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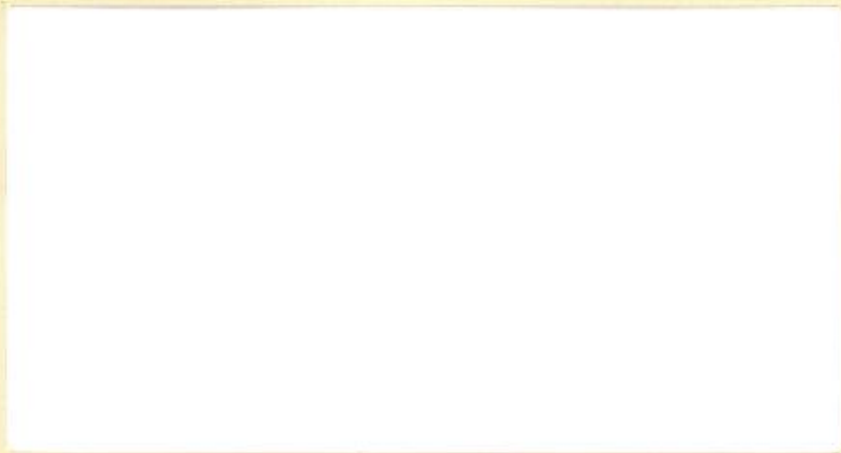
AB019496

Environmental impact statement for hard rock quarry "Langley
Heights" Oberon, N.S.W.

NSW DEPT PRIMARY INDUSTRIES



AB019496



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OBERON QUARRIES PTY LIMITED.

ENVIRONMENTAL IMPACT
STATEMENT FOR
HARD ROCK QUARRY
"LANGLEY HEIGHTS"
OBERON, N.S.W.

PREPARED BY:

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SUMMARY

1.0 SUMMARY

Oberon Quarries Pty Limited seek to establish a hard rock quarry on "Langley Heights" approximately 4km south of Oberon in the Central Tablelands. Development Consent is sought to extract and crush approximately 9 million tonnes of basalt over the life of the quarry. It is proposed to produce initially 100,000 tonnes of product per year. Once the plant is fully established, production is expected to increase to an average of approximately 200,000 tonnes giving the proposed development an expected life of in excess of 45 years. A full range of quarry products will include concrete aggregate, sealing aggregate, road base material, railway ballast and rip rap. Establishment of the quarry will provide a source of high quality quarry products to Oberon and surrounding regions and will ensure that a source of high quality road construction material is available to Oberon Shire Council in both the short and long term.

The proposed quarry will be a drill and blast operation with blasting occurring approximately once every three to four weeks. Blasted material will be loaded with a front-end loader and transported by rear dump trucks from the quarry area to a series of crushers and screens that will reduce the size of raw feed to a selected range of product sizes. Both primary and secondary crushers are to be enclosed to minimise dust generation potential and noise emissions from the processing area. At peak production the quarry will produce approximately 2000 tonnes of material per day requiring approximately 80 laden truck movements (160 trips) to transport finished product to market destinations. This is expected to occur infrequently. At an annual production level of 200,000 tonnes, an average of approximately 30 truck movements per day will be required. Product will be transported via a sealed haul road that is to be constructed by Oberon Quarries Pty Limited to Shooters Hill Road. From there, product will be transported either via Jenolan Caves Road to Oberon and other market destinations in the Central Tablelands or will be transported east via Titania Road to markets in the Lithgow, Blue Mountains and western Sydney regions. Once Titania Road is upgraded, east bound product will be transported via Titania Road to avoid additional heavy transport travelling through Oberon township. Oberon Quarries will make a proportional contribution towards the upgrade of Titania Road.

It is intended to operate the proposed quarry between the hours of 7:00am and 6:00pm weekdays and 7:00am and 4:00pm on Saturdays. Product will be despatched between the hours of 6:00am and 10:00pm weekdays and 7:00am and 4:00pm Saturdays. The quarry will not operate on Sundays or Public Holidays. Quarry operations will employ up to 15 people full-time on-site and up to 20 truck drivers. Establishment of the quarry will also serve to strengthen Oberon's service industry base through generating a need for ongoing service industry support.

The quarry location has been chosen due to its proximity to the Main Road system potential for the establishment of suitable environmental control procedures and central demographic position in relation to Oberon Shire. Establishment of the quarry will be of significant benefit to the Oberon Shire Council through the provision of high quality road construction material at an economically competitive rate. As Oberon Shire traditionally spends up to 60% of rates revenue on road construction and maintenance, the availability of

competitively priced high quality material will indirectly benefit the community through facilitating more efficient expenditure of rate revenue.

Detailed baseline studies have indicated that no rare or endangered flora or fauna species will be threatened by the proposed development and no archaeological sites of scientific or educational significance will be disturbed by the proposed development.

A series of environmental controls have been incorporated into the design of the proposed quarry operation to minimise the impacts of the development on the visual amenity and water quality of Lake Oberon and on amenity and productivity of adjoining land uses. Environmental controls include:

- * Detailed sediment and erosion control measures designed to contain sediment laden runoff from a 1 in 50 year storm event and designed to convey runoff at non-erosive velocities.*
- * Measures to ensure maintenance of surface and groundwater quality and quantity.*
- * Series of noise attenuation measures including quarry design, enclosure of crushers and choice of equipment.*
- * Appropriate drilling and blast design.*
- * Site screening proposals to screen the development from adjoining residences and local vantage points.*
- * Dust control measures including enclosure of crushers, sealing of haul roads and maintenance of the remaining trafficked areas in a moist condition.*
- * Monitoring programmes designed to assess the performance of the proposed environmental control procedures.*

The regional importance of Lake Oberon as a water supply and its local importance in terms of recreation and tourism have been taken into account in locating and designing the proposed quarry operations.

Assessment of the various components of the development indicate that it will not have a significant negative impact on the amenity of the area or on the socio-economic base of the Oberon community.

INTRODUCTION

2.0 INTRODUCTION

2.1 OBJECTIVES AND OUTLINE OF THE DEVELOPMENT

Oberon Quarries Pty Limited seeks development consent from Oberon Shire Council to extract and process basalt from a site 4km south of Oberon from an area known as Racecourse Hill on the property of "Langley Heights". The location of the proposed quarry site is shown on **Figure 1**.

As the proposal is a "designated development" within the meaning of the Environmental Planning and Assessment Act 1979 and Regulations 1980, the development application must be accompanied by an Environmental Impact Statement. Resource Planning Pty Limited has been commissioned by Oberon Quarries Pty Limited to prepare the statement on its behalf. Oberon Quarries Pty Limited will hereafter be referred to as the Company.

The proposed quarry, processing plant and haul road will be located on property which is in private ownership. The land subject to the proposed development is described as part of Portions 107, 108, 109, 110, 111, 213, and Lot A, DP 386067, Parish of Norway in the Shire of Oberon. The development site will be subdivided from the remainder of "Langley Heights".

The Company proposes to produce an average of approximately 200,000 tonnes per annum of quarry product to supply construction materials including concrete aggregate, road base and road sealing aggregate, and railway ballast to the Central Tablelands region, the Blue Mountains and Sydney's western sector.

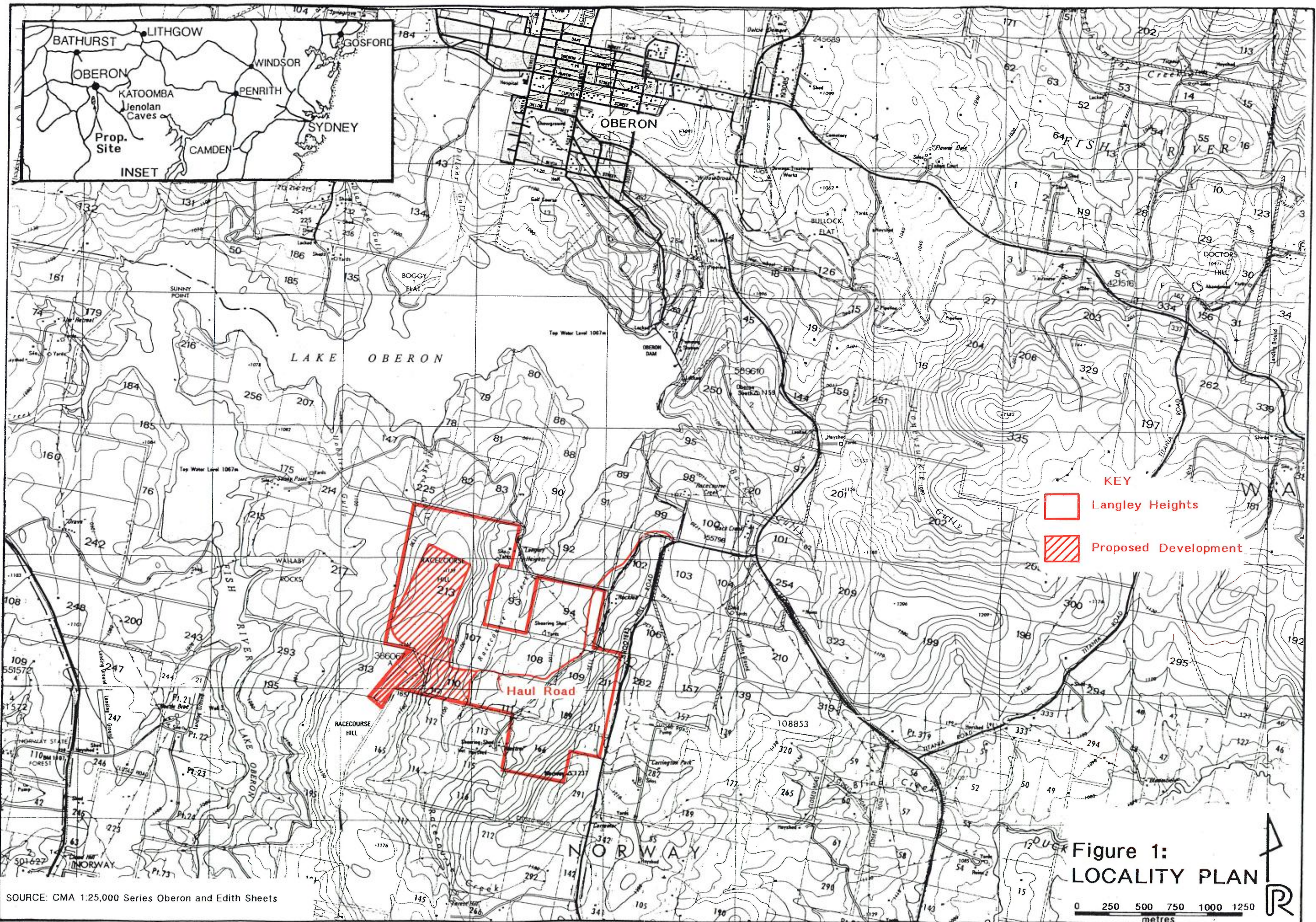
Basalt will be quarried using a drill and blast technique and then loaded into rubber tyred heavy duty off road trucks using a front end loader. The raw stone will pass through a series of crushers and screens to produce various size ranges and then be stockpiled before being transporting from the site.

The finished product will be hauled from site via Shooters Hill Road to Jenolan Caves Road. Trucks will travel north on Jenolan Caves road to Oberon and the Central West or south and then east on Titania Road to Lithgow, the Blue Mountains and Western Sydney.

The objective of the proposal is to establish a modern and effective processing operation to provide high quality quarry products to Oberon and surrounding regions. The Company proposes to utilise 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.

2.2 LAYOUT OF THE IMPACT STATEMENT

The Environmental Impact Statement has been prepared in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation 1980. The Director of the New South Wales Department of Planning was consulted as to the required form and content, and these requirements have been taken into account in preparation of the statement. **Appendix 1** presents



KEY

- Langley Heights
- Proposed Development

**Figure 1:
LOCALITY PLAN**

0 250 500 750 1000 1250 metres

SOURCE: CMA 1:25,000 Series Oberon and Edith Sheets

the requirements of the Department with respect to the proposed development.

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 sections 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 the layout adopted for the impact statement.

SECTION 1.0 SUMMARY

Section 1.0 summarises the findings of the environmental investigations.

SECTION 2.0 INTRODUCTION

The introduction presents the objectives and brief outline of the proposed development as required by **Clause 34(b)** of the Regulations. The layout of the statement and authorities consulted are presented.

SECTION 3.0 JUSTIFICATION FOR THE PROPOSED DEVELOPMENT

This section outlines uses and demand for quarry products in the region and the justification for the development in terms of environmental, economic and social considerations as required by **Clause 34(f)** of the Regulations.

SECTION 4.0 REVIEW OF ALTERNATIVES

This section describes the alternatives to the proposed development as required under **Clauses 34(h)** and **34(i)** of the Regulations. Alternatives considered are alternative materials, alternative sources, alternative haul routes, 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 and layout of the extractive operations and processing plant and in the design of the environmental management procedures. This information is essential 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. (**Clause 34(c)** of the Regulations).

Detailed supporting information are attached as appendices to the document.

SECTION 6.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

This section provides full details of the proposed development including methods and plans of the extractive operation, extraction rates, plant components, machinery, facilities, working hours, haul roads and workforce as required by **Clause 34(a)** of the Regulations.

SECTION 7.0 ENVIRONMENTAL MANAGEMENT PROCEDURES

This section describes the environmental management procedures to be incorporated into the project to protect the environment or mitigate adverse impacts on the environment of the site (**Clause 34(g)** of the Regulations). These include measures for the control of dust, noise, water quality, visual amenity, and energy, (**Clause 34(g1)** of the Regulations).

SECTION 8.0 ANALYSIS OF ENVIRONMENTAL INTERACTIONS AND IMPACTS

This section examines the effectiveness of the measures outlined in **Section 7.0** to protect the environment and provides an assessment of the residual environmental effects. Both adverse and beneficial effects are described in accordance with **Clauses 34(d)** and **34(e)** of the Regulations.

The reader should note that **Sections 2.0** to **7.0** and appendices provide the basic data to be considered in the assessment of impacts.

2.3 AUTHORITY CONSULTATION

During preparation of the environmental impact statement a number of State and local authorities were contacted by telephone and/or letter. Below is a list of the authorities and organisations consulted and from whom information was obtained. From the written responses presented in **Appendix 1**, a summary has been prepared of requirements of the respective authorities and organisation. The sections of the document in which each requirement has been addressed is also noted.

Oberon Shire Council

- * Consult with the Director of Planning (**Section 2.3** and **Appendix 1**).
- * Consult with the Department of Public Works (**Section 2.3** and **Appendix 1**).

Department of Planning

- * Proposals for site rehabilitation (**Section 7.7**).
- * Assessment and mitigation of impact on Lake Oberon and surrounding catchment including erosion, siltation and water quality (**Sections 7.1, 7.2, 8.3, and 8.4**).
- * Blasting impacts on the dam wall (**Section 8.7** and **Appendix 7**).
- * Visual impact (**Section 8.9**).
- * Assessment of noise and blasting impact on neighbouring properties (**Sections 8.6** and **8.7**).
- * Assessment and mitigation of dust impacts (**Sections 7.4** and **8.5**).

- * Mitigation of traffic impact on and off the site (**Section 7.6**).
- * Consultation with:
 - Public Works Department (**Section 2.3** and **Appendix 1**).
 - Department of Agriculture (**Section 2.3** and **Appendix 1**).
 - Environment Protection Authority (**Section 2.3** and **Appendix 1**).
 - Soil Conservation Service (**Section 2.3** and **Appendix 1**).

Environment Protection Authority

- * Base line and background levels for air, noise and water quality (**Section 5.0**).
 - Air:
 - Dust suppression on roads and stockpiles (**Section 7.4**).
 - Dust generation from blasting and drilling (**Appendix 9**).
 - Emissions from fuel burning equipment (**Section 7.4**).
 - Noise:
 - Boundary noise levels of 45 dBA from 7am to 7pm, 40dBA from 7pm to 10pm and 35 dBA from 10pm to 7am (**Section 8.6.1**).
 - Noise assessment (**Section 8.6.1**).
 - Blasting criteria (**Section 8.7** and **Appendix 7**).
 - Water:
 - Site discharge water quality (**Section 8.3.2**).
 - 1 in 50 year storm retention (**Section 7.1** and **7.2**).
- * Protection of the local water supply (**Sections 7.1** and **7.2**).
- * Impact on neighbouring properties (**Sections 8.5, 8.6, 8.7, 8.8, 8.9, and 8.10**).

Public Works Department – Fish River Water Supply

- * Alternate sites (**Section 4.2**).
- * Storage dam contamination from suspended solids, sewage, fuel and oil spills and ammonium nitrate from blasting (**Sections 8.3.2** and **8.4**).
- * Compliance with the Clean Water Act and Environment Protection Authority requirements on dust mitigation and noise (**Sections 8.3, 8.5 and 8.6**).
- * Maximum peak particle velocity not to exceed 10mm/sec at the dam wall (**Section 8.7** and **Appendix 7**).

National Parks and Wildlife Service

- * Identification of, and effect on, flora and fauna particularly any rare, threatened or endemic species (**Section 8.8** and **Appendix 5**).
- * Effect on wildlife corridors (**Section 8.8** and **Appendix 5**).
- * Survey of Aboriginal sites (**Section 8.10** and **Appendix 6**).

- * Restoration and revegetation using endemic species (**Section 7.7** and **Appendix 8**).
- * Impact on stream biota (**Section 8.8**).
- * Impact on geology, soils, landscape and recreational values (**Sections 8.2, 8.1, and 8.11**).
- * Alternate sites and haul routes (**Section 4.2** and **4.3**).

Department of Fisheries

- * Issues raised in the Freshwater Habitat Management Guidelines (**Sections 5.0, 7.0, and 8.0**).
- * Control of surface water run-off and sediment control (**Section 7.1** and **7.2**).

Department of Conservation and Lands Management – Soil Conservation Service

- * Site development, quarrying and rehabilitation (**Sections 6.0** and **7.7**).

Department of Conservation and Lands Management – Department of Lands

- * Continuity of legal access via Crown roads (**Section 8.13**).

Department of Agriculture

- * Impact on efficient grazing management and grazing areas (**Section 8.12**).
- * Sedimentation of Racecourse Creek, Hodges Gully and Hobbies Gully (**Section 8.3.3**).
- * Lake Oberon water quality (**Section 8.3.2**).
- * Impact of noise and dust on pastures and animals (**Sections 8.5** and **8.6**).
- * Visual impact and property values (**Sections 8.9** and **8.12**).
- * Impact on ground water quality (**Section 8.3.2**).
- * Rehabilitation plan for the disturbed areas (**Section 7.7**).

Department of Water Resources

- * Refer to:
 - "A Guide to Stream Channel Management"
 - "The 7 Step Method of Controlling Bank Erosion and Sediment Build up"
 - "General requirements for EIS's"

Roads and Traffic Authority

- * Address adjacent road networks and hierarchy (**Section 5.15** and **8.13**).
- * Proposals for improvement to the adjacent road network (**Section 7.6**).
- * Annual average daily traffic volumes and trends (**Section 5.15.2**).
- * Peak period traffic volume and intersection congestion (**Section 8.13**).
- * Impact on general traffic (**Section 8.13**).
- * Safety and efficiency of site access, internal roads and services, and parking (**Section 8.14**).

Southern Mitchell Electricity

- * Power requirements and site of crushing plant (**Sections 6.7.1** and **6.4**).

Bathurst Rural Lands Protection Board

- * No objections.

Telecom

- * No written response.

2.4 PROJECT TEAM

The Environmental Impact Statement was prepared by Resource Planning Pty Limited, Geological and Environmental Consultants, Maitland, New South Wales. Personnel included in the project included:

Valerie Smith B.Sc.(Hons), M.Sc., Hort Cert.	-	Project Manager
Peter Jamieson B.E. (Civil)	-	Project Coordinator
	-	Liaison with Company, and Government agencies
	-	Hydrological Studies
	-	Report Writing
	-	Traffic Impacts
Greg Thomson B.App.Sc.(Geology)	-	Base-line Studies
	-	Geological Investigations
	-	Noise Impact Assessment
Tim Procter B.E. (Chem Eng)	-	Base-line Studies
	-	Environmental Investigations
	-	Report Writing

Barbara Crossley B.Nat.Res.(Hons)	-	Soil Investigations
	-	Report Writing
	-	Noise Impact Assessment
Matthew Barber B.A.(Hons)(Archaeology)	-	Archaeological Investigations
Naomi Buchhorn B.Sc.(Hons)(Biology)	-	Flora and Fauna Survey
Megan Dewsnap B.Land Arch.	-	Visual Assessment and Impact
Nigel Holmes & Assoc.	-	Dust Impact Assessment

JUSTIFICATION FOR
THE DEVELOPMENT

3.0 JUSTIFICATION OF THE PROPOSED DEVELOPMENT

3.1 ECONOMIC CONSIDERATIONS

3.1.1 Use of Quarry Products

Hard rock aggregate is used as a raw material in the building industry for specific purposes such as high strength concrete, road base and sealing aggregate, railway ballast and concrete sleepers, rip rap and gabion material for sediment and erosion control. On average approximately 5.7 tonnes of quarry products are used per head of population per year.

An assessment of the basalt from the proposed quarry site indicates that, when processed, the rock will produce aggregate of the highest quality and will be suitable for use as concrete aggregate, railway ballast, road base material and road sealing aggregate. The quality of the aggregate must comply with the relevant specifications and standards set by the Roads and Traffic Authority and the Standards Association of Australia.

3.1.2 Production

From the data compiled by the Statistical Branch of the Department of Mineral Resources for the Sydney Mining Division and Orange Mining Division the production rates of local producers of ridge and river gravel, and a range of processed and unprocessed rock has been extracted. These figures are given in **Table 3.1** for the 1987-88, 1988-89 and 1989-90 periods.

From **Table 3.1** it can be seen that there are no operating hard rock quarries operating in the Oberon Shire that are capable of supplying a complete range of high quality products suitable for construction purposes. Oberon Shire Council currently extracts gravel from two pits both of which have limited remaining gravel reserves. The Bathurst Mount ridge gravel pit was estimated in 1992 to have ridge gravel reserves of only 18,000 cubic metres. Richardson's Road granite pit was estimated in 1992 to have granite reserves of 116,000 cubic metres.

Test results from the Roads and Traffic Authority show that gravel from the Bathurst Mount pit is satisfactory for use as sub-base material but is not suitable as a base course material. Tests on material taken from Richardson's pit indicate that it only just complies with Roads and Traffic Authority's specifications for a number of tests and is considered a borderline material for use as base course. Material from both pits show signs of breaking down under compaction and is not considered to be of high quality. The use of materials such as these, although relatively expensive to procure, result in high ongoing costs in terms of annual road maintenance and shorter periods between reshaping or reconstructing. Disruption to the community and consequent reduction in productivity further add to the cost of using inferior road construction material.

**TABLE 3.1
GRAVEL AND ROCK PRODUCTION IN TONNES**

	1987-88			1988-89			1989-90		
	Hard Rock	Gravel Ridge	River	Hard Rock	Gravel Ridge	River	Hard Rock	Gravel Ridge	River
Local Government									
Oberon - Shire	-	75300	-	-	66200	-	-	50100	-
- Forestry	-	15300	-	-	38200	-	-	-	-
Lithgow - City	5900	8700	-	6400	5300	-	-	4100	-
- Forestry	-	5200	-	6300	-	-	-	20400	-
Blue Mountains - City	2000	-	-	2000	-	-	11200	-	-
Bathurst - City	-	149200	-	65600	-	-	21200	46100	-
Total Local Government Production	7900	253700	0	80300	109700	0	32400	230400	0
Private Producers									
Oberon - Readymix	-	-	23800	-	-	15000	-	-	15700
Lithgow - Marr./Metromix	35600	13700	-	35100	27400	-	74300	-	-
- Hyrock	181900	-	-	108200	-	-	138200	-	-
- Others	23300	-	-	8800	-	-	700	-	-
Blue Mountains - AJ Brown	40000	-	-	51400	-	-	43200	-	-
Bathurst - Pioneer	118700	-	-	203200	-	-	180000	-	-
- Others	-	-	9200	-	-	-	-	-	-
Total Private Production	399500	13700	33000	406700	27400	15000	436400	0	15700

CSR Readymix Private have a river gravel quarry in the Oberon district that predominantly supplies aggregate for concrete production.

The Greater Cities of Lithgow and Blue Mountains are supplied with processed marble and limestone from local suppliers. Bathurst City Council has advised that they have an adequate supply of ridge gravel for construction purposes and when required can obtain process hard rock from a local supplier.

Private companies in the Central Tablelands produce a range materials varying in both material type and quality. The only large supplier of processed hard rock is the Pioneer quarry in Bathurst.

3.1.3 Future Demand

Current ridge gravel and decomposed granite reserves within the Oberon Shire have been estimated to have a remaining life of eight years or less at current depressed rates of extraction from these pits. In the long term, to maintain the road network within the Shire it has been estimated that approximately 70,000m³ (approximately 120,000 tonnes) of sub-base and road base material is required per year. Increased levels of manufacturing in the Shire and consequent increased production and transport volumes will further increase road maintenance and upgrading requirements.

In addition to this there is ongoing construction of roads by the Forestry Commission, and proposed construction of a truck bypass for Oberon.

In the longer term demand for quarry products will include proposed major upgrading of roads such as Jenolan Caves Road and Main Road 256 to Goulburn and potential upgrading of the 24km Oberon to Tarana rail link. In addition to roads, expansion to the manufacturing base within Oberon will also increase demand for quarry products through construction and associated provision of housing.

On a regional basis it is envisaged that in the short and long term there is considerable potential to supply high quality quarry products to the Bathurst, Lithgow and Blue Mountains regions at a competitive rate.

Oberon Quarries Pty Limited also intend to supply high quality concrete aggregate to associated and independent concrete batching plants in the western Sydney region. It is envisaged that up to 70,000 tonnes of material per year may be supplied to the western Sydney market.

3.2 SOCIAL CONSIDERATIONS

The development of a hard rock quarry in the Oberon Shire by the Company will have a beneficial impact on the local community and economy of the shire.

Oberon Shire is mainly dependent on the forestry industry and associated manufacturing industries, local agriculture and the Shire council for employment. Transport of forest products, agricultural produce and manufacturing industry products is undertaken exclusively by road with resultant high volumes of heavy vehicles being common on the local and regional road network.

Oberon Quarries has a policy of employing local staff, where possible, and supporting local services, such as fuel suppliers, hard ware suppliers and engineering services. The proposed quarry development will provide employment for up to 15 full-time staff and during peak production up to 20 truck drivers. The proposed development will provide a significant diversification of industry in the Oberon Shire.

Indirectly the proposed development will provide employment for support services, business services and retail trades in Oberon.

The Shire Council's road building and maintenance programme will also benefit from the availability of high quality quarry products. The availability of a centrally located high quality road base material and sealing aggregate source within the Shire has the potential to significantly reduce the cost of road construction and upgrades and will improve the durability and life of roads through the provision of high quality material for road construction.

In a Shire such as Oberon where traditionally up to 60% of rates income is spent on roads, benefits accruing from establishing the proposed quarry in both the short and long term could be considerable.

As the proposed development site is screened from Lake Oberon and will be

operated in accordance with sound environmental practices, it is considered the development will have a negligible impact on the tourist amenity of the area. The use of heavy vehicles to transport quarry product will not be out of place with current accepted heavy traffic levels within the area.

3.3 ENVIRONMENTAL CONSIDERATIONS

The environmental issues raised by the Department of Planning, other Government agencies, and those required to be addressed under the Environmental Planning and Assessment Act, 1979 and Regulations, 1980, as summarised in **Section 2.3**, have been dealt with in this document.

Potential adverse environmental impacts on the natural and man made environments as a result of the proposed quarry development will be mitigated by the planning proposals, design and management procedures outlined in this environmental impact statement.

ALTERNATIVES

4.0 ALTERNATIVES

4.1 ALTERNATIVE MATERIALS

Alternative materials available for use as road sealing aggregate, road construction material and concrete aggregate include crushed granite, crushed limestone/marble, ridge gravel, river gravel and metallurgical slags.

Crushed granite, crushed limestone and marble, and ridge gravel are generally used as road base for road construction purposes. The lack of availability of ridge gravel in the Oberon Shire has precipitated the use of crushed granite as road base material. Crushed limestone and marble are available from Lithgow but would not be an economical source of road base material.

Crushed granite, crushed limestone and marble, and ridge gravel are not recommended for use as road sub-base material or road sealing aggregate. Sub-base material and road sealing aggregate are not readily available in the Oberon Shire and must be drawn from outside the area.

Marble and river gravel, when crushed and sized, are suitable for concrete aggregate. The concrete batching plant in Oberon uses its own source of crushed river gravel for use as concrete aggregate.

Metallurgical slag produced at the Port Kembla and Newcastle steelworks have been used to replace crushed stone aggregates in certain uses.

There are three main types of slag produced at Port Kembla and Newcastle: blast furnace rock slag, blast furnace granulated slag and steelmaking slag. Of these, the blast furnace rock slag and processed steelmaking slag has the highest potential to replace crushed stone aggregates in certain uses. The distance from the Port Kembla and Newcastle steelworks to the Central Tablelands area indicates that slag would not be an economically viable alternative to hard rock.

4.2 ALTERNATIVE SOURCES

As outlined in **Section 3.1.3** there are a number of private quarries in the Oberon, Bathurst, Lithgow and Blue Mountain Shires, but only one of these can presently supply the complete range of quarry products required for high quality construction purposes.

Pioneer Bathurst supply up to 180,000 tonnes per annum of high quality construction material into these Shires and to the Roads and Traffic Authority from their Orange Road quarry located north-east of Bathurst. The remainder of the material required for use as road base is drawn from quarries in the Lithgow and Blue Mountains regions with a small amount available in the Oberon region.

A review of alternative sources of hard rock was undertaken by Resource Planning in 1991. Of the hard rock deposits identified, those being comprised of basalt were preferred due to the range and quality of quarry products that can be

produced. A number of similar Tertiary Basalt deposits exist south of Oberon, as indicated on **Figure 2**. The Racecourse Hill deposit was chosen for development in preference to the other deposits due to accessibility of the deposit and the proximity of the road network and markets.

4.2.1 Importance and Significance of the New Quarry Site

As outlined above, there are few alternative sources of high quality aggregate in the area. Additional aggregate supplies are currently drawn from outside the area, and only one quarry supplies material suitable for road sealing aggregate and road sub-base material.

Drilling and geologically mapping undertaken at the site has identified in excess of 39 million tonnes of basalt on "Langley Heights". Approximately 9 million tonnes of this material has been identified as being able to be extracted with negligible environmental impact.

There is a need to establish a quarry in the area to meet projected demands of high quality construction material. The material available at Racecourse Hill has been identified as being of a high quality and suitable for concrete aggregate and road construction. Establishment of the proposed quarry will also ensure that the projected requirements for road and rail upgrading and Shires within the area can be fulfilled with high quality material and low transportation costs.

4.3 ALTERNATIVE HAUL ROUTES

An alternative haulage route was investigated for moving the product from the quarry site to Shooters Hill Road. This route included a steep incline of 11% before entering the Shooters Hill Road 1km south of the proposed haulage route entrance. The noise impact associated with truck movements out of the quarry site and steepness of the access road prohibited this alternative.

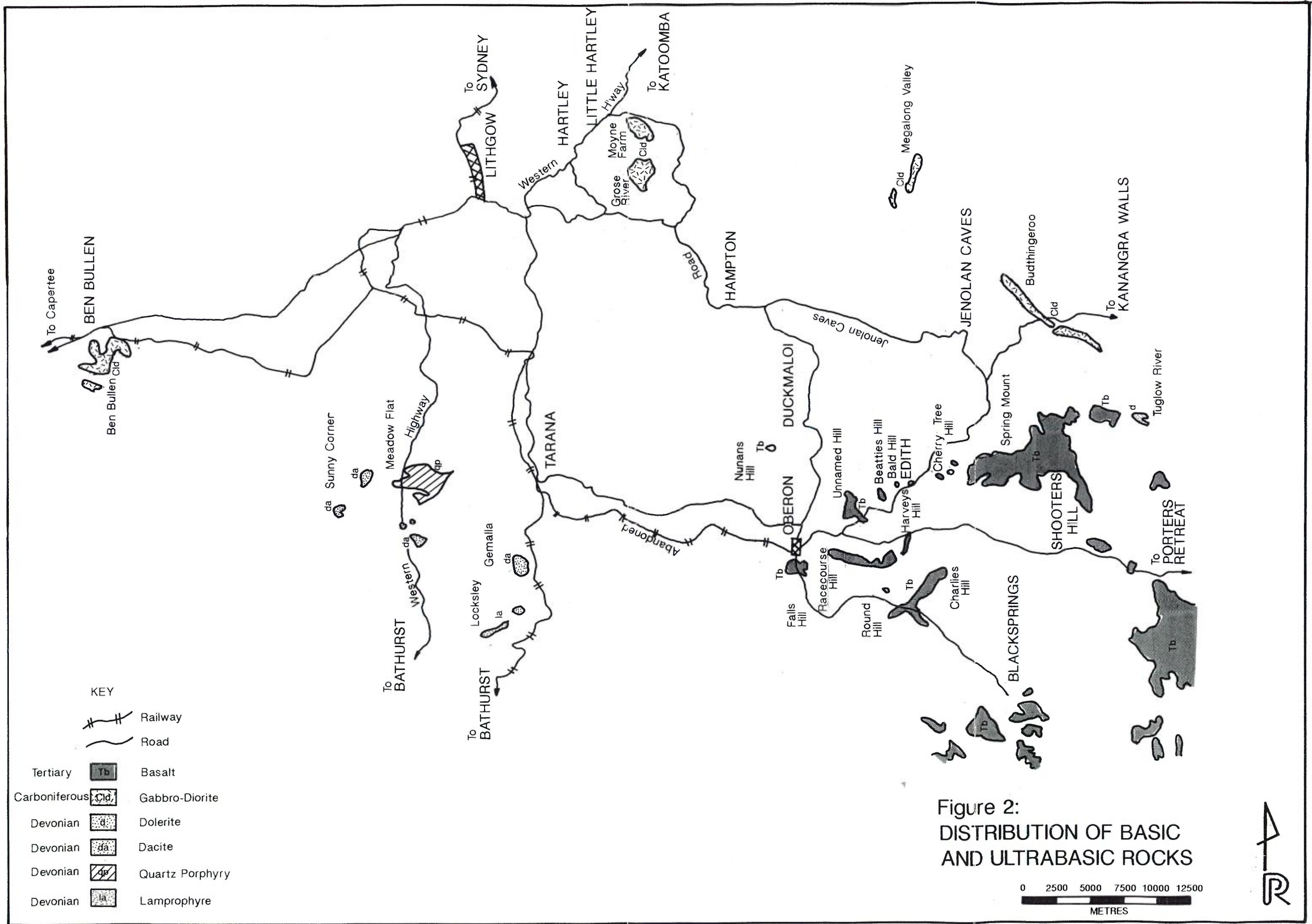
Originally it was intended to use the current alignment of Whalan's Lane which passes within approximately 50m of "Rocklea" homestead. Further site inspection identified a preferable alignment (see **Section 6.5.1**) approximately 75m to the west of the current alignment.

Two road haulage routes are proposed for transporting the product from the quarry site, north or south along the Jenolan Caves Road, to the respective markets. These haulage routes are detailed in **Section 6.5.1**.

4.4 ALTERNATIVE OF NOT PROCEEDING

The basalt deposit on Racecourse Hill has been assessed as highly suitable for use as concrete and sealing aggregate, roadbase material and rail ballast. The site is located in proximity to existing and projected markets and there are no significant environmental constraints to the development. If the development does not proceed then the opportunity will be lost to:

- a) Utilise a high quality local resource;



- b) Minimise cost of aggregate supply to the Oberon Shire due to the costs associated with current long distance transportation.
- c) Ensure high quality aggregate supply is available for road and railway upgrading and other future projects in the area.
- d) Minimise expenditure of public funds on current and proposed upgrading of the regions road network.
- e) Provide further diversification of the strong manufacturing base in Oberon Shire.

DESCRIPTION OF THE
EXISTING ENVIRONMENT

5.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

5.1 LOCATION

The proposed quarry and processing operations will be located on Portions 107, 108, 109, 110, 111, 213, and Lot A DP386067, Parish of Norway, Oberon Shire as shown on **Figure 1**. The site is located 4km south of Oberon and is accessed via Jenolan Caves Road and Shooters Hill Road.

5.2 LAND OWNERSHIP

The quarry, processing plant and haul road will be located on the property of "Langley Heights" (Portions 94, 107, 108, 109, 110, 111, 166, 211 and 213, and Lot A, DP386067, Parish of Norway) is freehold and is owned by B. Lang. Unformed Crown Road Reserves pass through the property as shown on **Figure 3**. The proposed development site will be subdivided from "Langley Heights" property.

Land ownership immediately surrounding the proposed development site is shown on **Figure 3**.

5.3 TOPOGRAPHY AND SLOPES

5.3.1 Topography

The development site occupies the northern end of Racecourse Hill with the processing area located on a natural bench on the eastern slopes of the hill. Racecourse Hill is an elongated flat top hill orientated approximately north-south.

The hill has a relief of 100m above Lake Oberon with a maximum elevation of 1167m AHD. The highest elevation of the surrounding section of the Tablelands is Norway Trig (1237m AHD) which is located 1.6km to the southeast of Racecourse Hill.

Racecourse Creek flows in a northeasterly direction into Lake Oberon forming a valley on the eastern side of Racecourse Hill. The eastern side of the valley rises up to 1190m AHD onto Shooters Hill Road.

The Fish River and Lake Oberon form a valley on the western side of Racecourse Hill. A number of gullies drain the northern and western sides of Racecourse Hill including Hodges Gully and Hobbies Gully.

5.3.2 Slopes

A slope analysis of Racecourse Hill on the property "Langley Heights" indicated 8 hectares of land steeper than 18° (**Figure 4**). Land with a slope greater than 18° is within the Soil Conservation Services Protected Land category. It is an offence to damage, cut down or destroy trees on land in excess of 18° gradient (Protected Lands) without an authority from the Catchment Areas Protection

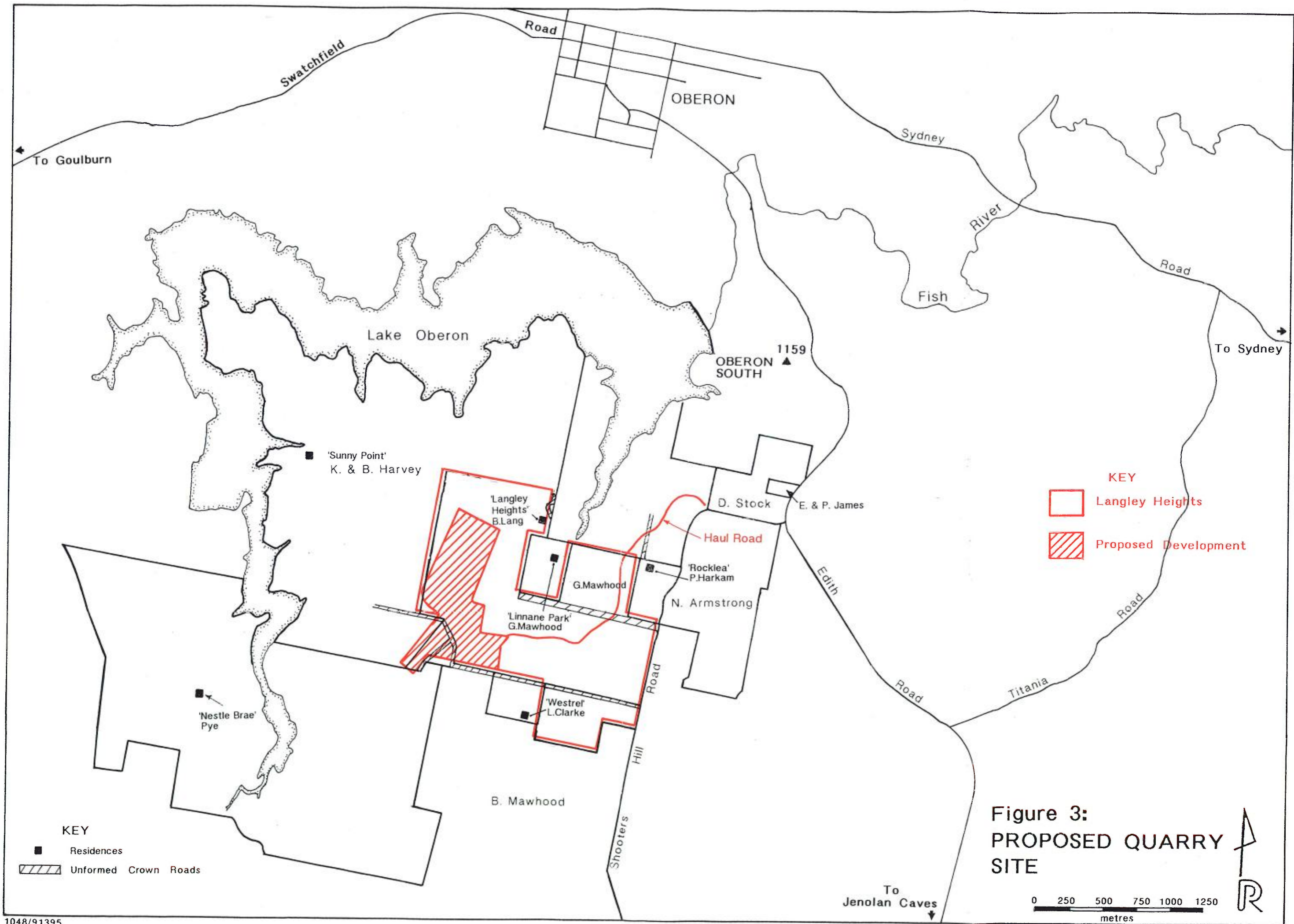


Figure 3:
PROPOSED QUARRY
SITE

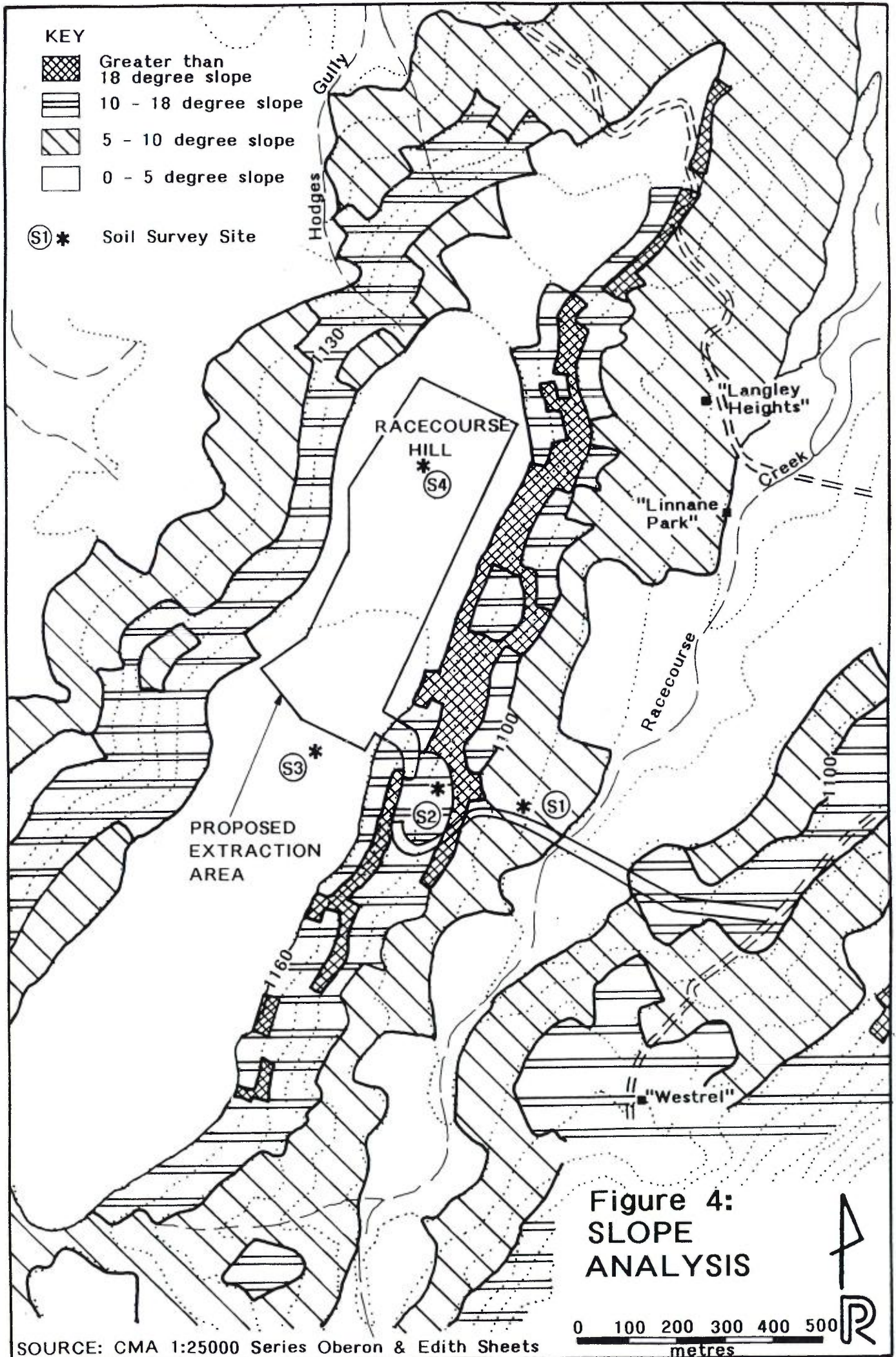
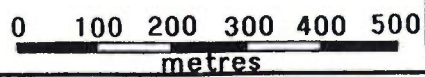


Figure 4:
SLOPE
ANALYSIS



Board. A licence will be sought from the Catchment Areas Protection Board prior to disturbance of Protected Lands on the site. The analyses also showed 21 hectares of land graded between 10° and 18°, with the lower slopes and top of the hill less than 10°.

5.4 SOILS

5.4.1 Previous Soil Mapping

The Soil Conservation Service has mapped soil landscapes of the area at a scale of 1:250,000 (Kovac, Lawrie, and Murphy, B.N. (1989)). The proposed quarry site is located within the Porters Retreat Soil Landscape described by Kovac and Lawrie (1990) as being dominated by Krasnozems (Gn 4.11, Gn 3.11, Dr 4.11) on mid to upper slopes, with chocolate soils (Gn 4.31) midslope, and red podzolic soils (Dr 2.11) and yellow solodic soils on lower slopes. General soil descriptions for this soil landscape unit given by Kovac and Lawrie (1990) are outlined below:

Krasnozems

Topsoil: Dark reddish brown to brown loam to fine sandy clay loam weak to moderate structure; pH 6.0–7.0; to 35cm depth.

Subsoil: Diffuse to clear change to dark reddish brown sandy clay to light clay with moderate structure pH 6.0–6.5.

Chocolate Soils

Topsoil: Brown loam, fine sandy with weak structure, pH 5.5, to 10cm depth.

Subsoil: Dark brown clay loam with moderate to strong structure, pH 5.5–6.0.

Kovac and Lawrie (1990) describe the Kraznozems as having low to moderate topsoil erodibility, moderate subsoil erodibility, moderate permeability, high available water-holding capacity, moderate shrink-swell potential and no mass movement hazard.

The proposed haul route, traversing "Langley Heights" on granitic parent material is mapped by Kovac, Lawrie and Murphy (1989) as part of the Lake Oberon Soil Landscape. Kovac and Lawrie (1990) describe this landscape as comprising the undulating low hills with granite boulders south of Oberon. Dominant soils are noted as yellow podzolic soils (Dy 4.21, Dy 3.41, Dy 2.21) and siliceous sands (Uc 4). A general soil description for the yellow podzolic soils within the landscape as described by Kovac and Lawrie (1990) is given below.

