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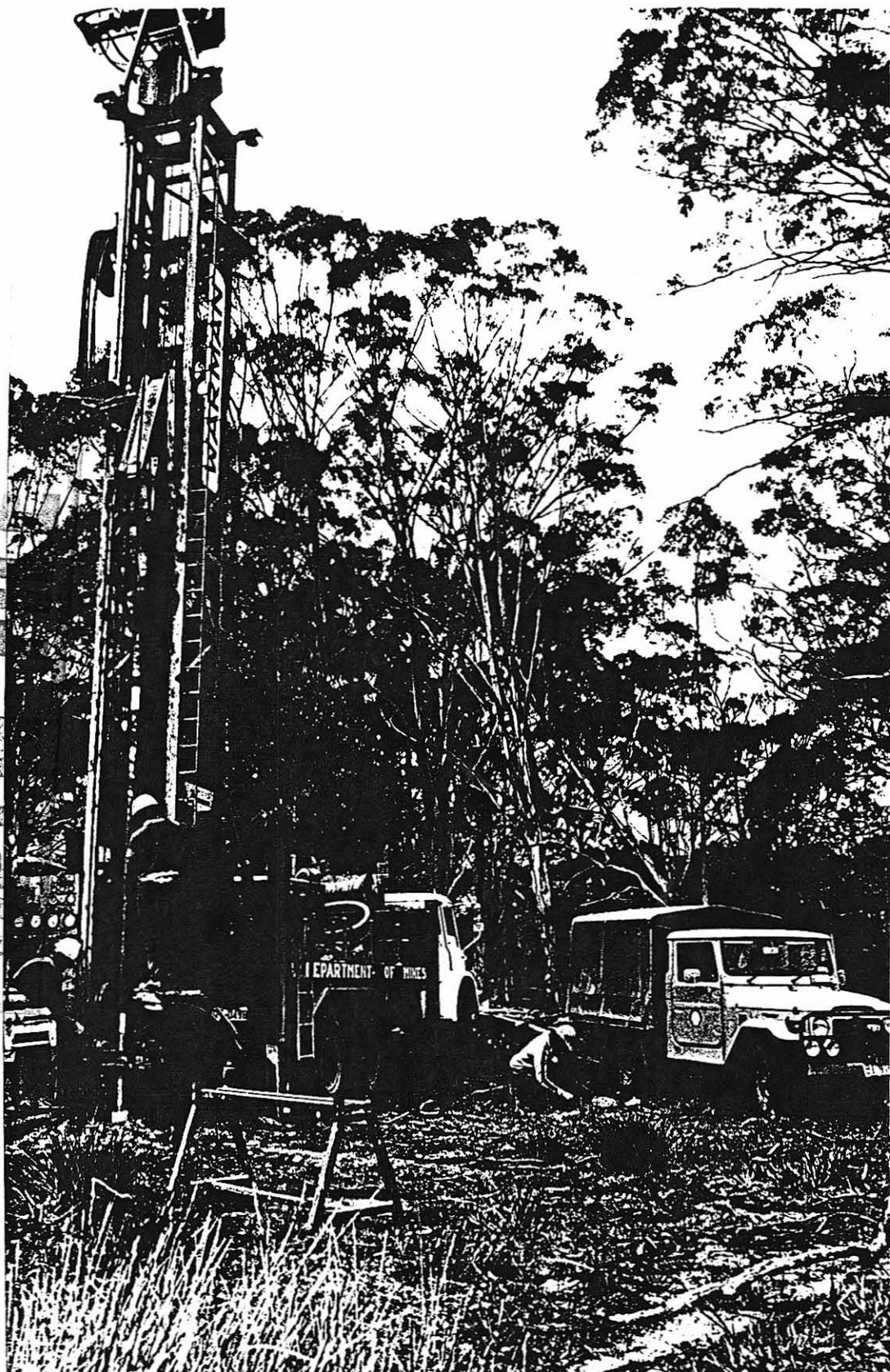
MT. NICHOLAS COAL DEPOSIT

Geology and Mine Development

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ABOVE - DRILL IN PROGRESS AT MT. NICHOLAS
COVER - CONTINUOUS MINER

PART A

MT NICHOLAS COAL MINE

SUMMARISED GEOLOGICAL APPRAISAL

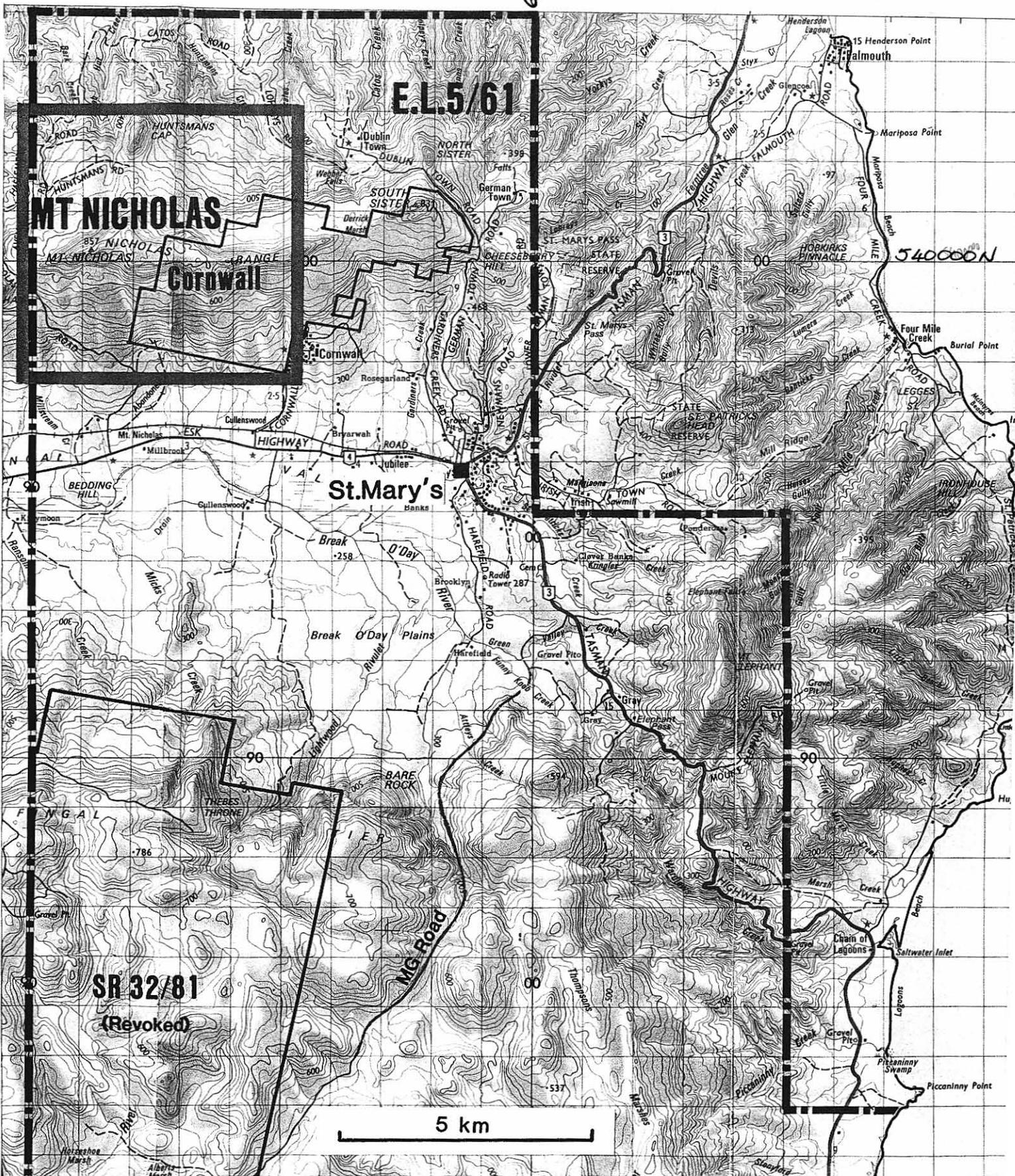
PART A

SUMMARISED GEOLOGICAL APPRAISAL

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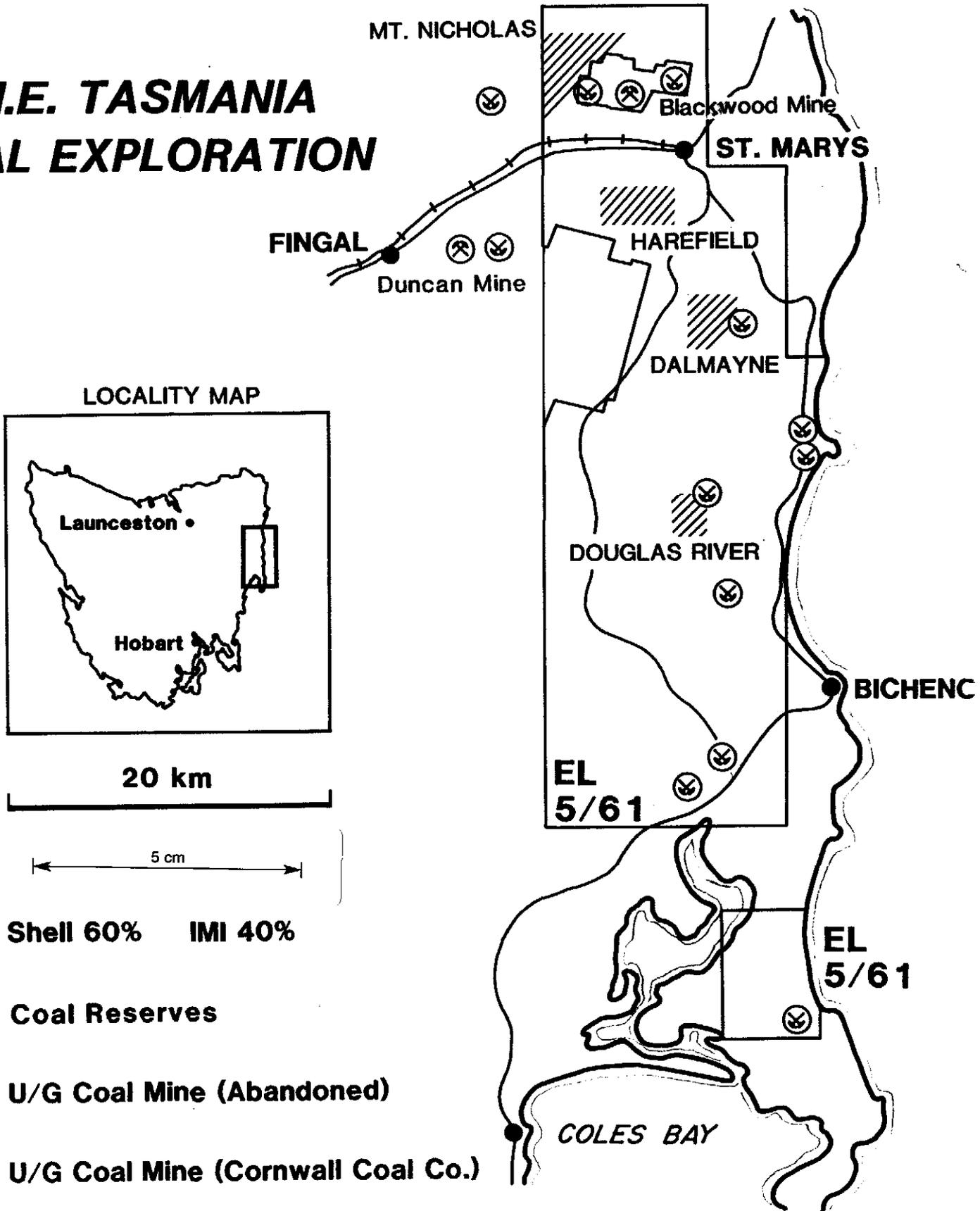
540000N



