EIS 1490

AA068123

Environmental impact statement for the Peak Hill gold project

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ASSOCIATED GOLD FIELDS NL

and

ALKANE EXPLORATION NL

ENVIRONMENTAL IMPACT STATEMENT

FOR THE

PEAK HILL GOLD PROJECT

R.W. CORKERY & CO. PTY. LIMITED

ASSOCIATED GOLD FIELDS NL

and

ALKANE EXPLORATION NL

ENVIRONMENTAL IMPACT STATEMENT

FOR THE PEAK HILL GOLD PROJECT

Prepared by: R.W. Corkery & Co. Pty Limited
Geological and Environmental Consultants
P.O. Box 80
ORANGE N.S.W. 2800

Telephone: (063) 62 5411
Facsimile: (063) 61 3622

On behalf of: Associated Gold Fields NL
P.O. Box 8260
129 Edward Street
PERTH W.A. 6849

Telephone: (09) 227 7769
Facsimile: (09) 227 8178

May 1993

ACN 002 033 712

Report No. 203/3
203peakhill/eis

EIS 1490

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FORM 4

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

This Statement has been prepared on behalf of **Associated Gold Fields NL** and **Alkane Exploration NL** for the **Peak Hill Gold Project.**

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

Mining by open cut methods;

Ore Treatment by heap leaching and gold recovery;

Installation and operation of water pipelines and associated facilities.

The development application relates to the land described in the attached Annexure.

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

Name, qualifications and address of person who prepared the Environmental Impact Statement:

Robert J. Corbett B.Sc.(For.)
75 Kite Street
ORANGE N.S.W. 2800

Certificate

I, Robert John Corbett, of 75 Kite Street, Orange, N.S.W., hereby certify that I have prepared the contents of this Statement in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

Signature .....

Date 24th May 1993

ANNEXURE TO FORM 4

The real property description of the land, the subject of a Development Application for the Peak Hill Gold Project proposed by Associated Gold Fields NL and Alkane Exploration NL, is set out below:

MINING AND PROCESSING SITE (The Project Site)

Portion 380
Portion 453 (Freehold)
PO 1974-6
PO 1956-3
Pt Portion 291 (Pt R 45718)
Pt Portion 290 (Pt R 45732)
Pt R 44725 (Trig Site)
Pt R 78459
Pt R 85369
Pt 39, 2r (In Trig Reserve for Peak Hill Water Supply)
Ref. Note 56 (easements for pipelines for Peak Hill Water Supply)

PARISH: Mingelo **COUNTY:** Narromine

BOGAN WEIR PUMP SITE AND PIPELINE ROUTE

Reserve 76298

PARISH: Cookopie **COUNTY:** Kennedy

Main Road #348 - Northern edge of reserve

Unnamed Crown Road between Portion 160 on W side and Portion 162 on E side

Unnamed Crown Road passing S of Portion 173, crossing the Parkes/Narromine railway and continuing S of Portion 185 and N of Portion 104 to the tertiary maturation pond

BOGAN WEIR PUMP SITE AND PIPELINE ROUTE - Cont'd.

Lot 1, D.P. 543131
Portion 187
Portion 187/Lot 1
Bivana Street
Vacant Crown Land

PARISH: Mingelo **COUNTY:** Narromine

"WESTRAY" PUMP SITE AND PIPELINE ROUTE

Lots 98 and 99

Under unnamed Shire road between Portions 99 and 379

Unnamed Crown Road between Portions 92, 379 and 296 to Project Site

PARISH: Mingelo **COUNTY:** Narromine

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FOREWARD

FOREWARD

The development of an operational mine at Peak Hill has been attempted on numerous occasions over the past twenty nine (29) years. The current proposal has reached the stage of a firm proposal as a result of improved metallurgical techniques and recognition by the proponent companies of the need to genuinely overcome a wide range of concerns of the residents of Peak Hill.

This Environmental Impact Statement has been prepared over a period of six (6) months and builds upon previous documentation obtained on the nature of the ore body and characteristics of the existing environment. Considerable emphasis has been placed in this document upon designing a mining and treatment operation that satisfies all reasonable community expectations and appropriate environmental criteria. This has been achieved through the incorporation of a range of design and operational safeguards and management procedures.

SUMMARY

SUMMARY

INTRODUCTION

This Environmental Impact Statement has been prepared by R.W. Corkery & Co. Pty Limited to support a Development Application by Associated Gold Fields NL and Alkane Exploration NL ("the Company") to Parkes Shire Council.

This Statement addresses the Company's proposed Peak Hill Gold Project, located on the eastern outskirts of Peak Hill township in the Central West of New South Wales.

The Company, R.W. Corkery & Co. Pty Limited and a total of seven (7) specialist consultants have worked on the development of the Company's proposal. A range of Government Authorities, Parkes Shire Council and Community Groups and the general public have been consulted.

THE APPLICANT

Associated Gold Fields NL and Alkane Exploration NL are publicly listed companies with significant interests in exploration and mine development throughout Australia and overseas.

The two companies have formed a joint venture to evaluate and develop the Peak Hill Gold Project.

THE PROJECT SITE

The location of the proposed Peak Hill Gold Project (the "Project Site") lies immediately to the east and north-east of the township of Peak Hill. The Project Site covers approximately 130 ha and comprises an area of vacant crown land, crown land subject to incomplete purchase and crown land reserved for various purposes.

The Company holds six (6) mining leases and a gold lease and has lodged two (2) mining lease applications incorporating the remainder of the Project Site. Additionally, the Company has applied for a permissive occupancy to enable the establishment of a pumping facility at the Bogan Weir.

MINING HISTORY

Alluvial gold in ancient drainage channels was discovered at Peak Hill in 1889. The mother lodes from which the alluvial gold originated were discovered a year later and worked by various methods until 1916. The large glory holes which remain at Peak Hill bear testimony to the substantial quantities of ore removed. Since 1916, mining activity has been sporadic and limited in extent. Since 1964, gold exploration work has been undertaken by a number of Companies including Anaconda, Alkane, Goldfields Exploration, Geopeko and Ashton Mining. Geopeko and Ashton Mining in particular undertook a wide range of ecological, metallurgical and environmental investigations. In each of the above cases, commercial and/or geological and metallurgical reasons were given for the failure to proceed with the development of the Peak Hill Gold Project.

Ashton Mining seriously considered re-developing the mine in 1990 as an open cut/heap leach operation. Since then, Associated Gold Fields NL and Alkane Exploration NL have formed a joint venture with the expectation of being in a position to commence site works in the latter part of 1993.

THE PROJECT

Outline of the Proposal

The Project would involve the open cut mining and processing of 1.8 Mt ore at the rate of 420 000 tpa. The overall strip ratio is 1.6:1 (waste rock:ore). A project life of approximately five (5) years is envisaged including a pre-production/construction phase of twenty seven (27) weeks.

Gold would be extracted from the mined ore using the heap leach method.

The main components of the Project which are shown on **Plate 1** would be:

- an open cut mine (400 m x 200 m x up to 100 m deep);
- a temporary open cut bund wall;
- a waste rock emplacement (18 ha and up to 20 m high);
- a crushing area;
- a single leach heap (600 m x 300 m x 10 m high);
- a contractor's area;
- three (3) soil stockpiles;
- ponds for process water and uncontaminated water;

- gold processing buildings and plant;
- a tourist viewing platform and access road; and
- relocated pipelines and reservoir access road.

Site Access

Access to the Project Site would be from the Newell Highway via the upgraded and sealed existing access road to the Shire's solid waste depot. The current access to the water reservoirs from Mingelo Street would be relocated, upgraded and sealed.

Tourist access to the open cut and historical workings would be provided by a sealed access road to a tourist viewing platform.

Mining Operations

Mining would be by an open cut method with the more weathered materials being ripped and the harder materials drilled and blasted. Ore and waste rock would be loaded into off-road rear dump trucks with a hydraulic excavator. Ore would be delivered to the run-of-mine (ROM) stockpile adjacent to the crushing plant whilst the waste rock would be placed in a tiered and contoured waste rock emplacement in the vicinity of the Shire's solid waste depot. All sulphide waste rock removed from the open cut would be encapsulated in the emplacement to prevent long term leaching of the material.

Ore Treatment

Gold would be extracted from the mined ore using the heap leach method. This involves crushing the ore to make the gold more accessible, then mixing with cement to bind together the very fine particles generated during handling. The products of this process are called agglomerates. The agglomerated ore, which has the appearance of marble-shaped particles, is stacked in modules to form a single flat-topped heap.

After each module of the heap is constructed, sections are sprinkled with a weak cyanide-bearing solution which percolates through the heap, dissolving the gold as it moves downward. At the base of the heap, pre-laid PVC lining and draincoil collects the gold-bearing (pregnant) solution and directs it to a PVC-lined collection pond.

Gold is recovered from the pregnant solution by passing the solution through tanks or columns of carbon. The gold leaves the solution and adheres to the carbon. The gold is removed from the carbon and after further processing is poured into gold bars.

Hours of Operation

The Company proposes to undertake mining (ripping, drilling, loading and hauling) between the hours of 7.00 am and 6.00 pm, six (6) days per week, forty eight (48) weeks per year. Crushing would generally be undertaken between the hours of 7.00 am

to 10.00 pm six (6) days per week and heap leaching and process plant operation twenty four (24) hours per day, 365 days per year.

Blasting would be confined to 9.00 am to 3.00 pm Monday to Saturday, but generally undertaken between 12.00 noon and 1.00 pm.

Employment

During the pre-production phase the anticipated workforce would range from six (6) persons to thirty (30) persons. During the production phase, the Company expects the project to employ approximately forty (40) persons. The Company also expects to source 50 to 75 per cent of its permanent workforce from the Peak Hill/Parkes district.

Services

The Company would obtain its annual water requirement of up to 255 ML from a combination of sewage treatment plant maturation pond effluent, Bogan River water extracted from the Bogan Weir, an impoundment on the "Westray" Merino Stud adjacent to Burrabadine Creek and harvested surface runoff from the Project Site.

Water from each of the Bogan Weir and the "Westray" impoundment would necessitate the installation of pumping stations and buried pipelines.

Electricity for the project would be supplied by the Central West County Council via an upgraded line located on the eastern extension of Bogan Street.

Telecom would install the necessary communication lines and appropriate sewerage facilities would be installed.

Rehabilitation

The Company proposes to incorporate rehabilitation procedures in all aspects of the Peak Hill Gold Project. Design planning of the project has addressed the need to ensure rehabilitation is as progressive as possible and provides a low maintenance site in the long term.

The final landforms created by the mining and treatment operations will comprise an open cut void with a range of safety measures around its perimeter, a hill at the waste rock emplacement site and a hill at the leach pad area. The final landform created from the overburden and spent ore (on the leach pad) would be contoured to ensure the outer slopes are left at a maximum slope of 18° (1:3 – Vertical:Horizontal) and vegetated with a mixture of grasses, trees and shrubs and will blend as far as possible with the landscape on and surrounding Peak Hill.

All other disturbed areas would be cleaned up, equipment removed and the areas ripped, topsoiled, seeded and fertilised using subsoil and topsoil materials stockpiled during the Project Site pre-production phase.

- gold processing buildings and plant;
- a tourist viewing platform and access road; and
- relocated pipelines and reservoir access road.

Site Access

Access to the Project Site would be from the Newell Highway via the upgraded and sealed existing access road to the Shire's solid waste depot. The current access to the water reservoirs from Mingelo Street would be relocated, upgraded and sealed.

Tourist access to the open cut and historical workings would be provided by a sealed access road to a tourist viewing platform.

Mining Operations

Mining would be by an open cut method with the more weathered materials being ripped and the harder materials drilled and blasted. Ore and waste rock would be loaded into off-road rear dump trucks with a hydraulic excavator. Ore would be delivered to the run-of-mine (ROM) stockpile adjacent to the crushing plant whilst the waste rock would be placed in a tiered and contoured waste rock emplacement in the vicinity of the Shire's solid waste depot. All sulphide waste rock removed from the open cut would be encapsulated in the emplacement to prevent long term leaching of the material.

Ore Treatment

Gold would be extracted from the mined ore using the heap leach method. This involves crushing the ore to make the gold more accessible, then mixing with cement to bind together the very fine particles generated during handling. The products of this process are called agglomerates. The agglomerated ore, which has the appearance of marble-shaped particles, is stacked in modules to form a single flat-topped heap.

After each module of the heap is constructed, sections are sprinkled with a weak cyanide-bearing solution which percolates through the heap, dissolving the gold as it moves downward. At the base of the heap, pre-laid PVC lining and draincoil collects the gold-bearing (pregnant) solution and directs it to a PVC-lined collection pond.

Gold is recovered from the pregnant solution by passing the solution through tanks or columns of carbon. The gold leaves the solution and adheres to the carbon. The gold is removed from the carbon and after further processing is poured into gold bars.

Hours of Operation

The Company proposes to undertake mining (ripping, drilling, loading and hauling) between the hours of 7.00 am and 6.00 pm, six (6) days per week, forty eight (48) weeks per year. Crushing would generally be undertaken between the hours of 7.00 am

to 10.00 pm six (6) days per week and heap leaching and process plant operation twenty four (24) hours per day, 365 days per year.

Blasting would be confined to 9.00 am to 3.00 pm Monday to Saturday, but generally undertaken between 12.00 noon and 1.00 pm.

Employment

During the pre-production phase the anticipated workforce would range from six (6) persons to thirty (30) persons. During the production phase, the Company expects the project to employ approximately forty (40) persons. The Company also expects to source 50 to 75 per cent of its permanent workforce from the Peak Hill/Parkes district.

Services

The Company would obtain its annual water requirement of up to 255 ML from a combination of sewage treatment plant maturation pond effluent, Bogan River water extracted from the Bogan Weir, an impoundment on the "Westray" Merino Stud adjacent to Burrabadine Creek and harvested surface runoff from the Project Site.

Water from each of the Bogan Weir and the "Westray" impoundment would necessitate the installation of pumping stations and buried pipelines.

Electricity for the project would be supplied by the Central West County Council via an upgraded line located on the eastern extension of Bogan Street.

Telecom would install the necessary communication lines and appropriate sewerage facilities would be installed.

Rehabilitation

The Company proposes to incorporate rehabilitation procedures in all aspects of the Peak Hill Gold Project. Design planning of the project has addressed the need to ensure rehabilitation is as progressive as possible and provides a low maintenance site in the long term.

The final landforms created by the mining and treatment operations will comprise an open cut void with a range of safety measures around its perimeter, a hill at the waste rock emplacement site and a hill at the leach pad area. The final landform created from the overburden and spent ore (on the leach pad) would be contoured to ensure the outer slopes are left at a maximum slope of 18° (1:3 - Vertical:Horizontal) and vegetated with a mixture of grasses, trees and shrubs and will blend as far as possible with the landscape on and surrounding Peak Hill.

All other disturbed areas would be cleaned up, equipment removed and the areas ripped, topsoiled, seeded and fertilised using subsoil and topsoil materials stockpiled during the Project Site pre-production phase.

ENVIRONMENTAL CONSTRAINTS AND SAFEGUARDS

The principal environmental constraints that have been addressed in the planning of the Peak Hill Gold Project are as follows.

- Drainage

  The Project Site is located within the catchment of the ephemeral upper Bogan River. The mining and processing water management system has been designed to ensure neither sediment-laden water nor water contaminated by process chemicals flows from the Project Site.

- Land Capability and Soils

  The Project Site comprises areas of Class III and Class V agricultural land. On Peak Hill itself, significant areas of the Class V land have been degraded during prior mining and gravel extraction activities.

  Soil resources on the Project Site range from non existent in areas of prior mining activity to deep loams in the flatter eastern areas. The soil management programme to be adopted by the Company would ensure that the soils on the Project Site (where recoverable) are properly stockpiled for subsequent use in rehabilitation. Soils disturbed during the installation of the pipelines would be immediately replaced and, where appropriate, seeded and fertilised.

- Water Resources

  Surface water and acceptable quality groundwater are relatively scarce in the vicinity of the Project Site. All creeks and rivers in the area are ephemeral and only flow after significant rainfall events.

  The Company's water management plan includes the sourcing of its processing and dust suppression water requirements from the sewage plant maturation pond, runoff harvested from the Project Site, water pumped from the "Westray" impoundment and water pumped from the Bogan Weir. The limitation proposed on extraction of water from the Bogan Weir would result in no adverse affect on agricultural users.

  Surface water quality in the area of the Project Site would be improved through the Company's removal and encapsulation of acid producing materials remnant of former mining activities.

- Noise

  The existing noise levels in the vicinity of the Project Site reflect the typical noise environment of a small rural town. The predominant noise source is road traffic, particularly heavy vehicles on the Newell Highway, although even residences along the highway can experience very low

background levels at night. Background noise levels to be adopted for impact assessment purposes vary from 35 to 40 dB(A).

- **Air Quality**

  Air quality in the Peak Hill district is influenced by a number of factors including nearby agricultural activities, traffic on unsealed roads; cleared areas on the Project Site, the town's solid waste depot and rail traffic, with the relative importance of each being a function of the prevailing weather conditions. The Project's air quality management system and the controls to be implemented have been designed to ensure the dust levels within Peak Hill remain at acceptable limits throughout the life of the Project.

- **Blasting**

  Due to the proximity of the open cut to the residences in Peak Hill and the town's water reservoirs, particular care has been taken to provide a range of blast design and operational safeguards that will ensure that flyrock, air vibration, ground vibration and dust are limited to a level which is compatible with the comfort and safety of the residents and the continued integrity of nearby dwellings, structures and facilities.

- **Flora and Fauna**

  The Project Site and surrounds comprises regenerating woodland disturbed to varying extents by past mining activities, and cleared agricultural land. A floral survey on the Project Site did not identify any rare or endangered species.

  A faunal study of the Project Site and surrounds identified four (4) habitat types. Two (2) individuals of rare and endangered species listed in Part 2 Schedule 12 of the NSW National Parks and Wildlife Act, 1974, and a number of uncommon species and one rare bird were identified. However, both rare and endangered species were found away from those areas to be disturbed by project activities.

  Along the pipeline routes, the majority of native vegetation has been cleared and now comprises a mixture of exotic and native grass species. Both the flora and fauna of the Project Site and pipeline routes are better represented elsewhere in the region.

- **Archaeology**

  No sites of aboriginal significance are located on the Project Site nor along or in close proximity to the pipeline routes.

  There are numerous relics from former mining activities in the area of the proposed open cut. The controls proposed by the Company, including the collection and placement of any surface items of significance at the site of the proposed tourist viewing platform, the

development of the remaining holes to the south of the proposed open cut as a tourist amenity and the installation of a permanent sign outlining the history of mining at Peak Hill, have been designed to minimise the impact on the area's industrial archaeology and any attendant impact on the tourist attraction of the area.

- **Zoning, Land Use and Land Ownership**

  The proposed Peak Hill Gold Project is located within an area zoned Rural 1(a) in the Parkes Local Environmental Plan. Land uses surrounding the Project Site range from rural to residential. The presence of residences as close as 200 m to the western boundary of the Project Site and the proposed open cut necessitate that matters relating to noise, air quality and blasting are thoroughly addressed in the proposal.

- **Parkes Radio Telescope**

  The Parkes Radio Telescope is located 31.5 km south of and with direct line of sight to the Project Site. A range of design and operational safeguards including installation of bunds, undertaking specific activities or locating facilities in areas out of the line of sight to the telescope and installation of specific electrical controls would ensure the project does not adversely affect the operation of the telescope.

- **Visibility**

  Peak Hill is part of an elevated and prominent landform in the district and, as such, is visible from most aspects of the surrounding countryside. In order to minimise any visual impact, as many trees as possible would be retained to screen the Project Site from nearby residences and public roads, and enrichment plantings and screen plantings would be employed in selected areas.

Other components of the local environment relating to geology, meteorology, groundwater, socio-economic factors, transportation and services are not significant constraints on the proposal. Nevertheless, each of these components has been taken into account during the planning of specific safeguards to ensure the impacts of the proposal are acceptable.

ENVIRONMENTAL IMPACTS

The project's impact on the environment around the Project Site has been examined after a range of design and operational safeguards and management procedures have been incorporated into the various components of the project.

Although some impacts would occur and some of the activities on the Project Site would be apparent to local residents from time to time, it has been determined that the level of these impacts is within specified criteria or acceptable community standards. The main impacts of the Peak Hill Gold Project are predicted to be as follows:

- Noise

  Noise levels from the pre-production and mining phases would be apparent but not excessive and would comply with Environment Protection Authority criteria.

  During Years 1 to 3, noise from the mining operation would be reduced to acceptable levels due to the existence of a temporary bund wall generally located within the confines of the open cut.

  With the exception of the crushing plant, noise generating activities would be limited to 7.00 am to 6.00 pm, Monday to Saturday.

  The crushing plant would normally operate between 7.00 am and 10.00 pm but may operate for longer hours during periods of peak production subject to proven compliance with appropriate noise criteria.

- Blasting

  The impacts of blasting at the adjacent residences and at the town's water supply reservoirs though apparent to varying degrees, would comply with the statutory limits at all times. Flyrock from infrequent free face blasts would be limited to 50 m in front of the blast face and 10 m behind newly created faces and dust would remain in the atmosphere for a short period only. Residences in Euchie Street could experience ground vibrations of 2.3 mm/s and airblast overpressures of 114 dB(L) from free face blasts which, though apparent, would not be a cause of annoyance, disturbance or damage. The maximum ground vibrations at the reservoirs of 16.1 mm/s from free face blasts approximates 64 per cent of the recommended limit. Airblast overpressure from the more frequent paddock blasts at the nearest residences would approximate 110 dB(L).

- Air Quality

  Development of the open cut and, in particular, the one month duration for the construction of the temporary acoustic bund, may result in short term episodic declines in local air quality during periods of adverse meteorological conditions. The first few rows of houses to the west and south-west of the project site would be potentially most affected with dust levels decreasing at residences further downwind. Specific dust controls would therefore be adopted under adverse weather conditions to maintain suspended dust levels within the USEPA primary standard and so eliminate any suggestion of health risk. In the event of a

protracted dry period water would preferentially be used for dust suppression;

- Water Resources

  The Project would require 255 ML water annually for its ore treatment and dust suppression activities. Approximately 45 per cent of this requirement would be sourced from the town's Sewage Treatment Plant with the remainder being sourced from harvested Project Site runoff, the Bogan Weir and the "Westray" impoundment.

  By restricting access to Bogan Weir waters for those periods when the water level in the Weir was within 1.5 m of top water level, the Company would ensure continued supply to adjacent and downstream water users.

- Land Capability

  The project development would necessitate the removal of approximately 13 ha of highly disturbed woodland to enable the development of the open cut and associated haulroads, the ROM stockpile area and the southern-most portion of the waste rock emplacement. The project would also necessitate the removal of an additional 100 ha of Class III agricultural land from production for the 5 year project duration. Approximately 35 ha comprising the rehabilitated waste rock emplacement and leached heaps would be downgraded to Class V agricultural land by virtue of the steepness of slopes and hence, susceptibility to erosion, and their unsuitability to any form of cultivation.

- Landform and Visual Impact

  The project would result in a significant and unavoidable modification of what is an already-modified landform on the Project Site. The existing open cut would be enlarged vertically and laterally and the waste rock emplacement and leach heaps will form elevated plateau in what is predominantly gently sloping cleared agricultural land. However, their low external batter slopes, combined with final landscaping and revegetation, would result in their blending in with the background slopes.

  The visual impact of vegetation removal in the area of the open cut would be reduced in the short term by temporary bund construction and revegetation, and in the longer term by the Company's site rehabilitation programme.

  Existing waste dumps, slag and miscellaneous rubbish would be removed from the Project Site resulting in an improvement to the aesthetics of the present site.

The potential impacts the project would have on other components of the environment such as drainage, soils, flora and fauna, archaeology, zoning and land use, the Parkes Radio Telescope, transportation and services are also addressed with the Statement.

CONCLUSION

As a result of extensive geological investigations and metallurgical test work undertaken since 1964 by a range of Companies, the Company has identified ore reserves mineable by open cut methods and amenable to heap leach treatment to extract the gold. This Environmental Impact Statement presents the details of the Company's mining and ore treatment proposal and the results of comprehensive environmental studies.

The Peak Hill Gold Project would be undertaken in accordance with state and local government planning and environmental safeguards using state-of-the-art mining practice. All environmental constraints imposed upon the project would be overcome through the implementation of a range of safeguards and management procedures to ensure the surrounding residents, and the physical environment, are not adversely affected by the proposal.

The project would become an important component in the local economy for a period of five (5) years and once again place Peak Hill as an important mining centre in New South Wales. Considerable benefit would also be derived for both the State and Commonwealth.

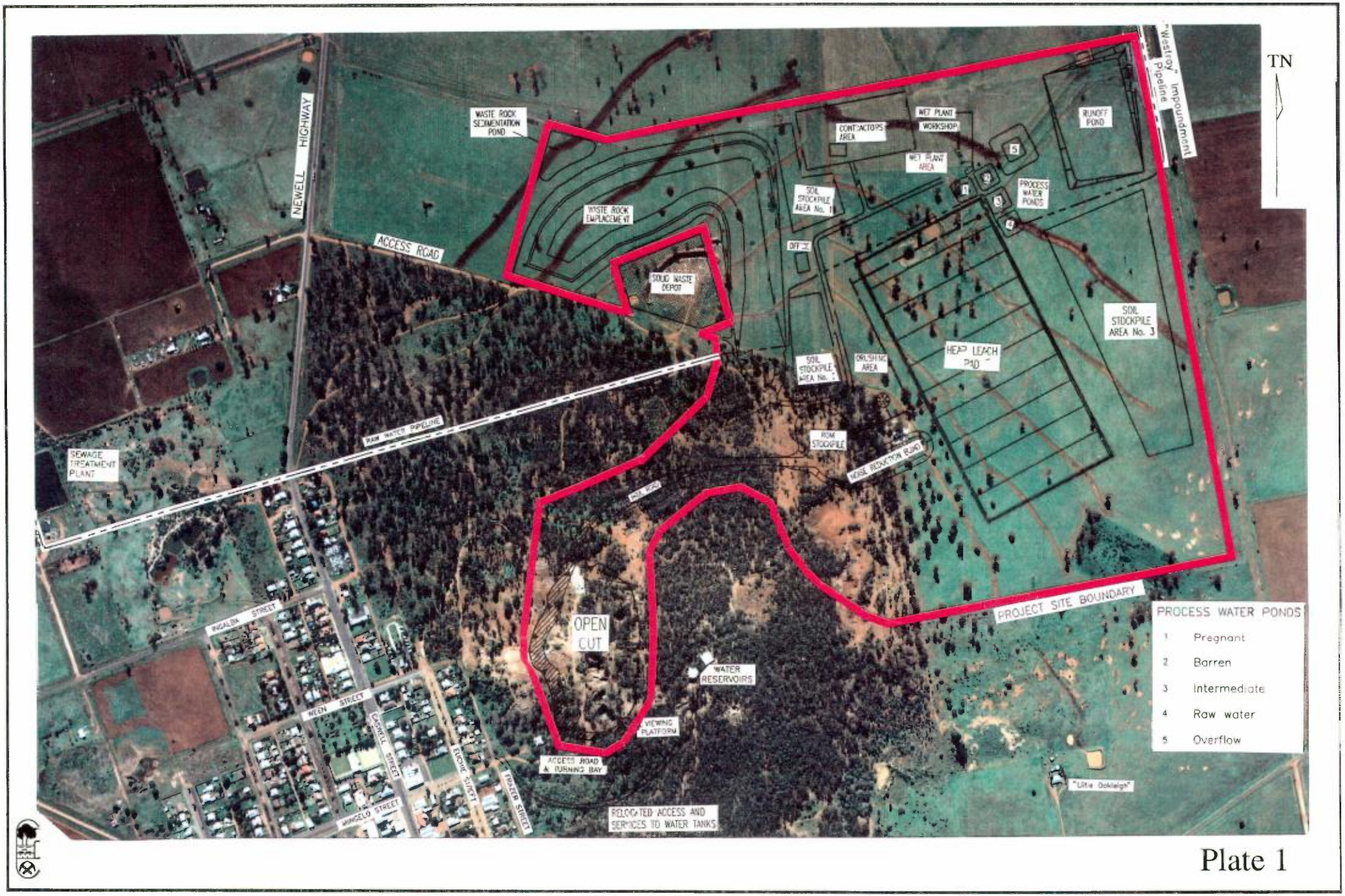

TN
NEWELL HIGHWAY
WASTE ROCK SEDIMENTATION POND
WASTE ROCK EMPLACEMENT
ACCESS ROAD
SOLID WASTE DEPOT
CONTRACTORS AREA
WET PLANT WORKSHOP
WET PLANT AREA
RUNOFF POND
SOIL STOCKPILE AREA No. 1
PROCESS WATER PONDS
DIP
SOIL STOCKPILE AREA No. 3
HEAP LEACH PAD
SOIL STOCKPILE AREA No. 2
CRUSHING AREA
ROM STOCKPILE
HORSE REDUCTION RUND
"Westroy" Impoundment
Pipeline
RAW WATER PIPELINE
SEWAGE TREATMENT PLANT
HAUL ROAD
OPEN CUT
WATER RESERVOIRS
VIEWING PLATFORM
ACCESS ROAD & TURNING BAY
RELOCATED ACCESS AND SERVICES TO WATER TANKS
PROJECT SITE BOUNDARY
"Little Oakleigh"
INGALBA STREET
WEIR STREET
CASWELL STREET
ENGINE STREET
FRASER STREET
MONGELO STREET
PROCESS WATER PONDS
1 Pregnant
2 Barren
3 Intermediate
4 Raw water
5 Overflow

Plate 1

SECTION 1

Introduction

SECTION 1

INTRODUCTION

1.1 SCOPE

This Environmental Impact Statement has been prepared by R.W. Corkery & Co. Pty Limited to support a development application by Associated Gold Fields NL and Alkane Exploration NL (hereafter referred to as "the Company") to Parkes Shire Council. Associated Gold Fields NL would be the project manager and operator on behalf of the two (2) companies in joint venture.

The Peak Hill Gold Project Site comprises an area of approximately 130 ha immediately to the east and north-east of Peak Hill township in the Central West of New South Wales (See Section 1.4, **Figures 1.1** and **1.2**). The Company proposes to establish an open cut gold mine and associated ore treatment plant.

Mining would be undertaken by conventional open cut techniques but with refinements to reflect the close proximity of the town. Ore would be hauled from the open cut to the crushing plant. Gold would be recovered from the crushed ore by the heap leach method and an adsorption/desorption gold recovery plant. Project development would also necessitate the establishment of a pumping station at each of the Bogan Weir, the "Westray" Merino Stud impoundment (the "Westray" impoundment) adjacent to Burrabadine Creek and the Peak Hill Sewage Treatment Plant (**Figure 1.2**); construction of a raw water pipeline from the Bogan Weir to the Peak Hill Sewage Treatment Plant; construction of a surge pond at the sewage treatment plant and a pipeline from the sewage treatment plant to the Project Site, and construction of a raw water pipeline from the "Westray" impoundment to the Project Site. The proposed routes for these facilities are also shown on **Figure 1.2.**

The project would have a life expectancy of almost five (5) years and would offer significant economic benefits to the residents of Peak Hill and the surrounding district. This Statement examines the environmental, social and economic implications arising from the proposed Peak Hill Gold Project.

Obtaining Development Consent for the project from Parkes Shire Council is a prerequisite for the Minister for Mineral Resources to grant the Company any additional mining leases and to amend the conditions attached to existing mining leases. The Company's activities are considered as a designated development within Schedule 3 (k) and (ma) of the Environmental Planning and Assessment Regulations, 1980 as amended.

This Statement would also serve as a basis for an application to the Environment Protection Authority for any approvals and the licences required to operate the open cut and treatment plant. It would also support a request by the Company to Parkes Shire Council for authorisation to relocate the existing unsealed open cut and water reservoir access roads.

1.2 FORMAT OF THE STATEMENT

This Environmental Impact Statement has been written in six (6) sections together with a glossary of technical terms and symbols and a set of appendices. The requirements of Clause 34 of the Environmental Planning and Assessment Regulations, 1980 and specific requirements of the Director of the Department of Planning (**Appendix 1**) and other Local and State Government Authorities (**Appendix 2**) have been incorporated into the appropriate sections of the Statement. Summary tables identifying where each of the specific requirements is addressed within the Statement are provided at the rear of each of **Appendices 1** and **2.**

The Statement format is as follows:

Section 1: Introduces the proposal and the Company, and outlines the background to the project and the history of mining at Peak Hill.

Section 2: Outlines the Company's objectives and proposed plans for the mining and treatment of the ore. The proposals for site preparation, waste rock emplacement and site rehabilitation are also presented.

Section 3: Describes the existing environment on and in the vicinity of the Project Site. Potential constraints imposed by the existing environment are identified.

Section 4: Presents safeguards that have been incorporated into the project to protect the local environment.

Section 5: Analyses the impact the safeguarded project would have on the environment.

Section 6: Justifies the project in terms of environmental, economic and social considerations and examines the consequences of not proceeding with the project.

Reference List

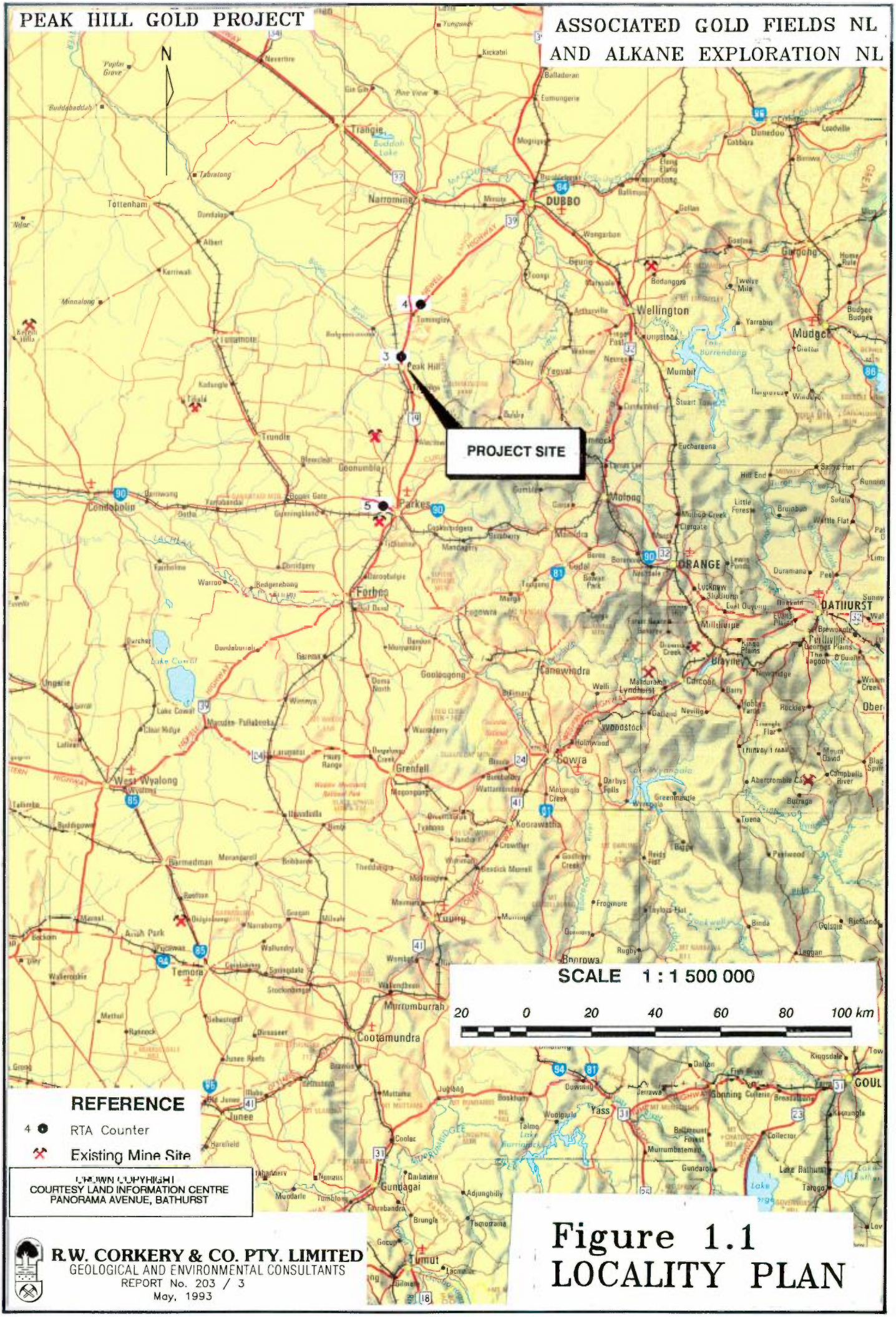
Glossary of Technical Terms and Symbols

Appendices: Present correspondence from the Department of Planning, other State Government Authorities and Parkes Shire Council, the Energy Statement and information on Cyanide in the Gold Mining Industry.

1.3 THE APPLICANT

Associated Gold Fields NL and Alkane Exploration NL ("Alkane") are publicly listed companies with significant interests in exploration and mine development throughout Australia and overseas (**Figure 1.3**).

Associated Gold Fields NL is involved in a tin mine at Emmaville, N.S.W. and is looking to develop a number of open cut gold mines within N.S.W. and elsewhere. Exploration activities include the search for gold, diamonds, base metals and oil and gas.


PEAK HILL GOLD PROJECT
ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL
N
PROJECT SITE
SCALE 1 : 1 500 000
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REFERENCE
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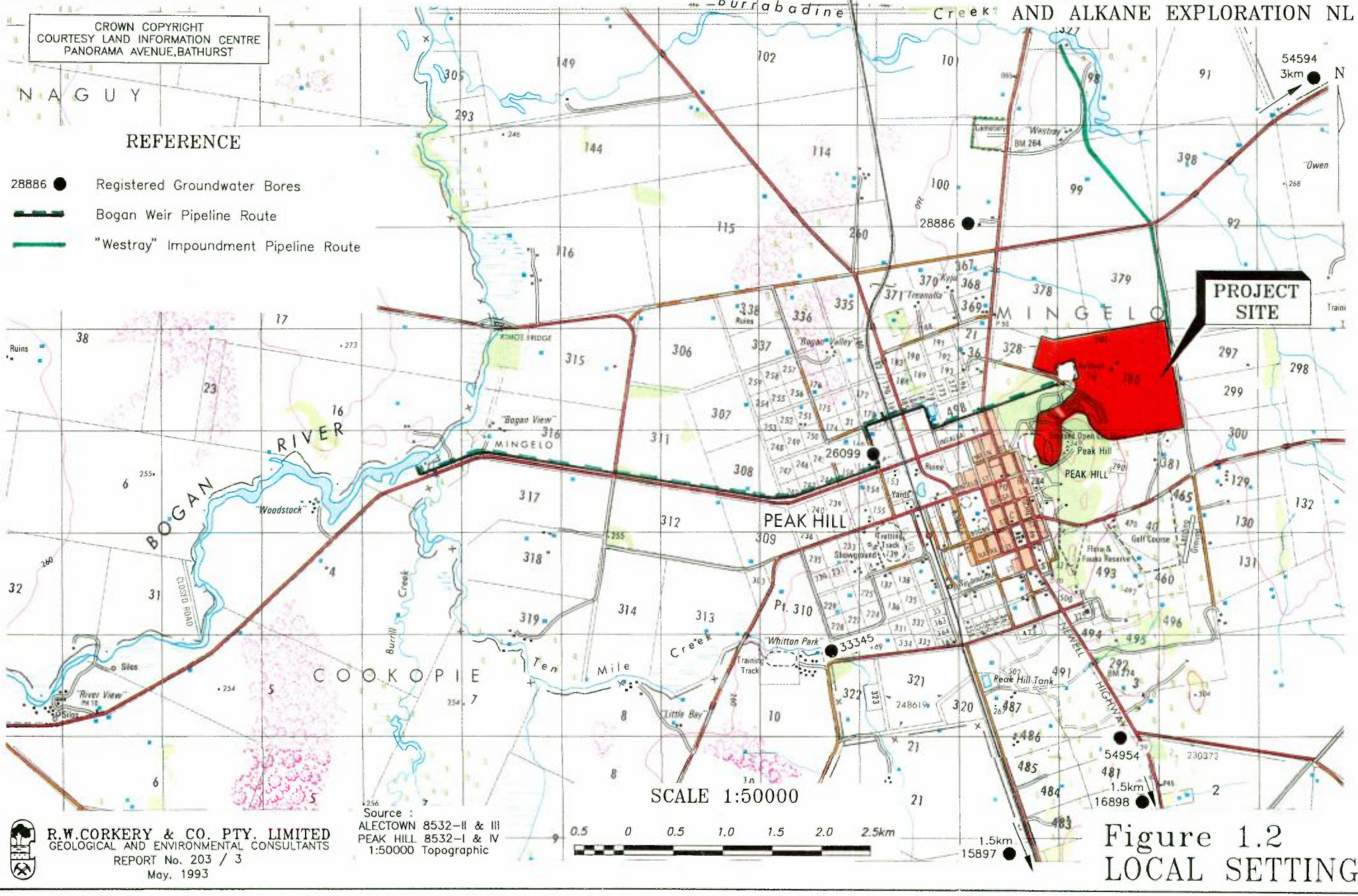
Existing Mine Site
CROWN COPYRIGHT
COURTESY LAND INFORMATION CENTRE
PANORAMA AVENUE, BATHURST
R.W. CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS
REPORT No. 203 / 3
May, 1993
Figure 1.1
LOCALITY PLAN

PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL

CROWN COPYRIGHT
COURTESY LAND INFORMATION CENTRE
PANORAMA AVENUE, BATHURST



Source :
ALECTOWN 8532–II & III
PEAK HILL 8532–I & IV
1:50000 Topographic

R.W.CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS
REPORT No. 203 / 3
May, 1993

Figure 1.2
LOCAL SETTING

PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL

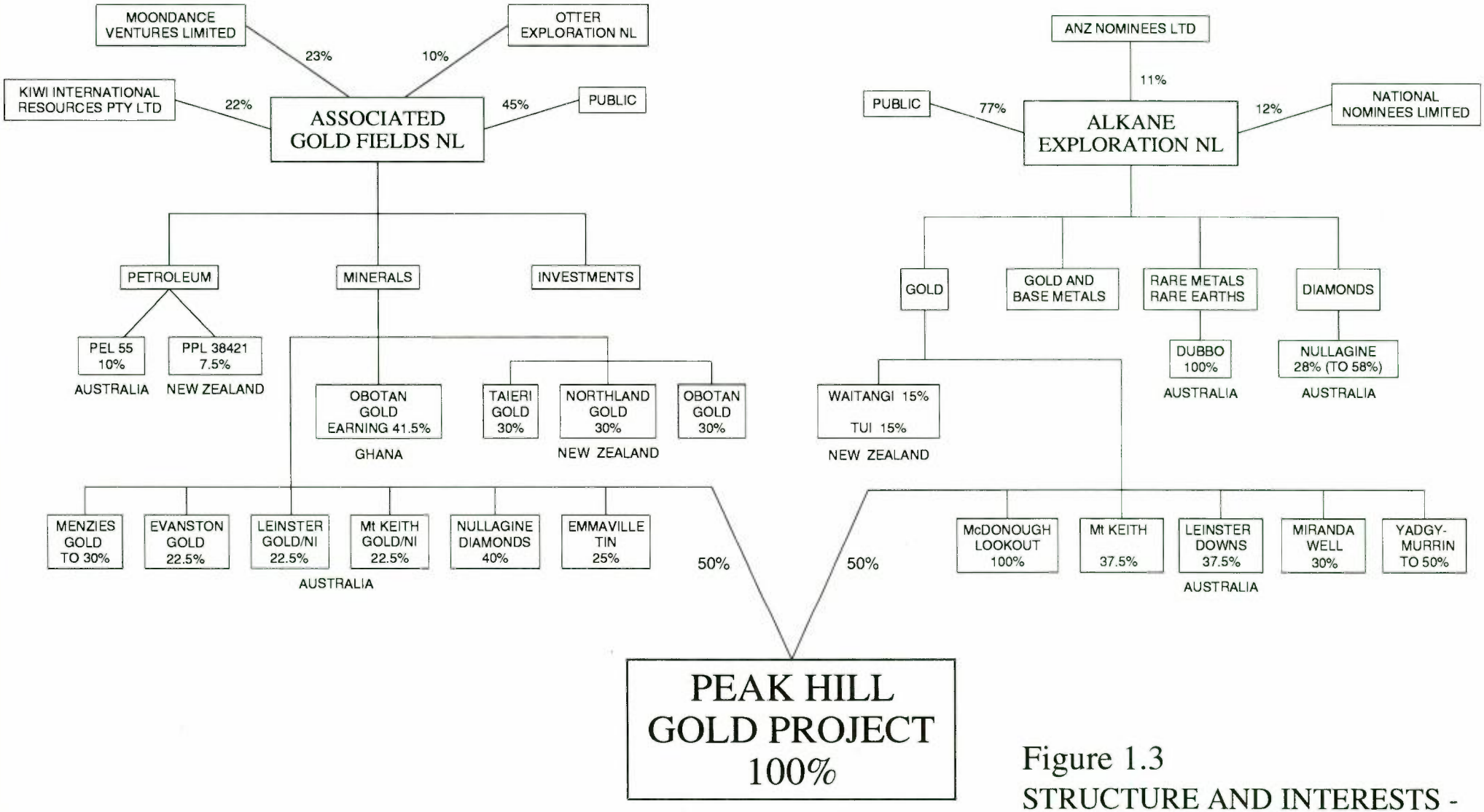


Figure 1.3
STRUCTURE AND INTERESTS - ASSOCIATED GOLD FIELDS NL & ALKANE EXPLORATION NL

R.W.CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS
REPORT No. 203 / 3
May, 1993

Alkane's interests include exploration for diamonds, gold, nickel, rare metals and rare earth elements. Much of this activity has been undertaken in N.S.W. over the last ten (10) to fifteen (15) years.

The two companies have formed a joint venture to evaluate and develop the Peak Hill Gold Project.

1.4 THE PROJECT SITE

The location of the proposed Peak Hill Gold Project (the "Project Site") is shown on **Figure 1.2** and **Plate 1**. The Project Site lies immediately to the east and north-east of the township of Peak Hill and is centred upon the small hill (Peak Hill) from which the town derives its name.

The Project Site covers approximately 130 ha and comprises an area of vacant crown land, crown land subject to incomplete purchase (Lot 380, D.P. 755113) and crown land reserved for various purposes including gravel (Reserve No. 45732, Portion 290), quarrying (Reserve No. 78459), trig purposes (Reserve No. 44725), night soil (Reserve No. 45718, Portion 291), soil conservation (Reserve No. 85369) and a special lease 1949/2 (Portion 468).

