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Environmental impact statement for a hard rock quarry and processing plant at Brandy Hill near Seaham

HUNTER VALLEY MINING CORPORATION PTY LIMITED

ENVIRONMENTAL IMPACT STATEMENT

HARD ROCK QUARRY AND PROCESSING PLANT
AT BRANDY HILL NEAR SEAHAM

HUNTER VALLEY MINING CORPORATION PTY LIMITED

ENVIRONMENTAL IMPACT STATEMENT

for

A HARD ROCK QUARRY AND PROCESSING PLANT AT BRANDY HILL NEAR SEAHAM

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May 1983

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FORM 4

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979 (SECTION 77 (3) (d)).

This Statement has been prepared on behalf of

Hunter Valley Mining Corporation Pty Limited

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:

Extractive Industry - Hard Rock Quarry and Processing Plant

The development application relates to the land described as follows:

Part portions 38 and 56
Parish of Seaham

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

CERTIFICATE

This is to certify that this Environmental Impact Statement has been prepared in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

Valerie Smith

Valerie Smith
DIRECTOR

Date 20th June, 1983

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SECTION 1

SUMMARY

1.0 SUMMARY

1.1 OUTLINE OF OBJECTIVES AND THE PROPOSAL

This environmental impact statement has been prepared for Hunter Valley Mining Corporation Pty Limited by Resource Planning to accompany a Development Application to Port Stephens Shire Council for approval to extract and process hard rock aggregate.

The location of the proposed development is part Portion 38 and 56, Parish of Seaham, County of Durham and is shown on ***Figure 1.*** *The land is freehold and owned by Hunter Valley Mining Corporation Pty Limited.*

The Company proposes to quarry rhyodacite from a low ridge flanking the eastern slopes of Brandy Hill and to process the stone in an adjacent plant. Initially up to 100,000 tonnes of material will be extracted annually rising to about 400,000 in 10-15 years. Reserves are sufficient for a long-term operation of at least 30 years.

The stone will be drilled and blasted, and transported to the plant by a front-end loader and off-road haulage trucks. Processing will involve crushing and screening the quarried stone to produce a range of different sized aggregates to meet required specifications. The crushed aggregate will be transported by truck to market centres throughout the region.

The Company proposes to apply efficient environmental management procedures to produce a wide range of aggregates to meet the growing demand for materials in the region.

All operations will be conducted in accordance with the requirements of State and local authorities.

1.2 IMPORTANCE AND SIGNIFICANCE OF THE PROPOSED DEVELOPMENT

A detailed appraisal of alternative sites and sources of materials ***(Section 4.2 and 4.3)*** *combined with a consideration of the planning, economic, environmental and social constraints* ***(Section 4.4 and 4.5)*** *has resulted in the identification of the Brandy Hill site as the optimum location for the siting of a hard rock quarry.*

The deposit has been identified as a suitable geological unit by the New South Wales Department of Mineral Resources, and detailed drilling and testing has shown the material to be highly suitable for a complete range of quarry products including concrete, asphalt, and decorative stone.

There is little overburden and reserves are high; capable of supplying the long term requirements of the lower Hunter Region for aggregate materials.

The deposit can be worked economically, is close to potential markets, and is serviced by main sealed roads. It occurs within a sparsely settled area where a quarry can be sited with minimal impact on the environment, and has appropriate land zoning.

The Brandy Hill deposit is considered by Hunter Valley Mining Corporation Pty Limited as an important source of high quality aggregate materials to meet the expected demand in the lower Hunter Region for the next 30 years. The Hunter Region is expected to continue to grow and require high volumes of concrete and asphalt for major domestic, commercial, and industrial developments as well as infrastructure needs, eg., roads and services.

Should the extractive operation not proceed, then it is expected that an alternative hard rock deposit will need to be developed to meet the projected demand for materials in the region.

The Brandy Hill deposit represents the optimum deposit of quality aggregate material for the lower Hunter Region that can be worked with minimal impact on the environment. To cart materials from more distant sources results in higher transport costs which are passed on to the general public through increased charges for materials. It should be remembered that the more distant the source, the longer the haulage distance and the higher the impacts on roads and road users.

To keep the cost of raw materials to a minimum, a major factor in minimising home construction costs, the Company has sought access to the Brandy Hill site.

1.3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Hunter Valley Mining Corporation Pty Limited proposes to extract hard rock aggregate for concrete, asphalt, decorative stone, and roadbase from an area of about 16 hectares on a low ridge flanking the eastern slopes of Brandy Hill, as shown on ***Figures 9*** *and* ***10.***

Stone will be drilled and blasted and hauled by a front-end loader and off-road haulage truck to an adjacent processing plant where the material will be crushed and screened to produce different sized aggregates to meet required specifications.

It is proposed to extract about 100,000 tonnes annually increasing to about 400,000 tonnes per year in 10 to 15 years in response to market demands.

An access road will be constructed to connect with Seaham Road or the nearby estate road and all products will be hauled by truck on main roads servicing the area.

On-site facilities will include an office, a lunchroom complex housing shower and toilet facilities, and a maintenance/store building for the repair of plant and equipment. A weighbridge will be sited near the access road adjoining the office.

Domestic water will be derived from tanks and process water from dams. Electricity will be obtained from normal reticulation services.

All domestic waste water will be disposed of by a septic system and process water and runoff from the quarry and plant will be treated in sedimentation dams.

Operations will be conducted during daylight hours 6am to 6pm Monday to Saturday and will provide permanent full-time employment for up to 11 persons together with up to 10 subcontractor positions.

The Company will apply the optimum environmental management procedures in the extraction and processing operations and will carry out its activities in accordance with the requirements of State and local authorities.

1.4 ENVIRONMENTAL MANAGEMENT PROCEFURES

1.4.1 Water Management

* *Upslope runoff will be diverted away from areas disturbed by quarrying operations through a series of diversion banks.*

* *To prevent soil erosion it is proposed to limit the area stripped ahead of the quarrying activities to a minimum. Heavy traffic will be confined to constructed roads and will not unnecessarily traverse undisturbed areas ahead of the face.*

* *The access road will be provided with adequate drainage channels, causeways, and creek crossings.*

* *Runoff from the quarry and working areas will be collected by a system of channels and directed to sedimentation dams for clarification. Following settlement, the water will be used for dust suppression or discharged to the natural drainage system downstream of the site during high flow periods. There will be no dry weather discharge.*

* *Runoff from the workshop and maintenance area will pass through an oil and grit arrestor prior to discharge to the sedimentation dam.*

* *Operator facilities will be provided with a septic system designed to the requirements of authorities.*

1.4.2 Dust Controls

* *Air quality will be protected by preventing or minimising the quantity of dust produced at potential site generation points.*

* *The access road and work areas will be regularly maintained and watered.*

* *The access road will be sealed within a period of 5 years.*

* *Exhausts from vehicles using the access road will be diverted away from the ground to prevent dust generation.*

* *The rig used for drilling blast holes will be fitted with dust collection equipment to minimise dust emissions.*

* *Blasting will not be undertaken during strong wind periods when the potential exists for dust to be conveyed towards residential areas.*

* *The process plant will be provided with automatic dust suppression equipment such as ring sprays and all equipment will be kept in good condition and regularly maintained.*

1.4.3 Noise and Vibration Control

* *All access and haul roads will be maintained in good condition and constructed with grades of less than 15 per cent. The gentle grades will minimise engine noise generated by the laden trucks and by maintaining roads in good condition, noise normally associated with empty trucks will be reduced.*

* *Trucks will not transport materials from the site to markets in convoy and will be normal roadworthy highway vehicles. All mobile equipment will be fitted with noise reduction equipment on exhausts and shielding around motors to ensure noise levels are not excessive.*

* *Blasting will be carried out during daylight hours normally between 1pm and 5pm, during suitable weather conditions. Blasting will not be carried out when strong winds are blowing in the direction of residences, or when there is likely to be temperature inversions in the area. Prevailing meteorological conditions will be checked before blasting.*

* *The operation will be required to be licenced with the State Pollution Control Commission who set limits on blasting overpressure levels and ground vibrations.*

1.4.4 Screening

The quarry and plant site will be located on a low eastern limb of Brandy Hill and will be naturally well shielded from areas to the south. The quarry operations will not intrude on the skyline of the hill and generally passing motorists on Seaham Road will not be aware of a quarrying operation.

1.4.5 Rehabilitation

Where practicable, progressive restoration of completely worked out benches will be carried out by spreading overburden on benches to a suitable planting depth with a covering of topsoil. The areas will be hydroseeded using indigenous tree and shrub species. ***Figures 12*** *and* ***13*** *illustrate this*

concept which has been used successfully in a similar quarry in Victoria ***(Earle, 1982)***

At the completion of quarrying operations all benches above normal ground level will be rehabilitated in the same manner and areas excavated below normal ground surface will fill with water. Plant and equipment will be removed and sedimentation dams filled, graded and contoured. In areas outside the quarry benches, rehabilitation will be carried out using hydroseeding methods or direct planting depending on the selected final land use.

1.4.6 Controls on Operations

* *The operation will be subject to compliance with conditions imposed by Port Stephens Shire Council and licenced with the State Pollution Control Commission.*

* *Regular inspections are made by inspectors from the Department of Industrial Relations and Council to ensure compliance with safety regulations and imposed conditions.*

1.4.7 Environmental Monitoring

* *In conjunction with the high standards incorporated into the design of the project, the Company will carry out regular monitoring of water quality, noise, and vibration.*

1.5 ASSESSMENT OF ENVIRONMENTAL IMPACTS

A. NATURAL PHYSICAL IMPACTS

Topography and Slopes: *The proposed development will alter the slopes on the lower eastern limb of Brandy Hill. The slopes will be replaced by a benched or stepped slope which will be progressively rehabilitated as extraction proceeds.*

Geology: *The main alteration to the geology of the site is the removal of part of the rhyodacite outcrop on the lower eastern slopes of Brandy Hill.*

The extraction and processing of hard rock on this site will make a significant contribution to the supply of high quality aggregate to construction projects throughout the lower Hunter valley for the next 20 to 30 years.

Soils and Soil Erosion: *The construction of diversion banks and sedimentation dams described in* ***Sections 6.15.2 and 6.15.3*** *will restrict overland flows and the incidence of sheet wash. These measures, together with restricting the area cleared at any one time and confining traffic to constructed roads and designated work areas, will minimise impacts on soil*

erosion.

It is expected that disturbed areas may be subject to some erosion before plantings become established. These areas will be quickly repaired as part of site management procedures.

Drainage: The existing flow directions of stream courses and gradients will be maintained. Flows in the small tributary flowing from the southern side of the ridgeline will be regulated by dams but this is not expected to adversely affect stream flows to water users downstream. All runoff from activities will be confined within the one catchment and there will be no alteration to the hydrology of Deadman's Creek on the northern side of the ridgeline.

Flooding: The site is well above known flood heights and there will be no impact from flooding.

Groundwater: The proposed operations will partly modify groundwater flows in the jointed volcanic and sandstone units within 200m of the immediate site area. However, there are no users of groundwater in this area and the alterations will not be sufficient to affect vegetation communities.

Water Quality: Sedimentation dams constructed downstream of all disturbed areas will ensure that the contribution of suspended solids to downstream flows will be minimal. The retention of runoff from disturbed areas in sedimentation dams allows settlement of suspended solids and reuse of excess water for dust suppression.

There will be no dry weather discharges from settlement dams; discharges will only be necessary during periods of heavy or prolonged rainfall when the level of suspended solids carried naturally by streams is higher and the contribution from sedimentation dams will not be significant.

Air Quality: The potential for any airborne dust being carried towards the nearest residences to the site is minimal. There are no residences north of the site to be affected by dust and the nearest residences west, east and south of the site are no closer than 1km to the quarry and plant site. The densely vegetated ridge lines and wide undisturbed zone around the site will provide a "buffer" to residences and land uses around the site.

Vegetation: The proposed development will result in the loss of vegetation occurring on the quarry and plant site.

The main alliance to be affected will be the **Eucalyptus crebra-Eucalyptus maculata** Open-forest. About 16ha of this forest will be disturbed together with about 0.5ha of the **Eucalyptus crebra** Tall Open-forest.

These forests are widespread throughout the area to the northeast and west of the site and throughout the Hunter Valley and the disturbance of this area represents a small percentage of the total vegetation cover in the region.

Wildlife: The proposed development will result in the loss of wildlife habitat through the clearing of about 16 hectares of native forest.

Provided surrounding forests have sufficient habitat capacity, some

displaced individuals will relocate in these areas. Overall some loss of individuals could be expected through reduction of the total habitat area, but no species extinctions are likely.

Impacts will be reduced by staged clearing and progressive rehabilitation programmes and impacts on wildlife are rated as low.

Visual Impact: *The proposed quarry and plant site are shielded from Seaham Road by a small east-west ridgeline and natural vegetation stands.*

The quarry is located on a low ridgeline that does not intrude into the skyline. As the quarry benches move further up the ridge however, the higher benches (about 70m AHD) will become visible above the trees from eastern parts of Seaham Road.

However, the quarry will be in mid ground and the main vegetated skyline will form a background and will remain undisturbed. While motorist travelling west along Seaham Road will have glimpses of the upper bench levels, the overall visual impact is rated as low to moderate. Some dust may be visible to motorists and residences on occasions particularly from the access road. But this visual impact will be significantly reduced when the access road is sealed within a five year period.

B. MAN-MADE PHYSICAL IMPACTS

Aboriginal Pre-history and Historical Sites: *The proposed development will have no impact on aboriginal relics, sites, or historical features.*

Landuse: *The proposed development will have no impact on agricultural or residential land uses in the area. A significant buffer zone has been provided around the quarry and plant site and this will ensure that the new 40 hectare rural/residential subdivision provided west of the site will be unaffected by the quarrying operations.*

The villages of Seaham, Wallalong, and Woodville are some considerable distance from the site ***(see Section 5.12)*** *and will be unaffected by the quarry activities.*

Land Zoning: *No alteration of existing zoning (Non-Urban A) will be necessary to permit the proposed development.*

Planning: *The proposed development will have no impact on the future development of surrounding land for subdivision development in accordance with the 40 hectare minimum subdivision provided for by the present zoning. The site is on the periphery of areas identified as having scenic and conservation value and impacts on these areas will be low.*

The proposed quarry site will be located in an area identified by the New South Wales Department of Mineral Resources as an important hard rock aggregate site and its development will be in accordance with the recommendations of the rural lands study ***(Port Stephens Shire Council 1983)*** *to protect these resources.*

Public Utilities: *The site can be readily serviced by power and telephone from existing reticulation services without inconvenience to power and telephone users in the district. There will be insignificant impact on the present capacity of these services.*

Roads: *It is expected that there will be an average of 17 trucks daily leaving the site rising to 67 at full production. About 75 per cent of daily truck movements will be to the east to Raymond Terrace.*

On this basis, the number of trucks travelling east will average between 13 and 50, while to the west, numbers will average between 4 and 17 daily over the life of the quarrying operation.

Since only main roads, and one upgraded shire road will be used by trucks, impacts on roads will be low.

The upgrading proposals and main road use will ensure that impacts on residences adjoining the road and other road users will also be low.

The expected truck levels will result in an increase of about 2.1 per cent on current traffic levels on Seaham Road and significantly less on other main roads in the region.

Since normal traffic levels are increasing annually at a rate of between 3 and 4 per annum, the relatively proportion of quarry traffic will remain relatively constant at about 2 to 4 per cent of total traffic levels and impacts are rated as low to moderate.

Health and Safety: *The quarry and buffer zone will be fenced to deter people entering the site and trucks will travel on the access road and public routes within the speed limit and give due consideration to local residents and road users. All drivers will be instructed to drive with a high regard to the amenity of the area and the concerns of local residents.*

Energy Resources: *The proposed quarry and plant sites are not underlain by coal and hence there will be no sterilisation of energy resources.*

The plant and facilities on the site will consume between 600 and 800kW of electrical power including workshop, office, weighbridge, and lunchroom facilities. This equates with a primary energy use of about 2.0 x 10^{12} joules and is negligible in comparison with the expected total New South Wales use of energy predicted for the non-metallic mineral industry of 42.3 x 10^{15} joules in 1982-83. ***(Department of National Development 1978).***

It is expected that mobile equipment on site will consume about 200,000 litres of diesel fuel annually and haulage trucks 230,000 litres per year. This consumption of fuel equates with a primary energy use of 8.8 x 10^{12} joules, a negligible amount in comparison with the total use of energy predicted for the non-metallic mineral industry in 1982-83.

Noise: *Noise levels from the quarrying and processing operations are not expected to exceed existing background levels at all existing or known proposed residences around the site.*

Expected noise levels at residences along the truck transport routes will ranged from 96dB(A) at 10m, 89dB(A) at 25m, 82dB(A) at 50m, 75.5dB(A) at

100m, to 69dB(A) at 200m from the road. The reduction in noise levels from trees or buildings have not been included and these peak noise levels are of a very short duration during the passing of the truck.

Since main roads and one upgraded shire road are to be used, these peak levels would be similar to noise levels currently being experienced at these residences from existing traffic. It is expected that the small increase in traffic on these main roads will not significantly affect noise levels currently experienced (refer to high L_{10} and Leq levels at sites N2 and N3, ***Section 5.16****). For a small number of residences along Wighton Street, noise levels from the increased traffic will be more significant, but will only be short duration peak levels as the truck passes.*

Blasting: *The New South Wales Department of Industrial Relations (Mines Inspection Branch) and the State Pollution Control Commission impose limits on overpressure levels (noise) and groundborne vibration from blasting. Limits currently being set by these authorities range from 115 to 120dB (lin) for overpressure and 7 to 10 mm/s peak particle velocity for vibration. These levels are well below* ***SAA Explosives Code Australian Standard 2187, Part 2 - 1979*** *maximum recommended limit of 20 mm/s peak particle velocity for structurally sound buildings.*

Blasts will be designed to maximise fragmentation of the rock and minimise overpressure and vibration. The use of suitable blasting patterns and delay detonators initiated electrically will ensure that overpressure and vibration levels are kept to a minimum.

The results show that by limiting the number of blast holes per delay detonator to 3, vibration levels at 1,000m will be approximately 10 mm/s peak particle velocity.

Since the nearest existing or known planned residence is approximately 1,500m from the site, levels specified by authorities will not be exceeded.

Residents in Seaham may detect noise from the blasting operations in the background, but these noise levels will not be intrusive and in most cases would be similar to or less than background noise levels.

C. SOCIAL AND ECONOMIC IMPACTS

Employment: *Initially, the employment level is expected to be 9 persons probably all of whom would be local except the plant manager.*

At full production, the on-site employment level would rise to a maximum of 11 persons with the engagement of two additional on-site haulage truck drivers. In addition, up to 10 subcontractor positions would result from the operation.

Induced employment could be as high as 15 positions mainly concentrated in the finance and business services, communications, wholesale and retail trades, building trades and recreation and entertainment industries. Also under indirect employment can be classed the employment opportunities

created by contractors employed in the construction stage.

Income Effects: The average salary for the direct employees is anticipated as being between $380 and $420 a week. At production stage, with an employment level of 11 this represents an average annual wage bill of between $220,000 and $300,000. The short-term economic impact will be derived from the creation of new sources of income as employment is procured from the local labour market and it is expected that the majority of the direct and a large part of the indirect income effect will be in the local area or region. In the first year the income generated could be as large as $500,000 consisting of wages and salaries of direct and indirect employees.

It is expected that the long term income effects of employment and capital outlay could be conservatively estimated to be in the order of $9.58 million (discounted to present value) over the projected life of the quarry ignoring taxes paid.

Population, Housing and Employment: This area is one of growth and it is expected that housing and construction generally will exhibit an upward trend. The provision of raw materials to enable this anticipated growth, and the potential job opportunities created by this development, could greatly assist development without placing any large burden on existing resources. As it is expected that much of the direct employment would be provided locally there is sufficient excess capacity in temporary accommodation facilities to cope with transitional problems.

The direct effect on population from the provision of employment opportunities would be minor as much of the labour will be drawn from the local area. The indirect effect will be to encourage additional employment opportunities. The level of unemployment among the young in Port Stephens Shire is a continuing problem which can only be alleviated by the provision of employment opportunities.

With the growth in population and subsequent expansion of housing this area provides an expanding market for the proposed development. Thus the extraction of quarry materials would accentuate, and also service, any additional expansion.

SECTION 2

INTRODUCTION

2.0 INTRODUCTION

2.1 OBJECTIVES OF THE PROPOSAL

This environmental impact statement has been prepared for Hunter Valley Mining Corporation Pty Limited by Resource Planning to accompany a Development Application to Port Stephens Shire Council for approval to extract and process hard rock aggregate.

The location of the proposed development is part Portion 38 and 56, Parish of Seaham, County of Durham and is shown on **Figure 1.** The land is freehold and owned by Hunter Valley Mining Corporation Pty Limited.

The Company proposes to quarry rhyodacite from a low ridge flanking the eastern slopes of Brandy Hill and to process the stone in an adjacent plant. Initially up to 100,000 tonnes of material will be extracted annually rising to about 400,000 in 10-15 years. Reserves are sufficient for a long-term operation of at least 30 years.

The stone will be drilled and blasted, and transported to the plant by a front-end loader and off-road haulage trucks. Processing will involve crushing and screening the quarried stone to produce a range of different sized aggregates to meet required specifications. The crushed aggregate will be transported by truck to market centres throughout the region.

The Company proposes to apply efficient environmental management procedures to produce a wide range of aggregates to meet the growing demand for materials in the region.

All operations will be conducted in accordance with the requirements of State and local authorities.

2.2 LAYOUT OF THE IMPACT STATEMENT

The impact statement has been divided into a number of Sections to facilitate reading of the document.

The sections are inter-related and basic data to support statements or conclusions made in one section of the statement may be found in other parts of the document. The reader is advised to read the Table of Contents carefully to locate all information of interest. As a further aid to locating information in the statement, the following notes outline for the reader the layout adopted for the impact statement.

SECTION 1.0 SUMMARY

Section 1 is a summary of the findings of the environmental investigations.

SECTION 2.0 INTRODUCTION

The introduction presents the objectives and brief outline of the proposed development as required in Clause 34b of the Regulations. It also outlines the layout of the statement, the consultation process, and authorities consulted.

SECTION 3.0 JUSTIFICATION FOR THE PROPOSED DEVELOPMENT

This section describes the different types of aggregates required to meet specifications, the present sources, demand and production, and the projected future demand for these materials. The section describes the need for the proposed development based on these existing and projected demands, and environmental, economic, and social considerations; in accordance with Clause 34f of the Regulations.

SECTION 4.0 REVIEW OF ALTERNATIVES

This section describes the alternatives to the proposed development as required under Clauses 34h and 34i of the Regulations. The alternatives considered are alternative materials and sources, and the alternative of not proceeding with the proposed development.

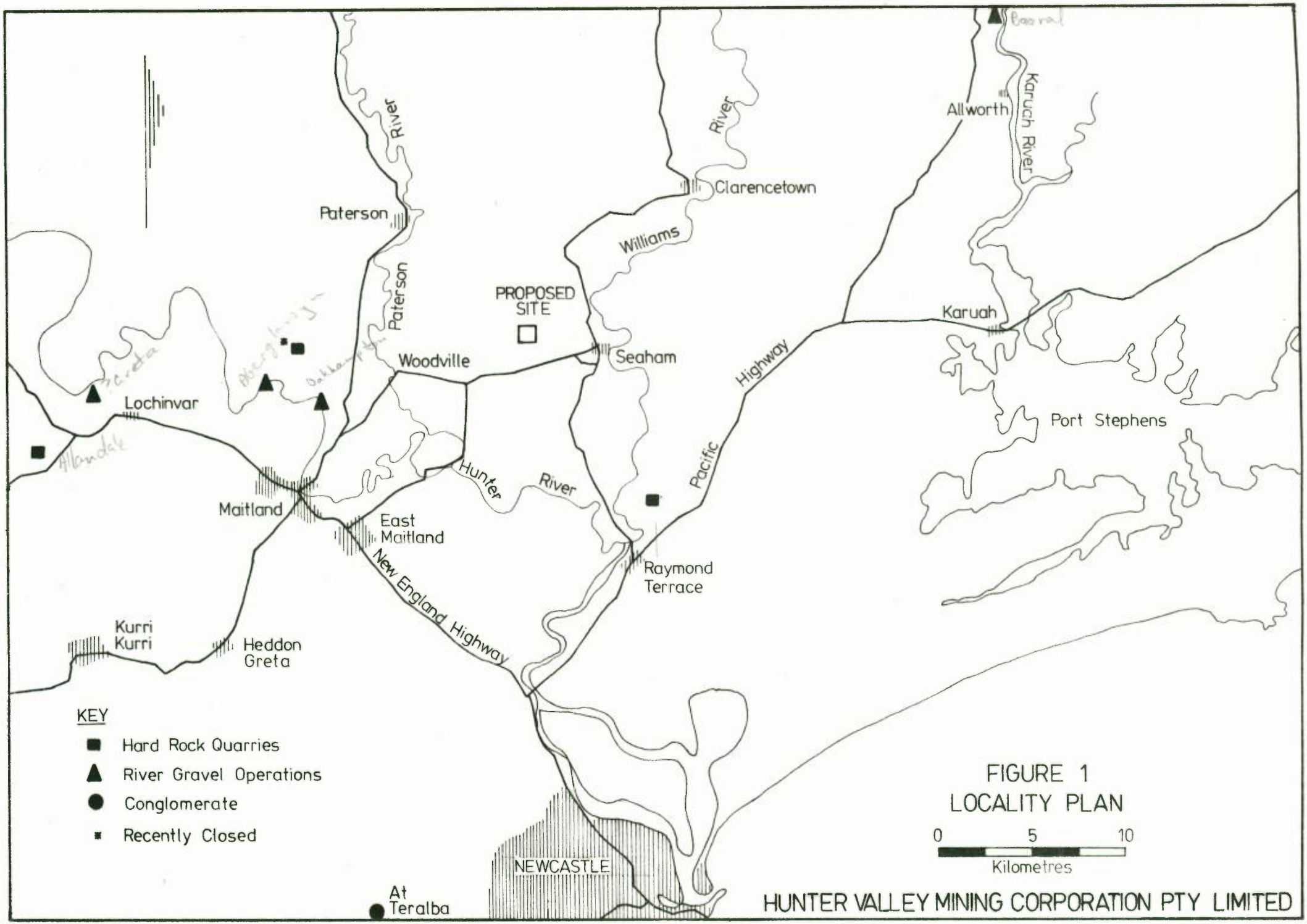
SECTION 5.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

Base-line investigations were carried out to establish the characteristics of the existing environment of the site and its surrounds. This information was used in the design of the quarry and the environmental management procedures and in assessing the impacts of the proposal. The section presents a description of the natural physical, and man-made features of the site together with social and economic factors considered in the proposal. (Clause 34c of the Regulations).

Supporting data are found in the accompanying appendices.

SECTION 6.0 THE PROPOSED DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT PROCEDURES

This section is divided into two basic parts. Part A provides full details of the proposed development including the quarry design, blasting procedures, extraction rate, plant components, operator facilities, working hours, infrastructure and workforce. (Clause 34a of the Regulations). Part B describes the environmental management procedures to be built into the design to protect or mitigate adverse impacts on the environment of the site as required in Clause 34g of


Paterson River
Paterson
Clarencetown
River
Williams
Allworth
Karuch River
PROPOSED SITE
Karuah
Woodville
Seaham
Highway
Lochinvar
Port Stephens
Hunter River
Pacific
Maitland
East Maitland
Raymond Terrace
New England Highway
Kurri Kurri
Heddon Greta
KEY
Hard Rock Quarries
River Gravel Operations
Conglomerate
Recently Closed
NEWCASTLE
At Teralba
FIGURE 1
LOCALITY PLAN
0 5 10
Kilometres
HUNTER VALLEY MINING CORPORATION PTY LIMITED

the Regulations. These include measures for the control of dust, noise, and vibration, protection of water quality and visual amenity.

SECTION 7.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

This section examines the effectiveness of the measures outlined in **Section 6.0** to protect the environment and provides an assessment of the residual environmental effects. Both adverse and beneficial effects are described in accordance with Clause 34d and 34e of the Regulations. The reader should note that **Sections 2.0** to **6.0** provide the basic data to be considered in the assessment of impacts.

2.3 DISCUSSIONS WITH AUTHORITIES

During preparation of the statement discussions were held with, and information obtained from a number of State and local authorities.

In accordance with the requirements of the Environmental Planning and Assessment Act (1979) and Regulations (1980), the New South Wales Department of Environment and Planning was consulted as to the required form and content of the statement and their guidelines, presented in **Appendix 1**, followed in preparing the document.

Listed below are State and local Authorities who provided information used in the preparation of the environmental impact statement and their assistance is gratefully acknowledged.

Commonwealth

Bureau of Statistics
Bureau of Meteorology

State

Department of Planning and Environment
State Pollution Control Commission
Department of Mineral Resources
Department of Lands
Department of Main Roads
National Parks and Wildlife Service
Soil Conservation Service

Local

Port Stephens Shire Council
Shortland County Council
Hunter District Water Board
Awabakal Co-operative

Environmental investigations were conducted by a team of specialist consultants. Details of each team members qualifications and role in the preparation of the statement are given in **Appendix 2.**

SECTION 3

NEED FOR THE PROPOSAL

3.0 JUSTIFICATION FOR THE PROPOSED DEVELOPMENT

3.1 SPECIFICATIONS AND USES OF AGGREGATE

There are three basic materials produced from hard rock quarries; crushed stone aggregate, prepared roadbase, and fine crushed rock. These "prepared" materials differ from the "natural" gravels and "earth" materials, and the characteristics and uses of these various materials are described in **Sections 3.1.1** and **3.1.4.**

3.1.1 Crushed Stone Aggregate

Crushed stone aggregate is hard rock won by quarrying methods. The quarried stone is usually crushed and screened into various size fractions and used as coarse aggregate in concrete, asphalt, rip-rap, breakwater stone, and railway ballast. Its main traditional use has been in sealing aggregate and "hot mix" asphalt.

Crushed stone aggregate used in concrete and asphalt must comply with stringent specifications set by the Standards Association of Australia, New South Wales Department of Main Roads, and the local authority. Factors such as the shape of the crushed stone, its density, strength, porosity and permeability, chemical stability, and grading are important in assessing the quality and use of the stone and it must be clean, hard, tough and durable.

3.1.2 Prepared Roadbase

Hard rock quarries produce a degree of "fine" material from the crushing and screening operations. This material is used in the preparation of roadbase comprising a blend of crushed aggregate, crusher fines and if necessary a binding material such as clay.

As with crushed aggregates, the material has to meet specifications issued by State and local authorities and possess a specific grading which produces maximum strength on compaction.

The material produced is generally a high quality roadbase and its main use is beneath the top course bituminous pavement of major roads and highways which carry high volume traffic.

3.1.3 Fine Crushed Rock

Crusher fines or "dust" is the third construction material produced from hard rock quarries. As well as being used to produce prepared roadbase, the dust is used as a filler in asphalt and concrete, particularly in concrete block manufacture.

3.1.4 Gravel

There are two types of "gravel" which vary in quality and use. Gravel used in concrete is mainly derived from rivers although small quantities are derived from weathered conglomerate units in the Hunter Region. River gravel may range from pebble to boulder size and generally produces a high-quality aggregate whether crushed or uncrushed. Gravel used in concrete must conform with specifications defined in Australian Standard 1465-1974, and generally for high strength concrete and asphalt products, crushed stone is preferred because of its larger surface area and adhesion value.

