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Wallamaine Colliery project : environmental impact statement
for the development of a 1 mtpa underground mine south of
Swansea, N.S.W.



WALLAMAINE COLLIERY PROJECT



Environmental Impact Statement for the Development of a 1 mtpa Underground Mine South of Swansea, N.S.W.

Volume 1

The Newcastle Wallsend Coal Company Pty Limited

Environmental Impact Statement for the Wallmaine Colliery Project

EIS
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Volume 1



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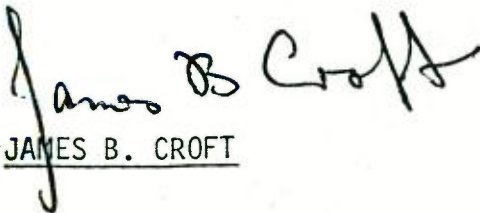
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1781/5106

WALLAMAINE COLLIERY ENVIRONMENTAL
IMPACT STATEMENT

CLAUSE 26 (1)(b) CERTIFICATE

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


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The Newcastle Wallsend Coal Company Pty Limited

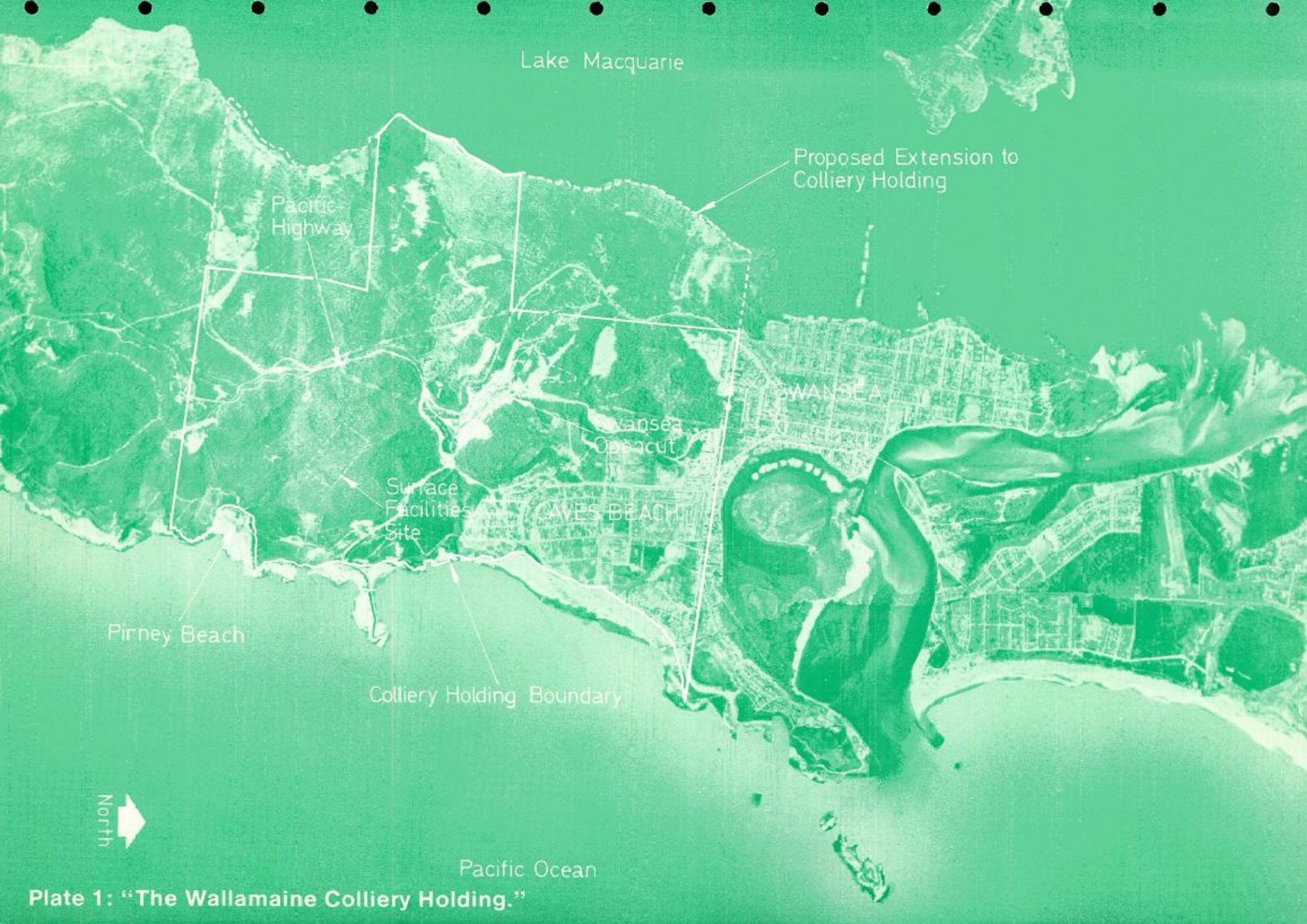
**Environmental Impact Statement
for the Development of a 1 mtpa
Underground Mine
South of Swansea, N.S.W.**

Volume 1

September 1981

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Lake Macquarie

Proposed Extension to Colliery Holding

Pacific Highway

Walsea Open-cut

Surface Facilities Site

WIVES BEACH

SWANSEA

Pirney Beach

Colliery Holding Boundary



Pacific Ocean

Plate 1: "The Wallamaine Colliery Holding."

LIST OF ABBREVIATIONS

AC	alternating current
AHD	Australian height datum
ASL	above sea level
bhp	brake horse power
CDR	crude death rate
CEBS	Church of England Boys' Society
CES	Commonwealth Employment Service
CSR	Colonial Sugar Refining
dB(A)	decibels ("A" weighted scale)
DC	direct current
DDH	diamond drill hole
DMR	Department of Main Roads
DOEP	New South Wales Department of Environment and Planning
d/wk	days per week
dwt	deadweight tonnes
ESP	exchangeable sodium percentage
g/m ²	grammes per square metre
Gwh	gigawatt hour
ha	hectares
HDWB	Hunter District Water Board
kg/a	kilogrammes per annum
kPa	kilopascals
kV	kilovolts
kWh/a	kilowatt hours per annum
L	litres
L ₉₀	background noise level exceeded 90 per cent of time
LGA	local government area
m	metres
M	million
M/a	million per annum
MJ	megajoules
ML	megalitres
MSB	Maritime Services Board

Mt/a	million tonnes per annum
MVA	megavolt-amperes
OMS	operating man shift
R.C.	reinforced concrete
RL	reduced level
ROM	run of mine
SCC	Shortland County Council
S.G.	specific gravity
SMR	standardised mortality rate
SPCC	New South Wales State Pollution Control Commission
SRA	State Rail Authority
t/a	tonnes per annum
TAFE	technical and further education
t/h	tonnes per hour
t/m ³	tonnes per cubic metre
UCV	Unimproved Capital Value
V:H	vertical to horizontal

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Summary and Overview

SECTION 1

SUMMARY AND OVERVIEW

THE PROPOSAL

The Newcastle Wallsend Coal Company Pty. Limited, (on behalf of the joint venture) and hereafter referred to as 'The Company' has prepared this Environmental Impact Statement in connection with its proposal to re-establish and extend mining operations in the Wallamaine Colliery Holding south of Newcastle. The location and proposed project layout are outlined in Figure 1.1.

The development centres on the establishment of the Wallamaine underground mine and surface facilities with associated limited reworking and major rehabilitation of the currently abandoned Swansea Opencut.

The opencut operation will last no longer than two years, with a maximum of 270000 t of ROM coal being sold to local buyers. Production is expected to commence in the second half of 1982.

The underground mine will produce 21 Mt of ROM coal over a 21 year period, yielding a saleable output of approximately 15 Mt. Production is planned to commence in the first half of 1983 and increase in six monthly increments until ultimate capacity is achieved two years later.

The coal from the underground mine is suitable for cement making, manufacturing and power generation and will be exported from the Port of Newcastle. Transport to the Port will be by means of existing road links to a point south of Morisset, where a rail loading facility is proposed. This proposal is the subject of a separate Environmental Impact Statement. The road haulage route will avoid built up areas for its entire length.

Coal reject disposal methods have been chosen to take advantage of existing degraded areas within the Colliery Holding, leading ultimately to an overall enhancement of the scenic qualities of the subregion. The use of band press filters to dewater coal preparation plant fines will yield an easily transportable and valuable fill material, in addition to providing a recycled water stream to the process and thus preventing the need for fines sedimentation dams.

The construction phase of the operation will provide direct employment for up to 77 persons. At ultimate capacity, 254 jobs will arise from the operation of the mine.

THE COMPANY

The Wallamaine Colliery is to be developed by a joint venture of companies comprising The Newcastle Wallsend Coal Company Pty. Limited (37.5 per cent), Wallamaine Limited (formerly Silver Valley Minerals N.L.) (37.5 per cent) and Marubeni Australia Limited (25 per cent). Australian ownership of the joint venture is in excess of 51 per cent.

SAFEGUARDS AND CONTROLS

The Company proposes to adopt significant design and operational safeguards to limit or eliminate offsite impacts. A water management plan will be instituted with a view to effectively using all available water supplies and to maximise recycling, thus reducing both external demands and discharge quantities.

As a result, assuming mine water makes are not excessive, there will be no dry weather discharge from developed areas. All runoff from disturbed and working areas will be collected and treated. Groundwater from underground operations will be used as make-up to the coal preparation plant. Sewage and washdown water will be treated and used for irrigation of the surface facilities site.

Air quality will be protected by minimising the quantity of dust generated and by confining potential sources. All coal transfer distances will be minimised and where possible operations will be within enclosures. Where enclosure is impractical, water sprays will be provided.

The fines content of stockpiles will be controlled by the addition of an agglomerating agent, whose action will be aided by the maintenance of wet stockpile surfaces. Regularly trafficked areas will be watered. The overall zone of disturbance will be kept to a minimum and all scars rehabilitated as soon as practicable.

Potential noise impacts will be controlled by restricting production operations to certain hours, by providing physical barriers to noise transmission and by careful selection and maintenance of potential noise generating equipment.

The scenic quality of the Colliery Holding and the potential for its enhancement in certain areas have been recognised. Plans have been formulated to both minimise the impact of operations on the local and subregional areas and to improve existing degraded elements of the landscape. The landscape treatment has been designed to emulate the natural character of the Colliery Holding with planting layout and density being varied to reflect the informal forest surroundings.

The Company plans to rehabilitate a significantly larger area of land than that directly affected by its own operations. In all cases, the following objectives will be adopted.

- i. to minimise damage to the site
- ii. to control soil erosion and water pollution
- iii. to revegetate using natural vegetation associations
- iv. to return land in terms of topographic appearance and productivity as closely as possible to its original condition.

To minimise the effects of the transportation of coal by road, both short term and long term haulage routes have been selected to avoid residential areas as far as possible. Coal trucks will be tarpaulin covered, and will pass through washing stations prior to leaving the mine site. Haulage hours will be restricted to between 7 am and 6 pm, 5 d/wk.

IMPACT ASSESSMENT

Physical Impact

The earthworks proposed for the surface facilities site will have an unavoidable impact on 10 ha of local topography. The location of the development will effectively screen the changes from most vantage points.

Some erosion of disturbed areas is likely before vegetative cover becomes established, but any solids suspended in runoff water will be removed in sedimentation dams.

In areas of total underground extraction, a surface subsidence of up to 1.5 m is anticipated. No areas underlying valuable surface assets will have supporting pillars removed.

No major watercourses traverse either the surface facilities site or the Swansea Opencut. The broad drainage patterns in the area will thus be unaffected. The minor reduction in flows downstream of the sites will have no significant impact.

Air Quality

In worst case conditions, assuming a situation of no safeguards, the residences nearest to the development will experience an increase in dust fallout of only 1 to 4 per cent over existing background levels. This increase will be undetectable. No impact will result on the areas amenity for recreation, habitation or natural growth.

Flora and Fauna

There will be an unavoidable impact on the flora and fauna of the area as a result of the clearing of approximately 10 ha for the surface facilities site, and lesser amounts for road and powerline easements. With the exception of a small area of Wet Sclerophyll Forest with Rainforest Elements, no endangered or rare vegetation communities will be cleared.

Rehabilitation of the currently degraded areas to conditions compatible with surrounding natural vegetation will enhance the overall integrity of the subregional vegetation unit. The overall impact on flora and fauna will be minor.

Noise Climate

The operation of the main noise sources will be restricted to day and afternoon shifts.

For over 90 per cent of the time, residences in the neighbouring Caves Beach area will be unaffected by operational noise. For short periods only, some houses nearest the Swansea Opencut will experience noise levels above evening ambient.

The operations at the surface facilities site and Radar Hill reject disposal area will be audible at Camp Yondaio, but should not cause any disturbance or nuisance.

Visual Impact

Mining of the Swansea Opencut will only marginally increase its viewshed. Lighting and material haulage will create some impact, but for the majority of time, vehicular traffic will be contained within the mine or screened by a specially constructed bund wall.

The surface facilities site will be seen by small numbers of visitors using the adjacent coastal strip for recreational purposes. At more frequently visited or used surrounding locations, the site will be either not visible or will be partially screened. In time the rehabilitated areas will add to the overall visual quality of the subregion.

Economic Impact

The proposed development will stimulate the local, municipal, regional and Australian economies.

Positive impacts will flow from the direct expenditure during the construction and operational phases, from indirect effects generated through the service support of other sectors and from induced effects arising from increased final consumption expenditures by the household sectors.

A total of \$37.4 M (1980 prices) will be directly expended during the 17 mth construction phase. The construction workforce will peak at around 80, creating an additional 50 to 137 jobs in the Hunter Region. The \$12.4 M direct capital expenditure in the region will increase the output value of industries by between \$19.5 M and \$29.4 M.

At full production, the project will have an annual output value of approximately \$33.5 M, employ up to 254 persons, and pay wages and salaries approaching \$5.0 M/a.

In the Hunter Region, between 113 and 346 additional flow-on jobs will be created. Australia wide, the project will generate up to 973 jobs.

The total increase in income in the region and for Australia over the projected life of the mine will be between \$156 M and \$229 M and \$169 M and \$307 M respectively.

Lake Macquarie Municipal Council is expected to receive \$1.38 M in rate income from the mine and its direct employees during the operating life. For the same period, New South Wales Government receipts will be \$142 M and Commonwealth income will be \$49 M.

The mine will increase contributions to Australia's balance of payments, with gross export revenue of \$504 M over the period of operations.

Social Impacts

During the construction phase, a maximum population increase of 163 is possible, though the final number is expected to be less. The operation of the mine will attract up to 513 persons to the region. The major in-migration is expected in response to the regional shortage of tradesmen. Any growth will contribute to a reduction of the declining rate of growth in the subregion, and will marginally reduce the ageing trend of the local and regional population.

The economic base of the region is characterised by an imbalance of industries in favour of mining, manufacturing, heavy engineering and power generation. The proposed development and others in the region will continue this situation. Opportunities will be provided for unskilled and unemployed persons in the region through the need to fill 129 mine worker positions. Vacancies are likely to be created by the transfer of currently employed persons to the mine, generating opportunities with their previous employers. Induced employment opportunities in the retail and wholesale trade are likely to benefit females, whose employment in the underground mine is prohibited.

Rental accommodation within the Lake Macquarie area is limited at present and will be further strained during the construction phase. Up to 114 housing units may be required for the permanent population increase arising from mine operations, stressing an existing tight housing supply. Serviced land is available in the Caves Beach area and this will ease the situation.

Educational facilities are well placed to cater for the likely enrolments arising from the development. At a local planning level, hospital capacity will be overstretched. On a regional basis however a surplus of beds will remain. Community health services, baby health centres and welfare services are all currently operating at or in excess of capacity. Further population growth will exacerbate this problem.

PLANNING AND LAND USE

The Colliery Holding forms part of an area of largely natural vegetation referred to as an 'intercity environmental zone'. The area of disturbance created by the mine proposal represents 1.1 per cent of the total Holding. Hence any alteration to this buffer zone concept is likely to be minimal.

Neither the Swansea Opencut nor the operation of the surface facilities will affect the two adjacent environmental protection zones.

The intrusion of the development within an existing natural zone will create an unavoidable impact on Camp Yondaio, a neighbouring recreational facility owned by the Church of England. However, the measurable impact will be slight and restricted in both terms of duration and extent.

ENERGY RESOURCES

The mine will be a large net producer of energy. The operation of the mine and rejects disposal will not compromise possible future extraction of deeper coal seams.

Approximately 90 per cent of the accessible coal in the opencut will be removed. Effective pillar extraction will result in recovery of 70 per cent of the underground resource.

COAL TRANSPORT

The Colliery Holding is not served by a railway line and has no direct access to a deepwater port. A combination road/rail coal transport plan is proposed, which although double the distance of the most direct road route, will result in only minor impacts on other road users and neighbouring properties.

Daily return coal truck movements will range from 32 starting in the second half of 1982 to a maximum of 136 starting in the first half of 1985 and extending for approximately 17 years thereafter.

Trucks will travel to a proposed rail loading facility south of Morisset (which is the subject of a separate Environmental Impact Statement) via the Company owned section of Scenic Drive, the Pacific Highway, Vales Road, Rutleys Road and Hue Hue Road.

The maximum increase in total flow on the Pacific Highway is expected to be 1.5 per cent. The increase in heavy vehicle traffic will peak at 10.5 per cent. The highway will be constructed to a four lane dual carriageway standard by the time full mine production is reached, thus reducing the overall impact.

A total of approximately 30 homes and farms are situated along Vales and Rutleys Roads. There will be an unavoidable increase in noise levels at these properties during daylight hours.

No residences line Hue Hue Road along the haul route. The impact of coal transportation is thus not seen to be of major proportions.

CONCLUSION

The Company believes it can continue its mutually beneficial relationship with the people and businesses of the Hunter Region by developing the Wallamaine Colliery.

The proposal will generate income and employment in the region while creating few adverse impacts. The attention given to environmental protection in the design and operation of the mine will ensure the minimisation of land use conflicts with surrounding areas and continue the long tradition of mining south of Lake Macquarie.

**Scope of Environmental
Impact Statement**

SECTION 2

SCOPE OF ENVIRONMENTAL IMPACT STATEMENT

This document provides information necessary for governmental departments and the local community to make an assessment of the effects of the proposal on the natural and manmade environment. Detailed design documentation will be provided as part of the subsequent application for approval to construct and licence the project with the Lake Macquarie Municipal Council and the State Pollution Control Commission respectively.

The statement is presented in three volumes:

- VOLUME 1 contains the text of the Environmental Impact Statement
- VOLUME 2 contains the 20 appendices which provide details of investigations undertaken and background data relevant to the context of the statement.
- VOLUME 3 comprises figures and diagrams to supplement the text

VOLUME 1 is divided into 8 sections as outlined below:

- Section 1* provides an overview of the proposal and summarises the safeguards to be incorporated and the residual impacts of the project on the environment
- Section 2* is this section
- Section 3* is the introduction and provides details of the joint venturers and the objectives of the proposal
- Section 4* describes the Company's proposal for constructing and operating the Colliery
- Section 5* presents background data concerning the natural and manmade setting prior to the establishment of the Colliery. The constraints imposed on the proposal are identified
- Section 6* details the safeguards which will be incorporated into the project to protect the environment
- Section 7* All the impacts of the fully safeguarded project on the natural manmade environment at both local and regional levels are assessed
- Section 8* Alternatives to the proposal are presented

Introduction

3.1 THE COMPANY'S OBJECTIVES

This document has been prepared in connection with an application by The Company for consent to develop a coal mining operation in the Wallamaine Colliery Holding south of Newcastle.

The Company intends to complete the recovery of coal from a previously worked opencut and to establish a new underground mine with associated surface facilities.

Mining methods and washery technology have been selected to maximise the yields of saleable coal, thus fully utilising available energy resources. Rejects will be generated in a form which will allow their beneficial use in the rehabilitation of existing surface scars within the Holding.

It is the Company's objective to minimise impacts during the operation of the mines and to ultimately return this area to the natural conditions which prevailed before earlier operations. The local community will be consulted and considered in respect of all matters affecting the current or future amenity of the Holding.

Export income flowing from the sale of coal will be directed to the local and regional economies in the form of wages and payments for goods and services and to the wider community through the agency of royalties, taxation payments and share dividends.

The Company is confident it can continue its mutually beneficial relationship with the residents and business enterprises of the Hunter Valley. It sees the proposed development providing short and long term net positive impacts in the Caves Beach-Swansea area.

3.2 THE JOINT VENTURE

The Wallamaine Colliery is to be developed by a joint venture of companies comprising The Newcastle Wallsend Coal Company Pty Limited (37.5 per cent),

Wallamaine Limited (formerly Silver Valley Minerals N.L.) (37.5 per cent), and Marubeni Australia Limited (25 per cent). Australian ownership of the joint venture is in excess of 51 per cent.

- i. The Newcastle Wallsend Coal Company Pty Limited is to manage the mining of coal on behalf of the joint venturers.

This Company is the coal division of Peko-Wallsend Limited and is the oldest operating coal mining company in Australia

The Newcastle Wallsend Coal Company Pty Limited currently operates collieries at Gretley, Ellalong, Pelton and Gunnedah. Approval is currently being sought to develop an opencut mine at Gunnedah. Management is also being provided to a joint venture involved in the development of a new underground mine at Bargo.

Active exploration for additional coal reserves is underway at Glennies Creek, Jerrys Plains and Bulga within the Hunter Region.

- ii. Wallamaine Limited (formerly Silver Valley Minerals N.L.) and its subsidiaries are the holders of the mining titles in the Wallamaine Colliery Holding and through one of its subsidiary companies, The Anson Bay Co. (Australia) Pty Limited is the owner of a large proportion of the surface land within the Colliery Holding and adjacent areas.

Wallamaine Limited is a public listed Company with 6000 shareholders. Since incorporation in 1954, the Company has been engaged in a wide range of mining activities including silver, antimony, gold and coal. More recently the Company has rationalised its operations, with the intent of concentrating its resources on the development of the Wallamaine Colliery.

- iii. Marubeni Australia Ltd. is the Australian subsidiary of the Japanese Marubeni Corporation and is to be responsible for the shipping and marketing of the saleable coal produced from the mine.

3.3 LAND INVOLVED IN THE PROPOSAL

The Wallamaine Colliery Holding is defined in Figure 3.1.

The Holding is 'owned' for the purposes of the Coal Mines Regulation Act by Wallamaine Colliery Pty Ltd., which has the right to mine the 909.6 ha contained therein. This right is by virtue of various titles covering 140.6 ha held under the Coal Mining Act 1973 and by a Private Agreement dated 16th October 1969, between the Anson Bay Co. (Aust.) Pty Ltd (Lessor)

TABLE 3.1

COLLIERY HOLDINGS WITHIN
THE NEWCASTLE DISTRICT

Colliery Holdings	Employment (1.1.79)	Saleable Output (t) (1977-78)
Awaba State	225	740 900
Belmont	35	137 700
Bloomfield	95)	578 800
Bloomfield Opencut	42)	
Borehill	42	74 700
Burwood	225	819 500
Chain Valley	345	794 700
Delta	104	201 500
Elcom Central Administration	85	
Gretley	149	332 000
Hexham Washery	57	
John Darling	397	366 200
Lambton	244	325 900
Macquarie	98	
Munmorah State	331	1 297 500
Newstan	294	411 800
Newvale No. 1	296	916 200
Newvale No. 2	320	762 400
Northern	11	
Stockrington No. 2	114	250 800
Stockton Borehole	360	572 900
Wallarrah	359	764 000
Wallsend Borehole No. 2	155)	516 400
Wallsend Borehole Opencut	50)	
West Wallsend No. 2	237	487 700
Wyee State	<u>282</u>	<u>1 112 200</u>
Total	<u>4952</u>	<u>11 552 400</u>

Source: *Coal Export Strategy Task Force, Coal Export Strategy Report of the Task Force, March 1979.*

and Wallamaine Colliery Pty, Ltd, covering all seams within an area of 796 ha for a term of 21 years.

The surface lands within an area of 10.12 ha shown as lot 1 on Figure 3.1 were also annexed to the Deed of Lease dated 16th October 1969 and included in the registered Colliery Holding.

To provide additional reserves and to 'square-off' the Holding the Minister for Mineral Resources has indicated his intention to invite the Company to apply for leases for adjoining portions. These areas, totalling 431 ha will be included in the western prolongation of the northern and southern boundaries of the Holding to the shoreline of Lake Macquarie, as shown on Figure 3.1.

3.4 REGIONAL SETTING

The Colliery Holding is located approximately 4 km south of Swansea on a narrow section of land separating Lake Macquarie from the Pacific Ocean. Caves Beach is the nearest urban concentration.

The land forms part of the municipality of Lake Macquarie, which is the most highly populated local government area in the Hunter Region. The region contains fifteen local government areas with a population exceeding 440 000 persons. Coal mining, heavy manufacturing, pastoral, horticultural, viticultural, forestry and fishing industries have provided the basis for development.

The region has recently entered a period of major growth, centred on the extraction of the Valley's plentiful coal resources. Both export and local demands for steaming grades in particular are expected to continue buoyant in response to the oil price rises of recent years. Existing colliery holdings within the Newcastle district are nominated in Table 3.1. The extent of adjoining holdings and authorisations is shown in Figure 3.2.

Existing and proposed development within the Lake Macquarie Municipality is expected to create an additional 7000 to 8000 jobs during the period 1980-86 with a consequent population growth of 15000 to 20000 persons (*Jackson et al*). Major projects in hand or envisaged include the following:

- i. Newcom Pty. Limited has recently opened the Myuna and Cooranbong Collieries and is investigating the possibility of opening Cooranbong No. 2.

Expansion is underway at Elcom Collieries Pty. Limited's Newstan Colliery while exploration of deeper seams is proceeding at Newvale and Wyee Collieries at Vales Point and at the Newvale No. 2 Colliery at Munmorah.

- ii. Coal & Allied Operations Limited is upgrading its collieries at Wallarah, Chain Valley and West Wallsend as well as investigating the Cardiff Borehole site.
- iii. The Broken Hill Proprietary Company Limited is intending to upgrade the existing Macquarie and Stockton Borehole Collieries to produce up to 4 Mt/a by 1986-88. Expansion is also planned for the John Darling Colliery and an ultimate production level of 2.2 Mt/a is anticipated.
- iv. The Eraring power station is expected to be operational by 1984.
- v. Expansion of the Sulphide Corporation's Cockle Creek smelter is under review.

3.5 HISTORY OF THE PROJECT

The Colliery Holding has been the subject of considerable activity and change of ownership over the past forty years.

It was formerly incorporated in the original Parbury Estate Coal Mine Holding and operated by those interests until 1948 when sold to the Mawson Group.

Exploratory drilling was undertaken by the Bureau of Mineral Resources and the N.S.W. Geological Survey between 1948 and 1950 largely to define the extent of Wallarah Seam coal amenable to opencut extraction. The

Mawson Group proceeded in this direction as a result, in addition to working the Fassifern Seam at the Normaine Colliery. Mining extended until 1958, when a downturn in coal demand caused a cessation of activity.

Deeper drilling of the area was undertaken in 1959 by Rio Tinto Australia Explorations Pty Limited under the supervision of the Joint Coal Board.

Wallamaine Limited (formerly Silver Valley Minerals N.L.) and its subsidiaries purchased the freehold land and all mineral rights from the Mawson Group in 1968. The Swansea Opencut was established to work the Wallarah Seam, with a breakwater being constructed at Spoon Rocks from overburden. The original intention of supplying Japanese and Pacific markets using small ships loaded at a berth at Spoon Rocks was abandoned in favour of a proposed extended mining operation.

An extensive exploration and feasibility study was prepared in 1969 in conjunction with Hancock and Wright and CSR. In June 1969, CSR commissioned the Joint Coal Board to re-appraise all previous studies relating to the area. CSR withdrew from the consortium in January 1970 when the re-appraisal indicated the lack of reserves necessary to support the scale of operations envisaged.

Mining of the upper split of the Wallarah Seam in the Swansea Opencut continued until early 1973, when declining markets rendered further extraction uneconomical. The opencut was left in its current condition.

Wallamaine Limited (formerly Silver Valley Minerals N.L.) studied several options for the continuing development of the Holding. In 1975, approval was sought for a project to mine 857000 t ROM Fassifern Seam coal per annum, for washing and subsequent transport by road to Belmont and thence by rail to the Port of Newcastle. Approval was granted in 1978, subject to the conditions listed in Appendix 2.

Subsequent to the granting of development consent, the current joint venture was established. Following further exploration and investigation, the proposal detailed in this document was formulated.

3.6 ENVIRONMENTAL INVESTIGATIONS

Environmental investigations have been an integral part of the various studies which culminated in the present proposal. Since the closure of the Swansea Opencut in 1973, the following work has been undertaken:

i. *"Caves Beach, Plan for the Growth of a Town"*

An environmental and engineering feasibility study was prepared in 1973 to examine the future development of urban land on the northern part of the Caves Beach Estate. The study investigated four alternative mine entry sites - Caves Beach School (1), Spoon Rocks Breakwater (2), west of Radar Hill (3) and Cams Entry (4), as shown on Figure 4.1 and concluded Site 4 was the most satisfactory.

ii. *"Wallamaine Colliery, Cams Entry Project - An Outline of the Proposal for a New Entry to Mine the Fassifern Coal Seam and an Environmental Statement"*.

Site 4 was studied in greater detail in 1974 in preparation of the above document. Further information was prepared with regard to the ecological implications of the development in May 1975.

The resultant development application was not favourably received by the residents of Nords Wharf and Cams Wharf. As a result, the possible use of the site was rejected in preference to the area known as Site 5, the subject of the current submission.

iii. *A development application entitled "Wallamaine Colliery Submission to Lake Macquarie Shire Council for Development Approval for Site 5" was prepared in 1975.*

Site 5 was chosen because "it has a minimum visual, noise and general environmental impact being remote from all urban development and physically isolated by the topographic features". It was concluded that the main areas of public impact were disposal of waste, coal transport, drainage, visual impact and noise. The unavoidable environmental impacts resulting from the mine development were considered to be:

- * Clearing of 10.12 ha of land for surface installations
- * Generation of traffic to and from the mine
- * A small addition to traffic volume.

As stated previously, approval was granted to the above application in 1978.

- iv. *Environmental investigations forming the basis for this document were commenced in September 1980.*

Detailed field and laboratory studies were undertaken to closely define existing conditions in the area of the Colliery Holding, and in related adjacent areas. Extensive traffic studies were made to enable evaluation of the potential impacts on alternative transport routes.

A 12 months duration monitoring programme was commenced in September 1980 to establish ambient water and air quality and noise levels.

Appropriate safeguards were developed to minimise or eliminate water, air, noise and visual pollution.

3.7 REQUIREMENTS FOR APPROVAL

The preparation of an environmental impact statement is a requirement in the overall process of seeking consent to build and operate a coal mine and preparation plant.

The proposal is defined as a designated development in accordance with Schedule 3 of the Regulation to the Environmental Planning and Assessment Act, 1979. Under section 101 (1) of this Act, the Minister for Environment and Planning has required that all coal mining developments within the Hunter Region be referred for his consideration. He is therefore responsible for determining the application (Section 101 (6)) and the normal provisions for appeals by the applicant or a third party do not apply (Section 101 (7)).

The following procedures are followed:

- i. The proponent formally notifies the DOEP that it intends to prepare an environmental impact statement in connection with the designated development.
- ii. Under Clause 58 of the Regulation, the proponent consults with the Director of the Department regarding the format and the required content of the environmental impact statement.
- iii. The draft environmental impact statement is submitted to the DOEP and following assessment and any revisions, is printed and placed on public display for a minimum of 30 days.

- iv. The Department assesses the Statement, particularly in the light of submissions received from the public, local government and State government authorities and advises the Minister accordingly.
- v. The Minister either grants or rejects development consent, in the former case normally subject to certain conditions.

If development consent is forthcoming, the following statutory approvals will be required:

- i. The project will be deemed a Scheduled Premises as defined by both the Clean Air Act (1961) and the Noise Control Act (1975). The administering authority, the SPCC, will require details of the engineered air pollution and acoustic safeguards to enable the granting of approvals to construct.
- ii. Under the Clean Waters Act (1970), approval will be sought from the SPCC for the construction of any effluent treatment, storage or disposal facilities.
- iii. Licences will be sought under the Clean Air and Clean Waters Acts prior to commissioning of the works. These annually renewable licences specify conditions applying at all times.

The Proposal

4.1 SCOPE OF PROPOSAL

The Newcastle Wallsend Coal Company Pty. Limited proposes to re-establish and extend mining operations in the Wallamaine Colliery Holding south of Swansea, NSW. The development centres on the establishment of the Wallamaine underground mine and surface facilities, with associated limited reworking and major rehabilitation of the currently abandoned Swansea Opencut. The project layout is shown in Figure 4.1, and a flow-chart of operations in Figure 4.2. Plate 2 provides an overview of the proposed development within the Colliery Holding.

The Company proposes to mine the middle and lower splits of the Wallarah Seam in the opencut operation. The coal will be sold locally in the ROM state and will be suited to steaming applications. Total calculated reserves are 270 000 t, which will be exhausted over a maximum two year period.

The underground operation will work the Fassifern Seam, the mine adits being established at the seam outcrop, with the surface facilities on an adjacent 10 ha site. The washed coal will be sold as export 'steaming' coal through the Port of Newcastle.

Production from the underground mine is planned to commence in the first half of 1983 with a single continuous mining unit producing 100 000 t of coal in the first six month period. Four further units will be brought on line at six monthly intervals. Ultimate production will amount to 990 000 t/a ROM or 750 000 t/a of washed coal.

It is intended to mine 20 Mt of ROM Fassifern Seam coal over a 21 year period, representing 70 per cent of the *in-situ* reserves. The saleable coal yield will be approximately 15 Mt.

Coal from the Swansea Opencut will be transported by road to either Coal & Allied Operations Pty. Limited's coal preparation plant at Catherine Hill Bay or to the Vales Point Power Station.

Production from the underground mine will be transported during daylight hours by truck via the Pacific Highway and Vales Point to a proposed rail loading facility located to the south of Morisset. From this point it

will be conveyed by SRA trains to the Port of Newcastle.

Coal reject disposal methods have been chosen to take advantage of existing degraded areas, leading ultimately to an overall enhancement of the scenic qualities of the subregion. The Swansea Opencut represents the major rejects disposal site and will be filled over a period of approximately 16 years, with progressive rehabilitation as finished surface levels are achieved.

An abandoned opencut at Radar Hill will be filled over a period of 16 months, and the area referred to as 'The Adit', similarly used over a period of 5 months. It is expected that a certain percentage of rejects will be sold for filling and landscaping purposes. A fourth site, to the west of the Pacific Highway could be used if required.

The proposed timing of operations is outlined in Table 4.1.

4.2 MARKETS FOR PRODUCTS

It is intended that Wallarah Seam coal from the Swansea Opencut will be sold on a ROM basis to either Coal & Allied Operations Pty, Limited's coal preparation plant at Catherine Hill Bay or to the N.S.W. Electricity Commission's Vales Point Power Station.

Fassifern Seam coal from the underground mine will be washed for sale as a 'steaming' coal and exported through the Port of Newcastle. The coal is also ideally suited to cement manufacture and a number of assured world wide markets are available.

If underground production predates the commissioning of the coal preparation plant, raw coal may be sold from this source to either Coal & Allied Operations Pty. Limited's Catherine Hill Bay coal preparation plant or to the Vales Point Power Station.

4.3 COAL RESERVES AND COAL QUALITY

A description of the subregional geology and the site geology is provided in Section 5.3.

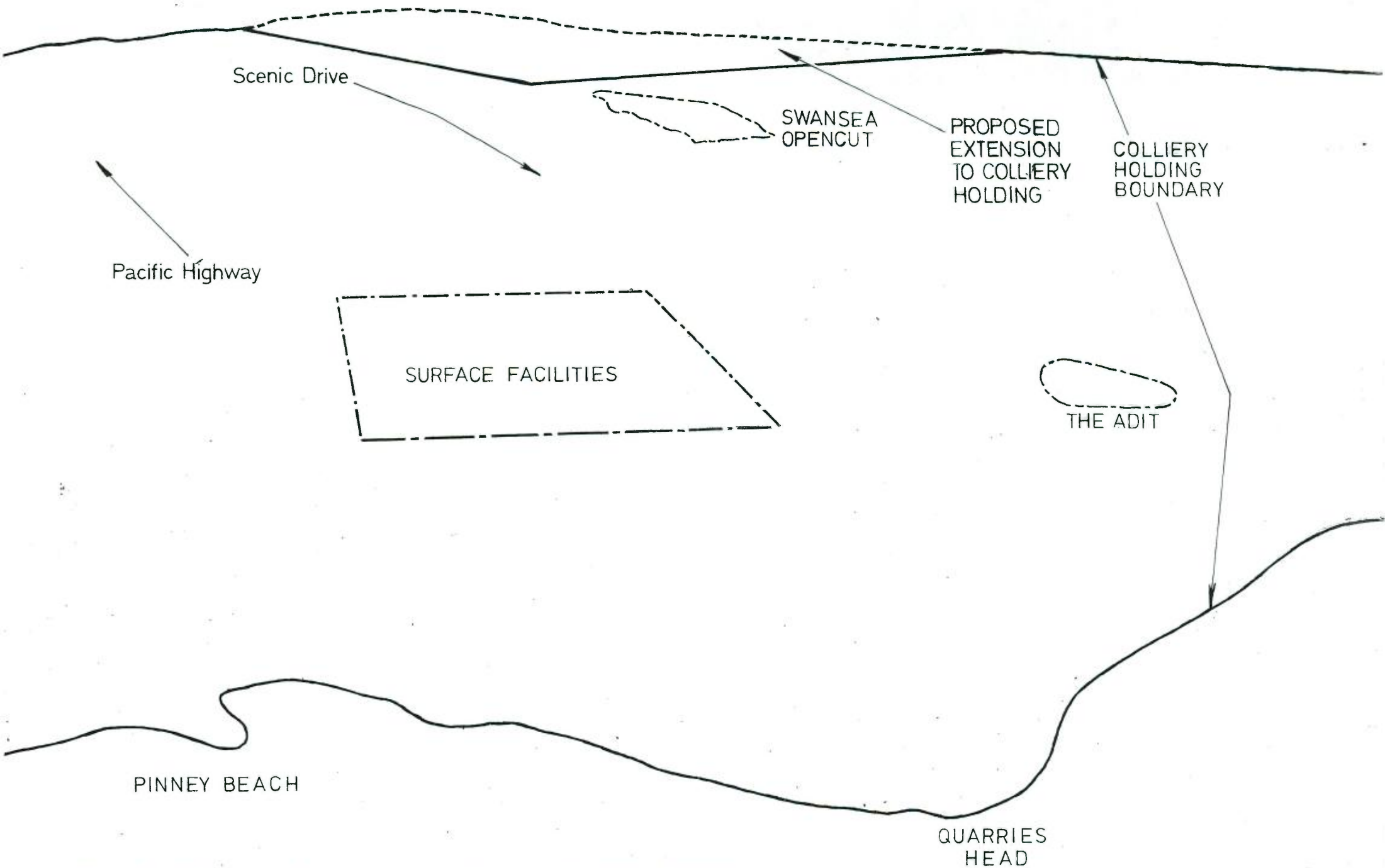


Plate 2: "Proposed Development within the Colliery Holding."



