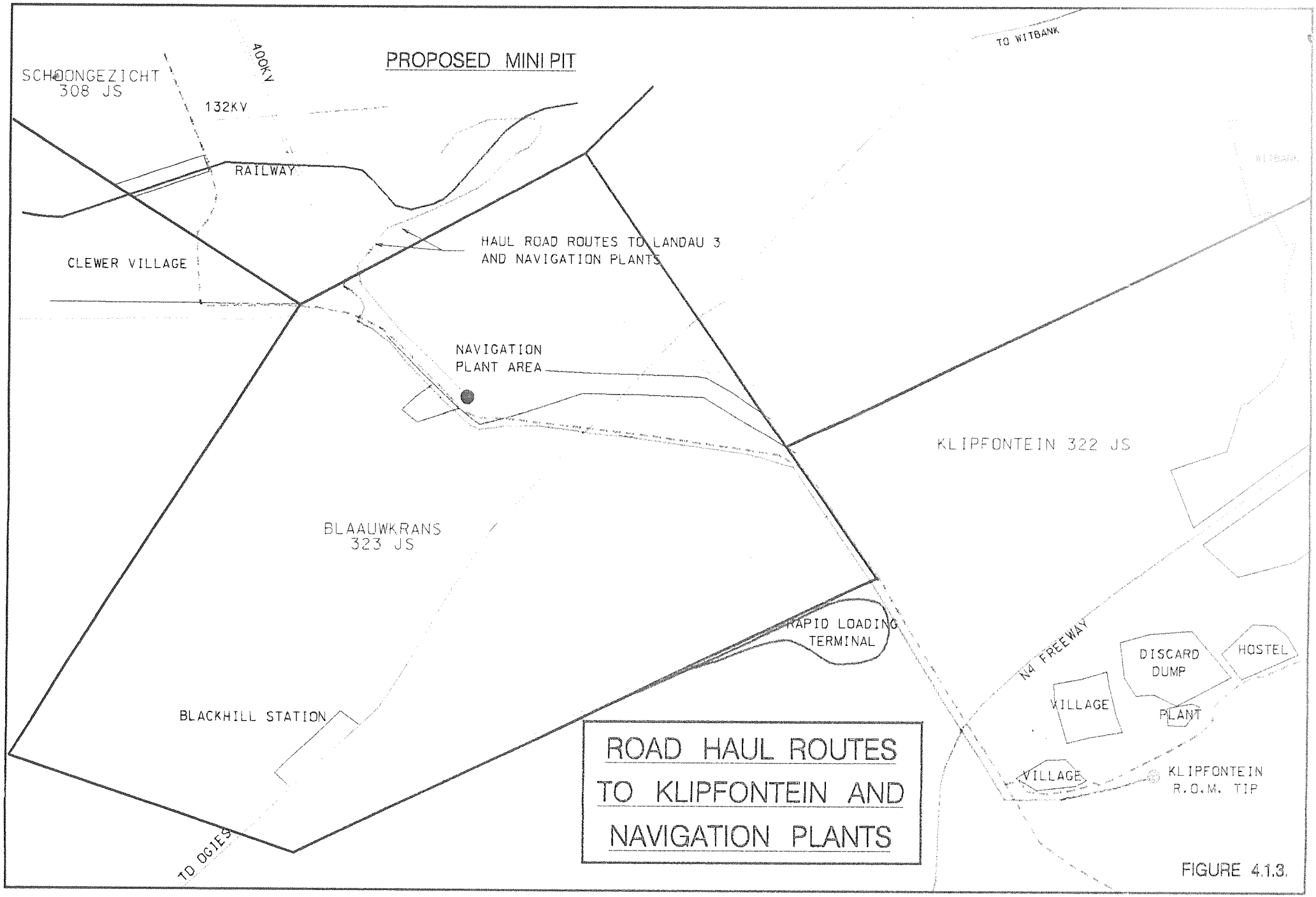
FIGURE 2.11.1.


WEST PIT
OVERHEAD POWERLINES
DAM
OVERHEAD POWERLINES
50 YEAR FLOOD LINE
IN PIT CRUSHER
CONTRACTOR'S SITE
WEIGHT BRIDGE
TO WITBANK
EAST PIT
TO PRETORIA
RAILWAY LINE
GRAVEYARD
N
LANDAU COLLIERY
No. 4 SEAM MINI PIT
0 100 200 300 400 500
METRES



SCHOONGEZICHT MINI PIT
POLLUTION CONTROL SYSTEM

FIGURE 4.1.2.


PROPOSED MINI PIT
SCHOONGEZICHT 308 JS
400KV
132KV
RAILWAY
CLEWER VILLAGE
HAUL ROAD ROUTES TO LANDAU 3 AND NAVIGATION PLANTS
NAVIGATION PLANT AREA
BLAAUWKRANS 323 JS
KLIPFONTEIN 322 JS
TO WITBANK
RAPID LOADING TERMINAL
BLACKHILL STATION
TO OGIES
N4 FREEWAY
DISCARD DUMP
HOSTEL
VILLAGE
PLANT
VILLAGE
KLIPFONTEIN R.O.M. TIP
ROAD HAUL ROUTES TO KLIPFONTEIN AND NAVIGATION PLANTS
FIGURE 4.1.3.

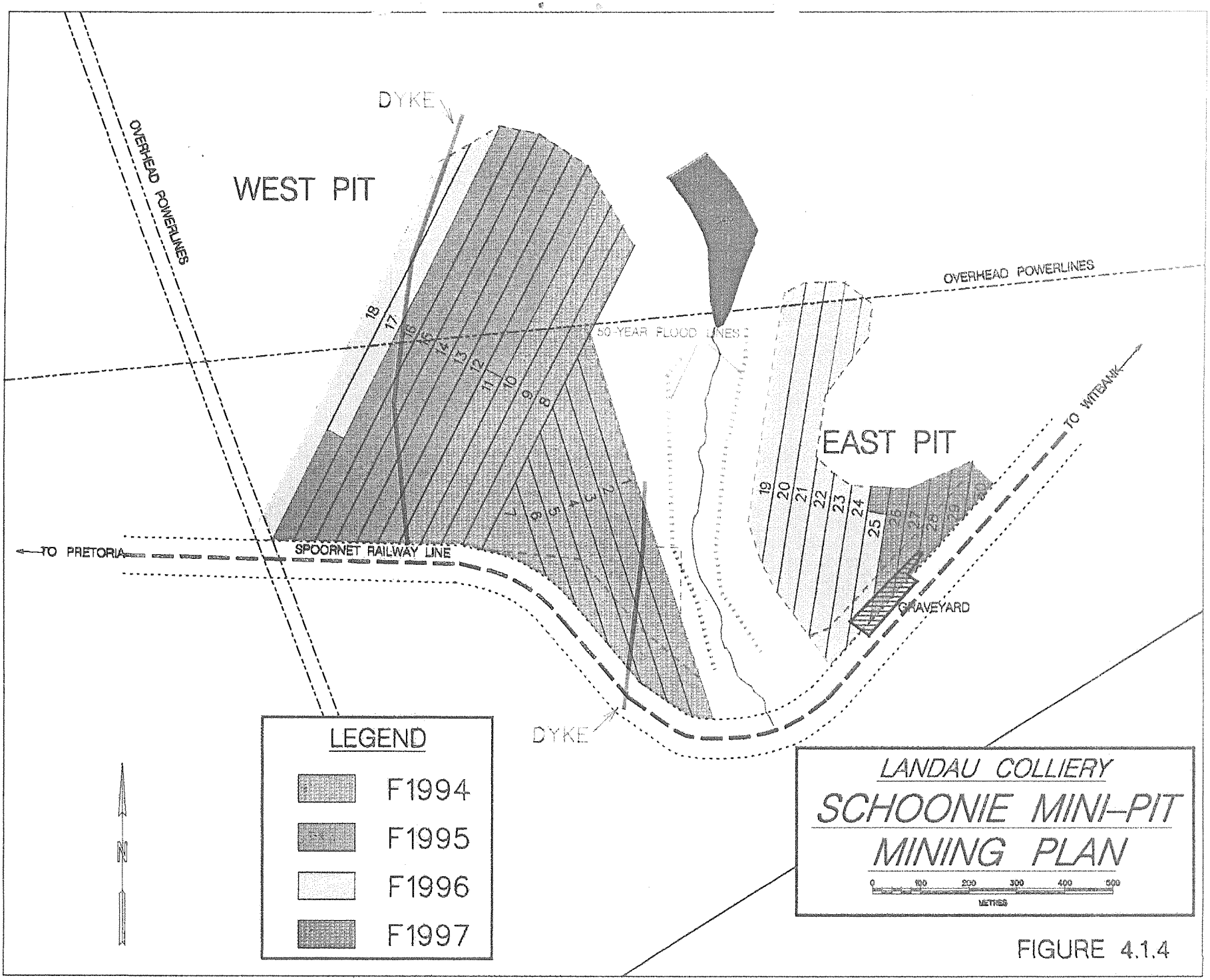

DYKE
WEST PIT
OVERHEAD POWERLINES
OVERHEAD POWERLINES
50 YEAR FLOOD LINES
EAST PIT
TO WITBANK
TO PRETORIA
SPOORNET RAILWAY LINE
GRAVEYARD
DYKE
LEGEND
F1994
F1995
F1996
F1997
N
LANDAU COLLIERY
SCHOONIE MINI-PIT
MINING PLAN
0 100 200 300 400 500
METRES

FIGURE 4.1.4

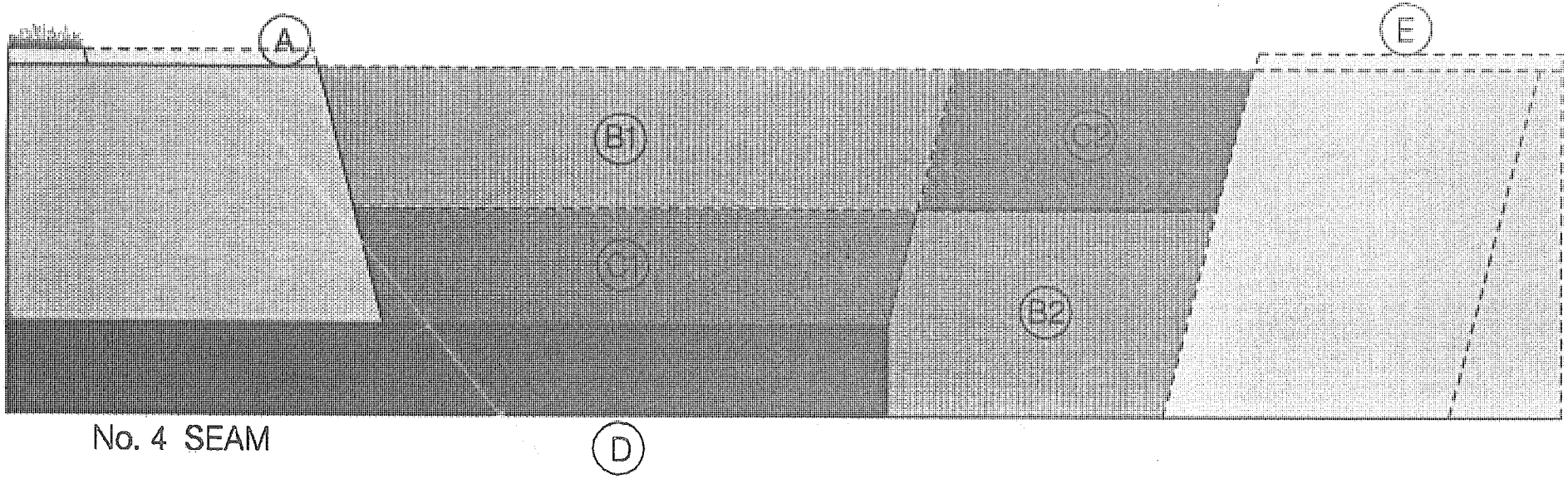
(A) : Topsoil stripped over virgin 4 Seam

(B) : Subsoils dozed into previous cut – (B1) to (B2)

(C) : Subsoils removed from (C1) by truck & shovel to (C2)