The second type of gravel is derived from weathered conglomerate and with few exceptions is generally not suitable for concrete but is used in road making and filling as an "unprocessed material". **(Section 3.1.5).**

3.1.5 Unprocessed Materials

The unprocessed materials consist of weathered rock, ridge gravel, soil and loam. In the Hunter Region, the main source of unprocessed materials are weathered conglomerates which are used principally in road making and filling operations by Government and local authorities in providing essential services.

Specifications for these materials are not as demanding as those for aggregates used in concrete and asphalt.

3.2 PRESENT SOURCES OF MATERIALS

Material that conforms to the specifications demanded by State and local authorities for concrete and asphalt must be hard, fresh, massive and durable with little weathering, overburden or deleterious minerals. Sources of hard rock or river gravel that can produce material of the quality are not as abundant as "unprocessed material" sources.

Material used in the construction of Shire roads and filling is more readily obtained, since the material is not subject to the stringent specifications set for higher quality concrete and asphalt materials. The most desired sources of Shire material is weathered rock that can be used directly as excavated in simple bulldozing or scraping operations, preferably close to areas of demand. Many small pits and scrapings that were initially established to provide road gravel in a limited area are now usually worked only occasionally for maintenance gravels and fill.

Figure 1 shows the existing quarries in the Hunter region currently producing concrete and asphalt aggregates. The figure shows that there are two hard rock quarries, one conglomerate, and four river gravel operations providing high quality aggregates on the open market. A fifth river gravel operation produces decorative aggregates rather than concrete or asphalt materials.

In recent months, a hard rock quarry at Maitland Vale has closed primarily due

to quality control problems rather than lack of demand for aggregate materials, and there is a number of small quarries which are worked only intermittently and production is insignificant.

3.3 PRESENT DEMAND AND PRODUCTION

Figure 2 shows graphically the production of hard rock aggregate, gravel, and prepared roadbase from the operating quarries shown on **Figure 1** since 1976-77.

The figure shows the following:

1. Total aggregate production in 1981/82 was in the order of 740,000 tonnes nearly 2.5 times the 1976/77 production.

2. Since 1976/77, the growth rate for aggregate production has been in the order of 20 per cent compound.

3. Two significant growth periods were 1978/79 and 1980/81 when production outputs increased by 47% and 36% respectively, over the previous year's production.

4. The graph illustrates a growing dependency on the crushed stone industry in the market area with a decrease in the production of river gravel.

5. In 1981/82, about 296,000 tonnes of prepared roadbase was produced at operating quarries in the market area.

6. The volume of prepared roadbase and fine crushed rock has declined and then stabilised since 1979/80 reflecting the variable demand for top quality roadbase.

Aggregates quarried in the region are primarily used in concrete and asphalt plants located throughout the region. Recent market studies undertaken on behalf of the Company **(Resource Planning, 1983)** show that currently most quarried aggregates are used in concrete with a small amount in asphalt, but that this demand varies from year to year depending on the availability of funds to State and local authorities. Overall, the current annual demand for quarry products is in the order of 850,000 tonnes of concrete and asphalt aggregates and 300,000 tonnes of prepared roadbase.

3.4 FUTURE DEMAND

3.4.1 Growth Rates

Figure 2 shows that aggregate production has been growing at a rate of 20 per cent compound since 1976/77. However it is considered that this exceptional growth rate reflects the number of new developments that have been taking place in the region since 1976 and does not reflect the long term growth trend in aggregate production in the region. To calculate an upper and lower demand for aggregate materials, growth rates of 4 per cent and 8 per cent have been adopted

as being more realistic growth rates for the quarrying industry in the market area.

Based on these growth rates, annual production of aggregates for five year periods to the year 2001 will be as shown in **Table 1.**

TABLE 1

PRODUCTION GROWTH RATES
(Tonnes)

Year		Growth Rate/Production 4% Compound	8% Compound
1981	740,000	901,000	-
1986		1,096,000	1,088,000
1991		1,334,000	1,599,000
2001		1,623.000	3,452,000

The table shows that the annual production of aggregates in the market area in 1991 will be required to be between 1 million and 1.5 million annually.

3.4.2 Population Growth

Overall, the Hunter Region as a whole has experienced an annual average growth in population of 1.39 per cent between the 1976 and 1981 census years. Within the potential market area, most significant growth has been in the Port Stephens and Great Lakes areas where growth rates of 5.73 per cent and 5.89 per cent respectively, have been experienced.

Population projections have been made on the basis of population growth trends and developments within the region. These projections prepared by the New South Wales Population Projections Group are shown in **Table 2.** These figures show that in 2001 the population of the market area will be in the order of 490,000 people, and 18 per cent increase on the census population of 1981.

There is a relationship between population and the production of quarry products, known as per capita consumption.

In 1976, 0.8 tonnes of aggregate was consumed by the population of the market area. In 1981, this figure had risen to 1.8 tonnes. Between 1981 and 1991, with an expected compound growth rate of 4 per cent, in the order of 10 million tonnes of aggregates will be consumed in the market area, with a per capita consumption of 2.4 tonnes per annum. This latter figure is in keeping with trends and aggregate usage in populated areas.

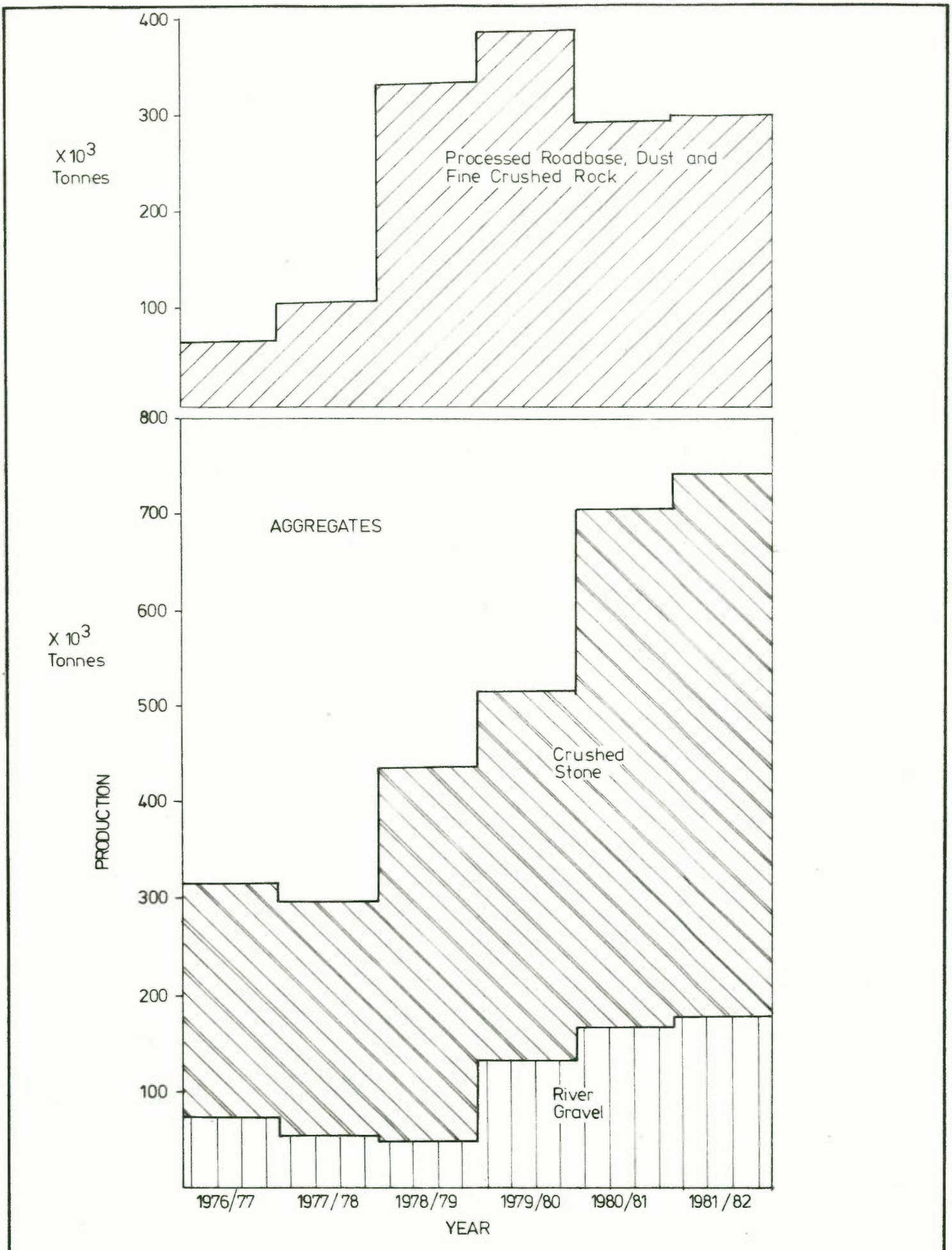


FIGURE 2
PRODUCTION

HUNTER VALLEY MINING CORPORATION PTY LIMITED

TABLE 2

POPULATION PROJECTIONS

Area	Years					
	1976*	1981*	1986	1991	1996	2001
Port Stephens	21,350	28,295	29,860	32,140	35,120	38,160
Maitland	36,600	39,938	47,670	52,510	58,650	64,970
Great Lakes	12,950	17,152	18,830	21,200	23,850	26,820
Cessnock	36,900	38,724	43,580	46,190	49,880	53,570
Newcastle	141,850	135,207	140,680	135,970	133,640	130,530
Dungog	6,000	5,900	6,270	6,400	6,180	5,930
Lake Macquarie	134,400	147,943	155,280	157,700	163,340	168,690
TOTAL	390,050	413,209	442,170	452,110	470,660	488,670

* Census Figures

3.4.3 Life of Current Operations

Studies have shown that of the two existing hard rock quarries, economic reserves available for quarrying will be depleted in about 5 years for one, while the quality of stone at the other is highly variable and some difficulties have been encountered in producing a top quality stone for concrete and asphalt purposes.

Reserves of river gravel remaining in existing operations are limited since no new gravel is brought down by the river to replenish operations. Environmental constraints are also significantly reducing the life of this type of extractive operation.

With the exception of one operation which has recently sought approval for extensions in adjoining areas, the supply of river gravel close to market areas will cease within 10 years.

3.4.4 Future Developments

The New South Wales Department of Environment and Planning has carried out a detailed planning study to identify future growth areas within the Hunter Region. The results of this study are detailed in the "Hunter Region. Regional Environmental Plan No 1" (1982) and "Urban Residential Land Program" (1982). A summary of the findings of this study are presented in **Appendix 3** and show that the region will experience significant housing growth to the year 2001.

For the past five years, the Hunter Region has experienced substantial growth associated with new coal, aluminium and associated developments.

In the present economic climate, many new projects have been curtailed or abandoned and others "shelved" for the time being. In the short-term, there will

be a number of new projects commenced, in addition to the increasing demand created by new residential subdivisions, commercial and retail developments.

Projects expected to consume large volumes of quarry products include:

1. Redevelopment of the abattoirs site at Mayfield-Sandgate for residential and commercial subdivisions.

2. Bi-centennial Road Programme including:

   a) Construction of a new bridge across the Hunter River at Hexham, and associated roadworks.

   b) A number of small bridge constructions throughout the region.

   c) Construction of a new bridge across the Hunter River at Singleton and associated roadworks.

   d) Reconstruction of roads through Greta and Scone.

3. Maitland City By-Pass.

4. New hotel complexes in Newcastle and Port Stephens.

5. Upgrading and expansion of the Williamtown RAAF base. The Commonwealth Department of Housing and Construction has indicated that over the 7 year development programme they would require between 4,000-5,000 tonnes of hot mix/year and 4,000-5,000m^3 of concrete/year.

6. Development of new subdivisions at Kurri Kurri, Nelsons Bay, Maitland, and Raymond Terrace.

7. Supply of rip-rap for the upgrading of Glenbawn dam and other dam construction works.

Based on projected long-term growth trends, it has been determined that a new hard rock quarry will be required in the lower Hunter Region to supply high quality concrete and asphalt aggregates to the growing regional markets.

Hunter Valley Mining Corporation Pty Limited has been monitoring the growth trends in the lower Hunter Region and has carried out a detailed market study to determine the future requirements of aggregate materials in this region.

The Company has identified the site on the eastern flank of Brandy Hill as the optimum for the siting of a hard rock quarry to serve the lower Hunter Region.

3.5 HUNTER VALLEY MINING CORPORATION PTY LIMITED

Hunter Valley Mining Corporation Pty Limited is a private company with interests in mining, quarrying, and real estate.

The Company currently operates a roadbase quarry at Seaham and the establishment of the hard rock quarry is seen as a logical extension of the Company's interests in quarrying activities.

SECTION 4

REVIEW OF ALTERNATIVE SOURCES

4.0 REVIEW OF ALTERNATIVES

4.1 INTRODUCTION

Surveys of construction material sources in the Hunter Region have been undertaken by the Geological Survey Branch of the New South Wales Department of Mineral Resources **(Gobert and Chesnut 1975)**. These surveys have identified existing quarries and potential resource areas in the lower Hunter Region which have been depicted on 1:100,000 scale maps.

The proposed quarry site was identified by the Geological Survey as a potential source of hard rock aggregate.

Prior to the selection of the Brandy Hill site, the Company carried out a survey of alternative sites to assess their potential for quarry development.

A wide range of factors affect site selection. These include the availability of rock units of suitable quality and quantity to support a hard rock quarrying operation, proximity to the market, suitable access over sealed roads, topographic suitability for the development of a benched quarry, adequate relatively level land for the siting of a processing plant, planning and environmental constraints.

4.2 GEOLOGICAL CONSTRAINTS

An examination of a regional geological map shows that the lower Hunter Region is divided into four main geological provinces. These are the Carboniferous rocks, the Newcastle Coal Measures, the Triassic sandstones, and the recent river alluvials.

4.2.1 Carboniferous

The Carboniferous rocks crop out principally on the northern side of the Hunter River and are separated from the younger Coal Measure rocks to the south by a fault system, known as the Hunter Thrust.

The Carboniferous rocks comprise a wide range of rock types which are complex mineralogically and structurally. Main rock types are conglomerates, acid and intermediate volcanics, tuffaceous sandstones, mudstones and siltstones. These units have been extensively folded and faulted.

Of these, only the acid and intermediate volcanics are considered to possess potential for the production of high quality aggregates, and although these are widely distributed throughout the outcrop area, most are distant from markets and/or accessible only by narrow Shire roads.

One of the existing hard rock quarries is sited in Carboniferous volcanics and this represents an important source of hard rock aggregate.

4.2.2 Newcastle Coal Measures

Most rock units occurring in the Maitland-Cessnock-Newcastle area and around the shores of Lake Macquarie are underlain by coal bearing strata of Permian age. In addition to coal, other rock types include conglomerate, sandstone, shale, tuff and minor basaltic material. The second of the hard rock quarries is sited in basaltic material in this group, but generally the rock types are unsuitable for the production of high quality hard rock aggregate. **(See Section 3.1.4 and 3.1.5).**

4.2.3 Triassic Sandstones

The Triassic sediments occur over a wide area south of Broke and Toronto. The main rock types are sandstones and conglomerates and few are suitable for the production of high quality concrete or asphalt aggregate.

4.2.4 River Gravels

At the present time, river gravels supply a large proportion of stone used for concrete in the lower Hunter Region. With the exception of one, reserves of stone in existing operations are rapidly diminishing and alternative deposits capable of supplying high volumes of aggregate are few. There is little gravel being transported by the river and the material in "storage" in point bars is not significant.

It is considered that while potential exists for the establishment of small operations none will be sufficient to supply the long term market requirements.

4.2.5 Summary of Geological Constraints

A detailed survey of alternative sources of aggregates in the lower Hunter Region has shown that only the Carboniferous volcanics, north of the Hunter Region have the potential to supply high volumes of high quality aggregate for concrete and asphalt to meet the long-term needs of the lower Hunter Region.

4.3 ALTERNATIVE MATERIALS

Apart from "natural" rock, only one other material can be used successfully in concrete and asphalt, and that is slag.

4.3.1 Slag

About 250,000 tonnes of slag produced at the BHP steelworks is processed

annually to produce aggregate suitable for concrete, hot mix, and prepared roadbase.

Although the potential for the use of slag as a replacement for crushed natural aggregate is high, the material has basic raw material problems that need to be overcome before the material becomes more widely accepted.

To be rendered suitable for concrete, the crushed slag has to be "weathered" to allow hydration of any free calcium oxide remaining on the surface. For this reason, crushed slag is not used extensively by the concrete market. The material also has a tendency to polish, and is subject to the same transport constraints as natural aggregates.

A major factor that determines the long-term supply of slag to the construction industry is steel production at the BHP steelworks.

4.4 PLANNING AND ECONOMIC CONSTRAINTS

The raw materials of the extractive industries are a resource which, like any other mineral resource, cannot be replenished. In terms of weight and volume more construction materials have to be quarried and moved to construction sites than any other type of resource material. It is for these reasons that construction material source areas need to be located as close as possible to developing areas where their exploitation is usually in direct competition with alternative land uses, e.g., residential subdivisions, commercial centres, industrial complexes, and public open space.

A quarry operation is industrial by nature: it uses heavy machinery, involves a processing procedure, and utilizes road routes for transporting its products. These features it has in common with most industrial uses of land. But it also has several unique characteristics that make it different from other forms of industry, viz:

(a) it can function only where nature has deposited the raw materials,

(b) it is self consuming - the longer it operates at any one location the shorter is its remaining life span,

(c) the value to weight ratio of its products is very low, making the transportation distance to the market of unusual significance in establishing its utility.

These factors cause the industry to require special consideration in any land-use plan.

The planner is concerned with providing for all appropriate uses of land and their proper relationship to other uses. Familiarity with the special characteristics of the quarrying industry, its position in the local economy, and its peculiarities that make it different from other material uses, is essential in the development of appropriate planning provisions.

4.5 ENVIRONMENTAL AND SOCIAL CONSTRAINTS

In selecting the optimium quarry site, consideration is given to environmental constraints imposed on this type of operation. These include the proximity of residences and land uses that may be affected by noise or vibration, suitable screening to reduce the visibility and dust from the quarrying operation, access to suitable main roads to reduce impacts on roads and traffic, and the appropriateness of the site for the incorporation of control measures for water quality, noise, vibration, dust, and visual amenity. In the Hunter region, there has been significant growth in the development of rural/residential type developments and these are significantly reducing the availability of suitable quarry sites.

4.6 IMPORTANCE AND SIGNIFICANCE OF THE PROPOSED DEVELOPMENT SITE

A detailed appraisal of alternative sites and sources of materials **(Section 4.2 and 4.3)** combined with a consideration of the planning, economic, environmental and social constraints **(Sections 4.4 and 4.5)** has resulted in the identification of the Brandy Hill site as the optimum location for the siting of a hard rock quarry.

The deposit has been identified as a suitable geological unit by the New South Wales Department of Mineral Resources, and detailed drilling and testing has shown the material to be highly suitable for a complete range of quarry products including concrete, asphalt, and decorative stone.

There is little overburden and reserves are high; capable of supplying the long term requirements of the lower Hunter Region for aggregate materials.

The deposit can be worked economically, is close to potential markets, and is serviced by sealed main roads. It occurs within a sparsely settled area where a quarry can be sited with minimal impact on the environment, and has appropriate land zoning.

4.7 ALTERNATIVE OF NOT PROCEEDING

The Brandy Hill deposit is considered by Hunter Valley Mining Corporation Pty Limited as an important source of high quality aggregate materials to meet the expected demand in the lower Hunter Region for the next 30 years. The Hunter Region is expected to continue to grow and require high volumes of concrete and asphalt for major domestic, commercial, and industrial developments as well as infrastructure needs, e.g., roads and services.

Should the extractive operation not proceed, then it is expected that an alternative hard rock deposit will need to be developed to meet the projected needs for materials in the region.

The Brandy Hill deposit represents the optimum deposit of high quality aggregate

material for the lower Hunter Region that can be worked with minimal impact on the environment. To cart materials from more distant sources results in higher transport costs which are passed on to the general public through increased charges for materials. It should be remembered that the more distant the source, the longer the haulage distance and the higher the impacts on roads and road users.

To keep the cost of raw material to a minimum, a major factor in minimising home construction costs, the Company has sought access to the Brandy Hill site.

The environmental investigations detailed in this study have shown that extraction and processing operations can be conducted on this site with minimal impact on the environment.

SECTION 5

DESCRIPTION OF THE EXISTING ENVIRONMENT

5.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

5.1 LOCATION AND LAND OWNERSHIP

The proposed quarry will be sited on a low ridge on the eastern flank of Brandy Hill, some 16km northwest of Raymond Terrace and 3.5km west of Seaham.

The location is shown on **Figure 3.** A total area of about 20 hectares will be occupied by the quarry and plant facilities on part portions 38 and 56, Parish of Seaham. The land is wholly owned by Hunter Valley Mining Corporation Pty Limited who have a total holding of 288.5 hectares in this area as shown on **Figure 3**. The surrounding owned land will be retained as a buffer zone.

A. NATURAL PHYSICAL ENVIRONMENT

5.2 TOPOGRAPHY AND SLOPES

5.2.1 Regional Physiography

The proposed site is located on the southern perimeter of an extensive hilly to mountainous area between the Williams and Patersons Rivers in the northwest of Port Stephens Shire.

The region to the north and west is marked by prominent hills and ridgelines, notably Brandy Hill (184m AHD), Mount Torrance (184m AHD) and Glenurie Hill (196m AHD). Intervening areas are cut by deeply incised creeks and hill slopes are steep, commonly with greater than 30 per cent gradients.

To the south, the mountainous country gives way to hilly terrain and the floodplain of the Hunter River.

The regional physiography is shown on **Figure 3.**

5.2.2 Site Topography

The proposed quarry site consists of an east-west oriented ridge-line on the lower eastern flanks of Brandy Hill. Elevations range from 40m AHD at the base of the ridge to 91.9m AHD on the ridge crest.

The plant will be located in a low lying area at the base of the ridge between 30m AHD and 38m AHD. The topography of the quarry and plant sites are shown on **Figure 4.**

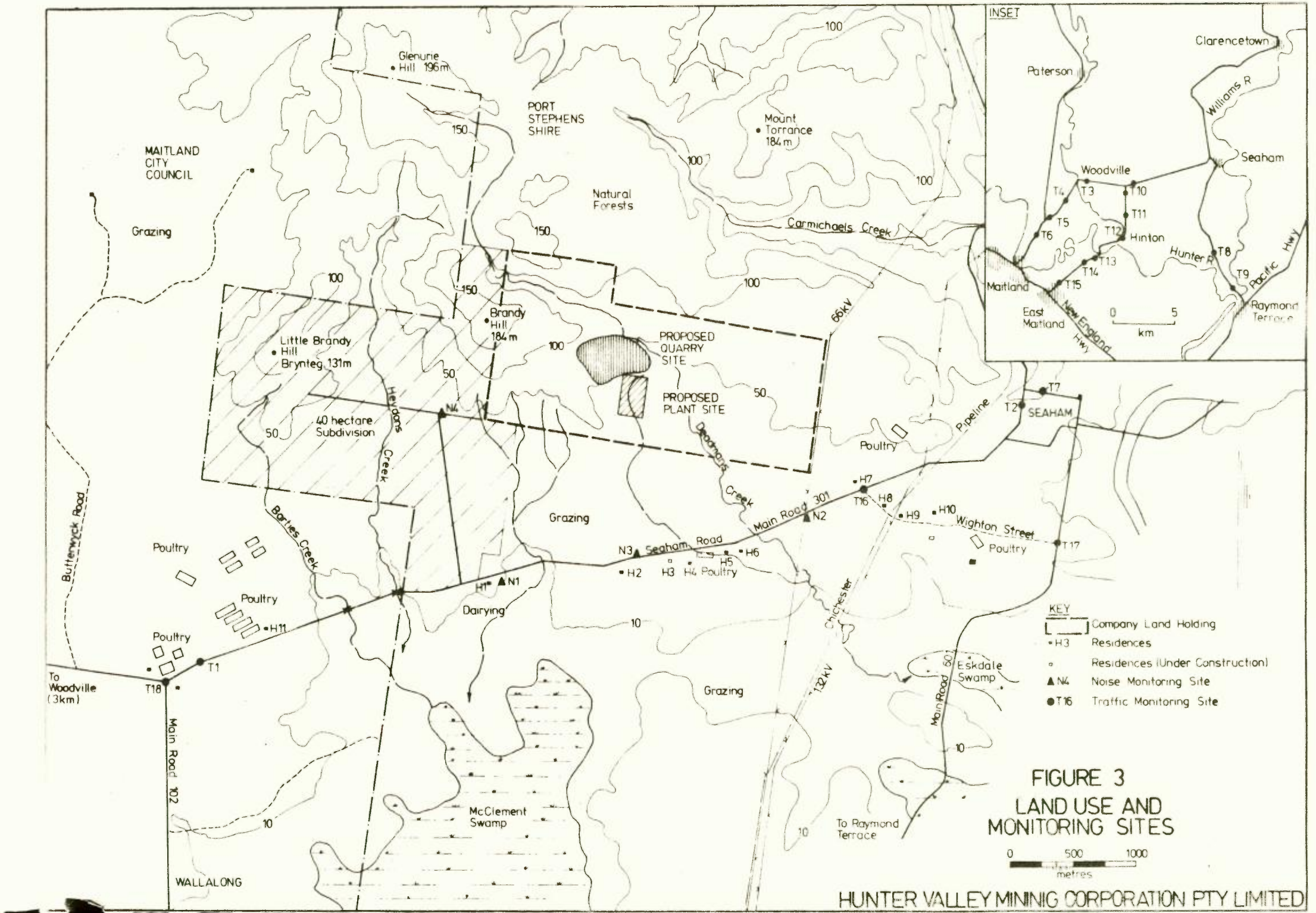

INSET
Clarencetown
Paterson
Williams R
Seaham
Woodville
T4
T3
T10
T11
T5
T6
T12
Hinton
Hunter R
T8
T13
T14
T15
Maitland
T9
Pacific Hwy
East Maitland
New England Hwy
0 5
km
Raymond Terrace
MAITLAND CITY COUNCIL
PORT STEPHENS SHIRE
Glenurie Hill 196m
Mount Torrance 184 m
Natural Forests
Grazing
Carmichaels Creek
66kV
Brandy Hill 184 m
Little Brandy Hill
Brynteg 131m
PROPOSED QUARRY SITE
PROPOSED PLANT SITE
40 hectare Subdivision
Heydons Creek
Deasmans Creek
Pipeline
Poultry
SEAHAM
T7
T2
H7
T16
H8
H9
H10
Wighton Street
T17
Main Road 301
N2
N3
Seaham Road
H2
H3
H4
H5
H6
Barties Creek
Butterwyck Road
H1
N1
Dairying
H11
T1
T18
To Woodville (3km)
Chichester
132kV
Eskdale Swamp
Main Road 602
Main Road 102
McClement Swamp
WALLALONG
To Raymond Terrace
KEY
Company Land Holding
H3 Residences
Residences (Under Construction)
N4 Noise Monitoring Site
T16 Traffic Monitoring Site
FIGURE 3
LAND USE AND MONITORING SITES
0 500 1000
metres
HUNTER VALLEY MINING CORPORATION PTY LIMITED

FIGURE 4

TOPOGRAPHY AND SLOPES

0 50 100

metres

HUNTER VALLEY MINING CORPORATION PTY LIMITED

5.2.3 Slopes

A slope analysis of the site shown on **Figure 4**, illustrates that the ridge slopes are gentle to moderate near the base (5-15%) and moderate to steep (15-30%) on the higher slopes. Steep slopes (30-50%) occur in isolated areas, particularly on the northern side of the ridgeline. The area proposed for the plant and facilities is flat to gentle (0-5%). All slopes are stable under natural conditions.

5.3 GEOLOGY

5.3.1 Regional Geology

The area is underlain by sandstones, conglomerates, and volcanics, belonging to the **Mount Johnson Formation** and **Paterson Volcanics** of Carboniferous Age.

Sandstones and conglomerates form prominent outcrop and underlie the peaks, Brandy Hill (184m AHD) and Little Brandy Hill (131m AHD) to the west and rugged country to the north.

The **Paterson Volcanics** forms the top part of the **Mount Johnson Formation** and crops out in the holding only on an eastern spur of Brandy Hill and as a thin interbed to coarse sandstones and conglomerates to the east. In this area, the **Paterson Volcanics** comprises a fine-grained rhyodacite. It is underlain by silicified tuffs, sandstones and conglomerates of the **Mount Johnson Formation** and overlain by fluvio-glacial conglomerate belonging to the **Seaham Formation.**

The units dip at between 10° and 15° to the south-southeast and have faulted boundaries to the east and west.

5.3.2 Site Geology

The proposed quarry is sited on the outcrop of the **Paterson Volcanics.**

Detailed geological investigations including diamond core drilling carried out by the Company have shown that the site is underlain by a fine-grained rhyodacite to a depth of 70m.

The rock is continuous over this depth with different colour variations ranging from white to blue reflecting various proportions of hematite in the groundmass. The rock is consistent in grainsize, composition, and texture. Testing has shown the stone to be hard and durable and highly suitable for the production of crushed aggregate for use in concrete and asphalt and as a crushed decorative stone.

There is little soil cover or overburden on the rhyodacite. Although supporting medium timber, soil depth is generally less than 50cm and passes abruptly into massive rhyodacite.

Figure 5 shows site geology.