TABLE 4.1

WALLAMAINE PROJECT DEVELOPMENT PROGRAMME

	1981				1982												1983																				
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D									
	1 MINE DEVELOPMENT APPLICATION AND APPROVAL TO PROCEED	████████████████																																			
2 ENGINEERING DESIGN	██																																				
3 ACCESS ROAD CONSTRUCTION							████████████████	████████████████	████████████████	████████████████	████████████████	████████████████																									
4 SURFACE SITE PREPARATION							████████████████	████████████████	████████████████	████████████████	████████████████																										
5 SURFACE BUILDINGS CONSTRUCTION											████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████																		
6 COAL HANDLING AND PREPARATION PLANT CONSTRUCTION																																					
7 COMMISSION COAL HANDLING AND PREPARATION PLANT																																					
8 EIS FOR RAIL COAL LOADING FACILITY AND APPROVAL TO PROCEED	████████████████																																				
9 RAIL COAL LOADER DESIGN WORK	████████████████																																				
10 RAIL COAL LOADER CONSTRUCTION AND COMMISSIONING							████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████	████████████████									
11 OPENCUT PRODUCTION																																					
12 UNDERGROUND PRODUCTION																																					

4.3.1 Exploration Programme

Previous exploration concentrating largely on the Wallarah to Great Northern Seam interval has been described in Section 3.5.

The current exploration programme comprised eight 45 mm diameter DDH's. Two of these tested the Swansea Opencut, two were located within the surface facilities site and the remainder were spaced throughout the Colliery Holding to provide infill information to previous drilling. The location of these drill holes is shown in Figure 4.3.

In addition, 64 m of 450 mm diameter auger drilling was undertaken at 13 locations across the surface facilities site to determine the depth to bedrock.

In addition three 200 mm diameter holes have been drilled to enable sampling of the Fassifern and Wallarah Seams to facilitate accurate coal analysis, and to obtain water samples.

4.3.2 Coal Seams and Coal Quality

Of the four seams within the Moon Island Beach Sub-Group, namely the Wallarah, the Great Northern, the Chain Valley and the Fassifern, only the latter is considered to have economic potential in this area. Figure 4.4 illustrates graphic logs of three drill holes which show the relationship of these seams within the Colliery Holding.

The Wallarah Seam has been previously worked out over most of this area, the exception being the middle and lower splits present within the abandoned Swansea Opencut.

The Great Northern and Chain Valley Seams are either too thin or too inconsistently developed within the area to enable economical extraction.

Seams of the Adamstown and Lambton Sub-Groups occur at greater depths, and are considered uneconomical to mine at present. Their future extraction will be uncompromised by the proposed development.

Wallarrah Seam

The Wallarrah Seam is the uppermost seam in the Wallamaine area and occurs essentially as two or three separate horizons. The upper or major split has been extensively worked by both underground and opencut methods.

In the Swansea Opencut, the upper split has been mined, leaving the middle and lower splits at very shallow depths in the floor of the opencut.

The middle split is about 0.6 m thick and comprises very high ash, dull coal or carbonaceous mudstone. It occurs at a depth range of between zero and 1.5 m below the floor of the opencut.

The lower split has a working thickness of about 1.8 m and its depth beneath the floor of the opencut averages about 5 m. The coal can be described as a medium to high ash steaming coal. The upper half comprises mainly clean dull coal, while the lower half has a higher proportion of brights and stone bands.

Table 4.2 presents results of raw coal laboratory analyses.

TABLE 4.2

ANALYTICAL RESULTS OF WALLARAH COAL (RAW)

Seam	Inherent Moisture (%)	Volatile Matter (%)	Ash (%)	Sulphur (%)	Specific Energy (GJ/t)	Specific Energy (K Cal/kg)
Middle Split	2.3	18.3	39.4	0.24	14.00	4 650
Lower Split	2.9	24.6	25.0	0.37	19.48	5 730

(Analysis by the Gollin Wallsend Coal Company Limited Laboratory).

Laboratory float/sink analysis at 1.60 S.G. indicates that the lower split would have a yield of about 78 per cent at approximately 16 per cent ash. Results for the middle split indicate a yield of 48 per cent at about 27 per cent ash.

Fassifern Seam

The Fassifern Seam is the uppermost seam of economic potential in the Wallamaine area suited to underground extraction.

The working thickness ranges from 2.5 m to 2.9 m with a coal roof between 1.0 and 1.8 m thick and a coal floor between 0.6 and 0.8 m thick. The seam thickness and working thickness is greatest in the eastern and central parts of the area with thinning to the northern, western and southwestern zones.

In general, the coal quality is poorer in the southwestern portion of the Colliery Holding, with a higher proportion of stone bands to coal in addition to an increase in coal ash content.

Washing of the Fassifern Seam will yield steaming coal only. The raw coal ash content of the working section ranges between 21 and 33 per cent, averaging about 26 per cent. Table 4.3 indicates the predicted quality of the washed product. A washing yield of about 75 per cent is anticipated.

TABLE 4.3

ANALYTICAL RESULTS OF FASSIFERN COAL
(Washed)

<u>Parameter</u>		
Total Moisture	(as received)	9.0%
Inherent Moisture	(air dried)	2.5% approximately
Volatile Matter	(air dried)	29.0% approximately
Fixed Carbon	(air dried)	52.5% approximately
Ash	(air dried)	16.0% maximum
Total Sulphur		0.6% maximum
Specific Energy (gross air dried)		27.4 GJ/t
Hardgrove Grindability Index		47
Ash Fusion Temperatures (reducing atmosphere)		
	Initial Softening	1410 ^o C
	Spherical	1450 ^o C
	Hemispherical	1470 ^o C
	Flow	1490 ^o C
Size		- 38 mm to + 0.1 mm

(Analysis by Gollin Wallsend Coal Company Limited Laboratory.)

4.3.3 Coal Resources

Wallarah Seam

Reserve estimates are detailed in Table 4.4. They are largely based on DDH's 1 and 2 from the southern and northern extremities of the opencut respectively, and to a lesser extent upon five non-cored holes drilled by Wallamaine Limited in 1978.

The 60 000 t of lower split coal in the proposed eastern extension of the opencut is inferred rather than proven.

TABLE 4.4

WALLARAH SEAM-MEASURED IN-SITU RESERVES

Seam	Existing Opencut	Eastern Extension to Opencut
Lower Split	160 000	60 000
Middle Split	50 000	-

Source: *Newcastle Wallsend Coal Company Pty. Ltd.*

Fassifern Seam

Reserve estimates for this seam are based on the eight 45 mm diameter DDH's and to a lesser extent upon previous drilling. Table 4.5 provides details of the results.

The overall mining extraction is assumed to be 70 per cent, with an assumed average washing yield of 75 per cent.

TABLE 4.5

FASSIFERN SEAM-MEASURED STEAMING COAL RESERVES¹.

In-situ	Mineable	Saleable
30 Mt	21 Mt	15 to 16 Mt

1. These reserves include coal within the extensions to the present Colliery Holding.

Source: *Newcastle Wallsend Coal Company Pty. Ltd.*

4.4 THE SWANSEA OPENCUT

4.4.1 Site Layout

The proposed site layout shown in Figure 4.5 indicates the extent of the abandoned opencut and the area selected for mining. Access is from Scenic Drive and where practicable, all haulage will be along an in-pit haulage road. A truck wheel washing station will be located between the opencut and Scenic Drive. The northwestern end of the abandoned opencut will not be mined but may be used for reject and some overburden disposal.

A perimeter system of catch drains will collect site runoff for direction to sedimentation dams. Mine water will be collected in an in-pit sump and pumped to the mine water dam for settlement before use in dust suppression throughout the site. An office and amenities building will be provided.

4.4.2 Basic Constraints

The upper or major split of the Wallarah Seam has been extensively worked in the surrounding area by both opencut and underground methods. The only unworked areas remaining are those under the Pacific Highway and

others peripheral to old workings or outcrops. The major split has been removed in the Swansea Opencut leaving the middle and lower splits of the seam at very shallow depth to the floor of the cut.

The opencut is located 350 m at the closest point to recent residential developments at Caves Beach and is overlooked from the Rotary Park Twin Lookout. Portions of the opencut are visible from Caves Beach, Swansea Channel, and the Pacific Highway.

4.4.3 Access

The present access to the opencut site will be upgraded by reducing the steep grade and improving the present lines of sight for both Scenic Drive and the access road. The access road will be bitumen-sealed from Scenic Drive to the truck washing station, a distance of approximately 250 m.

Warning signs will be erected on either side of the access road to advise motorists of heavy vehicles entering Scenic Drive. Stop signs will be installed on the access road at the same junction. Details of this intersection are shown in Figure 6.12.

4.4.4 Mining Method

The proposed extent of the opencut is shown in Figure 4.5. Plate 3 presents an artist's impression of the mine.

The total area to be mined is approximately 8 ha, which comprises 6 ha of known coal reserves and an inferred eastern extension of 2 ha. Mining of the opencut may reveal that this extension contains only oxidised coal in which case it will remain *in-situ*.

The conventional haulback method of mining will be adopted, using generally small scale earthmoving machinery. Mining will advance from the northwestern end of the existing opencut and proceed in a southeasterly direction, with overburden being returned to the previously mined section. Successive extraction of the middle and lower splits will take place

progressively within each of the 11 mining sections shown on Figure 4.5. The estimated production from each section is detailed in Table 4.6.

TABLE 4.6

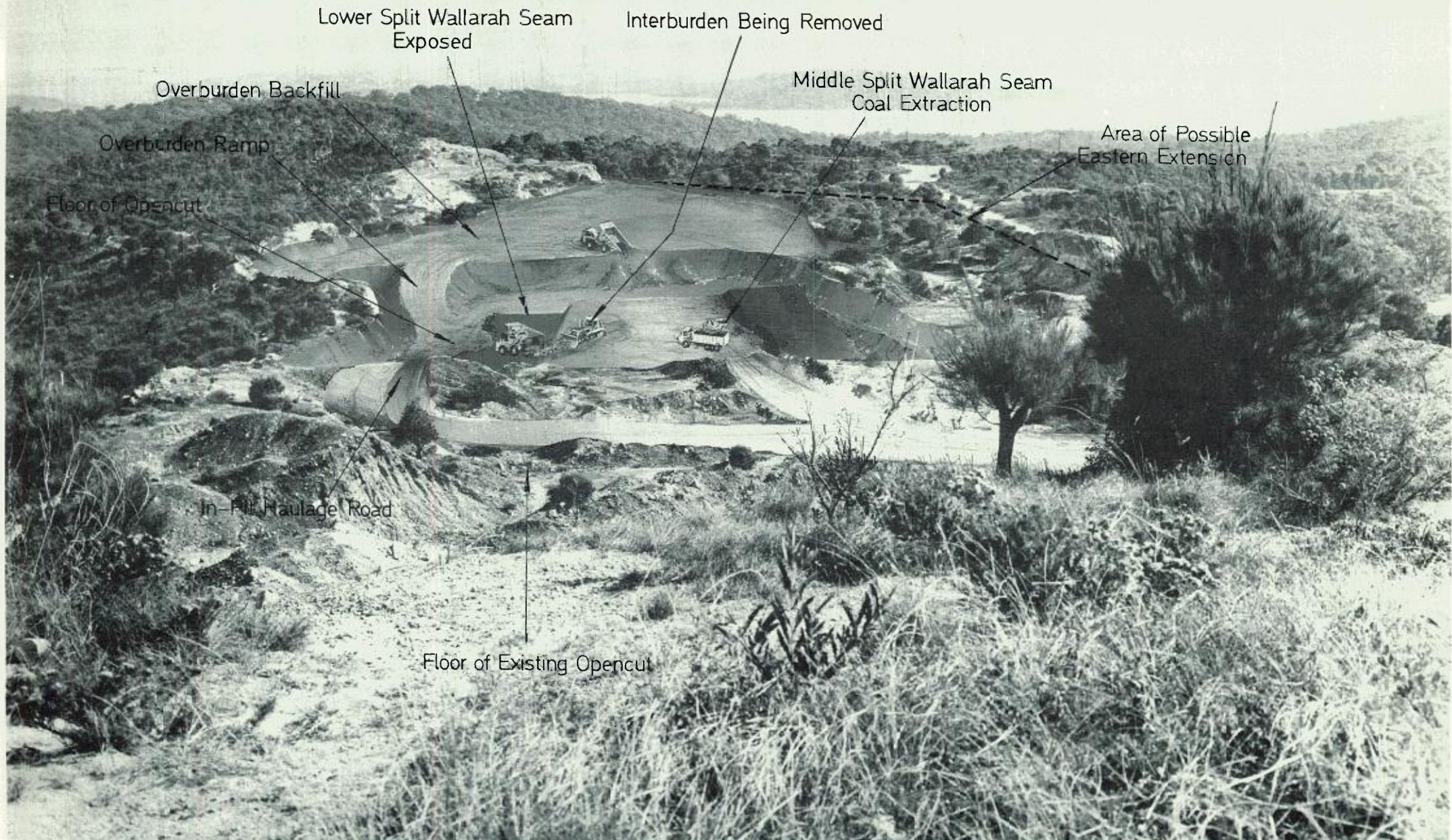
ESTIMATED MINE PRODUCTION-SWANSEA OPENCUT

Opencut Subdivision (Figure 4.5)	Area (m ²)	Volume of Solid Over- burden (m ³)	Coal Volume (m ³)	
			Middle Split Wallarrah	Lower Split Wallarrah
1	6240	19160	-	11230
2	7510	32520	3340	13520
3	16320	65250	6130	29380
4	12040	38670	5090	21670
5	9000	34380	4320	16200
6	5760	24660	2530	10370
7	5500	23890	2150	9900
8	5550	24170	2050	9990
9	4710	22220	2050	8480
10	8090	33870	4520	14560
11	2580	10320	-	4640
Total	83,300	329,110	32,180	149,940

Source: *Newcastle Wallsend Coal Company Pty. Ltd.*

Figure 4.6 shows typical sections through the mine and indicates the intended method of mining. Within each section, Lower Split Wallarrah Seam coal will be removed over one half of the mining section, whilst middle split coal is being mined simultaneously from the other half.

Initially overburden will not be disposed of within the confines of the present opencut but in an area to the northwest of the first mining section. Mounds of loose overburden on the floor of the present opencut,



Lower Split Wallarah Seam Exposed

Interburden Being Removed

Middle Split Wallarah Seam Coal Extraction

Area of Possible Eastern Extension

Overburden Backfill

Overburden Ramp

Floor of Opencut

In-Fill Haulage Road

Floor of Existing Opencut

Plate 3: "Artist's impression of Swansea Opencut Mine, from the Rotary Park Twin Lookout."

will be used to form bund walls along the northeastern side of the opencut, as described in further detail in Section 6.2.3., should mining of the eastern extension be undertaken. Overburden above the middle split of the Wallarah Seam varies from zero to 1.5 m in depth with the seam thickness averaging 0.6 m. Interburden between the middle and lower splits averages 3.6 m with the average lower split seam thickness being 1.8 m. The solid overburden to be removed during the opencut operation will total approximately 329 000 m³. Loose overburden heaps in the opencut totalling 70 000 m³ will also be hauled to the disposal areas and used in the construction of bund walls.

4.4.5 Equipment

By modern mining standards the opencut operation will be small, involving the movement of only 330 000 m³ of solid overburden and 70 000 m³ of loose overburden over a maximum time span of two years.

The confined site and small volumes reduce the options available for mine development. Draglines, electric shovels and large earthmoving plant are not applicable. Scrapers do not possess the necessary manoeuvrability to work within the available area. As a result, a bulldozer, a front-end loader or hydraulic shovel and truck combination is regarded as being the optimum selection.

The type and number of mobile plant required for the operation are listed in Table 4.7. All will be diesel powered and fitted with mufflers. The makes shown are indicative only.

4.4.6 Site Preparation

The area of the existing opencut which is to be mined is sparsely vegetated by regenerated growth consisting mainly of shrubs and small trees up to 6 m in height. This material will be removed up to 100 m in advance of overburden ripping. The vegetation will be stockpiled and burned as permitted. The site is virtually devoid of topsoil but any useable quantities found during site preparation will be placed directly onto existing areas requiring rehabilitation.

TABLE 4.7

TYPICAL EQUIPMENT LIST - SWANSEA OPENCUT

Number	Machine	Capacity	Noise Output
<u>Overburden Plant</u>			
1	Caterpillar 988 front-end loader	7 m ³	87 dB(A) at 15 m*
	OR		
	Hydraulic Shovel with 7 m ³ bucket		75 dB(A) at 7 m
3	Caterpillar 769 rear-dump truck	35 t	89 dB(A) at 15 m *
1	Caterpillar D9 bulldozer		89 dB(A) at 15 m *
<u>Coal Plant</u>			
1	Caterpillar 966 front-end loader	3.5 m ³	86 dB(A) at 15 m *
7	(9**) Highway coal truck	25 t	96 dB(A) at 1 m
<u>Rejects Disposal and Rehabilitation Plant</u>			
1	Dynapac CA25-PD compactor		102 dB(A) at 1 m
1	Michigan 280 rubber-tyred dozer***		
<u>Ancillary Equipment</u>			
1	Caterpillar 12E grader		85 dB(A) at 15 m*
1	Water Cart 20 000 L		96 dB(A) at 1 m

Key: * Noise levels specified by the manufacturer
 ** Additional trucks will be necessary if the coal is hauled to the Vales Point Power Station
 ***Also used at the surface facilities site.

Catch drains and sedimentation dams will be constructed to collect runoff from disturbed areas and to receive water pumped within the pit.

Details of erosion and drainage controls are presented in Section 6.2.1.

The existing entry road to the opencut will be reconstructed to improve vehicular access as outlined in Section 4.4.3.

It is proposed to use the existing opencut area to the northwest of the proposed mining operation form overburden and reject disposal. Small shrubs will be removed with the topsoil and stockpiled for later use in rehabilitating the backfill area.

4.4.7 Overburden Removal and Recycling within the Opencut

Overburden will be either ripped by the bulldozer and loaded by the front-end loader into the three rear-dump trucks or excavated by the hydraulic shovel. It is anticipated that blasting will be unnecessary due to the soft nature of the interburden.

Overburden will be hauled to a mined-out section of the opencut and tipped from an advancing face of about 5 m in height. The overburden will be compacted by vehicular movement to a density of approximately 2.0 t/m^3 . Upon completion of the backfilling operation the floor of the opencut will be approximately 1.7 m below the existing level.

Overburden will be removed over two 7 hour shifts per day (7 am to 2 pm and 2 pm to 9 pm) 5d/wk. Production of overburden is estimated at $6\ 500 \text{ m}^3/\text{wk}$.

Noise will be generated in two areas. Overburden ripping and loading will cause a peak noise level of 115 dB(A) at 1 m although this would be reduced if the hydraulic shovel is used. This operation will be performed on the roof of the coal seam within the confines of the opencut.

Overburden tipping will generate source noise levels of 112 dB(A) for single truck operation and occasionally 115 dB(A) for two trucks. As tipping will take place about 5 m above the floor of the opencut, it represents a potential external impact.

Should mining of the eastern extension be undertaken, the Company proposes to construct as necessary a bund wall varying in height from 3 m to 8 m approximately 100 m in advance of the working area to reduce likely noise and visual impacts. Further details are provided in Section 6.2.3.

4.4.8 Coal Removal and Loading

When sufficient area is exposed, coal will be ripped and heaped by bulldozer for loading into 25 t capacity highway trucks. Depending on the point of sale either seven or nine highway trucks will haul coal between

7 am and 6 pm, 5d/wk. Average daily production will be 800 t.

The existing excavation will shield noise sources and thus reduce off-site levels.

The coal loading area will be watered regularly to reduce overall dust generation. The inpit loading will minimise emission levels external to the opencut.

4.4.9 Coal Haulage

On Site

To minimise visibility and noise levels, coal will be hauled along the floor of the opencut, rising to the surface at the southeastern end as shown in Figure 4.5. Trucks will pass through a wheel washing station located between the opencut and Scenic Drive. The section of road between the washing station and Scenic Drive will be bitumen-sealed to prevent recontamination of the truck wheels.

The coal haulage road will be regularly graded to reduce the impact noise associated with empty coal trucks, and watered to prevent dust generation.

Off Site

After leaving the site, coal haulage will be along Scenic Drive to the Pacific Highway and then south, along one of two routes depending upon the point of sale. The two alternatives are shown in Figure 4.1.

Coal sold to Coal & Allied Operations Pty. Limited would be transported along the Pacific Highway and Wallarah Colliery private haul road to the coal preparation plant at Catherine Hill Bay. Each return truck trip will be approximately 19 km with an estimated cycle time of 50 minutes. Fifteen kilometres of each trip will be over public roads with the remaining 4 km on the private haul road.

In the case of sales to the Vales Point Power Station, the transport route would be via the Pacific Highway and Vales Road. Each return truck trip will be approximately 45 km with an estimated cycle time of approximately

100 minutes. The number of coal trucks would have to be increased from seven to nine.

4.4.10 Hours of Operation

Overburden removal and backfilling will be carried out on a two shift basis, 7 am to 2 pm and 2 pm to 9 pm, for 5d/wk. Coal extraction will be undertaken generally over one shift per day while coal haulage will be between 7 am and 6 pm, 5d/wk.

Coal rejects disposal will be undertaken over the period 7 am to 6 pm, 5d/wk.

In accordance with normal Colliery working conditions the opencut will operate on a 220 d/a basis.

4.4.11 Landscaping and Rehabilitation

During the mining operation tree and shrub planting will be carried out along the toe of the bund wall along the northeastern side of the opencut and on the verges of the main access road. Other earth mounds, cuttings and dam walls will be hydroseeded with stabilising grasses and native shrubs. This will complement the screening effect and acoustic control of these features. Further details of the proposed landscaping are provided in Section 6.2.4.

Progressive rehabilitation of the opencut and rejects disposal area will be carried out as the final surface contours are achieved. An area of up to 27 ha will be rehabilitated. This comprises the 8 ha of the initial opencut excavation and an additional disturbed area of 19 ha which in part will be regraded and in part used for rejects disposal.

When the final landform is achieved the area will be revegetated in the character of the surrounding forested areas.

4.4.12 Labour and Service Requirements

The labour requirements of the opencut operation are shown in Table 4.8.

Overall supervision to ensure accordance with the Coal Mines Regulations Act, 1912 will be undertaken by the Company with overburden recycling, coal mining and haulage being performed on a contractual basis. Labour requirements are based on two shifts per day for overburden removal and one shift per day for coal mining and haulage.

TABLE 4.8

CONTRACTUAL MANPOWER REQUIREMENTS - SWANSEA OPENCUT

Supervision		2
<i>Overburden</i>		
i. Front-end loader/hydraulic shover	2)	
ii. Rear-dump trucks	8)	12
iii. Bulldozer	2)	
<i>Coal Mining</i>		
i. Front-end loader	1)	
ii. Coal haulage trucks	7)	8
<i>Ancillary</i>		
i. Grader	2)	
ii. Water cart	2)	4
<i>Maintenance</i>		
i. Fitter/welders		3
<i>Administration</i>		
i. Clerk		<u>1</u>
Total		30

Source: *The Newcastle Wallsend Coal Company Pty. Limited.*

Water Supply

Potable water will be supplied by the HDWB at the rate of approximately 6 000 ML/a, servicing the truck washing station, and temporary offices and amenities. Opencut runoff will be recycled from the collected dam to provide water for dust suppression.

Power Supply

The power transmission line which currently traverses the opencut is to be relocated. Present plans by SCC, are to upgrade the line to 33 kVA and redirect it around the opencut. Power will be required for the temporary office, for general lighting and for pumping at the truck washing station.

Buildings

Transportable buildings will provide office accommodation and amenities, including ablution facilities.

4.4.13 Energy Use

A complete energy statement is provided in Appendix 3. The opencut mining operation will have a primary energy requirement of 61×10^6 MJ over the life of the mine. This consists of 2 000 kWh/a of electrical energy, 800 000 L/a of diesel fuel, 2 600 L/a of hydraulic and lubricating oils and 1 000 kg/a of grease.

Coal with an energy equivalent of 567×10^6 MJ will be sterilised during the mining operation, but has not been considered as actual energy consumption. Gross energy production from the opencut will be $5 675 \times 10^6$ MJ with the net energy production being $5 614 \times 10^6$ MJ.

4.5 THE WALLAMAINE UNDERGROUND MINE AND SURFACE FACILITIES

4.5.1 Site Selection

Five potential surface facilities sites have been examined during feasibility studies over the past seven years. The advantages and disadvantages of each site are listed in Table 4.9 whilst their locations are shown in Figure 4.1.

TABLE 4.9

EVALUATION OF POTENTIAL SURFACE FACILITIES SITES

Site	Advantages	Disadvantages
<p><i>Site 1</i> (adjacent to Caves Beach High School).</p>	<p>Located on outcrop of the Fassifern Seam, therefore minimal development costs.</p> <p>Proximity to existing services and road network.</p>	<p>Proximity to Caves Beach School and adjacent residences, with likely resultant impacts of dust, noise and night time illumination. Environmentally unacceptable.</p> <p>Highly visible and all transport would be through Caves Beach.</p>
<p><i>Site 2</i> Spoon Rocks Breakwater (The Adit)</p>	<p>Located on outcrop of the Fassifern Seam, resulting in minimal development costs.</p>	<p>Proximity to Caves Beach residential area (700 m at closest point), with likely resultant impact due to noise.</p> <p>Proximity to coastline and high visibility.</p> <p>Topography would necessitate considerable cut and fill to establish a suitable site area.</p>
<p><i>Site 3</i> Radar Hill</p>	<p>Remoteness from residential areas of Caves Beach, Nords Wharf and Cams Wharf.</p> <p>The site is presently disturbed as a result of previous mining operations</p> <p>Proximity to the Pacific Highway, would minimise access road length.</p>	<p>Proximity to Camp Yondaio hostel.</p> <p>High visibility from Rotary Park Twin Lookout and the Pacific Highway.</p> <p>Would result in some sterilisation of coal beneath the site.</p>
<p><i>Site 4</i> Cams Entry</p>	<p>Remote from the major urban settlement of Caves Beach.</p> <p>Screening provided by natural bushland.</p> <p>Transport route would not pass any residential concentrations.</p>	<p>In the event of discharge from the site, the delicate ecological balance of Lake Macquarie is likely to be affected more than discharge into the ocean.</p> <p>Objections to a prior application for a surface facilities development submitted in 1974, were made by the Nords Wharf and Cams Wharf community as well as governmental departments.</p> <p>Additional cost of driving a 300 m drift to reach the Fassifern Seam and the provision of a ventilation shaft. Estimated development time 12 mths or \$1.5 M in 1974.</p>
<p><i>Site 5</i> The proposed site</p>	<p>Topography of the site will result in relatively minimal cut and fill operations to obtain a suitable building site compared with other sites.</p> <p>Surrounding topography effectively isolates the site from Caves Beach residential area with respect to dust, noise and visibility.</p> <p>Located as the outcrop of the Fassifern Seam, resulting in minimal development costs.</p>	<p>Destruction of natural bushland on the site and intrusion into the coastal zone.</p> <p>Proximity to Camp Yondaio recreational areas.</p> <p>High cost of providing the access road and other services to the site.</p>

Site 5 was selected as being most suitable for the development of surface facilities on the basis of investigations and feasibility studies previously outlined in Section 3.5 and 3.6.

The mine entry is located adjacent to the inferred outcrop of the Fassifern Seam and very little development work, with the exception of portal establishment, will be necessary before production commences.

The site is located in a relatively isolated valley at the foot of steeply sloping hills. The topography effectively isolates the area from the urban development at Caves Beach to the north, and will aid in minimising any potential visual, noise or dust related impacts.

The site itself is relatively flat, reducing the need for extensive cut and fill operations. The steeper surrounding topography will create some difficulties in providing road and services access.

The location of additional alternative sites for the development of surface facilities to those listed in Table 4.9 is limited by the following factors:

- i. The proposed expansion to the township of Caves Beach as proposed in the Lake Macquarie Municipal Council's Draft Environmental Planning Instrument. This provides for future residential development as far south as the Swansea Opencut.
- ii. The area between Lake Macquarie and the Pacific Highway is proposed to be zoned as "Environmental Protection (Scenic)", under the Lake Macquarie Municipal Council's Draft Environmental Planning Instrument as shown in Figure 5.14.
- iii. Topography within the Wallamaine Colliery Holding is generally steep and comprises predominantly ridge and valley country, limiting the availability of relatively level 10 ha sites.

4.5.2 Site Layout

The site layout has been designed to minimise the total area of disturbance and to provide the least visual impact. Further details of design rationale are provided in Section 6.3.4.

The chosen layout is shown in Figure 4.7 and an artist's impression of the facility is presented in Plate 4. Its essential elements are as follows:

- i. The mine entry comprising three adits. One adit is to provide access for men and materials, another is for the conveyance of raw coal and the third serves the dual role of ventilation and an emergency means of egress.
- ii. The surface facilities site which is 10.12 ha in area, and includes the mine entry. The bath house, workshop and stores, electricity substation, office and car park have been located adjacent to the mine entry, while the coal stockpiles and breaker house have been sited as far to the north as possible. The coal preparation plant and sedimentation dams have been located within the southern section of the site for reasons outlined in Section 6.3.4. The major buildings are connected by a bitumen-sealed road located adjacent to the western boundary.
- iii. A double lane bitumen-sealed access road linking the surface facilities site with Scenic Drive, at a position opposite the entry to the Swansea Opencut. The water supply pipeline will follow the route of the access road.
- iv. A 33 kVA transmission line which will link the electricity substation situated at the northern corner of the site with the existing transmission line which at present bisects the Swansea Opencut.

4.5.3 Mining Operations

Underground Planning Constraints

The preliminary mine layout was designed after consideration of the following constraints:-

- i. Geology of the deposit
- ii. Direction and dip of seam.
- iii. Anticipated presence of water.
- iv. Direction of cleat or cleavage planes.
- v. Production schedule.
- vi. Ventilation requirements.



Pacific Highway

Rehabilitated Swansea Opencut

Scenic Drive

Workshop

Bath House

Raw Coal Stockpile

Powerline

Products Stockpile

Coal Preparation Plant

Main Access Road

Plate 4: "Artist's Impression of the Surface Facilities."

Geological investigations of the area and supporting evidence from the drilling programme indicate that the area is not affected by any major geological structures apart from a northwest-southeast trending normal fault which transects the abandoned Normaine Colliery.

The main joint and cleat lines of the area run in a northwest to southeast direction and mining in that direction would result in unstable and broken roadway ribs. As well as being a major safety hazard such a situation is conducive to floor heave and the 'guttering' of the roof at the ribs. Experience in the area has shown that mining conditions are improved by driving development roadways at 45 degrees to the angle of cleat. The stability of the floor and strength of the roof are critical factors in maintaining satisfactory production levels. For these reasons it is preferable to drive development roadways at 45 degree to the angle of cleat, or in this case in a north to south or east to west direction. By developing initially to the west, the full dip of the seam is followed allowing any water to gravitate to the working area where it can be collected and pumped to the surface. Any faults or dykes present will be proved in the course of development and the mine plan altered if necessary.

Choice of Mining Method

Two alternative mining methods were considered, Longwall, and Bord and Pillar.

Longwall mining was rejected for the following reasons:

- i. The high capital cost - up to \$10M per face.
- ii. The lack of flexibility in the event of striking poor mining conditions.
- iii. The concentration of production from one section at any given time.
- iv. The limited extraction possible in certain areas due to surface constraints.
- v. The lack of experience with this method in the Fassifern Seam.

Conversely, the Bord and Pillar system was favoured due to the factors listed below:

- i. A lower capital cost per unit of approximately \$1.15 M.
- ii. Greater flexibility.
- iii. The ability to provide for planned selective mining of different areas.
- iv. High extraction rates.
- v. Wide experience with the method in the Newcastle area.

Mine Plan

The proposed underground development is shown in Figure 4.9. It is designed to achieve an overall recovery of 70 per cent. Total extraction is prevented by the need to protect valuable surface assets. These are listed in Section 7.1.3 and shown on Figure 4.9.

Initial mine development will be to the west with seven headings being driven. Secondary development will be to the north and south with seven headings being driven in each direction. Production panels will be driven to the east and west off these north to south secondary development sections.

Roof stability will be effected by steel straps secured to the roof by resin anchor bolts set off the continuous miner. Mobile roof bolting machines will carry out supplementary bolting.

Prior to extracting pillars of coal beneath the old workings in the Wallarah Seam, these areas will be dewatered if necessary by drilling boreholes upward from the Fassifern Seam workings.

Mining Method

The gentle dip of the seam (about 4 degrees to the west and southwest) and a seam working thickness of 2.5 to 2.9 m suits the selection of a conventional continuous miner/shuttle car/breaker feeder operation at the coal face. Coal will be transported to the surface by a system of conveyor belts.

Coal will be mined by a continuous miner and loaded into shuttle cars of up to 12 t payload. The coal will be unloaded into a breaker feeder located at the tail end of the panel conveyor. It will be crushed to

a top size of 150 to 200 mm and loaded onto a conveyor belt at a predetermined rate of up to 400 t/h. The panel conveyor will be of 1060 mm wide PVC belting running on an open type structure. Conveyor drive heads will be double drum and driven by AC motors of up to 200 kW in size.

Panel conveyors will feed coal to the north and south secondary development conveyors which will be 1200 mm wide and driven by AC motors of up to 300 kW. Secondary development conveyors will have a capacity up to 1000 t/h.

The north and south development conveyors will feed a 500 t underground bunker located at their confluence. Coal from the bunker conveyor will discharge onto the main trunk conveyor which in turn will directly feed the raw coal handling system on the surface. The trunk conveyor will be 1200 mm wide driven by one 320 kW motor and capable of conveying 1000 t/h of raw coal.

Men and materials will be transported between the mine entrance and the working places in rubber tyred, diesel driven vehicles. Personnel transporters will be of sufficient capacity to accommodate a complete production unit crew. A materials transporter will be available for each production section.

Ventilation

The underground workings will be ventilated continuously by a variable speed centrifugal fan driven by a DC motor of 200 kW capacity. The fan will be located adjacent to the vertical upcast shaft, as shown in Figure 4.10. The maximum duty of the fan will be $142 \text{ m}^3/\text{s}$ at a water gauge of 1000 kPa, at which rate it will produce a noise level of 92 dB(A) at 1 m.

During the development phase the fan will operate at slower speeds, providing the necessary ventilation at lower mine resistance.

An alternative means of egress will be established in conjunction with the ventilation shaft for use during emergencies. This exit will be provided with an air lock to aid in the operation of the ventilation

system.

The shaft and access adit will be constructed by excavating a temporary boxcut from the surface facilities pad level of RL 20 m. The cut will have a gradient of IV:3H to correspond with the grade of the access adit, and will extend to the base of the upcast shaft. From this location a tunnel will be constructed directly into the coal seam to link with the workings.

The access adit and tunnel will be concreted for a distance of 4 m into solid rock to exclude air and water.

The upcast shaft will be concrete lined. The boxcut will be finally backfilled with selected compacted material to provide a tight seal.

The working places will be ventilated by deflecting and coursing the air using brattice curtains hung from wooden props.

The Fassifern Seam is not considered gassy but some low concentrations of methane gas may be anticipated in the return airways. The return air will be continuously sampled, analysed and automatically monitored to determine the presence of methane and carbon monoxide gas.

Production

Production is planned to commence early in 1983 with one continuous miner unit developing the mine from the outcrop. At six monthly intervals additional continuous miner units will be installed with full production being achieved approximately 2 years later.

At full production, five continuous miner units will operate two shifts per day, 5d/wk for a working year of 220 days. Average production per unit shift will be 450 t of ROM coal, with an annual production of 990 000 t.

Productivity at full production is estimated at 17.7 t/OMS on a ROM basis. Table 4.10 shows the production schedule and productivity figures for the five stages of development until maximum production, while Table 4.11 lists the production schedule for washed coal over

the life of the mine. Each production stage represents an additional continuous miner unit.

TABLE 4.10

PRODUCTION AND PRODUCTIVITY FIGURES - RAW COAL

Production Stage *	Production (t)	Workforce	Productivity (t/OMS)
Stage 1	99 000	76	11.4
Stage 2	198 000	114	15.8
Stage 3	297 000	163	16.6
Stage 4	396 000	217	16.6
Stage 5	495 000	254	17.7

* Each Stage represents 6 months.

Source: *The Newcastle Wallsend Coal Company Pty. Ltd.*

TABLE 4.11

PRODUCTION SCHEDULE FOR WASHED COAL

Production Stage*	Production (t)
Stage 1	75 000
Stage 2	150 000
Stage 3	250 000
Stage 4	300 000
Stage 5	375 000
Stage 6	750 000

* Each Stage represents 6 months, except Stage 6 which represents the annual production.

Source: *The Newcastle Wallsend Coal Company Pty. Ltd.*

4.5.4 Equipment

Table 4.12 provides details of the numbers and types of mobile equipment which may be used underground, on the surface facilities site and for refuse disposal. The list is indicative only of the machinery to be used.

TABLE 4.12

TYPICAL EQUIPMENT LIST

Number	Item of Plant	Typical Make and Model	Engine and Horsepower
2	Refuse lorry	Kenworth 144, 20 t capacity	Cummins Diesel 300 bhp
1	Rubber tyred dozer	Michigan 280	Cummins Diesel 350 bhp
1	Front-end loader	Caterpillar 966	Diesel 190 bhp
1	Fork lift	Toyota FDT 25	Toyota Diesel 250 bhp
1	Mobile crane	Coles 12 t	Cummins Diesel 250 bhp
6	Underground personnel transporter	PJB	MWM Diesel 56 bhp
5	Underground materials transporter	Fox Manufacturing Company	Caterpillar Diesel 100 bhp
1	Underground front-end loader	Domino Mining Machinery	MWM Diesel 56 bhp
1	Underground road grader	Domino Mining Machinery	MWM 56 bhp
1	Surface four-wheel drive	Toyota Land Cruiser	Toyota 26 bhp
5	Mobile roof bolters	Joy-Fletcher	Electric 60 hp
10	Shuttle cars	Joy Manufacturing	Electric 100 hp
5	Continuous miners	Joy Manufacturing	Electric 450 hp

It is intended that the rubber-tyred dozer be utilised mainly in rehabilitation work at the rejects disposal sites. The front-end loader will be

used to push both raw and washed coal into the reclaiming tunnels.

4.5.5 Site Preparation

Table 4.1 indicates the timing of the construction phase. Further details of safeguards adopted for construction and operational phases are provided in Section 6.