(D) : 4 Seam removed

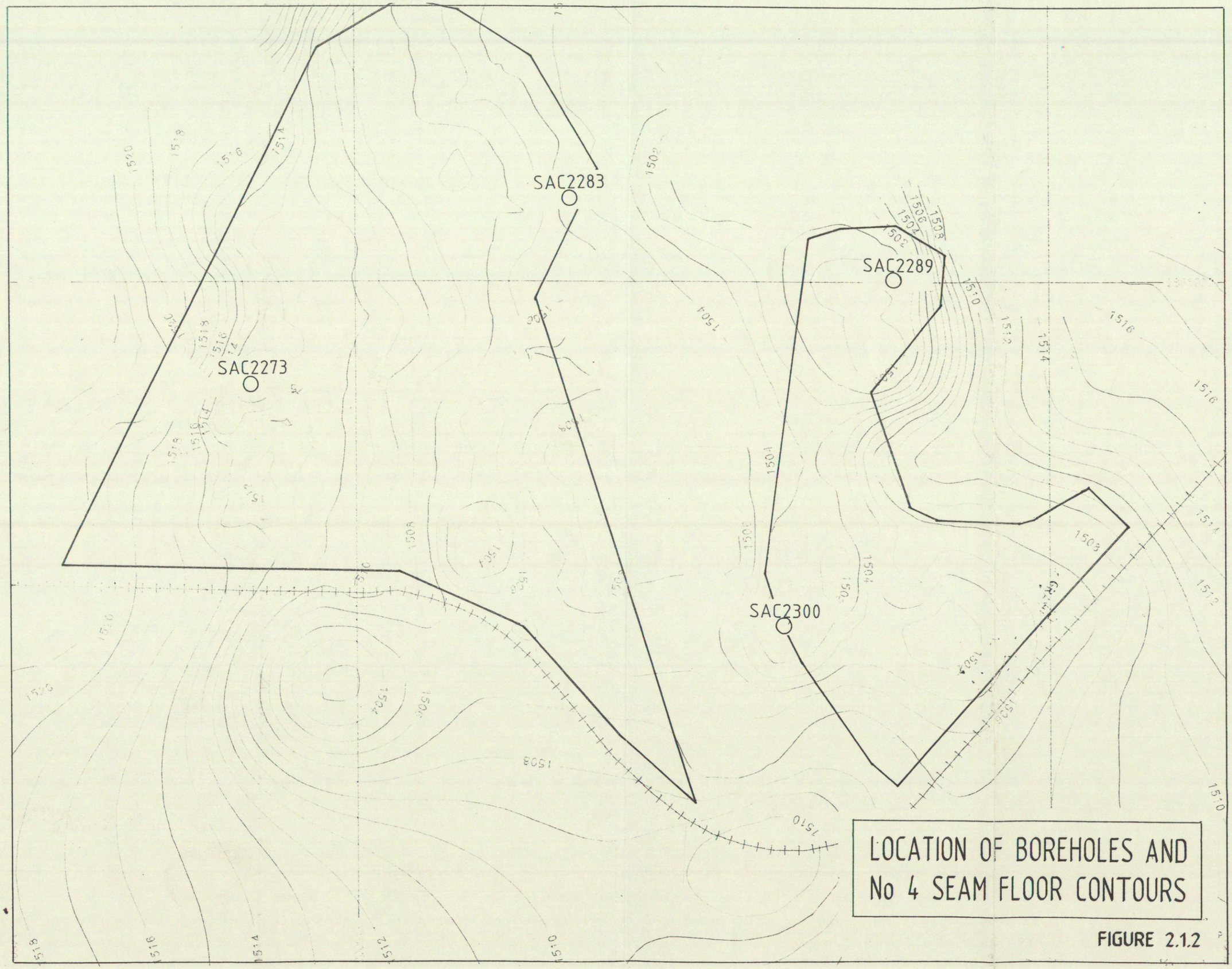
(E) : Topsoil replaced



SCHOONGEZICHT No. 4 SEAM MINI–PIT

MINING SEQUENCE

FIGURE 4.1.5

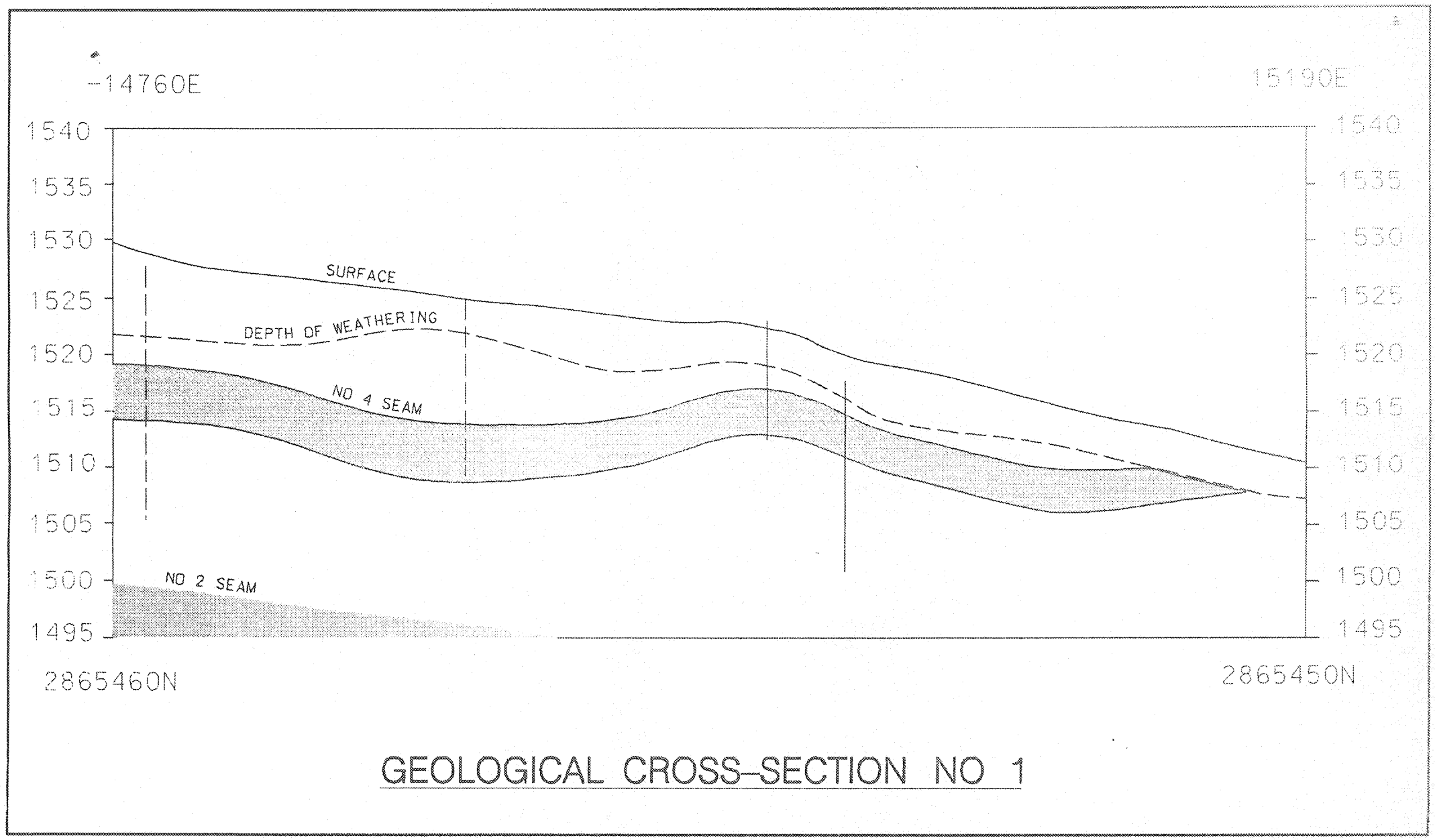


LOCATION OF BOREHOLES AND No 4 SEAM FLOOR CONTOURS

FIGURE 2.1.2

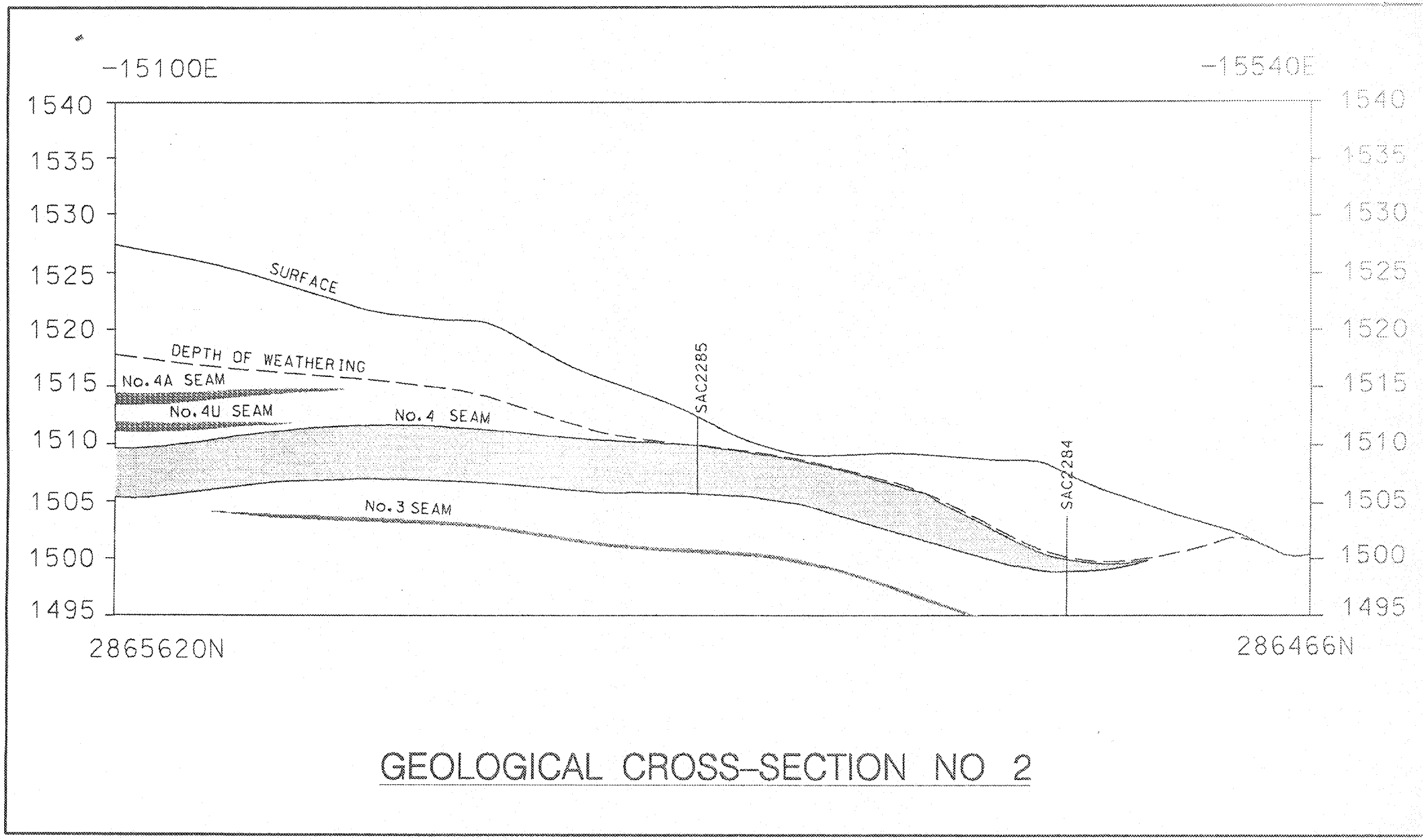
PRE MINING SURFACE TOPOGRAPHY

FIGURE 2.1.4



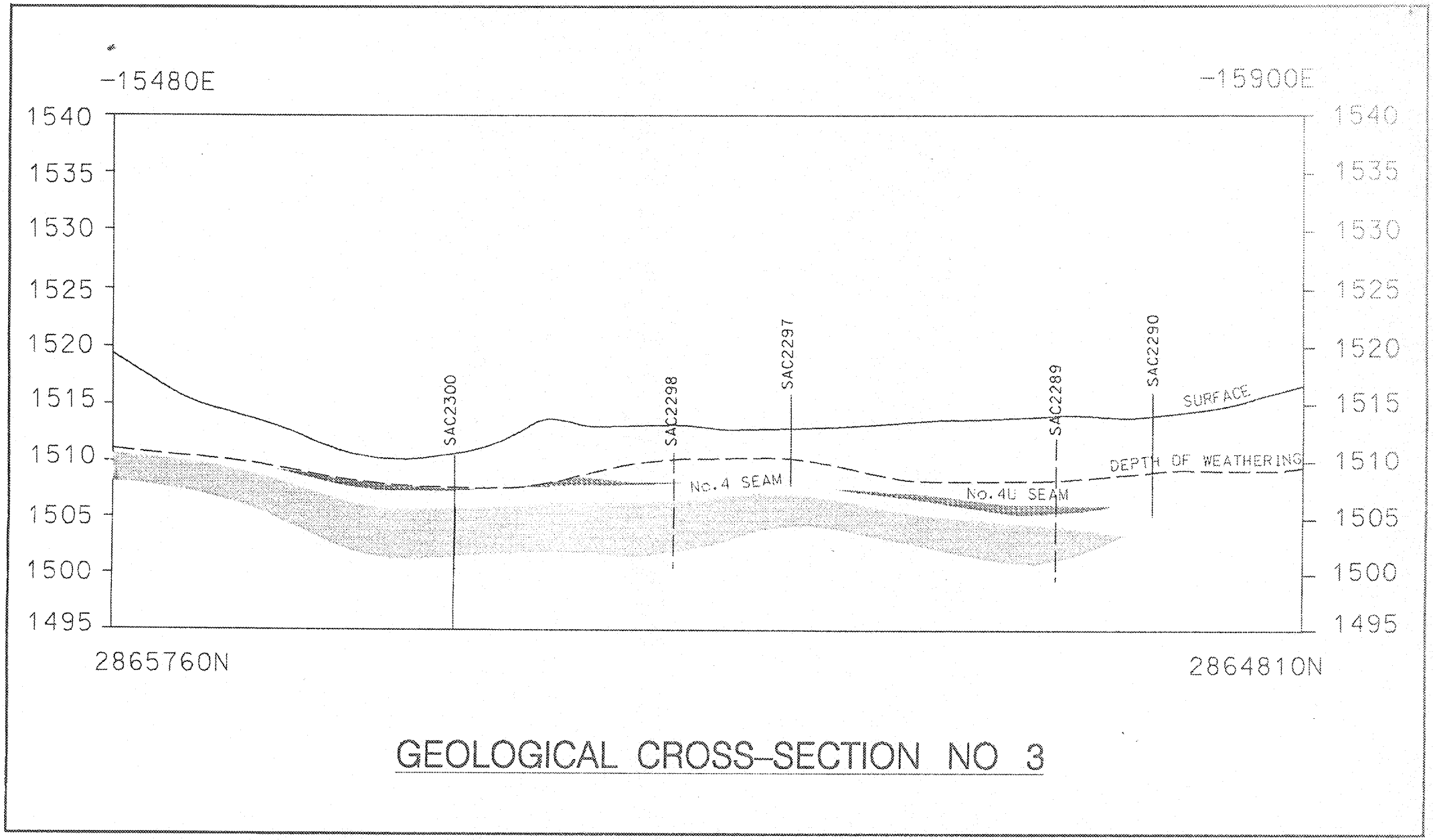
GEOLOGICAL CROSS-SECTION NO 1

FIGURE 2.1.3(a)



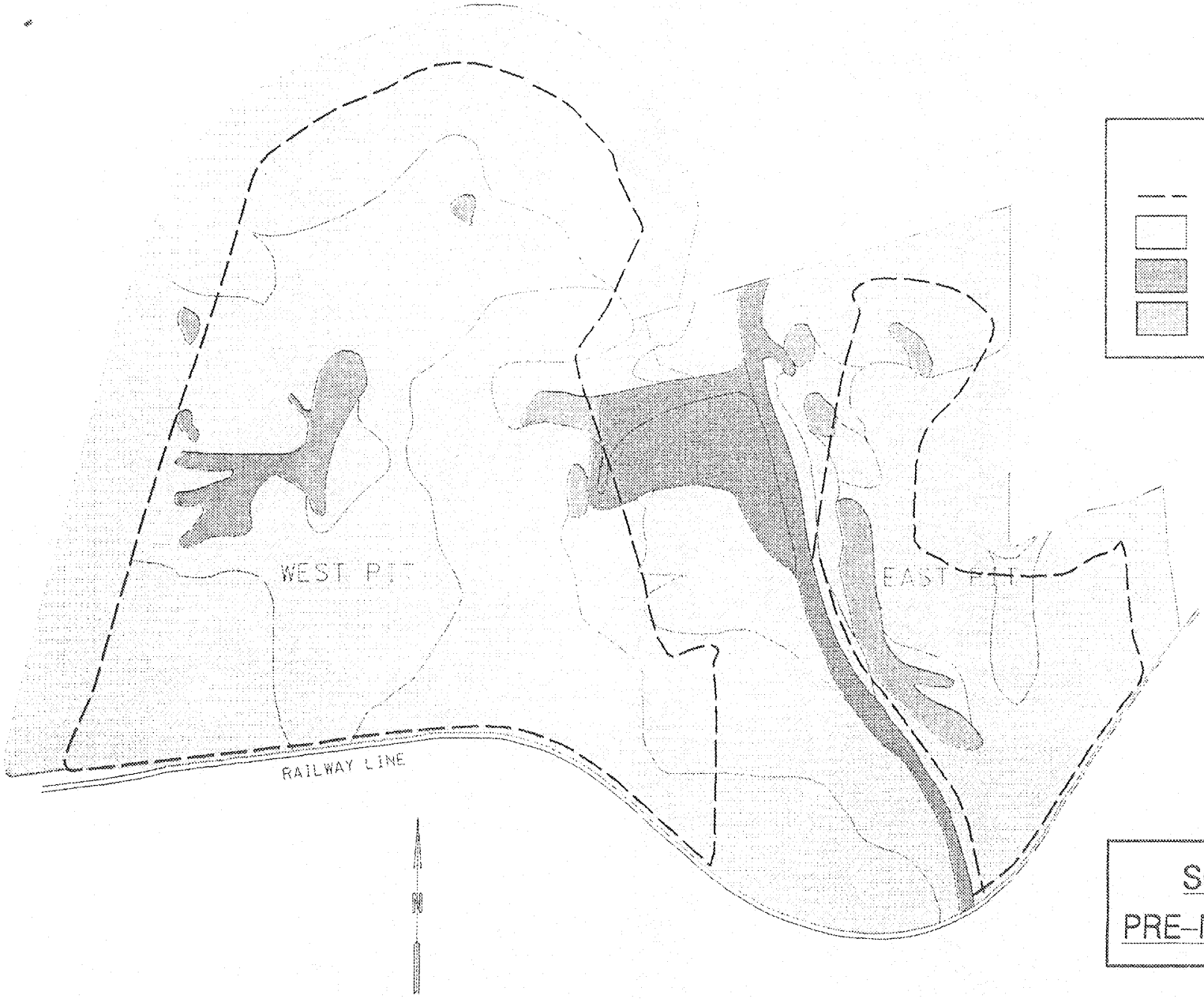
GEOLOGICAL CROSS-SECTION NO 2

FIGURE 2.1.3.(b)



GEOLOGICAL CROSS-SECTION NO 3

FIGURE 2.1.3.(c)



SCHOONGEZICHT
PRE-MINING SOIL TYPES

FIGURE 2.4.1.

4.3.3 Mineral processing

The mineral processing plants are described in the Landau Colliery and Kleinkopje Colliery EMPR's.

4.3.4 Plant residue disposal

Plant residues from the minipit will be disposed of at the Blaauwkrans and Klipfontein sites which are described in the Landau Colliery and Kleinkopje Colliery EMPR's respectively.

4.3.5 Transport

The raw coal transport routes are shown on Figure 4.1.3.

Product from the Klipfontein and Navigation plants will be conveyed into the SACE rapid loading terminal (RLT) for loading onto trains for the Richards Bay Coal Terminal. The RLT facilities are described in the Kleinkopje Colliery EMPR.

4.3.6 River diversion

The Schoongezichtspruit will not be diverted.

PART 5: ENVIRONMENTAL IMPACT ASSESSMENT

5.1 Construction phase

Impacts pertinent to the construction phase are covered in Section 5.2.

5.2 Operational phase

The following environmental impacts have been identified during the operational phase.

5.2.1 Geology

The geological sequence will be totally disturbed in the mining operation. Cores of overburden and carbonaceous shales have been analysed for their acid/base potential, and are reported on in Section 2. The NNP of the spoils based on a closed system is 0,616kg $CaCO_3$/ton of spoil. As this is well below the 30kg $CaCO_3$/ton threshold, water emanating from the spoils will be acid.

TABLE 5.2.1 - WATER VOLUMES AND SALT LOAD (SO_4) TO BE PUMPED FROM THE PITS

Based on 2000 mg/l SO_4

WEST PIT		J	F	M	A	M	J	J	A	S	O	N	D	AVERAGE TOTAL
F1994	l/s	17	14	13	6	4	5	4	5	7	14	19	17	10
	ton/day	2.87	2.47	2.24	1.04	0.69	0.86	0.69	0.86	1.21	2.47	3.28	2.94	1.80
F1995	l/s	10	8	8	5	4	4	4	4	5	8	10	9	7
	ton/day	1.73	1.38	1.39	0.86	0.69	0.69	0.69	0.69	0.86	1.38	1.73	1.56	1.14
F1996	l/s	8	7	6	4	4	4	4	4	4	7	8	8	6
	ton/day	1.39	1.20	1.03	0.69	0.69	0.69	0.69	0.69	0.69	1.20	1.39	1.39	0.98

EAST PIT		J	F	M	A	M	J	J	A	S	O	N	D	AVERAGE TOTAL
F1996	l/s	8	6	6	4	3	3	3	3	4	6	8	8	5
	ton/day	1.38	1.04	1.04	0.69	0.52	0.52	0.52	0.52	0.69	1.04	1.38	1.38	0.89
F1997	l/s	6	5	6	4	4	4	4	4	4	5	6	6	5
	ton/day	1.03	0.86	0.86	0.69	0.69	0.69	0.69	0.69	0.69	0.86	1.03	1.03	0.82

5.2.2 Topography

The predicted post-mining topography is shown on Figure 4.4.1 and is not very different from the original surface. Pit limits will be sloped to blend the unmined and mined surface in order to facilitate surface water flow and facilitate the use of the land for agricultural purposes.

5.2.3 Soils

The area to be disturbed by mining and associated operations is 75 hectares. Where practicable soil will be replaced directly onto levelled and graded spoils. Topsoil stockpiling will be kept to the minimum. This will result in soils being replaced very close to their original positions. The relative abundance of the five broad soil types in the area surveyed are as follows:

Soil type	Area (ha)	% of total
Red apedal soils	41.3	34.0
Yellow-brown apedal soils	58.6	48.4
Hydromorphic soils	7.5	6.2
Shallow soils	7.6	6.2
Exposed rock/hard plinthite	6.4	5.2
TOTAL	121.4	100.0

5.2.4. Land capability

The post-mining land capability will be returned to grazing.

5.2.5 Land use

During mining the total area of 75 hectares of the minipit will be withdrawn from agricultural use.

5.2.6 Natural vegetation

Natural vegetation will be disturbed during the operational phase.

5.2.7 Animal life

Animal life will be disturbed during the operational phase.

5.2.8 Surface water

The impact on surface water will be minimal, as cut-off drains shown in Figure 4.1.2 will direct water away from the mining area. The effect of mining on surface water is illustrated in Tables 2.9.3 to 2.9.5.

5.2.9 Ground-water

The natural occurring groundwater environment will be disturbed. Groundwater will enter the pit and become affected. The estimated volumes of groundwater affected are shown in Tables 2.9.3 to 2.9.5.

5.2.10 Air quality

Impact on air quality from the minipit will be minimal, as dust allaying will be practised. No residential sites are located adjacent to the mining area.

5.2.11 Noise

Noise impact will be minimal as the nearest residential area is in excess of 1 km from the mining area.

5.2.12/14 Archaeological, cultural, sensitive landscapes, visual

No impacts on these have been identified.

5.2.15 Regional socio-economic structure

The impact will be positive in terms of employment and earning of foreign exchange for the country.

5.2.16 Interested and affected parties

The parties affected, being a farmer, is described in Section 4.

5.3 DE-COMMISSIONING PHASE

During the decommissioning phase mining operations will cease and rehabilitation will be completed. Temporary structures will be removed and the surface areas occupied by them rehabilitated.

The pollution control facilities for managing affected water will have been put into place during the operational phase.

Table 5.3.1 shows the estimated post-mining salt load generated by the minipit. As the affected water from the minipit will be pumped to the Navigation plant, this salt load will not impact on downstream users.

TABLE 5.3.1 - SALT LOAD EMANATING FROM THE EASTERN AND WESTERN PITS ON CLOSURE

Sulphate @ 2000 mg/l

	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL AVERAGE
m^3	24261	22996	22702	20292	19645	19851	19615	19851	20409	22996	24672	23967	261257
l/s	9	9	9	8	7	8	7	8	8	9	9	9	8.2
Sulphate tons/day	2	2	1	1	1	1	1	1	1	2	2	2	1.4

PART 6: ENVIRONMENTAL MANAGEMENT PROGRAMME

6.1 CONSTRUCTION PHASE

The construction phase will be very short and merge with the operational phase. As such management of all environmental impacts are discussed under the Operational Phase.

6.2 OPERATIONAL PHASE

The opencast mining method to be employed is described hereunder and may be modified as circumstances change.

The mining method to be employed will be an open pit method employing scrapers, shovels and trucks. The operational steps are shown on Figure 4.1.5 and are described as follows:

1. Useable topsoil will be removed and either stockpiled separately for later use during rehabilitation, or placed directly over graded spoils. (Steps A and E)

2. The overburden to the top of coal will be either dozed over into the adjacent void after removal of the coal, or loaded into trucks and hauled around or across the pit and dumped into the void. The dumped and/or dozed spoils will be graded to conform with the required post-mining surface profile (Steps B1 to B2 and C1 to C2 respectively).

3. Strips of exposed coal, between 35 and 50 metres wide, will be blasted and then removed by shovel and truck and hauled to the ROM tip for crushing to minus 75mm. (Step D.)

4. Soil placement, after profiling of the spoils, will be controlled to achieve a planned soil distribution to conform with a land capability plan. After replacement, all profiled surfaces will be thoroughly ripped to overcome compaction of the soil induced by heavy mining equipment. Final tillage will produce a bed suitable for the planting of pasture seed.

   The pasture performance, fertiliser requirements, success of seed mixes and any other factors which affect growth will be monitored by the land rehabilitation section of AES.

5. Final voids will be filled, sloped for drainage and re-vegetated on completion of the two mining blocks.

Figures 2.4.1 and 2.5.1 show the pre-mining soil distribution and land capability respectively. It is planned to return the soils to a similar plan after mining.

6.2.1 Geology

It will not be possible to reinstate the pre-mining geological sequence. Post-mining surfaces will be profiled to facilitate surface water run-off and reduce ingress of surface water into the spoils.

6.2.2 Topography

The indicative post mining topography plan is included as Figure 4.4.1.

The objective is to rehabilitate the topography so that none of the slopes will have gradients that will exceed 7° (12%). This will promote surface run-off without generating erosion.

6.2.3 Soils

It is planned to remove, where available, the topsoil and sub-soils ahead of overburden removal. Soil will be replaced, as far as practicable, to at least 250mm thick over levelled and graded spoils to establish land with grazing potential. It is intended to remove and replace on rehabilitated ground 85% of usable soil as measured in the pre-mining soil survey report conducted by forestry soil consultants from the company Red Earth cc. (See Supplementary Report No. 1).

6.2.4 Land capability

The objectives of rehabilitation are to restore the land to grazing potential by means of applying appropriate measures to the restoration of topography, the rehabilitation of topsoil, vegetation, habitat and wild life. Where grazing capability cannot be achieved, the objective is to create stable wilderness areas.

The aim will be to establish environmental systems which will, as far as practicable, be self supporting.

After topsoil has been placed and graded, lime and fertilizer will be applied and seeded by normal mechanised methods. In this regard, suitable seed mixes normally in use on Amcoal collieries, will be used. The composition of the seed mixes are the result of numerous trials, experience and advice from specialist consultants. The fertilizer requirements will be determined by periodic routine analyses of the soil.

6.2.5 Land use

The objective is to restore, as far as practicable, land to its pre-mining potential. The minimum objective will be to return the land to grazing.

The Chamber of Mines rehabilitation guidelines were used in the determination of the land capability classes and present land use. The pre-mining land capability for the area to be disturbed is as follows:

Wetland	=	1.0 hectare
Arable	=	26.2 hectares
Grazing	=	33.2 hectares
Wilderness	=	5.5 hectares

6.2.6 Vegetation

In summary, the aims of revegetation, as stated in the Chamber of Mines guidelines, and to which the mine commits itself are:

- to stabilise the soil and minimise erosion.
- to prevent pollution of streams and air by particulate matter.
- to re-establish nutrient recycling.

Rehabilitation and farming techniques have been developed at all of Amcoal's operations to cope with a large variety of soil types, depths and vegetation. Amcoal is therefore well placed to guarantee a high standard of rehabilitation.

In terms of pastoral production the rehabilitated areas will have the ability to produce at least as much excellent veld as existed before mining to maintain ecological stability even after the application of fertiliser has been terminated.

The natural vegetation, which consists mainly of grasses, will be disturbed and replaced by a seed mix developed by Amcoal. In this regard suitable seed mixes normally in use on Amcoal collieries, and which will be used in this instance, are the result of numerous trials, experience and advice from specialist consultants. The fertiliser requirements will be determined by periodic routine analyses of the soil. However, if necessary and pending the availability of suitable water, supplementary irrigation may be provided to establish grass cover.

A typical seed mixture currently used by Landau Colliery is presented in Table 6.2.1. It is possible that this mixture will be modified with time as more experience is gained. The aim will be to establish environmental systems which will, as far as is practicable, be self-sustaining.

TABLE 6.2.1 - LANDAU COLLIERY REHABILITATION SEED MIXTURE

GRASS TYPE	%	kg/ha
Rhodes	33%	6
Smuts finger	33%	6
Tess	22%	4
Lucerne	12%	2

The above mix treats Teff as a nurse crop, in that good cover is provided in the first year by the fast germination characteristics of the grass. In subsequent years the percentage of Teff reduces to virtually zero, as the other three species take over. Teff therefore provides early erosion control.

6.2.7 Animal life

Amcoal does not plan to implement a specific wildlife introduction programme. After mining a natural migration of animal and bird life from adjacent areas onto the rehabilitated opencast area will take place.

6.2.8 Surface water

6.2.8.1 Water balance

Tables 2.9.3 to 2.9.5 show the anticipated volumes of affected water generated by the minipit. The water will be utilised in the Navigation plant.

6.2.8.2 Storm-water

Storm-water drains will be constructed as shown on Figure 4.1.2 These drains will channel clean water away from the mining area into the clean-water system. The objective will be to handle only storm-water falling on the mining area. Excess affected water will firstly be utilised in the Navigation plant, with additional excess water being pumped into the old Navigation underground workings for storage.

6.2.9 GROUND-WATER

6.2.9.1 Minimising ground water impact

There will be no ground-water impact outside of the mining area. All groundwater entering the spoils in the mined out area will gravitate to the manhole sumps and will be pumped to Navigation plant for use as process water. Due to this plan a head of water will therefore not develop in the spoils that could feed into the ground-water system.

Figure 2.1.2 shows contours of the No. 4 Seam mining floor. It can be seen that in pit water will gravitate to the northern points of Cuts 1 and 9. During mining the actual pit floor contours will be determined and the lowest points established for the sumps to be located.

6.2.9.3 River diversion seepage

As the ground water level in the spoils will be maintained below the stream bed no affected water will seep into the spruit.

6.2.10 Air quality

The objective is to minimise the amount of dust generated by the mining operations. Two additional single bucket monitoring points, as shown on Figure 2.11.1, have been installed to monitor dust generation from the minipit. Results from these buckets will be reported on in the annual Landau Colliery returns.

6.2.11 Noise

The objective is to minimise the amount of noise generated by mining operations and protect employees in high noise zones.

Noise levels measured from blast monitoring will be submitted annually as part of the Landau Colliery annual returns.

6.2.12 Sites of archaeological and cultural interest

No sites exist.

6.2.13 Sensitive landscapes

No sensitive landscapes have been identified.

6.2.14 Visual

Visual impacts will be minimal as the pit lies in a valley and is some 2km from the nearest public road.

6.2.15 Regional socio-economy

There will be no change to the socio-economic structures of the Witbank area during the operation phase.

6.2.16 Interested and affected parties

Liaison will be maintained with government departments and the public where necessary.

6.2.17 Submission of information

This report forms an addendum to the Landau Colliery EMPR and the results from the monitoring programmes will be incorporated into the Landau Colliery annual returns, the first of which will be submitted in July 1995.

The annual report will include results from routine monitoring with tables and graphical trends. Aspects that this report will cover are:

- Blast monitoring (air and ground vibrations).
- Dust monitoring.
- Surface water monitoring.
- Ground water monitoring.
- Management of rehabilitated opencast areas.

In addition to the above, more frequent reports on selected aspects will continue to be submitted to the authorities as required by legislation or on request.

Detailed comments on the methods and timing of the planned monitoring programmes will be supplied on request.