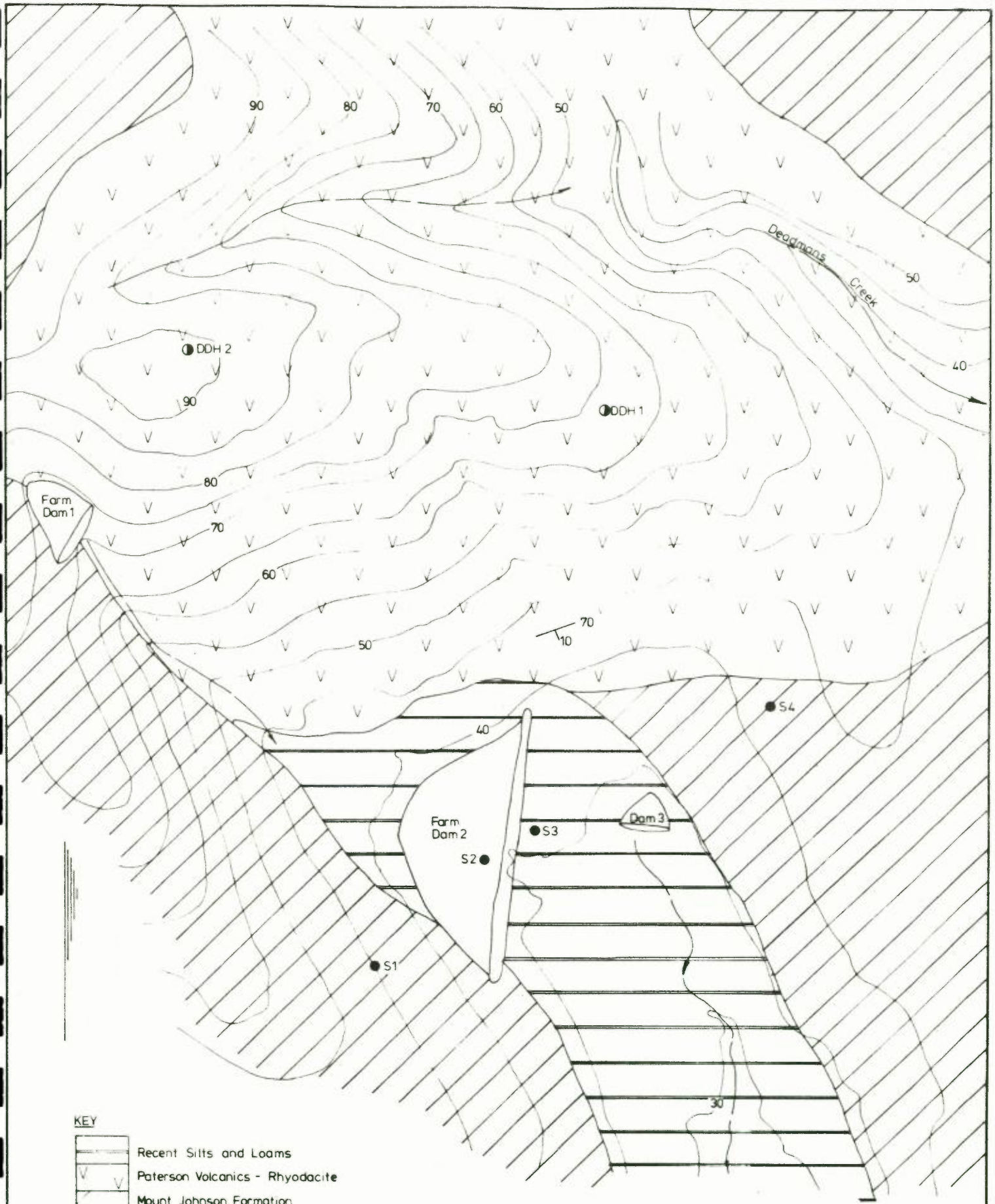


FIGURE 5
GEOLOGY AND SOIL SAMPLING SITES

HUNTER VALLEY MINING CORPORATION PTY LIMITED

5.3.3 Quality

The rhyodacite has been extensively tested in accordance with Australian Standards and Department of Main Roads specifications and has been found to be highly suitable for use as an aggregate in concrete and asphalt.

5.4 SOILS

5.4.1 General Description

The distribution of soil material on the southeastern flank of Brandy Hill is topographically controlled. In the western part of the quarry area, above the 50m contour, the soil material is nowhere more than 50cm thick, and is frequently absent altogether. The skeletal soil consists of a thin layer of undifferentiated residual sand with some clay, overlying weathering bedrock.

As slope angles are reduced, there is a gradual thickening of the solum with addition of colluvial material from upslope. Thin duplex soils characterise the area. Along the drainage lines of catchments A and B, shown on **Figure 6**, some alluvium is incorporated in the soil material.

All soil materials show an acid reaction trend, with pH values ranging from 4.5-5.5. Sandy loam is the ubiquitous surface material and forms the entire skeletal profile. The surface material is also characterised by the presence of subangular rhyodacite gravel at all sites. Where texture contrast soils occur, medium clays predominate in the B horizon. There is a sporadically developed A_2 horizon in these profiles. The presence of a bleached A_2 over clay generally indicates that the B horizon is relatively impervious, producing waterlogging of the immediately overlying soil material.

5.4.2 Soil Classification

The skeletal soils on the upper slopes fall into the Northcote Uc category (Uc 1.23). The Northcote classification of the texture contrast soils on the lower slopes is D6 - soils with brownish-grey, clay rich B horizons. Soil profile descriptions for selected sites are given in **Appendix 4.**

5.4.3 Clay Mineralogy

X-ray analysis of samples from six site **(Figure 5)** identified primarily kaolinite. Montmorillonite was identified in a sample taken immediately above bedrock at site S2.

The type of clay mineral present in the B horizon affects the behaviour of the soil. Kaolinite particles have a much smaller surface area per unit weight than do montmorillonite flakes. Montmorillonite also has a moveable crystal lattice and is thus able to accommodate relatively large amounts of water in the soil.

Kaolinite clay particles tend to stay in a flocculated state longer than do montmorillonite clay particles as water is added to the soil. The net result is that clay soils containing montmorillonite (2:1 structural clays) are much less stable when wet than are those containing 1:1 structural clays such as kaolinite. Montmorillonite rich soils characteristically expand and heave when wet, but crack widely when dry. Aggregates in kaolinite rich soils are less variable.

5.5 HYDROLOGY

5.5.1 Catchments

Figure 6 shows the catchment boundaries for creeks flowing north and south from the proposed development site.

Creeks on the northern side of the ridgeline flow into Deadman's Creek, a deeply incised stream that rises near the foot of Glenurie Hill and flows southwest to Eskdale Swamp.

Streams flowing from the southern side of the ridgeline flow south to a small tributary of Deadman's Creek which joins the main stream south of Seaham Road.

Further to the west, creeks on the southern side of Brandy Hill join Heydons Creek and flow south into McClement Swamp, near Wallalong.

Only catchment A and B, shown on **Figure 6**, receive streams flowing from the proposed development site and the size of the catchments to the points shown on **Figure 6** are listed in **Table 3.**

TABLE 3

CATCHMENT SIZES

Catchment	Size (ha)
A1	137
A2	7
B	33

5.5.2 Surface Drainage

With the exception of Deadman's Creek streams flowing from the site are intermittent and flow only for short periods following storm events. Recently constructed farm dams on streams in catchment B collect runoff from higher slopes and few streams contribute to downstream natural flows.

Deadman's Creek is a perennial stream and flows have been recorded even during drought conditions. It is only in the latter stages of the protracted drought that affected the lower Hunter Valley, did water cease flowing in Deadman's

Creek. The creek has a steep rock bank and bed with gravel lags and deep waterholes.

5.5.3 Flooding

The proposed development site is well above the 1 in 100 year flood level and is not affected by localised flooding.

5.5.4 Groundwater

Because of the dip of the strata and well jointed nature of the Carboniferous rocks in this locality, groundwater flows could be expected at depths below about 30m in the rhyodacite. No springs have been recorded in the development area and groundwater flows are unlikely to be significant.

5.5.5 Water Quality

To assess the existing water quality surrounding the proposed development site, water samples were taken from six sites shown on **Figure 6** and analysed in the field for pH and specific conductance using a portable pH/conductivity meter. Samples from sites W2 and W6 were further analysed for a range of chemical parameters.

Results of analyses are given in **Table 4.**

TABLE 4

WATER QUALITY ANALYSIS

Parameter	W1	W2	W3	W4	W5	W6
pH	5.6	5.6	5.0	5.2	5.4	5.2
Specific Conductance (micromhos/cm^3)*	135	265	200	230	83	145
Filtrable Residue -180^{0}C (mg/l)*		176				192
Non-Filtrable Residue -105^{0}C (mg/l)**		1				578
Total Hardness-as $CaCO_3$ (mg/l)		52				15
Chloride-as Cl (mg/l)		60				34
Sulphate-as SO_4 (mg/l)		50				54
Calcium-as Ca (mg/l)		10				3
Magnesium-as Mg (mg/l)		7				2

Note: * Measure of soluble salts,salinity
** Measure of suspended matter
W1 Farm Dam, muddy
W2 Creek, clear, flowing
W3 Creek, clear, flowing
W4 Creek, clear, flowing
W5 Creek, muddy, still
W6 Farm Dam, muddy

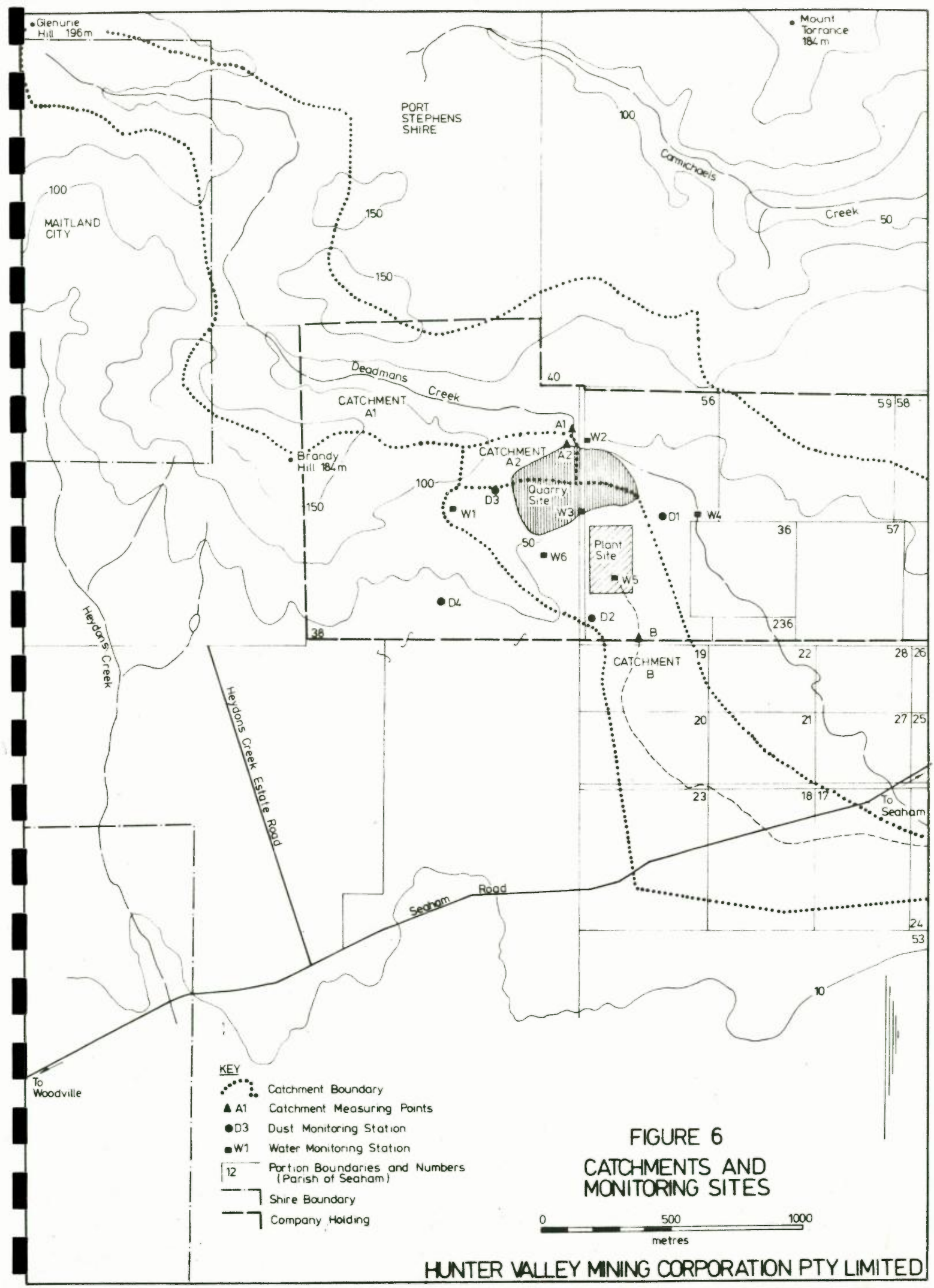


FIGURE 6

CATCHMENTS AND MONITORING SITES

HUNTER VALLEY MINING CORPORATION PTY LIMITED

The results show that:

(1) Surface waters are acidic (pH 5.0 to 5.6) reflecting the acidic nature of the soils found in the area (pH 4.5 to 5.5) (Refer **Section 5.4.1**). All water samples have pH levels less than the minimum level of 6.50 for drinking water recommended by the **Australian Department of Health (1980)**.

(2) Soluble salts, suspended matter, total hardness, magnesium and calcium levels are low and the water would be suitable for consumption by stock and irrigation of crops. The high non-filtrable residue at W6 appears to result from high levels of very fine clay particles in suspension (from surrounding earthworks associated with the construction of the dam) rather than from dissolved salts.

(3) The chloride and sulphate levels are low and below the maximum permissible level of 250mg/l specified in Schedule 2 of the **New South Wales Clean Waters Regulations (1970)**

(4) Levels for all measured parameters except pH conform with allowable impurity levels in water for human consumption recommended by the **Australian Department of Health (1980)**

5.6 METEOROLOGY

The proposed development site is located halfway between the official meteorological stations at Rutherford and Williamtown. The proposed development site would experience winds similar to those prevailing at Rutherford, while rainfall would be similar to Williamtown because of the surrounding more elevated land.

5.6.1 Rainfall

The average annual rainfall for the site would be in the order of 900mm per year which falls on an average of 115 days per year. Most rain falls between December and April with the highest falls in January and March: June is the wettest winter month.

July, August, and September are the driest months with an average of 20mm of rain falling in July.

5.6.2 Temperature and Humidity

Highest temperatures occur in January with a mean daily maximum between 28°C and 29°C and minimum in July with a mean between 3°C and 5°C.

Humidity ranges from 62 per cent to 80 per cent for 9am readings, and from 42 per cent to 58 per cent for 3pm readings. Mean relative humidity for the year is

in the order of 70 per cent (9am) and 50 per cent (3pm).

5.6.3 Wind Speed and Direction

Figure 7 shows wind speed and direction for typical months of the year. The strongest and most frequent winds blow from the west during the autumn and winter months. In spring, westerly winds prevail in the morning, but afternoon winds are more variable with strong southeasterly and easterly winds common. In the summer months, winds are light and variable in the morning with strong southeasterly and easterly winds prevailing in the afternoon.

5.6.4 Microclimate

The proposed quarry and plant sites are well protected from the prevailing autumn to winter westerly winds and the summer easterly winds. Only southerly winds have the potential to follow the open creek line and penetrate to the plant site and these prevail for only 30 per cent of the time on summer afternoons and for 15 per cent of spring afternoons.

5.6.5 Inversions

Depending on the prevailing winds and cloud cover at the site, inversions could form at almost any time of the year. **Table 5** presents inversion data for Williamtown (23km southeast) and Rathmines (38km south) of the site respectively. The percentage frequency of inversions in summer and winter for a range of heights are shown. All measurements were made at 5am eastern standard time.

TABLE 5

PERCENTAGE FREQUENCY OF INVERSIONS

WILLIAMTOWN AND RATHMINES

Top Height (m)	Summer	Winter	All Year
100	10.7	9.8	10.6
200	32.1	45.9	40.2
300	36.8	62.7	53.9
400	40.5	40.5	60.9
500	43.5	76.8	65.4
All heights	52.4	78.3	70.3

The table shows that inversions can be expected to occur on 50 per cent of mornings in summer and 78 per cent in winter.

Studies on the activities of inversions have shown that, while inversions are

close to the ground prior to sunrise, they increase in elevation as the region's temperature increases. By mid morning, the layer starts to diminish and by late morning, the inversion layer is generally dissipated.

5.6.6 Air Quality

Four dust monitoring gauges were installed on 6th January, 1983 at the locations shown on **Figure 6** to determine existing dust deposition rates of airborne particulates. Samples were collected at monthly intervals (4th February 1983, 10th March 1983, and 19th April 1983) and analysed for insoluble solids. Results are shown in **Table 6.**

TABLE 6

DUST DEPOSITION RATES

Period	Site	Insoluble Solids ($g/m^2/mth$)	Inorganic Fraction (%)
6/1/83 to 4/2/83	D1	1.04	34.3
	D2	2.55	44.9
	D3	1.00	36.1
	D4	2.04	29.0
	Mean	**1.66**	**36.1**
4/2/83 to 10/3/83	D1	2.17	59.1
	D2	2.91	49.0
	D3	2.34	49.6
	D4	2.34	46.0
	Mean	**2.44**	**50.9**
10/3/83 to 19/4/83	D1	0.39	19.3
	D2	0.56	24.5
	D3	0.34	17.9
	D4	0.36	24.9
	Mean	**0.41**	**21.7**

Results show that during the first period an average of 1.66 $g/m^2/mth$ of insoluble solids were deposited on the site, 2.44 $g/m^2/mth$ during the second period, and 0.41 $g/m^2/mth$ during the last period of recording. To determine the inorganic fraction the samples were ashed at 450°C. The results show that during the first period the samples contained a mean inorganic ('dust') level of 36.1 per cent, 50.9 per cent for the second period, and 21.7 per cent for the last period. The remainder was combustible organic matter.

The lower insoluble solids and inorganic fraction obtained during the third period result from rainfall and strong winds during this time. The rainfall would have kept the ground wet resulting in low amounts of free dust in the atmosphere. The strong winds would have led to higher amounts of organic matter from the surrounding vegetation being deposited in the gauges producing higher organic contents (ie. lower inorganic fractions).

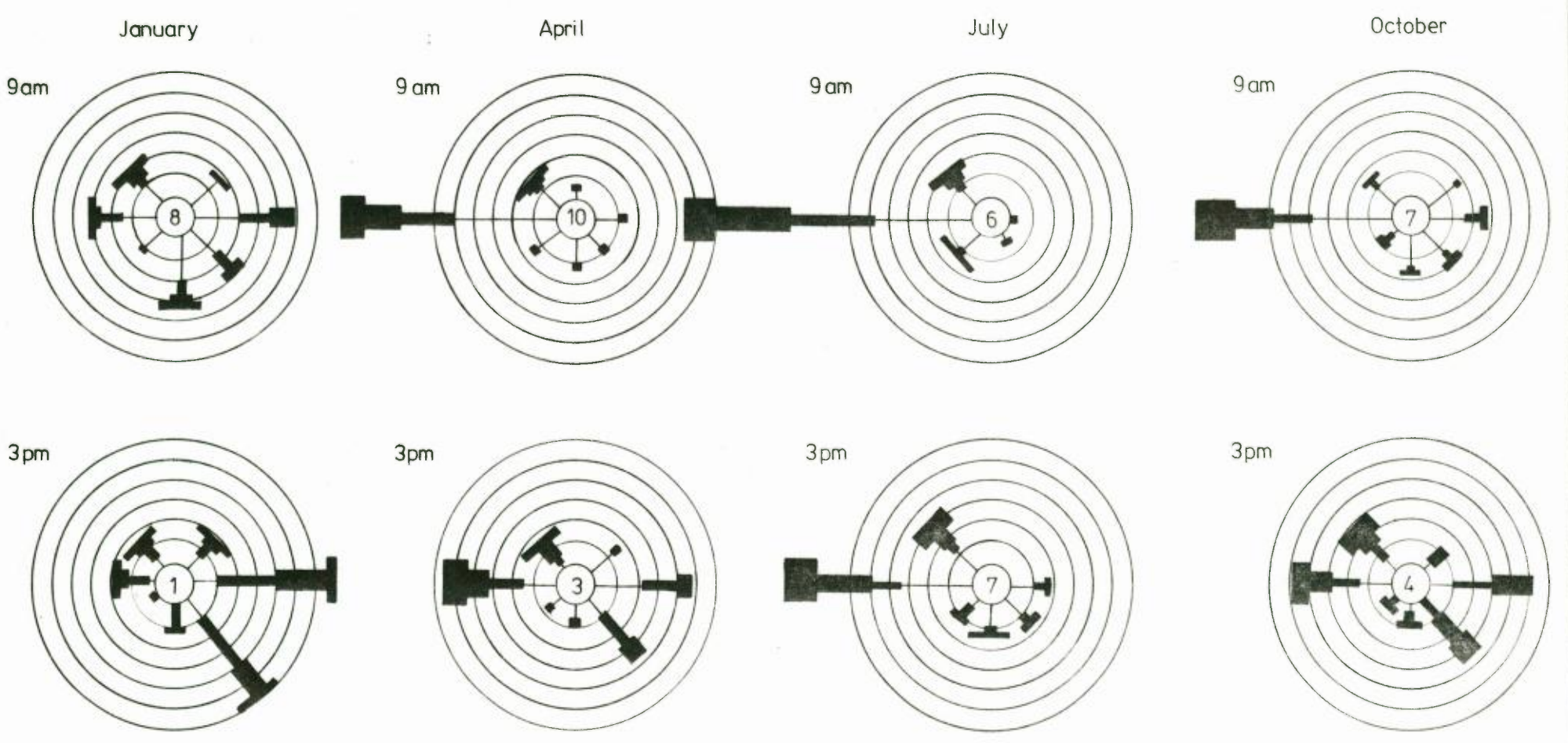


FIGURE 7

WIND SPEED AND DIRECTION

HUNTER VALLEY MINING CORPORATION PTY LIMITED

Station D2 was located near an open area where a new farm dam was under construction and consequently insoluble solids levels recorded were generally higher than those at other stations for the same period.

An average deposition rate of 1.66 g/m^2/mth recorded during the first period is similar to typical levels experienced in rural areas of 1.17 to 1.95 g/m^2/mth (Senate Select Committee on Air Pollution, 1969).

5.7 FLORA

Investigations of the flora were undertaken in spring 1982 with a veiw to compiling species lists, mapping structural alliances and assessing the rarity and importance of the vegetation community. Mapping was carried out with the aid of colour aerial photographs and in accordance with the structural classification of **Specht et al (1974)**. This system categorises vegetation communities by the height and projective foliage cover of the tallest stratum. Further delineation of communities can be achieved by identification of the dominant species within each structural unit. **Table 7** summarises the structural categories of **Specht et al (1974)**.

TABLE 7

STRUCTURAL CLASSIFICATION OF VEGETATION

Life Form and Height of Tallest Stratum	Projective Foliage Cover of Tallest Stratum			
	Dense (70-100%)	Mid-Dense (30-70%)	Sparse (10-30%)	Very Sparse (10%)
Trees 30m	Tall Closed-forest	Tall Open-forest	Tall Woodland	Tall Open-Woodland
Trees 10-30m	Closed-forest	Open-forest	Woodland	Open-Woodland
Trees 5-10m	Low closed-forest	Low open-forest	Low Woodland	Low Open-Woodland
Shrubs 2-8m	Closed-scrub	Open-scrub	Tall shrubland	Tall Open-shrubland
Shrubs 0-2m	Closed-heath	Open-heath	Low shrubland	Low open shrubland
Hummock grasses 0-2m				
Herbs				

From Specht et al (1974.)

Following this system seven alliances were identified and these are shown on **Figure 8**. Full species lists are presented for each alliance in **Appendix 5.**

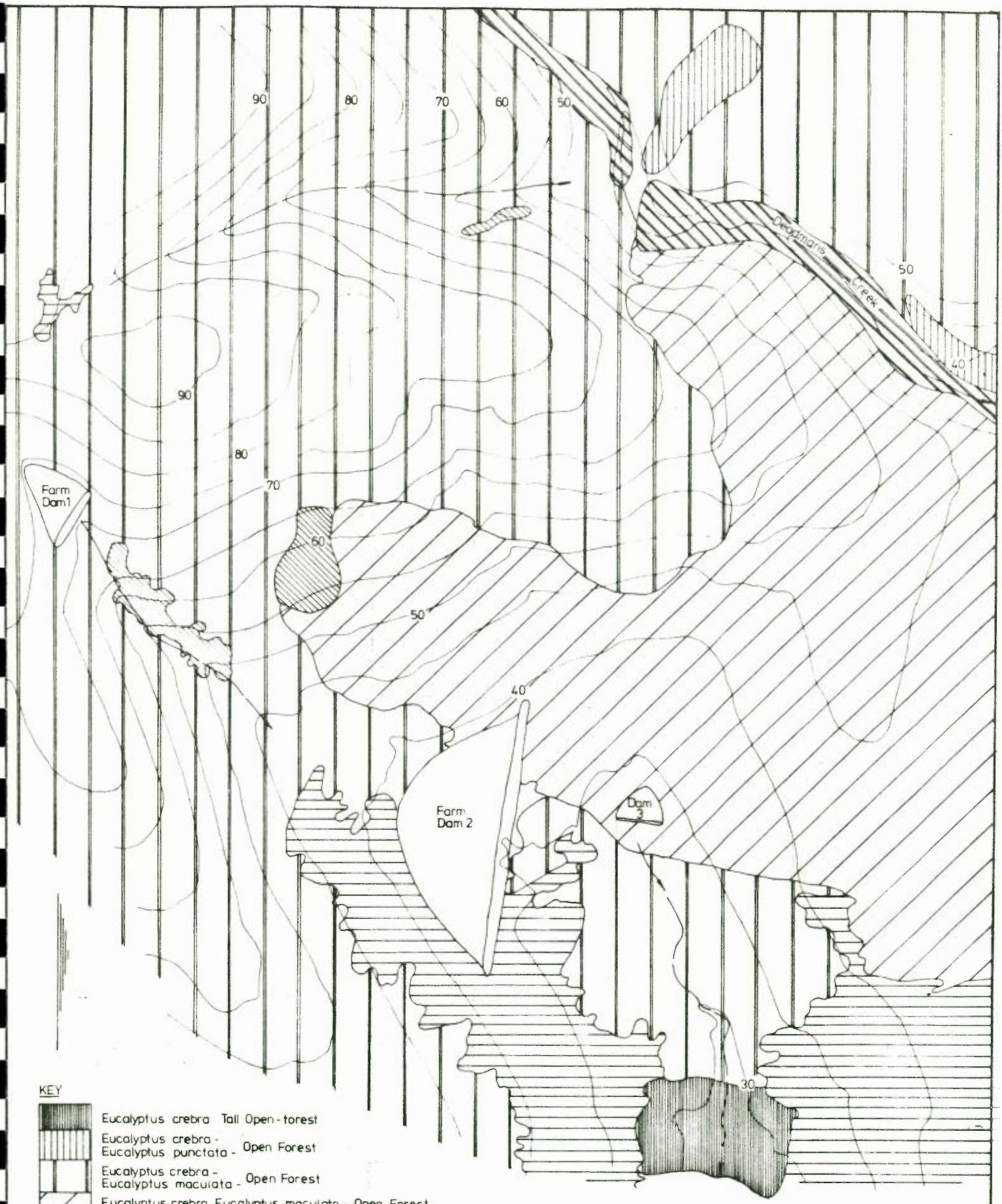


FIGURE 8
VEGETATION

0 50 100
metres

HUNTER VALLEY MINING CORPORATION PTY LIMITED

5.7.1 Vegetation Alliances

Eucalyptus crebra Tall Open-forest

This forest were noted on deeper, low slope soils in the southeastern section of the area. Narrow-leaved ironbark **(E. crebra)** was the dominant tree but Grey gum **(E. punctata)** and Spotted gum **(E. maculata)** are also present.

The alliance occurs beside a small intermittent stream and lacks a distinct understorey. There are large patches of bare ground with a covering of leaf litter; wetter parts have a covering of low herbs.

Eucalyptus crebra, Eucalyptus punctata Open-forest

This forest is found fringing Deadman's Creek in situations which are too exposed to support true rainforest species. The trees are mainly Eucalypts with scattered rainforest trees and shrubs. Lantana **(Lantana camara)** has extensively invaded portions of this alliance and formed stands up to approximately 2-5m in height. Other weeds are also common in patches of the understorey.

This is a two layered alliance with a relatively dense understorey up to about 2m, covered by a dense stratum of Eucalypts. The ground is seldom bare and there is only a sparse cover of leaf litter.

Eucalyptus crebra, Eucalyptus maculata Open-forest

The largest and driest forest type found within the study area is the **Eucalyptus crebra - Eucalyptus maculata** Open-forest. Although it was found in some low slope and sheltered positions it also occupied the steep dry exposed slopes in the northwest corner of the area.

In most cases it presented a two layered environment with low shrubs and ground cover plants predominating over larger shrubs. There are seven Eucalypt species present with the dominance almost equally shared by Narrow-leaved ironbark and Spotted gum. In some places, Forest red gum **(E. tereticornis)** is important while on the lower, less exposed slopes on the northwest of the site White box **(E. albens)** can be found.

The principle members of the lower storey include Prickly moses **(Acacia ulicifolia), Davesia ulicifolia, Pultenaea villosa** and **Aotus ericoides.** On the more exposed northwesterly slopes Hop bush **(Dodonea triquetra)** is by far the most common.

The occurrence of White box with the other Eucalypts in this alliance is unusual as this tree is usually confined to better soils of more western districts. Kurrajong **(Brachychiton populneum)** too, is unusual in this division of the State, being more usually found in the western districts and Upper Hunter Valley. In the study area it is confined to the dry, rocky, northwesterly ridge which trends east-west through the area.

The closely allied Flame tree **(Brachychiton acerifolium)** in contrast, is only found in the more moist protected portions of this forest, as well as an understorey species in the Closed-forests.

Eucalyptus crebra, Eucalyptus maculata Open-forest with **Melaleuca decora** Understorey

The tree species present in this alliance are similar to those in the other open-forest alliance with the addition of a very dense understorey of **Melaleuca decora** to about 3 and 4 metres in height.

The alliance is divided into two sections by a track. The eastern portion is much wetter and denser than the western. In the east, **M. decora** occurs almost to the exclusion of all other shrubs, except for cleared tracks and areas of pavement rock outcrop where shallow soils limit the growth of plants, grass, herbs and small shrubs.

Below the **M. decora** layer the ground is covered by an almost continuous growth of grasses and herbs, prominent among these being **Viola caleyana**.

The western section of this forest is much more open and drier with a lower and less dense shrub and tree cover. Parts of the understorey are sparse, resembling those described above, but more commonly it is similar to that described for the drier Open-forest alliance. The eastern most margins of this forest, too, show a gradual change toward the species composition of the drier forest.

Baeckea virgata Closed Scrub

There are two separate occurrences of this alliance, the northern area is in a moist sheltered gully while the largest, southern most occurrence is in an area of rock outcrop with shallow soil supporting only moss as an understorey. In this situation it is the only shrub species present and forms a closed canopy at between 2 and 3m.

In the northern situation the alliance is more moist and allows several other species to enter.

Backhousia myrtifolia Low Closed-forest

This is the densest and wettest community found within the study area. Along Deadman's Creek the alliance conforms reasonably well to the definition of "Dry rainforest" proposed by **Baur (cited in Williams and Harden, 1979)**, that is: "rainforest communities with few to many tree species forming a low to medium canopy layer and often with scattered larger trees (emergents) which are semi-deciduous or the scale-leaved conifer, Hoop Pine, canopy trees with small average leaf size; palms absent; stranglers rare or frequent; large vines common and diverse; vascular epiphyts rare, or common but with few species; mosses and ferns scarce; in low rainfall areas with rich soil, or in medium-rainfall areas on rocky, shallow- soiled steep slopes."

The main tree species is Grey Myrtle **(Backhousia myrtifolia)** which has a mallee-like growth habit with many or a few stems arising from the tree base, small leaves, and forms a canopy from about 4m high. It is not confined to rainforest and is widespread in gullies in Eucalypt forest along the east coast.

The community along Deadman's Creek is much more diverse, having numerous trees in its canopy and many climbers both small and large. It has a sparse understorey consisting of a few shrubs and young trees. Mosses are most common on the margins and ferns are well developed in patches; one species being epiphytic on rocks.

The tallest tree is a non-rainforest emergent, Tallow wood **(Eucalyptus microcorys)** which is found sparsley scattered through the alliance specially near its northern margin.

In several more open patches, Lantana forms a dense shrub layer but more generally weeds are confined to the edges of the forest.

Diversity and complexity of this alliance increase upstream along Deadman's Creek to the northwest of the area, where trees are more diverse, taller and show greater development of buttress roots. Vines are also more numerous and dense.

Themeda australis Closed-grassland

Clearing for grazing has created this alliance which lies in a mosaic between patches of Open and Closed-forest. It contains scattered emergent trees and shrubs which are allied to the surrounding forests. The ground cover is more or less continuous with some bare patches, tracks and rock outcrop. Kangaroo grass **(T. australis)** is the dominant herb, although others are numerous and occasionally replace it as the dominant in some places, such as damp depressions.

