

EIS 624

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Environmental impact statement for the mining and
beneficiation of magnetite at Tallawang, N.S.W.



ENVIRONMENTAL GEOLOGY SUBSECTION
GEOLOGICAL SURVEY OF N.S.W.

GARMARK PTY LIMITED

ENVIRONMENTAL IMPACT STATEMENT
FOR THE MINING AND BENEFICATION OF
MAGNETITE AT TALLAWANG, N.S.W.

DRAFT

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MINERALS AND PETROLEUM
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March, 1985

*Graham could you please
return comments by Thurs
28/3/85*

D. C. Green

EIS
624

FORM 4

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979 9 SECTION 77 (3)(d)
ENVIRONMENTAL IMPACT STATEMENT

This statement has been prepared on behalf of Garmark Pty Ltd being the applicant making the development application referred to below.

The statement accompanies the development application made in respect of the development described as follows:-

The open cut mining and beneficiation of magnetite.

The development application relates to the land described as follows:-

COUNTY : BLIGH

Parish : Tallawang

Portions : 1 Rem, 17, 63, 82, 94, 95 and 173

Parish : Goodiman

Portions : 173 and 182

The contents of this statement, as required by Clause 34 of the Environmental Planning and Assessment Regulation, 1980, are set forth in the accompanying pages.

| | |
|--|--|
| Name, Qualifications and Address of person who prepared Environmental Impact Statement Certificate | R.W. Corkery, B.Sc.,M.Appl.Sc., P.O. Box 80, ORANGE. NSW. 2800 |
|--|--|

I, Robert William Corkery of P.O. Box 80, ORANGE, NSW hereby certify that I have prepared the contents of this Statement in accordance with clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

.....
Signature

.....
Date

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SUMMARY

THE PROPOSAL

Garmark Pty. Limited, a subsidiary of Lydgate Holdings Limited, proposes to develop and operate a magnetite (iron ore) mine at Tallawang, 18 km north of Gulgong. The magnetite, once mined, will be crushed and ground for use as a dense medium in the State's coal washeries. Magnetite in a water slurry is a very effective means for separating high grade coal from low grade and non-coal fractions.

The Company has applied for two mining leases to undertake the mining operations and a mining purposes lease to erect and operate a beneficiation plant and associated activities.

The magnetite ore body is approximately 1.2 km long and up to 11 m wide. Exploration to date has defined approximately 1.5 million tonnes of low to high grade magnetite in the probable and proven category at the northern and southern end of the ore body. The Company expects to delineate further ore in the intermediate area.

Mining will be undertaken initially by open cut methods and at a later stage by underground methods. The Company proposes to commence mining in the north in the vicinity of an existing quarry (first mined in 1901) and gradually move southwards to the southern limit of the ore body. Once all the ore suited to open cut mining is removed, the Company will develop an underground mine close to the final open cut to mine the remaining economic ore.

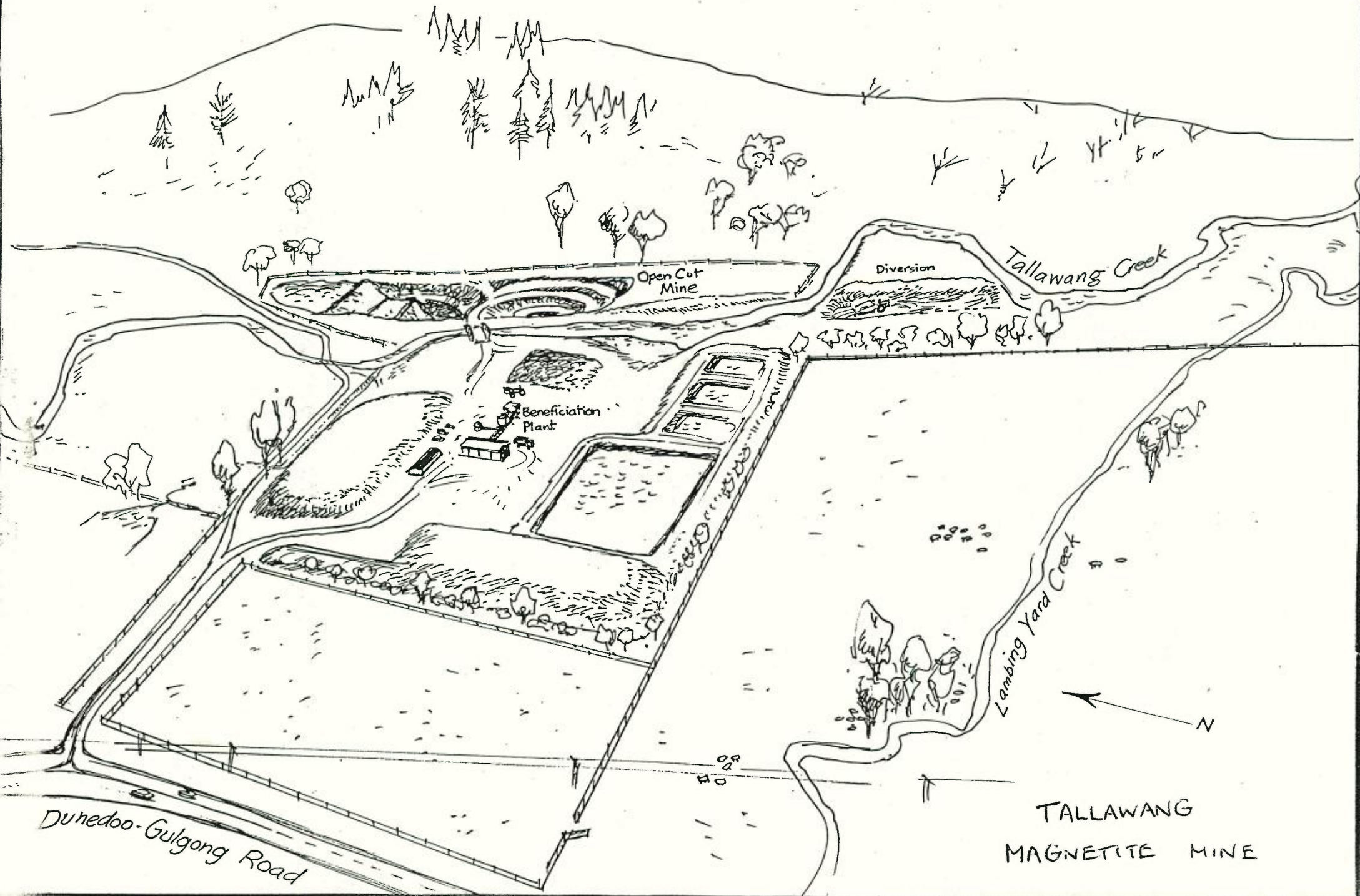
Ore won from the mine will be transported to the nearby beneficiation plant and either placed in a stockpile or fed directly into the plant. The beneficiation or upgrading of the ore will be a simple process involving crushing, grinding and magnetitic separation of the magnetite. Mining will be undertaken using conventional open cut methods involving

drilling and blasting with up to for 12 m benches. Overburden will be initially placed around the beneficiation plant to provide an audio-visual screen, and subsequently in the worked out section of the open cut. In order to effectively mine the magnetite ore body the Company will construct two creek diversions and a levee bank to prevent Tallawang Creek from inundating the open cut mine. The levee will be constructed from the alluvial clays to be extracted during the construction of the diversions. Surplus alluvial material will be used in rehabilitation of the mine site.

The open cut mining will be undertaken either by the Company on a limited continuous basis throughout the year or by a contractor in a number of regular campaigns throughout the year. Mining will be undertaken Monday to Saturday between 7.00 am. and 6.00 pm. The ore reserves and projected rate of mining (up to 100,000 tonnes per year) suggests a mine life of approximately 20 years.

The beneficiation of the magnetite will involve primary and secondary crushing (located outside the main plant building), and grinding and magnetic separation (within the main plant building). The ground magnetite will be stored in a damp state within the main plant building. The non-magnetic or low magnetic component separated from the product will be pumped in a slurry form initially to a tailings dam near the plant and in the longer term back to dams established within the worked out section of the open cut. The plant water will be obtained from the recirculation of water from the tailings dam, with makeup from the water within the open cut and if required creek water or bore water. The plant will be operated with approximately 1,000 KVA supplied by Ulan County Council.

The beneficiation plant will operate Monday to Friday and commence with two shifts (6.00 am - 2.00 pm and 2.00 pm to 10.00 pm) and eventually proceed to three shifts. The crushing component will only operate between 7.00 am and 6.00 pm. All activities between 6.00 pm and 7.00 am will be within the plant building.



Open Cut Mine

Beneficiation Plant

Diversion

Tallawang Creek

Lambing Yard Creek

Dunedoo-Gulgong Road



TALLAWANG
MAGNETITE MINE

The Company proposes to transport the magnetite to its customers in 20 to 25 tonne trucks at an average rate of 8 trucks per day between the hours of 7.00 am. and 6.00 pm Monday to Friday. It is possible that as many as 10 trucks could be depatched daily to satisfy market requirements.

The Company will employ up to ten workers plus contractors during the construction phase and a total of 21 permanent workers for the mining, beneficiation and transportation of the magnetite.

Site rehabilitation will involve the backfilling of the open cut mine areas to pre-mining levels with a dam (similar in size to the existing quarry) at the southern end of the mine area. Mullock stockpiles and dams in the vicinity of the plant will remain. All areas left will be grassed and trees and shrubs established.

CONSTRAINTS IMPOSED BY THE LOCAL ENVIRONMENT

The following constraints have been identified for which design and operational safeguards have been developed.

- Drainage: The mine development will be intimately involved with the nature and flow pattern of Tallawang Creek and its flood plain. Local drainage phenomena will also need to be planned for.
- Soils: Soils on the hillslopes are susceptible to erosion. Alluvial soils are moderately fertile.
- Rainfall: Highest average rainfall occurs during the summer months, with the least in Autumn.
- Winds: The prevailing winds throughout the year are from the southeast with winds from the northwest - southwest quadrant more prevalent during winter and spring.

- Water Resources:** Tallawang Creek and Lambing Yard Creek are a source of stock water. Gulgong's water supply is pumped from Wialdra Creek approximately 11 km downstream of the proposed development.
- Noise Levels:** Background noise levels are typical of rural areas - 29 to 34 dB(A) during the day and 23 to 27 dB(A) at night.
- Flora:** Approximately 60 trees occur within the area to be mined.
- Nearby** Eighteen residences occur within 2.9 km of the proposed mine area. The closest residence (currently unoccupied) is 0.55 km from the site of the beneficiation plant.
- Land Use:** The development will be located amongst rural land used for cropping and grazing merinos, herefords and horses.
- Aboriginal:** Four open scatters of artefacts are located in areas to be disturbed. Three other sites within the lease applications will not be disturbed.
- Visibility:** The development site is visible from the Dunedoo/Gulgong Road and nearby residences.
- Road Network:** The local road network has average to good pavements with daily traffic flows between 700 and 990 vehicles.

IMPACTS

The following impacts are predicated as a result of the development and operation of the Company's project.

Air Pollution: Impacts will be negligible since the Company will adopt measures such as road sealing (access road), road watering and crushed rock cover (haul roads), water sprays (on crushers).

Water The Company's project will not decrease water quality as all contaminated water (suspended solids only) will be placed either in the tailings dam or sedimentation dam prior to discharge (if required).

Drainage: The diversions, levee and local drainage controls will ensure that the development will not adversely affect the efficiency/operation of the local drainage system.

Soils: The stockpiling of soil, use in slope stabilisation and progressive rehabilitation will ensure the soil resources are prudently used and conserved.

Noise Aspects: The Company's project will result in local noise levels being increased. These increases will be kept within limits specified by the State Pollution Control Commission principally through a wide range of design and operational safeguards.

Archaeological The project will destroy four sites, however, the sites have been well documented.

Visual Aspects: The visual impact of the beneficiation will be minimised by grassed mullock stockpiles and trees and shrubs. Buildings will have a green hue. Mining activities will be partly visible in the short term but tree screening and mining on lower levels will reduce long term impacts.

Water Resources: The development will have negligible impact on water flows even when pumping creek water for plant use. Supplies of water for the landowner will be provided in the event that the Company adopts the option to divert Tallawang creek into Lambing Yard Creek. There will be no impact on Gulgong's water supply. The Company's activities will have no effect on local bores.

Nearby The nearby landowners will become aware of the Company's project through its visibility, local increases in noise levels, and local increases in traffic levels. The changes will, however, be kept within acceptable levels to ensure nearby landowners are not adversely affected by the change in land use

Gulgong The Gulgong district will benefit from the provision of approximately 12 jobs for local persons and the injection of wages and Company spending in the local community.

Transportation The traffic on local roads will be increased by up to 10 per cent. The upgraded intersection between the site access road and the Dunedoo - Gulgong Road will ensure safe conditions for all traffic.

CONCLUSIONS

The Company's project will become the only source of magnetite within New South Wales supplying the State's coal washeries. The nature and occurrence of the magnetite in its location at Tallawang has necessitated that the Company incorporate a number of design and operational safeguards in their project. Once implemented these safeguards will ensure that the impact of the Company's project on the local environment will be minimized to an acceptable level.

SECTION 1

INTRODUCTION

1.1 SCOPE

This Environmental Impact Statement has been prepared by R.W. Corkery and Co. Pty. Limited to support a Development Application by Garmark Pty Limited to the Mudgee Shire Council. The proponent, hereafter referred to as "the Company", proposes to mine magnetite at Tallawang initially by open cut methods and later by underground methods and beneficiate the magnetite on site. The Company has applied for two Mining Leases and a Mining Purposes Lease through the Department of Mineral Resources. Obtaining Development Consent is a pre-requisite before these leases can be granted. Mining within a Mining Lease is a designated development within Schedule 3 (Part m) of the Environmental Planning and Assessment Regulation, 1980.

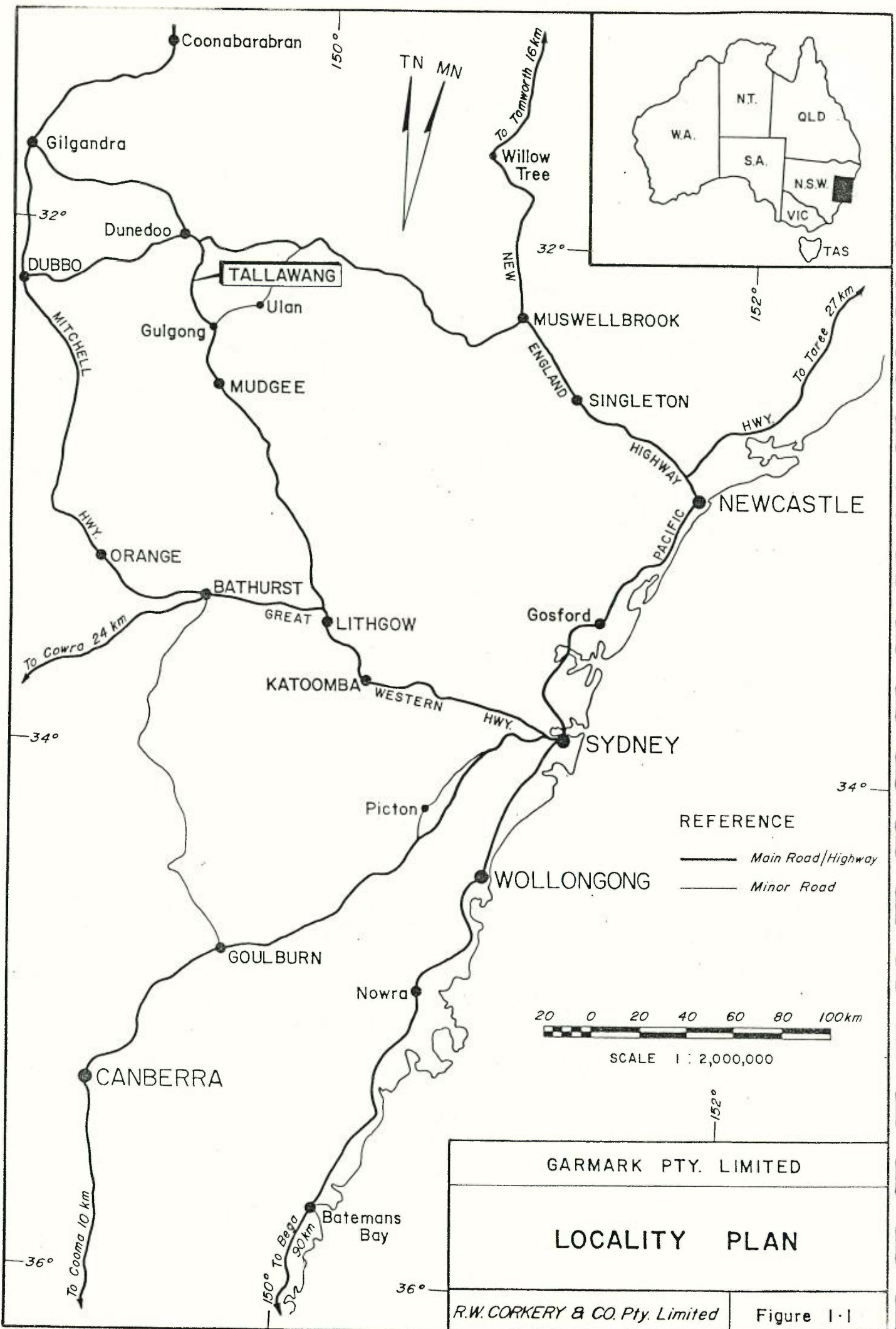
This Statement will also serve as a basis for applications to the State Pollution Control Commission for licences and approvals required to operate the mine and beneficiation plant, and the Water Resources Commission for a licence for changing the course of Tallawang Creek.

Figure 1.1 shows Tallawang is approximately 18 km north-northwest of Gulgong and 75 km east of Dubbo.

The Mining Leases sought are located on Crown and private land within the Parishes of Tallawang and Goodiman in the County of Bligh.

1.2 BACKGROUND OF PROPOSAL

Garmark Pty Limited holds two Exploration Licences (E.L. 1786 and E.L.2175) north of Gulgong.



During the exploration programme within E.L. 1786, the magnetite ore body at Tallawang was detected using an airborne magnetometer which indicated two magnetic anomalous zones. Subsequent ground magnetic survey work on the anomalous zones delineated further ore around and to the south of the existing quarry.

The southern portion of the ore body was subsequently drilled by rotary percussion and diamond drilling. Laboratory work on cuttings and core from the drilling indicated that the material, once beneficiated, would be of suitable quality for use as a dense media in coal preparation. Surface mapping and sampling was undertaken around existing quarry to show the occurrence of further ore available for mining.

Reserve estimates and further laboratory work indicated that sufficient ore had been delineated (upon which to base a mine and beneficiation plant) for the Company to proceed with their applications for Mining Leases and a Mining Purposes Lease.

1.3 THE PROPONENT

Garmark Pty Limited is a subsidiary of the holding company Lydgate Holdings Limited. Since Garmark Pty Limited was established in February, 1981 it has acquired the following projects :-

- (i) The Springs Sand and Soil Supply Pty Ltd at Elderslie (64 km southwest of Sydney) - June, 1981. This Company is the dominant supplier of mortar/building sand in the Liverpool, Campbelltown and Camden districts.
- (ii) Tallawang Magnetite Deposit. This deposit is the subject of this Statement. Details of the Company's involvement to date is presented in Section 1.2.
- (iii) Stafford Sand and Gravel near Bowral - December, 1984. This Company produces specialised washed sands and gravels at Kangaloon and Burrawang approximately 15 km west of Bowral.

GARMARK PTY. LIMITED

DUNEDOO

Leadville

TN MN

UARBRY

GWABEGAR

Talbragar

ROAD To Uarbry 27 km

Merotherie

River

REFERENCE

- Main Road
- - - Minor Road
- + + + Railway
- ~ ~ ~ Creek
- ▭ Lease Applications

SCALE



GOODMAN STATE FOREST

WALLERAWANG

Tallawang

Creek

MEROTHERIE

RAILWAY

Creek

COPE STATE FOREST

To Ulan 5 km

Wialdra

GULGONG

LOCAL SETTING

To Wellington 41 km

R.W. CORKERY & CO. Pty. Limited

To Mudgee 22 km

To Mudgee 24 km

Figure 1.2

1.4 HISTORY OF MINING AT TALLAWANG

The existence of a magnetite ore body at Tallawang was first documented by Wilkinson in 1886. The high grade of the ore was referred to by Jaquet in 1901, the year Messrs G. & C. Hoskins commenced the commercial open cut extraction of the magnetite. The magnetite was mined for 27 years during which the ore was transported to Lithgow where it was mixed with ore from Cadia and Carcoar. It was then smelted for the production of iron. A private rail line 3 km long joined the mine and the Mudgee rail line.

Mining ceased once the Lithgow smelting works closed down. During the period 1901 - 1927 approximately 510,000 tons of ore was produced.

Rayner (1956) noted that the mine remained idle for a number of years and became infilled with water. During the second world war, a small amount of magnetite was selectively mined from the walls of the mine using a punt. This material was used in radio equipment.

In 1951, Australian Magnetite Pty Ltd re-opened the mine first by dewatering followed by limited ore extraction. During the period 1951 to 1955, when operations again ceased, the Company had mined 5,926 tonnes of ore which produced 3,787 tonnes of magnetite (64 per cent recovery).

No mining has taken place since 1955 and the mine again filled with water.

Elcom Collieries Pty. Ltd. obtained three Mining Leases over the existing quarry in April, 1962, however, they have undertaken no mining since the leases were granted and renewed. These leases are in the process of being acquired by Garmark.

1.5 MAGNETITE - ITS PROPERTIES AND USES

Magnetite is an oxide of iron (Fe_3O_4) and is an ore of the metal, iron.

The major use of magnetite is as a blast furnace feed for the production of metallic iron. The deposit at Tallawang is too small for use as a raw material in a modern large scale iron and steel plant.

The magnetite from Tallawang will be put to other uses the most important of which will be as a dense medium for coal washing purposes. Magnetite, when finely ground to 90 per cent less than 50 microns (0.050 mm), and dispersed in water, forms a slurry with density greater than water, this is known as a dense medium. Density can be adjusted by altering the magnetite content in the slurry.

A dense medium is used in coal washing to separate clean coal from rock and high ash coal. The density of the medium is adjusted to the point where separation is desired. The clean coal floats while stone and high ash coal waste sinks. Both the coal and waste are washed free of the dense medium and the magnetite recovered for re-use. For every tonne of coal washed, approximately 0.5 kg of magnetite is lost, which has to be compensated for with the addition of new magnetite.

Minerals other than magnetite can be used to make a dense medium, however, magnetite is most suitable due to its:

- (i) High density
- (ii) Magnetic properties assist with recovery, as well as dispersion in the dense media
- (iii) Non reactivity, and
- (iv) Low cost relative to alternatives.

Minor uses of Tallawang magnetite may include its use as a flux, pigment and for colouring purposes in a number of industries, but these outlets will be small compared to coal washing purposes.



Plate 1

Northeasterly view from the Bulgong/Dunedoo Road to the existing quarry and proposed mine site.



Plate 2

view of the existing quarry from its northern end.

1.6 EXISTING AND PROPOSED MARKETS

1.6.1 Existing Markets

The present market for magnetite in N.S.W. is approximately 37,000 tonnes per year. This magnetite is used exclusively as a dense media agent in washing coal. Hence, magnetite milled to the right specifications is essential in the preparation of coal for the N.S.W./Australia export coal industry. In N.S.W., approximately one third of the total magnetite usage is used by the central and south coast collieries whilst approximately two thirds is used by collieries in the Hunter Valley.

In Australia over the last decade, the magnetite requirements of the coal industry, principally in Queensland and N.S.W., have been satisfied by Commercial Minerals Limited, (previously Steetley Industries Limited), a wholly owned overseas company, which currently obtains magnetite from the Savage River deposit in Tasmania and its own mine at Biggenden in Queensland.

1.6.2 Proposed Markets

Although the coal industry is presently experiencing an economic downturn, it is anticipated that the N.S.W. market will increase to at least 45 to 50,000 tonnes per year over the next decade. The Tallawang deposit is ideally situated to supply all N.S.W. markets.

1.7 FORMAT OF STATEMENT

This Environmental Impact Statement has been written in six sections with a set of appendices. The requirements of Clause 34 of the Environmental Planning and Assessment Regulation, 1980, have been incorporated into the most appropriate sections of the Statement. The format is as follows:-

- Section 1 - Introduces the proposal, examines the history of mining at Tallawang, the properties and uses of magnetite and outlines the scope of the Statement.
- Section 2 - Outlines the Company's objectives, the Leases sought and the proposed plans for mining, rehabilitation and beneficiation of the magnetite.
- Section 3 - Describes the existing environment around Tallawang and potential constraints imposed by the existing environment are identified.
- Section 4 - Presents the safeguards which have been incorporated in the mine plan and design of the beneficiation plant to protect the environment in the vicinity of Tallawang.
- Section 5 - Analyses the impact the safeguarded project will have on the environment around Tallawang.
- Section 6 - Justifies the project in terms of environmental, economic and social considerations and examines the consequences of not proceeding with the mine and beneficiation plant.
- Appendices - Present the Energy Statement, a list of birds, baseline stream sediment results and correspondence from the Department of Environment and Planning.

1.3 MANAGEMENT OF THE INVESTIGATIONS

The bulk of investigations and report writing has been undertaken by Robert W. Corkery, B.Sc., M. Appl. Sc., principal of R.W. Corkery and Co. Pty Limited. Fieldwork together with relevant background data and discussions regarding the project with the Mudgee Shire Council were

undertaken between October, 1984 and February, 1985. Discussions were held regularly with Company representatives and their consultants throughout the preparation of the Statement. Assistance with the Statement's preparation was obtained from:-

Mr. Graham Lee of Peter H. Stitt and Associates Pty Ltd - for preparation of geological data, mine plans and plans/information on the beneficiation plant.

The National Herbarium (Sydney) - for the identification of specimens of trees and shrubs collected in areas to be affected by the Company's activities.

Eden Dynamics Pty. Limited - for assessment of acoustical impact of the project.

Rankine and Hill Pty. Limited - for the preparation of hydrological information, safeguards and impacts.

Graham Wade of Pilgrim International Ltd - for the preparation of perspective sketches.

The following authorities were consulted during the preparation of the Environmental Impact Statement. Those marked (*) provided comments on the draft copy of the Statement.

Department of Environment and Planning (Sydney)
 Mudgee Shire Council (Mudgee)*
 Soil Conservation Service (Mudgee)*
 Department of Mineral Resources (Sydney* and Orange*)
 Department of Industrial Relations (Orange)
 Department of Agriculture
 National Parks and Wildlife Service (Sydney)
 State Pollution Control Commission (Bathurst)*
 Water Resources Commission (Sydney)*
 Department of Main Roads (Sydney and Lithgow*)

SECTION 2

DESCRIPTION OF THE PROJECT

2.1 OUTLINE OF PROPOSAL

The Company proposes to mine the magnetite rich ore body and beneficiate or upgrade the ore to a quality suitable for use as a dense medium in coal washeries.

Mining will be undertaken initially by open cut and at a later stage by underground methods. The Company proposes to commence open cut mining in the vicinity of the existing quarry and gradually move southwards to the southern limit of the ore body. Once all the ore suited to open cut mining is removed, the Company will develop an underground mine close to the final open cut to mine the remaining economic ore.

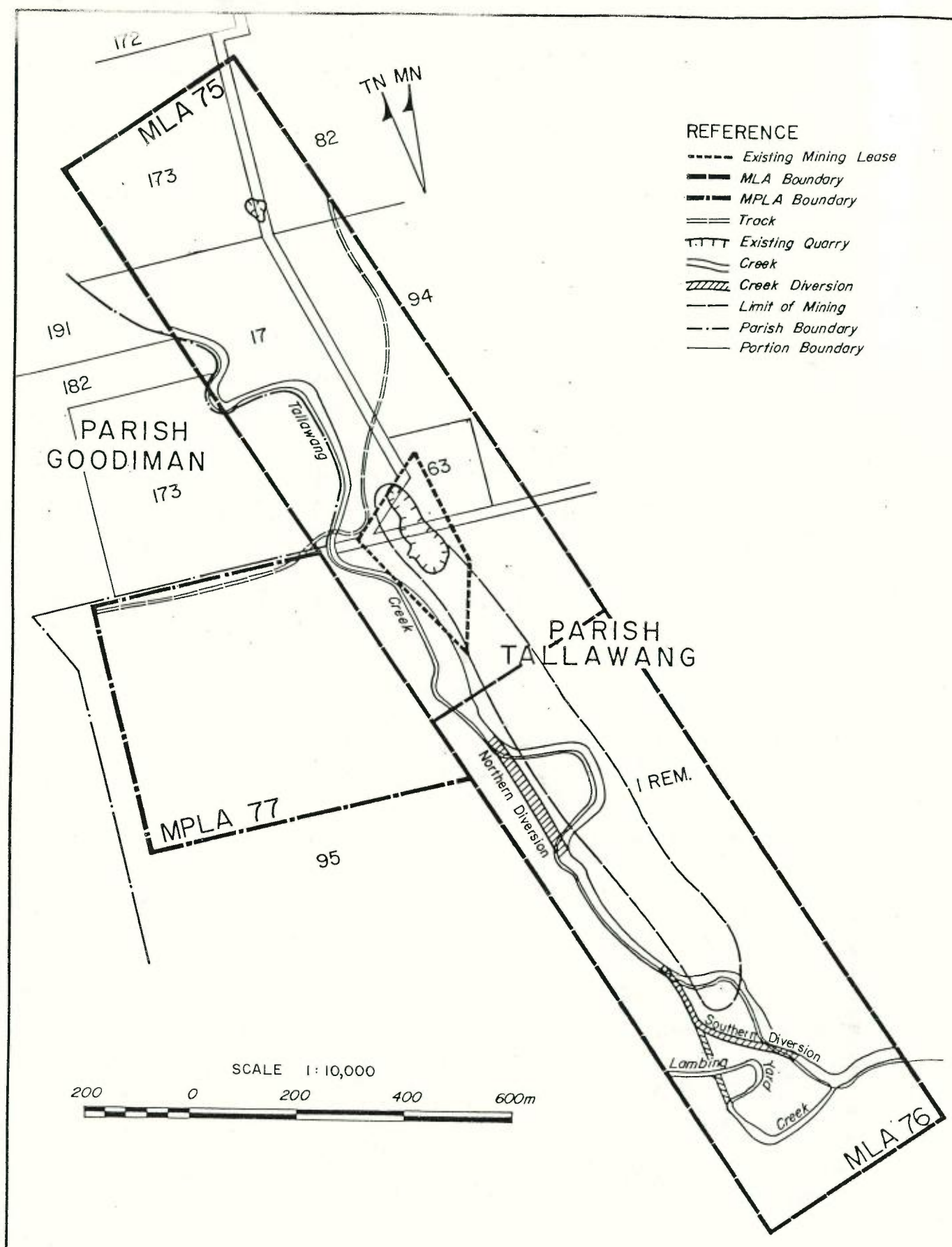
Ore won from the mine will be transported to the nearby beneficiation plant and placed in a stockpile awaiting beneficiation. The beneficiation or upgrading of the ore will be a simple process involving crushing, grinding, and magnetic separation of the magnetite.

Figure 2.1 presents the overall site layout showing the limit of open cut mining, on-site roads, the beneficiation plant and the proposed diversions of Tallawang Creek.

2.2 LEASES SOUGHT

The Company has applied for two Mining Leases (MLA 75 and MLA 76) and a Mining Purposes Lease (MPLA 77). In addition, the Company has purchased the three leases currently held over the existing quarry by Elcom Collieries Pty. Ltd. (PLL 3610 (06); PLL 1093 (24); ML 6023 (06)).