The access road to the surface facilities site will consist of a new running surface along the alignment shown in Figure 4.7. This work will include the provision of drainage controls to collect road runoff and channel it to a treatment dam. Any areas of previously undisturbed land will be cleared in the same manner as detailed below for the surface facilities area.

Diversion banks will be constructed on the upslope boundaries of the surface facilities site to prevent the flow of clean water across the site. Diversion banks will be 'V' shaped with side slopes of IV:4H. The diversion bank above the mine entry on the western side of the site will have a depth of 0.3 m. A bank of 0.5 m deep will be constructed to divert clean runoff around the eastern boundary of the site. Runoff which cannot be channelled in this direction, due to site topography, will be diverted to the proposed 5 500 m³ clean water dam to the northwest of the site. Overflow from this dam will pass through the site in a 1500 mm diameter reinforced concrete pipe.

With the exception of the area south of the main access road the site will be cleared of large shrubs and trees. These will be stockpiled and burned as permitted. Topsoil subsequently removed by bulldozer and scraper will be stockpiled for later use in site rehabilitation and landscaping.

The areas designated for the various buildings and structures will be levelled in a cut and fill operation using either a bulldozer on its own or in concert with self-elevating scrapers. Excavated material will be compacted to 95 per cent standard compaction using self-propelled compaction plant. Working areas will be watered to reduce dust emissions. Perimeter drains and the runoff sedimentation dam will be constructed

concurrently. The drains will be semi-circular concrete dish design 0.4 m deep, feeding the 4 000 m³ capacity sedimentation dam.

Any excavated material found unsuitable as filling will be trucked to the opencut site for disposal with overburden from that operation. It is envisaged that the only material which may have to be imported to the site will be for road base or dam wall construction.

4.5.6 Portal Establishment

The mine portals will be established by bulldozer excavation across the Fassifern Seam outcrop at the northwestern end of the surface facilities site. The seam will be exposed at the base of suitably stabilised and planted battered slope, varying in height from 18 m to 24 m.

Normal entry to the seam will be via two adits , one for the transport of men and materials, and the other for the conveyor belt to transport coal. The adits are shown in Figure 4.10.

The portals will be of reinforced concrete construction and will extend into the adit until competent strata are reached. A concrete upstand will be provided to prevent upslope surface material entering the mine.

A third entry into the seam will serve as an alternative means of egress in times of emergency. The main ventilation shaft will be located above the entry. The ventilation shaft and second means of egress is located to the south of the two main adits, as shown in Figure 4.10.

Topsoil removed in the establishment operation will be stockpiled for later use in rehabilitation of the surface facilities sites. Rock and other material will be used as fill on the site.

Until the coal preparation plant is commissioned, any coal produced will be sold raw.

4.5.7 Building and Structures

The locations of the main buildings and structures proposed are shown in

Figure 4.8, while Figure 4.11 and Plate 4 provide an indication of their appearance and scale. The buildings include the coal preparation plant and associated workshop and laboratory, administration office, bath house, truck repair shop and workshop and stores complex.

The office will be of single storey construction with concrete block external walls. All other buildings will be steel framed and clad with Colorbond-type sheeting. A sandwich-type cladding incorporating enhanced sound absorption characteristics is proposed for the coal preparation plant.

In addition, the following structures will be erected - a breaker house, three raw coal storage bins each of 250 t capacity, conveyor gantries, 350 t washed coal and 200 t refuse outloading bins, truck washing station and weighbridge, transformer yard and switchroom, sewage treatment plant and a thickener tank. A 5 000 t capacity raw coal stockpile pad and 10 000 t capacity washed coal stockpile pad will be located along the northern boundary of the site.

Four dams will be constructed, namely:

- i. A 1500 m³ emergency storage dam for storage of water normally contained in the coal preparation plant.
- ii. A 4200 m³ mine water storage dam.
- iii. A 5500 m³ fresh water dam.
- iv. A 4000 m³ site runoff dam.

Plate 5 pictures a similar-sized surface facilities layout operated by the Company.

4.5.8 Road Network

The road network on the site and the connecting link to Scenic Drive and the Swansea Opencut is shown in Figure 4.7. The access road which is to be located along the flank of a steep-sided ridge and for most of its route will be constructed in cut. Excavated material will be used where necessary to form a bund wall along the ridge to reduce noise levels off-site. The road will be 10 m wide with a 7 m bitumen seal. Maximum grades will be IV:8H with an average grade of IV:18H. Guard rails will

be erected as required. Semi-circular catch drains 0.3 m in diameter will collect all road runoff and direct it to a 700 m³ sedimentation dam located east of the surface facilities.

The continuation of the access road to the site car parks and the road loops for truck loading operations will be bitumen sealed. All other roads and trafficked areas will be constructed of compacted fill provided with a crushed rock running surface. Semi-circular concrete drains 0.3 m deep will be provided for all roads to direct runoff to the sedimentation dam for treatment. A truck washing station will clean trucks leaving the site carrying coal or refuse. Runoff from this area will pass to an oil and grit arrestor before being discharged to the sedimentation dam via the road drains. This dam has a capacity to accept one weeks discharge from the washing station, allowing for normal storm runoff.

4.5.9 Raw Coal Handling

The flow chart for raw coal handling is shown in Figure 4.12.

Raw coal will be delivered from the mine at a maximum rate of 1 000 t/h by a conveyor belt feeding directly into a rotary breaker. The breaker will be housed in a steel-sheeted enclosure to prevent dust transmission.

The ROM coal will be crushed to minus 38 mm. Large pieces of stone and tramp material will be discarded as refuse and fed into a three sided concrete hopper located adjacent to the breaker. The hopper will be periodically emptied and the refuse trucked to the opencut for disposal. To minimise the production of fines a raw coal sizing screen will be located upstream of the breaker to bypass most of the minus 38 mm fraction.

The crushed coal will be transported on a 1 000 t/h conveyor to three totally enclosed low profile 250 t capacity surge bins. Space exists for two additional surge bins to be added to the plant at a later time. A vibrating feeder of 450 t/h capacity services each surge bin discharging the raw coal onto a trash screen feed conveyor. The trash screen, located in the conveyor transfer tower, will remove any oversize material that may have passed the breaker and discharge to a hopper at ground level. The coal will be fed onto a 375 t/h plant feeder conveyor at the transfer tower.



Plate 5: A similar-sized Colliery operated by the Company.

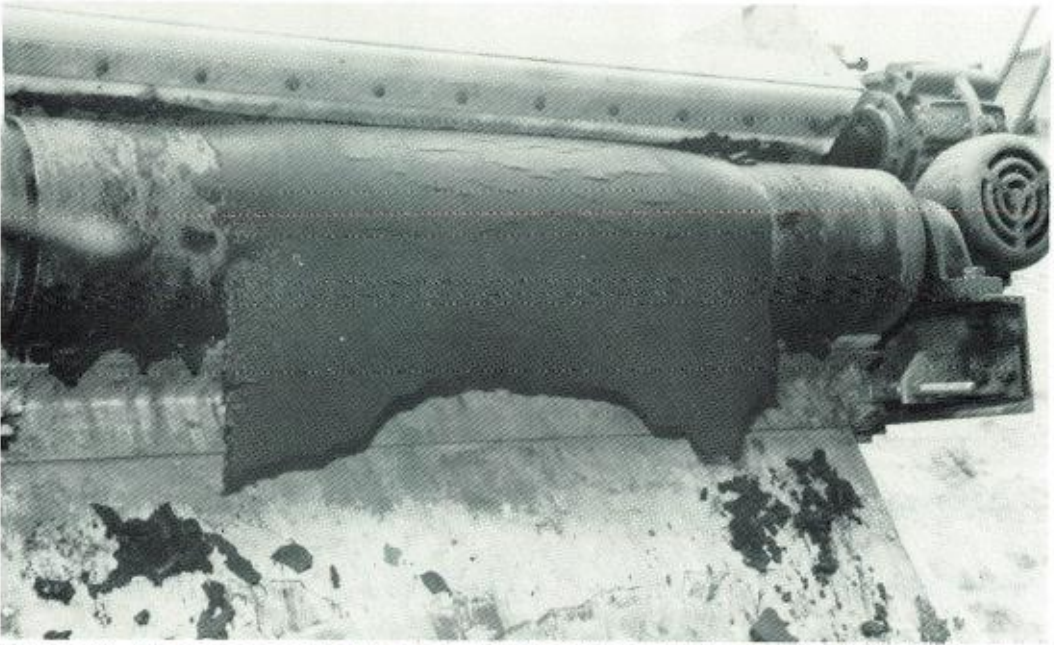


Plate 6: Dewatered Tailings in 'Filter Cake' Form at a Pilot Plant.



Plate 7: 'Filter Cake' Product ready for transport at a Pilot Plant.

The conveyors handling the raw coal will be covered on both the top and southern or windward sides. All transfer chutes will be totally enclosed to prevent dust emissions. All enclosures are to be constructed of a noise absorbing steel cladding such as 'Ondulit'. At all transfer points fine mist water sprays will be used to control dust generation. The runoff will be collected and passed via an oil and grit arrestor to the sedimentation dam. All drives on equipment will be by electric motors.

The design of the handling system will minimise the height of fall in transfer chutes and where possible avoid direct impact of coal onto metal.

An emergency coal stockpile with a capacity to handle 5 000 t of ROM coal will be provided to ensure continuity of mine production in the event of prolonged breakdown of the rotary breaker, handling or preparation facilities. A 1 000 t/h conveyor will direct coal to an 18 m high rill tower for stockpile initiation. Prior to discharging from the stockpile conveyor, the coal will be sprayed with an agglomerating chemical at the head chute. A system of automatically controlled water sprays mounted on the conveyor gantries will limit dust generation from the stockpile. Details of the spray systems are provided in Section 6.3.2. A reclaim tunnel housing a 450 t/h vibrating feeder reclaims the coal onto a conveyor. The reclaim conveyor will return the coal to the 1 000 t/h raw coal conveyor that feeds the rotary breaker.

4.5.10 Coal Preparation Plant

Details of the coal preparation plant and coal treatment processes are presented in Figures 4.12, 4.13 and 4.14. A list of equipment used is provided in Appendix 4.

Raw coal will be conveyed from the surge bins to two rotary scrubbers to ensure that the coal is thoroughly wetted and clay lumps and soft mudstone broken down into fines prior to desliming. This will provide a minus 0.5 mm x 38 mm feed to the heavy medium cyclones and a minus 0.5 mm feed for the water washing cyclones.

The large fraction will be separated with a magnetite medium in 700 mm diameter cyclones. Washed coal overflow will be rinsed and dewatered on sieve bends and screens, and further dewatered in centrifuges before being conveyed to storage. The refuse underflow will be separated at 13 mm, the 13 mm x 38 mm fraction passing directly to a refuse conveyor, and the 0.5 m x 13 mm fraction undergoing further dewatering in centrifuges prior to discharge to the refuse conveyor.

The minus 0.5 mm fraction from the desliming screens will be cyclone classified, the minus 0.1 mm portion being directed to a tailings thickener. The 0.1 mm x 0.5 mm fraction will be washed in 'water only' cyclones with underflow directed to the thickener and washed coal overflow after dewatering being conveyed to the washed coal storage.

After thickening, the minus 0.1 mm fraction will be dried with the aid of a flocculant and band press filters, yielding a filter cake of approximately 30 per cent moisture. Plate 5 shows a similar filter cake produced from a pilot plant. Appendix 17 provides details of the operation of the band press filter. This system obviates the need for the customary tailings dams. The filter cake will be mixed in a paddle mixer with the previously separated 0.5 mm x 38 mm refuse, providing a relatively dry mix suitable for road transport. It is anticipated that the final moisture content will be approximately 15 per cent. The refuse will be moved on the outloading conveyor to a 200 t bin for transfer to 20 t capacity trucks.

All equipment has been selected in an attempt to minimise noise generation. Average source noise levels within the plant should not exceed 90 dB(A).

4.5.11 Product Handling

Washed coal will leave the preparation plant on a 700 t/h outloading conveyor feeding a 350 t capacity bin for subsequent loading into normal 25 t capacity highway trucks. The capacity of the outloading conveyor allows for reclaiming of stockpiled coal at a rate of up to 700 t/h. When the bin is full the coal will be diverted to a 10 000 t stockpile by a 340 t/h conveyor feeding two 18 mm high rill towers. The conveyors

will be sheeted on the top and southern or windward side to minimise dust from coal movement.

The product will be reclaimed via a reclaim tunnel and directed to the out-loading conveyor and thence into the 350 t road bin.

Dust and noise controls will be similar to those proposed for the raw coal handling system. They include the enclosing of transfer points, provision of electric drives on conveyors, lining of transfer chutes and watering of stockpiled coal.

4.5.12 Coal Transportation

The proposed transport routes are shown in Figure 4.1.

Short Term

In the development stages prior to the commissioning of the coal preparation plant raw coal will be sold on the domestic market.

If sold to the N.S.W. Electricity Commission for use in the Vales Point Power Station, trucks will use Scenic Drive, the Pacific Highway, Vales Road and Rutleys Road.

In the case of sales to Coal & Allied Operations Pty. Limited, the route will follow Scenic Drive, the Pacific Highway and the private road to the Catherine Hill Bay coal preparation plant.

The haulage operation will occupy approximately three months and require 32 return trips daily between 7 am and 6 pm, 5d/wk.

Long Term

Once the preparation plant is operating washed coal will be transported by normal 25 t capacity highway trucks from the Colliery to the Wallamaine Colliery rail siding at Morisset, a distance of approximately 30 km. The route will be Scenic Drive, Pacific Highway, Vales Road, Rutleys Road and Hue Hue Road (MR 217).

At full production this operation will involve 136 return truck trips per day, between 7 am and 6 pm, 5d/wk.

Coal delivered to the siding will be loaded into SRA wagons for transport to the Port Waratah Coal Services facilities at Newcastle, a distance of 50 km.

4.5.13 Coal Rejects Disposal

Properties and Quantities

It is estimated that rejects from the coal preparation plant will amount to 25 per cent of the mine output. At full production, this represents a quantity of approximately 250 000 t/a. It is estimated that 20 per cent of the rejects will be fines of less than 0.5 mm in diameter while the remainder will be within the 0.5 m to 38 mm size range.

Table 4.13 details the quantities of rejects which will be produced during the development stages of the operation.

TABLE 4.13

ESTIMATED PRODUCTION OF COAL REJECTS

Production Stage*	Production ROM (t)	Coarse (t)	Rejects Fines (t)	Total (t)
Stage 1	99 000	19 800	4 950	24 750
Stage 2	198 000	39 600	9 900	49 500
Stage 3	297 000	59 400	14 850	74 250
Stage 4	396 000	79 200	19 800	99 000
Stage 5	495 000	99 000	24 750	123 750
Annual Production	990 000	198 000	49 500	247 500

* Each stage represents a 6 month period.

The chemical composition of the rejects is summarised in Section 5.5.3. The analyses conducted indicate that the reject composition will not vary markedly from that of the overburden material in the Swansea Opencut.

The moisture content of the coarse and fine rejects will be 7 per cent and 30 per cent respectively before mixing in the paddle mixer. The final moisture content of the filter cake will be a maximum of 15 per cent which will provide a mix suitable for road transport. Plates 6 and 7 show the likely form of the filter cake. Details of the compaction properties of the rejects are presented in Section 6.4.

Disposal Sites and Methods

Numerous abandoned and operating quarries and other disturbed and scarred areas exist in the vicinity of the proposed colliery. Details of the evaluation of each site are provided in Section 6.4.

The sites proposed for rejects disposal in order of filling are listed in Table 4.14.

TABLE 4.14

PROPOSED REJECTS DISPOSAL SITES

Site	Estimated Life (y)	Distance from underground mine (km)
Swansea Opencut	16.3	2.5
The Adit	0.4	1.2
Radar Hill	<u>1.4</u>	4.0
Total	18.1	

The three areas nominated are adequate to allow disposal of the rejects produced over 18.1 years of operation.

Experience at other collieries owned by the Company indicates a substantial quantity of reject material is saleable for use as fill or road base. Consequently, the above capacity would appear to be sufficient for the planned life of the mine.

In the event of more disposal volume being required, further potential

sites have been assessed, one on the western side of the Pacific Highway and another presently in use as a quarry by Lake Macquarie Municipal Council.

To achieve maximum disposal life at the sites and minimise the opportunity for spontaneous combustion the rejects will be dumped in thin layers not exceeding 600 mm and then compacted by a self-propelled compactor to achieve a density of approximately 2 t/m³. Details of the operation are presented in Section 6.4.

4.5.14 Service Requirements

Introduction

The services required during construction and operational phases are indicated in Table 4.15

TABLE 4.15

SERVICES

Service	Supply	Quantity
Construction		
Water	Hunter District Water Board	
Power	Shortland County Council	
Sewage	Portable units	
Operation		
Water - Potable	Hunter District Water Board	10.5 ML/a
Process	Runoff and mine water	202 ML/a
Power	Shortland County Council	11x10 ⁶ kWh/a
Sewage	On-site package plant	50 KL/d

Water

Two tanks of 250 000 L and 5 000 L capacity located below the ridgeline adjacent to the mine access road and as shown in Figure 4.7 will be used to supply clean water for both potable and underground purposes at the

required pressure. Potable water will be pumped from the HDWB's 4.5 ML reservoir at Caves Beach. Back siphonage will be prevented by a break in the line. The tank sizes and location comply with the requirements of the Coal Mines Regulations Act 1912, in terms of volume and pressure of the water supply.

The larger tank will be supplied with water from the clean water storage dam on site and according to demand will be supplemented by town water from the smaller tank. Both tanks will be maintained in a full condition. Water from the 250 000 L tank will be used for both general underground use and in the case of emergencies. The 5 000 L tank will satisfy the requirements of the workforce amenities.

All other requirements will generally be supplied from storm runoff and water pumped from underground, supplemented by water from the storage tanks as necessary.

Power

Power will be obtained from the SCC's main transmission line located approximately 1 km north of the mine as shown in Figure 4.7. Power will be transmitted via a 33 kV line terminating at a 10 MVA sub-station and distribution switchroom located in the northern corner of the surface facilities site.

Sewage Treatment

Sewage from the bath house, office and coal preparation plant together with washing from the workshop and truck repair shop will be piped to a 52 000 L holding tank. The tank will be able to handle one days waste production plus an additional 10 per cent surcharge. From there the waste will be fed at a constant rate of 0.6 L/s to a 'package type' sewage treatment plant, and thence discharged to a maturation lagoon via a chlorine contact tank. The lagoon will have a capacity of 400 m³ providing one weeks detention of treated effluent. The effluent will be used in the irrigation of the landscaped areas.

Ancillary Services

- i. *Firefighting Facilities:* A fire station equipped with appropriate fire fighting equipment will be located near the road entry to the mine. This equipment will be available for both surface and underground uses. Additionally, on the surface, appropriate fire extinguishers will be located at potentially hazardous areas such as fuel storage tanks, electrical equipment and in all mobile plants.

The perimeter water main will be a minimum 50 mm diameter and fire hydrants will be spaced at 100 m centres. Hydrants will also be spaced at strategic locations along the 100 mm diameter underground line. All installation will be in accordance with the NSW Fire Brigade regulations.

- ii. *First Aid:* A first aid room will be located in the main bathroom and qualified first aid men will be available on each shift to treat any injured employee.

- iii. *Eating Facilities:* Suitable facilities for employees to eat their meals will be provided in the store/workshop area, the truck shed and the coal preparation plant.

- iv. *Garbage Disposal:* Industrial waste will be deposited in hoppers and removed on a regular basis by a garbage disposal contractor.

- v. *Telecommunications:* Internal communication will be by a private 50 line PABX automatic telephone system with intrinsically safe circuitry for all telephones underground. A remote radio type paging system for selected personnel will be used in conjunction with the automatic telephone system.

A push button operated electrically connected 'Clear Call' system will be used in the washing plant and stockpile areas to enable effective communication alongside operating machinery.

External communication will be by three external telephone lines. The individual lines will be connected to a switchboard in the main office block. The external lines will be 'switched' to safety and control personnel out of office hours.

4.5.15 Construction

It is anticipated that construction of the coal preparation plant and surface facilities will commence early in 1982 and continue for 16 months.

The peak construction workforce of 77 personnel will occur 11 months after commencement, while a workforce in excess of 50 will occur over a five month period. Details of the development schedule are shown in Table 4.1, while the composition of the construction workforce is shown in Table 4.16. It is estimated that from 35 to 60 per cent of the construction workforce will be recruited from the local area. The remainder of the workforce will seek accommodation in the district for the construction period.

TABLE 4.16

ESTIMATED CONSTRUCTION WORKFORCE

	Months															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Trades Assistants	4	6	6	5	5	10	17	21	31	34	36	31	18	7	8	6
Tradesmen	-	2	2	5	5	10	21	27	28	33	33	29	17	8	4	3
Supervision	1	2	2	2	2	4	5	6	7	7	8	8	6	6	2	1
Total	5	10	10	12	12	24	43	54	66	74	77	68	41	21	14	10

Construction plant will be brought to the site by road transport along the Pacific Highway to Scenic Drive and then along the mine access road. As contracts have not been let, it is difficult to estimate the proportion of material which would be transported from Sydney and that from Newcastle.

However, no construction plant will travel through the residential area of Caves Beach. Construction plant will consist of pre-fabricated steel sections, earthmoving plant, temporary buildings and the necessary materials for the construction of the coal handling facilities, preparation plant and other surface facilities.

Table 4.17 provides an estimate of the type and number of heavy traffic likely to be generated over the 16 months construction period.

TABLE 4.17

ESTIMATED HEAVY CONSTRUCTION TRAFFIC

Type	Number
Concrete and brickwork	1 020
Reinforcement	21
Storage tanks	3
Trestles	42
Conveyor equipment	10
Steelwork	52
Equipment parts	128
Electrical	20
Pipework	18
Sewerage	2
Fencing and landscaping	5
Civil work equipment	12
Road base	21
Bitumen	4
Three mining units	60
Partly loaded trucks	<u>200</u>
	1 618

4.5.16 Permanent Workforce

Table 4.18 lists the layout requirement at full production of the mine and coal preparation plant. The workforce will ultimately total 254 persons.

The Company is to operate a training scheme in order to maintain a sufficient level of skilled personnel. Details of this scheme are provided in Section 6.6.2.

TABLE 4.18

ESTIMATED PERMANENT WORKFORCE AT FULL PRODUCTION

Classification	Number	
<u>Management:</u>		
Manager	1	
Deputy Manager	<u>1</u>	2
<u>Staff:</u>		
Undermanagers (one per shift)	3	
Assistant Undermanager	1	
Mechanical Engineer (in charge)	1	
Electrical Engineer (in charge)	1	
Shift Engineers	2	
Maintenance Engineer (underground)	1	
Coal Preparation Plant Supervisors	2	
Maintenance Engineer (coal preparation plant)	1	
Surface Foreman	1	
Surveyor	1	
Safety and Training Officer	1	
Chemist	1	
Chief Clerk	1	
Assistant Purchasing Officer	1	
Office Clerks (including Switch Board Operator/Typist)	4	
Stores Clerks	2	
Assistant Surveyors	<u>3</u>	27
Deputies		18
<u>Miners' Federation:</u>		
Underground	125	
Surface	2	
Bathroom Attendant	1	
Gardener	<u>1</u>	129
<u>Engineer Fitters:</u>		
Underground	22	
Coal Preparation Plant	6	
Surface (Workshop etc. including one apprentice)	<u>9</u>	37
<u>Electrical Fitters:</u>		
Underground	15	
Coal Preparation Plant	1	
Surface (Workshop etc. including one apprentice)	<u>5</u>	21
<u>Mine Mechanics:</u>		
Coal Preparation Plant	8	
Coal Handling and Stockpiling	2	
Samples	2	
Lorry Drivers	5	
Lorry Maintenance	1	
Mobile Equipment Operators	<u>2</u>	20
<u>Total</u>		<u>254</u>

4.5.17 Hours of Operation

Mining and coal preparation will be carried out on two production shifts of 7h/d with a third shift for maintenance. These activities will continue 5d/wk.

Shift times will be 7 am to 2 pm and 2 pm to 9 pm for production and 11 pm to 6 am for maintenance.

Coal haulage to the rail siding and rejects haulage to the disposal site will be carried out between 7 am and 6 pm 5d/wk.

4.5.18 Landscaping and Post-Mining Rehabilitation

The Company proposes to landscape all areas within the surface facilities site which are not required for the operation of the mine. In total, the area of planting amounts to approximately 3.8 ha or 40 per cent of the site area. Native plant material, preferably indigenous, will be used. Banks and road cuttings will be hydroseeded with a mixture of grasses and shrubs to ensure stability. Amenity and shade tree planting will be provided around buildings and the car park.

The main access road will be screened with a bund wall where exposed to view by plantings of shrubs and trees. The power line will be screened from the Caves Beach area by plantings of indigenous trees. Any damage caused by the construction of these services will be repaired.

A gardener will be employed on a full-time basis to maintain the landscaped areas.

At the cessation of mining all buildings and structures not required in the post-mining land use will be dismantled and removed and the site will be rehabilitated to harmonise with natural landscape.

Further details of the landscaping and rehabilitation proposals are outlined in Sections 6.2 and 6.3 respectively.

4.5.19 Energy Use

When in full production the mining operation will have a primary energy requirement of 147×10^6 MJ/a.

This will be comprised of 11×10^6 kWh of electrical energy, 220 000 L of diesel fuel, 99 000 L of lubricating oils and 6 000 kg of grease.

The energy equivalent of $12 460 \times 10^6$ MJ/a will be lost during the mining operation due to incomplete mine recovery and coal discarded as part of the coal preparation plant rejects.

4.6 WALLAMAINE COLLIERY RAIL SIDING

It is proposed to construct a rail siding and washed coal storage area adjacent to the Main Northern Railway south of the Morisset Golf Club. Road access will be from Hue Hue Road (MR 217).

This facility will be the subject of a separate Environmental Impact Statement. A conceptual layout is shown in Figure 4.15.

Coal will be delivered to the site by road and dumped into a ground level receival hopper. A conveyor will transfer the coal to a storage area where a mechanical stacker will create a stockpile of approximately 55 000 t capacity. The product will be mechanically reclaimed onto conveyors as required for train loading and delivered to a 750 t surge bin for discharge to the coal wagons.

The fully automated system will require minimal manning. It will have the capacity to load 42 CHS wagon unit trains of 3 200 t capacity in one hour.

Present planning provides for empty trains turning at the existing Vales Point rail loop to the south.

Discussions are being conducted with the relevant Government Departments on this matter. Siding length, track gradient and other details will be in accordance with SRA standards.

Existing Environment

5.1 SUMMARY OF THE EXISTING ENVIRONMENT AND POTENTIAL CONSTRAINTS

This section of the statement presents the results of baseline field and laboratory studies of the existing environment of the proposed mine site and the surrounding subregion. Aspects considered include physiographical, geological, chemical, hydrological, meteorological, ecological, visual, social, economic, planning and land use.

The objectives were to identify any potential constraints imposed by the environment as a whole on the proposed development. Important features having a bearing on the Company's proposal are summarised below:

Topography

The Colliery Holding occupies a dissected terrain comprising a complex, north-south orientated ridge with a mean height of 80 m AHD. To the west the land falls away to Lake Macquarie and to the east to the Pacific Ocean.

Site

The proposed surface facilities site comprises an area of 10.12 ha, contained by ridges up to 100 m in height to the northeast, northwest and southwest. Site elevations range from 18 m AHD to 36 m AHD.

The Swansea Opencut site is situated at the top of a northwest-southeast trending ridgeline, varying in elevation from 40 m AHD to 112 m AHD.

Geology

The site is situated on the eastern limb of the generally north-south trending Macquarie Syncline, a major structural element of the Newcastle coalfields. The full stratigraphic sequence of the Permian Newcastle Coal Measures is represented within the site area.

Soil Erosion

Duplex and gradational profile type soils dominate the study area. The duplex soils have a high erosion potential whilst for gradational soils this is low to moderate.

Overburden Properties

Overburden material obtained from the Swansea Opencut is inert and contains no toxic levels of the element for which analysis was conducted. It is low in nutrient levels. Mechanical and chemical treatment will be necessary to avert potential drainage and erosion problems.

Drainage

The Colliery Holding has a low drainage density and comprises a network of short intermittent watercourses flowing either to Lake Macquarie or the Pacific Ocean. The surface facilities catchment area drains in a southeasterly direction into a lagoon behind Pinney Beach.

Microclimate

The surface facilities site is located in a natural amphitheatre open to the southeast. This increases local precipitation and provides shelter from hot dry northwesterly winds. Consequently, high soil moisture levels are maintained. The Swansea Opencut is sheltered from southeasterly winds but exposed to northwesterlies. Soil moisture levels are considerably lower than at the surface facilities site.

Air Quality

Monitoring for dust revealed that fallout levels are low. More than 50 per cent of the collected material was organic.

Background Noise Levels

Background noise levels (L_{90}) varied from a night time low of 33 dB(A) to a daytime high of 42 dB(A).

The Ecosystem

Seventeen vegetation communities were defined in the Colliery Holding. Virtually all vegetation consists of regrowth after logging. The area is dominated by open-forest communities. At the time of study, bird populations were low due partly to the lack of plant flowering.

Ecological Relationships

The Colliery Holding forms part of a naturally vegetated unit which remains valuable as a result of the great diversity of flora and fauna. Most vegetation alliances are adequately conserved elsewhere in the State. Eight plants occurring in the area are protected species, whilst two bird and mammal species are regarded as rare or scarce.

Landscape and Visual Aspects

The Colliery Holding is considered to be within a strategic recreational location between the urbanised areas of Newcastle and Gosford-Wyong. Within the Holding, the coastal foreshores, the Lake surrounds and the densely vegetated steep ridgelines are considered to be of high visual quality. Within the site itself, eight landscape units were identified, three of which were considered to be of high visual quality. These were: forested slopes, ridges and valleys; Pinney Beach; protected gullies and watercourses.

Population

The population of Lake Macquarie Municipality in 1976 was 134 400 and the population within a 5 km radius of the surface facilities site was 3348. Between 1971-1976, Lake Macquarie grew at 1.5 per cent.

Employment

In employment terms, manufacturing, retailing and mining are important industries in both Lake Macquarie Municipality and the area adjacent to the Colliery Holding. In both areas, the greatest proportion of breadwinners fall into the process worker occupational category. In November 1980, the nearby Charlestown CES office recorded a total of 2034 persons unemployed with almost half of these falling into the young female clerical/administration and adult male semi-skilled categories.

Regional Planning

The Colliery Holding forms part of a 'green corridor' and 'intercity environmental zone', both proposed in the Hunter Regional Plan. The latter is intended as a buffer zone between the urban areas of the Central Coast and Newcastle.

Local Planning

The Colliery Holding and adjacent areas are zoned 'Non-urban 'A' under the Northumberland County District Planning Scheme. The Lake Macquarie Municipal Council's Draft Environmental Planning Instrument, due for gazettal in 1981 proposes a 'Rural A' zoning for the surface facilities site, but proposes a residential zoning for the majority of the Swansea Opencut and surrounding area.

Urban Areas

The suburban area of Caves Beach is located 2 km from the proposed underground mine site and 1 km from the abandoned Swansea Opencut. Four small villages also exist within 4 km of the mine site. These are Catherine Hill Bay - Middle Camp, Nords Wharf - Cams Wharf.

Industrial

A small industrial estate has been established at Caves Beach. Currently two industries have established premises there.

Retailing and Commercial

Lower order goods are offered at Caves Beach, whilst nearby Swansea and Belmont offer a wide range of low and middle order goods.

Special Uses

Camp Yondaio, a recreational facility operated by the Church of England is located to the immediate south of the proposed mine site. Part of its northern boundary abuts the mine site boundary. It is largely an area of

bushland extending to Pinney Beach and is used extensively for organised camping, educational purposes and 'wilderness' experience.

Accommodation

Lake Macquarie Municipality is currently experiencing a shortage in the low to medium cost housing classes. Rental accommodation particularly, is in short supply. Temporary accommodation such as hotels, motels and caravan park facilities are currently extended.

Education

The area within the vicinity of the Colliery Holding is served by a pre-school, primary school and high school. Currently, only the high school is experiencing accommodation stress.

Health Services

Lake Macquarie Municipality is experiencing a deficit in hospital beds, but on a regional basis, Newcastle City had a large surplus and was able to provide the additional required services. Community health and baby health facilities are also overtaxed.

Recreation

The Colliery Holding and adjacent area possesses a wide range of informal recreational facilities associated largely with the Lake and ocean foreshores. Formal recreational facilities are limited. In Lake Macquarie Municipality tennis, football, hockey and cricket facilities are experiencing excess demand.

Transportation Network and Services

The Pacific Highway bisects the Colliery Holding, while access to both the Swansea Opencut and the surface facilities site is gained from Scenic Drive. The site is not served by railway.

Electricity and water reticulation is available by extension from the existing service at Caves Beach.

Coal Transport and Port Infrastructure

11.57 Mt of saleable coal was transported within the Newcastle coal mining district during 1977-78.

The construction of the third coal loader planned for Kooragang Island will provide sufficient capacity for the export of coal from new projects.

5.2 PHYSIOGRAPHY

5.2.1 Subregional Topography

The Colliery Holding is located approximately 4 km south of Swansea on the narrow section of land separating Lake Macquarie from the Pacific Ocean. Figure 5.1 shows the dissected nature of the terrain comprising a complex, north-south orientated ridge system with an average height of approximately 80 m AHD.

To the west the land slopes to Lake Macquarie and to the east to the Pacific Ocean. The coastline consists of rocky headlands with wave cut platforms between Caves Beach to the north and Catherine Hill Bay to the south. Pinney Beach and the accumulated sand behind Spoon Rocks breakwater are the only exceptions to this statement.

5.2.2 Site Topography

The surface facilities site comprises an area of 10.12 ha and is contained by ridges up to 100 m in height to the northeast, northwest and southwest. The site is open to the southeast and is separated from Pinney Beach by two low ridges. Site elevations rise from approximately 18 m AHD at the southwestern corner, to a maximum of approximately 36 m at the northeastern corner.

The Swansea Opencut site is situated at the top of a northwest-southwest trending ridgeline which varies in elevation from a maximum of 112 m AHD in the vicinity of the tourist lookout to a height of 40 m in the northwest portion of the site. The adjacent tourist lookout is the highest point in the subregion.

5.2.3 Slope Distribution

The distribution of slopes within the Colliery Holding and immediate environs is shown in Figure 5.2 and described in Table 5.1.

Most of the area is undulating to steep in character with 39 per cent of the gradients exceeding 10 degrees. The steeper slopes are associated with the centrally located main ridgeline which the Pacific Highway and Scenic Drive traverse. Slopes are more gradual along the coastal and Lake Macquarie foreshores.

The proposed surface facilities site is located largely on land with slopes between 5 degrees and 10 degrees, while the road access and powerline route will cross areas with slopes exceeding 18 degrees.

TABLE 5.1

AREA OF LAND WITHIN EACH SLOPE CLASS

Slope Range (Degrees)	Class Definition	Area (ha)	Percentage
0 - 2	Drainage may be impeded	44	4
2 - 5	Moderate erosion potential *	388	28
5 - 10	High erosion potential *	396	29
10 - 18	Grazing only - no tillage	381	28
>18	Clearing requires permission from the Soil Conservation Service.	152	11
Total		1 361	100

* Subject to removal of vegetation.

Previous mining activity has lowered the floor of the Swansea Opencut up to 30 m below original contours. Adjacent natural slopes generally exceed 10 degrees and often exceed 18 degrees.

5.2.4 Disturbed Areas

The study area has been subject to prior mining as indicated previously. The abandoned Radar Hill and Swansea opencuts are the result of earlier coal extraction, whilst numerous small excavations to the west of the Pacific Highway represent active or exhausted clay pits.

5.3 GEOLOGY

5.3.1 Regional Geology

The site is situated on the eastern limb of the generally north-south trending Macquarie Syncline, a major structural element of the Newcastle coalfields.

The regional dip is to the west and southwest with coal seams dipping at about four degrees. The regional fault pattern, the igneous dyke trends and the major joint and cleat trends are northwest-southeast.

The full stratigraphic sequence of the Permian Newcastle Coal Measures is represented within the site area. This comprises a sequence of conglomerates, sandstones, mudstones, shales, claystones, tuffs and 14 main coal seams and varies in thickness from 100 m at Awaba to 400 m at Swansea.

The Newcastle Coal Measures are underlain by the Tomago Coal Measures and overlain by Triassic sediments.

5.3.2 Site Geology

The coal seams of the uppermost unit of the Newcastle Coal Measures, the Moon Island Beach Sub-Group, crop out across the area of the Colliery

Holding. The main seams of this unit in descending order are:

- i. Wallarah Seam
- ii. Great Northern Seam
- iii. Chain Valley Seam
- iv. Fassifern Seam.

Figure 4.3 shows the inferred outcrop of three of these seams and also a typical east-west orientated stratigraphic section across the site. Figure 4.4 presents graphic sections of DDH's 1, 2 and 3, showing the relationship of the four main seams of the Moon Island Beach Sub-Group and the composition of the floor and roof material.

The Wallarah Seam crops out on ridges in the central part of the area and on lower ground in the west towards Lake Macquarie. The immediate floor of the Wallarah Seam and its lower splits comprises soft tuffaceous claystone and fine sandstone. Conglomerates and coarse sandstones occur in the Wallarah to Great Northern interseam interval over the entire area, and are confined in the Chain Valley to Fassifern interseam interval towards the southwest. Over most of the area the Chain Valley to Fassifern interseam interval is relatively thin (about 4 to 6 m) and comprises micaceous fine grained sandstone and claystone.

The Fassifern Seam crops out on the sides of ridges and valleys in the eastern part of the area. The immediate stone floor of the Fassifern Seam comprises tuffaceous claystone which breaks down rapidly on exposure.

The Australasian Seam, the uppermost seam of the Adamstown Sub-Group, occurs 150 m below the Fassifern Seam at this location.

The Lambton Sub-Group occurs at depth in the Wallamaine area.

5.4 SOILS

5.4.1 Soil Types

Duplex and gradational profile-type soils dominate the study area defined

in Figure 5.3. To the east, duplex soils occupy the flatter lower slopes. They are characterised by brown or grey loamy topsoils of 50 to 350 mm depth and medium to heavy clay subsoils in a variety of colours. They have a high erosion potential. To the west the duplex soils are more freely drained with sandy loam topsoils of 300 mm depth over light clays, usually of red or orange colour. They have a moderate erosion potential.

Gradational profiles exist on flatter ridge tops generally above 80 m and on steep middle slopes to the east. They are freely draining with sandy to sandy loam topsoils. Their erosion potential is moderate to low.

A detailed discussion of soil distribution and characteristics is provided in Appendix 5.

5.4.2 Chemical Composition of Soils

Six representative surface soils were collected from the locations shown on Figure 5.3 and tested to determine their suitability for use in subsequent landscaping. The analytical results and detailed interpretation are provided in Appendix 6.