5.7.2 Ecological Relationships

The Hunter Valley is unique in New South Wales in that is is the only area where the Coastal subdivision directly adjoins the Western Slopes without intervening Tablelands. This, combined with local climatic and edaphic factors has produced an unusual flora in the region.

The site as a whole contains several species which are at the edge of their range and are more normally associated with other geographical regions, and some species which are not usually found together. This is a result of geographical factors which allow a predominantly western flora to exist close by an eastern one without a physical barrier between the two.

Thus the predominantly western species, Kurrajong **(Brachychiton populneum)** occurs beside the coastal Grey Gum **(E. punctata)**, White stringybark **(E. globoidea)** and Grey Box **(E. moluccana)**.

White Box **(E. albens)** is usually a "slopes and tableland" tree and only reaches

the coast in three locations, one of which is the Hunter Valley.

Similarly, species which are normally associated with the coastal subdivision can be found here in communities in which they would not normally occur. For instance the Flame tree **(Brachychiton acerifolium)** which can be found widely in the coastal region, north from Illawarra to Queensland, grows at this site in Open-sclerophyll forest whereas its more usual association is in rainforest. Hop bush **(Dodonea triquetra)** is common in Eucalypt forests on the east coast of this state but in the study area it is sometimes associated with Kurrajong; more usually a species of drier western regions.

Local edaphic and climatic factors are important in controlling small scale variations in vegetation. The driest forest type found was the **E. crebra, E. maculata** Open-forest. The northwesterly facing slope bordering Deadman's Creek was in turn the driest part of this alliance. It is here that the greatest concentration of Kurrajong trees is to be found.

Lower slope situations are generally covered with species which require more moisture and/or better soils.

The **Backhousia myrtifolia** Low Closed-forest is found on sheltered south and southwesterly slopes along Deadman's Creek. At Seaham the soils on which this forest grows are poor as they are mainly derived from conglomerate and sandstone of the **Mount Johnson Formation.** The rainfall, measured at Tocal Agricultural College, is moderately high at an annual average of 909mm. Therefore, it appears that shelter from extremes of heat and exposure are factors limiting the extent of this forest.

Further upstream along Deadman's Creek the height of the canopy, average leaf size, diversity and size of trees all increase. Investigations of this section of forest may reveal it to be a true Sub-tropical or warm temperate rainforest.

5.7.3 Past Disturbance to Vegetation

Reference to **Figure 8** illustrates the extent of past clearing to enlarge the grazing area for domestic stock. This has largely been beneficial to the large native herbivores which prefer open forests and grasslands in which to graze.

Most of the remaining forest has been subject to selective logging for the production of mine support timber resulting in few large mature trees remaining.

Weed infestation is not a major problem, although a number of introduced weeds are present. Even the aggressive weed, Lantana, does not form dense impenetrable stands in the area. It does become more prevalent and thicker along Deadman's Creek especially to the northwest of the proposed quarry site.

There is no evidence of recent fire damage to the flora. The nature of the understorey in the drier parts of the **E. crebra - E. maculata** Open-forest, i.e. those without **Melaleuca decora** understorey, indicates a fire at some past time which encouraged the germination of members of the families **Mimosaceae** and **Papilionaceae.**

Section 5.8.3 discusses how these agents, amongst others, have proved favourable to kangaroos and wallabies and detrimental to arboreal and small ground dwelling mammals.

5.7.4 Conservation Status and Regional Significance

Section 5.7.2, illustrates that the species composition of the flora does not strictly conform to any of the alliances surveyed by **Specht et al, (1974)**. There are, however, two alliances described in **Specht** which contain most of the major Eucalypt species found on the site. These are **E. maculata - E. paniculata** Open-forest and **E. moluccana - E. tereticornis** Open-forest.

The conservation status of these is listed as excellent and nil, respectively. Excellent conservation status is defined as "The plant community is well conserved in several large reserves, exhibiting ecological diversity and subject to little human influence". Nil is defined as "No reserve contains the plant community" **(Specht et al, 1974)**.

Species which occur in both the **E. maculata - E. paniculata** Open-forest and Open-forests of the site are; **E. maculata, E. globoidea, E. crebra** and **E. moluccana.**

In a regional context, forests similar to the Open-forests of the study site, but lacking the dryland species, can be found in the vicinity of Maitland, Seaham, Paterson and Clarencetown.

Backhousia myrtifolia can be commonly found alone in moist gullies in Eucalypt forest along the east coast. It is much less common in association with other rainforest species as found in this area.

There were no rare or endangered species recorded on site. Red box **(Eucalyptus rudderi)** is noted as being depleted in numbers from its former abundance **(National Parks and Wildlife Service, 1978)**.

There are two protected species occurring on site, these are Maiden hair fern **(Adiantum sp)** and the epiphytic Elkhorn **(Platycerium sp)**. In addition the following seven species are declared noxious weeds in parts of New South Wales; Dodder **(Cuscuta spp)**, Horehound **(Marrubium vulgare)**, Lantana **(Lantana camara)**, Paterson's curse **(Echium plantagineum)** Sifton bush **Cassinia arcuata)**, Spear thistle **(Cirsium vulgare)** and Wild cotton bush **(Gomphocarpus spp.)**.

5.8 FAUNA

5.8.1 Investigation Techniques

Investigations of the fauna of the area were of four types. **Table 8** summarises the methods used to survey each class of animal.

TABLE 8

FAUNA INVESTIGATIONS

Method	Class of Fauna Investigated
Direct Observations	Birds, Large Mammals, Reptiles, Amphibians
Indirect observations of dung, nests, eggs etc.	Birds, Large Mammals
Trapping	Terrestrial and Arboreal Mammals
Spotlighting	Terrestrial and Arboreal Mammals

Direct observations of birds was undertaken on fixed transects and at any other time the animals were observed during field investigations. Large terrestrial mammals were encountered periodically during investigations and these were identified as the opportunity arose. Searches for reptiles and amphibians were carried out to detect these animals.

In all cases, animals whose presence was inferred by identification of dung, eggs and nests were confirmed by direct observation.

Two types of traps were used in the investigations. Elliot "Type A" small mammal traps were used to trap small ground-dwelling mammals. Larger "Mascot Wire Works" platform traps were used in an attempt to sample larger ground and tree dwellers.

Spotlighting is a technique used widely for the detection and identification of nocturnal, arboreal and ground living mammals.

5.8.2 Birds

Forty eight species of birds were observed on the site. Of these, thirty were found only in Open-forest and nearby grassland, seven in Open and Closed-forest, nine in Closed-forest only, one was a water bird found on a small water hole and the last was a bird of prey observed flying overhead. A complete list is given in **Appendix 6.**

There are a number of honeyeaters and birds which feed on nectar within the area reflecting the large number of flowering trees and shrubs which were present. The bulk of species recorded, however, are predominately insectivorous.

Two ground dwelling birds were found breeding on the site. An egg of the White-throated nightjar was found on the ground in **E. crebra** Tall Open-forest and an adult Stubble Quail with young was observed in **E. crebra, E. maculata** Open-forest.

All species are relatively common and unrestricted in their range in New South Wales and none are listed as rare or endangered by the National Parks and Wildlife Service. Three species, Eastern Silvereye **(Zosterops lateralis),** Pied

Currawong (**Strepera graculina**) and Galah (**Cacatua roseicapilla**) are not protected under the National Parks and Wildlife Act, 1974.

This fauna is relatively rich and diverse and contains species which utilize a wide range of environmental opportunities. Spaces on the ground, tree trunks, foliage between trees, and above trees are all utilized by one or more species inhabiting the study area.

5.8.3 Mammals

Four species of Kangaroos (**Macropodidae**), one possum (**Phalangeridae**), two predators (**Canidae**) and two introduced rodents (**Muridae**) were found on the study site. They are listed in **Table 9** along with the method of detection of each.

TABLE 9

MAMMAL SPECIES

Common Name	Systematic Name	Method of Dectection
MACROPODIDAE		
Eastern Grey Kangaroo	**Macropus giganteus**	Sighted
Wallaroo	**M. robustus**	Sighted, Dung
Red-necked Wallaby	**M. rufogriseus**	Sighted, Spotlighted
Swamp Wallaby	**Wallabia bicolor**	Sighted, Dung
PHALANGERIDAE		
Brush-tailed Possum	**Trichosurus vulpecula**	Spotlighted
MURIDAE		
Black Rat *	**Rattus rattus**	Trapped
House Mouse *	**Mus musculus**	Trapped
CANIDAE		
Red Fox *	**Vulpes vulpes**	Sighted
Dingo	**Canis familiaris dingo**	Sighted

* Introduced Species.

The status of the large and small mammals inhabiting the site is quite different.

The Kangaroo fauna is relatively abundant and diverse, containing in one area species with a variety of habitat requirements. Eastern-grey kangaroos are large animals which inhabit open-forests and woodlands feeding on grasslands at night and sheltering in wooded areas by day. They inhabit the lower slopes and flatlands of the area, although they are encountered on some higher slopes in

the open-forest.

Wallaroos, also known as hill kangaroos, are sturdy animals which never venture far from ridges and rocky outcrops where they shelter during daylight hours. Individuals were sighted on the large southeasterly ridge located in the west of the study area, the physical feature on which they are dependent for shelter. Dung from these animals was found further to the east in lower-lying sections of forest. These would not provide suitable shelter for these animals but are used for nocturnal feeding.

The red-necked wallaby is similar to the large kangaroos except for its smaller size. It is an inhabitant of woodland/forest edges and denser scrub. It is monadic, i.e. neither seeks to form groups nor avoids other animals when it happens upon them, and is usually found singly or in groups of two or three. In this area it was observed chiefly in **E. crebra - E. maculata** Open-forest with **Melaleuca decora** understorey, singly and in groups of two, three and five.

Swamp wallabies usually inhabit dense vegetation in moist gullies, although they live in dry areas such as the Piliga scrub. They were found in similar areas to the above species but a group of six animals was observed crossing open-forest. However, the other groups of mammals present are much reduced in numbers and diversity and contain numerous introductions.

Only one arboreal mammal, the Brush-tail Possum, was observed during the study and even this animal was relatively uncommon. This species is widespread throughout the continent in a variety of habitats including suburban gardens, and relies largely on hollows in trees for shelter, although it will use caves and other shelters where suitable trees are scarce. On the site, large, mature trees which could provide suitable nesting sites were uncommon as it has been logged for mine support timber. Under these circumstances, most trees do not attain maturity and nest sites are limited.

There are areas of dense vegetation, which would appear to be suitable for Common ring-tailed possums **(Pseudocheirus peregrinus)**, which builds nests in trees of scrub communities. None of these animals were observed during this study.

Other arboreal mammals such as various gliders also depend on nesting hollows in the same way as the Brush-tailed possum and none were recorded in the area.

The ground dwelling fauna consisted of two introduced rodents which were each captured twice, representing a depleted fauna. House mice are widespread in Australia but their relationship to native mice, rats and marsupials is not known. The Black rat is also widespread but does not venture as far from human habitation as the above species. It is most often recorded from degraded forests but has been found in relatively undisturbed areas.

The lack of small ground dwelling mammals may in part be due to the presence of two predators, the Dingo and Red fox. Both are efficient hunters taking small mammals, birds, reptiles, insects, carion and some vegetable matter.

Dingoes are still relatively common over most of the continent except for Tasmania. It is a relatively new arrival compared to other native species, and is the product of evolution in an environment outside Australia.

The Red fox was introduced to this country in the mid to late 19th Century and is now common in most parts of the continent except for the far north and Tasmania.

5.8.4 Reptiles and Amphibians

Field studies revealed the presence of three lizards, two snakes and one frog in the area. They are listed in **Table 10.**

TABLE 10

REPTILE AND AMPHIBIAN SPECIES

Common Name	Systematic Name
AGAMIDAE	
Eastern Water Dragon	**Physignathus lesueurii**
SCINCIDAE	
Copper-tailed Skink	**Ctentotus taeniolatus**
VARANIDAE	
Lace Monitor	**Varanus varius**
LEPTODACTYLIDAE	
Tusked Frog	**Adelotus brevis**
ELAPIDAE	
Red-bellied Black Snake	**Pseudechis porphyriacus**
BOIDAE	
Carpet Snake	**Morelia spilotes**

All of the above species are protected in New South Wales under the National Parks and Wildlife Act, 1974. None is listed as rare or endangered. Only one species of reptile, the Broad-headed snake **(Hoplocephalus bungaroides)** is included as an endangered species in this State. While its range extends north to Newcastle, the Broad-headed snake has only been recorded from areas of Hawkesbury Sandstone and Narrabeen Shale **(Mersey, 1980)**, which does not occur at Seaham.

5.8.5 Fish

Two species of Fish were collected from Deadman's Creek. The first, common jollytail **(Galaxias maculatus)** is native and the second, Mosquito fish **(Gambusia affinis)** is introduced.

Gallaxiid (the family to which the common jollytail belongs) fish are commonly associated with rivers showing, high water flow rate, turbulent flow, small discharge, high oxygen concentrations and having a substratum of rock, pebbles, gravel or sand **(Bayly and Williams, 1973).**

The mosquito fish occurs further downstream in shallow pools with pebble bottoms. This species was introduced to control mosquito populations and there is now concern that the fish is competing with indigenous species which are at least as well able to eat mosquito larvae **(Lake, 1978).**

5.9 VISUAL ASPECTS

5.9.1 Sub-Regional Scenery

The landscape character of the visual catchment is divided into two distinct landscape units.

Unit 1 is the elevated, relatively undisturbed ridgelines encompassing Brandy Hill and hills to the north. The area is diverse in vegetation and terrain providing natural contrast and variety. The high hills and associated ridgelines form prominent visual elements and a skyline when viewed from surrounding villages. Views from hills surrounding the site are restricted by the dense vegetation cover.

According to a visual preference survey conducted by **Radford and Bartlett (1977)**, the surrounding region ranks as having high visual quality.

In contrast, unit 2, comprises low lying slopes characterised by clearing and agricultural pursuits. Large stands of remnant vegetation occur throughout. These lower slopes and plains rank as having moderate scenic value.

5.9.2 Viewing Points

The ridgeline proposed for the quarry site is located within relatively undisturbed natural bushland and is, for the most part, screened from view.

The ridgeline is located lower in the topography than the high ridges forming the skyline from viewing points.

Natural screening of the proposed quarry and plant site is provided by a lower ridgeline south of the site and existing vegetation north of Seaham Road. Only glimpses of the site are possible from Seaham Road through sections of cleared

land in the foreground between the road and the site.

B. MAN-MADE PHYSICAL ENVIRONMENT

5.10 ABORIGINAL PRE-HISTORY

An archaeological survey of the proposed development site was undertaken on foot in May 1983 to identify any evidence of aboriginal occupation. A close examination of the valleys of Deadman's Creek and its tributaries were made, with particular attention being focused on the exposed rock slabs on the southern side of the ridgeline. The survey was conducted by consultant archaeologists and members of the Awabakal Co-operative and their reports are included in **Appendix 7**. No sites or artifacts of archaeological significance were located.

5.11 EUROPEAN HISTORY

It has been reported that at the turn of the century, there were two small gold mines being worked in the Brandy Hill area but there is little evidence of these to-day. It is believed that enough gold for "pocket money" was recovered from these workings.

There are no historic homes in the vicinity of the proposed quarry and plant sites.

5.12 LAND USE

5.12.1 Residential

The nearest village areas to the proposed site are Seaham 3.5km to the east, Wallalong 5.5km to the southwest, and Woodville, 7km to the west.

These villages comprise both more established older homes and newer residences and have been experiencing significant growth in more recent times.

Table 11 shows subdivision and building data for these three villages for recent years.

TABLE 11

BUILDING STATISTICS
LOCAL VILLAGES

Village	1979	1980	1981	1982
SEAHAM				
Subdivision Applications	-	4	10	5
No. of Lots	-	26	70	15
Building Applications	16	19	19	-
WALLALONG				
Subdivision Applications	-	2	3	2
No. of Lots	-	4	11	7
Building Applications	8	7	7	-
WOODVILLE				
Subdivision Applications	-	-	4	1
No. of Lots	-	-	10	2
Building Applications	3	5	3	-

Source: Port Stephens Shire Council (1983).

The table shows the high growth in building activity in these village areas.

Between 1976 and 1981, the population of the Seaham, Nelsons Plains, Dunns Creek and Woodville area grew from 1,037 to 1,290 people, a growth of 24.4 per cent.

Figure 3 shows the nearest residences to the proposed site and **Table 12** lists their construction. The nearest residences are 1.5km south of the proposed plant site (H2 and H3) shown on **Figure 3**.

A 40 hectare subdivision of 10 lots has recently been developed to the west as shown on **Figure 3** with the nearest lot boundary 1km from the proposed quarry site.

5.12.2 Agriculture

Agriculture is the prime land use south, east, and west of the site. North of Seaham Road the land is used primarily for horse and cattle grazing while south of the road, a dairy is operated in conjunction with H1.

By far the most extensive agricultural activity in the vicinity of the site is the battering poultry and broiler farms.

Steggles Pty Limited have a large hatching plant and farm 3.5km west of the site

while two smaller operations are sited 1.5km to the south and 2.5km to the east.

The Steggles operation accounts for the major proportion of the poultry livestock within Port Stephens Shire which in March 1981 comprised 1.5 million chickens and turkeys in 28 farms.

TABLE 12

RESIDENCES IN PROXIMITY TO THE SITE

House No. (Figure 3)	Walls	Foundations	Roof	Approx. Age (years)
H1	W/Board	Pier	Gl	20
H2	H Plank	?	GI	10
H3	Brick	Slab	-	U/C
H4	H Plank	?	GI	10
H5	H Plank	Slab	GI	10
H6	Brick	Slab	Tile	5
H7	Brick	Pier	GI	5
H8	Brick	Slab	Tile	5
H9	Brick	Pier	Tile	10
H10	Log Timber	Pier	GI	5
H11	Brick	Pier	Tile	20

Note: W/Board = weatherboard
GI = galvanised iron
U/C = under construction
H Plank = Hardiplank

5.12.3 Natural Areas

Areas immediately north, east, and west of the site are covered in natural forest cover. The composition of these forests is detailed in **Section 5.7** and **5.8.**

5.13 PLANNING

5.13.1 Land Zoning

The proposed development site is zoned Non-Urban A in Interim Development Order No 23, Shire of Port Stephens under which extractive industries are permitted with the consent of Council.

5.13.2 Planning

A rural land study of Port Stephens Shire has recently been compiled by Council **(Port Stephens Shire Council 1983)** which identifies the constraints and opportunities for rural lands within the Shire.

The study identified the conservation and scenic value of the densely forested areas to the north of the proposed development site and recommended a scenic protection zoning for this area.

The proposed development site is on the periphery of this area and does not impinge on the skyline or on the more densely forested conservation areas north of the site.

The report also identified the significance and importance of hard rock aggregate resources in the Shire and the need to protect them from alternative land uses.

The proposed development site has been identified on maps and reports prepared by the Department of Mineral Resources **(Gobert and Chesnut 1975)** as an important hard rock aggregate deposit which requires protection from alternative and competing land uses.

5.14 PUBLIC UTILITIES

The site can be readily serviced by power and telephone facilities presently located in the vicinity of Seaham Road and which will be connected to the 40 hectare lots to the west of the site.

No easements for these services pass through the proposed site.

The area is not serviced by reticulated water or sewerage services.

5.15 ROADS

The site is presently accessible via a 1km long four wheel track from the end of the sealed Heydons Creek Estate west of the site.

The sealed estate road connects with Seaham Road (Main Road No 301) which is a DMR funded-Council maintained main road which provides the main access corridor between Maitland, Seaham, and Raymond Terrace.

To the west, Main Road No 301 passes through Woodville and joins Main Road 101 at Bolwarra, which provides access to Lorn and Maitland. Approximately 2.5km west of the intersection between the estate road and Seaham Road, a third main road (MR 102) joins Seaham Road. It provides access to Wallalong, Hinton, Morpeth and East Maitland. To the east Seaham Road connects with Main Road No 601 which passes through Nelsons Plains to join the Pacific Highway at Raymond Terrace.

Figure 3 shows the main roads and **Table 13** provides annual average daily traffic

readings for the stations shown on **Figure 3** measured by the New South Wales Department of Main Roads.

TABLE 13

TRAFFIC LEVELS (AADT)

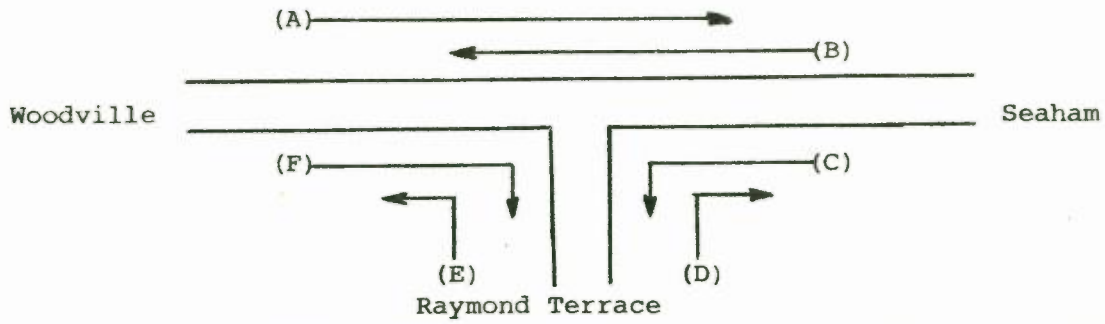
Road	Station	Number(T)	1976	1978	1980
MR 301	05584	1	700	-	650
	05585	2	460	-	900
	05346	3	790	-	1,070
	05345	4	530	-	730
	05344	5	1,190	-	1,770
MR 101	05343	6	2,670	-	3,670
MR 601	05845	7	590	-	810
	05993	8	-	-	1,680
MR 104	05009	9	3,990	-	4,500
MR 102	05366	10	620	-	590
	05365	11	580	-	770
	05364	12	1,230	-	1,280
	05363	13	1,960	-	2,270
	05362	14	2,740	-	3,490
	05360	15	3,310	3,170	2,490

Source: New South Wales Department of Main Roads (1980).

Detailed traffic surveys were undertaken at the intersections shown as sites T16, T17, and T18 on **Figure 3** to identify types of traffic using the main roads and results are shown on **Tables 14** to **16.**

TABLE 14

TRAFFIC SURVEY - T16
(27/4/83)



Time	Class	A	B	C	D	E	F
6.30-7.30am	HV	3	2	-	-	-	-
	LC	1	4	-	-	-	-
	PV	5	5	-	-	1	2
7.30-8.30am	HV	1	-	-	-	1	-
	LC	8	5	-	-	1	-
	PV	7	26	-	-	1	-
8.30-9.30am	HV	-	5	-	-	-	-
	LC	4	3	-	1	-	-
	PV	5	16	-	-	-	1
9.30-10.30am	HV	5	-	-	-	-	-
	LC	6	3	1	-	-	-
	PV	6	24	-	-	2	1
10.30-11.30am	HV	1	2	1	-	-	1
	LC	2	3	1	1	-	-
	PV	10	10	-	-	-	-
11.30-12.30pm	HV	-	1	-	-	-	-
	LC	6	2	-	-	-	-
	PV	6	9	-	1	-	-
12.30-1.30pm	HV	2	1	-	-	-	-
	LC	-	2	-	-	1	-
	PV	10	10	2	-	2	-
1.30-2.30pm	HV	2	1	-	-	-	-
	LC	9	1	-	1	-	-
	PV	12	7	-	1	-	-
TOTALS	HV	14	12	1	-	1	2
	LC	36	23	2	3	2	-
	PV	61	107	2	2	6	5
	TOTAL	111	142	5	5	9	7

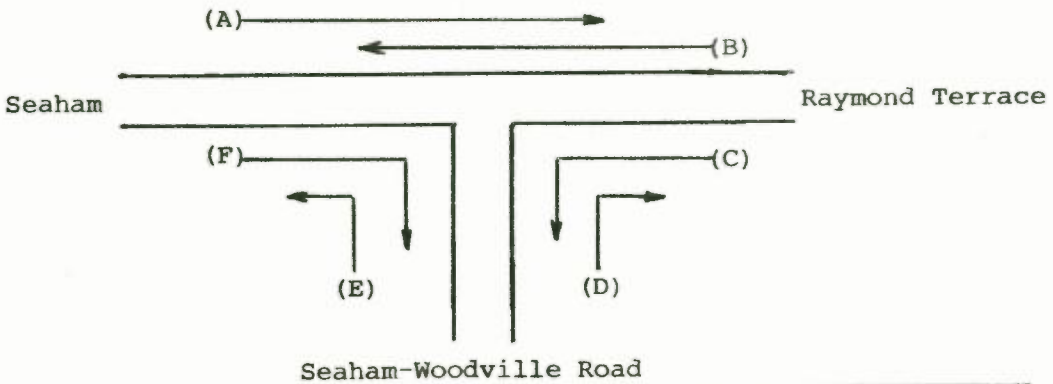
Note: (1) HV = Heavy Vehicles (includes tractors)
LC = Light Commercials (includes 4 WD's)
PV = Passenger Vehicles (includes motorbikes)

(11) Heavy Vehicles included:

School Bus	(1)	Builders Truck	(1)
Steggles Tip Trucks	(10)	Brick Truck	(1)
Cattle Trucks	(3)	Milk Tanker	(1)
Telecom Truck	(2)	Soft Drink Truck	(1)
Farm Truck	(3)	Garbage Truck	(1)
General Carrier Truck	(1)	Gravel Truck	(2)
Sani-Hire Pump-Out Truck	(1)	Goods Delivery Truck (Comet)	(1)

TABLE 15

TRAFFIC SURVEY -T17
(2/5/83)



Time	Class	A	B	C	D	E	F
10.30-11.30am	HV	2	3	-	-	-	-
	LC	3	5	1	2	-	-
	PV	22	16	1	2	-	-
11.30-12.30pm	HV	3	-	1	-	-	-
	LC	3	5	-	-	-	-
	PV	15	-	3	-	-	-
TOTALS	HV	5	3	1	-	-	-
	LC	6	10	1	2	-	-
	PV	37	19	4	2	-	-
	TOTAL	48	32	6	4	NIL	NIL

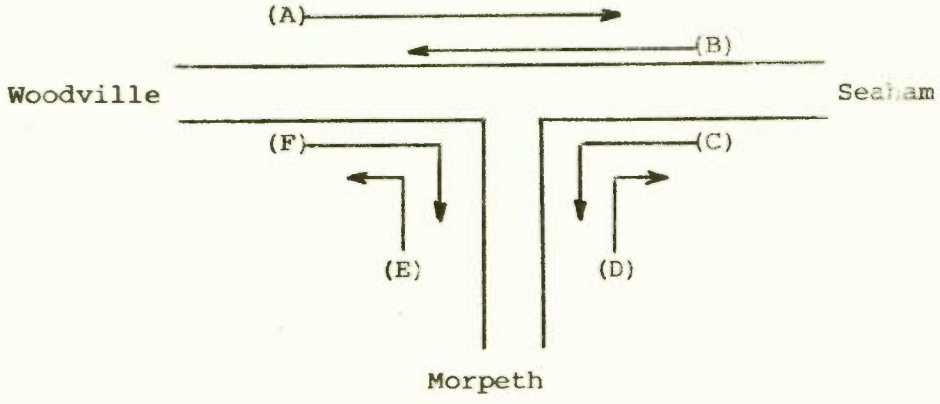
Note: (1) As for **Table 14**

(11) Heavy vehicles included:

Mobile Crane	(1)
Bus	(1)
Council Truck	(2)
Builders Truck	(1)
Milk Tanker	(1)
Tip Truck	(1)
Railway Truck	(1)
Grain Truck	(1)

TABLE 16

TRAFFIC SURVEY -T18
(2/5/83)



Time	Class	A	B	C	D	E	F
3.00-4.00pm	HV	3	2	-	1	1	-
	LC	4	2	5	4	6	5
	PV	14	11	8	16	8	11
4.00-5.00pm	HV	2	1	-	-	2	-
	LC	5	4	4	3	6	3
	PV	19	17	20	14	11	6
TOTALS	HV	9	6	9	7	12	8
	LC	9	6	9	7	12	8
	PV	33	28	28	30	19	17
	TOTAL	47	37	37	38	34	25

Note (1) As for **Table 14**
(11) Heavy Vehicles included:

Covered Delivery Truck	(1)
Cattle Trucks	(4)
Telecom Truck	(1)
Builders Truck	(1)
F.E. Loader	(1)
Steggles Tip Truck	(1)
Bus	(2)
Semi-trailer (Flat Top)	(1)

5.16 NOISE

5.16.1 Methodology and Definitions

Existing noise levels around the site were measured on 26th April, 1983 at four locations, N1 to N4 shown on **Figure 3.**

Details of the measuring equipment used and prevailing meteorological conditions are given in **Appendix 8.**

Readings were taken early in the morning at the proposed start up time when noise from the proposed operation would be most noticeable.

All measurements were conducted following guidelines set down by the Australian Standards Association (AS1055-1978) and the State Pollution Control Commission.

The sound level meter was set at "Fast" response using the "A" weighted scale which approximates the loudness level sensitivity of the human ear.

Approximately 100 noise levels were read over a ten minute period at each location, and noise sources noted.

The noise levels recorded were later analysed into L_{90}, L_{10}, and Leq classes where:

L_{90} - is the noise level exceeded for 90 per cent of the time
L_{10} - is the noise level exceeded for 10 per cent of the time
Leq - is the equivalent continuous noise level

For a large number of readings Leq can be approximated by calculating the root-mean-squared level(Lrms) using the method outlined in **The Standards Association of Australia Miscellaneous Publication MP44, Part 1 - 1979.** This method was used to calculate the Leq levels from the levels recorded.

According to the **State Pollution Control Commission Noise Control Guide (Data Sheet N1014), 1979** L_{90} is considered as background.

5.16.2 Discussion of Results

A summary of results obtained are presented in **Table 17.**

TABLE 17

BACKGROUND NOISE READINGS - dB(A)

Site	Start Time	L_{90}	L_{10}	Leq	Noise Sources
N1	6.15am	34	43	40	Birds, Traffic, Wind in trees
N2	6.30am	30	55	59	Traffic, Birds
N3	6.45am	32	66	63	Traffic, Birds, Plane
N4	7.10am	32	41	39	Birds, Wind in trees, Plane

During two of the recording periods a low "boom" was heard in the background on three occasions.

Although not recorded, high noise levels during the day from RAAF jets flying overhead were noticed on a number of previous visits to the site.

Background noise levels of 30 to 34 dB(A) are consistant with background levels experienced in rural areas.

C. SOCIAL AND ECONOMIC FACTORS

5.17 POPULATION

5.17.1 Port Stephens Shire

The proposed operation is located to the west of Seaham, in the local government area of Port Stephens Shire, a sub-district of the Newcastle Statistical District which, together with the balance of the Hunter Statistical Division, forms the Hunter Statistical Division.

There are five local government areas which form the Newcastle Statistical-District, including Maitland Municipality (City) which lies immediately to the west of Port Stephens Shire, and nine local government areas which form the balance of the Hunter Statistical Division.

Port Stephens Shire is, and has been, experiencing significant changes in its population. From **Table Al** in **Appendix 9** it is apparent that the population has increased about 2/3rds in a ten year period from 1971 to 1981.