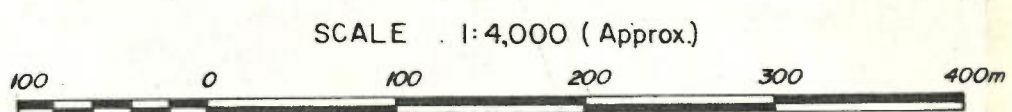
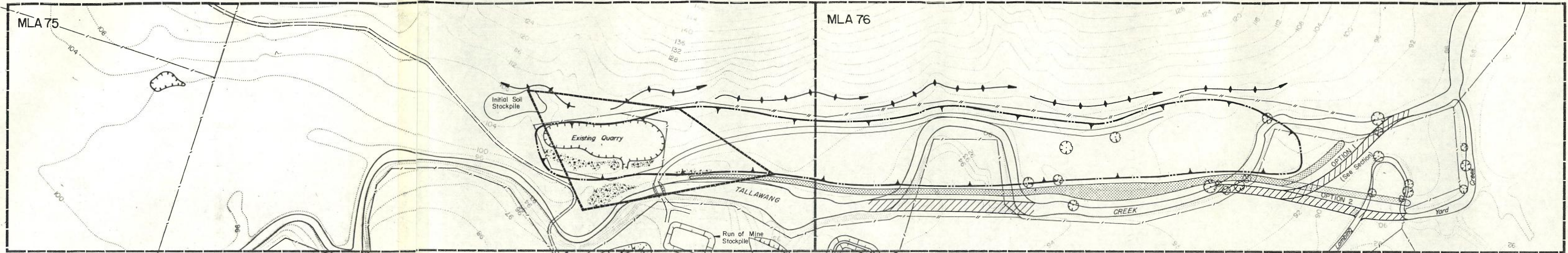
- REFERENCE
- Existing Mining Lease
 - ==== MLA Boundary
 - MPLA Boundary
 - ==== Track
 - ||||| Existing Quarry
 - ~~~~~ Creek
 - ||||| Creek Diversion
 - Limit of Mining
 - Parish Boundary
 - Portion Boundary



SCALE 1:10,000

200 0 200 400 600m

| | |
|---------------------------------|------------|
| GARMARK PTY. LIMITED | |
| LEASE APPLICATIONS | |
| R.W. CORKERY & CO. Pty. Limited | Figure 2-2 |



Contour Interval = 1m west of Tallawang Creek
 Contour Interval = 4m east of Tallawang Creek

To Dunedin 22 km

MPLA 77

To Gulgong 16 km

REFERENCE

- | | |
|---|--|
| <p>--- Existing Mining Lease</p> <p>--- MPLA Boundary</p> <p>--- MLA Boundary</p> <p>EXISTING FEATURES</p> <p>--- Contour</p> <p>--- Track</p> <p>--- Fence</p> <p>--- Power Line</p> <p>--- Telecom Line</p> <p>⊙ Large Tree</p> <p>--- Quarry Face</p> <p>--- Mullock</p> <p>--- Creek</p> | <p>PROPOSED DEVELOPMENT</p> <p>--- Limit of Open Cut</p> <p>--- Levee Bank</p> <p>--- Creek Diversion</p> <p>--- Mullock</p> <p>--- Bund Wall</p> <p>--- Diversion Bank</p> <p>--- Fence</p> <p>--- Haul Road (Built progressively)</p> |
|---|--|

NOTE: Diversion banks and fences will be constructed progressively as required around the advancing quarry.

| | |
|---------------------------------|------------|
| GARMARK PTY. LIMITED | |
| SITE PLAN | |
| R.W. CORKERY & CO. Pty. Limited | Figure 2-1 |

These leases were first granted on the 3rd April, 1962 and have been subsequently renewed to the 3rd April, 2003. The three leases have been amalgamated and are considered essentially as one lease. Figure 2.2. shows the location of all leases and lease applications.

The two Mining Lease Applications (MLA's) follow the strike direction of the magnetite ore body and cover a total of 96 ha (2400 m x 400 m). The leases are sought to enable the Company to mine the magnetite by both open cut and underground methods.

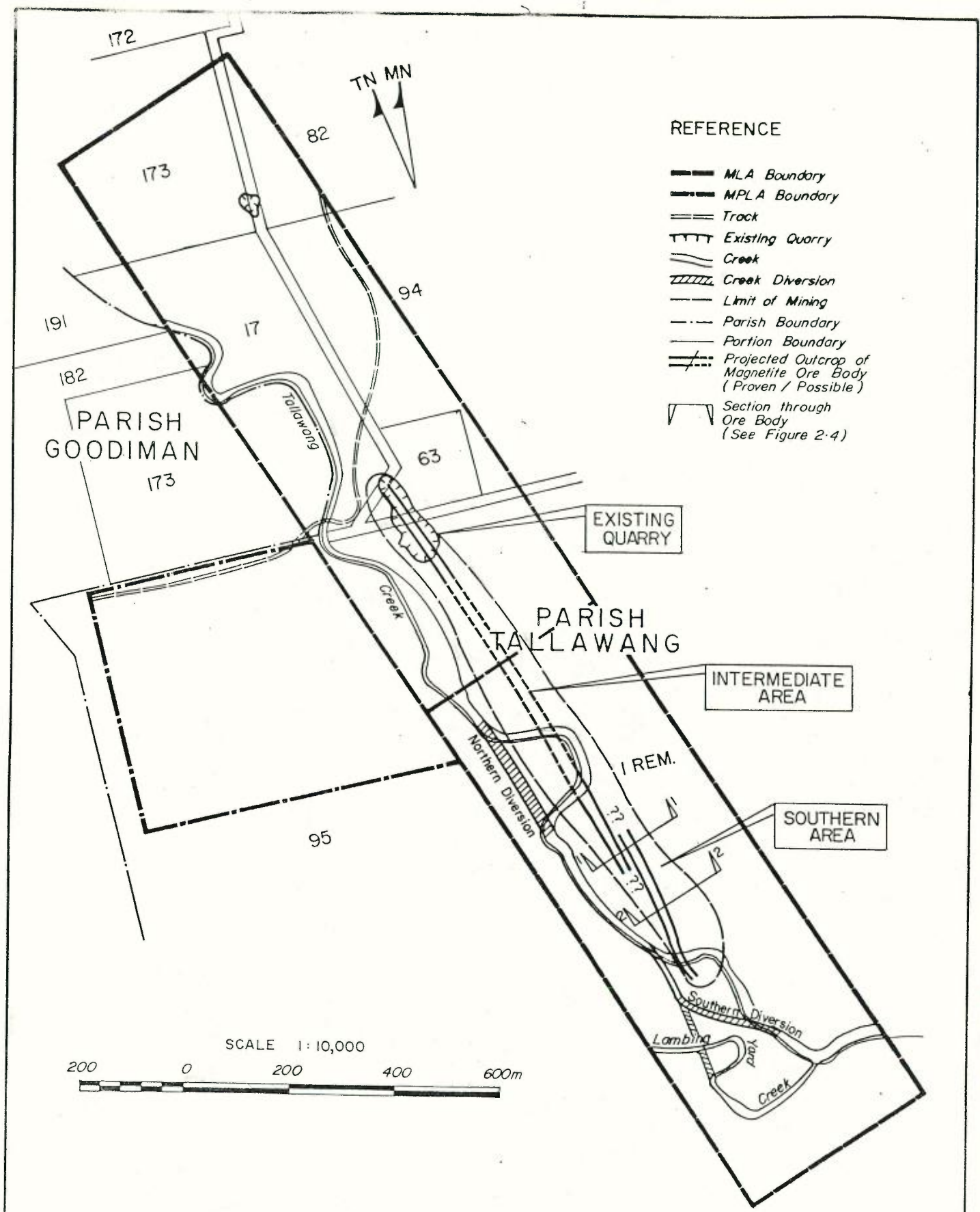
The Mining Purposes Lease Application (MPLA) covers approximately 27 ha and has been lodged to enable the Company to erect their beneficiation plant, water storage dams and preliminary tailings dam.

2.3 THE MAGNETITE ORE BODY

The magnetite occurs as near vertical tabular bodies varying in width from 1.9 to 11.0 m over the length of the mine area. Drilling to date has intersected high and low grade magnetite ore in the southern area of the proposed open cut area shown in Figure 2.3. Similar magnetite grades outcrop in the existing quarry. To date, no drilling has been undertaken in the intermediate area. However, the persistence of an airborne magnetic anomaly along the whole ore body strongly suggests continuity of the magnetite from the existing quarry area to the southern area.

Figure 2.3 shows a plan of the ore body as understood by Lee (1984). The figure shows that there are two tabular ore bodies parallel with each other in the southern area. These are shown in sections in Figure 2.4.

The reserves of magnetite ore have been classified in terms of high and low grade, and proven and probable. High grade ore produces a magnetite yield after beneficiation of greater than 50 per cent whereas low grade ore yields 20 to 50 per cent product.



- REFERENCE
- MLA Boundary
 - - - MPLA Boundary
 - == Track
 - ▤ Existing Quarry
 - ~ Creek
 - ▨ Creek Diversion
 - - - Limit of Mining
 - - - Parish Boundary
 - - - Portion Boundary
 - ▨ Projected Outcrop of Magnetite Ore Body (Proven / Possible)
 - ▤ Section through Ore Body (See Figure 2-4)

SCALE 1:10,000

200 0 200 400 600m

| | |
|---------------------------------|------------|
| GARMARK PTY. LIMITED | |
| THE MAGNETITE ORE BODY | |
| R.W. CORKERY & CO. Pty. Limited | Figure 2-3 |

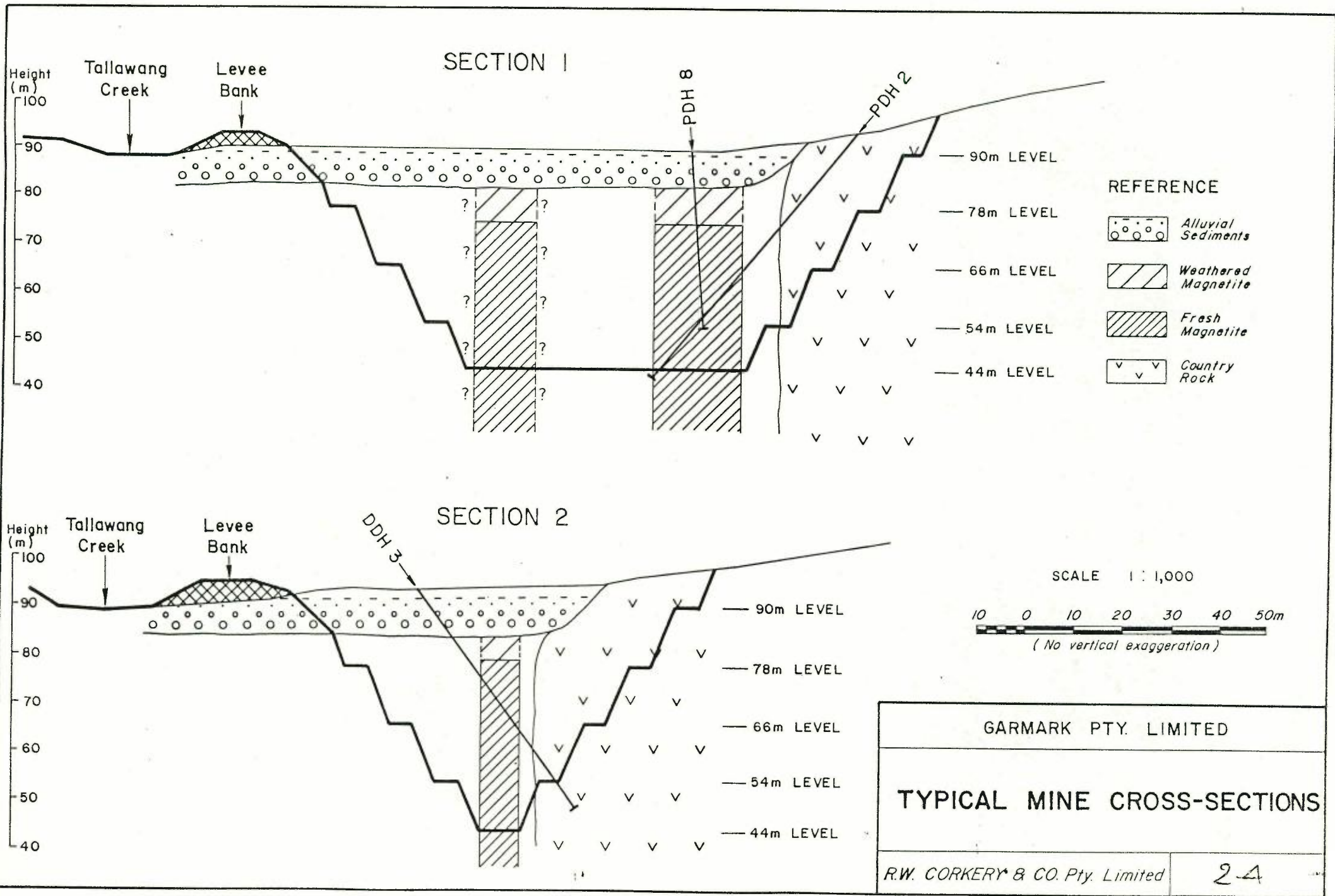
Plate 3

Southeasterly view of existing creek crossing,
and existing quarry.



Plate 4

Southerly view of intermediate area.



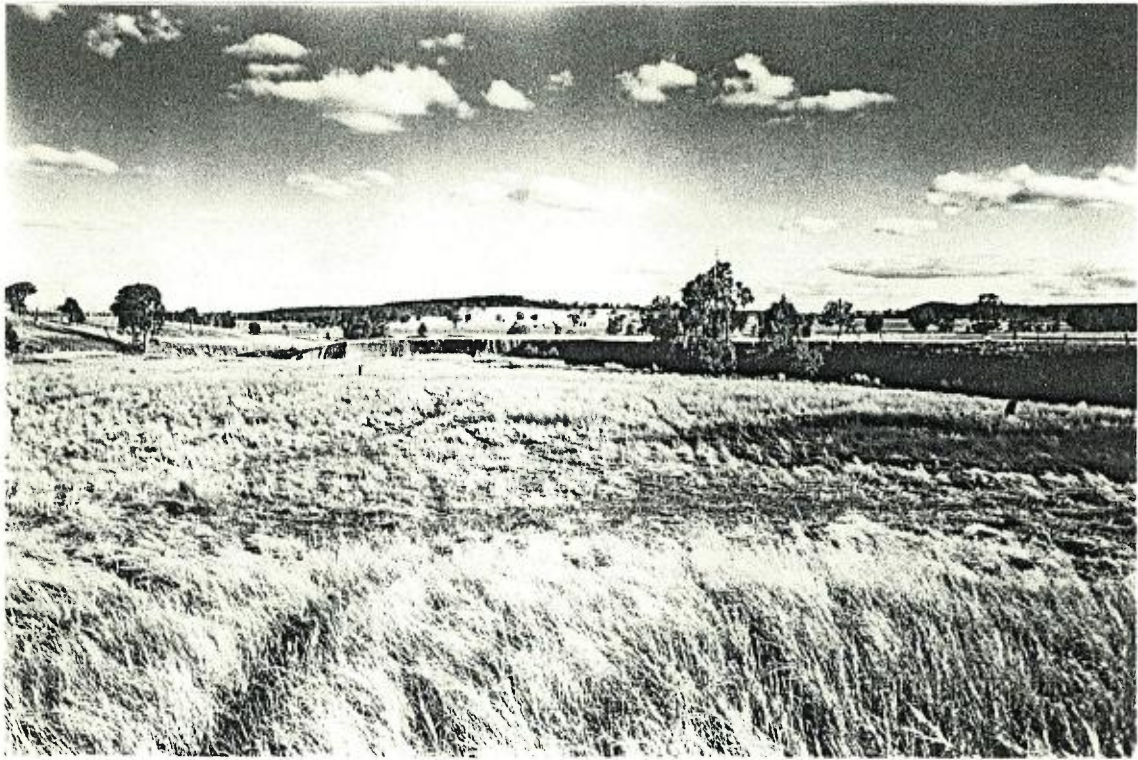


Plate 5 Southerly view of southern area.

Plate 6 Northeasterly view of site for beneficiation plant.

Lee (1984) estimates there is approximately 880,000 tonnes of ore suited to open cut mining and 665,000 tonnes of ore suited to underground mining in the southern areas and around the existing quarry. Details of the reserve estimates are presented in Section 3.3. Further exploration and drilling is expected to substantially increase the reserves.

2.4 MINING ACTIVITIES

2.4.1 Introduction

The Company proposes to mine the magnetite by open cut and underground methods.

Mining will commence in the vicinity of the existing quarry. During stages this period the ore in the intermediate area will be further investigated by drilling and sampling and detailed mine plans will be prepared. If economic ore is proven to exist in the intermediate area mining would then continue southwards from the existing quarry area through the intermediate area to the southern area. In the event that ore in the intermediate area is found to be of too low a grade to warrant mining, the area would be left and mining would re-commence in the southern area.

The Company proposes to undertake the open cut mining using either contractors or their own personnel.

(i) Contractors

Contractors would be engaged to undertake a series of mining campaigns throughout the year. For example, after initial mine development, contractors could undertake mining campaigns for one week every month.

(ii) Company Personnel

After initial mine development, Company personnel would undertake mining at the rate required to maintain a 15,000 tonne stockpile adjacent to the crusher.

Underground mining will be undertaken on a continuous basis and will commence during the final 2 years of open cut mining.

The bulk of this Statement examines the impact of open cut mining principally because it is the method of mining that is proposed for at least the first ten years of operation. Furthermore, the impact from the underground mining will be considerably less and no further surface areas will be disturbed.

2.4.2 Mine Development

The development of the initial mine in the vicinity of the existing quarry will be undertaken in the following manner:

- (i) A creek crossing across Tallawang Creek will be constructed in the position of the existing crossing (See Plate 3). This crossing will be a piped crossing with a gravel surface and will be constructed to a height of approximately 1 m above the existing natural creek crossing.
- (ii) All trees will be removed and placed to one side. After all timber useful in mine development and log firewood is obtained, all remaining timber will be burnt.
- (iii) The area to be mined in Stages 1 and 2 will be fenced.
- (iv) The water in the existing open cut will be pumped into the dams adjacent to the beneficiation plant. Any excess water will be pumped into Tallawang Creek. Water will be pumped through a floating pump into a section of Tallawang Creek with a solid rocky base. Only clear water will be pumped into the dams or creek. As the base of the open cut is approached, the turbid water/sludge expected in the base of the mine will be pumped into the tailings dam.

The remainder of the mining will be as set out below in Section 2.4.3 parts (iii) and (iv).

2.4.3 Open Cut Mining

The open cut mining will be undertaken in the following stages. Note: not all stages are applicable throughout the whole operation.

- (i) Topsoil will be removed where present and stockpiled in specially prepared areas (see Figure 2.1). This will be undertaken by either a scraper or bulldozer.
- (ii) The alluvial sediments will be removed primarily by scraper, and where necessary, by bulldozer and placed in levee banks, and spread as a subsoil layer in the mined out areas.
- (iii) The oxidised ore and waste rock will be removed by drilling and blasting using conventional benched quarry methods. The Company proposes to drill on a daily basis and blast between once and three times a week. The choice of blasting frequency (once, twice or three times per week) will depend on whether the Company undertakes intermittent mining campaigns using mining contractors or undertakes a regular continuous operation using their own personnel. Each blast will fragment approximately 1,000 tonnes of rock or magnetite ore.

The following criteria will be adopted.

| | | | |
|-----------------|---|---------|-------|
| Bench Height | = | 5 m | (max) |
| Bench Width | = | 15 m | (min) |
| Haul Road Width | = | 10 m | (min) |
| Haul Road Grade | = | 1 in 15 | (max) |
| Ramp Grade | = | 1 in 10 | (max) |
| Berm Width | = | 5 m | (min) |

Batters will be designed using geotechnical criteria. From existing exposures they should be capable of standing at greater than 70° from the horizontal.

Broken rock will be loaded into quarry dump trucks using a front end-loader for haulage to:-

- (a) the mullock dumps adjacent to the beneficiation plant or
 - (b) the worked out quarry.
- (iv) The magnetite ore once exposed will be drilled and blasted separately. It will be loaded into dump trucks using a traxcavator or front-end loader and transported to the ore stockpile adjacent to the beneficiation plant or loaded directly into the hopper.
- (v) The quarry will be developed to its maximum depth (approximately 50 m below the surrounding land surface) after which it will be progressively backfilled with mullock and tailings.

Figures 2.5 and 2.6 show the mine development proposed in the vicinity of the existing quarry. Stage 1 represents the initial mining stage when the existing quarry is widened and lowered to its expected full depth. Figure 2.6 shows the southern limit of mining in the vicinity of the existing quarry based on known ore. It is noted that backfilling is well advanced at this stage. Ore won in Stages 1 and 2 will be

transported to the beneficiation plant across the upgraded existing crossing.

Figure 2.7 shows the mine development in the southern area assuming the open cut commences in the area and is not a continuation of mining from the intermediate area. The haul road to the beneficiation plant will be maintained at the 90 m level. It is noted that Figure 2.7 depicts the development at the 66 m level. It is likely that at least one further bench at the 54 m level will be developed as shown in Figure 2.4.

2.4.4 Equipment for Open Cut Mining

The Company proposes to use or engage a contractor to use the following equipment:-

- Air track drill (and compressor)
- Scraper) only to be used
- D-9 Bulldozer) periodically
- Traxcavator or Front-end Loader
- Dump Truck (2)

The air track drill will be used once hard rock is encountered. The scraper and bulldozer will be used for soil removal and site preparation. The traxcavator or front-end loader will load the fragmented rock into the dump trucks for removal from the open cut area.

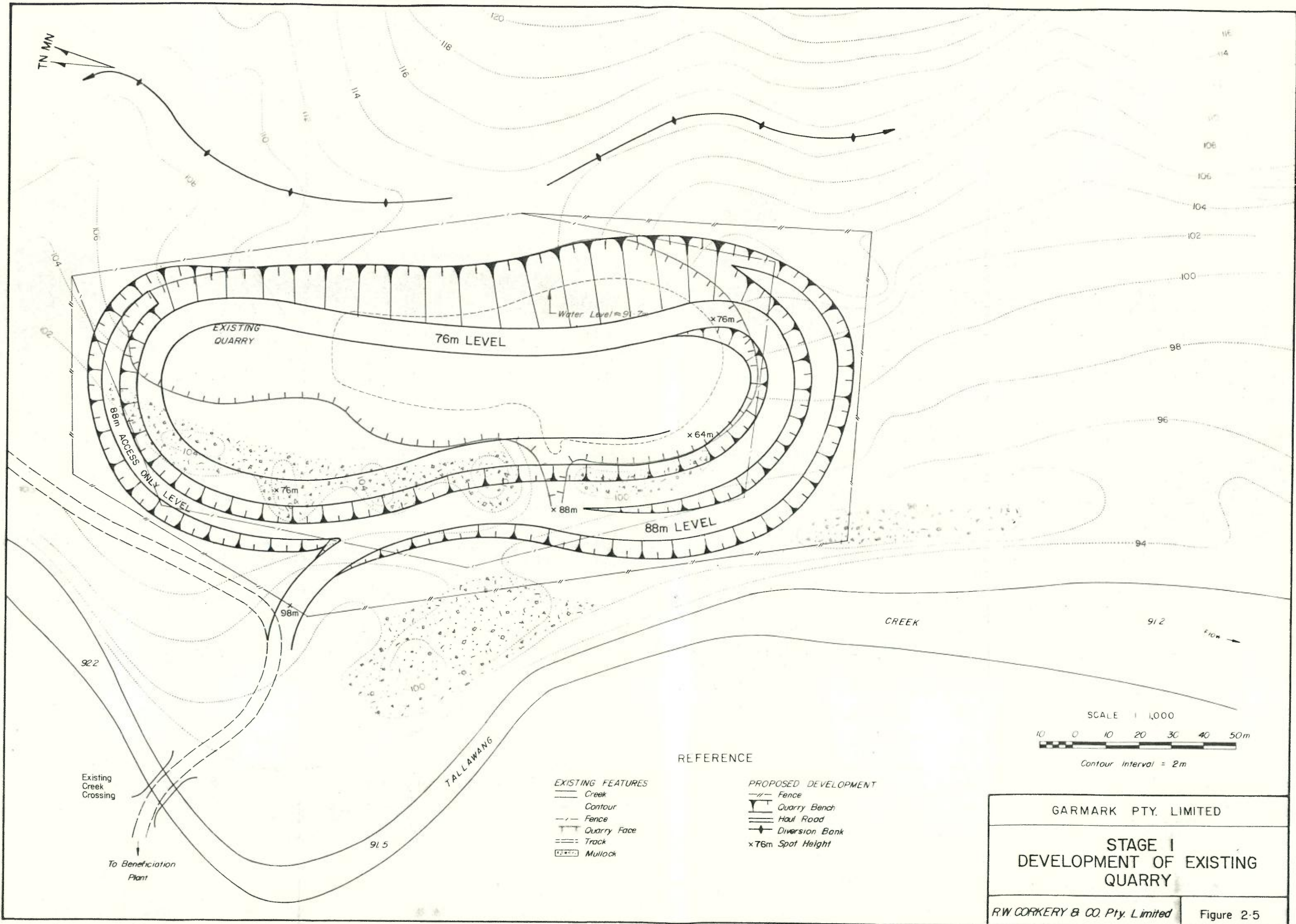
2.4.5 Underground Mining

The Company expects the underground mine will be developed close to the final open cut in the southern area. Ore will be won by conventional underground methods. The mine portal(s) will be developed at approximately the 80 m to 85 m level.

Ore will be brought to the surface where it will be transferred into dump trucks for transportation to the ore stockpile adjacent to the beneficiation plant. The dump trucks will follow the haul road developed for the final open cut.

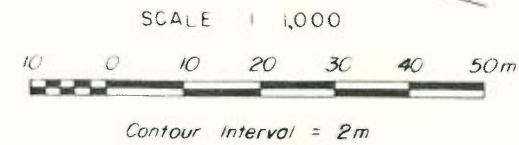
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- EXISTING FEATURES**
- Creek
 - Contour
 - - - Fence
 - ▬ Quarry Face
 - ≡≡≡ Track
 - ▨ Mullock

- PROPOSED DEVELOPMENT**
- - - Fence
 - ▬ Quarry Bench
 - ▬ Haul Road
 - ◆ Diversion Bank
 - x76m Spot Height

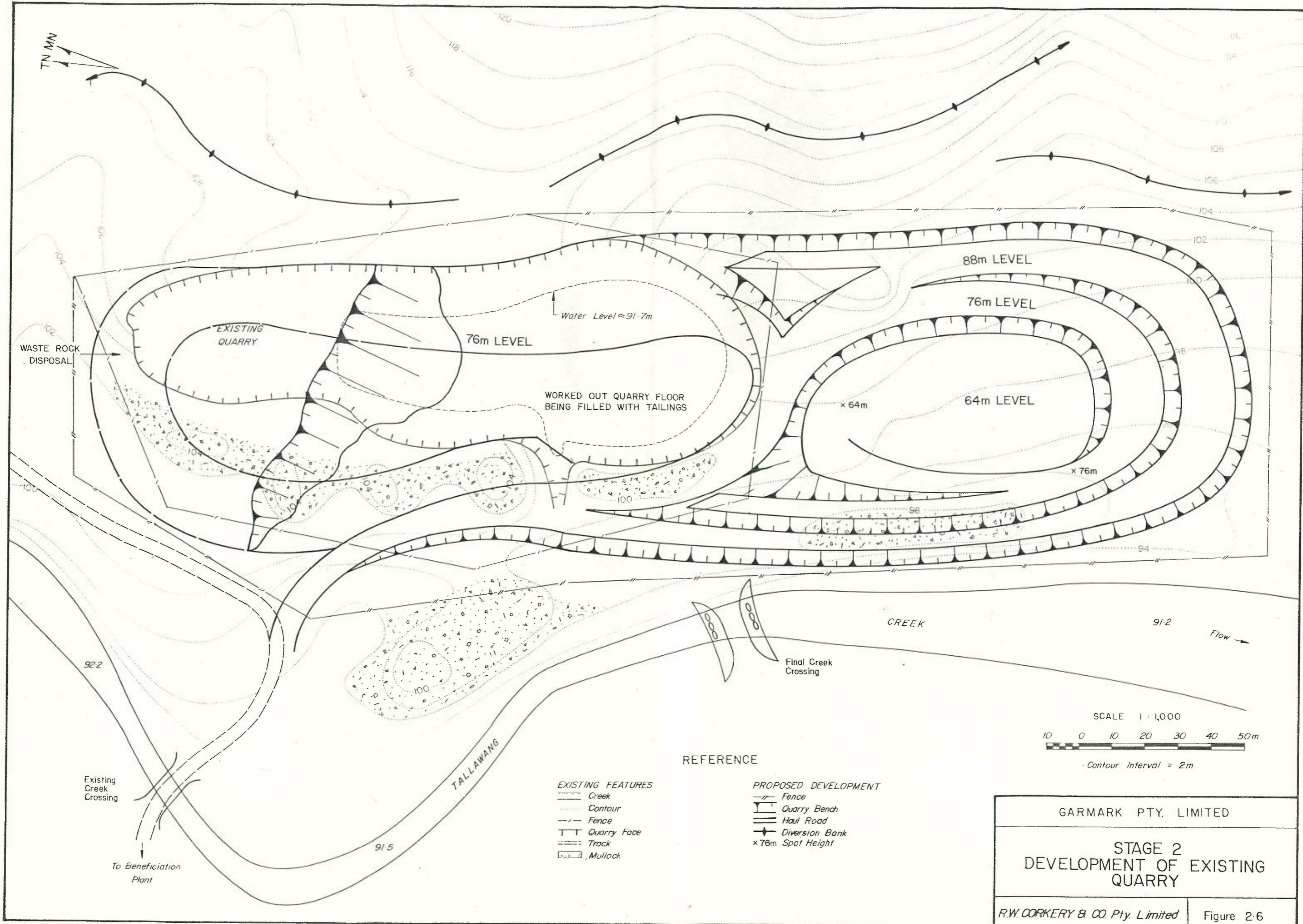


GARMARK PTY. LIMITED

**STAGE I
DEVELOPMENT OF EXISTING
QUARRY**

RW CORKERY & CO. Pty. Limited

Figure 2-5

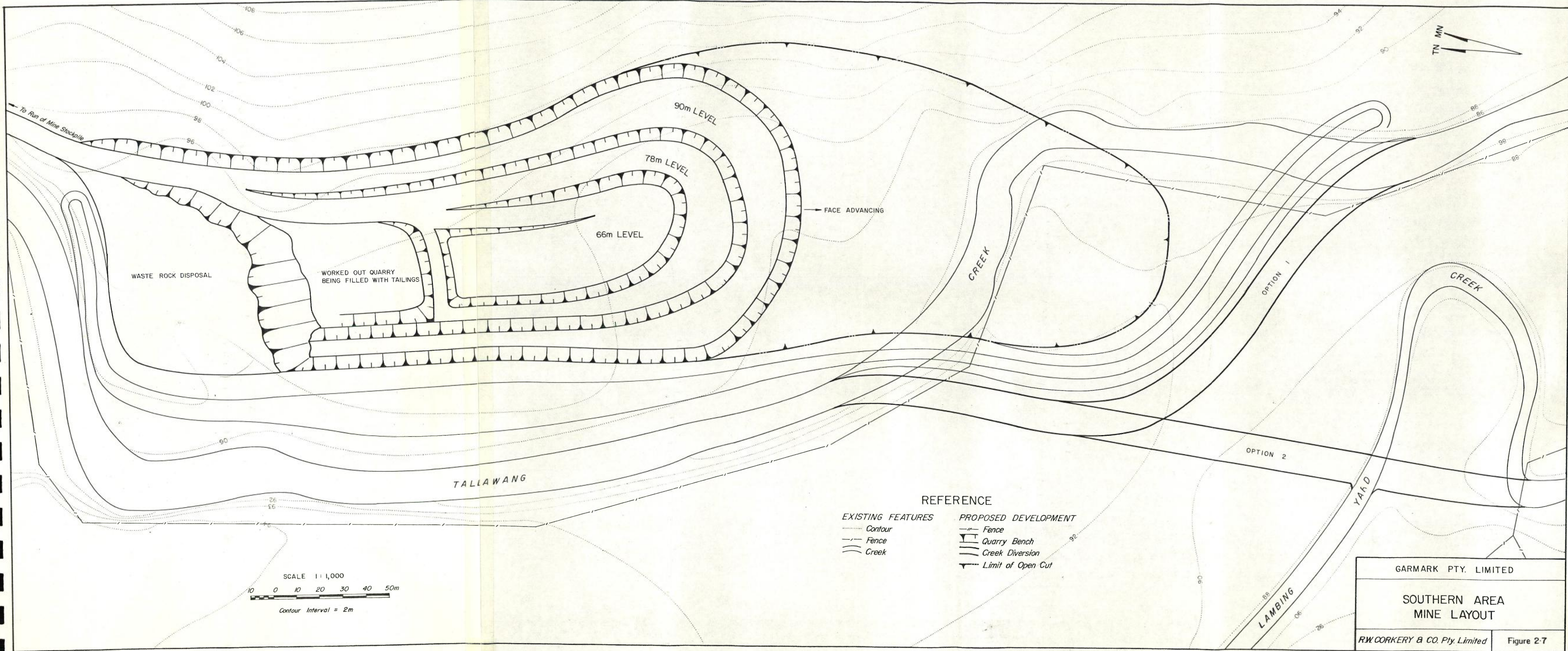


SCALE 1 : 1,000
 10 0 10 20 30 40 50m
 Contour Interval = 2m

REFERENCE

- | | |
|--------------------------|-----------------------------|
| EXISTING FEATURES | PROPOSED DEVELOPMENT |
| — Creek | — Fence |
| ... Contour | — Quarry Bench |
| - - - Fence | — Haul Road |
| — Quarry Face | — Diversion Bank |
| — Track | x 76m Spot Height |
| ▨ Mulloch | |

| | |
|--|------------|
| GARMARK PTY. LIMITED | |
| STAGE 2 DEVELOPMENT OF EXISTING QUARRY | |
| R.W. CORKERY & CO. Pty. Limited | Figure 2-6 |



| | |
|------------------------------|------------|
| GARMARK PTY. LIMITED | |
| SOUTHERN AREA MINE LAYOUT | |
| RWCORKERY & CO. Pty. Limited | Figure 2-7 |

2.5 BENEFICIATION PLANT

2.5.1 Introduction

The Company has applied for a Mining Purposes Lease on the western side of Tallawang Creek to enable it to construct a beneficiation plant to upgrade the mined ore to a grade suited for use as a dense medium.

The location of the Mining Purposes Lease Application (MPLA 77) has been chosen as it offers the Company a site which is:-

- (i) flat land,
- (ii) close to the open cut mining operation,
- (iii) close to Gulgong Road (M.R.55)
- (iv) provides sufficient area for the plant, storage, etc.
- (v) has power in close proximity.

The problems of visibility and flooding of the site will be overcome by a range of screening procedures and drainage controls. These are detailed in Section 4.

Figure 2.8 shows the proposed layout of the Mining Purposes Lease. The plant has been located centrally amongst the run-of-mine stockpile, mullock stockpile and various dams.

2.5.2 Outline of Process

Figure 2.9 displays the proposed flowsheet for the Company's beneficiation plant.

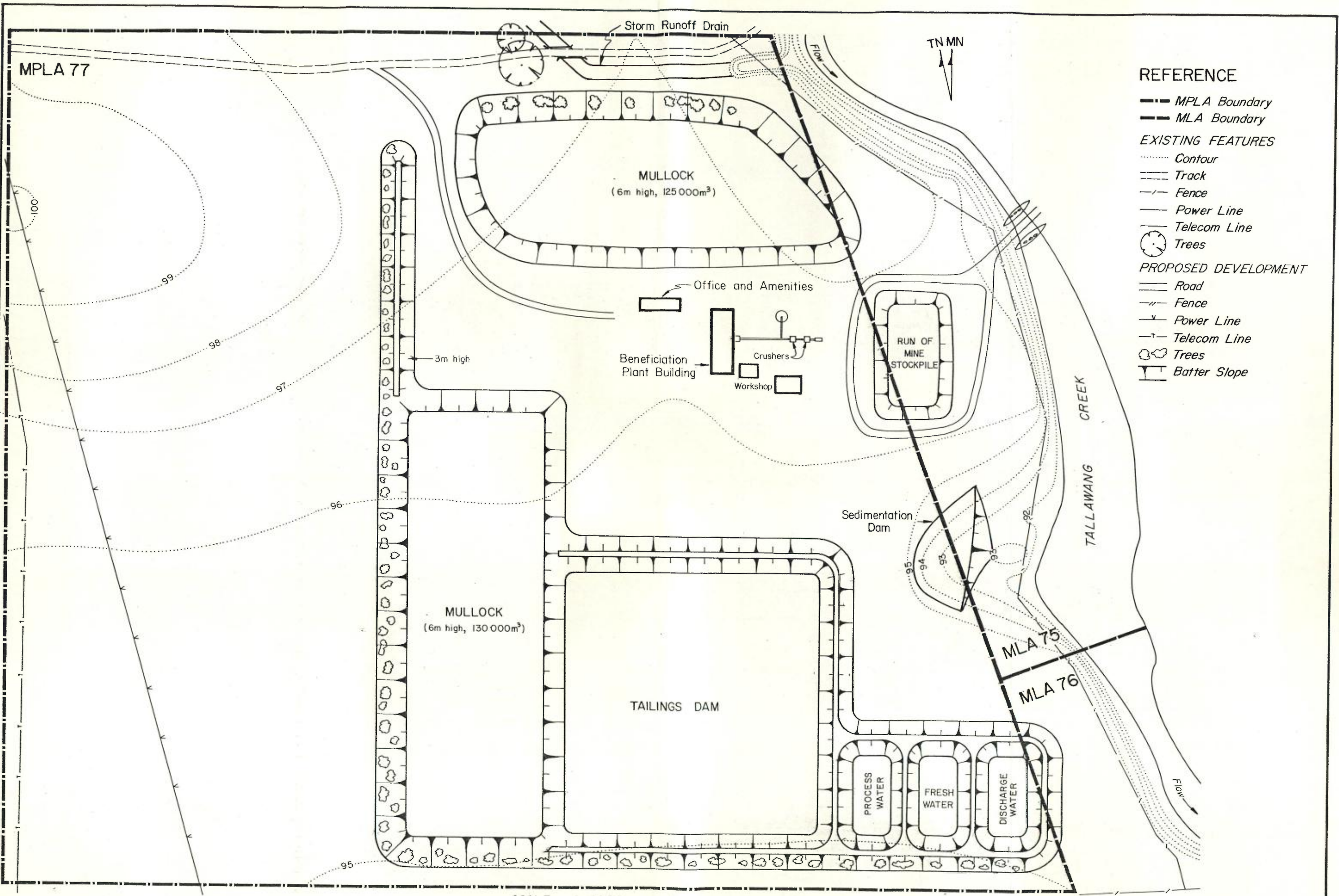
The Company will establish and maintain a stockpile of run-of-mine ore of approximately 15,000 tonnes (90 m x 50 m x 1.5 m) immediately east of the plant. Ore will either be drawn from the stockpile by front-end

loader and placed into the hopper or will be loaded directly into the hopper by the dump trucks from where it will be fed to the crushers and mills. The ore will be transported from one component to another by rubber conveyor belt. Magnetitic separators will be installed at two stages in the beneficiation process to separate the magnetite from the non or low magnetic components. The ground magnetite will be stored in a damp state within a covered shed at the end of the mill. The Company has made provision for approximately 8,000 tonnes to be stored within stockpiles inside the building. Trucks will be loaded within the shed using a front-end loader.

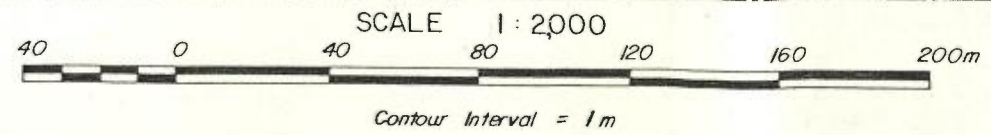
2.5.3 Site Preparation

Site preparation will involve:-

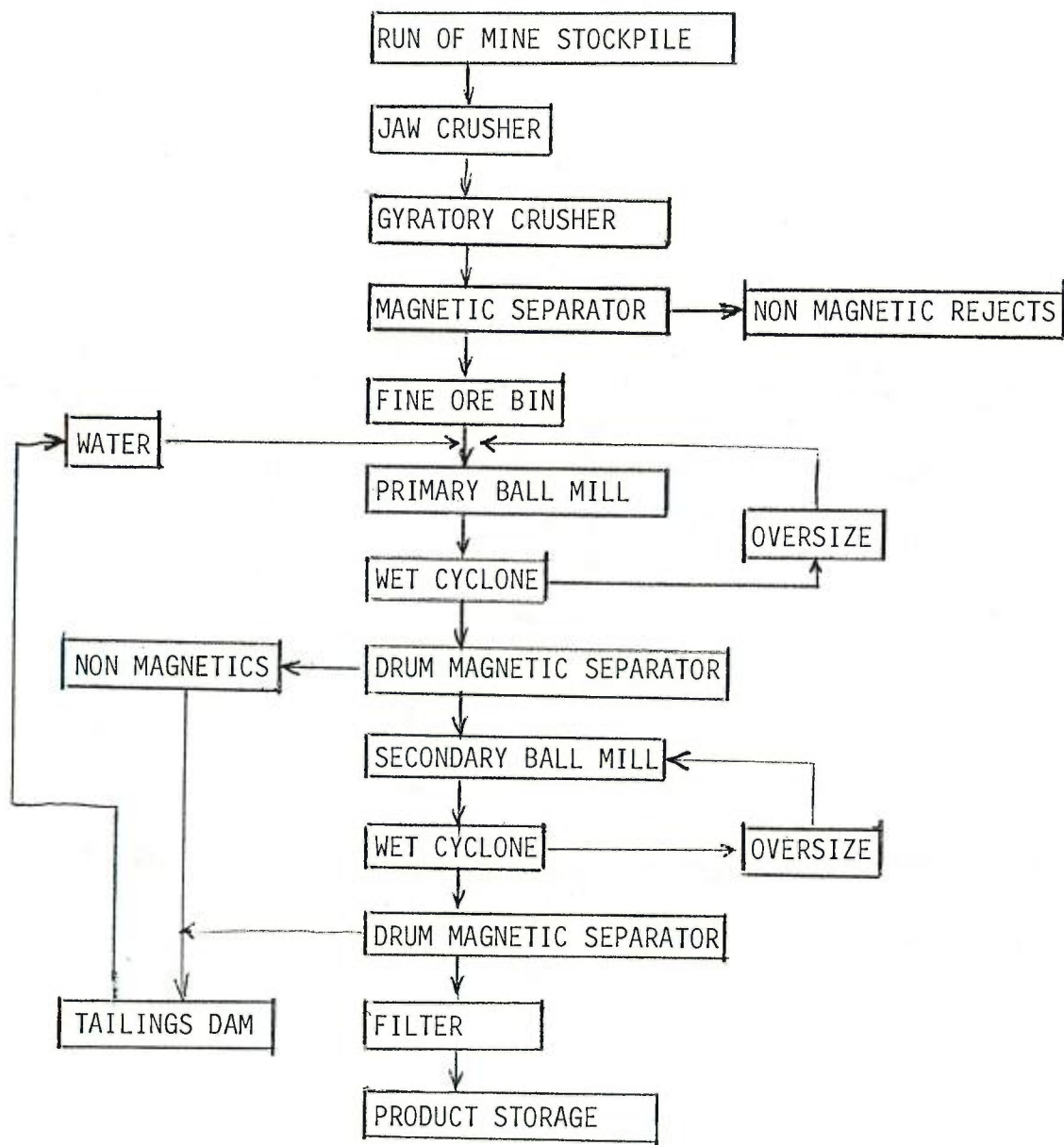
- (i) Construction of the fences around the plant site.
- (ii) All stopsoil will be removed by scraper from the areas of the proposed buildings, mullock stockpiles and dams and placed in temporary soil storage areas adjacent to the mullock stockpiles.
- (iii) The areas required for building will be levelled and prepared for subsequent construction. Similarly, any clay present will be won from the mullock areas to construct the dams on site.



- REFERENCE**
- MPLA Boundary
 - MLA Boundary
- EXISTING FEATURES**
- Contour
 - ==== Track
 - - - Fence
 - Power Line
 - Telecom Line
 - ⊗ Trees
- PROPOSED DEVELOPMENT**
- ==== Road
 - - - Fence
 - Power Line
 - Telecom Line
 - ⊗ Trees
 - ⊏ Batter Slope



Prepared by R.W.CORKERY & CO. PTY. LTD.



BENEFICIATION PLANT FLOW SHEET

R.W. CORKERY & CO. Pty. Limited

Figure 2.9

- (iv) The mullock and alluvial material will be progressively moved onto the site by dump truck and scraper respectively and placed in the position shown in Figure 2.8. Mullock will be first placed in the western position to provide the earliest possible screening of the plant site. All dams, that is, the tailings, *fresh and* process and discharge dams will be constructed with alluvial clays won from the re-shaping of the plant site and from the proposed mine areas (if required).
- (v) Once all dams and the western mullock area are constructed to the desired heights, topsoil will be retrieved from the temporary stockpile areas and placed on all slopes. The slopes will be seeded with a mixture of grasses appropriate to the season. A variety of quick growing trees and shrubs will be planted on the western side of the mullock storage area to provide further screening to motorists travelling along the Gulgong/Dunedoo road and residents to the west of the site.

2.5.4 Plant Buildings

The Company proposes to erect three buildings on site (See Figure 2.10).

(i) Main Plant Building

This building will be 42 m x 15 m and 8 m high and constructed from colour-bonded galvanised iron attached to a steel frame. This building will have a sloping flat roof with two major openings adjacent to the ball mills (see Figure 2.10) other small doors will be provided.

The southern end of the building will be open on its eastern side to allow truck access to the magnetite stockpiles. An internal wall will separate the milling section from the product stockpile area.

(ii) Workshop

A small pre-fabricated workshop 12 m x 8 m and 5 m high will be erected close to the main plant building. This building will also be clad with colour-bonded galvanised iron.

(iii) Office/Amenities

A portable office/amenities block will be placed on site. This building will be approximately 25 m x 8 m and 3 m high. This building will be aesthetically designed and presented.

2.6 CONSTRUCTION AND MINING RATES AND WORKING HOURS

2.6.1 Development Timetable

After the granting of the Mining Leases and Mining Purposes Leases, the Company will undertake the simultaneous development of the mine and beneficiation plant.

Mining Operation

The mine development outlined in Section 2.4.2 will be undertaken over a period of four months. Subsequent mining and placement of mullock will take a further five months. Mining of the magnetite ore will be commenced in the ninth month with sufficient stockpiles for beneficiation by the tenth month.

Beneficiation Plant

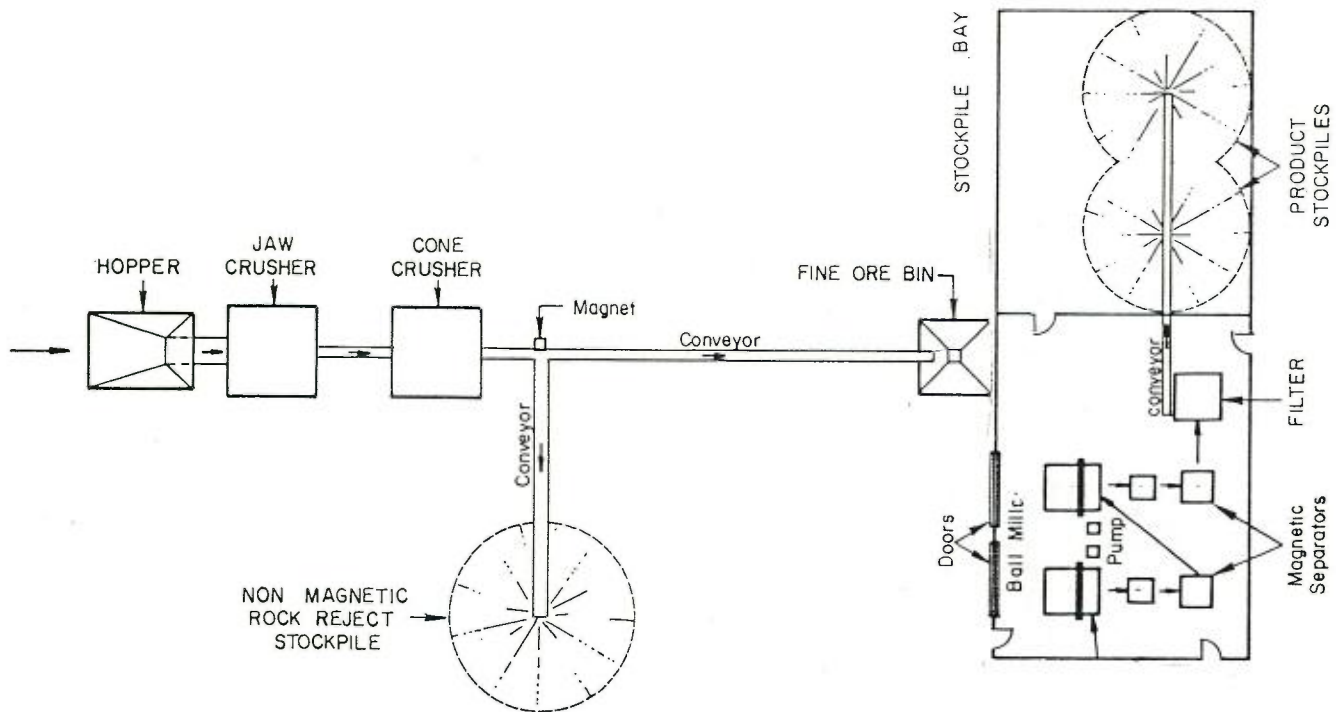
The site preparation, erection of plant buildings and installation of the plant equipment will be undertaken over a period of nine to twelve months.

2.6.2 Mining Rate

In the early years of operation, the Company proposes to produce a minimum of 25,000 tonnes of product per year. The predicted grade of ore which will be fed into the beneficiation plant will comprise approximately 50 per cent magnetite, therefore the minimum volume of ore treated will be approximately 50,000 tonnes per year.

RUN OF MINE STOCKPILE

Roadway



SCALE 1:500

5 0 5 10 15 20m



GARMARK PTY. LIMITED

BENEFICIATION PLANT
LAYOUT

R.W. CORKERY & CO. Pty. Limited

Figure 2-10

The Company proposes either:-

- (i) a continuous, small-scale mining operation which would produce approximately 200 tonnes of ore per day or 1000 tonnes per week, or
- (ii) a series of mining campaigns where up to 1000 tonnes of ore is mined daily. In this event, mining would be intermittent, say 1 week per month or 4 weeks per quarter. The exact timing would be dependent on the operator chosen.

The Company has not yet determined the scale of the mining operation. This Statement examines the impact of both (i) and (ii) above.

2.6.3 Rate of Beneficiation

The Company proposes to initially operate the plant at a rate of 15 tonnes/hour. The plant will have a capacity of 25 tonnes/hour or 50,000 tonnes/year based on a three shift/day operation.

2.6.4 Working Hours

The working hours sought by the Company are designed to give the Company sufficient flexibility to plan its operations to suit market requirements.

Constuction and Development Phase

During the construction and development phase, it is proposed that working hours will be from 7 a.m. to 6 p.m. Monday to Saturday.

Mining Operation

It is proposed to operate the mine from 7.00 a.m. to 6.00 p.m. Monday to Saturday. Blasting will only be undertaken during the hours 1.00 p.m. to 4.30 p.m.

Beneficiation Plant

The beneficiation plant will be operated with a minimum of two shifts daily, five days per week (6.00 am to 2.00 pm and 2.00 pm to 10.00 pm). Provision has been made to operate the plant on a three shift or 24 hour/day basis with an increase in demand. Only the mill component of the plant will operate two or three shifts daily whereas the crushers located outside the plant building will operate during the day shift from 7.00 a.m. to 6.00 p.m.

Product Transportation

The magnetite will be transported from the site between the hours 7.00 a.m. to 6.00 p.m. Monday to Friday.

2.7 LIFE OF MINE