6.2.18 MAINTENANCE

6.2.18.1 Rehabilitated land

During the operational phase the mine undertakes to maintain rehabilitated opencast land for a period of at least three years after initial seeding. This will entail fertilising, overseeding areas that have not vegetated, repairs to surfaces that have been eroded, etc. Thereafter, rehabilitated land will be maintained in a stable and productive state by appropriate fertilization and utilization strategies based on regular monitoring of the land.

6.2.18.2 Water pollution control structures

All presently constructed and future water pollution control structures will be maintained in good order through to the decommissioning phase. Routine inspections will be carried out and repair work implemented where necessary.

6.2.18.3 Rehabilitated residue deposits

Residue dumps to be utilised are covered in the Landau Colliery and Kleinkopje Colliery EMPR's.

6.3 DECOMMISSIONING PHASE AND CLOSURE

6.3.1 Closure objectives

No permanent structures will be erected. All temporary structures will be removed and the land they occupy tilled, fertilized and seeded.

The minipit area will have final voids filled, sloped, the area rehabilitated and returned to as close as is practical to grazing land capability. The pollution control measures implemented during mining will be operated and maintained by Landau Colliery after closure of the minipit.

6.3.2 Infrastructure and surface rehabilitation

The rehabilitation measures described in this section will conform with the requirements of Section 60 of the Minerals Act.

All temporary buildings and structures will be removed by the contractor, as well as their foundations.

6.3.3 Mine residue deposits

Not applicable to this submission and are dealt with in the Landau Colliery and Kleinkopje Colliery EMPR's.

6.3.3.1 Disposal facilities

Not applicable.

6.3.3.2 Control of seepage and rain water

The objective is to keep surface water from flowing from unmined areas onto rehabilitated land. This will reduce erosion of the rehabilitated land and ingress of water into the spoils.

Based on the calculations described in Section 2 it is anticipated that during the operational phase the minipit will generate some 3 to 19 litres per second of water containing between some 0.5 tons/day and 3.3 tons/day of sulphate. After closure the predicted water volumes will be between 7 and 9 l/s and 1 to 2 tons/day of sulphate. Water generated in the pit will be used in the Navigation plant, thus no decant into the Schoongezichtspruit will take place.

6.3.3.3 Long-term stability

The area mined by opencast will be stable, but will require localised minor maintenance for settling of the spoils. No buildings can be constructed on the two mined out areas of the pit.

6.3.3.4 Final rehabilitation in respect of erosion and dust control

Post-mining slopes and vegetation cover described in this report will eliminate dust being generated from rehabilitated mined areas. Erosion control over opencast rehabilitated land will require ongoing management, as is practised in agriculture.

6.3.4 Sealing of workings and dangerous excavations

Two old shafts exist in the minipit area from the No. 1 and No. 2 Seam underground workings. These will be filled with overburden during the mining operation thus rendering them totally safe.

All final voids will be sloped to gradients acceptable for agricultural purposes. No vertical high-walls will be left.

6.3.5 Final opencast rehabilitation

All ramps and final voids will be infilled and sloped to gradients acceptable for agricultural purposes. Top soiling and vegetating will be carried out in accordance with the post-mining land capability as defined in this report.

6.3.6 Submission of information

For the period post de-commissioning through to closure, Landau Colliery will continue to submit the following information as part of its annual returns on the minipit.

- Dust monitoring.
- Erosion of rehabilitated land and water courses.
- Vegetation cover.
- Water quality and quantities leaving the minipits boundaries.

6.3.7 Maintenance

Maintenance of the de-commissioned site will continue for a period of three years under the responsibility of Landau Colliery.

The water pumping system installed for de-watering the spoils will be ongoing and be operated and maintained by Landau Colliery.

As the Schoongezicht area could be mined by opencast in the future, this minipit will ultimately form part of the closure of these operations. Should this not materialise then decant water from the pit will be gravitated to the Schoongezicht pollution control dam and treated in a liming plant as described in Landau Colliery's EMPR.

6.4 PROPOSED TIMETABLE, DURATION AND SEQUENCE

6.4.1 Prospecting project

Not applicable.

6.4.2 Mining project

Mining commenced in April 1994.

6.4.2.1 Submission of EMPR and application for mining authorization

Mining authorization has been granted in terms of letter reference OT 5/3/2/96 dated 14 January 1993 received from the Department of Mineral and Energy Affairs - Witbank.

A preliminary EMPR for the minipit was submitted at the request of the DWAF at a meeting held on 24 March 1994. Following submission of this report a provisional mining authorisation was granted in terms of the Regional Directors letter dated 31 March 1994, reference OT 5/2/3/97.

6.4.2.2. Construction period

A short construction period of 1 month took place during April 1994.

6.4.2.3 Duration of mining activities

Mining activities are planned to span 1994, 1995, 1996 and 1997 based on a rate of producing between 750 000 and 1 000 000 sales tons per annum.

6.4.2.4 Rehabilitation programme

After cessation of mining in 1997 all rehabilitation will be completed within one year. Maintenance of the rehabilitated area will span three years, 1998 to 2000.

6.4.2.5 Dates for closure

Based on the above programme, closure will be applied for in the year 2000.

6.4.2.6 De-commissioning and after-care programme

The after-care programme for spoils water management will rest with Landau Colliery and form part of its closure plan.

6.4.2.7 Date for closure application

The anticipated date for closure application will be 2000.

6.5 FINANCIAL PROVISION

Details of the "Pollution Control Fund" for South African Coal Estates (incorporating Landau Colliery) has been lodged by Amcoal to provide the necessary funds to complete closure requirements of its mines. The minipit will contribute to these funds to provide for the de-commissioning and closure phases described in this EMPR.

The complete "Pollution Control Fund" for South African Coal Estates (incorporating Landau Colliery) has been lodged with the Regional Director - Eastern Transvaal and formed part of the application for Mining Authorization.

PART 7: CONCLUSION

Amcoal Management is committed to integrated environmental management. Responsibility is delegated to mine management to evaluate environmental impacts and implement management programmes. Adequate funds are provided to ameliorate negative impacts, both during operation and after mine closure.

The principal aspects of Amcoal's management approach include:

- Effective communication with government agencies and affected parties.
- Professionally designed environmental control measures.
- The use of specialist consultants when in-house skills are unavailable.
- Compliance with legal requirements based on BATNEEC.
- Monitoring of the implementation of the environmental programme.
- Compliance audits conducted on a regular basis.

The Amcoal Pollution Control Fund was established in August 1977 for each of its operating mines. This fund ensures that adequate pecuniary measures are provided for in terms of Section 9(5)e of the Minerals Act for mine closure. The contributions made to this fund are reviewed annually to ensure that funding levels are sufficient to meet the standards agreed to in the EMPR and any amendment that may from time to time occur.

Landau Colliery Management has holistically researched and identified the environmental impacts that will occur as a result of its minipit operation and have identified means to manage these impacts as laid down in Part 6, in conjunction with the general principles and application of BATNEEC.

PART 8: **STATUTORY REQUIREMENTS**

Table 8.1.1 lists the permits and permissions obtained from Government Departments which are directly related to environmental issues.

TABLE 8.1.1 **PERMITS AND PERMISSIONS**

PERMIT DESCRIPTION	AUTHORITY	PLACE OF ISSUE	DATE OF PERMISSION	PERMIT/ REGISTRATION NO	STATUTE
Water abstraction	Department of Water Affairs	Pretoria (Standerton)	10.05.1993	29/177/93	Water Act Section 56 (3)
Use of water for industrial purposes	Department of Water Affairs	Pretoria	12.06.1992	1407N	Water Act Section 12 (1)
Mining authorisation for the Schoongezicht No 4 Seam Minipit	Dept of Mineral and Energy Affairs	Witbank	31.03.1994	OT 5/2/3/97	Minerals Act No 50 of 1991
Mining closer than 100m to a railway line	Spoornet/ Dept of Mineral and Energy Affairs	Koedoespoort Witbank	14.04.1994 09.05.1994	S.NT/W 1076/4/1 OT 11/18/2-N136/S	Minerals Act No 50 of 1991 Regulations 5.3.1 and 5.3.2
Mining closer than 100m to powerlines	Eskom/ Dept of Mineral and Energy Affairs	Witbank Witbank	24.05.1994 09.05.1994	SO/298 W213 OT 11/18/2 - N136/S	Minerals Act No 50 of 1991 Regulations 5.3.1 and 5.3.2

PART 9: **AMENDMENTS**

This report is submitted as an addendum to the Landau Colliery EMPR.

SUPPLEMENTARY REPORT

NO 1

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SOIL SURVEY, STRIPPING GUIDE AND LAND CAPABILITY

OF

EAST PIT, WEST PIT AND SURROUNDS (SCHOONGESICHT VALLEY)

LANDAU COLLIERY

WITBANK DISTRICT

Prepared for

AMCOAL COLLIERIES LTD

by

R.I. Davies and B.B. McLeroth

June 1994 RE.MS.05

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OF

EAST PIT, WEST PIT AND SURROUNDS (SCHOONGESICHT VALLEY)

LANDAU COLLIERY

WITBANK DISTRICT

RE.MS.05

INTRODUCTION

A soil survey and land capability classification of East Pit, West Pit and surrounds, (approximately 121.4ha) of Landau Colliery was carried out in April 1994. The suitable soil material in the East and West Pit areas is to be stripped ahead of mining operations and replaced over the levelled spoil after mining operations are completed. This is done in order to comply with legislation as specified by The Chamber of Mines. The replacing of soil or 'topsoiling' as it is called, is based on the pre-mining land capability of the area. Thus, the objectives of this survey are to produce a soil map, stripping plan, and land capability map of the area concerned.

SURVEY METHODS (Map 1 and Appendix 1 and 2)

An intensive systematic grid survey was undertaken with sampling points 100 metres apart. The distribution of the sample points, examined with a soil auger, as well as the location of soil samples taken for laboratory analysis, are shown on Map 1. All information recorded at sample points is presented in Appendix 2, using the code as outlined in Appendix 1.

THE SOIL MAP (Map 2 and Table 1)

The different soil types identified were grouped together into soil mapping units on the basis of soil form, effective soil depth (ESD), factors affecting cultivation practices, and wetness hazard. Each soil mapping unit has a unique code which describes these factors.

Table 1 summarises the information on Map 2 in terms of soil form, ESD and soil volume (total area).

SOIL FORM			EFFECTIVE SOIL DEPTH														TOTALS		
Map Notation	Name	Horizon	15	14	13	12	11	10	9	8	7	6	5	4	3	2	0	ha.	% of area	m^3
Hu	Hutton	Orthic/R Apedal	-	-	3,3	3,9	2,3	5,7	9,6	-	1,5	6,1	3,1	-	-	-	-	35,5	29,2	320000
Cv	Clovelly	Orthic/YB Apedal	0,6	2,2	-	6,6	-	12,1	1,4	-	5,0	-	6,7	0,7	-	-	-	35,3	29,0	323900.
Gc	Glencoe	Orthic/YB Apedal/hard plinthic	-	-	-	-	-	1,6	-	-	10,0	0,7	3,4	0,9	-	-	-	16,6	13,6	10800.
Ia	Inanda	Humic/R Apedal	-	-	-	5,0	-	-	-	-	-	-	0,8	-	-	-	-	5,8	4,8	64000
Ma	Magwa	Humic/YB Apedal	-	-	-	-	1,6	-	-	-	-	-	-	-	-	-	-	1,6	1,4	17600
Av	Avalon	Orthic/YB Apedal/Soft plinthic	-	-	-	-	-	2,3	-	-	0,5	-	2,3	-	-	-	-	5,1	4,3	38000
We	Westleigh	Orthic/Soft Plinthic	-	-	-	-	-	-	-	-	-	-	-	-	-	1,2	-	1,2	0,9	2400
Ka	Katspruit	Orthic/G	-	-	-	-	-	-	-	-	-	-	-	-	-	2,9	-	2,9	2,4	5800
Lo	Longlands	Orthic/E/Soft Plinthic	-	-	-	-	-	-	-	-	-	-	-	3,4	-	-	-	3,4	2,8	13600
Ms	Mispah	Orthic/Hard rock	-	-	-	-	-	-	-	-	-	-	-	-	7,6	-	-	7,6	6,3	22800.
'BR'	'Boulder Rock'	'Solid Rock'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,9	3,9	3,3	-
Dr/BR'	Dresden and 'Boulder Rock'	Orthic/hard plinthic and 'Solid rock'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,5	2,5	2,0	-
TOTALS		ha.	0,6	2,2	3,3	15,5	3,9	21,7	11,0	-	17,0	6,8	16,3	5,0	7,6	4,1	6,4	121,4	100%	
		m^3	9000	30800	42900	186000	42900	217000	99000	-	119000	40800	81500	20000	22800	8200	-			919900.

TABLE 1. Summary of soil form, effective soil depth and soil volume (total area)

Table 1 shows the following soil forms to be the most common :

Clovelly	: Orthic A/yellow-brown apedal B	: 35.3 ha	: 29.0 %
Hutton	: Orthic A/red apedal B	: 35.5 ha	: 29.2 %
Glencoe	: Orthic A/yellow-brown apedal B/hard plinthite)	: 16.6 ha	: 13.6 %
'other'	: -	: 34.0 ha	: 28.2 %

The soils encountered may be divided into five broad types, namely, red apedal soils, yellow-brown apedal soils, hydromorphic soils, shallow soils and exposed rock/hard plinthite areas.

SOIL TYPES AND SUITABILITY FOR 'TOPSOIL' (Table 1)

The relative abundance of the five broad soil types are as follows :

i)	red apedal soils	41.3 ha	34.0 %
ii)	yellow-brown apedal soils	58.6 ha	48.4 %
iii)	hydromorphic soils	7.5 ha	6.2 %
iv)	shallow soils	7.6 ha	6.2 %
v)	exposed rock/hard plinthite	6.4 ha	5.2 %

i) red apedal soils

These are relatively deep (0.7m to 1.5m), well drained soils of the Hutton (orthic A/red apedal B) and Inanda (one small area only) (humic A/red apedal B) forms. The organic carbon (estimated) varies between 0.3 and 2 %. The orthic and humic A horizons, and the red apedal B horizons, with their favourable structure (apedal) and consistence (friable) are suitable materials for use as 'topsoil'.

ii) yellow-brown apedal soils

Relatively deep (0,7 to 1,0 but up to 1.2m), well drained soils of the Clovelly (orthic A/yellow-brown apedal B), Magwa (one small area only) (humic A/yellow-brown apedal B) and Glencoe (orthic A/yellow-brown apedal B/hard plinthic B) forms are found throughout the surveyed area. The 'usable' soil depth is dependent on the depth of the underlying material. This is made up of either weathered sandstone or a layer of hard plinthite 'rock'. A few of the soil profiles do also contain a weak quartz stoneline, and/or a concretionary layer. These layers however,

do not reduce the 'usable' depth of the soil significantly. Most of the soil forms are of a sandy nature.

The relatively poorly drained sandy soils of the Avalon (orthic A/yellow-brown apedal B/soft plinthic B) form are found mainly near the major waterway (between East Pit and West Pit). Most are of an intermediate depth varying from 0.4 to 0.5m. The'usable' soil depth is dependent on the depth of the underlying hydromorphic horizon. The soft plinthic B horizon of the Avalon soil form is the dominant hydromorphic horizon.

The orthic A, humic A, and yellow-brown apedal B horizons of the Clovelly, Magwa, Glencoe and Avalon soil forms are suitable materials for use as 'topsoil' having very favourable structure (apedal) and consistence (friable). Since soft plinthic and hard plinthic B horizons are unsuitable, the indicated soil depth does not include these horizons.

iii) **hydromorphic soils**

Most of the hydromorphic soils occur in the valley bottom (vlei) between East Pit and West Pit. The Westleigh (orthic A/soft plinthic B) and Katspruit (orthic A/G horizon) forms are most common in this area. The Longlands (orthic A/E/soft plinthic B) form occurs on the footslopes of this vlei.

The underlying soft plinthic B, G and E horizons occur at shallow depth (0.2 to 0.4m) and as a result the overlying topsoils are generally grey and mottled to a certain extent. The poor quality (mottled) orthic A horizons of these soil types are suitable for use as 'topsoil', the underlying hydromorphic horizons being unsuitable. These soils, being wet for long periods of the year pose a threat to machinery, and particularly so during the wet summer months.

iv) **shallow soils**

Small isolated areas of the Mispah (orthic A/hard rock) form occur in midslope positions. The shallow orthic A horizon (0.2 to 0.3m) is 'suitable' for use as 'topsoil'. The layer below the A horizon is usually solid sandstone or hard plinthite.

v) exposed hard plinthite and boulder rock (sandstone)

These are areas where either hard plinthite ('ouklip') or sandstone boulders are directly exposed at the surface. There is no soil covering, hence there is no 'usable topsoil'. The exposed materials are hard and cannot be penetrated with a soil auger. The dominant exposed material is hard plinthite (Dresden form), the sub-dominant exposed material being sandstone rock (Mispah form).

SOIL PIT DESCRIPTIONS (Maps 1 and 2)

Two common soil forms are described. Soil samples of the A and B horizons were taken for analysis, the data being presented in the section on SOIL ANALYTICAL DATA.

The pit descriptions are as follows :

(i) **Glencoe form** : representative of the yellow-brown apedal soils overlying hard plinthite.

PIT 1 (F1)

Orthic A
0 - 0.3m : dry, dark yellow-brown (10YR 4/4 dry), sandy loam (13% clay), soft consistence, single grain, frequent roots, moderate/rapid permeability (4 seconds), abrupt transition to.

yellow-brown apedal B
0.3 - 0.9m : moist, yellow-brown (10YR 5/6 moist), sandy loam (13% clay), friable consistence, apedal, rare concretions, rare roots, moderate permeability (3 seconds), abrupt transition to.

hard plinthic B
> 0.9m : solid.

(ii) Clovelly form

PIT 2 (I9)

Orthic A
0 - 0.3m : dry, dark yellow-brown (10YR 4/4 dry), loamy sand (4% clay), soft consistence, single grain, frequent roots, moderate permeability (3 seconds), abrupt transition to.

yellow-brown apedal B
0.3 - 0.6m : moist, yellow-brown (10YR 5/6 moist), sandy loam (17% clay), friable consistence, apedal, rare concretions, rare roots, moderate permeability (3 seconds), gradual transition to.

weathered sandstone
> 0.7m

SOIL ANALYTICAL DATA (Map 1 and Table 2)

Table 2 presents the analytical data for typical samples taken from the two pits indicated on Map 1 and 2.

Both samples were typical yellow-brown apedal soils of the Glencoe and Clovelly forms. The sandstone derived yellow-brown apedal B horizons have similar clay percentages, 13 and 17 % respectively. Most B horizons fall into the range of 15 to 25% clay. Topsoil clay was as low as 4%.

pH (KCl) of the apedal soils varied from 4.26 to 4.46. This is considered to be relatively high, and probably reflects the practice of liming of maize lands in the past. These soils are mesotrophic and have S-values (cmol(+)kg-1 clay) of over 5. Phosphorous (ppm) is high in the topsoils due to fertilisation.

Topsoil organic carbon (%) of the A-horizon samples varies from 0.84 to 0.91%. These extremely low figures are due to long periods of cultivation on these lands together with wind erosion.

SOIL SAMPLE	FI : Sample (1)		I9 : Sample (2)	
HORIZON	Orthic A	YB Apedal B	Orthic A	YB Apedal B
LABORATORY REFERENCE	4587	4588	4589	4590
TEXTURE (%)				
Sand	79	79	85	74
Silt	8	8	11	9
Clay	13	13	4	17
EXCHANGEABLE CATIONS $cmol(+)kg^{-1}$ soil				
Ca	1,01	0,69	1,01	0,60
Mg	0,33	0,23	0,32	0,18
K	0,28	0,07	0,15	0,03
Na	0,05	0,02	0,05	0,08
TOTAL(S-value)	1,68	1,01	1,53	0,89
S-VALUE $cmol(+)kg^{-1}$ clay	12,94	7,77	38,27	5,21
P(ppm)	6	1	4	1
ORGANIC CARBON (%) WB	0,91	0,53	0,84	0,37
pH : (KCl)	4,38	4,26	4,46	4,30
EXCHANGEABLE ACIDITY $cmol(+)kg^{-1}$ soil	0,42	0,59	0,26	0,85
ECEC $cmol_c\ kg^{-1}$ soil	2,1	1,6	1,8	1,7
SOIL FORM SOIL FAMILY CODE DEGREE OF LEACHING DOMINANT PARENT MATERIAL	Glencoe Crayden Gc 2200 Mesotrophic Sandstone		Clovelly Leiden Cv 2200 Mesotrophic Sandstone	
REMARKS	Sandy loam, low Ca^{2+} (expected to be lower.)		Sandy loam, low Ca^{2+} (expected to be lower.)	

TABLE 2. Soil analytical data

STRIPPING PLAN (Map 3)

Map 3 is a stripping plan showing average usable depth. This map summarises the soil map (Map 2) into soil groups and average usable depth. This simplified soil map was requested due to the complex nature of the soil map (large number of soil forms and effective soil depths) which makes it impractical as a stripping guide.

The broad soil groups indicated on the stripping plan include cropping, wetland and rock areas, while the average usable depth classes include 0 (0 - 0.1), 0.3 (0.2 - 0.4), 0.6 (0.5 - 0.7), 0.9 (0.8 - 1.0) and 1.2 (1.1 - 1.3) m. Only five depth classes were chosen since these simplify the soil map and are practical settings for the machinery used for stripping the 'topsoil'.

VOLUME OF SOIL SUITABLE FOR 'TOPSOIL' (Map 3 and Table 3)

Table 3 is extracted from Map 3 (stripping plan) and summarises the information for East Pit, West Pit and surrounds.

Table 3 shows that 907200 m^3 of soil is suitable for use as 'topsoil'. East Pit is made of 98400 m^3 , West Pit of 371400 m^3 and surrounds 437400 m^3 .

SOIL GROUP			LOCATION	AVERAGE USABLE DEPTH (cm x 10) OR EFFECTIVE SOIL DEPTH					TOTALS		
MAP NOTATION	FORMS INCLUDED	SOIL CHARACTERISTICS		12 (11-13)	9 (8-10)	6 (5-7)	3 (2-4)	0 (0-1)	ha.	% of Area	m^3
C	Av, Cv, Gc, Ma, Ia, Hu, Ms	Cropping soils, well drained yellow brown or red	EAST PIT	1,7	6,7	2,4	1,1	-	11,9	9,7	98400
			WEST PIT	14,9	2,9	24,8	3,1	-	45,7	37,4	363000
			SURROUNDS	15,9	16,1	14,2	3,7	-	49,9	42,1	432000
W	We, Ka, Lo	Wetland, vlei and valley bottom soils. Grey and mottled with fluctuating or permanent water table	EAST PIT	-	-	-	-	-	-	-	-
			WEST PIT	-	-	-	2,8	-	2,8	2,2	8400
			SURROUNDS	-	-	-	1,8	2,9	4,7	3,7	5400
R	Dr/BR and 'BR'	Exposed hard plinthite (ouklip) or boulder rock.	EAST PIT	-	-	-	-	2,5	2,5	2,0	-
			WEST PIT	-	-	-	-	3,0	3,0	2,3	-
			SURROUNDS	-	-	-	-	0,9	0,9	0,6	-
TOTALS			ha.	32,5	25,7	41,4	12,5	9,3	121,4	100	
			m^3	390000	231300	248400	37500	-	-	-	907200

TABLE 3. Summary of stripping plan and volume of soil suitable for topsoil

LAND CAPABILITY CLASSES (Table 4 and Map 4)

Table 4 is extracted from Map 4 (land capability units) and summarises the information for East Pit, West Pit and surrounds.