The soils are acid in reaction with a mean pH of 5.3. They are not saline and do not contain toxic levels of any elements for which analysis was undertaken. They have a low nutrient status, containing only small amounts of nitrate and phosphorus. The levels analysed indicate that fertilizer application will be necessary if the soils are to be used in rehabilitation and landscaping works. Extractable calcium to magnesium ratios indicate that the soils are likely to be structurally unstable and will break down readily upon wetting.

5.4.3 Topsoil Availability

The soil sampling programme indicated that for the surface facilities site, topsoil depth varies from an average depth of 200 mm for the northern portion to an average depth of 400 mm in the southern section. It is likely that an average depth of 300 mm of topsoil can be removed from the site and stored for later use in rehabilitation and landscaping.

Topsoil is not present within the Swansea Opencut site and any requirements for topsoil will necessitate importation.

5.4.4 Erosion Potential

The duplex soils of D2, D3 and in particular D1 types are highly prone to erosion. D1 soils exhibit both gully and wind scald erosion. D4 soils have a lower erosion potential because of their freer drainage. Though extensive disturbance has occurred on these soils, gully and tunnel losses have been only moderate.

Of the gradational soils, the G1 type will erode if subject to channelled runoff from impervious surfaces. Because of their topographic position and free drainage, the G3 soils have a low erosion potential.

5.5 CHEMICAL PROPERTIES OF OVERBURDEN ROCKS, OXIDISED COAL AND REJECT MATERIAL

5.5.1 Overburden

Overburden analyses were undertaken to determine:

- i. its suitability as a growing medium
- ii. the likelihood of toxic leachate generation.

Five overburden samples were obtained from the proposed Swansea Opencut area. Details of analyses and results are provided in Appendix 6.

With the exception of an isolated high manganese value, which can be readily corrected during rehabilitation work, the overburden material is inert and contains no toxic levels of the elements for which analysis was conducted. It is low in nutrient levels and is predicted to be prone to clay dispersion when wet. Mechanical and chemical treatment will be necessary to avert potential drainage and erosion problems.

5.5.2 Oxidised Coal

Badly oxidised unsaleable coal will be disposed of with the overburden. One sample of the Middle Split of the Wallarah Seam was analysed, as reported further in Appendix 6.

The oxidised coal is acid in reaction, having a pH of 4.7 and contains high levels of manganese. Its other properties are similar to those of the overburden material.

5.5.3 Coal Reject Material

Coal reject material from the proposed underground mine was tested to determine its suitability for use as fill in rehabilitation of opencut areas. Details of the analysis are provided in Appendix 6.

The material was found to be alkaline in reaction, precluding the existence of heavy metals at toxic concentrations. Salinity levels according to the N.S.W. Department of Agriculture classification varied from low to medium.

The low volatile content (10.7 per cent), high ash content (66.3 per cent), and low sulphur content point to a low potential for spontaneous combustion.

5.6 HYDROLOGY

5.6.1 Surface Drainage Patterns and Catchments

The stream pattern and drainage catchments for the Colliery Holding and adjacent areas are shown on Figure 5.4. Catchment characteristics are listed in Table A7.1, Appendix 7.

The Colliery Holding has a low drainage density and comprises a network of short intermittent watercourses flowing either to Lake Macquarie or the Pacific Ocean.

The surface facilities catchment area drains in a southeasterly direction into a lagoon behind Pinney Beach. The channel to the sea is open only in periods of high precipitation.

Stream gradients above the site are generally steep. Within the site, streams have a low to moderate gradient and are incised 1 to 1.5 m below the surface. Downstream the main watercourse has a low to moderate gradient and is partly incised into bedrock.

Runoff from the abandoned Radar Hill Opencut joins the above network below the proposed surface facilities site. Gradients in the vicinity of the old workings are steep and watercourses are ill-defined.

A northeasterly trending ridge separates the surface facilities site from the Swansea Opencut. Watercourses with steep gradients divert drainage from this area into the Galgabbee Creek network which subsequently discharges into Lake Macquarie.

5.6.2 Flooding

No records exist of flooding on the sites proposed for development. Examination of the area indicates that flows are confined within the banks of stable defined channels.

5.6.3 Surface Water Quality

Surface water quality was monitored within and around the Colliery Holding as described in detail in Appendix 7.

Water draining from the Swansea Opencut was slightly acidic with moderate levels of salinity. The surface facilities site runoff was also acidic, with higher salinity readings.

5.6.4 Groundwater

Groundwater flow rates were not established on the site. Results of tests from 200 mm diameter drill holes will be provided as an addendum to this report.

The probable quality of groundwater likely to be encountered was determined by analysing a sample drawn from an adjacent colliery mining the same seam.

The water was found to be suitable for use in a coal preparation plant, but not suited to agricultural usage. Analysis details are provided in Table A7.3.

5.7 CLIMATIC ASPECTS

5.7.1 General

A detailed description of likely site meteorology is presented in Appendix 8. Data are presented in Figures 5.6 and 5.7.

The annual mean maximum temperature is 21.1° C and the equivalent minimum is 14.2° C. The mean annual relative humidity at 9 am is 74 per cent and at 3 pm is 64 per cent.

Rainfall intensity is highest during autumn and lowest during spring. Nobbys Signal Station receives an average of 1145 mm of rain per annum over 131 raindays.

Winds are predominantly southeasterly during summer and northwesterly from May to September.

Surface inversions can be expected to occur on the coast approximately 70 per cent of the time in any one year.

5.7.2 Microclimatic Influences

As a result of the study area's uneven topography, local variations exist in exposure levels to winds and solar radiation.

The surface facilities site is located in a natural amphitheatre open to the southeast. The rain bearing nature of winds originating from this

direction results in the site being well watered, in addition to there being a local increase in wind speeds. The southeasterly aspect reduces exposure to solar radiation over the upper portions of the site, in addition to providing shelter from the hot dry northwesterly winds. These factors combine to maintain high soil moisture levels throughout the year, as evidenced by the thick growth of vegetation in the gullies and on the northeast and northwest slopes.

The Swansea Opencut is sheltered from the southeast winds but is very exposed to those from the northwest. These are funnelled along the opencut, locally increasing wind speeds and generating turbulence at the southeastern end. Because of its orientation the opencut is more exposed to solar radiation. Soil moisture is therefore considerably lower than at the surface facilities site. On hot days temperatures in the opencut are considerably higher than those in the surrounding area.

5.7.3 Air Quality

Dust deposition gauges were used to assess ambient air quality as further discussed in Appendix 8.

Dust fallout levels were low, averaging $2.2 \text{ g/m}^2 \cdot \text{mth}$. More than 50 per cent of the collected material was organic, probably reflecting the prevailing drought conditions.

5.8 EXISTING NOISE ENVIRONMENT

5.8.1 Ambient Sound Levels

Ambient sound levels were determined at the seven residences nearest to the proposed development. Details of methods and results are provided in Appendix 9.

At four residences, background noise was predominantly due to birds, insects or wave action. The remaining three were influenced by vehicular

traffic on the Pacific Highway and Scenic Drive.

Background levels (L_{90}) varied from a night time low of 33 dB(A) to a daytime high of 42 dB(A).

5.8.2 Attenuation Characteristics of the Area

As detailed in Appendix 9, a study was undertaken to determine the attenuation characteristics of the area.

Sound generated on the site of the proposed surface facilities was found to be attenuated by as much as 20 dB(A) by ground absorption, when measured at various locations off site.

5.9 FLORA

5.9.1 Field Studies

Species diversity, dominance and community structure were the main characteristics examined during a four day field investigation in February 1981.

Field observations were combined with aerial photograph interpretation to produce the vegetation map shown in Figure 5.8. As ecotonal zones between vegetation communities are broad, the boundaries are less defined in fact than those presented in the map.

5.9.2 Vegetation Assemblages

Virtually all the vegetation mapped consists of regrowth after logging. Consequently, following *Specht et al (1974)* structural formations were applied in classifying vegetation types rather than using "Associations".

In all, 17 vegetation communities were defined in the area, in many cases exhibiting much variation within themselves. The list of communities is

as follows - detailed descriptions of each are provided in Appendix 10.

- i. Open-forest dominated by Spotted Gum and Grey Ironbark
- ii. Low Open-forest dominated by Spotted Gum and Bastard Mahogany
- iii. Woodland to Open-forest dominated by Scribbly Gum, Rusty Gum and Red Bloodwood
- iv. Disturbed Scribbly Gum, Rusty Gum and Red Bloodwood
- v. Wet Sclerophyll Forest with Rainforest elements
- vi. Open-forest dominated by Rusty Gums and Stringybarks
- vii. Open-scrub and Open-heath dominated by Scrub She-Oak
- viii. Open-heath and Closed-heath dominated by Ball Honey-Myrtle
- ix. Closed-grassland
- x. Regenerating easement vegetation
- xi. Closed-scrub dominated by Red Mahogany
- xii. Communities of limited extent adjacent to Pinney's Lagoon
- xiii. Open-forest dominated by Stringybarks and Grey Gum
- xiv. Open-forest dominated by Broad-leaved Paperbark and Swamp Mahogany
- xv. Cumbungi Swamp
- xvi. Cleared and disturbed land
- xvii. Abandoned mines.

5.10 FAUNA

5.10.1 Field Studies

Field studies were conducted over a four day period in February 1981. Information so gained was supplemented by sightings recorded by the caretaker of Camp Yondaio.

All species sighted or expected to occur in the area are listed in Appendix 10.

5.10.2 Avifauna

Table A10.1 lists 63 birds that have been observed on or near the site and a further 25 species that are expected to occur there.

During field studies very few individuals of any species were observed. Low numbers could partly be related to the lack of plant flowering at that time of year.

The two most common birds noted were the Lewin Honeyeater (Meliphaga lewinii) and the Australian Magpie (Gumnorhina tibicen).

Passerines make up a very large proportion of the birds recorded in the area.

The diversity of birdlife recorded and expected is a reflection of the variety of habitats available on and near the site.

5.10.3 Native Mammals, Reptiles and Amphibians

Tables A10.2 and A10.3 list a variety of mammals and reptiles known or expected to occur in the area of the proposal.

The best known mammals in the area are arboreal, though it is expected that trapping surveys would reveal a variety of small ground dwelling mammals. Larger mammals appear to be absent, probably because of development and urbanisation in the region of the site and possibly because of shooting.

A number of exotic species are established in the area, the most prevalent being the domestic cat (Felis catus).

Few reptiles have been observed in the area. It is probable that the Lace Monitor (Varanus varius) would be the most readily observed, while the garden skink (Lampropholis guichenoti) would be expected to be the most commonly occurring.

No amphibians were recorded for the area. It is expected that some species inhabit the area, particularly near the small Cumbungi Swamp south of Caves Beach and in the creeks.

5.11 ECOLOGICAL RELATIONSHIPS

5.11.1 Vegetation Distribution

The two most obvious factors affecting the distribution of plant species over the study area are exposure to salt laden winds and topography.

The greatest salt loads are borne by Closed Grassland, Open-scrub and Open-heath dominated by Scrub She-Oak. These communities are bounded on the landward side by heaths. The poor sandy soils of the coastal strip have also influenced these distributions.

Areas of forest containing Rainforest elements have developed in protected gullies particularly on the southern slopes of ridges. Such positions are protected from a significant proportion of daily sunshine. Increased shading and the associated high soil moisture levels have enabled the establishment of species common to rainforest.

The variations in environmental conditions resulting in the distribution of other communities are more subtle. This is apparent from the fact that transition zones are broad and that individuals from one community occasionally occur well within other communities. This is also a reflection of the broad tolerance ranges of many species. Soil fertility appears to be a deciding factor in the distribution of Spotted Gum, Grey Ironbark, Scribbly Gum, Rusty Gum and Red Bloodwood communities.

Other local distributions are related to specific environmental conditions. For example, the presence of Juncus maritimus and Swamp Oak near 'Pinney's Lagoon' arises from the elevated soil moisture content in that area.

5.11.2 Fauna Distribution

The study area can be divided into four broad habitat types:

i. *Coastline including beaches and rocky shore*

Of all species of terrestrial vertebrates, birds would be most likely to occur in this zone. The main bird groups expected to occur here are the raptors such as the White-breasted Sea Eagle (Haliaeetus leucogaster) and shore birds that feed on invertebrates such as the Sooty Oystercatcher (Haematopus fuliginosus).

ii. *Heathlands and Closed grassland*

Birds which would be expected to occur here include Honeyeaters, Wrens and Richard's Pipit (Anthus novae-hollandiae). Mammals and reptiles are also likely to use these habitats. The Common Scaly Foot (Pygopus lepidopus) may be confined to such areas.

iii. *Dry Sclerophyll Forest to Woodland*

This broad habitat type occupies the largest area of the site. Most of the species recorded for the area would be expected to occur here. The communities exhibit a layered structure and are variable in floristics and understorey. Arboreal mammals, ground dwelling mammals, reptiles and birds would utilise these communities.

iv. *Forest containing Rainforest Elements*

This habitat grouping occupies the least area in the locality of the site. It contains a greater diversity of plant species and damper conditions than found in the other habitats. Species expected to occur here include the Crimson Rosella (Platycercus eximius) and pigeons, the Bush Rat (Rattus fuscipes), the Brown Marsupial Mouse (Antechinus stuarti) and the Diamond Python (Morelia spilotes var spilotes).

In many cases, species utilise more than one habitat type.

5.11.3 Man's Impact on the Environment

Logging has had a significant effect on vegetation in the locality of the site. Very few old trees remain. As a result, the number of nesting and shelter sites for arboreal mammals, reptiles and birds has been reduced.

The vegetation has not returned to a climax state, particularly in the case of a number of the wet sclerophyll forest areas. Cabbage Palms growing under a dry sclerophyll canopy suggest that rainforest elements may increase in distribution given suitable shade conditions.

Frequent burning (some of which is controlled) has altered species balance in some areas.

Quarrying activities and the establishment of tracks have enhanced the spread of introduced plants. Both Bitou Bush and Lantana are common in the area. In addition, physical disturbances have exposed previously protected plants to salt-laden winds. As a result, some areas of native vegetation have been degraded.

Introduced Mammals such as the cat and Red Fox (Vulpes vulpes) have had an impact on the indigenous fauna. Being efficient predators it is likely they have reduced the numbers of ground dwelling mammals and birds. The Red Fox also competes with insectivorous native fauna.

5.11.4 Processes of Succession

Black She-Oak is colonising the abandoned mine sites in the area. With time, it is expected that conditions may alter sufficiently to enable the return of other species, leading ultimately to the re-establishment of forest and woodland similar to that occurring in the general area.

The Wet Sclerophyll Forest areas appear to be in a state of flux at present. The regrowth of Dry Sclerophyll Forest since logging has altered conditions sufficiently to encourage the re-development of some rainforest species. In the long term a number of the areas containing rainforest elements may increase in size.

The establishment of Bitou Bush may also be considered the first stage of succession in disturbed areas. Since Bitou Bush did not evolve in Australia it is unclear which, if any species will replace it with time.

5.11.5 Status of the Site and Individual Species

The study area forms part of a naturally vegetated unit bounded by the Pacific Highway, Flowers Road and Scenic Drive. The length of coastline in N.S.W. in such a relatively natural state is decreasing. Although the area has been disturbed by logging, establishment of tracks and

introduction of exotic weeds, it remains valuable as a result of the great diversity of flora and fauna.

The conservation status of alliances as described by *Specht et al (1974)* was used to rate the communities identified. On this basis, it appears most are adequately conserved elsewhere in the state. Some doubt arises with respect to the Spotted Gum, whose conservation status is arguable.

The Wet Sclerophyll Forest containing Rainforest elements is poorly to reasonably well preserved. The conservation status of the Open-heath, Closed-heath and Closed-grassland is unclear.

The following plants occurring in the area are on the New South Wales National Parks and Wildlife Service Protected Plants List;

(Flannel Flower)	<i>Actinotus helianthi</i>
(Christmas Bell)	<i>Blandfordia</i> sp
(Hyacinth Orchid)	<i>Dipodium punctatum</i>
(Gynea Lily)	<i>Doryanthes excelsa</i>
(Cabbage Palm)	<i>Livistona australis</i>
(Crinkle Bush)	<i>Lomatia silaifolia</i>
(Maidenhair Fern)	<i>Adiantum aethiopicum</i>
(Maidenhair Fern)	<i>A. hispidulum</i>

Of those birds listed in Table A10.1 the following were found by *Morris (1975)* to be rare or scarce in the Northumberland County:

Rare:	(Sooty Oystercatcher)	<i>Haematopus fuliginosus</i>
Scarce:	(Green-winged Pigeon)	<i>Chalcophaps indica</i>
	(Brown Tree Creeper)	<i>Climacteris picumnus</i>
	(Little Friarbird)	<i>Philemon citreogularis</i>
	(Tawny-crowned Honeyeater)	<i>Phylidonyris melanups</i>

Bell (1978) states that the Wonga Pigeon (*Leucosarcia melanoleuca*) is considered to be of doubtful status and some consider it to be highly vulnerable. No other threatened bird species occur on the site.

The Diamond Python, known to occur in the area, is the only reptile whose future is in any doubt.

Bell (1978) considers the Sugar Glider (*Petaurus breviceps*), the Feathertail Glider (*Acrobates pygmaeus*) and the New Holland Mouse

(*Pseudomys novaehollandiae*) to be uncommon. At present however, there is no direct evidence of their future being threatened. All other mammals occurring in the area are considered to be widespread.

5.12. LANDSCAPE AND VISUAL ASPECTS

5.12.1 Subregional Scenery

The area between Swansea and Catherine Hill Bay is diverse in landform, vegetation and land use. The site is located between two urban landscape units - 'The Metropolitan Coast' and 'The Lake' as described by *Reynders, (1978)*. It is considered to be within a strategic recreational location due to its proximity to Swansea and Caves Beach and is important in a regional context as it forms part of the inter-city environmental zone between the urbanised areas of Newcastle and Gosford-Wyong.

Based upon a visual preference survey conducted by *Radford & Bartlett (1977)*, the features considered to be of highest visual quality are the coastal foreshores, the Lake surrounds and the densely vegetated steep slopes.

Aspects within the site which are considered to lower scenic value include areas cleared of vegetation for easements and as a result of mining, eroded tracks, abandoned gravel pits and quarries and areas littered with illegally dumped household rubbish.

5.12.2 Assessment of Landscape Units

The area between Radar Hill and Caves Beach has been divided into landscape units as shown in Figure 5.9. The units were determined on the basis of topography, soils, stream pattern, vegetation and land use. Figure 5.10, which is a typical section through the site, indicates the characteristics and relationship of the units.

Eight landscape units were identified and are described in detail in Appendix 11.

The units and their visual quality ratings are listed in Table 5.2.

5.12.3 Visual Prominence

With certain exceptions, the majority of land proposed for development is hidden from view from surrounding areas.

TABLE 5.2

LANDSCAPE UNITS - VISUAL QUALITY

Landscape Unit	Visual Quality
1. Forested slopes, ridges and valleys	High
2. Disturbed frontal dune	Low
3. Heathland	Low-moderate
4. Grassland	Low
5. Pinney Beach	High
6. Protected gullies and watercourses	High
7. Cleared slopes	Low
8. Caves Beach urban	Low

The Rotary Park Twin Lookout is located adjacent to the abandoned Swansea Opencut, with the result that this feature is prominent to those visiting the lookout. Sections of the opencut are visible from Swansea, Caves Beach and from the Pacific Highway.

The proposed surface facilities site is only partially visible from the lookout. With the exception of limited sightings through breaks in vegetation lining the Pacific Highway, the valley is hidden from passing motorists. It is not visible from any residences in the area.

5.13 HISTORY

5.13.1 Pre-history and Archaeological Value of the Site

The National Parks and Wildlife Service has indicated that evidence of aboriginal activity has been found in the vicinity of the proposed development. Two sites of importance located in the Pinney Beach area, have been listed.

An archaeological survey, presented in full in Appendix 12, found no evidence of further relics in areas proposed for development as the surface facilities site and access road.

5.13.2 Historical Settlement

The history of settlement in the area south of Swansea Channel dates back to the 1840's. Its development was related largely to the existence of coal mining in the area and the transport of coal and other goods by the lake and by sea. The significance of Swansea Channel to this trading function was the basis of the growth of the area.

In the period 1840-60, a population composed of fishermen, seamen, farmers and coal traders settled in the area. However, no established community was evident.

As a result of the 1861 Land Act, which made small lots available to settlers, the Swansea area experienced a period of increased growth. A significant contribution to this growth was the transportation of coal to Sydney from newly established coal mines at Cardiff and Morisset Point.

In 1873, a coal mine was established at Catherine Hill Bay by the New Wallsend Company. This development increased trade in the area, particularly via the Speers Point - Crangan Bay ferry route. The mine was abandoned in 1877, along with others in the area, due to problems involved with the shipment of coal to Sydney. The Catherine Hill Bay mine was re-opened and extended by the Wallarah Coal Company in 1888. English miners were imported and a company-owned settlement established.

Expansion of the mines' holdings in the early 1900's resulted in a considerable portion of land bordering the coast to the north being owned by the company. Additional mine adits and settlements were established at Mine and Middle Camps.

Concurrently, Cams and Nords Wharves developed as a result of their roles in the off-loading and transportation of workers and goods for the mines. A number of miners also resided in these settlements.

The Catherine Hill Bay Mine was acquired by Coal and Allied Industries in 1957. The settlement has experienced a decline in and ageing of its population. The Mine Camp no longer exists.

Until recently, Caves Beach was predominantly associated with coal mining. Residential development resulted from the purchase of land in the area by Mr. A. Mawson in the mid 1940's. Initially up to 800 men were employed in mining activities. Plans evolved in the late 1950's for the development of an integrated residential, mining, port and resort complex, but housing remained limited until the mid 1960's.

5.14 POPULATION CHARACTERISTICS

5.14.1 Subregional

A detailed discussion of the subregion's population characteristics is provided in Appendix 13.

The Lower Hunter Subregion combines five LGA's namely the Cities of Newcastle, Maitland and Greater Cessnock, the Municipality of Lake Macquarie and the Shire of Port Stephens. Since 1954 the subregion's rate of growth has been consistently lower than the State average.

Over the periods 1966-71 and 1971-76, rates of natural increase in population remained relatively stable. Hence any variations in growth rates were related to factors affecting inward or outward migration. The

apparent reversal in the declining growth late in the 1976-79 period can thus be assumed to be largely explained by in-migration.

The progressive ageing of the Australian population is reflected at an accelerated rate in the subregion. The more recently developed residential areas such as Lake Macquarie and Port Stephens exhibit more youthful characteristics.

The population of Wyong Shire has exhibited a growth rate of six per cent or above since 1954. This is a result of very high levels of in-migration and little contribution from natural increase. In the period 1971-76 the average annual growth rate of 8.7 per cent was far in excess of the State average of 0.7 per cent.

5.14.2 Lake Macquarie Municipality

Lake Macquarie has continued to increase its proportion of the subregion's population from 17.7 per cent in 1947 to an estimated 36.9 per cent in 1979. The major growth period was between 1950 and 1970. By 1979, it was the most highly populated LGA in the subregion.

Figure 5.11 highlights the interplay of natural increase and migration factors in Lake Macquarie's population growth. The graphs reflect both the area's role as a residential district for younger families and its retirement and recreational functions.

The essentially suburban role of the municipality is further demonstrated by resident marital status, which reveals a higher proportion of married persons in the area than found in the national population.

Lake Macquarie's population has a low ethnic component. In 1976 only 10.2 per cent of the population were born overseas in comparison with a national average of 20.2 per cent. The major migrant sources were U.K. and Eire, with lesser contributions from northeast Europe, Yugoslavia, Italy and New Zealand.

5.14.3 Local Area

At the 1976 census, the area bounded approximately 3 km to the north and 5 km to the south of the proposed mine site and by Lake Macquarie to the west and the Pacific Ocean to the east was occupied by 3348 persons. The areas of residential concentration are Caves Beach, Catherine Hill Bay - Middle Camp and Nords Wharf - Cams Wharf.

Caves Beach accounted for 73 per cent of the total, reflecting its essentially suburban character. Catherine Hill Bay - Middle Camp is characterised by its role as a mining settlement, whilst Nords Wharf - Cams Wharf reflects a post-mining and recreational function, modified by recent in-migration and an extension of recreational-retirement aspects.

Caves Beach exhibits a similar but accentuated form of Lake Macquarie's demographic characteristics. At the 1976 census, differences within Caves Beach were apparent with the northern sector exhibiting a younger age profile than the central and southern sectors. At that time this difference reflected the northern areas more recent developments and its high proportion of public housing. Since 1976 the southern sector, with elevated views and higher land values has experienced a greater rate of growth which may significantly alter the nature of these differences.

Catherine Hill Bay - Middle Camp and Nords Wharf - Cams Wharf house a higher proportion of persons in the 50 years and over age groups.

5.15 ECONOMIC BASE

5.15.1 Background

The planned development must be viewed in the context of its role in the Hunter Region, the State and Australia, but especially with regard to its relationship to the Lake Macquarie Municipality.

Coal mining is a significant and expanding activity in the economic base

of the Lake Macquarie Municipality and the local area. The agricultural base is small but well diversified while manufacturing activity is expanding rapidly. Continued population expansion and the attractiveness of the lake area for tourism and recreation has significantly increased retail and other service activities in both the municipality and the local area.

Extensive data supporting the following discussion are presented in tabular form in Appendix 14.

5.15.2 Rural Industry

Approximately 18 per cent of the total land area of Lake Macquarie Municipality comprises agricultural holdings. This low proportion is due to the large areas of unsuitable terrain, inadequate soils, forest areas and residential areas as well as the areas currently held by mining companies.

The number and area of rural holdings has decreased significantly since 1971-72, as indicated in Table A14.1. While the estimated gross value of production has remained relatively stationary in nominal terms, it has declined as a proportion of the regional rural value.

The most significant rural activity in the municipality is poultry farming which accounts for over 90 per cent of the total value of production as indicated in Table A14.2. Poultry farms are generally worked on a contract basis supplying the large processing centres in the Lower Hunter Subregion.

The majority of farms in the municipality are operated on a part-time basis. As indicated in Table A14.3, 25 per cent of farms produce 90 per cent of the total rural value of production.

5.15.3 Fishing

In 1976-77, 470 t of fish were caught in Lake Macquarie, accounting for 21 per cent of the catch from the Hunter Region. Details of the catch

are recorded in Table A14.4.

At the 1976 census only 34 persons were recorded as 'fishermen' in the municipality.

5.15.4 Forestry

The Watagan State Forest occupies areas of the Lake Macquarie Municipality. In 1978 five sawmills primarily located in the Freemans Waterholes and Cooranbong areas employed 21 persons producing mainly housing and mining timber.

In 1975-76, the royalty value of timber produced in the area was \$82000.

5.15.5 Coal Mining

Current figures indicate that the Hunter Region produces close to 70 per cent of total marketable coal in New South Wales. In the year ending June 1979, the region produced 29.82 Mt of coal, more than 95 per cent coming from the Newcastle and Singleton Northwest mining districts (Joint Coal Board, 1979).

Coal exports through the Port of Newcastle during this period totalled approximately 11 Mt. In the Newcastle mining districts, which cover the Newcastle, Lake Macquarie and Wyong local government area, 6.22 Mt were transported to power stations (by road and conveyor); 1.76 Mt to steelworks (by road and rail); 2.00 Mt to the port (by road and rail) and 0.92 Mt to Hexham Washery, (*Garlick and Michael, (1980)*).

There are currently eighteen colliery holdings within the Lake Macquarie Municipality, fifteen of which produce saleable coal. Table A14.6 indicates the mines, the quantity of their saleable output and their employment levels in the Lake Macquarie Municipality for 1977-78. In that period, a total of 5.8 Mt of saleable coal was produced, providing employment for 2756 persons.

Planned mining developments in the municipality indicate the continuing importance of the area as a coal producer. Table A14.7 lists new projects.

At the 1976 Census there were 105 persons employed in coal mining from the Caves Beach, Nords Wharf and Catherine Hill Bay areas. This represents about 11 per cent of the total employed population of the local area. In 1966 in the same area there were 181 persons, (or 24 per cent of the employed population) employed in coal mining.

5.15.6 Extractive Industries

Construction materials including crushed and broken stone, sand and gravel are quarried at a number of sites, particularly around Cooranbong, Swansea, Belmont and Teralba. Sand for construction and for glass making is mined at sites along the coast between Dudley and Swansea. Fire clay, stoneware clay and shale are quarried for use in the pipe and pottery industries.

5.15.7 Manufacturing Industry

Manufacturing industry employed just under 38000 people or about 25 per cent of the total regional workforce in 1978. Eighty-four per cent of manufacturing establishments and 95 per cent of manufacturing employment are located within 45 km of the Port of Newcastle (*Clough A.R., Garlick S.C. and Ray, P.G., (1978)*). The remaining establishments and employment are located in the central northwest (Singleton and Muswellbrook) and northeast (Stroud, Forster and Bulahdelah) portions of the region.

Most manufacturing establishments employ fewer than 25 persons with only one per cent employing more than 200 persons. A feature of the industrial structure of the Hunter Region is the dominance of the basic metal products industry with 45 per cent of total manufacturing employment.

Manufacturing industry accounts for 25.3 per cent of the employed labour force in Lake Macquarie Municipality. Table A14.8 discloses the significant growth in both employment and establishment numbers since 1968-69.

The predominant manufacturing activity in terms of employment within the municipality is fabricated metal products and other transport equipment

manufacturing. Table A14.9 shows the number of establishments for each form of manufacturing activity within the municipality.

The three major manufacturing locations in Lake Macquarie Municipality are at Cardiff, Bennetts Green and Warners Bay. Table A14.10 lists the three manufacturing establishments in the Swansea-Caves Beach area or 18 per cent of the employed labourforce were employed in manufacturing. The equivalent number in 1966 was 17 per cent.

5.15.8 Tertiary Industry

Introduction

Employment in the tertiary sector has increased over the period 1966 to 1976 in both the Caves Beach local area and the Lake Macquarie Municipality as a whole. The tertiary sector accounts for 68 per cent of total employment in the municipality and 70 per cent in the local area. This represents a significant increase over the 1966 figures which were 59 per cent and 58 per cent respectively. The increase in the local areas, in particular, has been due to increased employment in the electricity, generation, retailing and community services industries.

Electricity

Power stations in the Hunter Region generate over 85 per cent of total New South Wales electricity, producing more than 23000 GWh a year. Employment is provided for 1200 persons in Lake Macquarie Municipality and neighbouring Lake Munmorah.

At the 1976 Census 51 persons from the Caves Beach local area (5.1 per cent) and 1144 persons from the municipality (2.3 per cent) were employed in the electricity generation and distribution industry.

Retailing

Table A14.11 illustrates the growth in retail trade in the municipality between 1968-69 and 1973-74.

As indicated in Table A14.12, 16 retail establishments provided employment for 50 persons in the local area in 1978.

Building and Construction

As indicated in Tables A14.13 and 14.4, the number of dwellings approved and constructed in the Lake Macquarie and local Caves Beach areas have both increased over the past years. Non-dwelling building activity has shown a similar trend as indicated in Table A14.15.

At the 1976 Census 90 persons from the local Caves Beach, Catherine Hill Bay, Nords Wharf area were employed in building and construction. This represented 9.1 per cent of the employed workforce. In the total municipality 7.7 per cent of the employed workforce was engaged in building and construction.

Finance, Business Services and Public Administration

A total of 8.5 per cent of the employed population in Lake Macquarie Municipality is engaged in these activities. In the local area this figure is slightly higher at 8.8 per cent. These services tend to be located in the large urban centres in the municipality. The Charlestown, Belmont, Toronto and Cardiff urban centres appear to provide sufficient commercial and business services. The Swansea-Caves Beach area has been shown to be relatively under-serviced, particularly in relation to banks, building societies, accountants, solicitors and veterinary clinics (*Lake Macquarie Municipal Council, (1977)*).

Community Services

Health, education, entertainment and recreation services provided employment for 16.1 per cent and 17.1 per cent of the employed population in the municipality and the local area respectively in 1976.

5.15.9 Tourism

The economic and employment implications of tourism to the area are

demonstrated by Tables A14.16 and A14.17 which indicate gross takings in excess of \$1 M in the tourist accommodation industry in Lake Macquarie Municipality in 1978-79.

The renting of private dwellings provides further tourist income. The 1976 Census indicates that in the Lake Macquarie Municipality 6.5 per cent of unoccupied private dwellings were holiday houses. This compares to a national average of only 3.5 per cent. In the local Caves Beach area a high 64.2 per cent of unoccupied private dwellings were holiday homes. In terms of total dwelling numbers three per cent in the municipality and a high nine per cent in the local area were used for holiday purposes.

5.15.10 Employment

General

In 1976, the Lower Hunter subregional workforce numbered 224060 of whom 80026 or 36 per cent resided in Lake Macquarie. Detailed breakdowns of employment numbers and types are provided in Appendix 14.

Employment by industry in both Lake Macquarie and the local area reflects the subregional reliance on power generation, metal manufacture and engineering and coal supply and export. As indicated in Table A14.18 a significantly higher proportion of the workforce is engaged in mining and manufacturing as compared with national averages. The same figures highlight the relative isolation of the study area from major manufacturing centres and the mining function of the Catherine Hill Bay-Middle Camp area.

Occupational Structure

The imbalance in employment opportunities by industry type is reflected in a corresponding imbalance in occupational structure, as indicated in Table A14.19. Within the subregion, a lower proportion of workers are employed in the professional, administrative and clerical categories and a higher proportion in the mining and process worker categories as compared with national averages.

The Nords Wharf-Cams Wharf settlement and Catherine Hill Bay-Middle Camp area house disproportionately high numbers of persons employed in mining, as already stated. A different local pattern is obvious in the northern section of Caves Beach, where professional, administrative and clerical occupations are under-represented, while process workers reside in higher numbers than in neighbouring areas. Although Caves Beach is experiencing continuing growth, the concentration of persons with such occupational characteristics can be expected to continue as a distinct enclave.

Labourforce Participation

Labourforce participation rates for Lake Macquarie and the study area are outlined in Table A14.20.

Male participation rates have remained similar to state averages over the 1971-76 period.

Female participation rates at the regional level remain lower than state averages, reflecting the occupational structure referred to in the previous section. Rates at the local level show an even greater discrepancy as a result of the difficulty of access to centres providing suitable employment opportunities.

Unemployment

On the basis of CES registrations, shown in Table A14.21, the number of unemployed persons in the Lower Hunter Subregion totalled 10431 in November 1980. The clerical and administrative occupational category accounted for 63 per cent of unemployed females whilst the semi and unskilled categories accounted for 70 per cent of the unemployed males.

Registrations relating to an area encompassing the study area, shown in Table A14.22 indicate a similar trend. A further break-down of the unemployed into adult and junior categories reveals that despite similar numbers in each, the junior ranks are largely female and the adults are largely male.

Increased development in the Lower Hunter Subregion is currently imposing

some strains on skilled labour supplies.

5.16 PLANNING

5.16.1 The Regional Context

The New South Wales Planning and Environment Commission (now the Department of Environment and Planning) has proposed a strategic plan for the Hunter Region intended to provide guidelines for its future development.

The plan considers both the Lower and Upper Hunter Subregions and allows for an increase in population of 100000 persons in the Lower Hunter by the year 2001. It recommends that this population influx should be housed in areas abutting existing residential zones, thus maximising the use of existing infrastructure. Consequently East Maitland-Thornton, West Maitland, Kurri Kurri and the northern parts of Lake Macquarie Municipality will experience the greatest population growth. To reduce journey to work distances, it is proposed to create up to 12000 additional jobs in these areas. The strategy in relation to the proposal is illustrated in Figure 5.12.

The Colliery Holding forms part of the proposed Swansea-Caves Beach 'green corridor'. It also forms part of an area of largely natural vegetation, stretching from Caves Beach to Doyalson, designated as an 'intercity' environmental zone. The Department proposes that a buffer zone of this nature be retained to separate Sydney's northward expansion from predicted population growth in Lake Macquarie Municipality.

5.16.2 Local Government Constraints

Planning of Lake Macquarie began in 1948 when the Northumberland County Council was established to prepare a scheme for the Lower Hunter Subregion. The Municipality was subject to interim development control until 1960, when the Northumberland County District Planning Scheme

Ordinance was prescribed.

Since 1960 the County Scheme has been implemented but has been subject to a number of variations with the gazettal of some 198 interim development orders in draft various planning schemes adopted in 1964, 1966, 1969, 1972 and 1980.

Figure 5.13 illustrates the current zoning of the site and its surroundings. The site itself and much of the area to the immediate south is zoned 'Non-urban A', whilst a zone abutting the highway is zoned Non-urban B. Under the municipality's Draft Environmental Planning Instrument, which is currently being considered by the Department of Environment and Planning, these areas are zoned Rural A and Rural B respectively. In addition, this scheme proposes the extension of the existing Caves Beach residential area in a southerly and westerly direction. Figure 5.14 shows that as a consequence, the abandoned Swansea Opencut, formerly zoned 'Non-urban A', would be rezoned 'Residential A'. The instrument also allows for the creation of two special zones in close proximity to the site - 'Environmental Protection (Coastal Lands Acquisition) (7c)' and 'Environmental Protection (Scenic) (7a)'. These are also illustrated in Figure 5.14.

The site is within the Swansea-North Entrance Mines Subsidence District.

5.17 LAND USE

5.17.1 Introduction

Land use in the local area is outlined in Figure 5.15.

5.17.2 Agricultural Land Use

Agricultural land use within the local area is insignificant and is restricted to horse grazing. Between Cams Wharf and the Pacific Highway horse raising and agistment is practised. No stud breeding is undertaken.

5.17.3 Land Values

Land values in Caves Beach exhibit a pattern of increasing values from north to south. To the north of the shopping centre the UCV of a suburban allotment averaged \$8500 in 1979. This area is characterised by a concentration of Housing Commission homes on flat to undulating stabilised dunes which generally do not have any ocean views.

The central section of Caves Beach has allotments valued at an average of \$10500. This area is almost entirely privately owned with some homes having ocean views.

The southern area, bounded by Park Avenue, Scenic Drive and Ocean View Parade has an average UCV of \$12000 and generally has ocean views from elevated blocks.

The overall average UCV for land in Caves Beach is approximately \$10000.

5.17.4 Residential

The major urban residential areas of significance to the proposed development are Caves Beach and Swansea. Further residential areas exist at Nords Wharf, Cams Wharf, Catherine Hill Bay and Middle Camp. As these latter areas form isolated and discrete settlements, they are treated separately under the heading of villages. Little residential land use occurs outside these centres with the exception of a number of isolated homes. The locations of these residential areas are shown on Figure 5.15.

The Caves Beach area, predominantly suburban in character, is located within 2 km of the proposed underground mine site at its closest point and within 1 km of the abandoned Swansea Opencut.