Yellow Podzolic Soils

Topsoil: Brown sandy loam with weak structure or single-grained, pH 5.5–6.5. A₂ horizon, may be bleached (dry) yellowish brown sandy loam, pH 6.0.

Subsoil: Clear to gradual change to yellowish brown sandy clay loam with

moderate structure, pH 5.0–6.0.

Kovac and Lawrie (1990) describe the yellow podzolic soils as being well drained, moderately permeable, low to moderate available water-holding capacity, moderate to high topsoil erodibility, low to moderate subsoil erodibility, and low shrink–swell potential.

These soils are also described as having low chemical fertility and known nitrogen and phosphorus deficiencies.

5.4.2 Soil Survey

Detailed soil profile descriptions were undertaken on a single toposequence transect considered representative of the soils to be affected by proposed quarry operations. The soil sample positions are shown on **Figure 4**. An additional soil profile was described within the proposed quarry area, at the northern end of the plateau in the location shown on **Figure 4**.

Soils have been classified into Principal Profile Forms according to Northcote (1979) and an approximate correlation between these classifications and Great Soil Groups has also been given. Full descriptions of each Principal Profile Form described at the site are given in **Appendix 2**.

Krasnozems (Principal Profile Form Gn 4.11) occur on the flat plateau area (Sites S3 and S4). These soils are characterised by shallow depth (25–30cm), and gradational texture change with profile depth. Topsoil texture is fine sandy clay loam and subsoils are generally light clay material.

Side slope areas are dominated by Structured Loams (Um 6.13 and 6.14). Soils with Principal Profile Form Um 6.13 occur on the flat mid-slope area proposed to locate the processing plant (Site S2). Soil depth in this area varies from 2m to 4m and there is minimal texture differentiation throughout the profile. Topsoil material was noted at the survey site to have a silty clay loam texture and subsoil texture was noted to be fine sandy clay loam. These soils are crumbly in a moist condition.

In the lower slope area (Site S1) Principle Profile Form Um 6.14 occurs on colluvial material. Characteristics of these soils are similar to those occurring upslope although subsoil material is brighter reddish brown. Survey Site S1 was located near to the basalt/granite contact and it is expected that granitic soils would occur downslope from this location and are likely to have typical profile forms similar to the Yellow Podzolic soils described by Kovac and Lowrie (1990), refer to **Section 5.4.1**.

5.4.3 Existing Erosion and Soil Erodiability

Soil erodibility is determined by a combination of inherent structural, textural and chemical characteristics. The erosion hazard of particular soils varies depending on factors such as soil erodibility, topographic position, rainfall intensity and land management.

In general, soils which are susceptible to sheet erosion have light textured, weakly structured, hard setting topsoils. The soils within the proposed extraction area are not highly susceptible to sheet or rill erosion. This is due to the

combined factors of clay loam textures and friable surface conditions. Topsoil structure in the area is generally weak but the crumbly shear characteristic of this material reduces inherent soil erodibility. -

The proposed development site generally has a high proportion of groundcover and there is minimal existing erosion. The low gradient plateau area is well grassed and is not considered to be currently susceptible to sheet or rill erosion, or to mass movement. Steep sideslope areas are currently well vegetated and stable with some signs of previous minor slumping. Erosion potential will be high when vegetation is removed in these areas with steep gradient and long slope length.

5.4.4 Suitability of Soils for Stripping, Stockpiling and Site Rehabilitation

Suitability of soils for stripping, stockpiling and site rehabilitation depend primarily on the textural and structural characteristics of the soil. This determines the soils ability to maintain structure, grade and a friable surface after handling by heavy machinery. In general, soils which are not suitable for stripping and stockpiling are weakly structured, poorly drained or have high sand and/or gravel contents. Pedal soils which have strong consistency are also not suitable because the peds set hard and resist root penetration during revegetation.

Soil materials in the proposed extraction area have few of these negative characteristics and are considered suitable for stripping, stockpiling and use for site rehabilitation. Soils on the flat plateau area are shallow (25–30cm) but the entire profile is suitable for rehabilitation purposes. Sideslope soils have greater profile depth and both the topsoil and subsoil material is suitable for stripping, and use for rehabilitation purposes.

5.5 GEOLOGY

5.5.1 Regional Geology

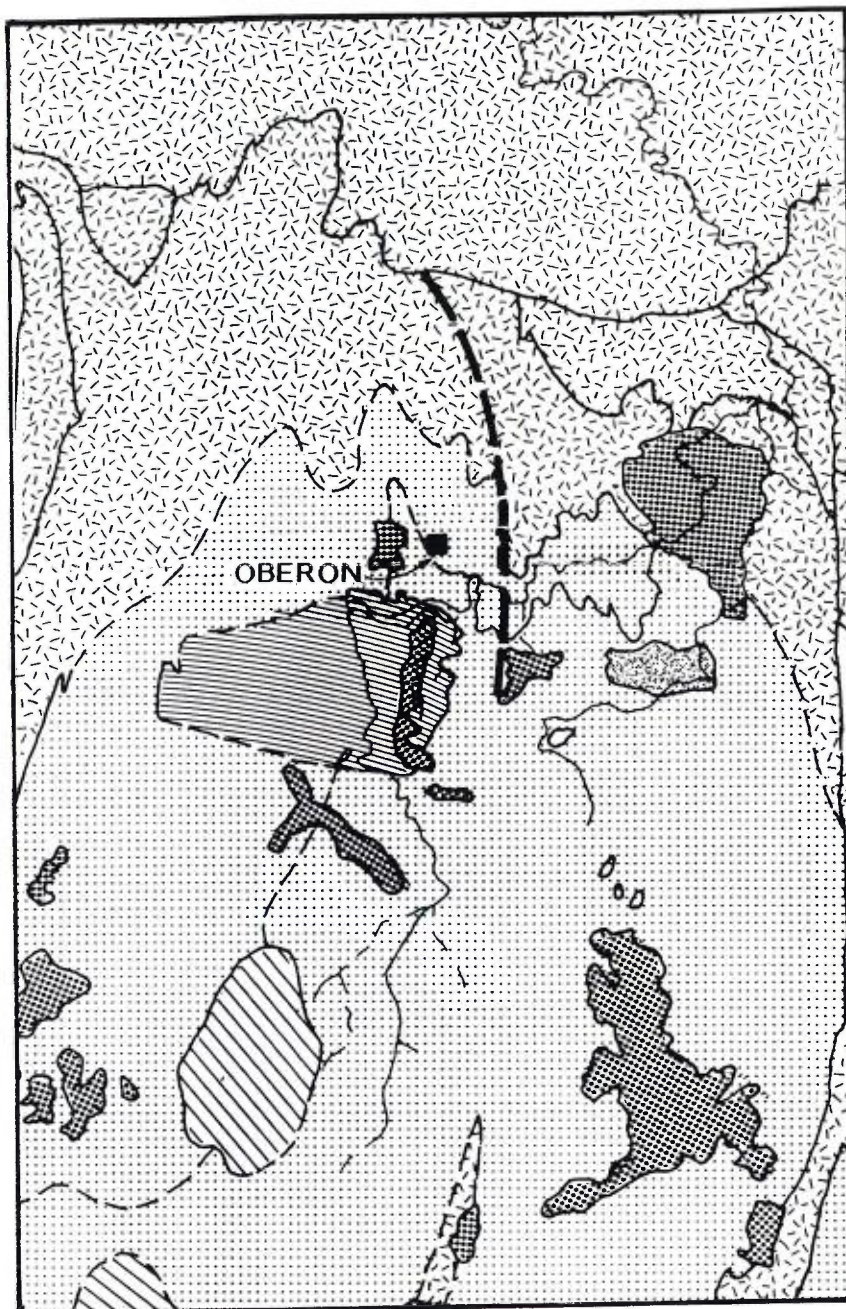
The proposed quarry is located on a basalt cap which was once part of a larger lava sheet which covered most of the Oberon area. Through weathering and erosional processes most of the lava flow has been removed to expose the underlying older rock units of Silurian and Ordovician (460 million years old) and Carboniferous (320 million years old) ages.

Regionally the younger Carboniferous material has intruded through the older rocks to form major units like the Bathurst Granite and Oberon Granite. The regional geology of the Central Tablelands in the Oberon region is shown on **Figure 5**.

5.5.2 Site Geology

Topographically the basalt forms a tabular high, which is known as Racecourse Hill, and it lies unconformably on the Oberon Granite.

Three fully cored holes were drilled during December 1991 by R and P Lord Brothers Pty Ltd. The hole locations are shown on **Figure 6**. DDH 1 intersected 18m of fresh basalt with filled vesicles, occasional high angle jointing and a clay



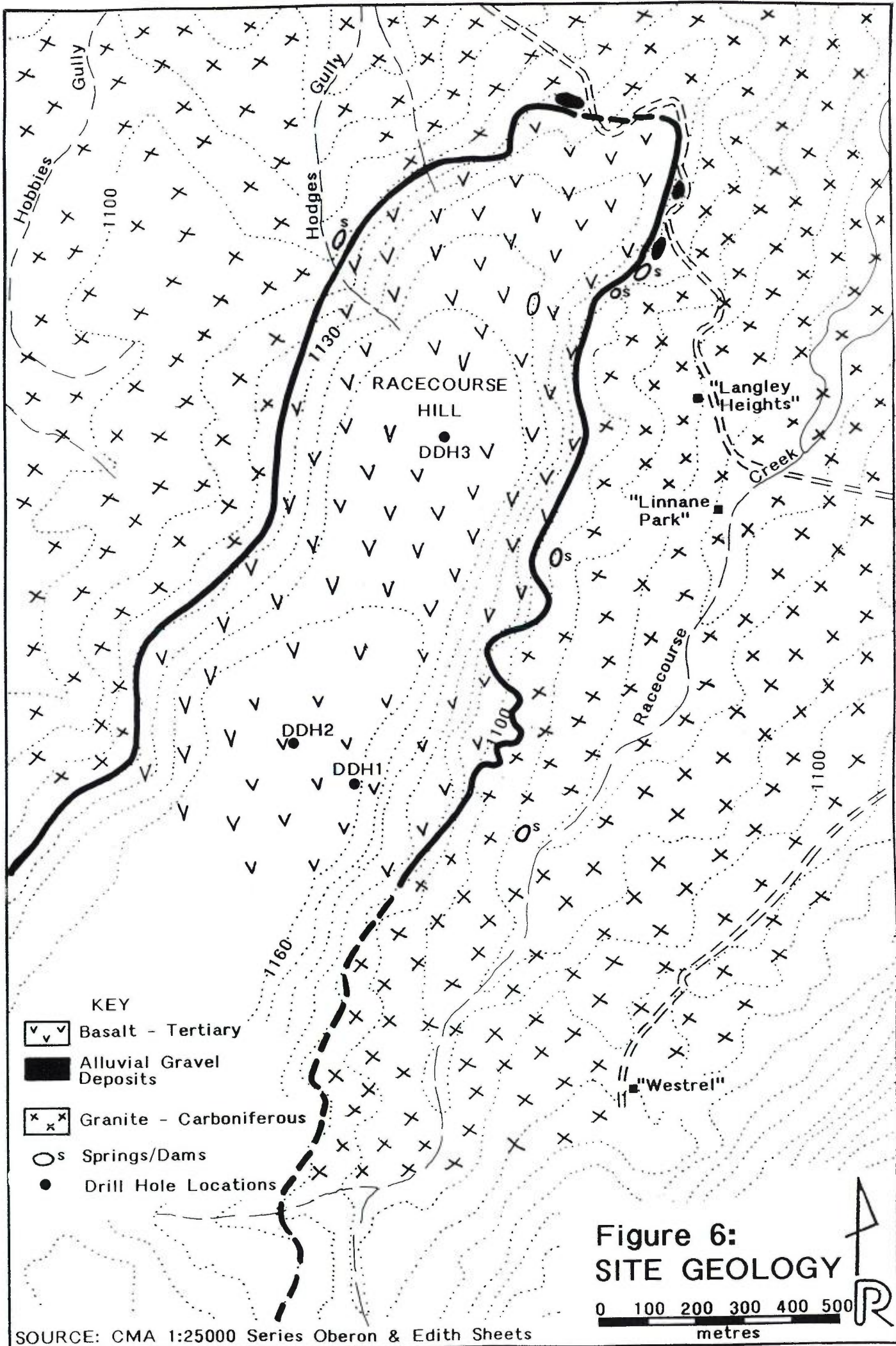
KEY

-  Basalt - Tertiary
-  Oberon Granite - Carboniferous
-  Duckmolo Stock - Carboniferous
-  Isabella Granodiorite - Carboniferous
-  Ordovician
-  Silurian
-  Fault

Figure 5:
REGIONAL GEOLOGY

0 2500 5000 7500 10000 12500
metres





- KEY**
- v v Basalt - Tertiary
 - Alluvial Gravel Deposits
 - x x Granite - Carboniferous
 - O_s Springs/Dams
 - Drill Hole Locations

**Figure 6:
SITE GEOLOGY**

0 100 200 300 400 500
metres

SOURCE: CMA 1:25000 Series Oberon & Edith Sheets

1048/91395

horizon from 14–16m. Underlying the basalt 2m of kaolinized granite was drilled before the hole was terminated. A 10cm quartz alluvial horizon was intersected between basalt and kaolinized granite.

This alluvial horizon has also been mapped outcropping north and northeast of Racecourse Hill, (see **Figure 6**).

The second fully cored hole (DDH2) was terminated at 30m with the last 2m being a brown-clay. A 2m brown clay horizon was intersected at 14m, the remainder of the core was fresh basalt. These clay horizons are believed to represent periods of weathering of the basalt in between different flow episodes.

The third hole located at the northern end of Racecourse Hill confirmed the continuous nature of the flow by intersecting 31m of fresh basalt with 1m of kaolinized granite at the base and 2m of clay at 14m. Basalt in the upper portion of the hole (0–14m) was slightly fragmented and the remainder more consolidated.

5.5.3 Field Mapping

Field investigations around the hill revealed an irregular contact between the basalt and granite with alluvial gravels outcropping along the contact, (see **Figure 6**). Dams and springs were noted as an aid in identifying the basalt/granite contact but in most cases these occurred in the granite as shown on **Figure 6**.

5.5.4 Basalt Reserves

Probable hard rock reserves have been calculated based on data collected from the three fully cored holes and field mapping (see **Appendix 3**). Total basalt reserves of approximately 39.7 million tonnes have been estimated.

The proposed extraction area, as detailed in **Section 6.3**, allows for either a 40 metre buffer between the edge of the extraction area and adjoining properties or a 10 metre buffer between the edge of the extraction area and the fenced perimeter of the Racecourse Hill plateau. The total extractable tonnes of basalt in this area have been estimated at 9.0 million tonnes (see **Appendix 3**).

5.6 METEOROLOGY

Meteorology data for the site has been derived from the Bureau of Meteorology records which were recorded at the weather station located in Buckley Crescent, Oberon. This station (Station Number 063063) is located approximately 4 kilometres north of the site.

5.6.1 Rainfall

The mean monthly rainfall figures for a 20 year period commencing in 1965 are shown in **Table 5.1**. The average annual rainfall for the 20 year period was 868mm with 1125mm being highest annual rainfall recorded (1971) and 354mm being the lowest annual rainfall recorded (1982) for the same period. On average rain falls on approximately 100 days per year or approximately 8 days

per month.

Highest mean monthly rainfall is experienced in January and lowest mean monthly rainfall occurs in April. The months between March and August are the period of low mean monthly rainfall during the year.

TABLE 5.1
MEAN MONTHLY RAINFALL, OBERON

Month	Mean Rainfall (mm)
January	107
February	78
March	71
April	54
May	70
June	56
July	60
August	81
September	79
October	78
November	71
December	63
Average Annual Rainfall	868

5.6.2 Temperature and Humidity

Temperature data collection commenced in 1946 and humidity data collection commenced in 1967. This data is presented in **Table 5.2**. The mean daily temperature ranges from -0.6°C lowest minimum to 24.5°C highest maximum in the months of July and January respectively.

Lowest mean relative humidity has been recorded during December with 57% measured at 9:00am and 44% measured at 3:00pm. Highest mean relative humidity has been recorded during June with 87% measured at 9:00am and 67% measured at 3:00pm.

5.6.3 Wind Speed and Direction

Wind speed and direction data for the 20 year period up to 1985 is illustrated in **Figure 7**. From **Figure 7** it can be seen that westerly winds predominate throughout the year in the Oberon area.

In spring, dominant morning winds blow from the northwest reaching speeds greater than 30km/hour. Secondary winds are from the southwest also reaching speeds greater than 30km/hour. In the afternoon, there are general northwesterlies to southwesterly all reaching speeds greater than 30km/hour. Autumn morning winds are predominantly southwest and northwest, while the afternoon is dominated by southwesterly winds. In summer, strong morning

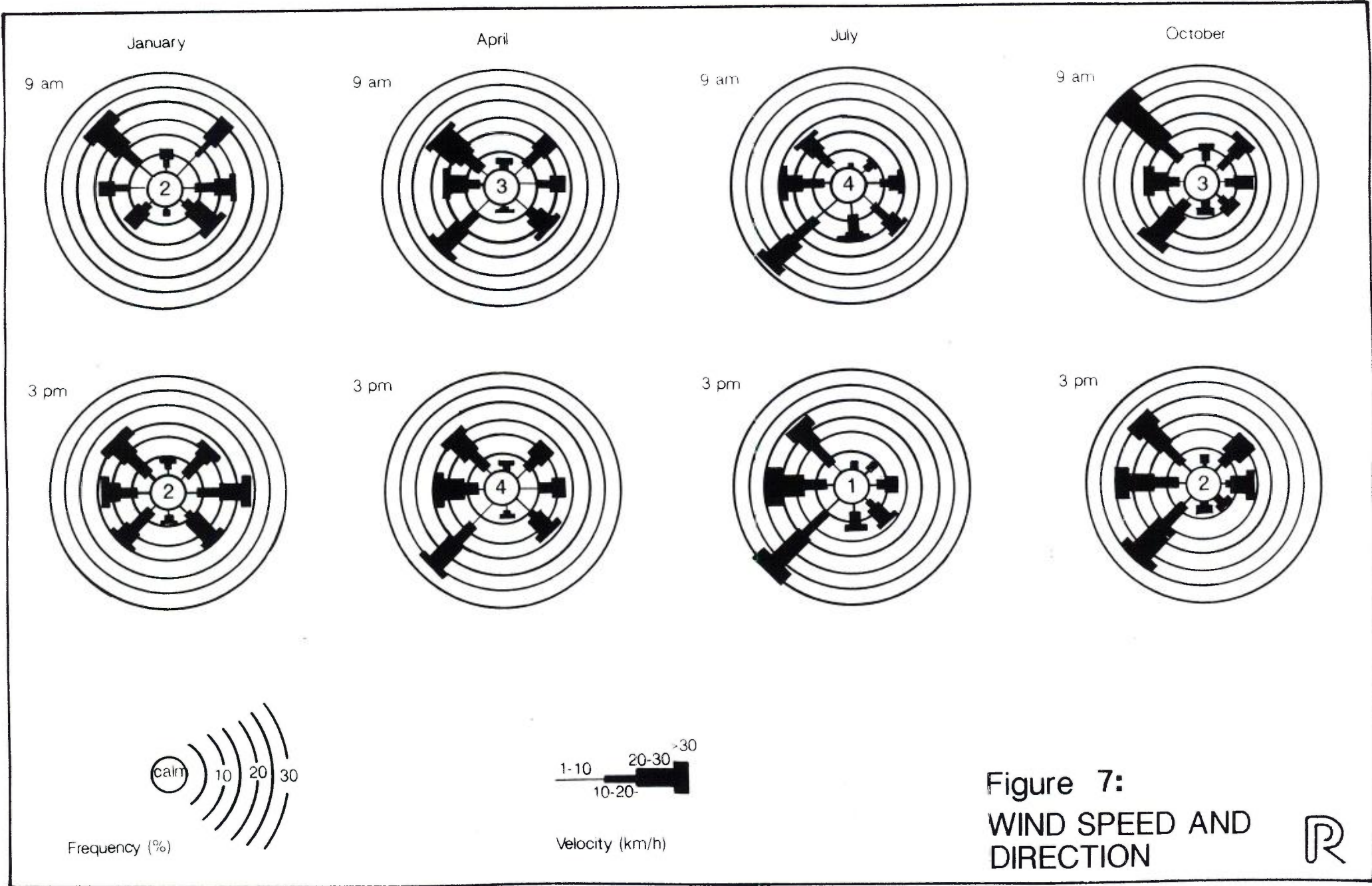


Figure 7:
WIND SPEED AND
DIRECTION



winds are dominantly northwest and east to southeast while afternoon winds are similar, and there is a stronger southwesterly component. Winter is dominated by southwesterly winds in the morning and afternoon reaching speeds greater than 30km/hour with the secondary winds coming from the west and northwest.

**TABLE 5.2
MONTHLY TEMPERATURE AND
RELATIVE HUMIDITY**

Month	Mean Daily Temperature (°C)		Mean Relative Humidity (%)	
	Maximum	Minimum	9.00am	3:00pm
January	24.5	10.4	67	49
February	23.9	11.0	72	54
March	21.5	8.9	70	54
April	17.2	5.2	73	57
May	12.8	2.4	83	62
June	9.5	0.6	87	69
July	8.6	-0.6	83	63
August	10.3	0.2	78	59
September	13.6	2.1	70	57
October	16.9	4.6	64	51
November	19.6	6.3	63	48
December	23.2	8.5	57	44

Note:

Humidity – period of record 1967–1985 (20 years)
Temperature – period of record 1946–1985 (40 years)

5.7 HYDROLOGY

5.7.1 Drainage

The proposed quarry site is currently drained to the east by Racecourse Creek and to the west by first order tributaries of Hobbies Gully and Hodges Gully. Racecourse Creek is ungauged and has a catchment area of approximately 498 hectares. The creek is fed by several springs and reportedly flows permanently.

A farm dam exists on Racecourse Creek approximately 30m upstream of Portion 93. Based on Public Works Department (1984) records for the period 1963–1984, mean annual runoff for the Lake Oberon Catchment was 155mm which represents a long term runoff coefficient of 18%. The farm dam has a catchment area of 416 hectares. For an average annual runoff of 155mm, average annual catchment yield of the farm dam is approximately 645ML. Peak discharges at the farm dam site have been estimated at 9.06m³/s and 17.59% for 5% and 1% Annual Exceedance Probability (AEP) storm events respectively.

Racecourse Creek, Hobbies Gully and Hodges Gully all drain to Lake Oberon

which is a man-made dam constructed within the Fish River valley. Lake Oberon was formed through the construction of a concrete dam wall across the Fish River. The lake has a surface area of 4.2km² and a capacity of 45,400ML. With a catchment area of 141km², Lake Oberon has an average annual catchment yield of approximately 21,855ML.

Lake Oberon forms a part of the Fish River Water Supply system. The Fish River Water Supply System supplies water to Oberon Shire Council, the Council of Greater Lithgow, Pacific Power at Wallerwang and Mount Piper, and the Water Board within the Blue Mountains.

5.7.2 Groundwater

Several small springs are located at the contact of basalt and underlying less pervious granitic material existing at the site. Springs to the north and west of the site are located at approximately 1100m AHD and are thought to be fed by water infiltrating through fractures in the basalt and collecting in the alluvial sediments that occur between the basalt and granite.

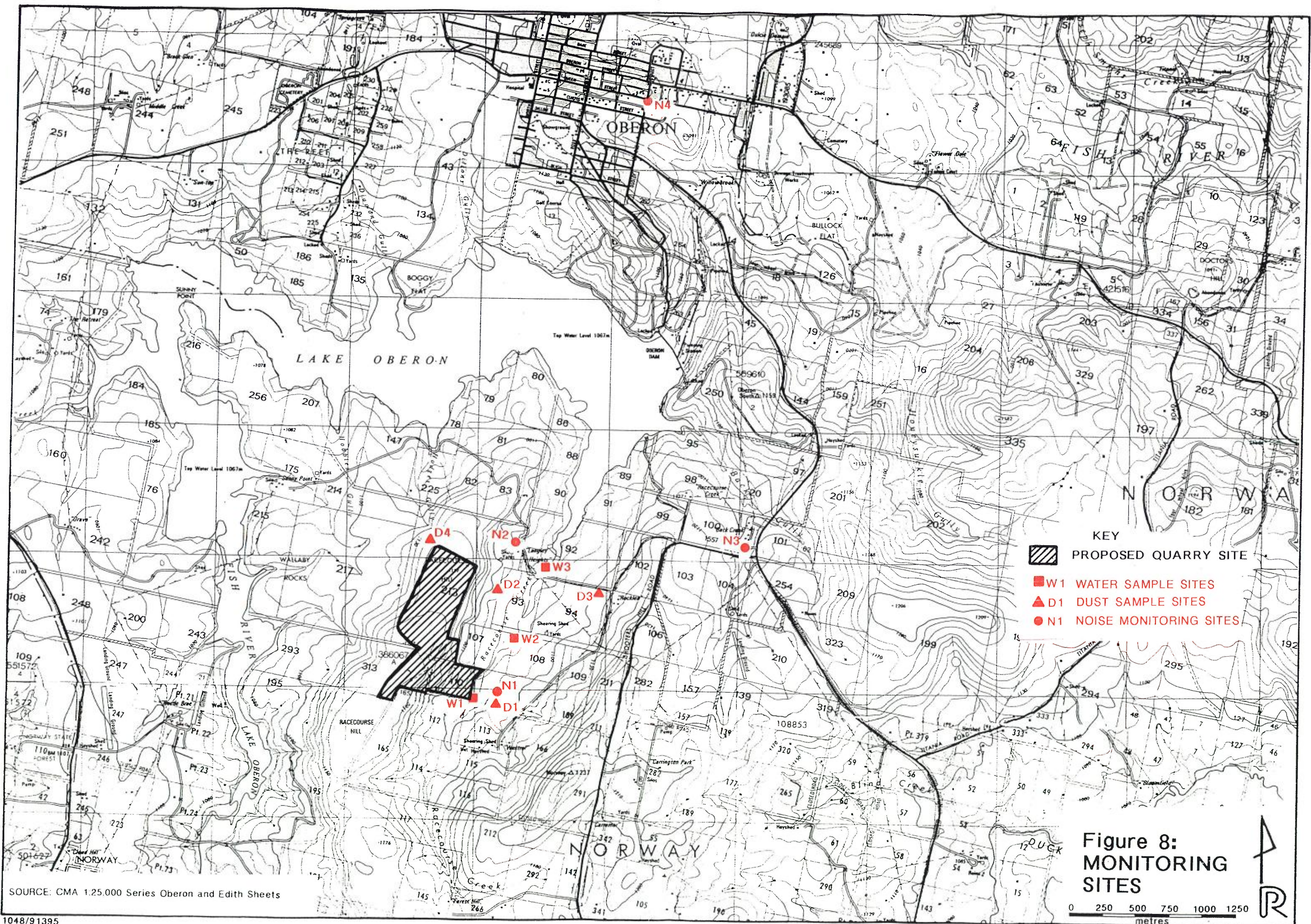
Groundwater springs and two bores on the eastern side of Racecourse Creek are supplied by a groundwater aquifer associated with the contact zone between the older Ordovician material and the younger granitic intrusion. Both of these groundwater sources would be classified as "fractured-rock" aquifers and would be expected to have low yields.





5.7.3 Water Quality

Three water samples were taken from Racecourse Creek at the locations shown on **Figure 8** on 6th February, 4th April, 13th April and 29th May, 1992. Each sample was analysed for a number of parameters and the results are given in **Table 5.3**.

The results show that the Racecourse Creek water samples comply with the recommended limits for drinking water set by National Health and Medical Research Councils (1987).

The water in Lake Oberon is sampled and analysed on a regular basis by the Department of Public Works – Fish River Water Supply. Typical analysis for the Lake Oberon water quality is given in **Table 5.4**. The results presented in Table 5.4 are reproduced from the Department of Public Works (1988) and are for samples taken on 13th January, 1992 at depths of 2.5, 5 and 8m.



- KEY**
-  PROPOSED QUARRY SITE
 -  W1 WATER SAMPLE SITES
 -  D1 DUST SAMPLE SITES
 -  N1 NOISE MONITORING SITES

**Figure 8:
MONITORING
SITES**

0 250 500 750 1000 1250 metres

SOURCE: CMA 1:25,000 Series Oberon and Edith Sheets

**TABLE 5.3
WATER QUALITY, RACECOURSE CREEK**

Sample Date Analysis	Sample W1				Sample W2			Sample W3			
	6/2	4/3	13/4	29/5	6/2	4/3	13/4	6/2	4/3	13/4	29/5
pH	6.7	6.9	6.9	7.0	6.7	7.0	6.8	6.7	6.9	6.9	6.9
Temperature (°C)	-	-	18.1	-	-	-	18.0	-	-	18.3	19.0
Conductivity (uS/cm)	99	95	82	93	116	120	110	105	132	120	110
Sulphate (mg/L)	-	-	<1	-	-	-	<1	-	-	<1	-
Phosphate (mg/L)	0.2	<0.1	0.08	0.14	0.4	<0.1	0.09	0.3	<0.1	0.08	0.19
Nitrate (mg/L)	-	-	<0.5	2.6	-	-	<0.5	-	-	<0.5	3.3
Total Suspended Solids (mg/L)	-	-	3	<5	-	-	8	-	-	4	<5
Total Dissolved Solids (mg/L)	-	-	67	812	-	-	87	-	-	76	92

Note: Sample not taken at Point W2 on 29/4/92.

Available data indicate that water in Lake Oberon is generally of good physical and chemical quality and fair bacteriological quality (Public Works Department, 1988).

The samples from Lake Oberon marginally exceed the National Health and Medical Research Council's recommended limits for drinking water for Manganese which is set at 0.1 mg/L

TABLE 5.4
WATER QUALITY, LAKE OBERON

Analysis	Units	2.5m Depth	5m Depth	8m Depth
Sample Number		8	7	6
pH		7.6	7.6	7.6
Conductivity	uS/cm	57	59	60
Sulphate	mg/L	< 1.0	< 1.0	< 1.0
Phosphorous, as P	mg/L	< 0.01	< 0.01	< 0.01
Nitrate, as N	mg/L	< 1.0	< 1.0	< 1.0
Colour, Apparent	TCU	11	11	11
Turbidity	NTU	2.2	2.1	2.3
Chloride	mg/L	5.4	5.3	5.2
Alkalinity, as CaCO ₃	mg/L	22	22	23
Total Hardness	mg/L	21	21	20
Calcium Hardness	mg/L	9.5	9.0	9.8
Sodium	mg/L	4.5	4.6	4.5
Potassium	mg/L	1.3	1.4	1.4
Iron	mg/L	0.13	0.12	0.13
Manganese	mg/L	0.14	0.14	0.16
Total Aluminium	mg/L	< 0.02	<0.02	0.03

5.8 BACKGROUND NOISE ENVIRONMENT

A survey of the existing background noise environment was undertaken on 5th and 6th of February and 3rd March, 1992. Survey methods and results are presented in detail in **Appendix 4**. The survey results are summarised in **Table 5.5** in which existing background noise levels are expressed as LA90 noise levels (i.e., noise levels exceeded for 90% of the time).

The location of the survey sites are shown on **Figure 8**. Site one (N1) was adjacent to "Westrel" property. Site two (N2) was adjacent to "Langley Heights" homestead and was located to give background noise levels for the neighbouring property of "Linnane Park". Site three (N3) was located at the corner of Edith Road and Shooters Hill Road and provides background noise levels for the property of "Back Creek". The fourth noise monitoring site (N4) was located north of the Curtis and Dudley Street intersection in Oberon.

Measured LA90 background noise levels listed in **Table 5.5** during daytime ranged from 37.3dB(A) to 50.3dB(A). At night-time LA90 background noise levels ranged from 29.8dB(A) to 35.8dB(A). The highest daytime and night-time noise levels were recorded at N1 averaging at 51dB(A) and 36dB(A), respectively. Major noise sources at this location were wind blowing in the trees, crickets and sheep. The lowest average daytime and night-time noise levels recorded at N2 were 40dB(A) and 30dB(A), respectively. Major noise sources at this location, which is 1.5km north of N1, are birds, crickets and background dogs barking.

**TABLE 5.5
BACKGROUND NOISE LEVELS, OBERON**

Site	Time	Date	LA90 Background Noise Levels dB(A)
N1	9:30am	5/2/92	48.8
N1	12:55pm	5/2/92	50.3
N1	11:30pm	5/2/92	35.8
N1	1:15pm	3/3/92	53.3
N2	11:50am	5/2/92	39.8
N2	3:50pm	5/2/92	37.3
N2	12:45pm	3/3/92	46.8
N2	11:55pm	5/2/92	29.8
N3	4:20pm	5/2/92	37.9
N3	2:00pm	6/2/92	40.8
N3	11:05pm	5/2/92	31.3
N3	12:36pm	3/3/92	47.3
N4	5:00pm	5/2/92	39.8
N4	10:40pm	5/2/92	31.8
N4	12:15pm	3/3/92	48.3

Site	Average L90 dB(A)		Minimum L90 dB(A)	
	Day	Night	Day	Night
N1	51	36	49	36
N2	41	30	37	30
N3	42	31	38	31
N4	44	32	40	32

Note: The Environment Protection Authority define daytime as Monday to Saturday, 7:00am to 10:00pm and on Sundays and Public Holidays, 8:00am to 10:00pm. Night-time is defined as all other times.

5.9 AIR QUALITY

The site is surrounded by cleared grazing land and land that is intermittently used to produce crops. No other major source of dust exists in the area.

Four dust deposition gauges were located around the site to measure the background dust deposition rates. The location of the dust deposition gauges are shown on **Figure 8**. The results from these gauges are given in **Table 5.6**.

TABLE 5.6
DUST DEPOSITION RATES, RACECOURSE HILL
 (Units - g/m²/month)

Date	Analysis	Point D1	Point D2	Point D3	Point D4
3/3/92	Insoluble Solids	0.4	1.6	0.8	0.7
	Ash	0.2	1.3	0.5	0.3
	Combustible Matter	0.2	0.4	0.2	0.4
10/4/92	Insoluble Solids	0.4	2.8 ¹	0.9	0.4
	Ash	0.2	2.1	0.7	0.3
	Combustible Matter	0.2	0.7	0.2	0.2
8/5/92	Insoluble Solids	0.5	2.4 ¹	0.6	0.1
	Ash	0.2	0.9	0.4	<0.1
	Combustible Matter	0.3	1.6	0.3	<0.1
25/5/92	Insoluble Solids	0.6 ²	0.5 ²	0.6 ²	0.5 ²
	Ash	0.1	0.2	0.3	0.1
	Combustible Matter	0.5	0.3	0.3	0.4
3/7/92	Insoluble Solids	<0.2	<0.2	<0.2	<0.2
	Ash	<0.2	<0.2	<0.2	<0.2
	Combustible Matter	<0.2	<0.2	<0.2	<0.2

Note:

1. Dust deposition gauge D2 contained large amounts of organic matter.
2. All dust deposition gauges contained large amounts of insect matter on the 25/5/92.

Results presented in **Table 5.6** indicate that background dust deposition rates are low reflecting the low existing potential for dust generation at the site.

5.10 FLORA AND FAUNA

A survey of the flora and fauna of the proposed hard rock quarry area was undertaken in April 1992.

5.10.1 Flora

The site was traversed on foot and vegetation communities identified following the classification system of Specht et al (1974). The vegetation of the area is shown on **Figure 9** and a list of all vascular plant species observed within the area presented in **Appendix 5**.

Vegetation Communities

The area has been largely cleared of native vegetation and the grasslands improved with introduced grasses for grazing of sheep. Remnants of native

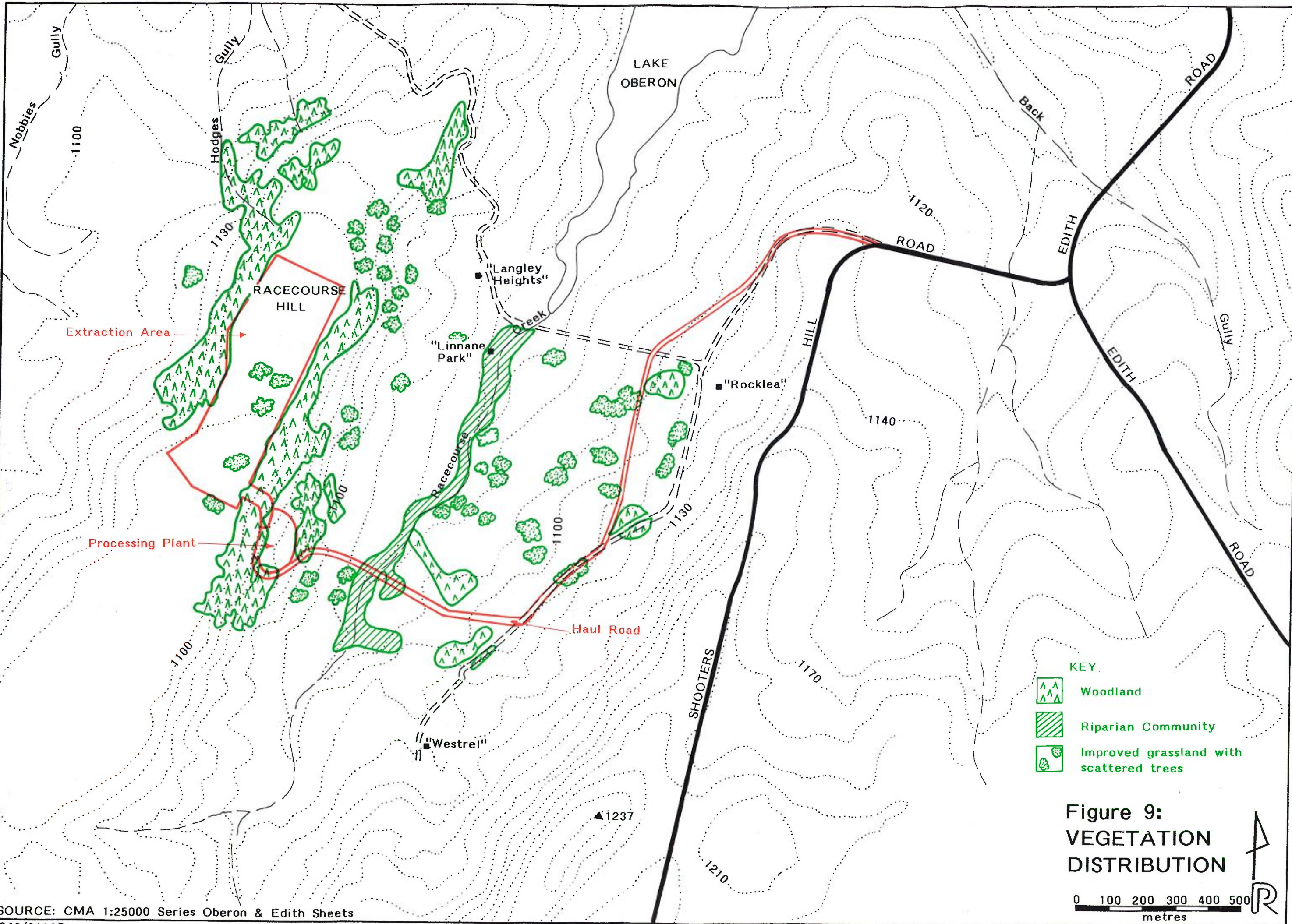


Figure 9:
VEGETATION
DISTRIBUTION



vegetation are retained on the slopes of Racecourse Hill and along Racecourse Creek.

The woodland community on the basalt derived soils on the upper slopes on Racecourse Hill is dominated by Manna Gum (***Eucalyptus viminalis*** subsp. ***viminalis***). On the granite derived soils of the lower slopes the woodland trees are Snow Gum (***Eucalyptus pauciflora***), Mountain Gum (***Eucalyptus dalrympleana*** subsp. ***dalrympleana***) and Candlebark (***Eucalyptus rubida***). The trees are generally less than 15m in height on the lower slopes and decrease in height with increased exposure on the higher slope. The woodland has a grassy understorey with scattered ***Acacia deanei*** trees.

The banks of Racecourse Creek are characterised by Willow trees (*Salix babylonica*), Eucalypts and areas of reeds. The Eucalypts occurring along the flats near the creek and throughout the pastureland are Grey Box and Black Sally (*Eucalyptus stellulata*).

Conservation Significance

The vegetation of the site has been modified by clearing and farming practices and has a low conservation significance.

The Eucalypts occurring on the site are known to occur in association in tall open forests to low woodlands throughout the tablelands of New South Wales (Specht et al, 1974). These communities are moderately to reasonably conserved in national parks and nature reserves of the Tablelands including Kosciusko National Park, Kanangra-Boyd National Park and Tabletop Nature Reserve (Specht et al, 1974).

According to Briggs and Leigh (1988) none of the species recorded on the site are considered to be rare or threatened. It is considered unlikely that any rare or threatened species would occur on the site.

5.10.2 Fauna

Fauna associated with the woodland, riparian community and improved grassland are typical of the fauna found throughout the tablelands of New South Wales.

Twelve species of avifauna were observed or heard during field work and are listed in **Appendix 5**. All of the birds are moderately common to abundant throughout New South Wales. The smaller birds such as the Superb Fairy-wren and White-browed Scrubwren were observed amongst thickets in the woodland. The Lewin's Honeyeaters were observed feeding on the Eucalypt blossom.

The area is used for grazing of sheep. Evidence was found of the presence of other introduced mammals such as dogs, cats, horses, rabbits and foxes. Native fauna possibly utilising the area include Wombat, Eastern Grey Kangaroo and Wallaroos.

Rocky outcrops on the slopes of Racecourse Hill, the drainage lines and farm dams provide habitat for herpetofauna. The Common Eastern Froglet (***Crinia signifera***) was heard calling from the edges of the farm dams. No evidence of

reptiles was observed during fieldwork, but this was expected given the cool weather conditions. Reptiles expected to occur throughout the area include the Eastern Tiger Snake (*Notechis scutatus*), Copperhead (*Austrelaps superbus*), and Yellow-bellied Black Snake (*Pseudechis guttatus*).

None of the fauna species recorded on the site, or considered likely to occur in the area are listed as endangered fauna (Schedule 12-NPW Act 1974). All of the fauna are common to abundant in New South Wales. The large number of introduced species occurring in the area is indicative of the high degree of disturbance.

Vegetation along Racecourse Creek provides habitat for smaller birds and mammals as well as a corridor for the movement of fauna between areas of natural bushland and as a refuge from drought. Riparian vegetation is also a valuable buffer between terrestrial and aquatic environments, stabilising the creek banks, trapping sediments and pollutants.

Lake Oberon is a valuable habitat for Rainbow Trout (*Salmo gairdneri*) and Brown Trout (*Salmo trutta*). Both of these species are introduced fresh water fish valued for angling.

Several attempts have been made to establish Trout in Racecourse Creek and have been unsuccessful possibly due to sediment accumulation along the creek bed. Both species of trout require shallow gravel bottomed streams with clear, running water for spawning. A dam across Racecourse Creek near the boundary of the site with "Linnane Park" has been constructed for the past twenty years and would stop any movement of fish upstream. These factors decrease the habitat value of Racecourse Creek for Rainbow and Brown Trout.

5.11 VISUAL ASPECTS

5.11.1 Regional Scenic Quality

Oberon is situated in the western slopes of the Great Dividing Range on the Oberon Plateau, with an elevation in the town of 1113m. The town is compact contained by the undulating nature of the topography. Surrounding rural land is predominantly sheep grazing with large tracts of State Forest adjacent to the town outskirts.

Each visual element within a landscape contributes towards the overall character of the landscape. The principal components of the landscape are topography, vegetation, water bodies and man-made elements such as roads, fences, power lines and buildings. Dominance of a single element or combinations of several elements will produce major changes in landscape character and quality.

Elements around Oberon that determine the landscape quality of the area are:

Topography: Undulating relief across the Oberon Plateau with maximum elevation of approximately 1350m to the south and east of the township. The majority of the plateau extends to height of 1100m, or slightly higher, forming an undulating topography.

Vegetation: Dominance of exotic vegetation with strong colours and textural

effects. Scattered native vegetation away from settled areas, along creek lines and in reserves. Pine forest located on outskirts of town.

Water Bodies: Abundance of creeks and small rivers bisecting the landform; dominating presence of Lake Oberon adjoining the town precinct, serving as a regional resource.

Roads: Network of rural roads linking small villages and criss-crossing undulating landform.

Buildings: Typical rural character of scattered farmhouses and outbuildings primarily on higher points of ground, with protective windbreak vegetation surrounding. Constant repetition of a similar theme, when viewed from roads and lookouts, establishes continuity and a definite character to the area.

These elements within the areas around Oberon result in a moderate-high scenic quality. The quality rating increases in value as diversity and contrast increase in the elements. The presence of water in any outlook greatly increases the quality, of the scene. In addition, distant views to rugged, vegetated mountains will be accorded a higher quality rating.

5.11.2 Local Scenic Quality

The proposed extraction area is on Racecourse Hill. It is a prominent highpoint to the south of Lake Oberon and Oberon township, with an elevation of 1159m.

Due to the hill's flat, terrace-like formation and lack of vegetation, the impact on the surrounding landscape is significant as a visual backdrop.

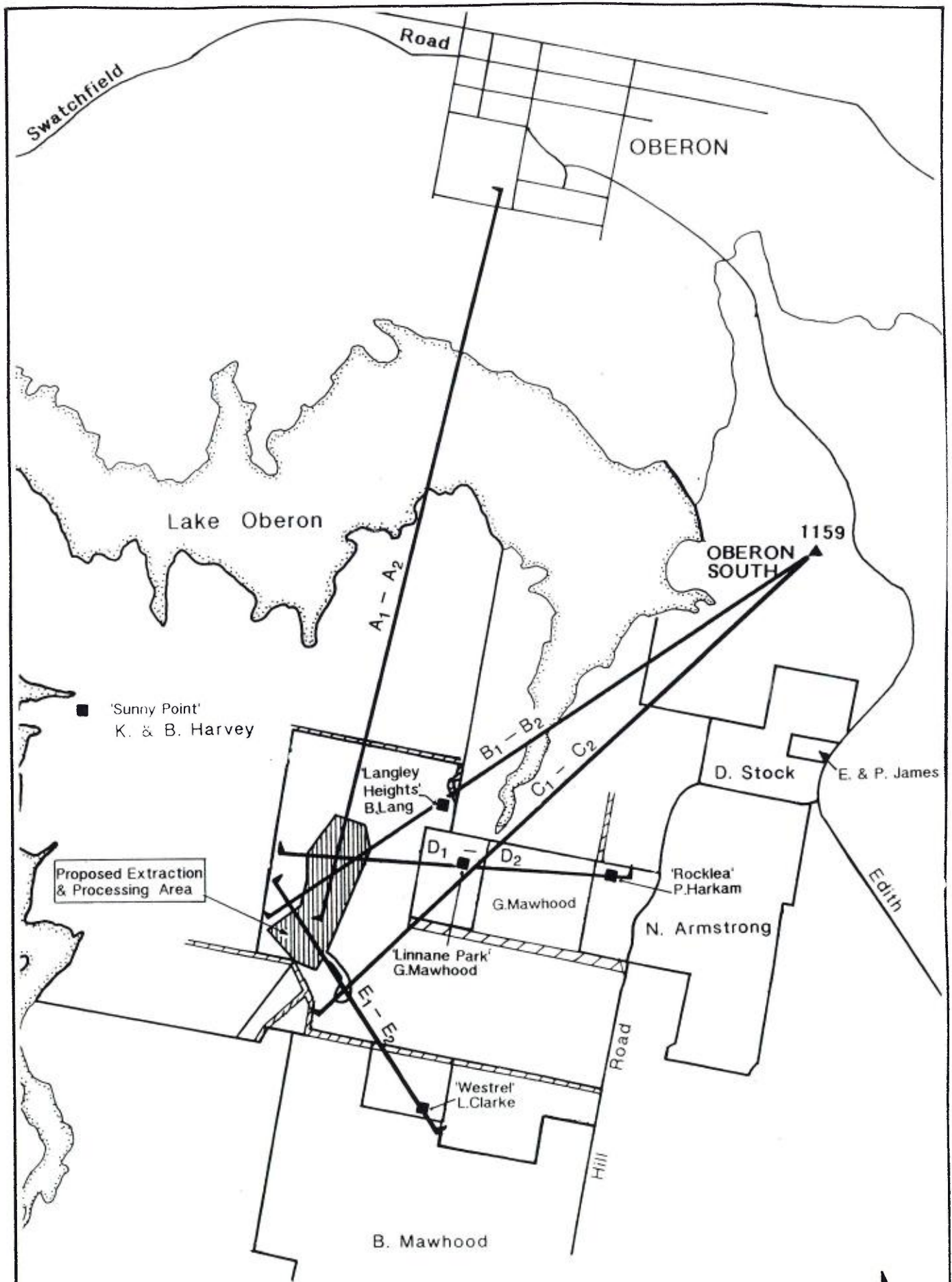
The local elements of importance to the scenic quality of Oberon are:

- * The extensive water body of Lake Oberon.
- * The backdrop of elevated hills such as Racecourse Hill which encircle the town.
- * Vegetation remaining along creeklines, ridgetops, around farm buildings, as windbreaks, avenue plantings and in reserves and parks. A distinct character has been achieved with the introduction of exotic species providing varied colour and texture, contrasting to the native species.