Proven and probable reserves of magnetite ore at Tallawang have been established at 880,000 tonnes (open cut) and 665,000 tonnes (underground). Hence, without further delineation of ore in the intermediate area, and an ore production increasing gradually from 50,000 to 100,000 tonnes, the life of the mine would be approximately 12 years (open cut) and 8 years (underground). Hence the total life of the mine is approximately 20 years. The delineation of further reserves in the intermediate area will naturally increase the life of the mine.

2.8 WASTE DISPOSAL

2.8.1 Nature of Wastes

Mining Operation

The Company's mining operation will produce three types of waste.

- (i) Alluvial Sediments: Alluvial sediments up to 10 m thick will be removed from above the magnetite ore body. The alluvial sediments comprise mainly sand, silt and clay with some gravel.
- (ii) Oxidised Magnetite ~~Ore~~: The upper portion of the magnetite ore is weathered and the iron oxidised^{hydrated?}. This material is unsuitable as a dense media product but may be suitable for ironstone fluxing purposes.
- (iii) Mullock: The mullock is the non magnetite bearing rock which needs to be removed as part of the mining operation. This material will be removed by blasting and is predicted to range in size up to 0.5 m in size. The mullock will comprise mainly hornfels.

Beneficiation Plant

The Company's beneficiation plant will produce two main types of waste.

- (i) **Crushed Rock:** Non magnetic crushed rock will be produced after passing through a magnetic separator following the gyratory crusher. This material will have a size range of 1 to 100 mm.
- (ii) **Tailings:** Tailings comprise the residual materials from the ground magnetite ore after the magnetic product is removed. The material is produced as a slurry with a pulp density of approximately 20 per cent. The tailings which are relatively fine are expected to have the following size distribution:-

100% less than 0.065 mm

15% less than 0.005 mm

The Company predicts the tailings, when dewatered, will have a density of approximately 1.5 tonnes/m³.

Table 2.1 lists the expected volumes of wastes to be produced annually during the mining and beneficiation of the magnetite ore.

TABLE 2.1

APPROXIMATE ANNUAL PRODUCTION OF WASTES - TALLAWANG

| Material | Year 1 | Year 5 | Year 10 | Year 15 | Tot quantity out-of-pit | Tot quantity |
|-------------------------------------|---------|---------|---------|---------|-------------------------------|-----------------|
| Alluvial Sediments(m ³) | - | - | 100,000 | 25,000 | ? | ? |
| Mullock (m ³) | 125,000 | 175,000 | 175,000 | 175,000 | ? | ? |
| Crushed Rock (tonnes) | 15,000 | 15,000 | 15,000 | 15,000 | ? | ? |
| Tailings (tonnes) | 35,000 | 35,000 | 35,000 | 35,000 | ? | ? |

These estimates of waste production have been based on an ore production with a constant production of 40,000 tonnes/year.

2.8.2 Disposal of Wastes

Mining Wastes

- (i) **Alluvial Sediments:** The clay component of the alluvial sediments will be used to construct the levee banks, walls of the tailings dam and process/fresh water dams. All excess material will be returned to the worked out open cut.

- (ii) Oxidised Ore: All oxidised ore will be stockpiled separately in the run-of-mine stockpile area for sale as markets arise.
- (iii) Mullock: The Company proposes to handle the mullock generated throughout the mining operation in the following manner.

The mullock to be removed from in the vicinity of the existing quarry will be placed around the site of the beneficiation plant as shown in Figure 2.8. Once the mining is completed in Stage 1 at the existing quarry, all further mullock will be placed in the worked out sections of the open cut.

- (iv) Crushed Rock: Crushed rock will be treated as mullock.

Tailings

During the initial stages of the operation the Company proposes to place the tailings from the beneficiation plant into a small (2.6 ha) preliminary tailings dam to be constructed to the south of the plant (see Figure 2.8). This dam will have a capacity of five year's supply.

After the preliminary tailings dam is filled, the Company will commence tailings disposal within the worked out sections of the open cut mine. This will be undertaken by constructing a dam within the base of the worked out mine using mullock from the mining operation. Tailings will be pumped directly from the beneficiation plant to the dam within the open cut. The wall containing the tailings within the open cut will be constructed to a height of approximately 4 m above the floor of the mine and subsequently raised 4 m at a time. Tailings will not be placed within 2 m of the final surface. Upon reaching the desired height, the

WATER SOURCES:

Creek/Bore

Mine

Site
Rain water
run off

STORAGE:

Fresh Water
Pond

Process Water
Pond

USAGE:

Beneficiation Plant
(Road Watering,
Misc. uses)

TREATMENT:

Discharge Water
Pond

Tailings
Settling

Sedimentation
Dam

DISCHARGE:

Tallawang
Creek

Tallawang
Creek

- Main Flow lines
- - - Intermittent Flow lines

WATER FLOWSHEET

tailings will be covered with mullock, alluvial sediments (when available) and topsoil.

The pipeline carrying the tailings to the open cut will cross Tallawang Creek on the upstream side of the creek crossing and will be secured to it. The pipeline will then follow the haul road to the point of entry to the tailings disposal area.

2.9 SERVICES

2.9.1 Water

Figure 2.11 presents the proposed water management for the Company's project.

Beneficiation Plant

The beneficiation process presented in the flow sheet in Figure 2.9 will require 10 tonnes of water for every tonne of magnetite product. A production rate of 40,000 tonnes/year (or 10 tonnes/hr) will require water at a rate of approximately 100 tonnes or 100,000 litres/hr.

The Company proposes to re-circulate its process water through the tailings dam which in turn overflows into the process water dam and back to the plant. The Company predicts a water loss to product, tailings and evaporation of approximately 10,000 litres/hr 13.5 per cent. This will be made up from the fresh water dam.

The Company propose to draw its fresh water requirements from seepage collected in the open cut. The long term occurrence of water within the old quarry and the water intersected during drilling on site confirms that there should be few problems with long term supply of water for the plant.

In the event that a shortfall does occur, the Company proposes to obtain its fresh water requirements from:

- (i) Tallawang Creek: Water will only be drawn from Tallawang Creek during periods of high flow when the flow exceeds 100,000 litres/hr or ten per cent of the Company's requirements.
- (ii) Bore Water: The Company envisages that if required, their plant make-up water could be obtained from two bores sunk into the fractured Tucklan Beds close to the boundary with the Gulgong Granite. The bores would be placed within the Company's Mining Lease.

Road and Site Watering

Water required for the road and site watering will be drawn from the process water dam.

Drinking Water

Drinking water will be supplied from tanks installed to collect the roof runoff from the main plant and office.

2.9.2 Power

The Company envisages the power load to operate the beneficiation plant will be approximately 1000 KVA. This will be drawn from the 22KV feeder passing across MPLA 77. Any additional line or station construction and reticulation will be within the boundaries of MPLA 77.

When designing the plant, due regard will be given to any voltage fluctuations that may occur during the starting and operation of equipment. The plant will thus present essentially a steady load to the power system.

Liaison with Ulan County Council during the planning and construction stages of the project will ensure that the quality of supply to other consumers will be maintained or improved.

2.9.3 Sewerage

The Company will install a septic system adjacent to the site office. The system will be installed in accordance with the requirements of the Mudgee Shire Council.

2.9.4 Telephone

A telephone connection will be made to the existing telephone line which occurs on the eastern side of the Gulgong - Dunedoo Road and along the western boundary of MPLA 77.

2.10 SAFETY ASPECTS

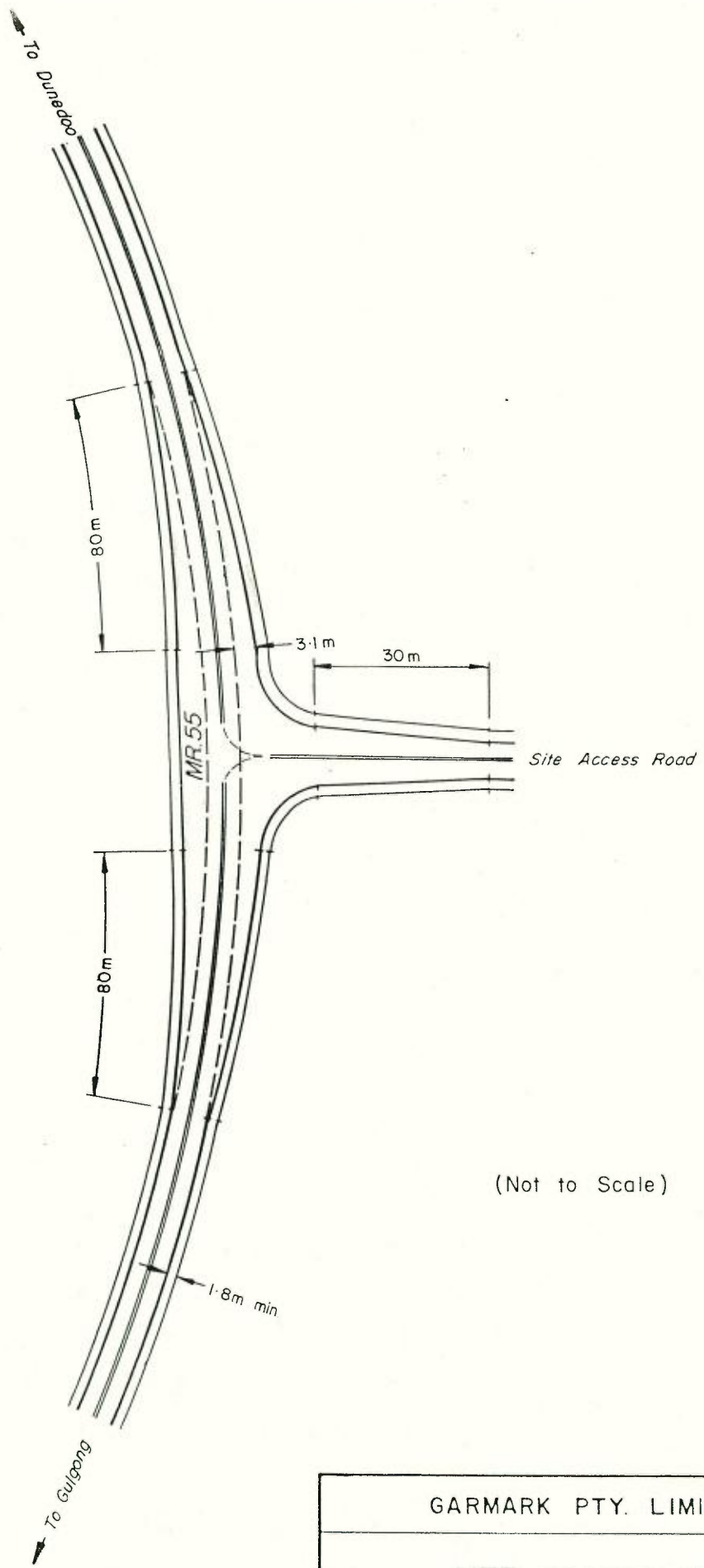
The following safety aspects will be carefully planned and implemented by the Company:

- (i) All benches/faces will be planned to ensure stability.
- (ii) All mine areas will be properly fenced.
- (iii) Roads on site used by owners of and visitors to "Belvedere" homestead will be sufficiently wide to allow easy passing (except on creek crossing). Visibility along roads will be adequate to provide good sight distances.
- (iv) A properly constructed intersection will be installed where the site access road joins the Dunedoo/Gulgong Road.

2.11 TRANSPORTATION

2.11.1 Access to the Site

Access to the site is from the Dunedoo/Gulgong Road (M.R. 55), which is adjacent to the western boundary of MPLA 77. The access road to the beneficiation plant will follow the first 250 m ~~of the~~ existing track to the "Belvedere" homestead and pass between mullock stockpiles. This section of road will be sealed. The intersection with M.R. 55 will be upgraded to provide passing lanes for vehicles to pass vehicles turning right onto the site (see Figure 2.12). This intersection is a variation on the standard Type 3 design.



(Not to Scale)

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SITE ACCESS ROAD
INTERSECTION WITH MR. 55

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Figure 2-12

Access to the open cut mine developed around the existing quarry will also be along the existing track to the "Belvedere" homestead, however, the access road will branch from the existing track approximately 50 m east of the Tallawang Creek crossing. The section of road from the turnoff to the plant and the exit beyond the creek will be reconstructed and surfaced with crushed rock.

Access to the intermediate area and southern area will be via a new creek crossing which will link the mine haul road and the road network around the beneficiation plant.

2.11.2 On Site Road Network

Beneficiation Plant

Roads around the beneficiation plant will provide access for employee's vehicles (car park adjacent to office), trucks transporting the product from the storage bay, service vehicles and dump trucks transporting ore to the run-of-mine stockpile and hopper. Figure 2.8 shows the proposed road layout.

Mine Area

Roads in the mine area will be kept to a minimum. The Company will establish and extend a haul road from the active mine area as required. It is the intention to utilise the same haul road throughout the whole mining operations. Figure 2.1 shows the haul road will be situated on the eastern side of the mine area and will be constructed at a level of 90 m (Local Datum).

2.11.3 Nature and Frequency of Vehicles

Construction Vehicles

Throughout the 9 to 12 month period during plant construction and mine development, the equipment and materials required will generally be delivered by conventional commercial vehicles (trucks and semi-trailers). Only some mining equipment and plant(eg. ball mills) will need to be floated to the site on extra width vehicles.

It is unlikely that the frequency of the above traffic would exceed five vehicles per day.

Employee's Vehicles

During construction, it is estimated that employee's cars will not exceed 15, that is, during the hours 7.00 a.m. to 6.00 p.m.

Once mining and beneficiation is underway, the Company expects up to eight cars per day during the day shift and only two or three for the evening and night shift.

In total, employee's vehicles during full scale mining and beneficiation will amount to approximately 15 vehicles.

Product Transport

The magnetite product will be transported from the site in 20 to 25 tonne capacity trucks. It is expected that an average of 175 tonnes per day or 8 truck loads will leave the site during the hours 7.00 a.m. to 6.00 p.m. Monday to Friday. Natural variability in expected timetables suggests that a maximum of 10 trucks would leave the site daily.

The above traffic frequencies have been prepared assuming an annual product output of 40,000 tonnes. Any increases in production toward the

plant's capacity of 50,000 tonnes will naturally increase traffic levels.

2.11.4 Transport Route

Figure 2.13 shows the proposed transport routes.

All trucks leaving the site will travel southwards towards Gulgong along M.R. 55. Those travelling to Lithgow (two truck per day or 25 per cent of trucks) will travel through Gulgong (via Caledonian and Fisher Streets) and continue along M.R. 55 towards Mudgee. Trucks travelling to Ulan and the Hunter Valley (6 trucks per day or 75 per cent of trucks) will turn from M.R. 55 into S.R. 170, which continues through Gulgong as Rouse Street. The trucks will then follow Station Street which after crossing the railway line near the flour mill becomes M.R. 598.

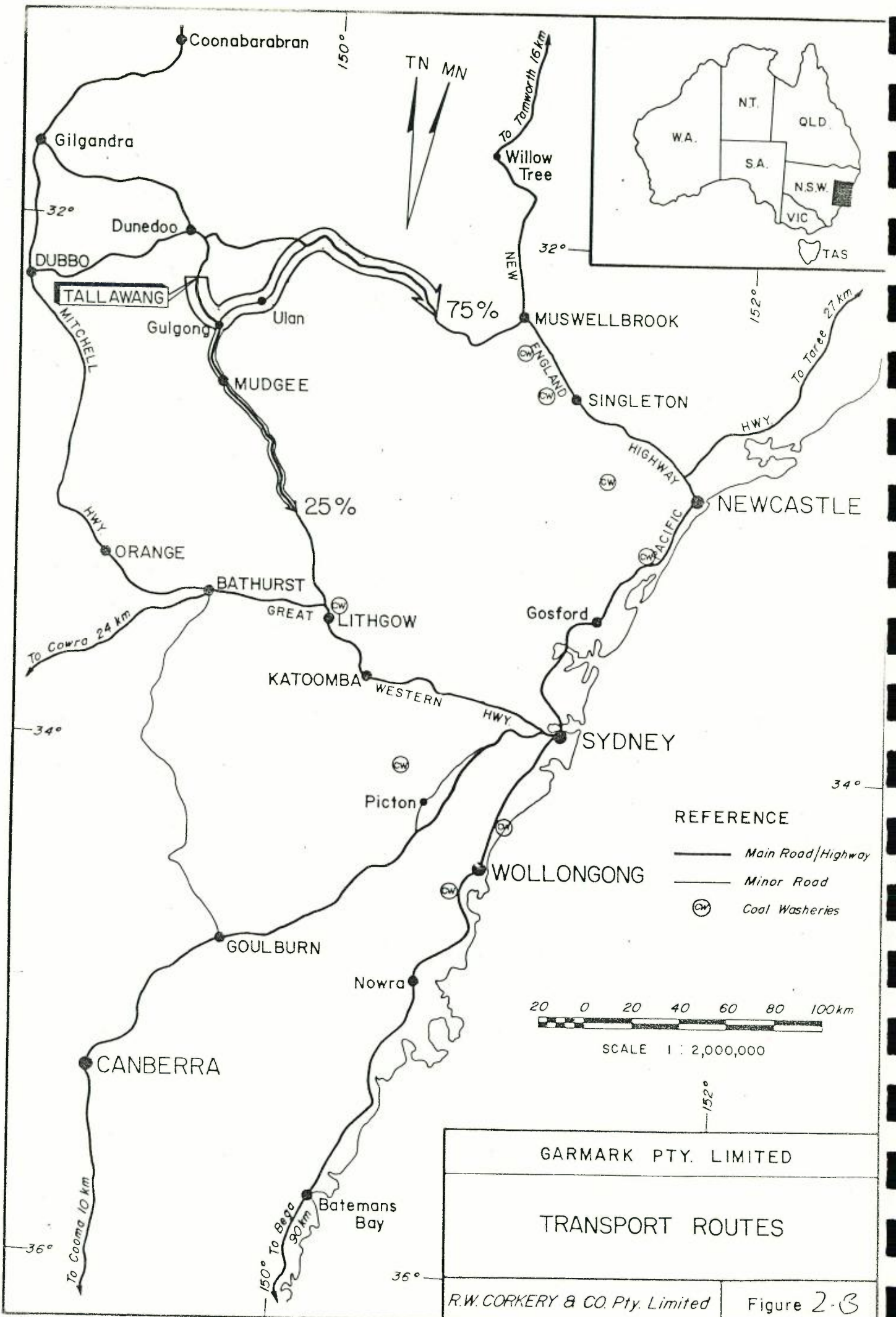
2.12 EMPLOYMENT

2.12.1 Construction

The Company will employ up to ten workers during the construction of the beneficiation plant. In addition, some local contractors will be engaged during various stages of construction.

2.12.2 Mining

Three persons would be employed full time if the Company undertakes its own continuous mining programmes. If a contractor is engaged to mine the magnetite up to six persons would be on-site during mining campaigns.



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TRANSPORT ROUTES

R.W. CORKERY & CO. Pty. Limited

Figure 2-B

2.12.3 Beneficiation Plant

The Company will employ ten persons to operate the beneficiation plant.

| | |
|---------------|---|
| Day Shift | - 4 Plant Operators |
| | - 1 Clerical Assistant |
| | - 1 Manager (also responsible for mining) |
| Evening Shift | - 2 Plant Operators |
| Night Shift | - 2 Plant Operators |
| TOTAL | 10 |

It is the Company's intention to recruit and train local persons as plant operators.

2.12.4 Product Transportation

The transportation of the magnetite to coal washeries will create ^{up to eight} positions for truck drivers. This number will rise as output rises.

2.12.5 Miscellaneous

The development of the mine will generate further work in the Gulgong district for services such as

- Installation and maintenance of municipal services (power, phone)
- Up grading the site road/M.R. 55 intersection
- Truck and vehicle maintenance.

Additional employment is likely to be generated in the Gulgong area as a result of the employment generated by the Company's project.

2.12.6 Summary

The mining, beneficiation and transportation of the magnetite from the Company's mine at Tallawang will generate a total of 21 permanent jobs. Up to 24 jobs would exist in future years as production increases.

2.13 HOUSING

During the construction period, persons employed will be either local residents with their own accommodation or contractors who will stay in local motels/hotels.

As the Company expects to recruit and train plant operators locally, there will be no need to provide housing for these employees. Similarly, mining personnel will also be engaged locally. Depending on the person chosen as plant manager, the Company may purchase or rent a home in Gulgong for their use.

2.14 REHABILITATION

2.14.1 Open Cut

Figure 2.15 shows the proposed landform after mining.

The main features of the rehabilitated open cut area will be :-

- (i) Most of the open cut will be backfilled with mullock and tailings to create a landform similar to the pre-mining landform. The backfilling programme will be undertaken on a regular basis as the open cut advances in a southerly direction. Provision will be made for the retention of the haul road throughout the life of the mine.

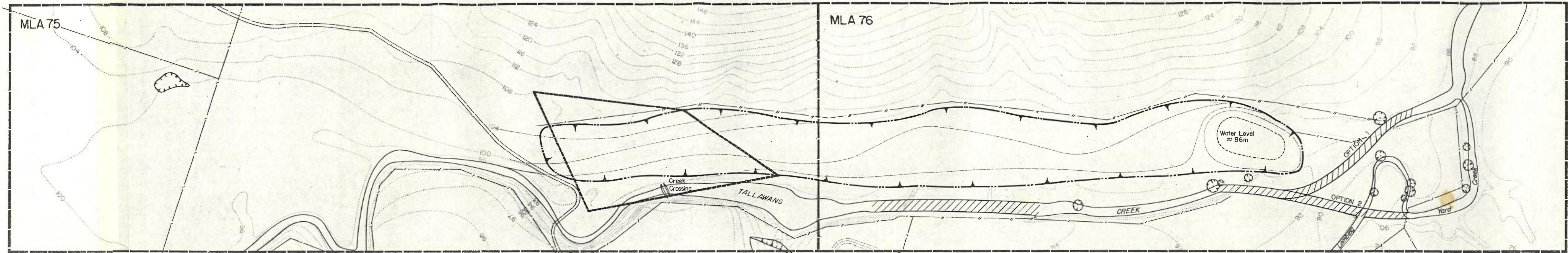
The Company proposes to undertake regular programmes to contour the land surface after the backfilling of the opencut is completed. The backfilled areas will be contoured once an additional 50 m length x 100 m width of area is filled to ground level. An allowance will be made for subsequent settlement.

Once the area is contoured, previously stripped topsoil will be spread over the area. The area will be sown with pasture grasses appropriate to the season and fertilised if necessary. The procedures, species planted, sowing density and application rates for fertiliser will be discussed with the Soil Conservation Service prior to commencement of rehabilitation. The initial rehabilitation area will be supervised by the Soil Conservation Service to ensure that the procedures adopted by the Company will be suited to the overall project.

Trees similar to those on the site prior to mining will be planted on the rehabilitated areas. Emphasis will be placed on creating shade areas for stock. Shade trees will be planted around the edge of the final water storage.

The fences constructed around the open cut area will be retained after rehabilitation commences to ensure new growth is not destroyed by stock or other animals. Limited grazing of the rehabilitated areas would be undertaken as required to reduce any fire risks.

- (ii) The creation of a water storage dam at the southern end of the open cut. This dam will cover approximately one ha (170 m x 90 m) and have sides with slopes of not greater than 1:3 (hor:vert). The Company expects the water storage to remain relatively full (approximate water level) of 86 m A.H.D. This assumption is based on observations of the existing open cut on the site and the recent drilling.



SCALE 1:4,000 (Approx.)

100 0 100 200 300 400m

Contour interval = 2m west of Tallawang Creek
 Contour interval = 4m east of Tallawang Creek

To Dunedoo 22 km

To Gulgong 16 km

REFERENCE

- Existing Mining Lease
- MPLA Boundary
- MLA Boundary

EXISTING FEATURES

- Contour
- Track
- Fence
- Power Line
- Telecom Line
- ⊙ Large Tree
- Quarry Face
- Mullock
- Creek

PROPOSED REHABILITATION

- Contour after Mining
- Fence
- Limit of Open Cut
- New Creek Boundary

| | |
|--------------------------------|-------------|
| GARMARK PTY. LIMITED | |
| PROPOSED REHABILITATION | |
| R.W.CORKERY & CO. Pty. Limited | Figure 2-14 |

- (iii) All underground portals within the open cut will be sealed to the satisfaction of the Department of Mineral Resources.
- (iv) The levee bank on the eastern side of Tallawang Creek will be removed and the material incorporated as fill in the final landscaping. ^{of the pit} Care will be taken to ensure as much soil as possible on the levees is retained for rehabilitation.
- (v) The diversion banks on the eastern side of the open cut will be progressively removed as the open cut advances southwards. They will, however, not be removed until such time as rehabilitation is well advanced.
- (vi) The diversion channels will be retained to provide the long term channel for Tallawang Creek.
- (vii) All fencing will be retained on the site unless it will interfere with the subsequent land use. Gates will be provided in the appropriate locations for the landowner.
- (viii) All creek crossings will be retained.

2.14.2 Beneficiation Plant Site

The beneficiation plant site will be rehabilitated in the following manner.

- (i) All crushing plant and foundations will be removed.
- (ii) All equipment will be removed from within the main building. The decision of whether to remove the building and its floor will be made at the completion of the project. The building may have an alternate use at the conclusion of the project.
- (iii) The ore stockpile site will be cleaned up and any residual rock buried in the open cut. The area will be topsoiled, ripped and sown with pasture grasses.
- (iv) All roads except the access road to the main building will be topsoiled, ripped and sown with pasture grasses.
- (v) The mullock dumps to the north and west of the plant site will be retained on site. Each dump will be left in a grassed state with tree growth on their outer edge. It is likely that the dumps will provide a long term source of hard filling material that could be of use to the Department of Main Roads, the State Rail Authority or Mudgee Shire Council. Material would be won from the inside of each dump or from the opposite side of the tree screen.
- (vi) The tailings dam will be covered, contoured and vegetated, whereas the process and freshwater dams will be retained to provide water storage as required by the landowner.

SECTION 3

DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 TOPOGRAPHY

The mine site is located on the edge of the alluvial plain of Tallawang Creek and abuts the western side of a prominent ridge (See Plate 1). Contours presented in Figures 3.5 and 2.1 show both the regional topography and the local topography on the lease applications.