The Company holds six (6) mining leases and a gold lease and has submitted two (2) Mining Lease Applications over the remainder of the Project Site. Details of the mining tenements are presented in Section 2.2 and of land ownership in Section 3.10. The Company has also applied for a permissive occupancy to enable the establishment of a pumping facility at the Bogan Weir.

1.5 HISTORY OF MINING AT PEAK HILL

1.5.1 Early Mining

Alluvial gold in ancient drainage channels was discovered at Peak Hill in 1889. The mother lodes from which the alluvial gold originated were discovered a year later and worked by various methods until 1916. Initially, high grade ore was extracted and treated through stamper batteries. Later, lower grade ores were economically treated in vats constructed of timber. The large glory holes which remain at Peak Hill bear testimony to the substantial quantities of ore treated by the vat leach method.

Total gold production from Peak Hill between 1890 and 1916 was approximately 1 925 kg recovered from about 475 000 t of ore processed, indicating an average recovered grade of just over 4 g/t Au.

Since 1916, mining activity at Peak Hill has been sporadic and limited in extent: total gold production in the 1939 to 1945 period was 52.1 kg and by 1965, production of gold had declined to just 0.14 kg.

A series of waste rock dumps, slag heaps and tailings dams was left from the early mining activities. These dumps and dams have contributed to the deterioration in water quality downhill from the mine site, particularly through Peak Hill township (see Section 3.6.1). However, in January and February 1993, the acid producing tailings were removed from the Project Site and rehabilitation was commenced by the Department of Conservation and Land Management under a joint initiative between the Company, the Department of Mineral Resources and the local Gulomogo Land Care Group.

1.5.2 Recent Investigations

Since 1964, gold exploration work at Peak Hill has been carried out by Mines Exploration Pty Limited (1964); Anaconda (1967); Occidental Minerals Corporation of Australia and Frio Mining and Exploration (1976); Jododex Australia Pty Limited and CRA Exploration Pty Limited (1978); Alkane (1983); Goldfields Exploration (1982-1986); Peko-Wallsend Ltd (Geopeko) (1987) and Ashton Mining Limited (1990). Peko-Wallsend Ltd and Ashton Mining Limited in particular, undertook a wide range of geological, metallurgical, geotechnical and environmental investigations.

In each of the above cases, commercial and/or geological and metallurgical reasons were given for the failure to proceed with the development of the Peak Hill Gold Project.

Although the proposed project is still sensitive to commercial aspects such as gold price, the Company's investigations, together with the improvements in heap leach technology, now indicate that a viable project is feasible.

1.6 MANAGEMENT OF INVESTIGATIONS

The investigations and report writing for this Statement have been undertaken by personnel from R.W. Corkery & Co. Pty Limited and the Applicant.

Mr R.J. Corbett B.Sc.(For.), Senior Environmental Scientist, has been responsible for the bulk of report writing, with input from Mr P. D. Walbran, B.Sc. (Hons), Dip.Hort.Sc, formerly Environmental Geologist. Mr G.R. Meates, Project Manager and Looten Kendall Engineers have provided information on the technical aspects of the Project. Ore reserve estimation and mine planning were undertaken by James Askew Associates Pty Limited.

Mr Rob Corkery, Principal of R.W. Corkery & Co. Pty Limited has reviewed the document and undertaken limited text preparation.

Specialist assistance with the preparation of this Statement was obtained from:

- Richard Heggie Associates Pty Ltd - acoustical impact assessment;
- Golder Associates Pty Limited - blasting, open cut and reservoir stability assessments;
- P. Zib and Associates Pty Limited - air quality assessment; and

- Dr David Goldney - for the floral and faunal components.

Each of the aforementioned studies involved the review of earlier work undertaken by those specialists on behalf of Ashton Mining Limited and, where appropriate, the up-dating of their reports to reflect the differences between the Ashton Mining proposal and that proposed by the Company.

An archaeological and historical study undertaken by Anutech Pty Limited on behalf of Peko Wallsend Limited has also been referenced.

All of the above supporting specialists have presented their individual assessments in separate reports referenced in this Statement and are available at display centres. However, the contents of each specialist's report have been summarised and incorporated in the body of this Statement.

1.7 GOVERNMENT AND COMMUNITY CONSULTATION

1.7.1 Government Consultation

The following Authorities were consulted by the Company, R.W. Corkery & Co. Pty Limited and/or their specialists during the preparation of the Environmental Impact Statement. Those Authorities identified with an asterisk (*) also received a draft copy of the Environmental Impact Statement for review and comment. Written responses on the draft were received from all recipients except the Department of Water Resources.

Department of Planning (Sydney)
Heritage Council of NSW (Sydney)
National Parks and Wildlife Service (Parramatta and Bathurst) (*)
Department of Water Resources (Dubbo) (*)
Central West County Council (Parkes) (*)
Environment Protection Authority(Bathurst) (*)
Department of Mineral Resources (Orange and St Leonards) (*)
Parkes Shire Council (Parkes) (*)
Department of Conservation and Land Management (Soil Conservation Service)(Orange) (*)
Department of Conservation and Land Management (Department of Lands) (Dubbo, Orange and Sydney) (*)
Mineral Resources Development Laboratory (Lidcombe) (*)
Roads and Traffic Authority (Parkes)
NSW Agriculture (Orange)

Correspondence from the Department of Planning is included as **Appendix 1** and correspondence received from other government departments and authorities, and Parkes Shire Council, is included as **Appendix 2**. Summary tables identifying where each of the specific requirements is addressed within the Statement is provided at the rear of the relevant Appendix.

1.7.2 Community Consultation

During the course of the preparation of the Statement (January 1990 to date), consultation with the Peak Hill Community has been extensive and undertaken in a number of ways.

In 1990, Ashton Mining Limited conducted a Public Awareness Meeting, distributed an Information Package and set up a Community Consultative Committee. Community reaction gauged from these activities was used as a basis for the current consultative efforts.

In January 1993, the Company set up an office in Caswell Street to advertise the project and enable the community to volunteer comments and ask questions. Members of groups such as the Peak Hill Ratepayers and Progress Association, the Aboriginal Lands Council and the residents of Frazer Court Hostel have been contacted on an informal basis and very positive discussions held. Business people were canvassed opportunistically.

Additionally, a door knock of Euchie Street and Frazer Street residents in closest proximity to the proposed operations was undertaken to gauge sentiment in an area identified as sensitive from the previous consultative work. An open letter to the residents of Peak Hill briefly describing the proposal and inviting feedback, was circulated in early May 1993.

Issues raised in each of the above forums has been addressed in this document.

SECTION 2

Description of the Project

SECTION 2

DESCRIPTION OF THE PROJECT

2.1 OUTLINE OF PROPOSAL

The Peak Hill Gold Project proposal as described below has evolved following technical studies, consultation with Parkes Shire Council and various Government Authorities and liaison with the local community. Various alternatives have been considered and are outlined in Section 2.14.

The proposed Peak Hill Gold Project would produce over 2 400 kg of gold bullion over a 4 to 5 year period using heap leach technology to remove the precious metal from low grade ore. The operation would entail extraction of approximately 1.8 million tonnes (Mt) of ore and 3.0 Mt waste rock by open cut mining methods. Ore treatment would commence following a twenty three (23) week pre-production phase.

Major project components are shown on **Figure 2.1** and comprise:

- an open cut mine;
- a temporary open cut bund wall;
- a waste rock emplacement;
- a crushing area;
- a heap leach pad;
- a contractor's area;
- three (3) soil stockpiles;
- process water ponds for cyanide-contaminated or potentially cyanide-contaminated water (pregnant, barren, intermediate, raw water and overflow);
- a pond for uncontaminated water (run-off pond);
- gold processing buildings and plant (wet plant area, **Figure 2.1**); and
- a tourist viewing platform and access road.

Other structures to be located in the general area of the wet plant include a cyanide store, an acid store, workshop, laboratory and office building.

The gold-bearing ore would be mined by open cut methods. Ore would be broken by bulldozer or blasting and an excavator and dump trucks would be used for ore and waste rock excavation, loading and haulage. Waste rock would be trucked to the waste rock emplacement area.

A crushing plant comprising a primary jaw crusher and secondary impact crusher would reduce the run-of-mine ore to <7 mm size prior to agglomeration by the addition of cement.

Agglomerated ore would be conveyed to the 0.75 mm thick PVC lined leach pad. On the leach pad, the agglomerated ore would be stacked in a single heap 300 m x 600 m and up to 10 m high. Water containing a low concentration of sodium cyanide would

be applied to the heap. The gold dissolved by the cyanide would drain to the pregnant pond from where it would be reclaimed for gold recovery processing.

The recovery plant would contain:

- a series of carbon adsorption columns to recover the gold from the pregnant solution;
- a stripping circuit where the metal is removed from the carbon and plated onto steel wool; and
- a barring furnace and gold room to smelt the metal into dore bars for refining to gold bullion off-site.

Solutions stripped of their gold content would flow through to the barren pond prior to recirculation to the heaps to repeat the process.

Because all solutions and chemicals are continuously recycled, the entire heap leach process would be a closed circuit system, with no discharge to the environment.

The project would be a significant water user. The Company has applied to the Department of Conservation and Land Management for a Permissive Occupancy (P.O.) over portion of Reserve 76298 at Bogan Weir and to the Department of Water Resources to permit extraction of up to 125 Megalitres (ML) water from the Weir (**Plate 2**) annually. However, extraction of water from the Bogan Weir would only be undertaken when the water level in the Weir was within 1.5 m of top water level. A further 114 ML per annum is available from the outfall from the Peak Hill Sewage Treatment Plant and an additional 120 ML per annum may be sourced from the existing "Westray" impoundment adjacent to Burrabadine Creek (**Plate 3**) under an agreement with the land owners. The Company has also applied to the Department of Water Resources for a licence to extract water from the "Westray" impoundment.

The Bogan Weir to Sewage Treatment Plant to Project Site pipeline and the "Westray" impoundment to Project Site pipeline are shown on **Figure 1.2**. The former would be located within road and rail reserves and Crown Land, whereas the latter would be located within private property and public road reserves.

2.2 MINING TENEMENTS

Mining tenements on the Project Site comprise six (6) Mining Leases, a Gold Lease, two (2) Mining Lease Application areas and an Exploration Licence Application. The Mining Leases, Gold Lease and Mining Lease Application areas are shown in **Figure 2.2** and listed in **Table 2.1**. All tenements are registered in the names of Alkane Exploration NL (50 per cent) and Associated Gold Fields NL (50 per cent).

PEAK HILL GOLD PROJECT

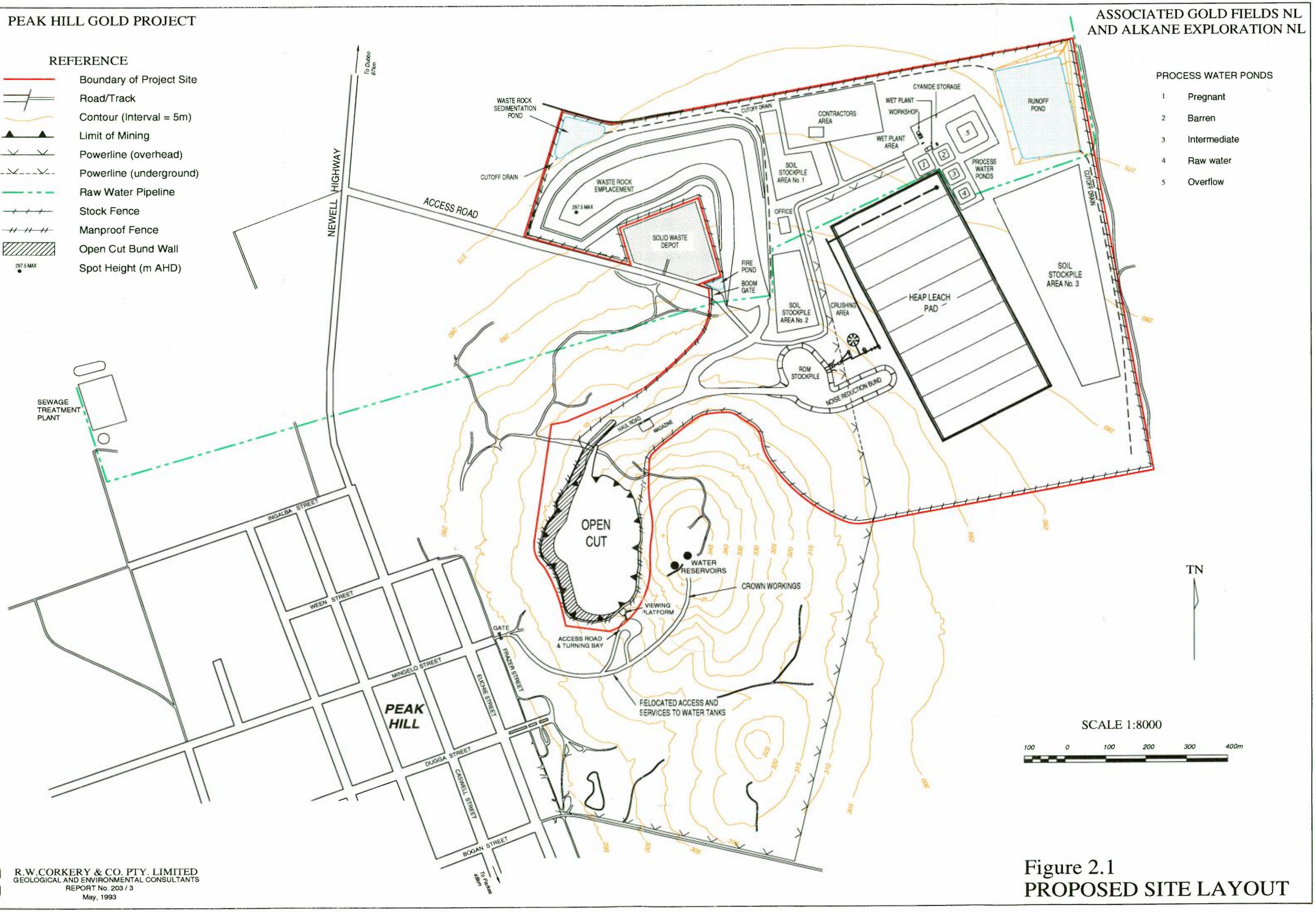
ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL

REFERENCE

- Boundary of Project Site
- Road/Track
- Contour (Interval = 5m)
- Limit of Mining
- Powerline (overhead)
- Powerline (underground)
- Raw Water Pipeline
- Stock Fence
- Manproof Fence
- Open Cut Bund Wall
- 297.5 MAX — Spot Height (m AHD)

PROCESS WATER PONDS

1. Pregnant
2. Barren
3. Intermediate
4. Raw water
5. Overflow



SCALE 1:8000

100 0 100 200 300 400m

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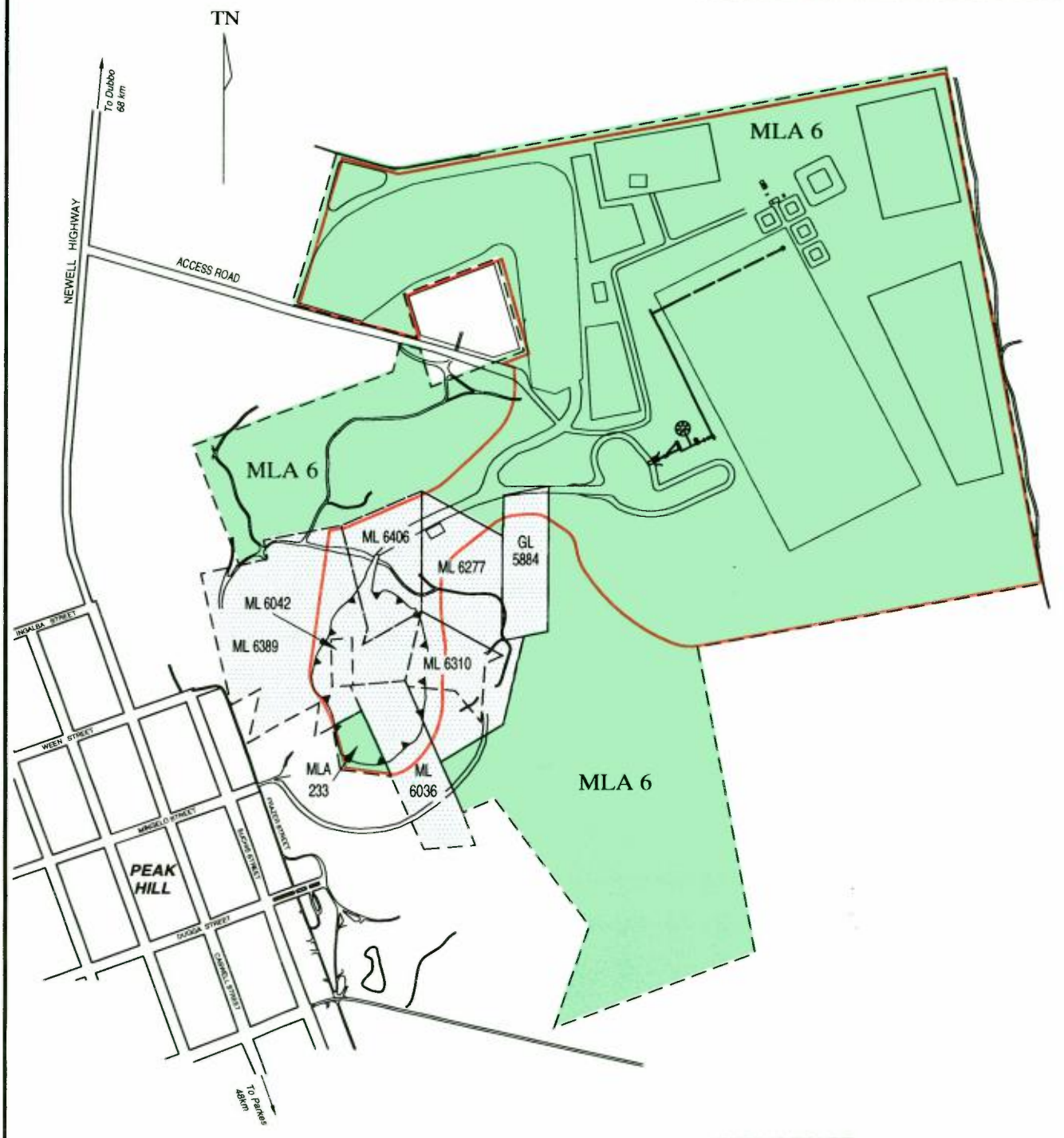
Figure 2.1
PROPOSED SITE LAYOUT

PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL



REFERENCE

- Project Site Boundary *
- Mining Lease Boundary *
- Road/Track
- Limit of Mining
- Existing Mining Lease
- Mining Lease Application

* Note : Project Site Boundary and Mining Lease Boundaries coincide, they are shown separated here for clarity

SCALE 1:12500

200 0 200 400 600m

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Figure 2.2
PROJECT SITE MINING TENEMENTS

Plate 2: A view to the south and west of the Bogan Weir. The proposed pump site lies upper left. (Ref: 203H/2,3)

Plate 3: The "Westray" impoundment. (Ref: 203J/3)

TABLE 2.1

Mining Tenements*

Tenement	Gazetted	Expiry Date	Area
MLA 233			2.000 ha
GL 5884 Renewal Pending	12/12/69	11/12/89	2.792 ha
ML 6036 Renewal Pending	7/03/69	6/03/88	3.960 ha
ML 6042 Renewal Pending	21/02/68	20/02/88	0.410 ha
ML 6277 Renewal Pending	12/03/71	11/03/91	6.424 ha
ML 6310 Renewal Pending	27/08/71	26/08/91	2.097 ha
ML 6389 Renewal Pending	6/04/73	5/04/93	11.080 ha
ML 6406 Renewal Pending	25/01/74	24/01/94	3.420 ha
MLA 6			163 ha

* Information supplied by the Company

At the time of lodgment, the Company was investigating use of the southern part of MLA 6 outside the current Project Site boundary as an alternative access to the processing area as well as the route for the incoming powerline. With the finalisation of the Project Site as defined in Section 2.1 and shown on **Figure 2.1**, the Company would modify its mining lease application, if required.

2.3 THE ORE BODY AND RESERVES

2.3.1 The Ore Body

The Peak Hill mineralisation occurs mainly associated with pyrite or its oxidised equivalents, with only minor enrichment occurring in quartz veins. The zone of mineralisation trends north-south and transgresses various rock types on the Project Site. A horizontal and vertical section showing the relationship of the ore body to the proposed open cut is shown on **Figures 2.3** and **2.4** respectively.

The 0.75 g/t gold grade contour outlines an area measuring 100 m x 400 m at the surface. Higher grade mineralisation (>1.5 g/t Au) is present in the main ore body, which is 50 m wide at the surface and narrows to 20 m at depth, and in smaller narrower zones flanking the main ore body.

2.3.2 Ore Reserve Estimation

For the Peak Hill Gold Project, gold-bearing ore has been defined to be those materials above the base of major oxidation (BOMO)(**Figure 2.4**) with a gold grade >0.75 g/t. Oxidised mineralisation with a gold grade of 0.5 g/t to 0.75 g/t is defined as low grade ore and all sulphide mineralisation and materials of a gold grade <0.50 g/t have been defined as waste.

Using the above design parameters, James Askew Associates Pty Limited have determined a measured and indicated resource, including stope backfill and alluvials, of approximately 1.8 Mt averaging 1.81 g/t gold.

In order to recover the ore, approximately 3.0 million tonnes (Mt) waste rock comprising approximately 256 000 t sulphide mineralisation, 273 000 t low grade oxidised mineralisation and 2.47 Mt oxidised waste rock, would have to be mined.

2.4 MINING

2.4.1 Outline of Method

Open cut mining techniques would be used to mine ore and waste rock within the open cut and haul them to the Run-of-Mine (ROM) ore stockpile, noise reduction bund or waste rock emplacement (**Figure 2.1**).

Ore and waste rock would be removed in successive horizontal slices or "lifts" 2.5 m thick. As each lift is removed, a 2.5 m high working face would be advanced across the open cut.

Golder Associates (1993a) estimate that blasting would be required for 45 to 50 per cent of the ore and waste. The remaining 50 to 55 per cent would be dug by excavator ("free-digging" material) or would require ripping by bulldozer prior to loading into dump trucks using the excavator. In general, the amount of blasting would increase as the open cut deepens (**Table 2.2**). Whereas blasting is not expected to be necessary in

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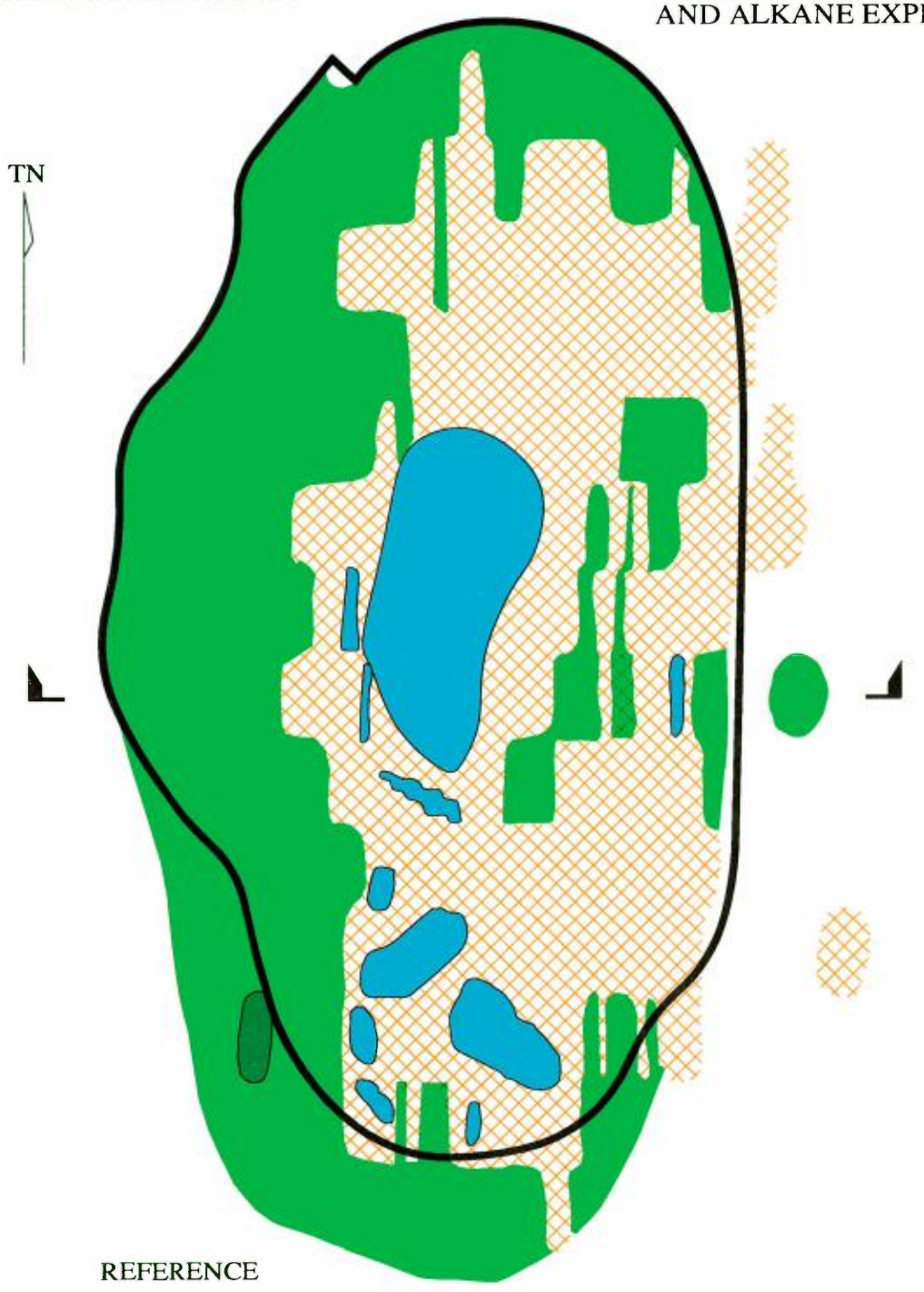

REFERENCE

Existing Open Cuts (Glory Holes)

Mineralised Zone

Weathered and Altered Foliated Andesite and Andesitic Tuff

Limit of Open Cut at 295m AHD

Figure 2.4 - Vertical Section through Ore Body
Figure 2.5 - Section : Open Cut Development

See Figure 2.4 for the location of the 295m AHD Section

SCALE 1:2000

20 0 20 40 60 80 100m

Figure 2.3
HORIZONTAL SECTION THROUGH ORE BODY - 295m AHD

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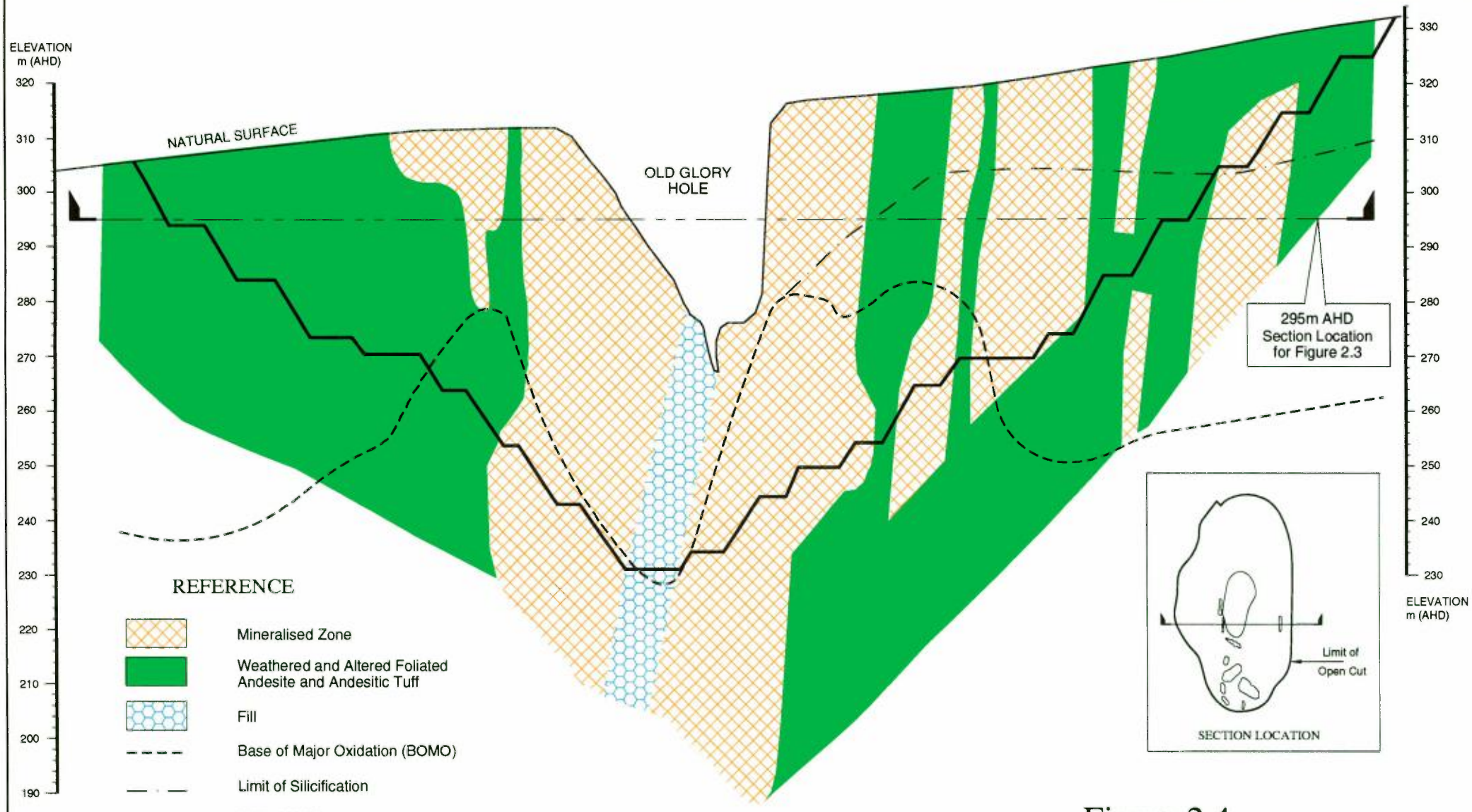

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Figure 2.4
VERTICAL SECTION
THROUGH ORE BODY

the first 20 m (340 m AHD to 320 m AHD), most rock in the lower 40 m (270 m AHD to 230 m AHD) would require blasting.

The walls of the open cut would be excavated such that horizontal benches 5 m wide would remain around the open cut periphery. Benches would be developed each 10 m vertically, with batter slopes of 60°. The overall open cut wall slope would approximate 43°. Details on the open cut wall stability are presented in Section 2.4.10. The final open cut would be progressively trimmed by use of the hydraulic excavator, thereby minimising the need for close-spaced perimeter blasting. The boundaries between ore and waste would be identified by assaying samples collected from trenches dug with a "ditch-witch" trencher, a bulldozer ripper or the corner of a grader's blade.

The deepest part of the open cut would be at 230 m AHD, 105 m below the eastern rim of the open cut and 75 m below the western rim. The final open cut would be approximately 200 m wide (east-west) and 400 m long (north-south).

TABLE 2.2

Blasting Requirements Schedule

Bench (m AHD)	Predicted Quantity of Rock Requiring Blasting ('000 t)	Predicted Percentage of Ore and Waste to be Removed by Blasting
340/330	0	0
330/320	0	0
320/310	99	15
310/300	289	25
300/290	323	34
290/280	296	34
280/270	260	38
270/260	466	93
260/250	244	90
250/240	74	80
240/230	17	55

Source: James Askew Associates Pty Ltd

Annual ore and waste production from the mine would be approximately 420 000 tonnes and 640 000 tonnes respectively.

Mining would be undertaken by a suitably experienced mining contractor with whom the Company would have a contract specifying environmental performance criteria.

2.4.2 Clearing

Clearing over the area of the proposed open cut, haulroads, ROM stockpile, waste rock emplacement, the initial three (3) modules within the leach pad area and other associated areas of disturbance would be undertaken during the pre-production phase of project development, where required.

Within these areas, all trees would be felled by bulldozer and any suitable materials cut and stacked for use as fencing materials or firewood. All remaining woody vegetative material e.g. stumps, logs, branches, would be stockpiled temporarily prior to re-spreading over areas of disturbance awaiting rehabilitation. Shrub and non-woody species would be retained and subsequently collected with the topsoil during the topsoil removal operation.

Once the clearing limits have been defined but prior to any clearing being undertaken, where applicable, the Company would construct a temporary catch drain on the downslope boundary of the area to be cleared. The drain, initially constructed as a 4 to 5 m wide channel (the blade width of a bulldozer) would be either incorporated into, or replaced by, the permanent site drainage system. Runoff collected within the catch drains would be directed to temporary sediment traps prior to release to the natural drainage lines. The necessity for and the size and location of these structures would be determined in consultation with the Department of Conservation and Land Management.

Removal of the remaining vegetation on areas of future leach pad module development would be undertaken as part of the leach pad module construction and development programme.

Prior to the removal/disposal of any relics of former mining activity (See Section 3.10), the Company would consult with the local historical society and, if so requested, would remove the items to storage for ultimate display at or near to the proposed open cut viewing platform.

2.4.3 Topsoil Removal

Once all timber has been removed from each area to be cleared, any available soil, together with shrubs and non-woody vegetation, would be removed by appropriate earthmoving equipment and either:

- immediately re-spread on available areas of the lower slopes of Peak Hill which have been denuded of vegetation and topsoil by former gravel extraction operations; or
- be placed in designated stockpile areas within existing clearings on the hill or on cleared agricultural land.

The Company is mindful of the need not to exacerbate the infestation of the remaining woodland on Peak Hill by the introduction of persistent agricultural grasses and weed species and accordingly would employ a source-specific soil management policy: topsoil or subsoil sourced from agricultural areas would be stored on and used for rehabilitation activities in cleared agricultural land only, whereas topsoil and subsoil

sourced from woodland areas would be stored and preferentially used for the rehabilitation of woodland areas.

Where sufficient soil depth is encountered, e.g. in the cleared agricultural areas of the Project Site, two stage stripping and separate stockpiling of topsoil (A horizon) and subsoil (B horizon) materials would be employed.

Three (3) stockpile locations totalling an area of 11 ha have been allocated for the storage of topsoil and subsoil from cleared agricultural land and are shown on **Figure 2.1.** Storage of topsoil and subsoil removed from the woodland areas would utilise the numerous clearings remnant of former mining or gravel extraction operations which lie in close proximity to the proposed open cut.

Topsoil stockpiles would not exceed 1.5 m in height and would, if necessary, be seeded with a mixture of native and non-persistent exotic grasses, herbs and shrubs to reduce erosion losses, improve structure and water permeability, increase soil aeration and prevent the development of anaerobic conditions, and assist in the maintenance of the biological viability of the resource. The specific composition of the seed mixture would be determined in consultation with local officers of the Department of Conservation and Land Management (Soil Conservation Service). The subsoil material, where available, would be stockpiled to a maximum height of 3 m, be covered with a thin veneer of topsoil and be similarly stabilised. The necessity for, and the nature of any additional controls to prevent erosion of the stockpiles would be determined in consultation with the Department of Conservation and Land Management.

2.4.4 Free Digging

At least 50 per cent of the ore and waste rock within the proposed open cut is sufficiently weathered that it would be removed by free digging. Free digging is the excavation of material without prior blasting.

For the Peak Hill Gold Project, free digging would be performed by excavator with or without prior ripping. During the pre-production phase, the Company proposes to use two (2) Cat 631 elevating or open bowl scrapers or an excavator and two (2) dump trucks for removal of waste rock from the open cut area and the construction of the temporary open cut bund wall. Details of the bund wall are provided in Section 2.4.11.

After commencement of production, free digging of both ore and waste would be by a Komatsu PC 650 excavator (or equivalent) loading into two (2) Cat 773B (or equivalent) haul trucks. Ripping, where required, would be by a Cat D8L (or equivalent) bulldozer.

2.4.5 Blasting

In view of the close proximity of the proposed open cut to the township of Peak Hill and the town's water supply reservoirs, and the Company's commitment to ensure that the side effects of blasting (flyrock, air vibrations, ground vibrations and dust) are compatible with the safety and the continued integrity of nearby dwellings and

structures, blast design for the Project has been undertaken by Consultant Engineers, Golder Associates Pty Limited.

Blasting would be required in the more competent materials. Blast holes (89 mm in diameter) would be drilled to approximately 6.0 m (5 m bench height and 1 m sub-drill) using an hydraulically powered production drill (Tamrock 500 or equivalent) on a nominal 2.9 m to 3.4 m equilateral triangular blast pattern.

Two forms of blasting would be used:

- "paddock" blasting - in which the rock being blasted is entirely surrounded by solid or previously blasted material; and
- "free face" - blasting in which the blast is unconfined on at least one side. The unconfined blast face is usually represented by a near-vertical rock face.

"Paddock" blasting, the principal form of blasting to be employed, uses wider spaced holes (3.4 m centres) with lower powder factors than free face blasting, causes less lateral displacement of rock and so assists the separate mining of ore and waste rock. Free face blasting would only be employed in waste rock and where there is a sufficiently wide buffer of waste rock between the ore and the free face. Recommended blasting parameters for both paddock and free face production blasts are presented in Golder Associates (1993a).

For free face blasts, blast design would ensure flyrock travel would be restricted to less than 50 m (usually 30 m or less) from the front of the exposed rock face, less than 25 m (and usually 15 m or less) to the sides of the blast and about 10 m (and usually less than 5 m) behind the newly created face. For paddock blasting, flyrock would be restricted to about 10 m or less in any direction.

The requirement for blasting would increase with depth from 0 per cent at the surface to 90 per cent as the base of major oxidation is approached or more silicified material is encountered. **Table 2.2** identifies the expected requirement for blasting at each level within the open cut. Because of the confined nature of the open cut and the greater proportion of silicified material at depth (**Figure 2.4**), all materials below 260 m AHD other than the stope backfill materials below the former glory holes (**Figure 2.4**) would be "paddock" blasted, regardless of hardness. Loose materials encountered in backfilled stopes would not be blasted.

Each drill hole would be loaded with the appropriate quantity of explosives (range 12.9 - 15.9 kg) and stemmed with gravel or drill cuttings to minimise airblast overpressure. In order to minimise the number of blasts per week (i.e. maximise the volume generated per blast) and yet maintain ground and air vibrations at the nearest residences and the water reservoirs within acceptable levels, the maximum block blast size would be 50 x 25 m, yielding approximately 13 750 t of material.

The estimated average number of blasts per week for the duration of the project is shown in **Table 2.3**. During the pre-production phase (Weeks 0 to 23), no routine blasting is envisaged. However, with the progressive deepening of the open cut, up to five (5) blasts per week may be required to yield the required volume of ore.

TABLE 2.3

Average Projected Frequency of Blasting

Activity	Year 1				Year 2 Production	Year 3 Production	Year 4 Production	Year 5 Production
	First Half Pre- Production		Second Half Production					
Estimated blasts per week	0	0	3	3	3	3	3	5

Although the mining contractor would be responsible for the design and implementation of each blast, all blast designs would require approval from the Company prior to commencement of any drilling operations. The Company also intends using consultant services to supervise blast monitoring and optimisation of blasting techniques in the early stages of open cut development. Each blast over the life of the Project would be monitored to ensure that airblast overpressure and ground vibrations comply with Environment Protection Authority (EPA) criteria at nearby residences and the Standards Association of Australia criteria at the water reservoirs (See Section 5.7). On the basis of the preliminary blast monitoring programme, permanent geophones would be established at selected residences in Euchie and Frazer Streets and near the water reservoirs.

A schedule of blasting times would be issued in advance, with a reminder being provided on the day of a blast. The method of notification to be employed for the community in general would be determined after discussions with local community representatives. However, for the residents of Frazer Court Hostel, it has been agreed that a telephone call to the supervisor on the morning of the blast would be an appropriate form of notification.

The Company also proposes to install a blasting notice board at the junction of the reservoir/tourist viewing platform access road and Frazer Street. Information of the proposed blasting programme would be updated daily. A blasting siren would also be sounded prior to any blast.

2.4.6 Equipment Used

Table 2.4 lists the typical earthmoving and mining equipment that would be utilised on the Peak Hill Gold Project. However, as both the earthmoving and mining activities would be undertaken by appropriately qualified and equipped contractors, the list must be considered indicative only, i.e. individual pieces of equipment as listed may be replaced by equivalent equipment produced by other manufacturers. However, it is noted that contracts with the various contractors would specify noise limitations upon all equipment used on the Project Site.

TABLE 2.4

Equipment List - Peak Hill Gold Project

Item of Equipment/Phase	Number
Pre-Production/Construction (Weeks 0-23 Year 1)	
Caterpillar D10N Bulldozer	1
Caterpillar 631 Scraper	2
Caterpillar 12E Grader	1
Mack R600 Water Truck (20 000 Litre)	1
Production (Week 24, Year 1 onwards)	
Komatsu PC650 Excavator	1
Caterpillar 773B (50 t) Dump Truck	2
Catepillar D8L Bulldozer	1
Caterpillar 12E Grader	1
Mack R600 Water Truck (20 000 Litre)	1
Tamrock 500 Blast Hole Drill Rig	1
Caterpillar 988 Front-end Loader	1

Subject to the approval of the Mines Inspector, reversing alarms on all mobile equipment would be replaced by flashing lights.

Where practicable, bund construction and overburden removal activities would be undertaken using two (2) Caterpillar 631 scrapers (or equivalent) following ripping with a Caterpillar D 10N bulldozer (or equivalent). However, in some areas, e.g. immediately adjacent to the old glory holes or where rock size precludes efficient scraper operation, the use of an excavator and dump trucks in lieu of scrapers would be required.

2.4.7 Mine Development Schedule

Development of the open cut would be undertaken in accordance with the schedule presented in **Table 2.5** and as shown in Section in **Figure 2.5**. The schedule has been developed in consultation with acoustic consultants, Richard Heggie Associates Pty Limited, to ensure that operational noise levels at the nearest residential receivers are acceptable at all times.

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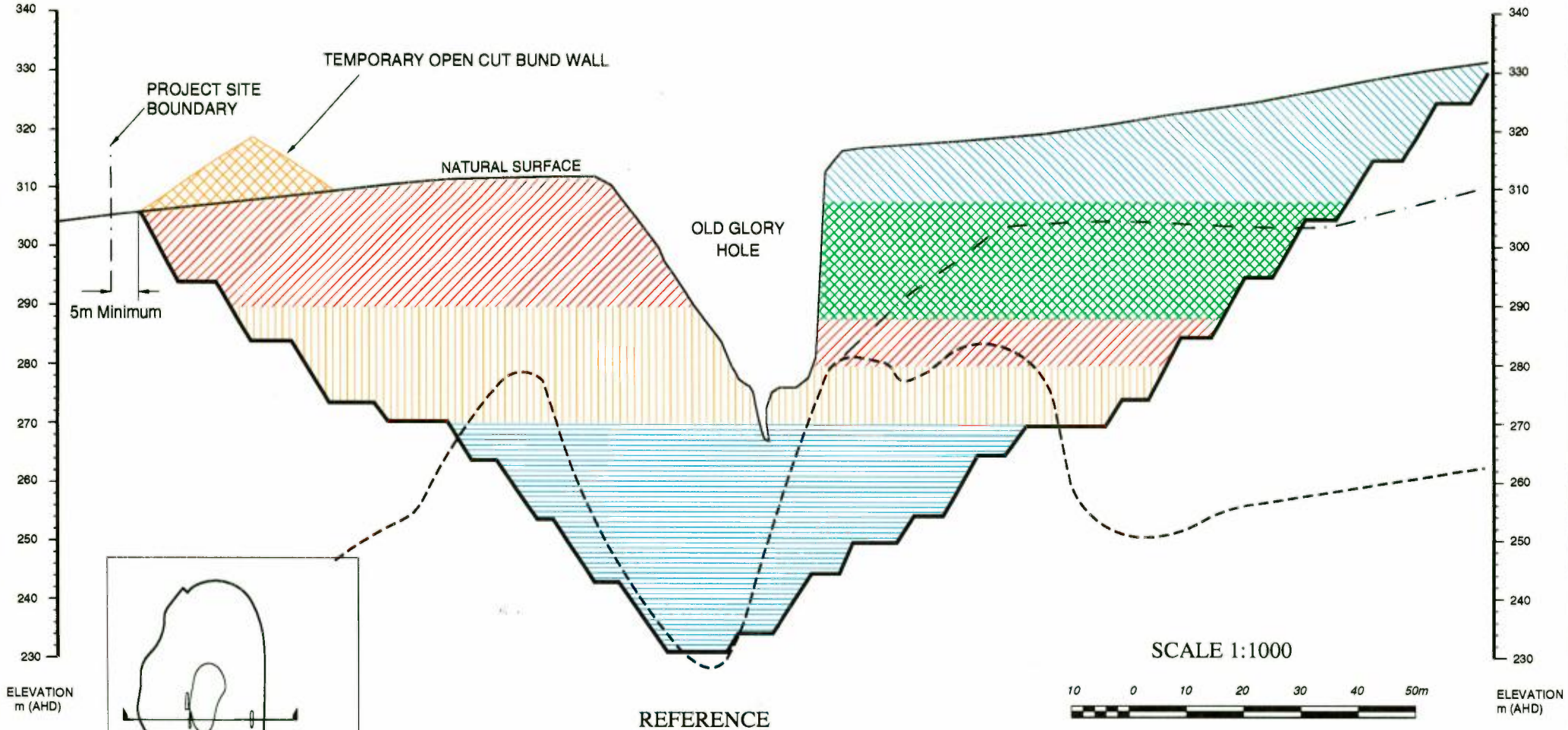

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Figure 2.5
SECTION : OPEN CUT DEVELOPMENT

2.4.8 Open Cut Design

During the initial four (4) weeks of the pre-production phase and Years 1, 2 and the early part of Year 3 of production activity, mining would concentrate on the eastern high wall area of the open cut (**Figure 2.5**). Only once open cut development had reached the 280 m AHD level would mining the western wall cutback commence.

At the end of Year 1 production, the base of the active open cut (eastern high wall) would average 4 m below the western rim of the existing glory hole (308 m AHD); at the end of Year 2 production, 24 m below the rim (288 m AHD); after Year 3 production, 32 m below the rim (280 m AHD) on the east wall cutback and 22 m below the rim (290 m AHD) on the west wall cutback and after Year 4 production, 42 m below the rim (270 m AHD).