5 cm

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N.E. TASMANIA COAL EXPLORATION



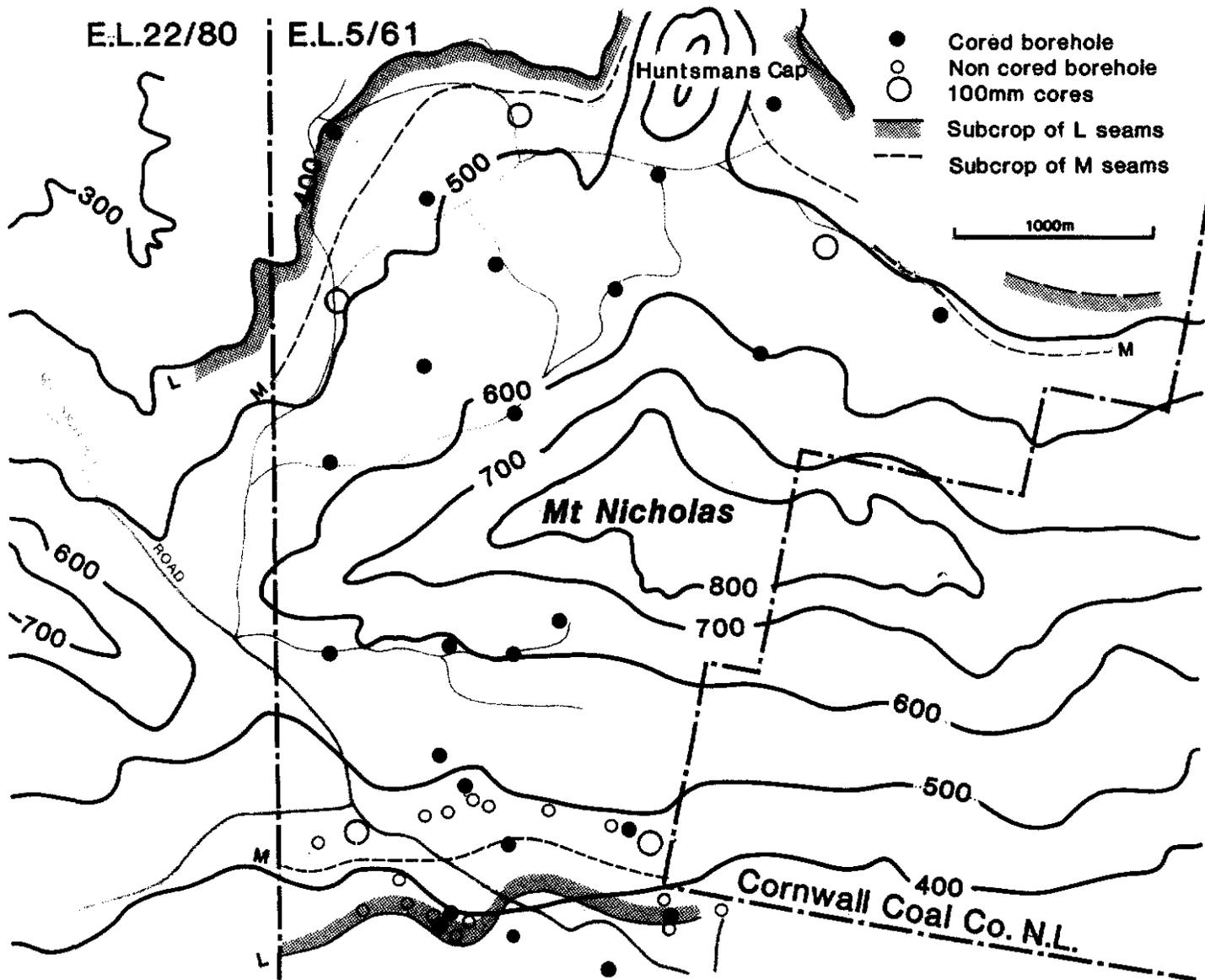
MOUNT NICHOLAS EXPLORATION PROGRAMME

1980/81	19 fully cored holes
1981/82	12 fully cored holes 16 non cored holes in southern subcrop areas
1982/83	5 pairs of holes with 100mm cores of representative seam sections.

- geological and geotechnical descriptions for all cores
- detailed ply and composite testing on coal cores
- geotechnical analyses on roof and floor samples
- wireline logs for 31 boreholes
- surface mapping and airphoto interpretations.