West of Tallawang Creek, the land slopes gently to the south and southeast at 0.2° to 0.5° . Slopes increase gently towards the access road where slopes approach 1.5° . The site of the beneficiation plant is located on an area with natural slopes of less than 0.5° .

With the exception of two small raised point bars, the land on the eastern side of Tallawang Creek rises from the creek to a height at the top of the adjacent ridge approximately 50 m above the creek level. The ridge east of the site trends in a northerly direction and has slopes on its western side varying from 4° to 22° . In the areas to be mined, slopes vary from 0.6° adjacent to Tallawang Creek to 15° on the slopes of the adjacent ridge.

The western bank of Tallawang Creek is often steep (50°) and occasionally vertical whereas the eastern bank in the area to be mined is comparatively gently sloping. In only one location does the eastern bank exceed 15° .

The existing quarry on the site has steep slopes (up to 70°). Other man made changes to the local topography include the numerous small mullock dumps around the existing open cut.

Elevations in the Tallawang area vary from 450 m to in excess of 500 m A.H.D. (See Figure 3.5). It should be noted that all mine plans have been

prepared using a local datum. Consequently all elevations on these plans are approximately 370 m below the Australian Height Datum (A.H.D.) Elevations in the proposed mine area vary from 87 m to 104 m (local datum).

3.2 DRAINAGE

3.2.1 Regional and Local Drainage

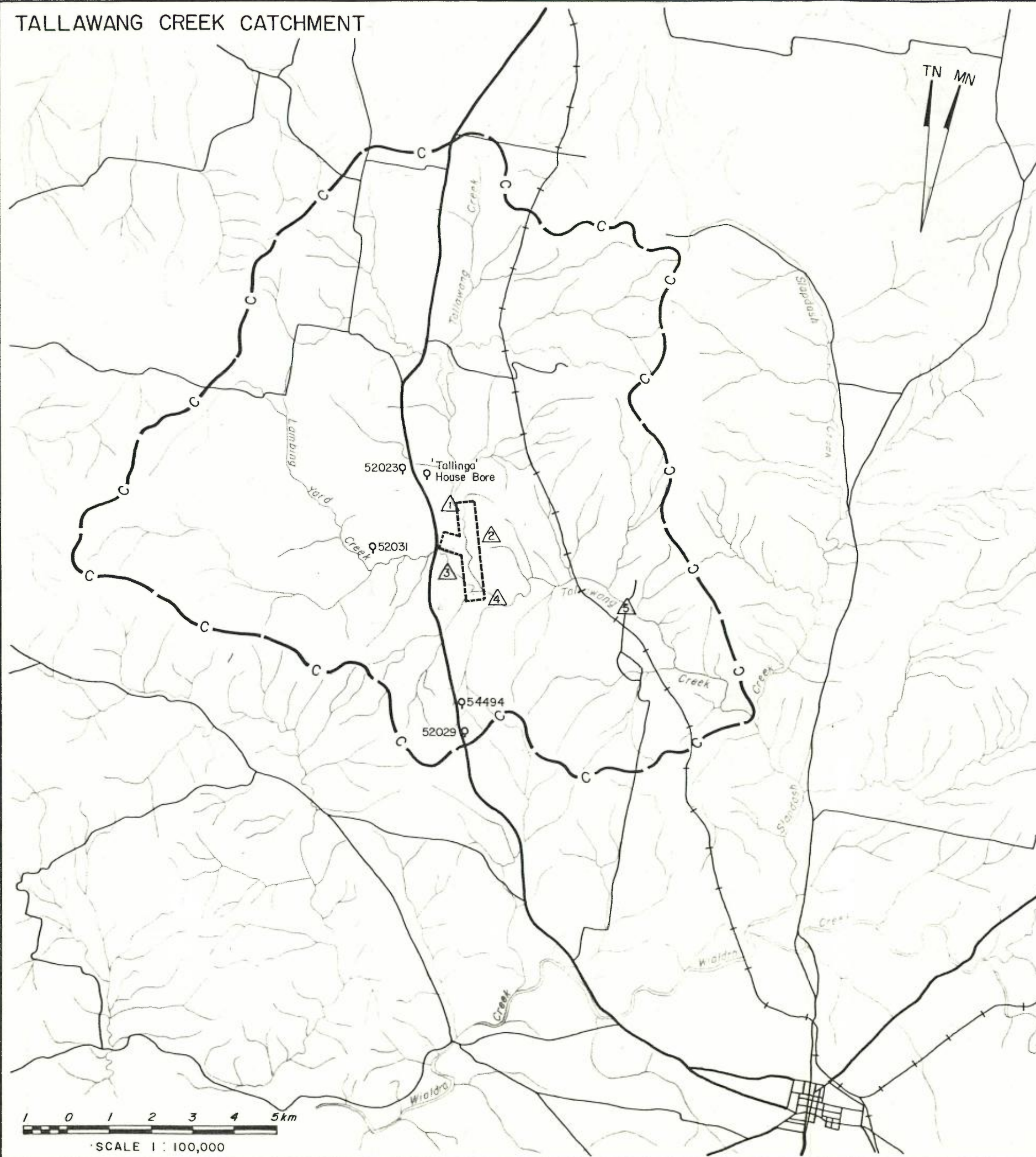
The mine site is drained by Tallawang Creek which traverses most of the length of the Mining Lease Applications. Figure 3.1 shows the catchment of Tallawang Creek and the location of the mine site within the catchment.

Figure 3.1 also shows that Tallawang Creek flows in a southerly direction where it joins Slapdash Creek which in turn flows into Wialdra Creek. Wialdra Creek flows in a southwesterly direction into the Cudgegong River which then flows into Burrendong Dam.

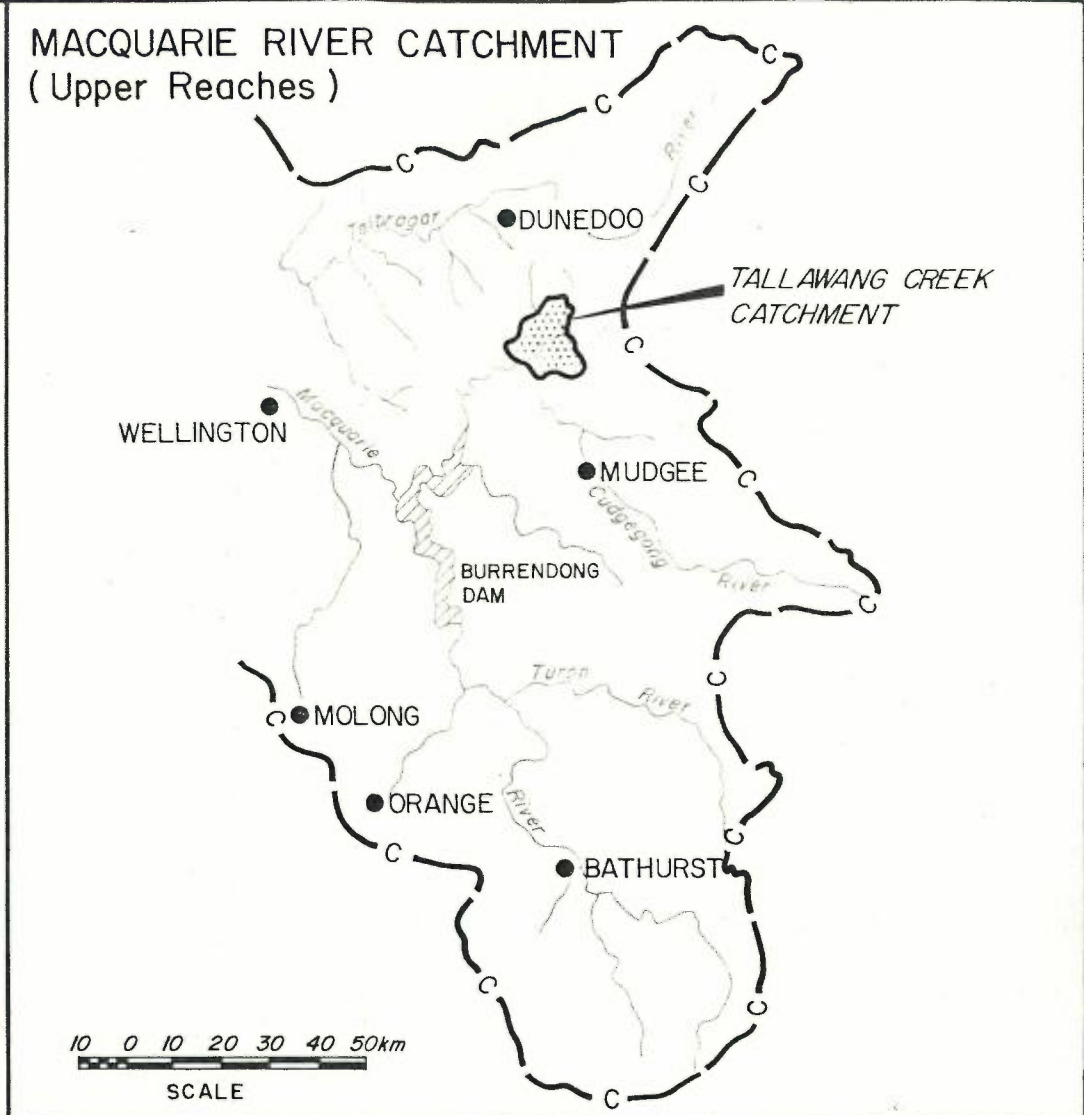
3.2.2 Site Drainage

Tallawang Creek and a small tributary, Lambing Yard Creek are the main streams on the site. Features of the site drainage are shown on Figure 3.2. The main feature of each of these streams are:-

TALLAWANG CREEK CATCHMENT



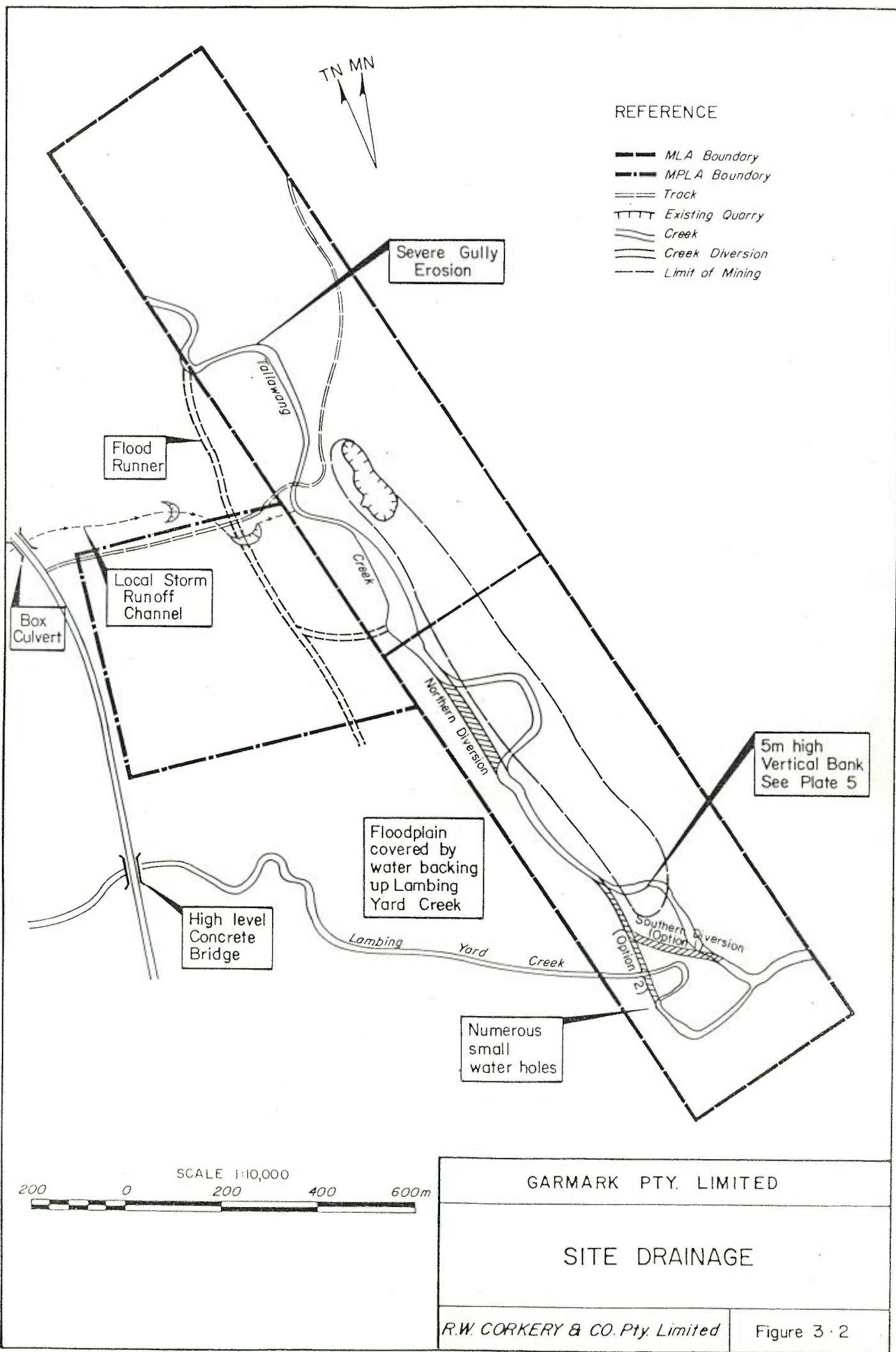
MACQUARIE RIVER CATCHMENT (Upper Reaches)



REFERENCE

- Main Road
- Minor Road
- Railway
- Creek/River
- C - Catchment Boundary
- ▭ Development Site
- Q Water Bore (W.R.C. Bore No)
- △ Water Sampling Location

| | |
|--------------------------------|------------|
| GARMARK PTY. LIMITED | |
| REGIONAL & LOCAL DRAINAGE | |
| R.W. CORKERY & CO. Pty Limited | Figure 3-1 |



Tallawang Creek

- (i) The creek is a meandering stream with a predominantly sandy bed. Occasional rock outcrop or mullock from previous mining operations occurs within the bed of the creek.
- (ii) The creek is non-perennial.
- (iii) The creek channel varies in width from 7 to 55 m, however, the average width is approximately 15 m.
- (iv) The creek falls 8.1 m in elevation throughout its 2.6 km length through the Mining Lease Applications (Average Grade of 1 in 320). Stream grades along the creek vary from 1 in 90 to 1 in 1000.
- (v) The creek comprises a series of riffles and pools some of which are relatively persistent when the creek is not flowing. The main waterhole is downstream from the junction with Lambing Yard Creek. The water holes in the creek are re-charged from groundwater passing through the adjacent alluvial gravels.
- (vi) *The creek channel is incised into the flood plain*
The banks of Tallawang Creek vary from gentle (1 in 6) to vertical. Bank heights range from 0.3 m to 5 m.
- (vii) Tallawang Creek, upstream from Lambing Yard Creek has a catchment area of approximately 60 square kilometres. Much of this catchment is cleared grazing land with scattered trees.

LAMBING YARD CREEK

- (i) The creek is a meandering stream with a predominantly silty bed. It is considerably different in nature to Tallawang Creek.
- (ii) The creek is non-perennial.
- (iii) The creek channel varies in width from 4 m to 20 m, however, the average width is approximately 8 m.
- (iv) The creek falls 2.6 m throughout its 0.6 km length through the Mining Lease Applications (average grade of 1 in 230). Stream grades along the creek are relatively uniform.
- (v) The stream banks vary from moderate (one in four) to vertical with bank heights varying from 0.1 m to 3.5 m.
- (vi) Lambing Yard Creek upstream from Tallawang Creek has a catchment area of approximately 42 square kilometres.
- (vii) The creek contains numerous small waterholes throughout its length across the Mining Lease Application. These are often full of water when the creek is not flowing and provide a good source of stock water.

Both creeks are experiencing a degree of minor erosion, associated with natural meanders. Local pockets of severe erosion occur where a tributary drain has been diverted and at points of stock access.

3.2.3 Flood Behaviour

Flood levels in both streams are influenced to some extent by the other. However, Tallawang Creek, having the larger catchment area is the dominant source of flooding and effectively determines flood levels in the vicinity of the site.

There are no streamflow records available for either Tallawang or Lambing Yard Creek. The nearest stream monitoring point is located on the Cudgegong River at Yamble Bridge (records available from 1939 - present). Former streamflow stations were Wialdra Creek at Gulgong (1966-1982) and Cudgegong River at Guntawang (1927-1939) both of which have been discontinued.

Flood discharges for Tallawang Creek were estimated by the application of synthetic hydrological techniques, calibrated on the available records. The estimated discharges for various recurrence intervals are shown in Table 3.1.

TABLE 3.1

Tallawang Creek - Discharges (m^3/sec)

| Frequency (years) | Discharge (m^3/sec) |
|-------------------|-------------------------|
| 1/5 | 55 |
| 1/10 | 85 |
| 1/50 | 175 |
| 1/100 | 250 |

Hydraulic computations show that the creek section within the Mining Lease Application has sufficient theoretical capacity to cater for the 1 in 100

year flow, without spillage over the western bank. However, field inspection indicates the possibility of a flood runner, (shown on Figure 3.2) which commences at a low section of the creek upstream of the lease application passes through the proposed plant area and joins Lambing Yard Creek downstream.

Discussions with local landowners reveal that overflow has occurred twice in living memory. Assuming this runner is active during major flood events, it has the capacity to cater for about 10 per cent of the total flow. Based on the estimated discharges quoted in Table 3.1, overflow would occur during events in excess of about 1 in 20 years frequency. Because of the relative elevation of the western bank, flows on the flood plain would be separated from that in the main channel even for events in excess of the estimated 1 in 100 year flood.

3.2.4 Local Runoff

Under existing conditions, the flood runner described above also caters for local runoff from about 3 square kilometres west of the Dunedoo/Gulgong Road. Storm runoff from this area passes below the road via a 3 cell 1800 mm x 900 mm box culvert and joins the runner immediately north of the proposed plant area.

The farm dam adjacent to the access road on MPLA 77 (See Figure 3.2) has had an overflow channel cut directly to Tallawang Creek. This dam and channel currently intercept local runoff. Surplus flows have initiated a pocket of erosion at the entry to Tallawang Creek.

3.3 GEOLOGY AND ORE RESERVES

3.3.1 Regional Geology

The Company's Mining Lease Applications are located within the Tucklan Beds, close to the eastern boundary with the Gulgong Granite (Reference: Dubbo 1:250,000 Geological Series Sheet, 1971 - Dept. of Mineral Resources). The Tucklan Beds comprises a range of metamorphosed andesites, tuffs, arkoses and shales. Most of the metamorphosed rocks close to the boundary within the Gulgong Granite occur as hornfels. The Gulgong Granite is variable in nature and occurrence, however, adjacent to the mine area, it occurs as a porphyry.

3.3.2 Local Geology

The magnetite occurs within a hornblende-biotite-magnetite metasomatic deposit. It lies between undifferentiated hornfels to the west and a porphyry to the east (Note: it is the porphyry that outcrops as the high ridge to the east of the Company's Mining Lease Applications).

The southern part of the magnetite deposit is overlain by between 4 m and 10 m of alluvial sediments. The sediments comprise clays near the surface with the sediment grain size increasing with depth to gravels at the base. Table 3.2 presents a description of the sediments.

TABLE 3.2

ALLUVIAL SEDIMENTS AT TALLAWANG

| Depth (m) | Thickness (m) | Description |
|--------------|------------------|---|
| 0 - 0.4 | 0.4 | SOIL |
| 0.4 - 1.0 | 0.6 | SANDY CLAY, orange/brown, variable thickness. |
| 1.0 - 1.8 | 1.8 | CLAY, mottled light brown/orange, bedding present, highly pedal, manganese present throughout, sporadic water washed pebbles to 15 mm throughout. |
| 2.8 - 3.3 | 0.5 | SANDY CLAY, red/brown, numerous rock fragments of variable rock types throughout, displays evidence of relict soil profile with remnant root development and leaching, grades into underlying unit. |
| 3.3 - 4.4 | 1.1 | SANDY GRAVEL, red/brown, pebbles and boulders to 100 mm set in sandy matrix. |
| 4.4 - 5.2 | 0.8 | GRAVEL, predominantly sub angular boulders to 200 mm with minor angular and well rounded. |

The above section was recorded in a creek exposure within the southern area. The main variable within the sediments elsewhere on the site is the increasing thickness of the top sandy clay towards the northern area and the beneficiation plant site. As this unit increases in thickness it tends to contain more pebbles throughout the unit.

3.3.3 Ore Reserves

The ore reserves on MLA 75 and MLA 76 have been reported by Lee (1988). Exploration to date has included geological mapping, chip sampling, aeromagnetic reconnaissance, percussion and diamond drilling. Table 3.3 presents the reserve estimates and their status.

TABLE 3.3
MAGNETITE ORE RESERVE - MLA 75 AND MLA 76

| Area | Open Cut or Underground | Tonnes In-situ | Tonnes Saleable Product | Status |
|----------------------|----------------------------|-------------------|----------------------------|------------------------|
| Existing Quarry | Open cut | 200,000 | 100,000 | probable |
| | Underground | ? | ? | |
| Intermediate Area | Open cut | ? | ? | |
| | Underground | ? | ? | |
| Southern Area | Open cut | 681,000 | 337,000 | proven and probable |
| | Underground | 665,000 | 324,000 | proven and probable |
| TOTAL | | 1,446,000 | 761,000 | |

The ore reserve estimates in the southern area are based on drilling results and the estimates in the vicinity of the existing quarry have been prepared after detailed surface mapping and chip sampling. Further

drilling will be done in the near future to more accurately define the exact location and nature of the magnetite reserves in the vicinity of the existing quarry. The Company will undertake further exploration in the intermediate area once mining is underway in the existing quarry.

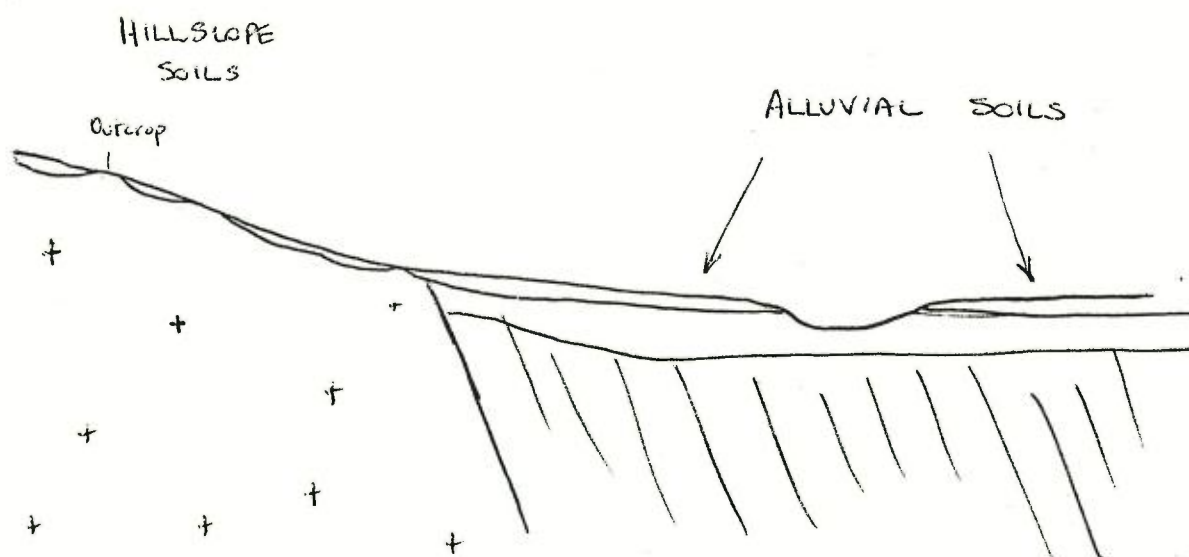
Lee (1984) lists that approximately 50 percent of open cut ore is high grade whereas as much as 55 percent of the underground ore is high grade.

3.4 SOILS

3.4.1 Nature and Distribution

Open Cut Mining Area

There are two types of soil present within the open cut area. They are shown pictorially below.



1. Hillslope Soils

These soils are developed close to the contact between the porphyry and magnetite ore body. The nature of the soil reflects the parent material. A typical profile is:-

- 0 - 0.08 m - LOAM, red/brown, minor small ironstone fragments throughout
- 0.08 - 0.5 m - LIGHT CLAY, red, sometimes sandy or silty, variable proportions of ironstone fragments (1-200 mm) displays poor pedality moderately hard setting.
- 0.5 m+ - WEATHERED BEDROCK

Soil thickness increases locally within minor drainage lines and soil thickness generally decreases upslope, where rock outcrop is common.

The soils developed on the upper slopes are essentially skeletal with little or no development of the B horizon.

2. Alluvial Soils

These soils are located both on the alluvial plains adjacent to both Tallawang and Lambing Yard Creeks. A typical section is:-

| | |
|--------------|--|
| 0 - 0.25 m | - LOAM, brown, occasionally sandy, grades into underlying unit. |
| 0.25 - 0.4 m | - SANDY CLAY, orange/brown, some small quartz pebbles to 15 mm throughout. |
| 0.4 - 0.8 m | - LIGHT CLAY, red, quartz and ironstone pebbles present between 0.4 and 0.6 m. |
| 0.8 m+ | - ALLUVIAL SEDIMENTS |

Beneficiation Plant Site

The beneficiation plant site is underlain entirely by alluvial soils similar to those outlined above.

3.4.2 Erosion Potential

The hillslope soils are moderately stable whilst the A horizon is present, however, if removed the underlying B horizon is more susceptible to erosion.

The alluvial soils have a low erosion potential principally because of their occurrence on the flood plain. Care will need to be taken when using the soils on batters.

The sandy clays and clays are susceptible to erosion. This is evident from the deep scour immediately south of the existing creek crossing.

3.5 METEOROLOGY

3.5.1 Source of Data

Rainfall, temperature, and fog frequency data has been drawn from records kept at Gulgong Post Office, 18 km south-southeast of the site. Information on wind speed and direction has been prepared from 16 years of records collected at Mudgee Post Office. Evaporation data has been drawn from the closest station at Wellington Research Station, 60 km southwest of the site.

3.5.2 Rainfall

The average annual rainfall of 642 mm occurs as shown in Table 3.4. The highest average rainfall occurs during the summer months, with the least in autumn.

The wettest years on record have had at least twice the average annual rainfall whereas during drought years, total annual rainfall has been less than 300 mm.

TABLE 3.4
MEAN MONTHLY RAINFALL - GULGONG POST OFFICE - mm

| Month | J | F | M | A | M | J | J | A | S | O | N | D | Year |
|-----------------------|----|----|----|----|----|----|----|----|----|----|----|----|------|
| Mean | 69 | 61 | 52 | 45 | 43 | 53 | 46 | 48 | 45 | 56 | 59 | 65 | 642 |
| Raindays per month | 6 | 7 | 5 | 5 | 6 | 7 | 7 | 8 | 6 | 7 | 6 | 6 | |

3.5.3 Evaporation

Table 3.5 presents mean monthly evaporation. Evaporation exceeds rainfall for all months except June.

TABLE 3.5
MEAN MONTHLY EVAPORATION* - WELLINGTON RESEARCH STATION** - mm

| Month | J | F | M | A | M | J | J | A | S | O | N | D |
|---------|-----|-----|-----|-----|----|----|----|----|-----|-----|-----|-----|
| Average | 275 | 220 | 187 | 125 | 80 | 50 | 54 | 76 | 100 | 160 | 208 | 280 |

* Class "A" pan ** 13 years of records

3.5.4 Temperatures

Table 3.6 presents the monthly variations in temperature. December and January are the warmest months with average maximums of 29°C and July the coldest with an average maximum temperature of 15°C. Average minimum temperatures vary from 16°C in January and February to 2°C in July.

TABLE 3.6
MEAN DAILY TEMPERATURES - GULGONG POST OFFICE - °C

| Month | J | F | M | A | M | J | J | A | S | O | N | D |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|
| Maximum | 29 | 27 | 27 | 23 | 18 | 16 | 15 | 16 | 19 | 23 | 25 | 29 |
| Minimum | 16 | 16 | 13 | 9 | 6 | 3 | 2 | 4 | 6 | 10 | 11 | 15 |

3.5.5 Temperature Inversions

Radiation inversions are the main type of temperature inversions likely to cause any noise to be enhanced. An indication of the frequency of radiation inversions is obtained by examining fog frequencies as fogs are radiation inversions when water vapour is present. Table 3.7 presents the recorded fog frequencies for Gulgong. It is noted that the Tallawang area often receives more fogs than Gulgong.

TABLE 3.7
FOG FREQUENCIES* - GULGONG POST OFFICE

| Month | J | F | M | A | M | J | J | A | S | O | N | D |
|-------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Av. No./Month | 0 | 0 | 0 | 1 | 1 | 3 | 1 | 1 | 0 | 1 | 0 | 0 |
| Max. No. Recorded/Month | 1 | 0 | 2 | 2 | 4 | 5 | 5 | 6 | 1 | 2 | 1 | 1 |

* 14 years of records

3.5.6 Wind

Figure 3.3 presents the wind roses prepared from information recorded at Mudgee Post Office. The roses show that during summer and autumn the dominant wind, both in frequency and direction, is from the southeast. Other winds during this period are from the east and the northwest-southwest quadrant.

During winter and spring the winds from the northwest-southwest quadrant are dominant. However, winds from the southeast are still prevalent.

3.6 WATER RESOURCES

3.6.1 Surface Water

The main sources of surface water on and around the site are Tallawang Creek and Lambing Yard Creek. Both of these creeks are non-perennial, however, often have permanent pools of water due to groundwater infiltration from the nearby alluvial gravels.

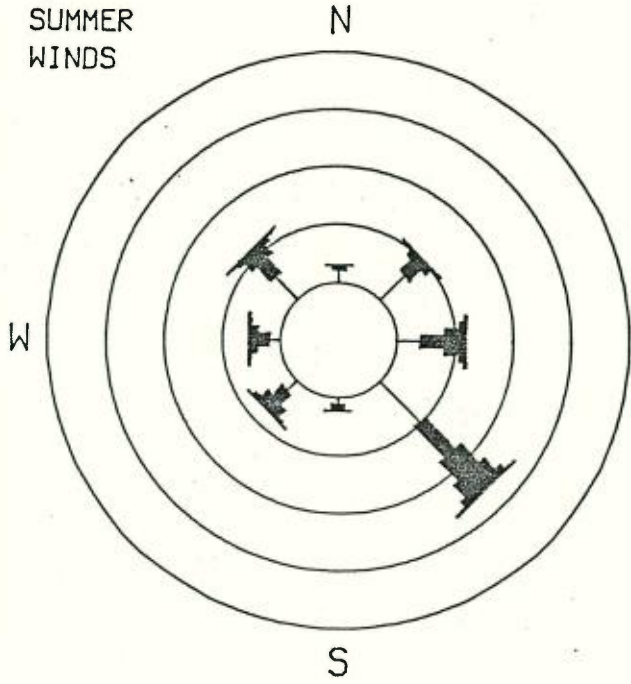
Surface water is also present within the existing open cut and local farm dams. Water within the open cut remained at a relatively constant level during the recent drought whilst all farm dams were dry.

The quality of water within the Tallawang/Lambing Yard Creek system has been examined. Water samples have been taken by the Company and the Department of Mineral Resources at five locations (See Figure 3.1). The analyses of the water are shown in Table 3.8.

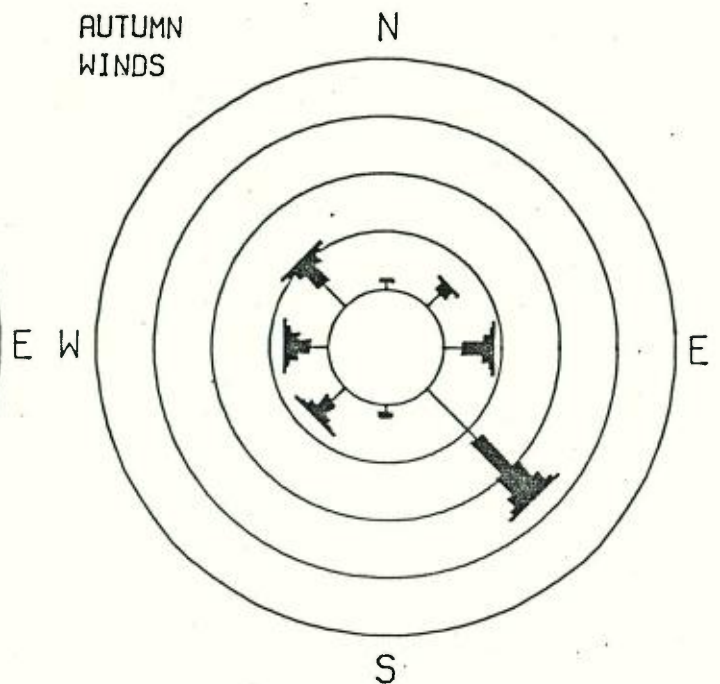
The results in Table 3.8 show that when the creeks are flowing, salt levels are relatively low whereas in low flow or still periods salt levels increase. The main salts present are sodium and magnesium chloride and bicarbonate. All waters tested were slightly alkaline. No heavy metals (eg. Copper, Lead, Zinc, Cadmium) were detected in the water. Suspended solid levels were higher downstream from site No. 1 (Figure 3.1) as the water flowed primarily through pools which were often disturbed by stock and continually disturbed by crayfish.

The water within the existing quarry is slightly more alkaline than the surrounding creek water. Salinity levels are marginally higher than the levels obtained in the nearby creek system. The water is suitable for irrigation of many forage crops and some grain crops (eg. wheat), that is based on Department of Agriculture criteria.

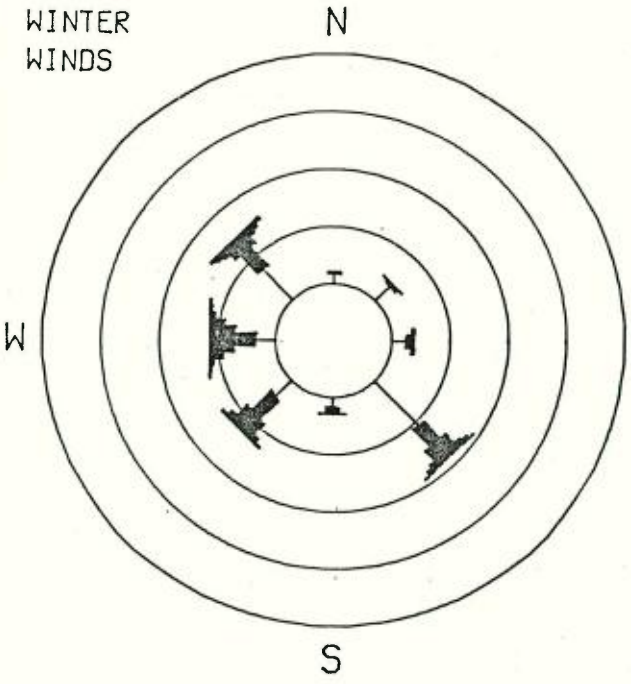
SUMMER WINDS



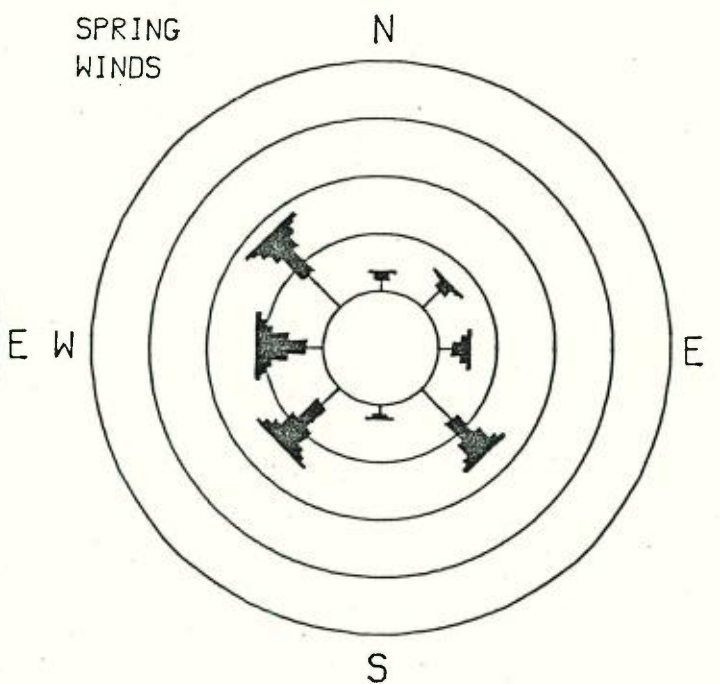
AUTUMN WINDS



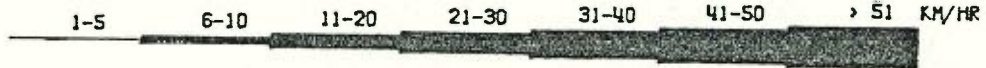
WINTER WINDS



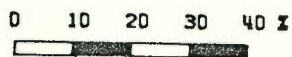
SPRING WINDS



VELOCITY



FREQUENCY



GARMARK PTY. LTD.

WIND ROSE DIAGRAM FOR
MUDGEES P.O., NSW.

COMPUTER PLOTTED BY GEOCON PTY. LTD., SYDNEY

R.W. CORKERY & CO. PTY. LTD. FIG. 3-3

Water Usage

The water within the Tallawang Creek/Lambing Yard Creek system in the vicinity of the proposed development is currently used for stock watering. The pools, especially within Lambing Yard Creek provide good waterholes for stock water.

Downstream of the site, at the junction of Slapdash Creek and Wialdra Creek, water is pumped to supply the township of Gulgong.

Graeme: ~~acknowledgement~~ acknowledgement
 to the Department's report
 "Hydrochemistry of Tallawang..."
 as requested to R. Corkery in my
 letter does not seem to have
 been made. K.B.

MRO please

TABLE 3-8

STREAM WATER ANALYSES - TALLAWANG

45 not
 950 - ammonia
 result sent to
 R. Corkery

| Site | T1 | | T2 | | T3 | | T4 | | T5 | |
|--------------------------|---------------------|---------------------|------------------------|---------------------|---------------------|--------------------|---------------------|--------------------|----------------|---------------------|
| | Co | DMR | Co | DMR | Co | DMR | Co | DMR | Co | DMR |
| pH | 7.2 | 7.2 | 8.7 | 9.5 | 7.5 | 7.85 | 7.5 | 7.6 | 7.9 | 7.8 |
| Conductivity | 465 | 485 | 1580 | 1685 | 860 | 1070 | 625 | 1065 | 660 | 400 |
| Hardness (Calculated) | 105 | ND | 520 | ND | 235 | ND | 170 | ND | 175 | ND |
| Sodium | 48 | 55 | 140 | 160 | 78 | 110 | 61 | 150 | 70 | 50 |
| Potassium | 5.6 | 7.5 | 2.4 | 2.55 | 4.1 | 5 | 3.8 | 3.8 | 3.5 | 3.55 |
| Calcium | 19 | 21 | 14 | 15 | 30 | 3.85 | 22 | 71 | 25 | 13.5 |
| Magnesium | 14 | 14.5 | 118 | 125 | 39 | 450 | 28 | 70 | 27 | 11.5 |
| Chloride | 89 | 84 | 390 | 405 | 185 | 200 | 102 | 28.5 | 115 | 68 |
| Carbonate | nil | ND | 9 | ND | nil | ND | nil | ND | nil | ND |
| Bicarbonate | 85 | 100 | 270 | 290 | 205 | 260 | 185 | 435 | 175 | 100 |