At completion of mining, the base of the open cut would be approximately 75 m below ground level at the western (lowermost) margin of the open cut and 105 m below ground level at the eastern (uppermost) margin of the open cut. The final open cut layout is presented in **Figure 2.6.**

Open cut design for the Peak Hill Project was determined by James Askew Associates Pty Ltd (1993) using the Datamine computer model, and open cut slopes based on the information documented by Golder Associates (1993b).

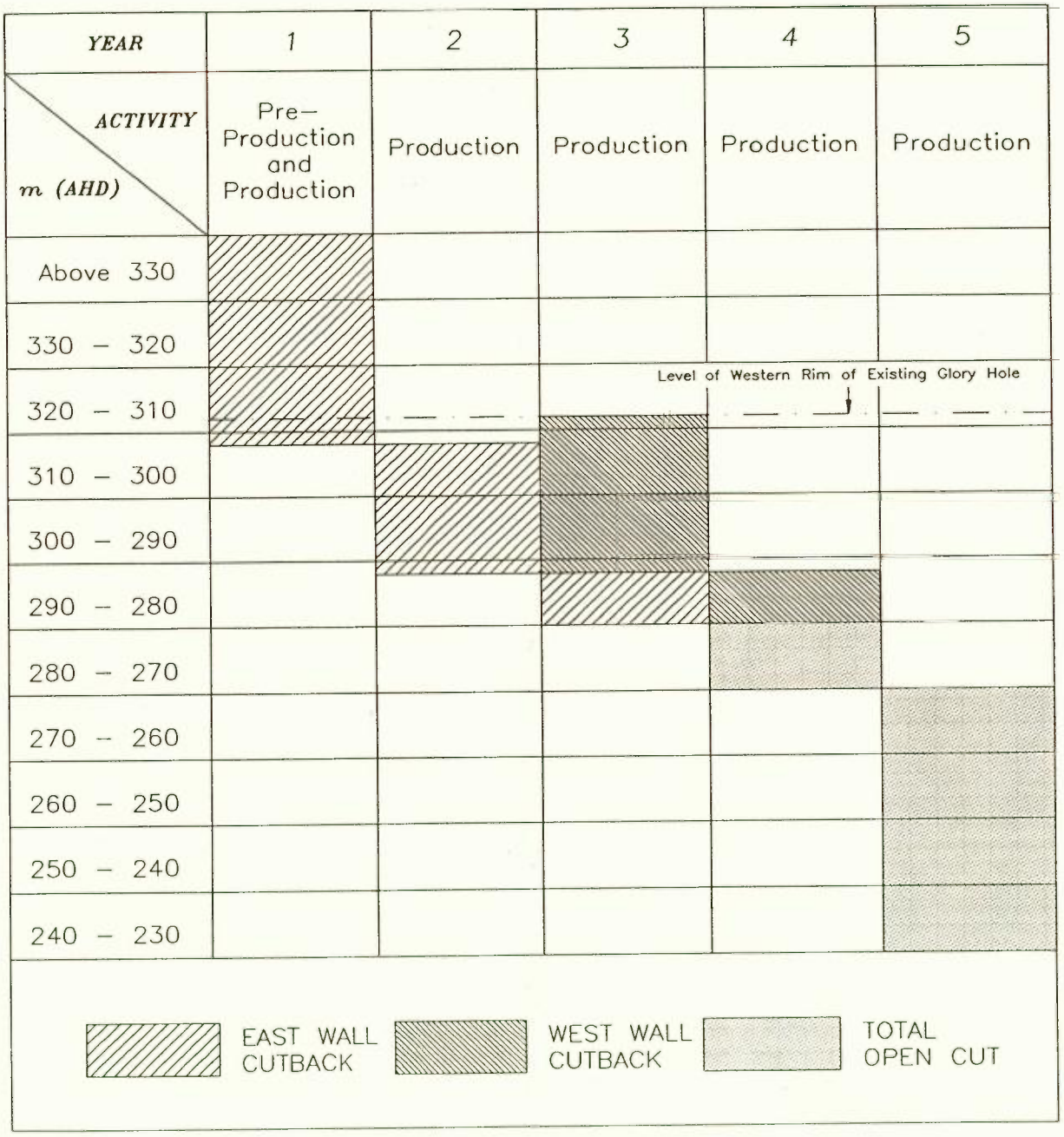
The proposed basic design of the open cut is as follows:

- face height 10 m;
- face slope 60° (to the horizontal); and
- berm width 5 m.

The overall slope, not including haulroads, would be 43° to the horizontal.

TABLE 2.5

Mine Development Schedule



PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL

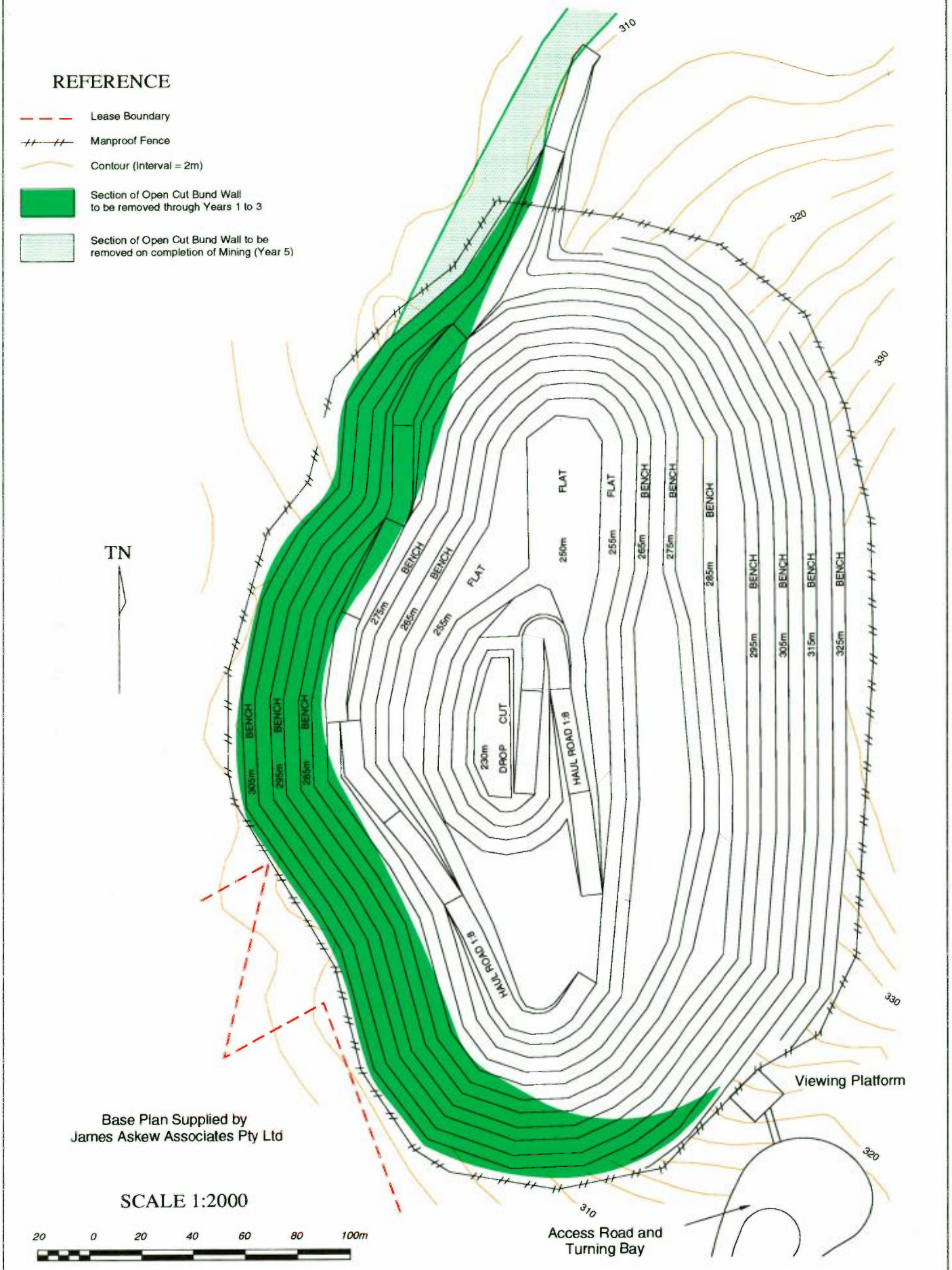


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Figure 2.6
OPEN CUT LAYOUT

2.4.9 Access and Haul Roads

The haul road within the open cut would be constructed to a maximum grade of 1:8 (vertical:horizontal). Formation width would be 8.0 m and incorporate a safety windrow along the open cut road edge. Haul road surfaces would be graded towards the open cut wall to assist road drainage and stability and all curves would be designed to suit 50 t rear dump trucks. Passing bays would be provided at the 275 m AHD and 250 m AHD benches and at the base of the open cut.

A single haul road exit at the north-west corner of the open cut would provide access to the ROM stockpile/crusher area and waste rock emplacement (**Figure 2.1**). Haul roads outside the confines of the open cut would be constructed as near to level as is practicable in order to minimise excessive haul truck noise, and for drainage purposes, would be graded to maintain a uniform cross-fall to the inner (uphill) road edge. All surface runoff from the haulroads external to the open cut would be directed via appropriately sized culverts and drains to the runoff dam and/or sedimentation pond (**Figure 2.1**).

Haul road development both within and external to the open cut would utilise materials sourced from within the confines of the open cut during the pre-production phase.

To prevent unauthorised entry to the Project Site, a single, lockable boom gate access through the perimeter fence would be provided (**Figure 2.1**). This gate would remain closed at all times and locked outside daytime working hours.

The perimeter fence (**Figure 2.1**) would comprise sections of both man-proof and stock-proof fencing. Man-proof fencing would be located around the perimeter of the open cut and for a distance of at least 100 m either side of the access road boom gate and would comprise 1.8 m chain mesh fencing and a single strand of barbed wire on top. Elsewhere, the Company would install a conventional stock-proof fence (**Figure 2.1**).

Access to the water reservoirs and the viewing platform would be prevented immediately prior to and following blasting by the closure and manning of a gate to be installed approximately 70 m east of the Frazer Street/Mingelo Street intersection.

2.4.10 Open Cut Wall Stability

Given the depth of the proposed open cut, the proximity of the proposed open cut to the township of Peak Hill and to the town's water supply reservoirs and the altered and foliated nature of the rock in the area of the proposed open cut, a geotechnical study was undertaken by Golder Associates Pty Limited (Golder, 1993b) to assess the consequences of the proposed mining activity on the stability of the two (2) water reservoirs located to the east of the proposed open cut and on the relocation of the pipeline to and from the water reservoirs.

Geotechnical information was obtained from diamond drill cores, materials testing undertaken on selected samples and inspections of the existing glory holes.

On the basis of this work, Golder Associates concluded that an unreinforced open cut wall design with a face height of 10 m; a face slope of 60°; a bench width of 5 m; and an overall slope of 43° (not including haulroads) would be stable.

Golder Associates also concluded that as the angle subtended between the nearest reservoir and the toe of the nearest point of the proposed open cut excavations is 31° and that the angle of repose of broken rock is 38°, the stability of the reservoir would be adequate down to the design depth of mining (230 m AHD).

If, however, mining should proceed below the 230 m AHD level, Golder Associates considers there would be an increasing risk of ground movement affecting the reservoir.

No instability of the south wall of the open cut was anticipated. However, Golder recommended the pipeline be relocated to between 20 m and 30 m from the open cut edge to allow for operational flexibility.

2.4.11 Bund Walls

In order to contain noise to acceptable levels at residences adjacent to the open cut, provide visual screening of mining activities and assist in the control of potential dust emissions, the Company proposes to construct a temporary bund adjacent to the open cut and haulroad as shown on **Figure 2.1**. A section through the open cut bund wall is shown on **Figure 2.7**. Proposed bund dimensions are:

Length	630 m
Width at Base	30 m
Maximum vertical height above ground	10 m (Crest height 318 m AHD)
Batter Slopes	35° to the horizontal

With the exception of a 200 m section of bund on the north-western corner of the open cut and adjacent to the western side of the open cut-crusher haulroad (**Figure 2.1**), the bund would be located within the confines of the open cut.

As mining progresses on the western side of the open cut (Year 3) the temporary bund would gradually be removed. By the time the floor of the open cut has reached 295 m AHD, there would be no further requirement for bunding adjacent to the active open cut. However, at all times, a minimum 5 m high barrier comprising the bund, the pit wall or a combination of both, would be retained between the floor of the open cut and the nearby residences. The section of the bund located outside the limits of open cut development (**Figure 2.6**) would be removed on completion of mining and haulage activities.

Prior to active open cut bund construction, the bund wall foundation area would be cleared of vegetation and any soil stripped and stockpiled immediately to the north of the open cut for subsequent rehabilitation works. Bund construction would be by scrapers and a dozer (or excavator, dump trucks and a dozer) and use approximately

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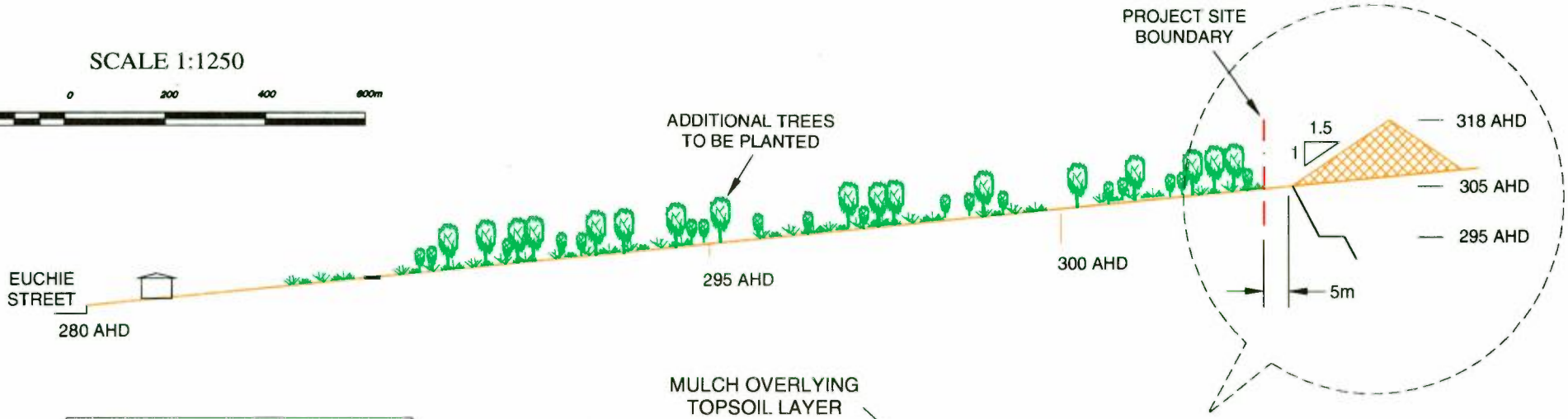
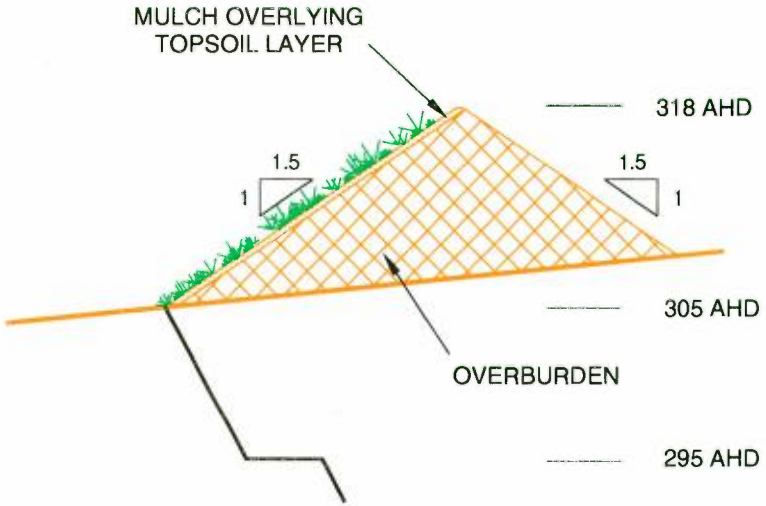
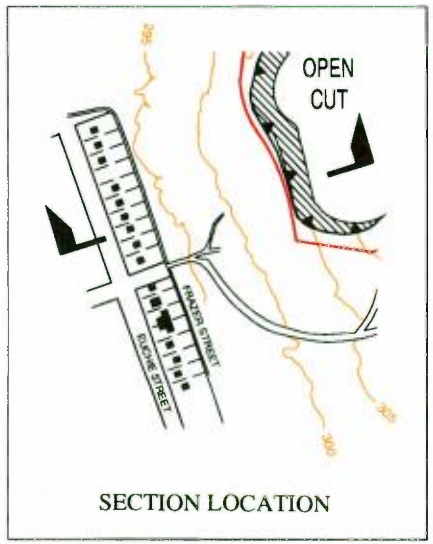
SCALE 1:1250

200 0 200 400 800m







SCALE 1:500

5 0 5 10 15 20 25m

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Figure 2.7
TEMPORARY OPEN CUT BUND WALL LOCATION & DETAIL

60 000 bank cubic metres (bcm) overburden from the eastern (high wall) cutback development (**Figure 2.5**). Bund construction would take approximately four (4) weeks.

Bund development would be staged, commencing from the southern end and progressing northwards in segments until completion. Access to each segment would be via ramps constructed on the eastern side of the bund, thereby maximising the shielding effect created by the partially constructed bund wall.

On completion of the open cut bund construction, the external (western) bund surface would be rehabilitated as described in Section 2.13.2.

Construction of the open cut bund wall and the southerly extension of the open cut to the limits shown on **Figure 2.1** would necessitate the relocation of the existing water storage reservoir pipelines, access road and associated services.

An additional bund would be constructed to the south of the crushing area to provide acoustic shielding to the "Little Oakleigh" homestead. This bund would be approximately 9 m high and constructed using waste rock from the pre-production phase following clearing and topsoil removal. The outer (southern) face of this bund would be topsoiled and revegetated as described in Section 2.13.2.

2.5 CONSTRUCTION AND MINING RATES AND WORKING HOURS

2.5.1 Construction Timetable

A construction timetable for the Peak Hill Gold Project from Contract Mining Tender through to first gold production is presented in **Figure 2.8**. The timetable allows for a period of up to twenty seven (27) weeks before commencement of heap leaching and a further four (4) weeks before the first gold pour. Design gold production would occur eight (8) weeks after the start of heap construction. Earthworks and plant construction run concurrently.

Construction activities would generally occur between the hours of 7.00 am and 6.00 pm Monday to Saturday. However, where specific high noise generation construction activities are audible at residential premises on Saturdays, such works would be restricted to between 8.00 am and 6.00 pm. No construction activities which are audible at adjacent residences would be undertaken outside daylight hours or on Sundays and Public Holidays. However, equipment installation or other activities which are inaudible at adjacent residences, e.g. electrical wiring etc., may proceed on a multiple shift basis, seven (7) days per week if required.

2.5.2 Mining Rates

The proposed mining rate would approximate 420 000 t ore and 640 000 t waste rock per annum as outlined in **Table 2.6.**

TABLE 2.6

Rate of Mining

Time Period	Ore (t)	Waste Rock (t)
Rate per week	8 750	13 350
Rate per day *	1 460	2 250

* Determined on a six (6) days per week; 10 hours per day; 48 week per year basis

2.5.3 Operating Hours

Proposed operating hours for the various mining and ore treatment components of the project are shown in **Table 2.7**. Mining would be scheduled for forty eight (48) weeks each year with a two (2) week break at each of Christmas and Easter, whereas ore treatment would continue for fifty two (52) weeks of each year.

TABLE 2.7

Hours of Operation

Activity	Hours of Operation	Days per Week
Ripping	7.00 am - 6.00 pm	6
Drilling	7.00 am - 6.00 pm	6
Blasting	9.00 am - 3.00 pm*	6
Load and haul	7.00 am - 6.00 pm	6
Crushers	7.00 am -10.00 pm**	6
Leaching	24 hours per day	7
Process Plant	24 hours per day	7

* EPA permitted times for 115 dB(Lin) overblast pressure and 5 mm/s ground vibration criteria.

** May extend beyond these hours during periods of maximum production subject to compliance with noise criteria.

Although blasting may be undertaken between the hours of 9.00 am and 3.00 pm, blasting would generally be undertaken during the mine lunch break (12.00 pm - 1.00 pm). Blasting later than 3.00 pm would only be undertaken for safety reasons.

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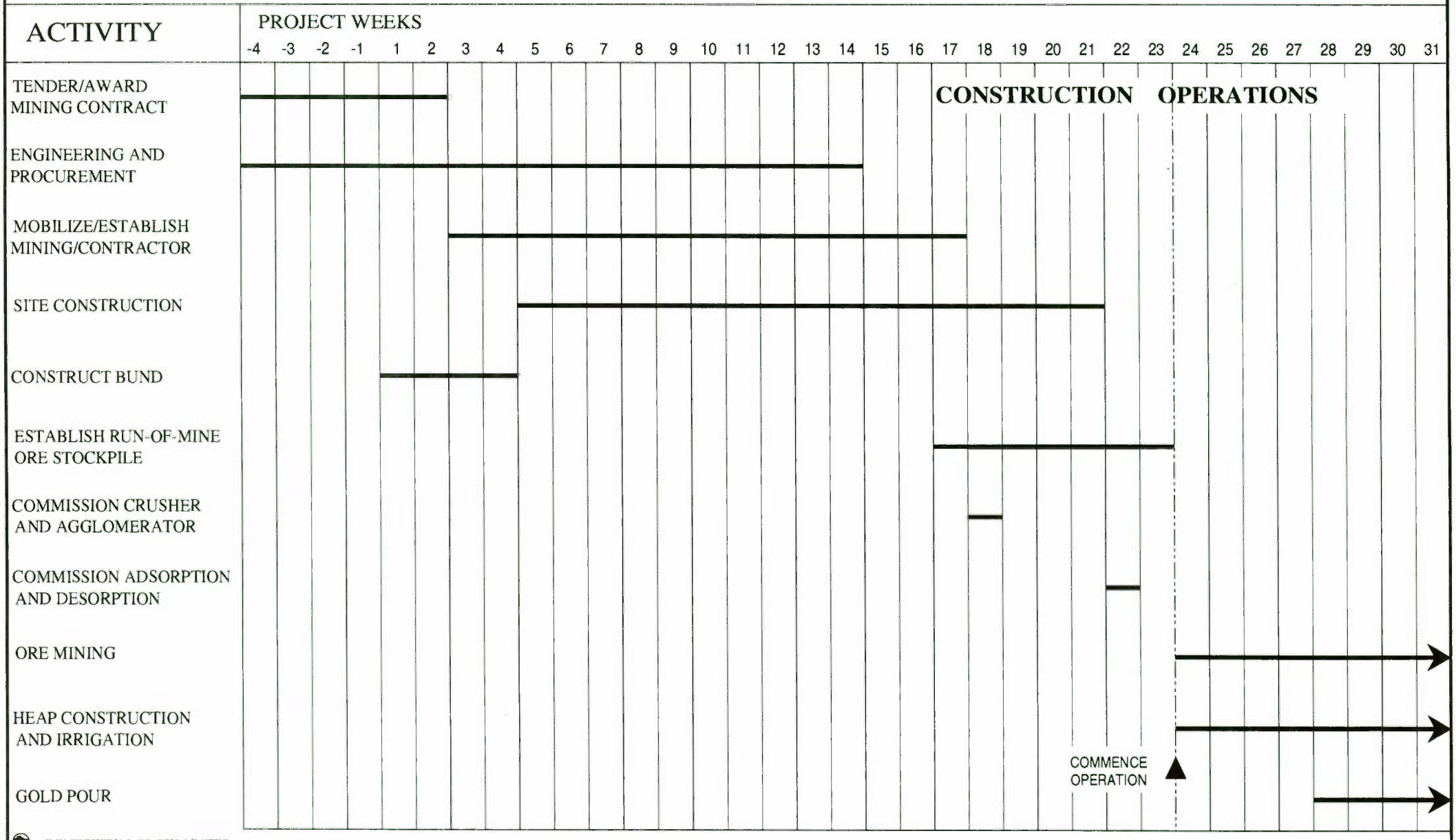

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Figure 2.8
CONSTRUCTION TIMETABLE

Fixed and mobile plant and equipment maintenance hours have been designed to minimise the acoustic impact on the residents of Peak Hill. Maintenance activities within the confines of the open cut prior to 7.00 am (equipment start-time) and after 6.00 pm (equipment shutdown) would be limited to low noise activities such as mobile equipment greasing.

Other, potentially high noise mobile equipment maintenance activities would either be undertaken during normal hours of operation or, if after 6.00 pm, at the contractor's compound, approximately 1.2 km from the nearest potentially affected residence.

Fixed plant maintenance would be scheduled during normal working hours, with infrequent emergency maintenance work only being undertaken outside those hours.

2.5.4 Life of the Mine

Based upon the expected total quantity of ore and waste rock to be mined as outlined in Section 2.3.2 and on the mining rate described in Section 2.5.2, a mine life (including pre-production) of approximately five (5) years is planned for the Peak Hill Gold Project.

Throughout the life of the mine, the Company plans to explore for possible ore extensions within its mining tenements. Further ore reserves indicated by this programme could extend the mine life.

2.6 ORE TREATMENT OPERATIONS

2.6.1 Introduction

Gold would be extracted from the mined ore using the heap leach method. Heap leaching is a simple process involving the application of a weak sodium cyanide solution onto a heap of crushed ore placed on an impervious pad liner. Dissolution of gold occurs within the heap as the cyanide solution percolates downward through the crushed ore.

2.6.2 Outline of Ore Treatment

A number of distinct treatment process stages would be required to obtain gold as the final product. A conceptual flow sheet for the treatment of ore is shown in diagrammatic form in **Figure 2.9**. The major components of the process viz. crushing and agglomeration, heap leaching and gold recovery, are discussed in the following sub-sections. Locations of the main ore treatment components are shown on **Figure 2.10**.

2.6.3 Crushing and Agglomeration

2.6.3.1 Site Selection

The proposed crushing and agglomeration site (see **Figure 2.10**) is a compromise between utilisation of existing topography and plant cost. The crusher site, though necessitating some minor earthworks, would enable the major noise generating equipment to be shielded by an easterly extension of the ROM stockpile and the haulroad from the open cut to be maintained at a gentle grade. **Figure 2.11** presents the crushing and agglomeration plant in plan and section.

2.6.3.2 Process Description

The crushing and agglomeration process is shown schematically on **Figure 2.9**. Run-of-Mine (ROM) ore would be reclaimed from the ROM stockpile by front-end loader and delivered to the ROM bin. The ROM bin would be fitted with grizzly bars set at 600 mm. Oversize (>600 mm) from the grizzly would be rejected to stockpile and undersize (<600 mm) would be fed to the primary jaw crusher for reduction to approximately 150 mm. Approximately once per year a rock breaker would be brought onto the Project Site to reduce the oversize to less than 600 mm.

Primary crusher discharge would be screened at 7 mm and the undersize material (<7 mm) directed either to the agglomerator feed bin or agglomerator feed stockpile. Oversize (>7 mm) from the screen would be directed to the secondary impact crusher. A belt magnet would be installed to remove trash iron from the secondary crusher feed and hence minimise the likelihood of crusher damage. Discharge from the secondary crusher would be returned to the screen for resizing.

The <7 mm ore from the crushing circuit would, together with cement from the cement silo, be conveyed to the agglomeration barrel (**Plate 4**).

Water is sprayed into the rotating agglomeration barrel and mixes with the cement and crushed product. The rolling action causes the development of small balls or agglomerates comprising a mixture of coarse and fine particles which subsequently assists the percolation of the leaching solution through the crushed ore heap and reduces ore leaching time.

The agglomerates would then be discharged onto an overland conveyor (**Figure 2.9**) and thence to a transfer conveyor and a system of piggyback conveyors to the radial stacker (**Figure 2.9** and **Plate 5**). The stacker slews back and forth discharging the agglomerates and forming the heap to a height of 10 m. On completion, the upper surface of the heap would be covered by shade cloth (**Plate 5**) to prevent agglomerate breakdown during subsequent heap irrigation activities (**Figure 2.12**).

Dust emissions during the crushing process would be controlled by a combination of dust suppression (using water) and dust extraction systems (See Section 4.2).

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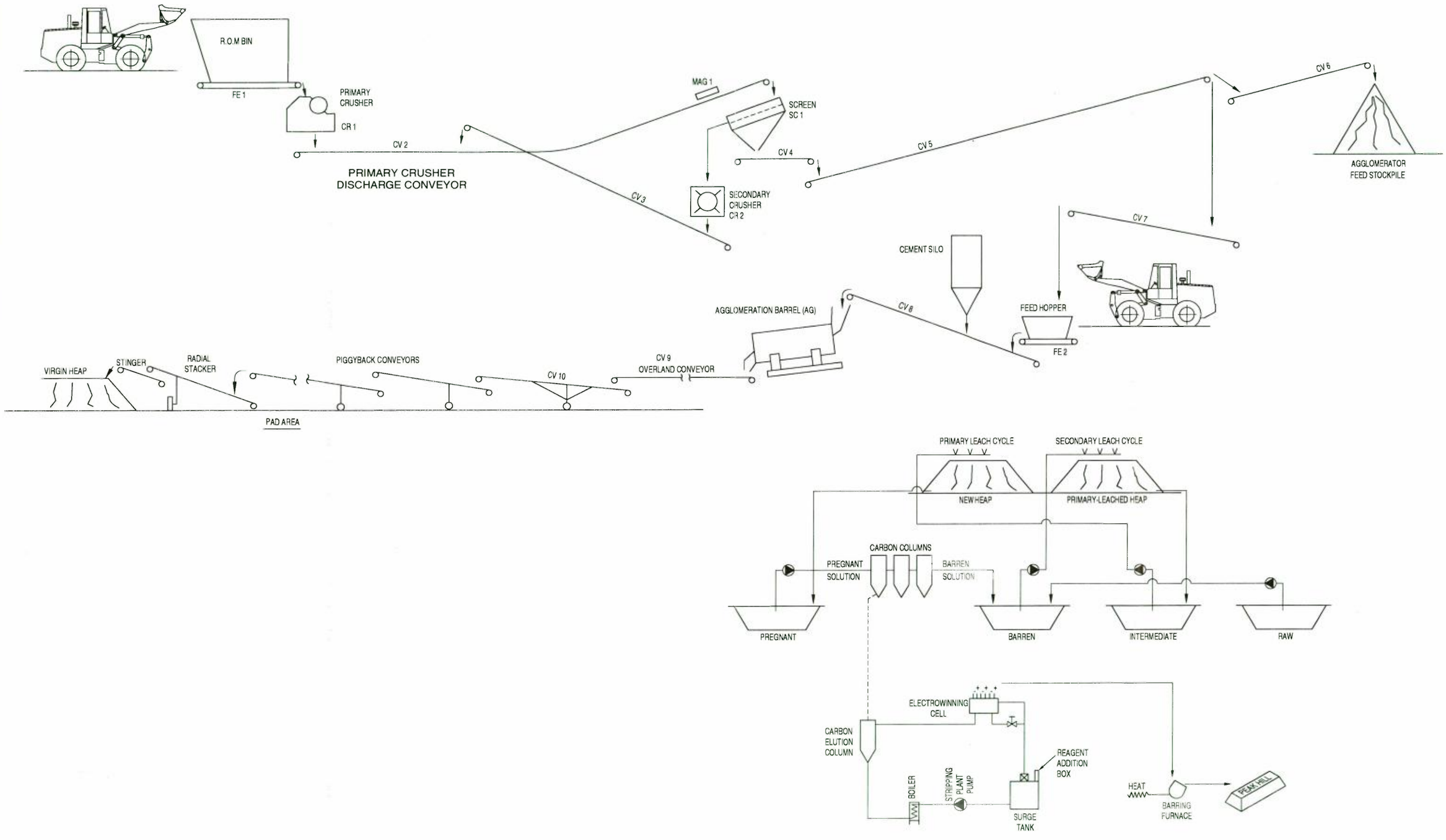

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Figure 2.9
PROCESS FLOWSHEET

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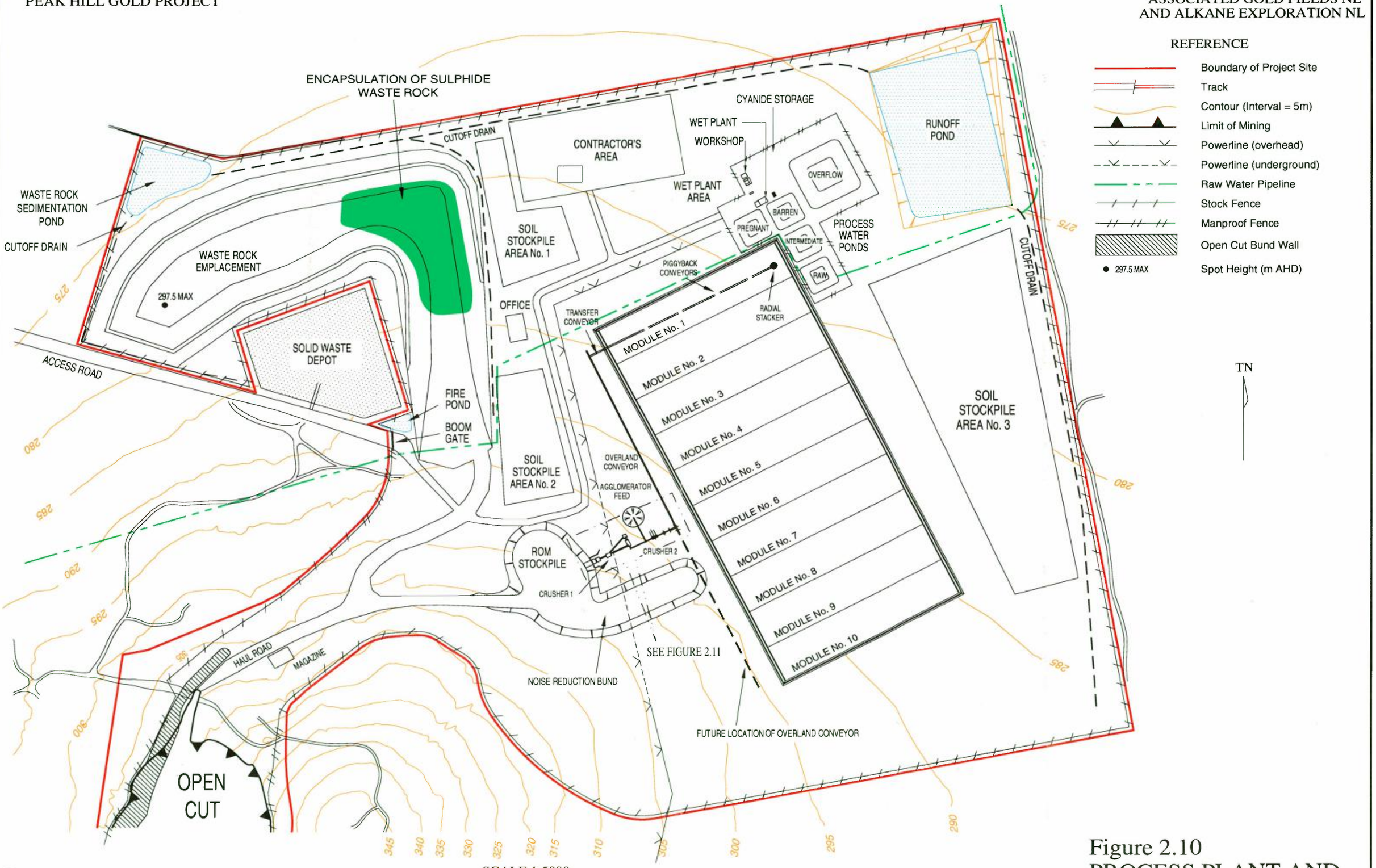

REFERENCE

- Boundary of Project Site
- Track
- Contour (Interval = 5m)
- Limit of Mining
- Powerline (overhead)
- Powerline (underground)
- Raw Water Pipeline
- Stock Fence
- Manproof Fence
- Open Cut Bund Wall
- ● 297.5 MAX — Spot Height (m AHD)

SCALE 1:5000

50 0 50 100 150 200 250m

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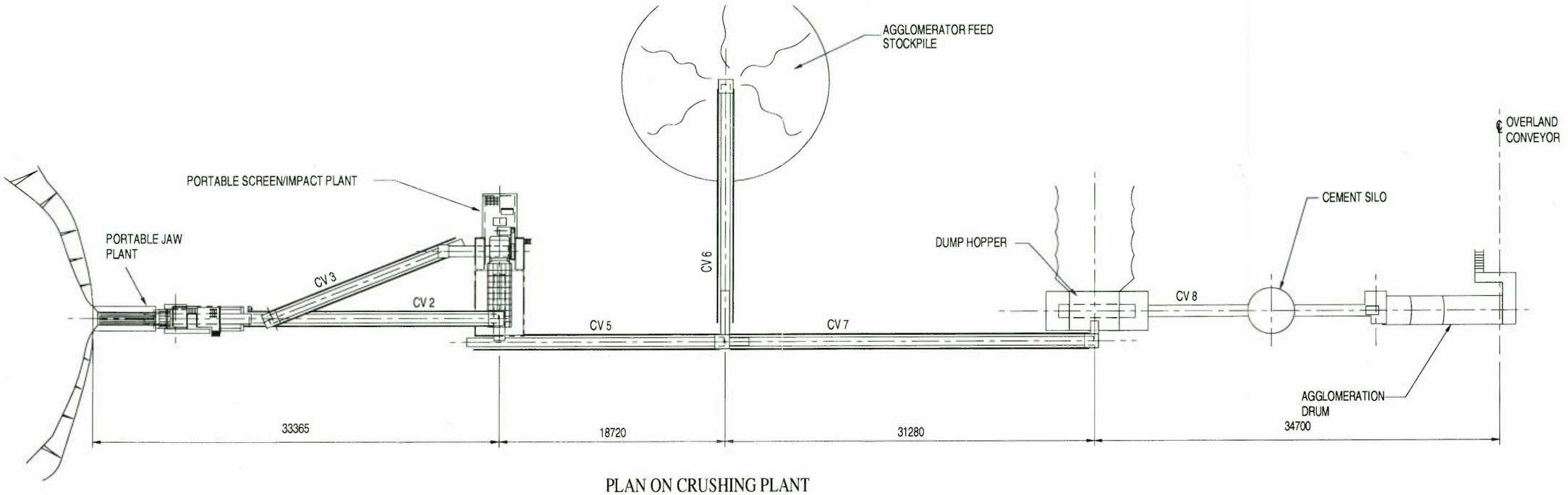
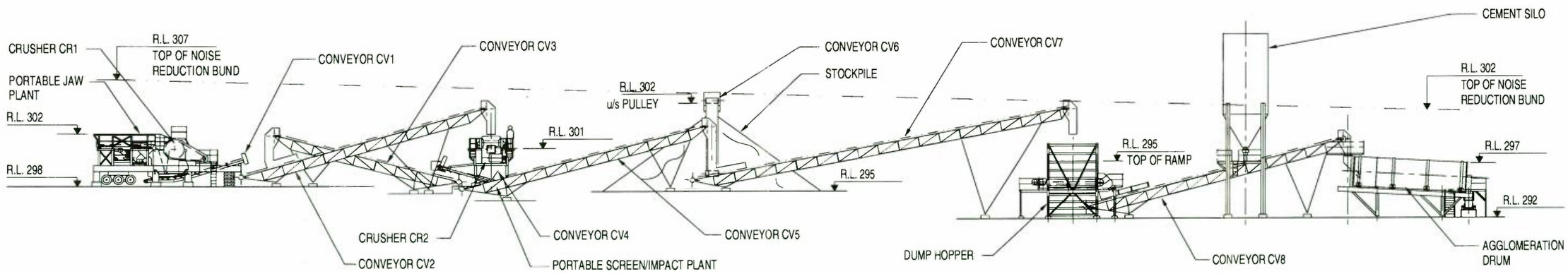
Figure 2.10
PROCESS PLANT AND
LEACH PAD LAYOUT



PLAN ON CRUSHING PLANT



ELEVATION ON CRUSHING PLANT

NOTE :
All R.L. Values shown are m, AHD
All Dimensions are in mm

SCALE

5 0 5 10 15 20 25m

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Figure 2.11
CRUSHING PLANT
PLAN & SECTION

2.6.4 Heap Leaching

2.6.4.1 Site Selection

An area approximately 300 m x 600 m has been selected 800 m to the north-east of the open cut for heap leach pad construction (**Plate 1** and **Figure 2.10**). The area slopes gently (2-3 per cent) in a north-easterly direction and this natural slope would be used to direct solution drainage. The area has a capacity of 1.8 Mt and could be extended southwards if further economic ore bodies were discovered.

A capacity of 1.8 Mt would more than adequately store all agglomerated ore from the open cut development, the subject of the current development application.

2.6.4.2 Pad Construction

Following clearing of approximately fifteen (15) semi-mature trees and stripping and stockpiling of soil and subsoil materials as discussed in Sections 2.4.2 and 2.4.3, the surface of the initial 300 m x 180 m of leach pad area (Modules 1, 2 and 3, **Figure 2.10**) would be scarified, picked of debris, graded and compacted. To achieve adequate compaction, a water truck would be used to maintain the correct moisture level. Compaction would leave a low permeability (permeability less than 10^{-7} m/s), smooth surface free of sharp stones and exposed roots. Any areas considered likely to present a threat to liner integrity would be sheeted with geotextile prior to laying the 0.75 mm thick impervious PVC liner.

The pad area would be internally and externally bunded into 60 m x 300 m modules, each capable of accepting at least 175 000 t in a 10 m high heap. For operational purposes each module is further sub-divided into five (5) leach units, each of 35 000 t capacity. The internal bunds would direct the leach solutions and enable adequate control for metallurgical purposes.

A diversion channel would be built around the up-slope perimeter of the pad to catch and re-direct surface runoff.

Development of Modules No's 4 to 10 would be undertaken over the life of the Project in the same manner as described above.

2.6.4.3 Liner Laying, Protection and Drainage

The 0.75 mm nominal PVC liner would be delivered to site in factory rolls which would be heat welded on site to provide a continuous barrier to cyanide leakage. A layer of geotextile would then be placed over the liner on which 50 mm perforated polyethylene pipe would be placed at 6.0 m centres to provide good drainage and prevent excessive hydrostatic head from developing on the PVC membrane (**Plate 6**). **Figure 2.12** presents a longitudinal and cross section through leach pad module and heap.

Following the installation of the perforated pipe, a layer of <40 mm crushed rock from the open cut would be placed over those areas of the liner to be subject to vehicular traffic and radial stacker operation (**Plate 6** and **Figure 2.12**). The protective layer, approximately 600 mm thick, would be spread over the liner/geotextile by bulldozer.

A PVC-lined V-drain would be constructed upslope of the perimeter bund and downslope of the heaps to collect heap leachate. Two (2) pipelines would be laid inside the drain to collect and direct leachate to either the pregnant or intermediate pond as required (See Section 2.6.6). T-pieces and threaded caps on the pipelines between the internal bunds would determine the flow of solution.

The internal inter-module bunds would be extended to the perimeter bund by means of concrete weirs (**Figure 2.12**) to ensure solutions cannot flow from one cell to another except as required or under periods of excessive flows, e.g. heavy rainfall. In the latter case, excess solution would overflow the internal bunds (but not the perimeter bund) and be directed to the intermediate pond.

2.6.4.4 Leach Solution Application

Circulating leach solution is the most active component of the heap leaching process. The solution extracts gold from the heap and then is processed to recover the precious metal. The solution continuously recycles through the heap to recover more gold. At the Peak Hill Gold Project, a two (2) stage leach cycle would be used as described below, i.e. a primary leaching cycle (for new heaps) and a secondary leaching cycle (for previously leached heaps). The heap leaching process is shown schematically in **Figure 2.9**.

In the primary leaching cycle, new heaps are irrigated with a low strength (200 pm) low gold grade cyanide-bearing solution pumped from the intermediate pond and reticulated via a series of poly pipes and Senninger "wobbler" sprinklers. Wobbler sprinklers are widely used in the heap leach industry and are designed to produce a low profile spray with large droplet size to minimise misting and potential wind drift (**Plate 7**). To further minimise the possibility of misting, the Company would operate the sprinklers at approximately 80 per cent of design capacity.

The solution percolating through the new heap dissolves more gold and reports to the pregnant pond as a much higher grade solution than that removed from the intermediate pond at the commencement of the cycle. This completes the primary leach cycle.

From the pregnant pond, solution is pumped to the Gold Recovery (Wet) Plant where it is stripped of its gold values (See Section 2.6.6). Stripped solution is discharged to the barren pond, cyanide is added, pH adjusted and the secondary leaching cycle begins.

In the secondary leaching cycle, the barren cyanide solution is irrigated onto a previously leached heap ("primary-leached heap").

In this cycle, the leach solution percolates through the heap dissolving gold and finding its way to the V-drain and thence to the intermediate pond from which it would be pumped to again commence the primary leaching cycle.

Each 35 000 t leach unit would be reticulated with a 6 m x 6 m "wobbler" sprinkler array as shown on **Figure 2.12.** No. 9 Senninger "wobblers" would be used enabling a solution application rate of 8-9 litres/m²/hour to be maintained. The sprinklers would sit on 300 mm risers tapped into 50 mm poly branch lines. Four (4) branches, each hosting five (5) sprinklers would run off either side of a 75 mm poly manifold **(Plate 7).** This configuration comprises one reticulation unit and gives coverage to a 24 m x 60 m area. Two reticulation units are therefore required for each 35 000 t leach unit. Eight (8) to ten (10) leach units may be operated together at any one time.

Solution flow of 12 to 14 m³ per hour to each reticulation unit is controlled by a 50 mm valve tapped into a 110 mm poly trunk line. The trunk line would be fed at the rate of 48 to 56 m³ per hour from the appropriate pond in front of the heap, i.e. the barren pond (for secondary leaching) or the intermediate pond (for primary leaching) **(Figure 2.10).**

Each leach unit would be irrigated for approximately four (4) months during the primary leach cycle followed by a rest period of approximately four (4) months prior to secondary leach cycle irrigation for a further one month. During the first month of the primary leach cycle, gold concentrations are expected to peak at around 3 g/t and drop off to less than 1 g/t. During the second, third and fourth months, gold concentrations from the primary leach cycle would drop to less than 0.1 g/t.

During the secondary leach cycle, gold concentrations within the leachate would commence at 1.0 to 0.5 g/t and decline to approximately 0.05 g/t at the completion of the cycle.