LAND CAPABILITY				
Map Notation	CAPABILITY	LOCATION	TOTALS ha.	TOTALS % of Area
W	Wetland : I	EAST PIT	-	-
		WEST PIT	1,0	0,8
		SURROUNDS	3,2	2,5
A	Arable : II	EAST PIT	8,4	6,8
		WEST PIT	17,8	15,5
		SURROUNDS	32,4	26,6
G	Grazing : III	EAST PIT	3,5	2,8
		WEST PIT	29,7	24,5
		SURROUNDS	19,0	15,6
L	Wilderness : IV	EAST PIT	2,5	2,0
		WEST PIT	3,0	2,3
		SURROUNDS	0,9	0,6
Totals			121,4 ha.	100%

TABLE 4. Summary of land capability units

The Chamber of Mines rehabilitation guidelines were used in the determination of land capability classes. Associated problems and pertinent comments relevant to the land capability classification exercise are as follows :

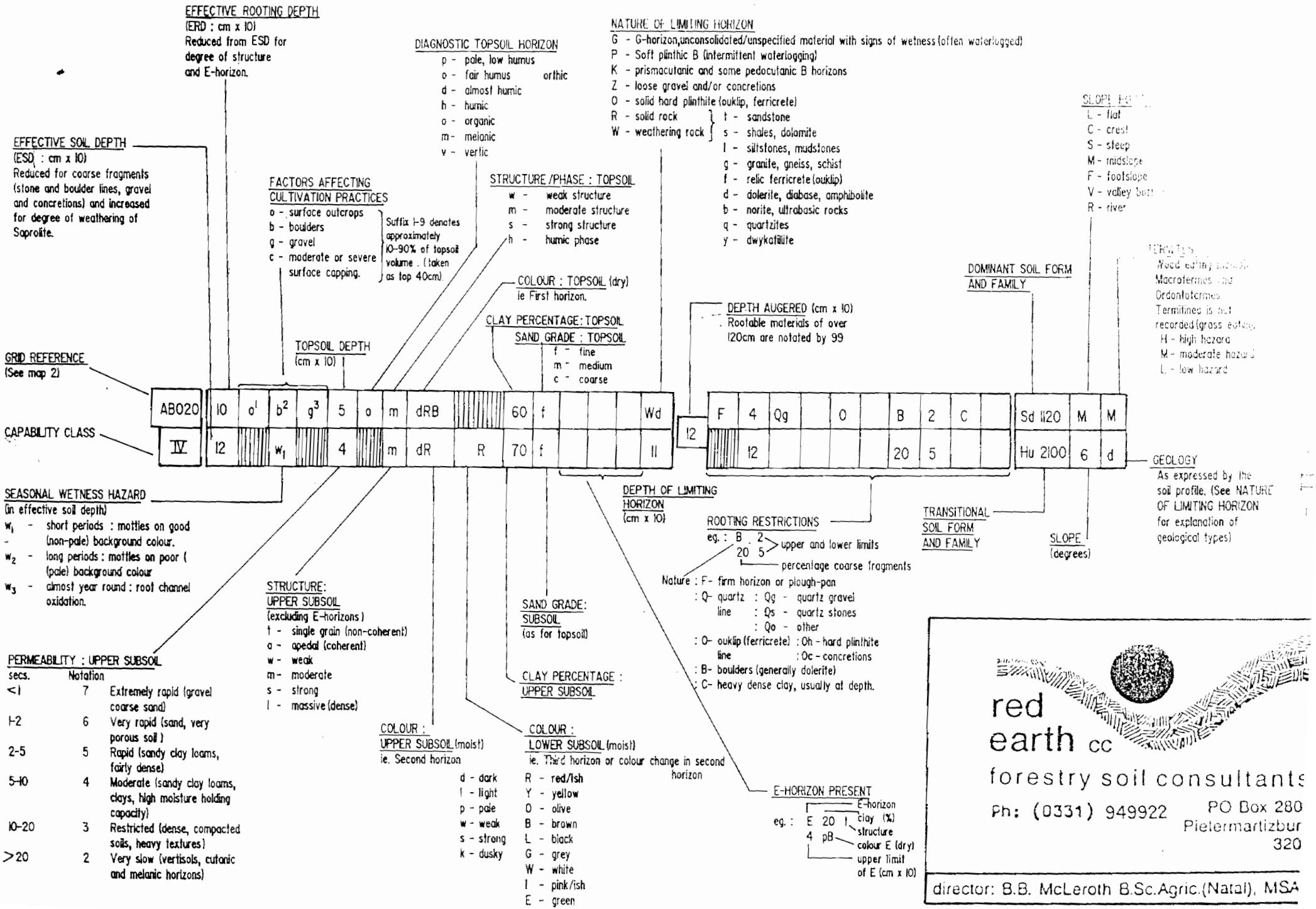
i) **Wetland** - Wetland is defined as 'an horizon that is gleyed throughout more that 50% of its volume and is significantly thick, occurring within 75 cm of the surface'. A number of soil units exhibited a soft plinthic horizon (fluctuating water table) at less than 75 cm of the surface. However, since a soft plinthic horizon requires only 10% mottles by volume, a number of these units were included in 'grazing' and not 'wetland' since the soft plinthic horizon was gleyed through less than 50% of its volume, to 75 cm. Also, certain parent materials such as sandstone may lead to pale soils due to their inherently low iron reserve. Since these colours have high values and low chromos they may be misinterpreted as wetland soils since these colours are those as specified for the bleached E horizon. Both comments infer that a more precise definition of wetland may be required.

ii) **Arable** - Most soil surveys are conducted by auger with a number of check pits. Augering to 120 cm will lead to twelve piles of soil laid out on the surface. An arable soil by definition, must for one be deeper than 75 cm. Soils with a depth of 70 cm were included in the arable category since it is difficult to differentiate horizon changes to the nearest 5cm.

iii) **Grazing** - This class caters for the shallow soil forms, and the soils where the hydromorphic horizon occurs at less than 75 cm. However, in the latter case gleying must be less than 50% by volume of the horizon at 75 cm, otherwise the soil falls into the wetland class.

iv) **Wilderness** - This includes the areas of exposed hard plinthite and rock.

APPENDIX 1 Soil profile code and symbols description



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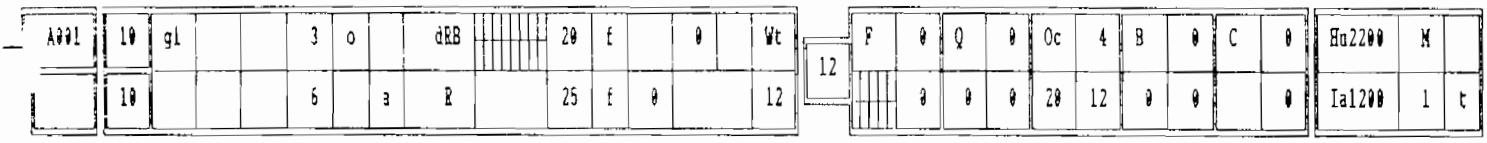
APPENDIX 2 Coded soil profile descriptions at observation points



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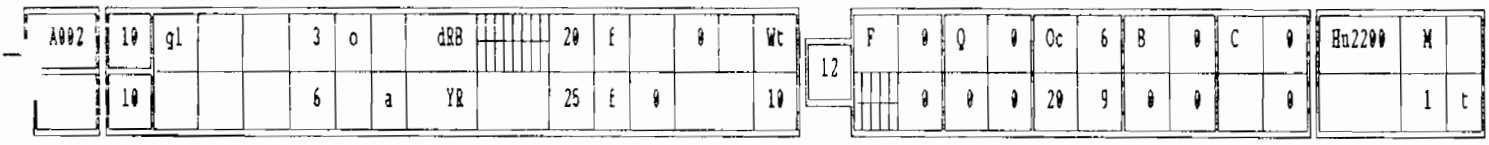

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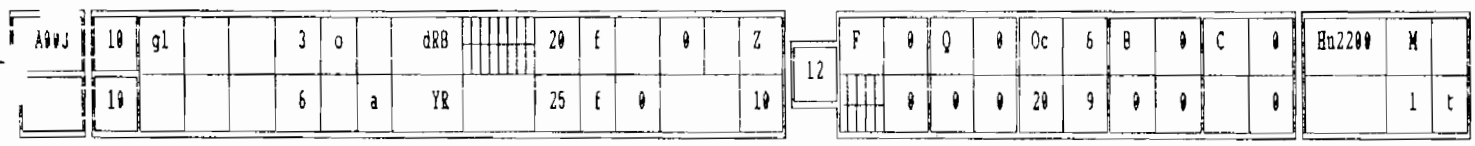

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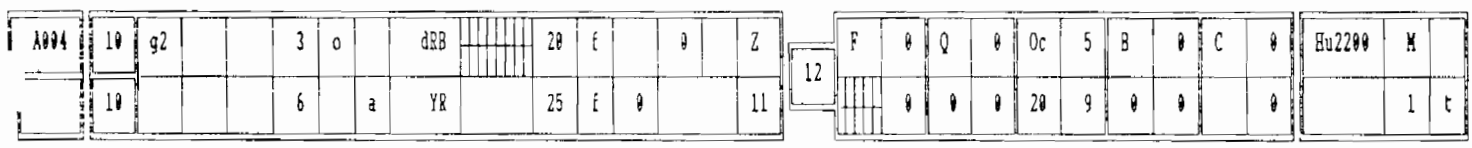

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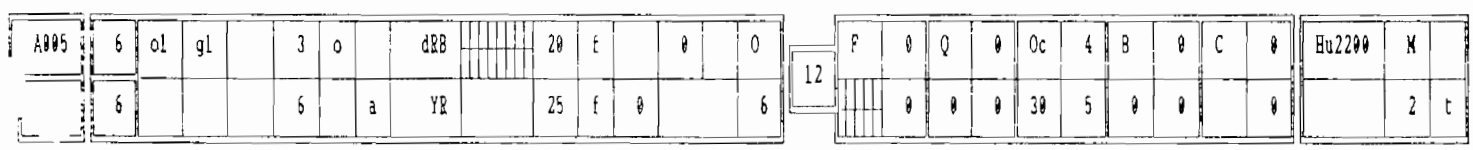

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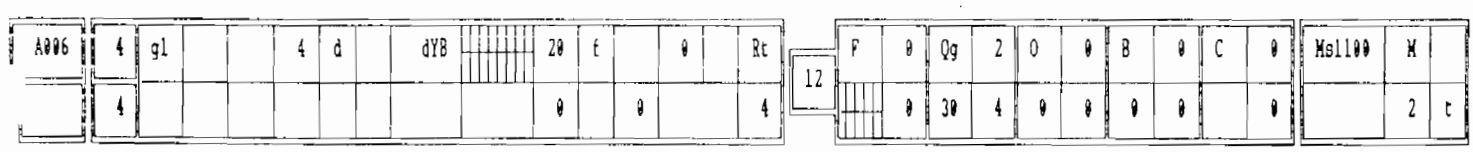

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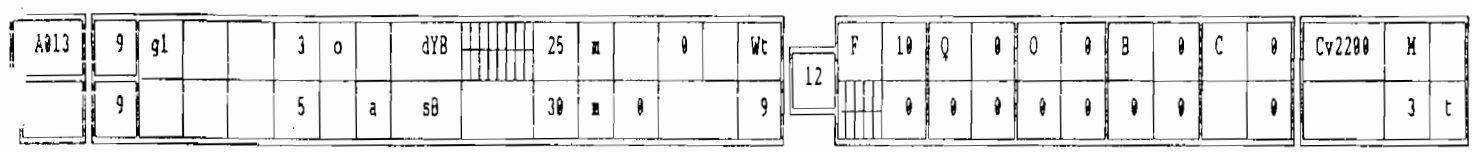

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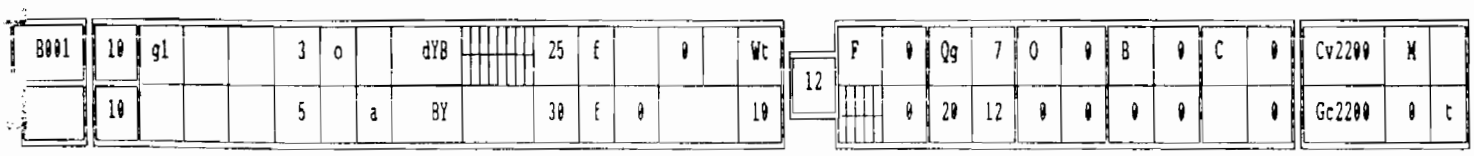
Dated : 12/04/94 Comments : at survey peg



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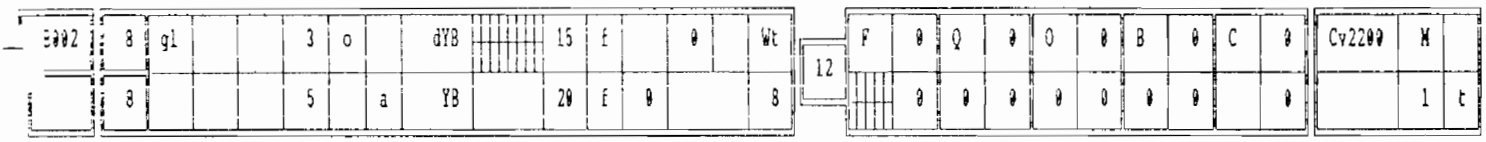
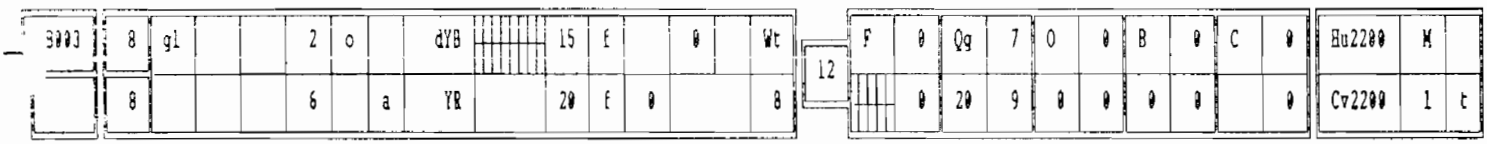
	10				5		a	BY		30	f	0			10		0	20	12	0	0	0	0		0	Gc2200	0	t

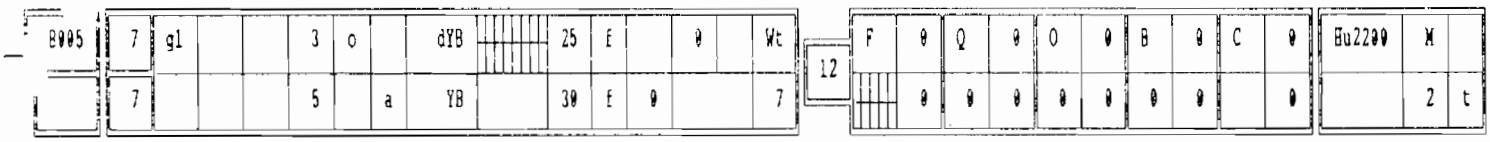
Dated : 12/04/94 Comments : yellow B



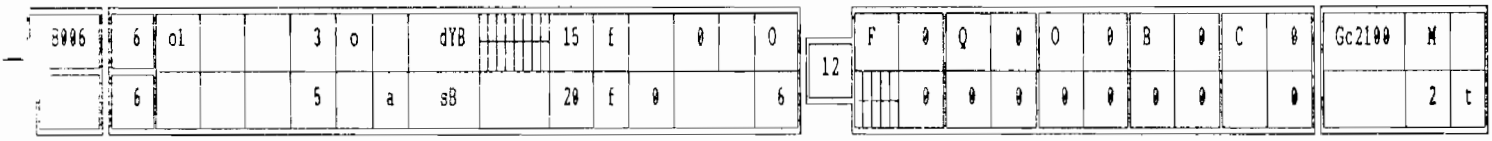
ed : 12/04/94 Comments :



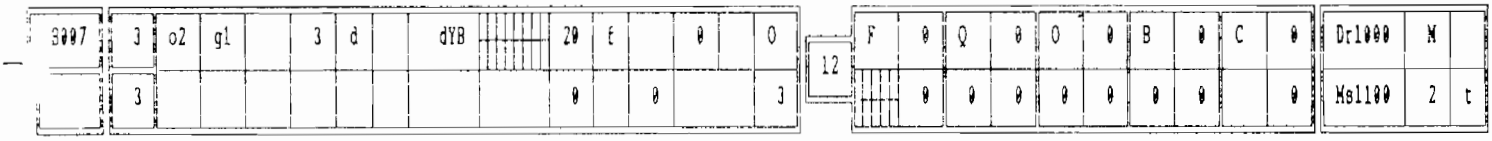
ed : 12/04/94 Comments :



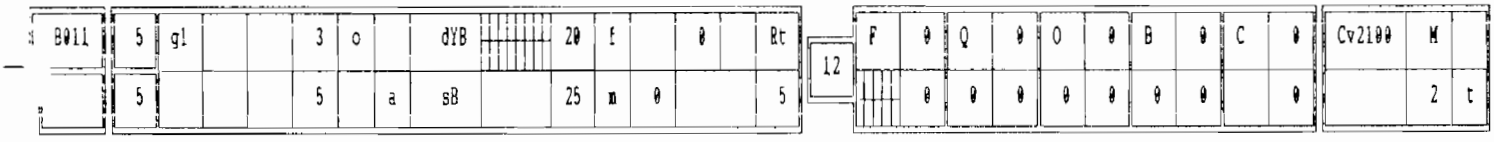
ed : 12/04/94 Comments :



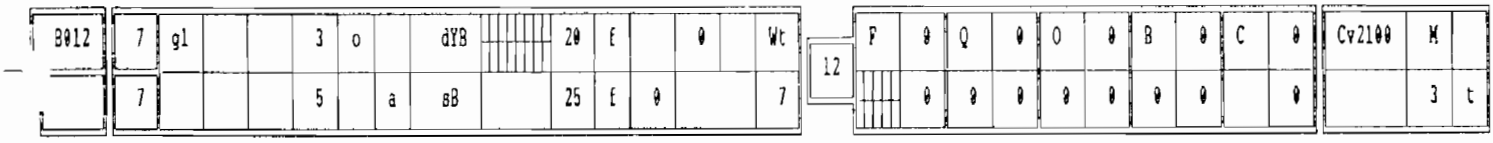
ed : 12/04/94 Comments : ouklip,sB/YR?



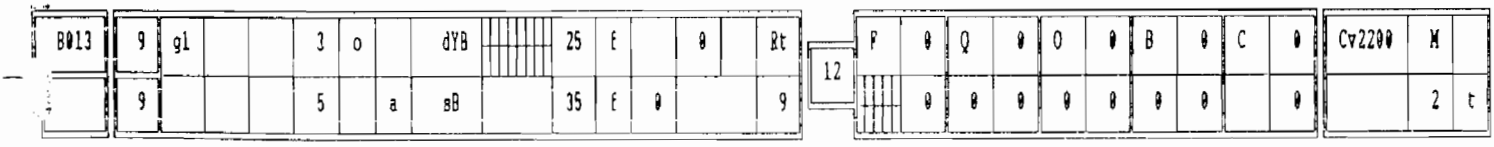
ed : 12/04/94 Comments : ouklip:30,pale A?



ted : 12/04/94 Comments : above dump



ted : 12/04/94 Comments :



Dated : 12/04/94 Comments :

C001	4	g2			3	o		dYB		25	f		0	0	12	F	0	Q	0	O	0	B	0	C	0	Gc2200	M	
	4				6		a	BY		30	f	0		4			0	0	0	0	0	0	0		0		1	t

ed : 14/03/94 Comments :

C002	7	gl			3	o		dYB		15	f		0	0	12	F	0	Q	0	O	0	B	0	C	0	Gc2200	M	
	7				5		a	YB		20	f	0		7			0	0	0	0	0	0	0		0		1	t

ed : 12/04/94 Comments :

C003	5	g3	ol		2	o		dRB		15	f		0	0	12	F	0	Q	0	O	0	B	0	C	0	Gc2200	M	
	5				6		a	sB		20	f	0		5			0	0	0	0	0	0	0		0		1	t

ed : 12/04/94 Comments : sB or YR?

C005	6	gl			3	o		dYB		25	f		0	Wt	12	F	0	Q	0	O	0	B	0	C	0	Hu2200	M	
	6				5		a	YR		30	f	0		6			0	0	0	0	0	0	0		0		2	t

ed : 12/04/94 Comments :

C006	12				4	o		dYB		15	f		0	Wt	12	F	0	Qg	9	O	0	B	0	C	0	Hu2200	M	
	12				5		a	YR		20	f	0		12			0	20	12	0	0	0	0		0		2	t

ed : 12/04/94 Comments :

C007	11	gl			3	o		dYB		15	f		0	Wt	12	F	0	Q	0	O	0	B	0	C	0	Hu2200	M	
	11				5		a	YR		20	f	0		10			0	0	0	0	0	0	0		0	Cv2200	2	t

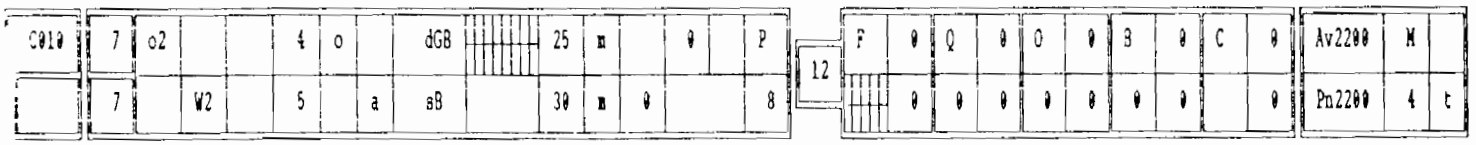
ed : 12/04/94 Comments : sB/YR?