| Sulphate | 19 | 20 | 42 | 50 | 13 | 30 | 27 | 60 | 21 | 5 |
| Nitrate | 8.5 | ND | 0.5 | ND | 0.7 | ND | 1.3 | ND | 0.6 | ND |
| Nitrate | 8.5 | ND | 0.5 | ND | 0.7 | ND | 1.3 | ND | 0.6 | ND |
| Fluoride | 0.12 | ND | 1.11 | ND | 0.20 | ND | 0.25 | ND | 0.24 | ND |
| Silica | 12 | ND | 20 | ND | 14 | ND | 37 | ND | 25 | ND |
| Total Iron | 0.12 (<0.01) | 0.35 (<0.05) | <0.01 (<0.01) | <0.05 | 0.46 (<0.01) | 0.4 (<0.05) | 2.92 (<0.08) | 0.6 (<0.05) | 0.68 (0.28) | 0.25 (<0.05) |
| Manganese | 0.05 | 0.45 (0.25) | 0.10 | 0.10 (<0.05) | 0.57 | 0.65 (0.30) | 0.32 | 0.5 (0.30) | 0.16 | 0.1 (0.05) |
| Arsenic | ND | <0.005 | ND | <0.005 | ND | <0.005 | ND | <0.005 | ND | <0.005 |
| Cadmium | ND | <0.002 | ND | <0.002 | ND | <0.002 | ND | <0.002 | ND | <0.002 |
| Copper | ND | <0.002 | ND | <0.002 | ND | <0.002 | ND | <0.002 | ND | <0.002 |
| Lead | ND | <0.002 | ND | <0.002 | ND | <0.002 | ND | <0.002 | ND | <0.002 |
| Zinc | ND | <0.005 | ND | <0.005 | ND | <0.005 | ND | <0.005 | ND | <0.005 |

Note: Company Samples collected

and DMR Samples collected 28th November, 1984.

Results in () are from filtered samples.

ND = Not Determined

3.6.2 Underground Water

There are two main sources of underground water in the Tallawang area.

(i) Alluvial Gravels

Section 3.3 describes the occurrence of alluvial gravels within the sediments of the alluvial plain adjacent to Tallawang and Lambing Yard Creeks. The gravels rest on the underlying bedrock. It is noticeable where the gravels are exposed in Tallawang Creek that there is natural inflow from these gravels into the creek. The extent of inflow is not known, however, it appears that the groundwater is the only source of water during dry periods.

No bores are sunk in the gravels in the vicinity of the Company's lease applications.

(ii) Fractured Rocks

The fractured Tucklan Beds are the main source of underground water in the Tallawang area. The bores known to occur in the area are shown on Figure 3.1. These bores are used primarily for stock watering during dry periods. Flow rates in these bores vary from 1,500 to 10,000 litres/hour (Source: Water Resources Commission and R. J. Croft).

The fractured rocks that occur adjacent to the magnetite ore body and the magnetite itself are also a source of underground. It is the underground water that has maintained the water level in the existing quarry. There are no bores within the north-south line of magnetite and its host rocks.

The relationship of the flow between the bores shown on Figure 3.1 is difficult to ascertain without detailed investigation. The direction of flow is controlled by joint patterns and the continuity between the joints. Since most of the joints in the Company's lease applications are in a north-south direction, it is likely that most of the groundwater flow will be in the north-south direction.

The quality of water in the bores around Tallawang is presented in Table 3.9. This data has been supplied by R. J. Croft of 'Tallinga' from analyses undertaken by the Department of Agriculture.

TABLE 3.9

UNDERGROUND WATER QUALITY- TALLAWANG

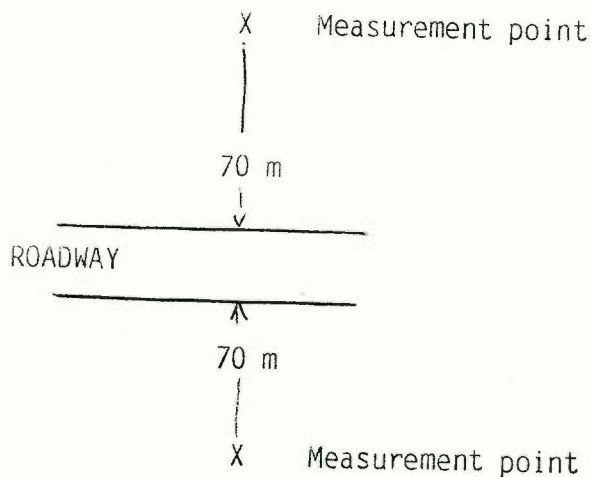
| | Talinga House Bore | Bore on Canon Hill (WRC Ref: 52031) |
|----------------------------------|--------------------|--|
| pH | 7.6 | 8.2 |
| Conductivity | | |
| Hardness (Mg & Ca) | 1269 | 656 |
| Total Alkalinity | 660 | 634 |
| Ca Co ₃ Saturation | +1.3 | 1.6 |
| Sodium | 198 | 220 |
| Potassium | 7 | 3 |
| Calcium | 228 | 121 |
| Magnesium | 170 | 86 |
| Chloride | 620 | 560 |
| Iron | 0 | 0.27 |
| Manganese | 0.01 | 0.08 |
| Copper | 0.02 | 0.05 |
| Zinc | 0.01 | 2.27 |

3.7 BACKGROUND NOISE LEVELS

3.7.1 Monitoring Procedures

Background noise levels were monitored at five sites shown on Figure 3.4. The measurement at these sites was considered sufficient to adequately describe the existing acoustic environment. Noise levels were monitored in accordance with Australian Standard AS1055-1978 on the 26th and 27th September, 1984. The noise levels were monitored using a Bruel and Kjaer integrating peak sound level metre type 2225. The metre was calibrated regularly using a Bruel and Kjaer sound level calibrator type 4230. A series of readings were taken at approximately 2 second intervals for a period of either 5 or 10 minutes using the fast response mode of the meter. All readings are "A" scale readings.

Additional measurements were taken to establish the effect of wind and other local factors on noise levels. Results were obtained by measuring the peak noise level at a point 70 m from the road as the same motor vehicle passed a given point at 100km/h. A mean noise level was obtained from measurements taken as the motor vehicle travelled in both directions.



3.7.2 Statistical Analysis

The data was statistically analysed into L_{90} , L_{eq} , and L_{10} classes. L_{90} is the sound level exceeded 90 per cent of the sampling time, L_{eq} is the sound level of continuous noise which emits the same energy as the fluctuating sound over a fixed period and L_{10} is the sound level exceeded 10 per cent of the sampling time. L_{90} is considered to be representative of background noise levels.

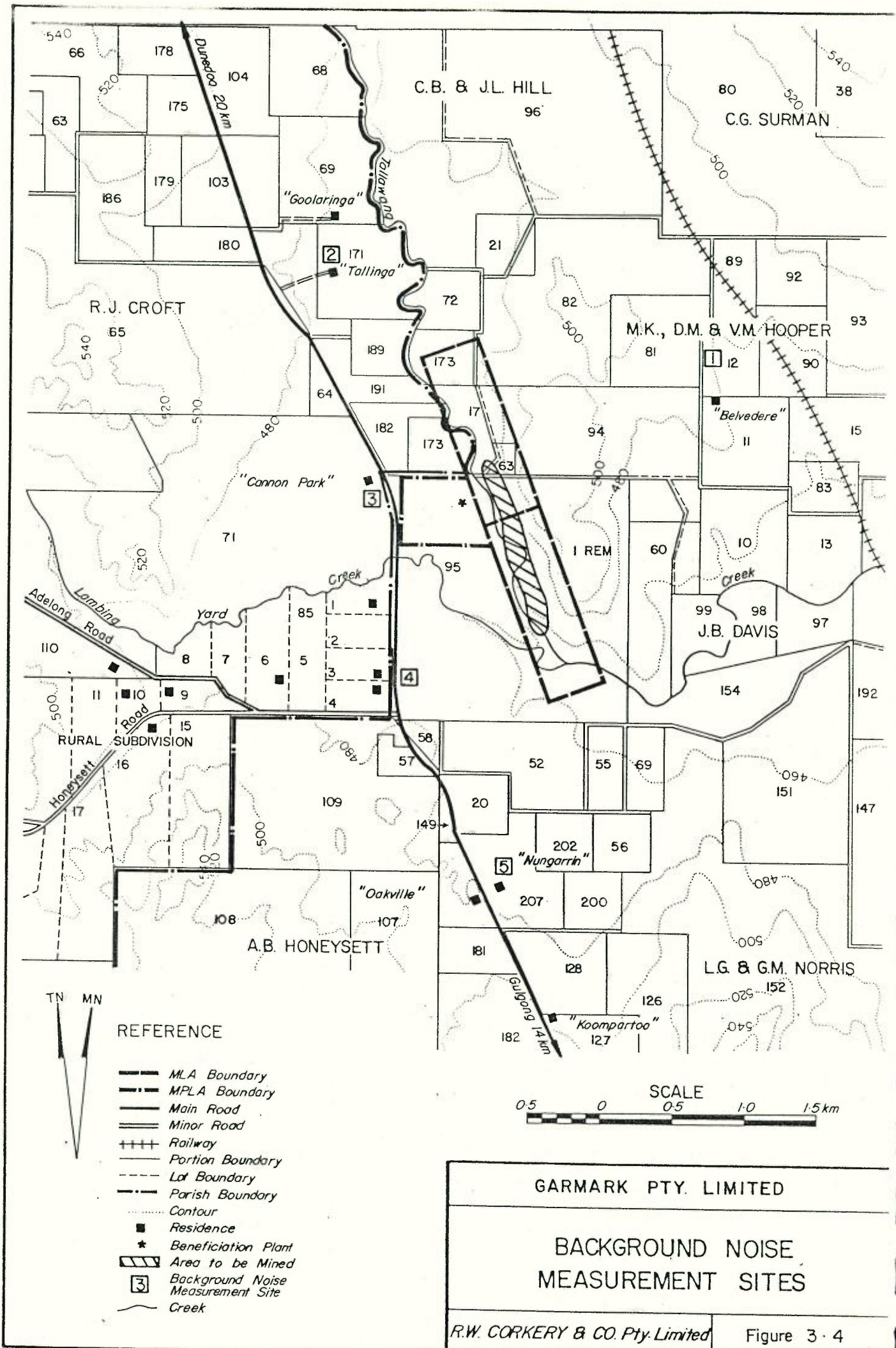
3.7.3 Results

The results of the background noise monitoring presented in Table 3.10 shows that the background noise levels (L_{90}) reflect the rural nature of the Tallawang area.

During the day, existing noise levels are low (29 to 34 dB(A)) when wind speeds are also low. These levels increased during gusty periods. During the late evening noise levels are very low (23 to 27 dB(A)). Noise levels at other periods were similar to the daytime levels.

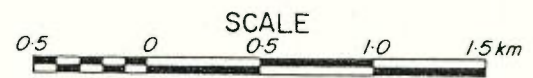
The relatively high L_{10} values reflects the occurrence of traffic on the Gulgong/Dunedoo Road. Noise levels were often in excess of 60 dB(A) at the residences within 100 m of the Gulgong/Dunedoo Road when large trucks or semi-trailers passed.

The following results were obtained from the brief programme to monitor the effect of wind and other local factors on noise levels.



REFERENCE

- MLA Boundary
- MPLA Boundary
- Main Road
- Minor Road
- Railway
- Portion Boundary
- Lot Boundary
- Parish Boundary
- Contour
- Residence
- Beneficiation Plant
- Area to be Mined
- Background Noise Measurement Site
- Creek



GARMARK PTY. LIMITED

BACKGROUND NOISE
MEASUREMENT SITES

R.W. CORKERY & CO. Pty. Limited

Figure 3 - 4

TABLE 3.10

BACKGROUND SOUND LEVEL MEASUREMENTS IN THE VICINITY OF TALLAWANG

| Site No. | Location* | Mid Afternoon | | | Early Evening | | | Late Evening | | | Early Morning | | |
|----------|---------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | L ₉₀ | L _{eq} | L ₁₀ | L ₉₀ | L _{eq} | L ₁₀ | L ₉₀ | L _{eq} | L ₁₀ | L ₉₀ | L _{eq} | L ₁₀ |
| 1. | North of "Belvedere" | 29 | 33 | 38 | 28 | 34 | 38 | 34 | 26 | 29 | 31 | 35 | 39 |
| 2. | Adjacent ot "Tallinga" | 32 | 36 | 44 | 30 | 35 | 46 | 25 | 27 | 32 | 34 | 36 | 40 |
| 3. | Adjacent to "Cannon Park" | 34 | 39 | 47 | 33 | 37 | 44 | 23 | 31 | 48 | 30 | 33 | 37 |
| 4. | Opposite Lots 3 and 4 | 32 | 38 | 45 | 30 | 33 | 36 | 27 | 29 | 33 | 32 | 35 | 40 |
| 5. | Adjacent to "Nungarrin" | 33 | 37 | 45 | 29 | 34 | 40 | 25 | 28 | 32 | 32 | 35 | 37 |

| | | | | | |
|-------------|------------------|-----------------------|-----------------------|------------------------|-----------------------|
| | Date: | 26th September, 1984 | 26th September, 1984 | 26th September, 1984 | 27th September, 1984 |
| FIELD | Time: | 2.00 p.m. - 3.30 p.m. | 7.00 p.m. - 8.30 p.m. | 11.30 p.m. - 1.00 a.m. | 6.00 a.m. - 7.00 a.m. |
| | Temp: | 18 ^o | 15 ^o | 12 ^o | 11 ^o |
| MEASUREMENT | Cloud Cover: | clear | clear | clear | 25% |
| CONDITIONS | Mean Wind Speed: | 5 to 9 km/h | 4 to 8 km/h | calm to 3.5 km/h | 0.4 to 5 km/h |
| | Wind Direction: | S.W. | S.W. | S.W. | N.E. to E |

NOTE: L₉₀ = Sound level exceeded 90% of the sampling time.

L_{eq} = Level of continuous noise which emits the same energy as a fluctuating sound over a fixed period.

L₁₀ = Sound level exceeded 10% of the sampling time

* See Figure 3.4 for site locations

- (i) During the afternoon a wind speed of 11 km/h resulted in a noise level 9 dB(A) higher in the downwind direction. Hence, at this wind speed noises are either enhanced or suppressed by 4.5 dB(A).
- (ii) After 7.00 p.m. when the wind speed was less than 0.5 km/hr, noise levels were not enhanced or suppressed. The noise levels measured were in fact similar to the downwind level measured and discussed in (i). Hence, the local meteorological conditions as evening approaches also tends to enhance noise levels compared to during the day.

3.8 FLORA

The flora on the site has been described following the identification of a number of plant/tree species by the National Herbarium in Sydney. The specimens were collected by R. Corkery in accordance with the guidelines set down by the National Herbarium. Table 3.11 presents the results of the sampling and distribution of the plants/trees over the areas to be mined and the beneficiation plant site.

Existing Quarry Area

There are a number of mature eucalyptus and roughbark apple trees adjacent to and within the existing quarry. A range of small ground cover occur beneath these trees. Approximately forty trees occur within the area to be mined (See Plate 3). The area immediately south of the existing quarry in the area to be mined is primarily grassland.

Intermediate Area

This area is primarily grassland with scattered trees (See Plate 4). A small area of pasture occurs in the vicinity of the northern diversion on the western side of Tallawang Creek. Willows and other trees occur on the banks of Tallawang Creek. Approximately ten trees occur within the area to be mined.

Southern Area

This area is mixture of grassland and pastureland with scattered trees (See Plate 5). The creek bed contains two varieties of rushes. Approximately ten trees occur within the area to be mined.

Beneficiation Plant Site

The plant site occurs within an area of pastureland. This area is periodically sown to wheat. Two large shade trees occur adjacent to the northern boundary of MPLA 77. *These will not be disturbed by the Company's operation.*

TABLE 3.11

EXISTING VEGETATION - TALLAWANG

| Scientific Name | Common Name | Existing Quarry | Inter-mediate Area | Southern Area | Plant Site |
|-----------------------|--------------------|-----------------|--------------------|---------------|------------|
| TREES | | | | | |
| Angorphora floribunda | Roughbark Apple | C | F | F | F |
| Eucalyptus melliodora | Yellow Box | A | F | F | F |
| Eucalyptus blakelyi | Blakely's Red Gum | F | - | - | - |
| Acacia lavococlada | - | C | F | - | - |
| Callitris | Cypress Pine | F | F | - | - |
| | Kurrajong | F | F | F | - |
| Salix babylonica | Wheeping Willow | - | F | F | - |
| SHRUBS/GROUND COVER | | | | | |
| Cassinia sp. | Dogwood | C | - | - | - |
| Hardenbergia violacea | False Sarsparilla | C | - | - | - |
| Hibbertia obtusifolia | Grey Guinea Flower | C | - | - | - |
| Lycium australe | Boxthorn | F | F | F | - |
| Andropogon virginicus | Whisky Grass | - | F | F | - |
| Aristida sp. | Spear Grass(?) | F | F | C | F |
| Rubus sp. | Blackberry | F | - | - | - |
| Echium plantagineum | Pattersons Curse | F | F | F | C |
| Urtica incisa | Stinging Nettles | F | - | - | - |
| Juncus sp. | Rush | - | C | C | - |
| Scirpus fluviatilis | Bulrush | - | C | C | - |
| Carthamus lanatus | Saffron Thistle | F | C | C | A |
| Centaurea calcitrapa | Star Thistle | F | - | - | F |

A: Abundant

C: Common

F: Few Present

-: Absent

Surrounding Area

Most of the surrounding land is either pastureland or grassland. The northern end of the ridge to the east of the site is moderately timbered with Cypress Pine and Eucalypts and the southern end of the ridge is mainly cleared with numerous dead trees.

3.9 FAUNA

The main fauna observed on site are stock (merino sheep) and birds. Appendix 2 lists the birds observed and known to occur on the site. A series of mud nests of the fairy martin occur within a sheltered area of the bank of Tallawang Creek in the southern area.

Other native and introduced species observed and known to occur on and around the site include the grey kangaroo, rabbits, hares, wombats, foxes, possums, snakes and lizards.

Within Tallawang Creek, small fish are observed. Other creek related fauna include crayfish, frogs and mussels.

3.10 ECOLOGICAL STATUS

The areas to be mined have a relatively low ecological status as they are primarily grassland or pastureland with scattered trees. The ecology of Tallawang Creek is typical of its entire length. However, its features should be maintained principally, the water holes for stock watering and wading birds.

3.11 LAND USE

3.11.1 Land Zoning

The Company's lease applications are located in two zones of the planning instruments adopted for planning in the Tallawang area, that is, Interim Development Order No. 1 - Shire of Cudgegong which was gazetted in November, 1967. The two zones are:

(i) Non Urban 1(a)

This zone covers all non urban or rural land more than 400 m from the Gulgong/Dunedoo Road (MR. 55). All of the Company's Mining Lease Application are within this zone.

(ii) Non Urban 1(b)

This zone covers all the land within 400 m of the Gulgong/Dunedoo Road (MR. 55). This area covers much of the Company's Mining Purposes Lease Application.

3.11.2 SITE'S LAND USE

The Company's lease applications cover pastureland and grazing land. The pasture land occurs west of Tallawang Creek on its alluvial plain and in the north of MLA 75. The most common crops sown on these areas is wheat and lucerne. Yields on these areas are generally good due to the good quality of the alluvial soils.

The grazing land is confined to areas east of Tallawang Creek in the vicinity of the proposed mine area where there is much outcrop and little soil development. Shade trees are also present throughout the grazing land.

Tallawang Creek provides stock drinking water for most of the year. Even during dry periods inflow from alluvial gravels maintains some water holes downstream from the existing quarry.

3.11.3 SURROUNDING LAND USES

Table 3.12 lists the land uses around the Company's lease applications. The land uses are essentially rural including a rural subdivision west of the Gulgong/Dunedoo Road (MR. 55).

TABLE 3.12

LAND USES SURROUNDING LEASE APPLICATIONS

| Direction | Land Use |
|-----------|-------------------------------------|
| North | Pasture (wheat, lucerne, oats) |
| | Grazing (Merinos, herefords) |
| East | Grazing (Merinos, horses) |
| South | Pasture (wheat, lucerne, oats) |
| | Grazing (Merinos) |
| West | Pasture (wheat, lucerne, oats) |
| | Grazing (Merinos, herefords, goats) |
| | Rural Subdivision |

3.12 NEARBY AND ADJACENT LANDOWNERS

Figure 3.5 shows the location of nearby and adjacent landowners and Table 3.13 lists the landowners and the approximate distance of their respective residence to the closest point in the mining operation and the beneficiation plant.

Table 3.13 also records the construction type and condition of each residence. The Company (with the approval of the residents) proposes to undertake a structural survey of each of the fifteen residences prior to the commencement of mining to establish the exact condition of each residence.

TABLE 3.13

NEARBY AND ADJACENT LANDOWNERS

| Property Name Construction | Owner | Distance from Residence to Beneficiation Plant (km) | Closest Distance from Residence to Open Cut Mine (km) | Residence | Condition |
|-------------------------------|---|---|---|-----------------------------|-----------------------------|
| LARGE LANDHOLDINGS | | | | | |
| "Nungarrin" | J. Davis | 2.7 | 1.8 | Brick Veneer | Good |
| "Oakville" | A.B. Honeysett <i>sp.</i> ← (main res) (rented res) | 2.8 2.0 | 1.9 1.6 | Fibro Weatherboard | Good Poor |
| "Koompartoo" | L.G. & G.M. Norris | 3.7 | 2.7 | | |
| "Cannon Park" | R.J. Croft | 0.55 | 0.7 | Fibro | Average |
| "Tallinga" | R.J. Croft | 1.8 | 1.7 | Brick/concrete | Good |
| "Goolaringa" | C.B. & J.L. Hill | 2.1 | 2.0 | | |
| "Belvedere" | M.K. D.M. & V.M. Hooper* | 1.8 | 1.6 | | currently being renov |
| RURAL SUBDIVISION | | | | | |
| Lot 1 | T.A. Peppernell | 1.0 | 0.9 | Caravan /shed | Average |
| Lots 2 & 3 "Weemara" | J.E. Takacs | 1.4 | 1.0 | Hardiplank | Good |
| Lot 4 "Amandeen" | V.M. Horner | 1.6 | 1.1 | Hardiplank | Good |
| Lot 5 | E.P.A. & E. Sullivan | | no residence | | |
| Lot 6 "Yarrahappini" | A.J. Waldon | 2.2 | 2.0 | Galvanised Iron | Good |
| Lot 7 | M. Coleman | 1.9 | 1.8 | Weatherboard (weekender) | Average |
| Lot 8 "Akoona" | H.J. Leonard | 2.3 | 2.3 | Concrete/brick | Good |
| Lot 9 | B.D. & J.J. Baragry | 2.5 | 2.4 | Fibro | Good |
| Lot 10 | J.T.C. Shoard | 2.7 | 2.6 | Fibro | Good |
| Lot 11 | J.A. & P.V. Watts | 3.0 | 2.9 | Fibro | Good |
| Lot 15 | P. Rily | | no residence | | |
| Lot 16 | R.J. & M.E. Martin | 2.7 | 2.6 | | |
| Lot 17 | S.H. Lloyd & T.M. Magee | | no residence | | |

*currently in process of sale to J. & K. Bourke

The Company's proposal has been discussed with all the adjacent landowners and some nearby landowners. A number of these landowners have had an opportunity to review the draft Environmental Impact Statement which the Company gratefully acknowledges.

3.13 PRE-EUROPEAN HISTORY

An archaeological survey for aboriginal sites was undertaken on the Company's lease applications by Archaeologists L. Smith and E. Rich, Associate Members of the Association of Consulting Archaeologists.

The survey resulted in seven open scatters of artefacts being located all within 50 m of Tallawang Creek. The sites are shown on Figure 3.6 and the findings of the survey are presented in Table 3.14.

Four of the areas in which artefacts were located are in areas to be disturbed by the mining operation.

TABLE 3.14

ABORIGINAL RELICS - TALLAWANG

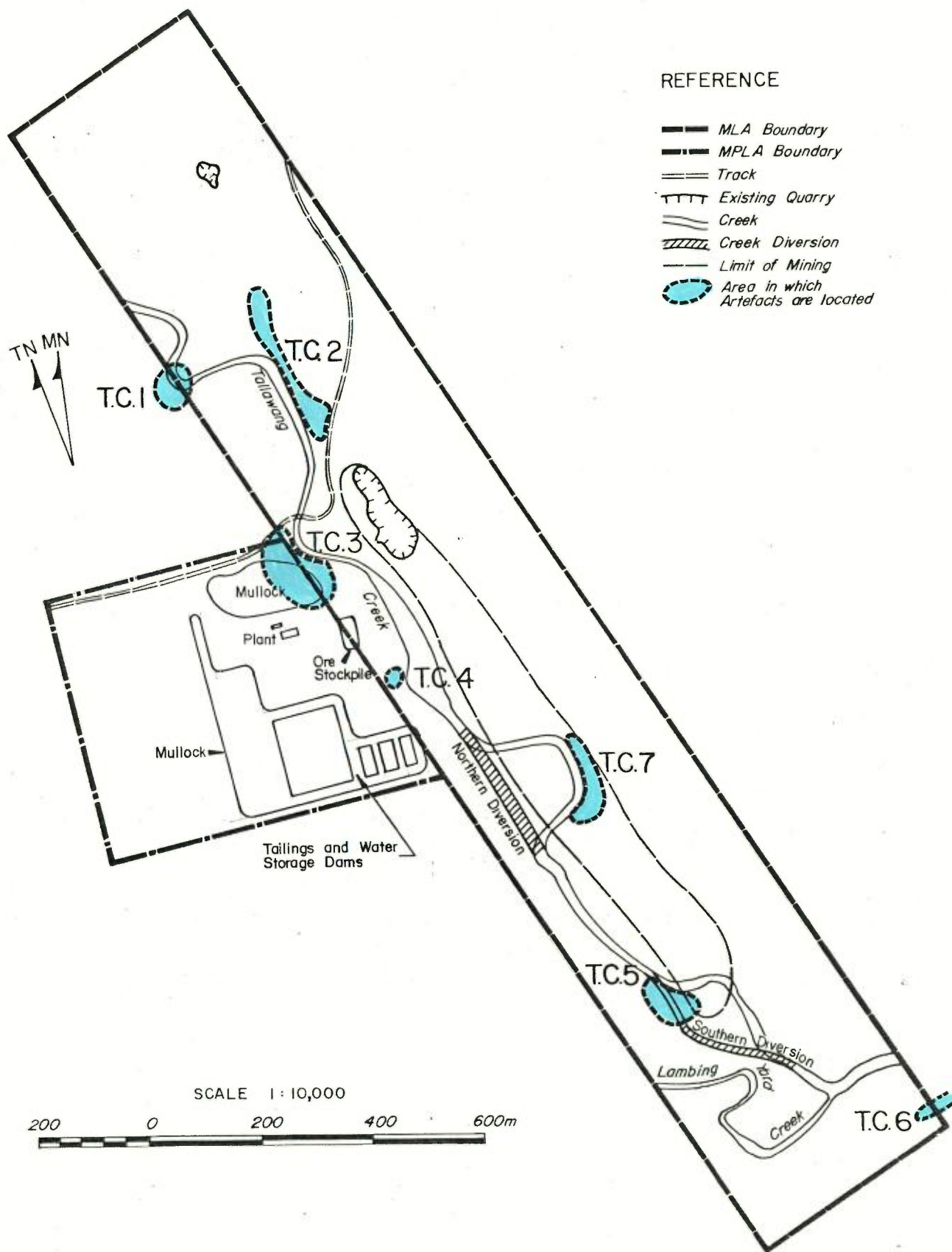
| Location | Type of Artefact | Comments |
|----------|--|---|
| T.C. 1 | Flakes, flaked pieces | More than 10 artefacts, all made of quartz. Located on eroding bank of creek. |
| T.C.2 | Flakes, backed blade, core and flaked pieces | Considered an important location. Includes knapping floor. (Area for preparation of tools). Possible contact site (possible glass artefacts present) |
| T.C.3 | Flakes, cores and flaked pieces | Located on flood plain on western side of Tallawang Creek. More than 18 artefacts present of quartz and indurated mudstone. |
| T.C.4 | Flakes, core and flaked pieces | Located in basin adjacent to Tallawang Creek. 8 artefacts found, all quartz. |
| T.C.5 | Flakes and flaked pieces | Located in basin adjacent to Tallawang Creek. 3 artefacts found. |
| T.C.6 | Flakes, broken core and flaked | Considered an important location. Located on southern side of Tallawang Creek. More than 50 artefacts were found (18 were measured), of a variety of materials. |
| T.C.7 | Flake, core and flaked pieces | Located on elevated rocky area adjacent to Tallawang Creek, 6 artefacts found. |

Smith and Rich (1985) record that the aboriginal people occupying the Tallawang area belonged to the Gamilaroi linguistic group. Tallawang Creek would have been a source of food and water with good camping sites nearby. The nature of the area lends itself to the occurrence of open sites. One site at Botobolar, 40 km to the southeast of Tallawang has been investigated and an estimated date of occupation recorded $5,770 \pm 100$ years before present (Pearson, 1981). However, only 15 other campsites have been recorded in a 20 km radius of Tallawang. This is due to the limited amount of archaeological investigation carried out in the region.

The artefacts at T.C.3, T.C.4, and T.C.5 may have been disturbed or relocated by flooding and ploughing. Further archaeological investigation will determine whether there is any in-situ deposit.

Smith and Rich made the following points in summary:

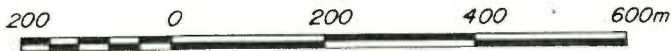
- (i) T.C.1, T.C.4, T.C.5 and T.C.7 appear similar in their site content yet the nature of their locations varied (high rocky ground (T.C.7) compared with shallow basins (T.C.4 and T.C.5))
- (ii) T.C.3 and T.C.6 appear similar in that they both contain artefacts manufactured from a wide range of materials and have relatively high artefact densities.
- (iii) T.C.2 appears to be distinctive from other sites in the area. The knapping floor contains small quartz artefacts. Larger artefacts of fine grained siliceous and indurated mudstone materials (found at T.C.3, T.C.6 and T.C.7) appear to be absent.



REFERENCE

- MLA Boundary
- - - MPLA Boundary
- ==== Track
- ||||| Existing Quarry
- ~~~~~ Creek
- ////// Creek Diversion
- Limit of Mining
- Area in which Artefacts are located