2.6.5 Solution Ponds

The Peak Hill Gold Project would utilise four (4) solution ponds as shown on **Figure 2.10** - the barren, pregnant, intermediate and raw water pond - and one overflow pond for the management of any excess potentially cyanide-bearing solutions.

The solution ponds would each be 44 m x 44 m x 4 m deep, and the overflow pond 80 m x 80 m x 4 m deep.

Each pond would be lined with a 0.75 mm thick PVC liner. Total pond capacity would approximate 47 000 m³ and would be sufficient to withstand a 1 in 100 year, 72 hour storm event without loss of any gold/cyanide bearing solution.

2.6.6 Gold Recovery

2.6.6.1 Process Outline

The gold recovery plant would be a closed circuit system comprising an adsorption circuit, a desorption circuit and a smelting area or gold room (see **Figure 2.9**). All solutions and chemicals used in gold recovery would be recycled for continuous use in the leaching process, with make-up reagents being added to maintain the required solution concentrations. Cyanide concentration would be maintained at a solution strength of 0.02 per cent (200 ppm) by the addition of pelletised cyanide via a small mixing box into which the column tail solution discharges (see Section 2.6.6.2). The solution then flows into the barren solution pond. It may also be necessary to add cyanide at the re-cycling point (intermediate pond).

Cement in the heaps would buffer the pH at 9.0 and lime would be used for additional alkali dosing if necessary. Maintenance of the leach solution at a pH of 9.0 is required to suppress the formation of HCN gas.

2.6.6.2 Adsorption Circuit

The pregnant solution would be pumped from the pregnant pond through carbon columns arranged in three (3) banks of three (3) columns connected in series (**Figure 2.9**). Each column would hold 1.5 t of carbon and be capable of handling flow rates as high as 30 m^3 per hour. Pregnant solution concentrations of up to 3 g/t entering the first column would be reduced to less than 0.05 g/t in the tail solution leaving the third column. A suitable pump would be installed and the solution reticulated via a 110 mm poly manifold tapped by 50 mm valves. Stainless steel Kamlock fittings and rubber hose would be used to interconnect the columns.

To ensure solution or carbon spillages are contained, all equipment would be placed on a concrete base draining to one of the solution ponds. Spillages from the gold room would be directed to the pregnant pond, and from the carbon column area, to the barren pond.

2.6.6.3 Desorption Circuit

Recovery of gold from the carbon would occur in the desorption circuit using the Zadra Process. In this process, hot caustic cyanide solution at atmospheric pressure in the carbon elution column would be used to re-dissolve gold from the carbon. Gold-bearing caustic cyanide solution emerging from the elution column would then be transferred to an electrowinning cell (**Figure 2.9**). The stripped carbon would be returned to the adsorption circuit.

During the electrowinning process, gold would be deposited from the pregnant strip solution by electrolysis onto steel wool cathodes contained in the electrowinning cell. When residual gold levels within the pregnant strip solution have declined to acceptable levels (after approximately 24 hours), the steel wool would be unloaded,

dissolved in hydrochloric acid to form a sludge and the sludge placed in a crucible for smelting. The barren strip solution would be re-circulated within the stripping circuit.

2.6.6.4 Carbon Regeneration

From time to time it would be necessary to reactivate the carbon. On site, this would be routinely done by acid washing to remove acid-soluble contaminants such as carbonates. A weak hydrochloric acid solution, 5 per cent HCl(v/v), would be mixed in an acid resistant tank and re-cycled through the carbon column prior to stripping. Spend acid solution would be returned to the raw water pond where any residual acid would be diluted and eventually neutralised in the barren solution pond.

Kiln reactivation to remove acid resistant contaminants would be required less frequently. Approximately 1.5 t/week carbon would be removed from the stripped column and transported in bulka bags to the Parkes Gold Mine or other suitable site for regeneration.

2.6.6.5 Smelting

Smelting to gold bullion would be carried out in an LPG-fired furnace. The furnace product is dore bullion (80 to 90 per cent gold) which would be weighed, assayed and marked with an identifying stamp before storage and subsequent transport to a refinery.

2.7 WASTE MANAGEMENT

2.7.1 Types of Waste

Wastes requiring management in association with the development of the Peak Hill Gold Project would include those produced directly by the Company's activities and those remaining from historical mining within and adjacent to the Project Site.

The wastes originating from each of the above sources are presented in **Table 2.8.**

It should be noted that the remnant acid bearing tailings formerly located adjacent to the northern end of Euchie Street have already been removed from the Project Site, treated for their gold values and neutralised in preparation for rehabilitation of this degraded area. This work, commenced by the Company in February 1993, is being financed jointly by the local Gulomogo Land Care Group, the Department of Mineral Resources and the Company.

TABLE 2.8

Source of Waste Materials

Proposed Development	Historical Mining
Non-Production Wastes Paper and general waste Oil and grease Sewage Production Wastes Gold production wastes Oxide waste rock Sulphide waste rock	Oxide waste rock Sulphide waste rock Tailings Slag

2.7.2 Characteristics of Waste Rock

The waste rock to be removed as part of the mining operation can be categorised as follows on the basis of decreasing extent of weathering and increasing rock substance strength:

(i) highly oxidised and altered rock;
(ii) stronger, slightly weathered to fresh rock; and
(iii) silicified oxidised rock.

Although the uppermost boundary of the stronger and slightly weathered rock approximates the base of oxidation and the limit of mining, the distribution of the different material types within the open cut means that the excavation of some of the stronger rock is inevitable.

Any sulphide material which is encountered within the confines of the open cut would be considered waste rock, irrespective of gold grades.

Table 2.9 summarises the analytical results of the range of materials present on the existing mine site, and proposed ore and waste rock. Only those heavy metals that significantly exceed comparative average concentrations for granite are quoted. Concentrations of all other heavy metals are close to or within the average concentrations and would not pose any threat to water quality. Sulphur and carbonate contents of each material are listed to give an indication of the potential for acid generation and acid-induced dissolution of the contained heavy metals.

Features of the ore and waste rock geochemistry outlined in **Table 2.9** include:

(i) Above average arsenic concentration values in the existing waste rock dumps and core samples of proposed oxidised waste rock. These values arise from the in-situ oxidation of minor amounts of arsenopyrite present in the original unoxidised bedrock. However, as such oxidised arsenic

species are generally incorporated within stable, weathered secondary Iron (III) mineralisation, no leaching of arsenic would occur under normal weathering conditions to which the waste rock emplacements would be exposed; and

(ii) above average concentrations of copper and arsenic in the sulphide waste rock. However, this also presents no problems because the waste rock management proposal is to place this rock in the core of the waste rock emplacement immediately it is encountered. This procedure would ensure that minimal oxidation of pyritic material (with acid leachate being produced) occurs.

The recently treated tailings also exhibited elevated levels of copper and arsenic.

Of the above waste materials, only the sulphide waste rock has the potential to generate acid leachate and release copper and arsenic. Within the oxidised waste rock, the sulphur exists in the form of sulphates resulting from the oxidation of pyritic material, and as such would have an insignificant acid leachate potential: existing exposures of oxidised waste rock both within and outside the existing glory holes show no evidence of acid generation.

As the proposed mining activity:

- is planned to be principally contained within the oxide ore and waste rock;
- the base of the open cut would approximate the oxide/sulphide rock interface; and
- the small amount of pyritic material (less than 10 per cent of the total waste rock volume) would be readily identifiable by sampling in advance of mining and by colour and texture during the mining operation,

such materials would be readily directed to the core of the waste rock emplacement for subsequent encapsulation within the oxide waste rock which would form the bulk of the waste rock emplacement. The location of the sulphide encapsulation area is shown on **Figure 2.13**.

2.7.3 Management of Existing Waste Materials

Waste materials present on the surface of the proposed development site (waste rock, slag and until recently, tailings) represent remnants of previous mining activity in the Peak Hill area and are a current source of surface water contamination. The extent of this contamination is discussed in Section 3.5. The Company proposes to process surface oxide wastes and slag and would dispose of the surface sulphide waste by encapsulation within the oxide waste rock emplacement (See Section 2.7.8). The remnant tailings have already been treated and disposed of in an approved manner at the Parkes Gold Mine.

TABLE 2.9

Ore and Waste Rock Geochemistry *

Material	No. of Samples	Cu (ppm)	Zn (ppm)	Pb (ppm)	Sb (ppm)	As (ppm)	Al_2O_3 (%)	Co (ppm)	Cr (ppm)	S (%)	CO_3^{2-} (ppm)
Average Concentration in Granite**		10-20	50-60	20		1.5		5-10	20-40		
1. WASTE ROCK DUMPS											
(a) Oxidised	7	39 - 113	2 - 23	7 - 76	1.2 - 13.1	132 - 993	3.67 - 13.9	5	28 - 81	0.08 - 1.34	10 - 979
(b) Sulphide	8	22 - 1566	2 - 79	6 - 15	1.4 - 65.0	70 - 675	2.52 - 9.48	9 - 46	37 - 71	2.43 - 11.5	10 - 2720
(c) Slag	1	2299	138	8	0.9	101	5.89	26	121	0.66	<10
2. ORE (DRILL CORE)											
(a) Oxidised	2	68 - 94	2 - 25	25 - 37	7.9 - 14.0	941 - 1335	0.75 - 5.49	5 - 18	41 - 48	0.55 - 1.91	10 - 490
(b) Sulphide	2	965 - 2676	238 - 343	8 - 197	2.7 - 3.8	251 - 609	6.9 - 19.0	77 - 103	34 - 67	11.5 - 23.0	<10
3. WASTE ROCK (DRILL CORE)											
(a) Oxidised	2	67 - 95	2 - 23	12 - 15	2.0 - 2.7	313 - 438	3.19 - 7.09	<5 - 13	32 - 67	0.5 - 2.12	<10
(b) Sulphide	2	727 - 735	155 - 211	7 - 128	1.2 - 5.2	106 - 474	8.41 - 24.2	31 - 79	24 - 64	5.84 - 17.7	<10

* Source: Australian Assay Laboratories Group Report 09 010519

** Source: Geological Survey of New South Wales Report No. GS1985/040

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2.7.4 Management of Proposed Waste Materials

Waste materials associated with the project can be defined as "non-production waste" (paper, and general waste, oil and grease and sewage) and "gold production wastes" (empty cyanide drums or boxes, goldroom wastes, spent ore and waste rock). No tailings are produced with heap leach treatment of ore.

2.7.4.1 Non-production Wastes

Paper and general wastes originating from the office, store and contractor's compound would be placed in appropriate containers for disposal at the local solid waste depot (**Figure 2.1**). Oils and grease from equipment maintenance would be stored in leakproof containers within a designated bunded area within the workshop area to await collection by a licensed re-cycling contractor.

Five (5) tanks would be provided for sewage collection and a separate tank for laboratory waste water. All tanks would be pumped out regularly by a licenced waste contractor engaged by the Company.

Rubble drains would be installed to direct water from the crib room and ablution areas towards the runoff pond (**Figure 2.1**).

2.7.4.2 Gold Production Wastes

The source, nature and proposed disposal location for each of the wastes produced in the crushing, adsorption, desorption and smelting phases of gold production are shown in **Table 2.10**.

TABLE 2.10

Gold Production Wastes

Source of Waste	Description	Treatment/Disposal Method
Cyanide mixing	Cyanide drums; boxes	Drums decontaminated, flattened and buried in waste rock emplacement. Boxes crushed and buried in the waste rock emplacement
Crushing/screening	Timber, tramp iron	To Council solid waste depot
Goldroom wastes	Slag Acid drums	Returned to crusher Returnable

2.7.5 Waste Rock Emplacement Site Selection

Approximately 18 ha of pastureland north of the open cut and bounded by the Project Site boundary to the north and west, soil stockpiles Areas No's 1 and 2 to the east, and the Project Site access road and Peak Hill solid waste depot to the south, have been designated for waste rock emplacement (see **Plate 1** and **Figure 2.1**). Details of the emplacement area in plan and section are shown in **Figure 2.13**.

The principal reasons for the selection of this site are:

(i) its close proximity to the open cut;

(ii) its accessibility by a road with least grade, thereby minimising haul truck acceleration and deceleration noise;

(iii) it contains sufficient area within Portion 380 for all waste rock;

(iv) it does not sterilise any prospective ore reserves;

(v) it would enable the ready encapsulation of any potentially acid generating (sulphide) materials; and

(vi) it would enable the dedication of an area for low grade ore stockpiling.

Additionally, the positioning of the waste rock emplacement to the north, east and west of the Council's solid waste depot could provide additional Council waste storage void capacity for use during and on completion of project development.

2.7.6 Site Preparation/Soil Stockpiling

Prior to the commencement of waste rock emplacement:

- drainage diversions and the Waste Rock Sedimentation Pond would be established to the design requirements of the Department of Conservation and Land Management (Soil Conservation Service);

- the few trees in the area to be disturbed would be removed and where suitable, stockpiled for fencing or firewood. Any unsuitable material would be stockpiled for use in the rehabilitation of disturbed areas; and

- all topsoil and subsoil would be progressively removed and separately stockpiled. Topsoil and subsoil would be fertilised and grassed to prevent erosion and maintain nutrient status, to the standards recommended by the Department of Conservation and Land Management (Soil Conservation Service). Topsoil would be stockpiled to a height less than 1.5 m to avoid compaction and loss of biological viability whereas subsoil would be stockpiled to a height of up to 3 m. Stockpile locations are shown on **Figure 2.10**.

Subsoil and topsoil would subsequently be replaced sequentially on the final emplacement surface during emplacement rehabilitation.

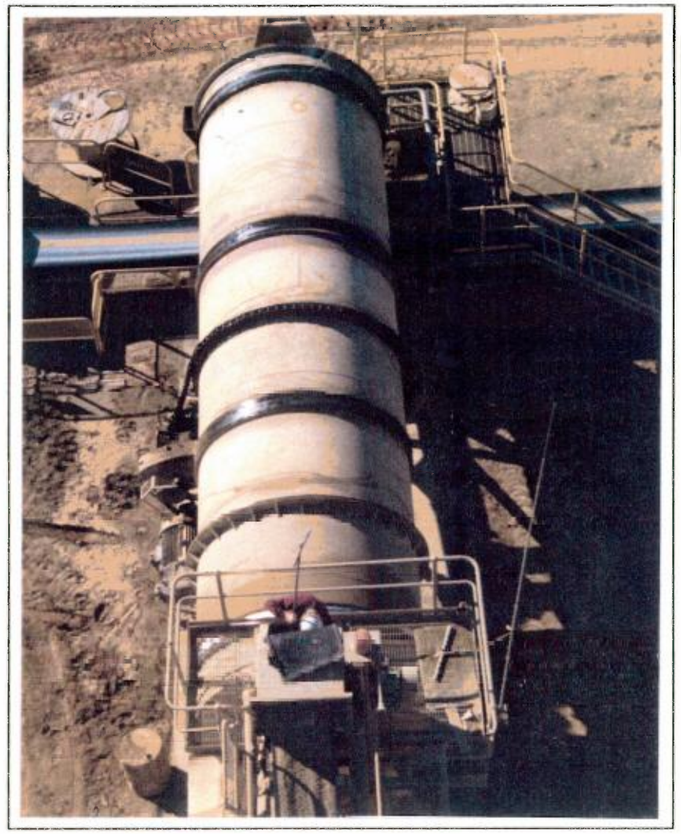

Plate 4: A typical agglomeration barrel. (Ref: GM/1)

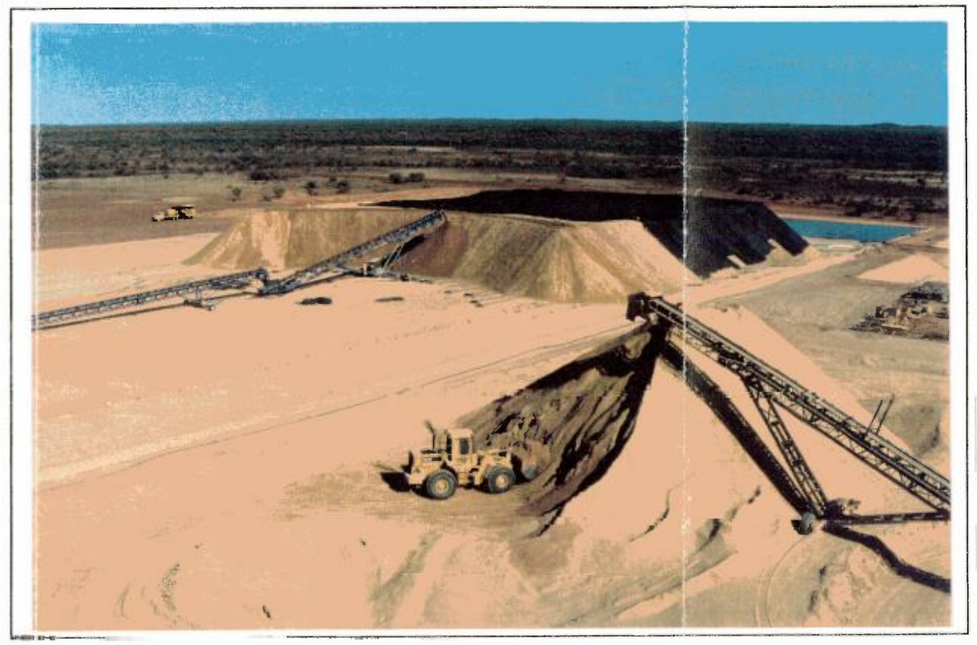

Plate 5: A typical heap leach arrangement showing heap module stacking by radial stacker (upper left), black shade cloth on heap surface, and agglomerator feed stockpile (lower right. (Ref: GM/2)

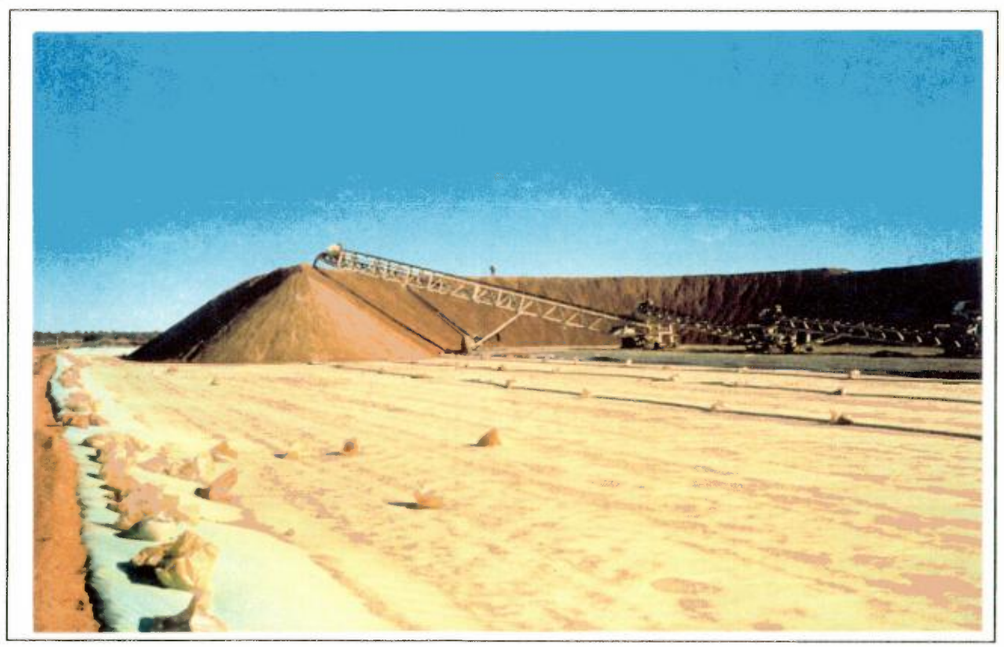

Plate 6: A typical heap leach pad arrangement showing from left to right peripheral bunding, leach pad liner, drainage coil, protection layer, radial stacker, piggyback conveyors and partially constructed heap module. (Ref: GM/3)

Plate 7: A heap leach irrigation system with operating Senninger "wobbler" sprinklers on 300 mm upstands over shade cloth. (Ref: GM/4)

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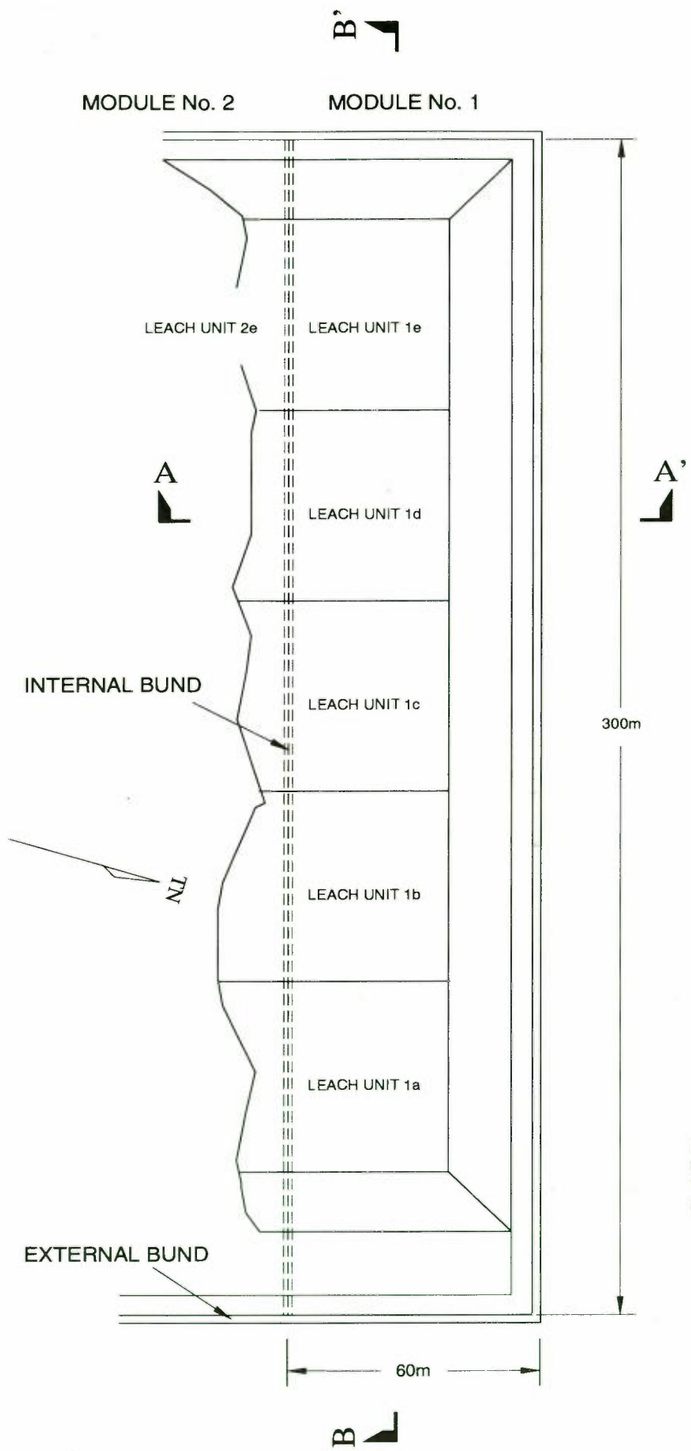
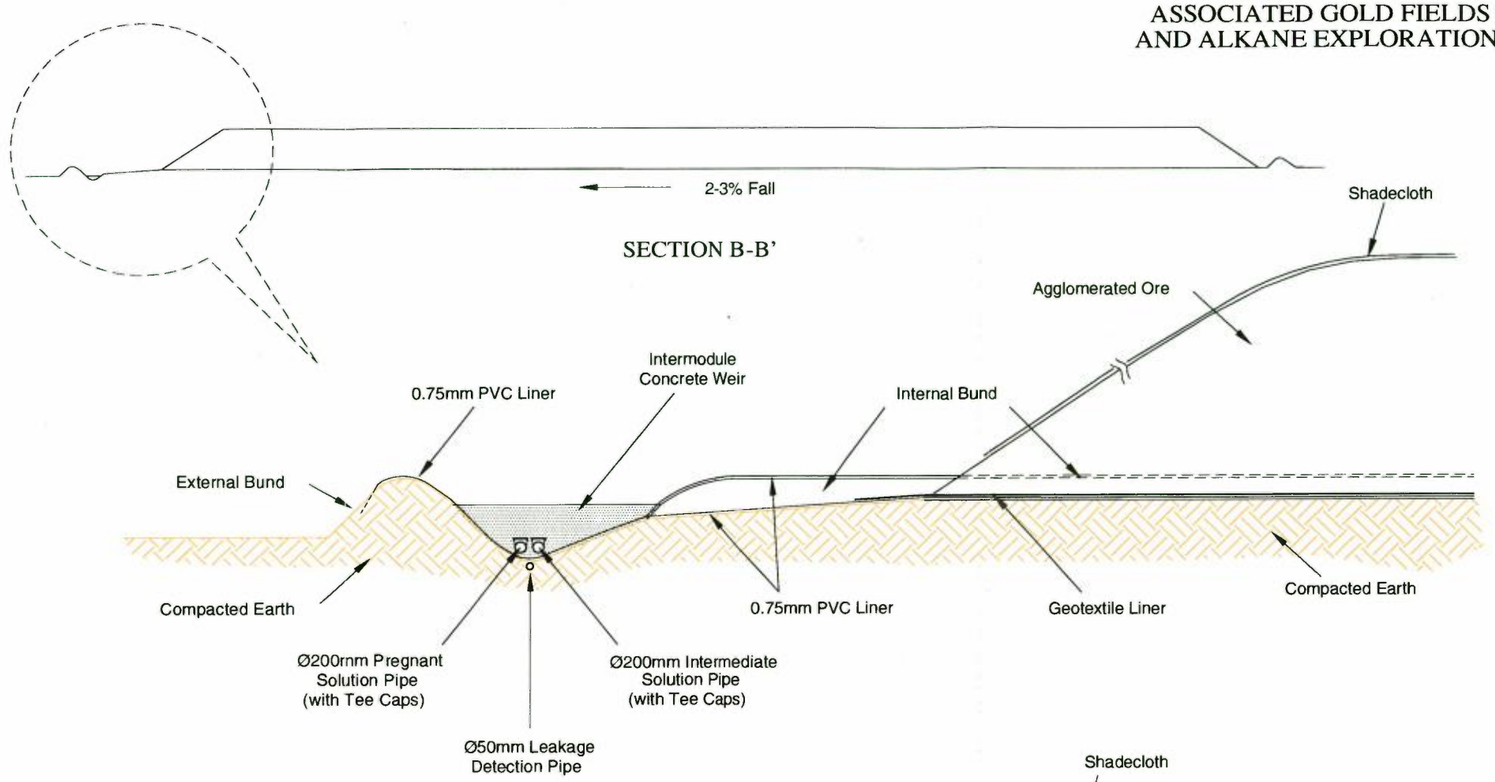
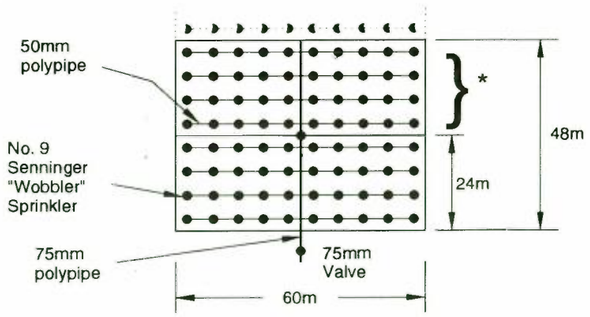
ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL

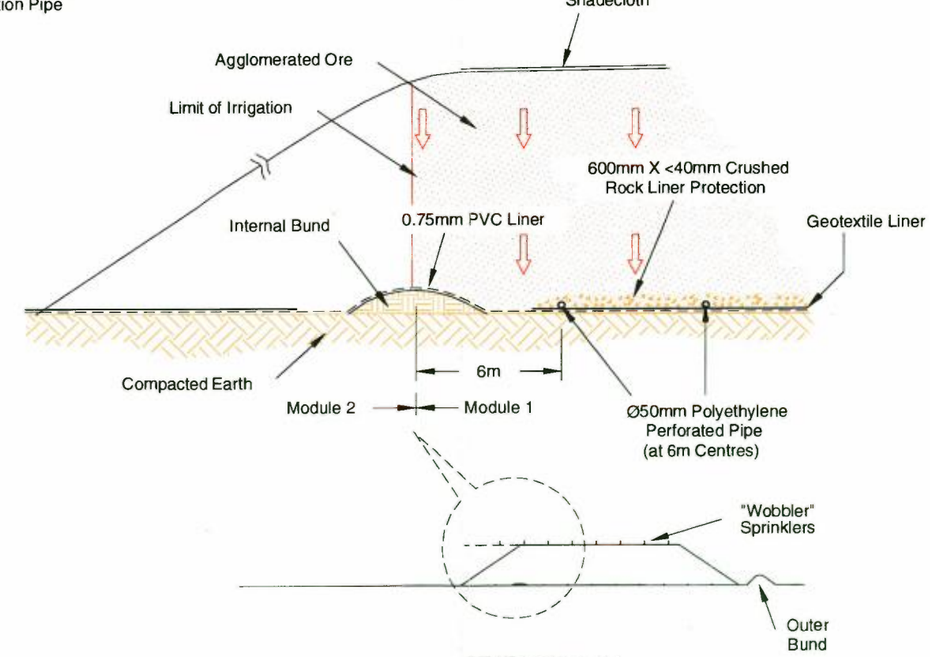






* Reticulation Unit

LEACH UNIT



SECTION A-A'

SCALE 1:1500

25 0 25 50 75m

NOTE : Enlarged Details of Sections
A-A' and B-B' are Not To Scale

Figure 2.12
HEAP LEACH PAD
PLAN AND SECTIONS

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2.7.7 Method of Construction

The waste rock would be hauled from the open cut by dump truck, tipped onto the prepared area and spread in thin layers, relying upon dump truck traffic and dozer movements to provide compaction. Within the emplacement, the low grade oxide mineralisation would be retained in a separate area to the bulk of the waste rock to avoid dilution of ore which may be processed economically in the future. This dedicated low grade area would remain open throughout the mine life. Some low grade mineralisation may also be stockpiled adjacent to the crushing plant noise reduction bund (**Figure 2.10**). Similarly, the sulphide wastes would be emplaced in a defined area within the body of the emplacement for subsequent encapsulation within the oxide waste rock. The location of the sulphide waste rock encapsulation site is shown on **Figure 2.13**.

The emplacement would generally be developed as a horseshoe from the lower perimeter face and retreat upslope in lifts of a maximum vertical height of 10 m. A 5 m wide bench would be constructed between lifts. For drainage purposes, the bench would be constructed with a 5 per cent backslope to the outer emplacement face and a 0.5 per cent longitudinal fall (**Figure 2.13**). The final face slopes would be battered to a slope of 1:3 (vertical:horizontal - approximately 18°). Maximum emplacement height would be approximately 20 m above existing ground level. A bund up to 1.0 m high would be maintained at the outer emplacement edge to prevent uncontrolled surface runoff and erosion of the batter faces. The long term waste emplacement storage requirement is outlined in **Table 2.11**.

Where necessary, the western and southern emplacement margin would be maintained approximately 3 m higher than the remaining emplacement surface, in order to act as a sound and visibility screen.

Any sulphide waste removed in the pre-production or mining phases of the project would be encapsulated within the bulk of the waste emplacement as shown on **Figure 2.13**. The natural low permeability of the sericite- and pyrophyllite-bearing waste, together with the compaction provided during emplacement construction, and subsequent emplacement revegetation, is considered adequate to minimise long term acid leaching of metal salts. Testing to determine the adequacy of the compaction around the sulphide waste would be undertaken.

In order to prevent the accumulation of water upslope of the waste emplacement in the area of the solid waste depot, the Company would either install a coarse rock underdrain or drainage pipe through the base of the emplacement (**Figure 2.13**). A minimum barrier of 50 m oxide waste rock would be retained between the encapsulated sulphide waste and the solid waste depot/emplacement underdrain.

TABLE 2.11

Waste Emplacement Storage Requirement

Material Type	Tonnes (t)	Specific Gravity (t/m^3)	Bank Cubic Metres (bcm)
0.5 - 0.75 g/t mineralisation *	600 000	2.2	273 000
Sulphide mineralisation	256 000	2.6	98 000
Oxidised waste rock	2 470 000	2.2	1 123 000
		Total	**1 494 000**
		Emplacement volume after 35% swell	**2 017 000**
		Emplacement volume net of 80 000 m^3 bund	**1 937 000**

* low grade mineralisation

2.7.8 Drainage Controls

All batter surface runoff or leachate emanating from the waste rock emplacement would either be collected in the emplacement bench drains (**Figure 2.13**) or in properly engineered cut-off drains (**Figure 2.13**) located at the toe of the waste emplacement batters. Runoff from the upper surface of the waste rock emplacement would be directed in an easterly and then southerly direction and discharged to the cut-off drains where the emplacement surface laps onto the hill. These drains would direct all flows to either the runoff pond located in the north-eastern corner of the Project Site or the sedimentation pond located in the north-western corner of the Project Site (**Figure 2.10**). Water within the runoff pond would subsequently be used for process make-up and as a source of water for dust suppression. Water within the sedimentation pond would be used for dust suppression purposes.

2.8 SAFETY/SECURITY MANAGEMENT

2.8.1 Public Safety

Access to the Project Area would be limited to employees and authorised personnel and vehicles. Public access would be restricted by a 1.8 m high man-proof fence around the periphery of the open cut and adjacent to the project site access and by a standard stock-proof fence elsewhere (**Figure 2.1**). A single lockable gate, which would remain

closed at all times and locked outside daylight working hours, would be constructed on the site access road (**Figure 2.1**). The wet plant area and the pregnant, raw water, intermediate, barren and overflow ponds would also be secured by means of a 1.8 m manproof fence.

Other than during blasting operations, public access to the viewing platform to observe mining operations would be available during daylight hours. During blasting operations public access to the platform would be prevented by the closure and manning of a gate to be installed approximately 70 m east of the Frazer Street/Mingelo Street intersection.

On completion of mining, the manproof fence would be extended to encircle the open cut and a bund constructed from large diameter waste rock or earth, would be positioned around the perimeter of the open cut at a location which would allow open cut observation but discourage access by people, domestic animals, stock and recreational vehicles. The viewing platform would be retained to allow visitors to view the completed open cut in safety (See Section 2.13 for further details.)

2.8.2 Employee Safety

A company safety manual, to be issued to all employees and contractors on commencement, would outline the procedures and safety measures that are to be followed whilst working on the Project Site. Company supervisory personnel would regularly brief employees on safety hazards and adequately train employees to avoid accidents and report the existence of potentially hazardous situations.

The Mines Inspection Act, 1901 stipulates the requirement for the occupational safety of employees and the general working conditions in and around the mine, and General Rule 72, the specific requirements for the use of cyanide in mines . The mine would be regularly inspected by officers of the Department of Mineral Resources.

The use of safety hats and safety boots would be mandatory on site as would the use of eye and hearing protection in high risk areas.

In the confines of the open cut, the construction of safety bunds on the open-cut side of all haul roads, the recognition of stope voids in road design, and construction and proper maintenance of equipment would minimise the possibility of accidents.

Storage and handling of other dangerous goods, e.g. acid, LPG, explosives, as defined under the Dangerous Goods Act, 1975, would be in accordance with the requirements of the Act, and the Company's licence to keep dangerous goods. The Workcover Authority would regularly inspect the project.

2.8.3 Chemical Handling and Usage

The Company would adopt stringent safety standards to ensure that health and safety of employees (and the public) are not endangered through the use or presence of cyanide and other reagents on site. The requirements pertaining to cyanide usage are set down by the Department of Mineral Resources in General Rule 72 (G.R.72) of the Mines Inspection Act, 1901 and include manager's responsibilities, first aid, protective clothing, ventilation, storage, security and other requirements. The requirements pertaining to other dangerous or hazardous goods are governed by the Dangerous Goods Act 1975 and administered by the Workcover Authority. Transportation of cyanide and dangerous goods would be undertaken by contractors licenced to transport those materials. The Company would seek an approval from the Department of Mineral Resources for the use of cyanide and a licence from Workcover to keep dangerous or hazardous goods and comply with all requirements of the Mines Inspection Act and Dangerous Goods Act at all times.

Additional information pertaining to the use of cyanide in the gold mining industry is provided in **Appendix 4.**

2.8.4 Explosives

The storage and use of explosives on site would be in accordance with the regulations laid down by the Department of Mineral Resources and the Workcover Authority.

The maximum on-site explosives inventory required is presented in **Table 2.12** and has been determined on the basis of product availability, order turnaround, blasting frequency, nominal batch delivery sizes, economic considerations and suppliers' recommended storage periods.

TABLE 2.12

Explosive Inventory

Item	Number	Unit
Explosive - ANFO	500	kg
Powergel Magnum 3151	8	25 kg cases (125 per case)
Nonel ms 'Primadet' detonators	90	kg
Nonel trunkline delays	5	17 kg cases (240 per case)
Nonel trunk cord	5	20.5 kg cases (1 500 m per case)
Nonel surface lead-in line	2	8.2 kg case (1 200 m per case)

Storage of the above materials would be in two 500 kg magazines excavated into the hill adjacent to the haul road approximately 200 m from the open cut (**Figure 2.1**) and bunded to shield haul road traffic. One magazine would store packaged explosives and the other, detonators and other blasting accessories.

Because blasting could occur as close as 200 m to the residences in Euchie Street and 60 m to the water reservoir, blast design and implementation would ensure no public hazard from flyrock, and control vibration to the extent that the continued integrity of nearby dwellings, structures and facilities is ensured. This would be achieved by:

(i) maximising the proportion of "paddock" blasting and minimising free face blasting. Paddock blasting aims to break-up but not displace the ore;
(ii) advancing working faces from east to west or north to south so that any flyrock produced is directed to the east or north;
(iii) ensuring burden distances and stemming lengths are such that explosive gases are virtually devoid of energy by the time they enter the atmosphere; and
(iv) by ensuring that charges detonate in a carefully designed sequence.

During blasting activities, public access to the viewing platform would be prevented by closing and manning a gate to be located on the reservoir/tourist access road approximately 70 m east of the Frazer Street/Mingelo Street intersection. A foot inspection of the viewing platform area would be undertaken prior to any blast initiation and blast warning sirens would be sounded both before and after each blast. The blast notice board would also explain the safety requirements during blasting operations.

In advance of any blasting activity, the Company would commission an independent report of the structural and superficial condition of all buildings on the eastern side of Euchie Street between Ween and Dugga Streets and Frazer Street in order to provide baseline information for an assessment of any subsequent damage claims.

2.8.5 Security

Although a local security firm would be engaged to provide patrols after hours, site security would be the responsibility of the heap leach supervisor. Goldroom security would include an alarm system, restricted key distribution and a double combination lock safe.

Facilities used for gold recovery from the loaded carbon and for smelting operations, together with bullion awaiting shipment, would be located within the goldroom and safe, respectively. Gold would be shipped once per week and at no time would more than one week's production accumulate on site.

2.8.6 Fire Protection

The raw water supply would service a fire fighting system in the plant area, with a ring main directing water to a series of hydrants in accordance with the provisions of AS 2419. Adequate fire extinguishers and hose reels would be provided within and around building and facilities. No fire detection system or fire sprinklers would be installed.

In the event of a major fire, the runoff pond could provide a back-up water supply, and the mining contractor's water tanker, additional suppression capacity.

2.9 SERVICES

2.9.1 Electrical Power

Power would be provided by the Central West County Council from a branch line on an up-graded (to 11 kV) line located on the eastern extension of Bogan Street to two (2) locations on the Project Site: the crushing and screening area and the wet plant area (**Figure 2.1**). 11 kV power would be transformed on site to 415 V for distribution around the Project Site. Average electrical power demand is presented in **Table 2.13**.

TABLE 2.13

Electrical Power Demand

Facility	Average Demand (kW) *	Usage Hours/Day ; Days/Week
Crushing, Agglomeration and Stacking	750	11; 6
Heap Leaching; Solution Circulation	120	24; 7
Sundries (e.g. security lighting, office)	30	10; 7
TOTAL:	**900**	

Crushing, Agglomeration and Stacking Area

Power would be provided by an 11 kV part overhead, part buried line adjacent to the primary crusher (**Figure 2.1**) where it would be transformed to 415 V for distribution via a Motor Control Centre to the various drives associated with the crushing, agglomerating and stacking processes.

Wet Plant

Power to the Wet Plant Area (**Figure 2.10**) would be provided by an 11 kV part overhead, part buried line terminating adjacent to the Wet Plant Motor Control Centre. This feeder would supply 415 V power to the desorption area Motor Control Centre which would in turn distribute power to the various pumps associated with the plant. Low voltage (240 V) power would also be supplied from there to the office, workshop/store and contractor's area.

Lighting

Wherever possible, light fittings for roads, parking and general areas would be mounted on buildings or plant adjacent to the area to be illuminated. Where this is not feasible, pole-mounted lights would be used. Lighting would be adequate for security and maintenance requirements.

Lights would be directed towards the area to be illuminated and be shielded from any distant residence, where possible.

2.9.2 LPG

The elution plant heating circuit, and the goldroom barring furnace would use LPG. The necessary storage for one month's reserve, together with installation of gas pipework to the relevant standards, would be the responsibility of the contracted gas supplier.

2.9.3 Water

Process and Dust Suppression Water

The Company proposes to utilise a combination of four (4) sources of raw water for its 255 ML annual process and dust suppression water requirements:

(i) overflow from the maturation pond at the Peak Hill Sewage Treatment Plant located on the north-western outskirts of Peak Hill township (**Figure 2.1**). Supply from this source is available at a rate of 3.6 L/sec or 114 ML/year;

(ii) water from Bogan Weir (**Figure 1.2**) under licence from the Department of Water Resources;

(iii) water from the "Westray" impoundment adjacent to Burrabadine Creek (**Figure 1.2**) under licence from the Department of Water Resources and an agreement with the landowner; and

(iv) harvested surface runoff stored within the runoff dam (**Figure 2.1**).

In order to minimise any impact on adjacent and downstream landowners by the use of Bogan Weir water, extraction of water from the Bogan Weir for processing and dust suppression purposes would be limited to those periods when the water level within the Bogan Weir was within 1.5 m of top water level. When the water level within the Weir was below the 1.5 m mark, the Company would source up to 120 ML per year

from the "Westray" impoundment under an agreement with the landowners, Mr R. Cannon and Ms L. Tremain. It is proposed to increase the existing storage capacity within the impoundment from 120 ML to 160 ML - 180 ML to provide adequate supplies to both parties. The 25 ML capacity surface water runoff pond would act as a further source of water.

Development of these sources would necessitate installation or construction of:

- a 7.5 kW in-line centrifugal pump adjacent to the Bogan Weir;
- a 110 mm pipeline within the road easements between the Bogan Weir and the sewage treatment plant;
- a 1 ML surge pond and pump adjacent to the sewage treatment plant;
- a 110 mm pipeline from the Sewage Treatment Plant to the Project Site;
- a 7.5 kW in-line centrifugal pump at the "Westray" impoundment; and
- a 90 mm diameter pipeline from "Westray" to the Project Site via private property and a public road reserve.

Water from both the sewage treatment plant and Bogan Weir would be directed to the surge pond from which it would be pumped to the 5 500 kL Raw Water Pond. Water from the "Westray" impoundment would be pumped directly to the Raw Water Pond. A non-return valve would be installed on each pipeline to ensure no loss of water from the raw water pond. The pipeline routes and the Sewage Plant surge pond location are shown on **Figure 2.1.** Pumping from the combined sources would be at a rate of approximately 13 L/sec, 24 hours per day during summer and 14 hours per day in winter. Where the Sewage Plant to Project Site pipeline passes the town's solid waste depot, a small PVC-lined pond (the Fire Pond, **Figure 2.1**) would be constructed together with a separate pump and stand pipe. This would serve as a water cart filling station for dust control and also a water source for fire fighting should a fire break out in the depot.

Water stored within the raw water pond would be distributed to:

(i) dust suppression and belt cleaning sprays at the crusher;

(ii) the agglomerator water dosing unit;

(iii) the barren pond; and possibly

(iv) the runoff dam.

Raw water requirements for the Peak Hill Gold Project for crushing, agglomeration, stacking and leaching would range from approximately 350 kL per day in winter to approximately 520 kL per day during summer, with the difference in summer and winter requirements being a function of evaporative losses. Annual raw water consumption for crushing, agglomeration, stacking and leaching would therefore approximate 158 ML.

Raw water requirements for dust suppression activities on haulroads and trafficked areas are a function of the surface area exposed; the amount of traffic and hence the succeptibility to dust generation and lift-off; the season; and the application rate.

Assuming:

- a haulroad and heavy equipment traffic area of 3.2 ha;
- a light vehicle service road area of 1.6 ha;
- a summer dust suppression application rate of 1.5 L/m²/hour on haulroads and areas trafficked by heavy equipment and a winter dust suppression application rate of 0.75 L/m²/hour during operational hours;
- application rates of 0.75 L/m²/hour and 0.375 L/m²/hour on service roads etc. during summer and winter respectively during operational hours; and
- twenty one (21) rain days in summer and 26 rain days in winter where no dust suppression water would be required,

average daily dust control water requirements would range between 170 kL and 360 kL, averaging 265 kL. Annual raw water consumption for dust suppression would therefore approximate 97 ML. It should be noted, however, that the above application rates are high by industry standards and are a reflection of the proximity of Peak Hill township.

Where available, surface runoff water stored in the runoff pond (**Figure 2.1**) would also be pumped to the raw water pond to supplement the raw water supply from the sewage plant surge pond or from the "Westray" impoundment.

In the unlikely event that the above sources are unable to supply sufficient water for processing and dust suppression requirements, dust suppression activities would take priority.

On completion of the Project, the Bogan Weir to Sewage Treatment Plant to Project Site pipeline, pumps, surge and fire ponds would revert to the Shire and the "Westray" pump and pipeline would be left in place for the landowner. The runoff pond would be retained for future agricultural use.

A schematic water budget for the project is presented in **Figure 2.14.**

Potable Water

The Company's annual potable water requirement is estimated at 5.8 ML. Potable water would be required for:

(i) personal use of staff and operators;

(ii) safety showers;

(iii) crushing area ablutions unit;

(iv) crib rooms;

(v) first aid room;

(vi) toilets;

(vii) laboratory; and

(viii) workshop.

Potable water would be obtained from the town gravity supply system via a takeoff point provided by the local water authority. Development of the open cut as shown on **Figure 2.1** would, however, necessitate the relocation of the existing rising water main and gravity water main to the town, and the associated reservoir access road. Relocation of the above facilities together with the up-grading of the pipeline to overcome existing pressure problems in Euchie Street would be undertaken by the local water authority and/or Company and be financed by the Company.