This area has maintained an overall average annual compound rate of growth in population (see **Table Al** in **Appendix 9**) of nearly 5 per cent for the ten year period between 1971 and 1981 with the period of most rapid growth being in more recent years (1976-81) when the rate of growth was 5.7 per cent per annum compared with only 4.0 per cent per annum in the period 1971-76.

As shown in **Table A2, Appendix 9** the growth figures for Port Stephens Shire are well above the corresponding figures for the State Division and District levels and reflect growth resulting from the relatively close proximity of the area to Newcastle and Sydney (for both people in the workforce and retired persons) and extension of the transport network.

For many years, this area has served as a retirement area, and weekend and summer recreational resort, but with the growth of Newcastle and the construction of the Stockton Bridge the area has been increasingly the focus of dormitory residential establishment.

The expectation is, on the available data, that this area will continue to grow at a rate above the State average, for a considerable period of time to come. Much of the recent growth in the population of the Port Stephens Shire has been from net migration; 80.6 per cent of the total increase in population in the 1976-81 period was attributable to positive net migration. This compared with all of the comparative data available and is typical of high growth areas.

The age distribution of Port Stephens Shire reveals a relatively younger population; only 33.8 per cent of the population are 40 years or more and only 9.5 per cent of the population are 65 years or more. This contrast with the figures of 36.5 per cent and 10.6 per cent respectively for the Newcastle Statistical District. However a comparison of the age distributions for 1976 and 1981 suggest that the proportion of persons in the older age categories may be increasing and that the attractiveness of the area as a place of employment or retirement may have increased **(refer Table A3, Appendix 9).**

Comparing other areas on the basis of the 1981 census, it appears that Port Stephens Shire and Maitland City have proportionally greater numbers of persons in the 0 to 9 years age category. But in contrast, Port Stephens has fewer persons in the 10 to 19 years age group and proportionally greater numbers in the 60 to 64 years age category when compared with all other areas. Also when compared with the Newcastle Statistical District and the Hunter Statistical Division, Port Stephens Shire also has proportionally more persons in the 25 to 49 years age group. This suggests overall that growth has occurred differentially in terms of young families and "early retired" persons moving into the area.

These figures also indicate that there exists at present a good proportion of economically independent persons in the population with associated higher potential for expansion of the labour force from the population resources in the future, assuming that employment opportunities are created. Port Stephens Shire appears at present not to provide all the educational and/or early employment opportunities to retain all its 10 to 19 year olds.

Since 1971, the growth in the female poulation in Port Stephens Shire has outstripped that of the male population so that at present the breakup of population is fairly even on a sex basis; males account for 51.1 per cent and females 48.9 per cent of the population.

5.17.2 Distribution of Growth Areas

Unlike other areas within the Hunter Statistical Division, Port Stephens Shire has a less centralized population with the major centres of population dispersed at either end of the area; Nelson Bay with a population of about 8,000 persons is located on the eastern peninsula, while Raymond Terrace in the west has a population of almost 7,600 persons and is the shire centre. Nelson Bay now has a larger population than Raymond Terrace reversing the situation which existed, with respect to population size, in 1976.

The population of the Shire of Port Stephens at the 1981 Census was 28,650 persons. The largest concentrations were, and remain, the urban districts of Raymond Terrace and Nelson Bay which together account for approximately 55 per cent of the entire population.

5.18 ECONOMIC BASE

The area's position in the Hunter Region and its proximity to the larger Sydney Metropolitan Region has meant that this area is progressively subjected to pressure by an expanding population. In an area of rapid population and housing growth it is not unexpected that it is also an area of growth of economic activity.

5.18.1 Agricultural Industry

In 1971 agriculture, forestry, fishing etc. accounted for 9.6 per cent of the total labour force in Port Stephens Shire but since that time the relative importance of agriculture has declined **(refer Table A4 in Appendix 9)**.

There has been a marked decline in the number of agricultural establishments from 493 in 1974-75 to 233 in 1980-81. The largest crop cultivated is crops and grasses cut for hay, although this too has declined. In 1974-75, 1,250 hectares of crop and grasses cut for hay were cultivated while in 1978-79 this figure had fallen to 1,158 hectares. Other crop production evident in the shire (i.e. other cereals, oats and fruit have likewise declined; both in terms of area and production.

Other major agricultural production includes the raising of cattle for meat production, poultry, and to a lesser extent cattle for milk production. Similar to the trend evident in crop acreage and production generally there has been some decline in beef and dairy cattle. With respect to pig production there appears to be a slight counter movement while the number of poultry batteries has significantly increased.

5.18.2 Other Primary and Extractive Activity

Commercial fishing and forestry still provide minor employment opportunities in Port Stephens Shire. Also sand mining was also reasonably important at one stage, however this activity has also declined. Coal mining has also provided employment opportunities for people living in this area who commute to other centres.

5.18.3 Manufacturing Industry

As early as 1971 manufacturing industries were providing employment to 19.3 per cent of the employed persons in Port Stephens Shire. At that stage many of these people were probably employed in either the Newcastle or Maitland industrial areas with only minor manufacturing capacity at such centres as Raymond Terrace and Nelson Bay. Progressively however, since that time there has been an enlargement of the manufacturing capability of the Shire.

In 1973-74 there were only 32 establishments undertaking manufacturing activities, while in 1980-81 this figure had almost doubled to 56. However, the

employment opportunities arising from the increase in workshops has been of the inverse order reflecting, in part, a movement to more capital intensive operations. From an employment figure of 1,925 in 1973-74 there were only 1,051 persons employed in manufacturing activities within the Shire in 1980-81. In 1974-75, the predominant local industry was Textile Fibres, Yarns and Woven Fabrics and Household Textiles followed by Wood and Wood Products (except Furniture) and Other Transport Equipment. With the closure of Courtauld's the Textile Fibre etc. levels would have significantly declined.

Port Stephens Shire is increasingly providing dormitory facilities to the industrial areas of Newcastle and Maitland and the proportion of the labour force engaged in manufacturing would have increased. For manufacturing activity in the Shire, there was an average annual growth rate of 8 per cent in the number of establishments over the period 1973-74 to 1980-81, an average annual growth rate of 8.5 per cent in the number of employees over the same period and an average annual growth rate of 11.7 per cent in the level of wages and salaries paid after standardizing with respect to the number of employees. The latter figure includes a large component of inflation and the residue would reflect the overall upward trend in real wages over the period for Australia as a whole.

Ventures such as the Tomago aluminium smelter will be significant in providing further employment opportunities.

5.18.4 Tertiary Industry

Consistent with world-wide trends, employment in the tertiary sector has increased over the period 1966 to the present for this area. The single most important employer in this category for the Shire is the Commonwealth Government. In 1971 the category "Public Administration, Defence" was the largest single employer in the labour force with a percentage representation of 26.5 per cent. This category would still be large with the RAAF base at Williamtown and the associated housing facilities at Raymond Terrace. Also the Army still owns considerable land near Nelson Bay which forms the Gan Gan Army Camp.

Employment in other tertiary activities has also been maintained. In 1979-80 there were 1,135 persons engaged in retailing in comparison with a figure of 1,161 in 1973-74. Lack of apparent growth in employment would reflect the major changes in the process of retailing over this period to the bigger supermarket facilities. Nevertheless the value of retail sales in real terms (after deflating by the Consumer Price Index) has certainly increased over this period.

Other industries which have grown in this area are the Entertainment, Recreation (etc.) Industry and Tourism. The area is a natural recreation area with many beaches and other features of attraction. The area provides ample opportunity for fishing, surfing and the like, at popular localities such as Boat Harbour, Birubi Point, Morna Point and Fingal Beach.

5.19 EMPLOYMENT

5.19.1 Occupation

There is no industry data available from the 1981 census to date, however data on occupation are available which can be used as a surrogate to gauge the relative importance of the different industries. The major employer remains the Commonwealth Government as 11.8 per cent of the labour force has an occupation as members of the armed services. As mentioned in **Section 5.18.4** this was the predominant industry in 1971 and has remained a very important "industry" providing employment opportunities.

However, the single largest occupational category is "tradesmen etc." While it is only supposition, it would seem reasonable to assume that the 3,311 persons in the Shire within this category were employed at a variety of manufacturing establishments, many of which were in either Newcastle or Maitland. This seems likely as in 1980-81 there were only 1,051 persons employed in the 56 manufacturing establishments in Port Stephens Shire and not all of these would have been tradesmen.

"Farmers, fishermen, etc." still account for 6.3 per cent of the labour force while only 0.7 per cent are in the "miners, quarrymen, etc." category. Eight per cent of the labour force are "sales workers" **(see Table A5 in Appendix 9)**.

In line with national trends and roughly approximating from occupational data, it appears that about 7 per cent of the labour force would remain in Primary Production, 34 per cent in Secondary Production and the residue, 59 per cent in Tertiary Production.

In contrast, Port Stephens Shire has fewer persons proportionally in the "professional, technical", "clerical works and transport", "communication" categories. While there are proportionally more "tradesmen etc." in Port Stephens Shire when compared with New South Wales as a whole, in comparison with the rest of the Hunter the figure is lower.

5.19.2 Unemployment

On the basis of the figures available for Port Stephens Shire from the 1981 census, it appears that of the people in the labour force 94 per cent are employed while 6 per cent remain unemployed. The labour force itself consists of 41.4 per cent of the population and those persons not in the labour force (of whom 54.09 per cent are aged 15 years and over) make up the remaining 58.5 per cent.

From **Table A6** in **Appendix 9** it can be seen that Port Stephens has the largest unemployment rate of all areas compared as at 30th June, 1981. This unemployment rate appears to have been high for some years in this area, as in 1976 the rate of 6.7 per cent occurred for Port Stephens Shire. The data available from this source are comparable with other information available. There is some slight discrepancy between C.E.S. (Commonwealth Employment Service) and A.B.S. (Australian Bureau of Statistics) figures but the magnitudes are similar. **Table**

A7 in **Appendix 9** presents comparison values for Australia for the period 1970 to 1980. However a much more serious unemployment problem exists among the very young workers **(refer Table A8, Appendix 9).**

The female population exhibits a higher proportion of its labour force unemployed indicating unemployed females find more difficulties in securing alternative employment. This would have been particularly the case of the female textile workers in the early to mid nineteen seventies. The female unemployment rate in 1981 was 9.2 per cent in Port Stephens Shire compared with a value of 4.6 per cent for males.

Overall it appears that the increase in the labour force in recent years has been accounted for disproportionably by an increase in the unemployment level. It appears overall that job opportunities have not increased sufficiently to take advantage of the increase in labour resource availability.

5.20 HOUSING AND ACCOMMODATION

5.20.1 Permanent Housing

With the growth in population there has been increased pressure on housing with associated growth in the number of dwellings. Overall, there has been an upward trend in the number of new houses together with an overall increase in the total new dwellings completed within Port Stephens Shire over the past eight years. The annual average rate of growth in new houses completed between 1975-76 and 1979-80 was 7.2 per cent whereas the annual average rate of growth of total dwellings for the same period was 12.3 per cent.

These rates of growth are high and reflect the rapid expansion in population and other development that has occurred in Port Stephens Shire particularly over recent years. A similar picture is reflected in the growth rate in the stock of houses; in the period 1971-1979 inclusive, the annual average compound rate of growth was 5.4 per cent and the corresponding figure for 1975-79 inclusive was 4.7 per cent.

As indicated in **Table A9** in **Appendix 9**, housing growth forms a significant part of building development. Figures on value of building jobs approved in December 1982 reinforce the predominant role of housing in comparison with other dwellings in Port Stephens Shire and also highlight the relative importance of housing in the latter area compared with other older-established areas. **(See Table A10, Appendix 9).**

5.20.2 Temporary Accommodation

With regard to temporary accommodation there exist several caravan parks and hotel/motel accommodation sites in Port Stephens Shire although most of these are on the coast rather than near the site of the development at Seaham. There are two caravan parks at Raymond Terrace, one at Fullerton Cove, one at Tomago, and 14 in and around the Nelson Bay area. All have adequate facilities including power and town water.

Hotel and motel accommodation is also available within minimal travelling distance. Again the concentration occurs within the more highly urbanized areas of Raymond Terrace and Nelson Bay, with approximately 5 establishments at the former location and approximately 15 establishments at the latter location.

5.21 COMMUNITY SERVICES AND FACILITIES

There are adequate schools in Port Stephens Shire, but no established general hospital. The Shire has one nursing home and two community health centres and adequate ambulance and doctors' services.

SECTION 5

DESCRIPTION OF THE PROPOSED DEVELOPMENT

6.0 THE PROPOSED DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT PROCEDURES

A. DESCRIPTION OF THE PROPOSED DEVELOPMENT

6.1 OUTLINE OF PROPOSAL

Hunter Valley Mining Corporation Pty Limited proposes to extract hard rock aggregate for concrete, asphalt, decorative stone, and roadbase from an area of about 16 hectares on a low ridge flanking the eastern slopes of Brandy Hill, as shown on **Figures 9** and 10.

Stone will be drilled and blasted and hauled by a front-end loader and off-road haulage truck to an adjacent processing plant where the material will be crushed and screened to produce different sized aggreates to meet required specifications.

It is proposed to extract about 100,000 tonnes annually increasing to about 400,000 tonnes per year in 10 to 15 years in response to market demands.

An access road will be constructed to connect with Seaham Road or the nearby estate road and all products will be hauled by truck on main roads servicing the area.

On-site facilities will include an office, and lunchroom complex housing shower and toilet facilities, and a maintenance/store building for the repair of plant and equipment. A weighbridge will be sited near the access road adjoining the office.

Domestic water will be derived from tanks and process water from dams. Electricity will be obtained from normal reticulation services.

All domestic waste water will be disposed of by a septic system and process water and runoff from the quarry and plant will be treated in sedimentation dams.

Operations will be conducted during daylight hours 6am to 6pm Monday to Saturday and will provide permanent full-time employment for up to 11 persons together with 10 subcontractor positions.

The Company will apply the optimum environmental management procedures in the extraction and processing operations and will carry out its activities in accordance with the requirements of State and local authorities.

Part B of this section details the Company's controls and safeguards to minimise impacts on the environment of the site.

6.2 CONSTRUCTION PHASE

The construction phase involves the construction of the access road, sedimen-

tation dams and bund wall, preparation of the plant and initial quarry sites, and construction of plant and facilities.

6.2.1 Access Road

An access road to the site will be constructed either from the sealed estate road to the west or directly from Seaham Road using locally obtained roadbase materials. The road will have grades of less than 1 in 15 and will be constructed with adequate erosion and drainage control measures. A minimum amount of vegetation will be cleared for the road and this will be stockpiled on the plant site and burned during suitable climatic and bushfire free conditions.

6.2.2 Sedimentation Dams

Sedimentation dams will be constructed in the areas shown to collect all runoff from disturbed areas. At the same time a diversion bank will be constructed around the northeast slope of the ridge to protect Deadman's Creek and across the top of the proposed quarry area to divert clean runoff away from disturbed areas. These banks will be progressively extended as required during quarrying operations.

6.2.3 Preparation of Plant Site and Initial Quarry Area

Only vegetation occurring on the initial quarry and plant sites will be stripped and burned **(Section 6.2.1)**.

While there is little soil occurring on the quarry site, the material available, together with that from the plant site will be stockpiled during the necessary earthworks for the plant and facilities. Because of the relatively flat area selected for the plant site, minimal earthworks will be necessary to provide a level area.

6.2.4 Construction of Plant and Facilities

The plant construction will take 3 to 4 months. A weighbridge and office complex will be sited on the access road to the site and a maintenance building will be constructed near the plant at the location shown on **Figure 9.**

6.3 EXTRACTIVE OPERATIONS

6.3.1 Extractive Material

It is proposed to quarry massive rhyodacite which forms bold outcrop over the quarry site. Testing of the material has shown that it is highly suitable for the production of concrete and asphalt aggregates, sealing aggregate, and

decorative stone, and meets the requirements of the Standards Association of Australia, Department of Main Roads and local Councils for these materials.

Type of products proposed to be produced include predominantly 20mm, 14mm, 10mm, 5mm or 7mm, aggregates, some larger sized stone of 40mm and 60mm size and larger, as required, prepared roadbase, and decorative aggregate.

6.3.2 Quarry Planning and Design

In the design and layout of the quarry the following environmental objectives were applied:

1. Retainment of the main visual elements such as prominent hills and ridgelines which provide a skyline when viewed from areas to the south.

2. Preservation of as much forest cover as possible, particularly areas of conservation value identified to the north and west. **(Section 5.7.2)**

3. Protection of Deadman's Creek catchment and stream course.

These objectives were balanced with economic considerations such as the location of rock of high quality, topographic suitability, and access.

The quarry is sited on a low ridge which does not form the skyline and hence will have a back drop of densely vegetated ridges and hills. The skyline when viewed from the south will remain intact.

The quarry has been designed to extract the maximum volume of high quality rhyodacite while maintaining as much as possible the natural forest cover of the area, and hence wildlife habitats.

6.3.3 Quarry Development

The quarry will be initially developed with a base level at 50m AHD as close as possible to the plant as shown on **Figure 9.**

A series of three to four "benches" of 10m height will be created commencing from the eastern extremity of the ridgeline and working in a westerly direction as shown in **Figure 10**. Working the quarry in this manner provides safer working conditions through the elimination of potential overhangs, allows natural drainage to the south to sedimentation dams, and ensures that blasted and processed stone is representative of the entire rhyodacite deposit, which in turn ensures consistency of quality and product. All benches will be free-draining to the south to the sedimentation dams constructed to collect runoff from the disturbed areas.

The final stage of quarry development will be the creation of two further benches within the excavation area below 50m AHD with quarry water for the lower bench pumped to the sedimentation dams located downstream. **Figure 9** shows the initial development, **Figure 10A** the medium term development and **Figure 10B** the

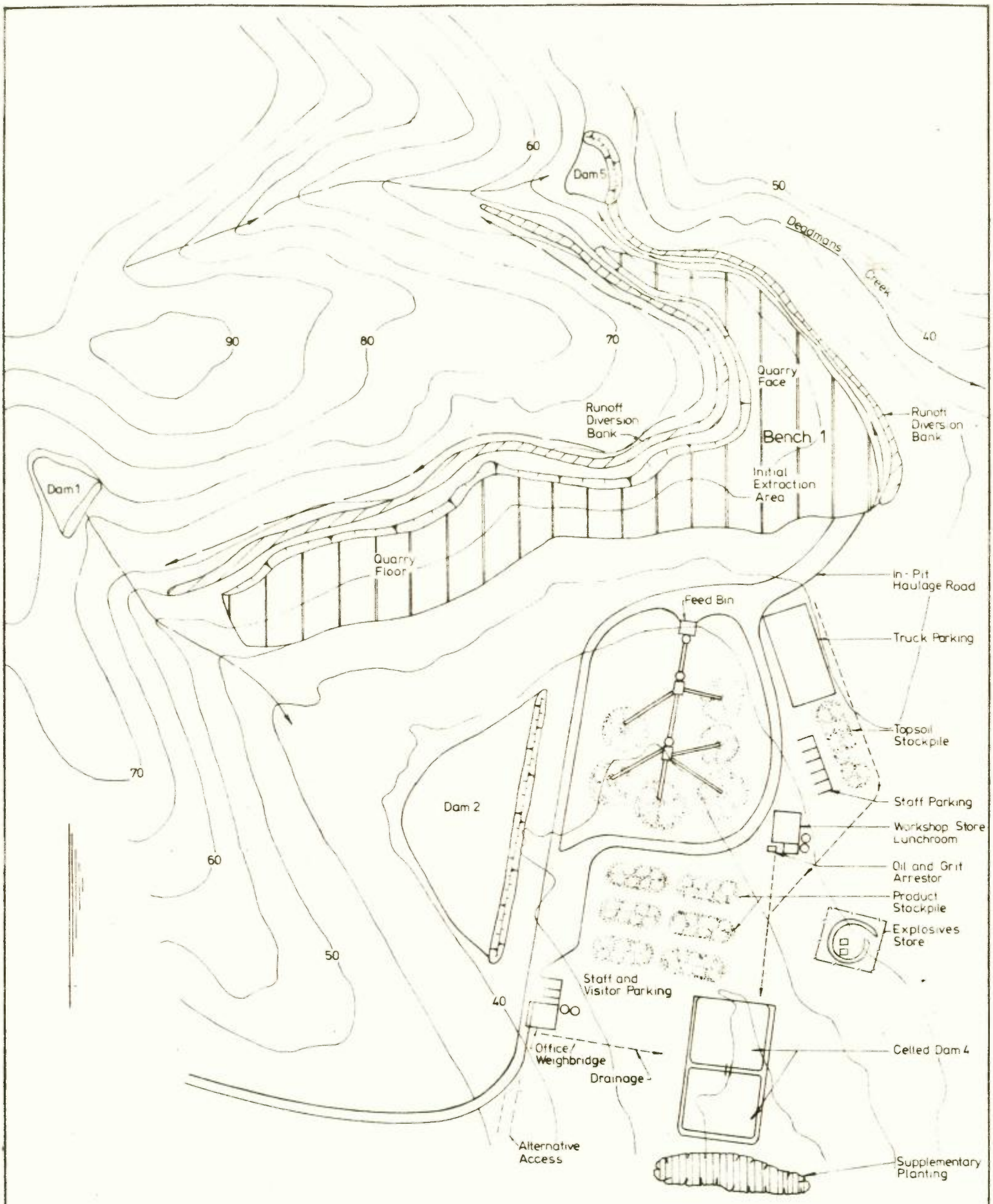


FIGURE 9
PLANT LAYOUT AND
INITIAL QUARRY DEVELOPMENT

HUNTER VALLEY MINING CORPORATION PTY LIMITED

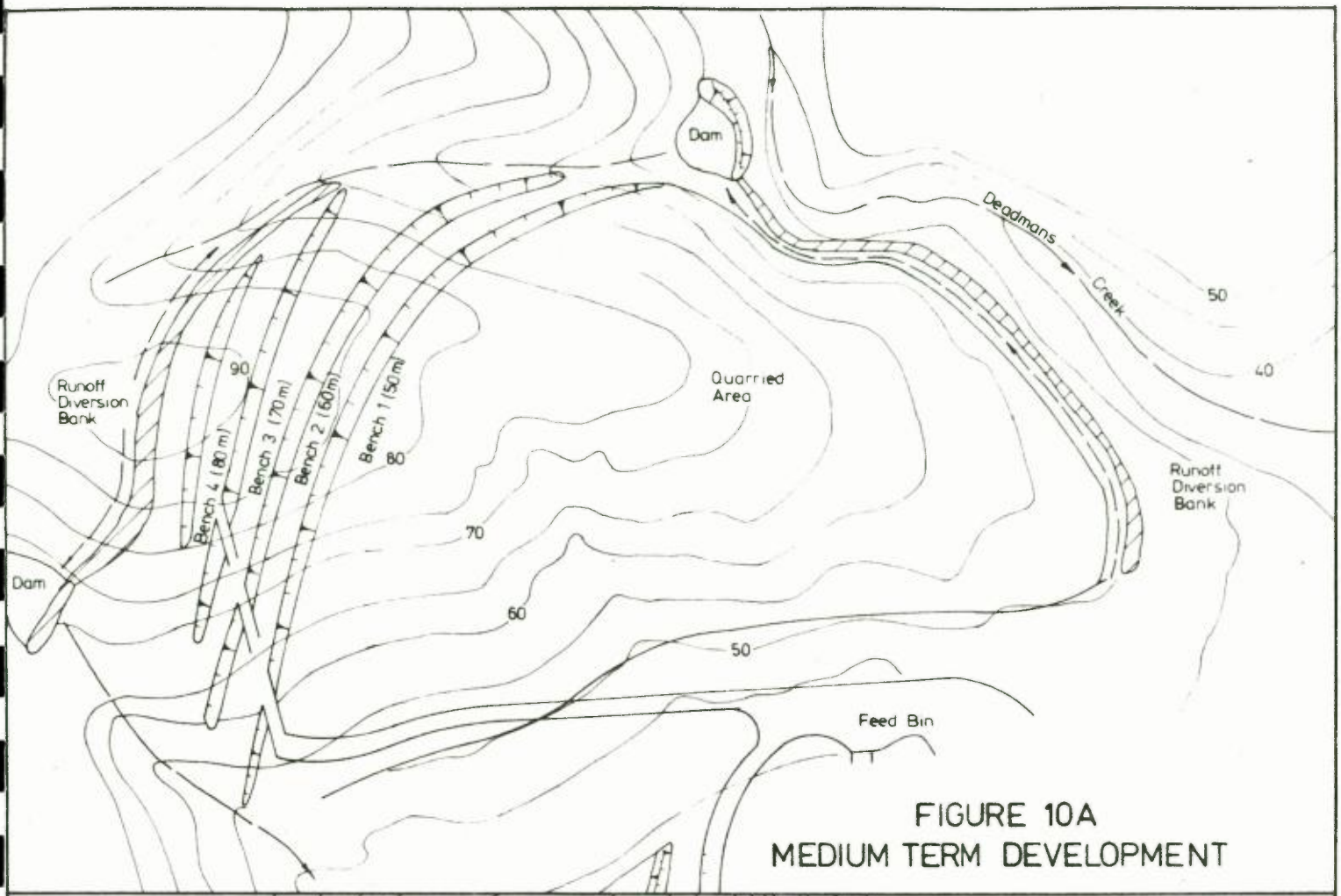


FIGURE 10A
MEDIUM TERM DEVELOPMENT

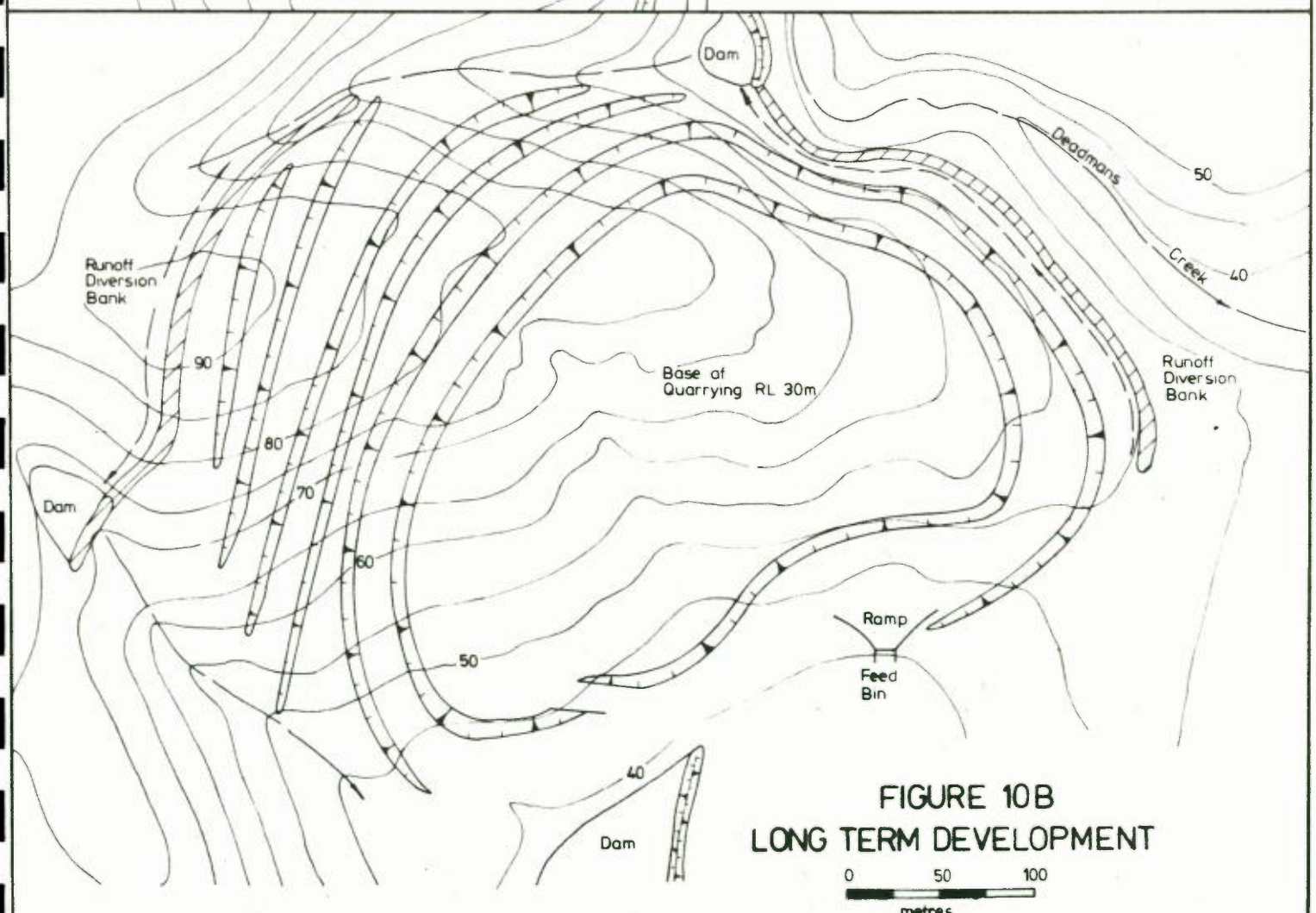


FIGURE 10B
LONG TERM DEVELOPMENT

HUNTER VALLEY MINING CORPORATION PTY LIMITED

long-term development of the quarry.

6.3.4 Site Clearing

It is proposed to clear only the minimum area necessary at any one time to conduct quarrying operations.

Vegetation clearing will be carried out progressively during the development of subsequent benches so that at any one time only two bench widths (about 40m) would be stripped ahead of quarrying operations.

6.3.5 Topsoil and Overburden Removal

There is little topsoil and virtually no "overburden" (i.e., weathered and unsuitable rock) occurring on the quarry site. However, useful soil material occurring on the site will be stockpiled at the location shown on **Figure 9** for use in rehabilitation works.

6.3.6 Drilling and Blasting

The fresh exposed rock will be drilled and blasted at an average frequency of 2 blasts per week. To minimise noise and dust, blasting will be carried out in afternoons, on weekdays, usually between 1pm and 5pm when inversion layers have dissipated, and when prevailing meteorological conditions are suitable.

Charges will be designed **(see Section 7.16.2)** to ensure that noise and vibration levels are below the recommended levels of the State Pollution Control Commission and Mines Inspection Branch of the Department of Industrial Relations.

6.3.7 Material Loading and Hauling

Initially, fragmented stone will be hauled by a $5m^3$ rubber-tyred front-end loader from the quarry face to the feed bin of the plant. As the operating face moves further away from the plant, one or two off-highway haul trucks will be used to haul quarried stone to the receiving bin of the plant.

6.3.8 Extraction Rate

Initially, it is expected that up to 100,000 tonnes of stone will be quarried annually, increasing to 400,000 tonnes per annum within a 10 to 15 year time frame, in accordance with market requirements.

6.3.9 Life of Operations

Minimum recoverable reserves on site are in the order of 20 million tonnes. On the basis of projected extraction rates, the quarry has a life of in excess of 30 years.

6.4 PROCESSING OPERATIONS

6.4.1 Site Selection

A gently sloping to flat area adjacent to the southern boundary of the quarry has been selected for the plant. This site was chosen since it is close to the quarry minimising in-pit haulage distances, is topographically suitable for the plant with minimum earthmoving being required, is within a valley allowing runoff to be collected naturally by sedimentation dams sited downstream, and is well screened by trees and ridgelines from prevailing winds and major sight lines.