5 cm

TOPOGRAPHY & BOREHOLE LOCATIONS



487008

MT. NICHOLAS

North

Vertical Exaggeration X5

South

MASL

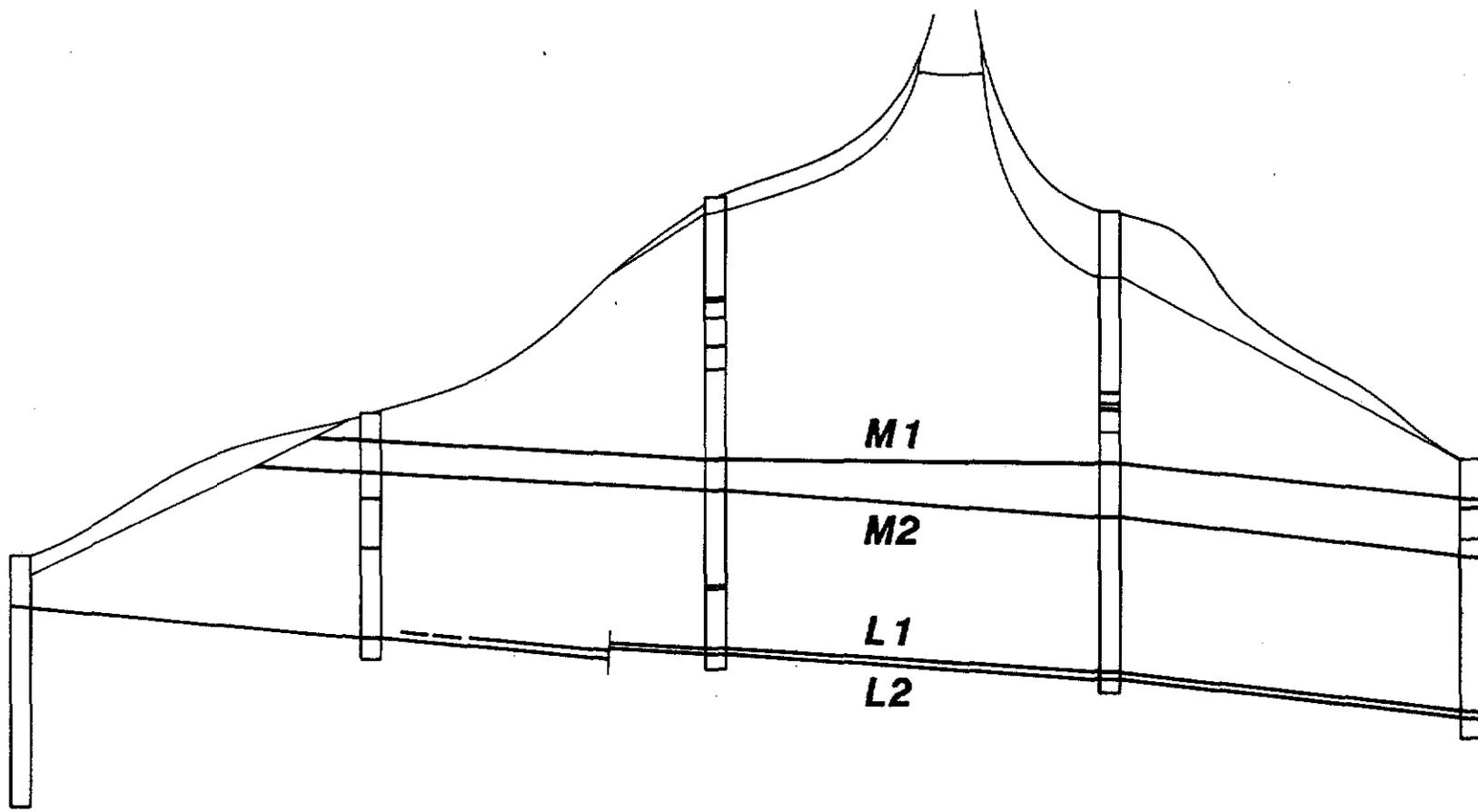
700

600

500

400

300



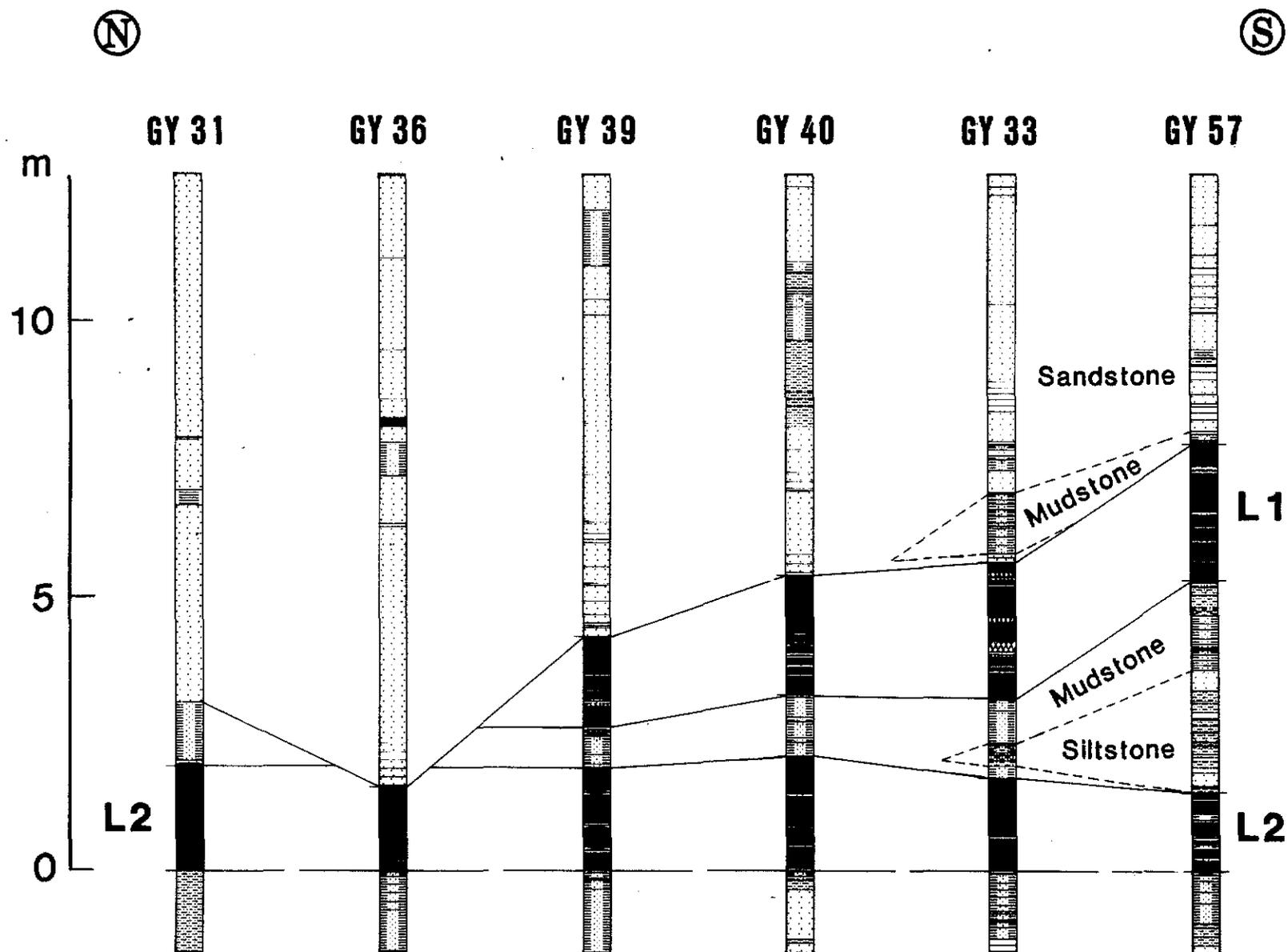
3 Km

5 cm

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P.5

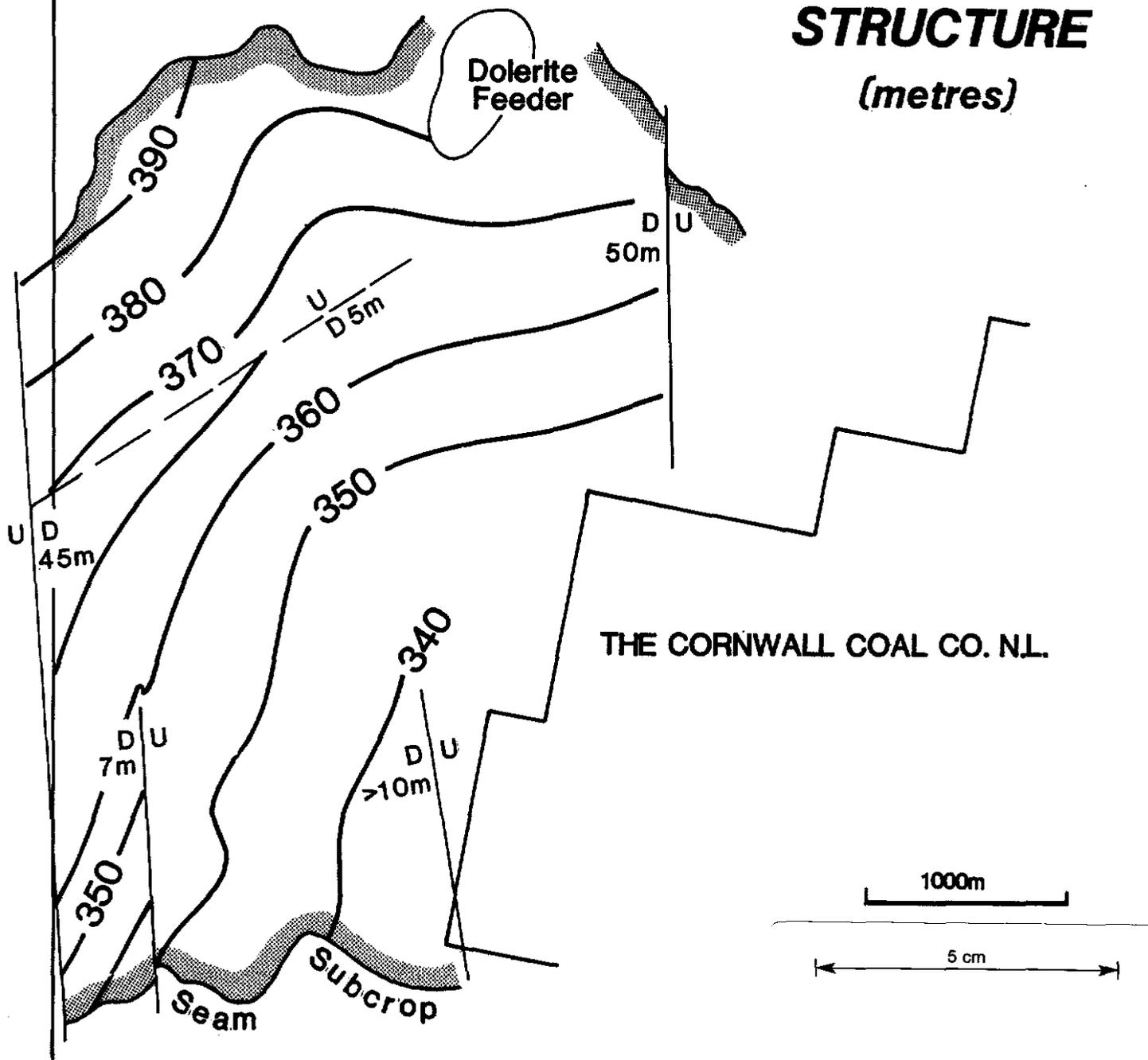
DIAGRAMMATIC ROOF AND FLOOR SECTIONS L1/L2 SEAMS



E.L.7/79

E.L. 5/61

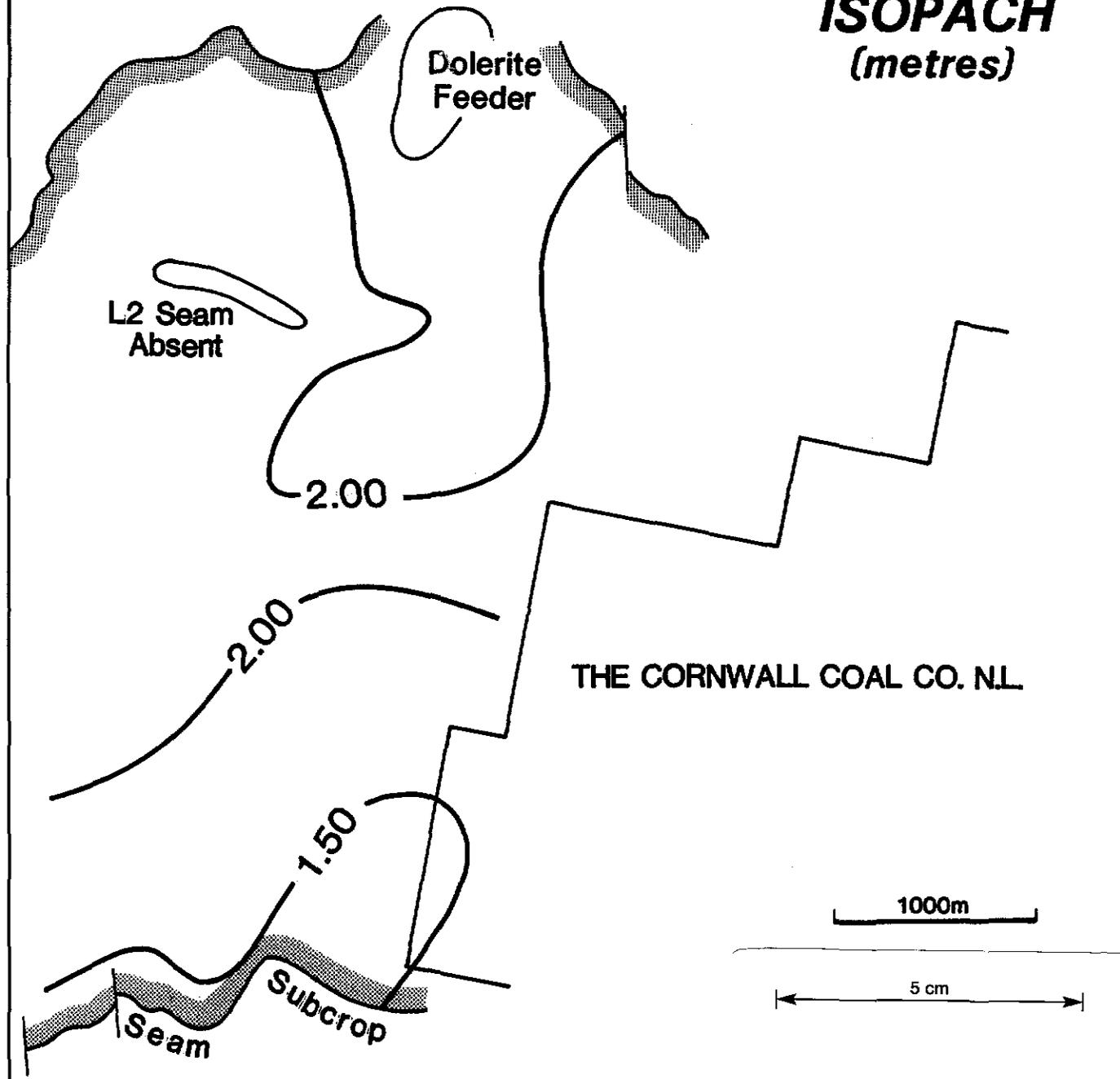
Simplified L2 SEAM STRUCTURE (metres)



EL. 7/79

E.L. 5/61

**Simplified
L2 SEAM
ISOPACH
(metres)**

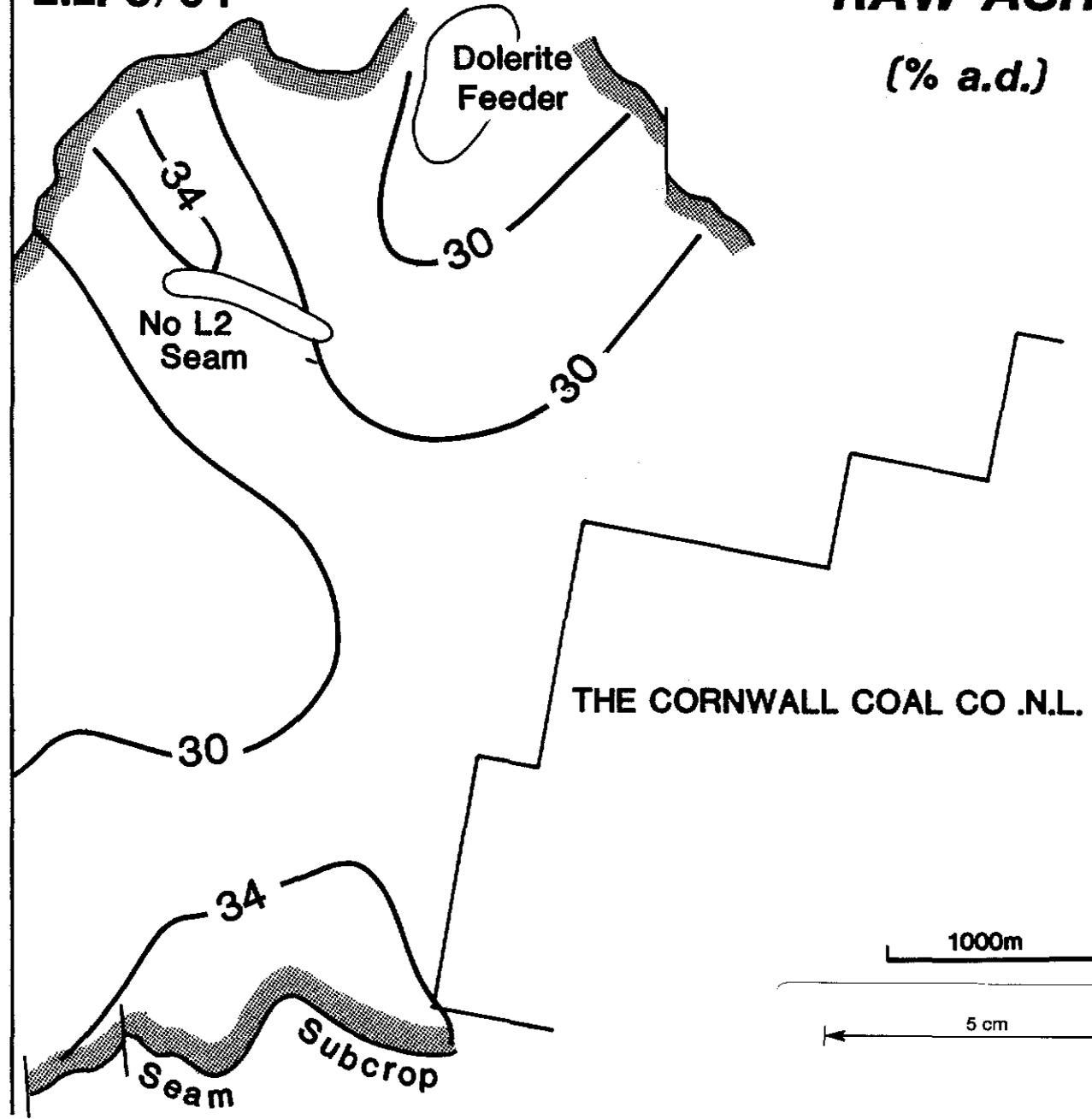


**Simplified
L2 SEAM
RAW ASH**

(% a.d.)