Man-made components of the landscape, i.e., roads, buildings, fences, powerlines, etc., do not influence or alter the moderate-high scenic quality rating on the Oberon locality.

5.11.3 Visibility

Visual transects of views to the proposed quarry site from Oberon and neighbouring properties are shown on **Figures 10 to 13**.

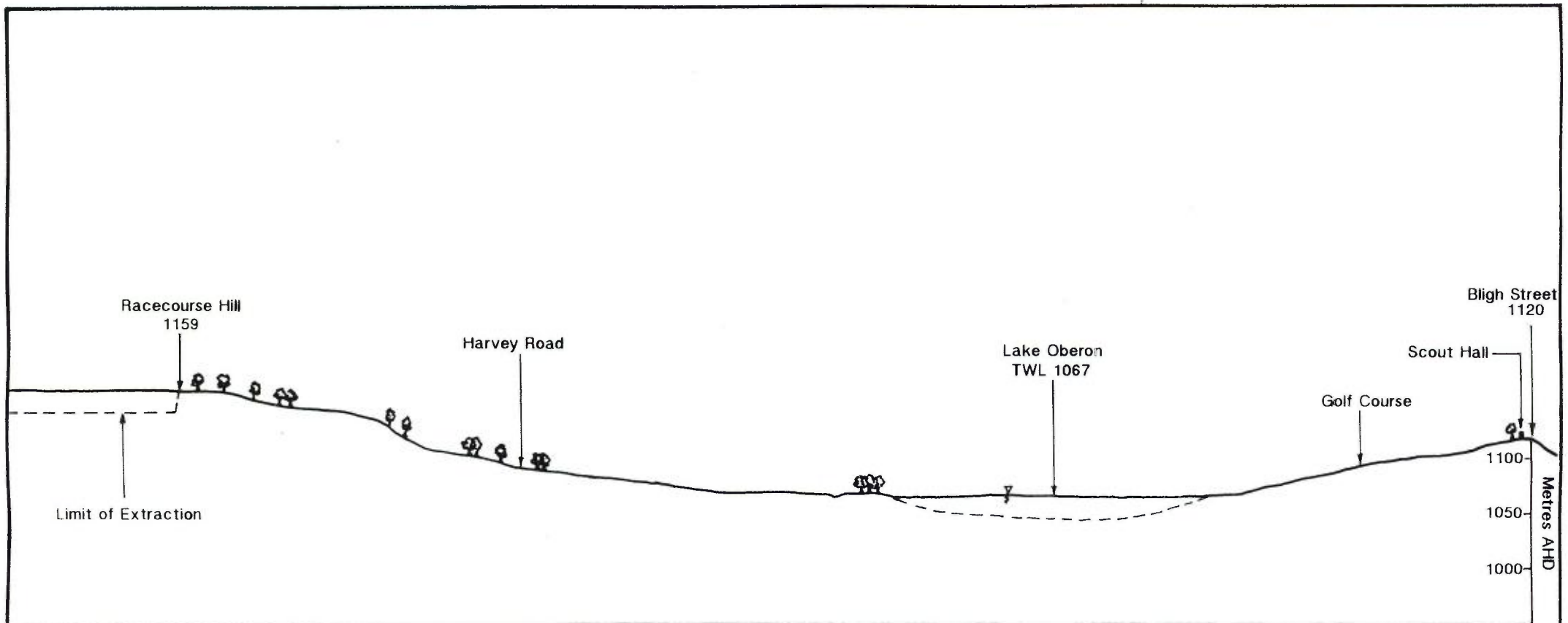


See Figures 11,12 and 13 for Transect Details

- KEY
-  A-A Transect Lines
 -  Residences
 -  Unformed Crown Roads

Figure 10:
LOCATION OF
VISUAL TRANSECTS





TRANSECT A₁ - A₂

Figure 11:
VISUAL TRANSECT



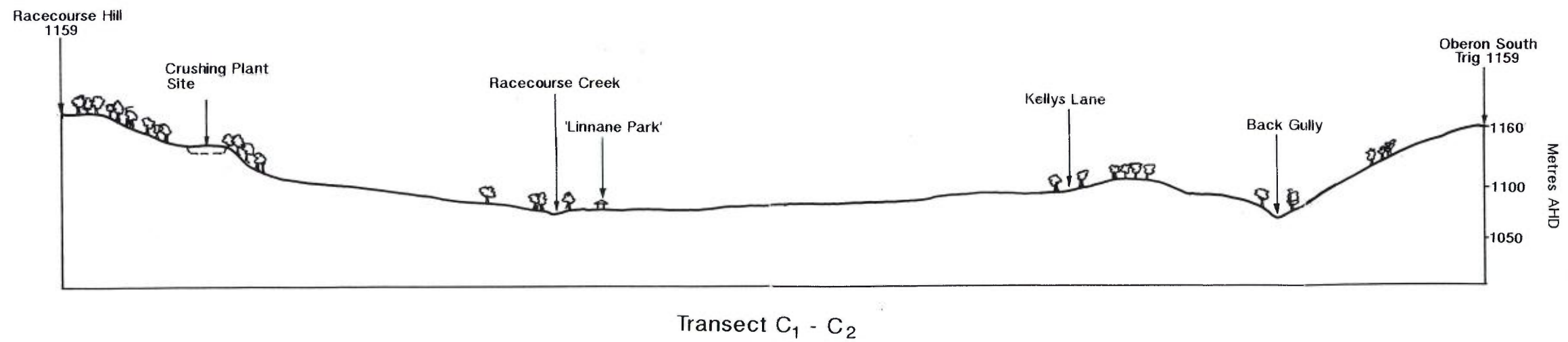
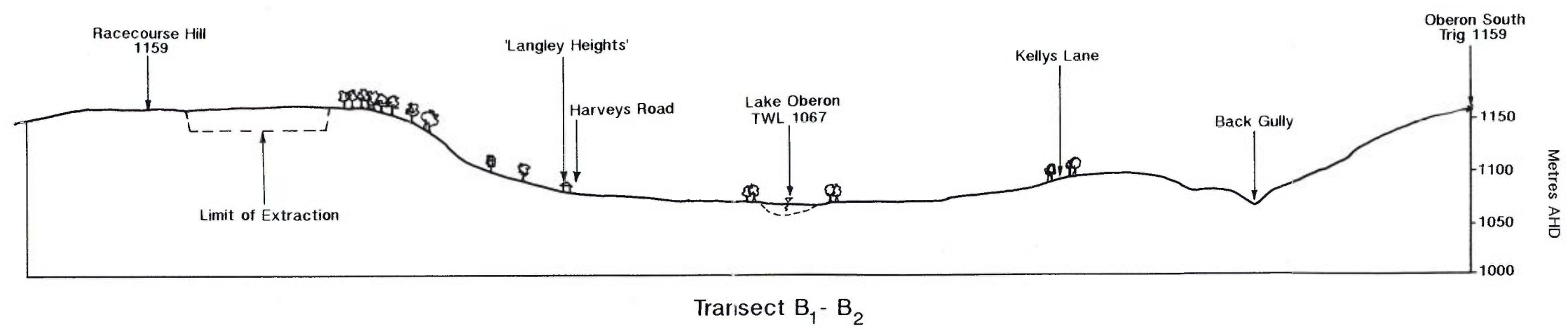
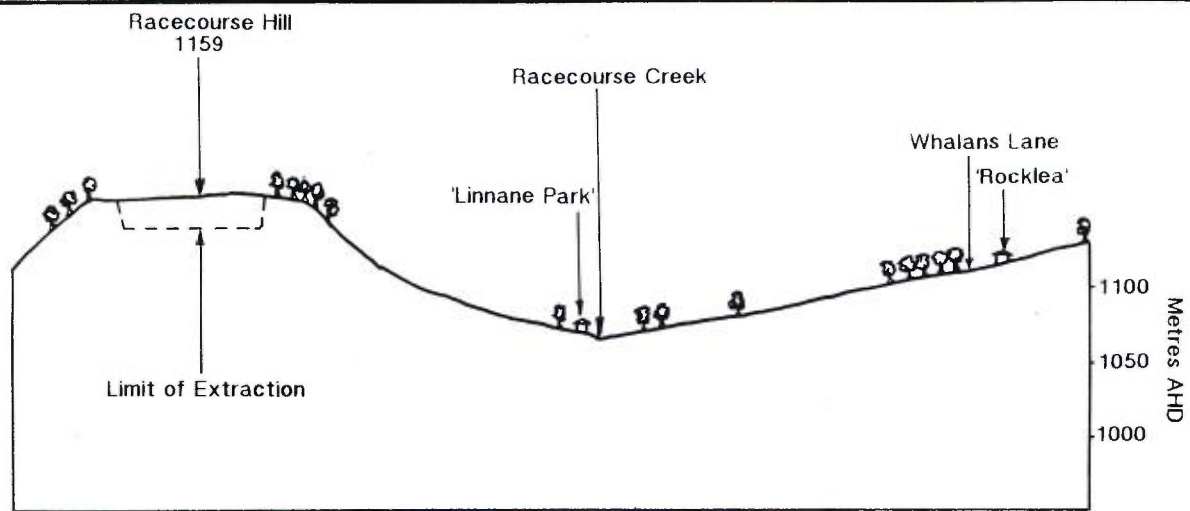
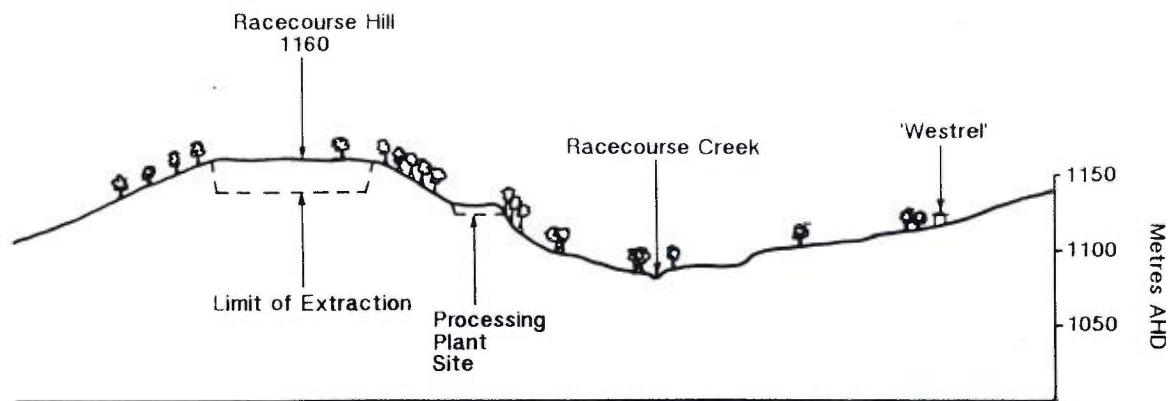


Figure 12:
VISUAL TRANSECT 



Transect D₁ - D₂



Transect E₁ - E₂

Figure 13:
VISUAL TRANSECT



5.12 LAND USE AND ZONING

5.12.1 Residential

Four residences are located within 1.2km of the proposed quarry site and processing area and are shown on **Figure 10**. The residence of the Lang family is located on the "Langley Heights" property approximately 1.0km northeast of the proposed location of the processing area and 400m east of the northern extent of the extraction area.

The residence of Mrs G. Mawhood, on the property "Linnane Park", is located approximately 850m northeast of the processing area and 500m east of the of the extraction area. The residence of P. Harkam, on the property "Rocklea", is located approximately 1.4km east-northeast of the processing area and 1.2km east of the northern extent of the northern limit of extraction. The residence of L. Clarke, on the property "Westrel", is located approximately 750m southeast of the processing area and 800m from the southern end of the extraction area.

The residences of the Harvey family on "Sunny Point" and the Pye family on "Nestle Brae" are located 1.9km northwest and 2.1km west respectively of the proposed quarry processing area. The Harvey Family residence is approximately 1.3km west of the northern extent of the quarry site

5.12.2 Agricultural

Sheep and beef grazing is the principle land use on and in the vicinity of the proposed quarry site. **Figure 14** shows the land use in the Oberon region. On "Langley Heights" and adjoining properties sheep are raised for wool and meat production. Sheep run on these properties include fine wool merinos, first cross ewes, Corridale ewes, Suffolks and White Suffolk. Beef cattle grazed in the area are mainly Herefords or Hereford cross with "Westrel" being a registered Poll Hereford Stud. In addition two thoroughbred mares are run on "Linnane Park".

Pasture in the area is predominantly improved being planted with a combination of white clover, subterranean clover, Phalaris, Rye and Cox Foot. Supplementary fed crops such as oats are also grown on adjoining properties.






5.12.3 Recreation and Tourism

Oberon and surrounding areas provide a wide range of recreational and tourist related activities. Lake Oberon is renown for trout fishing and is one of only a few water bodies in the Central Tablelands where sailing is permitted. The Oberon area, through its proximity to National Parks and State Forests, provides opportunities for bushwalking, fossicking, camping, sight-seeing and off-road driving. A Daffodil Festival is held in spring each year.

5.12.4 Zoning

The proposed development site and adjoining properties are zoned Non-Urban 1(a). Extractive industries and subdivisions are permitted within land zoned Non-Urban 1(a) with the consent of Oberon Shire Council.



- KEY**
-  Rural Residential/Residential
 -  Recreational
 -  Timbered Grazing
 -  Cleared Grazing
 -  State Forest (Blenheim)

SOURCE: CMA 1:25,000 Series Oberon and Edith Sheets

Figure 14:
LAND USE

0 250 500 750 1000 1250
metres

5.13 ABORIGINAL PREHISTORY

An archaeological survey of the development area was conducted by Matthew Barber of Resource Planning Pty Limited in conjunction with Roland Williams of the Wiradjuni Regional Aboriginal Land Council. The full report is included in **Appendix 5**.

Previous archaeological surveys in the Oberon region had identified elevated areas close to watercourses with level ground and well drained soils as having high archaeological potential. Such locations were present within the general development area. The archaeological survey examined these areas in addition to the proposed haul road route, crushing plant site and the hill to be quarried.

Although ground visibility was poor, three artefact scatters and an isolated find were recorded during the field investigation. One artefact scatter was found on top of Racecourse Hill and will be affected by the development. The isolated find will be affected by the proposed haul road. The remaining two sites were situated close to the bank of Racecourse Creek.

The site located on top of Racecourse Hill consists of three quartz artefacts in a disturbed state. They held little scientific or educational significance. The isolated artefact, a quartz pebble core, also has no scientific or educational significance and no site form was completed for this location.

The other two sites, in particular site three, have potential for sub surface deposits which make it scientifically important, however they will not be affected by the development.

5.14 PUBLIC UTILITIES

5.14.1 Electricity

A power supply will be required for the plant and Southern Mitchell Electricity has advised that three phase power is available at Shooters Hill Road.

The proposed quarry site is not crossed by powerlines.

5.14.2 Water Supply

Residences on adjoining farm properties obtain their water supply from house tanks, groundwater bores, dams or, where available, Lake Oberon. Reticulated water is not connected to the site.

5.14.3 Telecommunication

Telecommunication facilities are provided for the "Langley Heights" property and adjoining land owners. There are no telecommunications cables crossing the proposed development site.

5.15 ROADS AND TRAFFIC

5.15.1 Roads

The site is accessed from Shooters Hill Road which is two lane tar sealed rural road. From Shooters Hill Road access to the site is gained via Harveys Road which has approximately a 5m wide gravel surface. The intersection of Shooters Hill Road and Harveys Road is located at the start of a sweeping 90 degree bend. Visibility to the south of the intersection is restricted by a 2 metre high land form and stand of trees.

Shooters Hill Road connects with the Jenolan Caves Road (Main Road 253). The intersection has good sight distance characteristics. The Jenolan Caves Road is a main link between Oberon and the Jenolan Caves tourist resort.

Titania Road is 6 metre wide gravel road that inter-connects the Jenolan Caves Road between Oberon and Edith and Oberon-Duckmaloi Road (Main Road 558).

5.15.2 Traffic

Traffic levels on MR25 and MR558 have been obtained from the Roads and Traffic Authority at Parkes. **Table 5.7** presents the available Annual Average Daily Traffic volumes (AADT) for these roads at measured points from 1972 to 1988.

**TABLE 5.7
ROADS AND TRAFFIC AUTHORITY
ANNUAL AVERAGE DAILY TRAFFIC**

	1972	1976	1980	1984	1988
MR253 0.5km north of Scotia Ave	-	-	-	-	1152
MR253 8km south Oberon	160	200	250	320	-
MR253 North of MR558, Hampton	810	870	850	856	1001
MR558 West of Hampton	350	500	490	530	704
MR558 East of Tarana Rd Oberon	450	690	1010	870	-
MR558 East of Tarana Rd Oberon	-	-	-	-	1039

Traffic estimates for the haulage of forestry industry raw material and finished products were obtained for the Forestry Industry, Oberon (Forestry Commission, 1991). **Table 5.8** presents the traffic movements as total loads per year.

**TABLE 5.8
FORESTRY INDUSTRY
HAULAGE OF RAW AND FINISHED PRODUCTS (LOAD/YEAR)**

	1988	1990	Est. 1995
MR253 Shooters Hill Road	4522	7391	8031
MR253 North of Hampton	5000	5565	7000
MR558 East of Tarana Rd Oberon	9261	7957	8217

During the 1988 period the estimated forestry industry truck movements accounted for approximately 8% of the AADT volumes on these roads.

5.16 SOCIO-ECONOMIC ENVIRONMENT

Oberon Shire is approximately 2,925km² in area with a population of approximately 4,260. The township of Oberon has a population of 2,560 with unemployment approximately half the national average at 5.4% (Oberon Review, April 1992).

Main activities in Oberon Shire area associated with forestry, grazing and mixed farming. The town has a strong manufacturing base associated with forestry products and the region is well known for wool, fat lamb and beef production. In 1989 the town had 564 people employed in manufacturing industries with the manufacturing base set to expand further.

Due to the strong manufacturing base in the town, the majority of the service industries exist which are necessary to support and maintain a quarry operation. Service industries include electrical contractors, engineering workshops, trade outlets, fuel suppliers, hotels and other providers of accommodation, etc. Oberon's manufacturing and agricultural base are reliant on heavy vehicles to import service goods and export agricultural and manufacturing products.

Oberon also supports a strong tourist industry through its proximity to Lake Oberon (fishing and sailing), Jenolan Caves, Kanangra Boyd National Park and fossicking areas.

5.17 BUSHFIRE HAZARD

5.17.1 Methodology

The bushfire hazard potential of the site has been assessed in accordance with the Department of Planning Circular No. C10 "Planning in Fire Prone Areas", 1984. The Department's assessment provides an indication of the long-term fire hazard and does not consider the variability of fuel due to the management time since last fire, or day to day climatic effects. The assessment assumes that there has been little or no hazard reduction management, the vegetation carries maximum fuel load and the Fire Danger is extreme.

In determining the bushfire hazard of the site, three phases of investigations are

undertaken.

- Phase 1: State Fire Zone. The site is assigned to one of the three state fire zones which have different characteristics of fuel type, topography, climate and fire behaviour.
- Phase 2: Land Units. The area is divided into units which are uniform for vegetation type and landform.
- Phase 3: Rating for Fire Hazard. The land units are given a rating of high, medium or low fire hazard based on fuel (vegetation type) and landform.

5.17.2 Bushfire Hazard Assessment

Oberon is located on the edge of the Eastern fire zone, to the immediate west of the Great Dividing Range. In the eastern fire zone forest and shrub fires predominate.

The Central Tablelands are dominated by natural and improved grasslands with some forest (Luke and McArthur 1978). In this area the fire season often starts about November or December in the forested areas (Luke and McArthur, 1978).

The site is characterised by two main land units based on vegetation; dry sclerophyll woodland and improved grassland. Slope analysis of the area further divides each land unit allowing the land units to be given a fire hazard of low, medium or high.

The woodland is attributed a hazard index, derived from fire intensity of 0.43. The total fire hazard score for any area is calculated by multiplying the vegetation hazard by an index for slope (see **Figure 4**). On this basis the fire hazard scores for woodland within the area range from low fire hazard 0.43 (slopes 0–5%)–0.86 (slopes 10–20%) to medium fire hazard 1.29 (slopes >20%).

The grasslands of the site are improved pasture and are attributed a high fire hazard.

Pasture (native and introduced) are, however, only considered to be a genuine hazard to development in the Western Fire Zone. "They are included in the assessment for the Central Fire Zone so that the danger of fire in grasslands is not ignored, but in this zone their hazard ratings should only be considered where proposed development is for rural residential" (DEP, 1984). The rationale for this approach is stated as follows:

1. Grassland is capable of achieving high available fuel loads and consequent high intensity fires with a high rate of spread, but it does not result in the same planning problems as a forest or tall heath.
2. An area of grassland or pasture, should it pose a threat to adjoining development, can be easily mown or cleared without significantly altering the landscape, whereas a forest is less readily removed since the bushland is invariably part of the scenic and cultural amenity of that development. Grasses can be altered for bushfire management purposes in ways totally unacceptable for bushland in the same situation.

DESCRIPTION OF THE
PROPOSED DEVELOPMENT

6.0 DESCRIPTION OF PROPOSED DEVELOPMENT

6.1 OUTLINE OF OPERATIONS

It is proposed to establish a hard rock quarry on Racecourse Hill which is located approximately 4 kilometres south of Oberon, N.S.W. (see **Figure 1**) The material to be quarried forms part of an extensive deposit that is estimated to contain in excess of 39 million tonnes of basalt(see **Section 5.5.3**). Of this, 9 million tonnes have been identified as being capable of being extracted with minimal environmental impact.

Analysis of samples of basalt from the site indicate that when processed the rock is suitable for the production of high strength concrete, road sealing aggregate, base and sub-base material for road construction, rail ballast and rip-rap.

Quarry material will be won using a drill and blast operation. Blasted rock will be loaded into off-road rear dump trucks using a front end loader and transported to the crushing plant for processing. Product will be loaded into highway trucks and transported via a sealed haul road to Shooters Hill Road from where it will be distributed to markets as identified in **Section 3.1**.

6.2 EXTRACTIVE OPERATIONS

6.2.1 Quarry Plan

The extraction area (see **Figure 15a**) is approximately 750 metres long and 250 metres wide and encompasses an area of approximately 17.5 hectares. Extractive operations will be confined to the plateau that forms the upper perimeter of Racecourse Hill. The quarry floor will be located approximately 20 metres below the skyline and bounded on all sides by natural topography and vegetation.

Following the establishment phase outlined in **Section 6.4.1** quarrying will be undertaken in three stages as indicated on **Figures 15a, 15b, 15c**.

Stage 1

Quarrying will commence on the eastern face of the Racecourse Hill approximately 100 metres northwest of the proposed crushing plant and will proceed in a westerly direction with a 150 metre wide quarry face. Extraction will continue in a westerly direction for approximately 250 metres to the extraction boundary. Approximately 1.8 million tonnes of material will be extracted during Stage 1. At a production rate of 200,000 tonnes per annum extraction in Stage 1 will last approximately 9 years.

Approximately 9,375m³ of topsoil and overburden will be stripped and stockpiled at the northern limit of the extraction area during Stage 1 (see **Figure 15a**). Approximately 75,000m³ of interburden and reject material will be handled in Stage 1. This material will be incorporated into rehabilitation of the Stage 1 area.

As adequate space is created in the extraction area, sections of the quarry floor

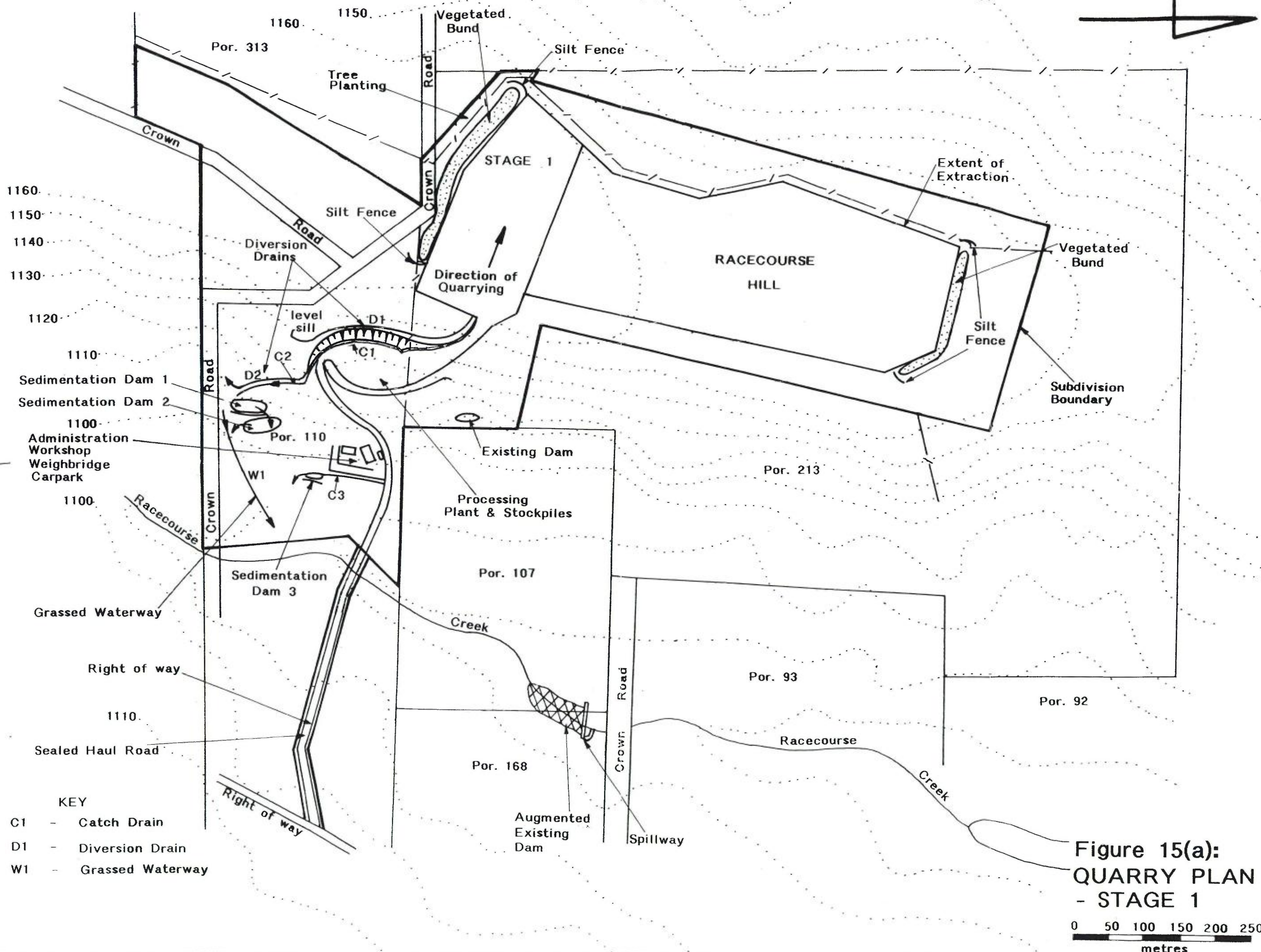
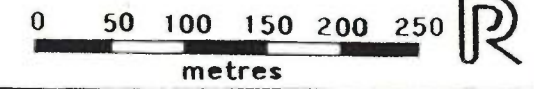
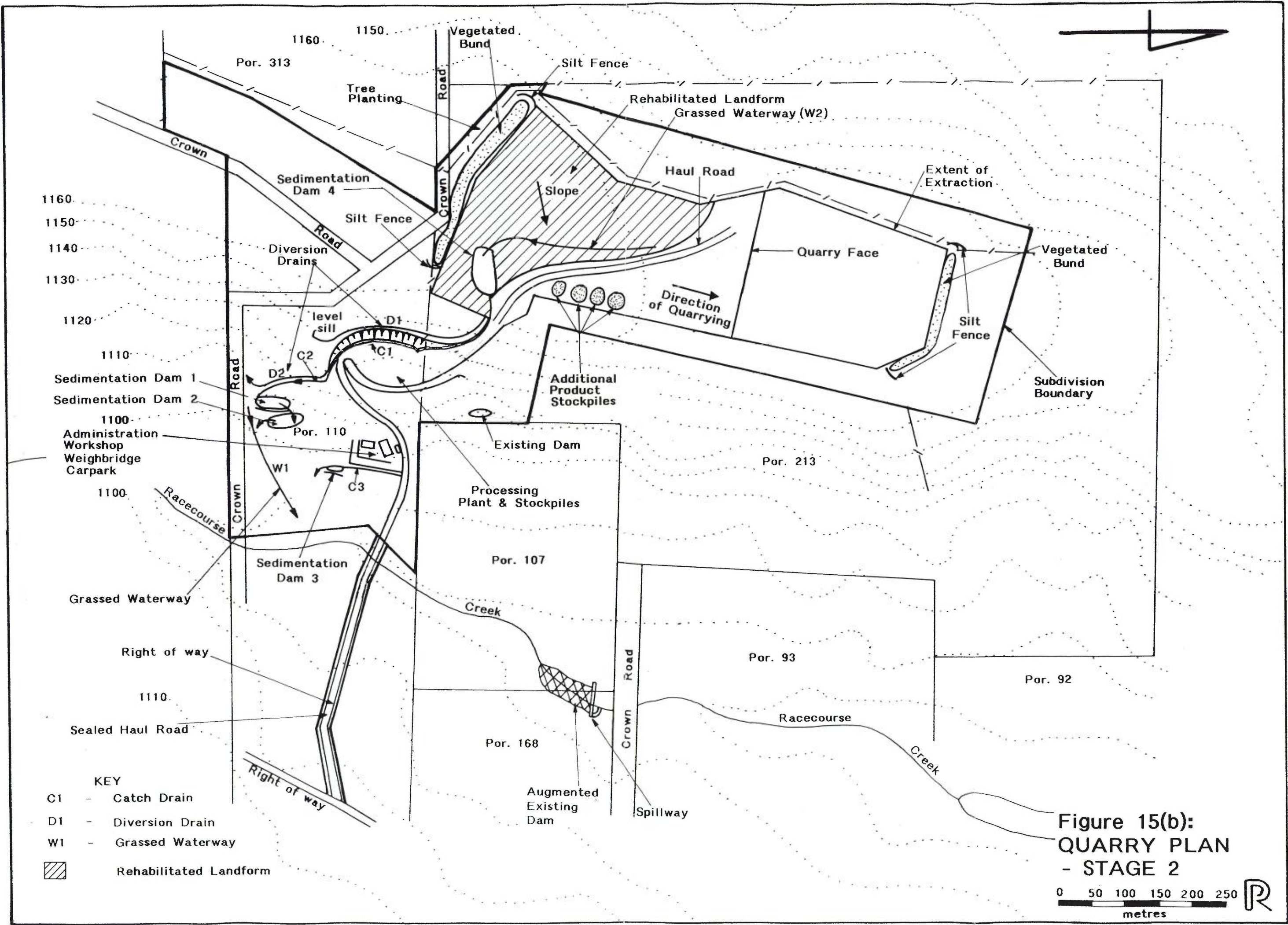


Figure 15(a):
 QUARRY PLAN
 - STAGE 1





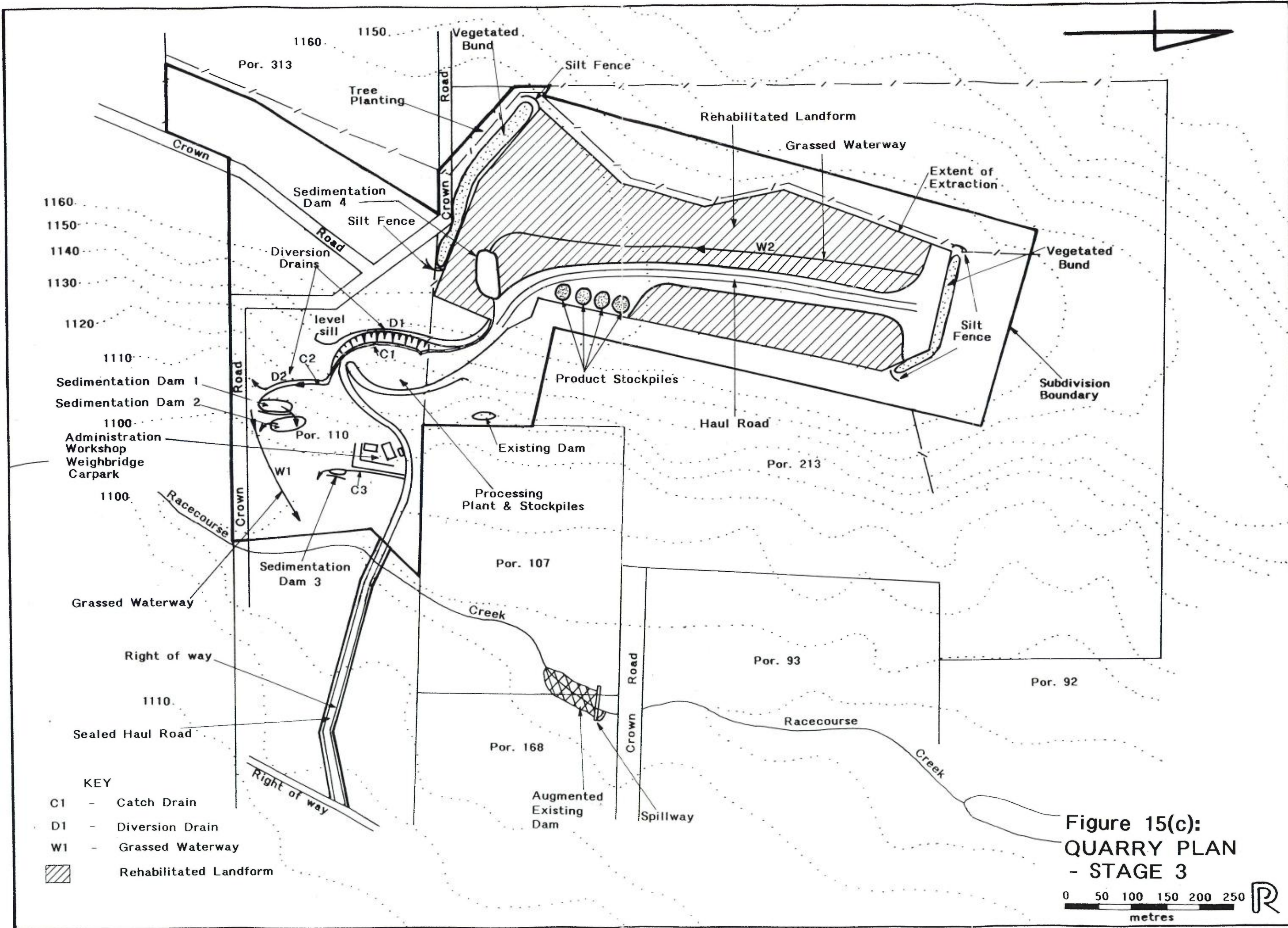
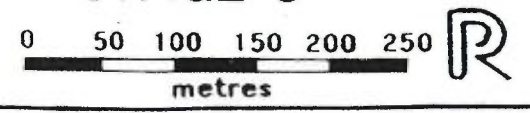


Figure 15(c):
 QUARRY PLAN
 - STAGE 3



- KEY
- C1 - Catch Drain
 - D1 - Diversion Drain
 - W1 - Grassed Waterway
 - Rehabilitated Landform

will be utilised for stockpiling product and the construction of an additional primary sedimentation dam (Sedimentation Dam No. 4). Interburden material will be placed on the quarry floor and later incorporated into the rehabilitated landform. The quarry floor will be maintained to ensure that run-off from the quarry face and extraction area are directed to the primary sedimentation dam.

Stage 2

In Stage 2 the quarry face will advance in a northerly direction (see **Figure 15b**). Quarrying will be undertaken on approximately a 250 metre wide face and will continue in a northerly direction for approximately 300 metres. Approximately 3.6 million tonnes of material will be extracted in Stage 2 requiring a period of approximately 18 years at an extraction rate of 200,000 tonnes per year.

During Stage 2 approximately 22,000 m³ of topsoil and overburden will be stripped and used initially in rehabilitation of the quarry floor in Stage 1 extraction area and later in Stage 2. Approximately 150,000m³ of interburden and reject material will be handled in Stage 2 and will be incorporated in rehabilitation of Stage 1 and Stage 2 areas.

Run-off from Stage 2 will be directed to the primary sedimentation dam located in Stage 1 area.

Stage 3

In Stage 3 quarrying will continue in a northerly direction for approximately 300m (see **Figure 15c**). Approximately 3.6 million tonnes of material will be extracted in Stage 3. Approximately 22,000 m³ of topsoil and overburden will be stripped and used in the rehabilitation of Stage 2 and Stage 3 quarry floors. Approximately 150,000m³ of interburden and reject material will be handled in Stage 3 and will be incorporated in rehabilitation of Stage 2 and Stage 3. At the completion of extraction of Stage 3 topsoil and overburden material at the northern and southern ends of the extraction area will be used in the rehabilitation of the quarry floor.

6.2.2 Vegetation Stripping

The majority of vegetation stripping associated with the development involves the temporary removal of improved and native pasture species from the proposed extraction area and associated haul road construction. Several Eucalyptus trees at the perimeter of the extraction area and within the alignment of the haul road will require removal. Cleared timber will be windrowed and utilised for fire wood where suitable or burnt at an appropriate time. The haul road alignment has been chosen to minimise the amount of tree clearing required.

6.2.3 Topsoil and Overburden Handling

Within the proposed extraction area soils are shallow and the depth of weathered rock is shallow averaging approximately 250mm in depth with areas up to 1.5m in depth, making the total volume of topsoil and overburden to be removed negligible. Topsoil and overburden will be stripped to approximately 10m in front of the quarry face to minimise erosion potential and allow sufficient space for drilling and blasting.

Topsoil and overburden will be stripped using either scrapers or front end loaders and rear dump trucks. Material will be stripped immediately in advance of preparation for drilling and blasting. Stripped material will be utilised to rehabilitate previously quarried areas as described in **Section 6.2.1**.

6.2.4 Production Rate and Life of Operation

Consent is being sought to quarry approximately 9 million tonnes of basalt. Extraction is expected to be initially at a rate of approximately 100,000 tonnes per year, increasing to an average annual production of 200,000 tonnes per year within the first ten years of operation. Peak daily production is expected to be approximately 2000 tonnes which is the maximum capacity of the processing plant. Production at this level is expected to occur infrequently.

At an extraction rate of 200,000 tonnes per year it is expected that the proposed development will have a life of approximately 45 years.

6.2.5 Blasting Techniques

Initially holes will be drilled to allow blasting on three faces. Holes will be drilled to a depth of approximately 10 metres using an hydraulic track drill. A preliminary blast design (see **Appendix 7**) has been determined based on a production of approximately 5000 m³ per blast. Blasting will be required to be undertaken approximately once every month.

Preliminary blast design has been determined to ensure compliance with Environment Protection Authority requirements of a maximum 5mm per second ground vibration and a maximum over-blast air pressure of 115 dB(A) at the nearest residence.

6.2.6 Extraction Techniques

Rock will be quarried in two benches approximately 10 metres high with material from the upper bench either being blasted or pushed with a bulldozer onto the quarry floor which will be located at approximately 1140m AHD. Once the rockmass has been dislodged by blasting a front end loader will load raw basalt rock directly into 30 to 40 tonne rear dump trucks which will haul the material to the processing area and crusher. Processing and crushing facilities are to be located on a hardstand area which will be located on the eastern side of Racecourse Hill at approximately 1126m AHD.

Oversized rock will be transported away from the quarry face and stockpiled until it undergoes secondary breaking with a contract hydraulic rock breaker. This activity will be carried out on an as need basis and will be dependent on existing degree of rock fracture and blast effectiveness.

6.3 MOBILE EQUIPMENT

On-site mobile equipment is envisaged to include:

- 2 x Scrapers (During establishment phase only)
- 2 x Front-end Loaders (3.5m³ capacity)

- 1 x D7 Bulldozer (or equivalent)
- 2 x 30–40 tonne Rear Dump Trucks
- 1 x Water Cart
- 1 x Hydraulic Track Drill

6.4 PROCESSING OPERATIONS

6.4.1 Site Selection and Preparation

The processing plant site has been selected to be close to the quarry and well screened from the surrounding areas. The quarry area and processing plant area have been chosen to be within one sub-catchment of Racecourse Creek and all run-off from both sites can be controlled by an integrated series of catch drains and sedimentation dams.

As far as possible the existing side slopes of Racecourse Hill will remain intact throughout the life of the quarry and quarry operations will be undertaken within the existing shell of the hill. To gain road access to the quarry floor level from the crushing plant a cut 20m wide at the base and 20m deep will be made into the side of Racecourse Hill. The road will be cut into the quarry floor at approximately 1135m AHD.

Establishment Phase

Initially Sedimentation Dams 1, 2, and 3 and associated water management structures will be constructed. Subsequent to this hardstands for the processing and administration areas will be prepared and haul roads to the quarry face and Shooters Hill Road will be constructed.

Preparation of the processing area will involve the removal of soil and weathered rock to a depth of approximately 4m from an area 120m by 70m. Scrapers and a bulldozer will be used for this operation and in all approximately 30,000 m³ of material will be removed.

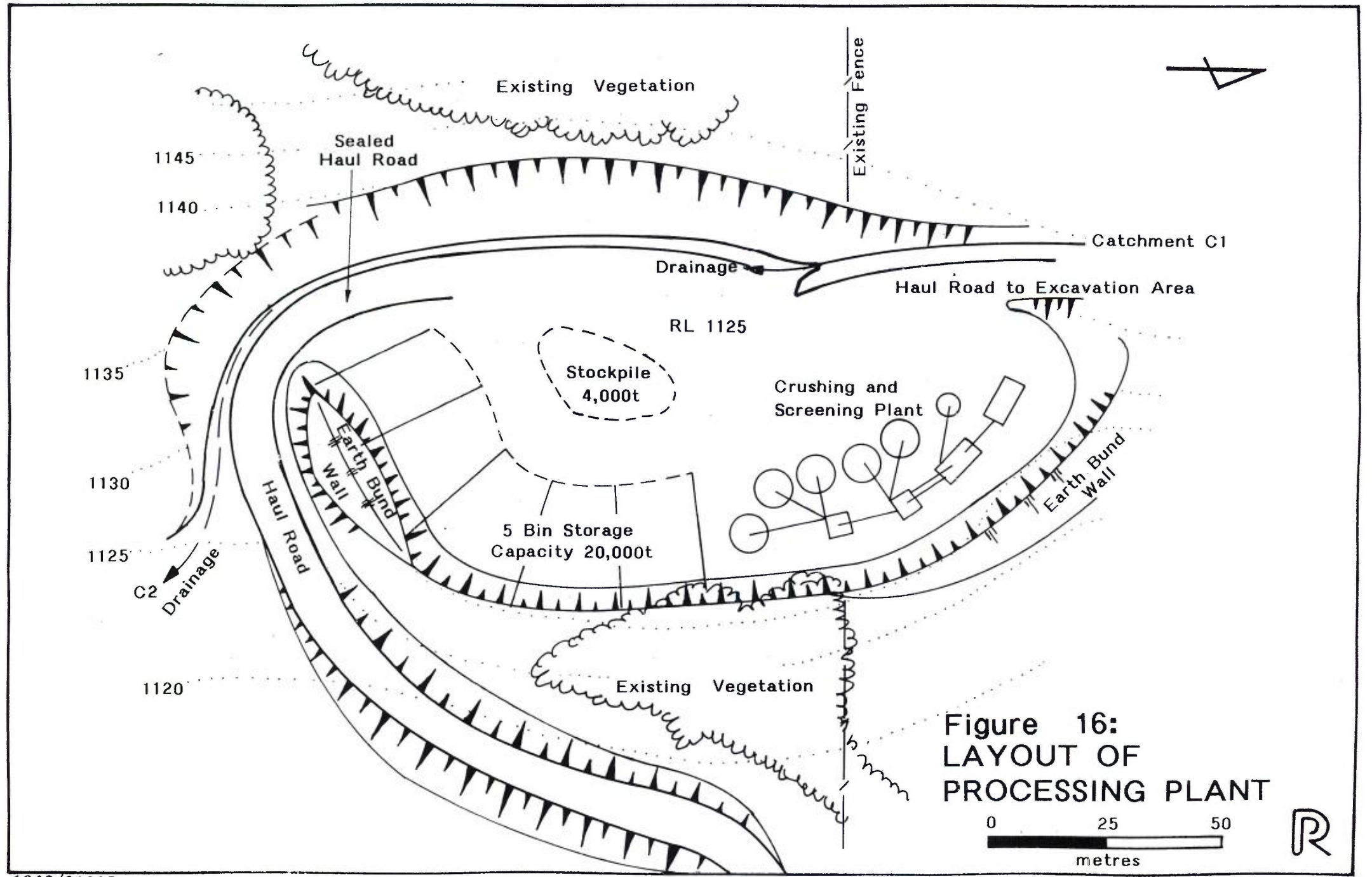
Topsoil and overburden material stripped from the processing area will be used to fill low sections of the processing area, construct a hardstand area for the administration facilities and weighbridge and used in construction of the haul roads. Approximately 8,000m³ of topsoil material will be transported to the southern side of the proposed extraction area on top of Racecourse Hill (see **Figure 15a**) and stockpiled for later use in rehabilitation of the excavation area.

Topsoil will be stockpiled to a height of approximately 3m and vegetated with improved pasture species.

6.4.2 Plant Layout and Components

The basalt rock will be taken from the quarry site to the processing area as shown on **Figure 15a**. The proposed layout of the processing plant and stockpile areas is shown in **Figure 16**.

The raw basalt rock from the quarry will be dumped directly into a hopper above the primary feeder. The feeder then controls the rate of supply of rock to an enclosed primary jaw crusher which reduces the size of larger rock pieces.



**Figure 16:
LAYOUT OF
PROCESSING PLANT**

Material from the primary crusher will then pass over a scalping screen, which removes the clay fraction from the finer sections of the raw feed, to the secondary crusher. Crushed rock continues on a cycle of tertiary recrushing and screening until the material has been separated into the individual required sizes. Once processed, crushed rock is delivered by conveyor to small product stockpiles as shown on **Figure 16**.

It is anticipated that the processing plant will be comprised of:

- Primary Hopper and Feeder
- Primary Jaw Crusher
- Scalping Screen
- Sizing Screen
- Secondary Gyratory Crusher
- Interconnecting Conveyors

6.4.3 Product Stockpiles

As stated in **Section 6.4.2** stockpiles of finished product will accumulate under each of the discharge conveyors. Five live stockpiles will normally be used each with an individual capacity of 600 tonnes.