Settlement in Caves Beach is relatively recent with the majority of homes being built since 1965. In the northern sector, buildings are of fibro, weatherboard and brick construction, largely due to the concentration of Housing Commission homes. Along the Black Ned's Bay foreshore, older homes of weatherboard predominate, interspersed with more recent brick homes.

From central Caves Beach to the south, homes are predominantly brick and of more recent construction. A substantial amount of residential land is available in a current subdivision to the south of Caves Beach.

A section of land to the south of the present residential area is currently being subdivided, whilst land to the west, although zoned non-urban, is envisaged to be used for residential purposes in the future.

Within the Lake Macquarie Municipality and particularly in the eastern zone, there is a shortage of land suitable for residential purposes. This is expected to ease with the more rapid release of land for development. The major sites for such development in the eastern zone are in the Eleebana, Valentine and Floraville areas. Little land is available in the area from Caves Beach to Belmont North.

5.17.5 Retailing and Commercial

A small integrated shopping centre serves the Caves Beach area. Ground floor premises include a small supermarket, butcher, cake shop, fruit shop, cafe, beauty salon, a commercial office and a veterinary clinic. One shop premises was vacant at the time of the survey.

First floor offices accommodate the Mawson Group of Companies' administrative offices. In addition to these premises, Caves Beach has a service station and hotel-motel. An extensive area adjacent to the existing shopping centre is available for future commercial development.

The larger commercial centre of Swansea offers residents higher order goods not normally available at Caves Beach. Swansea acts as a neighbourhood centre of approximately 80 establishments serving the Swansea, Blacksmiths, Caves Beach area. Little growth in commercial activity has occurred since 1973, due to the restricted extent of its catchment area to the south and the ability of Belmont, to the north, to supply alternative services. By acting as a neighbourhood centre Swansea provides a wide range of services. Of the 80 establishments, 31 are non-retail, providing such functions as financial and professional services, entertainment, public administration, transport and community services.

Although the extent of future population growth in the area will be limited, some alteration in the services required may occur due to the changing population characteristics of the area. This fact is illustrated by the planned development of a Coles Supermarket in the centre. Sufficient space is available both on and off the highway for any further expansion.

5.17.6 Industrial

Until the recent development of a light industrial estate in the north-western corner of Caves Beach, no industry was located in the local area. At present two industries have established premises on the estate.

A mining related engineering works specialising in diamond drilling equipment employs 13 men on the site. The business was initially established in Swansea but relocated in 1980. Although no physical expansion is planned, an increase in its workforce is a possibility in the future.

A bus servicing depot is also accommodated on the site, employing nine full time and five part-time workers. In addition, the depot employs a contract mechanic and cleaner. No plans for any expansion are anticipated.

There are 18 lots within the industrial estate, of which 17 have been sold.

5.17.7 Villages

Apart from the urban areas of Swansea and Caves Beach to the north, four villages exist within 4 km of the site. Their location in relation to the proposal is shown in Figure 5.15.

Catherine Hill Bay-Middle Camp

The villages of Catherine Hill Bay and Middle Camp lie south of the proposed site. Both villages have approximately 60 residences, mostly old weatherboard miners' cottages. Formerly owned by Coal and Allied Industries Limited many have been or are being renovated, reflecting their recent private acquisition. Each village also has several weatherboard houses of more recent design.

At Middle Camp, Coal and Allied Industries Limited have built three new substantial brick veneer, mine management residences. A two storey, brick general store/residence has also been constructed.

Community facilities available in the two villages at Middle Camp include a general store, Volunteer Bushfire Brigade, a small bowling club and an oval with netball courts. The village also has a cemetery and a small church.

Catherine Hill Bay has a weatherboard hotel, Police Station and Post Office. A brick surf club has recently been constructed near the old coal loading wharf.

Nords Wharf

In contrast to the other villages, Nords Wharf is much larger, more affluent and undergoing rapid growth. Residences are either older fibro or weatherboard construction as well as modern, one or two storey brick veneer. All residences are well maintained. At present property values are rising rapidly reflecting a high demand, particularly by retired persons. Some 30-40 per cent of existing development has occurred within the last ten years.

Community facilities include a small supermarket, real estate agent and Post Office, a community hall and public school. Baxter Park on the Lake Macquarie foreshore provides picnic and barbecue facilities. Canoes, catamarans and outboard fishing dinghies can be hired at the South Beach Wharf.

Camping and caravanning is discouraged at Nords Wharf, although for a nominal charge the Boy Scouts Association leases land from Coal and Allied Industries Limited, immediately south of the village, and has operated Camp Kanangra for the past eight years. Facilities include showers and septic toilets. Up to 200 people camp there on holiday weekends, the majority from Sydney. Schools have also used the area for overnight nature study excursions.

Cams Wharf

Cams Wharf village consists of a strip of old, poorly maintained fibro cottages along the Lake Macquarie foreshore. There are no apparent camping

restrictions in force and during the holiday season caravans and tents are numerous. There is a substandard caravan park with many permanent residents. A small fibro store services the caravan park and also hires small canoes, boats and outboard engines.

There are approximately a dozen more substantial residences immediately to the north and south of Cams Wharf and along Cams Wharf Road. Their condition ranges from old fibro construction needing maintenance to new brick veneer.

5.17.8 Mining and Extractive Industries

In general, extractive industries have been conducted at a low level of capitalisation with many sites being abandoned and many operating on a part-time basis.

Clay deposits are worked on the western side of the main ridge by Belmont Stoneware Pipe Pty. Limited. Coarse sands and gravels are extracted from pits to the west of the Caves Beach Primary School between Park Avenue, Caves Beach and the Pacific Highway. Within the same area, sandstone is being extracted in large blocks. Two road base quarries, one owned by the Lake Macquarie Municipal Council and the other Company owned, are operated in the area.

A coal preparation plant and loading facility is in operation at Catherine Hill Bay. This facility is owned and run by Coal and Allied Industries Limited.

5.17.9 Special Uses

Swansea Zone Sub-Station and Regulator Station

The Swansea Zone Sub-Station designed to transform 33 kV to 11 kV is currently being constructed on the Caves Beach Industrial Estate. This facility will provide the electricity supply to the Swansea-Caves Beach area. Previously this supply was obtained from a sub-station located at Marks Point.

A regulator station is located on the Pacific Highway adjacent to the Camp Yondaio entrance. Its function is to maintain the 11 kV supply to the area.

It is anticipated that these stations will be adequate to meet the demands of any developments in the near future.

Water Storage Tanks

The HDWB supplies the Swansea-Caves Beach area with water from a storage tank located in Scenic Drive, Caves Beach. The tank is of steel construction with a capacity of 4.79 ML. In addition a pump is used to transfer water to a 0.23 ML tank on the top of the hill to supply homes in the vicinity of Scenic Drive.

This facility will require amplification to meet with any additional demands created by further industrial or residential development.

5.17.10 Camp Yondaio

Camp Yondaio is a recreational facility owned and managed by the Newcastle Church of England Diocese. The camp provides a variety of camping and recreational facilities catering for a diverse range of groups and individuals in the community.

The land owned by Camp Yondaio extends from the junction of the Pacific Highway and Mine Camp Road to the high water mark at Pinney Beach. In part its northern boundary adjoins the site of the proposed development.

The camp itself is divided into a number of areas. The majority of development, including a caretaker's residence, youth hostel buildings and a large self-contained camping centre, is located at its western elevated end.

Further to the east and at a lower elevation is a site used by the Church of England Boys' Society (CEBS). This facility is largely in its natural state with the exception of shower and toilet facilities and a kitchen/multi-purpose building. Further to the east on the beach front is an area reserved for individual camping.

The major facility of the camp is the self-contained camping centre, catering for up to 40 persons. With the addition of tents, the centre can cater for up to 70-80 persons. This facility is designed for organised groups of campers such as school groups.

The youth hostel caters for up to eight persons in two buildings.

The site utilised by CEBS can accommodate up to 100 children.

The use of the beach front by campers is controlled from the camp which restricts their number in the area at any one time to three separate groups.

The beachfront and beach itself are also used on a regular basis by members of the public and by organised groups on week-ends.

Utilisation

The camp centre is extensively used by schools in the area. The major attraction of the camp for educational purposes is its access to rainforest, heathland and coastal areas in addition to the physical educational amenity of outdoor activities. The centre is also used by other community groups such as scouts and guides.

The youth hostel, although catering for only eight, can provide accommodation for larger numbers if space is available in the camp centre.

Utilisation of the CEBS camp varies from 30-100 children depending upon the nature of the visit. Diocesan camps involving up to 100 children are run twice each year. Smaller camps occur at more frequent intervals, catering for individual CEBS groups. In 1980, this particular facility was booked out for the last four months of the year.

The beachfront and beach area is used by all visitors to the camp, either for organised activities or for passive recreation. The extent of public use of the area, particularly at week ends is difficult to gauge. However on a number of weekends in January 1981, up to a dozen vehicles were counted at Pinney Beach with approximately 20 people in the near vicinity. The area is also used by trail-bike riders and fishermen.

Growth

In the past three years the Newcastle Diocese has implemented a policy of making Camp Yondaio self-supporting. It has employed a part-time caretaker with the possibility of a full-time caretaker being appointed in the future. In 1980, the number of campers using the site increased by 187 per cent over 1979 figures.

Future plans for the camp are not definite, but are expected to cater for any growth in demand, particularly with regard to the camp centre.

The policy for any such growth is to restrict it to the upper level of the camp and to retain the lower level, serving the CEBS, in its natural state.

5.18 ACCOMMODATION

5.18.1 Permanent Housing

Lake Macquarie and the Lower Hunter Subregion are characterised by a higher number of separate houses, a lower number of home units, and a greater proportion of owner occupied dwellings than the state average. Detailed statistics are provided in Appendix 15.

In the 1971-80 period, an annual average decline of 3.7 per cent was recorded in building approvals in Newcastle and Lake Macquarie. Although there has been a recent increase in building activity, (*Newcastle Morning Herald*, 21/1/81) the previous downturn coupled with the current general increase in economic development has resulted in a housing shortage, particularly in the low to medium cost brackets. Rental accommodation is in particularly short supply.

As indicated in Table A15.4, the nature of occupancy in the local study area follows the regional pattern with specific local differences. The differences rise from the existence of Housing Commission residences in Caves Beach North and Company housing in Catherine Hill Bay.

In the Swansea and Caves Beach areas the Housing Commission owns 140 and 122 houses respectively. The Commission does not own any land reserves in the area and no further development is expected in the immediate future.

5.18.2 Temporary Accommodation

At the 1971 Census, approximately 3.4 per cent of dwellings in Lake Macquarie Municipality were identified as unoccupied holiday homes. As the number of occupied holiday homes was not recorded, the actual number of homes available for this purpose was under-enumerated.

In 1976, this figure was approximately 3 per cent in comparison to 0.01 per cent in Newcastle and 12.1 per cent in Port Stephens.

Temporary tourist accommodation as measured by the Australian Bureau of Statistics has declined in the Lake Macquarie Municipality. In a census of tourist accommodation establishments in 1973-74, 27 such premises existed in the municipality. By 1979, this number had declined to 19. Of these 10 are located in the Belmont, Swansea, Caves Beach area and as Table A15.5 shows, provided 138 units.

Of the 14 caravan parks in the LGA, eight are located in the Belmont to Caves Beach area. Table A15.6 provides details of site and on site van availability.

Although availability fluctuates seasonally, temporary accommodation, particularly in hotels and motels is close to full utilisation at present. Caravan park facilities are presently over extended, particularly in the southern areas of Lake Macquarie (*Hunter Valley Regional Community Information Service, 1980*). Almost half of the permanent caravan park residents in the Hunter Region are located in parks around Lake Macquarie.

5.19 COMMUNITY SERVICES AND FACILITIES

5.19.1 Education

At the 1976 Census, 9.2 per cent of Lake Macquarie Municipality's population

was aged 5 years or under, whilst 20 per cent was of school age. These proportions are compared to the national and local averages in Table A15.7. It is apparent that as with other demographic patterns, the local area accentuates the difference between the Lake Macquarie and national averages.

The local area is served by a pre-school, an infants school, three primary schools and a high school.

Enrolments in each are shown in Table A15.8.

The pre-school is part of the Uniting Church's development in Caves Beach. This school, completed in 1977 is designed to cater for 40 children in two classrooms. There are currently 20 children enrolled.

Caves Beach Primary School, located on the western boundary of the residential area, enrolled 546 children in 1980. Of these 200 were enrolled in the infants' section. As the entire local area is currently experiencing a decline in enrolments, no expansion is anticipated in the near future. This declining trend in infants school enrolments is reflected throughout the region with the exception of growth centres such as Belmont North and Eleebana. The 346 primary school pupils are at present adequately accommodated in the existing facilities.

Catherine Hill Bay Primary School enrolled 23 pupils in 1980. Enrolments have remained relatively constant in recent years and no alteration to this pattern is anticipated in the near future.

Nords Wharf Primary School had an enrolment of 65 pupils in 1980. The pattern of enrolments in the infants' section reflects the subregional pattern of a decline in pupil numbers. This trend is expected to be maintained as the area's retirement and recreational role is strengthened.

Swansea High School enrolled 916 students in 1980 and has experienced increasing student numbers in recent years. The enrolments are expected to stabilise at present levels for the next couple of years until the present decline of primary school enrolments will produce a similar pattern in the high school.

The Lower Hunter Subregion is serviced by four Technical Colleges, the University of Newcastle and Newcastle College of Advanced Education.

The Technical College facilities of greatest relevance to the proposed development are those located at Tighes Hill, Glendale and Belmont. All coal mining certificate courses are conducted at the latter. The Tighes Hill College is the administrative centre of Technical and Further Education for the Hunter Region and provides the greatest range of courses and facilities in the region. In 1979, 15999 students were enrolled through the Tighes Hill College and its ancillary centres. Of these, 49 per cent were enrolled in Trade or Certificate Courses.

Glendale College accepted its first student intake in February 1981. It is anticipated that between 2000 and 3000 students will be enrolled by the end of 1982. This college caters largely for technical trade courses.

Belmont College enrolled 2409 students in 1979, mainly in technical trade courses. Expansion is currently underway to provide boilermaking teaching facilities.

Subregional TAFE enrolments increased by 5.6 per cent in 1979. In 1980 a 40 per cent increase in first year trade enrolments reflected the increased demand for tradesmen in the region. Other course areas have not as yet experienced such significant increases in demand.

The demand for tertiary education at both Newcastle University and the College of Advanced Education has declined in recent years. In terms of the college, this has results partly from a decrease in teacher training. The decline in enrolments for both the University and College reflects a general shift of emphasis in the community from academic to technical education.

5.19.2 Health

Health Characteristics of the Population

The morbidity ratio of the Hunter Region during the period 1975-77 was 102 compared with a base level for the state of 100 (*Health Commission, (1979)*¹).

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The Morbidity Ratio indicates the the likelihood of residents in the region developing illnesses requiring treatment is slightly greater than elsewhere in the state.

In the last twenty years, the crude death rate (CDR) for the Hunter Region has been approximately five per cent higher than the state average.

Crude death rates are gross indicators of mortality in that they do not take age and sex factors into consideration. Standardised Mortality Rates (SMR's) as computed by *Dobson et al (1979)*, shown in Table A15.9, take these factors into account. Differences between LGA's in CDR's and SMR's are striking, with Lake Macquarie and Port Stephens experiencing the lowest rates. This pattern is consistent over the 1961-76 period. The differences between LGA's can be attributed largely to differences in the demographic, social and environmental characteristics of each area.

Health Services

Lake Macquarie Municipality contains public and private hospital facilities providing, in 1978, 288 hospital beds. Of these 108 are available at Belmont Hospital, a unit of Royal Newcastle Hospital. Belmont Hospital is closest to the proposed development site and provides obstetric, paediatric, cardiac, emergency and general hospital services on a 24 hour basis.

On the basis of Health Commission recommendations of 5.1 beds per 1000 population, Lake Macquarie on 1978 estimates had a deficit of 195 beds. As shown in Table A15.10 however, the adjoining Newcastle area had a large surplus and was able to provide the additional required services.

A number of private hospitals operate in the LGA. The nearest to the proposed development are located at Gateshead and Warners Bay. These do not provide an emergency service and cater for referred patients only.

A number of private nursing homes exist in the LGA. The majority of these are located on the western side of the Lake. Since 1977 a retirement village has been established at Caves Beach, providing a self care service only. A further addition to the facilities available for the elderly in the eastern zone of the Municipality has recently been completed at Belmont North. This development, also by the Uniting Church, consists of 60 selfcare units, a 40 room hostel and a 60 bed nursing home, all within a single complex.

The ratio of doctors to population of 1:1947 in Lake Macquarie Municipality indicates the the Lake area was considerably disadvantaged relative to the subregional rates of 1:1218. This can be partially attributed to the high proportion of specialists based in Newcastle. With the establishment of branch surgeries by specialists in Lake Macquarie in recent years by 1980 (*Lake Macquarie Municipal Council, 1980*) the ratio had decreased to 1:1750. Of the doctors providing a service in Lake Macquarie, two thirds are located in the eastern zone.

A similar pattern is evident in the availability of dental services. In 1976, 15 dentists were providing services in Lake Macquarie with a ratio of 1 dentist to 8960 people. This was in comparison to the subregional ratio of 1:5700. In 1980 19 dentists were located in Lake Macquarie, reducing the ratio to 1 dentist per 7300 people.

Community Health

Community Health Centres provide an integrated approach to health care in Lake Macquarie from three centres. Of these Toronto and Windale serve as the major centres for the western and eastern zones respectively.

The centres are designed to supply a service which is preventative and supportive in nature, in addition to a specifically medical function. To this end the staff serving the eastern zone include community nurses, a psychologist, social worker, speech therapist, welfare officer, community physician and psychiatric nurses.

The ability of the eastern and western centres to operate effectively in recent years has been affected by a decline in funding and the imposition of staff ceilings. This latter factor has led to the loss of community nurses in the eastern zone of Caves Beach, Swansea, Windale and Gateshead.

Ambulance Service

The eastern zone of the LGA is serviced by ambulances based at Belmont. A further service located at Doyalson provides a service for the southern extremities of the zone.

Baby Health Centres

The provision of Baby Health Centres in the region is itemised in Table A15.11. The ratio of babies born to the number of centres indicates that the Lake area is disadvantaged in baby health care. A Baby Health Centre at Swansea serves the immediate local area. A centre previously serving Caves Beach on a part-time basis has been closed.

As no standard ratio of babies born to baby health staff is available, the only means of assessing the adequacy of facilities is by comparison with other regions in New South Wales. Although the Hunter Region appears to be well serviced by numbers of Baby Health Centres, an analysis of the staffing of these centres indicates that the region, relative to others and the state, is understaffed in terms of baby health nurses.

Community Services

A family day care service is provided in the eastern zone by Lake Macquarie Council. At present the service is designed to provide a home based day care service to 100 full-time children. The service is currently over-extended in that it provides an emergency service to children above the level of funding.

In conjunction with Lake Macquarie Municipal Council, a Family Support Scheme operates a women's refuge in Swansea. This service is designed for families requiring emergency and alternative accommodation facilities and acts in conjunction with similar facilities in the Hunter region.

An analysis of non-public welfare organisations indicates that these are predominantly located in the Newcastle local area. In particular, those organisations which provide emergency services in the food clothing and accommodation fields do so from premises in Newcastle. Similarly those organisations both private and public, which provide information, supportive and counselling services are also predominantly located in Newcastle.

The consequence of this geographical separation of those in need and the potential source of correction serves to maintain and increase the welfare and social problems in Lake Macquarie. This is particularly the case with

problems associated with children and the family as the ability of housewives and children to obtain service is severely limited by difficulty of access.

5.20 TOURISM AND RECREATION

5.20.1 Recreation

Recreational facilities within the Belmont-Swansea, Caves Beach area are characterised by their local and subregional roles.

Within the local area the major recreational resource is the beach and associated foreshore extending from Swansea Heads south to Catherine Hill Bay. The major formal recreational facility in this area is the Swansea-Caves Beach Surf Life Saving Club. The Caves Beach community is serviced by three open park areas, one of which contains playground facilities.

Two tennis courts provide the only other formal recreational facility in the area whilst the playing field and basketball courts of the high school are used on an informal basis.

The area south of the residential area including the proposed development site is used by both the local and regional population for fishing, bush-walking, trail bike riding, surfing and other passive recreation.

To the west of the existing residential area, the bushland is extensively used by trail bike riders.

The settlements of Catherine Hill Bay-Middle Camp and Nords Wharf-Cams Wharf possess a subregional recreational role, utilising the beaches at Catherine Hill Bay and nearby Moonie and the lake at Nords Wharf-Cams Wharf. Catherine Hill Bay is also served by a Bowling Club, Surf Lifesaving Club, sports oval and netball courts.

Park, picnic, barbecue, camping and boat hire facilities are available in both Nords and Cams Wharf.

In terms of sporting and recreation facilities the Regional Leisure Plan (*Hunter Valley Research Foundation, 1977*), indicated that, although the number of playing fields in the Lake Macquarie area was comparable with the region, the numbers for tennis, football, hockey and cricket were below those needed. Specifically the plan recommended that new grounds for these sports be provided in the East-Lakes area, in such areas as Belmont, Swansea and Eleebana.

5.20.2 Tourism

Lake Macquarie Municipality is a major tourist destination within New South Wales. Lake Macquarie and beach areas are the primary recreation sources within the municipality although the rivers and streams, state forests and bushland provide a wide variety and distinctive combination. The Swansea, Blacksmiths, Caves Beach, Redhead, Dudley and Belmont areas rank highly in terms of their popularity. The lake provides for a variety of still water based activities including cruising, fishing, sailing, swimming, spearfishing and power boat racing.

The stated main reasons for visitation to the area are outlined in Table 5.3.

TABLE 5.3.

MAIN AREAS OF TOURIST VISITATION
LAKE MACQUARIE MUNICIPALITY

Stated Main Reason	Percentage
Surfing	20.6
Swimming	1.5
Sightseeing while driving	27.9
Visit National Parks	-
Bushwalking	-
Photography	-
Visit Museums, etc	-
Visit Vineyards	4.4
Boating, Sailing etc.	14.7
Launch cruises	-
Horseriding	-
Fishing	2.9
Hunting	-
Visit relatives, friends	11.8
Relaxing	7.3
Passing through	7.4
Other	1.5
TOTAL	<u>100.0</u>

Source: *Hunter Valley Research Foundation, 1977.*

5.21 TRANSPORTATION NETWORK AND SERVICES

5.21.1 Road

Figure 5.16 illustrates the existing road network and indicates proposals for its upgrading. The Pacific Highway bisects the Colliery Holding and provides the major access to the site. The Highway is of two lane width, bitumen surfaced and contains numerous curves. This section will be upgraded to a four lane standard as part of the DMR's programme to provide a four lane access between Sydney and Newcastle.

Scenic Drive, which is a two lane, bitumen surfaced road, provides an alternative route from the site to Swansea via Caves Beach. The section between the entrance to Swansea Opencut and the Pacific Highway is a private road, owned by Wallamaine Limited.

A detailed analysis of traffic volumes on the Pacific Highway has been undertaken and the information is contained in Appendix 16.

The construction of the Sydney to Newcastle National Highway section west of Lake Macquarie within the next decade should reduce traffic levels on that section of the Pacific Highway which traverses the site.

Table 5.4 provides details of road distances from the site to major centres.

TABLE 5.4

ROAD DISTANCES

Centre	Route	Distance from site (km)
Doyalson	Pacific Highway	19.5
Caves Beach	Scenic Drive	2.5
Swansea	Pacific Highway	5.1
Belmont	Pacific Highway	12.1
Newcastle	Pacific Highway	33.4

5.21.2 Rail

The closest railway to the site is the privately owned Redhead Coal Company Railway Line which is operational as far as the John Darling Colliery located some 14 km to the northeast. The Main Northern Railway located to the west of Lake Macquarie is at its nearest point 23 km by road from the site.

5.21.3 Electricity

An 11kV supply from Swansea crosses the abandoned Swansea Opencut and continues in a southerly direction across the Colliery Holding parallel to the Pacific Highway. The cable is suspended from single timber poles approximately 12 m in height.

5.21.4 Water and Sewerage

Caves Beach is serviced by reticulated sewerage and water supply. Sewage is treated at the Swansea Heads sewage works.

5.21.5 Gas

Town gas is not available and at this stage it is not intended to connect this area with natural gas.

5.22 COAL TRANSPORT AND PORT INFRASTRUCTURE

5.22.1 Coal Transport

Within the Hunter Region coal is transported by road, rail and conveyor. Details are provided in Table 5.5. In the Newcastle coal mining district, of which the project will be part, 11.57 Mt of saleable coal was transported in 1977-78. These movements are illustrated in Figure 5.17.

TABLE 5.5

TRANSPORT USED FOR COAL DELIVERIES FROM MINING DISTRICTS
TO FINAL DESTINATIONS, 1977-78

Transport Used To Destination	Saleable Output from Mining Districts			
	South Maitland	Singleton- North West	Newcastle	Total
<u>Road Haulage To:</u>				
Hexham Washery #	93 100*	467 000	643 400	1 203 500
Port	6 800	3 100	1 414 200	1 424 100
Steelworks	-	-	62 200	62 200
Power Stations	-	-	1 791 700	1 791 700
Other	-	112 900	64 000	176 900
Road Total	99 900	583 000	3 975 500	4 658 400
<u>Road Haulage To Rail Siding To:</u>				
Hexham Washery #	-	177 500	-	177 500
Port	-	2 287 100	562 700	2 849 800
Other	39 300	12 600	-	51 900
Road/Rail Total	39 300	2 477 200	562 700	3 079 200
<u>Rail Haulage To:</u>				
Hexham Washery #	781 000	153 800	275 100	1 209 900
Port	331 800	2 664 800	-	2 996 600
Steelworks	-	37 100	1 700 500	1 737 600
Rail Total	1 112 800	2 855 700	1 975 600	5 944 100
<u>Conveyor Belt To:</u>				
Power Station	-	5 579 800	4 432 600	10 012 400
<u>Other Transport</u>	-	-	618 700	618 700
Total Coal Delivered	1 252 000	11 495 700	11 565 100	24 312 800

* Ayrfield Washery

To avoid double counting, haulage from Hexham Washery to the Port has not been included separately.

Source: *Garlick and Michael 1980.*

5.22.2 Port Facilities

In 1978-79, the Port of Newcastle shipped almost 11 Mt of coal from two loading facilities.

The Maritime Services Board's Carrington Basin Loader has two wharf mounted units with a nominal capacity of 1000 t/h each, or 6 Mtpa. In 1978-79, the MSB loader handled 5.47 Mt of coal.

The Port Waratah Coal Services Loader in Steelworks Channel has two loaders with a capacity of 2000 t/h and an annual capacity of 10 Mt. A total of 5.33 Mt of coal were handled in 1978-79.

A third coal loader planned for Kooragang Island will have a first stage capacity of 10 Mtpa increasing to 25-35 Mtpa. The scheduled completion date is 1985.

Newcastle Harbour is currently dredged to 12.5 m. Current works will increase this to 15.2m by the end of 1982, with further plans to deepen the harbour to 17.2 m in the future enabling the berthing of ships up to 170000 dwt.

The water depth in the Carrington Basin is 11.6 m, which is not expected to be increased. The existing minimum depth in the approach channel and swinging basin area will be increased from 11 m to 13.1 m allowing vessels of up to 60000 dwt to be fully loaded and depart using the tide with a draft of 12.5 m.

Water depth in the Steelworks Channel loading basin is 12.0 m which with deepening will be increased to 15.2 m permitting vessels of up to 110000 dwt to use the loader.

Design and Operational Safeguards

6.1 CRITERIA FOR THE DESIGN OF SAFEGUARDS

6.1.1 Water Management

Principles

The engineering design of the proposal incorporates a water management plan with the following objectives:-

- i. To effectively use all available water supplies.
- ii. To maximise recycling, reducing both external demands and discharge quantities.
- iii. To minimise offsite impacts.

The objectives will be attained by adherence to the design principles outlined below:-

- i. There will be no dry weather discharge from developed areas.
- ii. Upslope runoff in excess of that required will bypass developed areas, minimising the volume of water requiring treatment.
- iii. Runoff from disturbed and working areas will be collected by a system of surface drains and sumps and directed to sedimentation dams for clarification. Following settlement, the water will be used on site. Storm flows in excess of design quantities will be discharged to the natural drainage network downstream of the site.
- iv. Groundwater generated by underground mining operations will be collected and pumped to a surface storage dam, for subsequent use in the coal preparation plant.
- v. All sewage and washdown water will be collected and used for irrigation of the surface facilities site after conventional treatment using aerobic biological processes.

The specific implications and design elements embodied in these principles are explained in the following sections:

Water Balance

A detailed water balance is provided in Figure 6.1. All quantities are based on average annual generation and usage estimates.

The proposed water management system will maximise the use of water generated on the sites and supplement the supply with natural runoff from the immediate vicinity of the surface facilities. The only demands on the HDWB supply during average rainfall periods will be for potable water in the bath house, offices, emergency use underground and at the Swansea Opencut for potable use and as makeup to on-site collection for truck washing. Surface runoff from the Swansea Opencut is expected to be minimal.

During periods of prolonged drought, surface water collections will require supplementing from town supplies to enable site demands to be satisfied.

The Company is to undertake further detailed groundwater studies before commencement of mine development. On the basis of experience at neighbouring mines, it is expected that produced groundwater will be insufficient to satisfy the coal preparation plant makeup requirements and some town water will be used.

If, however, groundwater flows are greater than site requirements, various options for disposal will be investigated, the most obvious being ocean discharge via a pipeline and submerged outfall. Such investigations would be conducted to satisfy the requirements of all relevant authorities.

As the opencut mine is located on a ridge, no groundwater is anticipated.

Design Criteria for Drains and Dams

A system of drainage controls is proposed to safeguard both the natural environment and the areas designated for development.

Following examination of the consequences of discharging runoff high in suspended solids from the site, it was decided to adopt a storm return period of 10 years for the design of drainage controls. Generally the first flush of runoff from disturbed areas contains the majority of suspended solids generated by storm flows. In order to ensure that this first flush of runoff is contained and treated, controls have been designed to handle storms in which the entire catchment is contributing to runoff at the outlet. This duration is defined as the time of concentration of

the catchment. In specific instances, a greater capacity has been allowed for.

Diversion banks to direct upslope runoff around the surface facilities area will have the capacity to handle all storms with return periods of up to 20 years. They will be constructed such that any overflow from higher intensity storms will not affect their stability. The quantity of runoff which could overflow during such storms will not be likely to cause serious damage to the facilities or prejudice mining.

The proximity of the mine entry and coal stockpiles to the pipeline under the surface facilities site (which will pass all upstream flow from the main watercourse) dictates a higher design criterion. In this instance, the pipe has been designed to handle flows with a return period of 100 years, and an additional surcharge volume of 1000 m^3 will be provided in the clean water dam. All diversion banks will be constructed in the following manner:

- i. The topsoil will be removed from the working area and temporarily stockpiled adjacent to the stripped area.
- ii. The bank will be formed by borrowing soil upslope and compacting it to form a wide shallow cross-section with side slopes of 1V:4H. To prevent erosion, channel slopes will be kept to a minimum.
- iii. The topsoil will be replaced and access to the channel restricted until revegetation is complete.
- iv. The path from the end of the diversion bank to an existing watercourse will be well-grassed and where necessary provided with channel protection such as rip rap or jute mesh.

Earth drainage channels will be constructed in the same manner as the diversion banks except that the batters will be increased to 1V:3H reflecting the lower volumes to be handled.

The earth dams designed for water storage and polluted water treatment will be constructed in accordance with the following guidelines:

- i. The dam site will be stripped of all vegetation and topsoil together with any structurally unsound or permeable material.
- ii. The impounding walls will be constructed with graded soils containing sufficient clay to ensure impermeability.
- iii. The walls of the dams will be battered to safe slopes and grassed. The acceptable slopes are detailed in Table 6.1.

- iv. Where overflow may occur, a spillway will be provided at the edge of the dam wall and this will be adequately protected with stable rock, rip rap or mesh to prevent erosion and scouring. Discharges will re-enter the watercourses away from the base of the dam.
- v. Areas prone to leakage will be provided with a clay blanket or impermeable membrane lining to the walls and floor.
- vi. Where the impounding walls are founded on rock the wall will be designed to resist failure due to sliding. This will be provided by the weight of material used for the wall or by the cutting of trenches into the rock beneath the wall to provide a key with the base material.

TABLE 6.1

SLOPES FOR EARTH FILL DAMS

Soil Type	Unified Soils Classification	Upstream Slope	Downstream Slope
Gravels and Sands with low fines	GW, GP SW, SP	Pervious, not suitable for dams	
Silty or clayey sands and gravels	GC, GM	IV:2.5H	IV:2H
Silts and clays of low plasticity	CL, ML	IV:3H	IV:2.5H
Silts and clays of high plasticity	CN, MN	IV:3.5H	IV:1.5H

6.1.2 Air Quality

Air quality will be protected by minimising the quantity of dust generated, and by confining potential sources.

All coal transfer distances will be minimised and where possible operations will be within sealed enclosures. Where enclosure is impractical, water sprays will be provided.

The emission of fines from stockpiles will be reduced by the addition of an agglomerating agent, whose action will be aided by the maintenance of wet stockpile surfaces. To provide adequate water on the wind-dried surfaces, an application rate of 1.75 times the average evaporation rate has been adopted.

The passage of free air over coal surfaces during transport will be eliminated by sheeting and enclosures. Areas which are regularly trafficked will be watered at a rate of 1.5 times the average evaporation rate to allow for the additional drying created by the wheel movements.

The areas of disturbance will be kept to a minimum and all scars rehabilitated as soon as practicable.

6.1.3 Noise Control

Potential noise impacts will be controlled by restricting operations to certain hours, by providing physical barriers to noise transmission, and by careful selection and maintenance of potential noise generating equipment.

Bund walls will be constructed around operations that would otherwise produce excessive noise levels offsite. The heights of both the noise source and potential receptors have been considered in design calculations.

Mobile machinery was assumed to generate noise at the exhaust height of 3 m above ground level. The attenuation levels provided by bund walls were estimated by use of a graphical relationship described in Design Bulletin 26, published by the United Kingdom Department of the Environment.

6.1.4 Landscaping and Rehabilitation

The scenic quality of the Colliery Holding and the potential for its enhancement in certain areas has been recognised. Plans have been formulated to both minimise the impact of operations on the local and subregional areas and to improve existing degraded elements of the landscape.

Landscape Design Guidelines

The landscape treatment has been designed to emulate the natural character

of the Colliery Holding with planting layout and density being varied to reflect the informal forest surroundings. To achieve an equivalent structural diversity, row planting and areas with single species dominance will be avoided. Indigenous trees and shrub species will be used throughout the site except for amenity planting where native species with similar environmental characteristics will be used to increase the diversity of form and colour. This amenity planting will be used on the surface facilities site, around the administration office and the outdoor recreational area.

Banks, roads, dam walls and drainage channels will be graded to form harmonious relationships with the existing landform. Sloped areas will be hydroseeded with stabilising grasses and native shrubs. A complete cover of grass will be developed in the drainage channels.

Rehabilitation Design Guidelines

The Company plans to rehabilitate a significantly larger area of land than that directly affected by its own operations.

In the case of the Swansea Opencut, the intention is to recreate a visually pleasing landscape in a currently despoiled area. The aim with regard to the surface facilities site is to minimise the environmental disturbance and visual degradation of a natural landscape.

The following objectives will be adopted:-

- i. To minimise damage to the site.
- ii. To control soil erosion and water pollution.
- iii. To revegetate using natural vegetation associations.
- iv. To return land in terms of topographic appearance and productivity as closely as possible to its original condition.

6.2 SWANSEA OPENCUT

6.2.1 Water Management

The site layout and surface drainage controls for the opencut mine are shown in Figure 4.5.

The drainage control works will be constructed in conjunction with site preparation prior to the commencement of mining. They will handle storms of duration equal to the time of concentration of the catchment.

Runoff from the mine area will be collected in an in-pit sump from where it will be pumped to a 3200 m³ sedimentation dam. The dam will be divided into two cells with overflow from one cell to the next providing additional treatment opportunity.

Catch drains and diversion banks will be established as required. Runoff from the disturbed areas to the northwest will be collected by a 'V' shaped channel with batters of IV:3H and a depth of 0.5 m and directed to a sedimentation dam in the extreme northwest of the site. The dam will have a volume of 5000 m³.

A diversion bank will direct clean runoff around this disturbed area and sedimentation dam to the northwest. The diversion bank will be 'V' shaped with side slopes IV:4H and 0.4 m deep.

A catch drain will collect surface runoff downslope of the existing opencut low wall. The runoff will be directed to the minewater dam for settling. The catch drain will be 'V' shaped with side slopes IV:3H and 0.5 m deep.

An eroded area of backfill from the previous opencut operation exists to the northeast of the opencut. The backfill slopes steeply into a gully which contains elements of rainforest. The backfill area is shown in Figure 4.5 and a cross-section in Figure 4.6. Construction of a toe drain and sedimentation dam would be both difficult and result in severe damage to the area. Consequently it is proposed to reduce the velocity of runoff down the face by the provision of 'V' shaped contour banks with side slopes of IV:3H and a depth of 0.5 m. The contour banks will be at 50 m spacings and of sufficient capacity to retain the 1 in 10 year, five minute storm. The slope will be spread with topsoil and planted with suitable species to ensure stability. To similarly protect existing vegetation on the southern side of the opencut, unnecessary drainage controls will be avoided. Contour banks will be constructed during the rejects disposal operation, directing runoff to the sedimentation dam or in-pit sump.

Loaded coal trucks will be cleaned of adherent coal and dirt at a truck

washing station located to the southeast of the opencut prior to entering Scenic Drive. Approximately 700 L of water will be used in washing each truck. Runoff will pass through an oil and grit arrestor before being collected in a 200 m³ sedimentation dam. The dam will provide nine days retention and settling. During dry weather, it will be a source of water for dust suppression. Wet weather overflow will be through a pipe discharging to the natural watercourse.

6.2.2 Air Quality Control

A 20000 L capacity watercart fitted with a spray bar system will be used for dust suppression in the opencut operation. The overburden extraction area, overburden haul roads and dumping area, the coal extraction and loading area and coal haulage road to the truck washing station will all be watered. Watering will be at the rate of 1.5 times the evaporation rate to allow for the accelerated drying due to trafficking.

Water for dust suppression use will be obtained from the three onsite dams. In extended dry periods supply may have to come from the HDWB domestic supply.

The ROM coal will be hauled from the opencut in tarpaulin-covered lorries. Dust emissions from the base of the truck will be minimised by the previously described washing operation. The section of road between the truck washing station and Scenic Drive will be bitumen-sealed to prevent dust entrainment. The establishment of vegetation on the disposal area north of the truck washing station will both stabilise a potential dust source, and filter particulates from moving air.