E.L. 7/79

E.L. 5/61



1000m

5 cm

487013

P.9

RESERVES SUMMARY - MOUNT NICHOLAS

(million tonnes, air dried)

Seam	Mineable in situ	Recoverable
M ₁	9.5	6.7
M ₂	3.9	2.7
L ₁	5.0	3.5
L ₂	30.4	21.3
TOTAL	48.8	34.2

Excluded from Mineable in situ:

- barriers of 20m to lease boundary
- " " 20m to major faults
- " " 80m to subcrop
- " " 90m to igneous intrusions
- " " 100m to old workings
- areas with seams thinner than 1.5m
- areas with theoretical yield smaller than 70% for 22.5% ash product
- L₁ if L₂ is preferred
- L₂ if L₁ is preferred
- area in north east to the east of fault.

Recoverable reserves are 70% of mineable in situ reserves.

MOUNT NICHOLAS - TYPICAL WASHED COAL PROPERTIES IN L2 SEAM

Proximate analysis (air dried)

Moisture %	5.9
Ash %	20.0 - 25.0
Volatile matter %	25.2
Fixed carbon %	48.9

Ultimate analysis (dry ash free)

Carbon %	81.57
Hydrogen %	4.88
Nitrogen %	1.43
Sulphur %	0.47
Oxygen %	11.66
Carbonates % (as analysed)	0.55

Total Sulphur % (air dried)	0.35
Chlorine % (air dried)	0.05
Phosphorus % (air dried)	0.01
Arsenic ppm As ₂ O ₃	0.8

Specific energy MJ/kg (air dried)	23.0 - 20.0
Hardgrove grindability	55

Mean maximum reflectance of vitrinite %	0.55
---	------

Ash analysis

Si O ₂ %	60.96
Al ₂ O ₃ %	30.68
Fe ₂ O ₃ %	3.89
Ca O %	0.69
Mg O %	0.69
Ti O ₂ %	1.22
Na ₂ O %	0.23
K ₂ O %	0.42
P ₂ O ₅ %	0.09
Mn ₃ O ₄ %	0.03
SO ₃ %	0.15

Ash fusion temperatures (°C - reducing atmosphere)

Deformation	1330 - > 1600
Spherical	1480 - > 1600
Hemisphere	1500 - > 1600
Flow	1520 - > 1600

MOUNT NICHOLAS GEOLOGICAL REPORTS

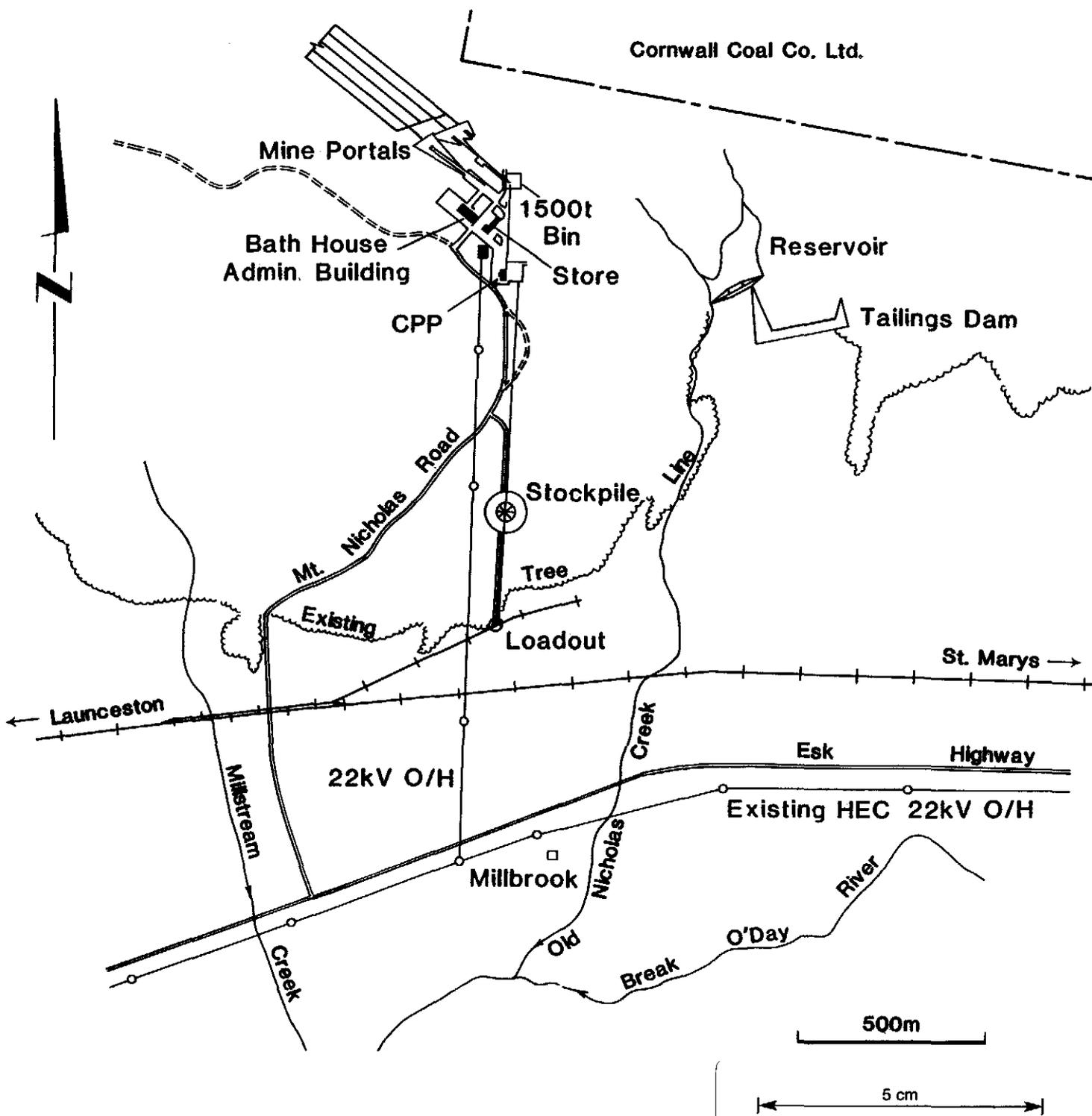
- Wolff I.M., Koppe W.H., Sansom P.W. (1981) -
An Assessment of the Mount Nicholas Coal Deposit,
SCOA Report CEPR 11/81.
- Patterson C.L. (1982) - Mount Nicholas Geological Report,
SCOA Report CEPR 31/82.
- Patterson C.L. (1983) - Mount Nicholas, Report on Testing of
100mm Core Samples, SCOA Report CEPR 12/83.

PART B

MT NICHOLAS COAL MINE

**PROPOSED DESIGN AND OPERATIONAL
FEATURES**

LOCATION AND SITE PLAN



PART B

MT. NICHOLAS COAL MINEPROPOSED DESIGN AND OPERATIONALFEATURESLIST OF CONTENTS

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MT. NICHOLAS COAL MINEPROPOSED DESIGN AND OPERATIONAL FEATURES1.0 INTRODUCTION

Following the completion of a detailed geological exploration of the Mt. Nicholas portion of EL.5/61 the information obtained has been used as the basis for an assessment of the feasibility of operating an underground mine to produce 600,000 tonnes per annum of marketable coal. The economical and technical viability of the proposed mine over a 20 year period have been examined, although at the proposed rate of extraction, the reserves are sufficient for a mine life in excess of 30 years.

2.0 MINE DEVELOPMENT2.1 Area of Economic Interest

The Mt. Nicholas portion of EL.5/61 contains economic reserves in four different horizons, the L₁/L₂ seams and the M₁/M₂ seams. To the north and south the seams subcrop to the colluvium which covers the slopes of Mt. Nicholas. The western boundary is a large N-S trending fault which virtually coincides with that part of the boundary of EL.5/61. To the East, the leases of the Cornwall Coal Company form the boundary of the reserves block, except along the northern side of the range, where a second large N-S trending fault occurs. The enclosed rectangular area of some 13.5 km² is the area of economic interest.

2.2 Access to the Seams

Measurements to the base of the colluvium show that there are only a few small areas along the flanks of Mt. Nicholas from which relatively easy access can be gained to each of the economic coal horizons. Elsewhere, the thickness of the colluvium would pose a major engineering problem. After taking into account mining and coal quality considerations and ease of access to road, rail, power and water services, a location on the southern flank has been selected. An added benefit of the selected site is the availability of a suitable flat area for the mine surface buildings.

The mine surface site is at a level which provides easy access to either the L₁ or the L₂ horizons. Borehole information shows that at this point the L₂ seam is only 1.5m thick and the L₁ seam, which is only 3m above the L₂ seam, is 2.25m thick. The L₁ seam has been selected as the preferred horizon for initial access.

After excavating the colluvium to expose the L₁ seam, three tunnel portals will be formed to provide a conveyor road, a transport/intake air road and a return air road. The three entries will be driven in a N.W. direction until they have passed through any disturbed ground normally associated with a subcrop zone, after which the normal mining development system will be established.

2.3 Mining Development System (Fig. 1)

The normal mining development system comprises five parallel roadways, each 5m wide and excavated to the full seam height, interconnected at 50m intervals by cross cuts. Mining development roadways will be driven by continuous miners which deliver the cut coal into shuttle cars for transportation to a conveyor belt system for delivery to the surface raw coal surge bin.