C008	4	gl			3	o		dB		25	f		0	Wt	12	F	0	Q	0	O	0	B	0	C	0	Ms1100	M	
	4									0		0		3			0	0	0	0	0	0	0		0		2	t

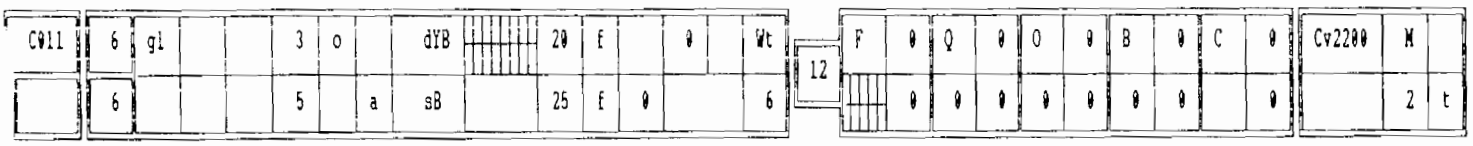
ed : 12/04/94 Comments : coal?

C009	14				4	o		dB		20	m		0	Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	14				5		a	dYB		25	f	0		14			0	0	0	0	0	0	0		0		3	t

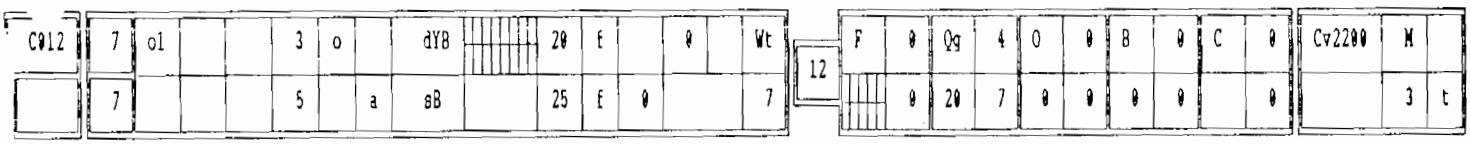
ted : 12/04/94 Comments : cutans?,dark



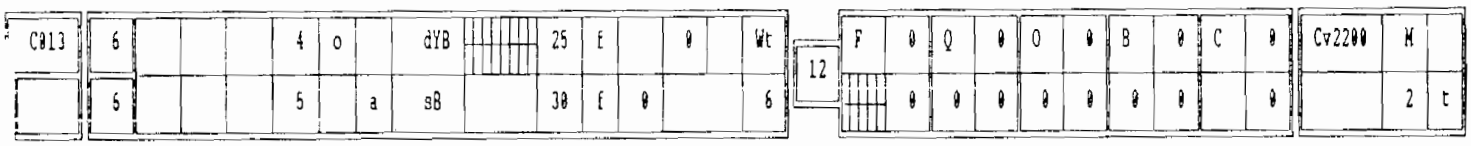
...ted : 12/04/94 Comments : near river,signs of wetness



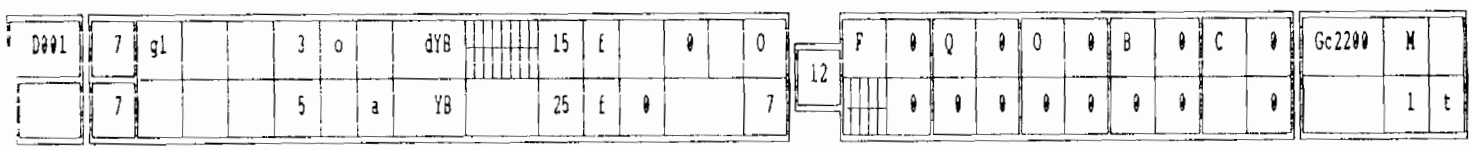
...ted : 12/04/94 Comments :



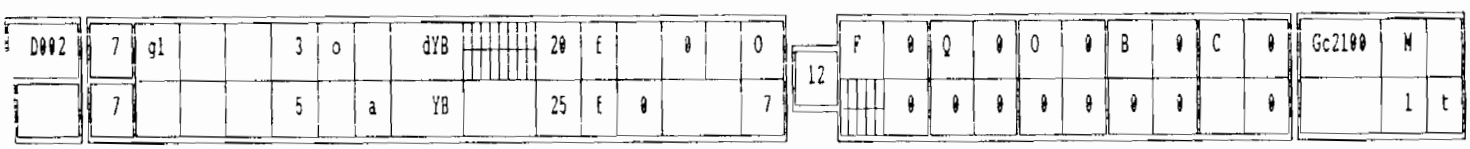
...ted : 12/04/94 Comments :



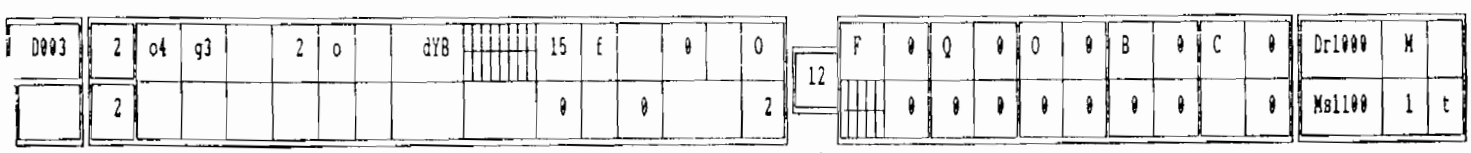
...ted : 12/04/94 Comments :



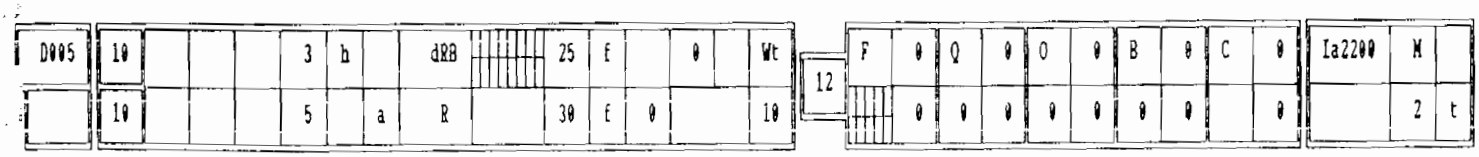
...ted : 12/04/94 Comments :



...ated : 12/04/94 Comments :



...ated : 12/04/94 Comments : shallow topsoil



...ated : 12/04/94 Comments :

D006	2	o3			2	d		dYB		15	f		0		Rt	12	F	0	Q	0	O	0	B	0	C	0	Ms1100	M	
	2									9		0			2			0	0	0	0	0	0	0		0		2	t

:ed : 12/04/94 Comments : rocky

D007	4	gl			3	o		dYB		15	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	4				5		a	YB		20	f	0			4			0	0	0	0	0	0	0		0		4	t

:ed : 12/04/94 Comments : above wetland and spring

D008	2				3	d		m L		15	m		0		G	12	F	0	Q	0	O	0	B	0	C	0	Ka1000	V	
	2		W3		4		1	m G		25	m	0			3			0	0	0	0	0	0	0		0	We2000	2	t

:ed : 12/04/94 Comments : wetland

D009	2	ol			3	d		m L		15	f		0		P	12	F	0	Q	0	O	0	B	0	C	0	We2000	V	
	2		W3		4		1	m G		30	f	0			4			0	0	0	0	0	0	0		0		1	t

:ed : 12/04/94 Comments : wetland

D010	12	gl			4	o		dYB		25	m		0		Wt	12	F	0	Qg	4	O	0	B	0	C	0	Cv2200	M	
	12				5		a	YB		30	m	0			11			0	20	7	0	0	0	0		0		4	t

:ed · 12/04/94 Comments : below rock

D011	8	gl			3	o		dYB		20	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	8				5		a	sB		25	f	0			8			0	0	0	0	0	0	0		0		2	t

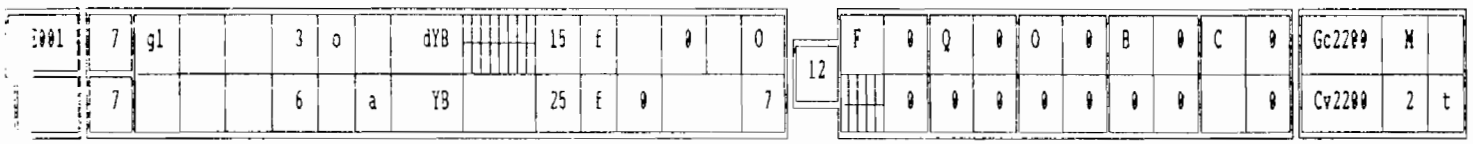
ted : 12/04/94 Comments : good soil,sandy clay

D012	10				3	o		dYB		20	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	10				5		a	sB		25	f	0			9			0	0	0	0	0	0	0		0		3	t

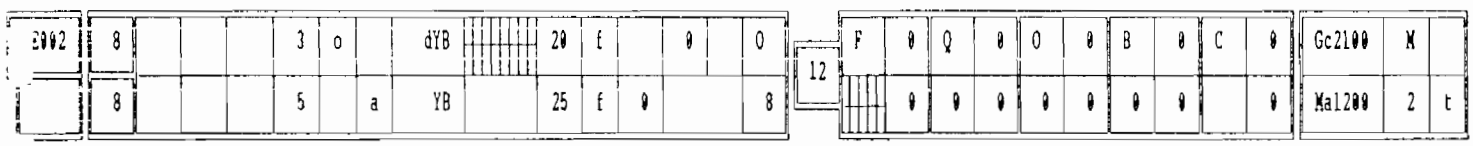
^-ted : 12/04/94 Comments :

D013	10				4	d		dYB		25	f		0		Rt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	10				5		a	sB		20	f	0			10			0	0	0	0	0	0	0		0		2	t

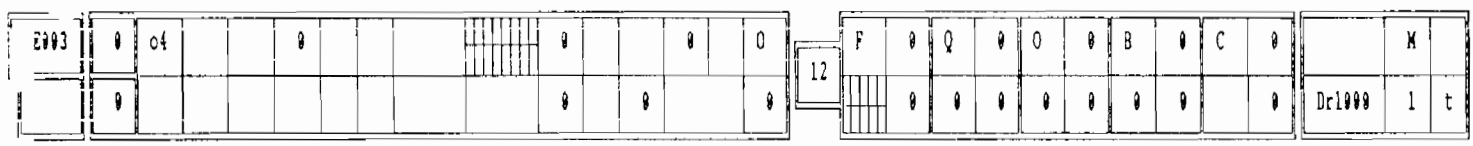
Dated : 12/04/94 Comments :



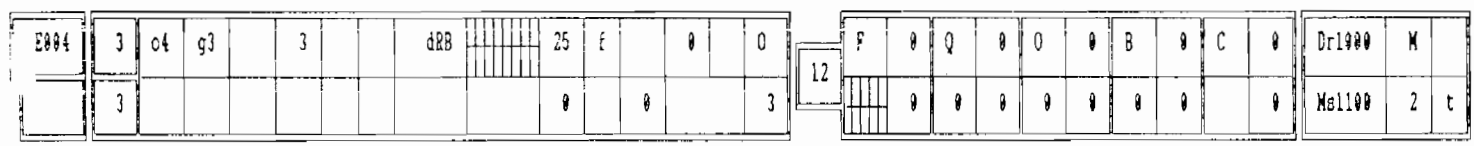
ed : 12/04/94 Comments : ouklip,Yellow B



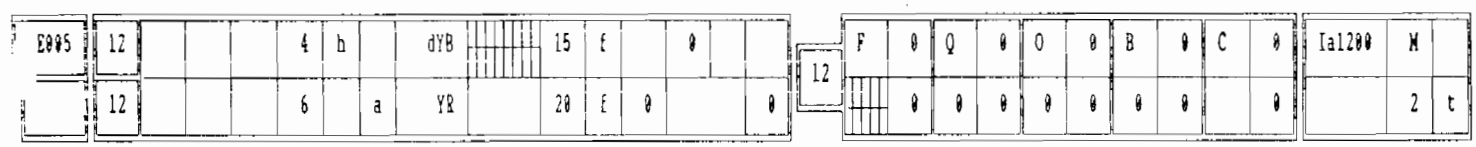
ed : 12/04/94 Comments :



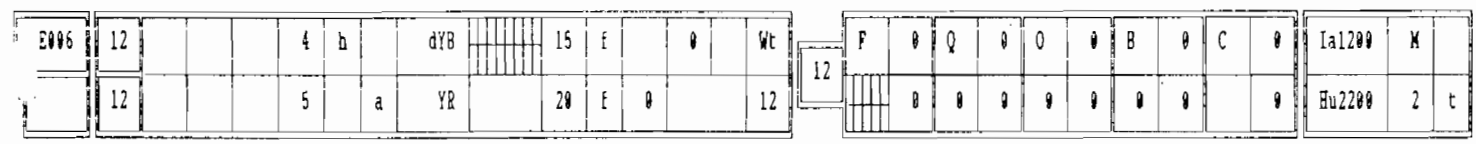
ed : 12/04/94 Comments : rock outcrop



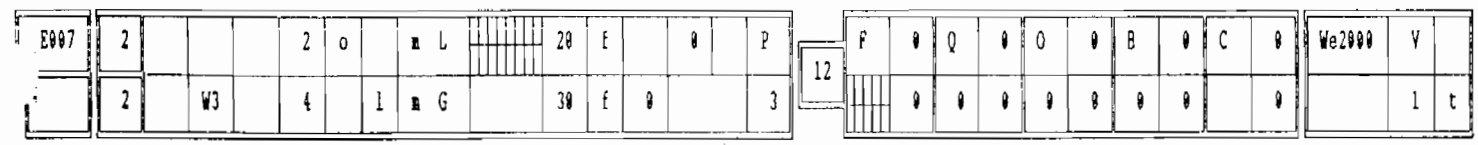
ed : 12/04/94 Comments : near opposed rock area,truncated Dr



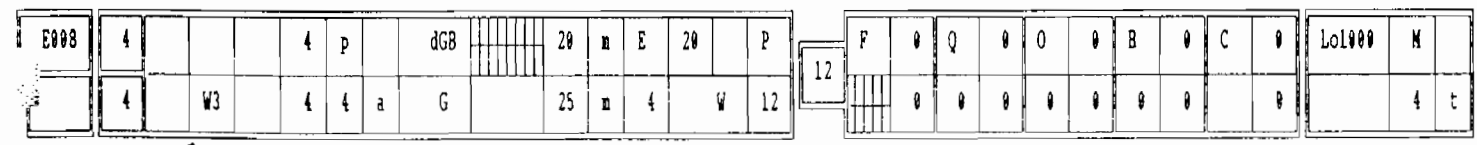
ed : 12/04/94 Comments :



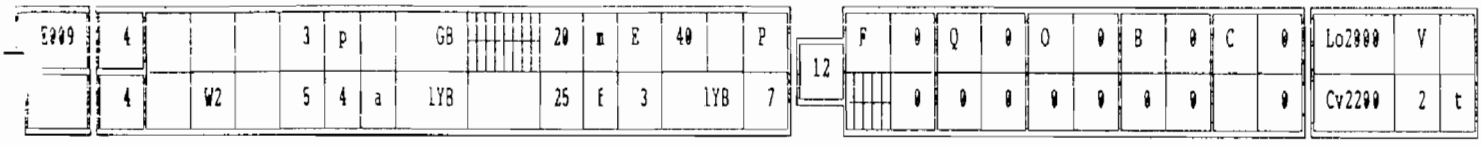
ed : 12/04/94 Comments : deep soil



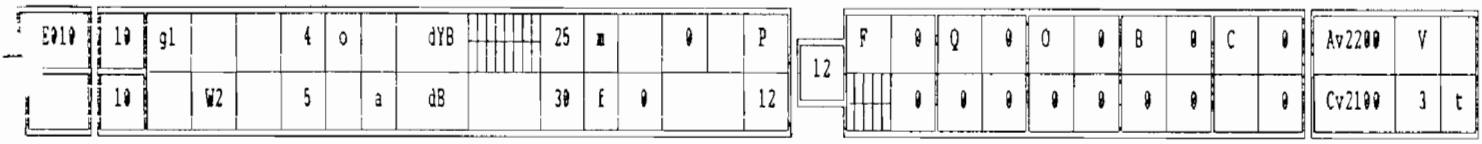
ed : 12/04/94 Comments : drainage,wetland



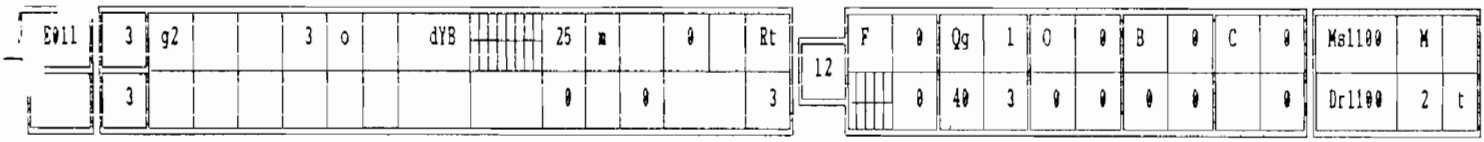
ed : 12/04/94 Comments : wetland nearby



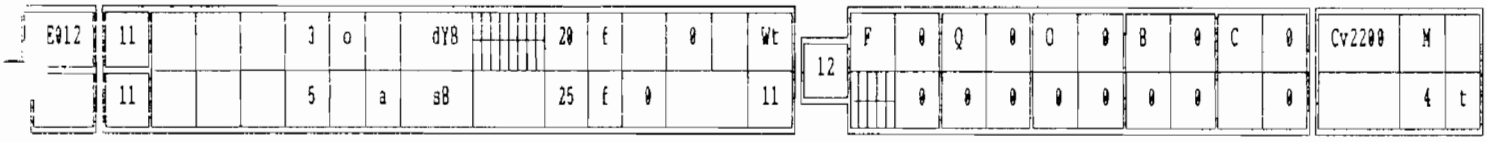
...ed : 12/04/94 Comments : yellow when moist,soft plinthic/lithocutanic



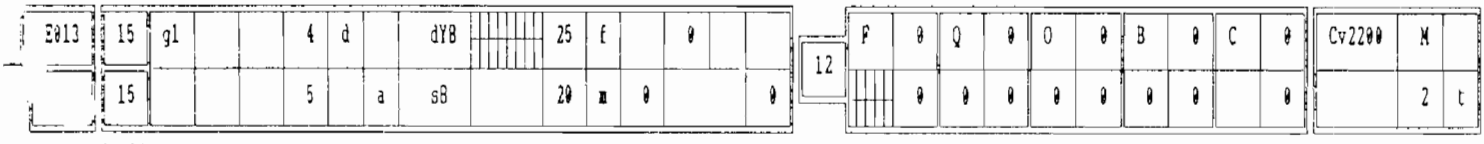
...ed : 12/04/94 Comments : below rock



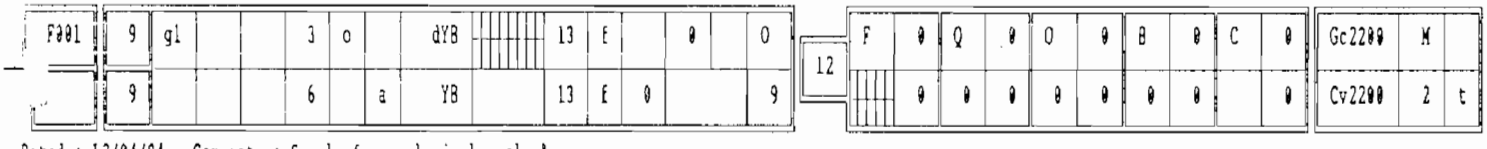
...ed : 12/04/94 Comments : between rock truncated?



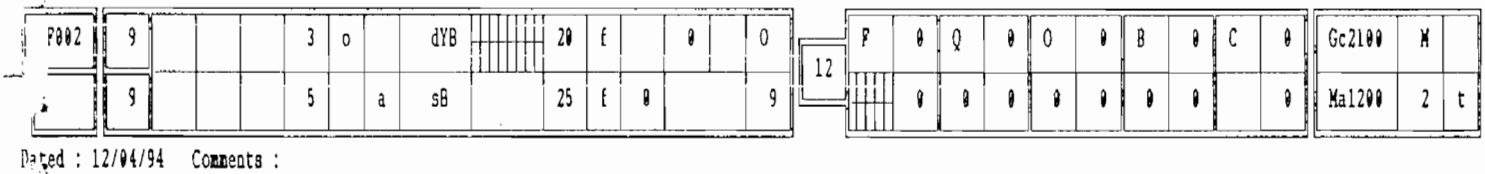
...ed : 12/04/94 Comments :



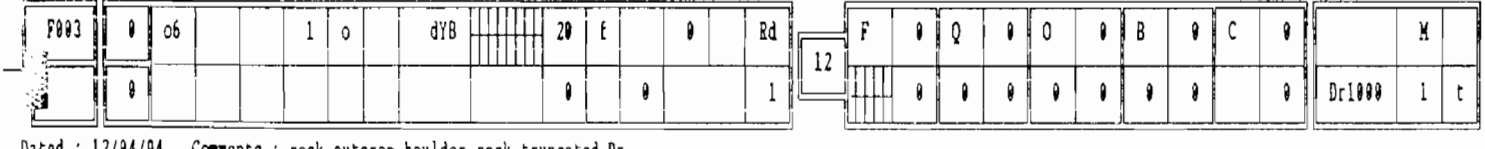
...ed : 12/04/94 Comments :



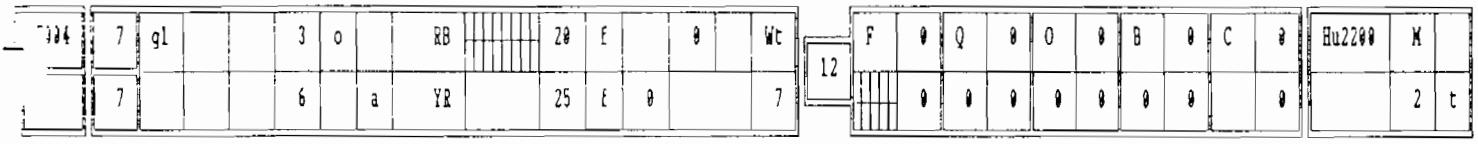
...ed : 12/04/94 Comments : Sample for analysis,low clay%



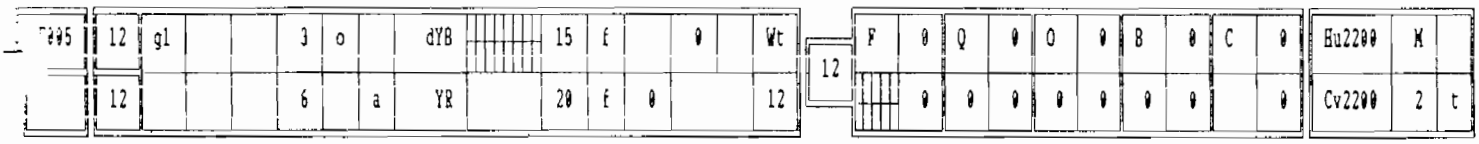
Dated : 12/04/94 Comments :



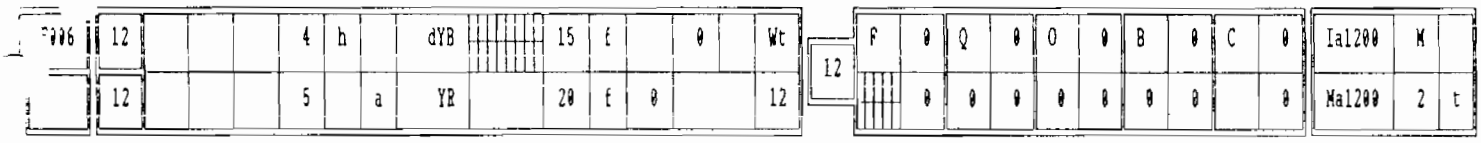
Dated : 12/04/94 Comments : rock outcrop,boulder rock,truncated Dr



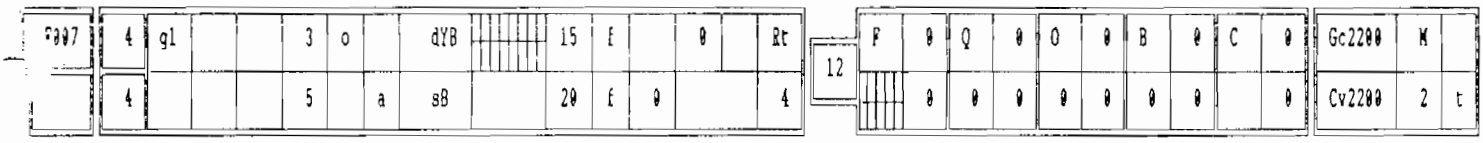
...d : 12/04/94 Comments :



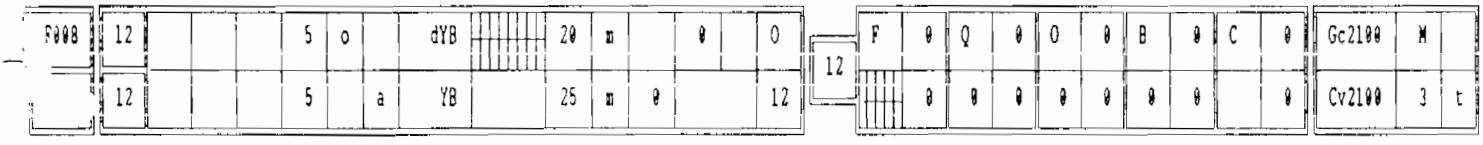
...d : 12/04/94 Comments : YR or sB?