Material will be transferred to product stockpile bays located as shown on **Figure 16** from where it will be loaded into highway registered trucks and semi-trailers for transport to market destinations. The total stockpile storage capacity for finished product within the processing area will be 20,000 tonnes. Once sufficient space is available within the extraction area it is envisaged that up to an additional 20,000 tonnes of product may be stored on the quarry floor.

6.4.4 Water Supply

Water will be required at the quarry site for processing operations, dust suppression, rehabilitation and potable supplies. Peak water demands for the quarry have been estimated at approximately 70KL/day with average daily demand being approximately 35KL. Water to meet these demands will be drawn in the first instance from on-site sedimentation dams. When these supplies are low, water will be drawn from an existing dam on Racecourse Creek that is to be increased in size to have a storage capacity of 2.7ML. Potable supplies will be drawn from Racecourse Creek and water collected from the roof of the administration centre and workshop.

6.5 MATERIAL HAULAGE

6.5.1 Road Haulage and Haulage Routes

Raw feed will be hauled in rear dump trucks on an unsealed haul road from the extraction area to the crushing plant at an average rate of approximately 22 to 30 laden trips per day with an expected peak of 80 laden trips per day.

Quarry product will be transported from the processing area along a sealed haul road to Harveys Lane which is to be upgraded and sealed to Shooters Hill Road. From Shooters Hill Road quarry product will either be transported north along

Jenolan Caves Road to Oberon from where it will be distributed to markets in the Central Tablelands or south along Jenolan Caves Road to Titania Road for distribution to markets in Lithgow, Blue Mountains and Western Sydney Regions. The alternative haulage routes are shown on **Figure 17**.

Finished product will typically be transported from the site in trucks of 10 to 25 tonne capacity. Products will be transported by trucks owned and operated by Oberon Quarries and trucks operated by local transport contractors. The Company will make its best endeavours to ensure that transport of all product from the quarry is undertaken in a safe and responsible manner.

Once full production is achieved, on average, approximately 30 laden truck trips per day will occur with approximately 70% of these heading north along Jenolan Caves Road towards Oberon and 30% heading south along Jenolan Caves Road and then east along Titania Road towards Lithgow, Blue Mountains and Western Sydney. Peak daily movements in the order of 80 laden truck trips are expected with a similar split in destinations to average daily movements.

6.5.2 Road Upgrading

As stated in **Section 6.5.1** Harveys Lane is to be upgraded to a 6 metre two lane sealed road. The intersection of Harveys Lane and Shooters Hill Road are to be upgraded in accordance with the requirements of Oberon Shire Council and Roads and Traffic Authority.

Oberon Quarries have indicated that they would be willing to make a proportional contribution towards the sealing of Titania Road and would make a contribution equivalent to 3 per tonnes/kilometre of product ex-quarry for maintenance of roads within Oberon Shire used for the transport quarry product.

6.6 FACILITIES

6.6.1 Administration Centre and Workshop

An administration centre, weighbridge and workshop are to be constructed on-site as shown in **Figure 15a**. Toilets, washroom and a Council approved aerated septic system are to be constructed in conjunction with the administration centre. The area will be fenced and a lockable gate erected at the entrance.

6.6.2 Parking

Parking areas will be provided adjacent to administration centre and within the processing area as shown in **Figure 15a**. When the quarry is not operating trucks and on-site mobile equipment will be parked within either the processing area or the extraction area.

6.6.3 Fuel Storage

Fuel will be stored in above ground fuel tanks capable of holding approximately 20,000 litres. Fuel tanks will be located within the processing area and will be covered and bunded in accordance with Environment Protection Authority requirements.

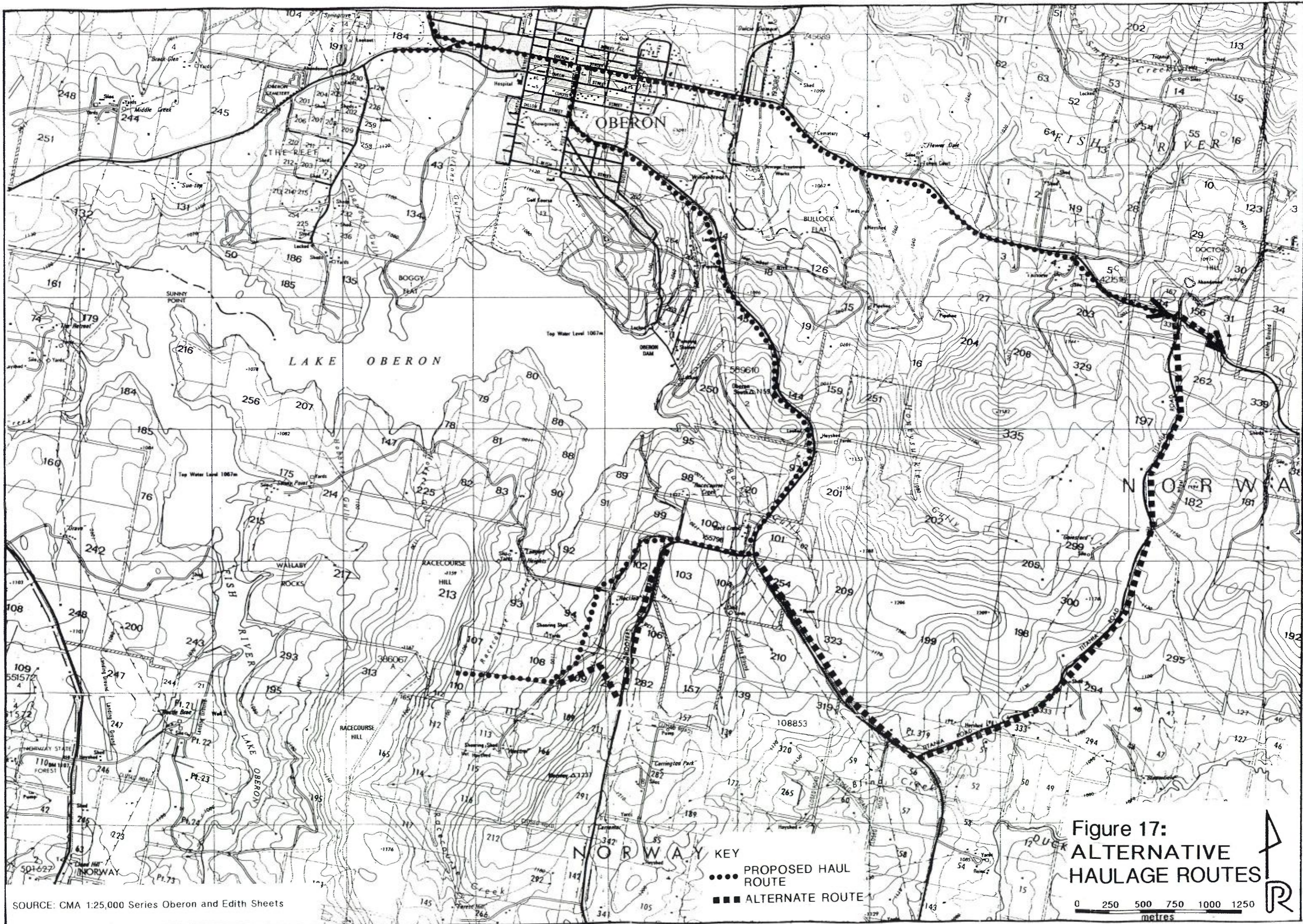


Figure 17:
ALTERNATIVE
HAULAGE ROUTES

- KEY
- PROPOSED HAUL ROUTE
 - - - - ALTERNATE ROUTE

0 250 500 750 1000 1250
metres

SOURCE: CMA 1:25,000 Series Oberon and Edith Sheets

6.7 UTILITIES

6.7.1 Electricity

Correspondance from the Southern Mitchell Electricity indicated that three phase power will be available from Shooters Hill Road.

Three phase and single phase power will be required for the crushing and processing plant, workshop, administration building and employee facilities. The total electricity usage is expected to be approximately 70,000 k.w.h. per month.

6.7.2 Telecommunications

Telephone connections will be obtained from the Telecom network supplying the surrounding properties.

6.8 HOURS OF OPERATION

Quarrying and processing will take place between the hours of 7:00am and 6:00pm weekdays and 7:00am to 4:00pm Saturdays. Plant maintenance and despatch of material will take place 6:00am to 10:00pm weekdays and 7:00am to 4:00pm on Saturdays.

From time to time plant maintenance may have to be done outside these hours.

6.9 WORKFORCE

The proposed operation of the quarry will provide full-time employment for up to 15 people on site and up to 20 truck drivers during peak production periods.

Indirectly the proposed development will provide employment for support personnel including equipment suppliers, business services and retail trades.

*15 total
employment*

6.10 ENERGY REQUIREMENTS

On-site energy requirements for crushing and processing will be provided by single and three phase electrical power as described in **Section 6.7.1**. On-site mobile equipment will be powered by distillate at an expected consumption rate of approximately 600L per day.

ENVIRONMENTAL MANAGEMENT
PROCEDURES

7.0 ENVIRONMENTAL MANAGEMENT PROCEDURES

7.1 WATER MANAGEMENT PLAN

Environmental management procedures adopted for the proposed development to maintain downstream water quality have been designed to complement the Sediment and Erosion Control procedures outlined in **Section 7.2** and are presented in full in **Appendix 8**.

7.1.1 Surface Runoff

To ensure that surface runoff from undisturbed areas is diverted around the extraction and processing areas, a series of diversion drains as shown on **Figures 15a** to **15c**, are to be constructed at the perimeter of the areas to be disturbed.

As described in **Section 6.2** all runoff from the extraction and processing areas is to be directed through a series of sedimentation dams. Water required for dust suppression purposes and processing will be drawn initially from sedimentation dams ensuring that these dams remain in a drawn down condition in all but prolonged wet periods.

There will be no 'Dry Weather' discharge from sedimentation dams. Sedimentation dams have been designed to provide adequate retention time to allow settlement of particles in excess of 40 μ m diameter for the 2% AEP design storm. By adopting a wet basin design the majority of entrained sediment will be captured during storm events well in excess of design criterion. A grassed waterway is to be constructed downstream of Sedimentation Dam 2 to convey surface runoff and treated runoff to the Racecourse Creek drainage system.

7.1.2 Groundwater

Geological analysis indicates that groundwater resources at the proposed extraction site have a localised aquifer recharge area which is confined to Racecourse Hill (refer to **Section 5.7.2**). Based on an analysis of the geology of the area, the groundwater aquifer at the proposed development site is independent of the groundwater aquifer that is utilised on the properties of 'Rocklea' and 'Westrel' on the eastern side of Racecourse Creek.

Several springs exist at the northern end of Racecourse Hill and it is believed that these springs are fed from groundwater accumulating in a Tertiary alluvial gravel deposit that exists between the overlying basalt flow and the underlying granite base. Extraction will not disturb the gravel layer. The final landform for the extraction site has been designed to reflect the drainage and infiltration characteristics of the pre-extraction landform. In this way the current infiltration regime of the underlying groundwater aquifer will be maintained.

In the advent of accidental spills of oil based products, quarrying operations have been designed to maintain a free draining landform from the quarry face. This will minimise the potential of accession of oil based products to the underlying groundwater resources if unforeseen accidents occur.

7.1.3 Water Quality

In addition to the sediment control procedures described in **Section 7.2** a number of other measures have been adopted to ensure that the proposed development does not deteriorate the existing water quality of Racecourse Creek or Lake Oberon. Procedures to be adopted include:

- * Fuel to be stored in above ground tanks. Tanks are to be covered and bunded to provide capture of ¹⁰⁰110% of the tanks storage capacity. Fuel tanks are to be located within the area serviced by the sedimentation dam system to provide an additional level of control in case of unforeseen failure of the system.
- * All runoff from the quarry face is directed through a series of three sedimentation dams prior to discharging to the Racecourse Creek drainage system. In this way the sedimentation dam infrastructure affords adequate potential to control and isolate any accidental spills that may occur. The sedimentation dam system affords similar control for the crushing and processing area.
- * All wastewater from onsite amenities buildings will be directed to a Environment Protection Authority approved aerated septic tank system. Effluent from the system is to be used to irrigate vegetated bunds and adjoining pasture.
- * A water quality monitoring programme will be established to assess the performance of water management procedures. Samples will be taken from Racecourse Creek upstream of Waterway 1 and at the downstream boundary of 'Langley Heights'.

7.1.4 Water Budget

As described in **Section 6.4.4** peak water demands for the operation have been estimated at approximately 70 KL/day with an expected annual water usage of approximately 9 ML. Water is to be drawn from onsite sedimentation dams in the first instance. When these reserves are low, water will be drawn from the augmented farm dam on Racecourse Creek which has been estimated to have an annual catchment yield of 645 ML (see **Section 5.7.1**). If quarry water needs were to be drawn entirely from Racecourse Creek, water usage would represent approximately 1% of annual flows in the creek. Licences will be sought from the Department of Water Resources to augment the farm dam and draw water from Racecourse Creek.

7.2 SEDIMENT AND EROSION CONTROL

A Sediment and Erosion Control Plan has been developed for the site and is detailed in **Appendix 8**.

The major objective of the Sediment and Erosion Control Plan is to ensure that the aquatic habitat of Racecourse Creek and the water quality of Racecourse Creek and subsequently Lake Oberon are not degraded by the proposed development both in the short and long term.

The underlying fundamental objectives of the Sediment and Erosion Control Plan are:

- * Provide adequate retention capacity to contain sediment laden runoff from a 1 in 50 year (2% Annual Exceedance Probability) storm event.
- * To divert, at non-erosive velocities surface runoff from undisturbed areas around the extraction and processing areas to the Racecourse Creek drainage system.
- * Maintain all runoff control structures in a vegetated and functional condition.
- * Provide adequate runoff control (ie. silt fences) downslope of topsoil and overburden stockpiles or vegetated bunds. Stockpiles and bunds are to be vegetated with an improved pasture species to minimise sediment generation potential.
- * Minimise the area of disturbance at any one point in time and rehabilitate disturbed areas as rapidly as is practical.
- * Provide a final landform that is stable and productive.

These fundamental objectives are to be achieved through the adoption of a range of control measures that are detailed in **Appendix 8**. These include:

- * Provision of four sedimentation dams with a total capacity of approximately 5850 KL. In addition to this each dam has been designed to contain up to 0.5m of sediment without reducing its design sediment trapping capacity. Sedimentation dams have been designed to contain runoff from a 1 in 50 year, 4 hour duration storm event. Spillways on each of the dams have been designed to be capable of conveying peak discharges from a 1 in 100 year storm event. Runoff control structures have been designed based on a fully developed quarry. This situation will not exist for approximately 40 years.
- * Construction of approximately 510m of grassed clean water diversion drains to separate clean runoff from runoff from the extraction and processing area.
- * Construction of 485m of vegetated catch drains and approximately 700m of grassed waterway to convey runoff from the quarry face and processing area to the sedimentation dam system.
- * Design of diversion drains, catch drains and waterways to convey peak runoff from a 1 in 20 year storm event at non-erosive velocities (ie. 1.6m/s or less).
- * Vegetating of dam batters and spillways to reduce sediment generation potential. Similarly sealing of the haul road from the edge of the processing area to Shooters Hill Road and the provision of concrete or stone pitched headwalls on culverts will further minimise erosion and sediment generation potential.

- * Establishment of sedimentation dams and associated runoff control structures prior to the commencement of major earthworks.
- * Adoption of sediment controls (ie. silt fences, staked haybales) to contain runoff from disturbed areas during the construction phase.

7.3 SOLID WASTE DISPOSAL

There will be no solid waste produced by the proposed development. Reject material produced through extractive and crushing processes will be incorporated along with overburden and topsoil into rehabilitated landform.

Refuse from the processing plant, administration area and workshop will be temporarily stored in a suitable container and subsequently disposed of at a location approved by the local authority.

7.4 AIR QUALITY CONTROLS

Air quality control measures have been designed to restrict dust levels to those below which may cause inconvenience to employees, surrounding residences and adjoining land uses. The crushing facilities will require a licence from the Environment Protection Authority and the conditions of this licence will be regularly monitored.

Air quality control measures to be adopted at the proposed development site include:

- * Enclosure of the primary and secondary crushers which are the major sources of dust generation in the processing operations.
- * Sealing of the haul road from the edge of the processing area to Shooters Hill Road. Provision to apply water at a rate of 1.5L/m²/hour to the remaining trafficked areas within the proposed development site to ensure they are maintained in a moist condition during hours of operation.
- * Appropriate design of proposed extractive operations which ensures that the majority of quarry activities will be shielded on all sides from prevailing winds, restricting dust generation potential.
- * Vegetating of exposed stockpiles and bunds and ongoing rehabilitation and revegetation of the quarry floor to minimise dust generation potential.
- * Permanent water sprays will be provided for stockpiled product material of 9mm or finer diameter.
- * Provision of a water spray system capable of saturating the product stream within the secondary crusher building. Water sprays will be installed at all conveyor discharge points.

- * All trucks carrying 9mm and finer product material will be suitably covered and sealed.
- * All mobile equipment will be regularly maintained to minimise emissions from fuel burning equipment.

An assessment of the effectiveness of these measures has been undertaken by Nigel Holmes and Associates and the findings are summarised in **Section 8.5** and presented in full in **Appendix 9**.

7.5 NOISE AND VIBRATION CONTROLS

A range of noise controls have been incorporated into the proposed development and the performance of these controls has been predicted using the computer based Environmental Noise Model which was developed by RTA Software in conjunction with the State Pollution Control Commission. Details of noise impact assessment is documented in **Appendix 4** and is summarised in **Section 8.6**. A preliminary blast design has been developed for the quarry and is presented in **Appendix 7**.

7.5.1 Noise Controls

Noise controls to be incorporated in the development are described in full in **Appendix 4** and include:

Quarry Operations

Adoption of an "enclosed" quarry design that allows quarry operations to be shielded on four sides for the majority of the life of the quarry. By adoption of this design, mobile equipment will only be in an acoustically exposed position for short periods when it is necessary to operate equipment within 2 to 3m of the top of Racecourse Hill.

The quarry floor is to be established at approximately 1140m AHD with equipment operating the majority of time either on the quarry floor or on a bench within the quarry at approximately 1150m AHD. During these times quarry activities will be shielded from adjoining residences by 10m to 20m of rock wall. By necessity a narrow opening will be cut into the side of Racecourse Hill to allow access to the quarry floor. Equipment to be utilised for quarrying has been chosen for their respective low noise emission levels.

Processing Operations

The crushing and processing facilities are to be constructed on a level area at approximately 1130m AHD on the eastern side of Racecourse Hill. To attenuate noise emission levels from the crushing operation the level area is to be excavated to approximately 1126m AHD allowing the crushing facilities to be established adjacent to a 4m wall of undisturbed material (see **Figure 16**). By excavating the floor level of the processing area to 1126m AHD, significant noise attenuation can be achieved without the need to establish acoustic bunding or remove existing vegetation immediately east of the processing area.

Noise from the crushing plant is to be further attenuated by enclosing the primary and secondary crushers. In addition, a visual/acoustic bund is to be constructed at the southern end of the product storage bays (see **Figure 16**). All crushing and screening equipment is to be maintained in a fully serviceable condition to reduce the potential for erroneous noise sources.

Transportation

To minimise impacts associated with transportation noise the haul road is to be sealed and maintained in a good condition from the edge of the processing area to Shooters Hill Road. By sealing the haul road potential noise sources such as trucks clattering over rough roads will be minimised.

7.5.2 Drilling and Blasting Controls

To minimise noise emissions associated with drilling it is proposed to utilise an hydraulic track drill due to its superior performance in terms of noise emissions when compared to air track drills. Periods of drilling are to be minimised by utilisation of modern and efficient drilling equipment.

A preliminary blast design has been prepared for the site (see **Appendix 7**) and has been assessed to theoretically comply with Environment Protection Authority requirements of a maximum of 5mm/sec ground vibration and a maximum over-blast air pressure of 115dB(A) at the nearest residence. Public Works Department have advised that a maximum ground vibration of 10mm/sec is permissible at Oberon Dam wall. As ground vibration attenuates with distance and the dam wall is some 2.1km from the extraction area, the need to comply with ground vibration levels of less than 5mm/s at residences approximately 500m from quarry activities will ensure that ground vibration of 10mm/sec is not exceeded at the dam wall.

7.5.3 Monitoring

Once the quarry is established, quarry operations will be monitored to ensure compliance with Environment Protection Authority requirements. If exceedances are recorded, operations will be modified so that compliance is achieved. Similarly trial blasts will be monitored and where necessary the blast design will be modified to comply with Environment Protection Authority requirements.

7.6 ROAD MAINTENANCE

The Company will construct and maintain a sealed haul road from the edge of the processing area to Shooters Hill Road. The haul road will incorporate sections of Harveys Road which will be upgraded and sealed to a 6m width. The haul road will be maintained by the Company for the life of the quarry. The intersection of Harveys Road and Shooters Hill Road will be upgraded in accordance with reasonable requirements of the Council.

A proportional contribution will be made to Council towards upgrading and sealing of Titania Road.

The Company acknowledges the impact that heavy transport has on road

pavement structure and maintenance requirements. Accordingly, the Company will make a road maintenance contribution equivalent to 3 cents/payload tonne/kilometre (indexed) to Oberon Shire Council for the maintenance of roads within Council's control that are used by the quarry development.

7.7 SITE REHABILITATION AND FINAL LAND USE

As described in **Section 6.2** overburden and interburden material is to be placed on the fully extracted quarry floor to a minimum depth of 0.5m and then shaped to provide a free draining surface. A minimum thickness of 100mm of topsoil is to be placed over the interburden/overburden layer and vegetated with improved pasture species. The final landform is to be shaped to provide slopes of less than 5%. A grassed waterway is to be constructed along the centre of the quarry area (see **Figure 18**) to convey runoff from rehabilitated areas and the quarry face to Sedimentation Dam 4.

Limited rehabilitation will take place during Stage 1 due to space and material constraints. Mid-burden material will be placed on the quarry floor away from Sedimentation Dam 4 and product stockpile areas. Emplaced interburden will be temporarily seeded with improved pasture species.

At the completion of Stage 1, topsoil and overburden from the Stage 2 area will be stripped and used directly to progressively rehabilitated Stage 1. This sequence will continue throughout Stage 2 and Stage 3 with rehabilitation and waterway construction progressing in a northerly direction in accordance with the progress of the quarry face. A distance of approximately 40m will be required between the quarry face and areas to be rehabilitated to allow for passage and turning of mobile equipment.

At the completion of extraction in Stage 3, stockpiled material at the northern and southern extremities of the extraction area will be used to rehabilitate the remaining quarry floor. Once extraction is completed crushing and processing facilities and the administration buildings, weighbridge and workshop will be removed. Hardstand areas will be deep ripped, topsoiled and planted with improved pasture species.

As part of the progressive rehabilitation programme a series of woodlots will be planted on the rehabilitated quarry floor to provide shelter for stock and habitat for native fauna. Woodlots will consist of eucalypts and acacia species that are known to grow in the area (see **Section 5.10**).

Once rehabilitated, the proposed site will be returned to productive grazing land. All sedimentation dams and runoff controls will remain in place to provide sediment and erosion control in the future and to provide additional water sites for stock and native fauna.

7.8 SITE SCREENING

The screening proposals have been determined for sections of the study area that are visible from adjoining residents or require infill planting to strengthen the

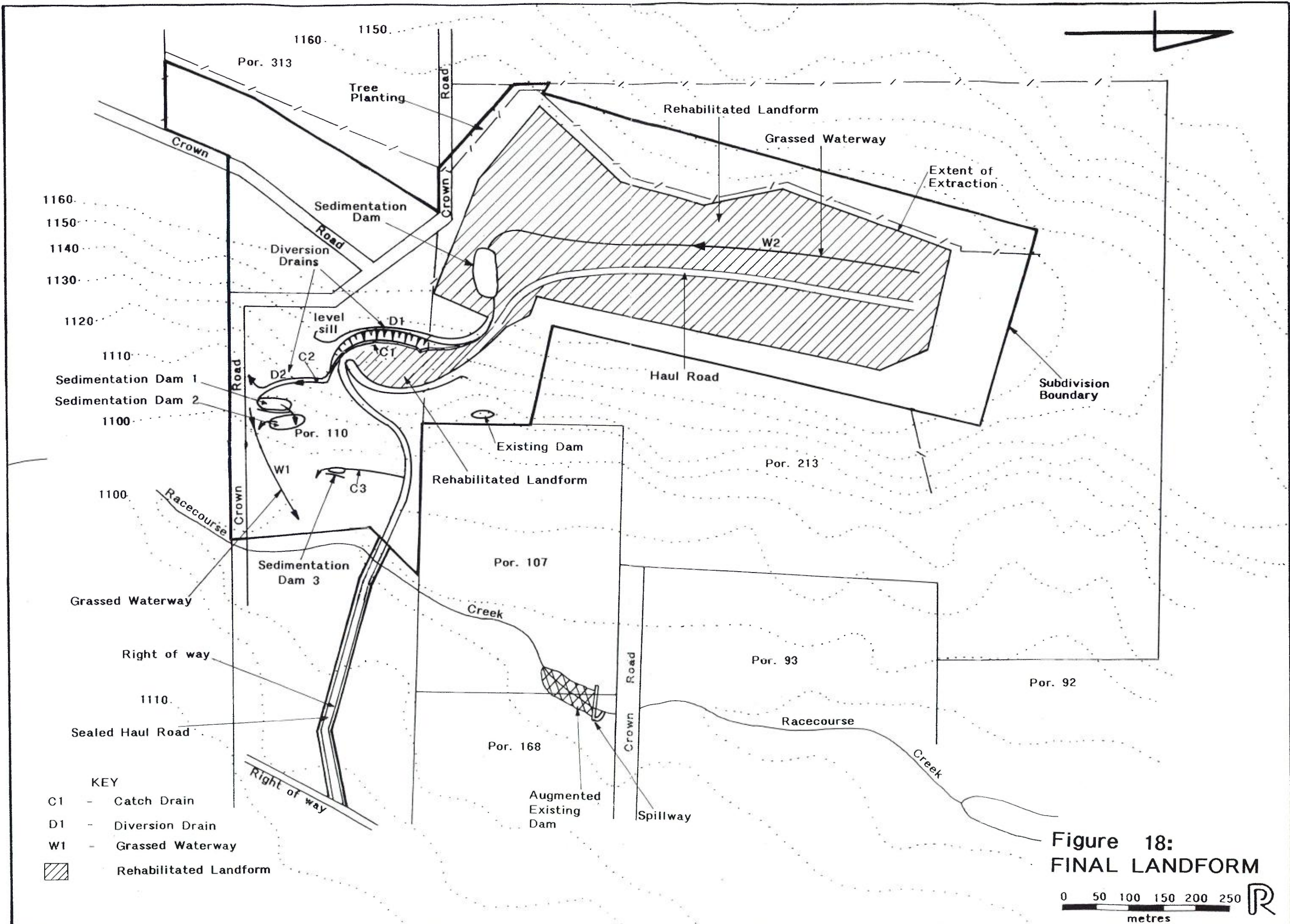


Figure 18:
FINAL LANDFORM



existing vegetated buffers.

Recommended areas of screen planting are shown on **Figure 19**. They include:

- * A section of infill planting on the northern extent of Racecourse Hill – trees (max. height 20m) planted in two rows following approximately the 1155m contour to strengthen the existing scattered vegetation.
- * Planting of small trees and shrubs (max. height 6m) to buffer views from 'Rocklea' homestead to proposed haul road, adjacent to Harveys Road. Placement and height of the screen planting has been design to shield the movement of trucks whilst still affording views of Lake Oberon from 'Rocklea' residence.
- * Infill planting of trees (max. height 20m) to screen the plant site from Mawhood's property to the south.
- * Infill planting along the eastern edge of Racecourse Hill will strengthen the existing scattered vegetation and create a continuous band of trees around the extraction area.
- * The plant site will be screened by groves of trees and shrubs.

The screening proposals will ensure views of the extraction area and plant site are buffered, minimising the visual impact of the proposed development on surrounding residences and roads.

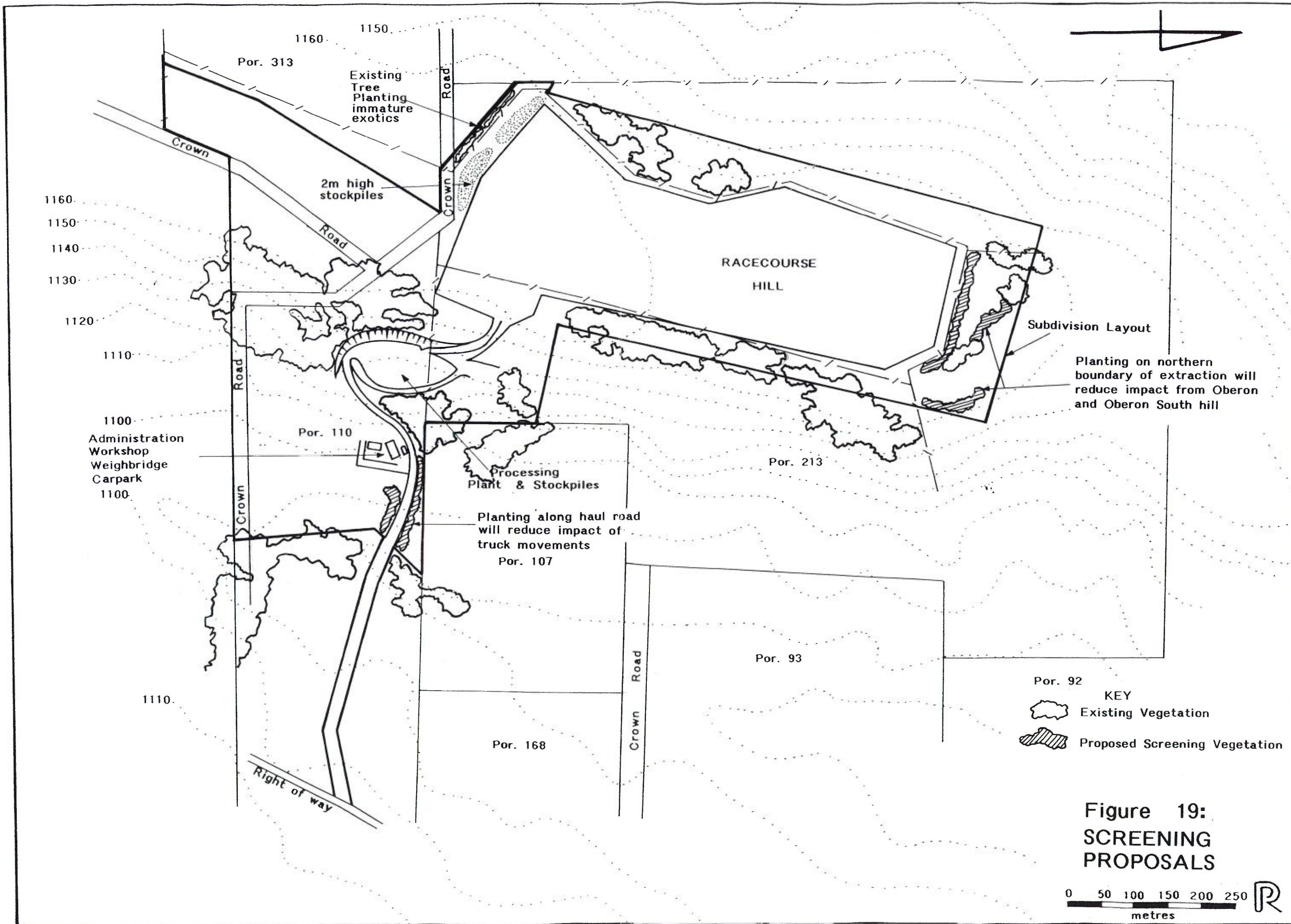
All species will be selected from those adapted to the site and present in the local area. Vegetation has been chosen to gradually blend in with existing trees and shrubs and result in natural forested slopes around Racecourse Hill.

7.9 ABORIGINAL PRE-HISTORY

Of the four archaeological locations recorded during the survey, two will be impacted by the development. Sites impacted by the development are the isolated artefact approximately 125m west of 'Rocklea' and the artefact scatter on top of Racecourse Hill (Site 4).

A Consent to Destroy permit will be sought from the Director of the National Parks and Wildlife Service for Site 4 on top of Racecourse Hill. No permit is necessary for the isolated artefact. According to National Parks and Wildlife Service definition the artefact does not constitute a site and consequently has not been recorded as such.

Site 3 is in close proximity to Racecourse Creek near the existing farm dam that is proposed for augmentation. During the construction phase Site 3 will be flagged and machinery operators notified of its presence. Although the site will not be directly affected by the development, care will be taken to ensure that it is not inadvertently damaged.



7.10 BUSHFIRE CONTROLS

Features of the proposed development that will aid in bushfire control include:

- * All mobile equipment to be fitted with suitable spark arresting mufflers.
- * Provision of adequate water storage on-site at all times.
- * Provision and regular maintenance of a water-cart and pumps suitable for fire fighting at the quarry site.
- * Construction and sealing of the haul road and watering of all other trafficked areas to minimise potential for vehicles to start fires.
- * Good housekeeping practice to ensure that refuse and other sources of potential fuel for bushfires are kept to a minimum.

7.11 CONTROLS ON OPERATION

Quarrying operations will be conducted in accordance with Development Consent conditions imposed by Oberon Shire Council and licence conditions imposed by the Environment Protection Authority. The site will be regularly inspected by Environment Protection Authority officers to ensure compliance with the Clean Air Act, Clean Water Act and Noise Control Act and associated licences and licence conditions.

The Mines Inspection Branch of the Department of Mineral Resources will also conduct regular inspections of the proposed development to ensure compliance with safety procedures.

Permits will be sought from the Department of Water Resources and Soil Conservation Service to augment the farm dam and remove trees from Protected Lands, respectively.

7.12 ENERGY CONSERVATION

To ensure efficient energy management, all equipment and plant will be maintained in good condition and operated only as required. The use of modern plant and mobile equipment will also aid in energy conservation.

ANALYSIS OF ENVIRONMENTAL
INTERACTIONS AND IMPACTS

8.0 ANALYSIS OF ENVIRONMENTAL INTERACTIONS AND IMPACTS

8.1 TOPOGRAPHY AND SLOPES

By necessity the high plateau in the central portion of Racecourse Hill will be lowered by approximately 20m and will be shaped to drain towards the proposed processing area, Sedimentation Dam 1 and Sedimentation Dam 2. The existing side slopes of the hill and the skyline will not be altered by the proposed development except for a small section on the eastern side through which the proposed haul road will pass.

The elevation of the level area on the eastern side of Racecourse Hill will be lowered approximately 4m to allow construction of the processing area. Slopes and vegetation immediately to the east of this area will remain intact.

These changes to the topography of the area will only be discernible from the immediate vicinity and will have a negligible impact on adjoining land holders or surrounding areas.

8.2 GEOLOGY

The nature of the quarrying operation necessitates that approximately 9 million tonnes of basalt will be removed from the site to produce high quality road base material, concrete and sealing aggregate and crushed rock such as railway ballast.

8.3 HYDROLOGY

8.3.1 Surface Drainage

At full extent of quarrying the effective catchment area of Racecourse Creek will be increased by approximately 7 hectares or approximately 1.7% when measured at the downstream boundary of the proposed development. This increase will occur progressively over approximately a 45 year period and will not have a significant impact on flood velocities or the flooding regime of Racecourse Creek. Any increases in catchment runoff as a result of the development will be offset by the flow retention achieved through the provision of the sedimentation dam system. Surface drainage to the west of the site will be insignificantly affected by the proposed development.

8.3.2 Water Quality

A series of sediment and erosion controls and water management procedures as described in **Section 7.0** have been incorporated in the development to minimise the impact on downstream water quality. Sedimentation controls are based on a 1 in 50 year (2% AEP) design storm and have been designed based on a fully extracted quarry (see **Appendix 8.0**). The layout of the quarry and processing facilities have been designed to be contained within one catchment to ensure

that all runoff from disturbed and processing areas is controlled by an integrated water management system. Performance of the water management system is to be monitored upstream and downstream of the development to ensure that Environment Protection Authority requirements for water quality are achieved.

Given the level of water quality controls that have been incorporated into the development it is considered that in both the short and long term the proposed development will have a negligible impact on the water quality of Racecourse Creek and Lake Oberon.

8.3.3 Groundwater

The proposed development will not significantly alter the groundwater regime at the site or its perimeters. The tertiary gravel layer that underlays the basalt deposit will not be disturbed by the extraction process leaving the groundwater conduit to the springs to the north and west of the quarry area intact.

A series of safeguards (see **Section 7.0**) have been incorporated into the development to minimise the impact on groundwater quality in the advent of accidental spills of oil based products. If spills occur, clay material remaining on the quarry floor and rehabilitated areas will provide additional protection to groundwater resources through its high hydrocarbon adsorbancy capacity.

Groundwater resources utilised at "Westrel" and "Rocklea" on the eastern side of Racecourse Creek will not be affected by the development.

8.4 SOIL EROSION

As detailed in **Section 7.2** and **Appendix 8** a series of erosion control measures have been incorporated into the proposed development to minimise the potential in both the short and long term for soil erosion at the site.

The adoption of a vegetated and stable final landform and the retention of sedimentation dams and associated erosion control structures will ensure that the proposed development will provide a relatively maintenance free and non-eroding landform.

Bank erosion that currently exists downstream of the farm dam on Racecourse Creek will be rectified when the dam is augmented. The proposed development will have no impact on soil erosion on adjoining properties.

8.5 AIR QUALITY

A detailed assessment of potential impacts from the proposed development on air quality at the site and on adjoining properties has been undertaken by Nigel Holmes and Associates.

The report is tabled in full in **Appendix 8** and assesses the effectiveness of the dust control measures proposed for the development (see **Section 7.4**) and compares the predicted impacts on air quality with relevant Environment

Protection Authority guidelines.

8.5.1 Predicted Air Quality Impacts

Figure 7 and 8 of Appendix 9 show the predicted dust deposition and concentration levels in the vicinity of the quarry during Stage 1 of development. These figures also show the location of occupied residences. The remaining sections provide an analysis of the impacts for different air quality criteria.

Figure 7 shows that no privately owned residence is predicted to experience average annual dust deposition from the quarry above an acceptable level of $2\text{g}/\text{m}^2/\text{month}$ (State Pollution Control Commission, 1985). The highest level is predicted at "Westrel" which is predicted to experience an increase in deposition level of approximately $0.7\text{g}/\text{m}^2/\text{month}$ (annual average). The increase in dust deposition at "Linnane Park" is predicted to be approximately $0.5\text{g}/\text{m}^2/\text{month}$ and at "Rocklea" it is predicted to be approximately $0.3\text{g}/\text{m}^2/\text{month}$.

Figure 8 of Appendix 9 shows the predicted increase in dust concentration due to the quarry operations. "Westrel" is predicted to experience an increase in dust concentration of approximately $8\mu\text{g}/\text{m}^3$ (annual average), which is significantly less than the NH&MRC's goal of $90\text{g}/\text{m}^2/\text{month}$ (annual average). "Linnane Park" is predicted to experience an increase in annual average dust concentration of $5\mu\text{g}/\text{m}^3$ and "Rocklea" an increase of approximately $3.5\text{g}/\text{m}^2/\text{month}$.

It is therefore concluded that the quarry is unlikely to cause a significant air quality impact on nearby residences.

8.5.2 Episodic Impacts

Dust concentrations under windy dry conditions are extremely difficult to assess reliably because of the difficulty of estimating dust emission rates from wind erosion under these conditions. The Environment Protection Authority's new goal is that 24-hour concentrations of dust less than $10\mu\text{m}$ in diameter should not exceed $150\mu\text{g}/\text{m}^3$. Such levels are from time to time exceeded in most areas of New South Wales and this will be true of the Oberon area regardless of whether quarrying activities take place or not. The presence of the Oberon Quarry will contribute to the overall dust in the air under such conditions and therefore could lead to an increase in the frequency with which the 150 micrograms/cubic metre (24-hour sub- $10\mu\text{m}$) concentration is exceeded. In years of good and average rainfall it is unlikely that the level will be exceeded at any residence during the course of a year. In drought years the level may be exceeded on a few days per year.

To assess the contribution that the quarry could make to short-term episodic impacts, it has been assumed that a wind of $17\text{m}/\text{s}$ is blowing continuously over 24 hours directly from the quarry towards the residences. In practice this is very unlikely to happen. Those emission factors which are dependent on wind speed have been increased accordingly. In the case of wind erosion from exposed areas an emission rate of $112\text{kg}/\text{ha}/\text{day}$ has been assumed (USEPA, 1981).

The predicted dust concentrations under these conditions are approximately $30\mu\text{g}/\text{m}^3$ at Westrel, $20\mu\text{g}/\text{m}^3$ at Linnane Park and approximately $7\mu\text{g}/\text{m}^3$ at Rocklea. Dust from the quarry is therefore not predicted to make a substantial

contribution to the overall dust impact in these circumstances.

8.5.3 Conclusions

The analysis presented here has used dispersion modelling to predict annual average dust deposition and dust concentrations expected for Stage 1 in the life of the quarry. This has been taken to represent the "worst-case".

It is predicted that at all stages in the development of the quarry the increase in dust concentration and deposition levels due to the quarry operation will remain below Environment Protection Authority and NH&MRC long-term air quality goals at all residences.

Under dry windy conditions it is likely that the Environment Protection Authority's $150\mu\text{g}/\text{m}^3$ (24-hour, sub- $10\mu\text{m}$) concentration goal will be exceeded occasionally in the area. This goal would be exceeded on occasions even if the quarry were not in existence. The number of exceedances is not expected to be any different with the quarry in operation.

8.6 NOISE IMPACTS

A detailed analysis of potential noise impacts from proposed quarrying, processing and transportation operations has been undertaken as part of this study. A full description of noise monitoring data, noise levels used for assessment purposes and calculated noise levels are given in **Appendix 4**. The following sections summarise the relevant assessment criteria, noise impact analysis and assessment for each component of the proposed development.

8.6.1 Quarrying and Processing Operations

Assessment Criteria

In assessing noise impacts of new projects, the Environment Protection Authority has two broad objectives.

1. That noise from any single source does not intrude greatly above the prevailing background noise level.
2. That the background noise level does not exceed the level appropriate for the particular locality and land use.

The Environment Protection Authority has proposed a schedule of recommended background noise levels for various land use categories to assist in balancing the individual and community effects and benefits from particular developments. Details of the relevant category is given in **Table 8.1**.

TABLE 8.1
RECOMMENDED OUTDOOR BACKGROUND NOISE LEVELS

Receiver Area	Time Period	LA90 Background Noise Level (dB(A))	
		Acceptable Limit	Extreme Limit
Residential in Rural Area	Day	45	50
	Night	35	40

Note:

From Monday to Saturday, daytime is defined as 7:00am to 10:00pm and on Sundays and Public Holidays, daytime is 8:00am to 10:00pm.

It is generally considered that noise from a particular continuous noise source will not be annoying if it does not exceed the background noise level by more than 5dB(A) at the boundary of the nearest residence. Based on measured minimum background noise levels (refer to **Section 5.8**) and consideration of the Environment Protection Authority recommended outdoor background noise levels (refer to **Table 8.1**), the average background noise level to be used for noise impact assessment of daytime operations at all residential receivers is 35 dB(A). On this basis a design goal of 40 dB(A) is appropriate for daytime quarry and processing noise emissions.

In reference to this particular development the Environment Protection Authority advised (refer to **Appendix 1**) that the following assessment criteria is applicable at the boundary of the nearest affected residence.

- 45dB(A) from 7:00am to 7:00pm
- 40dB(A) from 7:00pm to 10:00pm
- 35dB(A) from 10:00pm to 7:00am

Adoption of the 40dB(A) design goal is conservative by reference to this Environment Protection Authority recommended assessment criteria but is appropriate considering the rural land use designation of the area.

Major Noise Sources

The majority of on-site noise sources during quarrying and processing operations will operate on a daily basis and these include an enclosed crushing and screening plant, front-end loader, bulldozer, dump trucks and a water truck.

An hydraulic track drill will be operating on-site for approximately a one week period every three to four weeks. It is intended to extract material from the quarry using a 2 bench system. As such approximately half the time the drill rig will be operating on top of Racecourse Hill (at approximately 1160m AHD) and the remainder of the time it will operate on the lower bench which is to be located at approximately 1150m AHD. Hydraulic track drill noise emissions have been assessed separately from the other major noise sources in the following sections due to the intermittent nature of these noise emissions.

Noise levels for proposed plant and mobile equipment were obtained from monitoring of similar equipment and data utilised during previous studies (refer to

Appendix 4). Equipment noise sources used for assessment purposes and measured noise levels are presented in **Table 8.2**

TABLE 8.2
EQUIPMENT NOISE SOURCES AND SOUND POWER LEVELS

Equipment	Sound Power Level dB(A)
Enclosed Crushers and Screens	99.4
Scraper (Construction phase only)	117.0
D7 Bulldozer	109.9
Front-End Loader	105.5
35 Tonne Dump Truck	113.4
Hydraulic Track Drill	107.0
Water Cart	104.7

Impact Analysis

A computer model, incorporating all proposed noise sources and surrounding terrain features, was used to calculate maximum noise emission levels at surrounding residences due to quarrying and processing operations. The model used was the RTA Software's Environmental Noise Model which is a commercially available software system developed in conjunction with the State Pollution Control Commission.

Noise levels were calculated for 'normal' and 'worst-case' meteorological conditions. Normal conditions were based on Bureau of Meteorology long term weather records (refer to **Section 5.6**) and were adopted as a 14°C temperature, 64% relative humidity, and no prevailing temperature inversion. Temperature inversions may occur during early morning periods and, in some situations, significantly enhance noise propagation over a considerable distance. Consequently a temperature inversion of 3°C per 100m, in addition to the temperature and humidity parameters outlined above were adopted as the 'worst-case' meteorological condition.

Noise levels generated during each stage of quarry operations were compared by single point calculations to a few key locations. Stage 1 quarry operations were assessed to be the 'worst-case' situation in terms of generating highest potential noise levels. This is mainly due to the proximity of "Westrel" to crushing and screening operations and the negligible amount of noise attenuation afforded by intervening topography during this stage.

It was assumed for the calculations that all items of equipment, apart from the drill rig, will be operating simultaneously. The drill rig was modelled separately due to the intermittent usage of this equipment.

Noise contours generated for Stage 1 operations, using 'normal' and 'worst-case' weather conditions are shown on **Figures 20** and **21**, respectively. Predicted noise levels at nearest surrounding residences from continuous quarrying and processing operations are given in **Tables 3a** and **3b** in **Appendix 4** for both weather scenarios during Stage 1 and Stage 2 operations.