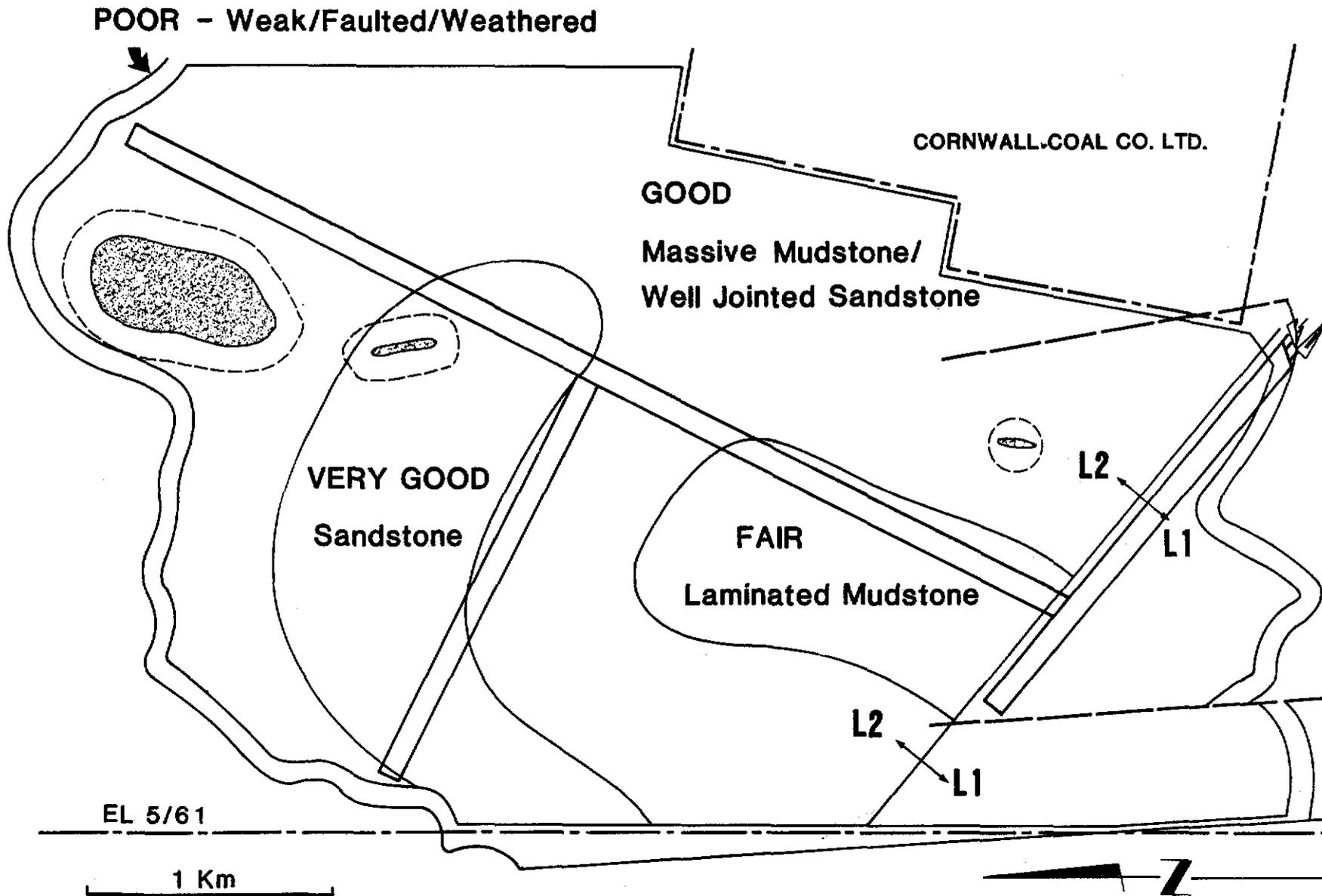
As the roadways are advanced in the seam, the exposed roof will be supported by roof bolts, steel cross straps and wooden props. A detailed study has been made of the roof rocks overlying each seam and an appropriate support system has been designed for each type of roof. The roof rocks vary from strong sandstone to fairly weak laminated mudstone. Nine sub-classifications of roof strengths have been identified, each requiring a different amount of support. The main variable in the support system is the spacing of roof bolts within the roadways, in order to achieve the most economic, safe support system for each type of roof.

Two continuous miner units will extend the development roadways in the L₁ seam until a point is reached where entry to the L₂ seam is planned to commence. At this stage, a third continuous miner unit also commences development mining, two units driving roadways in the L₂ seam whilst the unit still working in the L₁ seam continues until a fault paralleling the western boundary is reached.

Entry to the L₂ seam will be achieved by diverting the development roadways downwards until the floor level of the L₂ seam is reached, after which the roadways will be driven within the L₂ seam in a northeasterly direction towards an area of thin colluvium on the northern side of the range, allowing easy access to the surface to be achieved for additional intake airways. The main development of the mine will be completed at this stage, mining activities for the remainder of the 20 economic study period being entirely within the L₂ seam.

ROOF CLASSIFICATION L1/L2 SEAMS

5 cm



487023

Fig. 1

2.4 Extraction of L₁ and L₂ Seams (Fig. 2)

The main development roadways in the L₁ and L₂ seams provide the arterial roadway system by which the mine is serviced with air, water, power, coal transport and men and materials transport. Support systems within the roadways and the dimensions of the coal pillars between them are designed to provide stable roadways for the entire life of the mine.

The areas of coal lying between the main development roadways and the east and west boundaries of the mine are to be mined by methods which provide for the extraction of the highest possible amount of the coal contained there.

After due consideration of the location of known faults, igneous and other intrusions, a mining system has been selected which provides the high degree of flexibility in mine planning demanded by the presence of geological disturbances and the limited dimensions of the economic area. It is considered that in order to achieve the required level of production and to maintain the maximum degree of operational flexibility, a system based on the use of continuous miner units provides the highest degree of security to the production plan. Whilst it is recognised that a longwall system would produce a significantly higher annual tonnage if suitable fault free areas are found by advanced development, the total size of the resource is such that a significantly higher level of annual production will lead to the reserves being exhausted in much less time than the economic life of the power station which the mine is intended to supply. Given the probability of minor faults in association with these already identified, the inflexibility of a longwall could also result in major disruptions to supply and the loss of large parts of the reserves.

The proposed mining system is that known as the Wongawilli or lift and fender system, one which has a good record of success in similar conditions elsewhere. The system is capable of being varied to suit specific mining conditions and normally achieves a high percentage extraction of reserves. Mining tonnage calculations assume that within extraction areas 70% of the available coal will be mined, based on experience in other operations in Australia. For most of the mine's life, 5 continuous miner units will be used to develop and extract blocks of coal by this system.

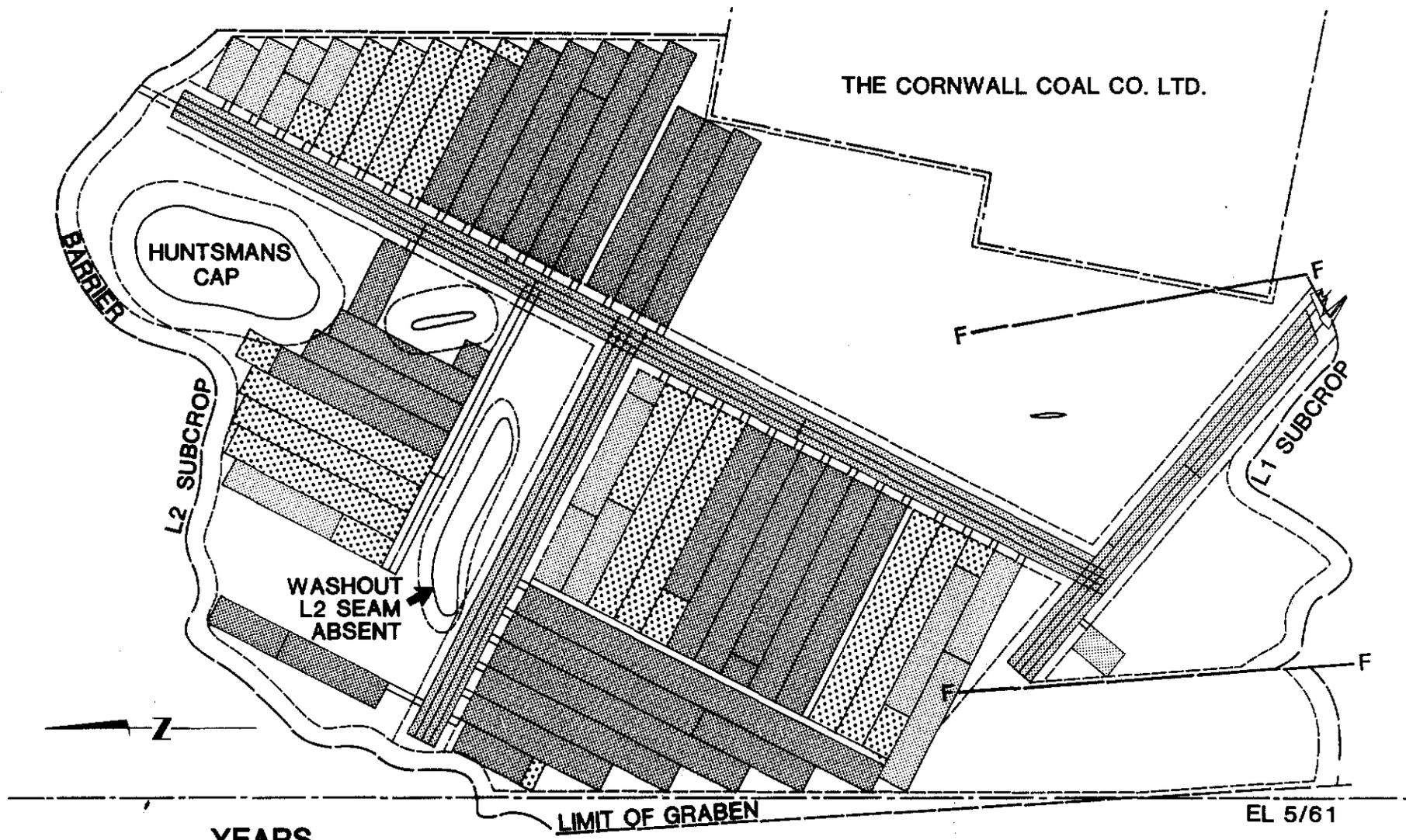
2.5 Planned Production Rates (Fig. 3)

Reference has been made to records of production rates being achieved elsewhere in mines where similar seam heights and mining conditions exist. Adopting a conservative approach to productivity until mining experience has been gained at Mt. Nicholas, these rates have been reduced somewhat and production levels are currently estimated to be:

	<u>t/u.s</u>	<u>t/u.d</u>
Main development headings	350	700
Pillar extraction	400	800
	(excluding dilution)	

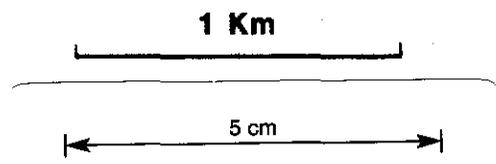
After taking into account overtime and absenteeism, the output per manshift (O.M.S.) at full production is 12 tonnes.

It is estimated that a little over four production units will be required to produce 600,000 tonnes of saleable coal per annum. The uncommitted capacity of the fifth unit provides a safeguard against tonnage shortfalls in the event of any unexpected geological abnormalities.



YEARS

	1-5
	6-10
	11-20



**MINE LAYOUT
L1/L2 SEAMS**

487026

Fig. 2

2.6 Mining Constraints (Fig. 4)

The planned mining operations are confined to these areas considered to be free from the constraints which inhibit the production of low cost coal. Coal will only be mined where the seam thickness exceeds 1.5m. Seams thinner than this can only be mined economically if the product coal is of high value such as prime metallurgical coking coal. The mining equipment which is available for working in seams down to 1.5m thick has a maximum height range of 3.0m, hence in areas where the seam thickness exceeds 3.0m it is only planned to mine the bottom 3.0m of the seam.