6.2.3 Noise Control

Mining

Overburden removal and backfilling and coal extraction operations will be restricted to between the hours of 7 am and 9 pm, 5 d/wk. For the majority of the time, these operations will be undertaken on the floor of the existing opencut. The existing highwalls and low walls will provide some shielding for external receptors.

To further reduce sound levels at the nearest residences at Caves Beach it is proposed to construct an earthen bund wall as necessary along the north eastern edge of the opencut, as shown in Figure 4.5. This will vary in height from 3 m to 8 m and will be up to 520 m in length. It is predicted that the bund wall will reduce sound levels generated at the site and received at the nearest residences by 15 to 16 dB(A). The need for this bund wall would be substantially reduced should mining of the eastern extension not be undertaken.

Where possible all transportation on the site will be via an in-pit haulage road. The existing opencut walls and the proposed bund wall will effectively reduce sound levels generated from the trucks. Adjacent to the section of haulage road between Scenic Drive and the opencut, a large mound will be constructed on the area previously used as an overburden dump. The path difference created by the mound will reduce sound levels generated by trucks by approximately 10 dB(A) at the nearest houses.

All diesel powered equipment will be maintained according to the manufacturers' specifications to ensure that the source noise levels listed in Table 4.7 will not be exceeded.

Rejects Disposal

A compactor with a source noise level of 102 dB(A) and a rubber-tyred bulldozer with a source noise of 105 dB(A) will be used to spread and compact the rejects material. This operation will be undertaken between the hours of 7 am-6 pm, 5 d/wk.

To minimise the noise impact of the rejects disposal operation, the bund wall constructed along the north-eastern side of the opencut will be maintained. Through the construction of perimeter bund walls at each filling level the rejects disposal operation will be shielded from residences to the north-east of the site for over 90 per cent of the time.

6.2.4 Landscaping and Rehabilitation

Objectives

The visual prominence of the opencut site necessitates the adoption of the

following two specific objectives in landscape design and rehabilitation:-

- i. A short term screening of operations.
- ii. A long term reconstruction of a stable landform harmonising with the surrounding landscape.

Visual Controls and Landscape Treatment during Mining

The location of the proposed visual controls is shown in Figure 4.5.

A bund wall is to be located along the northeastern side of the opencut to reduce noise levels and to minimise the visibility of the mining and reject filling operations. The batter slopes will be steep (IV:1.5 H,) in order to achieve the desired height within the confined cleared spaces. The bund wall will be constructed of overburden and hydroseeded with a mixture of stabilising grasses and indigenous trees and shrubs. As the wall will eventually be covered by the rejects refill, quick growing genera such as acacias have been selected for the planting programme. A mound will be constructed from overburden material on a previously disturbed area in the northeast of the site. Its main benefit will be to screen the operations from the elevated residential areas of Caves Beach. It will be planted with a variety of trees and shrubs to integrate the area with its surroundings.

The mine water storage dam has been sited out of view from the Pacific Highway, Caves Beach and Swansea and is positioned on land which has been disturbed previously. After mining, the dam will serve as a catchment for runoff and leachates from the rejects, and its surrounds will be landscaped.

Where possible the mine access road has been sited along the floor of the opencut to minimise the silhouette effect of trucks and other machinery along the ridgeline. Trees and shrubs will be established on the out-of-pit haulage road verge.

Consideration will be given to the establishment of arboreal screens, adjacent to sections of the Pacific Highway when the final realignment of the highway has been decided by the DMR.

Proposed Rehabilitation Programme

The proposed landform and planting of the Swansea Opencut site is shown in Figure 6.2 and Figure 6.3, while Plate 9 is an artist's impression of the rehabilitated site. Plate 8 illustrates the current status of the site.

The intention of the rehabilitation programme is to create a stable, landscaped landform, which will blend with the surrounding natural area. The programme has been designed with sufficient flexibility to allow modification at an interim stage of development to accommodate a final land use.

Rehabilitation will be progressive over the total period of rejects disposal. An area of up to 27 ha will be rehabilitated. This comprises the 8 ha of the initial opencut excavation and an additional disturbed area of 19 ha which in part will be regraded and in part used for rejects disposal. Table 6.2 outlines its phasing relating to the disposal stages shown in Figure 6.8.

TABLE 6.2

PROPOSED REHABILITATION PROGRAMME-SWANSEA OPENCUT

Reject Disposal Section	Year of Revegetation	Area of Section (ha)	Percentage of Total Area
A	4	3.3	11.9
B	8	2.9	10.5
C	10	2.2	7.9
D	12	2.9	10.5
E	14	2.0	7.2
F	16	1.8	6.5
G	18	2.1	7.6
H	18	10.5	37.9
<u>Total</u>		<u>27.7</u>	<u>100.0</u>

The final contours shown in Figure 6.2 have been derived based upon a maximum slope of IV:6H (10°).

Final earthworks and shaping of dams, drainage lines, contour banks will be executed with a small bulldozer. A grader will be used for trimming and levelling.

The overburden will be improved by tillage and the addition of fertilisers. Where necessary, imported topsoil will be spread over the surface. The area will be chisel ploughed on the contour, and rocks exceeding 200 mm in diameter removed. After harrowing, a grass seed mix approved by the NSW Soil Conservation Service will be sown. The mix is likely to include Hulled Couch, Rhodes Grass and Perennial Rye Grass. It is expected that native grasses such as Kangaroo Grass will invade and colonise the area. The grassing operation will be completed as soon as practicable on achievement of final levels.

To facilitate maintenance, an access road from Scenic Drive has been provided. This has been sited to be visually unobtrusive, and follows the contour to minimise the grades and reduce the amount of earthworks required. The road will be 6 m wide and constructed of gravel.

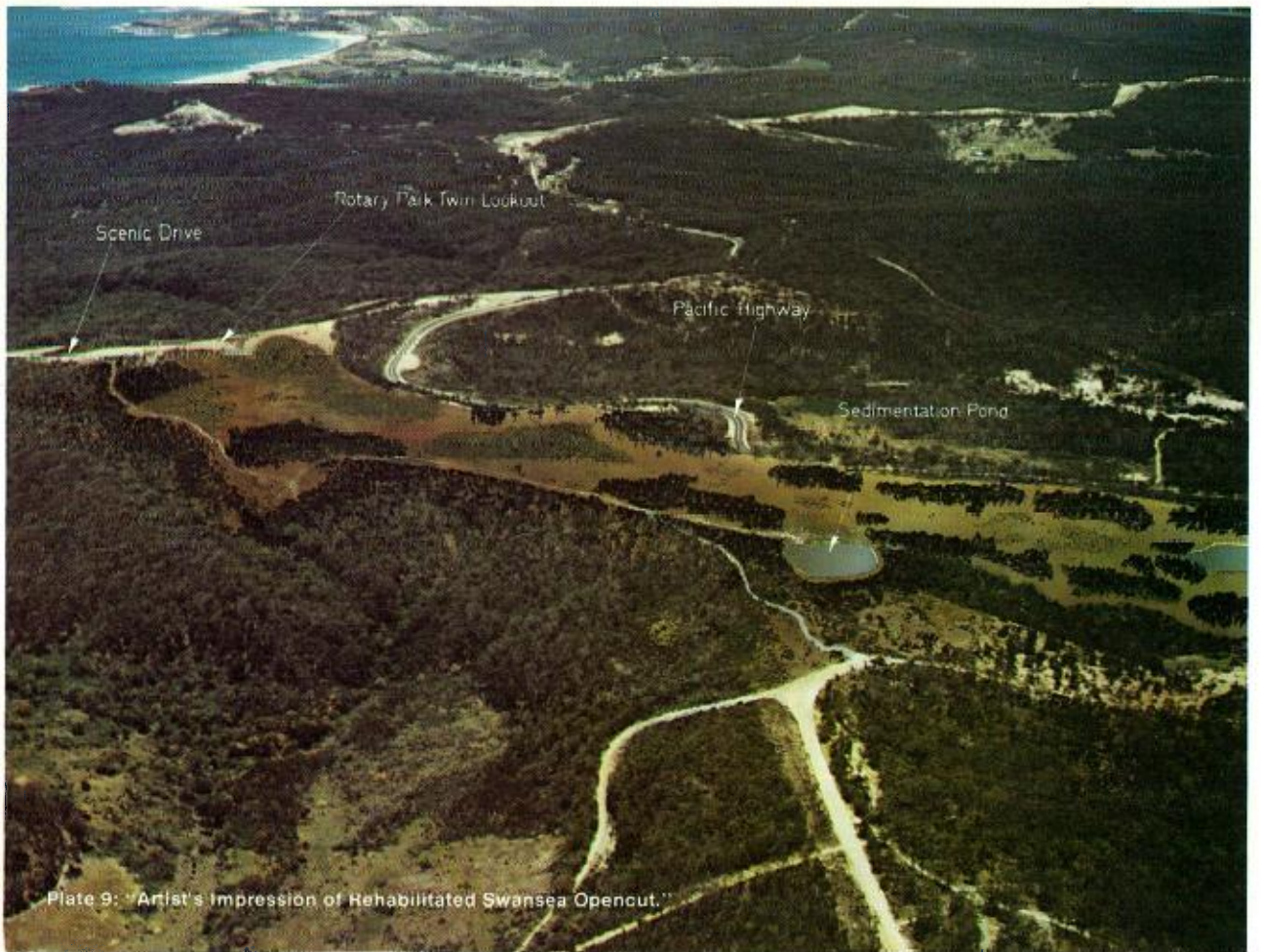
The three small sedimentation dams will be retained as long as necessary on the site to add another dimension to its physical structure, and to serve as focal points. Suitable trees, reeds and rushes will be planted about their perimeters.

Planting and Management

Figure 6.2 defines planting areas and the division of species combinations into Types A and B.

Type A species comprises trees and shrubs from the adjoining areas while type B planting incorporates predominantly upper canopy, indigenous species.

Generally, trees and shrubs will be included with the grass seed mix although this will be subject to review depending upon the success rate. The likely species are listed in the preliminary plant list in Appendix 11.



Protective fencing will be constructed progressively around rehabilitated areas to restrict pedestrian and vehicular access. If rabbits prove to be a problem, vermin proof fencing will be provided.

Any areas which subside, slump or erode will be refilled, graded and revegetated. Supplementary ploughing and sowing will be undertaken in cases of poor germination or growth. Seedlings will be watered during the first year after planting.

Post-Mining and Reject Disposal Land Use

The proposed rehabilitation programme will result in a stable landform suitable for a variety of final land uses. Possible options include the following:-

i. *Forestry*

The site is of sufficient size to warrant the establishment of a forestry operation based upon high value timber. The exposed location of the site and the future use of adjoining land are potential constraints which would need to be considered.

ii. *Residential*

Residential use of the site would be in accordance with the proposed zoning of the Lake Macquarie Municipal Council's Draft Environmental Planning Instrument. Adjoining areas, to the north, east and west of the site have a similar proposed zoning.

A detailed geotechnical study would be necessary to ascertain the suitability of the compacted material as a foundation for building purposes.

iii. *Hotel/Motel/Tourist Development*

The location of the site makes it ideally suited to the development of tourist-orientated facilities. The use of the site for this purpose would necessitate rezoning under the Draft Environmental Planning Instrument and would also require a detailed geotechnical study.

iv. *Active Recreation Facilities*

The construction of tennis courts, netball courts, sports fields and the like and/or golf course would result in these facilities being located adjacent to future residential development.

v. *Passive Recreation Facilities*

This option would provide for a range of activities including barbecue and picnic facilities, walking trails and play areas within forested surrounds in a similar setting to that at Blackbutt Reserve, Newcastle.

It is acknowledged that over the estimated 18 years period of rehabilitation at the Swansea Opencut, changing circumstances may alter preferences for final land use of the site. These will be progressively reviewed by the Company in conjunction with the local community, the Lake Macquarie Municipal Council and relevant government departments. The establishment of a working committee comprising representatives from each of the above organisations and the convening of public meetings will provide the means of assessing public opinion concerning the operation and the final land use of the site.

6.3 THE WALLAMAINE UNDERGROUND MINE AND SURFACE FACILITIES

6.3.1 Water Management

The surface site drainage controls are indicated in Figure 6.4.

All drains will have the capacity to handle at least time of concentration storms.

There will be four dams on the site.

- i. The runoff sedimentation dam will be of 4000 m^3 capacity and able to retain flows generated by 10 year return period one hour duration storms.
- ii. The mine water dam will be of the same 4200 m^3 capacity holding 3.5 days makeup for the coal preparation plant, plus a surcharge volume of 200 m^3 to accommodate direct rainfall. Upslope runoff will bypass the dam via a 0.5 m deep diversion bank. In the case of coal preparation plant malfunction, mine water will be temporarily stored underground. A continuation of this situation during periods of sustained rainfall may lead to the discharge of diluted mine water via the clean water dam and clean water diversion pipe.

- iii. The clean water dam will provide storage for up to 5 500 m³ and will be a source of water for on site use. The remaining runoff will be passed through the site in a 1 500 mm diameter pipe. All flows from storms with a return period of 100 years will be passed by this pipe. In the event of storms greater than this a surcharge capacity of 1 000 m³ will be provided in the dam.
- iv. An emergency storage will be provided to enable all water to be drained from the coal preparation plant if required. It will consist of a 1 500 m³ capacity empoundment adjacent to the plant, enclosed by an earthen dam downstream and a bund wall upslope to redirect storm runoff. The dam volume allows for two discharges from the 500 m³ capacity thickener, with additional provision for direct rainfall. Clear supernatant water will be returned to the plant as make up as soon as possible. The underflow will be processed by the band press filter.

Both the mine water and clean water dams will be constructed by excavating 1 m to 2 m of material from the existing creek sections and forming the required impounding walls. This method will minimise the surface area available for evaporation. In the case of the clean water dam it will also permit the top water level to be lower than the mine entry thereby eliminating the risk of flooding of the working in the unlikely event of the dam overtopping.

As it is desirable to permit evaporation from the site runoff dam, it will be formed without excavation of base material, thus maximising surface area.

Washings from the plant workshop and the truck repair shop will pass through oil and grit arrestors prior to discharge to the sewage treatment plant. Waste water from the truck washing station will be similarly treated before passing to the runoff sedimentation dam. This dam will also be provided with a fine coal trap to remove stockpile or road generated fines.

Straw bales will be provided at the inlet of the sedimentation dam to trap any oil washed from trafficked areas. The bales will be regularly changed and disposed of by burial. The dam overflow will be baffled to prevent any oil discharge from the site.

6.3.2 Air Quality Control

It is estimated that the moisture content of ROM coal delivered to the surface will be a minimum of 4 per cent, perhaps rising to 6-8 per cent. As this proportion will decrease with handling, it is proposed to incorporate controls to minimise dust generation at all points. Although coal washing will add moisture, supplementary safeguards will be provided.

All conveyors will be sheeted on one side and the top. The provision of sheeting on the southern or windward side will prevent the passage of high velocity air, while top sheeting will reduce turbulence. The leeward side of the conveyors will not be sheeted in order to facilitate inspection and maintenance. It is not desirable to totally enclose conveyors as there have been instances of serious fires within conveyors of this type.

The rotary breaker, sizing screens and all transfer chutes will be housed in steel sheeted enclosures. Fine mist sprays will be installed at all transfer points as shown in Figures 4.11 and 6.4. It is expected that these sprays will be required only intermittently.

An agglomerating agent, activated by a spray system, will be added to stockpiled ROM and washed coal. Water sprays will be of the traversing agricultural type (Valducci manufacture or similar) set to ensure full coverage of the piles.

The agglomerating agent will be diluted in water to one part in 10 000, and then applied in this form at the rate of one per cent by weight of coal. Conveyor trestle mounted water sprays will apply water at the rate of 1.5 L/h for each square metre surface area of stockpile.

The sprays will be automatically activated when wind speeds exceed 5 m/s, and provided with a humidity control to cancel wind activation during rainfall. A manual override will be available.

Coal free-fall and impact will be minimised by the use of rill towers for stockpile initiation. Dust generation will thus be reduced.

Stockpile reclamation will be by means of recovery tunnel. 'Dead' portions

will be reclaimed by mobile equipment to minimise the generation of fines on the pad.

Washed coal and rejects from the coal preparation plant will be loaded into trucks from elevated storage bins. The distance from the bottom of the bin to the lorry trailer will be minimised to reduce dust and noise generation. The coal trucks will be provided with covering tarpaulins, and will pass through the washing station prior to dispatch.

All coal haulage will be along sealed roads. The area of the surface facilities site which will be infrequently trafficked is to be provided with a crushed rock surface to reduce fines generation. All disturbed areas such as roadside batters will be grassed and vegetated.

The mine ventilation system is designed to settle the majority of workforce dust in the returns prior to atmospheric discharge.

6.3.3 Noise Control

Noise generation will be reduced by limiting production to two shifts, between 7 am and 9 pm. The third shift, between 11 pm and 6 am, will be restricted to maintenance and thus major, noise-producing machinery will not be operational. Operations will be carried out 5 d/wk and there will be the traditional close down over the Christmas period.

Materials Handling

Both the rotary breaker house and the conveyor transfer towers will be clad with steel sheeting. It is estimated that the sound level for the breaker under load will be 85 dB(A) at 1 m outside the enclosed building. The raw coal surge bins will be similarly enclosed.

The conveyors, stackers and reclaimers will generate low noise levels since they are electrically powered. These levels will be reduced further by the enclosure of transfer points and elevating conveyors.

Coal Preparation Plant

The following safeguards will be incorporated in the coal preparation

plant to ensure that the average sound level does not exceed 90 dB(A) within the building:-

- i. Screens will be mounted on resilient rubber tubes and be operated by two out-of-balance shafts driven by separate motors. No gearboxes will be used. Noise levels for these screens will be about 80 dB(A) at 1 m. The screens will be supported on full steel and concrete floors to isolate vibration and reduce sound generation.
- ii. Centrifuges will be of the rotating type only and be without vertical vibration. They will be mounted on resilient rubber blocks and be supported on full steel and concrete floors.
- iii. All high speed and vibrating equipment will be housed on the ground, first and second floors and be supported on concrete.
- iv. All other equipment on the upper floors will be slow moving, low noise producing or stationary.
- v. The building will be clad from the first floor level with painted steel sheeting of sandwich-type construction such as 'Ondulit' or similar. It is necessary to maintain large opening areas at ground floor level for safety reasons.
- vi. The flow of coal through the plant will be mainly by gravity. All chutes and launders will be tiled with high density, fused, alumina tiles to minimise wear and noise.
- vii. Compressors will be housed in a steel-sheeted sound proof enclosure outside the coal preparation plant. The plant air compressor is rated at 67 to 75 dB(A) at 1 m by the manufacturer.

The associated control building will be of brick construction with reinforced concrete floors and will be separate from the main building. Windows will be double glazed, with the glazing panels 6 mm thick at 150 mm centres and mounted in neoprene mouldings. Isolating doors will be solid core. As a result, noise levels for operators in the control and amenities rooms will be reduced.

On Site Haulage

All diesel-operated machines will be maintained according to the manufacturer's specifications ensuring that the source noise levels quoted

by the makers are not exceeded.

Surface haulage roads will be constructed with as low grades as possible to minimise the engine noise generated by laden trucks. Noise arising from empty haulage trucks will be minimised by regular maintenance of roads.

The haulage road from the coal preparation plant to Scenic Drive will be built, for the most part, below the existing ridgeline separating the site from Caves Beach. Excavated material will be used to construct a bund wall where noise attenuation is necessary. This is expected to reduce sound levels otherwise received in the Caves Beach area by 12 dB(A).

6.3.4 Landscaping, Rehabilitation and Visual Controls

Introduction

Major emphasis has been lent to the siting, layout and visual character of the surface facilities and associated service easements. Measures have been designed to minimise the visual intrusion of the development during its operational phase, and options have been examined for post-mining land use.

Landscape and visual safeguards have been developed with the following specific objectives:-

- i. to minimise visual impact
- ii. to repair environment damage
- iii. to control and prevent erosion and water pollution
- iv. to provide an aesthetically pleasing working environment
- v. to provide shade for buildings and car parks.

The development layout was designed within engineering, economic, environmental and aesthetic constraints. The adopted layouts are described in the following section.

Siting and Layout

i. Surface Facilities

Investigations of alternative sites are detailed in Sections 3.5, 3.6 and 4.5.1. The chosen site was approved by the Lake Macquarie Municipal Council in 1978 subject to the conditions outlined in Appendix 2.

Certain areas of the site are more visually prominent than others. Consequently, difficult to screen visually obtrusive structures have been located in the portions of the site either naturally screened, or with potential for added screening. As a result, the coal stockpiles are to be situated as closely as possible to the north-western boundary where they will be partially obscured from view from the Rotary Park Twin Lookout. The bath house, administration buildings and machinery sheds are located in the same area due to their required proximity to the mine entry.

The coal preparation plant, dams and car parks were sited in a more prominent section of the site as effective screening and design will render them relatively unobtrusive.

ii. Access Road

The access road generally avoids the ridgeline utilised by the present track to Pinney Beach, minimising both visual and audible impacts to Caves Beach. This effect will be enhanced by the provision of a bund wall planted with trees and shrubs, separating the road from potential observers.

iii. Power Line

The power line route shown in Figure 4.7 has been chosen to both reduce visual impacts and the need to disturb existing vegetation.

The line has been angled to avoid straight line vision along its length, and prominent ridgelines have been avoided.

After deviating from a route parallel to the existing track to Pinney Beach, the line will be located to the south of and slightly below the crown of the ridgeline. From this point the route turns through a right angle, traverses the flank of a densely vegetated spur and finally crosses a steep gully in a single span. Beneath this span minimal clearing will be undertaken and no access track provided.

Green coloured tanalith-treated timber poles will be used. With the exception of a four-wheel-drive access track, the 18 m wide easement will not be cleared of

growth less than 3 m in height.

Views of a 100 m section of line from Caves Beach will be restricted by the establishment of an arboreal screen.

Architectural Treatment

Preliminary design considerations for the major buildings are outlined in Section 4.5.7 and pictured in Figure 4.11 and Plate 4.

To ensure a high standard of design, details will be provided by a specialist consultant. The design brief will include specific reference to the following:-

- i. The achievement of site unity through the adoption of a similar scale for all buildings, use of compatible materials, interconnection of buildings with curved walkways where practicable, and consistent architectural detailing.
- ii. The use of low maintenance, texturally interesting materials in colours sympathetic to the natural surroundings.
- iii. The use of curved shapes to enclose the industrial structures such as conveyor gantries, breaker house and conveyor transfer points.
- iv. The adoption of a generally low profile design emphasised by the use of a gable-roofed structure with wide eaves overhang and projecting end walls.

Landscape Treatment and Design Criteria

The proposals illustrated in Figures 6.5 and 6.6 have been designed to reflect the informal character of the area and to create harmony between the mining and natural landscapes.

Extensive tree and shrub planting will be conducted to complement both the vegetation retained on the site and the surrounding forest landscape. Indigenous plant material will be used for the majority of the scheme. Native species with a greater variety of form and colour will be used for amenity plantings close to the administration building.

Similar planting will be undertaken within the broad zone intended as an outdoor recreation area and provided with facilities such as tables, seats and barbecues.

The large open space which follows the natural drainage line between the coal stockpile area and the workshop/bath house site will be planted with upper canopy trees similar in species and structure to the surrounding landscape. This will visually divide the site and reduce both the scale of the operation and the visual impact of the initial removal of natural vegetation.

Similarly extensive planting will be carried out on the eastern boundary to screen the operation from Pinney Beach and adjoining areas. This planting will be phased over a number of years to allow the subsequent growth of climax species. Salt tolerant plants will be established initially to provide protection for taller, less tolerant species selected to increase the effectiveness of the screening.

In areas indicated as infill planting in Figure 6.5, it is proposed to increase the density of existing sparse natural growth.

Dam walls will be graded to slopes not exceeding 1V:6H and will be hydroseeded with stabilising grasses and shrubs as soon as final design levels are achieved. Drainage channels will be broad-based and well-grassed to prevent erosion. Channel sides will be graded to a maximum slope of 1V:6H to relate with the existing landforms. Roadside runoff catchment drains will be grassed and planted with trees and shrubs.

The site will be bounded by a 1.2 m high fence constructed of green coloured, tanalith-treated timber poles and wire mesh and of similar unobtrusive style to those used on beach-front erosion control zones. The perimeter of the external storage areas will be enclosed by 1.8 m high plastic-coated mesh security fences. Trees and shrubs will be planted to reduce the visual impact of these barriers.

A full time gardener will be employed during the operation of the mine to maintain and manage the landscaping programme. All dead and damaged stock will be replaced. Hydroseeded areas which fail either to germinate

or maintain sufficient growth rates will be resown. An irrigation system will be constructed to serve the amenity planting areas.

Post-Mining Land Use Options

Four post-mining land use options have been investigated, all being considered appropriate to the conditions outlined in the Lake Macquarie Municipal Council Draft Environmental Planning Instrument. They are as follows:-

i. *Revegetation of reclaimed land with natural forest associations*

This would require dismantling and removal of all structures, ripping and regrading of roads and restoration of earthworks to pre-mining levels. The land would become a component of the inter-city environmental zone.

ii. *Subdivision of the area for residential development*

As it is unlikely that the surface facilities site would be developed in isolation, considerable additional earthworks and environmental damage would be necessary to prepare adjacent areas. The aspect and orientation of the valley would not permit full advantage to be taken of the solar benefits while exposure to less favourable elements would be unavoidable.

Developments of this nature would be contrary to the concept of an inter-urban green belt being retained in the area.

iii. *Development of the site and immediate foreshore into a comprehensive beach/recreation resort*

This landscape could be accommodated with minimal disruption to the subregional scenic quality. Facilities such as car parks and picnic and barbecue areas could be developed along the foreshore while change rooms, kiosks and other amenities could be sited within suitable surface facility structures.

The continual expansion of the residential areas in the vicinity will in all likelihood generate an increased demand for this form of development.

iv. *Development of a community recreational/educational complex within suitable surface facilities structures*

The implementation of this option would involve the use of such buildings and structures as the administration building, bath house, workshop and car parks.

The existing and access road and services would be maintained.

These options have been considered at this stage to assess the potential of the site and indicate the possible final land uses. These and others will be re-evaluated towards the end of the expected life of the mine in the light of changing social attitudes and physical conditions.

Rehabilitation

Without a final land use determination, rehabilitation procedures can only be generalised. However, it is expected that the following operations will be undertaken:-

- i. The mine entry will be sealed with a double thickness concrete block wall and the face backfilled to reform natural slopes.
- ii. Roads and work platforms will be deep-ripped and regraded to natural levels. Regrading will include the batter slopes and dams. Natural drainage networks will be re-created. Bitumen road surface material will be removed from the site.
- iii. All structures not used in the post-mining landscape will be dismantled and removed from the site. Foundations to a depth of 500 mm will be removed.
- iv. Where possible, trees and shrubs planted on the site during the mining operation will be retained. Some amenity planting may have to be destroyed if the natural landform is to be re-created.
- v. Security fences will be dismantled and removed from the site.
- vi. Imported topsoil will be spread over the site to a depth of 300 mm and chisel ploughed to mix with the existing soil.
- vii. The site will be sown with a seed mix containing both stabilising grasses and indigenous tree and shrub species. Seedling planting will be undertaken to complement the direct seeding. This operation will be carried out during the Autumn months.
- viii. The seedling plantings will be watered for the first year to ensure survival and vigorous growth. Any dead and

damaged stock will be replaced, true to species.

- ix. Protective fencing will be erected to restrict unauthorised vehicles and pedestrian access. Should rabbits prove to be a problem vermin-proof fencing will be constructed.

Maintenance and Management

To minimise maintenance on the site, indigenous species have been selected, mulches will be used where practicable to reduce weed growth, and an irrigation system is to be installed to serve the amenity planting areas.

A full time gardener will be employed during the operation of the mine to maintain and manage the landscape programme, including the rehabilitation of the rejects disposal sites. All dead and damaged stock will be replaced and hydroseeded areas which fail either to germinate or maintain sufficient growth rates will be resown. The management programme will include the eradication of noxious weeds such as bitou bush from the site and its surroundings. Planting outside the boundary will be undertaken to ensure maintenance of the present ecosystem.

A management proposal will be drawn up for both the rehabilitation area and the preferred land use option at the cessation of mining. It will be based on discussions between the Company, Lake Macquarie Municipal Council, local residents, community groups and relevant governmental bodies. The same working committee (comprising representatives of the above organisations) as proposed for reviewing the Swansea Opencut land use options will be used in this instance.

Fire protection management

The natural characteristics of the site provide a high degree of protection from fire as the southern and western boundaries are bordered by gullies and wet sclerophyll forest. The eastern boundary adjoins heathland/grassland and is some 500 to 600 m from the coastline. It has been established by *Luke and McArthur, 1978*, that the major bushfire threat probably will come from forested areas to the west with fires being fanned by westerly winds. Because of the amphitheatre-like topography surrounding the site, it is

relatively sheltered from westerly winds.

To achieve an adequate fire break without destroying the visual quality of the site, fire control management for the surface facilities sites will comprise the creation and maintenance of a fuel-reduced zone approximately 100 m wide surrounding the structures and coal stockpiles as shown in Figure 6.5. Initially all logs and tritter will be removed from the forest floor in this zone and a 'cool' controlled burn will be undertaken to establish the firebreak. In conjunction with the Lake Macquarie Municipal Council fire control officer and the local volunteer bushfire brigade controlled burns will be undertaken every two to three years. The procedure will be reviewed at the end of each season.

6.4 COAL REJECTS DISPOSAL

6.4.1 Rejects Treatment

The Company proposes to minimise any potential impacts which could arise from reject disposal by adopting two significant policies, namely:

- i. dewatering of coal preparation plant tailings,
- ii. rehabilitation of abandoned pits within the Colliery Holding.

All thickener tailings will be dewatered in a bandpress filter unit, producing a filter cake with a moisture content of approximately 30 per cent. Extracted water will be recycled in the plant. As a result, large tailings settlement dams will not be necessary. Plates 6 and 7 picture the filter cake from a similar pilot plant. Appendix 17 provides further details of the process.

The dewatered fines will be mixed with coarse rejects to produce a combined product of 12 to 15 per cent moisture. This material can be handled in standard trucks without water leakage, and can be disposed of in a manner similar to that employed for overburden.

6.4.2 Evaluation of Potential Disposal Sites

Fourteen potential disposal sites, within economical transport distance of the coal preparation plant, were investigated. Their locations are shown in Figure 6.7, and details of each are provided in Table 6.3. With the exception of site 4, all were abandoned or operating quarries and mines.

Sites 1 to 4 were found to be most suited for rejects disposal with potentially some additional capacity at site 5 in the future. Sites 7 to 13 are shallow clay pits whose lack of capacity prevents their effective use.

Given permission from the present owners, it is the Company's intention to rehabilitate surface scars within the Colliery Holding.

Site 1, the abandoned Swansea Opencut will initially be mined for remaining coal before becoming the major disposal area. It has an estimated disposal life of 18.3 years. The site layout is detailed in Figure 6.8 and the conceptual filling procedure and final levels in Figure 6.9.

Site 2, the abandoned Radar Hill Opencut, will be filled with rejects over a period of 1.4 years and progressively rehabilitated, resulting in the final contours shown in Figure 6.10.

Site 3, known as the Adit, has storage capacity for five months rejects production. Its final landform is shown in Figure 6.11.

Site 4, west of the Pacific Highway, comprises an abandoned clay pit, a former garbage disposal site and adjacent bushland. The site was approved by Lake Macquarie Municipal Council for rejects disposal in 1978. Its storage potential will be governed by the route chosen for the upgrading of the Pacific Highway.

The use of site 4 will be determined by the Company's success in selling coal rejects. During 1980, the Company sold 58 per cent of the reject material from its Gretley mine, located at Wallsend. Should an appreciable quantity be sold from the proposed operation, it is likely that this site will be unused. Without sales, disposal would be conducted for a maximum

TABLE 6.3

CHARACTERISTICS OF POTENTIAL REJECT DISPOSAL SITES

Site Number (refer Fig.6.7)	Area (ha)	Potential Capacity (years)	Distance from Coal Preparation Plant (km)	Physical Characteristics	Visibility	Ownership	Present Use	Adjacent Land Use	Suitability
1	27.7	16.3	2.5 km. Along proposed mine access road.	Defined boxcut within predominantly sandstone material. Regenerated She-oaks to 6 m.	High from Rotary Park Twin Lookout and Swansea.	Anson Bay	Abandoned Swansea Opencut Mine.	Natural. Residential area 500 m to NE.	Yes
2	3.8	1.4	4 km. Along proposed mine access road, Pacific Highway and existing road.	Defined boxcut. 10 m massive sandstone. Bare overburden disposal surface.	High from Rotary Park Twin Lookout. Elsewhere low.	Anson Bay	Abandoned Radar Hill Opencut Mine.	Natural. Remote.	Yes
3	1.8	0.4	1.2 km. Along proposed mine access road.	Near vertical surface, with adjacent bare area.	High from Quarry Beach Track. Elsewhere low.	Anson Bay	Abandoned Adit.	Natural. Residential area 1 km to N.	Yes
4	31.1	28	2.5 km. Along proposed mine access road and Pacific Highway.	Partly natural, partly disturbed. Slope range 3° to 12°. Regenerated vegetation to 10 m. Red-orange duplex soils.	High from Pacific Highway and Rotary Park Twin Lookout.	Anson Bay	Natural, disused shallow claypits and filled waste disposal site.	Natural. Remote.	Yes, subject to Highway re-alignment
5	4.0	3 - 5	4.5 km. Along proposed mine access road and Pacific Highway.	Benched quarry in conglomerate, surrounded by dense vegetation.	Low	Lake Macquarie Municipal Council.	Operating Council road base quarry.	Natural. Remote.	Yes, in long term, after cessation of quarrying
6	2.5	Low	3 km. Along existing tracks via Swansea Opencut.	Cleared site, with eroded face of weathered conglomerate exposed. Slopes exceed 18°.	High from Caves Beach and Swansea.	Anson Bay	Operating Council road base quarry.	Natural to W. Caves Beach Public School and residential areas adjacent.	No. Insufficient capacity and proximity to school.
7	1.1	Low	3.2 km. Existing tracks would require upgrading	Cleared, shallow excavation in duplex soil, surrounded by disturbed woodland to open-forest.	Low	-	Abandoned clay pit.	Natural. Remote.	No. Insufficient capacity.
8	0.2	Low	3.3 km. Existing tracks would require upgrading.	Cleared, shallow excavation in duplex soil, surrounded by disturbed woodland to open-forest.	Low	-	Abandoned clay pit.	Natural. Remote.	No. Insufficient capacity.

TABLE 6.3 (cont'd)

Site Number (refer Fig. 6.7)	Area (ha)	Potential Capacity (years)	Distance from Coal Preparation Plant (km)	Physical Characteristics	Visibility	Ownership	Present Use	Adjacent Land Use	Suitability
9	1.4	Low	3.5 km. Existing tracks would require upgrading.	Cleared, shallow excavation in duplex soil, surrounded by disturbed woodland to open-forest.	Low	-	Abandoned clay pit.	Natural. Remote.	No. Insufficient capacity.
10	0.6	Low	3.8 km. Existing tracks would require upgrading.	Cleared, shallow excavation in duplex soil, surrounded by disturbed woodland to open-forest.	Low	-	Abandoned clay pit.	Natural. Remote.	No. Insufficient capacity.
11	7.8	Low	4 km. Existing tracks would require upgrading.	Cleared, shallow excavation in duplex soil, surrounded by disturbed woodland to open-forest.	Low	-	Operating clay pit.	Natural. Remote.	No. Insufficient capacity.
12	0.2	Low	3.8 km. Existing tracks would require upgrading.	Cleared, shallow excavation in duplex soil, surrounded by disturbed woodland to open-forest.	Low	-	Abandoned clay pit.	Natural. Remote.	No. Insufficient capacity.
13	0.9	Low	3.5 km. Existing tracks would require upgrading.	Cleared, shallow excavation in duplex soil, surrounded by disturbed woodland to open-forest.	Low	-	Abandoned clay pit.	Natural. Remote.	No. Insufficient capacity.
14	1.3	Low	3.7 km. Existing tracks would require upgrading.	Excavation in weathered conglomerate.	Low	-	Operating road base quarry.	Natural. Remote.	No. Insufficient capacity.

period of two years. The capacity of the area would enable it to handle up to seven years production of rejects at planned rates.

6.4.3 Rejects Transport

Rejects will be hauled in normal 20 t highway trucks, operating between the hours of 7 am and 6 pm. Trucks will be washed prior to leaving the site. Their movements along the Colliery access road will be screened from the view of residences at Caves Beach.

The low moisture content of the rejects will prevent leakage from trucks.

6.4.4 Disposal Site Preparations

Drainage controls will be instituted at all disposal sites, with the construction of necessary diversion banks, catch drains and sedimentation dams. Any vegetation will be cleared and burned as permitted.

All timber and domestic wastes on the site will be collected and buried in areas not required for rejects disposal. Large rocks will be crushed or removed to prevent the creation of air pockets which could encourage spontaneous combustion.

A firebreak of adequate width and free of all vegetation with the exception of grass will be cleared around each site.

6.4.5 Rejects Placement

Rejects will be end dumped and spread by bulldozer in layers of approximately 600 mm. Each loose layer will be compacted with a minimum of six passes by a self-propelled compactor prior to further dumping.

Compaction has been designed to maximise the useful life of the sites and to minimise the occurrence of air voids and water infiltration, both contributors to the spontaneous combustion of coal rejects. For similar reasons, the entrainment of wastes such as grease, rags and wood will be prevented.

A compacted density of 2 t/m^3 has been assumed in volume calculations. Field testing will be employed to verify this figure and should significant variations arise, the disposal programme will be revised accordingly.

Working areas will be slightly graded to prevent rainfall ponding. Any runoff will be direct to catch drains or sumps.

6.4.6 Water Management

Runoff from within the sites will be directed by diversion banks and catch drains to sedimentation dams. Every effort will be made to prevent the movement of clean water into the filling areas. Discharge from dams will occur only in times of storm flows.

The drainage controls shown in Figure 4.5 for the Swansea Opencut mining operation will be maintained. In addition, 'V' shaped contour banks 0.5 m deep with side slopes of IV:3H will be constructed on the rehabilitated surface at intervals not exceeding 50 m. They will drain in a north-westerly direction to either the minewater dam or the sedimentation dam.

Figure 6.10 shows drainage controls proposed for the Radar Hill site. A 'V' shaped catch drain, 0.3 m deep, will direct runoff to a 800 m^3 sedimentation dam.

A 'V' shaped diversion bank with side slopes IV:4 H and a depth of 0.3 m will direct clean runoff around the Adit site and into a 250 m^3 sedimentation dam. These controls are shown in Figure 6.11.

6.4.7 Air Quality Control

Tarpaulin covers will not be required on reject haulage trucks as a result of the moisture content of the material. The trucks will be washed before leaving the surface facilities site.

Any unsealed roads to and within the disposal sites will be watered at the rate of 1.5 times the evaporation rate.