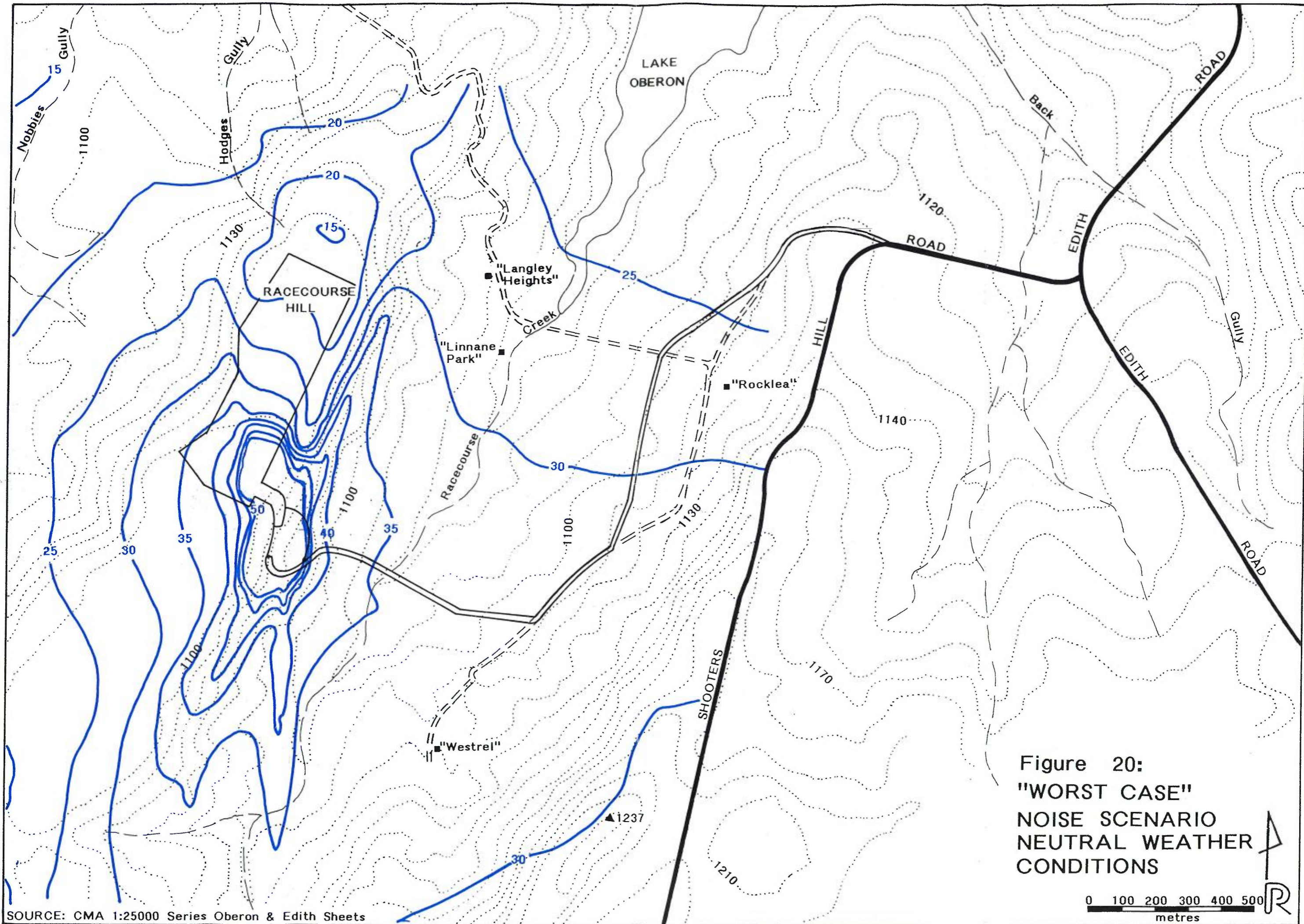
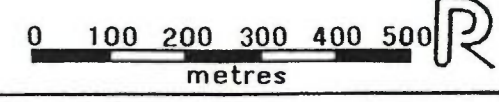


Figure 20:
 "WORST CASE"
 NOISE SCENARIO
 NEUTRAL WEATHER
 CONDITIONS



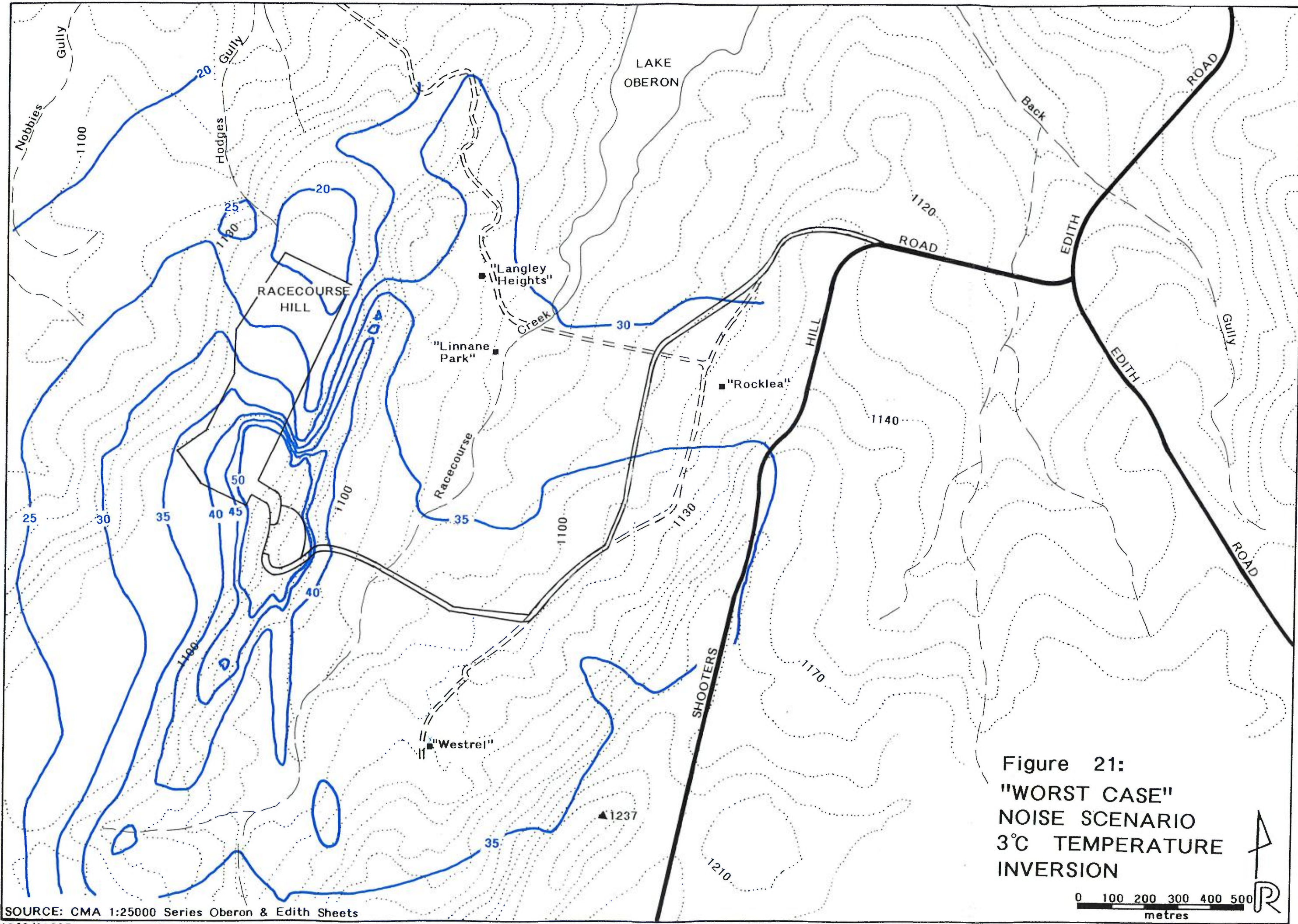


Figure 21:
 "WORST CASE"
 NOISE SCENARIO
 3°C TEMPERATURE
 INVERSION

SOURCE: CMA 1:25000 Series Oberon & Edith Sheets

1048/91395

0 100 200 300 400 500
 metres

Predicted noise levels for Stage 1 and Stage 3 operations given in **Appendix 4** have been calculated with and without drill rig operation. Calculations involving "worst-case" weather conditions with drill rig operation are considered to be maximum expected levels which would occur infrequently when all equipment, including the drill rig, is operating simultaneously during temperature inversion conditions.

Impact Assessment

Predicted continuous quarrying and processing noise levels calculated under 'worst-case' weather conditions are below the design goal of 40dB(A) at all nearby residences not associated with the development. Under 'normal' weather conditions the highest predicted noise level at surrounding residences during continuous operations is at "Westrel" with a level of 34dB(A) being well below the adopted assessment criteria. Maximum predicted noise levels are not expected to cause annoyance to occupants of surrounding residences.

Based on noise level predictions presented in **Appendix 4** a 2.3dB(A) exceedance of the 40dB(A) planning goal is predicted at "Westrel" during drill rig operation in Stage 1 under 'worst-case' weather conditions. Under 'normal' weather conditions there is no exceedance of the design goal at "Westrel" with drill rig operation. The exceedance of the design goal at "Westrel" during worst-case conditions with drill rig operation is not considered to be a significant impact due to the low level of exceedance and the likely infrequent occurrence of these propagation conditions. All other predicted quarry operation and drill rig noise levels are well within the 40dB(A) planning goal. Proposed noise monitoring (refer to **Section 7.5.3**) during the operation will ensure that noise emissions are maintained at acceptable levels at nearest surrounding residences.

It is considered that there will be no significant noise impact on surrounding residents or land use from both continuous daytime quarrying and processing operations and intermittent drilling operations. The distance from the proposed quarry to the township of Oberon is considerably more than that to surrounding residences and consequently there will be negligible noise impact from these operations within Oberon.

8.6.2 Construction Phase

Establishment of the quarrying and processing operations will require two scrapers and a D7 dozer (or equivalent) to excavate the proposed processing plant area and to dump material at the hard stand area shown on **Figure 15a**. These operations are expected to have a duration of less than four weeks. The scrapers will only be utilised for these initial construction activities and will not be a part of on-going quarry operations.

Assessment Criteria

The Environment Protection Authority provides the following guideline for assessing construction phase noise impacts for a construction period of 4 weeks or less.

- (1) The L₁₀ level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 20dB(A).

Time restrictions recommended for these activities are Monday to Friday, 7:00am to 6:00pm; Saturday, 7:00am to 1:00pm if inaudible at residential premises, otherwise 8:00am to 1:00pm; and no construction work to take place on Sundays or Public Holidays (**State Pollution Control Commission, 1986**).

A noise emission design goal for the construction phase of the development has been set at 55dB(A) by adopting a background noise level of 35 dB(A) (refer to **Section 8.6.1**) and applying the criteria outlined above.

Impact Analysis and Assessment

Noise levels from construction activities were predicted using the computer model described in **Section 8.6.1** and assuming "normal" weather conditions.

The predicted noise levels given in **Table 8.5** show that there is no noise exceedance at any nearby residences during this stage. Noise emissions during construction activities will have low impact on the amenity of surrounding residents.

**TABLE 8.5
PREDICTED CONSTRUCTION NOISE LEVELS**

Equipment	Location	Noise Level dB(A)				Noise Design Goal
		Westrel	Rocklea	Linnane Park	Sunny Pt	
Scraper	Excavation Site	40.7	33.0	36.9	6.0	55
Bull Dozer	Excavated Site	39.1	31.3	35.9	3.7	55
Scraper	Hardstand	41.9	33.1	34.5	9.1	55
Total		45.5	37.3	40.6	11.6	55

8.6.3 Transportation Noise Impacts

In assessing noise impacts for road traffic the Environment Protection Authority has adopted the following criteria.

1. Where traffic flows are low or intermittent L_{Aeq,T} noise level of 55dB(A) should be adopted for new developments. A L_{Aeq,T} level of 50dB(A) in rural areas is also considered appropriate.

Therefore, haul truck noise emissions should not exceed an L_{Aeq,T} noise level of 50dB(A) at rural residences adjacent to the haulage route.

Calculation of the $L_{Aeq,T}$ for truck movements is based on a noise level of 82 dB(A) at 10m from passing trucks (based on previous measurement of passing trucks), passing at an average speed of 60 km/hour over a ten second period. This results in an $L_{Aeq,T,1sec}$ noise level of 84 dB(A) at 10m from the road.

To obtain an hourly L_{Aeq} the $L_{Aeq,1sec}$ noise level is adjusted for traffic flow per hour by the following equation:

$$L_{Aeq,T} = L_{Aeq,1sec} + 10 \log N - 10 \log 3600$$

Where N = No. of truck movements.

The number of truck movements on the haulage route from the stockpiles at the processing plant site to Shooters Hill Road (refer to **Figure 17**) are predicted to range between 5 and 16 per hour. Calculated noise emissions from these truck movements are shown in **Table 8.6**.

TABLE 8.6
PREDICTED TRANSPORTATION NOISE

	Distance From Haul Rd (m)	Truck Movements /Hour	Resultant $L_{Aeq,T}$ dB(A)	EPA Design Goal $L_{Aeq,T}$	Exceedance
Rocklea	125	5	35.5	50	Nil
		16	38.5	50	Nil
Westrel	570	5	20.3	50	Nil
		16	25.4	50	Nil
Linnane Park	570	5	20.3	50	Nil
		16	25.4	50	Nil

The predicted $L_{Aeq,T}$ noise levels are well below the design goal of 50 dB(A) at the residences at Westrel, Rocklea, and Linnane Park and it is considered that transportation noise impacts at these residences will be low.

From the intersection of the haul road with Shooters Hill Road the potential for transportation noise impact decreases due to the combined influence of higher existing road traffic volumes and the potential for quarry traffic to take varying routes at this location. Despite this, it has been assumed that an absolute 'worst-case' situation involves a peak quarry truck movement number of 16 trucks/hour traversing the haul route from the Shooters Hill Road intersection to Oberon or along Titania Road to Hampton Road. The nearest rural residences to these sections of the haul route are estimated to be a minimum of 50m from the road and the calculated $L_{Aeq,T}$ noise level at this distance is 46.5 dB(A). The transportation noise impact in this worst-case situation is predicted to be within an acceptable level.

An $L_{Aeq,T}$ design goal of 55dB(A) is appropriate for non-rural residences adjacent to roads with low traffic volume within Oberon (refer to guideline (1) above). Again, it can be assumed that an absolute 'worst-case' situation involves a peak number of 16 truck movements/hour using the same route

through Oberon. Estimating that the nearest residence is 20m from the road, the calculated $L_{Aeq,T}$ noise level in this situation is 54.5 dB(A). This predicted transportation noise level is below the appropriate design goal and is not expected to significantly affect Oberon residents adjacent to the haulage route.

8.7 BLASTING IMPACTS

Based on the trial blast design described in **Appendix 7.0** ground vibration and airblast overpressure levels at each of the nearest residences and Lake Oberon (wall) have been calculated and are presented in **Table 8.7**.

TABLE 8.7
BLAST IMPACT ASSESSMENT

Residence	Minimum Distance to Residence	Ground Vibration (mm/sec)		Airblast Overpressure (dB Linear)	
		Predicted	Acceptable	Predicted	Acceptable
Westrel	800	1.0	5	110	115
Rocklea	1200	0.5	5	106	115
Linnane Park	500	2.1	5	115	115
Langley Hts	400	3.1	5	117	115
Sunny Point	1400	0.4	5	104	115
Lake Oberon (Wall)	2150	0.2	10	-	-

From **Table 8.5**, predicted blast emission levels at all nearest residences not associated with the development are below Environment Protection Authority's recommended "comfort" criteria for both ground vibration and airblast overpressure and are well below levels likely to cause structural damage to any residence.

At "Langley Heights" during the latter part of Stage 3 of extraction, theoretically "comfort" criteria for air blast overpressure will be exceeded by 2dBL. The theoretical calculations do not take into account topographic effects and hence in this case would dramatically over estimate actual levels. The same would apply for "Linnane Heights" where the effects of topographic shielding would reduce actual airblast overpressure levels to be well below theoretically predicted levels (see **Figure 13**).

A section of the residence at "Westrel" is made of mud brick or rammed earth. Worst case ground vibration at "Westrel" has been predicted to be 1mm/sec which is considerably less than recommended maximum ground vibration levels for historic buildings or buildings of special significance.

Predicted maximum ground vibration for the wall of Lake Oberon is 0.2mm/sec which is considerably less than the acceptable level of 10mm/sec advised by Public Works Department.

Animals are generally affected more by airblast overpressure rather than ground

vibrations. A study into the effects of aircraft sonic booms (which are similar in character to airblast overpressure) on animals concluded that for sonic booms in the range of 125dB(lin) to 136dB(lin) no abnormal behaviour by the animals results. The study covered beef cattle, horses, sheep and dairy cattle (Richard Heggie Associates Pty Limited, 1989).

Based on the above discussion it is not considered that blasting will have a significant impact on adjoining residences or land use.

8.8 FLORA AND FAUNA

As detailed in **Section 5.10** no rare or endangered fauna and flora species were recorded at the site. A few trees will be removed as part of the development and some pasture species will be temporarily removed. Tree screening proposals and rehabilitation of the quarry floor with improved pasture species and woodlots of native trees and shrubs will have a net positive impact on the habitat value of the area. Water quality controls incorporated into the development will ensure that the proposed development will have a negligible impact on the aquatic habitat of Racecourse Creek and Lake Oberon.

8.9 VISUAL IMPACTS

Adoption of an enclosed quarry design and provision of site screening proposals as described in **Section 7.0** will minimise the impact the proposed development has on the visual amenity of the area. Views from adjoining residences and Lake Oberon in particular have been considered in developing site screening proposals for the development.

Direct views of Racecourse Hill are obtained from the Public Reserve adjacent to Oberon Dam, the dam wall itself and intermittently along Edith and Goulburn Roads. These viewing points do not look into the designated extraction area due to the higher elevation of Racecourse Hill and the overall distance to the site (approximately 2 to 3km). The most dominant element when viewing the study area from the north are the lower slopes extending up to the terrace summit.

Racecourse Hill is visually separated from the township of Oberon by Lake Oberon and Pound Hill (1150m) located immediately south of the town. Transect A1-A2 on **Figure 11** shows how this lower hill effectively buffers direct views to Racecourse Hill from the town.

The closest residences to the extraction area(E) and processing plant site (P) are:

1. 'Linnane Park', 500m (E); 850m (P).
2. 'Langley Heights', 400m (E); 1.0km (P).
3. 'Rocklea', 1.2km (E); 1.4km (P).
4. 'Westrel', 800m (E); 750m (P).

5. 'Sunny Point', 1.4km (E); 1.9km (P).

Retention of the outer perimeter of Racecourse Hill and visual screening afforded by existing vegetation will preclude views of extractive activities from all adjoining residences.

Transects B1-B2 and C1-C2, **Figure 12** show the assessment of the visual impact the proposed extraction area and processing plant site will have on the residences of 'Linnane Park' and 'Langley Heights'. Transects D1-D2 and E1-E2, **Figure 13** show the extent of the visual impact the site will have on the residences of 'Rocklea' and 'Westrel'.

Sunny Point is located to the west of Racecourse Hill and therefore will not view the processing plant site located on the eastern side of the hill. Vegetation on the upper western slopes of Racecourse Hill and on adjoining high points will buffer the views to the proposed extraction area from 'Sunny Point'.

Figure 14 indicates visual transects from Oberon South Trig, northeast of the proposed quarry site to the proposed processing plant site and extraction area. Although the trig is 3km away it is elevated to a level of 1159m AHD, equivalent to the study area and well above Racecourse Creek and Black Gully. Existing vegetation around the proposed plant site provides initial screening to lessen the potential visual impact from to Oberon South Trig.

Views from the south to Racecourse Hill are buffered by the hill on which Norway Trig (1237m AHD) is located. The hill is extensively vegetated and restricts direct views from Shooters Hill Road.

The quarry and processing plant will not be visible from Lake Oberon (see **Figure 11**).

At both the local and regional levels the proposed development will have a negligible impact on the visual amenity of the area.

8.10 ABORIGINAL PRE-HISTORY

A consent to destroy permit will be sought from National Parks and Wildlife Service for site four on top of Racecourse Hill (refer to **Section 5.13**). Sites on Racecourse Creek and adjacent to "Rocklea" will be flagged so that they are not disturbed during the construction phase.

No sites of educational or scientific significance were identified during the archaeological survey and it is considered that the proposed development will not have a significant impact on the record of Aboriginal culture in the region.

8.11 LAND ZONING

The proposed development site is to be subdivided from "Langley Heights". No changes to the current land zoning are required to allow the proposed

development to proceed, however consent is required from Oberon Shire Council before the development can proceed.

8.12 LAND USE

8.12.1 Residential

The nearest residences to the proposed development are those on "Westrel" (750m), "Linnane Park" (850m), "Rocklea" (1400m) and "Langley Heights" (1000m). The proposed development has been designed to ensure that the amenity of these residences remains within parameters deemed suitable by the Environment Protection Authority in terms of dust, noise and vibration. The impacts associated with these aspects of the proposed development have been discussed in **Sections 8.5, 8.6 and 8.7**.

Visual aspects of the proposed development have been discussed in **Section 8.8**. Based on these considerations the amenity of the above residences will not be significantly altered by the proposed development.

The nearest urban area to the proposed development is the township of Oberon which is approximately 4km north of the proposed site. Visually the township is shielded from the development and in terms of air quality and noise environments, Oberon is distant and will remain unaffected.

The quarry will however have a beneficial impacts to the economic base of Oberon as described in **Section 8.15**.

8.12.2 Agriculture

The proposed development will result in the use of approximately 20 hectares of land changing from grazing to quarry activities for approximately the next 45 years. With the completion of the quarry activities the land will be rehabilitated and returned to productive grazing land. The loss of this land for grazing represents a negligible percentage of the total grazing land available in the region.

The effect of the proposed quarry operation on adjoining properties will be minimised by a range of environmental management procedures as described in **Section 7.0** including:

- * Enclosure of the crushing plant.
- * Sealing of the haul roads.
- * Adoption of a quarry plan that ensures that the excavation site remains within the perimeter of Racecourse Hill plateau for the life of the quarry.
- * Provision of adequate sediment and runoff controls.

Based on assessments presented in **Sections 8.5 and 8.6** the proposed development will not significantly effect agricultural pursuits on adjoining properties and subsequently should not have an impact on property values.

The bushfire controls discussed in **Section 7.10** will ensure that the proposed development does not increase the potential bushfire hazard of the site from that discussed in **Section 5.17**.

8.12.3 Tourism

The site is visually screened and sufficiently distant from Lake Oberon to ensure that the proposed development has a minimal impact on the tourist amenity of the lake. The use of heavy vehicles to transport product throughout the Shire is a common occurrence and it is considered that additional vehicle movements associated with the proposed development will have a negligible impact on the tourism potential of the area.

8.13 ROADS AND TRAFFIC

The development will not affect access to Crown Road Reserves on "Langley Heights" and adjoining properties. No Crown Road Reserves lie within the proposed extraction and processing areas. The proposed development will require the construction, upgrading and sealing of the haul route from the processing plant to Shooters Hill Road and the upgrading and sealing of the haul route from the processing plant to Shooters Hill Road and the upgrading of the intersection of Harveys Road and Shooters Hill Road. These works will be undertaken by the Company. The intersection of Harveys Road and Shooters Hill Road is to be upgraded by the Company in accordance with Council requirements and to a standard adequate to safely convey up to 16 vehicle movements per hour. In addition, the Company propose to make a proportional contributions towards sealing of Titania Road. The remaining local haul routes to be used by quarry traffic are suitable for use by heavy vehicles.

Heavy vehicles travelling roads controlled and maintained by Council do have an impact on the structural capacity of roads and associated maintenance and reconstruction costs. Oberon Quarries Pty Limited have acknowledged this impact and offered to make an ongoing road maintenance contribution of equivalent to 3 cents per payload tonne/kilometre of quarry product (indexed) transported from the Racecourse Hill site. This contribution is to be used for the maintenance of Council controlled roads used by quarry traffic.

8.14 HEALTH AND SAFETY

The proposed extraction area will be fenced to prevent stock access. Fencing and quarrying will be carried out in accordance with the requirements of the Mines Inspection Branch of the Department of Mineral Resources, Council and the landholder.

As outlined in **Section 7.4** a number of dust control measures have been incorporated in the proposal to ensure that dust generation will not be a health hazard to either on-site workers or surrounding residents.

Work procedures will be developed and maintained to ensure that safety standards are observed throughout the operating life of the quarry.

8.15 SOCIO-ECONOMIC

The proposed development will have a beneficial impact on the socio-economic environment of Oberon through the provision of employment opportunities and through diversifying Oberon's manufacturing and industrial base. Once in full production the quarry will provide full time employment for up to 15 people at the site and additional part-time employment for 20 truck drivers. In addition to this, the quarry will provide further stimulus to Oberon's trade and manufacturing base through ongoing material and service requirements. It is estimated the quarry will cost in excess of 1 million dollars to establish and generate in excess of \$750,000 annually in terms of wages and local expenditure.

Establishment of the quarry will place no significant burden on existing social infrastructure of Oberon and will not significantly alter the employment base or social structure of the town.

8.16 PUBLIC UTILITIES

All telecommunication and power needs will be obtained from facilities that service the local area. No augmentation of these facilities will be required to supply the proposed quarry operation with a telephone connection or a 70,000 k.w.h., 3 phase power supply.

8.17 CUMULATIVE IMPACTS

The proposed quarry is not located in close proximity to any other quarry operations or developments which have the potential to generate similar physical attributes to that of the proposed development. On this basis it is considered that there will not be any cumulative impacts other than in relation to product transport which has been addressed in **Section 8.13**.

8.18 ENERGY RESOURCES

Electricity requirements for the proposed development have been estimated at approximately 70,000k.w.h. per month. This represents a negligible amount of energy use when compared with state-wide energy useage in the industry. On-site fuel usage for the proposed development has been estimated at 600 litres per day. This consumption equates to 0.73×10^{14} joules of energy per annum and represents a negligible amount of 41.4×10^{15} joules of energy predicted to be used by the non-metallic mineral industry of New South Wales in 1981-82 (Department of National Development, 1978).

REFERENCES

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APPENDICES

APPENDIX 1

CORRESPONDENCE FROM
GOVERNMENT AUTHORITIES



Department of Planning

Valerie Smith
Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND 2323

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
DX. 15 Sydney

Telephone : (02) 391 2000 Ext:
Fax No : (02) 391 2111

Contact: M Beveridge
2083
S92/00246

Our reference :

Your reference :

Dear Ms Smith,

**Proposed Development of Hard Rock Quarry in Shire of Oberon:
Portions 213, 107, 110 and 313, DP.386067A Parish of Norway.**

Thank you for your letter of 17 January 1992 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

2. It is noted that your proposal involves both extractive industry and a crushing plant. As development consent is required for the proposal and it is a designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, as amended, an EIS must accompany the development application to the Oberon Shire Council. The EIS shall be prepared in accordance with clause 34 of the Regulation and shall bear a certificate required by clause 26(1)(b) of the Regulation (see Attachment No. 1).

3. In addition, pursuant to clause 35 of the Regulation, the Director requires that the following matters be specifically addressed in the EIS:

- . proposals for site rehabilitation;
- . assessment of impact on Lake Oberon and surrounding catchment, and proposed mitigation measures. Consideration should be given to erosion, siltation and water quality impacts, blasting impacts on dam wall and visual impact.
- . assessment of noise and blasting impact (vibration and overblast pressure) on nearest residences.
- . assessment of potential dust impacts, and mitigation measures.
- . traffic and transport impact both on and off site, and proposed mitigation measures.

. results of consultation with:

- Public Works Department
- NSW Agriculture
- State Pollution Control Commission
- Soil Conservation Service.

4. Attachment Nos 2A and 2B are guides to the type of information most likely to be relevant to the development you propose; not all of the matters raised therein may be appropriate for consideration in the EIS for your proposal; equally, the guides are not exhaustive.

5. In preparing your EIS you should approach the Oberon Shire Council and take into account any comments Council considers may apply to its determination of the proposal.

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

Yours faithfully,

B. Adams 19/2/92

B. Adams
Manager
Assessments and Resources Branch
As Delegate for the Director

DEPARTMENT OF PLANNING
ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS

In accordance with Part IV of the Environmental Planning and Assessment Act, 1979, an environmental impact statement (EIS) must meet the following requirements.

Pursuant to clause 34 of the Environmental Planning and Assessment Regulation, 1980, as amended, the contents of an EIS shall include the following matters:

- (a) full description of the designated development proposed by the development application;
- (b) a statement of the objectives of the proposed designated development;
- (c) a full description of the existing environment likely to be affected by the proposed designated development, if carried out;
- (d) identification and analysis of the likely environmental interactions between the proposed designated development and the environment;
- (e) analysis of the likely environmental impacts or consequences of carrying out the proposed designated development (including implications for use and conservation of energy);
- (f) justification of the proposed designated development in terms of environmental, economic and social considerations;
- (g) measures to be taken in conjunction with the proposed designated development to protect the environment and an assessment of the likely effectiveness of those measures;
- (g1) details of energy requirements of the proposed development and measures to be taken to conserve energy;
- (h) any feasible alternatives to the carrying out of the proposed designated development and reasons for choosing the latter; and
- (i) consequences of not carrying out the proposed development.

The EIS must also take into account any matters required by the Director of Planning pursuant to clause 35 of the Regulation, which may be included in the attached letter.

The EIS must bear a certificate as required by clause 26(1)(b) of the Regulation.

DEPARTMENT OF PLANNING
ATTACHMENT NO 2A

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT
STATEMENT (EIS) FOR AN EXTRACTIVE INDUSTRY

A definition of extractive industry may be found in paragraph (n) to Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, (as amended). These industries are operations undertaken for the purpose of mining sand, gravel, clay, turf, soil, rock, stone or similar substances. The definition of extractive industry specifically excludes coal, petroleum or minerals which are prescribed under the Mining Act, 1973. Extractive industries may take the form of dredging operations, quarrying operations, turf farms or various forms of land excavation etc. Processing of extracted material on the same site as the winning of the material may also constitute an extractive industry.

Extractive industries have prompted considerable public controversy in the past since, among other things, they affect visual amenity, generate heavy vehicle movements, raise dust and cause disturbance through noise and blasting. This is the prime reason for designation of extractive industries under the Environmental Planning and Assessment Act, 1979.

The purpose of this paper is to outline various issues relevant to the preparation and consideration of an EIS for extractive industries. It is intended to assist the preparation of the EIS. However, it is the applicant's responsibility to identify and address as fully as possible the matters relevant to the specific development proposal in complying with the requirements for EIS preparation (see Attachment No 1).

The matters nominated in this paper are not intended as a comprehensive identification of all issues which may arise in respect of an extractive industry. Some of the issues nominated may not be relevant to a specific proposal. On the other hand, there may be other issues, not included, that are appropriate for consideration in the EIS.

Information provided should be clear, succinct and objective and where appropriate be supported by maps, plans, diagrams or other descriptive detail. The purpose of the EIS is to enable members of the public, the consent authority (usually the Council) and the Department of Planning to properly understand the environmental consequences of the proposed development.

1. Description of the proposal.

The description of the proposal should provide general background information on the location and extent of the works proposed, an indication of adjacent developments, and details of the site, land tenure, zonings and relevant forward planning proposals and any other land use constraints.

The EIS should address the compatibility of the proposal with any regional strategy for extractive industries in the area and with the provisions of the Local Environmental Plans for existing and proposed development.

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the processes involved (highlighting any proposed crushing or blasting), disposal of wastes, landscaping and site rehabilitation. A description should also be provided of associated operations such as the transport of materials and use of the end product if likely to have environmental implications.

Particular details that may be relevant include:

- . Characteristics and economic significance of the resource.
- . Possible availability of alternative resources.
- . Quantity of materials to be extracted.
- . Details of any blasting and/or crushing.
- . Effects of vibrations.
- . Type of machinery and equipment to be used for dredging and stockpiling operations and for any processing plant.
- . Expected life of the operation.
- . Hours of operation.
- . Details of necessary stockpiling.
- . Access arrangements - truck routes, truck numbers etc.
- . Site drainage and erosion controls.
- . Proposals for rehabilitation.

2. Description of the Environment.

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

3. Analysis of Environmental Impacts.

Environmental impacts usually associated with extractive industries are listed below. Where relevant to the specific proposal, these should be addressed in the EIS, taking into account the adequacy of safeguards proposed to minimise them.

- . The flow of any affected rivers or watercourses.
- . The effect of the extraction on the sediment transport rate of any affected rivers or watercourses.
- . The bed and bank stability of any affected rivers during and after completion of the operations and any need for recurrent maintenance dredging.
- . Any possible siltation, sedimentation or downstream effects of the operation.
- . Any likely cumulative effects of the proposed operation when considered together with other operations in the vicinity.

- . Details of floods and any likely effects of the operation on flood liability of surrounding lands.
- . The possible effects of flooding on the operation.
- . Effects on flora and fauna.
- . The agricultural viability of the landholding.
- . Likely noise/vibration disturbance caused by the operations, including transport operations, on nearby residences.
- . Other impacts of trucking movements, including access over railways and onto highways.
- . Dust nuisance likely to be caused.
- . Effects on water quality of nearby watercourses.
- . Disposal of waste material.
- . Effects on the visual environment.
- . Any likely affectation of sites of Aboriginal archaeological or European heritage value if located in the vicinity of operations.
- . Impact of the operations on navigation aspects for all types of shipping (commercial, recreational, etc).

In addition, any potential for hazard or risks to public safety and any proposals to monitor and reduce environmental impacts should be included.

4. Contact with relevant Government Authorities.

In preparing the EIS, it is suggested that authorities, such as those listed below, should be consulted and their comments taken into account in the EIS.

- . The State Pollution Control Commission in regard to air, water and noise impacts and relevant pollution control legislation requirements;
- . The Department of Minerals and Resources concerning its responsibilities under Sydney REP No 9 Extractive Industry;
- . The Department of Water Resources concerning the implications of the proposal on their jurisdiction;
- . The Soil Conservation Service regarding appropriate erosion control and rehabilitation procedures;
- . The Department of Agriculture if prime agricultural land may be affected by the proposal;
- . The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance for the State; the National Parks and Wildlife Service if aboriginal places or relics are likely to be affected.
- . The Maritime Services Board in relation to navigational aspects of shipping; and
- . The Public Works Department in relation to hydrological impacts and relevant legislative requirements.

It is the responsibility of the person preparing the EIS to determine those Departments relevant to the proposed development.

DEPARTMENT OF PLANNING

ATTACHMENT NO. 2B

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR CRUSHING GRINDING OR MILLING WORKS

An EIS is required to be completed, pursuant to paragraph (k), Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, (as amended), for crushing, grinding or milling works, being works in which more than 200 tonnes per annum of rock, ores, minerals, chemicals or natural grain products are processed by crushing, grinding, milling or separating into different sizes. The reason for designation is that developments of these types have the potential to create considerable public nuisance due to noise, dust, odours and wastes which affect air and water quality.

(N.B. When determining the capacity of the works in this regard, it is considered reasonable to take into account the daily working hours, the working week and working year normal for such a plant and the maximum production rate of the plant to be installed).

The purpose of this paper is to outline various issues relevant to the preparation and consideration of an EIS for a crushing grinding or milling works. It is intended to assist the preparation of the EIS. It is the applicant's responsibility to identify and address, as fully as possible, the matters relevant to the specific development proposal in complying with the statutory requirements for EIS preparation (see Attachment No. 1).

The matters nominated in this paper are not intended as a comprehensive identification of all issues which may arise in respect of such work. Some of the issues nominated may not be relevant to a specific proposal. On the other hand, there may be other issues, not included, that are appropriate for consideration in the EIS.

Information provided should be clear, succinct and objective and where appropriate be supported by maps, plans, diagrams or other descriptive detail. The purpose of the EIS is to enable members of the public, the consent authority (usually the council) and the Department of Planning to properly understand the environmental consequences of the proposed development.

1. Description of the proposal.

The description of the proposal should provide general background information on the location and extent of the works, existing and proposed, an indication of adjacent developments, and details of the site, land tenure, zonings and relevant forward planning proposals and any other land use constraints.

The extent to which the supply of raw materials and access to markets for the finished product has determined the location of the plant in preference to alternative sites should be stated.

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the processes involved, wastes created and landscaping. A description should also be provided of associated operations such as the transport of materials and the use of the end product if such use is likely to have environmental implications.

Particular details that may be relevant include:

- . Characteristics and economic significance of the product.
- . Plans of operation.
- . Any proposals for future expansion, including staging and timing.
- . Capacity of plant now and in the future.
- . Sources and quantities of raw materials.
- . Type of machinery and equipment to be used.
- . Expected life of the operation of the plant.
- . Number of persons to be employed.
- . Hours of operation.
- . Means of storage, location, quantity and details of necessary stockpiling.
- . Types and quantities of finished products and details of any storage required.
- . Access arrangements - truck routes, truck numbers, parking, etc.
- . Site drainage and erosion controls.
- . Water supply requirements.

2. Description of the Environment.

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

3. Analysis of Environmental Impact.

Potential environmental impacts usually associated with these types of operations are listed below. Where relevant to the specific proposal, these should be addressed in the EIS, taking into account the adequacy of safeguards proposed to minimise them.

- . Likely noise disturbance caused by the operations, including transport operations, on nearby residences, particularly at night.
- . Other impacts of trucking movements, including access across railways and on to highways.

- . Potential for air pollution, including odours, organic vapours and particulate matter.
- . Water management: including water requirements and the separating of clean and contaminated runoff before discharge; water treatment; quality and quantity of effluent for disposal.
- . Treatment and disposal of waste material.
- . Effects on the visual environment.

In addition, any potential for fire hazard or risks to public safety and any proposals to monitor and reduce environmental impacts should be included.

4. Contact with relevant Government Authorities.

In preparing the EIS, it is suggested that authorities, such as those listed below, should be consulted and their comments taken into account in the EIS.

- . The State Pollution Control Commission in regard to air, water and noise impacts and relevant pollution control legislation requirements;
- . The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance for the State; the National Parks and Wildlife Service if aboriginal places or relics are likely to be affected;
- . The Department of Agriculture and Fisheries should be contacted if prime agricultural land may be affected by the proposal.

It is the responsibility of the person preparing the EIS to determine those Departments relevant to the proposed development.

Oberon Shire Council

COUNCIL CHAMBERS
OBERON NSW 2787

TELEPHONE: (063) 36 1100
FACSIMILE: (063) 36 2061

ALL COMMUNICATIONS TO BE ADDRESSED TO

THE SHIRE CLERK
PO BOX No. 84
OBERON NSW 2787

31st January, 1992

92/S1304/606 CJP:EHP

The Manager,
Resource Planning Pty. Ltd.,
P.O. Box 388,
EAST MAITLAND. 2323.

Dear Sir,

Development Proposal

Reference is made to your recent enquiry concerning the preparation of an Environmental Impact Statement to support an application for development consent to the establishment of a quarry in the Parish of Norway.

The development is "designated development" in terms of the Environmental Planning & Assessment Act, 1979, and accordingly the person responsible for the preparation should consult with the Director of Planning seeking any requirement in respect of the form and content of the Statement.

It should be prepared in accordance with Part VII of the Regulations of the aforementioned Act, and if the proposed site is within the catchment area of the Fish River Water Supply, consultation with the Department of Public Works is recommended.

Any further enquiries regarding the proposed development may be directed to Council's Town Planner, Mr. J.I. Drzyzga, during office hours.

Yours faithfully,



(C.J. Pritchard)
SHIRE CLERK.



Environment
Protection
Authority
New South Wales

219 Howick Street
PO Box 1388
Bathurst
NSW 2795

Telephone 063 32 1838
Facsimile 063 32 2387

Valerie Smith
Resource Planning Pty, Limited
P.O. Box 388
East Maitland NSW 2323

Our Reference: 260878A1

Your Reference:

Att: Valerie Smith

Dear Valerie,

Thank you for your letter of inquiry dated 17 January 1992.

In reference to the requirements of the Environment Protection Authority in considering the proposal of Oberon Quarries Pty Ltd, the following should be noted but is not restricted to:

1. Air Pollution

Dust suppression on roads and stock piles.

Dust generation from blasting and drilling.

Air emissions from fuel burning equipment if used.

2. Noise

Noise and blasting criteria as set out in the Authority's Environmental Noise Control Manual. A copy of this manual is usually available in the local council office.

The operations of the Quarry would be required to meet the following criteria:

Recorded at the boundary of the nearest affected residence -
45dBA from 7am to 7pm; 40dBA from 7pm to 10pm; 35dBA from
10pm to midnight and midnight to 7am.

A noise assessment would be required.

Address water quality of any discharges from the site and if it is determined that no dry-weather discharge is required, then a retention of a 1 in 50 year storm event is recommended. Retention time would be determined by water quality and the nature of contaminants.

In addition to the above requirements, any discharge would be required to meet a limit of suspended solids of 30 milligrams per litre. In the event of a dry weather discharge, a retention time should be calculated in earth works design to meet the above limits for any discharge.


Base line and background levels should be measured for air, noise and water quality assessments.

Protection of the local water supply and impact on neighbouring properties and their occupants may be of major concern.

If you have any further enquiries please contact Ian Pye at the Authority's Bathurst office by phoning 063 321 838.

Yours sincerely,

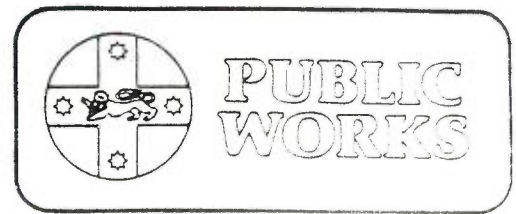
Richard Whyte
Regional Manager
Central West

per.....
Ian Pye

For Director General
8 May 1992

PW:DB

OUR REF: Direct to Officer (063) 334457
YOUR REF:



WESTERN REGIONAL
OFFICE

Mr. Greg Thompson,
Manager Environmental Services,
Resource Planning Pty. Ltd.,
P.O. Box 388
EAST MAITLAND NSW 2323

Mr. P. Winter

20th March, 1992

Dear Sir,

Proposed Hard Rock Quarry
Near Oberon

The Fish River Water Supply Trading Undertaking of the Public Works Department has provided a reply direct to you dated 18/3/92 and marked attention Mr. Peter Jamieson, copy attached.

No additional comment is offered on the proposed quarry at this stage by the Department of Public Works.

Please keep this Department informed as to decisions on the project.

Yours faithfully

A handwritten signature in black ink, appearing to read 'P. Winter', is written over a faint, larger version of the signature.

P. WINTER
Acting Regional Engineer
BATHURST



FISH RIVER WATER SUPPLY



RS:RS

Mr. Peter Jamieson
Manager, Environmental Services
Resource Planning Pty. Ltd.
P.O. Box 388
EAST MAITLAND N.S.W. 2323

OUR REF: File 15009

YOUR REF:

18th March, 1992

Dear Sir,

FISH RIVER WATER SUPPLY
PROPOSED HARD ROCK QUARRY WITHIN THE OBERON DAM CATCHMENT

In response to representations directly to me by various parties associated with the proposal to establish a hard rock quarry within the Oberon Dam catchment and your letter to the Regional Engineer, Bathurst dated 17th January, 1992 I wish to advise as follows:

Any proposed major development within either the Oberon Dam or Duckmaloi Weir catchments is of great concern to this Authority. Action is currently being taken to put into place a Catchment Management Plan covering both catchments.

Whilst a single development with appropriate runoff controls may have minimal adverse effect on the Scheme the cumulative influence of several developments could significantly affect the raw water quality and it would be inequitable to allow some developments and not others. This Authority would thus prefer to prevent any large developments within the two catchments and strongly recommends that in this case alternative sites be sought.

If our preference is not heeded and the the proposal is pursued further the following specific matters will need to be taken into account:

We would be concerned about potential for contamination of the dam storage by pollutants and runoff containing high levels of suspended solids. In particular, sewage (it is assumed that a septic tank system would be required), fuel and oil spills, and ammonium nitrate used in blasting are of major concern to us. Note that the dam is used for potable water supply and the only treatment the raw water receives between the dam offtake and the town of Oberon is chlorination - there is no water treatment plant.

Strict compliance with the Clean Waters Act and E.P.A. requirements relating to dust would probably suffice.

For dams of this nature it is normal to require that the maximum peak particle velocity does not exceed 10mm/sec at the wall. However, E.P.A. noise limits may require a lower maximum vibration in practice.

I trust that the preceeding assists you in deciding a course of action with respect to this matter and ask that you keep me informed in this regard.

Yours faithfully,

R. J. Still

R.J. STILL
Operations Manager
Fish River Water Supply

Copy for your information.

R. J. Still

18-3-92

1. Ken McDonald,

Dams Section.

2. Peter Winter,

Acting Regional Engineer,

Bathurst.

File No.:

O:185-1

Our Ref.:

BM:0452

LP:RW



Resource Planning Limited
PO Box 388
EAST MAITLAND NSW 2323

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

Dear Sir/Madam,

RE: PROPOSED DEVELOPMENT OF A HARD ROCK QUARRY
AT OBERON, OBERON SHIRE.

The N.S.W. National Parks and Wildlife Service's Oberon office suggest the following information be included in the E.I.S. for the proposed quarry.

- * The identification and effect on flora and fauna, particularly any rare, threatened or endemic species.
- * The possible effect on wildlife corridors.
- * Conduct a survey for Aboriginal sites. Sites have already been recorded only 1km north of the proposed site, on the foreshores of Oberon dam. Attached is a list of consultants for your information.
- * Details on restoration and revegetation using endemic species.
- * Details on any impact on water quality which may effect stream biota.
- * The E.I.S. should also consider impacts on geology, soils, landscape aesthetics, recreational values and alternative sites and/or routes.

If you have any further enquiries please contact me at our Oberon office on (063) 361972.

Yours faithfully

K. de Govrik
Senior Ranger
Oberon

12 February 1992.

Blue Mountains
District

Includes:
Blue Mountains
National Park

Kanangra Boyd
National Park

Hartley
Historical Site

THE HERITAGE
CENTRE

Govetts Leap Road
P.O. Box 43
Blackheath
N.S.W. 2785

Phone: (047) 878877

Fax: (047) 87 8514

NSW FISHERIES
P.O. Box 456 NOWRA NSW 2541
Phone (044) 232200 Fax (044) 232007

Valerie Smith
Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND 2323

25th February 1992

Our ref: HS 92/013

Dear Ms Smith,

**RE: PROPOSED DEVELOPMENT OF A HARD ROCK QUARRY AT OBERON,
OBERON SHIRE.**

I refer to your letter of 17 January 1992 in which you requested NSW Fisheries' requirements with respect to the Environmental Impact Statement for the above proposal.

NSW Fisheries is concerned with the protection of water quality and fish habitats in Lake Oberon and Racecourse Creek. These waterways are stocked with rainbow and brown trout, and trout are known to spawn in Racecourse Creek.

The Environmental Impact Statement should address the issues that are outlined in NSW Fisheries' Freshwater Habitat Management Guidelines (copy enclosed). Control of surface water runoff and sediment control should be addressed in detail. If you have any inquiries please contact me on (044) 230080.

Yours sincerely,

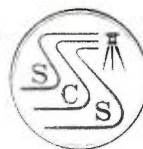


Peter Dalmazzo
Biologist (Habitat Management)
for R. Claxton
Director of Fisheries



Incorporating the...

Soil Conservation Service



Local Office:
N.S.W. Government Offices,
William Street, Bathurst.

P.O. Box 1480, Bathurst. N.S.W. 2795.

Phone (063)334340

Ms. Valerie Smith, Director,
Resource Planning Pty. Ltd.,
P.O. Box 388,
EAST MAITLAND. 2323.

Contact:

Our reference:

Your reference:

Dear Madam,

Re Proposed Development of a Hard Rock Quarry
at Oberon - Oberon Shire

I refer to your letter of 17th January, 1992 requesting the Department's requirements with respect to this development.

Enclosed is a copy of the Department's "Guidelines to meet requirements for information on soil and land stability in proposals for open cut mining and rehabilitation." This sets out the issues and information required in an Environmental Impact Statement. The E.I.S. should describe the physical nature of the are, highlight the constraints to site development, quarrying and rehabilitation, and propose practical solutions to these constraints.

A photocopy of the Protected Lands map showing that there are protected lands within the quarry site is enclosed.

This office also has copies of an Erosion Land Use map and a Land Capability map, both of Scale 1:100,000, and Soils Landscape map at Scale 1:250,000. The Soils map and accompanying book cost \$30.

Please do not hesitate to contact this office if you wish to discuss the above development, review a draft E.I.S. or arrange a site inspection.

Yours faithfully,

Justin Gouvernet,
Soil Conservationist,
BATHURST.