SCALE 1:10,000



GARMARK PTY. LIMITED

LOCATIONS OF ABORIGINAL
ARTEFACTS

R.W. CORKERY & CO. Pty. Limited

3 HISTORICAL ASPECTS

The history of the Tallawang mine has previously been outlined in Section 1.4. The only features relating to the original 1901 - 1927 period of mining are:

- (i) The existing quarry and a smaller quarry 600 m north of the existing quarry.
- (ii) Mullock dumps adjacent to the open cut mine.
- (iii) A few scattered brick and timber from old buildings located north of the proposed mine area.
- (iv) The route of the old railway spur line between the mine and the main railway line at Tallawang. The foundation of this line are still in place. Residents of 'Belvedere' utilize this route for access to their homestead.

3.15 SOCIO-ECONOMIC FACTORS

3.15.1 Introduction

Tallawang lies between two small towns, Gulgong and Dunedoo. Tallawang is considered to be part of the Gulgong District as it is slightly closer to Gulgong. Mudgee is the main regional centre that provides services to the Tallawang district. Some services etc. are controlled by Government Departments located in Dubbo.

3.15.2 POPULATION

Table 3.15 presents the population statistics for Mudgee, Gulgong, Gulgong District and Dunedoo. Gulgong has approximately twice the population of Dunedoo and approximately the same population as its surrounding district.

TABLE 3.15

POPULATION, EMPLOYMENT AND HOUSING

MUDGEE - DUNEDOO - GULGONG DISTRICTS - JUNE, 1981.

| Locality | Average Distance from mine (km) | | POPULATION * | | | HOUSING Private Dwellings | |
|---------------------|--|---|--------------|--------|-------|------------------------------|------------|
| | | | Male | Female | Total | Occupied | Unoccupied |
| Mudgee | 50 | T | 2889 | 3126 | 6015 | | |
| | | E | 1493 | 899 | 2392 | 2019 | 183 |
| | | U | 110 | 74 | 184 | | |
| Gulgong | 18 | T | 875 | 865 | 1740 | | |
| | | E | 435 | 228 | 663 | 557 | 53 |
| | | U | 27 | 25 | 52 | | |
| Gulgong District | 15 - 25 | T | 899 | 850 | 1749 | | |
| | | E | 463 | 254 | 717 | 537 | 171 |
| | | U | 43 | 25 | 68 | | |
| Dunedoo | 22 | T | 409 | 427 | 836 | | |
| | | E | 198 | 103 | 301 | 277 | 37 |
| | | U | 18 | 8 | 26 | | |

Source: 1981 Census

T = Total number

E = Number employed

U = Number Unemployed

Table 3.16 shows the age structure of persons throughout the district is typical of rural, small towns and a regional centre.

TABLE 3.16
AGE - BY POPULATION MUDGEE - GULGONG DISTRICT - DUNEDOO - JUNE, 1981

| Age (Yrs) | Mudgee | | Gulgong | | Gulgong District | | Dunedoo | |
|-----------|--------|------|---------|-----|------------------|-----|---------|-----|
| | M | F | M | F | M | F | M | F |
| 0-4 | 251 | 238 | 75 | 65 | 62 | 84 | 35 | 34 |
| 5-9 | 236 | 262 | 80 | 64 | 90 | 79 | 39 | 41 |
| 10-14 | 233 | 276 | 78 | 81 | 96 | 92 | 36 | 50 |
| 15-19 | 231 | 238 | 61 | 76 | 70 | 78 | 32 | 31 |
| 20-24 | 217 | 236 | 55 | 59 | 45 | 38 | 32 | 24 |
| 25-29 | 231 | 212 | 68 | 68 | 45 | 49 | 29 | 29 |
| 30-34 | 245 | 217 | 61 | 53 | 77 | 62 | 26 | 32 |
| 35-39 | 183 | 178 | 67 | 43 | 61 | 54 | 37 | 35 |
| 40-44 | 172 | 158 | 50 | 41 | 62 | 56 | 25 | 18 |
| 45-49 | 136 | 142 | 55 | 47 | 56 | 50 | 13 | 23 |
| 50-54 | 145 | 133 | 44 | 51 | 60 | 47 | 19 | 16 |
| 55-59 | 130 | 166 | 36 | 38 | 57 | 49 | 12 | 15 |
| 60-64 | 123 | 157 | 42 | 47 | 43 | 36 | 11 | 22 |
| 65-69 | 133 | 170 | 36 | 38 | 35 | 24 | 23 | 18 |
| 70-74 | 101 | 149 | 32 | 42 | 23 | 24 | 14 | 20 |
| 75+ | 122 | 194 | 35 | 52 | 17 | 28 | 26 | 20 |
| Totals | 2889 | 3126 | 875 | 865 | 899 | 850 | 409 | 428 |

Source: 1981 Census

3.15.3 WORKFORCE

Table 3.15 presents the level of employment and unemployment within the area around Tallawang. At present the level of unemployed in these districts is as follows:

Data to Come.

The 1981 census figures provides a breakdown of employment types in the area. Table 3.17 shows that the greater the population concentration, the higher the proportion clerical workers, sales workers, tradesmen, laborers and process workers. Almost 60 per cent of the working residents in the Gulgong district are directly involved with agriculture compared with 4 to 14 per cent in the nearby towns.

TABLE 3.17

EMPLOYMENT - BY INDUSTRY - % OF TOTAL EMPLOYED

MUDGEE - GULGONG DISTRICT- DUNEDOO - JUNE, 1981

| Employment Category | Mudgee | Gulgong | Gulgong District | Dunedoo |
|--|--------|---------|---------------------|---------|
| Professionals (Dr, teachers etc) | 11.0 | 13.0 | 2.7 | 10.6 |
| Administration | 6.0 | 6.0 | 0.7 | 5.6 |
| Clerical Workers | 14.1 | 10.6 | 3.4 | 13.5 |
| Sales Workers | 11.3 | 9.5 | 3.2 | 6.6 |
| Agriculture | 4.3 | 9.5 | 58.2 | 14.5 |
| Mining, Quarrying | 1.0 | 3.0 | 1.5 | 0 |
| Transport | 6.6 | 4.4 | 3.4 | 9.2 |
| Tradesmen, labourers and process workers | 26.1 | 24.9 | 9.5 | 21.5 |
| Service, sport & recreation | 10.7 | 10.1 | 2.7 | 11.9 |
| Not known | 9.0 | 9.0 | 14.8 | 6.6 |

Source: 1981 Census

3.16 Power Supply

The Electricity Supply Authority for the area is Ulan County Council, whose practice is to supply consumers at low voltage (415V). For larger consumers a demand tariff structure is available for both low (415V) and high (22KV) supply voltage levels.

Ulan County Council has an extensive 22KV and 11KV distribution system with one of the main feeders passing through MPLA 77 (See Figure 2.1 and 2.8).

3.17 VISUAL FEATURES

The site of the Company's open cut mining operation and beneficiation plant is visible from all directions except the east where the nearby ridge affords visual protection.

The existing quarry face is visible from the Dunedoo/Gulgong Road (M.R. 55) and houses adjacent to this road such as "Cannon Park" and residences on Lots 1, 3, 4 and 6 of the rural subdivision. Houses further west in the subdivision only have a partial view of the existing quarry as nearby vegetation acts as a partial screen. Distant views of the existing quarry are also possible from "Tallinga" and "Goolaringa" to the north and "Nungarrin" and "Oakville" to the south.

The southern and intermediate areas in the proposed mine area are topographically lower than the existing quarry and as such are less visible from the previously mentioned residences.

The site of the beneficiation plant is visible from the residences outlined above. Greatest visibility of the plant site is from "Cannon Park" and from M.R. 55.

3.18 TRANSPORTATION NETWORK

3.18.1 Road Network

Figure 3.7 shows the local road network between Gulgong and Dunedoo. The roads to be utilised by the Company and notes relating to their condition and current traffic use is presented in Table 3.18. It should be noted that the most up to date traffic data is from 1980. The traffic data listed in Table 3.18 and shown on Figure 3.7 can be up-dated using the annual rural traffic increases determined by the Department of Main Roads. Since 1980, rural traffic levels throughout NSW have increased by:-

- (i) 6.7% in 1981
- (ii) 2.4% in 1982
- (iii) %1.6% in 1983

These increases compound to give an increase in Annual Average Daily Traffic figures of at least 12 per cent. A conservative estimate in the increase to 1985 is 15 per cent.

TABLE 3.18

ROADS IN MUDGEES SHIRE TO BE USED BY THE
COMPANY FOR TRANSPORTATION OF PRODUCT

| Road | Width (m) | Condition | A.A.D.T.* (1980) | A.A.D.T. (1985) |
|------------------------------|-----------|--------------|---------------------|--------------------|
| M.R. 55 (Gulgong/Dunedoo) | 6.1 | Good/Average | 610 | 700 |
| S.R. 170 | 5.6 | Good | N.A. | N.A. |
| Rouse Street | 6.4 | Good | N.A. | N.A. |
| M.R. 598 (Gulgong/Ulan) | 6.1 | Good/Average | 860 | 990 |
| Caledonian Street | 6.4 | Good | N.A. | N.A. |
| Fisher Street | 6.4 | Good | N.A. | N.A. |

N.A. - Not available

* A.A.D.T. = Annual Average Daily Traffic

3.18.2 Railway

The State Rail Authority maintains the Wallerawang to Gwebegar railway line which passes approximately 3 kms east of the development site.

SECTION 4

DESIGN AND OPERATIONAL SAFEGUARDS

4.1 AIR POLLUTION CONTROLS

4.1.1 Nature of Contaminants

The principal potential air contaminant that could be generated by the Company's activities is dust arising from construction activities, vehicle movements, drilling and blasting, soil stripping and crushing.

Other potential sources of air pollution would include:-

- (i) exhaust emissions from diesel and petrol driven equipment and motors.
- (ii) fumes from blasting.
- (iii) burning off vegetation waste.

4.1.2 Dust Control Measures

The main sources of dust outlined above and safeguards designed to eliminate their dispersal from the site are set out in Table 4.1.

4.1.3 Control Measures for other Potential Air Contaminants.

Exhaust Emissions

The earthmoving equipment, vehicles and motors on site will be fitted with the appropriate exhaust controls. The Company proposes that equipment used on site by themselves and its contractors will be properly maintained to ensure that no unacceptable exhaust emissions are emitted.

Blasting Fumes

The volume of fumes liberated by blasting will be quickly dispersed into the local atmosphere without any hazardous levels extending beyond the mine area. Hence, no safeguards are necessary.

Burning Off

The vegetation removed from the open cut areas will be pushed to one side and allowed to dry. After all useable timber/firewood is obtained and the wood dried, the remaining material will be burnt (during a period allowable and under suitable atmospheric conditions). This safeguard will ensure that minimal smoke is generated.