Rehabilitated areas will be irrigated to aid the establishment of vegetation.

Areas left exposed over scheduled extended shutdown periods will be kept moist to prevent dust generation from dessicated layers of rejects.

6.4.8 Noise Control

Noise control safeguards adopted for the Swansea Opencut are detailed in Section 6.2.3.

The geographic location of the Radar Hill site and the Adit will obviate the development of any further noise attenuation methods.

6.4.9 Rehabilitation

Upon reaching final reject contours, the surface will be covered with inert fill compacted to a thickness of 1 m. The fill will be obtained from the existing overburden mounds in the case of the Swansea Opencut and imported for the other disposal areas. The overburden material will be improved by tillage and the addition of fertiliser. Where necessary topsoil will be imported for use in the preparation of the seed bed. Full details of revegetation procedures are provided in Section 6.2.4.

6.5 TRANSPORTATION SAFEGUARDS

6.5.1 Route Selection

A number of options for the transport of coal were evaluated as detailed in Appendix 18. To minimise the effects of the transportation of coal by road, both short term and long term, haulage routes have been selected to avoid residential areas as far as possible.

Short Term Haulage

If the coal is sold to Coal & Allied Operations Pty. Limited, Catherine Hill Bay, transport would be via the Pacific Highway and Coal & Allied's private road. This is some 3 km longer than the alternative route via Flowers Drive, which passes through the residential concentrations of Middle Camp and Catherine Hill Bay.

Long Term Haulage

The proposed haulage method for coal from the underground mine to the Port of Newcastle combines road and rail. In this manner, although approximately double the most direct link in distance, the route avoids the business and residential centres of Swansea, Belmont and Charlestown. The rail mode of transport is used well in excess of 50 per cent of the travelling distance. Road haulage distance is approximately 30 km, with rail distance being 50 km.

6.5.2 Proposed Road Intersection Upgrading

To facilitate coal haulage by road and to minimise delays to other users the Company proposes to upgrade two key intersections, in accordance with the requirements of the DMR and the Police Department.

- i. *The intersection of the Swansea Opencut access road, the Wallamaine Underground Mine access road and Scenic Drive.*

Sight lines at the access to the Swansea Opencut will be improved by benching of the road cuttings where necessary. Signs warning motorists of truck crossings will be erected at the requisite distances along Scenic Drive, while stop signs will be placed at both mine access road intersections with Scenic Drive.

Concrete-paved islands, painted chevron-marked medians and double yellow lines will be used to form turning lanes. The intersection will be lit by overhead lighting. Details of the proposed upgrading are shown in Figure 6.12.

- ii. *The intersection of Scenic Drive and the Pacific Highway.*

The Company intends to provide deceleration and acceleration lanes at this intersection to prevent any traffic congestion. The design would be in accordance with DMR requirements.

The Company will examine the intersection requirements at the proposed Wallamaine Rail Siding as part of the subsequent environmental impact statement for that facility.

6.5.3 Operational Safeguards

Operational safeguards which will be incorporated into the proposal are summarised below. Details of each have been provided previously.

- i. Hours of haulage will be restricted to between 7 am and 6 pm, 5 d/wk.
- ii. All trafficked roads will be either bitumen-sealed or be regularly watered and graded if gravel-surfaced.
- iii. Prior to travelling on public roads all loaded trucks will pass through a truck washing station.
- iv. Tarpaulins will be applied to all loaded coal trucks prior to leaving the mine site.
- v. Trucks will be maintained according to the manufacturer's specifications ensuring that exhaust gases and noise generation are kept to a minimum.

6.6 SOCIAL SAFEGUARDS

6.6.1 Provision of Housing

During the 16 months construction phase, temporary accommodation for the estimated 40 to 65 per cent of the workforce recruited from outside the local area will be provided in the form of hostels, located probably on the Company's land. The provision of these hostels will be the responsibility of the prime contractor.

Accommodation shortages within the Lower Hunter Subregion relate primarily to the supply of serviced land and to a lesser extent to the availability of labour and materials for the construction of housing. The Company,

through ownership of land in Caves Beach, will make available to the workforce up to 93 serviced allotments from its current subdivision abutting the southern section of Caves Beach and as shown in Figure 7.1. This land would be available during the early development stage of the mine, with further land being released from other areas owned by the Company as necessary.

In addition, the Company proposes to provide housing for the five senior management personnel.

6.6.2 Employment Training Scheme

The Company proposes to implement an in-house training scheme, whereby unskilled and semi-skilled employees will be trained to a skilled status. All new employees starting at the Colliery regardless of experience or classification will be trained in safe working practices and Company procedures at the Colliery training centre. New employees are classified in two categories:

i. *Employee without previous mining industry experience:*

These employees attend the Colliery training centre for the first five days where they undertake a training scheme which will give them a complete introduction to the mining industry. The scheme consists of lectures, safety films and one day underground. On completion of the training scheme the employee will be placed with experienced men of his classification for 'on job training' for a further three weeks where he will learn safe working practices. After this four week period it is considered that the employee can join the workforce and gather further knowledge working with experienced men.

ii. *New Experienced Employee:*

This employee although being an experienced underground person and having years of experience also must attend the Colliery training centre for the first three days of his employment and undertake a modified version of the training scheme. This scheme introduces the employee to the mine and its environment, bringing him up to date on

modern-day technology in mining. During the last two days of the first week he familiarises himself with the colliery workings and conditions by working on the job with experienced mineworkers of his classification. The employee then joins the workforce on the shift that is allotted to him in his job classification.

6.7 SAFEGUARDS APPLICABLE TO CAMP YONDAIO

The following summary of safeguards, outlined in detail throughout Section 6 are applicable to the reduction of impacts to the adjoining Camp Yondaio property.

i. *Noise*

Noise generation will be reduced by limiting production in the mine and the coal preparation plant to two shifts, between 7 am and 9 pm. The third shift, between 11 pm and 6 am will be restricted to maintenance and thus major, noise-producing machinery will not be operational.

Operations will be restricted to 5 d/wk and there will be the traditional close down over the Christmas period. This will reduce the likelihood of an impact during periods when the Camp is more likely to be used.

ii. *Dust*

The regular watering of Mine Camp Road during the 18 months period of rejects disposal at Radar Hill will effectively reduce the likelihood of dust generation from road haulage and thus the impact on the adjacent hostel and caretaker's residence.

iii. *Water*

A leachate dam at the base of the Radar Hill rejects disposal site will ensure that the present water quality within watercourses traversing the Camp Yondaio property is maintained.

The comprehensive system of water management on the surface facilities site will ensure that no dry weather discharge will occur. Water quality downstream of the site and in Pinney Lagoon will not be impaired.

iv. *Landscaping*

The proposed landscaping will reduce the impact of a manmade intrusion into a largely undisturbed environment.

v. *Safety*

The provision of fire hydrants and fire-fighting equipment as well as first-aid post on the site will be beneficial to the Camp in times of emergency.

vi. *Services*

The provision of power, telephone and water to the site would make it relatively easy to extend these services to the Camp.

6.8 ENVIRONMENTAL MANAGEMENT

In conjunction with the high standard of safeguards incorporated at the design stage of the project, the Company intends to maintain the efficiency of its pollution-control devices by regular monitoring. This will be undertaken jointly by the Colliery's chemist and either the Company's environmental officer or by consultants. The procedures will be in accordance with SPCC licence conditions.

Monitoring will be undertaken at the sites shown in Figure 5.5, unless by arrangement with the SPCC, alternative sites are monitored.

Water Quality

The quality of water in all dams and in adjacent watercourses both upstream and downstream of the surface facilities will be measured on a regular basis. In the case of dry weather discharges, water quantities will also be recorded.

Similar monitoring of the reject disposal leachate dams and the Swansea Opencut mine water dam and truck washing sedimentation dam will be undertaken.

Air Quality

The existing dust collection gauges will be retained and collected on a regular basis to check that dust control measures are operating satisfactorily.

Noise Levels

Sound pressure levels generated by the coal preparation plant, ventilation fan and mobile heavy machinery will be measured upon commissioning of the items to ensure that they conform with the manufacturer's specifications and that correct installation has been followed.

Landscaping and Rehabilitation

Final landform levels at the reject disposal sites will be surveyed to ensure their compatibility with adjacent surfaces. The adequacy of the reject material/overburden/topsoil mix will be determined by chemical analysis and any necessary adjustments made. The suitability of plant material and the type of application will be evaluated from initial trial plots and reassessed as rehabilitation proceeds.

Planting at the surface facilities site will be maintained by a full-time gardener who will also be responsible for the management of planting at the reject disposal sites. Special attention will be given to the repair and management of sensitive areas damaged during construction.

A photographic record will be kept to monitor the effectiveness of the landscaping and rehabilitation programme.

Reject Disposal

Regular field density tests will be undertaken at each of the sites to confirm that the specified compaction rates are being achieved.

Analysis of Impact of the Proposal

7.1 THE PHYSICAL IMPACT OF THE PROPOSAL

7.1.1 Topography

The most significant topographic impact will be the return of three major degraded areas, namely the Swansea Opencut, the Radar Hill Opencut and the Adit, to levels closely resembling the original landform. The aesthetic value of the area on a local and subregional basis will be greatly improved. The existing hazards to human safety will be removed.

The earthworks proposed for the surface facilities site will have an unavoidable impact on the local topography. The location of this development will effectively screen the changes from most vantage points. The overall visual impact is discussed in detail in Section 7.3.

Surface subsidence of up to 1.5 m is anticipated as a result of total pillar extraction. Based upon subsidence of this magnitude at other mining locations, this change in topographic relief is expected to be barely discernible. Vegetation, soils and watercourses will readily adjust to this gradual displacement and no abrupt changes in relief are anticipated. The dense vegetation cover throughout the majority of the site will screen any marginal effects of subsidence.

7.1.2 Soils and Erosion

Topsoil

Topsoil management will be designed to maximise the effective use of stockpiled material in landscaping and rehabilitation. Material stripped from the surface facilities site and along the main access road will be stockpiled for the shortest possible time, encouraging the regeneration of indigenous plant material on respreading.

No topsoil will be removed from the powerline route. The retention of low growth will reduce the visual impact of this feature.

Inert overburden material will be upgraded where possible by addition of fertilisers to minimise the need for importation of topsoil.

Erosion

Drainage safeguards detailed in Sections 6.2.1, 6.3.1 and 6.4.1 are designed to restrict flows across disturbed areas, reducing potential erosion effects. All earthworks will be provided with erosion control measures.

The area of disturbance beyond the mine site and working areas will be kept to a minimum. Any runoff will be collected and treated in sedimentation dams prior to discharge to natural watercourses.

Some erosion of disturbed areas is likely before vegetative cover becomes established. Repairs will be carried out as part of the site management plan. Suspended solids will be collected in settling dams as previously indicated.

The long term stability of newly created landforms at coal reject disposal sites will be ensured by the compacted emplacement procedures adopted, and as a result of the final slopes incorporated in the rehabilitated landform shapes.

7.1.3 Foundation Conditions

In those areas of total extraction of the Fassifern Seam, as shown in Figure 4.9 a surface subsidence of up to 1.5 m is anticipated. No areas underlying the valuable surface assets listed in Table 7.1 below, will have supporting pillars removed.

TABLE 7.1

VALUABLE SURFACE ASSETS WITHIN THE COLLIERY HOLDING
<i>Caretakers residence and hostel building - Camp Yondaio</i>
<i>Stone residence, opposite the junction of Scenic Drive and Pacific Highway</i>
<i>Residences on either side of Scenic Drive</i>
<i>HDWB water reservoirs (3)</i>
<i>The Rotary Park Twin Lookout</i>
<i>NESCA Substation</i>
<i>The Pacific Highway</i>
VALUABLE SURFACE ASSETS WITHIN EXTENSIONS TO THE COLLIERY HOLDING
<i>HDWB water reservoir</i>
<i>Bargoed House</i>
<i>DMR Depot</i>
<i>Residences at Nords Wharf as shown on Figure 4.19</i>

In those currently undeveloped areas where subsidence will occur, its major effects are expected within six months of pillar extraction. Surface ground condition should stabilise after a period of approximately two years and thereafter cause no foundation instability. The Holding is within a declared Mine Subsidence Area and approval for any future development will be required from the Mine Subsidence Board.

The proposed coal rejects emplacement procedures are intended to achieve 95 per cent standard compaction. As a result, the stability problems associated with the disposal of fine rejects by conventional slurry dams will be eliminated. The final stable land surface will allow the adoption of a wide range of post-rehabilitation uses, increasing the amenity potential of the area including the possible use of the site for residential development as proposed in the Lake Macquarie Municipal Council's Draft Environmental Planning Instrument.

7.1.4 Drainage Pattern

No major watercourses traverse either the surface facilities site or the Swansea Opencut. The broad drainage patterns in the area will thus be unaffected. The anticipated surface subsidence of up to 1.5 m is not expected to alter the drainage characteristics of the Colliery Holding. As the subsidence is likely to occur over a six month to two year period following pillar removal, watercourses will readily adapt to the new landform.

Upslope flows diverted around the surface facilities will rejoin watercourses downstream of the development without altering the hydraulic characteristics of the channels. Locations such as discharge points to existing creeks will be rip-rapped to prevent scour.

There will be some reduction in flows downstream of the sites as a result of on site collection and usage. As existing flows are ephemeral and support no unique flora or fauna the impact of a further reduction will not be significant.

The area referred to as 'Pinney's Lagoon' is a small hind dune depression containing highly saline water and is the receival point for site runoff, prior to discharge through the beach zone to the ocean. The peripheral vegetation comprises Juncus maritimus sedgeland and low open forest dominated by Swamp Oak, neither of which would be affected by a reduction in freshwater flow. The lagoon is very small in size and is not considered to be ecologically significant.

The control system proposed for the Swansea Opencut will establish a drainage pattern in keeping with the natural flow lines in existence before mining commenced. The current high velocity concentrated flow responsible for widespread erosion adjacent to the existing access road will be eliminated.

7.1.5 Water Quality

i. *Construction Phase*

Drainage controls will be incorporated in the first stages of site earthworks. Consequently, the contribution of suspended solids to downstream flows is expected to be slight.

ii. *Swansea Opencut*

No dry weather discharge will occur during the 18 months to two year operational period of the opencut.

Discharge will be necessary only during periods of heavy or prolonged rainfall. As sedimentation dams have been incorporated into the design, site discharges will be of better quality than those currently released. The impact downstream will be negligible.

iii. *Surface Facilities Site*

Clean runoff generated upslope of the site and not required for process or dust suppression needs will be redirected around or through the site without changes to its quality.

Assuming mine water makes are not excessive, the site will not discharge during dry weather. The likelihood of groundwater quantities exceeding surface demands is low. If however, volumes are larger than currently anticipated, the options for disposal will be studied in co-operation with relevant authorities.

Site runoff in excess of sedimentation dam capacity will be allowed to overflow via the spillways provided into natural watercourses. The quality of the water will not vary noticeably from that of the receiving stream, which is tidal in its lower reaches. Details of the quality of this stream are provided in Appendix 7, Table A7.1, Sites 2 and 3. No impact is expected downstream.

Oil and grease arrestors and the sewerage system will be designed as closed systems unaffected by runoff. No downstream contamination will arise from these sources.

Emergency discharges from the coal preparation plant thickener will be contained in an on site sedimentation dam whose capacity exceeds the requirement by a factor of three. No toxic or dangerous chemicals are used in the washing process and all are bio-degradable.

iv. *Coal Rejects Disposal*

The use of the band press filter process eliminates the need for fines settlement dams removing entirely a potential source of water pollution.

The rejects do not contain toxic levels of the common elements. Leachates are expected to be similarly unaffected, with higher proportions of only carbonaceous material and iron than normal surface runoff. In dry weather conditions, leachates will be evaporated from the sedimentation dams. During prolonged rainfall, runoff will be comprised predominantly of surface water rather than leachate. Consequently, discharge to existing watercourses will have no effect on their quality.

In the long term, the percolation of the rejects by rainwater will be minimised by the degree of compaction of the material and the provision of an inert covering layer. Sedimentation dams will be maintained after the cessation of mining until monitoring of discharges confirms the lack of effect on downstream water quality.

7.1.6 Microclimate

Some local changes to aspects of microclimate, particularly wind speed and solar radiation levels, will be noted on the surface facilities site. These minor effects will have no noticeable impact offsite.

In the long term, rehabilitation of the Swansea Opencut will reduce present wind funnelling effects experienced in northwesterly and westerly conditions. The combination of reduced velocities and improved groundcover will reduce existing dust generation at the site.

7.1.7 Air Quality

The mining and reject disposal operations will generate some dust. Potential deposition rates in surrounding areas have been calculated and are expected to have only marginal effects on background readings.

Potential dust deposition rates were calculated using relationships developed by *Bosanquet, Carey and Halton (1950)*. Predictions were based on measured emission rates of operating mines and coal handling facilities and took into account microclimatic effects and the proposed extent of mining and disposal operations. Worst case situations were assumed, based on a wind speed of 36 km/h and a total absence of the dust control measures outlined in Sections 6.2.2, 6.3.2 and 6.4.2.

The results of the analysis are presented in Figure 7.1, which indicates the maximum predicted dust deposition in excess of background levels.

Under the extreme conditions nominated and with the knowledge that wind velocities will be less than 36 km/h for 70 per cent of the time, operations at the Swansea Opencut and the surface facilities site would result in a maximum increase over background of only one to four per cent at the nearest houses. These increases will not be detectable. The residential subdivision to the south of Caves Beach will experience an increase in levels of one to two per cent, equally insignificant.

Without the adoption of safeguards, haulage of rejects along Mine Camp Road to the Radar Hill disposal site would increase dust deposition levels at the Camp Yondaio hostel by 20 per cent. As this road will be regularly watered during operational periods, no detectable increase in dust levels is anticipated.

Air quality in the areas surrounding the proposal will not be measurably affected. No impact will result on the areas amenity for recreation, habitation or natural growth.

7.1.8 Flora and Fauna

Flora

There will be an unavoidable impact on the flora of the area as a result of the clearing of approximately 10 ha for the surface facilities site and lesser amounts for road and powerline easements. With the exception of a small area of Wet Sclerophyll Forest with Rainforest Elements, no endangered or rare vegetation communities will be cleared. The overall impact will thus be slight. It will be further mitigated in the future by the return of up to 27 ha of currently degraded areas to a condition complementing surrounding vegetation.

Four communities will be affected in clearing the surface facilities site, namely:

Open-Forest, dominated by Rusty Gums and Stringybarks

Closed-Scrub dominated by Red Mahogany

Open-Heath and Closed-Heath dominated by Ball Honey-Myrtle

Wet Sclerophyll Forest with Rainforest Elements.

Of these, only the latter is regarded as relatively rare. The area to be cleared will represent only five per cent of total coverage of this community within the catchment. Some further dieback may occur in a patch bordering the development area. In the absence of the safeguards described in Section 6.3.4., exotic species such as Lantana would be encouraged to the detriment of rainforest elements. Similar changes would be likely to the structure of adjacent community boundaries, with an encouragement of understorey plants including weeds such as the Bitou Bush.

Clearing along the powerline easement will result in a minor impact on a small strip of open forest dominated by Spotted Gum and Grey Ironbark.

While the loss of vegetation caused by the construction of the access road will be insignificant in itself, some wider impacts are likely as a result of increased exposure to salt laden winds and the likely spread of exotic plants. The zone of impact will thus extend beyond the boundary of physical disturbance, but in time will be reduced by the proposed planting programme.

There will be no impact on vegetation established at Camp Yondaio, 'Pinney's Lagoon' or any other areas other than those specifically nominated.

Rehabilitation of the Swansea Opencut, Radar Hill and Adit rejects disposal sites will in time return currently degraded areas to conditions compatible with surrounding natural vegetation. The overall integrity of the subregional vegetation unit will thus be enhanced and the opportunity for continuing or increased disturbance be reduced.

Fauna

Fauna habitat will be destroyed on the surface facilities site, thus

marginally reducing the carrying capacity of the overall area. Damage to areas of Wet Sclerophyll Forest containing Rainforest Elements would be of greatest significance, as this area provides the habitat for the Wonga Pigeon and Diamond Python.

Noise may cause some initial fear in animals. However, this effect has been found to be shortlived and will have no long term impact.

As this is the case on all roads passing through largely undisturbed bushland, some road deaths will arise as a result of vehicle passage along the access road.

7.2 THE IMPACT OF THE PROPOSAL ON NOISE CLIMATE

7.2.1 Procedure

The noise levels in areas surrounding the development were predicted by assessing the effect of proposed noise sources at the various work sites with knowledge of attenuation properties of land separating the source from the observer. The predicted levels represent those resulting from the development and do not take into account other sources.

Details of the methods by which the attenuation properties of the area were evaluated are provided in Appendix 9. They were directly applied to determine the effect of the surface facilities operations on the area's noise climate.

In the case of the Swansea Opencut mining and rejects disposal operations, and the Radar Hill rejects disposal works, the Company proposes to construct bund walls to limit offsite noise levels. In these cases, the noise climate in surrounding areas was determined using the following formulate:

- i. 20 Log (r) for attenuation due to distance
- ii. a graphical relationship described in Design Bulletin 26, published by the U.K. Department of the Environment, for attenuation due to the bund wall.

The predictions were conservative, as no account was taken of attenuation arising from factors such as ground texture.

The major noise sources used in the predictions are listed in Table 7.2.

TABLE 7.2

MAJOR NOISE SOURCES

Source	Location	Noise level in dB(A) at 1 m.
Ventilation fan	Wallamaine underground mine	92.5
Coal preparation plant	Surface facilities site	90.0
Workshop	Surface facilities site	105.0
Highway trucks	Surface facilities site	96.0
Overburden removal	Swansea Opencut	115.0
Overburden dumping	Swansea Opencut	112.0
Bund wall construction	Swansea Opencut	112.0
Rejects disposal	Swansea Opencut	107.0
Rejects disposal	Radar Hill	107.0

Construction Phase

Assuming a maximum source noise of 115 dB(A) during the construction phase, the predicted noise levels are as shown in Figure 7.2.

Construction noises will be inaudible in most conditions at all likely surrounding listening points. The only increase above background will be recorded at the CEBS Camp, where an increase of 3 dB(A) is probable. This increase is unlikely to interfere with activities undertaken at this location.

Operational Phase

- i. *Swansea Opencut mine operation, surface facilities construction*

The above situation will apply for a 10 month period. Assuming a maximum noise source of 115 dB(A) in each case, predicted noise levels are as shown in Figure 7.2.

During construction of the bund wall along the eastern side of the opencut, noise levels at the closest residences (site S5) will exceed ambient by 15 dB(A). This operation will be undertaken in daylight hours and be of short duration.

ii. *Surface facilities operation, mining and rejects disposal at Swansea Opencut.*

Figure 7.3 illustrates the predicted noise levels in the above situation, assuming a source noise of 105 dB(A) for the surface facilities (largely from workshop operations).

In the worst case, noise levels would exceed background by less than 5 dB(A) during the evening at the nearest residences along the western side of Scenic Drive. This situation would only arise when machinery was operating at ground level on the eastern extension of the opencut.

The ridgeline separating the surface facilities site from Caves Beach will provide effective shielding to residences in Caves Beach.

iii. *Surface facilities operation and rejects disposal at Swansea Opencut.*

This above situation represents the long term operational mode of the Wallamaine Colliery.

Assuming a source noise of 107 dB(A) for the rejects disposal operation, predicted noise levels are as indicated in Figure 7.3. While audible in the vicinity of Site S5, levels will not exceed background by more than 4 dB(A), which is not likely to interfere with existing lifestyles.

Noise levels are likely to exceed these levels at Sites S4 and S5 for up to eight per cent of the daylight operating hours, during construction of the perimeter bund wall for each level of filling. During this period, sound levels are expected to rise to 52 and 51 dB(A) respectively at these sites.

Background noise levels will not be exceeded within the Camp Yondaio property.

iv. *Surface facilities operation and rejects disposal at Radar Hill*

Assuming noise generation at Radar Hill is equivalent to that from the Swansea Opencut, the noise levels shown in Figure 7.3 are predicted for the 16 months rejects disposal operation at that site.

In normal operation, noise levels at Camp Yondaio will be increased by less than 5 dB(A).

During construction of the perimeter bund wall for each level

of filling, noise readings are estimated to increase to 51 dB(A) at Site S1 and 48 dB(A) at Site S2. These levels will be audible above daytime ambient levels, but will occur only for a maximum time period of three months.

7.2.2 Predicted Noise Levels during the Construction and Operation of the Proposal

Table 7.3 lists predicted noise levels in areas surrounding the development.

7.2.3 Summary

The operation of the main noise sources in the Wallamaine Colliery will be restricted to day and afternoon shifts.

While audible at Camp Yondaio, the operations at the surface facilities site and reject disposal will cause an insignificant increase in background levels.

For the great majority of time, residences in the Caves Beach area will be unaffected by operational noise. For short periods only, some houses near the HDWB reservoir will experience noise levels above evening ambient.

7.3 VISUAL IMPACT

7.3.1 Construction Phase

Surface Facilities

Site preparation will extensively modify the landscape through the clearing of trees and shrubs from approximately two thirds of the 10 ha site. Cut and fill operations will reshape the site forming a number of level platforms for buildings, structures and carparks, while four dams will be constructed both within and adjacent to the site.

TABLE 7.3

PREDICTED NOISE LEVELS IN dB(A) DURING THE CONSTRUCTION AND OPERATION OF THE PROPOSAL

Sound Levels	S1 CYCA	S2 CYH	S3 PHSC	S4 CB(NR)	S5 CB	S6 CB	S7 CB
BACKGROUND (L ₉₀)							
Daytime	36-43	39-46	45-54	42	42	38-46	44-47
Evening	42	39-44	48	41-42	41-42	44-45	41-44
PREDICTED NOISE CLIMATE FOR EACH OPERATION							
Surface facilities site preparation and building construction	39	*	*	*	*	*	*
Site facilities building construction & Swansea Opencut mining	39	*	45	42	46	42	*
Surface facilities & underground mine operation, Swansea Opencut mining & rejects disposal.	36	*	45	42	46	42	*
Surface facilities & underground mine operation, Swansea Opencut rejects disposal	36	*	45	*	45	*	*
Surface facilities & underground mine operations, Radar Hill rejects disposal.	41	*	*	43	*	*	*

Key: CYCA = Camp Yondaio camping area
 CYH = Camp Yondaio hostel
 PHSC = Pacific Highway & Scenic Drive
 CB (NR) = Caves Beach (nearest residences)
 CB = Caves Beach
 * = Background

In the short term, these earthworks and the presence of cranes and other mobile machinery will result in an unavoidable visual impact, the prominence of which will vary according to the observation position. From the Rotary Park Twin Lookout, it is estimated that only the southern half of the site will be visible, as a result of the steep densely vegetated topography between the Lookout and the northwestern boundary of the site. From sections of the present 4 wheel-drive and walking tracks to Pinney Beach, the site will be visible, but these are relatively un-utilised. At other locations, including the Pacific Highway and the Camp Yondaio property only rare glimpses will be possible to the site.

Service Provisions to the Surface Facilities Site

The construction of the 10 m wide access road will result in clearing of vegetation along the 1.5 km route between the site and Scenic Drive. The road location will be visible only in the lower section between the site and the vegetated ridgeline.

It will be necessary to remove a strip of trees to form the required 18 m wide power line easement. However, the route has been sited to avoid visually prominent locations and views to powerlines will be minimal. Tree planting is proposed for a 200 m ridgeline section where views to the line are possible from Caves Beach and this should be effective within six to nine years. The impact of the clearing of the power line easement will be minimised over a period of a few years as shrubs regrow to the prescribed height of 3 m. The use of green tanalith-treated timber poles will further reduce the overall visual impact.

7.3.2 Operational Phase

Swansea Opencut Mine

As shown in Figure 7.4, mining of the Swansea Opencut will only marginally increase its viewshed.

A visual impact will be created by haulage traffic and lighting. For short periods the mining machinery will be visible from Caves Beach but generally views will be screened by the bund wall proposed along the eastern boundary. For the majority of time, vehicular traffic will be contained within the mine and the bund wall. Views to the mine from Rotary Park Twin Lookout will be direct and will include the whole mine as shown in Plate 10. This elevated vantage point, affording an overview of the mining operations from such close proximity is likely to be of interest to both student groups and to tourists.

Lighting will present a visual impact for those living close to the mine, though in the summer months the impact will be negligible as operations will cease at 9.00 pm.

Unavoidable visual impacts resulting from the mine will be short term as the projected maximum life of the operation is two years.

Surface Facilities Site Operation

Figure 7.4 shows the marginal increase in the visibility of the established site from the Rotary Park Twin Lookout. Figure 7.5 indicates the relative visual prominence of the facility from both the Lookout and from the Pacific Highway, Camp Yondaio and Pinney Beach. Plates 12 and 13 illustrate the site before and after development viewed from the Rotary Park Twin Lookout.

Only a small percentage of the southern most section of this site will be visible from this lookout. Occupants of the Camp Yondaio property will see only glimpses of the surface facilities because of the dense existing vegetation and the proposed planting. The facility will not be visible from Pinneys Beach but will be noticeable from headlands either side of the beach and from along the access tracks. In general terms the surface facilities will be seen by visitors who use the coastal strip area between The Caves and Spoon Rocks for recreational purposes. During surveys, this number was estimated at a maximum of 20 persons.

The prominence of the site will be further reduced as the proposed landscaping becomes effective.

Tree and shrub planting will significantly reduce the scale of surface facilities after a period of six to nine years. It will eliminate the majority of views from the access roads and the area near Pinney Beach. Tree canopies above the main surface facilities such as the coal stockpiles and coal preparation plant will minimise the impact of the mine on views from the lookout and Scenic Drive.

Between year nine of operation and its eventual closure, the visual impact of the mine will continue to diminish. As the vegetation matures the prominence of the surface facilities will be minimised from all viewing points. Landscaping, particularly the belt of trees planted between the coal stockpile and the main workshop, will physically unite the site with the surrounding area.

Lighting

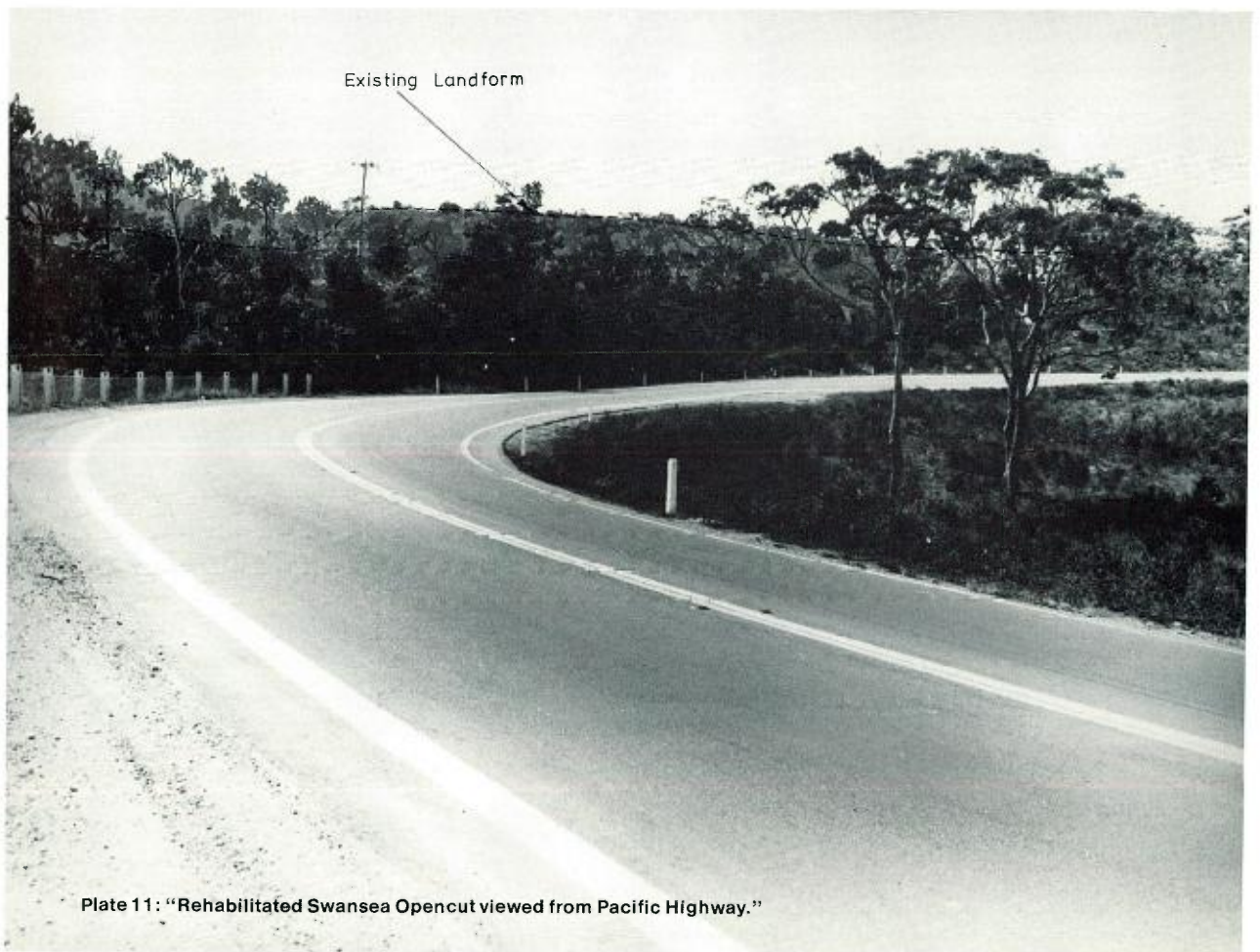
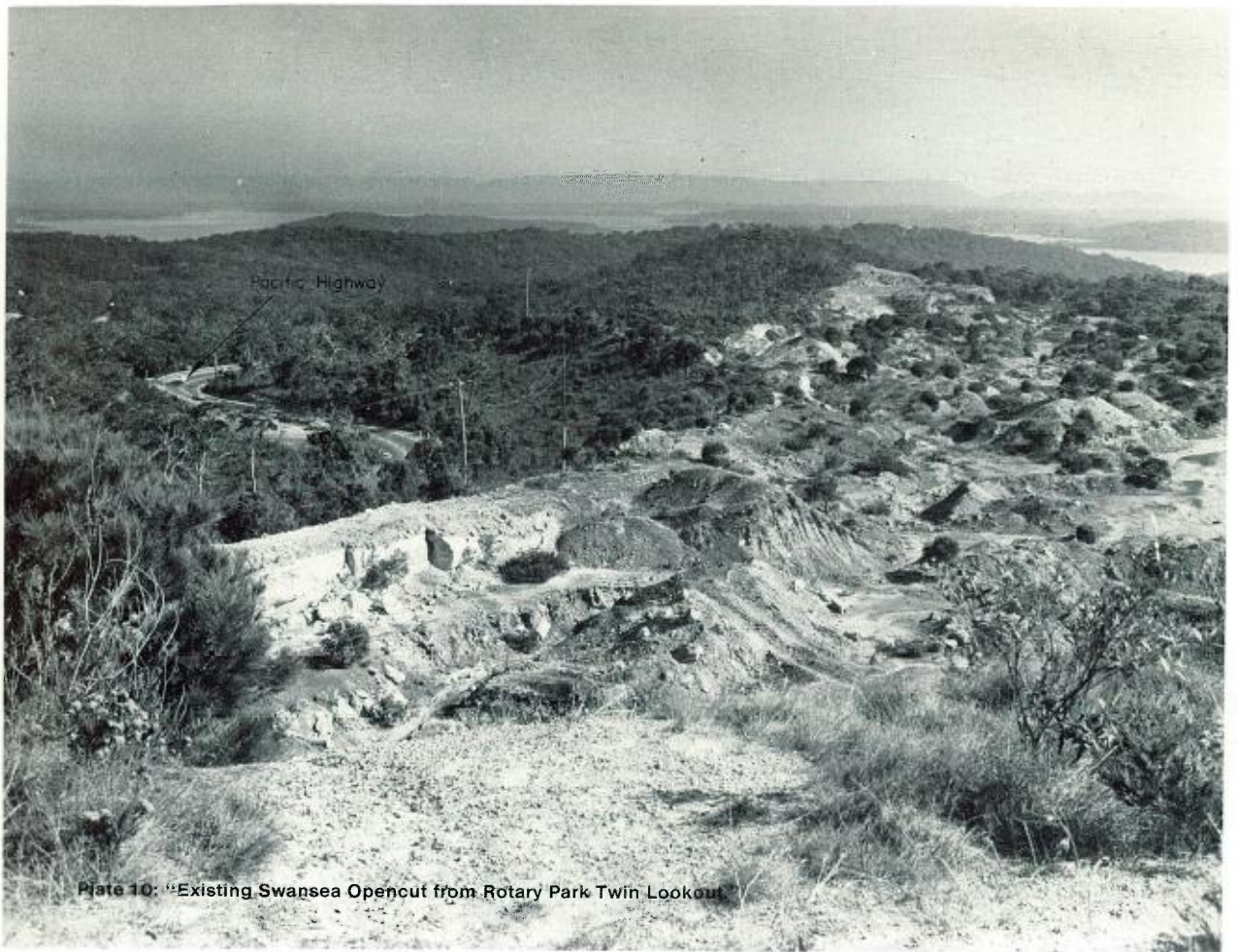
The night time illumination of the site will have minimal impact on all viewing points except Camp Yondaio, from where it will highlight the location of the mine in an otherwise forested landscape.