2.9.4 Sewerage

Septic tank facilities would be installed at each of the offices, crusher, store/workshop, treatment plant and contractor's areas. A separate tank would be installed to store waste water from the laboratory. All tanks would be pumped out regularly by a waste disposal contractor and the waste transported to the town sewage works or other appropriate location for disposal. Rubble drains would be installed to disperse the laboratory and crib room and ablution water by soakage and evaporation.

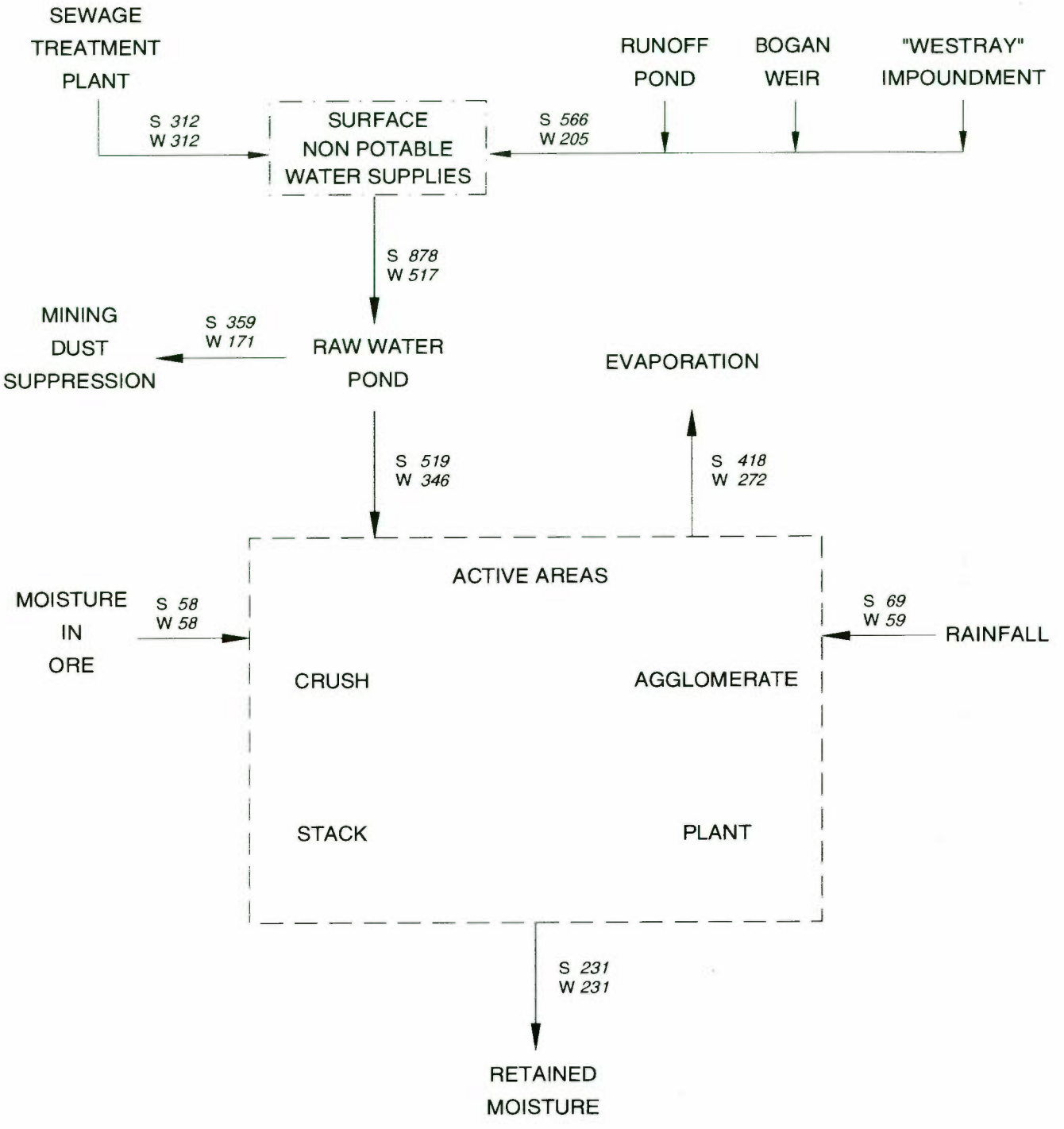
2.9.5 Communications

Standard Telecom connections would be provided. Handset phones with direct dialling and/or interconnection facilities would be provided at the following locations:

- office building;
- crushing area;
- gold room; and
- store.

One facsimile machine would be provided in the office building.

A single phone/facsimile line would be provided to the contractor's area. Vehicles would be provided with two way radio communication.



REFERENCE

S *222* = Summer (October to March)

W *222* = Winter (April to September)

222 = kilolitres of water per day

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Figure 2.14
SCHEMATIC DAILY WATER BALANCE

2.10 EMPLOYMENT

Projected employment levels during the twenty three (23) week on-site pre-production (construction) phase of the project are outlined in **Table 2.14**. Employment during this period would be on a contractual basis.

TABLE 2.14

Pre-production Workforce

Weeks	Number of Employees	Type of Work
1 - 4	8	Site clearing, topsoil stripping, bund construction
5 - 9	8	Civil works, earthworks, treatment plant area preparation
10 - 14	30	Construction, structural, civil works (builders, plumbers, electricians, etc.), and earthworks
15 - 19	30	Construction and structural works (builders, plumbers, electricians, etc.), pad installation
20 - 23	6	Construction and structural works (builders, plumbers, electricians, etc.)

Professional people employed during the pre-production period would be temporarily transferred from the designer's off-site office. Other workers would be recruited locally, or from further afield if people with appropriate skills are not available in the Peak Hill/Parkes district.

Once fully operational, the Company expects the project to employ approximately forty (40) persons in mining, processing and administration of which between twenty (20) and thirty (30) would be employed from within the Peak Hill/Parkes district. Overall supervision and leach operations would be undertaken by the Company's employees whereas mining, crushing, agglomeration and agglomerate stacking would be the responsibility of contractors. A breakdown of the anticipated full-time workforce employed by the Company and the contractors is presented in **Table 2.15**.

TABLE 2.15

Proposed Full Time Workforce

Company	
Mine Manager	1
Receptionist	1
Mine Superintendent	1
Accounts Clerk	1
Environmental Officer	1
Heap Leach Superintendent	1
Mine Geologist	1
Grade Control Sampler	2
Leading Hand (Heap Leach)	1
General Labourer	3
Sub Total	**13**
Mining Contractor	
Supervisor	1
Leading Hand	1
Accounts Clerk	1
Maintenance Fitter	2
Operator	4
Powder Monkey	1
Sub Total	**10**
Crush, Agglomerate, Stack Contractor	
Supervisor	1
Accounts Clerk	1
Leading Hand	1
Maintenance Fitters	2
Operators	6
General Labourers	1
Sub Total	**12**
Surveying Contractor	**2**
Exploration Personnel	**3**
Total Personnel on Site	**40**

2.11 HOUSING AND INFRASTRUCTURE

It is expected that the majority of employees would live in Peak Hill or on nearby farms. Rental housing is scarce in Peak Hill although there is more than adequate housing available for purchase. Over the past twelve (12) months a continuous listing of between forty (40) and fifty (50) houses for sale has been maintained by local real

estate agents. Given the shortage of rental accommodation, the Company may need to provide housing for some imported staff. The Company would also contribute $15 000 to the Shire to assist in the up-grading of recreational facilities within the town.

2.12 TRANSPORTATION

2.12.1 Site Access

During the early part of the pre-production phase, site access for all vehicles would be via the present unsealed road which provides access to the town's solid waste depot. This road, which would be upgraded to a dual lane sealed road during the pre-production phase, intersects the Newell Highway approximately 0.5 km north of the town boundary. The access to the Project Site currently available from Mingelo Street would be blocked off by the Project Site boundary fence and temporary open cut bund wall (**Figure 2.1**).

2.12.2 Traffic Levels

During the construction period, private vehicles would arrive on site between 6.30 am and 6.50 am for a commencement of work at 7.00 am, and depart after 6.00 pm. Heavy vehicles would arrive and depart at irregular times between 7.00 am and 6. 00 pm.

Approximately three (3) semi-trailers per week carrying construction materials are expected to arrive on site during the third, fourth and fifth months of the construction period and one (1) arrive per week during the sixth month. However, in the sixth month, reagent deliveries and supplies for the mining and processing operations would also commence. Construction workers would arrive on site in a fleet of up to four (4) mini-buses or in private vehicles.

Once mining and processing operations commence, most employees would arrive for work between 6.45 am and 7.00 am and leave between 6.00 pm and 6.45 pm. Office staff would generally arrive at 8.00 am and depart at 5.00 pm. Delivery trucks would arrive and depart irregularly between 7.00 am and 6.00 pm.

Traffic levels associated with the mining phase of the project are indicated in **Table 2.16.**

TABLE 2.16

Estimated Traffic Movements Associated with the Operational Peak Hill Gold Project

Source	Type of Vehicle	Frequency
Employees	Cars*	60 per day
Supplies/Reagents	Tray truck	6-8 per week
Cement	Tankers	4-6 per week
Miscellaneous supplies	Small trucks	8-10 per day
Fuel	Tanker	4 per week
LPG	Tanker	2-4 per month
Visitors	Cars	8 per day

* Staggered arrival and departure times due to shift operations.

Bullion would be transported off-site by security vehicle once per week.

2.12.3 Internal Road Network

The Project Site's internal road network is shown in **Figure 2.1.** On-site roads would be constructed of compacted base course sourced from within the open cut during the pre-production phase. A hardstand comprising compacted base course would also be constructed in the crushing plant area.

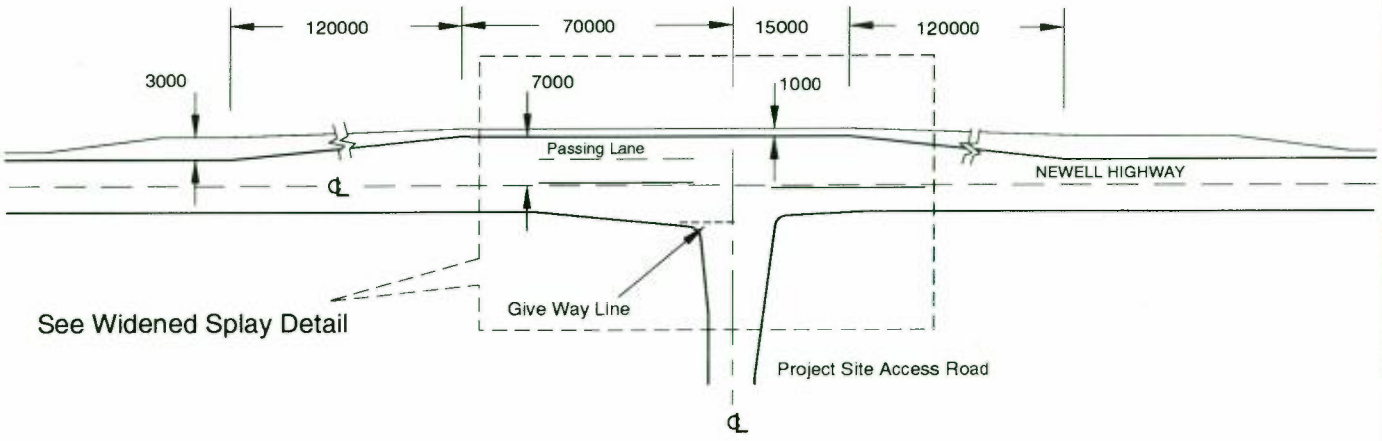
A vehicle washdown facility or vehicle wheel bath would be provided at the security gate to prevent mud being carried onto public roads by project-related vehicles.

Details of haul roads are presented in Section 2.4.9.

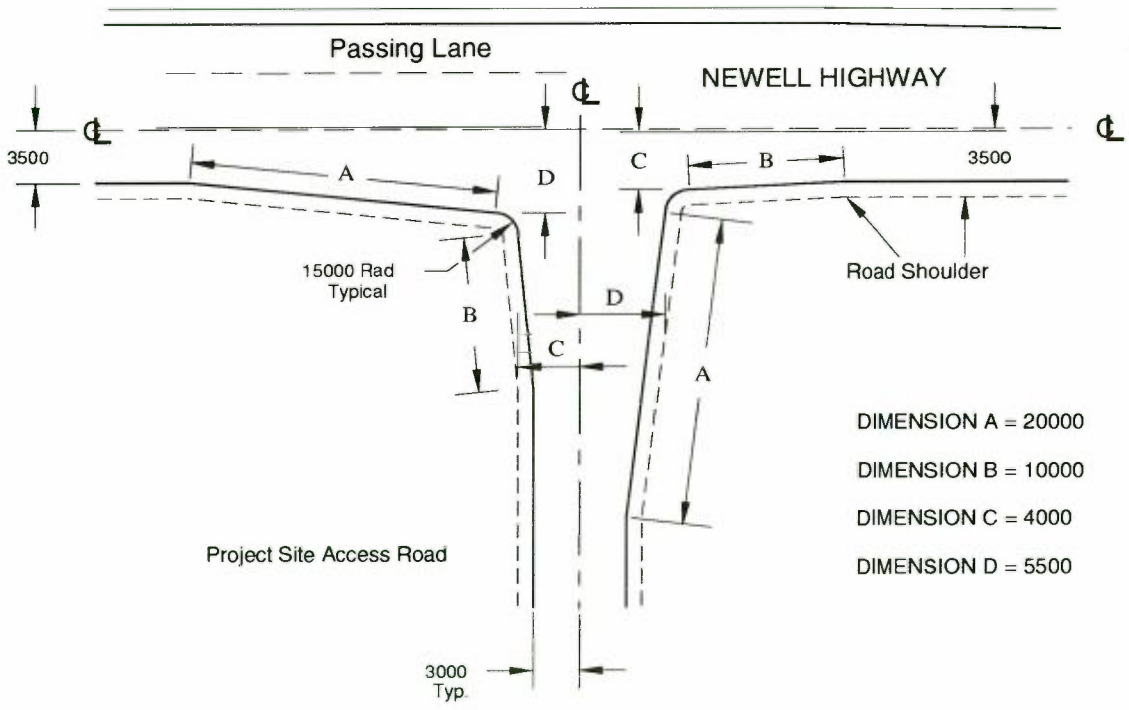
2.12.4 Road Upgrading

The Newell Highway would be upgraded allowing for a passing lane on the western (northbound) side of the highway at the intersection with the site access road and widened splays on the eastern (southbound) side of the highway as shown on **Figure 2.15.**

The passing lane is of the Roads and Traffic Authority's type "AUR" right turn treatment with tapers and lane lengths as shown on **Figure 2.15** based upon those required by a B-Double Unit to pass another stationary vehicle of the same dimensions.



PASSING LANE DETAIL



WIDENED SPLAY DETAIL

NOTE : Details shown above
are Not to Scale

Dimensions are in millimetres

Source : R.T.A.

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Figure 2.15
INTERSECTION DETAILS -
NEWELL HIGHWAY/PROJECT
SITE ACCESS ROAD

The widened splays are of the Authority's type "BAL" left turn treatment. The dimensions shown on **Figure 2.15** allow for the passing of vehicles both entering and leaving the site simultaneously.

Some minor clearing of trees and bushes would be required on the southern side of the intersection to improve visibility towards Peak Hill. No clearing would be required on the northern side of the intersection.

The site access road would be upgraded to a sealed two lane road from the highway intersection with the Newell Highway to the Project Site entrance gate, a distance of approximately 1 km. This would result in improved access for local residents to the solid waste depot.

The Company would also construct a new, sealed access road to the town water supply reservoirs on the top of the hill (**Figure 2.1**). This road would, as at present, be an extension of Mingelo Street. During the life of the project, no access from this road to the Project Site would be provided other than to and from the new tourist viewing platform (**Figure 2.1**).

2.13 REHABILITATION

2.13.1 Introduction

The Company proposes to incorporate rehabilitation procedures in all aspects of the Peak Hill Gold Project. Design planning of the project has addressed the need to ensure that rehabilitation is progressive, where practicable, and provides a low maintenance site in the long term. **Figure 2.16** shows the rehabilitated landform proposed at the completion of the Project.

The final landform features would, as far as practicable, blend with existing topography. With the exception of the open cut void the maximum slopes of the landform features would be 18° (1:3 (vertical:horizontal) with midslope berms where necessary, so that long term geotechnical stability is achieved and erosion is minimised.

The overall objectives of the rehabilitation proposal may be summarised as follows:

(i) as far as practicable to blend the created landforms with the surrounding land fabric;

(ii) to provide a stable ground cover for erosion control;

(iii) to minimise impacts on scenic amenity by the retention of existing vegetation where practical and by the implementation of progressive revegetation;

(iv) to revegetate with native tree and shrub species and/or pasture species comparable with pre-existing vegetation communities; and

(v) to provide a low maintenance, stable and safe landform commensurate with a grazing land use capability.

Additionally, the Company proposes to assist in rehabilitating areas of disturbance associated with prior mining and gravel extraction activities.

Environmental procedures for soil management and revegetation proposed as part of the overall rehabilitation of the site are presented in detail in Section 4.5 of this Statement.

Table 2.17 lists some locally occurring species suggested for inclusion in revegetation programmes to be adopted on the Project Site. Species would be selected following discussions with the Department of Conservation and Land Management and an assessment of each location and purpose. All seed/tubestock would be planted with the appropriate fertiliser.

TABLE 2.17

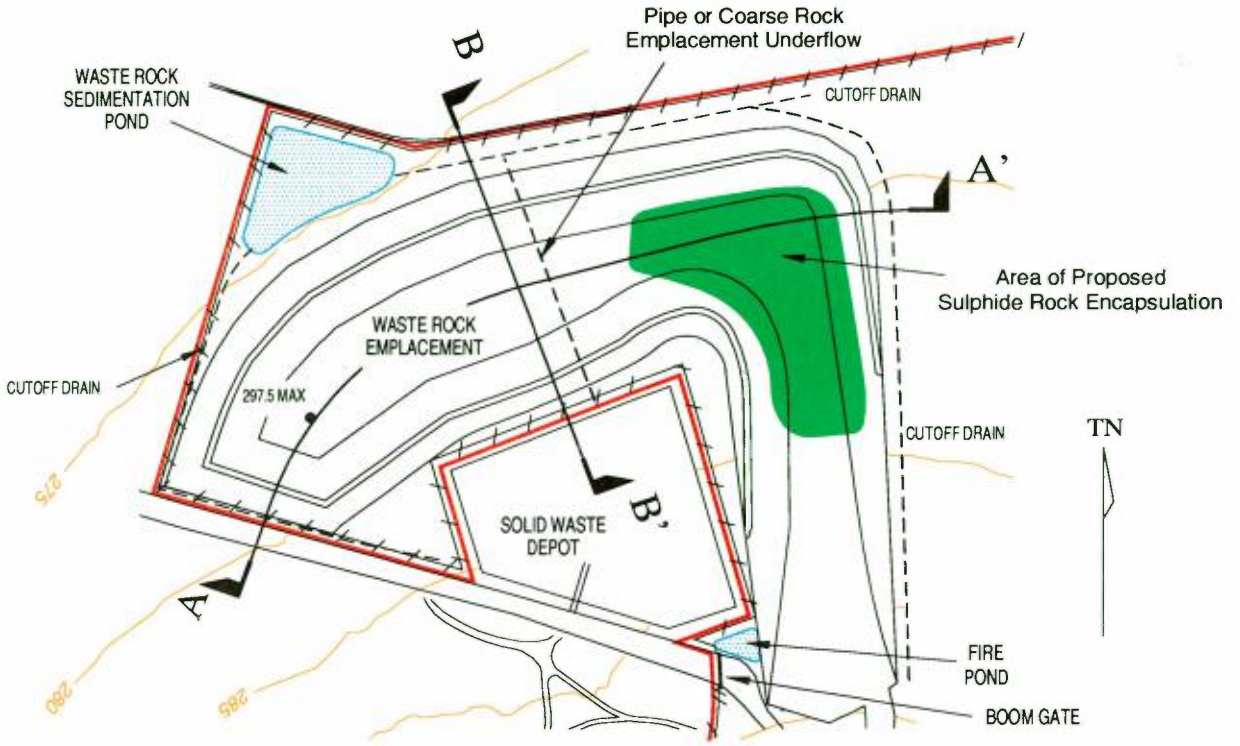
Species List

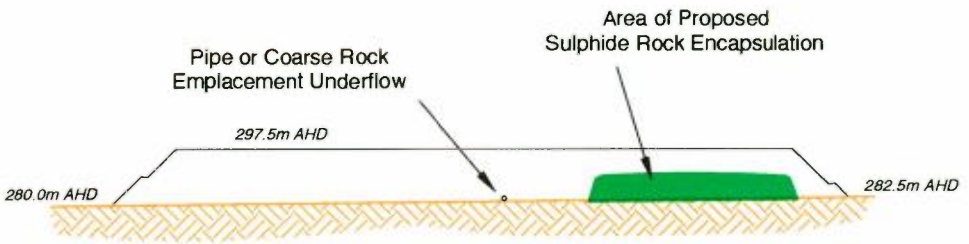
Scientific Name	Common Name
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus dwyeri	Dwyers Red Gum
Eucalyptus sideroxylon	Mugga Ironbark
Acacia decora	Western Silver Wattle
Acacia doratoxylon	Spearwood
Schinus areira	Pepper Tree
Callitris endlicheri	Cypress Pine
Allocasuarina stricta	She-oak

2.13.2 Temporary Open Cut Bund Wall

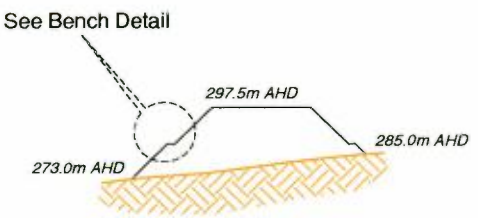
The external (western) face of the temporary open cut bund wall constructed within the confines of, and to the north of the open cut to reduce operational noise, would be topsoiled and revegetated immediately on completion. Once all topsoil is in place, the outer surface of the wall would be mulched with a mixture of straw, seed and fertiliser specifically formulated to impart rapid surface stability.

As mining progresses on the western side of the open cut, the temporary bund would gradually be removed. By the time open cut development on the western cutback achieves a level of 295 m AHD (Year 3), there would be no further requirement for bunding adjacent to the open cut. Removal of the bund from within the confines of the open cut would be by raking down and allowing the bund material to slump into the open cut. Removal of the remaining section of the temporary open cut bund from areas outside the confines of the open cut would be undertaken on completion of mining and haulage activities. Once bund removal has been completed the Company would rip the surface on contour, re-spread topsoil stockpiled during the pre-production phase and/or salvaged from the outer face of the bund, and seed the area





SECTION A-A'
Vertical Exaggeration = 3



SECTION B-B'
Vertical Exaggeration = 3

BENCH DETAIL
No Vertical Exaggeration
SCALE 1:200

SCALE 1:6000

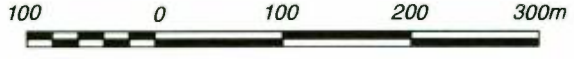


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Figure 2.13
WASTE ROCK EMPLACEMENT PLAN AND SECTIONS

PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL

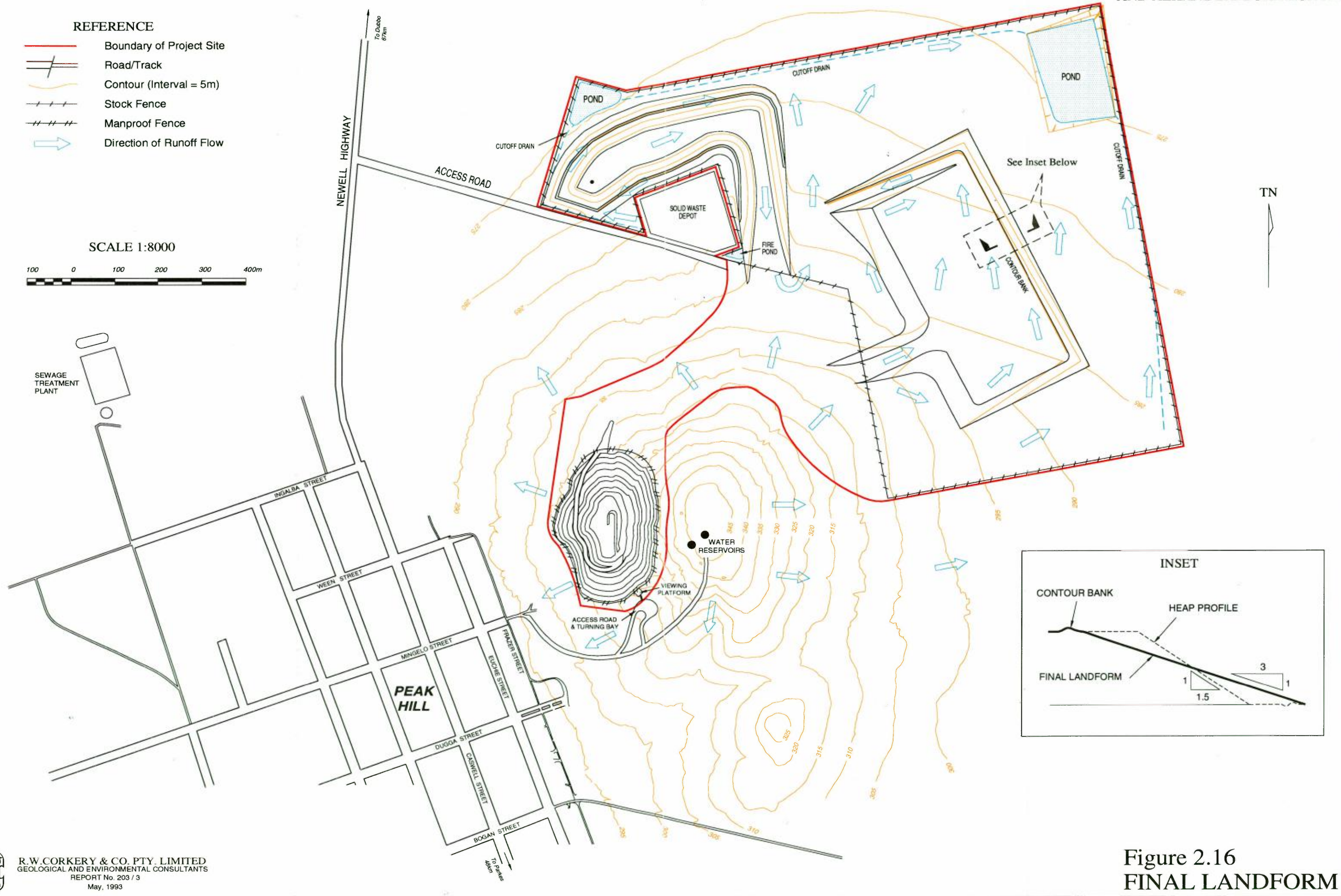
REFERENCE

- Boundary of Project Site
- Road/Track
- Contour (Interval = 5m)
- Stock Fence
- Manproof Fence
- Direction of Runoff Flow

SCALE 1:8000

100 0 100 200 300 400m

TN



INSET

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Figure 2.16
FINAL LANDFORM

with seed collected from trees and shrubs growing on Peak Hill. The area would also be mulched with seed-bearing branches harvested from the hill.

The Company would also carry out enrichment planting of the area between the Project Site boundary and Frazer Street using the already prolific Peppertree (*Schinus areira*) and other species as recommended by the Department of Conservation and Land Management.

2.13.3 Open Cut

During the early stages of mining operations a sealed tourist access road of suitable width for bus access and parking, together with a tourist viewing platform, would be constructed at a location on the southern end of the proposed open cut as agreed with the Council and local tourism representatives. The viewing platform would be positioned to provide the best possible views of the operating open cut and Peak Hill township and would be accompanied by a permanent sign highlighting the history of mining on Peak Hill. If so required, relics of former mining at Peak Hill salvaged during the pre-production phase would be placed adjacent to the viewing platform to provide additional tourist interest. In addition, the historical Crown Workings (**Figure 2.1**) would be developed as a tourist attraction. Fencing and walkways would be constructed to provide safe access to this amenity.

At the completion of mining, the Company would undertake a number of measures to leave the open cut as a safe landform. The emphasis upon safety is given in light of the close proximity to the town and the continued use of the area as a tourist attraction. The rehabilitation measures would include the following.

(i) The open cut access would be blocked with large boulders to prevent the entry of vehicles to the open cut area.

(ii) A 1 m high waste rock or earth barrier would be constructed around the perimeter of the open cut to prevent accidental or deliberate passage of vehicles over the edge of the open cut. The area of disturbance adjacent to the barrier would be sown with a native grass/shrub/tree mixture to provide a long term attractive fringe to the open cut. The 1.8 m high Cyclone manproof fencing installed around the perimeter of the open cut during mining operations would be retained and any openings closed off, e.g. adjacent to the open cut access road.

Rehabilitation activity within the confines of the open cut would be limited to shallow ripping and planting of trees on the upper benches which are visible from within Peak Hill. Elsewhere, it is likely that natural growth of trees and shrubs would occur on the benches and floor of the open cut as it has in the existing glory holes. Given that the groundwater table within the area generally lies at or below the base of the proposed open cut (See Section 3.6.2), the void should remain dry except following significant rainfall events.

2.13.4 Waste Rock Emplacement

In advance of waste rock disposal, the Company would commence planting of trees and shrubs along the western and northern project boundaries to assist the long term screening of the waste emplacement from traffic on the Newell Highway.

A principal rehabilitation consideration in the design of the waste rock emplacement proposed is the need to selectively handle and thence encapsulate waste rock identified as potentially acid generating. Proposed emplacement procedures are presented in Section 2.7.7. These involve formation of an outer downslope barrier wall of weathered waste rock, selectively emplacing "pyritic" waste rock as a core and capping with subsequent lifts of weathered waste rock.

The waste rock emplacement would be constructed in such a manner that it would not be possible to undertake any substantial rehabilitation until the end of the second year of mining. As far as possible, it is intended that the western and southern side of the emplacement would be constructed at a greater rate than the eastern side.

Once the final surface of the emplacement is completed and shaped, the surface would be covered with up to 200 mm of subsoil and topsoil recovered from soil stockpiles No.'s 1 to 3. The surfaces would then be seeded with an appropriate mixture of grass and shrub species as determined in consultation with the local office of the Department of Conservation and Land Management. Contour banks would be constructed on all slopes.

The upper surface of the waste rock emplacement would be similarly treated. The final surface would be contoured to direct runoff to the south-eastern corner where the emplacement laps onto the flanks of Peak Hill. From this point, the water would flow to the runoff pond and sedimentation pond via drainage channels. A berm would also be retained around the outer margin to present runoff discharging over the batter faces. Revegetation of the emplacement would be undertaken so that the final surface would be fully grassed, with selected tree lots established on the side slopes and upper surface.

2.13.5 Spent Ore Heaps

At the completion of the project, the spent ore heaps would be flushed out with fresh water and neutralised with one of a number of standard reagents to remove the remaining sodium cyanide within the heaps. Once this activity is completed and the residual entrained cyanide levels are less than 0.001 per cent weakly acid dissociable cyanide, the sprinkler system would be dismantled and removed and the shade cloth removed prior to the heaps being re-contoured. Because of the large void volume between the agglomerates within the heap and the ease with which water and air can permeate, oxidisation of the low level of residual cyanide would continue to occur after flushing is completed to form carbonates and ammonia.

On completion of heap leaching activities:

- the sides of the spent ore heaps would be reduced in slope to a maximum 18 per cent or 1:3 (Vertical:Horizontal) (**Figure 2.16**);

- a contour bank would be installed along the eastern extent of the upper surface to collect surface flows and prevent discharges over the batter surfaces;
- the northern end of the heap (Module No. 1) would be regraded to provide a westward draining drainage channel to the flanks of Peak Hill (**Figure 2.16**). The drainage channel would be approximately 20 m wide and of a gradient of approximately 0.7 per cent; and
- contour banking would be installed on the uper surfaces and batters as required.

The PVC liner under the heaps would remain in place and the outer, exposed areas of liner comprising former bunds and V-drain would be covered by ore pushed down during the establishment of the final slopes (**Figure 2.16**). Once all drainage controls are in place, subsoil and topsoil would be spread across the surface, and the area seeded with a mixture of grass, shrub and tree species determined in consultation with the Department of Conservation and Land Management. The separate placement of subsoil onto the heaps is considered important to ensure that this layer provides some water retention beneath the topsoil. Without the subsoil being present, the highly permeable material would cause the topsoil to dry out rapidly.

2.13.6 Plant and Equipment

At the completion of the project, the crushers, conveyors, the wet plant, buildings and all ancillary equipment would be decommissioned and removed. All portable buildings would be removed intact. All concrete footings/slabs would either be broken up, removed and placed in the raw water pond or covered with waste rock and soil. The raw water pregnant, intermediate, barren and overflow ponds would be filled with waste rock, subsoil and soil respread, and the area revegetated. The fire pond, sedimentation pond and runoff pond would be retained as water holding structures for future waste depot, fire suppression and/or agricultural use.

2.13.7 General Site

The Company would progressively rehabilitate disturbed areas once they are no longer being used. Once rehabilitated, these areas would be well defined to prevent inadvertent passage by vehicles.

At the completion of the project, the Company would:

- remove all on-site roads, other that those required by Council or the Department of Conservation and Land Management;
- remove compacted rock from hardstand areas;
- rip all former road, hardstand and stockpile areas;
- install any recommended drainage controls; and

- apply subsoil and topsoil and seed as recommended by the Department of Conservation and Land Management.

2.13.8 Areas of Existing Disturbance

The area to the west and north of the proposed open cut is currently in a degraded state as a result of former mining and gravel extraction operations and the disposal of acid producing tailings, slag, and other wastes on the surface. The area has also been used to dispose of items such as car bodies. Rehabilitation of these areas has, and would continue to be, a joint effort between the Gulomogo Land Care Group, the Department of Mineral Resources and the Company. Work to date has comprised the removal of the acid-producting tailings from site and the removal of some miscellaneous rubbish. Rehabilitation of this area is currently underway.

On completion of these activities, the Company would rip the surface and apply soil and vegetative mulch salvaged from the open cut area during the pre-production phase and establish contour banking and other drainage controls as required. In the unlikely event that additional seed application is required, only seed collected from the Peak Hill woodland vegetation community would be applied.

2.13.9 Maintenance

The Company's commitment to effective rehabilitation would involve an on-going maintenance programme. This would include re-seeding and fertilising and, if necessary, re-topsoiling. During site rehabilitation, drainage controls would be maintained and boundary fences repaired as necessary to prevent stock/rabbit access to the site. Selected grazing by sheep or cattle would be permitted to reduce the fire hazard created by new grass growth.

2.14 DEVELOPMENT ALTERNATIVES

2.14.1 Introduction

Clause 34 of the Environmental Planning and Assessment Regulation, 1980 requires that any feasible alternatives to the carrying out of the proposed designated development be addressed.

The consideration of alternatives fall within the following categories:

- the no development option, that is, not extracting the Peak Hill resource;
- alternative mining methods;
- alternative methods and sites for ore treatment operations;
- alternative sites and methods for waste rock disposal operations; and
- alternative process raw water supply sources.

2.14.2 The No Development Option

The no development option involves not mining the Peak Hill resource. The consequences of the no development option are described in Section 6.2 of the Statement but would include the loss of significant economic and social benefits to the Peak Hill District, and Parkes Shire, in the form of job creation and financial investment and an opportunity lost for mining to play an increasingly significant part in the Parkes District economy.

2.14.3 Alternative Mining Methods

No alternative to open cut mining was considered economically viable. Underground mining would be uneconomic. Underground mining is unsuited to the shape and size of the oxidised ore body, would not enable the recovery of all the defined ore and technically, would be difficult in the weak ground conditions. The Company has also investigated the use of in-pit crushing and conveying in order to minimise the use of haul trucks close to Peak Hill township. However, the location, size and shape of the open cut and the waste rock to ore ratio does not lend itself to other than haul truck transport of ore and waste rock.

2.14.4 Ore Treatment Alternatives

Metallurgical test work has shown the Peak Hill ore is amenable to both carbon-in-pulp (CIP) and heap leach treatment. The following factors have influenced the selection of heap leaching for this project:

- available process water is limited in the Peak Hill district, thereby necessitating a relatively low water usage method;
- the small size and relative low grade material of the deposit makes other ore treatment methods uneconomical; and
- gold is easily extracted at low concentrations of sodium cyanide (NaCN) with typical NaCN consumption being 0.1 to 0.2 kg per tonne of ore.

Heap leaching of precious metal ores has become economically attractive in the past 10 years following development of efficient practices in the United States of America. The heap leaching method has proven extremely advantageous for treatment of large low-grade ore bodies through greater simplicity, low capital and operating costs and shorter start-up times when compared with conventional milling operations.

Environmentally, the heap leach method has gained wide acceptance because of the weak concentrations of reagents required and the fact that the method does not require large tailings dams. Furthermore, as all chemicals and water are recycled, no discharge occurs from the system. The spent ore heaps remaining from the leaching process are easily reclaimed compared with the slimes (very finely crushed rock slurry) contained in tailings dams created from a conventional CIP operation.

The open texture of the heaps compared with the slimes within CIP tailings dams also facilitates the degradation or "killing" of cyanide such that at project decommissioning there is no residual cyanide and hence no significant potential environmental hazard.

The sites selected for the treatment operations, i.e. crushing, agglomeration, heap leaching and gold recovery, have been selected to best utilise the natural topography for drainage purposes and provide additional pad area for the treatment of further economic ore bodies discovered and yet provide the maximum screening to the township of Peak Hill.

Within Portion 380, the site layout as shown on **Figure 2.1** represents the only practicable arrangement to satisfy the above requirements.

The Company has also examined the use of alternative liners for the heap leach pad and alternative means of heap irrigation. The selection of a PVC liner in lieu of an HDPE liner was due to the greater resistance of PVC to puncturing or splitting and to avoid problems associated with the thermal expansion of HDPE liners. The PVC liner proposed has a seven (7) year guaranteed ultra violet light resistance.

Senninger No. 9 "wobbler" sprinklers were selected in lieu of drip irrigators because they are easier to install, easier to relocate on completion of leaching and easier to maintain and, when operated at design pressures or less, form large droplets which do not create misting problems. Drip irrigators, though using less leach solution, are liable to scaling and the attendant reduction in efficiency and would necessitate the introduction of descaling chemicals to the leach solution. Malfunctions within the irrigation system are easier to detect when "wobbler" sprinklers are used.

2.14.5 Alternative Waste Rock Emplacement Sites

The possibility of an alternative site to that proposed for waste rock disposal was examined during the project feasibility stage. No alternative was found which would not:

(i) sterilise prospective ore reserves;
(ii) require haul truck operation on steep grades (and increased noise generation);
(iii) lead to major problems in leach pad establishment; and
(iv) require additional land utilisation for the project.

Some minor variations to the layout as shown on **Figure 2.13** to accommodate possible changes in Council's waste management policy for the Peak Hill Solid Waste Depot could be implemented and would be subject to negotiation with Council.

2.14.6 Alternative Raw Water Supplies

In developing the proposal as described within this Statement, the Company has examined, and incorporated a range of alternatives for the supply of its 255 ML annual raw water requirement for process and dust suppression purposes. The combination of supplies selected, i.e. the sewage treatment plant effluent (114 ML per annum); Bogan Weir water (when water levels are within 1.5 m of top water level, up to 125 ML per

annum); the "Westray" impoundment (up to 120 ML per annum) and the use of harvested water from the Project Site stored in the runoff dam (storage capacity 25 ML), represents a manageable system of alternative supplies which would result in negligible impact to other water users.

SECTION 3

Description of the Existing Environment

SECTION 3

DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 PREAMBLE

This section examines a wide range of components that collectively form the existing environment on and around the Project Site. The constraint(s), if any, imposed upon the Project by each component and the need for design and operational safeguards is discussed at the end of each sub-section and highlighted in italics.

3.2 TOPOGRAPHY AND DRAINAGE

3.2.1 Topography

Peak Hill and the associated ridgeline to the south of Peak Hill township are a prominent topographic feature in the area. The hill rises to an elevation of 349 m with respect to Australian Height Datum (AHD). The surrounding countryside is flat to gently undulating (**Plates 1** and **8**) and lies at an elevation of approximately 260-280 m AHD (**Figure 1.2**).

The hill's flanks steepen with increasing elevation from less than 2 per cent below 300 m AHD in the eastern section of the Project Site to 15 per cent above 320 m AHD, with local steepening to about 20 per cent in the vicinity of gullies to the south-east of the proposed open cut.

3.2.2 Drainage

Peak Hill is located within the catchment of the upper Bogan River. The area between Peak Hill and Parkes (**Figure 1.1**) forms the headwaters of the Bogan River which is a tributary of the Darling River system. In the Peak Hill area, the major tributaries of the Bogan River are Burrill Creek, Ten Mile Creek and Burrabadine Creek (**Figure 1.2**). These and other minor tributaries are ephemeral and, when flowing, drain to the north, west and north-west. The Bogan River itself is ephemeral, flowing only after significant rainfall events. At other times, the Bogan River reverts to a series of water holes. During droughts, periods of up to twenty eight (28) months have been recorded between significant flows. Based on 100 years available data, the average annual flow over the Bogan Weir is 21 000 ML.

Surface runoff on the Project Site is generally radial, with all flows entering either Ten Mile or Burrabadine Creeks. On the north-eastern and southern sides of Peak Hill, runoff flows within a series of minor gullies. Sheet flow is common on the eastern and western sides of the hill. Runoff from the hill towards Peak Hill township is collected in a contour drain constructed on the lower slopes. Water from this drain is directed to a small creek in the northern section of the township.

Surface runoff from the Project Site is comparatively minor and should be easily managed through the use of diversion banks and storage dams. Appropriately designed structures should be incorporated into project planning. Structures to contain contaminated runoff would require a design capacity sufficient for 1 in 100 year 72 hour storm event. Structures to contain sediment laden water would require a design capacity sufficient for a 1 in 25 year 72 hour storm event.

3.3 GEOLOGY

3.3.1 Regional Geology

Gold mineralisation at Peak Hill is hosted by Late Ordovician Mingelo Volcanics which consist mainly of andesitic lavas and andesitic pyroclastic rocks with minor interbedded sedimentary rock types. Above the Mingelo Volcanics is the Tomingley Siltstone, a sequence of siltstone and fine sandstone. The Tomingley Siltstone is found low on the eastern side of Peak Hill and underlies paddocks further east (**Figure 3.1**). To the west of Peak Hill, bedrock is covered by soil and alluvium deposited by tributaries of the Bogan River.

The rock sequence has been tightly folded so that individual rock layers now dip steeply, usually to the east. All bedrock units contain a schistosity or foliation that trends north-south and dips steeply, usually westward. The schistosity is a product of the deformation that formed the folds in the rocks. Similarly, all bedrock has undergone moderate regional metamorphism.

3.3.2 The Peak Hill Deposit

Overview

The Peak Hill gold deposit is the largest of several known gold prospects within 1 km of Peak Hill township, and comprises a weathered gold-bearing cap overlying a gold-copper deposit that extends downwards for at least 250 m (the limit of previous mining).

Plate 8: A view from the north-eastern Project Site boundary looking towards the area of the proposed leach pad (centre) and waste rock emplacement (right). Peak Hill lies upper right of photo (Ref. 203J/5,7)

Plate 9: A typical disturbed area within Faunal Habitat 1. The existing glory holes lie centre left of photograph. The upper extent of open cut mining approximates the right hand margin of photograph. (Ref: 203J/24)

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REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Mining
- Contour (Interval = 5m)
- See Figure 3.2

GEOLOGICAL REFERENCE

- Sandy and gravelly alluvium/colluvium
- Argillic altered andesite, mainly purple, soft, outcrop uncommon - mainly colluvial soil cover
- Peak Hill Alteration Zone - strongly foliated, argillic and silicic altered sedimentary and andesitic volcanic rocks, outcrop uncommon on higher slopes
- Microcrystalline quartz rocks

} Mingelo Volcanics

- Thinly interbedded siltstone and fine tuffaceous / lithic sandstone, outcrop uncommon - mainly colluvial soil cover

} Tomingley Siltstone

SCALE 1:12500

200 0 200 400 600m

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Figure 3.1
REGIONAL GEOLOGY

Local Geology

All "hard rock" deposits at Peak Hill lie in the Peak Hill Alteration Zone, a north-south band about 0.5 km wide that is exposed over a length of 2 km through the higher ground east of town (**Figure 3.1**).

The north-south trending schistosity or foliation is strongly developed in this zone as is a distinctive style of alteration. The primary or original minerals of the volcanic rocks have been replaced by secondary minerals, especially quartz, sericite mica and the talc-like mineral, pyrophyllite (**Figure 3.2**).

Geological Structures

The dominant geological structure in the vicinity of the proposed open cut is the north-trending schistosity mentioned above in Local Geology.

A later, weaker east-west schistosity dips steeply north and is most intense near the south end of the main "glory hole".

A few steep east-west cross faults are also recognised in the walls of the open cuts and glory holes.

Weathering

The gold resource is largely contained within the zone of oxidation, which extends from the surface down to the irregular base of oxidation (BOMO, **Figure 3.2**). The rocks in this upper zone are red, brown, orange or cream, are rich in clay and iron oxides, and are generally softer than the underlying unweathered rocks.

Below the base of oxidation which is 16 m to 100 m deep (averaging 40 m), the rocks are grey, firm to hard, and contain little clay or iron oxides. The base of oxidation is a transition zone 0.1 m to 1.5 m thick.

Mineralisation

Below the base of oxidation, gold is closely associated with the mineral pyrite (also called "fools gold".)

Within the zone of oxidation, the pyrite has been weathered to iron oxides, releasing the gold, and making the ore easier to treat. Erosion of this weathered ore has supplied gold to the alluvial deposits flanking the hill.

3.3.3 Seismology

Based on the Seismic Zone Plan of Australia (AS 2121M-1979), the region is within Seismic Zone A. In Zone A the average return interval for an earthquake of Modified Mercalli Intensity VI, that is, of an intensity likely to cause some superficial damage, e.g. broken windows, would be fifty (50) years.

3.4 LAND CAPABILITY AND SOILS

3.4.1 Land Capability

Land capability maps prepared by the Soil Conservation Service of New South Wales provide a basis for assessment of optimum land use on and around the Project Site. Classification is based upon the physical characteristics of the land, the extent to which these characteristics would limit a particular type of land use and current technology available for land management. This classification also incorporates an assessment of the soil erosion hazards, with an emphasis on a level of land use which avoids potential environmental problems caused by soil erosion and sedimentation. Climate, soils, geology, geomorphology, soil erosion, site and soil drainage characteristics and current land use data are all considered in determining land capability.