TABLE 4.1
POSSIBLE SOURCES OF DUST AND PROPOSED SAFEGUARDS

| POSSIBLE SOURCE OF DUST | PROPOSED SAFEGUARDS |
|--------------------------------|--|
| Site Preparation | The stockpiling of soil and removal/ placement of alluvial material will generate dust. However, where practical, areas will be watered prior to this activity. |
| Access Road from M.R. 55 | This section of road will be sealed. |
| On-site roads and haul road | Dust on these roads will be suppressed in the early stages of development by regular watering from a water cart. Once crushed rock is produced in the plant, the on site roads and haul roads will be surfaced with crushed rock to reduce dust generation. Watering will be undertaken as required. |
| Drilling | The air track drill be fitted with dust collectors. |
| Blasting | Standard blasting practice will ensure dust is kept to a minimum. |
| Vehicle Exhausts | All exhausts will be directed upwards so as not to impinge on the ground. |

| | |
|---------------------|--|
| Crushing | Both the primary and secondary crushers will be fitted with water sprays to suppress dust. |
| Bundwalls/damwalls | All dam walls and faces of mullock stockpiles will be grassed. |
| Rehabilitated Areas | All rehabilitated areas will be grassed and watered as soon as the final landform is created. Fencing will prevent stock from grazing on rehabilitated areas prematurely and causing bare patches which in turn will reduce dust problems. |
| Tailings Dam | The surface of the tailings dam will always remain damp. |

4.2 WATER POLLUTION CONTROLS

The main potential type of water pollution emanating from the Company's project could be the increase of suspended solids due to a wide range of particulates entering the water system. Studies of water quality in the existing quarry, and the absence of any chemicals to be used in the beneficiation process dictates that no problems of a chemical nature will occur.

The potential sources of suspended solids that could enter the drainage system and safeguards to prevent any pollution occurrences are set out in Table 4.2.

TABLE 4.2

POTENTIAL SOURCES OF SUSPENDED SOLIDS AND PROPOSED SAFEGUARDS

| Potential Source of Suspended Solids | Proposed Safeguards |
|--|---|
| Soils/Alluvial Sediments during site preparation | Diversion drains will be established prior to mining commencing. The sedimentation dam on the western side of Tallawang Creek will be the first structure constructed. |
| Dewatering existing quarry | All sludge/suspended solids will be pumped into the tailings dam adjacent to beneficiation plant. |
| Dewatering proposed open cut | Any water infiltrating or falling into the open cut will be pumped to the process water dam (if suspended solid levels are high) or the fresh water pond (if clear). Any discharge into Tallawang Creek will first pass through the discharge water pond. |
| Runoff from stockpile areas and beneficiation plant site | All runoff from these areas will be directed into the sedimentation dam shown on Figure 2.8. |

| | |
|------------|--|
| Tailings | All tailings will be placed either in the dam adjacent to the beneficiation plant or in the worked out section of the open cut. |
| Diversions | The diversions will be installed prior to their use to ensure that the banks and floor are well grassed. The design of the diversions outlined in Section 4.3 will ensure no bank erosion results. |
| Levee Bank | All levee banks will be grassed as soon as they are in place to ensure contaminated runoff is minimised. Their design as outlined in Section 4.3 will ensure both long term stability and erosion from the levee slopes. |

4.3 DRAINAGE AND FLOODING CONTROLS

4.3.1 Introduction

The safeguards incorporated in the Company's project to minimise the impact of stream diversions and the levee on the existing regime have been developed by Rankine and Hill Pty. Limited, Consulting Engineers.

Three main changes will need to be implemented.

- (i) Creek Diversions in areas where Tallawang Creek crosses the magnetite ore body.
- (ii) Levees adjacent to Tallawang Creek to prevent floods entering the open cut.

- (iii) Local drainage controls to prevent runoff from entering the beneficiation plant site.

4.3.2 Creek Diversion

The Company proposes to construct two creek diversions to enable it to effectively mine the magnetite ore within its lease application.

The two diversions proposed are:

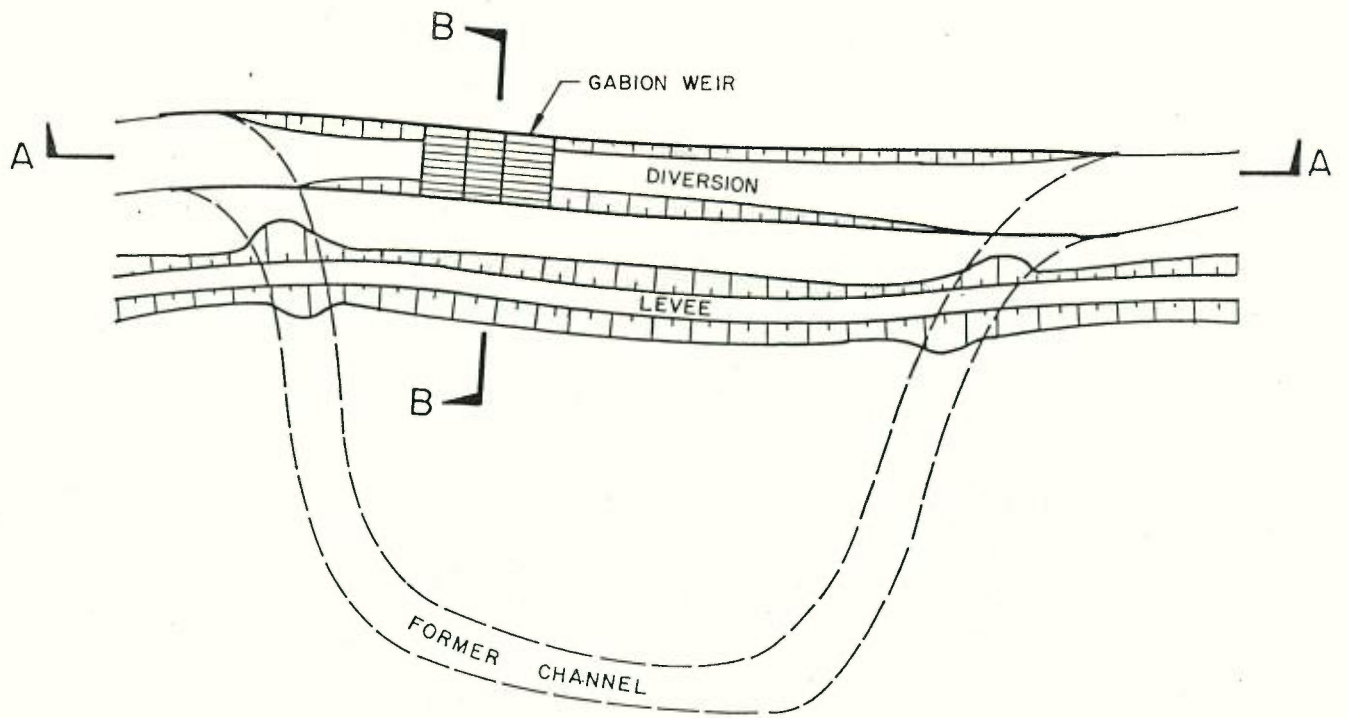
1. Northern Diversion

This diversion bypasses a large meander immediately downstream of the existing quarry.

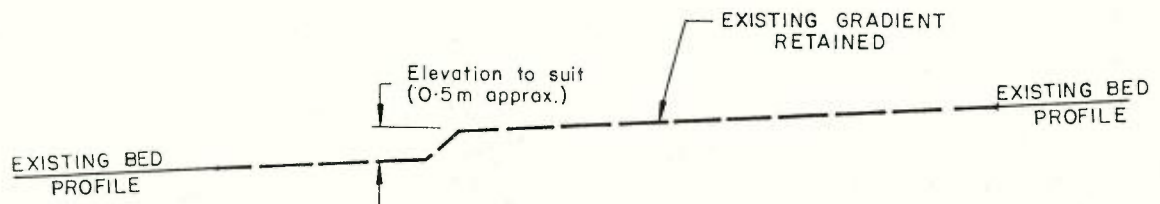
This results in a shortening of the natural creek channel by 150 m. In order to control headward erosion, a gabion weir would be constructed (See Figure 4.1). Upstream and downstream of the weir, the existing grade would be maintained, and the discontinuity between bed profiles located at the weir itself. The difference in elevation between upstream and downstream profiles would be 0.5 m. A sketch of the proposed weir is shown on Figure 4.2.

2. Southern Diversion

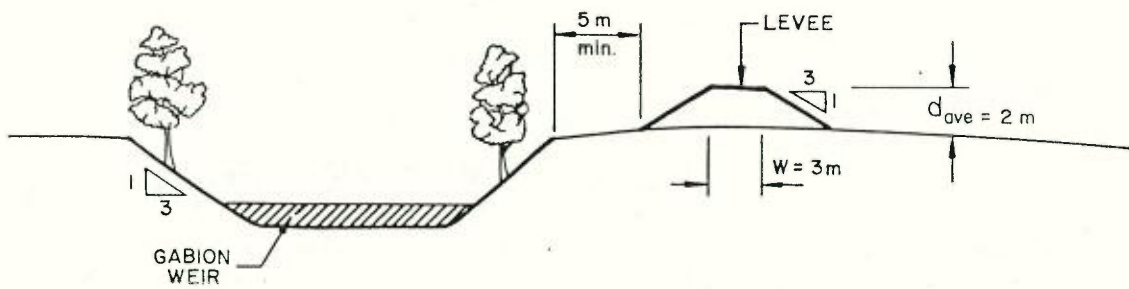
This diversion bypasses the southern extremity of the magnetite ore body.



PLAN



SECTION AA (NOT TO SCALE)



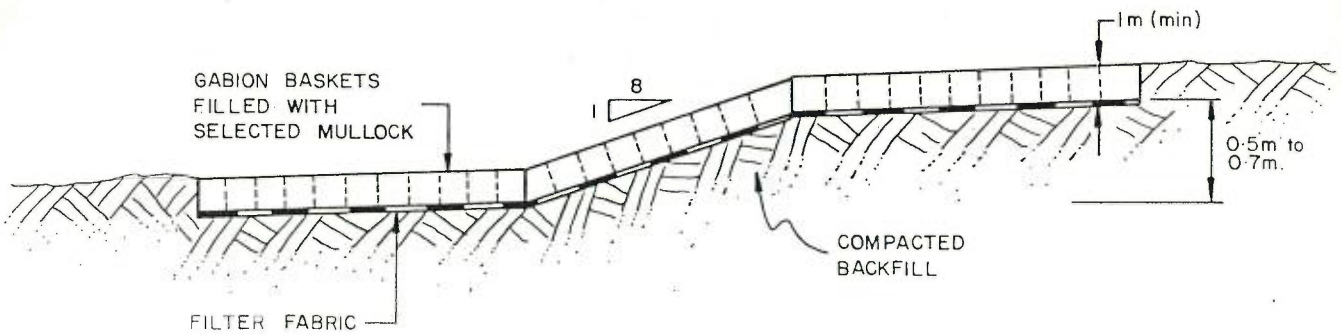
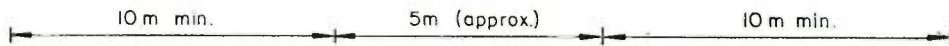
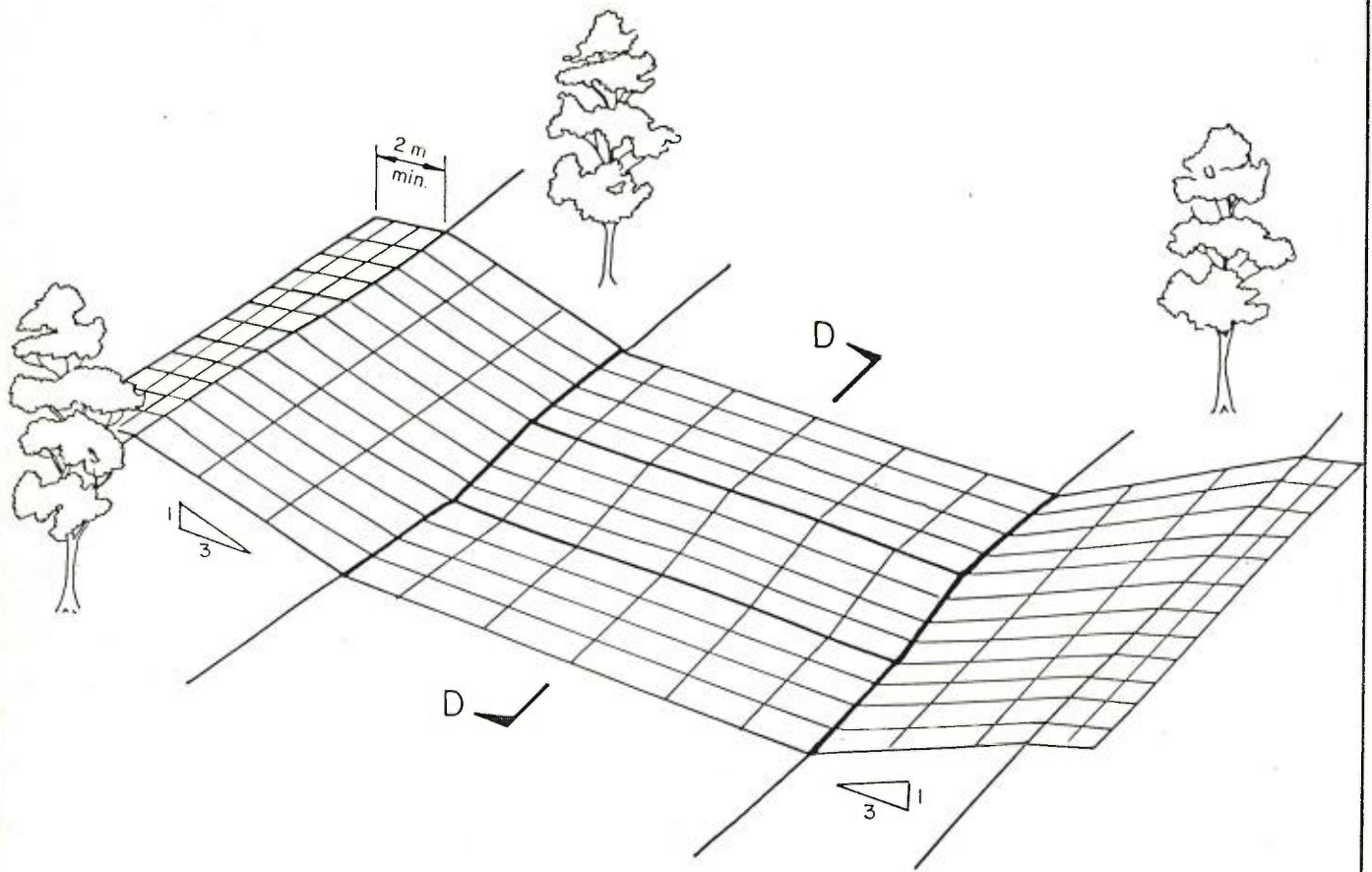
SECTION BB (NOT TO SCALE)

GARMARK PTY. LIMITED

SCHEMATIC DETAILS
OF CREEK DIVERSIONS

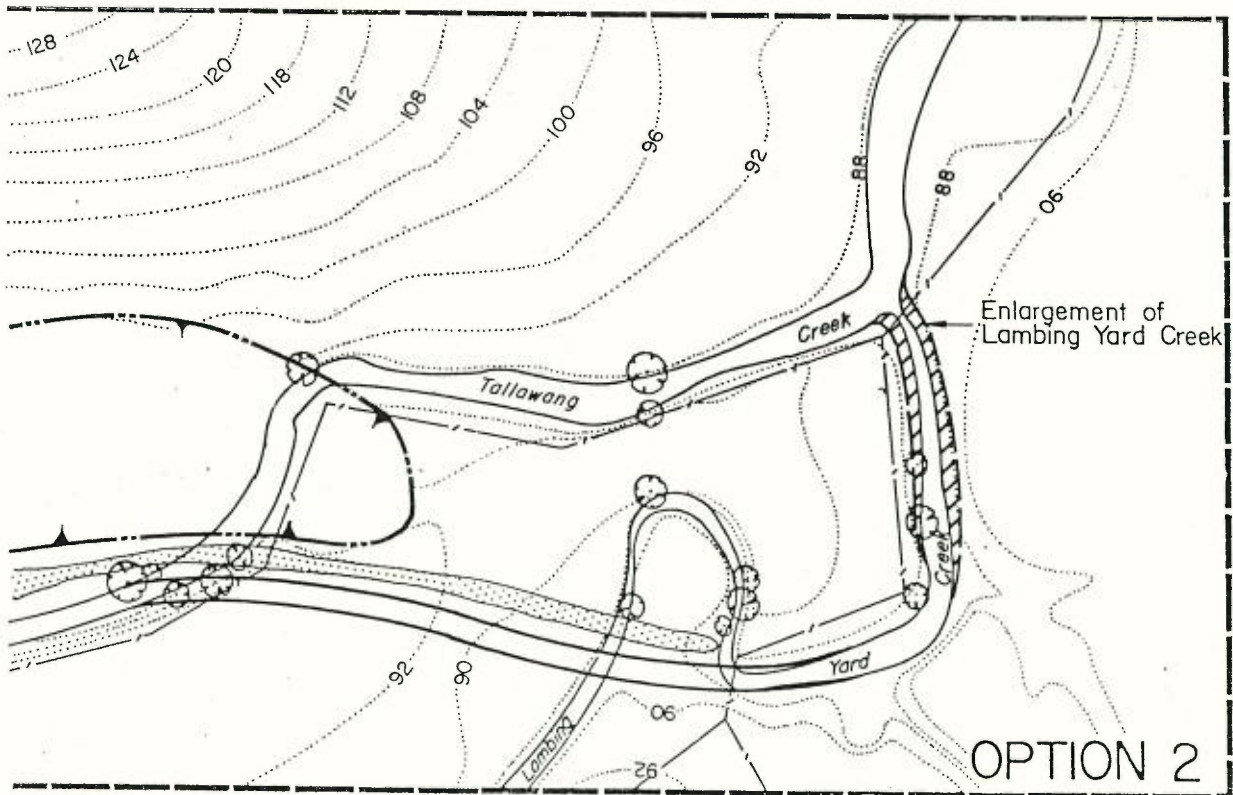
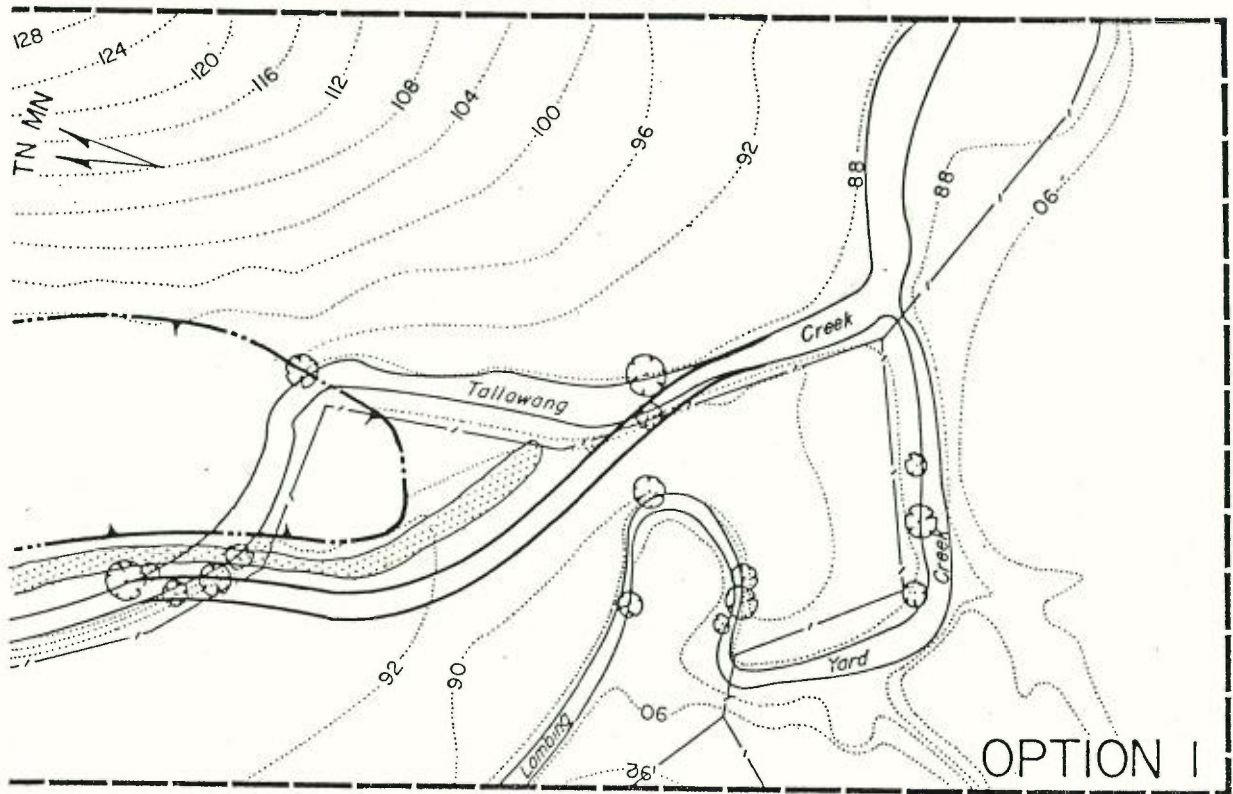
R.W. CORKERY & CO. Pty. Limited

Figure 4-1






SECTION DD (NOT TO SCALE)

| | |
|---------------------------------|------------|
| GARMARK PTY. LIMITED | |
| DETAILS OF GABION WEIR | |
| R.W. CORKERY & CO. Pty. Limited | Figure 4.2 |



REFERENCE

-  Limit of Open Cut
-  Creek Diversion
-  Levee Bank

SCALE = 1 : 4,000



GARMARK PTY. LIMITED

SOUTHERN DIVERSION
OPTIONS

R.W. CORKERY & CO. Pty. Limited

Figure 4.3

There are essentially two options, as illustrated on Figure 4.3.

Option One: Re-routing of Tallawang Creek - this would involve a bypass of the existing meander on the eastern bank. The creek length is shortened by 50 m and similar measures to those described for the northern diversion are required to maintain the existing stream gradient.

Option Two: Diversion Lambing Yard Creek - this would involve the relocation of the junction of the two creek systems and increasing the capacity of the downstream portion of Lambing Yard Creek.

Each of these options poses some engineering difficulties and environmental hazard which are discussed in Section 5.

The hydraulic capacity of the diversion channels will be consistent with the capacity of the existing stream. Batters will be fixed at 1:3 (Vert:Hor) and established with vegetative cover, prior to commissioning. Where appropriate, the banks will be armoured with rock.

The diversions will be constructed in parallel with the mine sequence, with the downstream diversion deferred until required.

4.3.3 Levee

The levee is located as shown on Figure 2.1, within a cross-sectional profiles shown on Figure 4.1.

The levee will be set back about 5 m from the edge of the bank and have a minimum one metre freeboard over the estimated 1 in 100 year flood. The crest will be fixed at a level above the western bank, to provide additional security in the event of flows exceeding the 1 in 100 year flood.

Under these criteria, the average height of the levee is approximately 2 m, except at the southern extremity of the lease, where heights in excess of 4 m are required.

The levee will be constructed of insitu materials appropriately compacted and, if necessary, stabilised with lime or cement. Embankment slopes will generally be 1:3 (Vert:Hor), topsoiled and grassed.

Where crest heights exceed 2.5 m, special treatment of the embankment profile may be required, such as construction of an impermeable core, toe drains and cut-off walls and provision of flatter bank slopes. Appropriate criteria would be developed on the basis of geotechnical investigation and advice.

4.3.4 Local Drainage

There are two components of the local drainage that will require safeguards to ensure the beneificiation plant is not flooded and land immediately north of MPLA 77 is not waterlogged by standing water.

- (i) Flood runner: The flood runner shown on Figure 3.2 will be diverted back into Tallawang Creek through a grassed channel constructed on the nothern side of the northern mullock dump. The channel will be designed to carry water from both the flood runner and the local drainage from (ii) below.

The point of entry to Tallawang Creek will be treated with rock armouring and/or gabion baskets to ensure erosion is contained.

- (ii) Local drainage from the west: The drainage flowing from west of M.R. 55 and through the northeastern corner of MPLA 77 (See Figure 3.1) will be diverted into the channel constructed for (ii) above.

A grassed channel of waterway area consistent with the box culverts below the Gulgong/Dunedoo Road would be constructed upstream of the plant area to cater for the local runoff described in Section 3.2.4.

4.4 SOIL EROSION CONTROLS

The principal controls incorporated within the project to ensure the soil resources on the site are maintained are:-

- (i) All topsoil will either be properly stockpiled in previously defined areas to a maximum depth of 1 m or replaced directly onto rehabilitated mine areas, levees or stockpiles.
- (ii) Diversion banks upslope of the mine area will ensure that runoff upslope of the rehabilitated areas will be diverted until good permanent growth is achieved.
- (iii) The fencing around the rehabilitated areas will ensure that regeneration on site is maintained and stock kept away.

All the safeguards to ensure the maintenance of the soil resources on each site will be planned and implemented with the assistance of the local office of the Soil Conservation Service.

4.5 NOISE CONTROLS

4.5.1 Site Preparation

Site preparation will involve the use of a range of earthmoving equipment. The principal equipment will be a D9 bulldozer and scraper. Other vehicles periodically present on site will include cranes and concrete trucks. All this equipment will be fitted with standard exhaust mufflers.

4.5.2 Open Cut Mining

The main sources of noise during the mining operation will be the equipment listed in Section 2.4.4 and blasting.

Table 4.3 lists the equipment to be used on site, the proposed safeguards and measured spectator noise levels.

The Company proposes to adopt the following safeguards during blasting operations:-

- (i) Adequate stemming of the drill holes will ensure the airblast is reduced to an acceptable level.
- (ii) Detonator cord will be adequately covered on the surface with waste material prior to blasting.
- (iii) Cracks and fissures in the rock face will be avoided so that the burden on the material to be fragmented will be even. Consequently, premature fragmentation will be avoided. The amount of explosives in each hole will be adjusted to avoid over-charging.
- (iv) The type of explosive will be selected to suit the type of rock to be fragmented.

TABLE 4.3
SOURCES OF NOISE - OPEN CUT AND BENEFICIATION PLANT

| NOISE SOURCE | PROPOSED SAFEGUARDS | NOISE LEVEL (dB(A) at 7 m) | SOURCE OF NOISE LEVEL |
|----------------------------|---|-------------------------------|----------------------------------|
| OPEN CUT | | | |
| Compressor | Silenced model | 75 | Atlas Copco Aust. Pty Ltd. |
| Track drill | Specially designed hood, shield & hoses | 90 | Atlas Copco Aust. Pty. Ltd. |
| Scraper | Standard Muffler | 92 | Waugh and Josephsons |
| D-9 Bulldozer | Residential class Muffler | 92 | Waugh and Josephsons |
| Dump Truck (2) | Standard Muffler | 85 | Blackwood Hodge (Aust) Pty. Ltd. |
| Traxcavator | Standard Muffler | 88 | Waugh and Josephsons |
| CRUSHING | | | |
| Front-end loader | Standard Muffler | 88 | Waugh and Josephsons |
| Primary Crusher | Partially enclosed | 88 | Dept. of Mineral Resources |
| Gyratory Crusher | Partially enclosed | 85 | Dept. of Mineral Resources |
| BENEFICIATION PLANT | | | |
| Ball Mill (2) | Enclosed within additional building | 83 | Allis Chalmers Aust. Pty. Ltd. |
| Electric Motors | | | |
| Ball Mill - 175 kw | Motor enclosed | 79 | Pope Electric Motors |
| Disc Filter - 150 kw | Motor enclosed | 79 | Pope Electric Motors |
| Front-end loader | Standard Muffler | 88 | Waugh and Josephsons |
| TRANSPORTATION | | | |
| Highway Trucks | Standard Muffler | | |
| - Max Revs | | 89 | Eden Dynamics |
| - Max Speed | | 85 | Eden Dynamics |

- (v) Ground vibration will be kept within the specified limits by:
 - (a) keeping the material to be blasted to a suitable volume by adjusting the distance between the blast holes and the face.
 - (b) Care will be taken in the spacing of the blast holes.
 - (c) The delay between blasts will be adjusted to achieve even fragmentation of the rock.
- (vi) A test blast will be carried out using the above safeguards. The airblast overpressure and ground vibration would be monitored to ensure that the limits set are not exceeded and to assist in the design of future blasting on the same site.
- (vii) Blasting will only be undertaken during acceptable meteorological conditions.

Once approvals are granted and the extractor known, any additional details relating to noise safeguards etc. will be provided to the S.P.C.C. when an approval under Section 27 of the Noise Control Act is sought.

4.5.3 Beneficiation Plant

Table 4.2 lists the noise sources involved in the crushing and grinding of the magnetite. The safeguards proposed for each individual item are listed with the measured spectator noise level listed. In addition to the individual noise components, the Company has designed a number of safeguards which will assist in noise reduction:

- (i) Hours of Operation: The Company will restrict crushing to the day shift only. In addition, the plant will only operate between 6.00 am and 10.00 pm in the early stages and will not proceed to a 3 shift operation until all noise safeguards are fully installed and satisfy State Pollution Control Commission criteria.
- (ii) Plant Orientation: The main plant building will be oriented north-south primarily to provide shielding to the crushing and grinding operation. The 8 m height of the building will assist significantly in reducing noise levels at "Cannon Park".
- (iii) Building Design: The Company will incorporate the following safeguards during the construction of the plant.
 - (a) The outside walls of the southern end of the building will be designed with two layers of steel cladding with sufficient space for sound absorption material in the cavity. Eden Dynamics Pty. Ltd. suggest that the plant could be constructed with one layer of cladding and if noise levels are not low enough a second layer of cladding with cavity filling could be added.
 - (b) Noise absorption baffles will be hung from the ceiling of the plant building. These baffles will absorb much of the sound reverberating throughout the building
- (iv) Bundwalls: The Company will place most of the initial overburden from the mining operation in the vicinity of the existing open cut around the beneficiation plant. The stockpiles which will be placed to the north and west of the plant will be approximately 6 m high.

4.6 SAFEGUARDS FOR ARCHAEOLOGICAL SITES

The Company will construct a permanent fence around the knapping floor within the open site T.C.2. This activity will satisfy the requirements of the National Parks and Wildlife Service.

No other safeguards are required as the other sites documented in Section 3.11 will either be not affected by mining activities or will be destroyed (after consent is granted by the National Parks and Wildlife Service).

4.7 VISUAL CONTROLS

4.7.1 Open Cut Mining

The Company will undertake selected planting of a tree screen on the western side of Tallawang Creek to reduce the visual impact of the mining operation, particularly when mining occurs on the eastern side of the proposed open cut. This planting programme will be undertaken soon after the operation commences as greatest benefit will be achieved for the period when mining is undertaken in the intermediate and southern areas.

4.7.2 Beneficiation Plant

The Company will incorporate the following safeguards to reduce the visual impact of the plant.

- (i) The plant buildings will be constructed from a green colour-bonded steel.
- (ii) The mullock stockpiles constructed around the beneficiation plant will be grassed, and the outskirts planted with trees and shrubs.
- (iii) The site will be tidy at all times.

SECTION 5

THE PROJECT'S IMPACT ON THE ENVIRONMENT

5.1 TOPOGRAPHY

The main changes to the existing topography that will remain after the completion of the Company's mining operation will be:

- (i) The existing quarry area will be restored to the pre-mining surface.
- (ii) A dam of similar size to the existing quarry will be left at the southern end of the mine area.
- (iii) The mullock stock piles, tailing dam and other dams will remain with the relief shown on Figure 2.14.

5.2 DRAINAGE AND FLOODING

5.2.1 Introduction

The impacts of the drainage and flooding controls on the local environment have been prepared by Rankine and Hill Pty. Ltd. These impacts have been assessed in three main areas:

- (i) Beneficiation Plant Area
- (ii) Diversion Channels
- (iii) Levee

5.2.2 Beneficiation Plant Area

The plant area, mullock disposal and tailing dam will be constructed in the path of the flood runner described in Section 3.2.3. As a result, flood flow will be obstructed and diverted back to the main channel through the channel described in Section 4.2. For the 1 in 100 year flood, the flood runner caters for about 10 per cent of the flow. At this level, the effect of an additional 10 per cent in flowing the main channel would be to increase levels by an average of 200 mm and velocities from 4.1 m/s to 4.3 m/s. Since the average channel gradient is steep, the effect of this afflux would not extend very far upstream. No development is affected.