6.4.2 Plant Site Preparation

The plant site will be levelled and topsoil stockpiled. The site will be graded and gravelled to provide a stable base for plant components.

6.4.3 Plant Layout and Components

Figure 9 shows the proposed plant layout. Minor variations to the configuration shown may occur but the overall layout will remain essentially unchanged.

The plant will have the capacity to process 300 tonnes of stone per hour and will comprise the components listed in **Table 18.**

TABLE 18

PLANT COMPONENTS

1 Feed Bin
1 Vibratory Feeder
1 Primary Jaw Crusher
1 Secondary Gyratory Crusher
1 Tertiary Gyratory Crusher
1 Surge Bin
1 Two Deck Screen
2 Triple Deck Screens
Connecting Conveyors
1 Pre-coat Plant

6.4.4 Processing Operations

Raw feed from the quarry will be dumped directly into the feed bin by the loader or haulage truck and fed to the primary crusher via a grizzly by-pass chute. Scalpings are removed at this stage and stockpiled.

The primary crushed rock passes to a series of screens for separation of the various size fractions. Oversize stone is returned to the secondary and tertiary crushers where further size reduction takes place. The rescreening process is continued and the various products separated and stockpiled.

The plant will be about 100m long, 20 to 30m wide, and 15m high.

6.4.5 Stockpiles

Processed stockpiles are shown on **Figure 9**. Average stockpile size beneath the stacker conveyor would be between 2,000 and 3,000 tonnes with additional product stockpiles up to 15,000 tonnes sited south of the plant.

6.5 OFF ROAD HAULAGE

Quarried material will be transported by a front-end loader or off-road haulage truck to the plant via an internal haulage road.

6.6 ROAD HAULAGE

All processed material will be hauled from the site via an access road connecting to either the estate road to the west or directly to Seaham Road.

Trucks will typically be tri-axle semi-trailers carrying 24 tonne payloads which will be loaded by a $3m^3$ rubber-tyred front-end loader from product stockpiles located near the plant site.

The main haul routes will be via Seaham Road (MR301) to the New England Highway at Maitland or via Seaham Road, Wighton Street Seaham, and Main Road (MR601) to the Pacific Highway at Raymond Terrace. Wighton Street, Seaham, bypasses the main village area between MR301 and MR601 and will be upgraded at the Company's expense in accordance with the requirements of Port Stephens Shire Council.

Assuming quarrying and hauling operations are conducted over 50 weeks each year, the average number of trucks leaving the site daily will be 17 (100,000 tonnes/year) rising to 67 (400,000 tonnes/year) in 10 to 15 years. About 75 per cent of trucks will travel to the east to the Pacific Highway.

Contractors will be used for haulage operations.

6.7 MOBILE EQUIPMENT

Typical mobile equipment to be used in quarrying and processing the rhyodacite are listed in **Table 19.**

TABLE 19

MOBILE EQUIPMENT

1 x $5m^3$ rubber-tyred front-end loader
1 x $3m^3$ rubber-tyred front-end loader
1 x Mobile drilling rig
1 x Water cart
1 x Light truck/utility (1 tonne max.)
* 2 x Off-highway dump trucks.
1 x Dozer

* To be used only with increased production and as haulage distances from quarry to plant increases.

6.8 OPERATOR FACILITIES

6.8.1 Office Block

An office block will be provided at the entrance to the quarry site as shown on **Figure 9**. The office will house the Quarry Manager and Despatch Clerk as well as a toilet and shower.

6.8.2 Weighbridge

A 60 tonne weighbridge will be sited adjacent to the site office as shown on **Figure 9.**

6.8.3 Workshop and Store

A workshop and store will be provided for general repairs and maintenance of fixed and mobile plant and will be located in the plant area together with underground fuel storage tanks for 30,000 litres of diesel and 1,200 litres of petrol for mobile equipment and staff vehicles. The store will contain consumables such as processing plant spares, screen cloths, crusher parts, and special oils and greases. The building will be a corregated iron covered steel-framed shed with lock-up sliding front doors.

6.8.4 Operator Facilities

A lunch room and ablutions block will be attached to the store and workshop complex for quarry and plant employees.

6.8.5 Explosives Store

Explosives will be stored in two concrete buildings housing explosives and detonators separately. The buildings will be constructed, locked and sited in accordance with the requirements of the local Mines Inspector.

6.8.6 Car Parking

Adequate car parking facilities will be provided adjacent to the office and workshop complexes for quarry personnel and visitors.

6.9 WATER SUPPLY AND SEWERAGE

6.9.1 Process Water

Water is required primarily for dust suppression and will be drawn from an existing farm dam shown on **Figure 9**. Water from this dam will also be used for dust suppression on roads and work areas.

6.9.2 Domestic Water

There is no reticulated water supply to the site and supplies for drinking and washing will be drawn from tanks sited near the office and workshop complexes.

6.9.3 Sewage Disposal

All waste water from showers and toilets will be disposed of via a septic system designed and operated in accordance with local authority requirements.

6.10 ELECTRICITY

All power for plant and facilities will be drawn from normal reticulation supplies. Consumption will be in the order of 600 to 800 kW.

6.11 REFUSE DISPOSAL

All refuse will be collected in a temporary industrial waste collection bin and disposed of regularly in a Council refuse depot.

6.12 HOURS OF OPERATION

Extraction and processing operations will be carried out during daylight hours 6:00am to 6:00pm, Monday to Saturday.

6.13 WORKFORCE

The proposed development is expected to provide full-time permanent employment for 9 people increasing to 11 with higher production.

Positions to be created include quarry manager, despatch clerk, two loader drivers, driller, one plant operator, one production foreman, maintenance fitter and a labourer. With increased production a further two positions will be created for in-pit haul truck drivers.

In addition up to 10 sub-contract positions will be created.

6.14 MARKETS

The Company proposes to produce high quality concrete aggregate primarily for concrete batching plants located throughout the lower Hunter Region. Some stone may be "exported" to the Sydney Region.

In addition, the Company proposes to produce asphalt and sealing aggreates with major customers expected to be the New South Wales Department of Main Roads, Port Stephens Shire Council, Maitland City Council, other local Councils and authorities, as well as local contractors.

B. ENVIRONMENTAL MANAGEMENT PROCEDURES

Part A of **Section 6.0** described the operation of the quarry and plant.Part B describes in detail the controls and measures to prevent soil erosion, pollution of surface waters, controls for dust and noise, screening and rehabilitation provisions.

6.15 WATER MANAGEMENT

Specific objectives of the water management plan are:

1. Prevention of soil erosion,

2. Control of clean surface runoff,

3. Containment and treatment of runoff from disturbed areas,

4. Minimal alteration of existing groundwater tables or hydrological conditions.

5. Minimal inconvenience to downstream users of water from the site.

Drainage controls are shown on **Figures 9** to **10** and have been designed for a storm return period of 1 in 10 years.

Generally, the first flush of runoff from disturbed areas contains the majority of suspended solids generated by storm flows. To ensure that these first flushes are contained and treated, controls have been designed for storms of duration equal to the time of concentration of the catchment **(Pattison 1977).**

6.15.1 Runoff Controls

To prevent clean water runoff from entering the quarry and plant site, diversion banks will be constructed upslope of these areas as shown on **Figures 9** and **10.** These measures will direct upslope runoff to creeks downstream of the site, bypassing disturbed areas.

It is expected that since these banks are located high in the catchments they will have the capacity to convey all expected storm runoff. Any runoff overflow will be collected in the quarry area and diverted to the settling dams.

All channels will be constructed with the following design criteria:

(i) Topsoil will be removed and temporarily stockpiled.

(ii) Banks will be "V" shaped with batters of 1 in 3 and height of 0.5m.

(iii) Topsoil will be replaced and the banks stabilised.

(iv) Where necessary the paths from the end of the diversion banks to the existing water courses will be provided with channel protection such as rip rap.

Two existing farm dams, shown as Dam 1 and Dam 2 on **Figure 9,** regulate flows entering the plant site from upstream areas. These dams will continue to serve as control measures throughout the life of the quarrying operations and to provide process water for dust suppression. Farm dam 3 on the plant site will be removed during site preparation activities.

6.15.2 Soil Erosion Controls

To prevent soil erosion problems developing as a result of quarrying activities, the Company will develop the runoff controls described in **Section 6.15.1** early in quarrying operations. Areas stripped ahead of the quarry face will be minimised and heavy traffic confined to constructed roads and quarry areas, and will not traverse undisturbed areas unnecessarily.

The access road will be provided with drainage channels, causeways and creek crossings which will be designed for the expected flows from upslope areas and stabilised to prevent scouring and rilling.

Rehabilitation will be carried out progressively following extractive operations to ensure a stable landform and to control soil erosion. Runoff controls described in **Section 6.15.1** for the quarrying operation will aid in the control of soil erosion.

6.15.3 Quarry Water Control and Disposal

Runoff from the quarry and working areas will be collected by a system of channels and directed to sedimentation dams for clarification. Following settlement, the water will be used for dust suppression or discharged to the natural drainage system downstream of the site during high flow periods. There will be no dry weather discharge.

Dams 1 and 2 already exist, while dams 4 and 5 shown on **Figure 9** will be constructed prior to quarrying and will handle storms of duration equal to the time of concentration of the catchment.

Criteria adopted for the design of sedimentation dams are:

(i) Dam sites will be stripped of topsoil and impermeable material.

(ii) Walls will be constructed of clayey subsoil to ensure impermeability.

(iii) The walls will be battered to safe slopes and stabilised.

(iv) Overflow pipes will be provided near the top of the dam to convey overflow. This area of will be protected with rip rap to prevent erosion, and discharges will re-enter the water course away from the base of the dam.

(v) Dam 4 will be constructed with two cells with overflow from one cell to the next providing additional treatment opportunity.

At later stages of the operation, the excavation will extend below natural drainage levels, but this is not expected to occur within a 15 year time frame. At this time, quarry water will be pumped to sedimentation dams. Upon completion of the operation, the excavation below natural drainage levels will form a water reservoir or pondage for stock, or recreation use. **(See Section 6.19).**

6.15.4 Control of Oil and Grease

Used oils and greases will be collected in underground tanks and removed by a licenced contractor for disposal off-site in an approved disposal area.

Runoff from the workshop and maintenance area will pass through an oil and grit arrestor (shown on **Figure 9**) prior to discharge to the sedimentation dam. Dam overflows will be baffled to prevent any oil discharge from the site.

6.15.5 Sewage Disposal

Operator facilities will be provided with a septic system designed to the requirements of authorities.

6.16 DUST CONTROLS

Dust control measures are designed to restrict dust levels below those that cause inconvenience to employees or surrounding residents.

The Company will apply the optimum dust control measures in carrying out its operations and will comply with the requirements of the New South Wales Clean Air Act 1961. Air quality will be protected by preventing or minimising the quantity of dust produced at potential site generation points.

6.16.1 Access and Haul Roads

Within a period of 5 years, the Company will bitumen seal the access road. In the interim, the access road will be regularly maintained and watered using a water cart fitted with a spray bar system. Watering will be at the rate of 1.5 times the evaporation rate to allow for accelerated drying due to traffic. Excessive watering will be avoided to prevent material adhering to truck tyres.

All internal haul roads will be regularly maintained and watered in a similar manner with water for dust suppression being obtained from the sedimentation dams strategically located throughout the area.

The exhaust from vehicles using roads will be directed away from the ground to prevent dust generation.

Existing vegetation surrounding the access road and the early planting of quick growing tree species below the plant will entrain any dust that may be generated from these sources.

6.16.2 Quarrying Operations

Areas of disturbance will be kept to a minimum and worked areas rehabilitated as soon as practicable.

The rig used for drilling blast holes will be fitted with dust collection equipment to minimise dust emissions.

Blasting will not be undertaken during strong wind periods when potential exists for dust to be conveyed towards Seaham Road or residential areas to the west.

The natural topography of the area will provide protection from prevailing wind directions and shield stockpiles, truck loading operations, and the crushing and screening plant. The processing plant will be fitted with automatic dust suppression controls incorporating ring sprays on stockpiles and fine sprays on the receival bin, conveyor transfer points, and crusher inlets.

The processing equipment will be kept in good condition and regularly maintained.

6.17 NOISE AND VIBRATION CONTROL

6.17.1 Noise Controls

Safeguards will be incorporated in the project to reduce noise impact.

All access and haul roads will be maintained in good condition and constructed with grades of less than 15 per cent. The gentle grades will minimise engine noise generated by laden trucks and by maintaining roads in good condition, noise normally associated with empty trucks will be reduced. Trucks will be normal roadworthy highway vehicles and will not transport materials from the site in convoy. All mobile equipment will be fitted with noise reduction equipment on exhausts and shielding around motors, and crushing and screening equipment will be maintained in good condition and regularly serviced.

Attenuation due to distance and topography, as well as existing vegetation and proposed plantings will further reduce noise levels.

6.17.2 Blasting Controls

Blasting will be carried out during daylight hours normally between 1pm and 5pm, weekdays at an average frequency of 2 blasts per week. Blasting will not be carried out when strong winds are blowing in the direction of residences or when there is likely to be temperature inversions in the area. Prevailing meteorological conditions will be checked before blasting.

The New South Wales Department of Industrial Relations (Mines Inspection Branch) and the State Pollution Control Commission impose limits on overpressure levels and groundborne vibration from blasting. Limits currently being set by these

authorities range from 115 to 120dB(lin) for overpressure and 7 to 10 mm/s peak particle velocity for vibration, measured at the property boundary. These levels are well below SAA Explosives Code Australian Standard 2187, Part 2-1979 maximum recommended limit of 20mm/s peak particle velocity for structurally sound buildings (measured at the building).

Blasts will be designed to ensure that the limits mentioned above are not exceeded. The use of suitable blasting patterns and delay detonators initiated electrically will ensure that overpressure and vibration levels are kept to a minimum. Initially, and as the quarry progresses from stage to stage, blasting will be monitored and if necessary the blast design modified to ensure that set limits are met.

6.18 SCREENING

The quarry and plant site will be located on a low eastern limb of Brandy Hill and will be naturally well shielded from areas to the south. The quarry operations will not intrude on the skyline of the hill and generally passing motorists on Seaham Road will not be aware of a quarrying operation.

6.19 REHABILITATION

The proposed quarry operation has an expected life in the excess of 30 years.

Where practicable, progressive restoration of completely worked out benches will be carried out by spreading overburden on benches to a suitable planting depth with a covering of topsoil. The areas will be hydroseeded using indigenous tree and shrub species. **Figures 12** and **13** illustrate this concept which has been used successfully in a similar quarry in Victoria **(Earle, 1982)**

While these trees are not expected to reach the height of mature trees in surrounding forests, they will in the long term reduce the overall visual impact of the worked out quarry faces.

At the completion of quarrying operations all benches above normal ground level will be rehabilitated in the same manner and areas excavated below normal ground surface will fill with water. Plant and equipment will be removed and sedimentation dams filled, graded and contoured. In areas outside the quarry benches, rehabilitation will be carried out using hydroseeding methods or direct planting depending on the selected final land use. **Table 20** lists species to be used for site rehabilitation.

The protection of natural areas of bushland within the site and surrounding areas during operations will also aid in the natural regeneration of the site after completion. The final landform is shown on **Figures 11** and **13.**

The conceptual final land use indicated is one of natural bushland with the potential for low key recreation as shown conceptually on **Figures 12** and **13.**

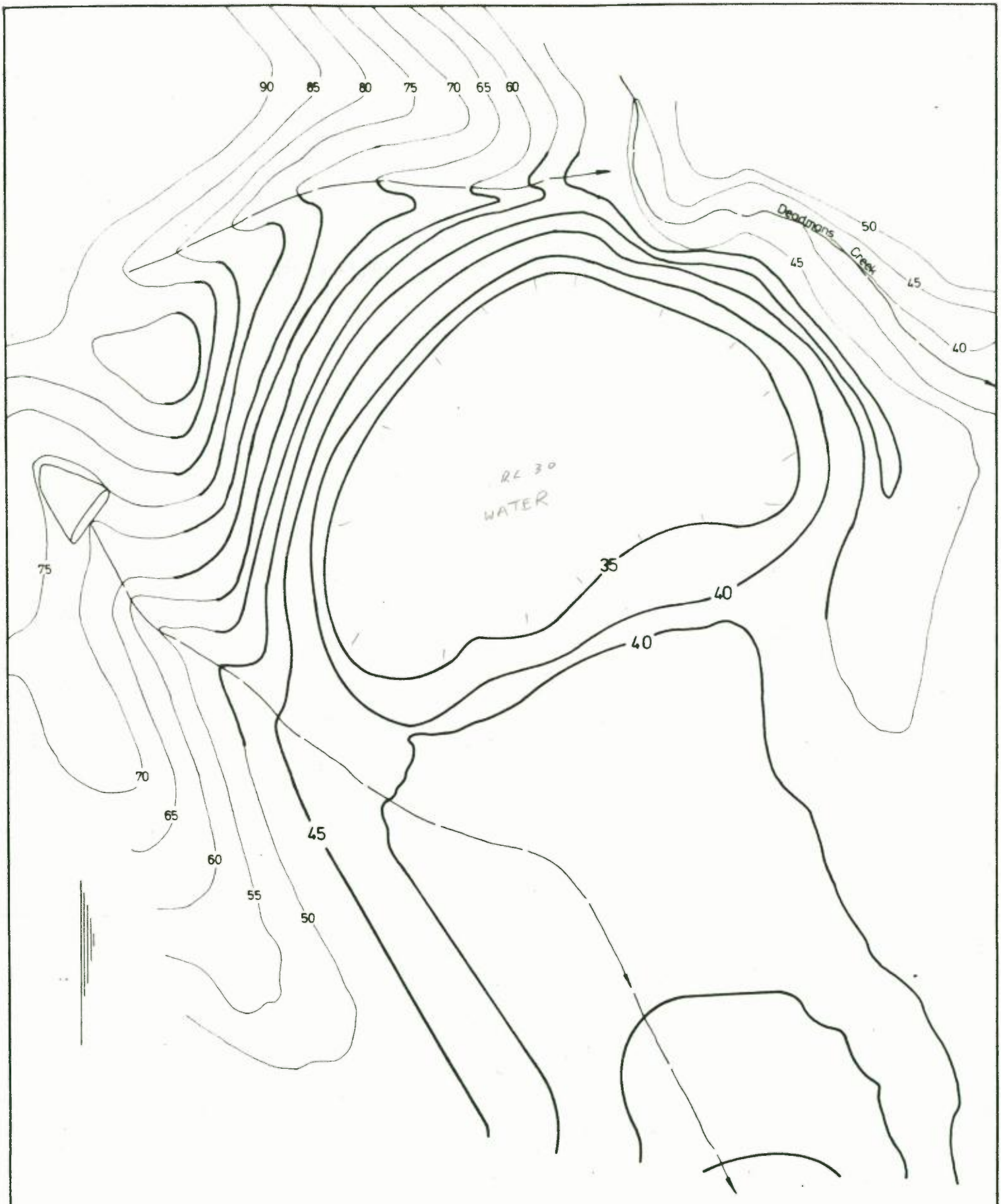


FIGURE 11
FINAL LANDFORM

0 50 100
metres

HUNTER VALLEY MINING CORPORATION PTY LIMITED

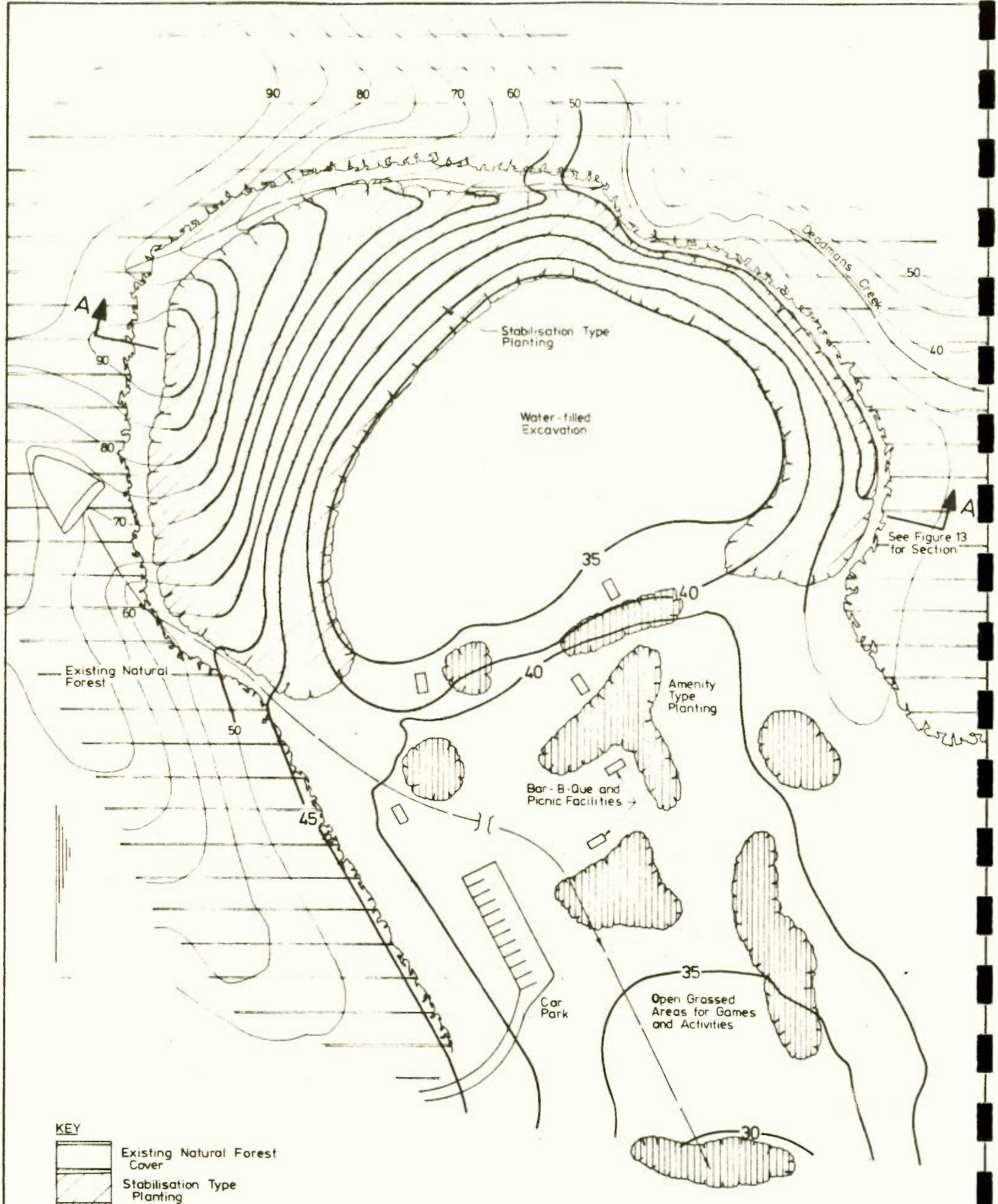


FIGURE 12
CONCEPTUAL FINAL LAND USE

0 50 100
metres

HUNTER VALLEY MINING CORPORATION PTY LIMITED

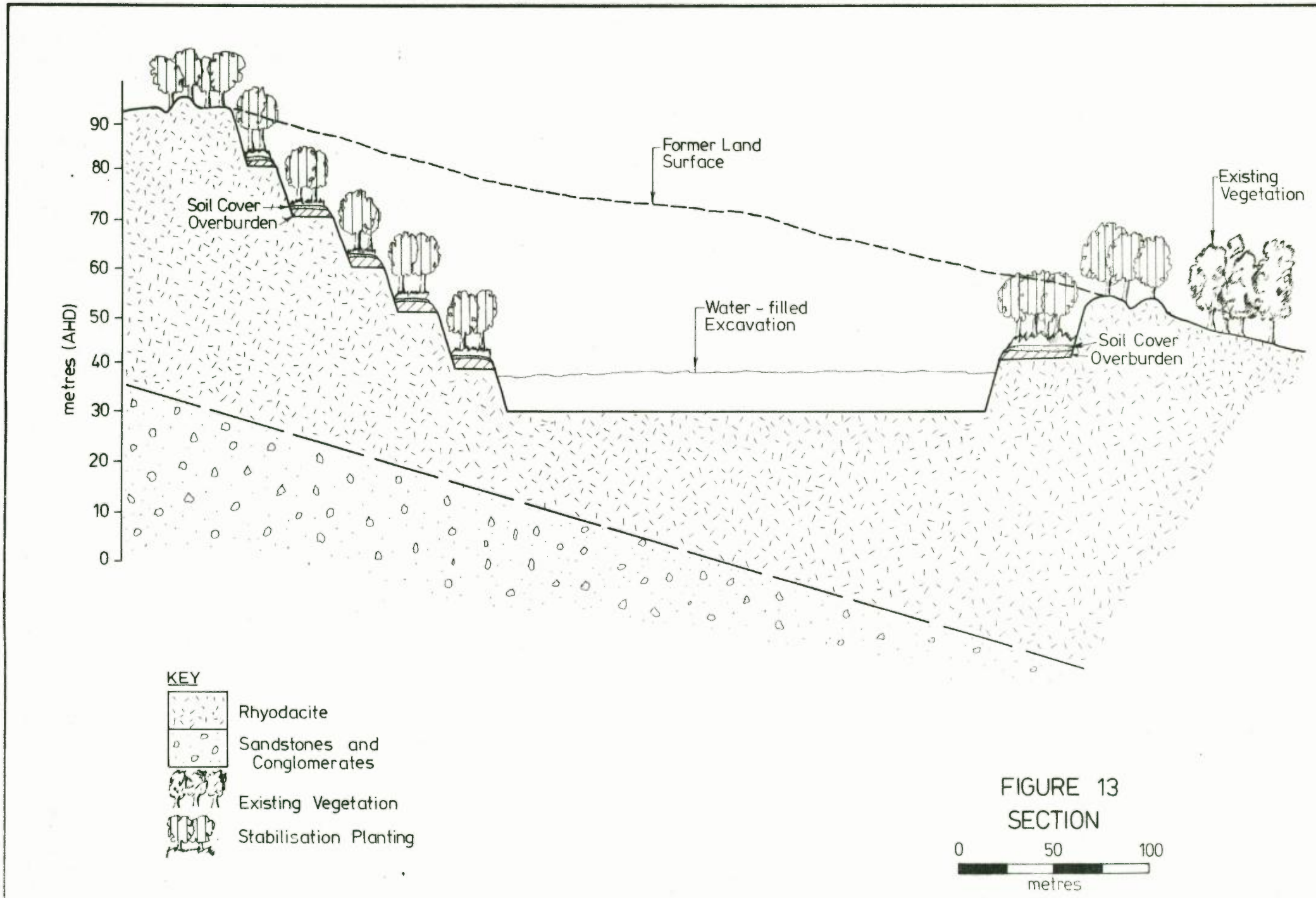


FIGURE 13
SECTION

HUNTER VALLEY MINING CORPORATION PTY LIMITED

TABLE 20

REHABILITATION SPECIES

Common Name	Scientific Name
Trees	
Smooth-barked Apple	Angophora costa
Scribbly Gum	Eucalyptus haemastoma
Bangalay	E. botryoides
Grey Gum	E. punctata
Red Bloodwood	E. gummifera
Black She-oak	Casuarina littoralis
Prickly Paperbark	Melaleuca styphelioides
Bracelet Honeymyrtle	M. armillaris
Shrubs	
Sydney Golden Wattle	Acacia longifolia
Sweet-scented Wattle	A. suaveolens
Hill Banksia	Banksia collina
Red Honeysuckle	B. serrata
Red Bottlebrush	Callistimon citrinus
Mountain Devil	Lambertia formosa
Ground Covers	
Kangaroo Grass	Themeda australis
Purple Coral Pea	Hardenbergia violacea
Dusky Coral Pea	Kennedia rubicunda
Native Snow Grass	Poa australis
Twining Guinea Flower	Hibbertia scandens

The landform has potential for the development of a picnic area, with tables and barbeques, including a small car park, with walking trails leading to surrounding natural areas.

It is acknowledged that during the life of quarrying and rehabilitation on the site, changing circumstances may alter preferences for the final land use. These will be progressively reviewed by the Company in conjunction with Port Stephens Shire Council, the local community and relevant Government authorities.

6.20 SAFETY

The Company will construct a fence around the perimeter of the buffer zone to restrict access to the quarry and plant site.

6.21 CONTROLS ON OPERATIONS

The operation is subject to compliance with conditions imposed by Port Stephens Shire Council and licenced with the State Pollution Control Commission.

Regular inspections are made by Mines Inspectors from the New South Wales Department of Industrial Relations to ensure that operations are conducted safely and in accordance with regulations and imposed conditions.

6.22 ENVIRONMENTAL MONITORING

In conjunction with the high standard of safeguards incorporated in the design of the project the Company will carry out regular monitoring of water quality, noise, and vibration. The results will be made available to authorities for inspection and auditing.

SECTION 7

ANALYSIS OF ENVIRONMENTAL INTERACTIONS & IMPACTS

7.0 ASSESSMENT OF ENVIRONMENTAL IMPACT

A. NATURAL PHYSICAL IMPACTS

7.1 TOPOGRAPHY AND SLOPES

The proposed development will alter the slopes on the lower eastern limb of Brandy Hill. The slopes will be replaced by a benched or stepped slope which will be progressively rehabilitated as extraction proceeds. **Figure 13** shows the modified landform of the ridge.

Where possible, the benches will be aligned with existing undisturbed contours north and south of the site. There will be no interference to the physiographic characteristics of Deadman's Creek channel or ridges and hills to the north.

About 12 hectares of flat to gentle land at the base of the southern side of the ridge will be modified to provide for the plant and sedimentation dams.

7.2 GEOLOGY

The main alteration to the geology of the site is the removal of part of the rhyodacite outcrop on the lower eastern slopes of Brandy Hill.

The extraction and processing of hard rock on this site will make a significant contribution to the supply of high quality aggregate to construction projects throughout the lower Hunter valley for the next 20 to 30 years.

7.3 SOILS AND SOIL EROSION

There is little soil cover on the rhyodacite and moderate cover on the plant site. Where available, the soil will be retained and used as a resource in rehabilitation works.

The construction of diversion banks and sedimentation dams described in **Sections 6.15.2 and 6.15.3** will restrict overland flows and the incidence of sheet wash. These measures, together with restricting the area cleared at any one time and confining traffic to constructed roads and designated work areas, will minimise impacts on soil erosion.

The access road will be constructed to a suitable standard using roadbase materials and provided with drainage controls to contain erosion. Cut and fill areas will be quickly stabilised and together with the drainage works will ensure the long-term stability of the road.

It is expected that disturbed areas may be subject to some erosion before plantings become established. These areas will be quickly repaired as part of site management procedures.

7.4 HYDROLOGY

7.4.1 Surface Drainage

The existing flow directions of stream courses and gradients will be maintained. Flows in the small tributary flowing from the southern side of the ridgeline will be regulated by dams but this is not expected to adversely affect stream flows to water users downstream. All runoff from activities will be confined and there will be no alteration to the hydrology of Deadman's Creek on the northern side of the ridgeline.

Upslope flows diverted around disturbed areas will rejoin water courses downstream of the site without altering the hydraulic characteristics of channels. Locations such as discharge points to existing creeks from sedimentation dams will be rip-rapped to prevent scour.

7.4.2 Flooding

The site is well above known flood heights and there will be no impact from flooding.