Coal seams in close proximity to geological disturbances are also likely to be disturbed. It is not planned to mine any coal within 90m of a known disturbance.

Each of the seams is bounded on the northern and southern side by a subcrop zone where the seam abuts a surface cover of unconsolidated material. Drilling to test the thickness of colluvial material in the subcrop zones suggests that it would be prudent to leave a barrier of coal 80m wide there, to avoid mining into the zone where surface water may be tapped.

Parts of the M. seam contain such a high proportion of high ash coal that after processing in a wash plant less than 70% of the coal mined would be saleable. Mining such low recovery coal is not economical, when the product coal itself has a low intrinsic value, it has therefore been excluded from the mine plan.

KEY PRODUCTION PARAMETERS

<i>Full production</i>	600,000 tpy product
<i>Manning level</i>	195 wages 20 staff 215 total
<i>Production days</i>	200 per year
<i>Production shifts</i>	2 only 8 hour shifts/day
<i>Maintenance shifts</i>	1 only 8 hour shift/day
<i>Continuous miner unit shifts</i>	8 per day
<i>Continuous miner units</i>	5
<i>Continuous miner productivity (Raw Coal)</i>	350 tpus development 400 tpus pillar extraction
<i>ROM coal = Raw coal plus 5% dilution allowance</i>	
<i>Output per man employed</i>	14 tonne/day
<i>Seam heights</i>	1.5 – 3.0m

The L₁ and L₂ horizons are separated by up to 3m of strata and are therefore too close together to be regarded independantly as mineable areas. Accordingly mining is only planned in one seam at any once location. Fortunately, in most areas, only one seam meets the necessary criteria for it to be considered mineable.

Old mine workings exist in part of the M seam. Uncertainty about the precise location of the limits of the working requires that a barrier 100m wide be provided.

The boundary of the Cornwall Coal Company's leases require that a 20m barrier be left in situ.

3.0 RESERVES

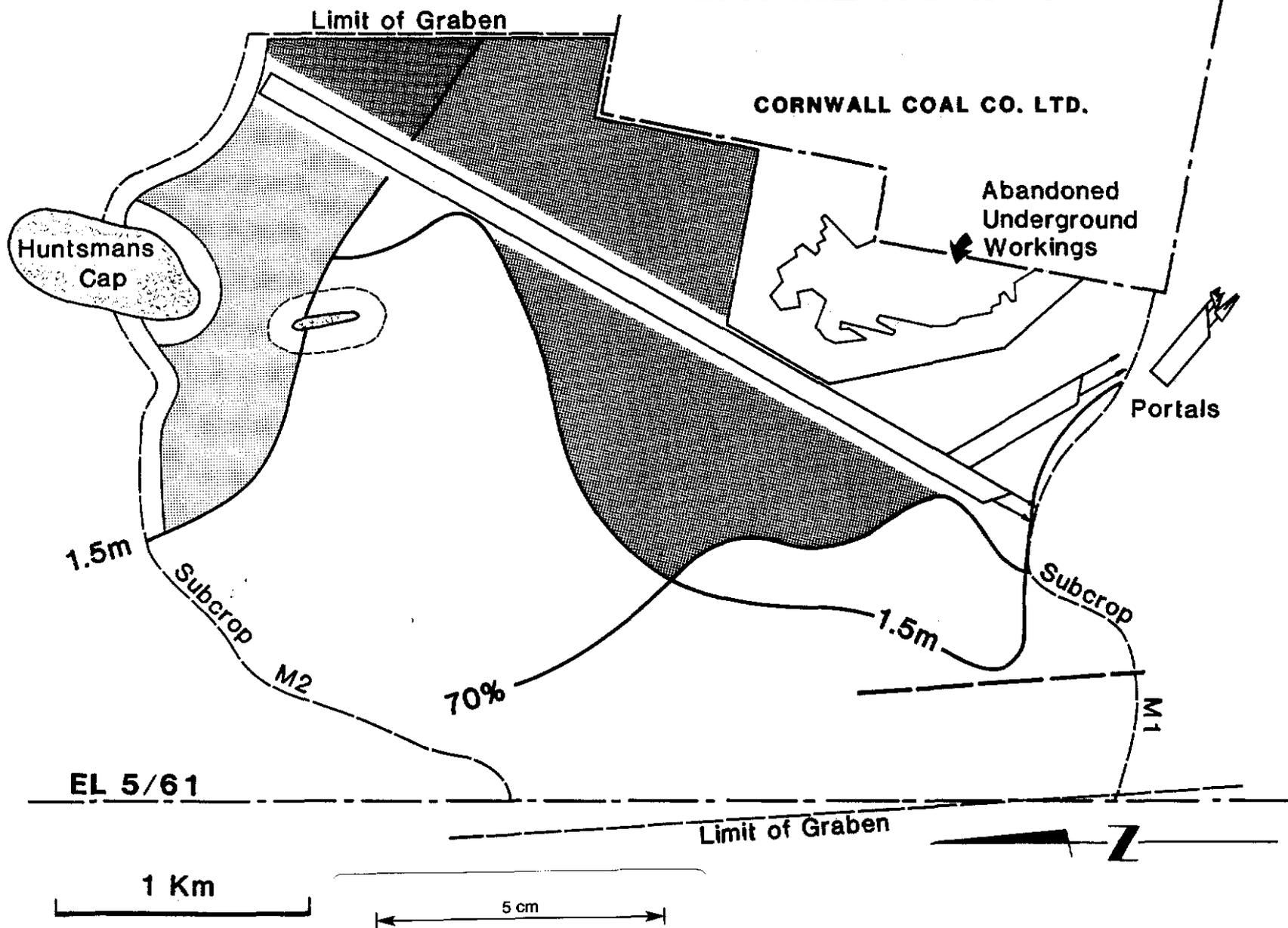
3.1 Mineable In Situ Reserves

The term Mineable In Situ Reserves has been used to describe the calculated reserves in each seam after the areas identified as 'constraints' are excluded. The calculated Mineable In Situ Reserves used for mine planning purposes are 46.5 Million tonnes of which 64% are in the L₂ seam. A variation between the mine planning reserves and the geological report reserves is due to the exclusion of a block of L seam reserves likely to be isolated by a fault in the S.W. corner of the mine.

3.2 Recoverable Reserves

For mine planning purposes it has been assumed that mining can be carried out throughout the areas in which Mineable In Situ Reserves are contained. Applying conventional recovery factors for continuous miner units it has been estimated that 70% of the Mineable In Situ Reserves can be extracted, resulting in a raw coal production of 31 million tonnes over the life of the mine.

MINE LAYOUT M1/M2 HORIZON



487030

Fig. 4

RESERVESGEOLOGICAL ESTIMATES

<u>MINEABLE IN SITU</u>	<u>RECOVERABLE</u> <u>(RAW COAL)</u>	<u>MARKETABLE</u> <u>(22.5% A.D.)</u>
<u>MT</u>	<u>MT</u>	<u>MT</u>
48.6	34.2	25.9

MINE PLANNING ESTIMATES

46.5	31.0	24.8*
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* AT 25% ASH A.D. THIS WOULD INCREASE TO 26.1 M.T.

3.3. Marketable Reserves

The total amount of marketable coal produced during the life of the mine will depend, amongst other things, upon the ash level specified by the customer, for a 22.5% ash coal (air dried, 6% moisture), the total marketable reserves are 24.8 million tonnes. An increase in ash level to 25% would increase the marketable reserves to 26.1 million tonnes.

4.0 MINE SERVICES

Full provision has been made for the supporting services required by continuous miner units.

4.1 Coal Transport

Coal transport will be by means of conveyor belts from the point of discharge from the shuttle cars to the surface. Conveyors have been selectively sized on the basis of load and maximum lump size.

4.2 Men and Materials Transport

Rubber tyred, diesel powered multi purpose vehicles (MPVs) have been selected for this purpose. Each MPV prime mover will have available to it a range of transport modules to cover all transportation requirements.

4.3 Ventilation

The mine will be ventilated by an exhaust fan system located at the return air portal. The anticipated maximum duty is $160 \text{ m}^3/\text{sec}$ at 1.5 kpa. Face ventilation will be effected by brattice screens.

The system provided allows $15 \text{ m}^3/\text{sec}$ for each working panel, $5 \text{ m}^3/\text{sec}$ for each non working face area and assumes an overall ventilation efficiency of 50%.

Ventilation provisions have been calculated to ensure a high standard of ventilation throughout the mine. Gas emission rates are believed to be low and therefore adequately controlled by routine detection methods and good ventilation standards.

4.4 Mine Drainage

Ground water has been detected within the subcrop zones only, where fissuring of the thin covering strata is the main cause. Elsewhere the seams are expected to be relatively dry therefore pumping requirements are not large. The effect of water on the floor strata could hinder mining and transport therefore priority has been given to removing water from the vicinity of the working areas and pumping it to the surface.

4.5 Fire Fighting

At the surface and underground, water services are provided to ensure that all N.S.W. statutory requirements relating to flow rates and pressures are complied with at all times. In addition to a dedicated storage of 200,000 L for fire fighting purposes, fire extinguishers, containers of sand and stonedust, hose stations and hydrants are provided throughout the mine and on mobile equipment as appropriate.

4.6 Power Supply

Incoming power from the HEC distributor system will be supplied at 22kV to a surface substation from which the mine reticulation system will distribute power at 11kV. Suitable protective devices will be provided throughout the reticulation system.

Major items of underground equipment will be operated at 1.1kV, the supply being via 750kVA, 11kV to 1.1kV transformers and gate end boxes. All electrical equipment within 100m of the faces or in return airways will be flameproof. Elsewhere the electrical equipment will be suitable for use in non-hazardous areas.

4.7 Compressed Air

A surface compressor house, containing 3, 350 L/s rotary screw type compressors will supply compressed air via a surface and underground reticulation system. Underground, the service will power pumps, roof bolters, stone dusters, portable tools and other general requirements. At the surface, the supply will operate coal handling, workshops and coal preparation plant equipment.

4.8 Water Supply

Measurements on a number of streams on the southern flank of Mt. Nicholas confirm that even in drought periods sufficient flow is available to meet the total mine water requirement. The estimated demand is 230 ML/a. It is planned to store sufficient water to meet 6 months demand from the mine.

The selected site for primary water storage is on the Old Nicholas Creek where a dam with pumping facilities will be installed. From the primary water storage, the pumps will elevate the water to three 300,000 L storage tanks, located at suitable levels to meet surface and underground pressure requirements. Fire fighting reserves of 200,000 L are additional to the mine's operational water supply.

5.0 SURFACE FACILITIES (Fig. 5)

The selected site for the mine portals is adjacent to the old Mt. Nicholas township site and this has been adopted for the mine surface facilities.

5.1 Bathhouse/Administration Building/Laboratory

A single building with a floor area of 1400m² will house these facilities, and will include Lamp room and first aid room services.

The bathhouse will be of conventional modern design to allow ease of maintenance and security for employees' possessions. Heating and ventilation services are included.

Space provisions exceed those stipulated by N.S.W. mining law.

5.2 Workshop and Store

A steel portal frame constructed building with profiled steel cladding will house the mine workshop and stores. Crane and other services for equipment overhauls are provided.

The store area contains material bins and racks, issuing and receipt areas and a stores records centre. An outside storage area will be used for pit timber and other stores not requiring covered storage.