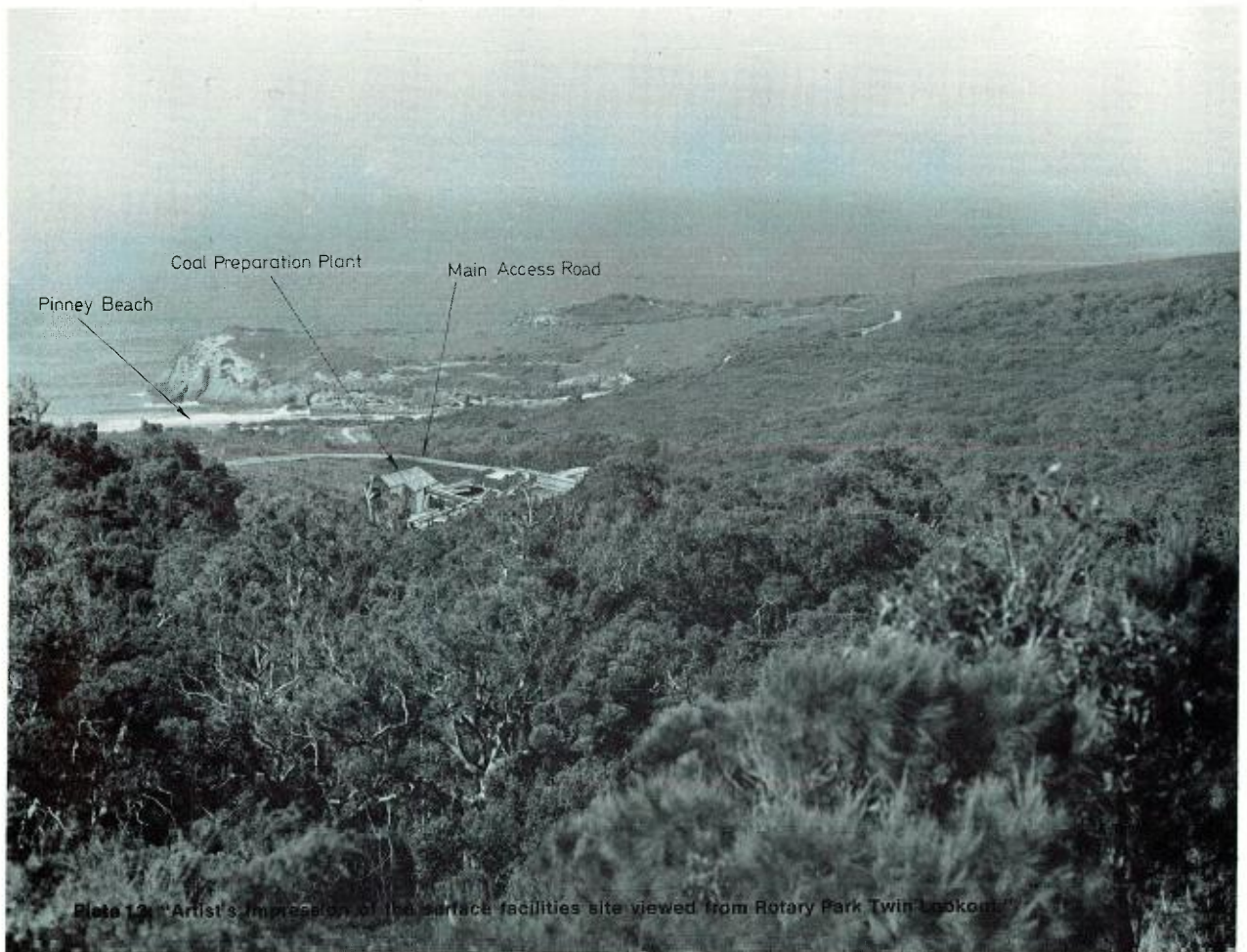
7.3.3 Rejects Disposal Sites and Surface Scars

Swansea Opencut and Radar Hill are currently visually unattractive and barren. The rehabilitation proposed for these and other degraded sites will significantly improve the visual quality of the Colliery Holding.

Swansea Opencut disposal site

Initial filling operations will be screened from Caves Beach and Swansea by natural and manmade barriers. As filling progresses to the height of the existing highwall, sections of the operation will be visible for a period of up to 10 years until final revegetation of Section E as shown in Figure 6.8. Trucks and machinery will be silhouetted along the recreated ridgeline.





Beyond Section E, the filling operation will be visible only from Rotary Park Twin Lookout.

The mature vegetation of the final landscape will be visually and structurally compatible with the surroundings. The improvement predicted is shown in Plate 9.

Plates 11, 14 and 15 illustrate the final landform viewed from surrounding vantage points.

Radar Hill disposal site

Filling operations will be visible from the Rotary Park Twin Lookout, sections of the Pacific Highway and the Pinney Beach area for about 14 months at about year 17 of the project, but thereafter will diminish as the proposed rehabilitation programme takes effect.

In the long term, it is anticipated that the site will become visually integrated with its surroundings through the establishment of a similar vegetative structure.

The Adit disposal site

Short term visual impact will be minimal as the site has a viewshed limited to the Spoon Rocks area and filling will be over a period of only four months. In the long term, the site will appear similar to its surroundings.

Surface Scars

The proposed rehabilitation treatment of the disused shallow clay pits, will result in an overall upgrading of the visual quality of the area.

7.4 HISTORICAL ASPECTS

The proposed development will not directly effect any significant

archaeological relics. The mine access road will improve access to two middens located on the foreshores of Pinney Beach.

The site does not include any features of historical value as assessed by the N.S.W. Heritage Council and The National Trust of N.S.W.

7.5 ECONOMIC IMPACT

7.5.1 Introduction

The proposed development will stimulate the local, municipal, regional and Australian economies.

Positive impacts will flow from the direct expenditure during the construction and operational phases, from indirect effects generated through the service support of other sectors and from induced effects arising from increased final consumption expenditures by the household sector.

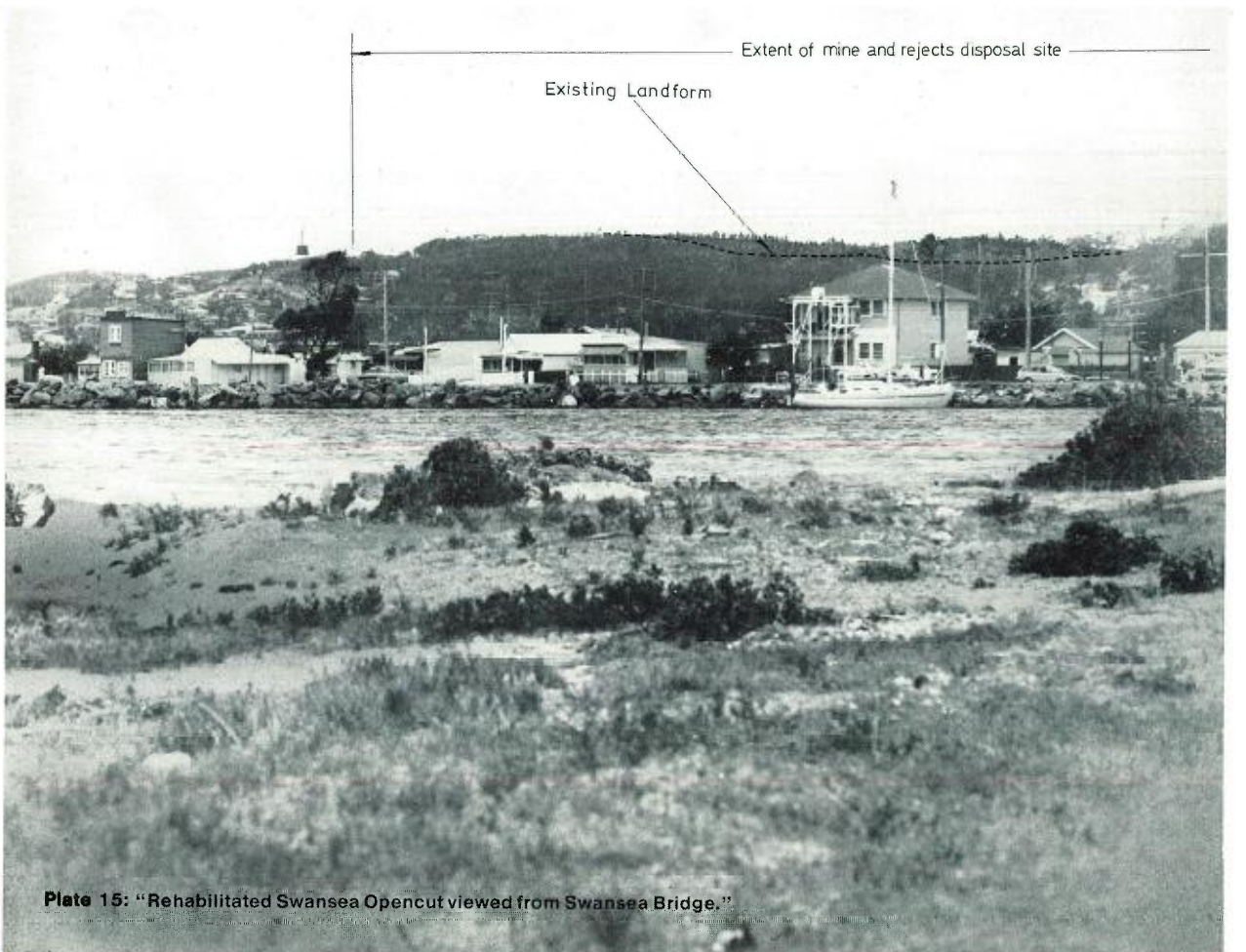
The magnitude of the direct, indirect and induced effects of the proposed investment depends on a number of factors. These include: the life of the project; magnitude of the investment and the proportion of total expenditure outlaid in the local area; wages bill and employment directly created; and the magnitude of the employment, income and output multipliers associated with the project.

The derivation of the specific multipliers and the assumptions under which they are valid are presented in Appendix 19. The tables referred to in the following discussion are contained in Appendix 20.

7.5.2 Construction Phase

i. *Mine Construction Costs*

Table A20.1 details expenditure during the construction phase (1980 prices). This sum will be expended over 17 months, 36 per cent within the Hunter Region, 60 per cent in other areas of Australia and the remainder overseas.



ii. *Direct Employment*

The construction workforce required by the Company will average 32 increasing from an initial level of 10 to a peak of around 80. Employment will exceed 50 for about five months. Table A20.2 shows a monthly breakdown of employment during the construction phase.

iii. *Indirect and Induced Employment*

Table A20.3 lists the likely gains in indirect employment in the Hunter Region at the peak of construction. An average increase of 20 is expected, rising to a peak of 50. The duration of this additional employment will be limited to the extent of the construction phase. It is probable that most of the employment increase will be generated in the Lower Hunter Subregion where the major purchases will be made and major industry linkages exist. (*Clough A.R., Garlick S.C., Ray P.G. (1978)*). Some jobs are likely to be created in the Lake Macquarie Municipality. Table A20.4 lists the maximum employment likely to be induced in the Hunter Region by the effects of increased consumer spending. The existing industrial economic base of the local Swansea-Caves Beach area and that of the wider Lake Macquarie Municipality and the way in which induced employment is created, indicates considerable employment numbers, particularly in wholesale and retail trade, could be created in the local area and in the municipality. In the municipality further additional jobs could be created in finance and business services, public authority, community services, transport and communication, food and beverage and building and construction. Considerable induced employment gains will occur in all industry sectors in the regional economy where the economic base is considerably broader and of a higher functional order.

It is possible that some induced jobs could be created in the neighbouring Wyong area should some of the direct construction workforce reside in this area.

Table A20.4 also shows the total employment by industry sector at the peak of the construction phase. Total employment effects are inclusive of direct, indirect and induced employment.

Table A20.5 indicates the estimated numbers of different occupations likely to be created as a result of the direct, indirect and induced employment impacts of the construction phase. The extent to which these additional employment opportunities will be filled by unemployed persons within the local area, municipality and region, depends on the existing excess labour supply, as indicated by recorded unemployment numbers (i.e. registered as unemployed) and the degree of occupational mobility of the existing employed labourforce. This has been examined in Section 7.6.

iv. *Australian Employment Impact*

Inclusive of the Hunter Region, between 152 and 297 jobs will be created by the construction phase.

Of this number, between 26 and 83 will be created outside the region. The employment effects related to the construction will last only for the time work is in progress although to the extent that there are other developments in the Hunter Region, the impacts may be extended.

v. *Income*

A short-term economic impact will be derived from the creation of new sources of income.

A total of \$0.95 M will be paid in wages and salaries to the direct workforce over the construction period. The direct and indirect income increase in the Hunter Region will be \$1.36 M and Australia wide \$1.74 M.

The total effect on direct, indirect and induced incomes could amount to \$2.0 M in the Hunter Region and \$3.16 M nationally over the same period. It is probable that a significant proportion of the induced gain will occur in the local area, particularly the wages bills of the wholesale and retail trade, financial and other business services and recreation and entertainment industries.

vi. *Industry Output*

Industry output values will rise in response to construction phase expenditures.

The \$13.4M direct capital expenditure in the Hunter Region will increase the output value of industries by between \$21.07 M through the simple output multiplier and \$31.73 M through the total output multiplier.

The increase in output value in Australia as a whole will be between \$74.55 M and \$132.34 M.

7.5.3 Operational Phase

i. *Mine Costs*

At full production, the project will have an annual output value of approximately \$33.5 M, employ up to 254 persons and pay wages and salaries approaching \$5.0 M/a. A significant proportion of annual operating expenditure will occur within the local and regional areas.

ii. *Direct Employment*

Tables A20.6 and A20.7 detail the numbers and categories of persons that will be directly employed by the Company during mine operations. The resultant employment and population impacts are assessed in detail in Section 7.6.

iii. *Indirect Employment*

Tables A20.8, A20.9 and A20.10 detail the indirect and induced employment effects expected in the Hunter Region and the division of jobs by industry type. Table A20.11 indicates the occupational structure of the additional employment created.

Between 113 and 346 jobs will be created in addition to those directly associated with the development.

It is possible that some of this induced employment could occur in the Wyong area depending on the residential location of the mine workforce.

Indirect employment will be concentrated in the transport, storage and communication category, while induced employment will primarily be created within the wholesale and retail trades.

iv. *Australian Employment Impact*

The total employment likely to be created Australia wide will be 973 persons at full production. Details are provided in Table A20.12.

v. *Income*

Tables A20.13 and A20.14 indicate the increases resulting from Type I and Type II multipliers for the Hunter Region and Australia respectively.

It is likely that the majority of the indirect income will be created in the Newcastle area. A significant proportion of the induced income gain is expected in the local and municipal areas particularly through the wages bills for the wholesale and retail trade, finance and business services, public authority, community services and recreation and entertainment industries.

It is also likely that some induced income gains would occur in the Wyong Shire through the consumption expenditure of these mineworkers resident in this area.

The total increase in income in the region and for Australia over the projected life of the mine will be between \$155.9 M and \$228.8 M and \$168.7 M and \$307.3 M respectively.

vi. *Industry Output*

Tables A20.15 and A20.16 detail the expected industry output gains for the region and Australia.

The total increase in output in the Region and for Australia over the projected life of the mine will be between \$940 M and \$1468 M and \$940 M and \$1490 M respectively.

vii. *Lake Macquarie Municipal Council Income*

Table A20.17 indicates the rate income likely to flow to Council from the Company and its direct employees. The amount is expected to total \$1.38 M (1980 values) over the life of the mine.

The revenue derived from indirect and induced employees residing in the municipality has not been included as a result of the difficulty in determining the number likely to move into the area.

viii. *State and Commonwealth Government Revenues*

Tables A20.18 and A20.19 indicate the revenue likely to accrue to the Government.

The N.S.W. Government is likely to receive \$142 M over the life of the mine. For the same period, Commonwealth income will amount to \$49 M.

The mine will increase contributions to Australia's balance of payments. Gross export revenue will rise to \$25 M by 1984/5 and total \$504 M over the period of operations.

7.6 SOCIAL IMPACTS

7.6.1 Employment and Population Effects

The impact of the construction and operational phases of the proposal on employment and population has been assessed with reference to the occupational characteristics of the required workforce relative to the nature of the regional surplus of labour. Details of workforce requirements are presented in Sections 4.5.15 and 4.5.16 while unemployment characteristics are detailed in Appendix 14.

The location of these effects are considered to occur primarily in Lake Macquarie and the Lower Hunter Subregion. Analysis of workforce statistics of a mine near the proposed site indicates that approximately 90 per cent of both the entire workforce and new employees since 1978 reside in this

area. A similar analysis of the workforce of a mine at the southern extremity of Lake Macquarie, in Wyong Shire, indicates that this proportion declines to 80 per cent.

Construction

At the peak construction period direct employment will be provided for 74 persons, including 40 tradesmen and supervisors. Of 226 unemployed, skilled building construction, metal and electrical tradesmen in the Hunter Region in November 1980, 113 are in those trade areas likely to be required. Hence the positions could potentially be filled from within the region.

This potential is influenced by such factors as the mobility of the unemployed and the staging of requirements throughout the construction phase. The static nature of this analysis, its reliance upon CES unemployment statistics and the influence of other development projects occurring in the region may also significantly affect its apparent potential to meet the requirements. The impact of these influences cannot be assessed, thus preventing any precise projection of in-migration and of the consequent population effects.

To cover all likely situations, population estimates have been provided assuming various levels of in-migration as indicated in Table 7.4.

In-migration has been assumed to be necessary only in the case of tradesmen, as it is expected tradesmen's assistants will be available from the local area.

On this basis, a maximum population increase of 163 is possible. As at least some skilled positions will be filled from within the region, the final number is expected to be something less. The direct workforce is likely to be concentrated in the Lake Macquarie area as close to the site as available accommodation will allow.

As a number of new caravan parks have been constructed to the south of Catherine Hill Bay in Wyong Shire, a proportion of the direct workforce can be expected to reside in this area. The indirect and induced effects are likely to be distributed throughout the region.

TABLE 7.4

ESTIMATES OF POPULATION INCREASE DUE TO DIRECT, INDIRECT AND INDUCED EMPLOYMENT EFFECTS DURING THE PEAK CONSTRUCTION PERIOD

Case	Direct Employment Effects	Indirect and Induced Employment Effects	Total Population Impact
I	52	30	82
II	104	59	163

- Note: i. Case I: 50 per cent of tradesmen are obtained through in-migration.
 Case II: 100 per cent of tradesmen are obtained through in-migration.
 ii. 50 per cent of workforce is married.
 iii. Average family size is 2.1 children (*Borrie 1978*)

Operational

Table 7.5 presents estimates of possible population increases arising from direct, indirect and induced employment effects.

TABLE 7.5

ESTIMATED POPULATION INCREASE:
OPERATION

Case	Direct Employment Effects	Indirect and Induced Effects	Total
I	150	158	208
II	298	215	513

- Note: i. Case I: 50 per cent in-migration of trade and professional workforce.
 Case II: 100 per cent in-migration of trade and professional workforce.
 ii. 70 per cent of workforce married.
 iii. Average family size 2.1 children.

The regional shortage of tradesmen is again likely to result in in-migration. Any worker mobility within the region will only shift vacancies rather than fill them. A similar situation exists in the managerial and professional/technical areas, with excess demand for such persons within the region.

Other categories of employment are expected to be filled locally. The indirect and induced workforce opportunities created in clerical, sales, semi-skilled and service occupational areas are likely to match existing high unemployment levels in those categories.

The total population increase will range up to 513 persons.

7.6.2 Impact on Existing Patterns

i. *Population Growth*

The Hunter Regional Plan (Hunter Regional Planning Committee, 1978) anticipates an increase of 40 000 people for the Lower Hunter Subregion and 17 000 for Lake Macquarie by 1986. The maximum expected population increase of 513 persons associated with the proposal accounts for 1.2 and 2.3 per cent of these figures respectively. If considered as an addition to the previous projections, this number will contribute to a reduction of the declining rate of growth in the subregion.

Assuming that 10 per cent of the population effects occur in Wyong Shire, these effects will account for 0.3 per cent of the DOEP's estimate for population growth of the Shire between 1981-86.

ii. *Population Characteristics*

The development will reduce the ageing trend of the local and regional population, although its impact will be slight due to the relatively small numbers involved.

The trend towards out-migration from the region in the 20-30 years age group is expected to decline. Additionally, an in-migration in this age group may also occur.

Within Lake Macquarie, the anticipated growth in the lower age groups will maintain the area's characteristic relative youthfulness.

Due to the dominance of male employment in mining, the direct impact of the proposed development on population structure will be limited to a possible increase in the number of single and married males and their families.

The population characteristics of Caves Beach have altered since 1976. The area initially served as a source of cheaper housing for young families. Rising land values caused a decline in this function in favour of settlement of the area by established families and retired persons. The ability of the mine workforce in maintaining the youthfulness of the area is expected to be limited.

iii. *Employment*

In the 1971-6 intercensal period employment in the coal industry declined in the Hunter Region and particularly in the Lower Hunter. The present proposal and others in the Lower Hunter will ensure that this source of employment will continue, if not increase. This is important to Lake Macquarie and the local area in particular as coal mining has been a significant historical source of employment where alternative local opportunities have been limited.

The economic base of the region is characterised by an imbalance of industries in favour of mining, manufacturing, heavy engineering and power generation. In the 1971-6 period a decline in mining and manufacturing and an increase in tertiary employment resulted in a reduction of this occupational imbalance. The proposed development and others in mining, manufacturing and power generation, can be expected to reverse this decline.

The relative inability of the existing economic base and present developments to provide occupational opportunities, particularly in the tertiary sector has its greatest impact on female employment. This sector provided employment for 78 per cent and 87 per cent of the female workforce in the Lower Hunter Subregion and Lake Macquarie respectively in 1976. The mining industry's ability to correct this situation is limited by Acts prohibiting the employment of females for underground work.

Opportunities will be provided for unskilled and unemployed persons in the region through the need to fill 129 mine worker positions. Vacancies are likely to be created by the transfer of currently employed persons to the mine, generating opportunities with their previous employers and it is probable that some of these vacancies could be filled by females.

7.6.3 Housing and Accommodation

i. *Temporary*

The availability of rental accommodation within the Lake Macquarie area is limited. Particularly during the construction phase, additional demands are likely to be imposed. Rentals will continue to increase, following recent trends. In the

period July 1980 to January 1981, rentals for two bedroom homes increased by 12.5 per cent (*Hunter Regional Community Information Service, 1981*).

The availability of accommodation for tourists will be reduced. The effects are, however, likely to be only short term.

ii. *Permanent*

In the unlikely event of all the increase in population being derived from outside the region, a maximum of 114 housing units would be required.

Table 7.6 demonstrates the possible range of needs.

TABLE 7.6

ESTIMATED ADDITIONAL HOUSING REQUIREMENTS
FOR THE OPERATIONAL WORKFORCE

Workforce	Case I ¹	Case II ²
Direct		
Indirect and Induced		
Total		

- Note: 1 Assumes 50 per cent of skilled labour requirements are obtained outside the subregion.
2 Assumes 100 per cent of skilled labour requirements are obtained outside the subregion.
3 Houses are allocated for married employees only.

Regardless of the exact requirement, strains will be imposed on an existing tight housing supply. In the short term, the recent increase in building activity will be insufficient to meet demands. Residential housing is likely to increase in price as a result.

Development in the Lake Macquarie Municipality is likely in the Charlestown-Elleebana-Tingara Heights area. The only short term likelihood of land release in proximity to the mine site involves 93 allotments south of the present residential development in Caves Beach, currently being subdivided by the Company. This will account for 81 per cent of the maximum possible housing requirements (Case II above) and more than is required in the Case I assumption. The Draft Environmental Planning Instrument provides for additional residential land in the Caves Beach area.

7.6.4 Education, Health and Welfare Services

i. *Education*

Contingency plans formulated by the N.S.W. Department of Education provide for three additional primary schools and a high school in the Croudace Bay-Eleebana area. They are expected to be able to cope with anticipated population growth. The regional decline in primary school enrolments will provide sufficient flexibility within schools to accommodate any increase in numbers arising from the development.

If, however, further large scale localised population increases occur, the present school system will be subjected to considerable stress.

Swansea High School enrolments are expected to reflect primary school numbers.

While schools in the local area are currently able to meet demand, the proposed housing developments in Caves Beach and possible future subdivision may lead to the need to expand current facilities.

TAFE colleges at Belmont and in the subregion will be able to cope with any additional demands arising from the development.

ii. *Health and Welfare Services*

Hospitals:

On the basis of providing hospital facilities at a local planning level, any increase in the population of Lake Macquarie Municipality will highlight the existing shortage of beds in the area. On a regional basis however a surplus of beds will remain.

A report assessing the ability of Belmont Hospital to meet future demands concluded additional bed space would be needed by 1986. (*Makepeace, 1980*). Any acceleration of the population increases assumed would bring forward this date.

Community Health Services, Baby Health Centres:

Both the above services will experience increased demand in proportion to the expected population growth. The need will be strongest in the area of family and child services in response to the likely ratio of married employees with young children. Without additional staffing, the centres will be operating under some strains.

Welfare Services

The geographic separation of the Lake Macquarie area and particularly its southern portions, from the majority of the region's non public welfare organisation results in a shortage of welfare service in the area. Any increase in population will exacerbate this problem. The greatest need in the area is for organisations providing supportive, counselling services.

7.6.5 Impact on Local Residents

The impact of the proposal on local residents will in most instances vary only slightly from the overall effects on the subregion. The proximity of the mine to residential areas will under most conditions and for a majority of the time have only marginal effects on very few houses. In the long term, the local community will benefit most from the rehabilitation of the currently degraded areas.

The establishment of the surface facilities site will represent an intrusion into a relatively unspoiled portion of coastline for the duration of the project. However, the development will not be visible from any houses in the area and will have only limited lines of sight from surrounding vantage points. The use of Pinney Beach will be uncompromised by the mine. With the exception of the 10 ha cleared from the surface facilities and a small bordering zone and the access road, vegetation will be unaffected.

Dust levels in the local area will be effectively unchanged. With the exception of particular short term operations affecting a small number of residences, noise levels will be similarly unchanged.

No coal haulage will be undertaken through either Caves Beach or Swansea/Belmont. A rise in passenger vehicle traffic is likely, with approximately 120-150 vehicle movements expected at shift changes.

Employment opportunities will be created for local residents. Indirect and induced effects are likely to benefit the local commercial and retail sphere.

7.7 IMPACT ON PLANNING AND LAND USE

7.7.1 Regional Planning

The Colliery Holding forms part of an area of largely natural vegetation designated as an 'intercity environmental zone'. The area of disturbance created by the mine proposal represents 1.1 per cent of the total Colliery Holding and as such will not interfere with the use of this area as a buffer zone. The eventual rehabilitation of opencut scars will, in fact, enhance the area's role as a buffer zone.

The preferred strategy of the Hunter Regional Plan also recommends urban consolidation in the northern parts of Lake Macquarie. As outlined in Section 7.7, it is likely that a considerable number of incoming construction and operational personnel will reside in these areas.

7.7.2 Local Government Planning

The Swansea Opencut falls within a zone proposed for 'residential A' development in the Draft Environmental Planning Instrument. It will be necessary to maintain a suitable buffer zone around the edge of the proposed reject disposal site until rehabilitation is completed and thus avoid the creation of a potential conflict situation with respect to noise. The use of the site at the cessation of rejects disposal will be the subject of ongoing discussion between the Company, the local community and the Lake Macquarie Municipal Council. Its subsequent use for residential purposes would require a detailed foundation investigation.

The proposed mining and subsequent rehabilitation of the Swansea Opencut will facilitate implementation of the Draft Environmental Planning Instrument in this location as it is unlikely that funds would otherwise be available to restore such a large disturbed area.

The surface facilities site is located within a 'Rural A' classification and hence is a conforming use.

Neither the Swansea Opencut operation nor the operation of the surface facilities will affect the two adjacent environmental protection zones.

The construction of the mine access road will not hinder public access to Pinney Beach and environs. It is desirable that a management plan be prepared for the use of this coastal strip. The Company would co-operate in its formulation.

7.7.3 Urban Land Use

It is anticipated that the proposal will contribute to increased demands for residential development in the Caves Beach area. It is not unreasonable to assume that a large proportion of employees recruited from outside the local area will reside in the near vicinity of the proposal, as a result of minimising travel distances and the desire to live in a pleasant environment. Sufficient land is zoned for residential purposes under the Lake Macquarie Municipal Council's Draft Environment Planning Instrument to cater for these demands.

7.7.4 Industrial and Commercial Land Use

The proposed mine will not adversely affect either industrial or commercial land use in its immediate vicinity. The increased scope for small mining-related industrial development as a result of its operation could lead to the establishment of additional firms in the Caves Beach industrial estate.

Impact on the commercial centres at Caves Beach and Swansea will depend largely on the availability of land for residential development. Given such development the range of commercial and non-commercial services available in Caves Beach and Swansea can be expected to increase. Sufficient land is available in both commercial areas to cope with any increase in development.

The construction and operation of the mine will provide further economic benefits to related industries and retail outlets both in the local area and throughout the lower Hunter.

7.7.5 Utilities

The proposal will require the construction of a 150 mm diameter water pipeline from the existing HDWB reservoir in Scenic Drive to the surface facilities site. This will not affect the existing water supply network in the Caves Beach area, but through the provision of hydrants along the line, the fire-fighting capabilities of this area will be improved.

The proposal will require the re-routing of the existing 11 kV powerline which transects the Swansea Opencut site. This line is currently being upgraded to 33 kV as far as the Wallarah Colliery. A branch from this line will supply power to the surface facilities site.

The Shortland County Council is at present constructing a sub-station on the industrial estate to serve the local area. It is expected that this facility will be sufficient to meet demands in the near future.

Although plans for realignment of the Pacific Highway adjacent to the Swansea Opencut are not finalised, the Company's proposals for this area are not expected to compromise any options.

7.7.6 Camp Yondaio

Camp Yondaio's existence is based upon the utilisation of the area's natural amenity. In as much as the surface facilities site represents a manmade intrusion, an unavoidable impact will arise. However, consideration of the physical manifestations of the development indicates the measurable impact will be slight and restricted in both terms of duration and extent.

The surface facilities site will be screened from all areas of the Camp and from Pinney Beach, by a combination of natural vegetation and Company planting. Only fleeting glimpses of some structures will be obtained from isolated vantage points.

With the exception of the actual cleared area, the vegetation of the coastal zone will be largely unaffected. The valuable patches of Wet Sclerophyll Forest with Rainforest Elements will not be compromised. The minor loss of faunal habitat will only marginally influence overall animal counts.

The Camp will be largely unaffected by dust emissions. A maximum increase in background levels of 20 per cent and would be obtained at the Hostel without the implementation of any safeguards on the haulage of rejects to Radar Hill. As the haul road will be continually watered, the actual increase in dust levels will be much less than this figure and probably below measurable levels.

The construction and operation of the surface facilities will be audible at some points of the camp property. However, in most instances the predicted noise climate will not exceed existing background levels by more than 5dB(A). Consequently, although the development may introduce a different noise source to the area and thus change the nature of the background, it will not significantly increase overall levels.

7.8 TOURISM AND RECREATION

Tourism

The tourist value of the Lake Macquarie Municipality and the local area will be uncompromised by the proposed development. The amenity of the subregion for surfing, swimming and sailing will be unaffected. In the long term, the scenic quality of the area will be upgraded as rehabilitation of currently despoiled zones progresses.

The shortage of rental and holiday accommodation will be even more evident during the construction phase but this potential impact will be reduced by the provision of a hostel for the construction workforce. Casual stays

by overnight travellers may be limited by the lack of caravan park and hotel and motel facilities. These effects are expected to extend no longer than two years.

Recreation

The subregion is generally adequately supplied with recreational facilities. In some areas of concentrated development and growth, the supply has not kept pace with the demand. The Hunter Regional Leisure Plan (*Hunter Valley Research Foundation, 1977*) indicated that the East Lakes area is deficient in a number of sporting facilities. Further growth without an equivalent increase in the number of recreational facilities could lead to a significant under supply in this area.

The use of Pinney Beach will be largely unaffected by the operation of the surface facilities site. Noise and dust impacts from the site and the access road will not impinge on the value of the foreshore.

7.9 THE IMPACT OF ENERGY RESOURCES

The operation of the underground mine and the disposal of rejects will not influence possible future extraction of deeper seams. The Australasian Seam which is situated 150 m below the Fassifern Seam, exhibits coking coal potential. It appears to have a working section of approximately two metres and it is possible that by extending cross measure drifts from the Fassifern Seam, that this seam could be worked at a later date using the existing surface facilities.

High underground recovery rates of the order of 70 per cent are anticipated as a result of the proposed mining method. Pillar extraction will be practiced in all areas excepting those underlying valuable surface assets. These assets are listed in Table 7.1.

Washing operations will yield approximately 75 per cent saleable coal. The sale of washed product for steaming applications and cement manufacture will maximise yields. Reject material will have a low energy value.

Approximately 90 per cent of the remaining Wallarah Seam coal will be recovered from the Swansea Opencut. The likely extent of oxidised coal in the partially exposed Middle Split and the need to prevent contamination of the coal with interburden will limit further recovery.

The total energy consumption of the operation will be small in terms of both liquid petroleum product and electricity usage. The mine will be a large net producer of energy.

7.10 IMPACTS ON THE ROAD NETWORK

7.10.1 Introduction

The Colliery Holding is not served by a railway line and has no direct access to a deepwater export port. As the mine production is destined for overseas markets, options were investigated for the transport of washed coal to the Port of Newcastle. A discussion of the methods studied is provided in Appendix 18.

The favoured methods combine road and rail transport in such a way as to minimise impacts on both other road users and neighbouring properties. A breakdown of specific impacts is provided in the following discussion.

Operations at the Swansea Opencut and the underground mine have been in most instances combined as they will utilise the same public roads.

7.10.2 Construction Transport

Average daily truck movements during the 16 months construction period are estimated to be 11, based upon information provided in Table 4.16. This represents a one per cent increase in total traffic movements along Scenic Drive and an equivalent 0.1 per cent increase for the Pacific Highway south of Scenic Drive. In terms of truck movements the construction traffic will represent a 0.5 per cent increase for the Pacific Highway.

Deliveries will be generally made during normal daylight hours.

7.10.3 Coal Transport

Coal transportation will be undertaken between the hours of 7 am and 6 pm on weekdays, 220 days per year. All trucks will be tarpaulin covered and pass through a washing station prior to leaving the mine.

Average daily coal truck movements will range from 64 (32 return movements) starting January 1982 to a maximum of 272 (136 return movements) starting August 1984 and extending for approximately 17 years thereafter.

i. *Scenic Drive*

Truck movements will only affect that section of Scenic Drive owned by the Company, increasing total vehicular movements by approximately 20 per cent. Travel distance along Scenic Drive

The passage of heavy trucks along the light vehicle route will cause an unavoidable decrease in pavement quality and life. However, as this section of the road belongs to the Company the road may be upgraded if necessary.

Truck noise will not affect any neighbouring properties. No dust will be generated from the trucks.

Truck congestion will be prevented at the intersection with the Pacific Highway by the provision of turning lanes in each direction. Redesign of the entry point to the mine access road from Scenic Drive will ensure safe movement of vehicles.

ii. *Pacific Highway*

Coal will be hauled a distance of 17 km along the Pacific Highway. The impact of truck movements on existing and predicted usage patterns on the Pacific Highway is indicated in Table 7.7. This takes no account of the likely decrease in total traffic movements likely to accrue from the progressive upgrading of the western bypass around Lake Macquarie.

The maximum increase in total flow is expected to be 1.5 per cent. The increase in heavy vehicle traffic will peak at 10.5 per cent. Both represent unavoidable impacts.

The Pacific Highway is being reconstructed between Swansea and Doyalson and current planning incorporates the completion of a four lane dual carriageway for all but 3 kms of the distance by the time coal haulage to Morisset commences. It is anticipated that the remaining section will be completed late in 1984, at almost the time of full mine production.

TABLE 7.7

ESTIMATED DAILY IMPACT OF COAL
HAULAGE VEHICLES ON THE PACIFIC HIGHWAY

Period+	Coal truck movements	Estimated AADT #	Estimated Heavy Vehicles 6 am - 6 pm	Increase in total traffic (%)	Increase in heavy vehicle traffic 6 am - 6 pm
Stage 1 1982	64	16 010	2 280	0.4	2.8
2 1982/1983	118*	16 400	2 340	0.7	5.0
3 1983	174*	16 810	2 390	1.0	7.3
4 1983/84	246*	17 220	2 450	1.4	10.0
5 1984	218	17 650	2 510	1.2	8.7
6 1984/85	272	18 090	2 580	1.5	10.5
7 1985	272	18 530	2 640	1.5	10.3
8 1985/86	272	18 990	2 710	1.4	10.0

* Coal haulage from both opencut and underground operations

Annual average Daily Traffic. Increase of 5% per annum assumed.

+ Each Stage represents a 6 months period.

The movement of coal will thus have only minor effects on traffic flow and safety. It can be expected that there will be some overall reduction in pavement life.

iii. *Vales Road & Rutleys Road*

Travel distance along Vales Road is 1.6 km and 7.5 km along Rutleys Road. These roads are currently used largely by coal trucks and employee traffic serving the Vales Point Power Station and traffic serving the residential areas of Mantering Park and Wyee Bay.

The Electricity Commission plans to reduce road haulage to Vales Point with the construction of the Vales Point rail loop and an overland conveyor, designed to handle coal from the Upper Hunter Valley. The transport of coal from the proposed mine will partially replace the existing truck movements.

The route passes through no built-up areas. A total of approximately 30 homes or farms and a caravan park are situated along its boundaries. There will be an unavoidable increase in noise levels at these properties, though it will be restricted to daylight hours.

The intersection with the Pacific Highway has good visibility and is provided with storage and speed change lanes for turning traffic.

iv. *Hue Hue Road (MR 217)*

Coal will be hauled for a distance of 3 km along Hue Hue Road. No residences line this section of the route. Visibility at the intersection with Rutley's Road is good.

It is expected that work on the western freeway will be completed to the Morisset interchange by 1985. Through traffic would in most cases use this route in preference to Hue Hue Road. The impact of coal transportation on Hue Hue Road is thus not seen to be of major proportions.

7.10.4 Passenger Vehicles

Increased passenger vehicle traffic will be generated in the vicinity of the mine at the change of shifts, as detailed in Table 7.8.

TABLE 7.8

ESTIMATED EMPLOYEE VEHICLE MOVEMENTS*

Period #		6am-7am	1.30pm- 2.30pm	9 pm- 11 pm
Stage 1	1982	5	10	5
2	1982/83	55	60	35
3	1983	75	85	55
4	1983/84	95	110	85
5	1984	125	135	100
6	1984/85	145	155	120

* Assumes 33 per cent of employees share transport, two per car and remainder drive own cars.

Each stage represents a six months period.

The employees will increase current usage levels of Scenic Drive by approximately 10 per cent. This represents an unavoidable impact on the residences to the north of the mine site.

7.10.5 Goods Deliveries

Approximately eight goods deliveries will be made daily, pit timber being the major single item. The incremental increase in traffic volumes from this source will be insignificant.

**Alternatives to the
Proposal**

8.1 ALTERNATIVES TO THE PROPOSAL

The Company has undertaken exploration of the Colliery Holding and has delineated sufficient reserves to justify the establishment of a Colliery based on the short term opencut mining of the Wallarah Seam and the long term underground extraction of the Fassifern Seam.

The resource is finite and cannot be transferred to another site. The alternatives to the proposal are therefore restricted to either opencut extraction of the Fassifern Seam or not to proceed with the project.

As the average depth below the surface to the Fassifern Seam is approximately 70 m, an opencut operation would be uneconomic due to the high overburden to coal ratios. On environmental grounds the establishment of a major opencut mine would pose many difficulties.

The consequences of not carrying out the proposal would include the following:-

- i. The economic benefits resulting from the creation of direct and indirect employment and the generation of wealth throughout the region and the nation would not be realised.
- ii. A number of abandoned opencuts and quarries would remain in their present degraded and unsafe condition.
- iii. The planned expansion of the residential area of Caves Beach would make it increasingly difficult to extract the resource if a decision was made to defer the proposal.

Options relating to components of the proposal, for example, transportation, rejects disposal sites and final land use of sites are discussed within the relevant sections of the report.

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