27 February 1992.



DEPARTMENT
OF LANDS

"A Division of the Department of Conservation and Land Management"

M/S Valerie Smith
Director
Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND NSW 2323

YOUR REF:
OUR REF: OE92 H 18
CONTACT OFFICER: Mr Baxter
TELEPHONE NO: (063) 638293

3 Feb 92

Dear M/S Smith

Re: Proposed development of a Hard Rock
Quarry at Oberon, Oberon Shire

I refer to your correspondence of the 17 January 1992 regarding the subject development of Hard Rock Quarrying at Oberon.

A status investigation revealed that the proposed Quarry site and access covers several Crown roads as illustrated on Diagram "A" as attached.

The Department is concerned with the potential effect of the continuity of legal access, to the subject and surrounding portions. This matter should be addressed in the Environmental Impact Statement, together with any intention to use and therefore construct a Crown road, for access. The applicant must apply for a licence to construct a Crown road under Section 45 of the Crown Lands Act 1989 with an accompanying \$315.00 application fee.

The subject roads are currently held under Road enclosure permits, therefore being enclosed into the adjoining lands.

We trust this information will assist your investigations, and look forward to a copy of the Environmental Impact Statement.

Yours faithfully

D J Baxter
for Regional Director



1:50,000 series (ALTS) is the
is shown thus 85/704703.

DISTRICT

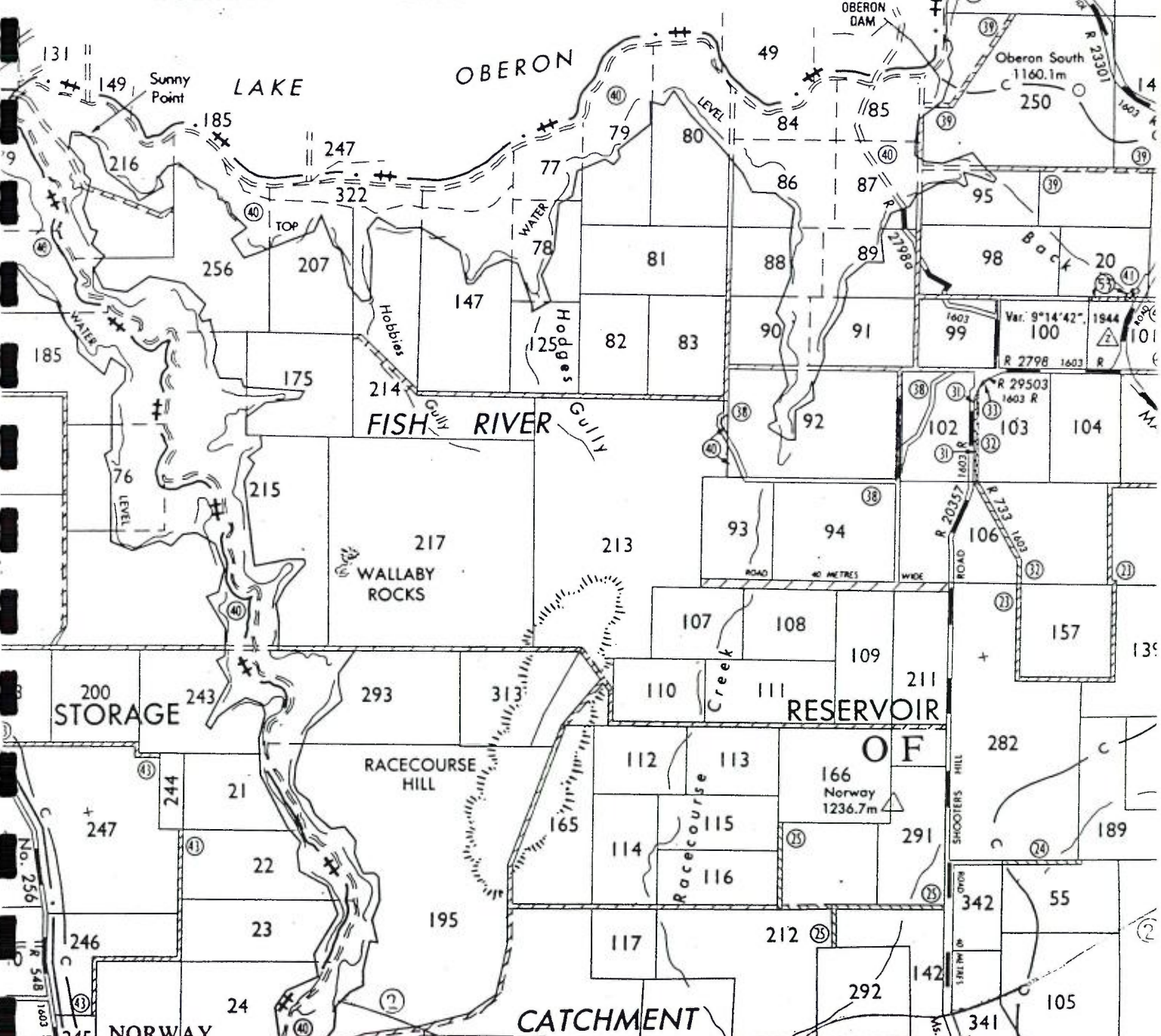
LAND OBERON

*unformed
Crown Roads*

TOWN OF
OBERON

BULLOCK

OBERON DAM



No. 256
R 548 1003 R

NORWAY

CATCHMENT

RESERVOIR

166
Norway
1236.7m

SHOOTERS HILL

55

105

189

139

101

14

19

12

1

1

1

1

1

1

1

1

1

1

1

1

1



NSW Agriculture

Central West, South East and Illawarra Region

P.O. Box 53,
ORANGE, NSW 2800
AUSTRALIA

Telephone: (063) 638 250/251
Facsimile: (063) 638 356

3 February 1992

Our Ref: AJD/WO'K 4E1/7 DA1.92

Valerie Smith
Director
Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND NSW 2323

Dear M/s Smith,

Re: Proposed Development of a Hard Rock Quarry at Oberon

The site of the proposed hard rock quarry has been inspected by an officer of NSW Agriculture. This inspection was in response to your letter of 17th January, 1992.

The following aspects of the impact of the proposed development require addressing:-

1. The impact on the efficient grazing management of the affected property and those that adjoin the development. This would also include the impact of the proposed access road on the grazing areas through which it traverses.
2. The prevention of sedimentation and siltation of Racecourse Creek, Hodges Gully and Hobbies Gully.

This proposal is in very close proximity to Lake Oberon and the prevention of any loss of water quality in this area is of prime concern.

3. The impact that noise and dust generation would have on the adjoining pastures and animals requires addressing.
4. This proposal is a very prominent visual feature of an agricultural landscape. The impact that the long term destruction of the hill will have on property values needs addressing.

5. The impact that the removal of rock from the proposed site would have on the quality of groundwater in the area requires addressing.
6. The rehabilitation plan for the disturbed area once the quarrying is complete requires addressing.

NSW Agriculture would be pleased to review the Environmental Impact Statement for the proposed development when it is displayed.

Yours faithfully,



D J McDonald
REGIONAL DIRECTOR
NSW AGRICULTURE





The Manager
Resource Planning Pty Limited
PO Box 388
EAST MAITLAND NSW 2323

Telex: 121188
Facsimile: (02) 895 7281
Telephone: (02) 895 6211
Ext: 7441
Contact Name: John Ross
Our Reference: 0050131 & 0051832

13-2-92

Attention: Valerie Smith, Director

Dear Sir/Madam,

Re: Proposed Concrete Plan[†] Appin Rd, Appin, and Proposed Hard Rock
Quarry, Oberon.

Thank you for your letters of 7 and 17 January, 1992, (respectively) seeking this Department's comments and requirements for the above proposals.

This Department has no special comment or advice on the subject proposal. However, in the conduct of the E.I.S.s it is recommended that you make full use of the three documents sent to you with the Department's letter of 28 June, 1991 (copy attached). All appropriate matters discussed in these guideline documents should be addressed in the above studies.

Again, the Department would appreciate being sent draft copies of the subject documents for review and endorsement.

Yours faithfully,

John A. Ross
for J.F. Clarke, Manager
Sydney-South Coast Region.

attach.

344.5351 (RW:MM)
Mr Waggs

Roads and Traffic
Authority
Central Western Division

Ms Valerie Smith
Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND 2323



24 JAN 1992

28 Currajong Street
Parkes
New South Wales 2870
~~Telephone (068) 62 1141~~
PO Box 334
Parkes NSW 2870
DX 3029
~~Telex 62829~~
Facsimile (068) 62 1326
Tel (068) 629799

*SHIRE OF OBERON. PROPOSED DEVELOPMENT OF A
HARD ROCK QUARRY AT OBERON.*

Dear Valerie

The Authority's mission is to manage the use, maintenance and enhancement of the State's roads and traffic systems, with emphasis on road safety and transport efficiency as an integrated and balanced transport system.

Because of the impact of the proposed quarry development on surrounding roads, and to enable a proper assessment to be made, the following criteria is set down as a minimum which should be addressed:

- * Adjacent road network and hierarchy, and proposals for improvement.
- * Annual Average Daily Traffic (AADT) volumes and historical trends on key adjacent roads
- * Peak period traffic volume and congestion levels at key adjacent intersections
- * Traffic generation/attraction and trip distribution of the proposed development
- * Impact of generated traffic on:
 - a) Key adjacent intersections
 - b) roads in neighbourhood of development
 - c) the environment
 - d) nearby development

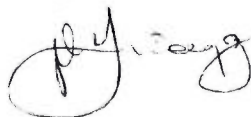
- * Safety and efficiency of access between site and adjacent road network
- * Safety and efficiency of internal road layout including service and parking areas.
- * Improvements to the adjacent road network, deemed necessary by the new development

Should any further information be required please contact Mr R Wagg (068) 62 9727 of this office.

Yours faithfully



P J Dearden
Divisional Engineer



ALL MAIL TO:
GENERAL MANAGER,
P.O. BOX 172, BATHURST. N.S.W. 2795
PH. (063) 335 633 TELEX 74571 FAX (063) 31 9733



Your Ref:

Our Ref: KS:SH 17/7/4267

Contact: Mr K. Sweeney

13th March, 1992

The Director,
Resource Planning Pty Ltd.,
P.O. Box 388,
EAST MAITLAND N.S.W. 2323

ATTENTION: Mr Peter Jamieson

Dear Sir,


RE: PROPOSED DEVELOPMENT OF A HARD ROCK QUARRY
AT OBERON.

Further to your letter of the 10th February, 1992, you are advised that Southern Mitchell will require further details in regard to the capacity, in kVA, of the power requirement together with the most likely site that the crushing plant will be located in order to provide indicative costs for the project.

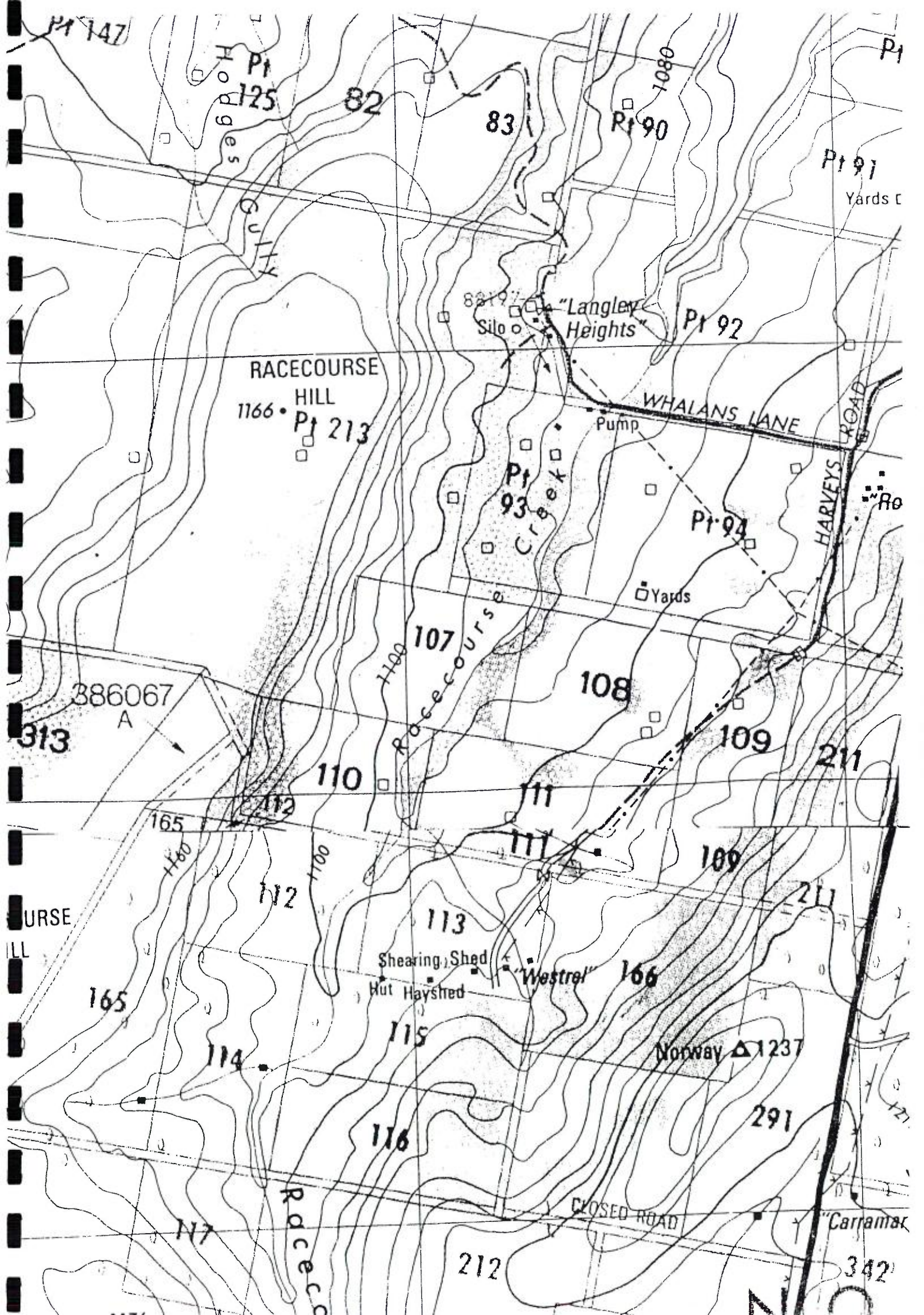
As you are aware a single phase power line currently crosses portions 109 and 111 to service the property 'Westrol'. The passage of heavy transport and the construction of an access road may require the augmentation and or relocation of this particular line, highlighted on the enclosed plan.

It is believed that adequate three phase power could be made available, the nearest supply point being Shooters Hill road. Thus it would require the reconstruction of the existing lines into the immediate area and presumeably extension of the line to the crushing site and the installation of a substation. These works would require your client to pay a capital contribution to cover the cost of the said works.

Yours faithfully,


J. HORNER,
GENERAL MANAGER

Encl.



Bathurst Rural Lands Protection Board

All Correspondence to be
addressed to the Secretary.

169A Havannah Street, Bathurst, 2795
Phone: (063) 31 1377 — P.O. Box 20

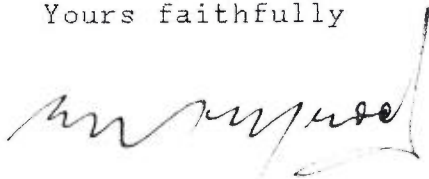
13 February 1992

The Director
Resource Planning Pty Ltd
PO BOX 388
EAST MAITLAND NSW 2323

Dear Madam

I refer to your letter dated 17 January, 1992. It is
advised that the Board has no objections to the proposed
development of a hard rock quarry at Oberon.

Yours faithfully



R E Gaywood
Secretary

REG:maw

APPENDIX 2

SOIL PROFILE DESCRIPTIONS

APPENDIX 2 SOIL PROFILE DESCRIPTIONS

Full profile descriptions are given below for representative profiles for each soil type:

Structured Loam

Site S1, Um 6.14

Profile located on lower slope on colluvium. Aspect southeasterly, and 100% groundcover. Surface friable and no appreciable erosion.

Topsoil: 0–5cm, 7.5YR 4/6 (brown), pH 4.5. Fine sandy clay loam. Weak pedality, rough faced sub-angular blocky peds, 50–100mm breaking to 20–50mm. Less than 2% stones. Weak consistence, crumbly in moist condition.

Subsoil: 5–20cm+, 5YR 5/8 (bright reddish brown), pH 5.5. Light clay. Weak pedality, rough-faced, sub-angular blocky peds, 20–50mm breaking to 10–20mm. Less than 2% stones. Weak consistence, crumbly in moist condition.

Site S2, Um 6.13

Profile located on small flat area in mid-slope position on basalt. Groundcover 90–100%, surface friable and no appreciable erosion.

Topsoil: 0–15cm, 5YR 3/4 (dark reddish brown), pH 6.0. Silty clay loam. Weak pedality, rough-faced sub-angular blocky peds, 20–50mm breaking to 10–20mm. Less than 2% stones very weak consistence, crumbly in moist condition.

Subsoil: 15–70cm+, 5YR 4/6 (reddish brown), pH 6.0. Fine sandy clay loam. Moderate pedality, rough-faced, sub-angular blocky peds, 20–50mm breaking to 10–20mm. Less than 2% stones. Moderate consistence, crumbly in moist condition.

Krasnozem (Sites S3 and S4)

Site S4, Gn 4.11

Profile located on flat plateau location on basalt parent material. Groundcover 90–100%, surface friable and no appreciable erosion.

Topsoil: 0–10cm, 5YR 4/6 (reddish brown), pH 4.5. Fine sandy clay loam, weak pedality, rough-faced peds, sub-angular blocky, 50–100mm breaking to 20–50mm. Less than 2% stones. Weak consistence, crumbly in moist condition.

Subsoil: 10–25cm, 5YR 4/6 (reddish brown), pH 5.0. Light clay, weak pedality, rough-faced peds, sub-angular blocky, 50–100mm breaking to 20–50mm. 10–20% stones (2–20mm). Weak

consistence, crumbly in moist condition.

APPENDIX 3

PROBABLE RESERVE
CALCULATIONS

APPENDIX 3 PROBABLE RESERVE CALCULATIONS

Utilising drill hole data and field mapping two cross sections have been drawn and used to calculate the area of basalt at these localities, see **Section 1**. A third cross section was generated based on topography field mapping with an assumed horizontal base. These three areas were each averaged with its corresponding neighbour to give these final calculations moving north to south (**Section 2**), e.g., Area x Length x Specific Gravity = Tonnes.

1. $16,509 \times 118 \times 2.9 = 5,649,379$
2. $13,364 \times 335 \times 2.9 = 12,983,126$
3. $12,908 \times 468 \times 2.9 = 17,518,733$
4. $15,597 \times 80 \times 2.9 = 3,618,504$

TOTAL = 39,769,747 TONNES

The area is constrained to the north and south by property boundaries.

PROPOSED EXTRACTION AREA

The proposed extraction area calculation has the following constraints.

1. Area 170,000m².
2. A 40m buffer between extraction edge and adjoining properties.
3. An extractable thickness of 18m which assumes:
 - * Horizontal blast design.
 - * Average 2m of mid burden clays.
 - * One metre overburden.
4. Specific gravity of 2.9 for basalt.
5. Total extraction tonnes,

Area x Thickness x Specific Gravity = Tonnes

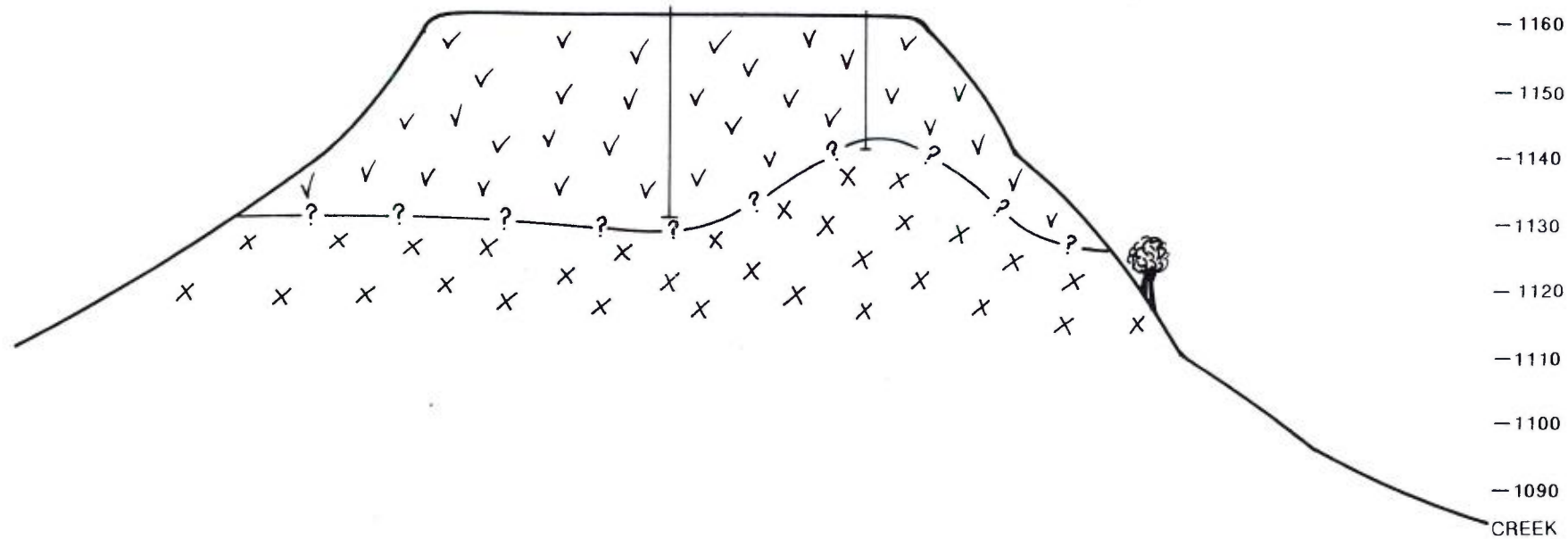
$$\begin{aligned} 170,000 \times 18 \times 2.9 &= 6,000,000 \\ &= 8,874,000 \text{ tonnes} \end{aligned}$$

WEST

EAST

DDH2

DDH1



SECTION 1

KEY

✓ BASALT

X GRANITE

Vertical Scale
10
0
metres

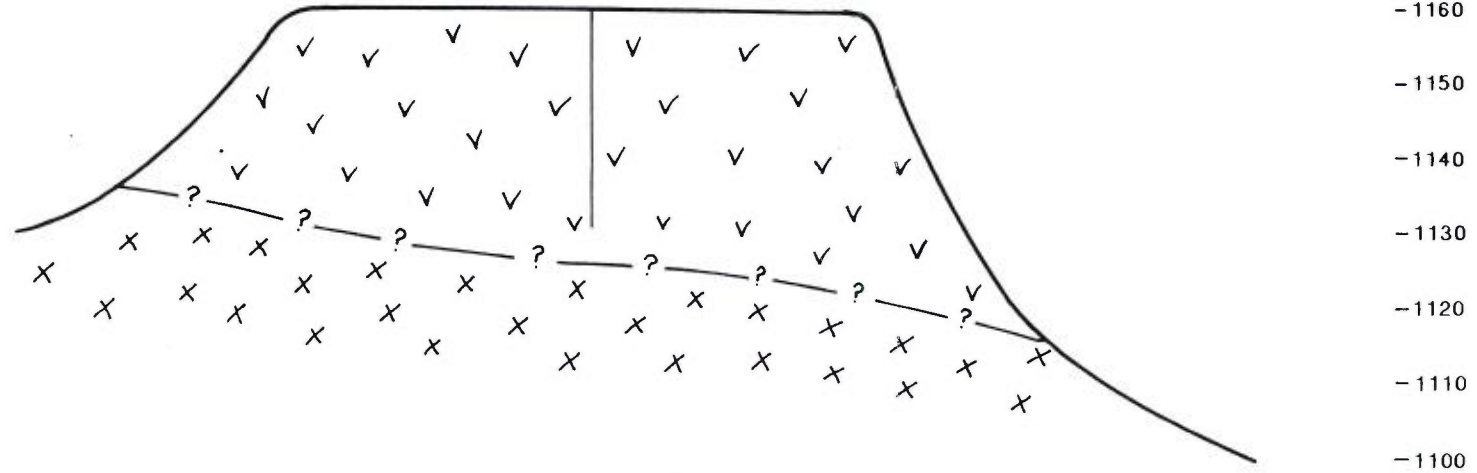
0 50 100
metres
Horizontal Scale

A
R

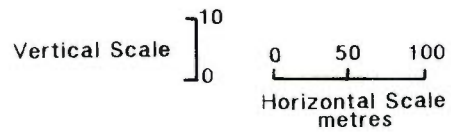
WEST

EAST

DDH3



SECTION 2



KEY
V BASALT
X GRANITE



APPENDIX 4

NOISE ASSESSMENT

APPENDIX 4 NOISE ASSESSMENT

1.0 MONITORING EQUIPMENT AND SURVEY PROCEDURES USED FOR BACKGROUND NOISE ASSESSMENT

Bruel and Kjaer Type 2231 Precision Sound Level Meter
 Bruel and Kjaer Type 4155 Microphone
 Bruel and Kjaer Type UA0207 Windshield
 Bruel and Kjaer Type BZ7101 Statistical Analysis Module
 Bruel and Kjaer Type 2318 Graphics Printer
 Bruel and Kjaer Type 4230 Sound Level Calibrator

The microphone was located at approximately 1.2m above the ground and away from reflecting surfaces. The calibration was checked before and after each series of readings, and did not fluctuate by more than $\pm 0.2\text{dB(A)}$.

The meter was set on fast response, A weighting, with the Sound Incidence Correction set on Random.

Noise levels were recorded over a fifteen minute period, analysed into the percentile noise levels (L_N) and equivalent continuous noise level (L_{eq}) and recorded on the graphics printer. Prominent noise sources were also noted.

2.0 BACKGROUND NOISE SURVEY DETAILS

Background noise levels were monitored on the 5th and 6th of February, the 3rd of March. Noise levels were recorded for 15 minute intervals using equipment detailed in **Section 1.0**. Monitoring was undertaken at several periods during the day. Periods were chosen to assess typical background levels both during the proposed hours of operation and at times when the quarry would not be operating.

**TABLE 1A
NOISE SURVEY RESULTS**

Site	Date	Time	EPA Time	LA10	LA50	LA90	LAeq	Source
N1	5/2/92	9:30am	Day	53.3	51.3	48.8	51.5	1,2,3,4
	5/2/92	12:55pm	Day	52.8	51.8	50.3	51.9	1,2,3,4
	5/2/92	11:30pm	Night	39.8	37.8	35.8	38.1	5,2
	3/3/92	1:10pm	Day	54.8	54.3	53.3	54.1	1,2,5,8
N2	5/2/92	11:50am	Day	44.3	41.8	39.8	42.3	1,2,6
	5/2/92	3:50pm	Day	41.3	38.8	37.3	40.5	1,2,3,6,7
	5/2/92	11:55pm	Night	33.3	30.8	29.8	31.9	2
	3/3/92	2:45pm	Day	49.8	48.8	46.8	48.7	1,2,5

**TABLE 1A (CONT'D)
NOISE SURVEY RESULTS**

Site	Date	Time	EPA Time	LA10	LA50	LA90	LAeq	Source
N3	5/2/92	4:20pm	Day	49.8	41.3	37.9	48.9	1,3,8,9
	5/2/92	11:05pm	Night	34.8	32.8	31.3	41.4	2,9
	6/2/92	2:00pm	Day	49.8	43.3	40.8	51.0	1,2,9,10
	3/3/92	12:35pm	Day	50.8	48.3	47.3	50.4	1,2,9,12
N4	5/2/92	5:00pm	Day	51.3	42.3	39.8	55.6	7,9
	5/2/92	10:40pm	Night	36.8	33.3	31.8	45.0	2,9
	5/2/92	12:15pm	Day	51.8	49.3	48.3	52.3	3,9,11

Key:

1	-	Birds
2	-	Crickets
3	-	Background Traffic
4	-	Sheep, Cattle, Horses
5	-	Distant Dogs
6	-	Gate Creaking
7	-	Distant Children Playing
8	-	Wind in Trees
9	-	Passing Traffic
10	-	Background Lawn Mowing
11	-	People Talking
12	-	Low Plane

**TABLE 1B
WEATHER CONDITIONS DURING SURVEYS**

Parameter	5/2/92	6/2/92	3/3/92
Cloud Cover	100%	100%	100%
Wind Speed	2-5 Knots	Nil	5 Knots
Wind Direction	Southerly	Nil	Northerly
Temperature	14-19°C	20-25°C	25°C

3.0 MONITORING EQUIPMENT AND SURVEY PROCEDURES USED TO ASSESS CRUSHING AND SCREENING EQUIPMENT

Bruel and Kjaer Type 2231 Precision Sound Level Meter
 Bruel and Kjaer Type 4155 Microphone
 Bruel and Kjaer Type UA0207 Windshield
 Bruel and Kjaer Type BZ7101 Statistical Analysis Module
 Bruel and Kjaer Type 2318 Graphics Printer
 Bruel and Kjaer Type 4230 Sound Level Calibrator
 Bruel and Kjaer Type 1625 1/3-1/1 Octave Filter Set
 Bruel and Kjaer Type BZ7103 Frequency Analysis Module

The meter was set on fast response, linear "all pass" and a preset number of spectra of 2.

The microphone was located at approximately 1.2m above the ground and away from reflecting surfaces. The calibration was checked before and after each series of readings, and did not fluctuate by more than $\pm 0.2\text{dB(A)}$.

4.0 SOUND PRESSURE LEVELS FOR PLANT AND MOBILE EQUIPMENT

Equipment used in the noise predictions models discussed in **Section 8.6** are listed in **Table 2** with their corresponding sound pressure levels. The primary jaw crusher, gyrotory crusher and proposed screens to be used at Oberon were monitored on the 22nd June 1992 while operating near Taree. The size and configuration of the processing equipment did not allow individual components to be monitored. A total noise emission from the processing plant was monitored and the information obtained was subsequently used for modelling purposes. The remaining equipment noise levels were obtained from previous noise assessments.

**TABLE 2
SOUND POWER LEVELS**

Equipment	Sound Power Level dB(A)
Crusher & Gyrotory Crusher Attenuated	99.4
149kW Dozer	109.9
2.5m ³ Front-End Loader	105.5
8 Tonne Water Cart	104.7
35 Tonne Dump Truck	113.4
23.7m ³ Scraper	110.9

5.0 PREDICTED NOISE LEVELS

**TABLE 3A
PREDICTED NOISE LEVELS
STAGE 1 OPERATIONS**

Residential Receiver	Predicted Noise Level-dB(A)			
	"Normal" Weather Conditions		"Worst-Case" Weather Conditions	
	Without Drill Rig	With Drill Rig	Without Drill Rig	With Drill Rig
"Westrel"	34.0	40.0	37.4	42.3
"Linnane Park"	28.5	29.3	31.5	32.7
"Rocklea"	28.0	33.4	32.4	36.3
"Sunny Point"	13.8	25.9	16.4	32.4
"Langley Heights"	27.7	29.7	29.6	32.6

**TABLE 3B
PREDICTED NOISE LEVELS
STAGE 3 OPERATIONS**

Residential Receiver	Predicted Noise Level-dB(A)			
	"Normal" Weather Conditions		"Worst-Case" Weather Conditions	
	Without Drill Rig	With Drill Rig	Without Drill Rig	With Drill Rig
"Westrel"	32.8	33.4	35.9	36.3
"Linnane Park"	29.1	30.3	31.8	32.5
"Rocklea"	25.6	29.0	31.0	31.7
"Sunny Point"	20.3	24.1	25.7	27.2
"Langley Heights"	29.6	30.6	31.3	32.3

APPENDIX 5

FLORA AND FAUNA
INVESTIGATIONS

**APPENDIX - 5, PART B
BIRDS OBSERVED IN THE STUDY AREA.**

Common name	Scientific name	Status in N.S.W.
ARDEIDAE White-faced Heron	<i>Ardea novaehollandiae</i>	A.N
PSITTACIDAE Sulphur-crested Cockatoo Crimson Rosella	<i>Cacatua galerita</i> <i>Platycerus elegans</i>	C.PN A.R
MUSCICAPIDAE Willie Wagtail	<i>Rhipidura leucophrys</i>	A.R
MALURIDAE Superb Fairy-wren	<i>Malurus cyaneus</i>	A.R
ACANTHIZADEA White-browed Scrubwren	<i>Sericornis frontalis</i>	A.R
CLIMACTERIDAE Brown Treecreeper	<i>Climacteris picumnus</i>	A.R
MELIPHAGIDAE Lewin's Honeyeater	<i>Meliphaga lewinii</i>	A.R
ZOSTEROPIDAE Silvereye	<i>Zosterops lateralis</i>	A.PN&V
GRALLINIDAE Magpie-Lark	<i>Grallina cyanoleuca</i>	A.PN
CRACTICIDAE Grey Currawong	<i>Strepera versicolor</i>	MC.PN
CORVIDAE Australian Raven	<i>Corvus coronoides</i>	A.R

Key:

Status in N.S.W (Morris et al 1981)

A	-	Abundant
C	-	Common
MC	-	Moderately Common
U	-	Uncommon
S	-	Scarce
Ra	-	Rare

R	-	Resident
Se	-	Sedentary
B	-	Breeding
RB	-	Resident Breeder
N	-	Nomad
P	-	Partial
M	-	Migrant
SM	-	Summer Migrant
WM	-	Winter Migrant
V	-	Visitor
SV	-	Summer Visitor
WV	-	Winter Visitor

**APPENDIX - 5, PART C
MAMMALS OBSERVED AND EXPECTED IN THE STUDY AREA
AND ENVIRONS**

Common Name	Scientific Name	Status/ Record	
ORNITHORHYNCHIDAE			
Platypus	<i>Ornithorhynchus anatinus</i>	C(SC)	E
VOMBATIDAE			
Common Wombat	<i>Vombatus ursinus</i>	C	Ev
MACROPODIDAE			
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	A	E
Common Wallaroo	<i>Macropus robustus</i>	A	E
INTRODUCED MAMMALS			
Black Rat	<i>Rattus rattus</i>	A	E
House Mouse	<i>Mus musculus</i>	A	E
European Rabbit	<i>Oryctolagus cuniculus</i>	A	E
Fox	<i>Vulpes vulpes</i>	A	Ev
Feral Cat	<i>Felis catus</i>	A	E
Feral Dog	<i>Canis familiaris</i>	C	E
Horse	<i>Equus caballus</i>	C	O
Sheep	<i>Ovis aries</i>	A	O

Key

STATUS

Australian status from Strahan (1983)

Listing of endangered fauna from New South Wales NPWS (1992)

A	-	Abundant
C	-	Common
I	-	Limited
U	-	Uncommon
VR	-	Vulnerable and Rare
T	-	Threatened
SC	-	Fauna of Special Concern

RECORD

E	-	Expected to occur in region
O	-	Observed during field surveys
Ev	-	Identified from evidence of the presence of species (scats, tracks, marks)

APPENDIX 6

ARCHAEOLOGICAL SURVEY

APPENDIX 6
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OBERON EIS ARCHAEOLOGICAL SURVEY

1.0 INTRODUCTION

As part of the Environmental Impact Statement for a proposed hard rock quarry near Oberon on the NSW Central Tablelands, an archaeological survey was undertaken. The objective of the survey was to identify any archaeological sites that may have been affected by the proposed quarry operations and to make recommendations for the management of any sites that were found.

This report details the results of the investigation. It includes details of previous archaeological surveys, the location of Aboriginal sites in the area and an overview of the local environment. The report outlines the survey methodology utilised and makes recommendations for management of sites in the development area.

2.0 BACKGROUND

2.1 LOCATION

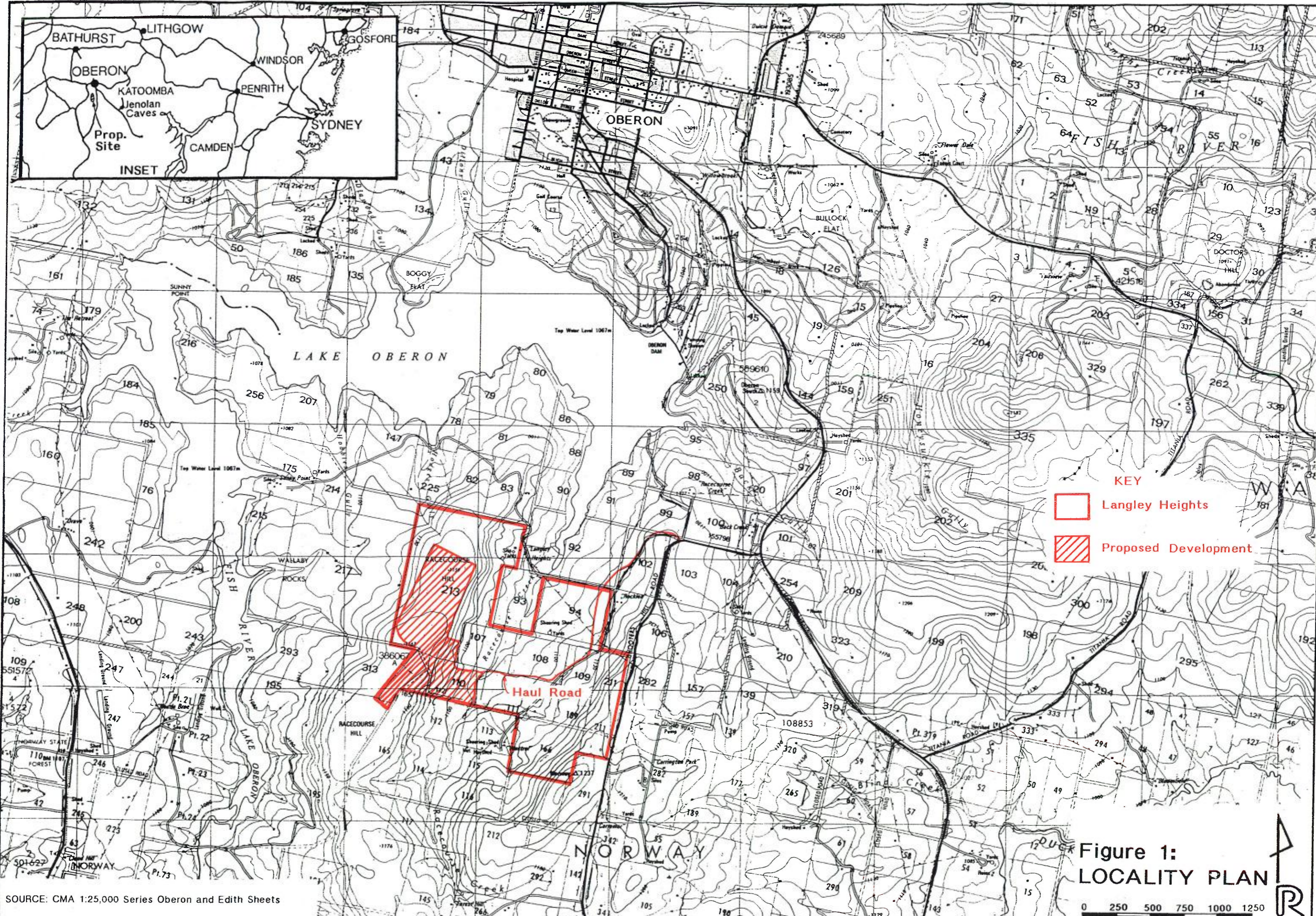
The location of the proposed quarry is Racecourse Hill, a flat top hill 1 km south of Lake Oberon (**Figure 1**). The development includes the establishment of a quarry on Racecourse Hill, a crushing plant and the construction of siltation dams and a haul road. All of the quarry infrastructure is to be located within the Langley Heights property.

2.2 ENVIRONMENTAL SETTING

Oberon is situated on the Central Tablelands of New South Wales approximately 1000m above sea level. The geology of the area consists of Ordovician quartz rich greywacke and andesite and tuff, intruded by Carboniferous granite within the Capertee Anticline. The area of interest for the present archaeological survey is a flat topped Tertiary basalt hill overlying the granite formation. There are many such basalt outcrops in this part of the Central Tablelands (Bathurst 1:250,000 Geological Map 1966).

An interesting feature of Racecourse Hill that has archaeological implications is the existence of water worn gravel deposits between the basalt flow and the granite base of the hill. The gravels consist mainly of quartz pebbles of various sizes. The archaeological implication is that the band of pebbles is eroding out of the hill at various places and this would have provided the Aborigines with an easily accessible and suitably sized stone resource for making stone tools.

The Oberon region consists mainly of undulating hills with a sparse tree cover. The area contains many creeks and waterways. The Fish River is the main water source near the study area. The climatic change between the summer and Winter months is very dramatic. Summer in the area brings hot days with



KEY

- Langley Heights
- Proposed Development

**Figure 1:
LOCALITY PLAN**

0 250 500 750 1000 1250 metres

SOURCE: CMA 1:25,000 Series Oberon and Edith Sheets

temperatures often in the high 30's degrees Celsius. Winter however is generally very cold with snow a regular occurrence at some stage of the season.

The region surrounding the study area has a history of disturbance from the time Europeans invaded the area. Clearing of the land to make way for the grazing stock is one of the main disturbances.

2.3 ARCHAEOLOGICAL SETTING

The National Parks and Wildlife Service Aboriginal site register shows that there have been a number of sites found within the Oberon district but formal archaeological survey work has been limited. A regional study was carried out of the Central Tablelands and Western Slopes by Michael Pearson as a PhD thesis (1981). He established that there were characteristics common to most of the open sites he investigated and that if some or all of these characteristics were present at a location then there should be a site there. The characteristics were:

- Proximity to water.
- Good drainage.
- Elevation above cold air drainage.
- Level ground.
- Sunny aspect.
- Adequate fuel (Pearson 1981:101).

Subsequent surveys in the region have established that the site attributes are real. Gollan and Bowdler (1983) undertook an archaeological survey by sampling areas of State Forests in the Bathurst Management Area which includes Oberon. Their aim was to identify what types of sites were present in the area and where they were likely to be located. Their results show that sites in the area have the same locational characteristics as identified by Pearson.

There have been two other Archaeological surveys relevant to the present investigation. Brayshaw (1986, 1987) carried out a survey for a particleboard plant just north of the Oberon township. She located four sites, all in eroded areas where the grass had been removed. Visibility restrictions prevented her from finding any other sites. Brayshaw was present when the area was cleared for the development but found only a few more artefacts. The sites that she recorded appeared to be different exposures of the same sparse artefact scatter (1987:5).

In 1987, Lance and Truscott undertook a survey for the Bathurst to Oberon Natural Gas Pipeline. They recorded a number of artefact scatters and investigated the reports of a quarry at Mt. Oberon. Their survey found that Pearson's criteria for site location was very useful and most of the artefact scatters they encountered could have been predicted using Pearson's model.

Pearson (1981) found that the Oberon and Portland plateau regions contained less sites than neighbouring regions. His conclusion was that this was the result of unfavourable weather conditions and possibly less food availability, especially plant foods. However, Lance and Truscott (1987) concluded that the region was probably archaeologically very rich.

2.3.1 Site Types

A range of different site types were likely to be encountered during this investigation. The most common site type likely to be found in the area is the open artefact scatter. Artefact scatters are the remnants of stone flaking, where the Aborigines made stone tools to use for their daily needs. They may represent an overnight campsite or just a short stopover for tool maintenance. The scatters are often found lying on the ground surface. Some however, are associated with subsurface deposit, where the processes of sediment deposition over a long period of time have covered over the site.

Another site type that may have been encountered during the survey is scarred trees. This is where the Aborigines have removed bark or wood from the tree in order to make a wooden implement such as a coolamon or a canoe. Such trees are rare due to their age and the effects of land clearing and as such are highly significant.

Another site that could be found is a stone quarry. Aborigines were very adept at identifying suitable outcrops of stone to use for tools. A range of rock types were exploited including quartz and basalt, both of which are found within the study area. Quartz was generally used as a rock suitable for cutting. Basalt on the other hand was generally used for more specific purposes. The hardness of the rock made it ideal for manufacturing axe heads, either ground or flaked to an edge. Quarry sites are identified by the mass of flaking debris found around the source of rock. The debris is particular to the method employed to extract the stone and to form it into the desired shape or more manageable chunks.

The other site that may be found during the investigation into the area are sacred sites. They may take a variety of forms such as stone arrangements, bora rings or mythological sites. Such sites are often associated with unusual natural features and Racecourse Hill could be considered unusual because of its flat top. The identification of this site type is difficult and usually relies on the knowledge of the local Aboriginal community.

3.0 SURVEY METHODOLOGY

According to the NSW National Parks and Wildlife Service Aboriginal site register, no sites have been recorded within the study area. However sites have been recorded in the Oberon district. The aim of the survey was therefore to examine the areas that would be affected by the development and also to investigate areas with high archaeological potential.

A range of topographic units were surveyed in order to obtain a more accurate assessment of the potential for sites to be located in the area and to find the possible range of site types.

All areas of the proposed development were examined on foot. The proposed route of the haul road, areas set aside for dams, the location of the crushing plant and the top of Racecourse Hill were all surveyed. It was considered that the banks of the creeks and elevated areas adjacent to the creeks may have been a focus for Aboriginal occupation and so these areas were also examined.

The survey was quite thorough but was hampered by problems of low surface visibility. The grass cover in many areas was thick and this restricted the ground surface that could be viewed. However, there were some areas that provided better visibility in particular vehicle and stock tracks, along fencelines, in gateways and where there had been earthworks to construct farm dams, these were also examined.

Within the paddocks there were some large granite boulders and these were inspected on the off chance they had paintings or other markings on them. The basalt outcrops on Racecourse Hill were also investigated for signs of quarrying.

4.0 SURVEY RESULTS

A total of approximately 37,500 m² was examined across the Langley Heights property. However in real terms this was considerably less when the surface visibility is considered. On average, the area surveyed had only 15% visibility which reduced the actual area surveyed to 5625 m². This represents only a small portion of the Langley Heights property.

The survey found and recorded three artefact scatters and an isolated find (**Figure 2**). The isolated find was located on the edge of a grove of trees, approximately 500m east of Racecourse Creek. The artefact was a quartz pebble which had been flaked. There was limited visibility but no other artefacts were located. The artefact has not been declared a site, according to the National Parks and Wildlife Service definition.

Site two consisted of two artefacts found 10m to the east of Racecourse Creek in a cutting made during the construction of the earthwall dam. The artefacts were found on the slope of the cutting but it was not clear whether they had come from the surface or had eroded out of the cutting. No other artefacts could be found in the area even after an intensive search.

The third site was found on the western side of Racecourse Creek. This was the most extensive site found during the survey. It consisted of five artefacts spread along the edge of the creek for approximately 120m. The artefacts were found in stock tracks that ran parallel to the creek. Visibility off the tracks was poor and there are likely to be more artefacts present. There is also a chance for subsurface deposit to be present at this site as it is in an aggrading landscape. The deposit would be shallow however and is estimated to be no more than 30cm.

The fourth site found during the survey was located on top of Racecourse Hill. It was in a disturbed state, where the property owner had excavated a trench in order to bury hay. The three artefacts were found on the edge of the excavation and one was embedded in the bank but above the layer of hay. This site is disturbed and is unlikely to have any subsurface deposit.