The elevated section of the Project Site is defined as Class VII land by the Department of Conservation and Land Management (1:100 000 Peak Hill Rural Land Capability Map), and that on the eastern section of the Project Site as Class III land (**Plate 8**).

Class VII land generally comprises areas of steep slopes, shallow soils and/or rock outcrop and is best protected by green timber. Destruction of trees is not generally recommended, but partial clearing for grazing purposes under strict management controls can be practised on small areas of low erosion hazard.

Class III land is fair to good agricultural land suitable for cropping on a rotational basis and is generally suitable for a wide range of uses, although productivity would vary depending upon fertility. Soil erosion problems are often severe.

Under the five (5) Class Agricultural Land classification system employed by NSW Agriculture which ranks areas according to their productivity for a wide range of agricultural activities, the elevated section of the Project Site and area of former mining activity would be classified as degraded Class V land, and the area in the east of the Project Site as Class III land.

3.4.2 Soils

Reasonable topsoil cover is present across most of the Project Site. Only in the most disturbed areas has the topsoil been largely removed. Typically the upper 10-15 mm comprises a medium dark brown loam with a gravel layer. The clay content of the soil increases with depth without an appreciable change in colour. Gravel increases once again towards the base of the profile. In the eastern section of the Project Site the medium-dark brown loam passes into a red clay loam at about 500 mm.

Across the Project Site, soil cover ranges from less than 200 mm on the upper slopes of the hill to up to 700 mm on the lower slope adjacent to Frazer Street and the main access track to the hill. In the area of proposed topsoil stockpile No. 3 (**Figure 2.1**) the soil is approximately 600 mm thick and under the proposed waste emplacement, approximately 500 mm. For rehabiliation purposes, the upper 200 mm of the profile containing any organic enrichment and seed store is defined as topsoil, with the remainder being classified as subsoil.

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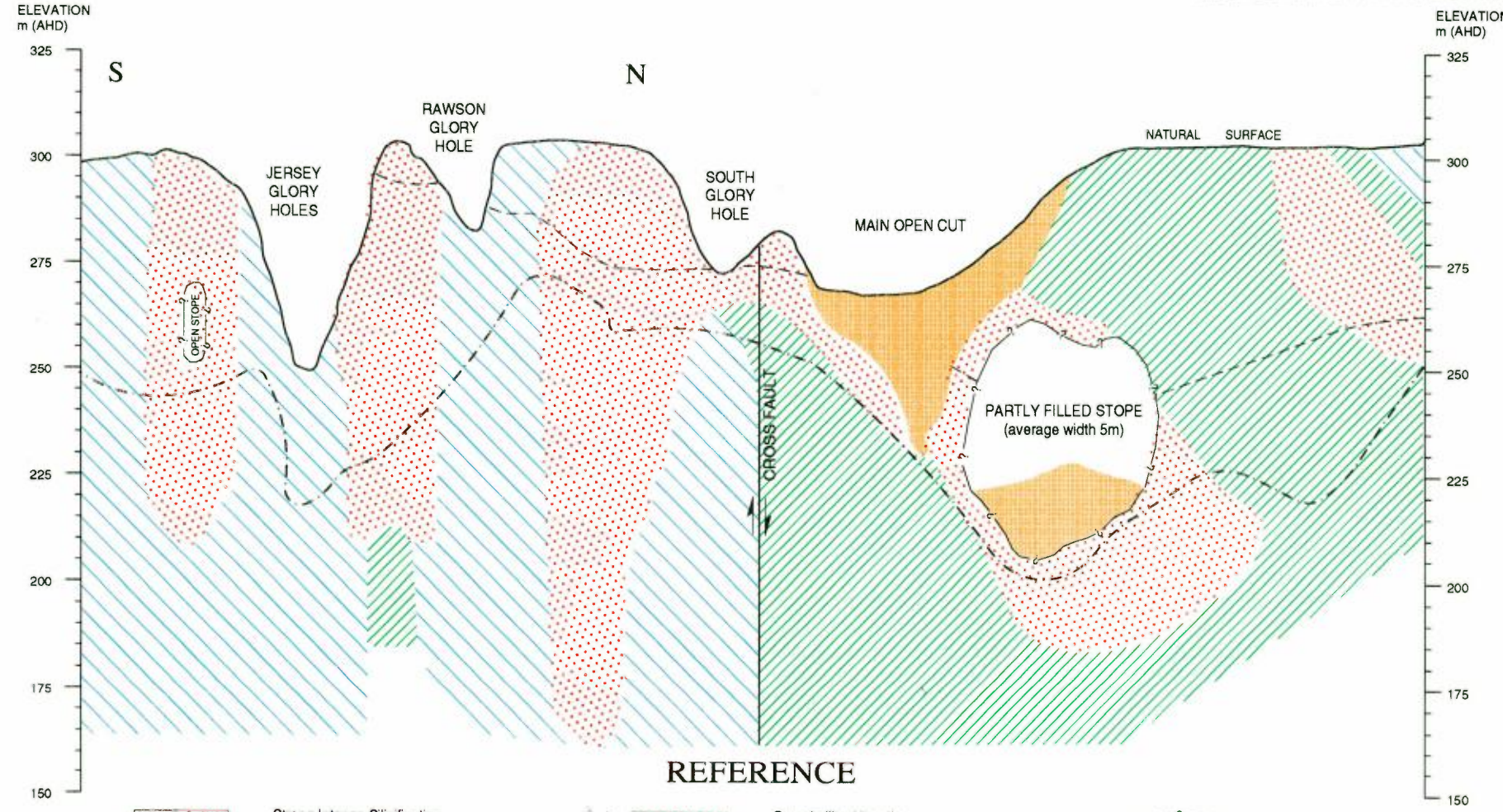

REFERENCE

- Strong Intense Silicification (50 - 80% Silica)
- Quartz Sericite Alteration (10 - 80% Sericite)
- Pyrophyllite Alteration (10 - 80% Pyrophyllite)
- Underground Development - Filled
- Underground Development - Open
- Zone of Increased Competence
- Base of Major Oxidation (BOMO)

See Figure 3.1 for Section Location

SCALE 1:1500

25 0 25 50 75m

NO VERTICAL EXAGGERATION

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Figure 3.2
LONGITUDINAL SECTION - MINERALISED ZONE

All soils on the site, especially those on the lower, flatter parts of the slope and those in relatively undisturbed bushland, are of value for rehabilitation.

All topsoils removed on the Project Site should be carefully stored and managed for use in site rehabilitation. Where possible, subsoils should be stored separately from topsoils. To avoid further introduction of pasture species and exotic weeds into the Peak Hill woodland community, where possible, only soils from woodland areas should be stored and re-used in the rehabilitation programme within that community. Soils disturbed during pipeline installation works should be immediately replaced and any necessary erosion protection measures implemented.

3.5 METEOROLOGY

3.5.1 Source of Data

The following summaries are based on information from the Bureau of Meteorology records collected at Peak Hill Post Office and Parkes Post Office, approximately 40 km south of the Project Site (**Figure 1.1**).

Data collected from Peak Hill Post Office comprise:

- temperature;
- rainfall;
- fog;
- frost;
- winds; and
- relative humidity.

Pan evaporation data was obtained from the Parkes Post Office, the nearest available source of evaporation data.

3.5.2 Temperature

Average daily maximum and minimum temperatures recorded at Peak Hill Post Office are presented in **Table 3.1**. The Peak Hill district does not generally experience extremes in temperatures. January and February are the warmest months of the year and July the coldest. Diurnal variation in temperature is greatest during summer and least during winter.

3.5.3 Rainfall

Mean monthly rainfall figures and number of rain days for both Peak Hill and Parkes are presented in **Table 3.1**.

TABLE 3.1

Climatic Summary

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (°C) * - Peak Hill Post Office													
Mean Daily Maximum	32.6	32.4	29.3	24.8	19.6	16.1	15.0	16.9	19.9	24.4	27.7	31.4	
Mean Daily Minimum	18.8	19.0	16.1	11.7	8.6	5.5	4.2	5.7	7.6	11.5	13.8	16.7	
* 24 Years of Records													
RAINFALL (mm) ** - Peak Hill Post Office and Parkes Post Office													
Peak Hill													
Mean Monthly	61	50	49	42	44	44	44	43	36	49	46	46	554
Rain Days per month	5	5	4	4	6	7	7	7	6	6	5	5	67
Parkes													
Mean Monthly	61	47	48	41	48	50	48	48	40	52	46	50	579
Rain Days per month	6	5	5	5	7	9	10	9	8	8	6	6	84
** 96 Years of Records													
PAN EVAPORATION (mm) * - Parkes Post Office**													
Maximum	310	224	202	138	135	56	62	76	132	198	255	295	
Minimum	174	126	130	69	42	34	99	46	63	96	405	189	
Average	239	179	161	102	60	43	46	65	96	143	189	245	1 568
*** 12 Years of Records													
FROST FREQUENCIES # - Peak Hill Post Office													
Maximum No. recorded per Month	0	0	0	2	4	16	18	10	11	1	0	0	
Minimum No. per Month	0	0	0	0	0	0	3	0	0	0	0	0	
Average No. per Month	0	0	0	0	1	5	9	5	2	0	0	0	
# 24 Years of Records													
FOG FREQUENCIES ## - Peak Hill Post Office													
Maximum No. recorded per Month	2	0	0	0	2	6	2	1	1	0	0	0	
Minimum No. recorded per Month	0	0	0	0	0	0	0	0	0	0	0	0	
Average No. per Month	0	0	0	0	0	1	1	0	0	0	0	0	
## 24 Years of Records													

Droughts, which commonly occur in regions west of the Great Dividing Range, affect the Peak Hill district. A comparison of the rainfall figures and the number of raindays per month suggests that most summer rainfall is of a higher intensity than that which occurs in winter and spring. Winter and spring rainfall is associated with frontal activity whereas summer rainfall tends to be convective. Winter rainfall is more reliable than that which occurs in summer.

3.5.4 Pan Evaporation

Table 3.1 presents the mean monthly pan evaporation figures for Parkes. Similar, though marginally higher, evaporation levels could be expected for Peak Hill. A comparison of rainfall and evaporation data presented in **Table 3.1** indicates that average pan evaporation exceeds rainfall in all months except June when evaporation and rainfall are almost equal. The average yearly evaporation of 1 568 mm is in excess of 2.7 times the average yearly rainfall.

3.5.5 Relative Humidity

The relative humidity in the Peak Hill area is typical of a mediterranean climatic zone. 9.00 am relative humidities range from 50 per cent in summer to 80 per cent in winter. 3.00 pm relative humidities range from 30 per cent in summer to 55 per cent in winter.

3.5.6 Temperature Inversions

Radiation inversions are the main type of temperature inversion likely to cause noise enhancement. An indication of the frequency of temperature inversions can be obtained from frost and fog frequency data as fogs represent radiation inversions in the presence of water vapour. Inversions invariably occur on clear frosty mornings or in the presence of fogs. A review of **Table 3.1** shows that temperature inversions are most likely to occur in Peak Hill during the months of May to September. Temperature inversions occur in the early morning and usually disappear by 9.00 am.

3.5.7 Wind

A detailed summary of the speed and frequency of winds blowing from the Project Site towards Peak Hill township is given in **Table 3.2.**

TABLE 3.2

Frequency of Winds Blowing Towards Peak Hill Township from the Project Site*

Wind Direction From	Wind Speed (km/hr)	J	F	M	A	M	J	J	A	S	O	N	D
North	<10	21	19	18	14	9	10	13	14	14	14	16	18
		15	**14**	**16**	**9**	**7**	**5**	**8**	**10**	**9**	**10**	**9**	**14**
	10-20	5	5	3	5	2	1	2	4	4	6	3	6
		1	**1**	**1**	**1**	**1**	**1**	**-**	**2**	**1**	**2**	**1**	**3**
	>20	-	1	1	-	-	-	-	-	1	1	1	1
		-	-	-	**1**	-	-	-	-	**1**	-	-	-
Northeast	<10	12	17	12	8	8	6	5	8	5	6	6	9
		7	**12**	**6**	**5**	**6**	**5**	**3**	**4**	**2**	**5**	**3**	**4**
	10-20	4	5	3	3	3	1	1	2	2	2	3	3
		2	**2**	**2**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**
	>20	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-
East	<10	4	7	5	5	4	4	4	2	2	4	4	4
		5	**7**	**6**	**3**	**3**	**2**	**2**	**-**	**2**	**3**	**2**	**1**
	10-20	1	2	3	2	1	1	-	1	-	-	-	-
		-	**1**	**1**	**1**	-	**1**	**1**	-	-	**1**	-	**1**
	>20	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-
Southeast	<10	3	4	4	4	4	7	7	4	3	3	2	3
		4	**5**	**6**	**3**	**2**	**5**	**2**	**2**	**3**	**3**	**2**	**3**
	10-20	1	1	1	-	1	-	-	-	1	1	1	1
		1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	-	**1**
	>20	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-

* 22 years of records
Morning Winds (9.00 am)
Afternoon Winds (3.00 pm)

Seasonal wind speed and direction at Peak Hill are summarised in **Figure 3.3.**

The wind patterns shown in **Figure 3.3** reflect the change in directional influence throughout the year with northerly winds predominating in summer and southerlies in winter. Autumn and spring winds tend to be intermediate, although with significant southerly and northerly influences.

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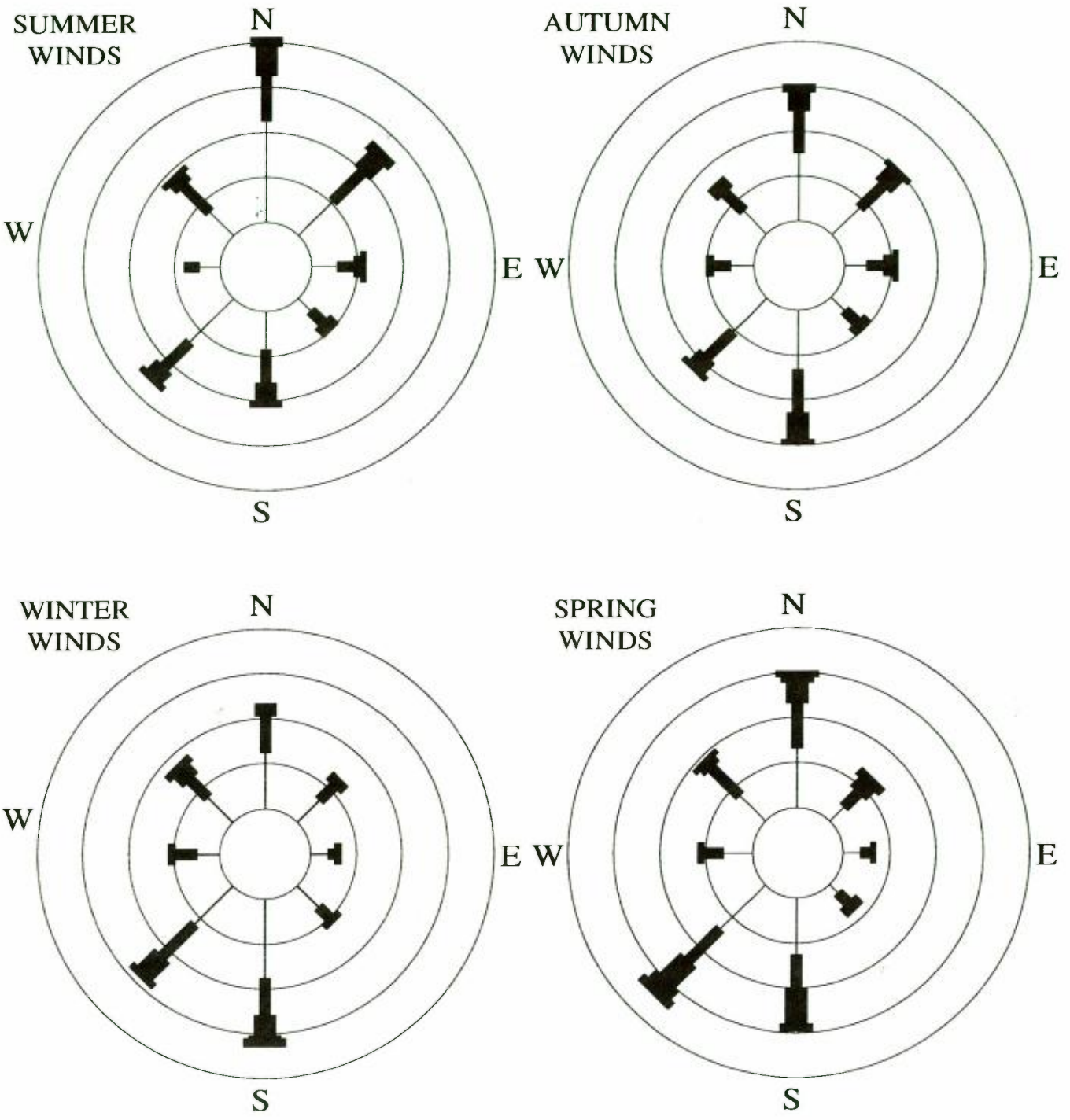

PREPARED FROM DATA COLLECTED
AT PEAK HILL FOR 21 YEARS

Figure 3.3
WIND SPEED
AND DIRECTION

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Continuous recordings (hourly averages) of wind speed and direction for Peak Hill, taken between March 1987 and May 1988 also indicate two main wind direction sectors (P. Zib & Associates Pty Limited, 1993). The first includes winds from the south to south-west and the second is associated with winds in a broad band between east and north to north-east. The continuous recordings show a higher relative frequency of easterly to north-easterly winds when compared to the long-term records presented in **Table 3.2**, possibly reflecting the differences in recording times, methodology and possibly sampling conditions, as well as fluctuations in wind regimes from year to year.

The climatic data provides a basis for mine planning, particularly with respect to air quality, noise enhancement and rehabilitation. There would be a greater need for dust suppression in summer due to evaporation and the predominance of northerly and north-easterly winds blowing towards the town.

3.6 WATER RESOURCES

3.6.1 Surface Water

Surface water in the vicinity of Peak Hill is a relatively scarce commodity. All creeks within the area and rivers are ephemeral and only flow following moderate to heavy rainfall. The Macquarie River, approximately 55 km to the north and northeast of Peak Hill, is the closest permanently flowing channel to the Project Site. The most permanent sources of surface water are the numerous small to moderate sized storage dams which are located on properties throughout the area, and the Bogan Weir (**Figure 1.2**) approximately 6 km west of the Project Site. These are replenished by surface runoff and used for watering of stock. The sewage treatment works, located on the north-western outskirts of the town (**Figure 2.1**), Bogan Weir (**Figure 1.2** and **Plate 2**) and the "Westray" impoundment (**Plate 3**), are the closest significant sources of surface water to the Project Site. The Sewage Treatment Plant produces effluent at a rate of 3.6 L/s, the Bogan Weir has a storage capacity of 385 ML and the "Westray" impoundment, an existing storage of approximately 120 ML. Across the Project Site, runoff occurs along several gullies and in erosion gutters adjacent to the numerous access tracks. Two small dams are located immediately adjacent to the northern Project Site boundary. Two water reservoirs, Peak Hill's water supply, are located on the top of the hill.

A baseline water quality monitoring programme was undertaken at the sites indicated in **Figure 3.4** in order to determine the quality of runoff on the Project Site and for comparison with data to be collected during the mining operation. These monitoring sites are:

PHW-1 - Diversion bank 300 m northwest of the main "glory hole";

PHW-2 - Ephemeral drainage line 700 m northeast of the main "glory hole";

PHW-3 - Ephemeral drainage line 550 m south of the main "glory hole";

PHW-4 - Ephemeral drainage line 620 m east of the main "glory hole";

PHW-5 - Ephemeral drainage line 540 m north, north east of the main "glory hole".

Surface water chemical data for two sampling periods, in March and April 1990, are presented in **Table 3.3.**

Runoff draining from the tailings dumps and some waste rock dumps (PHW-1) was found to be highly acidic and contain concentrations of sulphate, arsenic, copper and iron above the maximum limits set by the Environment Protection Authority (then State Pollution Control Commission). Higher concentrations of sulphate, arsenic, copper and iron were recorded at Site PHW-1 in March as rainfall during this period followed a long dry period during which significant oxidation of the tailings and waste rock dump material had occurred. Lower April values reflected a shorter oxidation period and sampling during a comparatively prolonged wet period.

High suspended solid levels were recorded at each of Sites PHW-1, PHW-2, PHW-3 and PHW-4 at the time of the March sampling. However, these results are typical of ephemeral flows from agricultural land or areas with limited ground cover, particularly when following an extensive dry period.

Since the baseline monitoring was undertaken, the Company, in association with the local Gulomogo Land Care Group and the Department of Mineral Resources, has removed the acid producing tailings and commenced rehabilitation works. Though no sampling has been undertaken since this action, it would be expected that improved water quality at Site PHW-1 would have resulted.

A sample of effluent from Peak Hill Sewage Treatment Plant (PHW-6) revealed the water from this source to be alkaline with a moderate sodium chloride level **(Table 3.3).**

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REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Mining
- Contour (Interval = 5m)
- Powerline (overhead)
- Powerline (underground)
- Raw Water Pipeline
- Residence
- PHN-1 Noise Monitoring Site
- PHA-1 Dust Monitoring Site
- PHW-4 Surface Water Monitoring Site

SCALE 1:12500

200 0 200 400 600m

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Figure 3.4
ENVIRONMENTAL MONITORING

TABLE 3.3

Surface Water Chemical Data, Peak Hill

Date Sampled	pH	E.C.	HCO_3	Cl	SO_4	Ca	Mg	K	Na	S.S.	Unfiltered							Filtered						
											As	Cu	Pb	Zn	Mn	Cd	Fe	As	Cu	Pb	Zn	Mn	Cd	Fe
Units		uS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SPCC LIMITS	-	-	-	250	250	-	-	-	-	-	0.05	1.0	0.05	5.0	-	0.01	-	-	-	-	-	0.001	-	0.3
PHW-1																								
30.03.90	2.60	1850	<1	45	800	28	4.7	3.7	3.0	2970	0.44	27	0.09	1.1	0.56	0.0	240	0.49	27	0.06	1.1	0.55	0.01	230
19.04.90	3.00	570	<1.0	7.2	170	27	2.9	2.2	2.5	450	0.30	3.3	0.02	0.57	0.14	0.01	14	0.01	3.3	0.03	0.58	0.14	0.01	14
PHW-2																								
30.03.90	5.60	29	3.9	4.0	4.0	0.4	0.3	2.3	1.7	3410	0.01	0.02	0.04	0.02	0.18	<0.01	1.5	0.01	0.06	0.02	0.02	0.19	<0.01	1.8
19.04.90	3.80	260	<1.0	16	78	10	9.1	11	8.5	28	<0.01	0.02	0.01	0.04	0.38	0.02	1.7	<0.01	0.02	0.01	0.04	0.38	0.02	1.7
PHW-3																								
30.03.90	5.50	48	4.9	8.1	2.7	1.5	0.7	2.3	1.4	1380	0.01	0.02	0.02	0.04	0.13	<0.01	1.4	0.01	0.03	0.01	0.04	0.13	<0.01	1.3
19.04.90	5.10	39	3.0	5.5	4.6	1.7	1.0	2.3	2.3	18	<0.01	<0.01	0.02	0.01	0.02	0.03	0.75	<0.01	<0.01	0.03	0.01	0.02	0.02	0.36
PHW-4																								
30.03.90	5.50	31	8.9	3.6	1.2	0.7	0.6	3.7	1.2	4790	<0.01	0.01	0.02	0.02	0.33	<0.01	1.6	<0.01	0.01	0.01	0.02	0.33	<0.01	1.5
19.04.90	5.05	100	3.0	23	2.6	1.7	2.5	4.5	11	32	<0.01	<0.01	0.01	0.01	0.04	0.02	1.1	<0.01	<0.01	0.04	0.01	0.04	0.02	0.81
PHW-5																								
30.03.90	5.60	46	5.9	5.0	2.1	1.8	1.0	4.8	1.3	76	0.01	<0.01	<0.01	<0.01	0.08	<0.01	0.80	<0.01	0.01	<0.01	0.02	0.08	<0.01	0.33
19.04.90	4.70	110	10	19	13	5.0	3.1	4.4	6.9	<1	<0.01	<0.01	0.02	0.01	0.05	0.04	0.43	<0.01	<0.01	0.02	0.01	0.05	0.02	0.29
PHW-6																								
30.03.90	9.0	870	82	150	59	11	2.6	19	150	42	<0.01	0.01	<0.01	0.03	0.01	<0.01	0.45	0.01	0.01	<0.01	0.03	0.01	<0.01	0.45

E.C. = Electrical conductivity
S.S. = Suspended solids

3.6.2 Groundwater

Information on registered groundwater bores located within a 5 km radius of Peak Hill was obtained from the Department of Water Resources to assess water availability for the project and the potential for groundwater contamination. Locations of these bores are shown on **Figure 1.2** and available information is presented in **Table 3.4**. Based on observations during exploratory percussion drilling on the Project Site, the water table within the area of the proposed open cut lies at or below 230 m AHD, the proposed limit of open cut development.

TABLE 3.4

Summary of Groundwater Bores in the Peak Hill Area

DWR No.	Distance from Project Area	Depth (m)	Aquifer	Yield (l/s)	Water Quality
15879	4.4	91.4	Unknown	Unknown	Unknown
16698	4.4	76.2	Unknown	Unknown	Unknown
26099	2.0	49.4	Unknown	Unknown	Unknown
28886	2.2	121.9	Unavailable	0.0	Unknown
33345	2.6	83.8	Fractured rock	0.4	Fresh
54594	6.0	61.1	Unknown	Unknown	High iron content
56594	2.5	54.2	Fractured rock	1.9	Good

The Peak Hill Sewage Treatment Plant effluent, the Bogan Weir and the "Westray" impoundment represent opportunities rather than constraints on the proposed development. Nevertheless, water collection and storage facilities on site should maximise interception and retention of surface runoff. Any water encountered within the base of the open cut should be retained within the confines of the open cut.

3.7 NOISE LEVELS

3.7.1 Introduction

A noise survey to establish the existing noise environment in the area of the Project Site was undertaken by Richard Heggie Associates Pty Limited on the 18th, 19th and 20th July 1990 in association with the Ashton Mining Proposal. Richard Heggie Associates Pty Limited have reviewed these levels and are of the opinion that as nothing has changed which would have reduced the ambient noise climate, the figures recorded at that time would still be applicable (Heggie, 1993).

Monitoring sites are shown on **Figure 3.4** and correspond to:

Site PHN-1: 41 Euchie Street (rear yard);

Site PHN-2: 26 Caswell Street (front boundary);

Site PHN-3: 77 Euchie Street (Dugga Street boundary);

Site PHN-4: Eastern property boundary at north-eastern end of Dugga Street.

Continuous (long-term) monitoring was carried out at Site PHN-1 over the 24 hour period 19th to 20th July 1990. Short term ("spot") monitoring over 15 minute intervals was carried out at Sites PHN-1, PHN-2, PHN-3 and PHN-4 on the night of 18th July 1990; during the mid and late morning, afternoon, evening and night of 19th July 1990 and during mid morning of 20th July 1990.

Sampling times were subsequently subdivided into:

- week day daytime (7.00 am to 10.00 pm); and
- week day night-time (10.00 pm to 7.00 am).

3.7.2 Statistical Analysis

Because environmental noise levels vary with time, it is necessary to describe the noise in terms of statistical descriptors. The statistical noise exceedance levels L_N in dB(A), are the levels exceeded for N per cent of the measurement period. For example, the L_{90} is the noise level which is exceeded for 90 per cent of the measurement period and approximates the average minimum noise level. This is often referred to as the "background" noise level. Similarly the L_{10} is the level exceeded for 10 per cent of the measurement period, and approximates the average maximum noise level. The L_{eq} provides a measure of the total noise energy during the measurement period.

The A-weighting is a standard electronic weighting applied to the measurement of sound to approximate the frequency response characteristics of the normal human ear when judging the loudness of a sound. **Table 3.5** presents a list of typical noise levels.

TABLE 3.5

Typical Noise Levels (dB(A))

Noise Level (dB(A))	Typical Noise
0	Threshold of hearing for a youth
20	Sound-proof booth of a broadcasting studio
30	Soft whisper at 2 m, clock ticking
40	Quiet refrigerator
50	Trees and grass rustling
55	Inside an average home
60	Inside a large store, birds whistling
65	Normal conversation, typewriter
70	Near a busy road
80	Motor car at 7 m, telephone ringing
90	Heavy truck at 7 m, lawnmower
100	Angle grinder
110	Pneumatic jackhammer at 2 m
120	Jet plane taking off at 70 m
130	Threshold of pain
140	Drag racing car at 3 m

3.7.3 Results

Results of background sound level measurements are presented in **Table 3.6** and reflect the typical noise environment of a small rural town. The predominant noise source noted during the surveys was road traffic, particularly heavy vehicles on the Newell Highway. However, the results at Site PHN-2 indicate that even those residences along the highway can experience background levels below 30 dB(A) at night. **Table 3.6** also includes the typical background noise levels adopted for the purposes of noise impact assessment.

TABLE 3.6

Measured Background Sound Levels

Monitoring Location (See Figure 3.4)	Background (L_{90}) Sound Level (dB(A))			
	DAY		NIGHT	
	Range	Typical L_{90} Level	Range	Typical L_{90} Level
Site PHN-1	27 - 37	35	28 - 37	30
Site PHN-2	39 - 47	40	22 - 35	30
Site PHN-3	35 - 45	35	26 - 34	30
Site PHN-4	31 - 41	35	21 - 40	30

The generation of noise on the Project Site would be a major constraint upon the development and operation of the project and would necessitate controls to ensure the acoustical amenity of nearby residential receivers is not adversely affected by project activities.

Ground vibration and airblast overpressure from blasting would similarly be a constraint on project operations.

3.8 AIR QUALITY

3.8.1 Existing Dust Sources and Levels

Air quality in the Peak Hill district is influenced by a number of factors, the most significant of which are:

- nearby agricultural activities;
- traffic on unsealed roads on and adjacent to the hill;
- cleared areas on the Project Site;
- old dumps of mine waste;
- the town's solid waste depot located adjacent to the Project Site to the north of the open cut; and
- rail traffic.

The relative impact of each of the above on the township is a function of the prevailing weather conditions. Wind data (**Figure 3.3**) suggests that winds from the east, i.e., those most likely to carry dust into the town from the open cut, constitute

only a small percentage of the overall wind patterns in Peak Hill. However, moderately strong northerly or northeasterly winds which are particularly prevalent during the summer months, would also have a significant influence on conditions within the town.

A dust monitoring programme was undertaken at five (5) residences within Peak Hill over the period March 1990 to May 1991 and re-established commencing December 1992 (**Figure 3.4**). The results of this programme are set out in **Table 3.7**.

The measured air quality with regard to dustfall of between approximately 0.75 and 1.5 g/m²/month (**Table 3.7**) is consistent with background dust levels recorded in other regions of New South Wales. Existing dustfall in the residential area (Sites PHA-1, PHA-4 and PHA-5, **Figure 3.4**) is influenced by local traffic and other activities consistent with residential living. Consequently, the mean dust deposition in the residential area is greater than the dustfall at Sites PHA-2 and PHA-3 which are located some distance away. Although particulate matter, in the form of atmospheric dust, is the major impurity in the air, organic material of mainly plant and insect origin is an essential part of the total atmospheric fallout. The mean organic component within the deposited dust comprised 24 to 38 per cent of the dust fall at each of the monitoring locations PHA-1 to PHA-5.

The Company should apply appropriate controls to minimise dust generation from bund construction, mining and processing activities. Successful control would necessitate the wetting down or surface layer binding of operational areas, particularly haul roads and other unsealed on-site roads, and early stabilisation/revegetation of surfaces such as the temporary bund wall.

TABLE 3.7

Deposit Gauge Analyses - Peak Hill Gold Project

PERIOD	SITE														
	PHA-1			PHA-2			PHA-3			PHA-4			PHA-5		
	Insoluble Solids	*Ash Fraction*	*Rainfall (mm)*	*Insoluble Solids*	*Ash Fraction*	*Rainfall (mm)*	*Insoluble Solids*	*Ash Fraction*	*Rainfall (mm)*	*Insoluble Solids*	*Ash Fraction*	*Rainfall (mm)*	*Insoluble Solids*	*Ash Fraction*	*Rainfall (mm)*
Baseline															
02.03.90 - 01.04.90	1.76	1.45	47	1.18	0.81	57	0.81	0.60	46	1.87	1.58	43	1.43	1.15	48
01.04.90 - 30.04.90	0.45	0.30	118	0.25	0.23	115	0.24	0.20	109	0.83	0.65	115	0.58	0.31	115
01.05.90 - 01.06.90	0.68	0.42	62	0.63	0.32	59		ND			ND		0.53	0.39	60
01.06.90 - 30.06.90	0.56	0.34	23	0.35	0.22	20	0.45	0.22	22	0.91	0.74	23	0.46	0.39	22
01.07.90 - 01.08.90	0.56	0.33	77	0.37	0.23	81	0.54	0.28	78	1.08	0.84	75	0.85	0.50	71
01.08.90 - 31.08.90	0.29	0.18	68	0.32	0.23	64	0.36	0.20	70	0.70	0.53	69	0.62	0.30	37
31.08.90 - 02.10.90	1.01	0.46	37	0.66	0.35	33	0.54	0.23	38	1.28	0.82	35	1.27	0.73	24
02.10.90 - 01.11.90	0.73	0.44	30	0.92	0.58	30	0.44	0.22	32	1.33	1.05	31	0.77	0.47	28
01.11.90 - 02.12.90	3.34	1.81	35	0.88	0.56	2	0.97	0.69	17	2.00	1.40	20	2.53	1.55	17
02.12.90 - 31.12.90	2.27	1.48	26	1.13	0.79	9	1.26	0.84	14	1.84	1.47	22	2.56	1.86	27
01.01.91 - 01.02.91	1.16	0.80	63	1.11	0.83	59	1.07	0.61	64	1.42	0.95	62	2.94	2.62	94
01.02.91 - 02.03.91	0.64	0.37	35	0.69	0.49	19	0.61	0.37	27	1.28	0.92	34	1.99	1.48	33
02.03.91 - 02.04.91	1.94	1.32	12	1.21	0.86	8	1.32	0.91	10	2.32	1.81	11	2.70	2.11	4
04.04.91 - 04.05.91	1.09	0.86	13	0.62	0.41	7	0.83	0.52	12	1.61	1.25	14	1.15	0.65	11
04.05.91 - 31.05.91	1.57	0.75	45	0.85	0.61	44	1.01	0.65	44	1.69	1.40	43	1.78	1.21	45
02.12.92 - 01.01.93	0.59	0.55	92	0.26	0.20	78	0.45	0.39	86	0.22	0.19	85	0.45	0.44	97
01.01.93 - 31.01.93	0.99	0.87	88	0.82	0.70	86	1.27	0.99	78				2.32	1.90	82
13.01.93 - 31.01.93										1.41	1.16	82			
01.02.93 - 01.03.93	1.53	1.11	73	1.16	0.76	65	0.96	0.62	65	1.61	1.21	75	1.70	1.19	70
Mean	1.17	66%		0.75	68%		0.81	62%		1.38	76%		1.48	72%	
Standard Deviation	0.78			0.34			0.41			0.52			0.86		

Note: Analyses undertaken by Australian Laboratory Services Pty Ltd

Insoluble Solids and Ash Fraction are expressed in grams/square metre/month

Except where noted, all units in g/m^2/month

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3.9 FLORA AND FAUNA

3.9.1 Introduction

A survey of the flora and fauna of the Project Site and adjacent areas was undertaken by Dr David Goldney of Charles Sturt University. Summaries of the results of these studies are presented below. A full copy of the report is presented in Goldney (1993).

3.9.2 Project Site Flora

Sampling Methodology

Vegetation was sampled along three (3) parallel transect lines running east-west across the study area, approximately 200 m apart. The middle transect passed through the Peak Hill Trig Station. Additional searches were carried out along the drainage lines, along tracks and intensively over the proposed mine site. Particular attention was given to the possible location of rare and endangered plant species.

Results

The vegetation structure of Peak Hill is typical of regenerating woodland and varies between the lower slopes adjacent to the town, steeper westward-facing midslopes and the ridgetop region. Box-type eucalypts such as *Eucalyptus melliodora* and *E. microcarpa* were dominant on the lower slopes, *E. dealbata* and a smaller number of *E. sideroxylon* were predominant on the midslopes and *E.dwyeri* and *Acacia doratoxylon* were most abundant on the ridgetop. The composition of the understorey also varied across the area.

In general, the northern section of the hill showed a much greater diversity of plant species than the fenced-off flora and fauna reserve immediately to the south (**Figure 3.5**). The flora and fauna reserve (**Figure 3.5**) contained an *E. dealbata-E. sideroxylon* association with a noticeably depleted understorey. The eastern and northern sections of the Project Site comprise cleared paddocks dominated by introduced herb species. No rare or endangered plant species were identified on the Project Site.

3.9.3 Project Site Fauna

Sampling Methodology

The following methods were used to identify vertebrate fauna in the area of the Project Site:

- **Mammals**
  - small mammal trapping using Elliot traps;
  - spotlighting; and
  - spoor, bones, hair identification and observation of tracks and sound.

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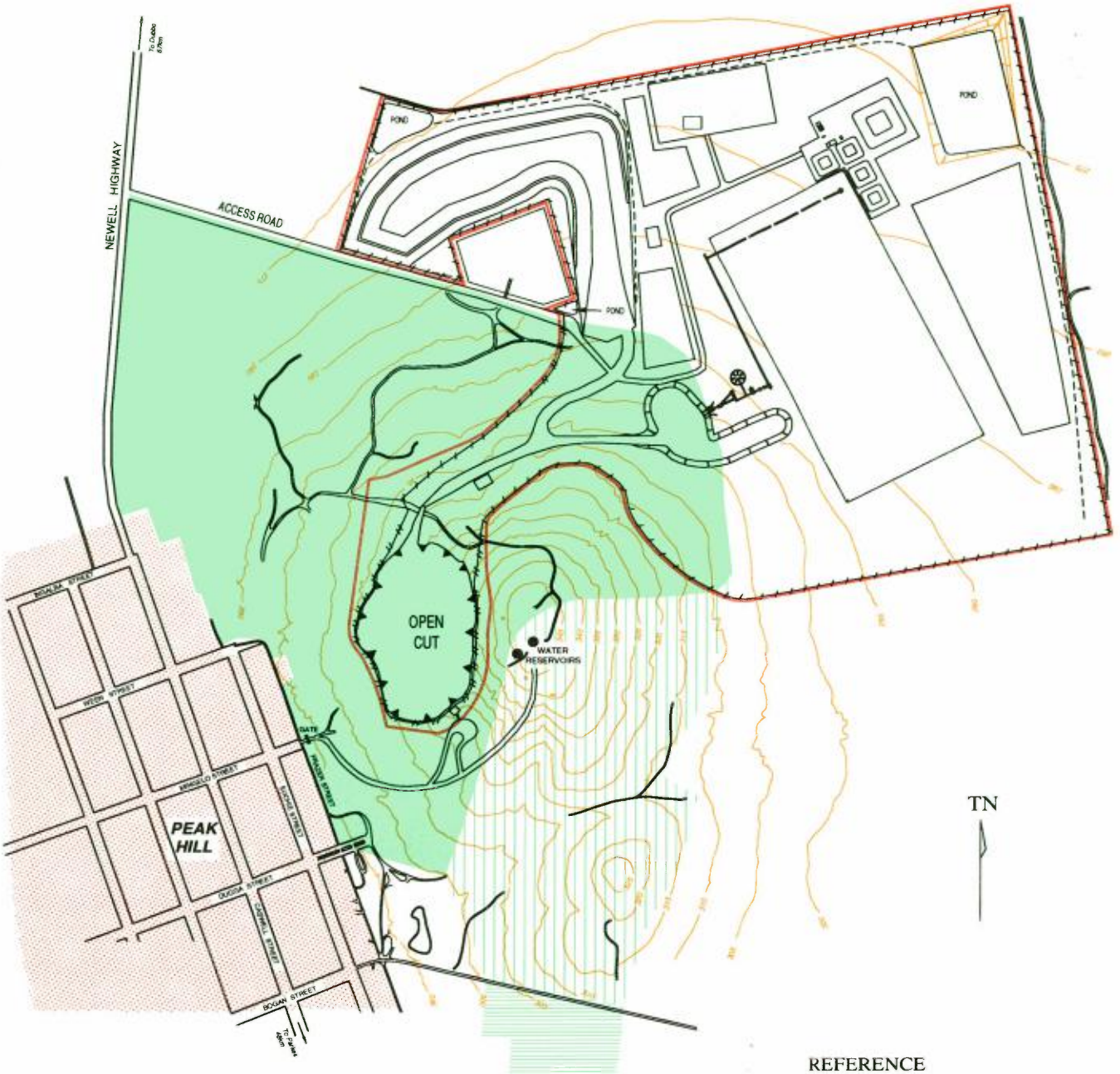

REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Mining
- Contour (Interval = 5m)
- Built-up Area

VEGETATION COMMUNITIES

- Habitat 1 — Very Disturbed Area
- Habitat 2 — Remnant Regenerating Woodland
- Habitat 3 — Flora and Fauna Reserve
- Cleared Pasture

SCALE 1:12500

200 0 200 400 600m

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Figure 3.5
VEGETATION AND FAUNAL HABITATS

No suitable flyways were observed being used by bats and hence no mist netting was undertaken.

- **Avifauna** - Birds were identified by sight, sound and in some cases traces by systematically walking along vegetation transect lines in the early mornings and late afternoons.
- **Reptiles and Amphibia** - Reptiles and Amphibia were searched for under logs, bark and rocks during the day and/or located during spot-lighting at night. Frogs were also identified by calls.

Results

Sixty three (63) vertebrate species were identified during the survey comprising three (3) amphibian, six (6) reptilian, forty six (46) avian and eight (8) mammalian species.

Of the species captured or observed, two (2) bird species (the Swift Parrot and the Painted Honeyeater) are listed in Part 2 Schedule 12 of NSW National Parks and Wildlife Act (1974), and a number of uncommon species and one rare bird, the Barking Owl (*Ninox connivens*) were identified. The single Swift Parrot and Painted Honeyeater observed, though occurring within the Company's mining leases, were found away from those areas to be disturbed as part of proposed project activities: the Painted Honeyeater was sighted in a small clearing approximately 400 m south-east of the town's water reservoirs and the Swift Parrot was sighted in trees along the roadside approximately 1 km south of the proposed ROM stockpile area.

3.9.4 Project Site Habitat and Species Diversity

Goldney considered that although the majority of the study area would be classified as regenerating woodland, it could be sub-divided into four (4) habitat types as shown on **Figure 3.5**.

Habitat 1 - highly disturbed area containing the bulk of the former gold mines, cleared areas, roads and weed infestation (**Plate 9**). Eucalypt regeneration is occurring often with significant stands of Biddy Bush and Acacias in the understorey. Arboreal mammals were absent, birds were uncommon, and smaller reptiles were commonly associated with scrap metal. Amphibians were associated with a small dam.

Habitat 2 - an area disturbed by past mining and containing a number of clearings but undergoing regeneration. The most species-rich of the four (4) habitats. Limited arboreal mammals were observed and the habitat where the Painted Honeyeater, Swift Parrot and Barking Owl were found.

Habitat 3 - The Flora and Fauna Reserve. The vegetation is similar to Habitat 1 but with fewer species mainly due to overgrazing by the captive kangaroos, and with significant weed invasion. A lack of management has led to a steady decline in habitat quality. Ground dwelling and arboreal mammals are absent and there were significantly fewer bird species present than in the other Habitats 1 and 2.

Habitat 4 - cleared agricultural land - vegetation comprises scattered box trees together with a mixture of native and introduced grasses and a range of weeds. The area was found to contain only a very small subset of the vertebrate species found in the adjacent bushland.

3.9.5 Flora and Fauna Along Pipeline Routes

The pipeline route from the Bogan River to the sewage treatment plant is generally cleared of native vegetation with occasional clumps of eucalypts remaining. The predominant ground cover comprises exotic and native pasture grass severely degraded by the infestation of weeds. The Bogan River pump station site has been cleared in the past for a former pumping station. Vegetation is limited to a mixture of native and exotic grass species and the occasional river gum.

In the area of the proposed sewage treatment plant surge pond, the vegetation comprises a stand of Cumbungi (*Typha orientale*) in the waterlogged areas currently receiving maturation pond effluent and exotic and native grasses on the drier slopes. The area also contains scattered eucalypts.

The pipeline route within Crown Reserve No. R78459 to the Project Site boundary comprises the very disturbed woodland community (Habitat 1) described by Goldney (1993) (**Figure 3.5**).

The pipeline route from the "Westray" impoundment to the Project Site comprises cleared agricultural land both on the "Westray" property and on the public road reserve to the east of the Project Site. Occasional small clumps of trees on both have been retained for stock shelter.

Faunal usage of all but the Crown Reserve section of the pipeline routes would generally be limited to that by birds roosting in transit between the larger vegetation communities such as that on Peak Hill and, for example, similar areas along the Bogan River. Faunal usage of the pipeline route within Reserve No. R78459 would be as described by Goldney (1993).

The occurrence of native vegetation on the proposed open cut and haulroad areas is not a constraint upon the proposal. The principal community of ecological significance (Habitat 2) would be unaffected by project activities. Furthermore, both the flora and fauna on Peak Hill are better represented in the nearby Hervey Range State Forest and Curembenya Nature Reserve. Similarly, the vegetation communities along the pipeline routes would not pose a constraint to project development. However, in the latter case, where possible the pipeline route would avoid the unnecessary disturbance of the remaining trees.

3.10 ZONING, LAND USE AND LAND OWNERSHIP

3.10.1 Planning Instruments

The Project Site and the adjacent township of Peak Hill are located within the Parkes Shire, County of Narromine and Parish of Mingelo.

The Project Site is zoned Rural 1(a) in the Parkes Local Environmental Plan gazetted 14th December 1990. Mining activities such as those proposed are a permissible land use with Council consent. Peak Hill township is zoned 2(v) under the Local Environment Plan. Zone boundaries are indicated on **Figure 3.6.**

It is notable that within the Shire of Parkes Planning Study (July 1986), prepared as a background document for the draft of the Parkes Local Environmental Plan, the potential for mining to play a significant part in the Parkes District economy was recognised. Accordingly, there is no proposal for the development of Peak Hill township in an easterly direction from its current limits. Any future expansion would firstly utilise available land within the existing 2(v) zone and then areas to the west of the railway line (**Figure 1.2**).