7.4.3 Groundwater

The proposed operations will partly modify groundwater flows in the jointed volcanic and sandstone units within 200m of the immediate site area. However, there are no users of groundwater in this area and the alterations will not be sufficient to affect vegetation communities.

Because of the strike and dip of the rhyodacite, some seepage into the quarry from groundwater sources may occur. This water will be collected by quarry drains and diverted to sedimentation dams for clarification.

7.4.4 Water Quality

Sedimentation dams constructed downstream of all disturbed areas will ensure that the contribution of suspended solids to downstream flows will be minimal. The retention of runoff from disturbed areas in sedimentation dams allows settlement of suspended solids and reuse of excess water for dust suppression.

Water quality analyses show that pH levels in the soil and in water bodies are low (acidic) and the proposed quarrying operations do not have the potential to alter these levels.

There will be no dry weather discharges from settlement dams; discharges will only be necessary during periods of heavy or prolonged rainfall when the level of suspended solids carried naturally by streams is higher and the contribution

from sedimentation dams will not be significant.

Discharges will meet the requirements of the New South Wales Clean Air Act 1970. The impact on water quality will be negligible.

7.5 AIR QUALITY

The Company will apply efficient dust control measures as outlined in **Section 6.16** to ensure compliance with the New South Wales Clean Air Act 1961.

Figure 7 shows that prevailing winds are from the west in the autumn and winter months and from the southern quadrant in the summer months.

The potential for any airborne dust being carried towards the nearest residences to the site is minimal. There are no residences north of the site to be affected by dust and the nearest residences west, east and south of the site are no closer than 1km to the quarry and plant site. The densely vegetated ridge lines and wide undisturbed zone around the site will provide a "buffer" to residences and land uses around the site.

Measurements conducted around a similar quarry and plant with similar control measures for dust, gave readings ranging from 1.2 and 1.5g/m^2/mth at distances of between 250m and 400m from the quarry site. These levels are similar to existing background levels prevailing on the Brandy Hill site and impacts on surrounding residences from the quarrying and processing operations will be negligible.

It should be noted that the **National Research Council** (1979) found that only dust levels in excess of 30g/m^2/mth have the potential to cause damage to vegetation and these are far in excess of actual levels measured around a quarrying operation and those measured in industrial areas by the **State Pollution Control Commission** (1980). These levels are also far in excess of levels that would be permitted under the Clean Air Act 1961. Impacts on vegetation and residents from dust will be negligible.

7.6 VEGETATION

The proposed development will result in the loss of vegetation occurring on the quarry and plant site.

The main alliance to be affected will be the **Eucalyptus crebra-Eucalyptus maculata** Open-forest. About 16 ha of this forest will be disturbed together with about 0.5 ha of the **Eucalyptuscrebra** Tall Open-forest.

These forests are widespread throughout the area to the north, east and west of the site and throughout the Hunter Valley and the disturbance of this area represents a small percentage of the total vegetation cover in the region.

The proposed quarrying operations will not extend to the northwesterly ridge or lower, wetter areas where the western species (e.g. Kurrajong) and Flame Trees were observed. The retention of this ridge will ensure that protection for the **Backhousia myrtifolia** Low Closed-forest in Deadman's Creek will be retained and

its viability secured. No recognised, rare or endangered species will be affected by the proposed operations.

7.7 WILDLIFE

The proposed development will result in the loss of wildlife habitat through the clearing of about 16 hectares of native forest.

Provided surrounding forests have sufficient habitat capacity, some displaced individuals will relocate in these areas. Overall some loss of individuals could be expected through reduction of the total habitat area, but no species extinctions are likely.

Impacts will be reduced by staged clearing and progressive rehabilitation programmes and impacts on wildlife are rated as low.

It has been demonstrated at other similar quarry sites, that wildlife quickly adapt to the presence of these activities and several incidences of kangaroos and possums frequenting the work areas and buildings have been reported by quarrymen.

7.8 VISUAL IMPACT

The proposed quarry and plant site are shielded from Seaham Road by a small east-west ridgeline and natural vegetation stands.

The quarry is located on a low ridgeline that does not intrude into the skyline. As the quarry benches move further up the ridge however, the higher benches (above 70m AHD) will become visible above the trees from eastern parts of Seaham Road.

However, the quarry will be in mid ground and the main vegetated skyline will form a background and will remain undisturbed. While motorist travelling west along Seaham Road will have glimpses of the upper bench levels, the overall visual impact is rated as low to moderate. Some dust may be visible to motorists and residences on occasions particularly from the access road. This visual impact will be significantly reduced when the access road is sealed within a five year period.

B. MAN-MADE PHYSICAL IMPACTS

7.9 ABORIGINAL PRE-HISTORY AND HISTORICAL SITES

The proposed development will have no impact on aboriginal relics, sites, or historical features.

Plate 1: View of the proposed quarry site from Seaham Road showing later stages of the quarrying operation visible from the road.

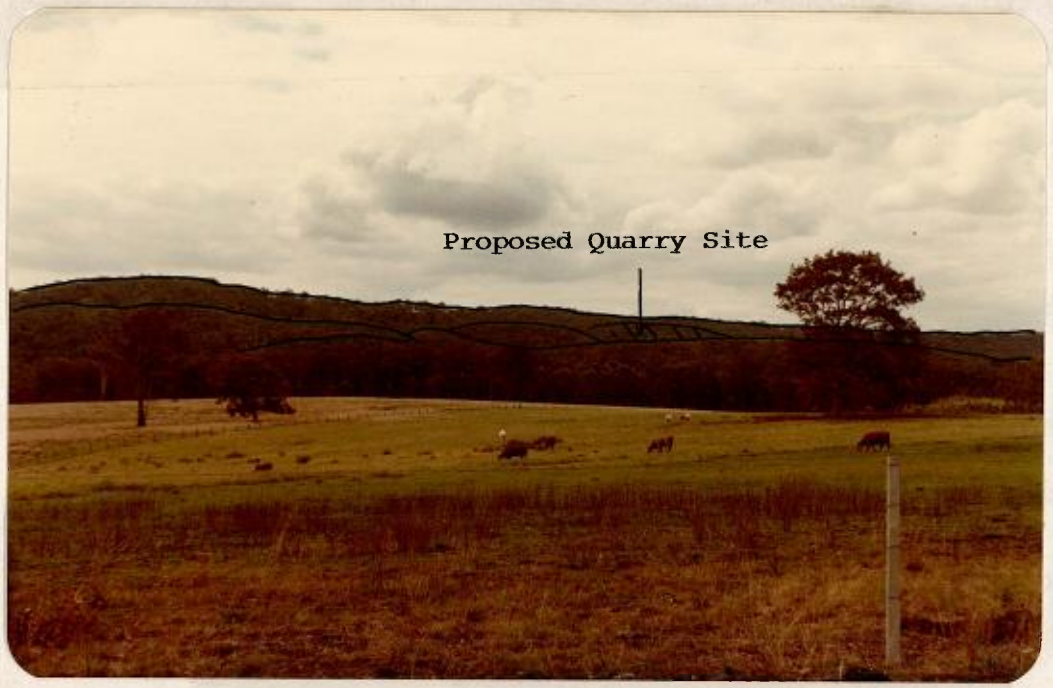


Plate 2: View of proposed quarry site from Seaham Road. The ridge in the middle of the plate will shield the plant site from the road and surrounding areas.

7.10 LAND USE

The proposed development will have no impact on agricultural or residential land uses in the area. A significant buffer zone has been provided around the quarry and plant site and this will ensure that the new 40 hectare rural/residential subdivision provided west of the site will be unaffected by the quarrying operation.

The villages of Seaham, Wallalong, and Woodville are some considerable distance from the site (see Section 5.12) and will be unaffected by the quarry activities.

Impacts on Water Quality, Air Quality, Noise and Vibration are discussed in Sections 7.4.4, 7.5, and 7.16, respectively.

7.11 PLANNING

7.11.1 Land Zoning

No alteration of existing zoning (Non-Urban A) will be necessary to permit the proposed development.

7.11.2 Planning

The proposed development will have no impact on the future development of surrounding land for subdivision development in accordance with the 40 hectare minimum subdivision provided for by the present zoning. The site is on the periphery of areas identified as having scenic and conservation value and impacts on these areas will be low.

The proposed quarry site will be located in an area identified by the New South Wales Department of Mineral Resources as an important hard rock aggregate site and its development will be in accordance with the recommendations of the rural lands study (Port Stephens Shire Council 1983) to protect these resources.

7.12 PUBLIC UTILITIES

The site can be readily serviced by power and telephone from existing reticulation services without inconvenience to power and telephone users in the district. There will be insignificant impact on the present capacity of these services.

7.13 IMPACTS ON ROADS

Trucks delivering aggregates to the region will travel via main roads MR301,

101, and 601 to the New England and Pacific Highways, respectively. To by-pass Seaham village, trucks will travel via Wighton Street which will be upgraded at the Company's expense, in accordance with the requirements of Port Stephens Shire Council.

It is expected that there will be an average of 17 trucks daily leaving the site rising to 67 at full production. About 75 per cent of daily truck movements will be to the east to Raymond Terrace.

On this basis, the number of trucks travelling east will average between 13 and 50, while to the west, numbers will average between 4 and 17 daily over the life of the quarrying operation.

Tables 13 to 16 show traffic currently using the proposed routes daily.

Since only main roads, or roads upgraded to a standard suitable for heavy vehicles will be used by trucks impacts on roads will be low.

The upgrading proposals and main road use will ensure that impacts on residences adjoining the road and other road users will also be low.

The expected truck levels will result in an increase of about 2.1 per cent on current traffic levels on Seaham Road and significantly less on other main roads in the region.

Since normal traffic levels are increasing annually at a rate of between 3 and 4 per annum, the relatively proportion of quarry traffic will remain relatively constant at about 2 to 4 per cent of total traffic levels and impacts are rated as low to moderate.

7.14 HEALTH AND SAFETY

The quarry and buffer zone will be fenced to deter people entering the site and trucks will travel on the access road and public routes within the speed limit and give due consideration to local residents and road users. All drivers will be instructed to drive with a high regard to the amenity of the area and the concerns of local residents.

7.15 IMPACT ON ENERGY RESOURCES

The proposed quarry and plant sites are not underlain by coal and hence there will be no sterilisation of energy resources.

7.15.1 Electrical Power

The plant and facilities on the site will consume between 600 and 800kW of electrical power including workshop, office, weighbridge, and lunchroom facilities. This equates with a primary energy use of about 2.0×10^{12} joules and is negligible in comparison with the expected total New South Wales use of

energy predicted for the non-metallic mineral industry of 42.3×10^{15} joules in 1982-83. (Department of National Development 1978).

7.15.2 Fuel

It is expected that mobile equipment on site will consume about 200,000 litres of diesel fuel annually and haulage trucks 230,000 litres per year. This consumption of fuel equates with a primary energy use of 8.8×10^{12} joules, a negligible amount in comparison with the total use of energy predicted for the Non-metallic mineral industry in 1982-83.

7.16 IMPACT FROM NOISE AND BLASTING

7.16.1 Noise from the Quarrying Operation

Studies have been undertaken to assess potential noise impacts from the quarrying operation on nearby residents. As discussed in Section 5.16 background noise levels vary from 30 to 34 dB(A) at various sites around the area.

To predict expected noise levels at surrounding residences from the extraction and processing operations, typical noise levels for the proposed plant were obtained from previous measurements of similar equipment performing similar operations. These levels are shown in Table 21.

TABLE 21

TYPICAL NOISE LEVELS FROM PLANT AND EQUIPMENT

Equipment	Noise Level dB(A) at 7m
Front-end loader	93
Dozer	98
Off highway haul truck	86 (idling)
	98 (hauling)
Water cart	90
Mobile drilling rig	102
Jaw crusher	89
Gyratory crusher	86
Screens	80

To determine noise levels at residences the following formula was used:

$$Lp_2 = Lp_1 - 20 \log r_2/r_1 - Ae$$

where: Lp_1 = sound pressure level at distance r_1 from the source
Lp_2 = sound pressure level at distance r_2 from the source
r_1, r_2 = distance on the same line from the source
Ae = excess attenuation for the distance $r_2 - r_1$

(Beranek 1971)

To determine the excess attenuation (Ae) consideration was given to ground absorption and the effect of topography. Some additional absorption of the sound waves by the trees and vegetation surrounding the site could be expected, but was not included in the calculation of Ae.

Past experiments conducted in the Hunter Valley to determine values for ground absorption have varied from 2.5 dB(A) per 100m to 7.75 dB(A) per 100m, and overseas studies have found even higher values. For calculation purposes a conservative value of 2.5 dB(A) per 100m, up to a maximum of 30 dB(A), for distances greater than 70m was used.

To calculate expected noise levels at the residences, the equipment was divided into two groups or sources, namely the quarrying operation and the processing operation. Expected noise levels were calculated for each source and then combined to give an overall noise level.

Noise levels up to 5 dB(A) above background are usually considered not significant in **Australian Standard AS1055-1978** and by the State Pollution Control Commission.

The results show that the expected noise levels from the quarrying and processing operations will not exceed existing background levels at all existing or known proposed residences around the site.

7.16.2 Noise and Vibration from Blasting

As mentioned in **Section 6.17** limits on blast overpressure and ground vibration will be imposed by Government authorities.

The New South Wales Department of Industrial Relations (Mines Inspection Branch) and the State Pollution Control Commission impose limits on overpressure levels (noise) and vibration from blasting. Limits currently being set by these authorities range from 115 to 120 dB(lin) for overpressure and 7 to 10 mm/s peak particle velocity for vibration. These levels are well below **SAA Explosives Code Australian Standard 2187, Part 2 - 1979** maximum recommended limit of 20 mm/s peak particle velocity for structurally sound buildings.

Blasts will be designed to maximise fragmentation of the rock and minimise overpressure and vibration. The use of suitable blasting patterns and delay detonators initiated electrically will ensure that overpressure and vibration levels are kept to a minimum.

To ascertain likely vibration levels from blasting, reference was made to **Department of Mines,** and **ICI Australia Operations Pty Limited (1980)** and calculations based on the following:

Diameter of hole	:75mm
Depth of hole	:11m
Sub-drilling	:1m
Burden	:3m
Spacing	:3m
Explosive	:ANFO (gravity loaded)

The results show that by limiting the number of blast holes per delay detonator to 3, vibration levels at 1,000m will be approximately 10mm/s peak particle velocity; 19mm/s at 500m, and 50mm/s at 200m.

Since the nearest existing or known planned residence is approximately 1,500m from the site, levels specified by authorities will not be exceeded.

Initially, and as the quarry progresses from stage to stage, a number of blasts will be monitored (vibration and overpressure levels) and if necessary the blast design modified to ensure that set limits are met.

Since the area surrounding the site is already punctuated by noise from blasting at distant quarries, the existing gravel quarry near the site and frequent high noise levels associated with the overflights of RAAF jets, the effects of noise from the proposed blasting on residents and stock will be minimal.

Discussions with officers of the Department of Agriculture indicate that stock, and in particular chickens, adapt to routine noise (such as blasting on a regular basis) without ill effects, but are more likely to be effected by a "one-off" occurrence of a high noise.

Poole (1982) reported that studies in England on the effect of sonic booms on farm animals found that farm animals, and in particular poultry, display behavioural startle when they first experience a boom but appear to adapt to further booms. The main conclusion of the study was that it could not be demonstrated that deaths, injury or loss of production would be a consequence of sonic boom exposure.

It was also reported by **Poole (1982)** that a study by the United States Air Force Environmental Health Laboratory into the effects of sonic boom on the hatchability of poultry eggs and the effect of overflights of subsonic aircraft and helicopters on poultry aged 1-62 weeks found that the overall effects of sub and supersonic aircraft were minimal.

Residents in the region may detect noise from the blasting operations in the background, but these noise levels will not be intrusive and in most cases would be similar to or less than background noise levels.

7.16.3 Noise from Road Transport

Noise measurements of trucks passing on bitumen roads show that, on average, trucks travelling at less than 60 kph (eg. arriving at or leaving the site) will have peak noise levels of approximately 97 dB(A) at 7m, and trucks travelling at greater than 60 kph (eg. on main roads) will have peak noise levels of approximately 100 dB(A) at 7m.

At residence H1, noise levels from trucks turning onto or off Seaham Road could be expected to peak (briefly) at around 85 dB(A) during the passing of the truck if the existing estate road is used as the route.

Should the alternative access route be used, no residence would be affected by trucks turning onto or off Seaham Road, and the number of trucks passing residences H1 to H6 would be decreased.

Expected noise levels at residences along the transport routes were calculated and ranged from 96 dB(A) at 10m, 89 dB(A) at 25m, 82 dB(A) at 50m, 75.5 dB(A) at 100m, to 69 dB(A) at 200m from the road. The reduction in noise levels from trees or buildings have not been included and these peak noise levels are of a very short duration during the passing of the truck.

Since main roads and one upgraded shire road are to be used, these peak levels would be similar to noise levels currently being experienced at these residences from existing traffic. It is expected that the small increase in traffic on these main roads will not significantly affect noise levels currently experienced (refer to high L_{10} and Leq levels at sites N2 and N3, Section 5.16). For a small number of residences along Wighton Street noise levels from the increased traffic will be more significant, but will only be short duration peak levels as the truck passes.

C. SOCIAL AND ECONOMIC IMPACTS

7.17 EMPLOYMENT

7.17.1 Direct Employment

Initially, the employment level is expected to be 9 persons probably all of whom would be local except the plant manager. The on-site employees will include a plant manager, despatch clerk, two loader drivers, one driller, one plant operator, one production foreman, maintenance fitter and a labourer. It is envisaged that the plant would be fully automated, however the direct employment effects are significant. About 10 haulage subcontractor positions will be made available by the operations.

At full production, the on-site employment level would rise to a maximum of 11 persons with the engagement of two additional on-site haulage truck drivers.

7.17.2 Indirect and Induced Employment

Induced employment in the first stage could be as high as 15 positions mainly concentrated in the finance and business services, communications, wholesale and retail trades, building trades and recreation and entertainment industries. Also under indirect employment can be classed the employment opportunities created by contractors employed in the construction stage.

7.17.3 Income Effects and Impacts

The average salary for the direct employees is anticipated as being between $380 and $420 a week. At production stage, with an employment level of 11 this represents an average annual wage bill of between $220,000 and $300,000. The

short-term economic impact will be derived from the creation of new sources of income as employment is procured from the local labour market and it is expected that the majority of the direct and a large part of the indirect income effect will be on the local area or region. In the first year the income generated could be as large as $500,000 consisting of wages and salaries of direct and indirect employees.

The anticipated life of the quarry is in the vicinity of 30 years. Therefore in the long term income effects will be significant. Initially there will be $2.5 million expended to construct the road, to clear the site, undertake the earthworks, and to construct the plant. In addition the upgrading of Wighton Street will require an additional expenditure.

It is expected that the long term income effects of employment and capital outlay could be conservatively estimated to be in the order of $9.58 million (discounted to present value) over the projected life of the quarry ignoring taxes paid.

7.13.4 Government Revenue

Revenue would be increased to all levels of government through this project. The local council would gain through rates payable by residents induced into the area seeking employment and through the upgrading of Wighton Street, and the State and Federal Governments would gain from payments made for payroll tax, income tax and the like.

7.14 SOCIAL IMPACTS

7.14.1 Population and Housing

This area is one of growth and it is expected that housing and construction generally will exhibit an upward trend. The provision of raw materials to enable this anticipated growth and the potential job opportunities created by this development could greatly assist development without placing any large burden on existing resources. As it is expected that much of the direct employment would be provided locally there would be only limited additional pressure on housing. In addition, there is sufficient excess capacity in temporary accommodation facilities to cope with transitional problems.

The direct effect on population of the provision of employment opportunities from the proposed production would be minor as much of the labour will be drawn from the local area. The indirect effect will be to encourage additional employment opportunities. The level of unemployment among the young in Port Stephens Shire is a continuing problem which can only be alleviated by the provision of employment opportunities.

With the growth in population and subsequent expansion of housing this area provides an expanding market for the proposed development. Thus the extraction of quarry materials would accentuate, but also service, any additional expansion.

7.14.2 Employment

In an area of high unemployment with a large proportion of the population in the 5 to 19 years age group, it is essential to encourage industry and economic growth. With the indirect and induced effect on employment the proposed extractive industry could provide opportunities for additional skilled and unskilled persons in the region.

Also in the past many of the young people, particularly the males, have had to seek employment outside the area, and this situation can be reversed if growth-generated industries can be established in the area.

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REFERENCES

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APPENDIX 1

APPENDIX 1

Department of Environment and Planning

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
DX 15 Sydney 266-7217
Telephone (02) XXXXXXX
Contact T. Kalra
Our reference 83/46
Your reference

Ms Valerie Smith,
Resource Planning,
P.O. Box 235,
BELMONT. N.S.W. 2280 62

Dear Madam,

Proposed Hard Rock Quarry, Part Portion 38 and 56, Parish of Seaham, County of Durham.

Thank you for your letter of 8th March, 1983 which indicates that you are consulting with the Director with regard to the preparation of an environmental impact statement for the above project.

2. As development consent is necessary for the proposal 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 environmental impact statement accompany the development application.

3. The basic requirement is that an environmental impact statement 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 environmental impact statement it is advised that the Director requires that you should take into account those matters specified in the attachment. These matters are to be adequately addressed in the environmental impact statement.

5. 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 environmental impact statement.

6. When an adequate environmental impact statement has been completed, you should arrange to forward to Port Stephens Shire Council an adequate number of copies of the document for public exhibition purposes and consideration of the proposal by Council.

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

Yours faithfully,

C.J. Wright
Manager,

NEW SOUTH WALES DEPARTMENT OF ENVIRONMENT AND PLANNING

83/46

ATTACHMENT TO LETTER OF ADVICE ON ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED HARD ROCK QUARRY AT PART PORTION 38 AND 56, PARISH OF SEAHAM COUNTY OF DURHAM BY HUNTER VALLEY MINING CORPORATION.

In addition to meeting the requirements of Clause 34 of the Environmental Planning and Assessment Regulation, 1980, the environmental impact statement for the above project should account for the following specific matters:

2.A clear description of the proposal and its proposed environmental safeguards, the environment potentially affected by the proposal and associated environmental impacts, concentrating on relevant issues. Clear unambiguous descriptions should be given in a comprehensive report of limited length with appropriate drawings to enable the proposal to be readily understood.

3.Delineation of matters for which development consent is sought and other necessary consents required in order for the proposal to be farried out.

4.Identification of current land uses in the vicinity of the proposal, including location of residences. This should include a site map showing the adjacent development and any other known proposed developments.

5.Criteria used in selecting this particular site and a justification of that selection.

6.Details of proposal including:

. Hours of operation.
. Workforce requirements.
. Mining and associated operations.
. Working sequence of operations.
. Production out put.
. Expected life of the operations.
. Types of machinery and equipment to be used.
. Means of access to the site.
. Mode of transport proposed for products including the routes.
. Quantities and methods of disposal of wastes.

7.Storage of product materials and proposals to control their potential to affect the local environment.

8.Water management, including:

. Proposed methods of treatment of contaminated water before discharge.
. Proposals for differentiating between clear and contaminated runoff from the site.
. Anticipated quantity and quality of effluent for disposal.
. Proposals for avoiding any contaminated water discharge into Deadman's Creek.
. Identification of any impact on the quality on the downstream wetlands.

9.Noise and vibration effects including:

. Existing and predicted noise levels (day and night).
. Identification of proposed noise sources and proposals to minimise noise generation.
. Identification of any residences or land uses which may be affected by noise and quantification of noise impact thereon.
. Identification of proposed vibration generating sources and proposals to minimise vibration and overpressure therefrom.
. Identification of any residences or land uses including agricultural equipment which may be affected by vibration and overpressure and quantification of such impact thereon.

10.Air quality effects including:

. Existing air quality of the site and its surroundings.
. Identification of likely sources of air pollution and proposals to minimise impacts to acceptable levels.

11.Landscaping measures and rehabilitation, including:

. Description of flora and fauna at the site and in the surrounding area.
. Landscaping measured proposed to minimise the visual impact of the development on the motorist travelling on Seaham Road.
. Rehabilitation procedures to be adopted during and on completion of the extraction.

12.On site parking facilities for the workforce.

13.Future expansion, including:

. Statement of proposals for various stages of the development.
. Likely timing and implementation of various stages.

14.Details of proposed routes taken by the haulage trucks for the products to their respective destination points and an assessment of impact of the increased transport attributable to the development on the existing transport system, both in the vicinity and the region generally.

15.The State Pollution Control Commission's environmental criteria for blasting overpressure and ground vibration (for blasts between 9.00 a.m. and 5.00 p.m.) are currently 115dB (lin) and 2 or 7 mm/sec (depending on the age and condition of the residence) at the nearest affected residence. Appropriate consideration should be given to meet the above criteria.

APPENDIX 2

APPENDIX 2

PROJECT TEAM FOR ENVIRONMENTAL INVESTIGATIONS

RESOURCE PLANNING

V. Smith	B.Sc(Hons)(New'cle) M.Sc.(NSW)	* Project Co-ordination and Management * Aspects of the existing environment * Project description, safeguards and controls * Interaction and impact identification and assessment * Report writing and editing
F. Rice	Met.Cert.(W'llong)	* Monitoring programme for air, water, and noise * Traffic studies * Impact Assessment
G. Baxter	B.Nat.Res.(Hons) (UNE)	* Flora, fauna and ecological studies
J. Henley	B.App.Sc.(Land-scape Design) (CCAE)	* Visual analysis

SPECIALIST SUB-CONSULTANTS

P. Dean-Jones	B.A.(Hons-Geomorph) (Mac'q)	*Soil and erosion studies
K. Renfrew	B.Comm(Hons-Econ) B.Math (New'cle)	* Social and economic studies
S. Creer H. Brayshaw	Consultant Archaeologists	* Archaeological Survey
Awabakal Co-operative		* Archaeological Survey

HUNTER VALLEY MINING CORPORATION PTY LIMITED

B. Marheine	General Manager

APPENDIX 3

APPENDIX 3

FUTURE GROWTH AREAS

The New South Wales Department of Environment and Planning has carried out a detailed planning study to identify future growth areas within the Hunter Region. The results of this study are detailed in the "Hunter Region. Regional Environmental Plan No. 1" (1982) and "Urban Residential Land Program" (1982). The following is summarised from these reports:

1. Most of the Region's expected 100,000 population increase from 1981 to 2001 will occur in the Lower Hunter.

2. An increase in population of 15,000 people can be accommodated in East Maitland and a further 13,000 in West Maitland.

3. In the City of Maitland, 3,690 lots will be produced over the next five years, with the potential for significantly more lots in the West Maitland area. Approximately two thirds of lots to be produced over the next five years will be in the East Maitland area. These developments will rely particularly on the Land Commissions proposals for this area.

4. Kurri Kurri can provide for the settlement of 13,000 people and is closer to the Newcastle urban area than Cessnock.

5. Cessnock City has negligible residential land now and growth will result in the release of two substantial areas. The Land Commission proposal at Weston and a Cessnock City Council proposal at West Cessnock will together provide over 830 lots during the next five years.

6. Raymond Terrace can provide for a population increase of 5,000 people.

7. Port Stephens Shire propose to release 3,540 lots over the next five years. Approximately two-fifths of these lots are located at Raymond Terrace where water and sewerage systems have the capacity to cope with the proposed development. Almost an additional one-sixth of the total lots will result from Crown Land proposals.

8. The Tomaree Peninsula, on the southern shores of Port Stephens, is proposed to accommodate a resident population increase of 11,000 people, largely as a result of the acceptance of existing zones for urban purposes. With the low occupancy characteristic of resort areas, it represents a major expansion of the Port Stephens urban areas and it is considered that any further growth above the proposed level would have substantial adverse environmental consequences.

9. The future growth of urban Newcastle will rely heavily on

land supply in Lake Macquarie Municipality with the program allowing for over 6,600 lots. These proposed lots are scattered over 30 sites throughout the Municipality, and are basically part of an infill approach to make better use of existing urban facilities.

10. On the eastern side of Lake Macquarie, major population growth of 12,000 people is proposed within the large area extending easterly from Eleebana, through Tingira Heights to Redhead. The area is readily accessible to both the coast and the Lake, with the retail and other commercial facilities focussing, principally, on Charlestown and Belmont.

11. Population growth in the South-Western Lake Macquarie area ought to be limited to 3,000 people in view of:-

    (a) more suitable opportunities for urban development elsewhere; and

    (b) the need to protect the waters of Lake Macquarie from pollution due to urban run-off.

12. A proposed increase in population of 9,000 people at Booragul reflects the Land and Housing Commissions' involvement in the former Quigley Estate.

13. Development of the Cardiff/Warners Bay area to accommodate an additional 11,000 population will form an extension to the existing urban area, taking advantage of high accessibility to the Cardiff employment area and a pleasant residential environment. Much of the proposed development in this area is already committed by way of existing urban zones.

14. A proposal to attempt to halt the decline in population from the established areas of inner Newcastle have important implications for urban policy and management. Inner city population decline is evident in most major cities and experience to date shows that such is a most difficult trend to reverse. Clearly, the outflow of population from the central area of Newcastle adversely affects accessibility to jobs and Central Business District facilities and services, as well as resulting in substantial under-utilisation of such facilities and services.

15. A proposal to expand the Wallsend area, including the major Elermore Estate development proposal, to accommodate a further 4,000 people is supported by higher accessibility characteristics to the existing urban area than any other comparable location. The Land Commission proposes to make available 1,640 lots in the Wallsend area during the next five year period.

16. Population growth in the Dungog-Gloucester-Great Lakes area

is expected to continue along the more recent trend of strong growth in the Great Lakes area. It is proposed that population increase of about 15,000 people be accommodated, mainly in the Great Lakes area, with the situation elsewhere expected to mirror that of the remainder of the Upper Hunter with population growth concentrated in a few settlements, while the rural areas decline or at best stabilise at the present level of population. One exception should be modest growth in Gloucester as a result of coal development south from the town.

In anticipation of these developments, the Program includes land with a potential yield of 300 lots in the town. Gloucester Council has recently augmented the town's water supply and is investigating the augmentation of the sewerage system. Council has undertaken a Local Environmental Study as a prelude to the preparation of a Local Environmental Plan covering the whole Shire.

In the Shire of Great Lakes, it is anticipated that there will be a demand for approximately 2,200 dwelling sites over the next 5 years. It is expected that the demand for residential land will be concentrated in the towns of Forster and Tuncurry. Significant population growth is also likely in the coastal centres of Tea Gardens and Hawkes Nest, as well as the Pacific Palms area. Growth in the inland rural centres of the Shire is likely to be minimal, although an increase in population in the town of Stroud could result from proposed coal mining in the Wards River area.

Forster-Tuncurry, at the northern extremity of the Region is expected to accommodate a population increase of about 8,000 people, while Hawkes Nest/Tea Gardens to the south should accommodate a further 2,000 people.

The program proposes that some 1,200 lots will be required in Forster/Tuncurry by 1987, with a significant proportion of this figure being provided for medium density housing. There is sufficient land already zoned in this area to meet this demand, and Council is currently carrying out a study to ensure that services can be extended and amplified to new residential areas, as required.

A study of the feasibility of urban development on a large tract of mainly Crown land north of Tuncurry is being carried out by consultants for Council and the Crown Lands Office. As well, a major canal-type development comprising 1,200 dwellings is proposed for Destination Bay north of Tuncurry.