5.3 Explosives Magazine

The use of explosives at Mount Nicholas is expected to be small. A provision has been made for a magazine to be located at a suitable distance from other surface buildings.

5.4 Communications

PABX telephone services will be provided. Underground telephone will be connected to the PABX system by a suitable approved link.

A two channel U.H.F. radio system will be used for communication between the surface and mobile equipment operators and other selected personnel.

5.5 Roads, Parking Areas and Vehicle Hardstands

The general standard for these areas will be for a crushed rock base layer to be bitumen sealed, with kerb and guttering and rainwater drains.

5.6 Surface Drainage

A surface water run-off collection system will service all sealed areas, stockpiles and wash down areas. Drainage water will pass through one or more settlement pits and grease traps before being added to the coal preparation process water.

6.0 COAL PREPARATION AND COAL HANDLING

6.1 R.O.M. Coal Handling

R.O.M. coal will be transported from the mine on a belt conveyor and discharged into a 1500t storage bin with alternative ground storage if the bin is full or waste material is being conveyed.

Coal is elevated from the discharge of the R.O.M. coal bin to a scalping screen and roll crusher.

MINE SURFACE LAYOUT

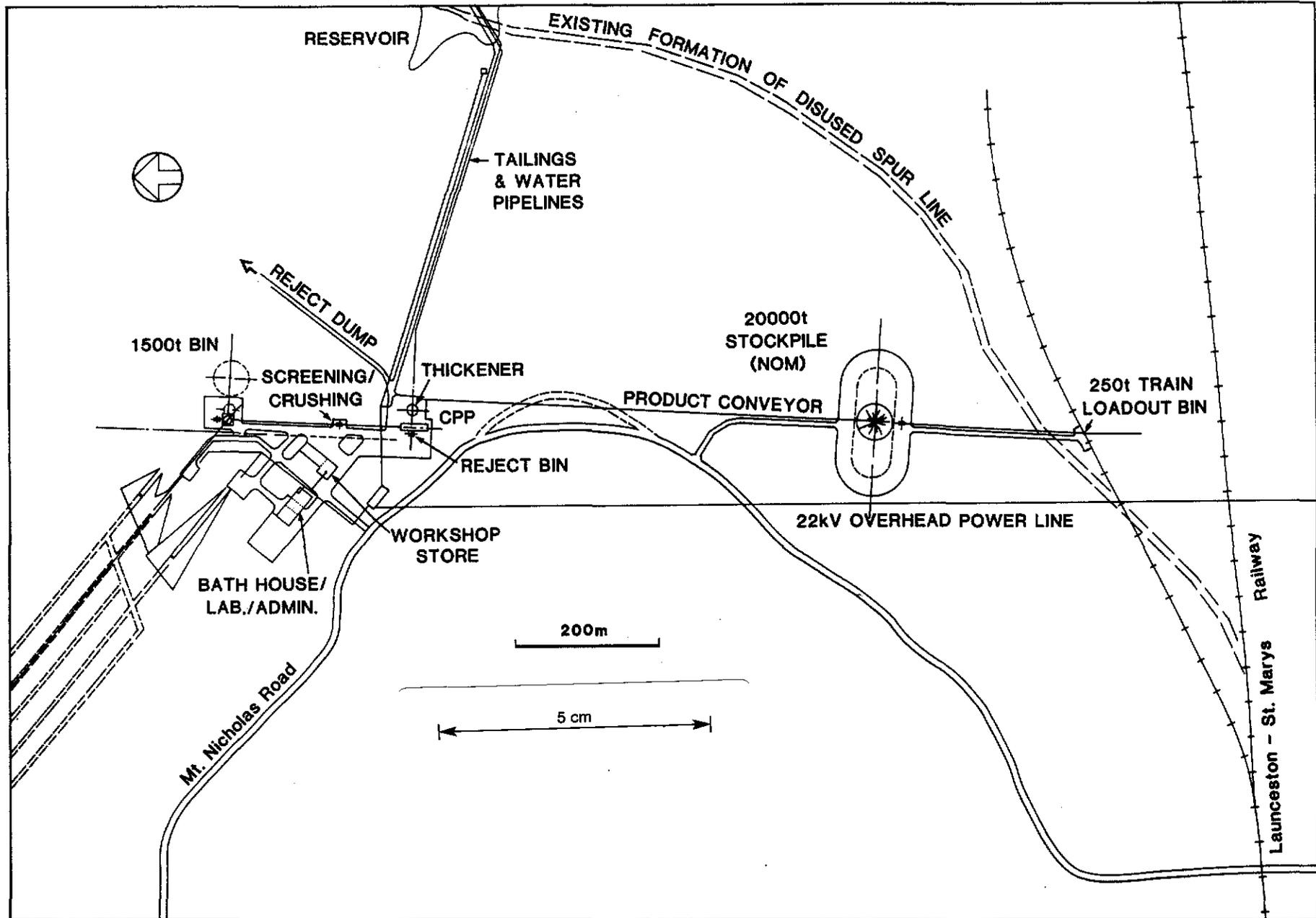


Fig.5

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All structures in the R.O.M. coal handling system are steel framed. Dust suppression and noise attenuation are provided throughout.

6.2 Coal Preparation Plant (Fig. 6, 6A, 6B, 6C)

A plant has been designed which is compact, economic and capable of meeting a range of operational requirements.

Coal from the crusher is passed over a screen to separate the -1.4mm fines which are then deslimed at approximately 0.125mm in classifying cyclones. The -1.4 + 0.125mm fines fraction may then be washed on spiral concentrators or bypassed to the product stream unwashed.

Material which is -45mm, +1.4mm can be cleaned either in a jig or a dense medium cyclone, depending on the ash level required by the customer.

Product coal will be a blend of washed -45mm coal and treated or untreated fines. The moisture content of the product coal will be 13% including inherent moisture.

6.3 Product Coal Handling

Product coal will be delivered to a 20,000 tonne capacity stockpile with further provision for an additional 30,000 tonnes if required. The load out facilities will be dependent on the form of transport preferred by the customer, but current provisions are for a rail loading bin located on a new spur line to the St. Marys branch line.

Sampling and weighing requirements will be provided for.

6.4 Coarse Reject Disposal

A coarse reject dump area has been selected to the north east of the mine surface area, in a location where existing vegetation will mitigate any adverse visual effects.

6.5 Tailings Disposal

After treatment in a 28m diameter tailings thickener, the underflow is planned to be pumped to a tailings dam on relatively level ground to the east of the minesite.

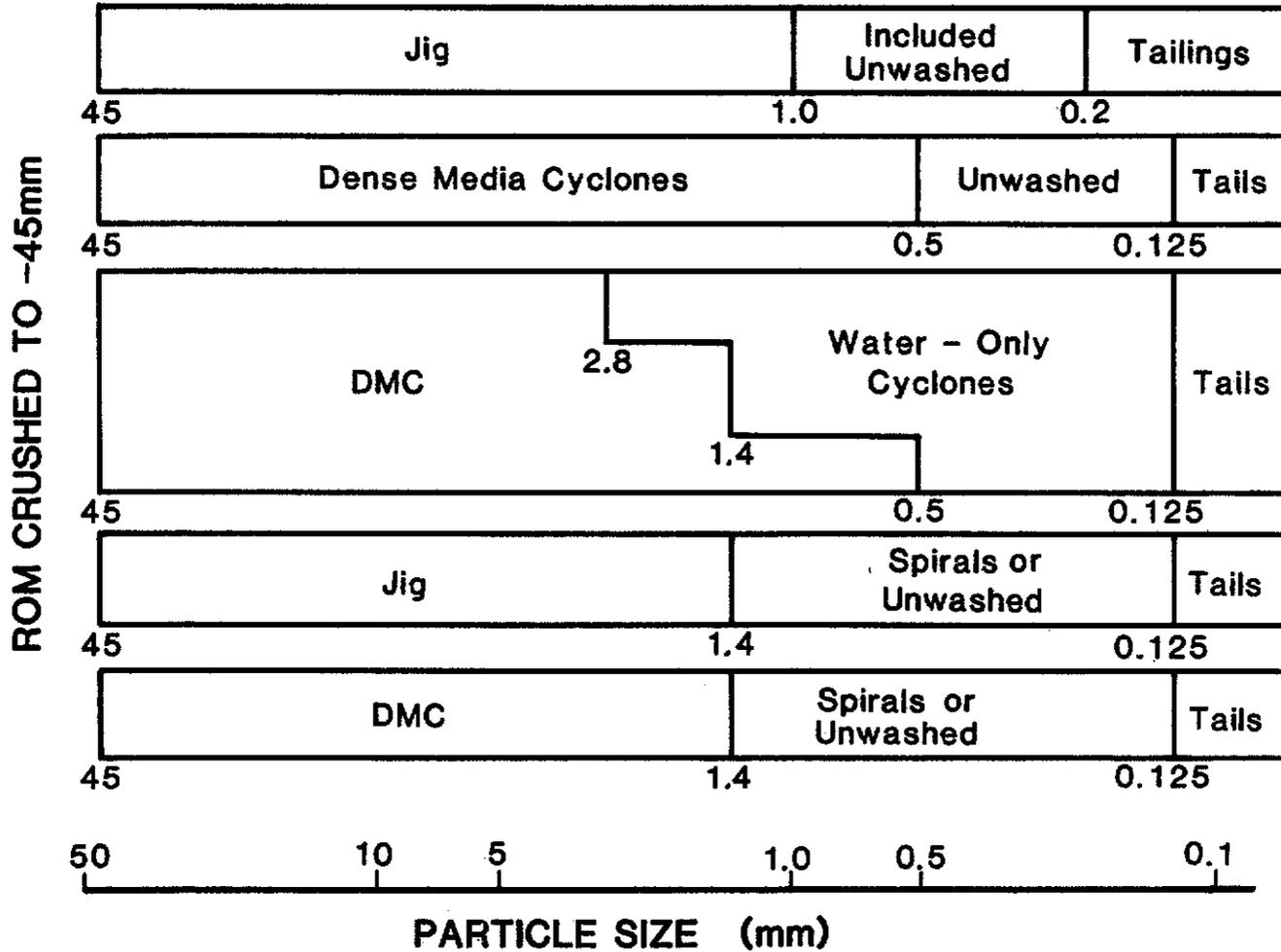
Tailings disposal by this method entails a high capital cost and alternative methods of treating tailings are still being investigated.

7.0 MANNING AND SUPERVISION

At full production the mine will have 215 employees on site, comprising 20 salaried staff and 195 wages employees. Staff provisions are limited to those involved in the operation of the mine, marketing, purchasing support, finance and auditing being off site functions.

Operational manning and supervision requirements have been estimated from experience with other comparable underground mines, and fully satisfy all statutory requirements. An overall provision of 5% to cover absenteeism reflects the existing stable industrial climate in the region.