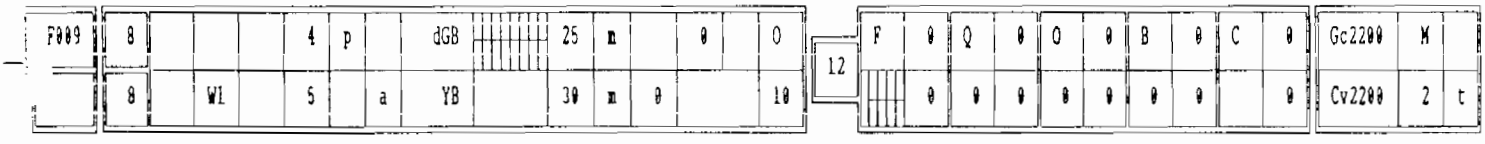
...d : 12/04/94 Comments : deep



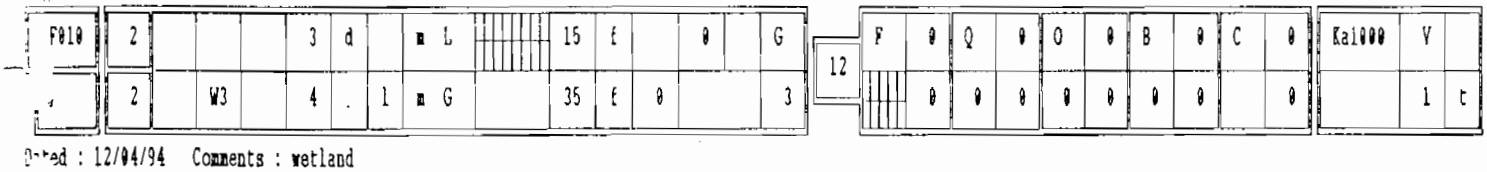
...d : 12/04/94 Comments : shallow



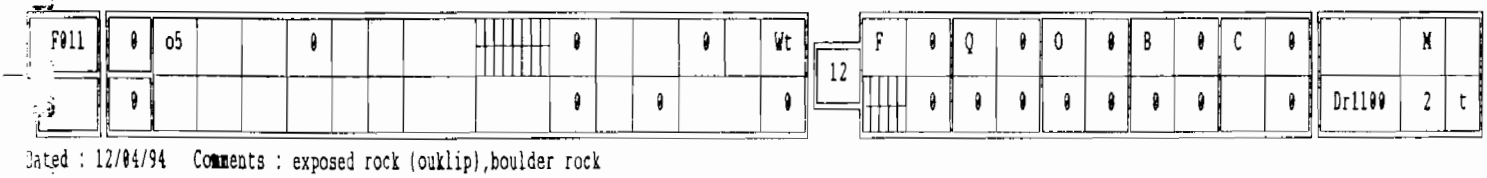
...d : 12/04/94 Comments :



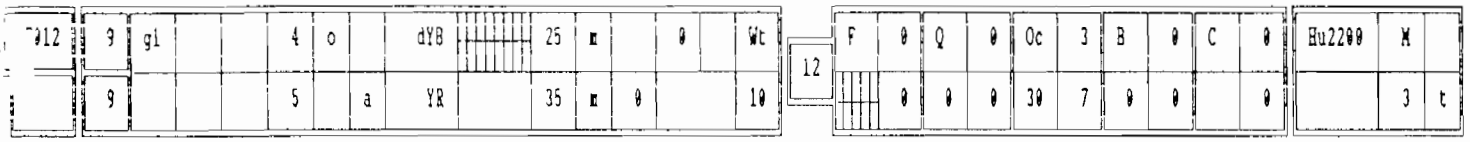
...ed : 12/04/94 Comments :



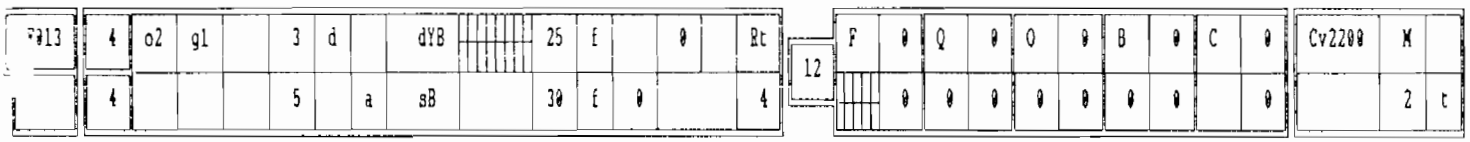
...ted : 12/04/94 Comments : wetland



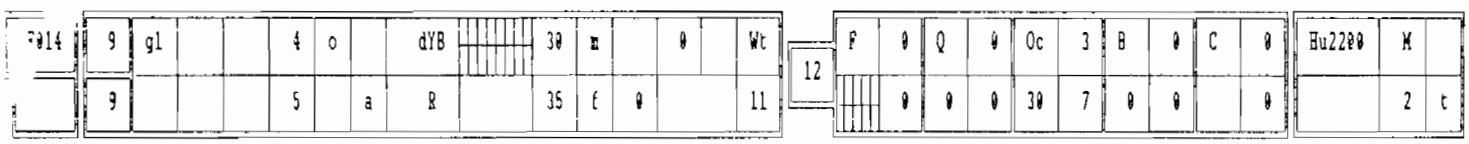
Dated : 12/04/94 Comments : exposed rock (ouklip),boulder rock



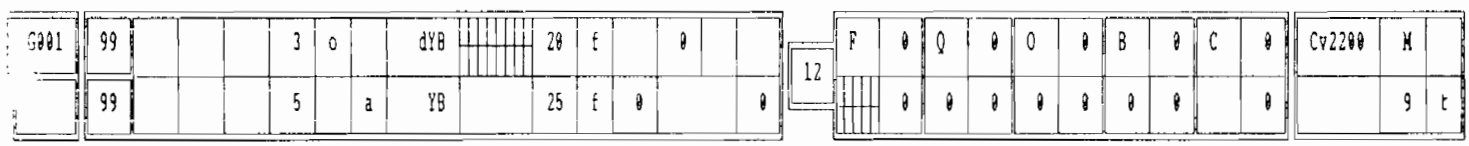
...d : 12/04/94 Comments :



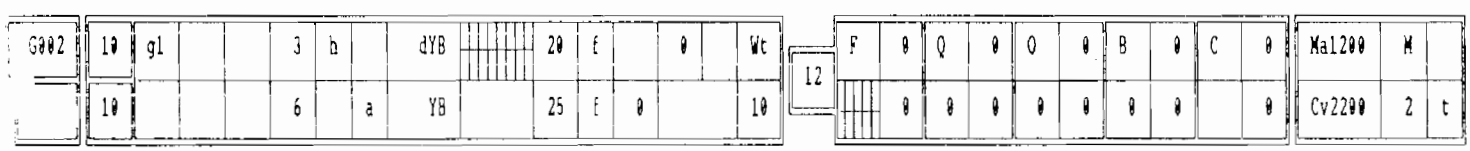
...d : 12/04/94 Comments : hard plinthite outcrop nearby



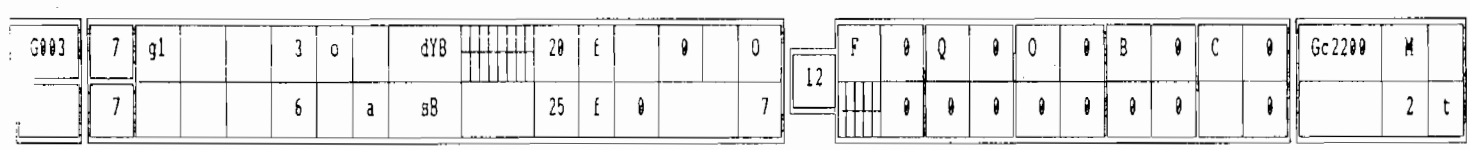
...d : 12/04/94 Comments : concretions



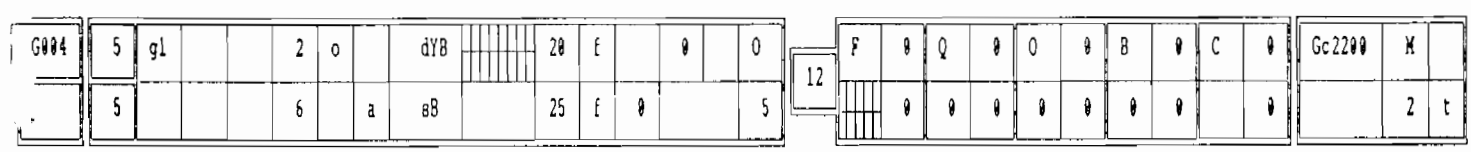
...d : 12/04/94 Comments : deep



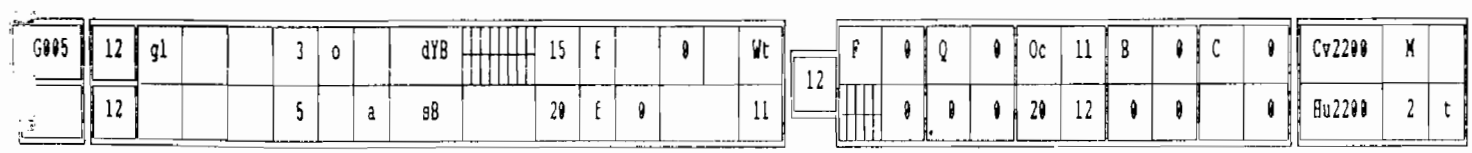
...d : 12/04/94 Comments :



...ted : 12/04/94 Comments : ouklip,sandy



...ated : 12/04/94 Comments : ouklip:50,sB in B



...ated : 12/04/94 Comments : sB or YR?,concretions at 11

G006	12				4	h		dYB		15	f		0			12	F	0	Q	0	O	0	B	0	C	0	Ia1200	M	
	12				5		a	YR		20	f	0			0			0	0	0	0	0	0	0		0	Hu2200	2	t

Dated : 12/04/94 Comments : deep

G007	5	gl			3	o		dYB		15	f		0		Rt	12	F	0	Qg	3	O	0	B	0	C	0	Cv2200	M	
	5				5		a	YB		20	f	0			6			0	30	6	0	0	0	0		0		3	t

Dated : 12/04/94 Comments : quartz gravel

G008	14				4	o		dYB		25	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	14				5		a	dB		30	f	0			14			0	0	0	0	0	0	0		0	Ma1200	3	t

Dated : 12/04/94 Comments : deep soil,dark colours

G009	10				4	o		dGB		25	m		0		P	12	F	0	Q	0	O	0	B	0	C	0	Tu2120	M	
	10		W1		5		a	dB		30	m	0			12			0	0	0	0	0	0	0		0		4	t

Dated : 12/04/94 Comments : 100m above the river,signs of wetness,grey colours

G010	2				2	d		m L		15	f		0		P	12	F	0	Q	0	O	0	B	0	C	0	We2000	V	
	2		W3		4		1	m G		30	f	0			4			0	0	0	0	0	0	0		0		1	t

Dated : 12/04/94 Comments : wetland

G011	1	o5			1	o		dB		15	f		0		Rt	12	F	0	Q	0	O	0	B	0	C	0		M	
	1									0		0			1			0	0	0	0	0	0	0		0	Dr1100	2	t

Dated : 12/04/94 Comments : exposed rock (ouklip),boulder rock

G012	10	gl	ol		3	o		dYB		25	f		0		O	12	F	0	Q	0	O	0	B	0	C	0	Hu2200	M	
	10				5		a	YR		30	f	0			10			0	0	0	0	0	0	0		0		4	t

Dated : 12/04/94 Comments : high clay %

G013	6	gl			4	o		dYB		25	f		0		Rt	12	F	0	Q	0	Oc	4	B	0	C	0	Hu2200	M	
	6				5		a	YR		35	f	0			6			0	0	0	40	5	0	0		0		2	t

Dated : 12/04/94 Comments : low organic matter

Red Earth Forestry Soil Consultants Printed : 18/05/94 at 11:37:18

05 - Landau Colliery,E/W Pit:AMCOAL

014	13	gl			4	o		dYB		30	m		0		Wt	12	F	0	Q	0	Oc	7	B	0	C	0	Hu2200	M	
	13				5		a	YR		35	f	0			14			0	0	0	20	9	0	0		0		2	t

ed : 12/04/94 Comments : near graves

3001	5	gl			2	o		dYB		15	f		0		0	12	F	0	Q	0	O	0	B	0	C	0	Gc2200	M	
	5				6		a	YB		20	f	0			5			0	0	0	0	0	0	0		0	Ma1200	2	t

ed : 12/04/94 Comments : ouklip

7002	12	gl			3	h		dYB		20	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Ma1200	M	
	12				5		a	sB		25	f	0			11			0	0	0	0	0	0	0		0	Cv2200	2	t

ed : 12/04/94 Comments :

9003	7	gl			2	o		dYB		20	f		0		0	12	F	0	Q	0	O	0	B	0	C	0	Gc2200	M	
	7				6		a	sB		25	f	0			7			0	0	0	0	0	0	0		0		2	t

ed : 12/04/94 Comments : ouklip,low clay %

H004	5	g2			2	o		dYB		20	f		0		0	12	F	0	Q	0	O	0	B	0	C	0	Gc2200	M	
	5				6		a	sB		25	f	0			5			0	0	0	0	0	0	0		0		2	t

ed : 12/04/94 Comments :

H005	12	gl			4	o		RB		25	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Hu2200	M	
	12				5		a	R		30	f	0			11			0	0	0	0	0	0	0		0		2	t

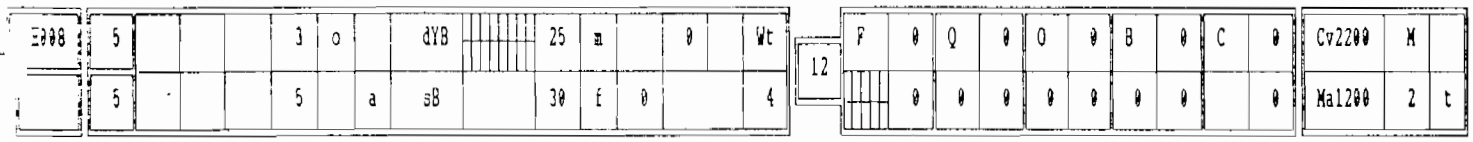
ed : 12/04/94 Comments :

H006	12				4	o		dYB		15	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Hu2200	M	
	12				5		a	YR		20	f	0			11			0	0	0	0	0	0	0		0		2	t

ted : 12/04/94 Comments : deep/sandy

H007	11				4	o		dYB		15	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	11				5		a	YB		20	f	0			11			0	0	0	0	0	0	0		0		2	t

ted : 12/04/94 Comments : deep



E008	5				3	o		dYB		25	m		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
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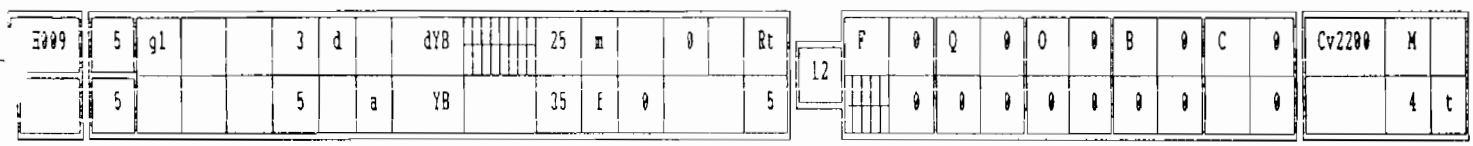
ted : 12/04/94 Comments :



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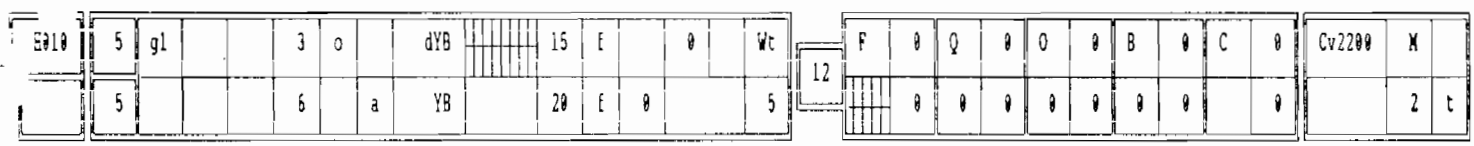
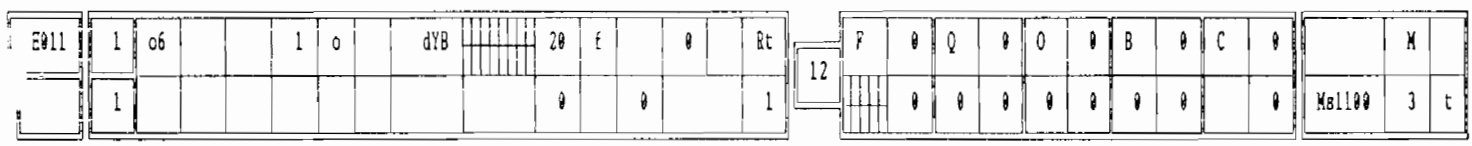
ted : 12/04/94 Comments : rock



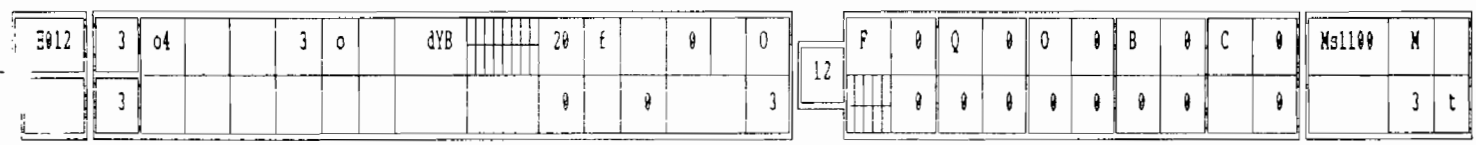
E010	5	gl			3	o		dYB		15	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	5				6		a	YB		20	f	0			5		0	0	0	0	0	0	0		0		2	t

ted : 12/04/94 Comments :



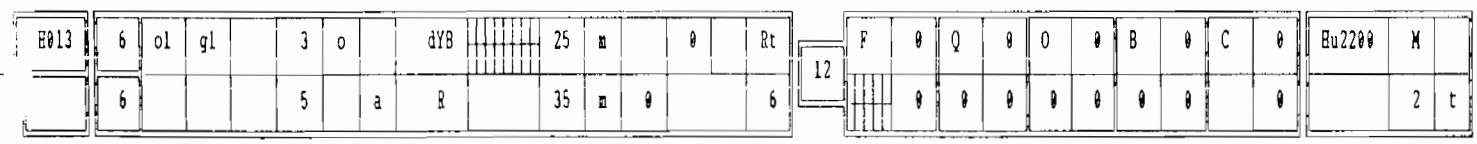
E011	1	o6			1	o		dYB		20	f		0		Rt	12	F	0	Q	0	O	0	B	0	C	0		M	
	1									0		0			1		0	0	0	0	0	0	0		0	Ms1100	3	t

ted : 12/04/94 Comments : boulder rock



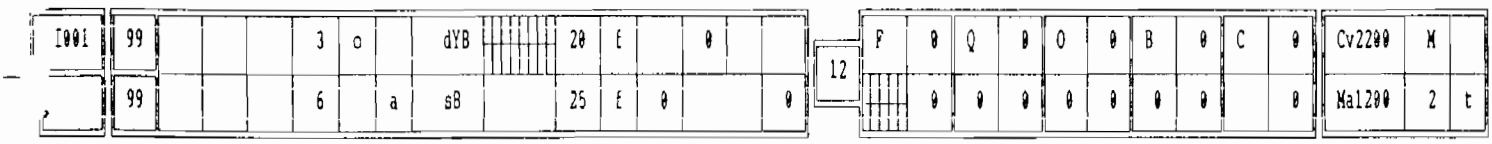
E012	3	o4			3	o		dYB		20	f		0		0	12	F	0	Q	0	O	0	B	0	C	0	Ms1100	M	
	3									0		0			3		0	0	0	0	0	0	0		0		3	t

ted : 12/04/94 Comments : ouklip



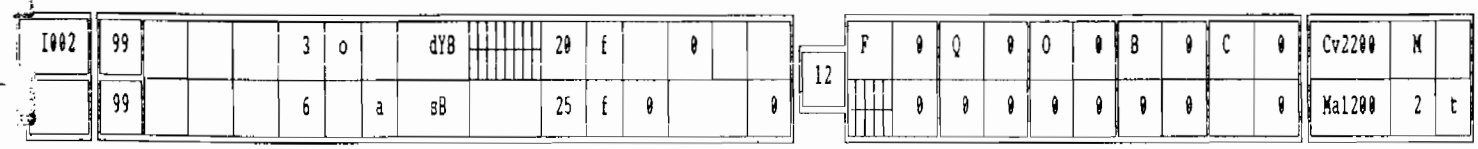
E013	6	o1	gl		3	o		dYB		25	m		0		Rt	12	F	0	Q	0	O	0	B	0	C	0	Hu2200	M	
	6				5		a	R		35	m	0			6		0	0	0	0	0	0	0		0		2	t

ated : 12/04/94 Comments : rock outcrops



I001	99				3	o		dYB		20	f		0			12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	99				6		a	sB		25	f	0			0		0	0	0	0	0	0	0		0	Ma1200	2	t

Dated : 12/04/94 Comments :



I002	99				3	o		dYB		20	f		0			12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	99				6		a	sB		25	f	0			0		0	0	0	0	0	0	0		0	Ma1200	2	t

Dated : 12/04/94 Comments : sB or YB?