3.10.2 Site's Land Use

The abandoned glory holes on Peak Hill are presently a tourist attraction. The numerous access tracks on the hill provide a course for weekend trail bike riders. The hill's elevation lends itself for use as a location for communications equipment and the town's water supply reservoirs. Parkes Shire Council obtains gravel for road maintenance from an open cut on the northern slopes of the hill (P.O.1956/3 - Reserve No.78459 - **Figure 3.7** and **Plate 1**). The residence on Portion 452 is owned by Associated Gold Fields NL.

3.10.3 Surrounding Land Uses

The solid waste depot for Peak Hill township is located on the north-eastern slopes of the Peak Hill, adjacent to the Project Site (Reserve No. R35008 - **Figure 3.7** and **Plate 1**). The depot currently covers less than 1 ha of the 4 ha area set aside for it.

A flora and fauna reserve and Peak Hill golf course are located to the south and southeast of the Project Site respectively (**Figure 3.7**). The centre of Peak Hill township is located approximately 400 m west of the Project.

The closest residences to the Project Site, those on Euchie Street between Mingelo and Ween Streets, lie approximately 200 m from the closest Project Site boundary. Frazer Court Hostel, comprising ten (10) self-care units and a nine (9) bed hostel for those people requiring some nursing care, is located at the southern end of Frazer Street, approximately 250 m from the southern-most extension of the proposed open cut. The nearest residence to the processing plant and leach pad area is the "Little Oakleigh" homestead, approximately 600 m south of leach pad module No. 10 (**Plate 1**).

Cleared land to the southeast, east and north is used mainly for sheep and cattle grazing and wheat growing.

3.10.4 Land Ownership

Details of land ownership in the vicinity of the Project Site are shown on **Figure 3.7.** Owners of properties on the eastern side of Euchie Street, between Ween and Dugga Streets including those within Frazer Street, are listed in **Table 3.8.**

Portion 509 was formerly the subject of Aboriginal Land Claim 2844. Portion 512 was the subject of Aboriginal Land Claim 2638. Title to these Portions was granted to the Peak Hill Local Aboriginal Lands Council on 20th March 1987 and 16th March 1988 respectively.

TABLE 3.8
Peak Hill Property Owners*
(Eastern side of Euchie Street between Ween and Dugga Streets)

Euchie Street				Frazer Street	
No.	Owner	No.	Owner	No.	Owner
41	Mr A.F. Currington	63	Mr W. M. Hartin		Frazer Court Hostel
43	Mr and Mrs R.G. Davis	65, 67	Trustees, Masonic Lodge	2	Mrs E. Harrison
45	Mr A.T. Angus	69	Mr G.E. Nisbet	3	Mr I.R. Sellers
47	Mr A.T. Angus	71	Mr and Mrs J. H. Davis		
49	Mrs H.E. McGrath	73	Mr P.S. Aitchison		
51	Mr and Mrs J.W. van der Reyden	75	The Manager, Warramunga Advancement Co-Op Pty Ltd		
53	Mr D. Dinh/Ms C. Ting	77, 79	Mrs J.R. Sellers		
55	Hebola Pty Ltd				
57	Mr and Mrs D.J. O'Leary				
59	Mr D.M. McAuliffe				
61	Mr and Mrs N.J. Kopp				

* Information supplied by Parkes Shire Council

Most land within the Project Site boundaries is Crown land on which a number of leases, reserves and permissive occupancies etc. currently exist. These are also shown on **Figure 3.7** and the status of each is indicated in **Table 3.9.**

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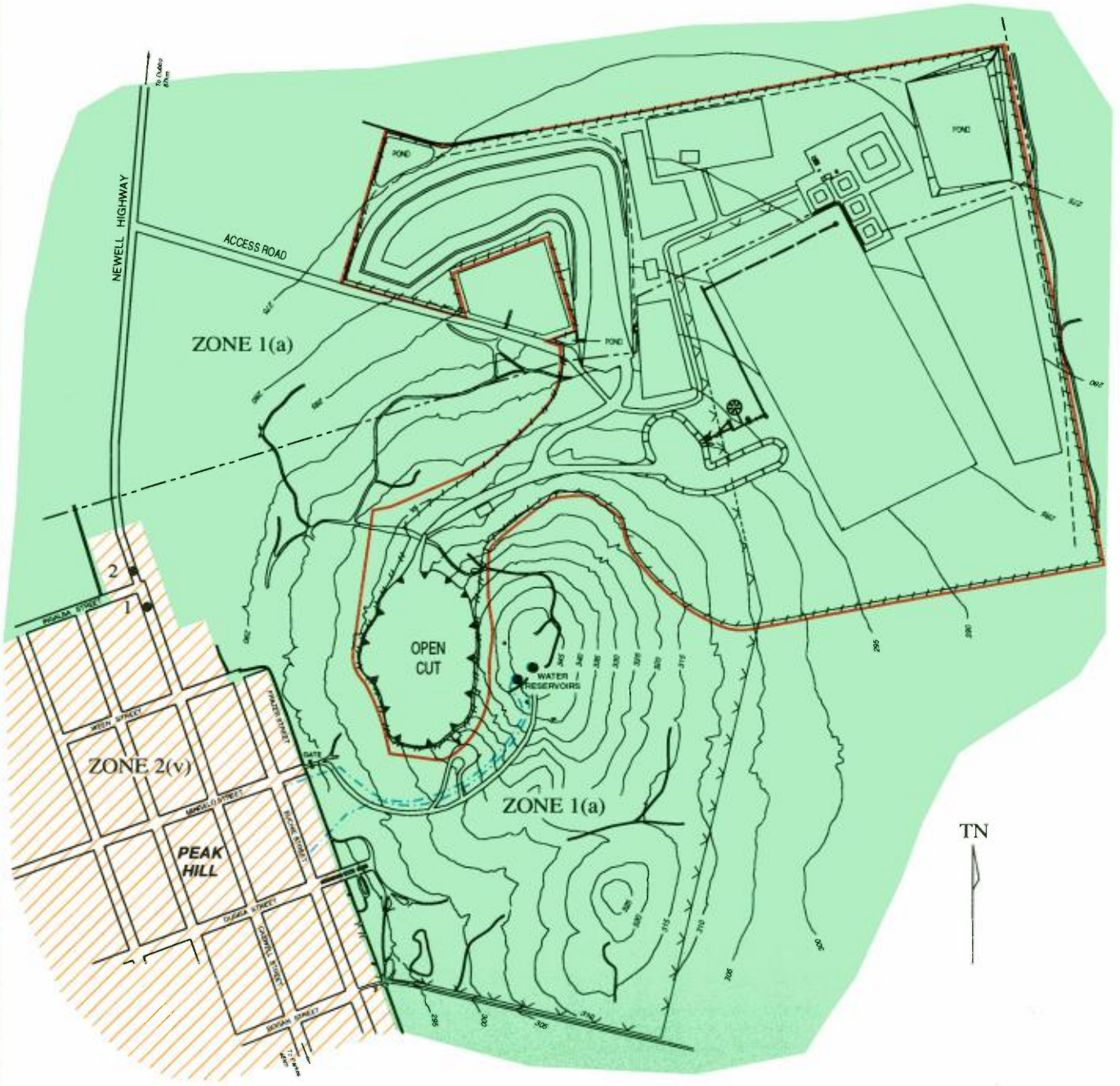

REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Mining
- Contour (Interval = 5m)
- Proposed Powerline (overhead)
- Proposed Powerline (underground)
- Proposed Raw Water Pipeline
- Re-routed Town Water Supply Main
- 2 ● Traffic Counter
- Zone 1(a)
- Zone 2(v)

SCALE 1:12500

200 0 200 400 600m

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Figure 3.6
ZONING, TRANSPORT AND SERVICES

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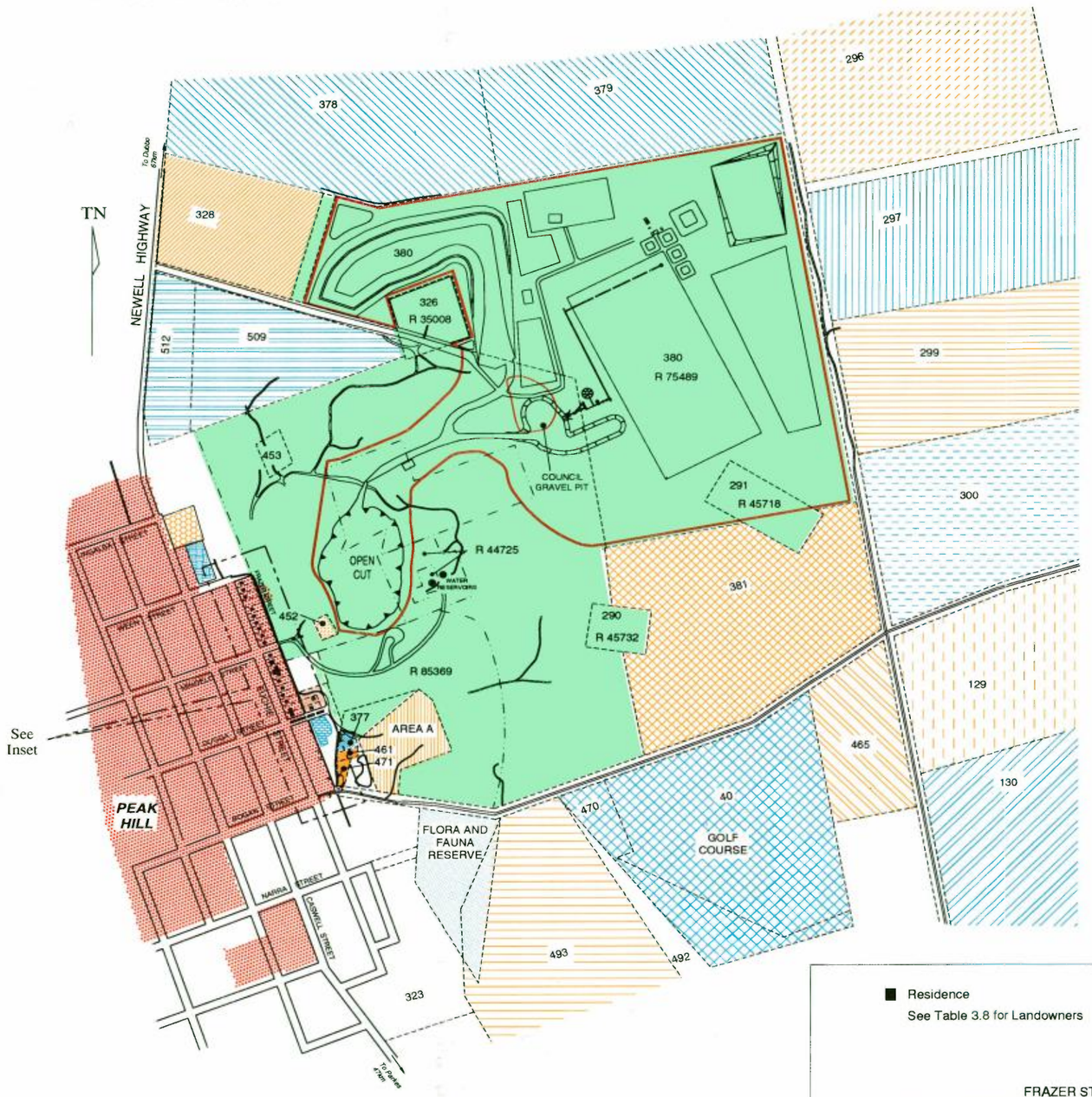
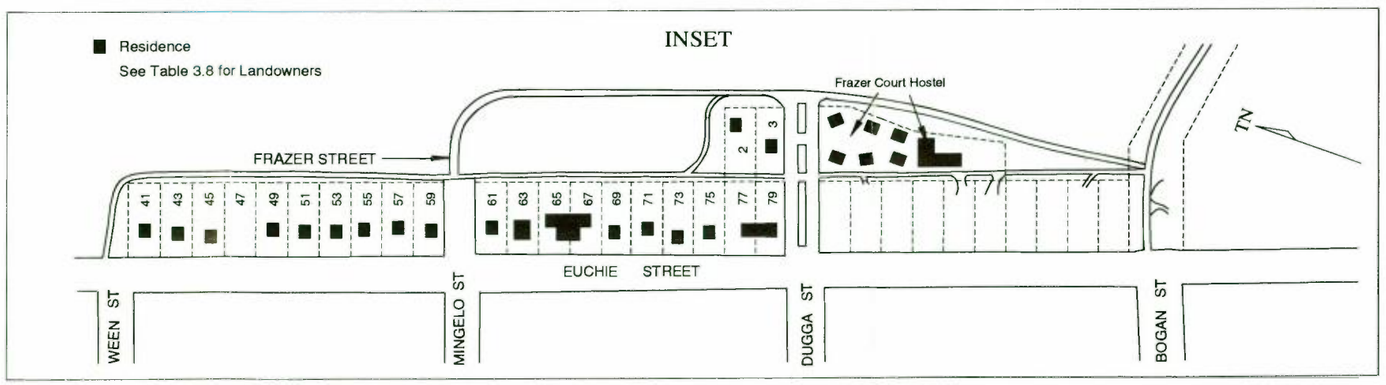


REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Extraction
- Built-up Area
- 380 Lot Boundary and Number
- Motel
- Frazer Court Hostel
- Caravan Park
- Crown Reserve Boundary

LAND OWNERSHIP

- R 45732 Crown Land (Reserve No. shown)
- 380 Mr D.R. Stanford (incomplete purchase of Crown Land)
- Mr D.R. Stanford
- Mr R.M. Stanford
- Mr P.J. Davies
- Mr & Mrs P.M. Hundy
- Mr P.F. O'Leary
- Mr T. Attenborough
- Mr H.F. Stone
- Mrs D.N. Job
- Mr G.J. Rosser
- 452 Associated Gold Fields NL
- Peak Hill Aboriginal Land Council
- 453 Parkes Shire Council (Crown Land : P.O. 1956-3)
- Mrs V.V. Denyer
- Mr K.J. Stone
- Mr N.I. Rosser
- Peak Hill Golf Club Limited
- Flora & Fauna Reserve
- Mr & Mrs F.J. Castle
- Mr & Mrs J.W. Ivers, Mr & Mrs L.J. Gallagher as Area A - Lots 468, 376, 145, 466, 467, 489



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SCALE 1:15000
200 0 250 500 750m

Figure 3.7
LAND OWNERSHIP

TABLE 3.9

Status of Crown Land

Figure 3.7 Reference	Tenure Classification/Status
Portion 380	Incomplete purchase in the name of D.R. Stanford
Reserve 35008	For rubbish depot
Reserve 78459	From sale for quarry
Permissive Occupancy 1956- 3 Parkes	Parkes Shire Council for gravel and sand extraction.
Reserve 44725	For Trig Purposes - Trig Station and water reservoirs (Note: areas appropriated 13.3.1912 and 28.12.1912 for Peak Hill Water Supply)
Reserve 85369	From sale for Soil Conservation
Portion 290	Reserve 45732 for night soil depot

Current mining tenements on the Project Site are shown in **Figure 2.2.**

Zoning, land uses and existing land users do not pose a constraint on the proposal. However, the close proximity of some residences within Peak Hill township and the surrounding areas would constrain the project with respect to air quality, noise and blasting.

3.11 ARCHAEOLOGICAL HISTORY

3.11.1 Survey Methods

The Pre-European and European history of the Project Site and adjacent areas was studied by consultant archaeologists Anutech Pty Limited on behalf of Peko Wallsend Limited. The study comprised:

- archival research;
- discussions with the Peak Hill Aboriginal Lands Council; and
- field investigations.

3.11.2 Archaeological Sites and Significance

Pre-European Sites

Within close proximity to Peak Hill, a number of pre-historic sites has been recorded. For the most part, the lithic scatters which mark open camp sites are found close to watercourses. Similarly, carved and scarred trees are found in close proximity to rivers and creeks.

Immediately to the north of the Project Site, an area of land (Portions 509 and 512, **(Figure 3.7)**, the site of a 1950's - 1960's "shanty" camp, has been granted to the Peak Hill Aboriginal Lands Council.

Within the Project Site, as shown on **Figure 2.1** and the pipeline route within Reserve No.78459, no archaeological sites were located. Furthermore, the Peak Hill Aboriginal Lands Council has also advised the Company that there are no sites of aboriginal significance within or in close proximity to the Project Site, nor any sites of aboriginal significance along the proposed pipeline from the Bogan Weir to the surge pond, from the surge pond to the boundary within Reserve No. R 78459, nor from the "Westray" impoundment to the Project Site.

European Sites

The significance of the Peak Hill mines lies in their historical ties to Peak Hill, their proximity to the town and the belief that the majority of the existing glory holes and all of the exploratory shafts were dug by hand. As such, Anutech Pty Limited (1987) considered it likely that some members of the local community would wish to have some relics of the town's mining history preserved. The relics from former mining include:

- the large open cut and shafts;
- numerous shafts and mullock heaps;
- structural remains, e.g. concrete foundations **(Plate 10)**;
- debris from an assay laboratory; and a
- Cornish boiler **(Plate 11)**.

Vandalism of the remains has occurred.

The Company has consulted with the NSW Heritage Council and been advised that nothing within the area of the Project Site is subject to a conservation instrument, order or notice **(Appendix 2)**. Similarly the National Trust of NSW has not assigned any classification to the area.

Although the N.S.W. Heritage Council has no listing for the site of former Peak Hill gold mining activities and the National Trust of N.S.W., though listing the area has not attributed any classification, historical aspects do pose a constraint on the proposal. Prior to the removal of any remains of mining apparatus and evidence of past mining technology, the Company should consult with the local historical society and if so required, retrieve any items of local historical significance. The Company should also assist tourist accessibility to areas of former mining on Peak Hill which are to be unaffected by the proposal, e.g. the Crown Workings.

Plate 10: Existing areas of disturbance adjacent to the main glory hole showing remnant concrete foundations and waste stockpiles. (Ref: 203J/16)

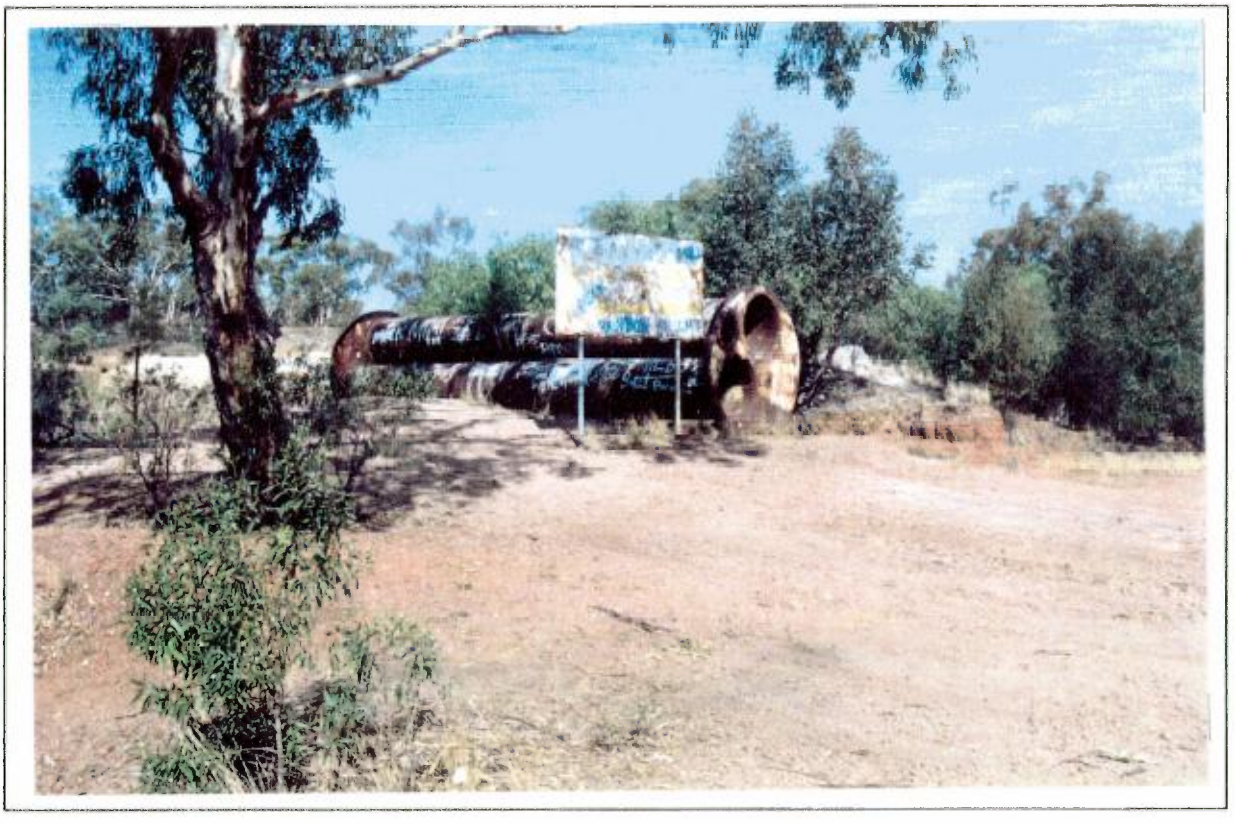


Plate 11: The remnant cornish boiler adjacent to the main glory hole. (Ref: 203J/17)

Pre-European aspects do not pose a constraint on the proposal.

3.12 PARKES RADIO TELESCOPE

3.12.1 Potential Sources of Interference

The Parkes Radio Telescope is located 31.5 km south of, and with direct line of sight to the eastern side of the Project Site. The possible impact of the project on the functioning of the telescope has been discussed with Dr Brian Robinson and Mr Malcolm Sinclair (CSIRO Radiophysics Division, Epping, New South Wales) and Mr David Cooke (Experimental Scientist and Officer in Charge, Parkes Observatory).

Of greatest concern is the generation of electromagnetic frequencies in the band from about 100 mHz to 2 000 mHz. Equipment which is likely to produce frequencies within this range include:

- large electric motors, especially DC motors;
- welding equipment;
- heavy current switch gear, both mechanical and solid-state (e.g. thyristors);
- high voltage power lines with undersize insulators;
- some two-way radio equipment; and
- some computer terminals, especially mainframe computers.

A range of design and operational safeguards would need to be developed to ensure the project does not adversely affect the operation of the Parkes Radio Telescope.

3.13 SOCIO-ECONOMIC FACTORS

3.13.1 Siting

The Project Site lies within Parkes Shire. Parkes, 48 km south by road and Dubbo, 71 km north-east by road are the closest major centres to the Project Site (**Figure 1.1**).

With the exception of information pertaining to housing and accommodation, socio-economic data in this Statement is drawn from the 1986 Census and preliminary 1991 Census data provided by the Australian Bureau of Statistics.

1986 Housing and Accommodation census data has been updated through consultation with the real estate agents in Peak Hill.

3.13.2 Population

In 1986, the township of Peak Hill and Shire of Parkes had populations of 1 091 and 14 057 persons respectively. Approximately 59 per cent of the 1986 Peak Hill population were of working age (15 to 64 years) which was significantly lower than the State average at that time of 66 per cent. At 15.4 per cent, elderly residents (i.e. those

65 years or older) represented a significant proportion of the Peak Hill population. Elderly residents within Parkes Shire in the 1986 census represented 12.9 per cent of the population.

The preliminary 1991 Census population for Parkes Shire was 13 462. Over the intercensal period 1981-1986, the population of Parkes Shire exhibited a minor (2.5 per cent) net population decline. Based on the preliminary 1991 census data, this trend appears to have continued.

3.13.3 Employment

In 1986, community services, wholesale/retail and agriculture were the most significant employment sectors in Peak Hill, accounting for more than 54 per cent of the workforce and reflecting the town's role as a service centre to the local district. The remainder were largely employed in construction (6 per cent), finance property and business services (6.7 per cent), transportation (6.4 per cent) and manufacturing (4.6 per cent). At the time, the mining industry accounted for less than 2 per cent of the Shire's workforce and employed no Peak Hill residents.

Within Parkes Shire, preliminary 1991 Census data shows agriculture (20 per cent), community services (17 per cent), wholesale/retail (17 per cent), recreational and personal (8 per cent) and transport related employment (7.3 per cent) to be the major employers, followed by recreational/personal (6.2 per cent) and finance, public administration, construction and manufacturing, each employing 4 to 6 per cent of the workforce. In 1991, mining continued to account for less than 2 per cent of the Shire's workforce, although by now this number would have increased with the development of the Northparkes venture.

Unemployment levels within the Peak Hill community are high and at the time of the 1986 Census was approximately 25 per cent or approximately three (3) times the State average of 8.3 per cent. Within Parkes Shire unemployment levels at the time of the 1986 Census was 13 per cent. Unemployment levels for Parkes Shire at the 1991 Census had increased to 15 per cent and although the latest data is unavailable, there is no reason to expect this trend of increasing unemployment levels would not have also continued within Peak Hill.

3.13.4 Housing

According to the 1986 census, very little accommodation was available in Peak Hill. Of the 36 vacant dwellings in town at that time, only four were listed as being for sale and three were available for rental. In early May 1993, the Peak Hill real estate agents advised that there were in excess of fifty (50) houses listed for sale but no rental accommodation available. However, there is an application with Parkes Shire Council for the construction of four (4) units/flats for rental purposes and/or sale.

Peak Hill's two caravan parks have limited short-term accommodation available. The town also has three (3) motels (total 86 beds) and two (2) hotels (total 34 beds). An additional 38 beds are available in Tomingley. Hotel, Motel and rental accommodation would also be available in Parkes.

3.13.5 Services

Several clubs, including the golf club, bowling club and Ex-services and Citizens' club, offer recreational activities within the town. Peak Hill has four (4) churches, a hospital, swimming pool, a retirement complex (Frazer Court Hostel) and two (2) schools. One school provides education to Grade 6 and the other to Grade 12, and both have the capacity to accept any increase in enrolments that may eventuate.

In addition to local commercial and service businesses, the town of Peak Hill has a small steel fabrication industry and a leisure, arts and crafts centre. However, several of the premises within the business district are vacant.

Socio-economic aspects should not be a constraint upon project development. The township is adequately provided with services and facilities and there is an available and currently unemployed workforce. Short term rental accommodation in houses within Peak Hill may be a constraint during the project pre-production phase.

3.14 VISIBILITY

3.14.1 Existing Visibility

Peak Hill is part of an elevated and prominent landform in the district and, as such, is visible from most aspects of the surrounding countryside. Views of the hill from within the town itself vary depending on the proximity to the hill, and the extent and height of intervening vegetation and buildings. Views of the hill from Warrah Street, Borri Street, Dugga and Derribong Streets are presented in **Plates 12, 13, 14** and **15.**

From south of Mingelo Street, areas of prior disturbance on the western and north-western face of the hill are generally shielded by the existing vegetation, particularly the Pepper Trees located to the east of Frazer Street. Existing areas of disturbance are not visible from properties north of Mingelo Street, despite the more open vegetation.

In order to minimise visual impact, as many trees as possible should be retained to screen the Project Site from nearby residences and public roads. Progressive rehabilitation together with enrichment plantings and screen plantings in selected areas should be employed to further reduce long-term visual impact.

3.15 TRANSPORTATION

3.15.1 Road Network

Peak Hill is serviced by the Newell Highway (MR 39) which passes through the centre of town and which, within the town, is referred to as Caswell Street. The highway is maintained in average condition and carries the large number of trucks travelling between Brisbane and Melbourne via Dubbo and Parkes. Department of Main Roads/Roads and Traffic Authority (RTA) figures indicate increasing vehicular usage of the Newell Highway in Peak Hill over the last 10-15 years. Prior to 1985, traffic counting stations were located immediately north and south of Ingalba Street (Tullamore Road) Peak Hill (**Figure 3.6**). Between 1976 and 1984 (last available data) annual average daily traffic (AADT) levels south of Ingalba Street (Station No. 1, **Figure 3.6**) increased from 2 350 to 2 930 (25 per cent) and north of Ingalba Street (Station No. 2 **Figure 3.6**) from 2 240 to 2 510 (12 per cent). AADT figures do not differentiate between vehicle types or direction of travel.

Prior to 1981, a traffic counting station was maintained on the Newell Highway, 5 km south of the Peak Hill post office. The AADT count for 1980 at this location was 2 390.

Three (3) counting stations continue to operate on the Newell Highway:

- approximately 5.1 km north of the Post Office (Station No.3, **Figure 1.1**);
- immediately north of Tomingley, 18 kms north of Peak Hill on the Newell Highway (Station 4, **Figure 1.1**); and
- 3.2 km north of Parkes (Station No. 5, **Figure 1.1**).

The 1988 AADT count for the Station No. 3 was 3 296 and the 1991 AADT for Station No. 4, 3 070 vehicles. The 1991 AADT for Station No. 5 was 3 700 vehicles. Straight line regression analyses for Station No's 4 and 5 were undertaken by the Roads and Traffic Authority using a measured 2.9 per cent (Station No. 5) and 0.3 per cent (Station No. 4) annual increase in AADT. On this basis, the AADT for the Newell Highway at Station No. 4 would be 3 130 in 1995 and 3 180 in 2000 AD, and for Station No. 5 would be 4 170 in 1995 and 4 710 in 2000.

The RTA has advised that in excess of 30 per cent of vehicle movements on the Newell Highway are attributable to heavy vehicles.

Within Peak Hill township, most roads are sealed. However, Frazer Street, west of the Project Site is unsealed. Other minor roads between Peak Hill and nearby small settlements are sealed for short distances out of Peak Hill only.

Several unsealed roads currently provide access to the Project Site from Peak Hill township. The main access to the top of the hill is an extension of Mingelo Street. Other tracks previously connected to both Ween and Dugga Streets have been blocked by bunds constructed to direct runoff from the hill around Peak Hill township. The Project Site itself is crossed by a number of unsealed tracks.

Plate 12: A view to the east from Warrah Street towards Peak Hill. Areas of former mining on the hill are shielded by intervening vegetation. (Ref: GM/5)

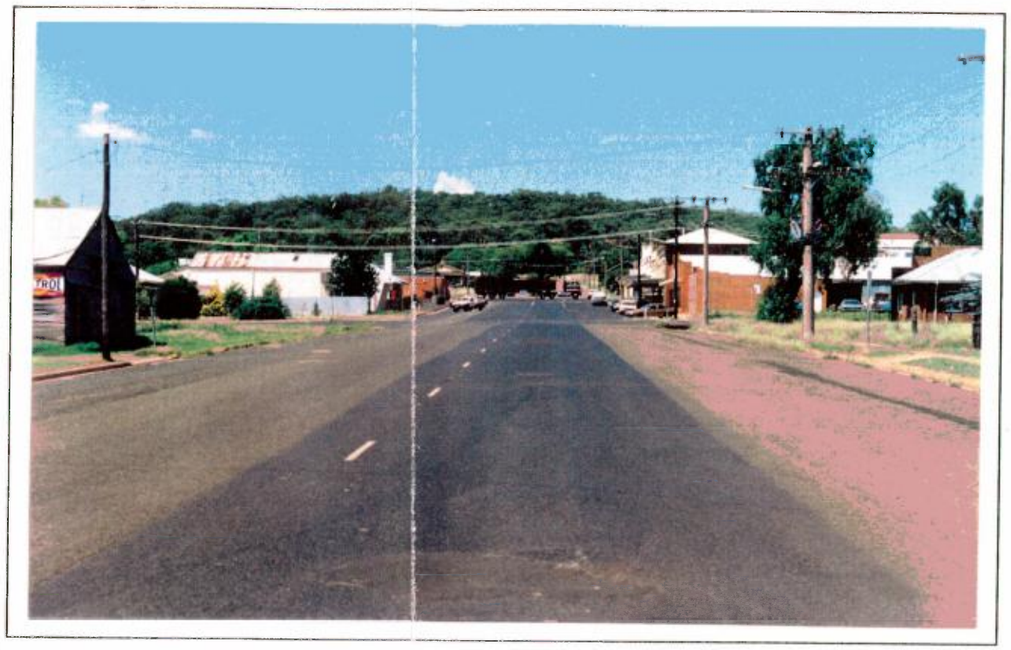
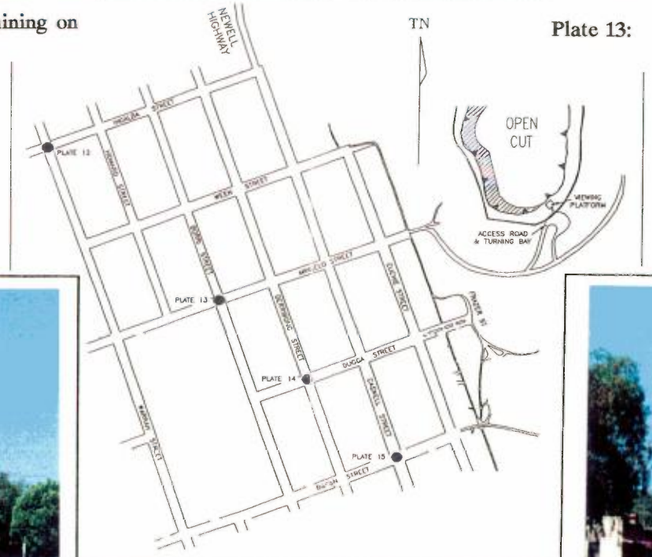


Plate 13: A view to the east from Borri Street along Mingelo Street towards Peak Hill. (Ref: GM/6)



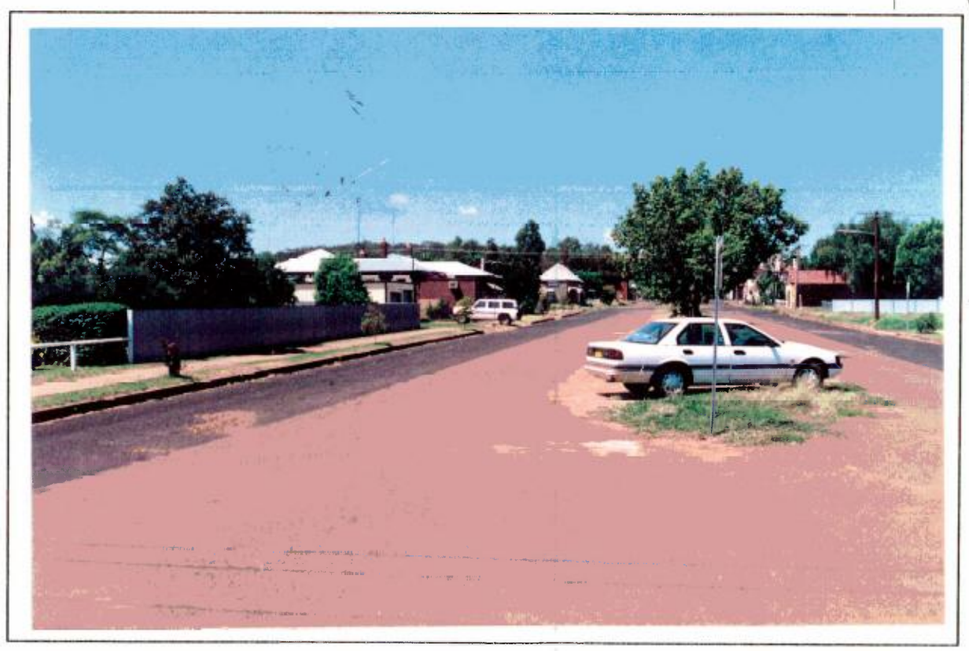


Plate 14: A view along Dugga Street to the east/north-east towards Peak Hill. Views of Peak Hill are obstructed by intervening buildings and vegetation. (Ref: GM/7)

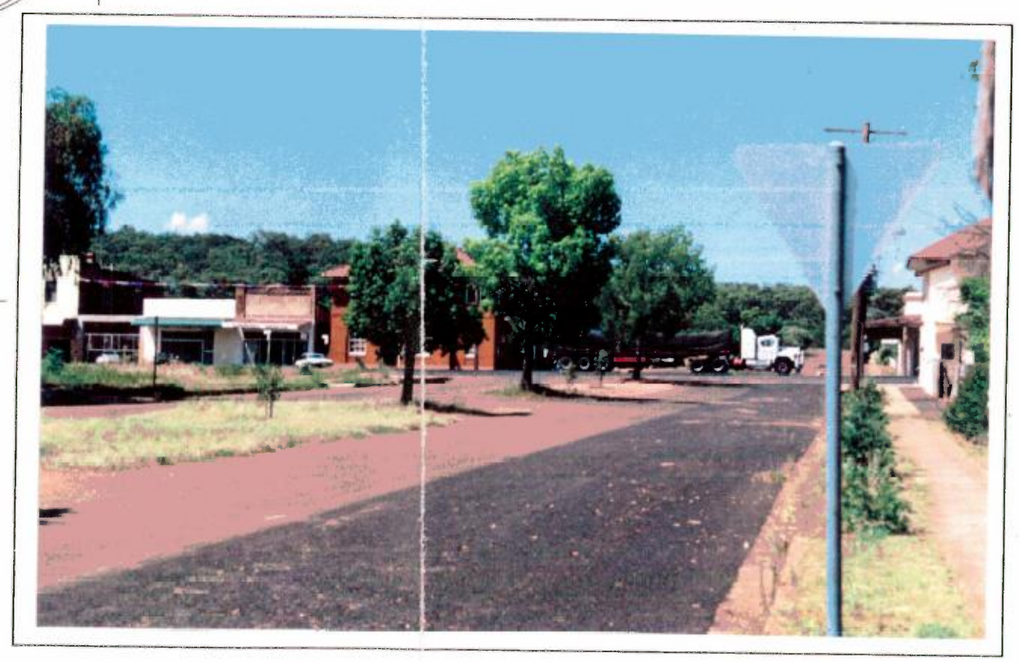


Plate 15: A view to the north-east towards Peak Hill from the intersection of Derribong and Bogan Streets. (Ref: GM/8)

The unsealed road to the north of the Project Site leads to the town's solid waste depot. This road is used mainly by Council employees on week days and local residents on weekends and also provides access for Council trucks to the gravel open cut at the northern end of the hill (**Figure 3.7**). Visibility from the solid waste depot access road to the north along the Newell Highway is unobstructed although views to the north are partially obstructed by roadside trees.

A number of narrow roads provide access to the water reservoirs at the top of the hill. The principal reservoir access road, which runs up the western side of the hill from Mingelo Street, is rutted in the steeper upper sections.

3.15.2 Rail Network

Peak Hill township is serviced by the Parkes-Dubbo railway line which skirts the western side of the town (**Figures 1.1** and **1.2**). This line carries an average of thirteen (13) general freight trains per week in each direction, with the number increasing to 25 to 30 during the wheat harvest.

The existing transportation network does not represent a constraint to the proposed development. However, development of the open cut would necessitate the relocation of the water reservoir and tourist access road. Road modifications including an overtaking lane and widened splays would be required on the Newell Highway adjacent to the Project Site access road (the existing solid waste depot access) to ensure employee and public safety.

3.16 SERVICES

Peak Hill obtains its potable water from Parkes via two covered reservoirs located at the top of the hill. These concrete reservoirs, one of which is sealed and sits above ground level and the other which is excavated into the hill and covered with a locked shed, are fed by a 200 mm diameter rising water main and supply a 150 mm gravity water main to the town.

Water pressure in the town, though adequate, has been a problem in the past to the residents in Euchie Street.

An underground telephone cable and overhead power line have been connected to the reservoir area from the town.

According to the Central West County Council, the electricity authority responsible for the Peak Hill area, an 11 kV supply is available in the town for use on the Project Site. However, supply to the Project Site would necessitate the upgrade of the existing line along the western extension of Bogan Street to 11 kV and the construction of an 11 kV branch line to the Project Site.

Adequate telephone capacity for a mine site would also be available, if required.

The existing services do not pose a major constraint on project development. However, the Company should develop a reliable alternative to town water for its processing and dust suppression requirements. Upgrading of the existing Bogan Street power line and construction of a 11 kV branch line would also be required. Blasting activities should be designed to ensure the continued integrity of the water reservoirs and pipelines.

SECTION 4

Design and Operational Safeguards

SECTION 4

DESIGN AND OPERATIONAL SAFEGUARDS

4.1 PREAMBLE

This section describes the environmental safeguards, operating procedures and monitoring programmes which would be adopted into the design and operation of the proposed Peak Hill Gold Project to ensure that the area within and surrounding the proposed Project Site is not adversely affected by the proposal and that the level of impact meets specified criteria or community expectations.

4.2 AIR POLLUTION CONTROLS

4.2.1 Potential Air Contaminants

Atmospheric dust would be the main component of air emissions from the project, most notably from topsoil stripping and road, bund and leach pad and infrastructure construction during the pre-production phase and from drilling, blasting, vehicle movements and ore crushing operations, and from the surfaces of topsoil stockpiles, the waste rock emplacement and the bund walls during the production phase. Other possible sources of air emissions would be exhaust fumes from mobile equipment, blasting fumes, smoke, and evaporative and spray emissions from the leaching area.

4.2.2 Dust Control Measures

Wind patterns for Peak Hill (**Figure 3.3**) and computer modelling of dust emissions based upon continuous wind data indicate that the potential for increased levels of atmospheric dust in the air outside the mine would be at its maximum in summer when moderate to strong northerly and north-easterly winds blow across the town from the Project Site.

The Company would ensure a wide range of dust and management controls is incorporated into the project to guarantee the air quality in Peak Hill is not adversely affected by the operation, and to satisfy the accepted environmental standards of the Environment Protection Authority as described in Section 5.6.

The individual sources of air emissions and the proposed air pollution controls are outlined below:

- **Pre-production Phase Activities**

  Many of the pre-production phase activities responsible for dust generation (i.e. stripping of topsoil, road construction, pad construction and excavation for buildings) would be restricted to the northern and eastern sides of the Project Site and not immediately adjacent to the town. The construction activity most likely to increase the potential for nuisance dust reaching the town would be the construction of the temporary open cut bund wall, particularly if this were undertaken during the summer months. It should be noted, however, that the project development schedule provides for the construction of the bund wall over a four (4) week period in early spring 1993, prior to the occurrence of regular north-easterly winds. However, if weather conditions prevail which promote dust levels in excess of EPA criteria, even with the degree of watering required for material compaction, bund construction operations would cease temporarily. Cessation of bund construction operations would occur when wind strength associated with the critical directions exceeds an average hourly speed of 20 kph as indicated by an audible alarm on a continuously recording anemometer. Watering of the completed surface and mulching would help reduce dust episodes until such time as vegetation becomes established.

- **Production Phase Activities**

  (i) **Vehicle Movements and Windblown Dust**

  Wetting or use of dust suppressants on roads would be undertaken on a sufficiently regular basis to ensure dust on the roads is not stirred up by wind or moving vehicles. The frequency of treatment would be dependant on climatic factors and usage. However, water requirements for the Project Site and sizing of facilities, e.g. pumps, pipes and ponds, have been determined on the basis of:

  - 1.5 L/m^2/hour for 10 hours per day in summer and 0.75 L/m^2/hour for 10 hours per day in winter on haul roads and areas trafficked by heavy equipment; and
  - 0.75 L/m^2/hour for 10 hours per day in summer and 0.375 L/m^2/hour for 10 hours per day in winter on service roads.

  The above application rates are high by industry standards and have been designed to ensure dust levels in Peak Hill township attributable to the Project remain within acceptable limits under the most severe of meteorological conditions.

The temporary open cut bund wall and soil stockpiles would be potential sources of airborne dust until their surfaces are covered with a straw mulch, and/or stabilised by vegetation. Rehabilitation of the bund wall and soil stockpiles would be undertaken immediately on establishment during the pre-construction phase. Regular watering to encourage vegetation establishment on the temporary bund wall would also assist wind blown dust control.

(ii) **Drilling and Blasting**

The hydraulically powered production drill rig would be fitted with dust collectors and all drill hole cuttings would either be removed or moistened to ensure the least quantity of fine material is present on surfaces to be blasted. Standard blasting practices, including adequate stemming and the use of NONEL initiation would ensure that dust is kept to a minimum.

(iii) **Crushing, Agglomeration and Stacking**

Water spray dust suppression systems would be installed at each of the top of the ROM bin and the agglomerator feed hopper (**Figures 2.9** and **2.11**). The raising of the front-end loader bucket would cut a light beam activating the spray dust suppression system. The sprays would continue to operate until the loader bucket is lowered. A combination of mist sprays and dust extraction systems would be installed to control the emission of fine particles from the primary crusher. Dust particles collected in the extraction system would be returned to the primary crusher discharge conveyor (CV-2 **Figure 2.9**) but underneath the crushed ore, thereby minimising the likelihood of windblown dust generation. Dust emissions from secondary crushing and screening would be similarly controlled.

A spray system would be mounted on the discharge end of the agglomerator feed stockpile conveyor to control dust generation during stockpiling operations.

The cement silo would be fitted with a baghouse to prevent the discharge of cement dust during filling operations. Cement would be added to the agglomerator feed conveyor underneath the feed by means of a belt plough, thereby minimising the likelihood of windblown cement generation.

During the agglomeration process, sufficient water would be added to the crushed ore/cement mixture to stabilise the fine dust particles. The wet agglomerates would be stacked onto the heap via a system of conveyors for curing prior to leaching operations. Some drying would occur during this process, but no wind-blown dust would be generated.

(iv) Dust Suppression Water

The Company has sought approval to access up to 359 ML annually from outside the Project Site boundary to supply its 255 ML annual dust suppression and process water requirement (Bogan Weir 125 ML, "Westray" impoundment 120 ML, Sewage Treatment Plant 114 ML). In the unlikely event of there being inadequate supplies for the Company to undertake both treatment and dust suppression activities, available water would preferentially be used for dust suppression.

4.2.3 Control Measures for Other Potential Air Contaminants

(i) Exhausts

Earthmoving equipment and on-site vehicles would be fitted with appropriate exhaust controls. The Company would ensure that its equipment and that of its contractors would be properly maintained to ensure no unacceptable exhaust emissions occur. The exhausts of all equipment would be directed upwards or to the side so as not to impinge on the ground.

(ii) Blasting Fumes

Fumes liberated by blasting would be rapidly dispersed into the atmosphere.

(iii) Chemicals

Odours from chemicals used in the plant, such as sodium cyanide (NaCN) and sodium hydroxide (NaOH) may be detectible in close proximity to the plant from time to time. However, these would be confined well within the area of the Project Site, quickly disperse and would not be apparent in town.