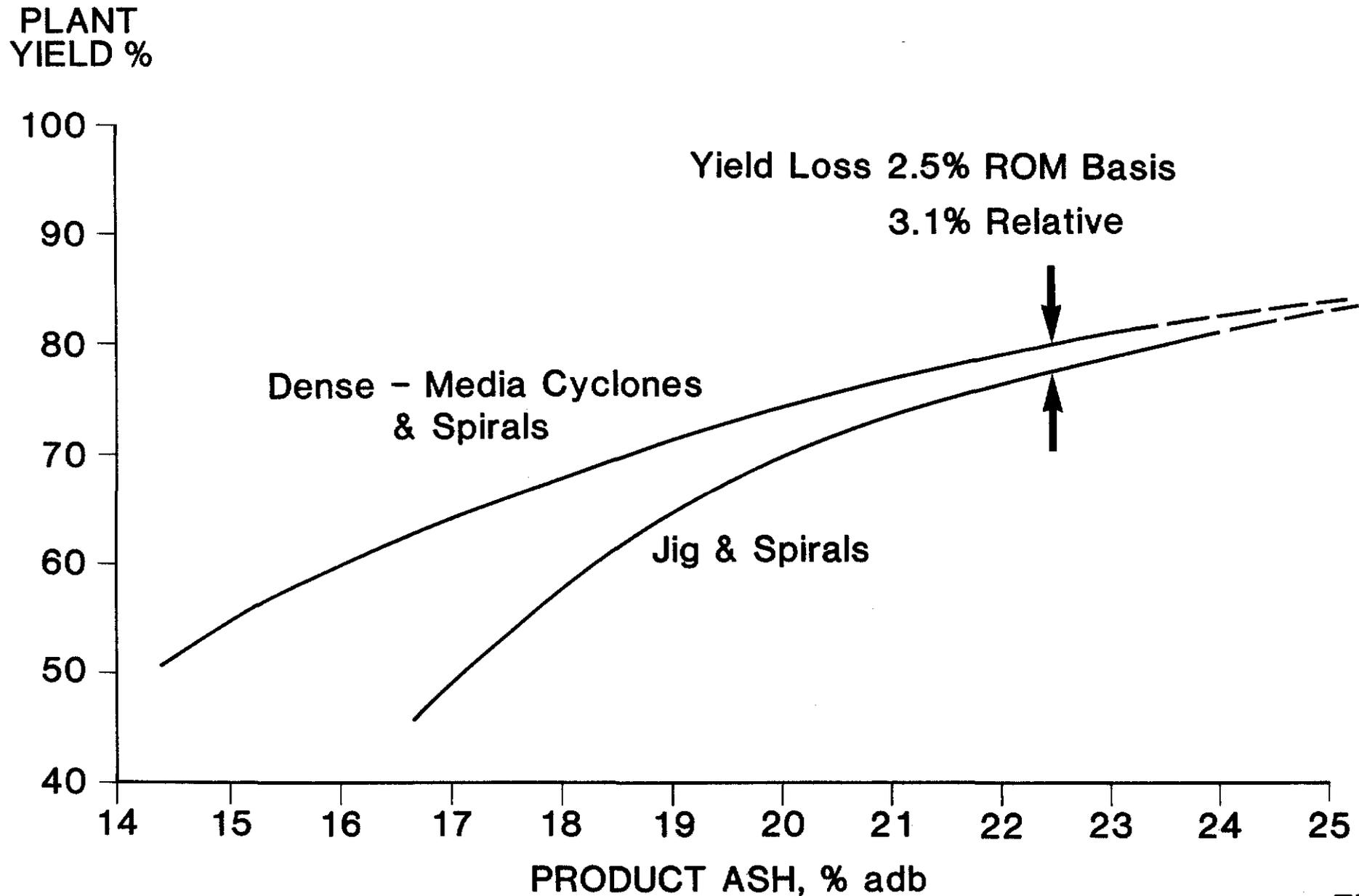
MT NICHOLAS COAL PREPARATION MAJOR PROCESS OPTIONS EVALUATED



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Fig. 6

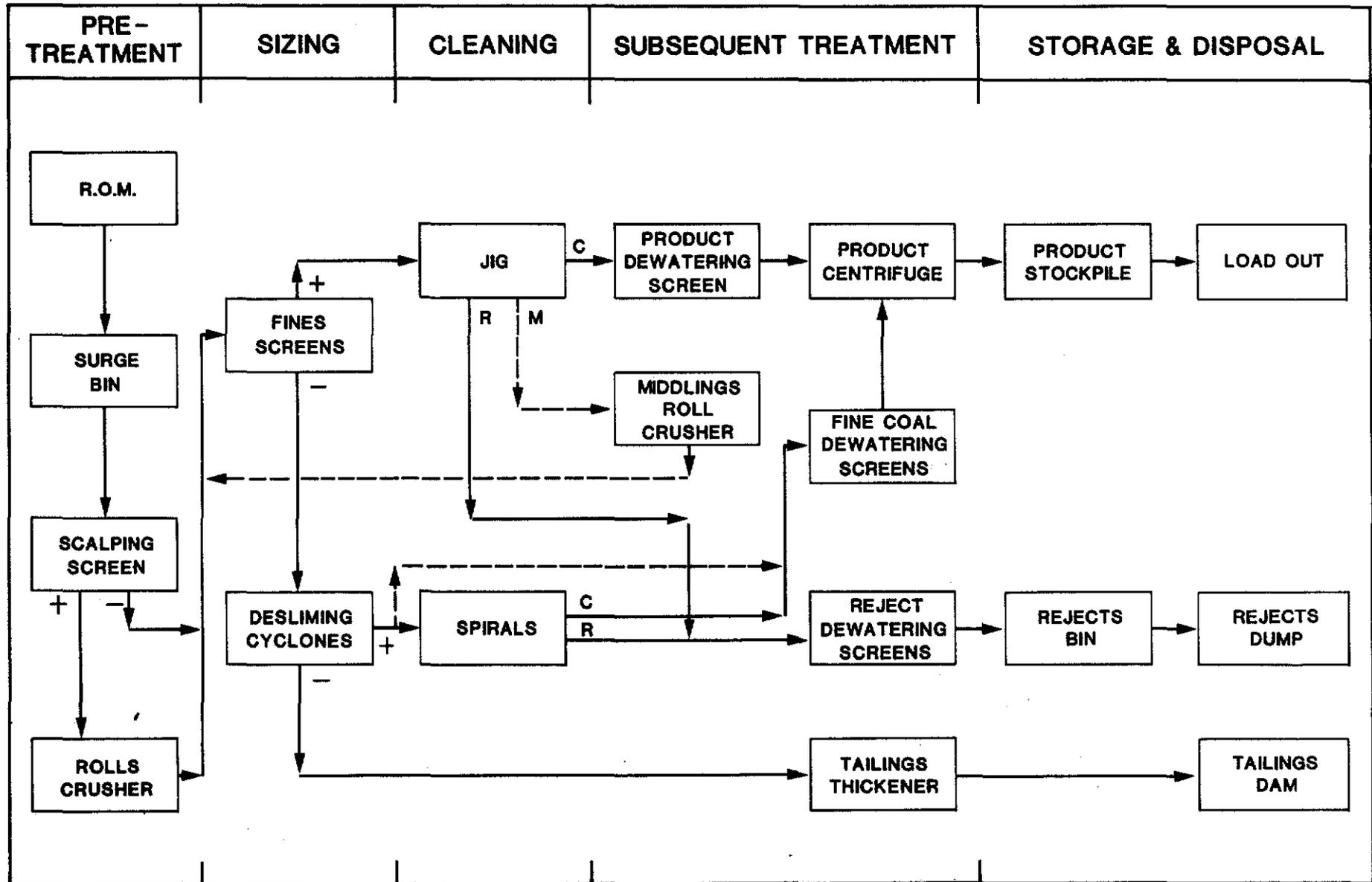
MT. NICHOLAS COAL PREPARATION OPTIONS PREDICTED YIELD/ASH CURVES



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Fig. 6A

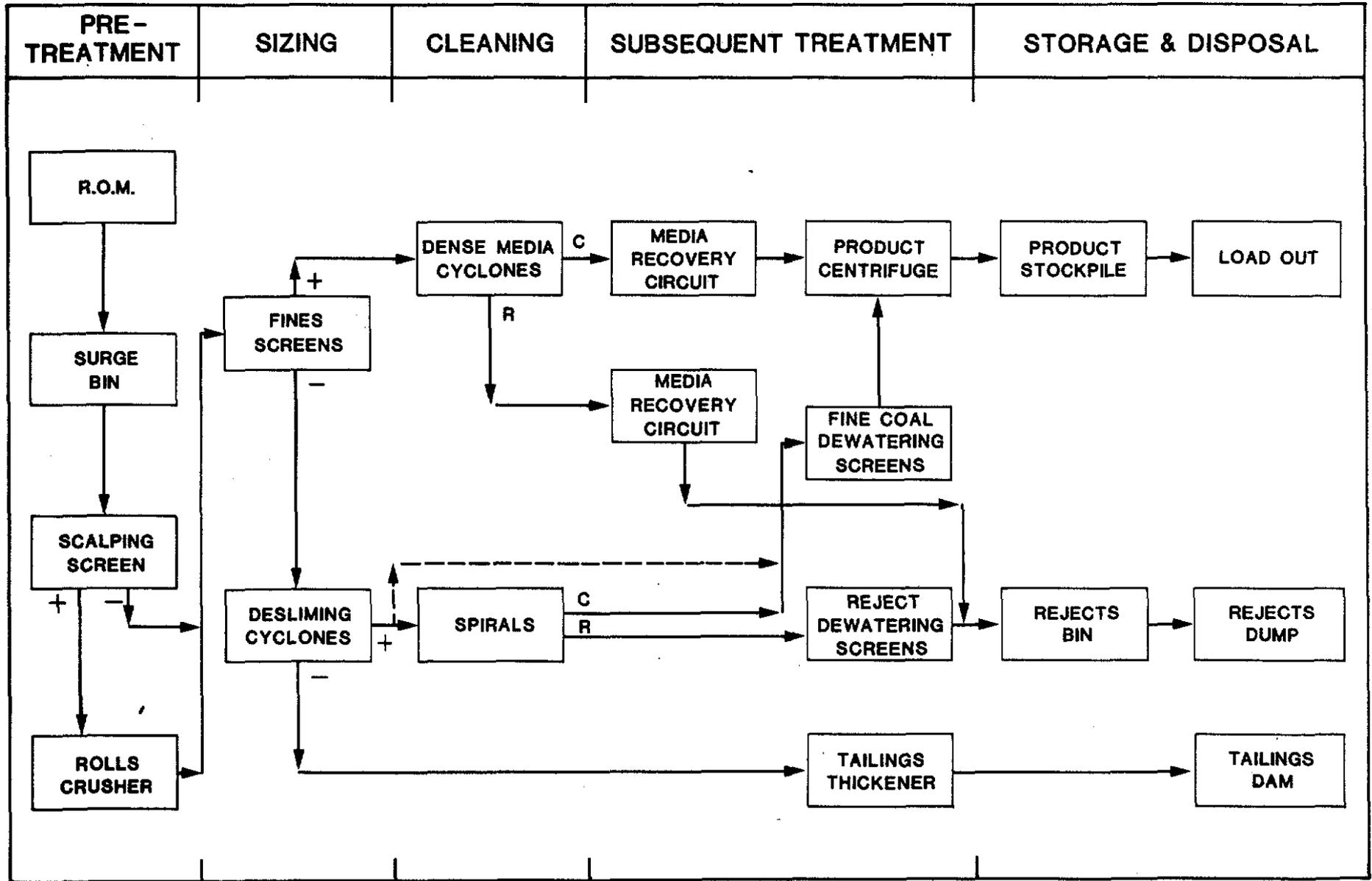
SCHEMATIC COAL PREPARATION FLOW CHART - JIG OPTION



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Fig.6B

SCHEMATIC COAL PREPARATION FLOW CHART - DMC OPTION



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Fig.6C