I003	6	gl			2	o		dYB		20	f		0		O	12	F	0	Q	0	O	0	B	0	C	0	Gc2200	M	
	6				6		a	sB		25	f	0			6			0	0	0	0	0	0	0		0		2	t

...ted : 12/04/94 Comments : ouklip

I004	12	gl			3	o		dYB		20	f		0		Wt	12	F	0	Q	0	Oc	10	B	0	C	0	Cv2200	M	
	12				6		a	sB		25	f	0			12			0	0	0	20	12	0	0		0	Gc2200	2	t

...ed : 12/04/94 Comments :

I005	10				4	o		RB		25	f		0		Z	12	F	0	Q	0	Oc	8	B	0	C	0	Hu2200	M	
	10				5		a	R		30	f	0			9			0	0	0	30	11	0	0		0		2	t

...ted : 12/04/94 Comments : concretions 10/higher clay %

I007	12				4	d		YB		15	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	12				6		a	BY		20	f	0			12			0	0	0	0	0	0	0		0		2	t

...ted : 12/04/94 Comments : sandy

I008	5	gl			3	o		dGB		20	m		0		Rt	12	F	0	Q	0	O	0	B	0	C	0	Cv2100	M	
	5				5		a	lB		25	m	0			5			0	0	0	0	0	0	0		0	Ma1200	2	t

...ted : 12/04/94 Comments : pale colours in B

I009	7	gl			3	o		dYB		4	m		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	7					5	a	YB		17	f	0			6			0	0	0	0	0	0	0		0		4	t

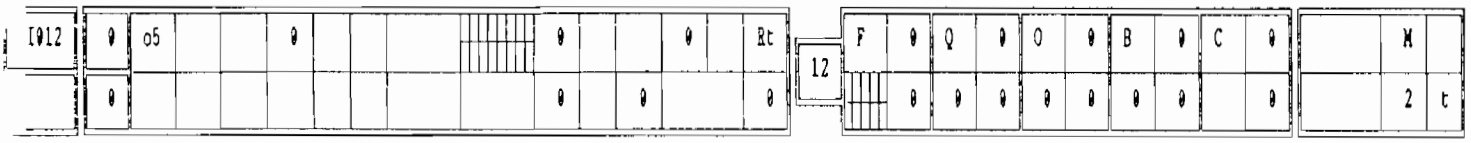
Dated : 12/04/94 Comments : SAMPLE TAKEN,high sand %

I010	5	gl			4	o		dYB		30	f		0		Wt	12	F	0	Q	0	O	0	B	0	C	0	Cv2200	M	
	5				5		a	YB		35	f	0			4			0	0	0	0	0	0	0		0		4	t

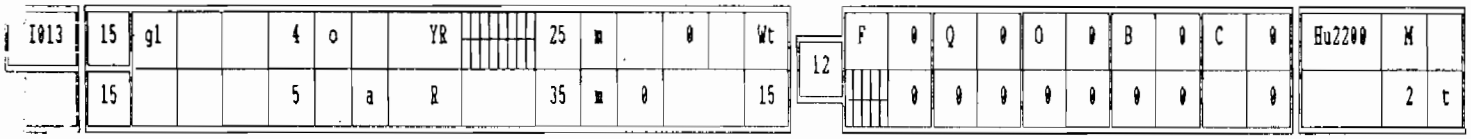
Dated : 12/04/94 Comments : near manhole

I011	5				4	o		dYB		30	f		0		P	12	F	0	Q	0	O	0	B	0	C	0	Av2200	V	
	5		W2		5		a	sB		35	f	0			6			0	0	0	0	0	0	0		0		2	t

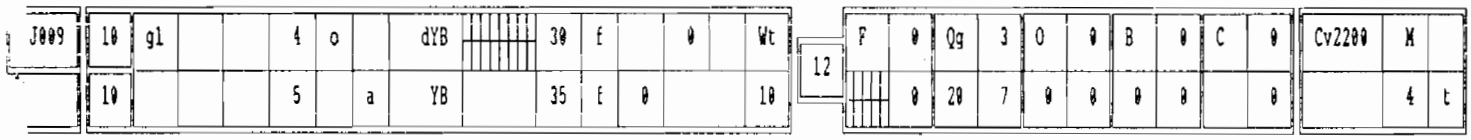
Dated : 12/04/94 Comments : soft plinthic



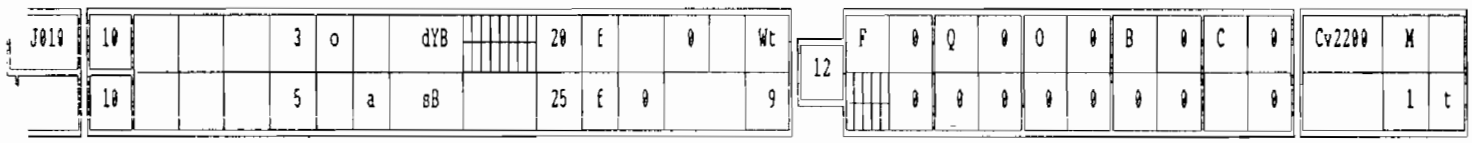
Dated : 12/04/94 Comments : boulder rock



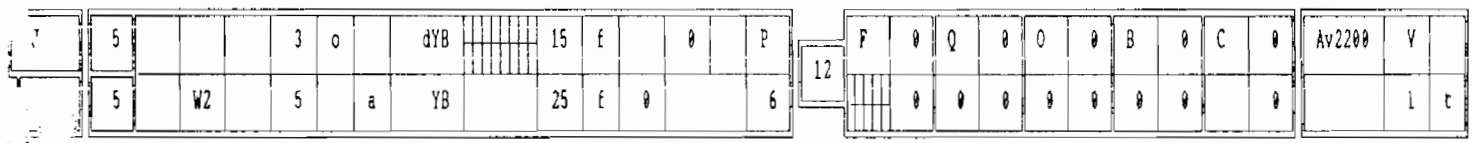
Dated 12/04/94 Comments : 10 m north of point,5YR 4/6,25YR 4/8



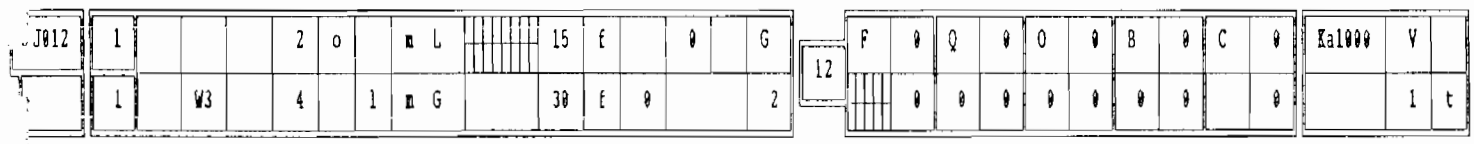
Dated : 12/04/94 Comments : near railway line,YB/sB?



Dated : 12/04/94 Comments :



Dated : 12/04/94 Comments : signs of wetness



Dated : 12/04/94 Comments : wetland

SUPPLEMENTARY REPORT

NO 2

PRE-MINING SURVEY OF VEGETATION AND WILD LIFE WITHIN THE DESIGNATED NAVIGATION MINI PIT AREA IN THE SCHOONGEZIGHT VALLEY (EASTERN TRANSVAAL; WITBANK DISTRICT; LANDAU COLLIERY), AND COMMENTS ON THE LIKELIHOOD OF THE OCCURRENCE OF RARE OR ENDANGERED SPECIES.

SUMMARY:

A pre-mining vegetation survey was conducted within the proposed mini pit area in the Schoongezight valley. Approximately 50 % of this area is currently planted to maize. The remaining natural vegetation is the Eastern variation of Bankenveld, but is degraded and dominated by the grasses *Hyparrhenia hirta* and *Aristida diffusa*. In the time available it was not possible to conduct a comprehensive faunal survey, however, red data species which may occur in the district were listed and a comment made on their possible presence based on habitat availability, the degraded nature of the natural vegetation and the close proximity of informal dwellings.

INTRODUCTION:

A pre-mining survey of the Navigation mini pit area was requested by Landau Colliery to fulfil DMEA requirements for a survey of the fauna and flora of the area, prior to the commencement of mining under a temporary mining authorization. The objectives of the survey were twofold, namely to assess the condition and composition of the vegetation within the designated mini pit area and secondly to determine whether any rare or endangered species (red data species) were present prior to the commencement of mining. A detailed vegetation survey was undertaken to identify species present, identify different plant communities present and assess species abundance and ground cover within the major plant communities recognised. Wild animals are very secretive and many are nocturnal, consequently, a thorough faunal survey requires a considerable period of time to trap animals for identification. As only two days were available in which to conduct this survey before mining commenced, a comprehensive faunal survey was not possible. In this report species of birds, mammals, reptiles and amphibians which were observed during the survey period are listed. In addition, all red data species which may occur in this region, as determined from published distribution maps, have been tabulated and a comment is made on their possible presence in the mini pit area, based on habitat availability.

The area to be mined is located in the Schoongezight valley North of the Navigation Plant. Fourteen percent of the designated area falls within the 1:50 year flood line and will not be mined. The bulk of the remaining 86 % of the land to be mined (68 %) lies to the West of the Schoongezight stream, with only a small portion (18 %) to the East of the stream. Forty nine percent of the land within the mini pit area West of the stream is currently under maize.

METHODS:

Vegetation abundance and ground cover were assessed using a descending point method. When determining abundance the nearest plant to the dropped point was scored. When basal cover was determined each dropped point was scored as a strike (on a plant) or a miss (on bare ground). Three hundred descending points were used. In addition to the species sampled using the above methods, a total collection of all species detected in each plant community was made and a comprehensive species list for the surveyed area compiled.

VEGETATION:

Natural veld within this region is described by Acocks (1988) as the Eastern Variation of Bankenveld. This veld type, if well managed and in good condition, is dominated by grass species such as *Tristachia leucothrix, Eragrostis racemosa, Heteropogon contortus, Digitaria tricholoenoides* and *Themeda triandra*. Under poor management (eg. incorrect use of fire, overgrazing, physical

disturbance) annual species and species of low palatability increase in abundance. Such species would include the grasses *Hyparrhenia hirta, Aristida spp., Cynodon dactylon* and the shrub *Stoebe vulgaris* which proliferates in overgrazed areas.

Plant communities:

Within the mini pit area five plant communities (excluding the arable land under maize) were recognised (Fig. 1):

A: a tall grassland community dominated by *Hyparrhenia hirta*

B: a short grassland community dominated by *Eragrostis curvula, E. racemosa* and *Cynodon dactylon*

C: a short grassland community located on the eastern bank of the stream, dominated by *Aristida diffusa*

D: a mesophytic community established in a drainage line on the western side of the Schoongezight stream

E: a mixed plant community associated with the sandstone outcrops on the eastern side of the valley

Community A: ***Hyparrhenia hirta*** dominated grassland.

This grassland community comprises the bulk of the natural vegetation within the mini pit area. The grassland is dominated by *H. hirta* (63 %), with *Eragrostis curvula* (10 %), *Cynodon dactylon* (7 %) and *E. racemosa* (6 %) in abundance. Species present at a level between 1 - 5 percent are; *Aristida diffusa, Pogonarthria squarrosa, Microchloa caffra* and *Stoebe vulgaris*. Basal cover equals 16.5 %.

Community B: Disturbed ***H. hirta*** grassland.

This small area of grassland shows signs of past physical disturbance. Dominant species are *E. curvula* (42 %), *C. dactylon* (19 %) and *E. racemosa* (18 %). Species present at a level between 1 - 5 % are; *Aristida congesta* var. *congesta, Sporobolus africanus, Melenis repens, Trichoneura grandiglumis, Pogonarthria squarrosa* and *Felicia muricata*.

Community C: ***Aristida diffusa*** dominated grassland.

This grassland community is widespread on the eastern side of the valley and is dominated by *A. diffusa* (61 %), with *E. curvula* (8 %) and *Themeda triandra* (8 %) in abundance. Species present at a level between 1 - 5 percent are; *E. racemosa, C. dactylon, P. squarrosa, Andropogon chinensis, Panicum natalense,Schizachyrium sanguineum* and *Tristachya biseriata*. Basal cover equals 24.7 %.

Community D: Mesophytic community.

A natural spring supports a mesophytic community on the western side of the Schoongezigt valley. This community is dominated by *Paspalum dilatatum*, but shows signs of past disturbance with the weedy and opportunistic species *C. dactylon, E. curvula, Amaranthus hybridus* and *Verbena brasiliensis* in abundance.

Community E: Sandstone community.

A high number of species are associated with the sandstone outcrops on the eastern side of the Schoongezigt valley. This high species diversity is attributed to greater habitat diversity as a result of the broken topography in the sandstone outcrops. This community

shows little sign of disturbance.

Area established to maize.

Approximatly half (49 %) of the land in the area to be mined is currently planted to maize. Species present within this area are *Cynodon dactylon, Verbena braziliensis, Ipomoea purpurea, Bidens formosa, B. pilosa* and *Tagetes minuta.*

The condition of the natural vegetation within the mini pit area is poor, with the grassland dominated by species of low grazing value. The natural vegetation within this area is, however, stable and provides a high basal cover exceeding 15 % . No endangered or rare plant species are present. A full list of species identified, and the plant communities in which they occur, is listed in Table 1.

AMPHIBIANS AND REPTILES:

No reptiles or amphibians were observed during the survey period. Based on published distributions of red data species, no threatened reptile or amphibian species occur in the Witbank region.

BIRDS:

Birds observed during the survey period were:

Common name	SA Bird No.
Yellowbilled duck	104
Common quail	200
Redknobbed coot	228
Feral pigeon	348
Red eyed dove	352
Laughing dove	355
Fiscal shrike	732
Red bishop	824
Redshouldered widow	828

Bird species which may occur in the Witbank district and are listed in the South African Red data book are tabulated below. A comment is made on whether these species can be expected to occur in the survey area.

Common name	SA bird No.	Status[1]	Comment
Bittern	80	R	favours large swamps with tall vegetation: FAVOURED HABITAT ABSENT - OCCURRENCE UNLIKELY
Grass owl	393	I	favours perennial grassland ca. 1m high: OCCURRENCE POSSIBLE
Yellowbreasted pipit	725	V	favours high altitude grassland, but shy of disturbance: AREA SUBJECT TO HUMAN DISTURBANCE - OCCURRENCE UNLIKELY

[1] R = Rare: I = Indeterminate: V = Vulnerable

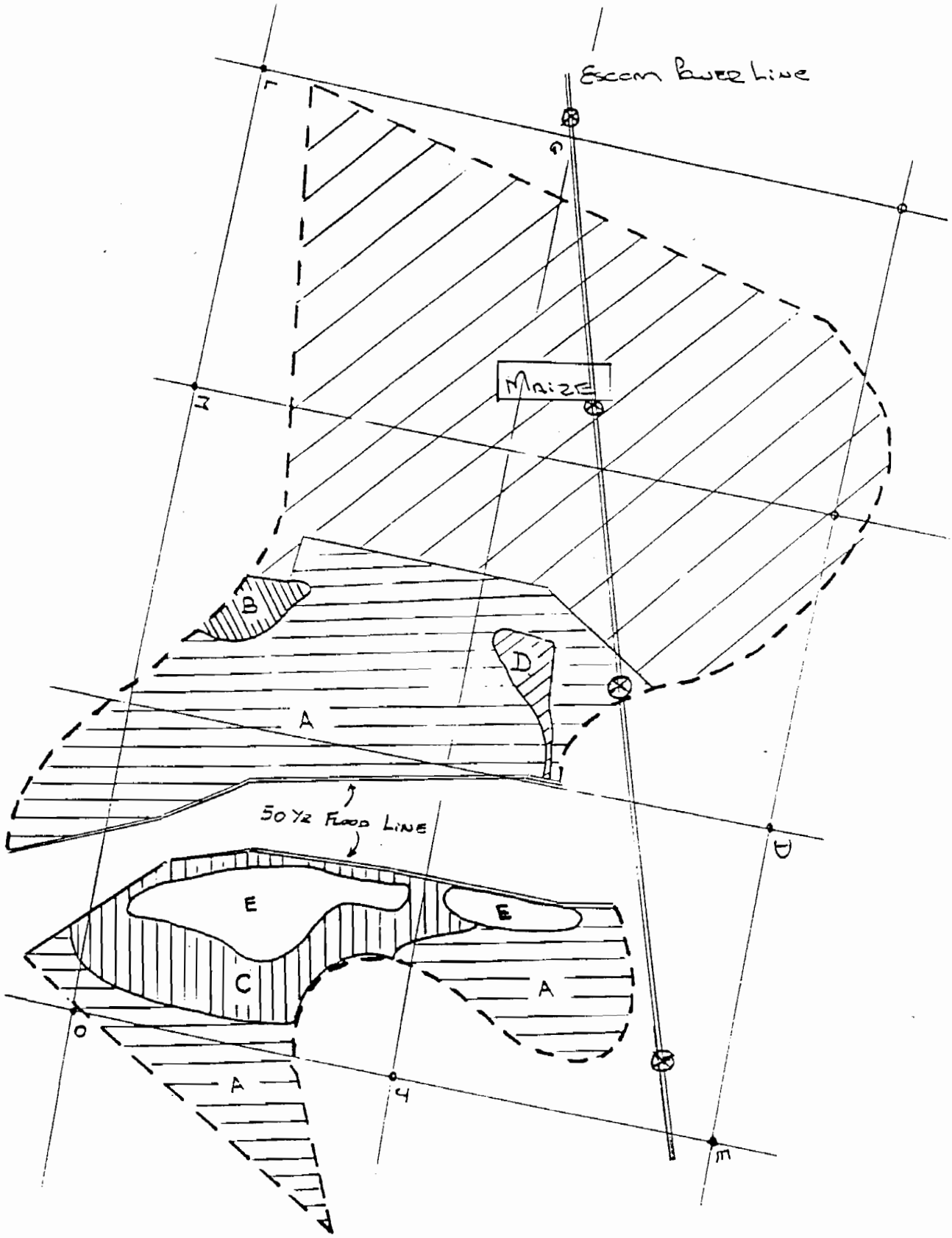


Figure 1: A vegetation map of the proposed Navigation mini pit area, in the Schoongezicht valley, indicating the distribution of the different plant communities recognised.

A: *Hyparrhenia hirta* dominated grassland
B: Disturbed *H. hirta* grassland
C: *Aristida diffusa* dominated grassland
D: A seep in *H. hirta* dominated grassland
E: Plants associated with sandstone outcrops

MAMMALS:

No mammals were observed during the survey period, but droppings of Common duiker and mole hills were evident. Mammals which may occur in the Witbank district and are listed in the South African Red data book are tabulated below. A comment is made on whether these species can be expected to occur in the survey area.

Common name	Status[1]	Comment
Rough-haired golden mole	V	burrows entrance open at surface: NOT EVIDENT IN SURVEY AREA
Oribi	V	GRASSLAND IN SURVEY AREA IS DEGRADED - OCCURRENCE UNLIKELY
African wildcat	V	OCCURRENCE POSSIBLE
Antbear	V	NO EVIDENCE OF ANTBEAR BURROWS IN SURVEY AREA
Striped weasel	R	OBSERVED AS ROADKILL IN WITBANK DISTRICT - OCCURRENCE POSSIBLE
Aardwolf	R	NO EVIDENCE OF BURROWS OF SUFFICIENT SIZE - OCCURRENCE UNLIKELY
Brown hyaena	R	OCCURRENCE UNLIKELY

[1] R = Rare: I = Indeterminate: V = Vulnerable

Table 1: A total list of plant species present in the proposed Navigation mini pit area in the Schoongezight valley. Distribution of species in the different plant communities recognised within the suevey area are marked (*). Plant communities recognised have been mapped (Fig. 1) and described.