It is expected that some 300 lots will be required in the Hawkes Nest/Tea Gardens area over the 5 year period. A new local environmental plan has recently been completed for this area, and there is sufficient zoned land to meet demand well beyond 1987. Water and sewerage services are available

and could be extended, if necessary. Recent growth has been significant in the Pacific Palms area despite the lack of services, due to the availability of subdivided land and the attractive coastal location. Council is currently preparing a study for this area, which will determine the extent of future growth and indicate the feasibility of providing water supply, in particular, and sewerage services to the area.

In the Upper Hunter Sub-region, the programme contains land in the Local Government Areas of Dungog, Gloucester, Great Lakes, Merriwa, Murrurundi, Muswellbrook, Singleton and Scone having a potential yield of approximately 10,400 lots, based on current standards. In general, achievement of the Upper Hunter program depends upon positive action towards extension and augmentation of the water supply and sewerage systems in the towns of Singleton, Muswellbrook, Denman, Scone and Aberdeen, the steady production of land in the hands of private developers, and an annually high production rate of land proposed to be developed by the Councils and the Crown over this period.

APPENDIX 4

APPENDIX 4

SAMPLE SOIL PROFILE DESCRIPTIONS

SITE S2

0-15cm:	Colour 7.5YR 7/3 / 10YR 7/2 pH 5 texture sandy loam, low coherence dry powdery soil material mixed with sub angular and sub rounded gravel, including larger fragments to 5cm length. Scattered float at surface. Fabric - auger sample only, fabric destroyed in sampling. Northcote Uc 1.23

SITE S3

0-12cm:	Colour 7.5YR 5/2 - 10YR 5/2 pH 4.5 texture: sandy loam
12-25cm:	Colour 10YR 6/8 texture: medium clay gritty - including mineral fragments. pH 4 Fabric: auger sample only. Northcote Db 3.11

SITE (Southwest of study area)

0-5cm:	Colour 10YR 5/1 pH 5 texture: light sandy clay loam
5-24cm	7.5YR 7/1 pH 5 sandy loam
24cm+	10YR 5/6 pH 5 medium - heavy clay Fabric: auger sample only. Northcote Db 3.21

APPENDIX 5

APPENDIX 5

EUCALYPTUS CREBRA TALL OPEN-FOREST ALLIANCE

Trees	Shrubs	Ground Cover
E. crebra F. Muell	M. decora (Salisb.) Britten	Imperata cylindrica (L.) Beauv.
E. punctata D.C.	Acacia decurrens (Wendl.) Willd.	Poa. sp. L.
E. maculata Hook		Themeda australis (R. Br.) Stapf.
		Pratia concolor (R.Br.) Druce
		P. purpurascens (R. Br.) Wimm.

EUCALYPTUS CREBRA - EUCALYPTUS PUNCTATA CLOSED-FOREST

Trees	Shrubs	Aquatic Species In Creek
E. crebra F. Muell	A. decurrens (Wendl.) Willd.	Eleocharis sphacelata R. Br.
E. punctata D.C.	A. ulicifolia (Salisb.) Court.	Triglochin procera R. Br.
E. maculata Hook	Phebalium diosmeum A. Juss	
Trema aspera (Brongn.) Blume	Clerodendrum tomentosum R. Br.	Ground Cover
Melaleuca styphelioides Sm.	Cassinia arcuata R. Br.	
	Callistemon salignus (Sm.) D.C.	Paspalum dilatatum Poir
	Davesia ulicifolia Andr.	Imperata cylindrica (L.) Beauv.
	Lantana camara L. *	Pteridium esculentum Scop.
	Brachychiton acerifolium	Kennedia rubicunda Vent.
		Glycine clandestina Wendl.
		Senecio vagus F. Muell
		Eupatorium adenophorum Spreng. *
		Clematis glycinoides D.C.

EUCALYPTUS CREBRA - EUCALYPTUS MACULATA OPEN-FOREST

Trees	Shrubs	Ground Cover
E. crebra F. Muell	M. decora (Salisb) Britten	Themeda australis (R. Br.) Stapf.
E. maculata Hook	Jacksonia scoparia R. Br.	Imperata cylindrica (L.) Beauv
E. tereticornis Sm.	Acacia melanoxylon R. Br.	Poa sp. L.
E. punctata D.C.	A. decurrens (Wendl) Willd	Dianella caerulea Sims
E. globoidea Blakely	A. falcata Willd	Dianella sp. Lam
E. agglomerata Maiden	A. ulicifolia (Salisb) Court	Lomandra longifolia Labill
E. paniculata Sm.	Dodonea triquetra Wendl.	Lomandra sp. Labill
E. albens Miq	Davesia ulicifolia Andr.	Stypandra caespitosa R. Br.
E. moluccana Roxb.	Aotus ericoides (Vent.) G. Don	Kennedia rubicunda Vent
Melaleuca styphelioides Sm.	Gompholobium latifolium Sm.	Mirbelia rubiifolia (Andr.) G. Don.
Brachychiton populneum R. Br.	Pultenaea euchila DC.	Glycine clandestina Wendl
B. acerifolium (A. Cunn ex Don) F. Muell	P. villosa Willd	Hardenbergia violacea (Schneev.) Stearn
	Oxylobium ilicifolium (Andr.) Domin	Platylobium formosum Sm
	Casuarina torulosa Ait	Goodenia heterophylla Sm
	Persoonia linearis Andr	Calystegia marginata R. Br.
	Hakea teretifolia (Salisb.) J. Britten	Correa alba. Andr.
	Leptospermum sp. Forest et f.	Hibbertia scandens (Willd) Gilg.
	Callistemon salignus (Sm) D.C.	Pomax umbellata (Gaertn) Soland
	Cassinia arcuata R. Br.	Pratia purpurascens (R. Br) Wimm.
	Bursaria spinosa Cav.	Eustrephus latifolius R. Br.
	Gahnia sp. Forest	Billardiera scandens Sm
	Breynia oblongifolia J. Muell	Wahlenbergia gracilis (Forest et.f.) Schrad.
	Exocarpos cupressiformis Labill	Pimelea linifolia Sm
	Rubus parvifolius L.	Stylidium graminifolia Swartz ex Willd.
	Citriobatus pauciflorus A. Cunn. ex Ettingsh	Cheilanthes sp. Sw.
		Adiantum sp. L
	Phytolacca octandra L. *	
	Lantana camara L. *	
	Sambucus sp. L.	
	Xanthorea sp. Sm	
	Leucopogon sp. R. Br.	
	Baeckea virgata Andr.	

APPENDIX 5 (CONT)

EUCALYPTUS CREBRA, EUCALYPTUS MACULATA OPEN-FOREST WITH MELALEUCA DECORA UNDERSTOREY

Trees	Shrubs	Ground Cover
E. crebra F. Muell	EASTERN	EASTERN
E. maculata Hook		
E. punctata D.C.	Melaleuca decora (Salisb.) Britten	Themeda australis (R. Br.) Stapf.
	M. styphelioides Sm.	Imperata cylindrica (L.) Beauv
	Jacksonia scoparia R. Br.	Paspalum dilatatum Poir
	Acacia ulicifolia (Salisb.) Court	Poa sp. L.
	Davesia ulicifolia And:	Viola caleyana G. Don.
	Callistemon salignus (Sm.) D.C.	Dianella caerula Sims
	Bursaria spinosa Cav	Smilax australis R. Br.
	Lantona camara L. *	Glycine clandestina Wendl.
		Kennedia rubicunda Vent
	WESTERN	Eustrephus latifolius R. Br.
	M. decora (Salisb.) Britten	WESTERN
	M. styphelioides Sm.	
	Jacksonia scoparia R. Br.	As for E. crebra, E. maculata Open-forest
	Acacia falcata Willd.	
	A. ulicifolia (Salisb.) Court	
	Cassinia arcuatata R. Br.	
	Bursaria spinosa Cav.	
	Rubus parvifolius L.	
	Citriobatus pauciflorus A. Cunn ex Ettingsh.	
	Lantana camara L. *	
	Leucopogon sp. R. Br.	

BAECKEA VIRGATA CLOSED-SCRUB

Trees	Shrubs
Melaleuca styphelioides Sm.	Baeckea virgata (Forest & Forest f.) Andr.
Ficus rubiginosa Desf. ex Vent	Callistemon salignus (Sm.) D.C.
	Omalanthus populifolius Grah.

BACKHOUSIA MYRTIFOLIA LOW CLOSED-FOREST

Trees	Shrubs	Ground Cover
Backhousia myrtifolia Hook f. et Harv.	Citriobatus pauiflorus A. Cunn ex Ettingsh.	Senecio vagus F. Muell
Alphitonia excelsa (Fenzl) Benth.	C. lancifolius F.M. Bail	Culcita dubia (R. Br.) Maxon
Glochidion ferdinandi (J. Muell) F.M.	Hibiscus heterophyllus Vent.	Doodia aspera R. Br.
Notelaea longifolia Vent	Coelebegyne ilicifolia J. Sm.	D. caudata (Cav.) R. Br.
Planchonella australis Pierre	Clerodendrum tomentosum R. Br.	Pyrrosia rupestris (R. Br.) Ching.
Melia azedarach L.	Omalanthus populifolius Grahm.	Plagiogyra sp. F. Muell
Elaeocarpus reticulatus Sm.	Baeckea virgata Andr.	Selaginella sp. Beauv.
Ficus rubiginosa	Lantana camara L. *	Marrubium vulgare L.
Eucalyptus microcorys F. Muell		Lomandra longifolia Labill
E. rudderi		

CLIMBERS AND EPIPHYTES

Malaisia scandens (Lour.) Planch.
Parsonsia straminea (R. Br.) F. Muell
Embelia australiana (F. Muell.) Mez.
Dioscorea transversa R. Br.
Cayratia clematidea (F. Muell) Domin
Passiflora sp. L.
Platycerium bifurcatum (Cav.) C. Chr.

APPENDIX 5 (CONT)

THEMEDA AUSTRALIS CLOSED-GRASSLAND

Emergents

Trees and Shrubs from surrounding forests.

Shrubs peculiar to this grassland include;

Callistemon linearis D.C.
Gomphocarpus fruiticosus (L) R. Br. *

Ground Cover

Themeda australis (R. Br.) Stapf.
Poa sp. L.
Chloris gayana Kunth.
Danthonia sp. D.C.
Paspalum dilatatum Poir
Imperata cylindrica (L) Beauv.
Chielanthes sp. Sw.
Lomandra sp. Labill
Epacris sp. Cav.
Dianella caerulea Sims
Dianella sp. Lam
Hardenbergia violacea (Schneev.) Stearn
Aotus ericoides (Vent.) G. Don
Pomax umbellata (Gaertn.) Soland
Pratia purpurascens (R. Br.)
Datura sp. L.
Imperata cylindrica (L) Beauv.
Wahlenbergia gracilis Carolin.
Cirsium vulgare (Savi) Ten.
Goodenia heterophylla Sm.
Correa alba Andr.
Platylobium formosum Sm.
Plantago lanceolata L.
Trachymene incisa Rudge
Marrubium vulgare L. *
Solvia pterosperma (Juss.) Less. *
Senecio vulgaris L.
Stylidium graminifolium Swartz ex Willd.
Rubus parvifolius L.
Carex inversa R. Br.
Citriobatus pauciflorus A. Cunn. ex Ettingsh.
Viola caleyana G. Don.
Echium lycopsis L.
Convolvulus erubescens Sims
Cotula australis (Sieb. ex Spreng.) Hook. f.
Anagalis arvensis L. *

* Introduced Species.

APPENDIX 6

APPENDIX 6

BIRD SPECIES

Common Name	Systematic Name	Open-forest	Closed-forest
ANATIDAE			
Black Duck	Anas superciliosa	U	
ACCIPITRIDAE			
Wedge-tailed Eagle	Aquila audax	U	
PHASIANIDAE			
Stubble Quail B	Coturnix pectoralis	C	
COLUMBIDAE			
Brown Pigeon	Macropygia amboinensis		U
Crested Pigeon	Ocyphaps lophotes	C	
CACATUIDAE			
Galah	Cacatua roseicapilla	C	
POLYTELITIDAE			
King Parrot	Alisterus scapularis		U
PLATYCERCIDAE			
Eastern Rosella B	Platycerus eximius	C	
CUCULIDAE			
Fan-tailed Cuckoo	Cuculus pyrrhophanus	C	C
CAPRIMULGIDAE			
White-throated Nightjar B	Caprimulgus mystacalis	U	
ALCEDINIDAE			
Laughing Kookaburra	Dacelo gigas	C	
CAMPEPHAGIDAE			
Black-faced Cuckoo-Shrike	Coracina novaehollandiae	C	
Cicada Bird	C. tenuirostris	C	C

APPENDIX 6 (CONT)

BIRD SPECIES

Common Name	Systematic Name	Open-forest	Closed-forest
MUSCICAPIDAE			
Eastern Yellow Robin	Eopsaltria australis		U
Jacky Winter	Microeca leucophaea	U	
Rufous Whistler	Pachycephala rufiventris	U	
Golden Whistler	P. pectoralis	U	
Satin Flycatcher	Myiagra cyanoleuca	O	
Rufous Fantail	Rhipidura rufifrons		C
Grey Fantail	R. fuliginosa	C	
Willie Wagtail	R. leucophrys	U	
ORTHONYCHIDAE			
Eastern Whipbird	Psophodes olivaceus		C
TIMALIIDAE			
Grey-crowned Babbler	Pomatostomus temporalis	C	
MALURIDAE			
Variegated Wren	Malurus lamberti	C	C
ACANTHIZIDAE			
White-browed Scrub Wren	Sericornis frontalis		C
Speckled Warbler	S. sagittatus	C	
Brown Thornbill	Acanthiza pusilla	C	
Striated Thornbill	A. lineata	C	U
Yellow Thornbill	A. nana	C	
CLIMACTERIDAE			
White-throated Treecreeper	Climacteris leucophaea	U	C
MELIPHAGIDAE			
Red Wattlebird	Anthochaera carunculata		U
Noisy Friar Bird	Philemon corniculatus	U	
Bell Miner	Manorina melanophrys		C
Noisy Miner	M. melanocephala	C	
Lewin's Honeyeater	Meliphaga lewinii	U	
Eastern Spinebill	Acanthorhynchus tenuirostris		
Yellow-faced Honeyeater	Lichenostomus chrysops		

APPENDIX 6 (CONT)

BIRD SPECIES

Common Name	Systematic Name	Open-forest	Closed-forest
PARDALOTIDAE			
Spotted Pardalote	**Pardalotus punctatus**	C	
ZOSTEROPIDAE			
Silvereye	**Zosterops lateralis**	C	
PLOCEIDAE			
Red-browed Firetail	**Emblema temporalis**	C	C
Double-barred Finch	**Poephila bichenovii**	C	
CORCORACIDAE			
White-winged Chough	**Corcorax melanor-hamphus**	C	
ARTAMIDAE			
White-browed Wood Swallow	**Artamus superciliosus**	U	U
CRACTICIDAE			
Grey Butcherbird	**Cracticus torquatus**	U	
Pied Butcherbird	**C. nigrogularis**	U	
Australian Magpie	**Gymnorhina tibicen**	C	
Pied Currawong	**Strepera graculina**	U	
CORVIDAE			
Little Raven	**Corvus mellori**	C	

C - Common, observed on more than one occasion, or in large numbers
U - Uncommon, observed on one occasion only
O - One individual only sighted
B - Observed breeding within the study area

APPENDIX 7

APPENDIX 7

AN ARCHAEOLOGICAL SURVEY OF A PROPOSED GRAVEL EXTRACTION SITE NEAR SEAHAM, NSW

Ms S. Greer & Dr H. Brayshaw
Consulting Archaeologists

June 1983

Report prepared for Resource Planning - Belmont NSW

1. INTRODUCTION

On the 2nd June 1983, an archaeological survey was carried out on the site of a proposed quarry development, some 5km west north west of Seaham, NSW. The survey was commissioned by Resource Planning of Belmont, on behalf of the Hunter Valley Mining Corporation Pty Ltd. The proposed project involves quarrying of a ridge, and the construction of a plant on the adjacent flat land.

Plans for the development indicate that the total area of flat land will be utilized. The initial extraction area would be located on the lower slopes, however the quarry would eventually extend over the whole ridge.

The aims of the survey were to locate and record archaeological sites within the survey area, to assess significance within the local and regional context, and to make recommendations concerning their management.

Constraints on the survey included wet conditions and in some places, poor ground surface visibility.

2. BACKGROUND INFORMATION

Description of the Survey Area

The survey area is approximately 650m long and 550m wide. It consists of a small ridge in the northern half, a small spur in the south west corner, and an area of flat land in the south east. Small creeks run down the slopes of the ridges and onto the flat land. Deadman's Creek - a larger and more permanent water source - is located near the northern boundary.

The survey area falls within Permian coal measures, with rock types including shale, mudstone, sandstone, tuff and coal. On the surface, several large flat sandstone slabs were observed, and sandstone and shale rubble litters the top of the ridge and its slopes. Soils in the area consist of a yellow clayey loam top soil with underlying clay.

Vegetation consists of medium sized eucalypts, with a dense lower story of shrubs and bushes in places (for example on the ridge top). Casuarina, Melaleuca and wattle were also observed. The pattern of vegetation is uniform throughout.

In the past, this area was cleared and possibly logged, and used for grazing. In addition, dams have been constructed, tracks have been graded with bulldozers, and in one location on the eastern side, rock has been blasted. Extensive modification of the landscape has taken place, and it is estimated that 50% of the survey area has been disturbed as a result of these activities.

Previous Archaeological Investigations

Only a small number of archaeological surveys have been carried out in the region. Brayshaw (1979) surveyed the route of the natural gas pipeline between Sydney and Newcastle. She located a large open site south of the present survey area (Minmi Road Open Site - NPWS Site Register No 38-4-70). Artefacts of chert and silcrete were found along the top of a ridge. In 1981, Brayshaw investigated the area of the proposed Wallsend Borehole Colliery extension. No sites were found in this survey. In 1982, she conducted a survey

at Maryland, near Wallsend. Artefacts were found at three locations during this survey and consist of:

- an isolated find - one broken flaked piece of red banded chert,
- an open site - one broken flaked piece of siltstone and one silcrete core,
- an open site - several hundred artefacts (mainly flakes and cores) of fine-grained silicious material.

The isolated find and artefacts from the small open site were collected and have been lodged with the Australian Museum. It was recommended that the large open site be retained without further disturbance.

North of the survey area, Brayshaw (1981) investigated the proposed site of the Tomago Aluminium shelter near Hexham. She found no evidence of Aboriginal occupation or activity in the area, with the exception of a dead tree showing a large scar. Dallas and Greer (1983) have also conducted a survey at Wallaroo. No archaeological sites were located in this investigation.

Summary

There have been few archaeological investigations in the region. However given the current state of information, one might anticipate open sites - artefact scatters - particularly on ridge tops and near creeks. Raw materials for artefacts could include chert, silcrete and other fine-grained silicious stone. In addition, it was felt that scarred trees might be found.

3. ARCHAEOLOGICAL INFORMATION

Survey Methods

Methods employed in the survey were:

- close inspection of tracks and other exposed areas
- inspection of creek banks
- examination of sandstone slabs for axe-grinding grooves and engravings
- clearing of leaf litter at intervals in areas where it inhibited ground surface visibility
- and the inspection of trees of sufficient age which might show evidence of Aboriginal scarring.

The survey area was thoroughly investigated, though special attention was given to less disturbed areas (e.g. the ridge top).

Results

No archaeological sites were found during the investigation. The lack of sites may be partially explained in terms of the amount of disturbance within the area. Small artefact scatters often consist of only a few artefacts and such sites are vulnerable in terms of extensive landscape modification. Given the disturbance in this area, some sites may have been destroyed in the past.

Poor ground surface visibility was another factor inhibiting the location of archaeological sites, however measures were taken to alleviate this problem, and these should indicate the general pattern of sites found in the area.

4. ABORIGINAL INTEREST IN THE AREA

Messrs P. Haslam, T. Sails and H. Sails, representatives of the Central Coast Aboriginal Sites Protection Committee have inspected the survey area. A report is being prepared by them and will be forwarded.

During discussions on site, the representatives indicated that they have no objection to the proposed development.

5. CONCLUSIONS AND RECOMMENDATIONS

The survey results indicate that there are no archaeological constraints on the proposed development. However, it is recommended that the Central Region Archaeologist, National Parks and Wildlife Service be immediately informed if sites are exposed during operations.

BIBLIOGRAPHY

Prayshaw, H. 1979 Archaeological Survey of the route of the Natural Gas Pipeline between Sydney and Newcastle NPWS

— 1981 Archaeological survey of Wallsend Borehole Colliery Extension NPWS

— 1981 Archaeological survey of proposed site of Tomago Aluminium smelter near Hexham, NSW NPWS

— 1982 Archaeological survey at Maryland, near Wallsend NPWS

Dallas, M. & S. Greer 1983 An archaeological survey of a proposed land fill waste disposal facility at Wallaroo, NSW

APPENDIX 8

APPENDIX 8

NOISE INVESTIGATION DATA

A. NOISE MEASUREMENT EQUIPMENT

Manufacturer	Type	Model	Serial Number
Bruel and Kjaer	Integrating Sound Level Meter	2225	851244
Bruel and Kjaer	Prepolarising Condenser Microphone	4175	852022
Bruel and Kjaer	3m Extension Cable	AO 0185	
Bruel and Kjaer	Sound Level Calibrator	4230	861507

B. METEOROLOGICAL CONDITIONS

Date: 26th April, 1983

Site	Start Time	Cloud Cover (1/8 Parts)	Temp (°C)	Wind Speed (km/hr)	Wind Direction
N1	6.15am	7	14	9	N
N2	6.30am	6	15	9	N
N3	6.45am	7	15	5	N
N4	7.10am	7	16	5	N

APPENDIX 9

APPENDIX 9

SOCIAL AND ECONOMIC DATA

TABLE A1

POPULATION OF PORT STEPHENS SHIRE

AND COMPARISON AREAS: 1971 TO 1981

Area	Years		
	1971	1976	1981
Port Stephens Shire	17,734	21,650	28,650
Maitland Municipality	31,051	37,450	41,250
Newcastle Statistical District	351,536	379,950	402,250
Hunter Statistical Division	405,573	441,400	472,850
New South Wales	4,601,180	4,914,300	5,237,050

Source: **Handbook of Local Statistics New South Wales** various issues A.B.S. (N.S.W. Office)

TABLE A2

AVERAGE ANNUAL COMPOUND RATE OF GROWTH

IN POPULATION FOR PORT STEPHENS SHIRE

AND COMPARISON AREAS: 1971 TO 1981

		Years	
Area	1971-81	1971-76	1976-81
Port Stephens Shire	4.8	4.0	5.7
Maitland Municipality	2.9	3.8	2.0
Newcastle Statistical District	1.3	1.6	1.2
Hunter Statistical Division	1.6	1.8	1.4
New South Wales	1.3	1.4	1.2

Note: These figures are derived from the information in **Table A1** and do not always correspond with published values. The discrepancy arises basically because of changes in the 1971 and 1976 census figures through re-evaluation

Source: **Derived from Table A1.**

TABLE A3

AGE DISTRIBUTION OF PORT STEPHENS SHIRE:

30TH JUNE, 1976 AND 30TH JUNE, 1981

Age Group	Year 1976 Per Cent	1981 Per Cent
0-4	10.5	8.8
5-14	19.0	18.1
15-19	7.8	7.5
20-64	54.6	56.1
65+	8.2	9.5
TOTAL	100.0	100.0

Source: **1981 Census:** Characteristics of Persons and Dwellings in Local Government Areas, N.S.W. Part 1: Sydney Hunter and Illawarra Statistical Division A.B.S. (New South Wales Office.)
Handbook of Local Statistics 1979 A.B.S. (New South Wales Office).

TABLE A4
AGRICULTURAL ACTIVITY WITHIN PORT STEPHENS SHIRE

	Years					
	1974-75	1975-76	1976-77	1977-78	1978-79	1980-81
Agricultural Holdings	493	373	228	201	200	233
Total Area (Hectares)	34,593	34,089	25,572	22,493	22,762	21,268
Crops: Area (hectares)						
Crops and Grasses cut for Hay	1,250	1,006	915	969	1,158	N/A
Other Cereals (grain)	286	141	175	139	156	N/A
Oats (grain)	-	36	-	-	2	N/A
Fruit	36	35	29	31	34	N/A
Other	-	-	-	19	49	N/A
TOTAL	1,572	1,218	1,119	1,158	1,399	
Crops: Production (tonnes)						
Hay (Cereal, lucerne, and grass)	5,658	3,924	3,064	2,684	3,753	2,910
Non-citrus orchard fruit	(7,266 Bushels)	133	96	161	100	101
Citris fruit	(3,060 Bushels)	80	35	43	70	72
Other Cereals (grain)	-	64	45	80	442	176
Other	(1,156 (Bushels)	36	-	24	96	7
TOTAL		4,237	3,240	2,992	4,461	3,266
Livestock and Livestock Products (Number) (at 31st March)	**1975**	**1976**	**1977**	**1978**	**1979**	**1981**
Cattle for Meat Production	11,294	11,606	8,492	7,349	6,458	7,231
Cattle for Milk Production	7,662	6,980	6,891	5,549	5,309	4,242
Pigs	1,149	705	1,314	1,413	1,026	1,026
Other	104	22	-	1,040	2	-
TOTAL	20,209	19,313	15,697	15,351	12,795	12,499
Predominant Agricultural Industries			**1976-77** Poultry for Meat Milk Cattle		**1977-78** Poultry for Meat Milk Cattle	

Source: As for Table A1.

TABLE A5

OCCUPATION OF THE LABOUR FORCE
PORT STEPHENS SHIRE AND COMPARISON AREAS:
30TH JUNE, 1981

	Port Stephens		Maitland	N.S.D.*	H.S.D.**	N.S.W.
Occupation	No.	%	%	%	%	%
Professional, Technical	986	9.0	11.7	12.6	12.0	13.5
Administrative etc.	426	3.9	3.3	3.6	3.6	5.0
Clerical Workers	1,197	10.9	13.4	13.4	12.8	18.0
Sales Workers	882	8.0	8.2	8.4	8.1	8.5
Farmers, Fishermen, etc.	695	6.3	3.4	1.7	4.2	5.3
Miners, Quarrymen, etc.	76	0.7	1.3	2.9	2.9	0.7
Transport, communication	453	4.1	5.5	5.0	5.0	4.9
Tradesmen etc.	3,311	30.1	39.0	36.8	35.3	28.6
Service, Sport, Recreation	955	8.7	7.0	8.4	8.4	8.3
Members Armed Services	1,295	11.8	1.0	1.1	1.4	1.0
Inadequately Described or Not Stated	730	6.6	6.3	6.0	6.3	6.3
TOTAL	11,006		100.0	100.0	100.0	100.0

Notes: * Newcastle Statistical District

** Hunter Statistical Division

Source: As for Table A4

TABLE A6
OCCUPATIONAL STATUS
PORT STEPHENS SHIRE AND COMPARISON AREAS:
30TH JUNE, 1981

	Port Stephens Shire		Maitland	N.S.D.*	H.S.D.**	N.S.W.
In the labour force	No.	%	%	%	%	%
-employed	11,005	38.9	41.2	40.7	40.8	43.5
-unemployed	713	2.5	1.9	2.5	2.5	2.6
Total Labour Force	11,718	41.4	43.1	43.2	43.3	46.1
Not in the labour force						
-aged 15 years and over	8,980	31.7	28.1	32.4	32.0	29.4
-aged less than 15 years	7,597	26.9	28.7	24.4	24.6	24.5
Total not in Labour Force	16,577	58.6	56.8	56.8	56.6	53.9
TOTAL	28,295	100.0	100.0	100.0	100.0	100.0

Note: * Newcastle Statistical District
** Hunter Statistical Division
Source: As for Table A4.

TABLE A7
UNEMPLOYMENT IN AUSTRALIA: 1970-1980

A. Registered Unemployed as a proportion of the Total Labour Force

	Per Cent
September 1970	0.9
August 1971	1.1
September 1972	1.6
September 1973	1.1
August 1974	1.8
June 1975	4.1
August 1976	4.5
August 1977	5.3
August 1978	6.1
August 1979	6.2
August 1980	6.2

B. Civilian Population Aged 15 years and over, Number Unemployed as a proportion of the Total Labour Force

	Per Cent
August 1970	1.4
August 1971	1.7
August 1972	2.5
August 1973	1.8
August 1974	2.4
August 1975	4.6
August 1976	4.7
August 1977	5.7
August 1978	6.2
August 1979	5.8
August 1980	5.9

Source: **Unemployment Benefit Recipients in Australia, 1970-1980: An Analysis.** Department of Social Security November 1981 (Table 2, Table 8C).

TABLE A8

CIVILIAN POPOLUATION AGED 15 TO 19 YEARS,
NUMBER UNEMPLOYED AS A PROPORTION OF THE TOTAL
15 TO 19 YEAR OLD LABOUR FORCE

	Per Cent
August 1970	3.2
August 1971	3.7
August 1972	5.8
August 1973	4.7
August 1974	5.8
August 1975	12.9
August 1976	14.2
August 1977	18.0
August 1978	16.8
August 1979	17.4
August 1980	16.7

Source: As for Table A7

TABLE A9

BUILDING STATISTICS FOR PORT STEPHENS SHIRE

Stock of Dwellings

1971	6,061	1977	8,417
1972	6,401	1978	8,897
1973	6,725	1979	9,339
1974	7,208		
1975	7,740		
1976	8,154		

Census Data	30th June, 1976 No.	Per Cent	30th June, 1981
Private Occupied Dwellings	6,080		8,525
Non-Private Occupied Dwellings	40		N/A
Total Occupied Dwellings	6,120		N/A
Unoccupied Dwellings	2,034	24.9 (9.1% Hunter)	2,607
Total Dwellings	8,154		N/A
Persons per Occupied Dwelling	3.4		N/A

Total Number of New Dwellings Completed

	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81*
New Houses	383	373	415	421	511	840
Total Dwellings	435	471	507	494	710	1,110

Note: * Refers to commenced dwellings only.

Source: As for Table A1 plus
Building N.S.W. 1979-80 (A.B.S. (N.S.W. Office))
Building N.S.W. 1981-82 (A.B.S. (N.S.W. Office))

TABLE A10

VALUE OF BUILDING JOBS APPROVED IN PORT STEPHENS SHIRE AND COMPARISON AREAS, DECEMBER 1982 ($000)

Area	New Dwellings			Alterations (a) and Additions	Other Building Jobs (b)	Total
	Houses Value	Other Dwellings Per Cent				
Port Stephens Shire	713	62.1	156	71	208	1,148
Maitland Municipality	1,883	46.4	-	98	2,077	4,059
Newcastle Statistical District	6,558	44.0	856	1,371	6,135	14,920
Hunter Statistical Division	9,623	48.6	1,214	1,595	7,354	19,787
New South Wales	76,773	30.9	20,650	25,769	124,880	248,063

Notes: (a) Alterations and additions to dwellings valued at $10,000 or more

(b) Includes alterations and additions valued at $10,000 or more

Source: Building N.S.W. 1981-82. A.B.S. (N.S.W. Office).

HUNTER VALLEY MINING CORPORATION PTY EIS
230
Hard Rock quarry and processing a
plant at Brandy Hill

HUNTER VALLEY MINING CORPORATION PTY

EIS
230
a

Hard Rock quarry and processing plant at Brandy Hill

Borrower's name	Date	Ext

RAECO