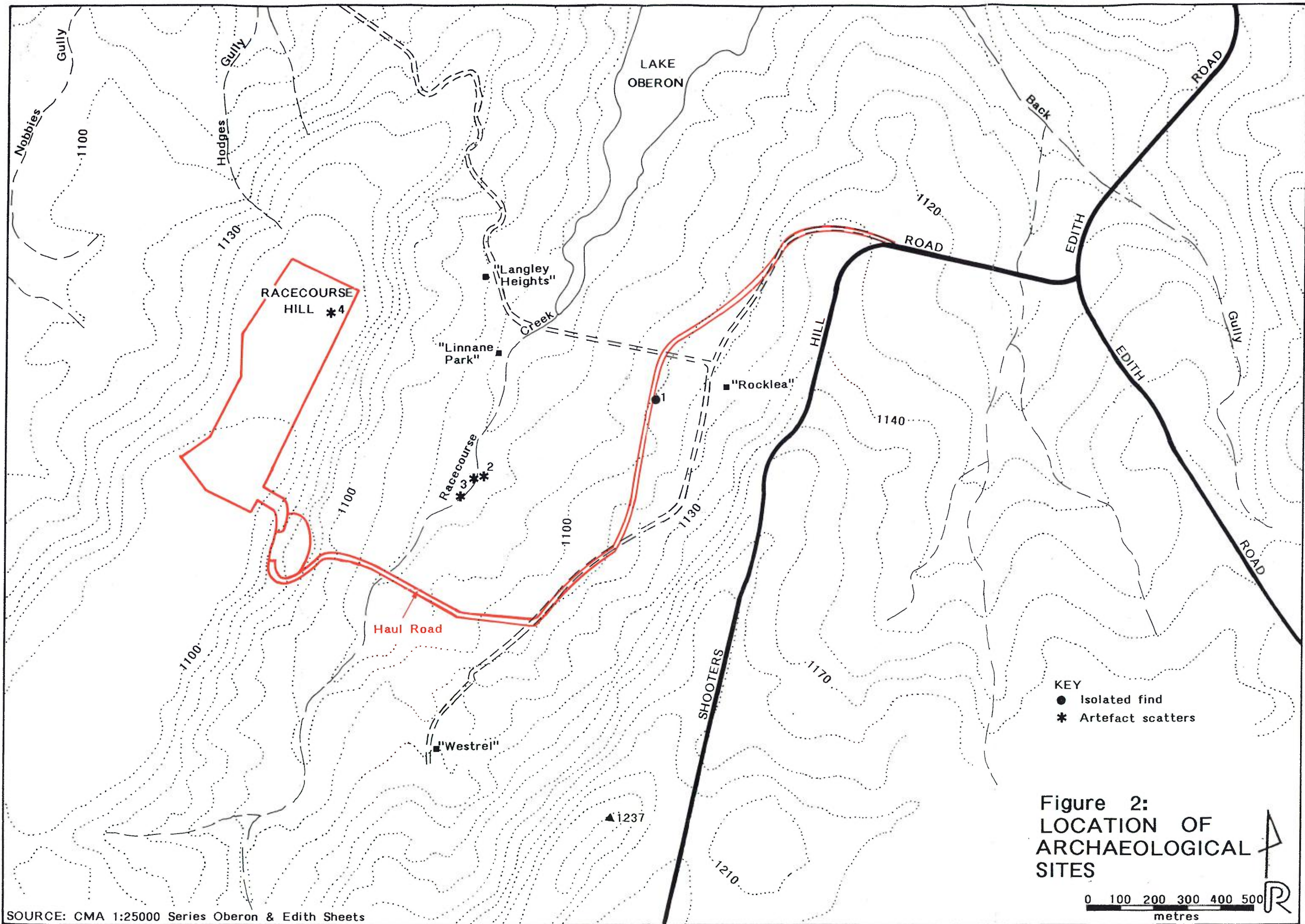


Figure 2:
 LOCATION OF
 ARCHAEOLOGICAL
 SITES



5.0 DISCUSSION

The location and content of the sites found reveals some information about the Aboriginal occupation of the area. The location of two of the sites supports the general characteristics of site location that have been identified by other studies and mentioned above. The largest site found during the survey was adjacent to a creek on gently sloping, well drained ground and there would have been plenty of fuel available at the time the site was occupied. There was also a site on the opposite side of the creek in the same environmental setting. The location of these sites appears to strengthen the model of site location previously identified.

It is difficult to assess a single artefact for occupational information as it may have been dropped by the Aboriginal or even picked up and dropped by a European. As there were no other artefacts located in the vicinity of this artefact there is not much that can be said about it.

There was however, another site that does not fit the model. This was the artefact scatter that was found on top of Racecourse Hill. The explanation for the location of this site is not difficult. Even though it was over 500m from the nearest water, it had other advantages. The height of the hill and its flat top nature, makes it an ideal look-out point. A person or group camping on top of the hill would have been able to see smoke from campfires, the location of other groups or enemies, or the location of food sources such as herds of kangaroos. It also has an advantage in that it is above the cold air drainage line but this may be negated in some situations by the wind chill factor.

None of the sites located during the survey are particularly extensive in size or quantities of artefacts. There is however, an important aspect of the tool technology and stone material use of the area that these sites may assist in enhancing. Previous archaeological surveys of the region have noticed the almost complete absence of retouched tools and domination of quartz in the assemblages (Pearson 1981, Lance and Truscott 1987). The artefacts found during this survey are no exception as **Table 1** shows.

Although only eleven artefacts were found, nine of them were quartz and two were chert. None of the artefacts were retouched. Although the sample is small, it does not dispute the findings of other archaeologists in the region.

The assessment of site significance is based on the following criteria; educational significance and scientific significance. None of the sites have any educational value. They are small dispersed scatters, hard to locate nor are they aesthetically pleasing.

The scientific significance is however worth considering. The isolated find may be disregarded as significant. It is a single artefact that can tell us very little about the Aborigines. The site on top of the hill has no potential for the study of stone tool technology but is interesting in terms of its location. Once the details have been recorded however, the site does not demand that it be preserved.

The only sites that may hold some scientific significance are those adjacent to the creek. Site two is less significant due to its disturbed nature with only two artefacts being located. Site three however, is considered to be the most significant site found during the survey. It is the largest site located and has the

potential for subsurface deposit as it is situated in an aggrading landscape. It is likely that the site is a lot larger in terms of artefact numbers and should not be disturbed.

**TABLE 1
ARTEFACT CHARACTERISTICS**

Site	Artefact Type	Raw Material	Length (mm)	Width (mm)	Thick. (mm)	Cortex (%)	Comments
1	Pebble Core	Quartz	87	70	45	90	Flaked through thickness, 3 neg. scars
2	Flake	Quartz	15	18	6		Broken Possibly bi-polar
	Flake	Quartz	28	27	10		
3	Flaked piece	Chert	33	11	11	15	Vein cortex 4 neg. scars, rotated Possible core. Crystal quartz, 5 neg. scars.
	Flaked piece	Quartz	30	17	10		
	Flaked piece	Chert	20	15	6		
	Flaked piece	Quartz	38	30	12		
	Flaked piece	Quartz	27	25	13		
4	Core	Quartz	65	55	50		Rotated, some blade like scars.
	Flaked piece	Quartz	20	15	8		
	Flaked piece	Quartz	20	15	7		

6.0 ABORIGINAL CONSULTATION

The Windradyne Local Aboriginal Land Council was contacted and informed that the survey was to be undertaken. Arrangements were then made for Mr Roland Williams, the Sites Curator of the Wiradjuri Regional Aboriginal Land Council to assist the archaeologist in conducting the field investigation. When the field survey had been completed, a draft of the report was sent to Mr Williams for his comments. A letter detailing his agreement with the recommendations is attached as **Appendix 1**.

7.0 RECOMMENDATIONS

It is recommended that the development should proceed on archaeological grounds provided the following recommendations, based on the assessment of the sites and the proposed quarry plan, are adhered to.

It is recommended that Oberon Quarries apply for a consent to destroy permit for site four, on top of Racecourse Hill. The site will be destroyed by the proposed quarry operation.

The other two sites will not be affected by the development. It is recommended therefore that their location be noted by the developer and that they be left as they are.

The developer is reminded that if any other sites are located during the construction of the haul road, crushing plant and quarrying operations work must cease immediately and the National Parks and Wildlife Service notified.

8.0 REFERENCES

Brayshaw, H. 1986. Archaeological Survey of Fireboard Plant at Oberon, NSW.

Brayshaw, H. 1987. Exposure and Collection of Artefacts at the site of the Oberon Fineboard Plant, NSW.

Gollan, K. and Bowdler, S. 1983. Aboriginal Sites on the Crown Timber Lands of the Bathurst Management Area, NSW.

Lance, A. and Truscott, M. 1987. An Archaeological Survey for the Bathurst to Oberon Natural Gas Pipeline.

Pearson, M. 1981. Seen Through Different Eyes. 2 vols. Unpublished PhD thesis, Department of Prehistory and Anthropology, ANU.

APPENDIX 7
BLAST DESIGN

**APPENDIX 7
PROPOSED BLAST DESIGN
FOR OBERON QUARRIES PTY LIMITED**

Design Criteria

Proposed Production	200,000TPA
Volume of Production	75,000m ³ solid
Proposed Blast Size	5,000m ³ solid
Number of Blasts per year	15
Target ground vibration	2mm/sec
MIC allowable	130kg
Maximum MIC allowable per hole	98kg
Drill Hole Diameter	102mm
Stemming	2.7m
Sub Drilling	0.75m
Explosive per hole (using ANFO)	55.7kg
Target Powder Factor	0.75kg/m ³
Pattern	2.8x2.65m
Useful Volume of Rock per hole	74m ³
Number of Holes/5,000m ³ Blast	67

Predicted Results

Ground vibration at Linnane Park	1.8mm/sec
Airblast at source	110/112dB
Exposive/blast	3731.9kg

Noise/Vibration Control Measures

Each hole will be fired individually, using Nonel Surface delays of 25ms along rows and 42ms between rows. All holes will be primed, using 500ms Nonel detonators and 32mm Emulite primers. The preferred explosive would be ANFO.

The ground vibration from the pattern and explosive give totally adequate ground vibration.

Airblast control would include:

- * Stemming to be equivalent to burden.
- * Stemming to be 14mm aggregate.
- * Nonel surface detonators covered with quarry dust.

Explosives

Ammonium Nitrate and Fuel Oil (ANFO) is the most commonly used form of explosive due to cost and safety factors. If blasting is performed during wet weather conditions it is recommended that Powergel emulsions or equivalent be used as ANFO is not water resistant. Powergel is a water-in-oil emulsion and any groundwater present will not dissolve the oil matrix.

APPENDIX 7 BLAST DESIGN AND IMPACT ASSESSMENT

1.0 TRIAL BLAST DESIGN

A trial blast design for the proposed hard rock quarry at "Langley Heights" was prepared on behalf of Oberon Quarries by Inlol Pty Limited.

1.1 DESIGN CRITERIA

Proposed Production	200,000TPA
Volume of Production	75,000m ³ solid
Proposed Blast Size	5,000m ³ solid
Number of Blasts per year	15
Target ground vibration	2mm/sec
MIC allowable	130kg
Maximum MIC allowable per hole	98kg
Drill Hole Diameter	102mm
Bench Height	10m
Stemming	2.7m
Sub Drilling	0.75m
Explosive per hole (using ANFO)	55.7kg
Target Powder Factor	0.75kg/m ³
Pattern	2.8x2.65m
Useful Volume of Rock per hole	74m ³
Number of Holes/5,000m ³ Blast	67

1.2 NOISE/VIBRATION CONTROL MEASURES

Each hole will be fired individually, using Nonel surface delays of 25ms along rows and 42ms between rows. All holes will be primed, using 500ms Nonel detonators and 32mm Emulite primers. The preferred explosive would be ANFO.

Airblast control would include:

- * Stemming to be equivalent to burden.
- * Stemming to be 14mm aggregate.
- * Nonel surface detonators covered with quarry dust.

1.3 EXPLOSIVES

Ammonium Nitrate and Fuel Oil (ANFO) is the most commonly used form of explosive due to cost and safety factors. If blasting is performed during wet weather conditions it is recommended that Powergel emulsions or equivalent be used as ANFO is not water resistant. Powergel is a water-in-oil emulsion and any groundwater present will not dissolve the oil matrix.

2.0 VIBRATION AND OVERPRESSURE FROM BLASTING

2.1 ASSESSMENT CRITERIA

The Environment Protection Authority and the Department of Mineral Resources, Mines Inspection Branch impose limits on the levels of vibration and airblast overpressure from blasting.

The Environment Protection Authority limits are based on receptor comfort, rather than damage effects, and are shown in **Table 1**.

**TABLE 1
VIBRATION AND OVERPRESSURE LEVELS**

Time of Blasting	Airblast Overpressure (db(lin))	Ground Vibration (mm/sec-Peak vector sum)
9:00am – 3:00pm Monday to Saturday	115	5
6:00am – 9:00am Monday to Saturday	105	2
3:00pm – 8:00pm Monday to Saturday	105	2
6:00am – 8:00pm Sunday and Public Holidays	95	1
8:00pm – 6:00am Any Day	95	1

Note:

- (1) All measurements are relevant to affected residences.
- (2) Exceedance of the overpressure limit of 115dB(lin) should be on infrequent occasions, limited to a maximum of 5% of the total number of blasts, and should not exceed 120 dB(lin) at any time.
- (3) Exceedance of the ground vibration limit of 5mm/sec should be on infrequent occasions, limited to 5% of the total number of blasts, and should not exceed 10mm/sec at any time.

(Source: State Pollution Control Commission, 1985).

The Department of Mineral Resources limits are based on damage criteria and are set sufficiently low to minimise the possibility of damage. The Department's limits are:

Airblast Overpressure	120dB(lin)
Ground Vibration (Peak Vector Sum)	10 mm/sec

The Australian Standard 2187-1983, Part 2 "Use of Explosives" contains recommended maximum ground vibrations for different types of structures, and these are given in **Table 2**.

**TABLE 2
RECOMMENDED PEAK PARTICLE
VELOCITY FOR STRUCTURES**

Type of Building or Structure	Maximum Ground Vibration (mm/sec Peak Vector Sum)
Historical buildings and monuments, and buildings of special significance.	2
Houses and low-rise residential buildings commercial buildings not included below.	10
Commercial and industrial buildings or structures of reinforced concrete or steel construction.	25

Note:

- (1) These criteria refer to the peak vector sum vibration measured in the ground near the foundations of a building.
- (2) This table does not cover high-rise buildings, buildings with long span floors, specialist structures such as reservoirs, dams, hospitals, and buildings housing scientific equipment sensitive to vibration.

The standard does not recommend maximum limits for airblast overpressure.

To assess the potential impacts from blasting for the proposed development, the following was adopted as an appropriate design criteria:

Airblast Overpressure	115dB(lin)
Ground Vibration (Peak Vector Sum)	5mm/sec at residences 2mm/sec at historical buildings.

The above criteria were chosen as it is intended to restrict the period of blasting to 11:00am to 3:00pm Monday to Saturday. This will avoid amplification of the airblast overpressure by temperature inversions and assist compliance with the Environment Protection Authority criteria for impact on residential premises.

2.2 ASSESSMENT METHODOLOGY

2.2.1 Ground Vibration

The main factors influencing ground vibration levels from blasting are the geometry of the explosions, geological conditions, types of explosives and their performance.

A widely accepted general equation for the prediction of vibration levels is:

$$V = K \cdot \left(\frac{R}{Q^{1/2}} \right)^B$$

V = Vibration as Peak Particle Velocity (mm/sec).

R = Distance between charge and point of potential damage (m).

Q = Charge mass per delay (kg).

K } Constants related to site and rock properties. The following
= values have been found to relate to "average" rock under
B } "worst case" conditions.

$$K = 1140$$

$$B = 1.6$$

This formula will normally give very conservative vibration predictions.

At critical locations, where there has been no prior blasting experience, it is wise to carry out initial blasts with conservative charges and monitor the levels of vibration generated.

2.2.2 Airblast Overpressure

Airblast overpressure levels for fully confined blasthole charges may be estimated using the following formula:

$$P = 3.3 \times \left(\frac{R}{Q^{1/2}} \right)^{-1.2}$$

This formula can also be written to calculate approximately the airblast overpressure in decibels:-

The constants in airblast and ground vibrations should be derived from site measures. If these are not available the constants in the following formula may be used.

$$\text{dBL} = 164 - \left[24.0 \times \log \left(\frac{R}{Q^{1/2}} \right) \right]$$

P - Pressure (kPa).

Q - Mass of charge detonated (kg)/hole.

R - Distance from the charge (m).

2.2.3 Predicted Results

Based on the trial blast design described in **Section 1.0** and using the assessment methodology outlined in **Section 4.1**, ground vibration and airblast overpressure levels at each of the nearest residences have been calculated and are presented in **Table 3**.

**TABLE 3
BLAST IMPACT ASSESSMENT**

Residence	Minimum Distance to Residence	Ground Vibration (mm/sec)		Airblast Overpressure (dB Linear)	
		Predicted	Acceptable	Predicted	Acceptable
Westrel	800	1.0	5	110	115
Rocklea	1200	0.5	5	106	115
Linnane Park	500	2.1	5	115	115
Langley Hts	400	3.1	5	117	115
Sunny Point	1400	0.4	5	104	115
Lake Oberon (Wall)	2150	0.2	10	-	-

From **Table 3**, predicted blast emission levels at all nearest residences not associated with the development are below Environment Protection Authority's recommended "comfort" criteria for both ground vibration and airblast overpressure and are well below levels likely to cause structural damage to any residence.

At "Langley Heights" during the latter part of Stage 3 of extraction, theoretically "comfort" criteria for air blast overpressure will be exceeded by 2dB(Lin). The calculations do not take into account topographic effects and hence in this case would dramatically over estimate actual levels. The same would apply for "Linnane Park" where the effects of topographic shielding would reduce actual airblast overpressure levels to be well below theoretically predicted levels.

A section of the residence at "Westrel" is made of mud brick or rammed earth. Worst case ground vibration at "Westrel" has been predicted to be 1mm/sec which is considerably less than recommended maximum ground vibration levels for historic buildings or buildings of special significance.

Predicted maximum ground vibration for the wall of Lake Oberon is 0.2mm/sec which is considerably less than the acceptable level of 10mm/sec advised by Public Works Department.

Animals are generally affected more by airblast overpressure rather than ground vibrations. A study into the effects of aircraft sonic booms (which are similar in character to airblast overpressure) on animals concluded that for sonic booms in the range of 125dB(lin) to 136dB(lin) no abnormal behaviour by the animals results. The study covered beef cattle, horses, sheep and dairy cattle (Richard Heggie Associates Pty Limited, 1989).

Based on the above discussion it is not considered that blasting will have a significant impact on adjoining residences or land use.

APPENDIX 8

SEDIMENT AND EROSION
CONTROL PLAN

APPENDIX 8 SEDIMENT AND EROSION CONTROL PLAN

The following features of the Sediment and Erosion Control Plan are shown on **Figure 1**.

1.0 SEDIMENTATION DAMS

It is proposed to construct four sedimentation dams on-site to treat sediment laden runoff. In accordance with Environment Protection Authority requirements for this development, dams have been designed to have a storage capacity equivalent to the expected runoff from a 1 in 50 year (2% Annual Exceedance Probability, AEP) storm event. To allow for settlement of fine particles during extended periods of rainfall, sedimentation dams have been sized to accommodate runoff for 2% AEP storm events of 4 hour duration. During these periods sedimentation dams will act as "wet basins" providing adequate detention time (4 hours) to allow settlement of fine particles in excess of approximately 40µm. Dams have been designed based on a sediment storage depth of 0.5m and water storage depth of 1.5m or 2m. All dams are to be constructed with 2.5H:1V batters. External batters are to be grassed. Spillways on each of the dams have been designed to convey peak discharge from a 1 in 100 year (1% AEP) storm event.

1.1 DAM SIZING

1.1.1 Sedimentation Dams 1 and 2

Sedimentation Dams 1 and 2 have been designed to treat runoff from all of Stage 1 extraction area and the crushing plant and stockpile area. Sedimentation Dams 1 and 2 have been designed to service a catchment area of approximately 5.4 hectares.

Total runoff from a 4 hour duration 2% AEP storm event is given by:

$$Q_t = 0.222 \times C_{50} \times I_{50} \times A \times t$$

$$\begin{aligned} \text{Where } C_{50} &= 0.304 \\ I_{50} &= 18.1 \text{ mm/hour} \\ A &= 5.4 \text{ hectares} \\ t &= 240 \text{ minutes} \end{aligned}$$

$$\begin{aligned} Q_t &= 0.222 \times 0.304 \times 18.1 \times 5.4 \times 240 \\ &= 1583 \text{ m}^3 \text{ say } 1600 \text{ m}^3 \end{aligned}$$

As both dams service this runoff and are to be constructed in series to provide adequate retention time each dam requires a storage capacity of 800m³. For an effective storage depth of 1.5m both dams should be approximately 48m long and 15m wide at Top Water Level (TWL).

As extraction progresses into Stage 2 and 3, sediment laden runoff will be

directed to Sedimentation Dam 4 for sediment control. Discharge from Sedimentation Dam 4 will be conveyed to Sedimentation Dams 1 and 2 before being directed via a grassed waterway to Racecourse Creek. Peak discharge from Sedimentation Dams 1 and 2 from the fully developed quarry catchment during a 1% AEP storm event is given by:

$$Q_{100} = 0.278 \times C_{100} \times I_{100} \times A$$

$$\begin{aligned} \text{Where } C_{100} &= 0.356 \\ I_{100} &= 95.9 \text{ mm/hour} \\ A &= 0.176 \text{ km}^2 \end{aligned}$$

$$\begin{aligned} Q_{100} &= 0.278 \times 0.356 \times 95.9 \times 176 \\ &= 1.67 \text{ m}^3/\text{s} \end{aligned}$$

To accommodate a peak discharge of 1.67m³/s Sedimentation Dams 1 and 2 will require spillways approximately 8m wide. Flow depth over the spillway under these conditions would be approximately 0.27m. A freeboard of 0.5m should be provided above this depth making the top of the dam wall approximately 0.77m above TWL. The spillway between Sedimentation Dams 1 and 2 will form an 8m wide channel connecting the dams. Sedimentation Dam 2 spillway is to be constructed to have a maximum slope of 8% and is to be 11m wide at the outlet. Both spillways are to be grassed. Under these conditions the spillway of Sedimentation Dam 2 would convey peak runoff from a 1% AEP storm event at a maximum velocity of 1.5m/s. Discharge would be directed to adjoining pastured land and grassed waterway (W1).

1.1.2 Sedimentation Dam 3

Sedimentation Dam 3 is designed to collect runoff from the administration and workshop area (approximately 0.5 hectares). For a 2% AEP 4 hour storm event a storage capacity of 147m³ is required. To accommodate this a dam approximately 6m wide 20m long and 2.0m deep is to be constructed. Approximately 0.5m of this depth will be provided for sediment storage. Peak discharge from a 1% storm event has been calculated at approximately 0.08m³/s (80L/s). A level sill a minimum of 4m long is to be constructed at the outlet of Sedimentation Dam 3 to dissipate flow to adjoining pasture areas.

1.1.3 Sedimentation Dam 4

Sedimentation Dam 4, at full extent of extraction, will have a catchment area of approximately 14 hectares. At any one point in time up to 6 hectares of this may be disturbed with the remainder being rehabilitated and revegetated. Based on a 14 hectare catchment Sedimentation Dam 4 is to have a storage capacity of 4100m³ and will be approximately 80m long, 25m wide and 2m deep. An additional 0.5m depth will be provided for sediment storage. The dam is to be constructed below the level of the final quarry floor and will provide primary sediment control for extractive operations and unrehabilitated surfaces. Discharge from Sedimentation Dam 4 will be directed to Catch Drain C1.

1.2 MAINTENANCE

External batters of sedimentation dams will be kept in functional and vegetated condition. Dams are to be cleaned out prior to sediment storage capacity being reduced to 70% of the original volume. Material removed from sedimentation dams will be utilised with overburden material in rehabilitation of the quarry floor.

2.0 DIVERSION DRAINS

As shown on **Figure 1**, three diversion drains will be constructed on-site to convey clean runoff away from disturbed areas, facilities and sedimentation dams. Diversion drain characteristics are detailed in **Table 1**.

**TABLE 1
DIVERSION DRAIN**

Diversion Drain No.	Catchment Area (m ²)	Length (m)	Slope (%)	Q ₂₀ (m ³ /s)	Drain Width (m)	Flow Depth (m)	Velocity (m/s)
D1	31130	277	3.6	0.21	1.66	0.1	1.39
D2	39120	118	8.3	0.24	1.66	0.1	1.62
D3	3750	115	4.3	0.03	0.61	0.1	1.09

Note:

- * Drain widths quoted refer to base width.
- * Drains are to be grassed with improved pasture and maintained in a vegetated and functional condition.
- * Drains have been designed to have 3H:1V upslope batters and 2H:1V downslope batters.
- * Channels to be constructed with 0.5m free-board.
- * Level sills of 4m minimum length are to be constructed at diversion drain discharge points.

3.0 CATCH DRAINS

Three major catch drains are to be constructed on-site to convey sediment laden runoff from the processing area and extraction area to sedimentation dams. Catch drains are to be trapezoidal in cross-section with side batters of 2.0H:1V. Drains are to be vegetated with improved pasture species and have been designed to convey peak runoff at non-erosive velocities of 1.5m/s during a 5% AEP storm event. Catch drain locations are shown on **Figure 1** and design characteristics are documented on **Table 2**.

**TABLE 2
CATCH DRAINS**

Catch Drain No.	Catchment Area (m ²)	Length (m)	Slope (%)	Q ₂₀ (m ³ /s)	Drain Width (m)	Flow Width (m)	Velocity (m/s)
C1	176000	285	3.9	0.84	3.3	0.17	1.5
C2	176000	125	11.1	0.84	7.0	0.08	1.5
C3	5000	75	1.3	0.05	0.5	0.10	1.0

Note:

- * Drain widths quoted refer to base width.
- * Catch drains are to have a minimum depth of 0.5m.

Catch drains are to be maintained in a functional and vegetated condition.

4.0 GRASSED WATERWAYS

Two grassed waterways are to be constructed on-site. Waterway W1 will convey runoff from Sedimentation Dam 2 overland towards Racecourse Creek. Waterway 2 will act as a catch drain for the extraction area conveying runoff from the quarry face and rehabilitated areas to Sedimentation Dam 4.

Both waterways are to be grassed with improved pasture species and are to be constructed with 6H:1V side batters and a minimum free board of 0.5m. Waterways have been designed to convey peak runoff from a 5% AEP storm event at non-erosive velocities of 1.5m/s or less. Waterway locations are shown on **Figure 1** and design characteristics are presented in **Table 3**.

**TABLE 3
WATERWAYS**

Waterway No.	Catchment Area (m ²)	Length (m)	Slope (%)	Q ₂₀ (m ³ /s)	Drain Width (m)	Flow Width (m)	Velocity (m/s)
W1	207130	193	8.7	0.96	6.8	0.095	1.48
W2	140000	698	0.7	0.71	4.3	0.23	0.71

Note:

Waterways have been designed to be grassed and a Manning 'n' of 0.04 has been assumed. Sufficient freeboard has been provided to allow for lush growth within the water way that would tend to show flows more than has been assumed by the use of a "n" value of 0.04.

5.0 CONSTRUCTION PHASE

5.1 CONSTRUCTION SEQUENCE

Sedimentation dams, external catch drains, diversion drains and Waterway W1 are to be constructed and functional prior to the commencement of major earthworks on the proposed development site. During the construction phase care will be taken to ensure that runoff from disturbed areas is directed to the sediment control structures described in this plan.

5.2 HAUL ROAD

The haul road is to be sealed to a width of 6m from the edge of the processing area to Shooters Hill Road.

5.2.1 Racecourse Creek Crossing

A crossing is to be constructed over Racecourse Creek as shown on **Figure 1**. The culvert has been designed to convey peak discharges from a 5% AEP storm event in Racecourse Creek which have been calculated at approximately $9\text{m}^3/\text{s}$. To accommodate a discharge of $9\text{m}^3/\text{s}$ two 1500mm diameter concrete pipes (or equivalent) will be required. The culverts are to be installed with either stone pitched or concrete headwalls both upstream and downstream. Disturbed batters are to be vegetated with improved pasture species. A silt curtain will be erected on the downstream side of the crossing to contain sediment that may be generated during construction phase. Once construction is complete and associated disturbed areas have established a suitable vegetative cover the silt curtain will be removed.

5.2.2 Minor Culverts, Batters and Table Drains

A number of minor culverts will be required under haul road. Culverts are to be nominally of 450mm diameter and are to be installed with prefabricated concrete headwalls. During construction phase either a silt fence or staked haybales are to be placed downstream of culverts to contain sediment that may be generated.

Due to the lack of crossfall on the proposed haul road alignment it is envisaged that cuts and fills in excess of 1m will not be required except for the section of the haul road between the administration area and the edge of the processing area. A silt fence is to be erected during the construction phase immediately downslope of the toe of the fill batter. Cut and fill batters are to be no steeper than 2H:1V and are to be vegetated with improved pasture species.

Table drains are to be grassed with improved pasture species and to be constructed with either staked haybales or a silt fence at their termination points. Haybales or silt fences are to remain in place until suitable vegetative cover is achieved.

5.3 EXISING FARM DAM ON RACECOURSE CREEK

The existing farm dam on Racecourse Creek (see **Figure 1**) is to be augmented to have a capacity of approximately 2.7ML. To achieve this the top water level of the dam will need to be lifted 1m to 1075m AHD. This will require relocation of an existing 600mm concrete culvert, raising of the dam wall by 1.0m to 1076m AHD and construction of a high flow spillway on the eastern side of the dam wall.

The creek bank adjacent to the culvert outlet is currently eroding. To allow for this problem to be rectified and to facilitate raising of the top water level, the 600mm culvert is to be relocated to have its invert coincident with the augmented top water level of 1075m AHD. The culvert is to be positioned to discharge outlet approximately 100mm below downstream water level. Rip rap of nominal 200mm diameter is to be placed at the outlet of the culvert for scour protection and to dissipate flow energy.

Peak discharge from a 5% AEP storm event at the dam has been calculated at approximately $9\text{m}^3/\text{s}$. To convey this discharge at non-erosive velocities a grassed spillway 15m wide with a maximum slope of 10% is required. Under these conditions the spillway would have a flow depth of 0.5m. Peak discharge for a 1% AEP storm event has been calculated at $17.6\text{m}^3/\text{s}$. For the spillway to accommodate the 1% AEP peak discharge a total minimum freeboard depth of 0.9m is required.

During construction phase a silt curtain is to be placed downstream of the dam to contain sediment that may be generated. Dam wall is to be constructed with 2.5H:1V batters. Batters are to be grassed with improved pasture species and maintained in a vegetated condition.

6.0 TOPSOIL AND OVERBURDEN STOCKPILES AND VEGETATED BUNDS

All topsoil and overburden stockpiles and bunds are to be vegetated with improved pasture species.

Stockpiles and bunds are to be constructed to a height of 3m and are to have maximum of 2H:1V side batters. Suitable sediment control structures (i.e., silt fences or haybales) are to be constructed downslope of stockpiles and bunds. Catch drains are to be constructed at the perimeter of stockpiles and bunds to direct sediment laden runoff to the previously described sediment control structures.

7.0 REFERENCES

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Pilgrim, D.H., (Ed), 1987. Australian Rainfall and Runoff – A Guide to Flood Estimation – Volumes 1 and 2 – Institution of Engineers, Australia, 1987.

APPENDIX 9

AIR QUALITY ASSESSMENT

Prepared By Nigel Holmes & Associates

**AIR QUALITY ASSESSMENT
PROPOSED HARD ROCK QUARRY
OBERON**

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24 August 1992

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1.0 INTRODUCTION

This report has been prepared by Nigel Holmes & Associates on behalf of Resource Planning Pty Limited. It assesses the air quality impacts that will be associated with the proposed development by Oberon Quarries Pty Ltd of a hard rock quarry on Racecourse Hill approximately four kilometres south of Oberon, New South Wales (see Figure 1).

The approach to the assessment has been to analyse the operations of the proposed quarry and to develop estimates of the dust that will be generated from each operation. The estimated dust emissions have been used with a long-term dust dispersion model to calculate annual average dust deposition rates and concentrations at a grid of points surrounding the quarry for Stage 1 in the quarry development. This has been assumed to represent the "worst-case". The predicted deposition rates and concentrations have been presented as contour plots, which can be used to determine the air quality at dust sensitive locations.

Dust impacts have been assessed by comparing estimated dust concentrations and fallout levels with relevant air quality criteria.

2.0 LOCAL SETTING AND DESCRIPTION OF THE PROJECT

2.1 Local setting

The proposal is described in detail in the main body of the Environmental Impact Statement. A brief summary of those aspects relevant to air pollution is presented here.

The quarry will be developed over 45 years in three separate stages, as shown in Figures 2a, b and c. The surrounding area is used primarily for farming and there are three privately-owned farm residences in the vicinity of the quarry. The closest of these, Linnane Park (see Figure 3) is located approximately 500 m east of the NE boundary of the pits. The next closest residence, Westrel, is located approximately 900 m SW of the processing area and a third residence, Rocklea, is approximately 1.2 km to the east of the quarry.

It is proposed to quarry 9 Mt of basalt. Production will start at about 100,000 t/year and rise to 200,000 t/year. The rockface will be blasted and rocks loaded by front-end loader (3.5 cubic metre capacity) to two 30 to 40 t rear-end dump trucks which will transport the rock to a dump hopper and primary crusher. The layout of the processing plant is shown in Figure 4. After crushing, screening and stockpiling, the product will be loaded by front-end loader to 10 to 25 tonne highway trucks for transport to the end-user.

Dust controls will comprise water sprays on the dump hopper and conveyor transfer points, enclosure of the primary and secondary crusher, covering of conveyors and watering of the unsealed haul roads and other trafficked areas.

The road to the quarry will be sealed to the processing area.

Quarrying operations will be carried out between 7 am and 6 pm on weekdays and between 7 am and 4 pm on Saturdays. Plant maintenance and despatch of materials will take place between 6 am and 10 pm on weekdays and between 7 am and 4 pm on Saturdays.

3.0 CLIMATE AND DISPERSION METEOROLOGY

The computer-based dispersion model used to predict dust deposition and concentration levels requires data on wind speed, wind direction, atmospheric stability categories and mixed layer height ¹. The data base used and the way in which it has been used to derive the parameters required for dispersion modelling is discussed below.

3.1 Wind Speed and direction

The closest meteorological monitoring station to the site is the Bureau of Meteorology station at Oberon (Station 063063, approximately 3.5 km NNW of the quarry site). The data available for Oberon comprise 9 am and 3 pm observations of wind speed and wind direction over a 21 year period (1965-1985).

Figure 5 presents the seasonal and annual wind rose diagrams compiled from all 9 am and 3 pm wind speed and direction observations over the 1965 to 1985 interval. On an annual basis, the most common winds are from the SW, followed by the NW. This pattern persists in winter and spring, while in summer and autumn, winds from the E, NE and SE are also common.

3.2 Atmospheric Stability ²

There are no direct data on atmospheric stability and the procedure adopted here has been to assume that all emissions of dust occur under neutral, or so called D-class conditions. For ground-level sources, such as will be found in

¹ The term mixed-layer height, refers to the height above the ground through which ground-based emissions will eventually be dispersed once a plume has been thoroughly mixed. An elevated plume, initially above the mixed-layer height will remain isolated from the ground until such time as the mixed-layer height reaches the height of the plume. In general the mixed-layer height will increase during the day as the sun causes convection to deepen the turbulent layer of the atmosphere close to the ground. Mixed-layer height will also increase if the wind speed increases because higher wind speeds will increase turbulence as the wind blows over the rough ground.

² In dispersion modelling, the term stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme (as used in this study) there are six stability classes, A through to F. Class A relates to unstable conditions, such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

the quarry, the more stable the atmosphere the higher will be the ground-level concentration of dust. Quarrying will be confined to the day when stability conditions will be either neutral, or unstable (except during the very early morning and late evening). Therefore, assuming that the atmosphere is at all times in a neutral stability conditions will tend to overstate the air quality impacts and in the absence of detailed data on atmospheric stability it has been assumed that neutral stability applies for all hours of the day.

3.3 Mixed-layer Height

Mixed-layer heights are not critical in determining dust concentrations and dust fallout levels from surface sources of dust, but approximate values are required by the dispersion model. These have been provided to the data file used by the model by assuming that seasonal average values of 1200 m for autumn and spring, 1000 m for winter and 1500 m for summer. As noted earlier the model is insensitive to the precise values for mixed-layer height, for all reasonable values.

3.4 Data file for modelling

The meteorological data file produced by the above procedure was then processed to produce a joint frequency file of wind speed, wind direction and stability class which was suitable for use with the dispersion model.

3.5 Rainfall

Although rainfall data are not significant in determining dispersion, they are of interest in determining the rate of generation of dust from stockpiles and other exposed areas.

Rainfall data collected over 97 years commencing 1888 at Oberon (Bureau of Meteorology Station Number 063063, Buckley Crescent, Latitude 33 Degrees 43 Minutes south and Longitude 149 Degrees 52 Minutes east, elevation 1085 m) are presented in Table 1. The annual mean rainfall is 839 mm and the average number of raindays per year is 100. Data have also been collected at the Oberon Prison Camp commencing in 1933 and 52 years of records are available. This station recorded a higher annual average rainfall (1001 mm) than the Buckley Crescent Station and an average number of raindays per year of 133. For the purposes of the air quality assessment in this report, a conservative approach has been adopted and the data from Buckley Crescent have been used as these represent drier conditions and therefore higher rates of dust emissions.

TABLE 1
OBERON RAINFALL DATA STATION NUMBER O63063

Month	Mean (mm)	Median (mm)	Number of Raindays
Jan	81	69	8
Feb	60	47	7
Mar	64	45	7
Apr	57	52	7
May	61	52	8
Jun	82	65	11
Jul	70	60	10
Aug	74	73	10
Sep	68	62	9
Oct	81	73	9
Nov	69	55	7
Dec	72	66	7
Year	839	823	100

Source: Bureau of Meteorology (1988)

4.0 AIR QUALITY CRITERIA

The effects of dust on health and amenity can be assessed by comparing dust deposition rates and dust concentrations with recognised air quality criteria established as a result of research both in New South Wales and overseas. To cover the full range of possible adverse impacts it is necessary to make reference to criteria for both long-term (annual averages) and short-term (24-hours) periods.

4.1 Short-term criteria

Concentration

New South Wales has no regulations concerning acceptable short-term concentrations of dust in the ambient air. However, in assessing the acceptability of mining projects the Environment Protection Authority of New South Wales (EPA) formerly referred to the US EPA primary and secondary ambient 24-hour air quality standards, which are 260 and 150 microgram/cubic metre respectively. These have been changed recently to make specific reference to the particles sizes of the dust and the air quality goal now refers to a concentration of 150 micrograms/cubic metre for sub-ten micrometre particles. The primary standard is designed to protect the public against

adverse health effects with an "adequate margin of safety"³, and is not to be exceeded more than once per year. The secondary standard is designed to protect against "known or anticipated adverse effects of a pollutant", and again is not to be exceeded more than once per year.

The United States also publish criteria known as Alert, Warning and Emergency level criteria for 24-hour average particulate matter concentrations. These are as follows:

Alert -	375 microgram/cubic metre
Warning -	625 microgram/cubic metre
Emergency -	875 microgram/cubic metre.

A pollutant reaching concentrations between the primary standard and the alert level would be expected to cause "mild aggravation of symptoms in susceptible persons, with irritation symptoms in the healthy population". Between the alert and warning level concentrations there would be "significant aggravation of symptoms and decreased exercise tolerance in persons with heart or lung disease, with wide spread symptoms in the healthy population". Between the warning level and emergency level there would be "premature onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance in healthy persons".

Deposition

There are no air quality criteria for short-term dust deposition rates.

4.2 Long-term criteria

Concentration

The EPA refer to the National Health and Medical Research Council (NH&MRC) (Australia) 90 microgram/cubic metre annual average goal when assessing long-term dust impacts. This level is recommended as the maximum permissible level that should be permitted in urban environments. The 90 microgram/cubic metre annual goal is now supplemented with the US EPA 50 micrograms/cubic metre annual goal for sub-ten micrometre particles. In practice because approximately 50 per cent of particles in dust near mining and quarrying industries are in the sub-ten micrometre range then the two goals are very similar.

Deposition

In the past the EPA has considered that residential areas would begin to experience dust related nuisance impacts when annual average dust (insoluble solids) deposition levels exceeded 4 grams/square metre/month, and that dust impacts would be at unacceptable levels when they reached 10 grams/square

³ Text between inverted commas in this section has been taken from Stern et al. (1987) "Fundamental of Air Pollution - Second Edition" - see Section 11.0 for full reference.

metre/month (SPCC 1983). Recently, the EPA (Dean et al., 1990) has refined these criteria. **Table 2** shows the maximum acceptable increase in dust deposition over the existing dust levels.

For example, in rural/semirural areas with annual average deposition levels of between 1 and 2 grams/square metre/month, as applies for the present location (see **Section 5.0**) an increase of up to 2 grams/square metre/month would be permitted before it is considered that a significant degradation of air quality had occurred.

The above criteria for dust fallout levels are set to protect against nuisance impacts and they are not relevant for interpreting the significance of dust in quarry working areas, where the concept of dust fallout level becomes meaningless in, for example, areas where overburden is being dumped.

TABLE 2-ENVIRONMENTAL PROTECTION AUTHORITY CRITERIA FOR DUST FALLOUT

Existing dust fallout level (grams/square metre/month)	Maximum acceptable increase over existing fallout levels - (grams/square metre/month)	
	Residential	Other
2	2	2
3	1	2
4	0	1

5.0 EXISTING AIR QUALITY

5.1 Dust deposition

Dust deposition and concentration levels can vary markedly with location and depend strongly on the distance from the source of dust and the prevailing meteorological conditions. To use the information discussed in **Section 4.0** to select appropriate criteria it is necessary to know the dust deposition and concentration levels for the residences or areas being assessed. High dust concentration or deposition levels within the quarry itself, or on land used for quarry infrastructure, does not cause an environmental impact. High levels in residential area, or in farming areas, may be considered a problem. Thus the key requirement is to determine dust deposition data at private residences and on privately owned land.

The nearby privately owned residences are shown on **Figure 3**. The closest is Linnane Park which is approximately 500 m to the east of the proposed quarry.

The next closest is Westrel which is approximately 900 m to the southeast followed by Rocklea, 1.2 km to the east.

Dust deposition gauges have been installed at the four sites shown in Figure 6 and data collected from March to July of 1992 are presented in Table 3. The dust deposition levels are generally low and indicate that the area is not greatly affected by dust.

Gauge	Month (1992)				
	March	April	May	June	July
D1	0.4	0.4	0.5	0.6 ²	<0.2
D2	1.6	2.8 ¹	2.4 ¹	0.5 ²	<0.2
D3	0.8	0.9	0.6	0.6 ²	<0.2
D4	0.7	0.4	0.1	0.5 ²	<0.2

¹ Dust deposition Gauge D2 contained large amounts of organic matter.

² All dust deposition gauges contained large amounts of insect matter.

6.0 EMISSIONS INVENTORY

Dust emissions have been estimated by analysing the quarry operations for Stage 1. This has been taken to represent the "worst-case" as the quarrying operation will be closest to the processing plant at this stage and all of the dust generating activities will be concentrated in the one area. Although the quarrying operations in Stage 3 will be closer to Linnane Park than in Stage 1, a bund wall will significantly reduce this impact and it is considered that Stage 1 will result in the maximum impact for all residences. The operations which apply under these conditions (that is, how much material is moved, how far it is moved and so on) have been used with emission factors developed, both locally and by the US EPA, to estimate the amount of dust produced from each operation in the quarry. Estimated emission amounts for each activity are presented in Table 4. Details of the calculations are presented in Appendix A.

For the purpose of estimating dust deposition and concentration levels it is also important to know the distribution of particle sizes in the dust from various activities. This information been taken from research undertaken in the Hunter Valley and in the United States. The distributions used are summarised in Table 5.

TABLE 4
INVENTORY OF DUST EMISSIONS
FOR STAGE 1 AFTER APPLICATION OF CONTROLS

ACTIVITY	ESTIMATED EMISSION OF DUST (kg/year)
Blasting	276
Drilling	603
Excavator loading trucks	1938
Road haulage	
- from pit to dump hopper	15257
- from product stockpile to sealed road	3682
Dumping rock to hopper	1138
Crushing	
- Primary and secondary	3360
- Tertiary	55800
Screening	28800
Conveyors and transfer points	31200
Loadout to highway trucks	1138
Wind erosion from unsealed road, stockpile area and plant area.	78183
TOTAL	<u>221375</u>

TABLE 5
DISTRIBUTION OF PARTICLE SIZES FOR DUST FROM QUARRYING

PROCESS	% Fine Particles (≤ 2.5 micrometres)	% Inhalable Particles (2.5 - 15 micrometres)	% Coarse Particles (≥ 15 micrometres)
PIT AREA			
Blasting	5	39	56
Drilling	9	62	29
Excavator Loading	4	40	56
Haulage	6	53	41
Pit erosion	0	67	33
PROCESS AREA			
Screening	4	40	56
Primary and Secondary crushing	20	50	30
Tertiary crushing etc	20	50	30
Conveyors	0	67	33
Transfer Pts	4	40	56
Process area erosion	0	67	33
Transport	6	53	41
Loading	4	40	56
Unloading	4	40	56
STOCKPILES			
Loading	4	40	56
Unloading	4	40	56
Haulage	6	53	41
Erosion	0	67	33

7.0 APPROACH TO PREDICTING AIR QUALITY IMPACTS

Air quality impacts have been assessed using a computer-based dispersion model known as DUSTGLC. DUSTGLC has been widely used in the Hunter Valley and a full technical description is presented in the Environmental Impact Statement for the Lemington Northern Open Cut Extension (Dames & Moore, 1984). Validation of the model, in which predicted dust deposition levels are compared with measured deposition levels at two operating mines in the Hunter Valley, is also presented in the same report.

The model uses work by Slinn (1982) to estimate dust deposition rates and is based on the sector average model outlined by Turner (1970).

8.0 PREDICTED AIR QUALITY IMPACTS

Figures 7 and 8 show the predicted dust deposition and concentration levels in the vicinity of the quarry during Stage 1 of development. These figures also show the location of occupied residences. The remaining sections provide an analysis of the impacts for different air quality criteria.

Figure 7, shows the predicted dust deposition due to the quarry. The figure shows that no privately owned residence is predicted to experience dust deposition from the quarry above 2 grams/square metre/month (annual average). The highest level is predicted to be experienced at Westrel which is predicted to experience an increase in deposition level of approximately 0.7 grams/square metre/month (annual average). The increase in dust deposition at Linnane Park is predicted to be approximately 0.5 grams/square metre/month and at Rocklea it is predicted to be approximately 0.3 grams/square metre/month.

Figure 8 shows the predicted increase in dust concentration due to the quarry operations. Westrel is predicted to experience an increase in dust concentration of approximately 8 micrograms/cubic metre (annual average), which is significantly less than the NH&MRC's goal of 90 micrograms/cubic metre (annual average). Linnane Park is predicted to experience an increase in annual average dust concentration of 5 micrograms/cubic metre and Rocklea an increase of approximately 3.5 micrograms/cubic metre.

It is therefore concluded that the quarry is unlikely to cause a significant air quality impact on the nearby residences.

9.0 EPISODIC IMPACTS

Dust concentrations under windy dry conditions are extremely difficult to assess reliably because of the difficulty of estimating dust emission rates from wind erosion under these conditions. The EPA's new goal is that 24-hour concentrations of dust less than 10 μm should not exceed 150

micrograms/cubic metre. Such levels are from time to time exceeded in most areas of New South Wales and this will be true of the Oberon area regardless of whether quarrying activities take place or not. The presence of the Oberon Quarry will contribute to the overall dust in the air under such conditions and therefore could lead to an increase in the frequency with which the 150 micrograms/cubic metre (24-hour sub-10 μm) concentration is exceeded. In years of good and average rainfall it is unlikely that the level will be exceeded at any residence during the course of a year. In drought years the level may be exceeded on a few days per year.

To assess the contribution that the quarry could make to short-term episodic impacts, it has been assumed that a wind of 17 m/s is blowing continuously over 24 hours directly from the quarry towards the residences. In practice this is very unlikely to happen. Those emission factors which are dependent on wind speed have been increased accordingly. In the case of wind erosion from exposed areas an emission rate of 112 kg/ha/day has been assumed (USEPA, 1981).