[1] SUMMARY OF PLANT COMMUNITIES RECOGNISED

A: *Hyparrhenia hirta* dominated grassland
B: Disturbed *H. hirta* grassland
C: *Aristida diffusa* dominated grassland
D: A seep in *H. hirta* dominated grassland
E: Plants associated with sandstone outcrops

PLANT SPECIES PRESENT	Plant community [1]				
Generic name	A	B	C	D	E
GRASSES:					
Andropogon chinensis			*		
A. shirensis			*		*
Aristida congesta sub.sp. *congesta*	*	*	*		*
A. diffusa	*		*		*
Ctenium concinnum			*		*
Cymbopogon excavatus				*	*
Cynodon dactylon	*	*	*	*	
Elionurus muticus			*		
Eragrostis chloromelas			*		
E. curvula	*	*	*	*	
E. gummiflua	*		*		*
E. micrantha				*	
E. racemosa	*	*	*		*
Eulalia villosa	*				*
Heteropogon contortus	*				
Hyparrhenia hirta		*	*		*
Loudetia simplex	*		*		*
Melenis repens	*	*	*		*
Microchloa caffra					
Monocymbium ceresiiforme			*		*
Panicum deustum				*	
P. natalense			*		*
Paspalum dilatatum	*			*	
Perotis patens	*	*	*		*
Pogonarthria squarrosa		*	*	*	*
Schizachyrium sanguineum		*	*		*
Setaria pallide-fusca	*			*	
Sporobolus africanus		*			
S. nitens	*				*
Themeda triandra		*	*	*	*
Trachypogon spicatus					*
Trichoneura grandiglumis			*		
Tristachya biseriata			*		

OTHER:					
Amaranthus hybridus				▪	
Aster harveyanus					▪
Bidens formosa					
B. pilosa					
Callilepis leptophylla					▪
Cleome maculata		▪			▪
Commelina livingstonii		▪			
Crassula spp.					▪
Crepis hypochoeridea			▪		
Dicoma anomala sub. sp. *anomala*			▪		▪
Diospyros lyciodes					▪
Euryops laxus					▪
Felicia muricata		▪			
Gazania krebsiana		▪			
Gomphrena celosiodes		▪			
Helichrysum cephaloideum					▪
H. coriaceum	▪				
H. krausii	▪	▪			
H. rugulosum	▪				
Indigofera daleoides		▪			
I. melanadenia					▪
Ipomea purpurea					
Justicia anagalloides		▪			
Ledebouria spp.		▪			
Leonotis microphylla					▪
Lobelia erinus				▪	
Lotononis calycina			▪		
Mariscus congesta				▪	
Nidorella anomella	▪				
Pellaea calamelanas					▪
Pentanisia angustifolia			▪		
Pollichia campestris	▪	▪			
Poyygala hottentotta			▪		▪
Schistostephium crataegifolium	▪			▪	
Schkuhria pinnata					▪
Schoenolplectas carymbosus				▪	
Selaginella dregei					▪
Senecio coronatus			▪		
S. lydenburgensis			▪		
Stoebe vulgaris	▪		▪		▪
Striga elegans					▪
Tagetes minuta					
Verbena brasiliensis				▪	▪
Vernonia natalensis		▪			

B.J.M. Baxter
Assistant Scientific Officer

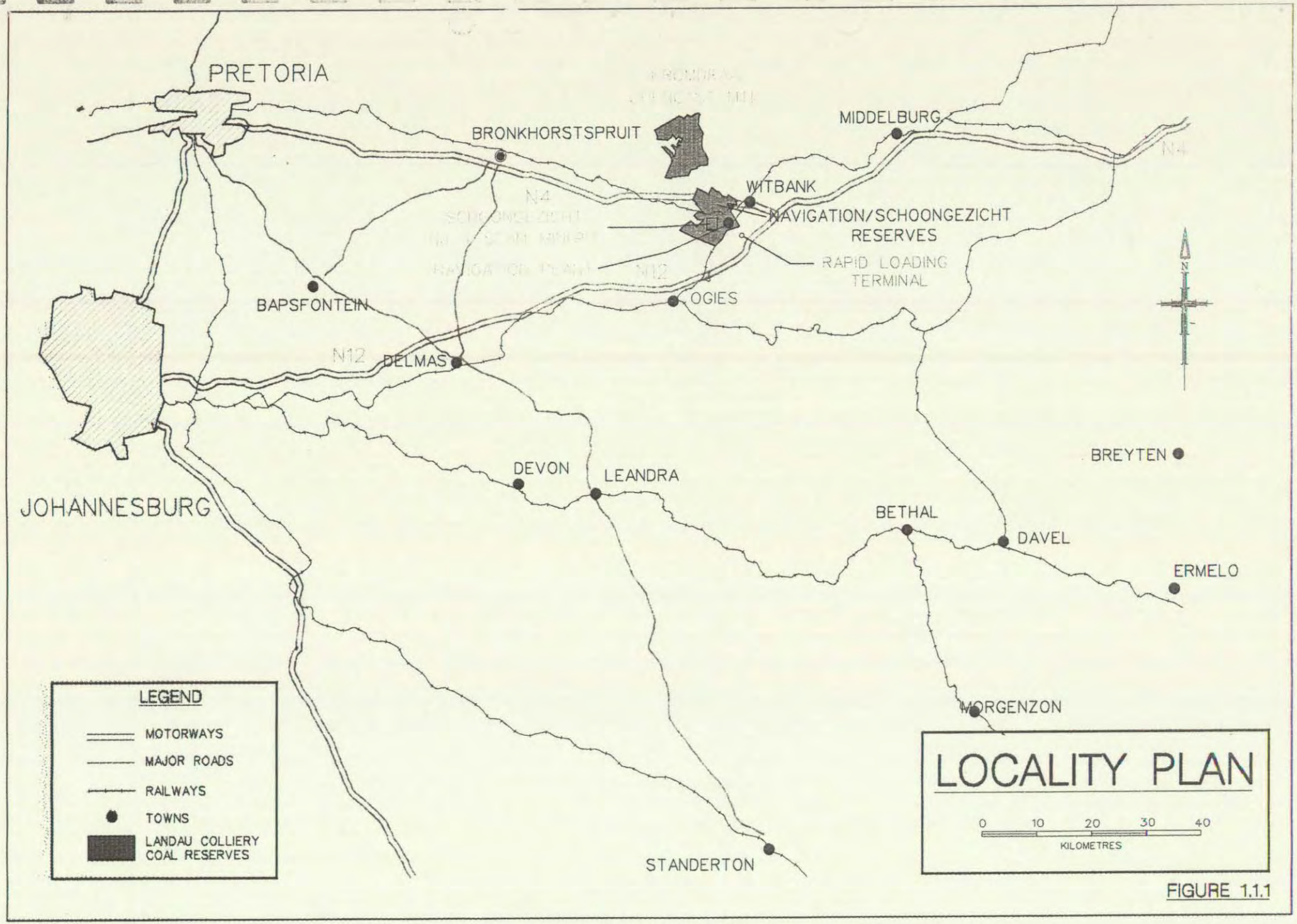
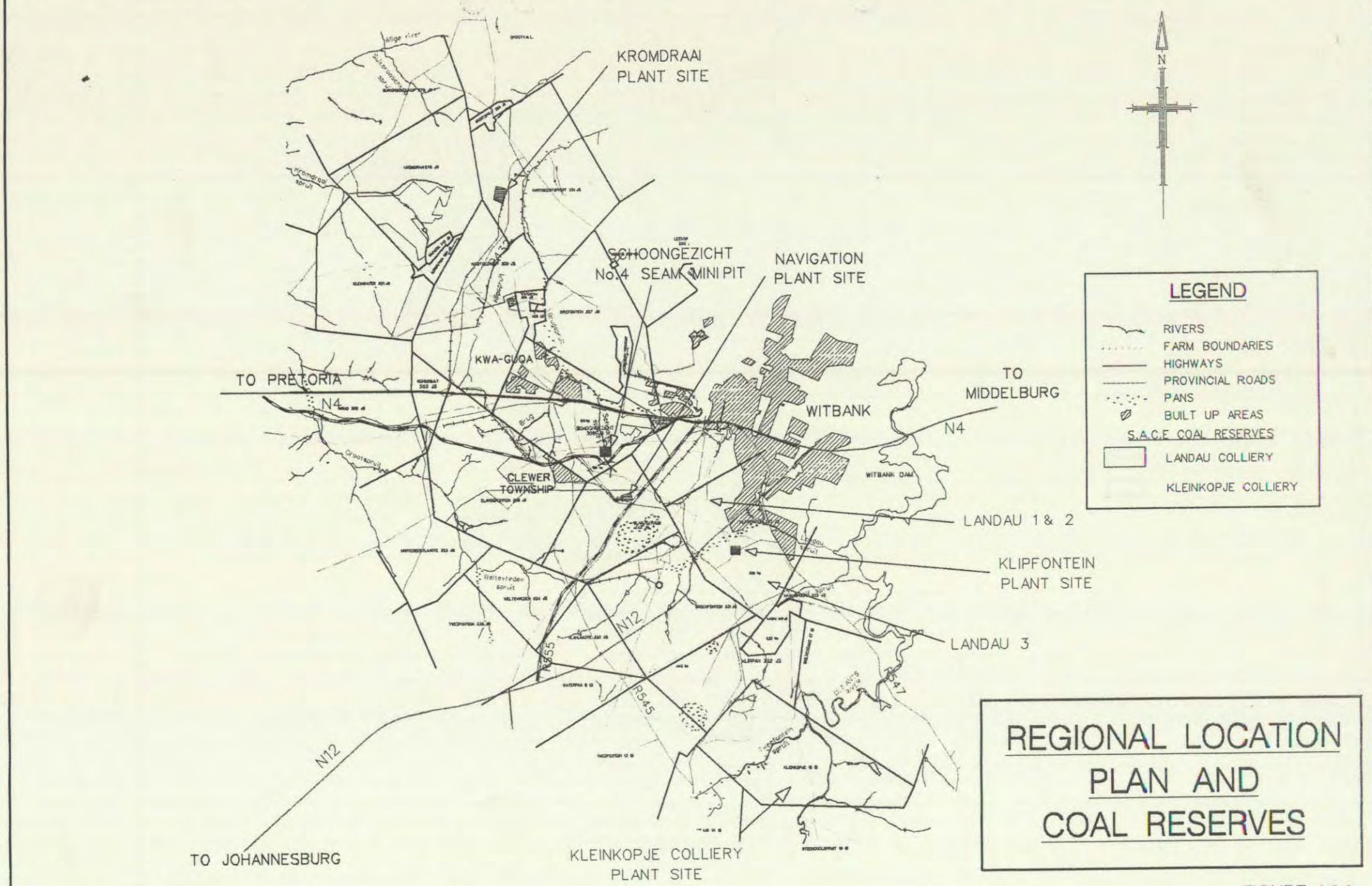

PRETORIA
BRONKHORSTSPRUIT
MIDDELBURG
N4
WITBANK
NAVIGATION/SCHOONGEZICHT
RESERVES
RAPID LOADING
TERMINAL
BAPSFONTEIN
OGIES
N12
DELMAS
JOHANNESBURG
DEVON
LEANDRA
BREYTEN
BETHAL
DAVEL
ERMELO
MORGENZON
STANDERTON
N
LEGEND
MOTORWAYS
MAJOR ROADS
RAILWAYS
TOWNS
LANDAU COLLIERY
COAL RESERVES
LOCALITY PLAN
0 10 20 30 40
KILOMETRES

FIGURE 1.1.1



REGIONAL LOCATION PLAN AND COAL RESERVES

FIGURE 1.2.1

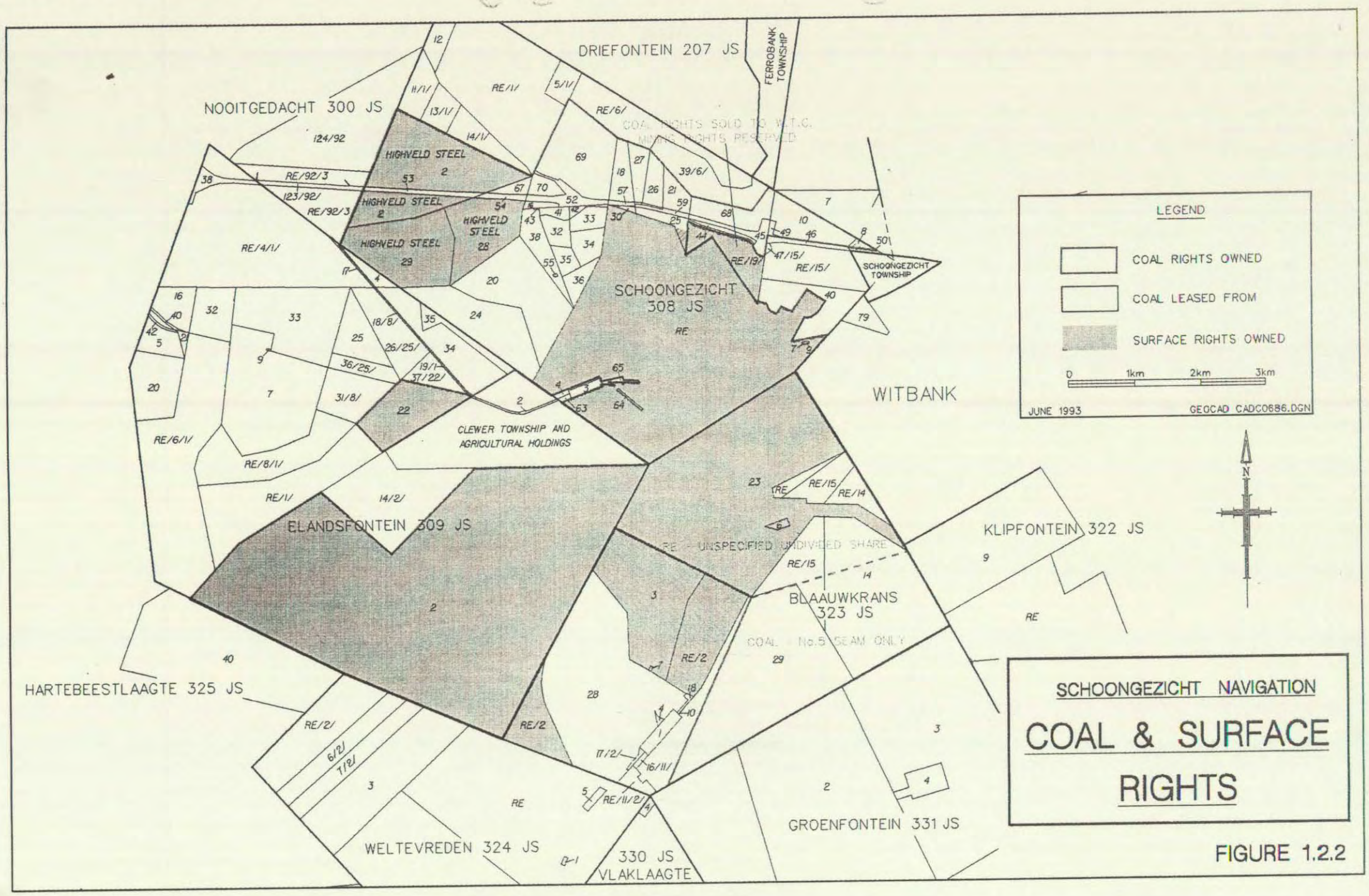

DRIEFONTEIN 207 JS
NOOITGEDACHT 300 JS
FERROBANK TOWNSHIP
COAL RIGHTS SOLD TO W.I.C.
MINING RIGHTS RESERVED
HIGHVELD STEEL
SCHOONGEZICHT TOWNSHIP
SCHOONGEZICHT 308 JS
WITBANK
CLEWER TOWNSHIP AND AGRICULTURAL HOLDINGS
ELANDSFONTEIN 309 JS
KLIPFONTEIN 322 JS
RE - UNSPECIFIED UNDIVIDED SHARE
BLAAUWKRANS 323 JS
COAL - No.5 SEAM ONLY
HARTEBEESTLAAGTE 325 JS
WELTEVREDEN 324 JS
330 JS VLAKLAAGTE
GROENFONTEIN 331 JS
LEGEND
COAL RIGHTS OWNED
COAL LEASED FROM
SURFACE RIGHTS OWNED
0 1km 2km 3km
JUNE 1993
GEOCAD CADC0686.DGN
N
SCHOONGEZICHT NAVIGATION
COAL & SURFACE RIGHTS

FIGURE 1.2.2

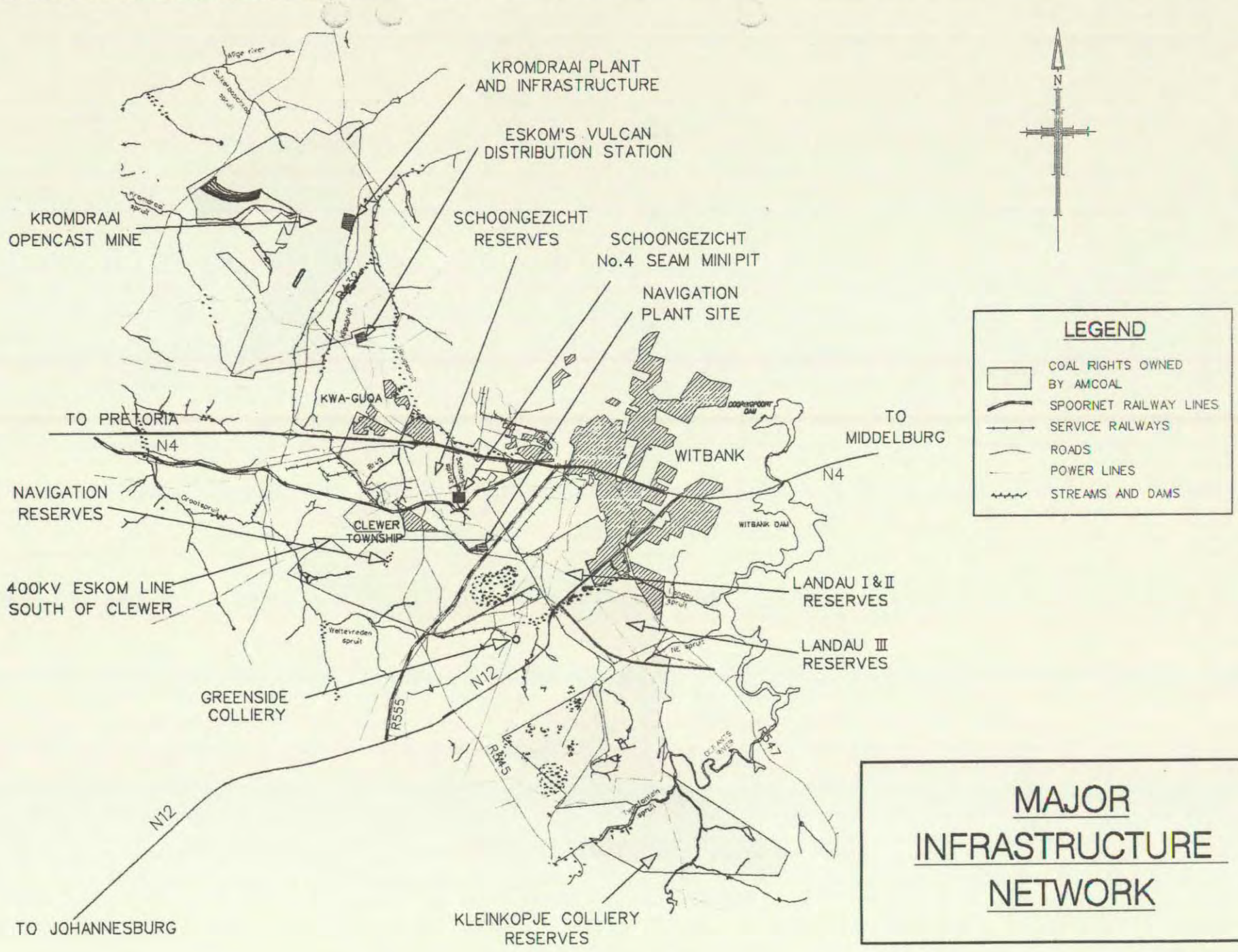

KROMDRAAI PLANT AND INFRASTRUCTURE
ESKOM'S VULCAN DISTRIBUTION STATION
KROMDRAAI OPENCAST MINE
SCHOONGEZICHT RESERVES
SCHOONGEZICHT No.4 SEAM MINI PIT
NAVIGATION PLANT SITE
KWA-GUQA
TO PRETORIA
N4
TO MIDDELBURG
N4
WITBANK
NAVIGATION RESERVES
CLEWER TOWNSHIP
400KV ESKOM LINE SOUTH OF CLEWER
LANDAU I & II RESERVES
LANDAU III RESERVES
GREENSIDE COLLIERY
N12
R555
R545
R547
N12
TO JOHANNESBURG
KLEINKOPJE COLLIERY RESERVES
N
LEGEND
COAL RIGHTS OWNED BY AMCOAL
SPOORNET RAILWAY LINES
SERVICE RAILWAYS
ROADS
POWER LINES
STREAMS AND DAMS
MAJOR INFRASTRUCTURE NETWORK

FIGURE 1.5.1

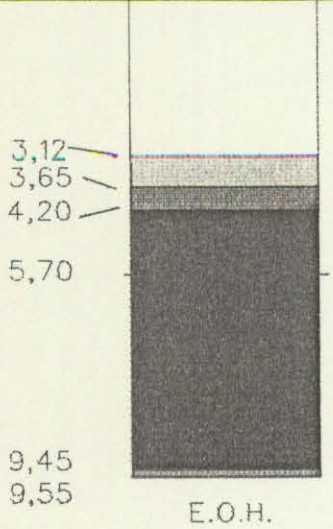
BOREHOLE NO 2273

DEPTH	SECTION	WIDTH	RECORD OF STRATA
		1,57	NO RECOVERY: reddish-brown. Lateritic soil.
1,57			
		6,01	SANDSTONE: reddish-yellowish, white, medium-coarse grained, moderately weathered, massive
7,58			
		1,14	COAL: No 4 UPPER SEAM.
8,72		0,18	SANDSTONE: grey, fine grained.
8,90			
		5,45	COAL: No 4 SELECT SEAM.
16.15		0,15	SANDSTONE : grey, medium-grained, massive.
16.30	E.O.H.		

SCHOONGEZICHT
NO 4 SEAM MINIPIT
GEOLOGICAL LOGS

FIGURE 2.1.1.(a)

BOREHOLE NO 2283



DEPTH	WIDTH	RECORD OF STRATA
	3,12	NO RECOVERY
3,12		
3,65	0,53	SANDSTONE: white, coarse grained, broken core, moderately weathered, massive.
4,20	0,55	SHALE: black, carbonaceous. Possibly p4 parting.
5,70	1,50	COAL: NO 4 TOP SEAM
	3,75	COAL: NO 4 SELECT SEAM.
9,45	0,10	SHALE: grey, carbonaceous.
9,55		E.O.H.

SCHOONGEZICHT
NO 4 SEAM MINIPIT
GEOLOGICAL LOGS

FIGURE 2.1.1.(b)

BOREHOLE NO 2289

DEPTH	SECTION	WIDTH	RECORD OF STRATA
		4,90	NO RECOVERY
4,90		1.30	SILTSTONE: black, slightly weathered.
6,20		0,95	NO 4 UPPER SEAM:
7,15		0,45	SILTSTONE: brownish-black, coaly towards the base.
7,60		0,40	
8,00			COAL: NO 4 TOP SEAM
		4,15	COAL: NO 4 SELECT SEAM.
12,15		0,45	SANDSTONE: dark grey, coarse grained, carbonaceous.
12,60	E.H.O.		

SCHOONGEZICHT
NO 4 SEAM MINIPIT
GEOLOGICAL LOGS

FIGURE: 2.1.1.(c)

BOREHOLE NO 2300

DEPTH	SECTION	WIDTH	RECORD OF STRATA
		2,71	SANDSTONE: grey, very coarse to fine grained, gritty, poorly sorted, moderately weathered.
2,71		0,50	COAL: NO 4 UPPER
3,21		0,73	SHALE: slightly weathered. carbonaceous and with coal laminae at top.
3,94		0,86	
4,80			COAL: NO 4 TOP SEAM
		4,31	COAL: NO 4 SELECT SEAM.
9,11			
		4,50	SANDSTONE: light brownish-grey, very coarse to fine grained, poorly sorted, gradational contact at base.
13,61			
		3,00	70% SANDSTONE: light grey, medium grained, interlaminated 30% SILTSTONE : dark grey, micaceous, gradational contact at base.
16,61			
		4,55	SILTSTONE: dark grey, slightly shaly, micaceous.
21,16		1,07	SHALE: dark grey, silty.
22,23		1,41	COAL: NO 2 UPPER SEAM.
23,64		0,84	SHALE: dark grey, carbonaceous, coal laminae.
24,48			
		3,05	COAL: NO 2 SELECT SEAM.
27,53	E.O.H.		

SCHOONGEZICHT
NO 4 SEAM MINIPIT
GEOLOGICAL LOGS

FIGURE 2.1.1.(d)