The Tallawang Creek channel is incised through the lease applications, and has sufficient surplus capacity to cater for the additional flow, without deleterious effect.

The diversion of the storm runoff from west of M.R.55 into the channel constructed for the flood runner will result in no accumulation of water north of MPLA 77. Furthermore, the construction of a gabion weir should ensure problems of erosion around the re-entry point to Tallawang Creek are minimized.

5.2.3 Diversion Channel

The diversion channels will alter the time of travel through the reach. Assuming a celerity (average velocity) of 2.7 m/s, travel time through the reach will be reduced by one minute, which is negligible given a time of rise of 3.5 hours for the catchment.

The southern diversion, described in Section 4.2, poses some engineering and environmental difficulties.

Option 1: Re-routing of Tallawang Creek would involve its relocation to a lower portion of the flood plain, since there is a significant fall toward Lambing Yard Creek, and the relative elevation of the eastern bank would be reduced by 1.5 m. As a result, floodwaters would overflow toward Lambing Yard Creek, posing a potential erosion risk. A significant height of levee (up to 4 m) is also required on the other bank to protect the open cut mine.

Option 2: The diversion to Lambing Yard Creek will necessitate enlargement of Lambing Yark Creek downstream of the confluence, in order to increase its hydraulic capacity. Whilst the system could be designed to maintain the stream's characteristics (i.e. riffle and pool profile), such interference would be contrary to the landholder's expressed preferences for the creek not to be disturbed.

5.2.4 Levees

The impacts of the construction of the levee adjacent to the open cut mine will be:

- (i) The open cut mine will not be inundated from flood waters.
- (ii) Five hectares of flood plain on the eastern bank will be lost. However, the active portion of this flood plain is negligible and consequently the effects of redistribution of flow on the levels in the main channel or west bank flood plain would also be negligible. Similarly the loss of storage can be ignored.

5.3 WATER RESOURCES

5.3.1 Surface Water

The Company's operation will have the following impacts on the quantities of surface water in Tallawang Creek.

- (i) The quantity of water within the Creek could be increased periodically if the Company has excess water from the open cut which cannot be utilised within the beneficiation plant circuit. The impact of this activity will be beneficial to landowners downstream as stream flows would be increased. No stream floor or bank erosion will occur as a result of this activity. It should be noted that the Company does not expect this occurrence often.
- (ii) The quantity of water within the creek could also be increased if the Company needs to discharge water from the beneficiation plant circuit. Any discharge would be made via the discharge water dam and would be a quality acceptable under the Clean Waters Act.

- (iii) Overflow from the sedimentation dam into Tallawang Creek will result in increased flows, delayed by the storage time in the dam. However, it should be noted that the water would have normally flowed into the creek if it had not been constructed.
- (iv) If the Company needs to pump water from Tallawang Creek for make-up purposes for the beneficiation plant it will only be pumped when their requirement is less than ten per cent of the flow within Tallawang Creek. Hence, the impact of pumping will be minimal.
- (v) The Company's proposed diversion will result in changes to the occurrence of stock watering holes along the creek.
 - (a) Stock watering holes in sections bypassed by the northern and southern diversions will be eliminated. This would be of minor impact as the new channels would also provide a source of stock water.
 - (b) The southern diversion (Option 2) would change the character of the lower part of Lambing Yard Creek due to the widening required and increased flow. The occurrence of frequent watering holes along this section of creek could change. The impact of removal of these watering holes would be mitigated by the Company's assurance (included in an agreement with the landowner) that stock water will be provided continually from the Company's water source or by appropriate design of the modified channel profile.

5.3.2 Underground Water

The Company's operation will have the following impacts on the occurrences of underground water in the Tallawang area.

- (i) The continual pumping of the open cut mine to provide make-up water for the beneficiation plant will result in the local groundwater within the fractured rocks falling to a depth similar to the depth of the open cut at the time. Hydrogeological principles suggest that the water table will be lowered for a maximum distance of 1 km from the open cut. The regional north-south fracture system suggests that greater reduction in water table would occur in this direction.

There are no bores within 1 km of the proposed mine area. The closest bore is approximately 1.7 km northwest of the closest point to the mine area. Hence, the impact of pumping water from the open cut mine on bores within the fractured rocks in the Tallawang area will be negligible, if at all discernible.

- (ii) The construction of the creek diversions will result in the intersection of the alluvial gravels which transmit underground water towards and into Tallawang Creek. The water will then flow into the new channel instead of flowing towards the existing channel. If the southern diversion (Option 2) is adopted the waterholes immediately upstream of the junction within the Lambing Yard Creek Tallawang Creek will not be replenished. Such an impact is considered minor as the Company has undertaken to provide adequate stock water supplies to the landowner.

- (iii) If the Company needs to obtain its make-up water supplies from underground sources, there should be little or no impact on surrounding bores for the reasons outlined in (i) above. The Company's bore would be drilled (if required) within their mining lease.

5.4 SOILS

The safeguards outlined in Section 4.4 will ensure that the soil resources of the areas affected by mining activities will be retained and provide useful assistance throughout the project.

5.5 AIR QUALITY

The safeguards outlined in Section 4.1 will ensure that local dust levels will be kept to acceptable levels. Possible problems during initial start up will be similar to if the same area was being cultivated.

There will be no dust problems arising from the crushing, grinding and milling of the magnetite.

5.6 FLORA

The Company's proposed mining activities will result in the removal of at least sixty trees over the 20 year life of the mine. The Company's planned tree planting programme, for screening purposes, and rehabilitation will ensure the number of trees (same as existing species) will in fact be increased significantly.

5.7 FAUNA

The Company's proposed mining activities will result in the following impacts:

- (i) Noise generated by equipment and blasting will cause native animals and birds to avoid the area throughout the period of mining. Once mining is completed, it is expected that many animals and birds would return to the area. Hence, the long term impact of mining will be minimal.
- (ii) The habitats for birds (trees, creek and creek banks) will be removed during the mining operation, however, the long term impact of mining will be minimal.
- (iii) The proposed creek diversions and drainage controls will cause small changes to the configuration of Tallawang Creek. These changes will, however, not significantly affect the use of Tallawang Creek by birds, crayfish and fish.

5.8 NOISE LEVELS

5.8.1 Introduction

The impact of the noise levels from the Company's mining operation has been assessed using criteria followed by the State Pollution Control Commission. The impact of the noise generated throughout the project has ^{been} assessed jointly with Eden Dynamics Pty.Ltd., Accoustical Consultants of Sydney.

5.8.2 Criteria for Noise Assessment

Table 5.1 presents the noise criteria accepted and used by the State Pollution Control Commission to assess noise impact. It should be noted that the levels set in Table 5.1 are for persons outside their residences. Accordingly, if persons are inside their residence noise levels could be expected to fall by 5 to 10 dB(A).

TABLE 5.1
CRITERIA USED TO ASSESS NOISE IMPACT

| Time Period | Sound Pressure Level dB(A) Measured at Residence | | Noise Source |
|----------------------------------|---|---------|--|
| | Acceptable | Maximum | |
| Morning (6.00 am-7.00 am) | 35 | 40 | All noise sources |
| Daytime (7.00 am-6.00 pm) | 45 | 50 | Average noise of whole operation over a long period. |
| | 50 | 55 | Construction noise for 4 to 26 weeks. |
| | 60 | 65 | Construction noise for periods less than 4 weeks. |
| Evening (6.00 pm-10.00 pm) | 40 | 45 | All noise sources. |
| Night-time (10.00 pm-6.00 am) | 30 | 35 | All noise sources |

Table 5.2 presents the criteria for assessing impact of blasting.

TABLE 5.2
LIMITING CRITERIA FOR THE CONTROL
OF BLASTING IMPACT AT RESIDENCES

| Time Period | Blast Overpressure (Sound level) (dB(A)) | Peak particle Velocity Ground Vibration (mm/sec) |
|-------------------|--|---|
| Monday - Saturday | | |
| 9.00 am - 3.00 pm | 115 | 5 |
| 6.00 am - 9.00 am | | |
| | 105 | 1 |
| 3.00 pm - 8.00 pm | | |

NOTE : The Company proposes to blast Monday to
Saturday - 1pm to 4.30pm.

5.8.3 Predicted Noise Levels

Table 5.3 presents the predicted maximum noise levels at a number of surrounding residences. These levels have been calculated for the events when noise levels could be expected to be highest eg. when all the equipment is working under full load. The discussion in the remainder of this Section is based on Table 5.3, however, a number of factors need to be considered.

- (i) It is unlikely that all the equipment would be working under full load for any more than 10 per cent of the mining time.
- (ii) Mining will either be undertaken by regular campaigns or during restricted hours. Hence, the noise levels from mining will not be heard throughout the year.
- (iii) Noise levels could be enhanced or attenuated by local winds or enhanced by local temperature inversions.
- (iv) The maximum noise levels in Table 5.3 assume a non-absorptive ground surface between the noise source and the residents. However, ground surfaces such as crops and ploughed ground can be significantly reduce noise levels through ground attenuation.

Site Preparation

The preparation of the site for the beneficiation plant will cause moderate noise levels at nearby residences for relatively short periods. The levels audible at "Cannon Park" will approach 50dB(A), however, these levels will be for short periods when the mullock stockpiles and dams are constructed. The predicted maximum noise levels are within the criteria set for construction noise allowable by the State Pollution Control Commission, that is for 4 to 26 weeks (See Table 5.1).

TABLE 5.3
 PREDICTED MAXIMUM NOISE LEVELS AT SURROUNDING RESIDENCES

| SOURCE: | EXISTING QUARRY | | | | CLOSEST POINT OF OPEN CUT | | | | BENEFICIATION PLANT | | | | | | |
|-----------------------|----------------------------|------------|-------------------|----------|----------------------------|------------|-------------------|------------|----------------------------|---------------|-------------------|----|------------------|------------|------------|
| | Distance to Residence (km) | | Noise Level dB(A) | | Distance to Residence (km) | | Noise Level dB(A) | | Distance to Residence (km) | | Noise Level dB(A) | | Total at surface | 88 m level | 76 m level |
| | sur face | 88 m level | 76 m level | sur face | 88 m level | 76 m level | sur face | 88 m level | 76 m level | Mill/ (Night) | Mill/ Crushing | | | | |
| 'Nungarrin' | 2.7 | 30 | 25 | 18 | 1.8 | 37 | 32 | 25 | 2.7 | 9 | 31 | 38 | 35 | → 31 | |
| 'Oakville" (main res) | 2.8 | 30 | 25 | 18 | 1.8 | 37 | 32 | 25 | 2.8 | 9 | 31 | 38 | 35 | 31 | |
| (rented res) | 2.1 | 33 | 28 | 21 | 1.6 | 38 | 33 | 26 | 2.0 | 16 | 37 | 41 | 38 | 37 | |
| "Koompartoo' | 3.7 | 29 | 24 | 17 | 2.7 | 28 | 23 | 16 | 3.7 | 18 | 33 | 34 | 34 | 33 | |
| 'Cannon Park' | 0.7 | 48 | 43 | 36 | 0.7 | 48 | 43 | 36 | 0.5 | 30 | 46 | 50 | 48 | 46 | |
| 'Tallinga' | 1.7 | 37 | 32 | 25 | 1.7 | 37 | 32 | 25 | 1.8 | 16 | 38 | 41 | 39 | 38 | |
| Goolaringa' | 2.0 | 33 | 28 | 21 | 2.0 | 33 | 28 | 21 | 2.1 | 11 | 37 | 38 | 38 | 37 | |
| 'Belvedere' | 1.6 | 38 | 33 | 26 | 1.6 | 38 | 33 | 21 | 1.8 | 18 | 36 | 41 | 39 | 38 | |
| Lot 1 | 1.1 | 41 | 36 | 29 | 0.9 | 46 | 41 | 34 | 1.0 | 21 | 43 | 48 | 46 | 43 | |
| 'Weemara' | 1.5 | 39 | 34 | 27 | 1.0 | 44 | 39 | 32 | 1.4 | 18 | 40 | 45 | 43 | 40 | |
| "Akoona' | 2.5 | 31 | 26 | 19 | 2.3 | 35 | 30 | 23 | 2.3 | 11 | 30 | 36 | 34 | 30 | |

Open Cut Mining

Table 5.3 presents the predicted noise levels from the proposed mining in the vicinity of the existing quarry and the closest point to the surrounding residences. The principal continuous source of noise will be the track drill drilling the holes for blasting. Similar maximum noise levels would be obtained when the D-9 bulldozer is used on the surface.

The Company will implement a range of safeguards on the drill to ensure that noise levels at the surrounding residences are within the criteria set out in Table 5.1. Never-the-less, in satisfying the criteria in Table 5.1 the Company's mining operation when operating on the surface will still be audible at the residences within 1.7 km. The impact from the noise from the open cut will gradually decrease as the open cut moves downward. After the 76 m level is reached the principal noise source will be the dump trucks transporting the ore to the plant. The mining operation at this stage would only be audible at "Cannon Park".

Beneficiation Plant

Table 5.3 lists the maximum predicted noise levels for the crushing/grinding operation. These noise levels to be generated between 7.00am and 6.00pm are within the criteria set by the State Pollution Control Commission. At periods when there is no mining, the crushing and grinding operation will be audible at residences within 2 km, however, with the exception of "Cannon Park" and Lot 1, noise levels will only be above the existing background levels. The operation of the crushing/grinding component of the plant will marginally add to the noise levels generated by the open cut mining when it is at its closest point to the residences west and north of the plant.

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The noise levels generated by the ball mills between the hours of 6.00pm and 7.00am will only be audible at "Cannon Park" and only then the levels are up to 5dB(A) above background levels.

Transportation

Noise levels from vehicles transporting magnetite to the Company's customers will be similar to noise levels currently generated by the trucks travelling along M.R.55. The exception will be in front of "Cannon Park" and Lots 1 to 4 where trucks will be passing through gears to reach top speed. Hence, the impact during the day (Monday to Friday), especially at "Cannon Park" will be moderate.

5.9 LAND USE

5.9.1 Site's Land Use

The Company's project will result in a small reduction in the area of land available for cropping. There will be no reduction of grazing land. Furthermore, the final dam will provide water accessible to stock.

5.9.2 Adjacent Land Use

The rural activities of grazing/cropping adjacent will not be affected. It could be expected that stock will move away from the site during the day, however, return close to the boundary of an evening.

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5.10 PRE - EUROPEAN SETTLEMENT

Four open sites identified by Smith and Rich (1985) on the lease applications will be destroyed as a result of the mining operation. They are :-

T.C.3 - To be partly covered by a mullock stockpile

T.C.4 - The site of a sedimentation dam

T.C.5 - The site of a creek diversion around the mine site

T.C.7 - To be removed as part of the open cut mine

The open sites at these locations have been well documented by Smith and Rich (1985) for future reference. As outlined in Section 3.11, there are other sites within the area of the lease applications that will not be disturbed by mining that are similar to the open sites. This factor, and prior salvage of the sites, will reduce the impact of their destruction.

The construction of a permanent fence around the knapping floor in site T.C.2 will protect the site from damage.

5.11 SOCIO-ECONOMIC FACTORS

5.11.1 Employment

There will be considerable economic benefit by the provision of up to 21 permanent jobs, many of which will be filled by local residents. Indirect employment (eg. fuel sales and delivery) will also increase locally.

5.11.2 Housing

The Company's project will not adversely affect the demand for housing in the district as most employees will be engaged locally. Some houses will be rented.

5.11.3 Local Economy

The local economy will benefit from a weekly payroll of \$8,000 per week or \$400,000 per year, plus the Company's spending on services, fuel, etc.

5.12 VISUAL ASPECTS

5.12.1 Open Cut

Some of the more elevated areas will be visible in the initial stages, however, these will be hidden in the long term by a tree screen established on the western side of Tallawang Creek. Similarly, the movement of trucks along the haul road will be screened from views from the west.

5.12.2 Beneficiation Plant

The site will be visible during site preparation and establishment of mullock stockpiles. This impact will be short term, however, the long term impact will be less since the grassed mullock dumps and tree screen will be more effective. The choice of a colour bonded building with a green hue will also ensure the impact of the buildings is minimised.

5.13 TRANSPORTATION

The Company's project will result in a maximum additional 30 passenger vehicle movements and up to 20 heavy vehicle movements (10 return trips) along the local road network outlined in Section 3.18.

The impacts of the additional traffic will be moderate since the maximum of 50 vehicle movements per day would represent an increase of approximately 7 per cent on M.R. 55 and 5 per cent on M.R. 598.

It is difficult to predict the impact on the local roads in the vicinity of Gulgong as no A.A.D.T. statistics are available. However, the roads used by the heavy vehicles would be the same as the heavy vehicles currently passing through Gulgong.

The proposed intersection between the site access road and M.R. 55 will ensure that vehicles using and passing the intersection do so with safety.

5.14 SERVICES

5.14.1 Power

Ulan County Council have advised the Company that they can be supplied their power requirement without any detrimental impact on nearby consumers.

5.14.2 Telephone

The construction of the intersection with M.R. 55 will be undertaken after consultation with Telecom Australia to ensure that the line passing the site is not interfered with.

SECTION 6

EVALUATION OF THE PROJECT

6.1 JUSTIFICATION OF THE PROJECT

Clause 45(f) of the Environmental Planning and Assessment Regulation, 1980 requires this Statement to justify the proposed development in terms of environmental, economic and social considerations.

6.1.1 Environmental Considerations

The Company's project will be adequately safeguarded during its operation to ensure that the environment around Tallawang will not be adversely affected. The principal impacts the project will have on the local environment will be:

1. Alteration of the creek system to allow mining to remove all economic magnetite ore.
2. The local noise climate will change, however, the increases in local noise levels will be within the limits set by the State Pollution Control Commission.
3. An increase of up to 7 per cent in traffic levels will be noticeable on the local road network.
4. The Gulgong District in particular will benefit from additional employment and increased local spending.

The local environment will be cared for in terms of air pollution and water pollution. The Company will endeavour to recycle all water and utilise the water in the mine to avoid any use of creek water or underground water.

The Company is keen to maintain a good relationship with the residents of Tallawang and the Gulgong district. This will naturally involve the Company maintaining acceptable environmental standards throughout the entire project.

6.1.2 Economic Considerations

The Company's project will have the following economic benefits:

- (i) Gulgong District: The project will generate considerable employment for local persons and contractors during the construction phase and operation of the project. At least \$8,000.00 per week will be issued in wages. In addition, Company spending on fuel, accommodation and other services will also benefit the Gulgong district.
- (ii) New South Wales: The State will benefit from increased employment and the supply of an important commodity for the State's coal mines from within the State. The State Government will also receive income for royalty collection.
- (iii) Australia: The Commonwealth will also benefit from increased employment, taxes paid, etc. However, the project's greatest benefit will be reduction in imported magnetite and hence Australia's import bill.

6.1.3 Social Considerations

The principal social considerations that will result from the Company's project will be:-

- (i) Provision of direct and indirect local employment.
- (ii) A minor need for local housing.

6.2 CONSEQUENCES OF NOT PROCEEDING WITH THE PROJECT

1. An economic deposit of at least 1.5 million tonnes of magnetite ore, within close transport distances to the State's coal washeries would not be exploited.
2. The economic and social benefits outlined in Section 6.1 would not result.
3. Company shareholders would not benefit from a profitable mining venture.

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APPENDIX 1

ENERGY STATEMENT

The format of this Energy Statement follows the guidelines set out by the Energy Authority of New South Wales.

1. BACKGROUND INFORMATION

Garmark Pty. Limited proposes to develop and operate a magnetite (iron ore) mine at Tallawang, 18 km north of Gulgong. The magnetite, once mined, will be crushed and ground for use as a dense medium in the State's coal washeries. The Company proposes to transport the magnetite to the Hunter Valley, Newcastle, Ulan, Lithgow and the south coast.

Mining will be undertaken initially by open cut methods and at a later stage by underground methods. The Company will use a track-drill, a scraper, D-9 bulldozer, front-end loader and dump trucks in its mining operation.

Ore won from the mine will be transported to the nearby beneficiation plant and either placed in a stockpile or fed directly into the plant. The beneficiation or upgrading of the ore will be a simple process involving crushing, grinding and magnetic separation of the magnetite.

The Company proposes to transport the magnetite to its customers at an average rate of 8 trucks per day, however it is possible that as many as 10 trucks per day may be despatched to satisfy market requirements.

2. OPERATIONAL ENERGY REQUIREMENTS

2.1 Construction Phase

During the construction of the treatment plant and site preparation the following fuel driven vehicles will be used on site:

- crane
- D-9 bulldozer
- scraper
- concrete mixer
- front-end loader
- small trucks

The Company expects that the above vehicles will use approximately 40,000 litres of fuel during the construction period.

2.2 Open Cut Mining

The fuel driven equipment and their expected annual fuel usage is as follows:

| | | |
|----------------------------------|---|----------------|
| Track drill | = | 20,000l |
| Front-end loader/ traxcavator | = | 60,000l |
| D-9/scraper | = | 10,000l |
| Dump Trucks | = | <u>15,000l</u> |
| | | 105,000l |

2.3 Beneficiation Plant

The plant will operate primarily using electrical power supplied by Ulan County Council. The Company expects to use approximately 1000 KVA. The fuel usage for loading ore and product has been taken into account above in Section 2.2..

2.4 Transportation

The following fuel usage has been prepared based on the Company's estimates of an average of 6 trips daily to the Hunter Valley and 2 trips daily to Lithgow and the South Coast.

| | |
|------------------------------|------------------------|
| Ulan/Hunter Valley/Newcastle | |
| 1,320 trips/years | = 260,000 litres |
| South Coast/Lithgow | |
| 440 trips/year | = <u>80,000 litres</u> |
| Total | 340,000 litres |

2.5 Total Fuel Usage

The annual total fuel usage by the project will be approximately 450,000 litres.

3. JUSTIFICATION OF FUEL USAGE

3.1 Open Cut

The method of mining is the only feasible, practical method to produce the feed required for the beneficiation plant.

3.2 Transportation

The choice of highway trucks to transport the magnetite to the coal washeries is justified in the following terms.

- (i) There is no rail link existing between the site and the closest railway line.
- (ii) There is no siding at Tallawang.
- (iii) The magnetite will be delivered to washeries in consignments of not more than 50 tonnes, which could not be economically transported by railways.
- (iv) Existing facilities at coal washeries only allow for delivery by truck.

APPENDIX 3

BASE LINE STREAM SEDIMENT ANALYSIS RESULTS - TALLAWANG

| Site No. | | T -1 | | T -3 | | T -4 | | T -5 | |
|-----------|---------------|------|------|------|------|------|------|------|------|
| | Size Fraction | Wt% | | Wt% | | Wt% | | Wt% | |
| ARSENIC | +600 | 83 | 10 | 21 | 35 | 60 | 5 | 75 | 10 |
| | -600+200 um | 14 | 5 | 20 | 20 | 29 | <5 | 75 | <5 |
| | -200+100 um | 2 | 25 | 13 | 35 | 5 | 25 | <1 | 15 |
| | -100 um | 1 | <5 | 46 | 10 | 6 | 5 | <1 | 25 |
| CADMIUM | +600 um | 83 | <1 | 21 | <1 | 60 | <1 | 75 | <1 |
| | -600+200 um | 14 | <1 | 20 | <1 | 29 | <1 | 25 | <1 |
| | -200+100 um | 2 | <1 | 13 | <1 | 5 | <1 | <1 | <1 |
| | -100 um | 1 | <1 | 46 | <1 | 6 | <1 | <1 | <1 |
| COBALT | +600 | 83 | 5 | 21 | 20 | 60 | 10 | 75 | 5 |
| | -600+200 um | 14 | 15 | 20 | 20 | 29 | 10 | 25 | 5 |
| | -200+100 um | 2 | 15 | 13 | 15 | 5 | 15 | <1 | 20 |
| | -100 um | 1 | 15 | 46 | 15 | 6 | 20 | <1 | 20 |
| COPPER | +600 | 83 | 5 | 21 | 80 | 60 | 25 | 75 | <5 |
| | -600+200 um | 14 | 10 | 20 | 60 | 29 | 5 | 25 | <5 |
| | -200+100 um | 2 | 25 | 13 | 40 | 5 | 15 | <1 | 20 |
| | -100 um | 1 | 30 | 46 | 45 | 6 | 20 | <1 | 10 |
| IRON | +600 | 83 | 1.3 | 21 | 5.0 | 60 | 2.25 | 75 | 0.75 |
| | -600+200 um | 14 | 1.25 | 20 | 2.9 | 29 | 1.1 | 25 | 0.75 |
| | -200+100 um | 2 | 2.15 | 13 | 2.65 | 5 | 2.15 | <1 | 2.65 |
| | -100 um | 1 | 2.65 | 46 | 2.45 | 6 | 2.6 | <1 | 2.7 |
| LEAD | +600 | 83 | 20 | 21 | 10 | 60 | 115 | 75 | 20 |
| | -600+200 um | 14 | 5 | 20 | 5 | 29 | 5 | 25 | <5 |
| | -200+100 um | 2 | 25 | 13 | 10 | 5 | 0 | <1 | 55 |
| | -100 um | 1 | 40 | 46 | <5 | 6 | 20 | <1 | 55 |
| MANGANESE | +600 | 83 | 260 | 21 | 885 | 60 | 325 | 75 | 185 |
| | -600+200 um | 14 | 335 | 20 | 775 | 29 | 215 | 25 | 220 |
| | -200+100 um | 2 | 510 | 13 | 835 | 5 | 435 | <1 | 1305 |
| | -100 um | 1 | 650 | 46 | 685 | 6 | 655 | <1 | 1435 |
| NICKEL | +600 | 83 | 5 | 21 | 20 | 60 | 5 | 75 | 20 |
| | -600+200 um | 14 | 5 | 20 | 15 | 29 | 5 | 25 | 15 |
| | -200+100 um | 2 | 10 | 13 | 15 | 5 | 5 | <1 | 15 |
| | -100 um | 1 | 10 | 46 | 15 | 6 | 15 | <1 | 15 |
| ZINC | +600 | 83 | 10 | 46 | 50 | 60 | 15 | 75 | 5 |
| | -600+200 um | 14 | 15 | 20 | 40 | 29 | 10 | 25 | 10 |
| | -200+100 um | 2 | 35 | 13 | 35 | 5 | 25 | <1 | 35 |
| | -100 um | 1 | 35 | 46 | 40 | 6 | 35 | <1 | 50 |



Department of Environment and Planning



Mr. R. W. Corkery,
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Box 3927 G.P.O. Sydney 2001
DX. 15 Sydney

Telephone: (02) 266 7111 Ext.

Contact: 7568

Our reference: **Ms. G. Reffell**

Your reference: **84/11404**

Dear Sir,

Proposed mining and beneficiation of magnetite at part portions 1, 17, 63, 82, 94, 95, 173 and 182, Parish of Tallawang, By Garmark Pty. Ltd.

Thank you for your letter of 11 September, 1984 which indicated that you are consulting with the Director with regard to the preparation of an environmental impact statement (E.I.S.) for the above proposed development.

2. As development consent for the proposal is necessary and it is a designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, it is necessary that an E.I.S. accompany the development application to Council and to assist in comprehension, a copy of the Director's requirements should be appended to the E.I.S.
3. The basic requirement is that the E.I.S. is to be prepared in accordance with Clause 34 of the Environmental Planning and Assessment Regulation, 1980, and that it shall bear a certificate required by Clause 26(1)(b) of the Regulation.
4. With regard to the form and content of the E.I.S., it is advised that the Director requires that you should take into account those matters specified in the attachment to this letter. These matters are to be adequately addressed in the statement, and should be taken into account in the determination of the proposal by Council with whom we suggest you confer.
5. Further, the National Parks and Wildlife Act contains legislative requirements for the preservation of relics and aboriginal places. The advice of the National Parks and Wildlife Service should be sought on the need for a professionally conducted aboriginal archaeological survey for inclusion in the E.I.S. and on the appropriate manner for carrying out such a development.

6. Where matters are likely to come within the scope of legislation relative to air, water and noise control as administered by the State Pollution Control Commission, the views of the Commission should be sought and taken into account in preparing the E.I.S. If aspects of the proposal significantly affect agricultural land or agricultural industry, the views of the Department of Agriculture should also be sought and appropriately addressed in the E.I.S.

7. Should you require any further information regarding this matter, please do not hesitate to contact us again.

Yours faithfully,

A handwritten signature in cursive script, appearing to read "E. Wrighter", with the date "19.10.74" written to the right of the signature.

E. Wrighter
Assessments Branch
As Delegate for the Director

NEW SOUTH WALES DEPARTMENT OF ENVIRONMENT AND PLANNING

ATTACHMENT

Proposed mining and beneficiation of magnetite at part portions 1, 17, 63, 82, 94, 95, 173 and 182, Parish of Tallawang, By Garmark Pty. Ltd.

A comprehensive environmental impact statement (E.I.S.) shall adequately cover all the matters specified in Clause 34 of the Environmental Planning and Assessment Regulation, 1980.

These matters shall be clearly and succinctly outlined in the text and where appropriate supported by adequate maps, plans, diagrams or other descriptive details to enable all concerned to gain a clear understanding of the full scope of the development and its likely impact on the environment.

The following particular matters shall also be included in the E.I.S.:

1. Background information.
 - . Location of works and indication of adjacent developments
 - . Broad nature and extent of works proposed.
 - . Land tenure, boundaries, site details in relation to environmental planning instrument zonings and any other land use constraints.
2. Detailed description of the proposal.

This description shall not only describe the proposal at the site but also describe any associated operations such as winning and transport of materials, processes involved (highlighting any proposed crushing or blasting), disposal of wastes, rehabilitation, landscaping and use of the end product if likely to have environmental implications.

Particular matters to be covered include:

- . Characteristics and economic significance of the resource.
- . Possible availability of alternative sources.
- . Methods of extraction/plans of operations.
- . Type of machinery and equipment to be used.
- . Expected life of the operation.
- . Number of persons to be employed.
- . Hours of operation.
- . Times of any blasting or crushing envisaged.
- . Location and quantity of any necessary stockpiling.
- . Access arrangements to Main Road No.55 - truck routes and number of truck movements.
- . Effect of truck movements on the local road system.
- . Quantity of materials to be extracted.

- . Noise levels.
 - . Site drainage and erosion controls.
 - . Proposals for rehabilitation and assurances of effective completion.
3. Description of the environment.

This description shall provide details of the environment in the vicinity of the development site and also of aspects of the environment likely to be affected by any facets of the proposal. In this regard, physical, natural, social, archaeological and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impact of the proposed development.

4. Assessment of environmental impact and measures to be taken to reduce the impact especially with respect to:-

- . The flow of Tallawang Creek and other watercourses.
- . Effect of extraction on sediment transport rate of any affected rivers.
- . Bed and bank stability of any affected rivers during and after the operations.
- . Possible siltation, sedimentation or downstream effects of the extraction.
- . Any likely cumulative effects of the proposed operation when considered together with other operations in the vicinity.
- . Details of floods and any likely effects of the operation on flood liability of surrounding lands.
- . Possible effects of flooding on the operations.
- . Effects on fauna and flora and on bank vegetation.
- . Agricultural viability of the land holding.
- . Likely noise disturbance caused by the operations, including transport operations, on nearby residences.
- . Other impacts of trucking movements including the impact on Main Road 55.
- . Dust control and any nuisance likely to be caused.
- . Water treatment and other pollution control measures.
- . Disposal of waste material.
- . Landscaping measures and effects on the visual environment.
- . The proposed final use of the site and likely effectiveness of rehabilitation.
- . Any likely affectation of sites of aboriginal archaeological or heritage value if located in the vicinity of the operations.

5. Authorities contacted.

The names of authorities contacted should be listed. Any comments relating to specific matters of interest raised by such authorities should be declared, including those in relation to possible cumulative environmental problems that may result.

EIS 624

GARMARK PTY LIMITED

EIS

624

Mining and beneficiation of magnetite
at Tallawang, NSW