The predicted dust concentrations under these conditions are approximately 30 micrograms/cubic metre at Westrel, 20 micrograms/cubic metre at Linnane Park and approximately 7 micrograms/cubic metre at Rocklea. Dust from the quarry is therefore not predicted to make a substantial contribution to the overall dust impact in these circumstances.

10.0 CONCLUSIONS

The analysis presented here has used dispersion modelling to predict annual average dust deposition and dust concentrations expected for Stage 1 in the life of the quarry. This has been taken to represent the "worst-case".

It is predicted that at all stages in the development of the quarry the increase in dust concentration and deposition levels due to the quarry operations will remain below the EPA and NH&MRC long-term air quality goals at all residences.

Under dry windy conditions it is likely that the EPA's 150 micrograms/cubic metre (24-hour, sub-10 μm) concentration goal will be exceeded occasionally in the area. This goal would be exceeded on occasions even if the quarry were not in existence. The number of exceedances is not expected to be any different with the quarry in operation.

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**APPENDIX A
DUST EMISSION ESTIMATES**

ESTIMATED DUST EMISSIONS

This appendix provides estimates of dust emission from each of the principle operations on the quarry. The quarrying operation will take place over 45 years, during which time the excavation area will move over a distance of 750 m. The amount of dust produced will remain approximately constant over the life of the quarry and many of the dust sources, such as the crushing plant, stockpiles and haul roads will remain fixed in location. To provide a picture of "worst-case" impacts it has been decided to estimate dust emissions for Stage 1 when the quarrying activities are closest to the processing plant. The assessment assumes that the quarry will be operating at its proposed maximum rate of 200,000 tonnes of product per annum.

Excavator loading trucks

The emission factor (in kg of dust per tonne of rock loaded) for loading feed rock into the 30 to 40 tonne rear-end dump trucks is given by Equation 1 (US EPA 1985) as follows,

$$E = \frac{k.(0.00090).(\frac{s}{5}).(\frac{U}{2.2}).(\frac{H}{1.5})}{(\frac{M}{2})^2.(\frac{Y}{4.6})^{0.33}} \quad (1)$$

where,

- k = particle size multiplier (taken as 0.73 for batch dropping operations and sizes < 30 μ m),
- s = material silt content (taken as 1.6 %),
- H = drop height (taken as 2 m),
- U = average wind speed (taken as 5 m/s)
- M = material moisture content (0.7 %), and
- Y = the capacity of the dumping device (taken as 3.5 cubic metre).

Using Equation 1 and the parameters listed above the dust emission factor is 0.00569 kg/t. With a production rate of 200,000 t/year the total amount of dust from this source is estimated to be 1138 kg/year.

An additional 9375 cubic metre of topsoil and 75,000 cubic metre of interburden will also be removed over a 9 year period. Assuming a density of 2.4 t/cubic metre and a silt content of 10%, gives a dust emission rate of 800 kg/year. Therefore the total dust emission rate for loading to trucks in the pit is 1938 kg/year

Road Haulage

Rock from the quarry has to be transported from the active face of the quarry to the dump hopper. In Stage 1 this will involve a round trip of approximately 1.2 km. Assuming 222,500 tonnes of rock and overburden are transported in this way in 35 tonne trucks then the number of trips will be 6357. Using the SPCC dust emission factor of 2.0 kg of dust per vehicle-km (after the application of water to suppress dust) the amount of dust from haulage of rock will be 15,257 kg/year.

Product will be transported off-site in 10 to 25 t trucks (average load 22 t). Assuming the two way haul distance of 1.35 km on sealed road and that the emission rate is 0.3 kg/vehicle-km, the total dust from product haulage will be 3682 kg/year [$1.35 \times 0.3 \times (200,000/22)$].

Dumping rock to dump hopper

Approximately 200,000 t of rock will be dumped to the dump hopper. The amount of dust generated in this process can be estimated using Equation 1. It will be similar, but because of the larger capacity of the dumping device, it will be less than the quantity generated during the loading operation. For assessment purposes it has been taken to be the same and has been set at 1138 kg of dust per year.

Crushing and screening

It has been assumed that all material passes through primary and secondary crushing with each stage generating dust at the rate of 140 g/t of material processed (US EPA, 1985). Water sprays will reduce this by approximately 70 % so that the total dust from crushing will be 16,800 kg [$200,000 \times 2 \times 0.140 \times (1-0.7)$]. The primary crusher will be enclosed which will reduce emissions by approximately 80% to 3360 kg/year.

Tertiary crushing has an emission rate of 930 g/t, which can be reduced by 70 % through the use of water sprays to produce 55,800 kg [$200,000 \times 1 \times 0.930 \times (1-0.7)$].

Screening produces dust at the rate of 80 g/t of dry material processed, which again is reduced by 70 % by the use of water sprays (US EPA, 1985). Assuming on average six levels of screening for all the product the total amount of dust due to screening will be 28,800 kg [$200,000 \times 80 \times 6 \times (1-0.7)$].

Loadout of product

This has been taken as 1138 kg/year, that is the same as loading of original rock.

Conveyor transfer points and loading to stockpiles

Dust emission from transfer of material from one conveyor to another and to stockpiles (in kg of dust per tonne of throughput) can be estimated from Equation 2 as follows:

$$E = \frac{k.(0.00090).(\frac{s}{5}).(\frac{U}{2.2}).(\frac{H}{1.5})}{(\frac{M}{2})^2} \quad (2)$$

where, all terms have previously been defined.

Conservatively assuming a drop height of 3 m, Equation 2 gives an emission factor of 0.0078 kg/t. Assuming that 200,000 t of material passes, on average, through 20 transfer points the total dust generated will be 31,200 kg.

Wind erosion from exposed areas and from stockpiles

The US EPA (1985) equation for wind erosion from exposed area (in kg/ha/day) is:

$$E = 1.9(\frac{s}{1.5}) \frac{(365-p)}{235} \frac{f}{15} \quad (3)$$

where,

- p = the mean number of days with rainfall greater than 0.25 mm (taken as 100), and;
- f = the percentage of time the unobstructed wind speed exceeds 5.4 m/s at the mean height of the stockpile (taken as 50 %).
- s = silt content (taken as 10%) for exposed areas (Nigel Holmes and Associates, 1992).

Using the parameters with Equation 3 gives an estimated wind erosion emission rate of 47.6 kg/ha/day. Assuming an area of 4.5 ha for unsealed roads, stockpiles, and un-rehabilitated quarry floor the total estimated wind erosion will be 78,183 kg/year.

In episodic conditions, where the wind is assumed to be blowing continuously at 17 m/s, the wind erosion from exposed areas has been taken as 112 kg/ha/day. This was derived from a study on scoria (USEPA, 1981) which has limited applicability to the present study.

Blasting and Drilling

Blasting will take place on 15 occasions per year, with a proposed blast size of 5000 cubic metre, 67 holes per blast of depth 10 m. The equation (US EPA

1981) used to estimate dust emissions in kg per blast is as follows:

$$E = 344 \times \frac{A^{0.8}}{D^{1.8} \times M^{1.9}} \quad (4)$$

where A is the blast area, assumed to be 500 m², D is the depth of the holes, assumed to be 10 m and M is the moisture content, assumed in this case to be 7.2%, which is the lowest of the range of numbers appropriate for this equation. For 15 blasts per year the annual dust emission rate is estimated to be 276 kg.

The emission rate for drilling is assumed to be 0.6 kg/hole (US EPA, 1981). For 67 holes per blast and 15 blasts per year, the annual dust emission rate is 603 kg.

Scrapers

Scrapers will be used in the establishment phase only and the dust emissions from this activity have not been included in the dust inventory which applies to Stage 1 of operation. For the sake of completeness the dust emissions from this activity have been calculated. Equation 5 shows the estimated dust emission in kg/km travelled for this operation.

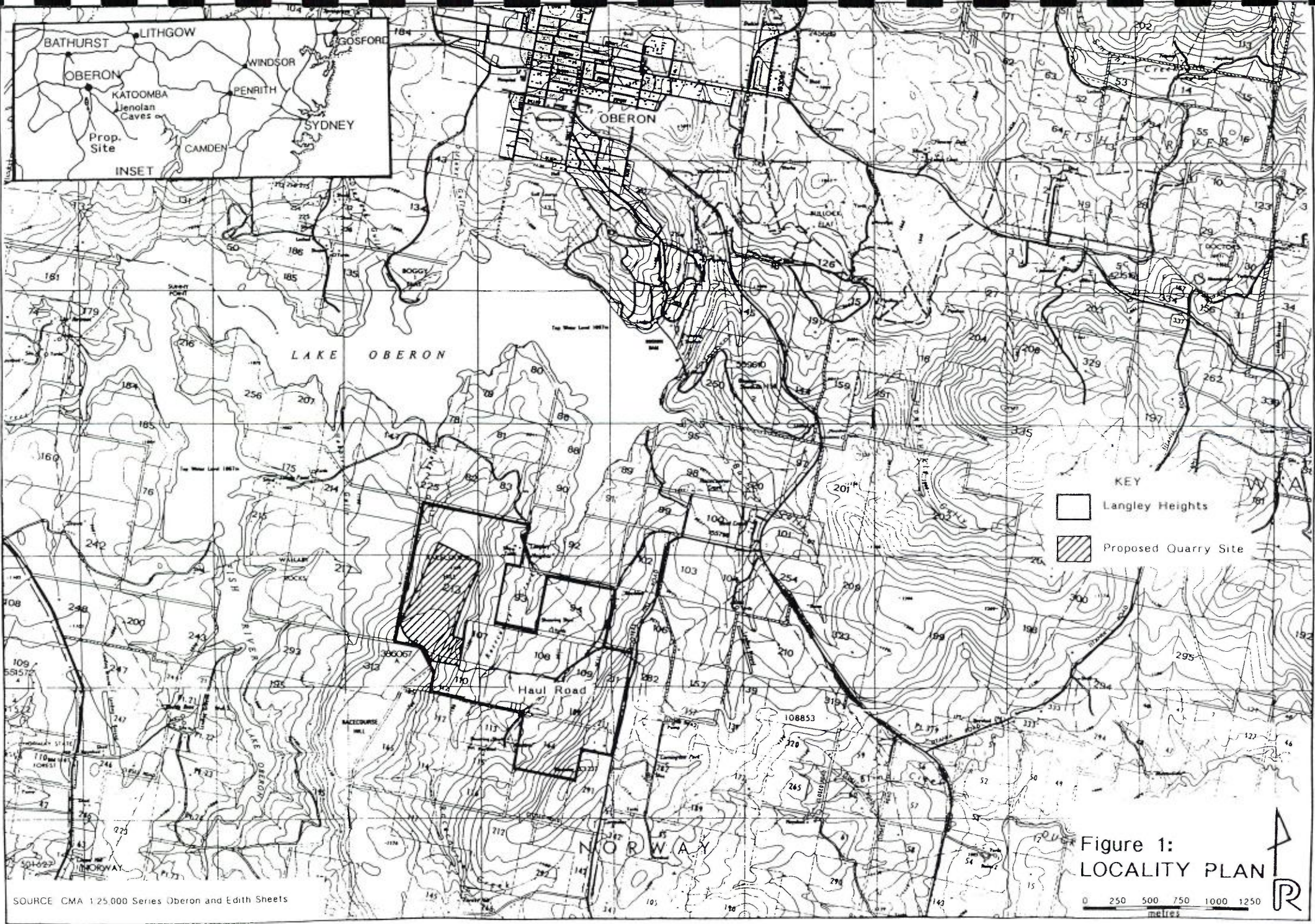
$$E = 7.3 \times 10^{-6} \times s^{1.3} \times w^{2.4} \quad (5)$$

where:

s = silt content of topsoil assumed to be 10%
w = weight of scraper assumed to be 72 t.

For a scraper of 45 t capacity moving 72,000 t of topsoil per year, making a total of 1600 trips of 400 m length, the total dust emission are estimated to be 2673 kg/year. This is only about 1% of the estimated dust emissions for Stage 1 of the development and would therefore not cause any detectable impact on nearby residences.

FIGURES

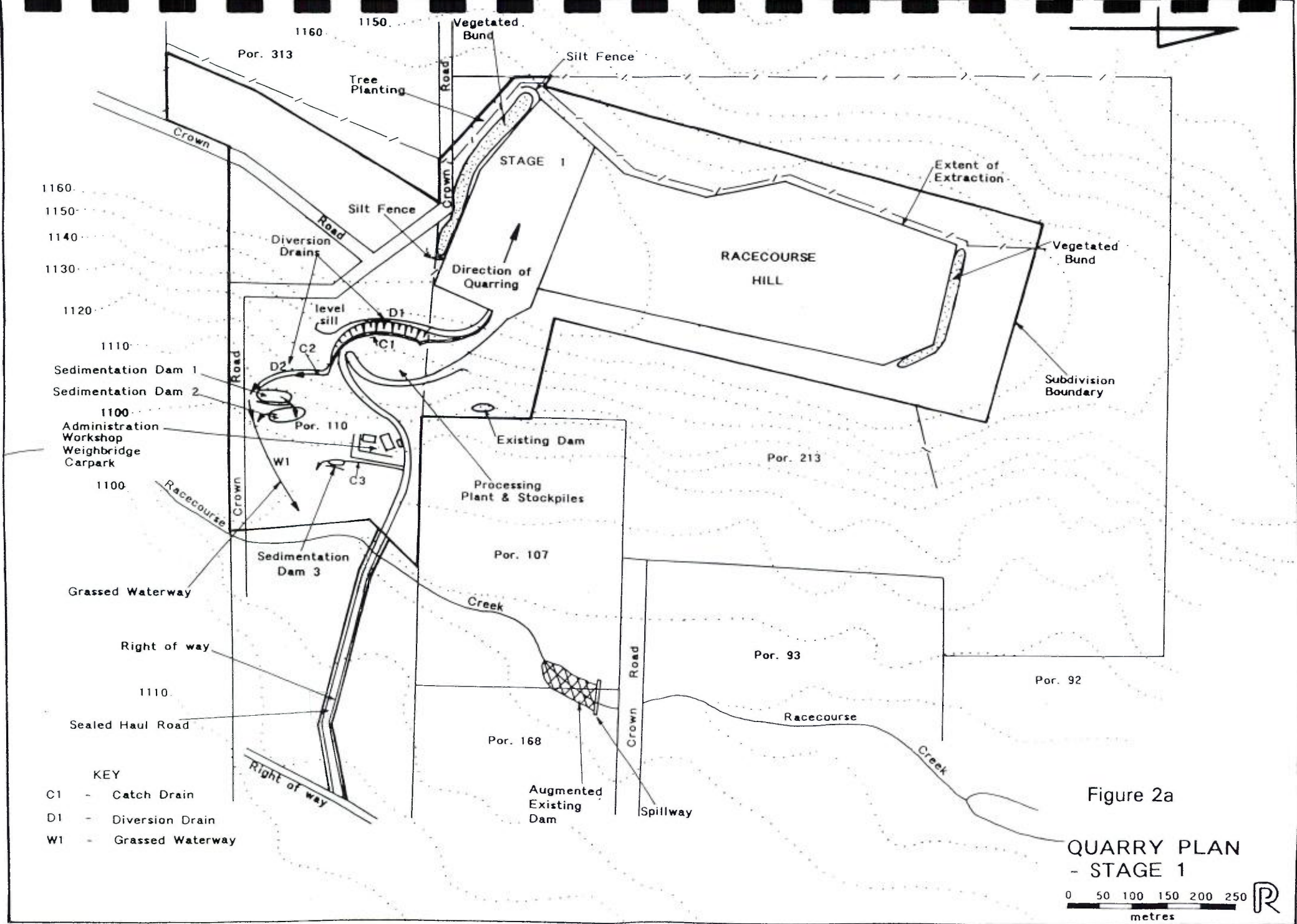


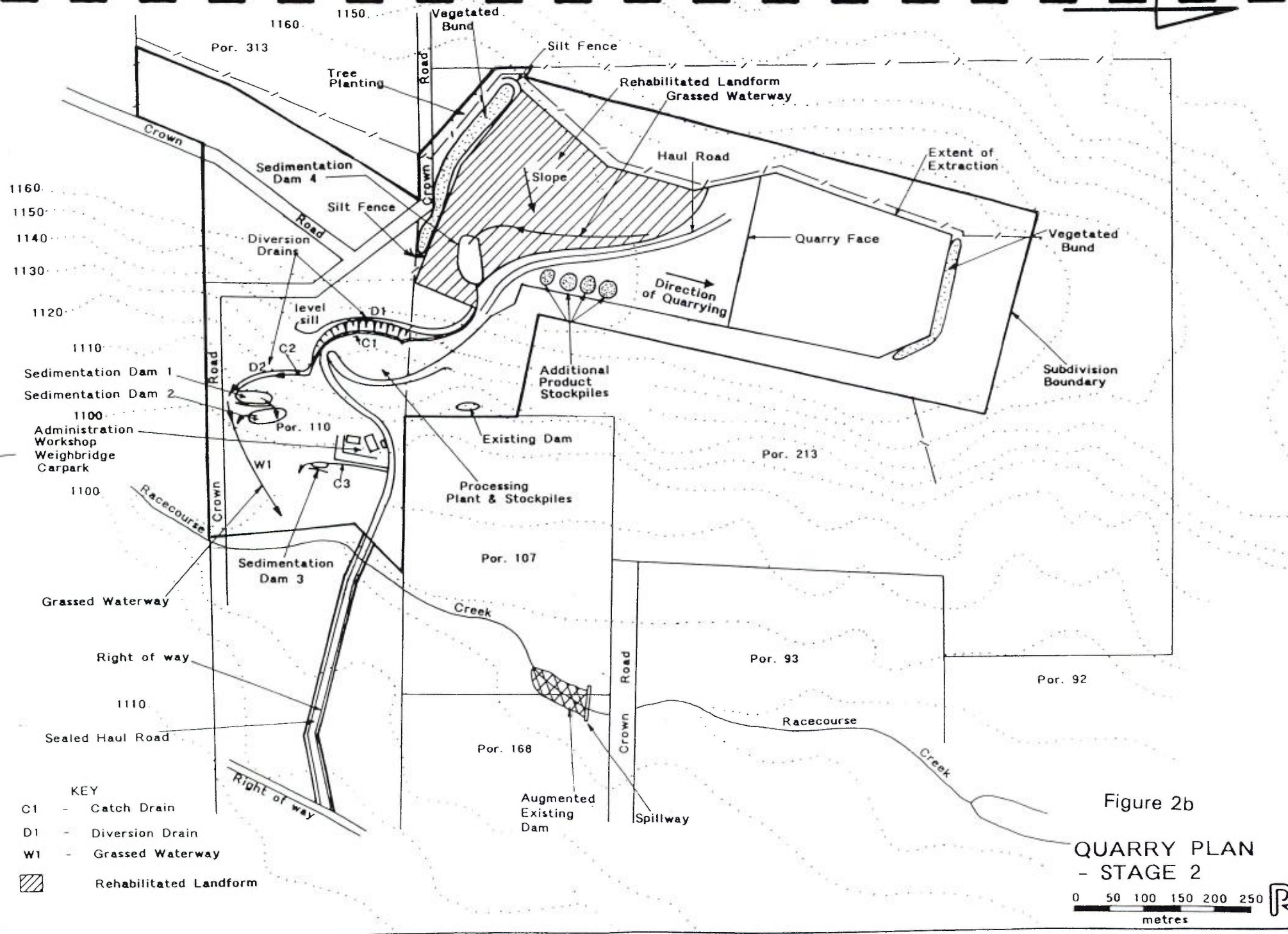
SOURCE CMA 1:25,000 Series Oberon and Edith Sheets

Figure 1:
LOCALITY PLAN

0 250 500 750 1000 1250
metres







- KEY**
- C1 - Catch Drain
 - D1 - Diversion Drain
 - W1 - Grassed Waterway
 - Rehabilitated Landform

Figure 2b
**QUARRY PLAN
 - STAGE 2**

0 50 100 150 200 250
 metres

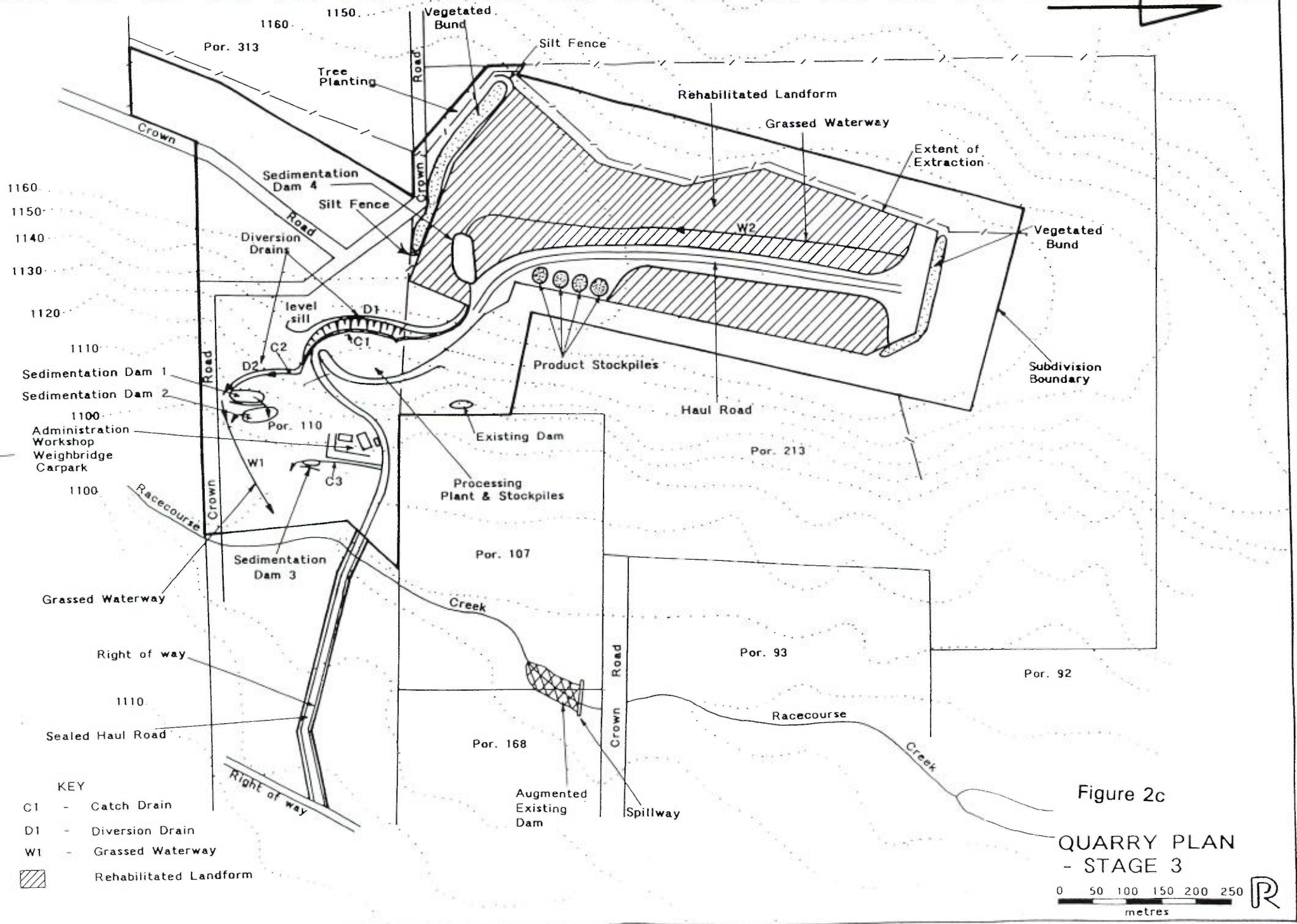
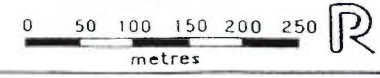


Figure 2c
 QUARRY PLAN
 - STAGE 3



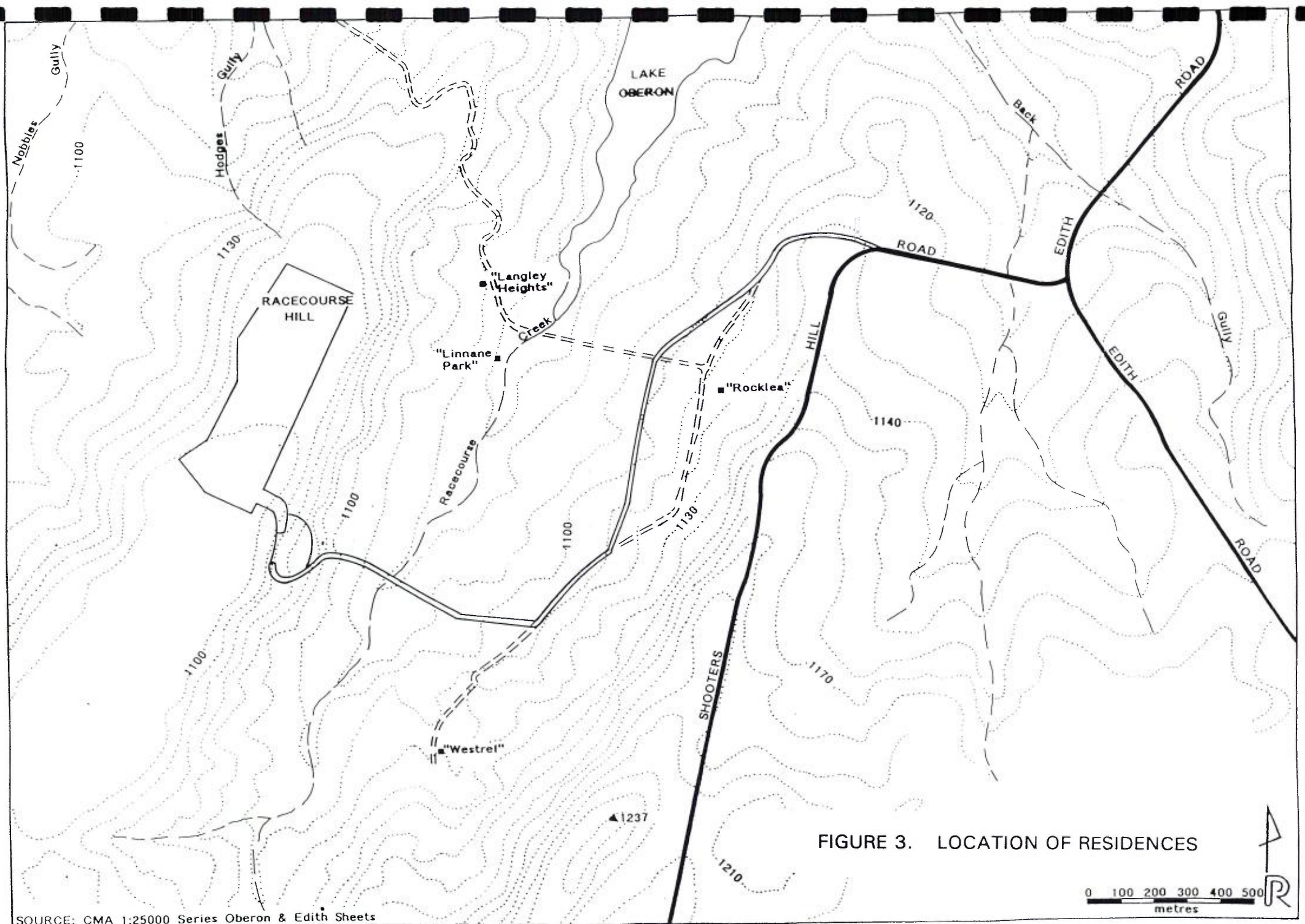
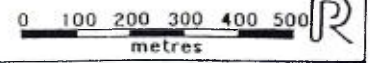


FIGURE 3. LOCATION OF RESIDENCES

SOURCE: CMA 1:25000 Series Oberon & Edith Sheets

1048/91395



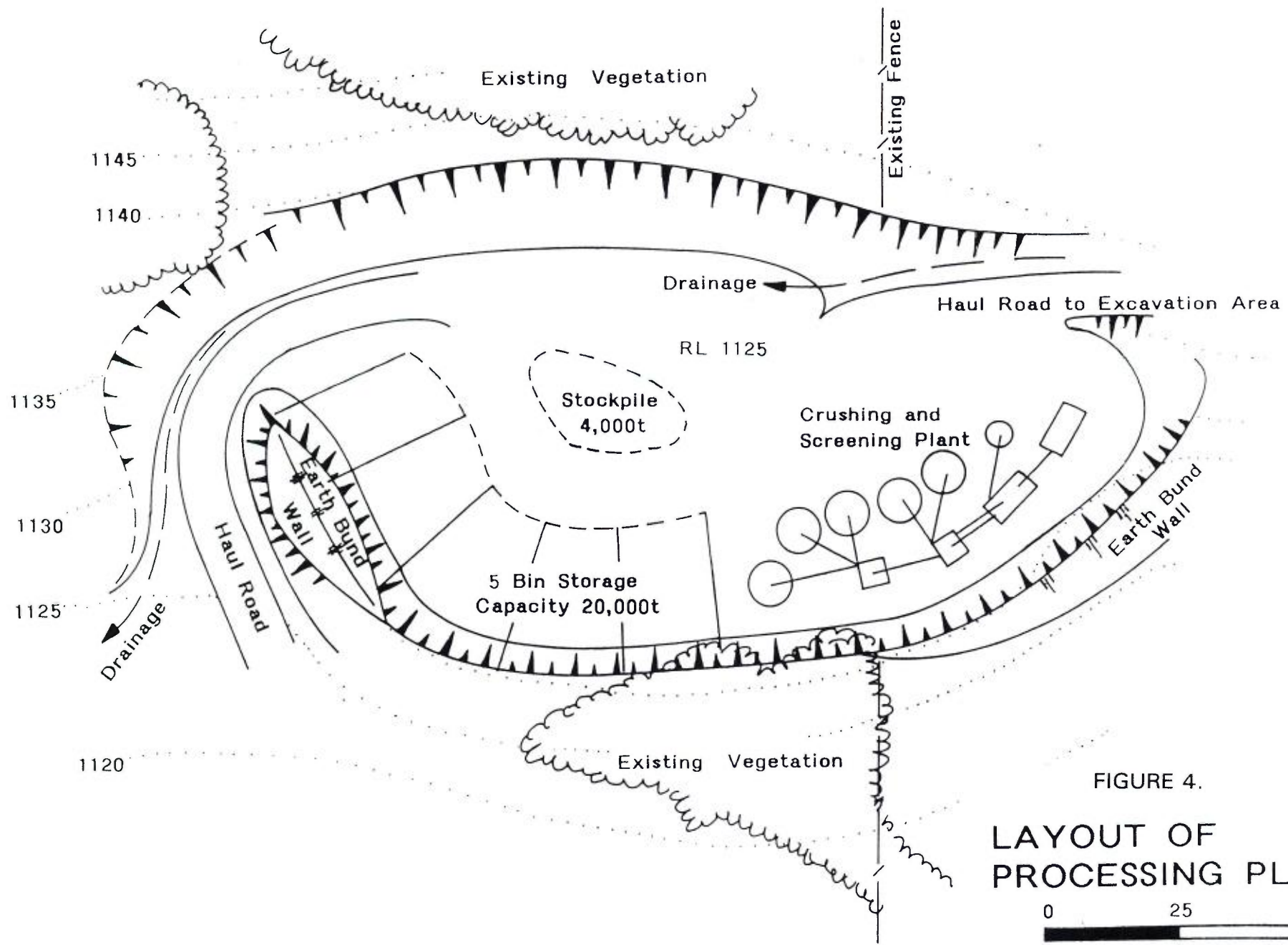
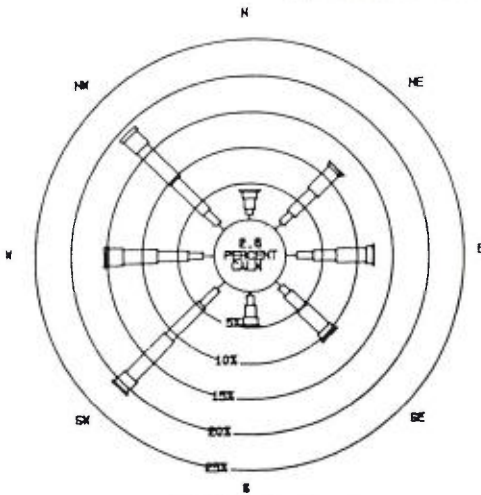
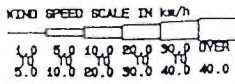


FIGURE 4.

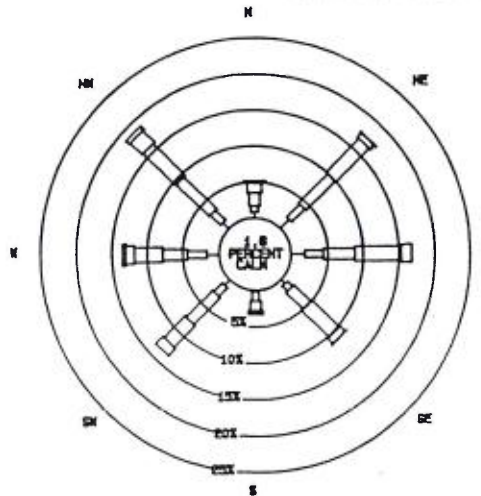
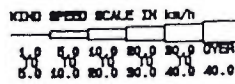
LAYOUT OF
PROCESSING PLANT



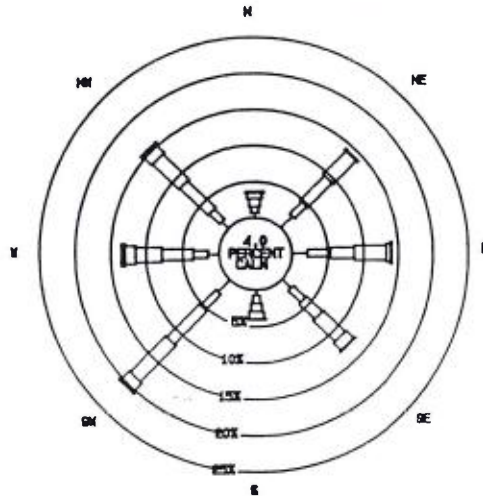
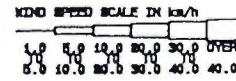


DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Oberon 9am and 3pm combined Annual

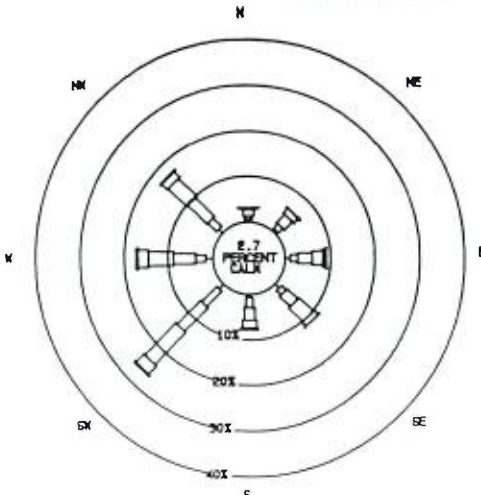
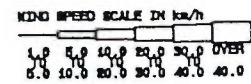
OBERON ANNUAL AND SEASONAL WINDROSES



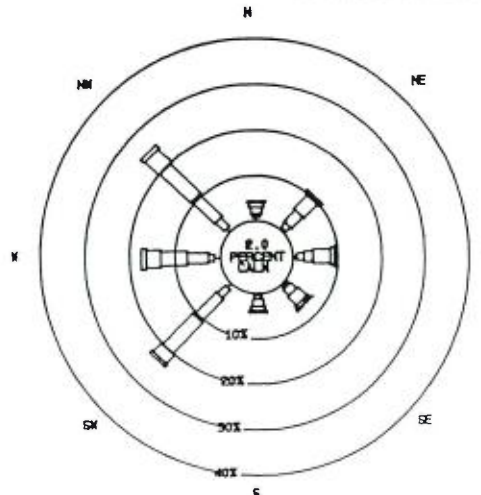
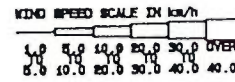
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Oberon 9am and 3pm combined Summer



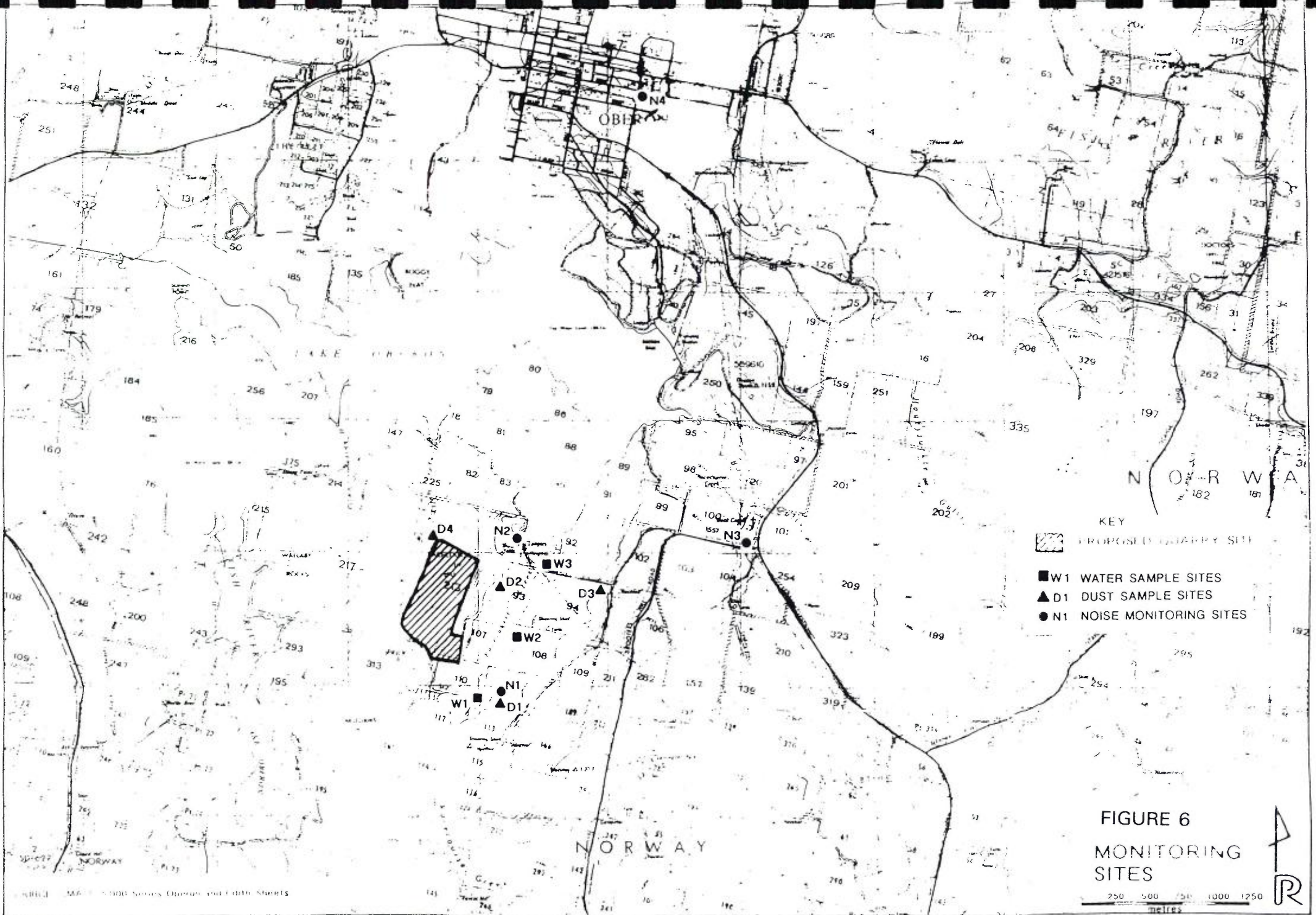
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Oberon 9am and 3pm combined Autumn

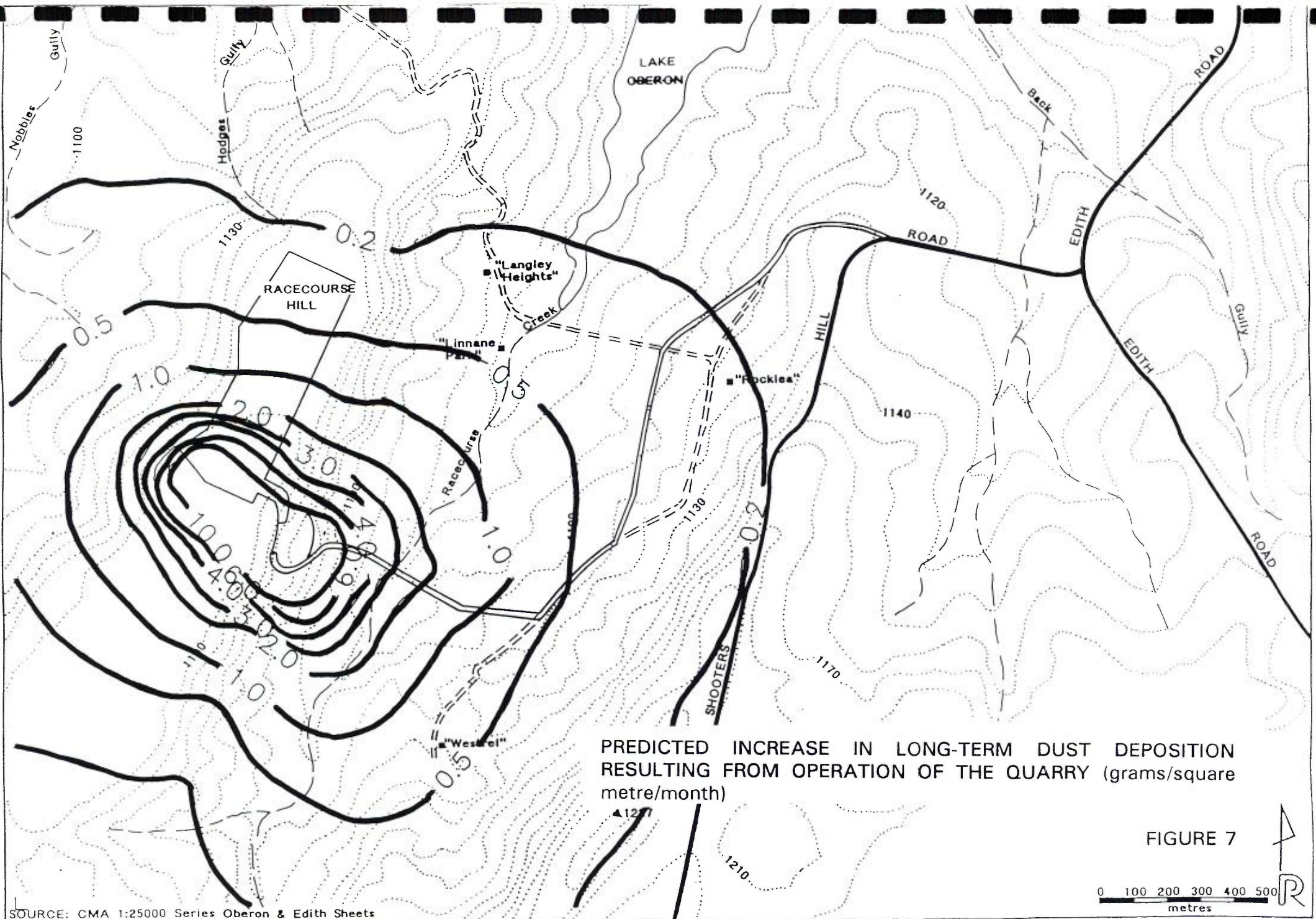


DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Oberon 9am and 3pm combined Winter



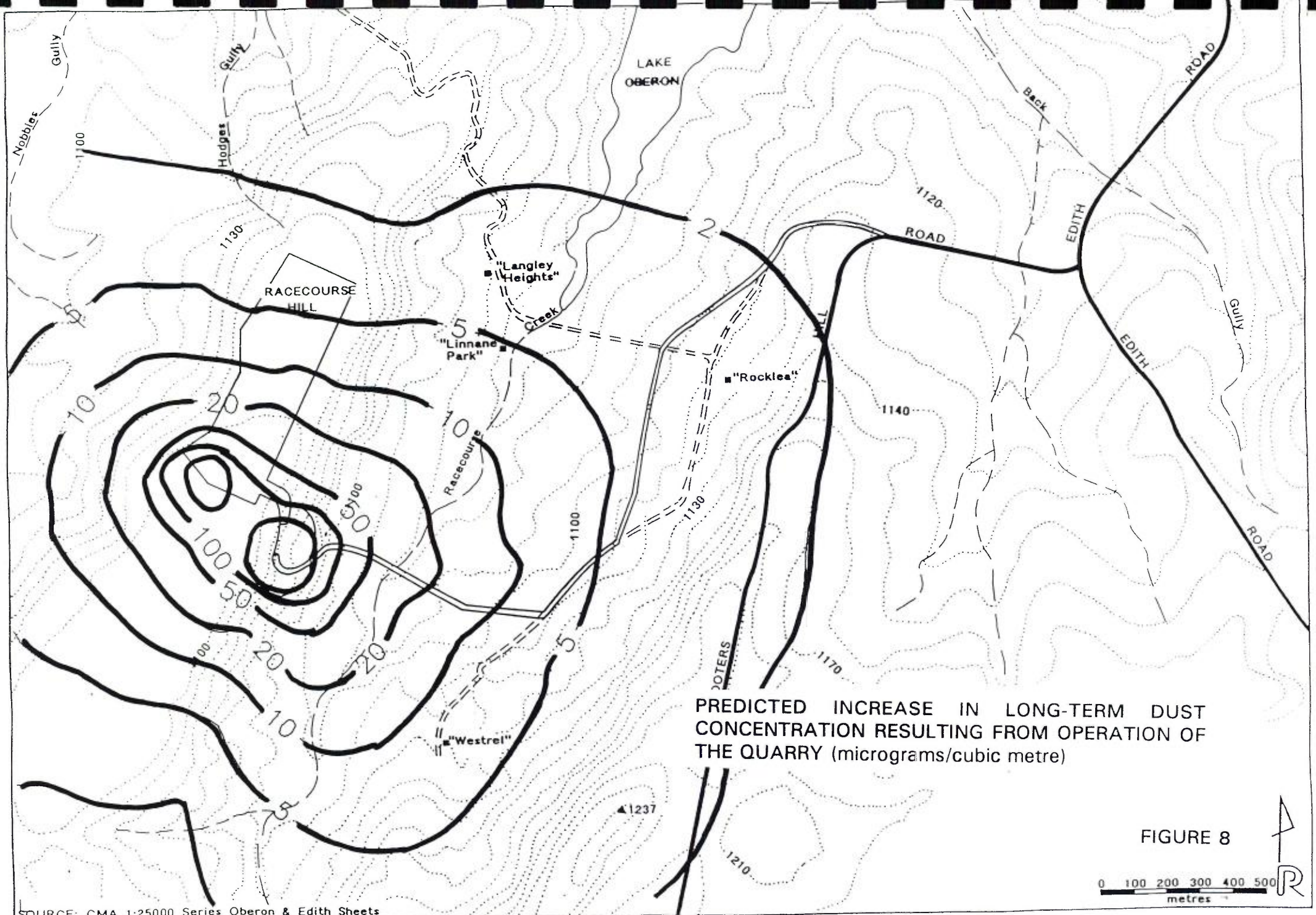
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Oberon 9am and 3pm combined Spring





PREDICTED INCREASE IN LONG-TERM DUST DEPOSITION RESULTING FROM OPERATION OF THE QUARRY (grams/square metre/month)

FIGURE 7



PREDICTED INCREASE IN LONG-TERM DUST CONCENTRATION RESULTING FROM OPERATION OF THE QUARRY (micrograms/cubic metre)

FIGURE 8



SOURCE: CMA 1:25000 Series Oberon & Edith Sheets