NaCN is odourless. However, on contact with water of a low pH, hydrogen cyanide gas (HCN) forms. The principal safeguards proposed by the Company to suppress the formation of HCN are to ensure that stores of NaCN are kept in a secure dry storage area and the process water is maintained at a minimum pH of 9.0. The alkalinity of the process water would be monitored and, if required, lime would be added to maintain the desired pH.

During the gold stripping operation, minute quantities of ammonia are produced. These are vented and readily dispersed.

The potential for droplets of water containing dilute cyanide solution entering the atmosphere would be reduced to negligible amounts using an irrigation system comprising Senninger "wobbler" sprinklers mounted no more than 300 mm above the surface of the heap. The "wobbler" sprinklers to be used emit a

low profile with large droplets and very little mist. The operation of the sprinklers at approximately 80 per cent of their design pressure and capacity would further reduce the likelihood of misting. The extension of the plastic liner from the base of each heap to beyond 5 m would assist in the collection of any wind blown droplets.

On-going monitoring of dust levels and wind would enable manipulation of specific site activities to maintain levels of air pollutants at acceptable levels.

4.3 WATER MANAGEMENT

4.3.1 Objectives

The objectives of Project Site water management would be:

- to provide optimum use of the project's water supply for the mining and processing operations;
- to minimise the impacts of the mining and processing operations on water quality in accordance with statutory requirements;
- to ensure that site water management and control structures are consistent with rehabilitation objectives; and
- to ensure water that drains from the site when mining and processing operations cease is non-polluting.

4.3.2 Potential Sources of Water Pollution

Potential sources of water pollution associated with the project are:

(i) surface runoff containing suspended sediment but no chemical contamination;

(ii) surface runoff contaminated with chemicals used on site;

(iii) spillage of reagents from the gold recovery plant area;

(iv) leakage of process liquors from the leach pad;

(v) leakage or overtopping of the pregnant, intermediate, barren, raw water and overflow pond;

(vi) spillages of fuels and lubrication oils from the contractor's area and workshop;

(vii) leachate from the waste rock emplacement; and

(viii) groundwater contamination through fuel spillages in the open-cut.

Accordingly, the water on site has been divided into three (3) classifications for control purposes:

Clean: rainfall runoff from relatively undisturbed catchments, but including those areas of former mining or gravel extraction activities unaffected by project activities;

Dirty: rainfall runoff from disturbed catchments, haul roads, the waste rock emplacement, the ROM stockpile, soil stockpiles, the contractor's area and the open cut which could carry sediments; and

Contaminated: water which contains, or could potentially contain process chemicals. Contaminated water would include process water and runoff in the heap leach pad and processing plant catchment areas.

4.3.3 Water Pollution Control Measures

The water management plan for the project is shown in **Figure 4.1.** Throughout the project the Company would strictly adhere to a range of management procedures which would safeguard the quality of local and regional surface water and groundwater. Measures to be adopted for each of clean, dirty and contaminated water systems are outlined below:

(i) **Clean Water**

Clean water from areas inside and upslope of the Project Site would either be:

- diverted around the Project Site to existing drainage lines downstream; or
- directed via a system of graded banks and open drains to the runoff pond to be constructed in the north-western corner of the Project Site. The runoff dam would be constructed with an appropriately-sized spillway. The inlets to the runoff pond and the graded banks and open drains would be located and constructed in accordance with the advice of the Department of Conservation and Land Management so as to prevent soil erosion. The runoff dam excavated to produce a storage capacity of approximately 25 ML, would also function as a sediment control structure for dirty water from the Project Site.

Harvesting water from the Project Site would reduce the Company's requirement to source raw water from the Bogan Weir and/or the "Westray" impoundment as well as the Sewage Treatment Works.

PEAK HILL GOLD PROJECT

REFERENCE

- Boundary of Project Site
- Road/Track
- Contour (Interval = 5m)
- Limit of Mining
- Powerline (overhead)
- Powerline (underground)
- Raw Water Pipeline
- Stock Fence
- Manproof Fence
- Open Cut Bund Wall
- 297.5 MAX — Spot Height (m AHD)
- Direction of Water Runoff
- Clean Water System
- Dirty Water System
- Contaminated Water System

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL

PROCESS WATER PONDS

1. Pregnant
2. Barren
3. Intermediate
4. Raw water
5. Overflow

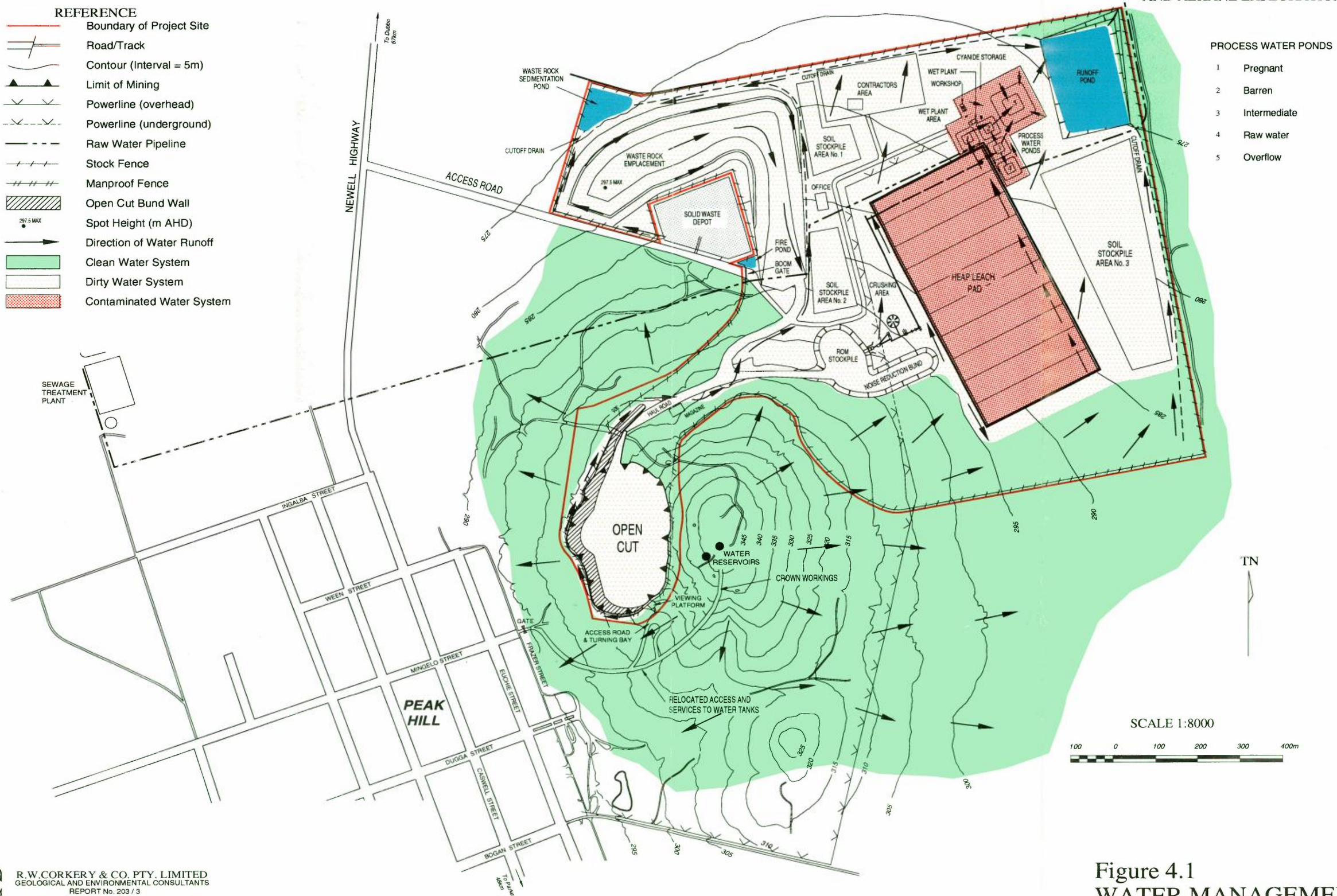


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Figure 4.1
WATER MANAGEMENT

(ii) **Dirty Water**

All runoff from disturbed catchments, e.g. roads, topsoil and ore stockpiles, the contractor's compound and the waste rock emplacement surface would be directed via graded banks or open drains to the runoff dam or waste rock sedimentation pond (**Figure 4.1** and **Plate 1**) prior to discharge to natural drainage channels. Both structures would be constructed with a storage capacity sufficient to contain the runoff from a 1 in 25 year 72 hour storm event.

Runoff within the open cut would be collected in a sump in the floor of the open cut and either used for dust suppression purposes within the confines of the open cut itself, or be allowed to migrate through the old workings to the groundwater table. Due to the low pH and high mineral salts content of water collecting or contained within the open cut and the likely adverse affect such water could have on vegetation and/or soil fertility, no water within the open cut would be discharged or used outside the open cut excavation.

(iii) **Contaminated Water**

The contaminated water management system comprising the leach pad and heaps and the barren, raw, intermediate, pregnant and overflow ponds; the wet plant area; the cyanide storage and mixing area and surrounds are shown on **Figure 4.1**. The main features of the contaminated water management system are as follows.

- Depending on the source of the contaminated flow, water would be directed via a PVC lined drain to either the raw, barren, intermediate, pregnant or overflow pond. All ponds would be PVC lined, inter-connected and have a combined storage capacity sufficient to contain the runoff from a 1 in 100 year 72 hour storm event. A leak detection system would be incorporated under each pond.

  All liquor transfers within the contaminated water system would be by gravity in open drains, or by pumping. There would be no through-wall pipelines.

- Bunds would be constructed around all areas where environmentally hazardous chemicals are stored or used. The bunded areas would incorporate sumps to facilitate spillage collection and return to process, or drainage to the barren pond or overflow pond.

- Specific design controls would be applied to the construction of the heap leach pad and to containment of the leach solution. Containment and recovery of the leaching solution would be critical to gold recovery and economic viability. Seepage loss of

solutions through the pad would, apart from environmental consequences, mean a loss of gold and revenue.

The heap leach pad would be constructed on a compacted, almost impermeable base (permeability less than 10^{-7} m/s) with a gradient that enables gravity collection of leach solutions in ponds. The design of the pad allows for a dual liner, namely:

(a) a low permeability floor of compacted in situ clay material; and

(b) an impermeable PVC liner below the heap with extensions to form a V-drain and bund.

An agricultural type drain with sampling points would be located under the leach pad collection V-drain (**Figure 2.12**). In the event of a leak in the PVC liner, the leachate would preferentially flow between the liner and the compacted clay pad floor to the leak detection drain.

In the unlikely event of a major leak occurring within the PVC leach pad liner, the Company would cease irrigation, flush the heap with water and, depending upon the remaining gold within the heap, either remove the ore and repair the liner or consider that portion of the heap spent and do nothing further. For any minor leaks, the source would be located and isolated and the contaminated water pumped out to the pregnant pond (**Figure 4.1**).

- All routine maintenance of mobile equipment would take place in either the workshop or the contractor's area (**Figure 4.1**). Any spillages of oils, lubricants or fuel would be cleaned up immediately so as to avoid possible water contamination. All water used within the workshop area and likely to contain degreasers, oil, grease or fuel would be passed through an oil trap prior to discharge to the waste rock sedimentation pond.

- Fuelling of low mobility equipment would take place within the confines of the open cut. Any resultant spills would be immediately cleaned up and stored for subsequent re-cycling with other petroleum wastes produced during routine equipment maintenance. The contaminated ore would be spread out thinly in a nominated area on the surface of the waste rock emplacement to encourage biological breakdown of the contaminants.

- The strategy for waste rock emplacement, i.e. the encapsulation of sulphide wastes within weathered low permeability oxide waste rock, has addressed the requirements for water quality in the long term.

4.3.4 Bogan Weir

In order to minimise any potential impact on the agricultural water requirements of adjacent and downstream landowners as a result of extraction of water from the Bogan Weir, the Company would limit water extraction to those periods when the water level within the Weir was within 1.5 m of top water level. Once the water level within the Weir dropped to the 1.5 m mark, Company water extraction would cease. Approximately 30 per cent of Weir storage volume (i.e. 115 ML) is retained below the 1.5 m mark.

4.4 NOISE CONTROLS

4.4.1 Introduction

The proximity of the Project Site, and particularly the proposed open cut mine, to the township of Peak Hill has necessitated the incorporation of noise controls in project layout design and operational planning to ensure the project would comply with the appropriate noise criteria.

The principal noise control measures to be adopted are described below. The necessity for, and the efficiency of these controls when in place, has been determined by Richard Heggie Associates Pty Ltd using measured background and operational noise levels, and RTA Software's Environmental Noise Model (ENM) for what are the worst case situations during the early (bund construction) stages of pre-production and during Years 1 and 2, and Year 3 production operations. Separate calculations were undertaken for daytime and night-time operations. ENM is a commercial software system developed in conjunction with the NSW Environment Protection Authority which has been endorsed by the Australian Environment Council and all State Environmental Authorities throughout Australia as being the most appropriate currently available. The octave band sound power levels used in the prediction programme and presented in **Appendix B** of Heggie (1993) comprise measured levels from well maintained equipment of the same or equivalent size and type as proposed for use on the Project.

Where possible, the use of the natural topography or physical barriers has been employed in preference to operational controls.

4.4.2 Temporary Open Cut Bund Wall Construction

Initial investigations indicated that without some form of noise control between the open cut and the town, operational noise levels at the nearest residence in Euchie Street would approximate 60 dB(A), 20 dB(A) above the acceptable daytime level of 40 dB(A), i.e. 25 dB(A) above the typical daytime background level as presented in Section 3.7.3. Conversely, the provision of a 10 m high temporary bund on the western and southern sides of the open cut and a 5 m high bund wall for the first 150 m outside the open cut along the western margin of the open cut to crusher haulroad would maintain noise levels within acceptable limits.

To minimise noise impacts during actual bund wall construction, construction activity would be performed in stages, with each stage of 100 m to 200 m wall length being completed to a designated height before work on the next stage commences. Scraper or truck access to each stage via ramps to be constructed on the eastern side of the completed stage would minimise the time equipment would be on the top of the bund and maximise the shielding effect of the completed stages of the bund. All equipment used in bund wall construction would have residential-grade silencers.

4.4.3 Mining Operations

The main noise sources during mining would be the drilling and blasting, ripping, and loading and transportation of ore and waste rock.

Mining during Years 1 and 2 would be concentrated on the eastern wall of the open cut as shown on **Figure 2.5**, extending both towards the township and deeper into the open cut in subsequent years. Development of the open cut as shown on **Figure 2.5** and in **Table 2.5** would provide increasing benefit from the natural shielding provided by the open cut walls. The temporary open cut bund would be gradually removed as mining progressed to the 295 m AHD bench.

Haul roads within the open cut would have a maximum grade of 1 : 8 (vertical:horizontal). In order to minimise brake noise, outside the open cut, haul roads would be constructed with as gentle a grade as possible and at no time exceeding 1 : 20 (vertical to horizontal). Drilling prior to blasting would be by hydraulically powered production drill.

Mining operations would be limited to the hours of 7.00 a.m. to 6.00 p.m., six (6) days per week.

Construction of the waste rock emplacement would be between the hours of 7.00 a.m. and 6.00 p.m. Monday to Saturday. Where necessary, the western and southern margins of the waste rock emplacement would be maintained approximately three (3) metres higher than the remaining emplacement surface to act as an acoustic screen for receivers on or adjacent to the Newell Highway north of Peak Hill.

All mobile equipment to be used on the Project Site would be fitted with appropriate noise safeguards such as mufflers and engine cowlings and be well maintained to ensure that the Environment Protection Authority criteria are satisfied. As a further control, all mining and earthmoving contracts would require that prior to any mobile earthmoving or mining equipment being brought onto the Project Site, the Company be provided with certification of compliance with the noise levels shown in Appendix B of Heggie (1993).

Reversing alarms, though constituting an additional source of noise, are not considered to be of major noise significance in terms of overall operational levels. However, subject to the approval of the Mines Inspector, reversing alarms on all mobile equipment would be replaced by flashing lights.

Blasting warning sirens, though by design intrusive, are of infrequent occurrence, short duration and mandatory in nature and are similarly not considered to be of major significance in terms of impact assessment.

4.4.4 Processing Operations

The principal potential noise sources during processing operations would be crushing and agglomerating operations, heap stacking and irrigation, and the gold recovery plant.

Crushing and Agglomerating Plant

The proposed location of the crushing and agglomerating plant maximises the natural acoustic shielding to the town provided by Peak Hill. However, to also ensure noise levels at "Little Oakleigh" conform to the Environment Protection Authority criteria, the Company would construct a 9 m high noise reduction bund immediately to the south of the crushing and agglomerating plant using waste rock.

Heap Stacking and Operation

Heap stacking would generally occur between 7.00 am and 10.00 pm using electric powered conveyors and a radial stacker. Pumps to be used for 24 hour heap irrigation would be located adjacent to the solution ponds. Shielding of any pumping noise from the township and surrounding residences would be provided by the heap, the waste rock emplacement and the topography. The heap would adequately shield "Little Oakleigh" from any pump noise.

Gold Recovery Plant

No specific noise controls are required for the gold recovery plant.

4.5 EROSION CONTROL AND ECOLOGICAL MANAGEMENT

4.5.1 Soil Management

The Company would conserve the soil resources on the Project Site to assist in the rehabilitation of the Site during, or on completion of, mining and treatment operations. The main soil management programme features would be as follows.

(i) Removal of soil/subsoil from all operational areas in advance of operations. For all but the leach pad area where development would be staged, topsoil stripping would occur during the pre-production phase of the project.

(ii) Where practicable, organic topsoil (A horizon) and subsoil (B horizon) would be stripped and stockpiled separately.

Three (3) nominal soil storage areas totalling approximately 11 ha have been allocated for the temporary storage of soil (**Figure 2.1**). Within these areas, A and B horizon material would be stockpiled separately.

To maintain the integrity of the soil resource, the A horizon stockpiles would have a maximum height of 1.5 m and the B horizon stockpiles a maximum height of 3 m.

Additional soil storage areas would be available in areas of former disturbance adjacent to the open cut.

Stockpiles would be protected from erosion, if required. The nature of the stockpile protection to be implemented would be determined in consultation with the Department of Conservation and Land Management.

Where required, both topsoil and subsoil stockpiles would be seeded with an appropriate mixture of native and non-persistent exotic grass, herbs and shrubs. Prior to seeding, the stockpiles would be ripped to overcome any compaction problems resulting from placement methodology.

(iii) The soil stockpiles would be pegged for identification and to avoid disturbance by other site activities.

(iv) Where possible, rehabilitation would be undertaken progressively to minimise the soil storage period and to minimise the likelihood of erosion and downslope sedimentation. Where topsoil and subsoil have been stripped separately, replacement would be in the reverse order, i.e. subsoil then topsoil.

(v) Earthworks for surface water management would involve soil removal, excavation as required, replacement of soil and stabilisation with vegetation.

Regular liaison would be established with the Department of Conservation and Land Management and their advice sought on matters pertaining to soil management, erosion control and revegetation.

Estimates based upon soil sampling suggest that up to 80 000 m^3 of A horizon material (100 - 200 mm thick), and 140 000 m^3 of B horizon material would be stripped and either directly placed on areas awaiting rehabilitation, or stockpiled during site development. Topsoil and subsoil from the bund area would be retained adjacent to the temporary open cut bund wall and used for rehabilitation of that structure immediately on completion.

4.5.2 Revegetation Procedures and Ecological Management

The Company would adopt the following objectives in carrying out rehabilitation of the Project Site:

(i) to enhance the aesthetic value of existing vegetation communities on site by noxious weed eradication and supplementary planting;

(ii) to provide vegetative communities consistent with those existing on the Project Site and suitable as faunal habitats;

(iii) to provide a ground cover of native grasses and non-persistent introduced species to reduce erosion during and after project operations; and

(iv) to provide screening of mining operations and associated activities.

Tree and shrub species proposed in revegetation for the project would be based upon the list of locally occurring species. Such species would include:

Eucalyptus dwyeri, E. melliodora, E. microcarpa, E. sideroxylon;
Callitris endlicheri;
Acacia deanei, A. decora, A.doratoxylon;
Allocasuarina stricta; and
Schinus areira.

The native seed collection and propagation would be undertaken on the Project Site and supplemented by seed purchased from a local wholesale nursery. All seed propagation, planting, maintenance and site supervision would be co-ordinated by the Company's environmental consultant and undertaken by the Company's site rehabilitation officer.

The following procedures would be applied to site revegetation and ecological management:

(i) **Seed Collection**

Where required, native seed to be used on the Project Site would be preferentially collected from the woodland community on Peak Hill.

(ii) **Stock Control**

All areas undergoing regeneration would be fenced off from stock both during the project life and preferably for up to five years after rehabilitation activities cease.

(iii) **Competition**

In the areas currently cleared for agricultural purposes, tree and shrub plantings would be clumped in specific designated patches over the rehabilitated topsoiled surface. Grass sowing for soil stabilisation would be avoided in the specific patches so designated to minimise competition, and a mulch of gravel or rotted hay would be applied around individual plantings.

(iv) **Weed Control**

Weed eradication programmes would be undertaken.

(v) **Protection from Vermin**

Protection from rabbits and kangaroos would be undertaken by plastic guards around the tube stock and advanced seedlings. Eradication programmes would be undertaken to control feral pests.

(vi) **Surface Disturbance**

Surface disturbance would be localised as much as possible, e.g. by concentrating buildings, etc. into one area and minimising the number of access roads.

(vii) **Habitat Protection**

Cleared woody debris, tree stumps etc. would be collected and replaced on rehabilitated surfaces within the Peak Hill vegetation communities to encourage faunal recolonisation.

4.6 CONTROLS ON BLASTING

4.6.1 Introduction

The degree of blasting required would be dependant on the ease of digging the rock, grade control requirements and mine scheduling. The majority of the pre-production phase removal of waste rock and initial mining of ore and waste rock would be in weathered oxidised materials and involve hydraulic excavation and ripping by a bulldozer. However, blasting would increase to about 90 per cent as the base of major oxidation (**Figure 2.4**) is approached and more silicified material is encountered.

The potential undesirable side effects of blasting are:

- flyrock;
- air vibrations (noise and airblast);
- ground vibrations; and
- dust.

However, each of these side effects is highly transient and, through the implementation of controls in blasting design and blasting procedures, can be limited to a level where:

(i) the generation of dust and fly rock is minimised and maintained at acceptable levels;

(ii) ground vibration from blasting is at acceptable levels and ensures the continued integrity of nearby dwellings, structures and facilities;

(iii) noise and air vibration levels at nearby residences are within acceptable limits and compatible with safety and comfort of human beings; and

(iv) the safety of employees, contractors, adjacent residents or any tourists to the area is not threatened.

In order to control flyrock, air vibrations, ground vibrations and dust, the Company would implement the following controls as recommended in Golder (1993a).

4.6.2 Controlling Flyrock

Flyrock would be controlled by:

- advancing working faces on the west side of the pit towards the east (the closest neighbours are on the west side) and, therefore, heaving the bulk of the blasted rock to the east;
- ensuring that burden distances and stemming lengths are such that explosion gases are virtually devoid of energy by the time they emerge into the atmosphere; and
- ensuring that charges consistently detonate in carefully designed sequences.

For the relatively infrequent free-face blasts, flyrock range would be limited to:

- about 50 m (and usually 30 m or less) in front of the face;
- about 25 m (and usually 15 m or less) to either side of the blast block; and
- about 10 m (and usually 5 m or less) behind newly created faces.

For paddock blasts, flyrock range would be limited to about 10 m or less.

4.6.3 Controlling Air Vibrations

Noise and airblast would be controlled by ensuring that all, or nearly all, of the explosion energy is consumed in fragmenting and displacing the burden rock by the time the gases vent (via the broken burden rock and/or ejected stemming material) into the atmosphere. This objective would be met by ensuring:

- that the burden distance and stemming length are carefully selected and then implemented precisely; and
- that charges detonate in the correct sequence and with inter-row delays that provide good progressive relief of burden.

Additionally, where practicable, the Company would fire blasts at a time when:

- there is a low probability of a temperature inversion in the atmosphere; and
- high-velocity winds are not blowing towards the nearest neighbours in Euchie Street.

The propagation of air vibrations away from a blast depends upon weather conditions. If temperature and wind vary, identical blasts may produce quite different air vibration levels at a particular point. Normally, air temperature and air vibration velocity decrease with increasing altitude. This condition results in air vibration waves being

bent upwards away from the earth's surface, so that the noise and airblast levels on the ground rapidly decrease with increasing distance from a blast. A temperature inversion is present if the air becomes warmer with increasing altitude. In this case, air vibration waves are bent back towards the earth's surface and increase air vibration levels on the ground, sometimes by factors as high as two (2) (i.e., by up to 6 dBL). To minimise the probability of blasting when a temperature inversion exists, blasts would be fired between about 10.30 am and 3.00 pm and preferably as close as possible to midday. Where practicable, the Company proposes to initiate blasts during the lunchtime meal break (12.00 pm to 1.00 pm).

The effect of wind is directional and almost always results in increased air vibration levels downwind. Conversely, by blasting when winds are blowing away from residential areas, particularly when wind speeds are high, the air vibration levels at the nearest residences can be reduced.

4.6.4 Controlling Ground Vibrations

Ground vibrations would be controlled by ensuring:

- that the minimum practicable weight of explosive detonates at an instant, i.e. by using the maximum number of delay periods in each blast; and
- that most of the energy liberated by the charge(s) on a given delay number is consumed in providing good fragmentation, adequate displacement and a loose, highly diggable muckpile, rather than in creating ground vibrations, i.e. by ensuring that the burden distance and effective sub-drilling are not too large.

4.6.5 Controlling Dust

Blast-generated dust would be minimised by ensuring that inadequate stemming columns are not ejected for considerable distances into the atmosphere. Stemming columns would be such that their ejection velocities are low.

Additionally, the Company proposes to use NONEL-type delay detonators to initiate charges. The use of NONEL-type delay detonators obviates the need for detonating cord downlines and, therefore, prevents the stemming disruption that the detonation of such downlines causes. The absence of detonating cord trunklines (i.e. surface lines) prevents the dust cloud that is formed when such trunklines detonate on a dry dusty surface.

Although the design and implementation of each blast would be the responsibility of the mining contractor, all blast designs would require approval from the Company prior to the commencement of any drilling operations.

In order to ensure continued compliance with the design criteria, the Company proposes to use consultant services to supervise blast monitoring and optimisation of blasting techniques in the early stages of open cut development. Each blast over the life of the project would be monitored to ensure airblast overpressure and ground

vibrations comply with Environment Protection Authority criteria at nearby residences and the Standards Association of Australia criteria at the water reservoirs.

Because blast generated noise is impulsive and can startle people, particularly at times of low background noise, the Company proposes to:

- issue a schedule of blasting times in advance of operations;
- issue a reminder on the day of the blast.

The method of notification to be employed for the community in general would be determined after discussions with local community representatives. However, for the residents of Frazer Court Hostel, it has been agreed that a telephone call to the Supervisor on the morning of the blast would be an appropriate form of notification.

A blasting siren in advance of blast initiation would also advise residents in close proximity to the mine of the imminent blast.

4.7 VISUAL CONTROLS

The Project Site's prominent location makes visual impact inevitable. The site is moderately well vegetated at present and the Company would endeavour to ensure that as many trees as possible are retained.

The hill is a natural feature which would serve to provide visual screening from the town of much of the operation, including the crushing plant and leach heaps. Existing vegetation and topography would also screen the waste rock emplacement from the town, and the construction of the temporary open cut bund wall would screen the majority of day-to-day mining activity.

The Company would undertake an extensive tree planting programme aimed at minimising the visual impact and assisting in the long term rehabilitation of the Project Site. Areas to receive particular attention would include the area between Frazer Street, Euchie Street and the Project Site boundary and those areas of the hill which have been degraded as a result of prior mining and gravel extraction activity. Additionally, the Company would undertake progressive rehabilitation of disturbed areas to reduce impact for residents within the town, on adjoining rural properties and for motorists on nearby roads. The site would be kept clean and tidy. Rehabilitation of the upper visible benches within the open cut would also minimise any long term visual impact from within the township.

4.8 SAFETY CONTROLS

The Company is conscious of the need to ensure the safety of its employees, and the residents of Peak Hill and any visitors to the mine both during and after mining operations cease. The controls to be implemented were discussed in Section 2.8 and are summarised below.

4.8.1 Public Safety

The following controls would be implemented throughout the life of the project:

- fencing to restrict access. Man-proof fencing would be provided adjacent to the open cut, the access road boom gate and around the wet plant and process pond areas. Elsewhere, stockproof fencing would be provided;
- a single Project Site entry with a lockable boom gate;
- a gate on the road to the tourist viewing platform;
- implementation of blasting controls as identified in Section 4.6;
- upgrading the access road to the Council's solid waste depot and its intersection with the Newell Highway;
- provision of an upgraded and sealed access to the tourist viewing platform and safe access to the Crown Workings; and
- compliance with the requirements of the Mines Inspection Act, 1901 and the Dangerous Goods Act, 1975, at all times.

On completion of the project and during the site decommisioning phase, the Company would block the access road to the open cut, extend the man-proof fence to encircle the open cut and construct a bund of large diameter rock or earth around the perimeter of the open cut to further discourage access by people, domestic animals, stock and recreational vehicles, ensure residual cyanide levels in the spent leach heaps are at acceptable levels and remove all infrastructure which could be considered a hazard to public safety.

4.8.2 Property Protection

The protection of both public and private property throughout the life of the project would be achieved through the implementation of the blasting controls (See Section 4.6) and the development of the open cut to the design recommended in Section 2.4.10. Additionally, the Company would commission an independent report on the structural and superficial condition of the buildings on the eastern side of Euchie Street between Dugga and Ween Streets and in Frazer Street in order to provide baseline information for any subsequent damage claims.

4.8.3 Employee Safety

The controls to be implemented to ensure employee safety would include:

- employee induction and education;
- compliance with the Mines Inspection Act, 1901 and Dangerous Goods Act, 1975, at all times; and
- the mandatory use of safety equipment.

4.9 ARCHAEOLOGICAL CONTROLS

4.9.1 Mining History

Development of the open cut would necessitate the removal of the large "glory hole" which is currently a tourist attraction in the town and a number of surface relics of former mining activity.

In order to mitigate the extent of impact, the Company would:

- collect and place any surface items of significance at the site of the proposed tourist viewing platform;
- develop the remaining holes to the south of the proposed open cut, e.g. the Crown Workings, as a tourist amenity by the provision of safe access and viewing areas; and
- install a permanent sign highlighting the history of mining at Peak Hill.

Should any additional relics from historical mining be encountered during the mining operations, where practicable, these too would be salvaged for display at the viewing platform.

4.9.2 Pre-European History

Based on the results of the archaeological survey and the advice of the Peak Hill Aboriginal Lands Council, no specific controls are required. However, should the Company encounter any artefacts during its operation, it would immediately cease operations in the relevant area and advise the National Parks and Wildlife Service.

4.10 PARKES RADIO TELESCOPE

The following design and operational safeguards would assist in reducing any impact the project would have on the Parkes Radio Telescope.

(i) The noise reduction bund to be constructed on the southern side of the crushing plant would not only provide acoustic shielding for the residents at "Little Oakleigh" but also intercept line of sight to the radio telescope;

(ii) The 11 kV substation to be constructed on site would effectively filter "spikes" produced by electrical equipment.

(iii) Where practicable, welding would be undertaken inside workshop buildings or in the contractor's area out of line-of-site from the radio telescope.

(iv) Oversize insulators would be used on high voltage transmission lines to prevent arcing through moist dust.

(v) Power output, base station location and operating wave-length of two-way radio networks would be determined in consultation with CSIRO personnel.

(vi) Micro-computers only would be installed on site. These would be housed in the office building and thus shielded from the outside environment.

4.11 CONTROLS FOR INSTALLATION OF PIPELINES

Installation of the pipelines would be undertaken during the project pre-production phase. The following controls would be applied during the installation of the "Westray" to Project Site pipeline, Bogan Weir to Sewage Treatment Plant surge pond pipeline and Sewage Treatment Plant surge pond to Project Site pipeline.

(i) the pump sites would be positioned to avoid clearing of the remaining trees, where practicable;

(ii) soil excavated during installation of the pipes would be quickly replaced and sown with a pasture mix as recommended by the Department of Conservation and Land Management. The necessity for additional erosion controls would also be determined in consultation with the Department of Conservation and Land Management;

(iii) landowners would be advised for stock control, and any dismantled fences replaced progressively during pipeline installation;

(iv) the Bogan Weir to Sewage Treatment Plant surge pond pipeline and the surge pond to the Project Site pipeline would be laid beneath the railway line and Newell Highway by existing culverts to avoid pavement damage or disruption to services;

(v) the pipelines would remain in place at the end of the project life; and

(vi) very few, if any, trees would be removed along the routes.

4.12 ENVIRONMENTAL MONITORING

4.12.1 Objectives

Environmental monitoring would be undertaken to quantitatively determine the degree of impact the mining and treatment operations are having on the surrounding environment. Assessment of these results would establish if environmental management systems are being successfully applied in the short term and if these management systems need to be amended or can be scaled down in the medium to long term.

Figure 3.4 indicates the location of air, water and noise monitoring sites. On the basis of the preliminary blast monitoring programme, permanent geophones would be installed at selected residences in Euchie and Frazer Streets and near the water reservoirs. All blasts would be monitored.

4.12.2 Water Quality Monitoring

Baseline water quality monitoring has been undertaken at the five sites shown in **Figure 3.4.**

Continued monitoring at four of these sites (PHW-1, PHW-3, PHW-4, PHW-5) would provide an appropriate indication of any potential impact of the mine on surface water quality and would continue, on a quarterly basis, throughout the life of the mine. In addition and where practicable, samples would be taken within twenty four (24) hours of rainfall events. The fifth site (PHW-2) would be buried by the ROM stockpile.

In addition to the above programme, the Company would routinely sample the leak detection sumps below the heap leach pad V-drain and process water ponds, the runoff pond (Site PHW-8, **Figure 3.4**) and the waste rock sedimentation pond (Site PHW-7, **Figure 3.4**).

Water quality parameters to be measured would include, as appropriate:

- Total cyanide, pH, electrical conductivity;
- Bicarbonate and sulphate; and
- Copper and a range of other heavy metals.

4.12.3 Air Quality Monitoring

Monitoring of deposited dust was undertaken at five (5) sites surrounding the project on a monthly basis between March 1990 and May 1991 and between December 1992 and March 1993 (**Figure 3.4**). The results of the monitoring to date are presented in **Table 3.7.** Monitoring of the project's impact on air quality would continue at these five sites throughout the life of the project.

During bund construction, and until the bund wall surface has been sufficiently stabilised and revegetated to prevent wind erosion resulting in short-term dust episodes in town, additional monitoring to ascertain the levels of deposited and atmospheric dust, verify the results of the predictive modelling (See Section 5.6) and

compliance with Environment Protection Authority criteria would be undertaken within the adjacent residential area. The details of this monitoring programme, and a procedure for reducing nuisance dust levels and dealing with any complaints relating to dust emanating from the Project Site, would be produced by the Company prior to any site disturbance adjacent to the town.

4.12.4 Atmospheric Cyanide Monitoring

Although:

- the Company proposes to use "wobbler" sprinklers for the irrigation of leach heaps because of their low profile spray, large droplet size and minimal misting potential;
- the leach solution would be of a low strength (200 ppm Sodium Cyanide);
- irrigation of similar solutions on gold projects elsewhere, e.g. Marvel Loch (W.A.) and Barnicoat (W.A.) has not created occupational health or safety problems for workers in intimate contact with the heaps;
- the nearest residence, "Little Oakleigh" is approximately 0.6 km from the leach pad; and
- cyanide in any droplets carrying outside the Project Site boundary would be readily oxidised to harmless compounds,

the Company would establish a monitoring programme to demonstrate that the presence of cyanide on the Project Site does not pose a threat to the local community.

4.12.5 Noise Monitoring

The Company would undertake noise monitoring as a means of verifying the noise predictions presented in this Environmental Impact Statement and to assess the success of noise controls implemented. Monitoring would be undertaken at the four sites surveyed during the baseline survey (**Figure 3.4**).

4.12.6 Blast Monitoring

Vibration and airblast overpressure levels would be monitored for every blast throughout the life of the project to confirm compliance with statutory comfort and structural criteria limits. The location of the monitoring site for each blast would be dependant on the results of the preliminary blast monitoring undertaken and the location of the individual blast with respect to the town and the reservoirs.

4.12.7 Reservoir and Open Cut Wall Stability Monitoring

In order to monitor the integrity of the open cut wall and the town's water supply reservoirs monthly open cut wall stability surveys would be undertaken. The results of these surveys would be provided to Parkes Shire Council on receipt.

SECTION 5

The Project's Impact on the Environment

SECTION 5

THE PROJECT'S IMPACT ON THE ENVIRONMENT

5.1 PREAMBLE

This section examines the potential impact the project's mining and ore treatment operations would have on the environment both during the life of the project and after decommissioning occurs at the end of the mine life. The impacts have been assessed, where necessary, with appropriate design and operational safeguards incorporated.

5.2 TOPOGRAPHY

The final rehabilitated landform proposed at the completion of the Peak Hill Gold Project is shown on **Figure 2.16**.

The final landform created by the mining and ore treatment operation would consist of:

- an open cut void with an average depth of 85 m and with a surface area of approximately 8 ha. The existing main glory hole together with other smaller holes would be removed during the creation of the new open cut;
- a tiered waste rock emplacement forming a "horseshoe" around the Council's solid waste depot and blending into the northern flank of Peak Hill. The emplacement would be constructed to a height of 297.5 m AHD which is a maximum height of 20 m above existing ground surface;
- a 10 m high elongated hill and ridgeline created by shaping the spent ore on the leach pad and the former crusher noise reduction bund;
- the waste rock sedimentation pond, runoff pond and fire pond; and
- a drainage system superimposed on these landforms.

The above changes would be notable in the local context, however the impact on the regional topography would be minor.

5.3 DRAINAGE

5.3.1 Internal Drainage

Throughout the life of the project there would be a number of changes to the local drainage network around the Project Site. However, these changes would be minor and assist in overall site water management and soil erosion control. The Company

would guarantee continuity of supply to the two (2) small dams immediately north of the Project Site boundary. Their long term impact would be negligible as the diversions would direct runoff to the sedimentation pond and runoff pond and ultimately provide a source of water for stock and, if required, fire suppression purposes.

Runoff within the Project Site would be collected and used for process water in the heap leaching process and for road watering or other forms of dust suppression.

5.3.2 External Drainage

During the production stage of the project, the flow regimes away from the Project Site would be unchanged other than from the minor reduction in catchment area resulting from the Company's "contained" water policy and water harvesting activities.

The rehabilitation objectives of the project include provision of free draining surfaces on the disturbed areas with the exception of the open cut void. All water collecting within the open cut would either seep through the former workings to the groundwater table or be used within the confines of the open cut for dust suppression purposes. The impact of the loss of runoff over the pit area would, however, be minor.

5.4 WATER RESOURCES

5.4.1 Raw Water Supplies and Bogan Weir

By seeking access to 359 ML water external to the Project Site annually from which to source its annual dust suppression and processing requirement of 255 ML, and by sourcing water from both east and west of the Project Site, the Company has ensured an adequacy of supply for both treatment and environmental (dust suppression) activities during all but the most severe drought period. However, in the unlikely event of a protracted drought period, the Company would reduce or cease treatment activities in order to guarantee an adequate supply of water for dust suppression purposes. Even in the absence of water from the Bogan Weir and "Westray" impoundment, the 114 ML supply from the Sewage Treatment Plant would more than adequately satisfy the annual dust suppression requirements.

The operational restrictions on the extraction of water from the Bogan Weir would ensure the adequacy of supplies for adjacent and downstream agricultural requirements. Limitation of water extraction to those periods when the water level is within 1.5 m of top water level would ensure a minimum of 30 per cent of Bogan Weir storage capacity was retained for agricultural users. Thirty (30) per cent of storage capacity equates to 115 ML water.

5.4.2 Potable Supplies

The Company's annual requirement for 5.8 ML potable water for its workforce would have no significant effect on the availability of water within Peak Hill.

5.4.3 Project Site Surface Water Quality

The Company's water management strategy outlined in Section 4.3, particularly the controls to be implemented to contain potentially contaminated waters, would ensure that the quality of water downstream from the Project Site would not be adversely affected. Rather, the Company's activities, including the recent removal of acid-producing tailings which were spread on the surface of the hill, and the encapsulation of the sulphide material, would significantly improve runoff from this section of the Project Site.

On completion of the project, all areas within the contaminated water system would be detoxified to eliminate the possibility of post-project water pollution problems.

5.4.4 Project Site Groundwater

With the exception of diesel fuel for equipment operation, substances capable of contaminating the groundwater would not be used within the open cut. The Company's strategy, outlined in Section 4.3, to deal with any fuel spillages that might occur within the open cut would ensure that the quality of groundwater is not affected by the operation.

Similarly, installation of the PVC liner over a virtually impermeable base and the installation of leak detection/collection systems would minimise the possibility of process solutions seeping into sub-surface aquifers.

5.5 SOILS

The design and operational safeguards outlined in Section 4.5 would ensure the soil resources on the Project Site are properly removed, stored and replaced. The Company's desire to maintain all soil on site in good condition throughout the duration of the project would result in negligible impact on the soil resources. The rehabilitation procedures for the project involving runoff diversion and sedimentation and progressive rehabilitation would minimise the potential for soil erosion in accordance with accepted practice and advice provided by the Department of Conservation and Land Management. Similarly, the controls for pipeline installation presented in Section 4.11 would ensure no adverse short term or long term impacts result.

5.6 AIR QUALITY

5.6.1 Air Quality Guidelines

Dust Deposition

Dust deposition or dustfall does not affect health because of the large size of falling particles. Depositing dust may, however, cause nuisance and affect residential amenity. Previously in New South Wales, the Environment Protection Authority (then SPCC)

used an annual average of 4.0 g/m²/month as the level at which amenity was likely to be affected and to cause complaints of nuisance dust.

More recently, the Environment Protection Authority provided new amenity-based criteria for dust deposition (**Table 5.1**).

TABLE 5.1

NSW EPA Criteria for Dust Fallout

Existing Dust Level (g/m²/ month)	Maximum Acceptable Increase over Existing Dust Level (g/m²/ month)	
	Residential Suburban	Rural, Semi-Rural Urban Commercial and Industrial
2	2	2
3	1	2
4	0	1

Note: If the existing dust level in any area is greater than 4 g/m²/month (i.e. five (5) or above) then no increases in dust fallout is acceptable as a result of any proposed dust emitting works.

When applied to the proposed Peak Hill Gold Project, the new criteria specify a mean annual increment of 2.0 g/m²/month as the maximum acceptable increase over the background level for all land located outside the Project Site.

Total Suspended Particulates

Health effects of atmospheric dust are more directly related to the concentration of total suspended particulates in the ambient air than to the deposition rates. The National Health and Medical Research Council of Australia (NHMRC) recommends an annual concentration of 90 μg/m³ as the maximum permissible level of total suspended particulates in the air to protect public health in residential environments.

Exposure periods shorter than one year are not covered by the NHMRC goals. In the United States, the United States Environment Protection Agency (USEPA) uses a primary air quality standard of 260 μg/m³ to protect public health. This standard applies to peak concentrations experienced over 24 hours and may not be exceeded more than once a year. A secondary standard of 150 μg/m³ over twenty four (24) hours is used by the USEPA to protect the public against nuisance dust. The NSW EPA has adopted the primary standard of 260 μg/m³ as its objective, but not the secondary standard of 150 μg/m³.

More recently, the USEPA and regulatory authorities in a number of European countries adopted air quality objectives which were specifically designed to address the levels of particles which have aerodynamic diameters of less than 10 μm in size (PM10). Total suspended particulates which are covered by the objectives listed above range in size to 30 μm and possibly higher.

In recognition of these developments, the NSW EPA has now also listed the US EPA ambient air standards for PM10 concentrations among its objectives. These objectives seek to limit the mean annual concentration of PM10 in residential environments to 50 $\mu g/m^3$. Similarly, the maximum concentrations of PM10 over an interval of twenty four (24) hours are limited to 150 $\mu g/m^3$.

No air quality guideline values are available either in Australia or overseas which would relate to the concentration of total suspended particulates in the air during brief dust episodes. Such episodes are the result of adverse weather conditions, usually strong winds and dry weather, coinciding with higher than normal emissions of dust. Wind erosion of dusty surfaces is the main source of the emission which may last for a few hours. Because of this relatively short duration of exposure, the particles of dust present in the air during episodic conditions may cause nuisance and so lead to complaints, but are not linked to health effects.

5.6.2 Predicted Levels and Impacts - Dust Deposition

Dust dispersion modelling of relative increases in the mean annual rate of dust deposition which could be expected for various depths of the open cut were undertaken in order to obtain an indication of the effect that retention of dust particles within the pit would have on the predicted levels of atmospheric dust outside the open cut. The third year of operations was used to develop inventories of dust emissions used in the model given this was assessed by P. Zib and Associates (1993) to potentially be the worst year for dust generation.

Retention of a portion of the atmospheric particulates inside the pit is a well known phenomenon which increases with increasing depth of the pit floor in relation to the surrounding terrain. In addition, the provision of a bund wall would enhance the retention of dust particles inside the pit during the first three (3) year's operation.

The modelling predictions using a minimum rate of dust retention of 35 per cent is presented diagramatically in P. Zib and Associates (1993) by means of dust deposition contours and illustrate the benefit of retaining as much atmospheric dust as possible within the main open cut which would be located at a close distance upwind of the residential area. If unprotected by a bund wall and/or the wall of the open cut, residences within 500 m of the open cut were predicted to experience a mean annual incremental increase in excess of 2.0 g/m^2/month, that is the amenity-based criterion of the EPA beyond which residential amenity is likely to start to be affected. Conversely, when protected as described, the mean annual increment of about 2.0 g/m^2/month during the worst year (Year 3) was predicted to be largely aligned with the Project Site boundary in the direction of the residential area and with only a

minor excursion beyond the edge of the residential boundary. Approximately twelve (12) residences lie just within the 2.0 g/m²/month contour shown on **Figure 5.1.**

It needs to be emphasised that the approach to the calculation of predicted increases in dust deposition was conservative and that in reality exceedance of the incremental criterion at monitoring site PHA-1 is unlikely even in Year 3 (P. Zib pers comm). The Company's monitoring programme would establish the actual level of dust deposition at PHA-1 during the first two (2) years of operation and should the 2.0 g/m²/month level be approached in the third year at that location, additional safeguards would be considered during the periods when winds are blowing towards the nearby residences.

P. Zib and Associates (1993) also predicted that the remaining large majority of residents of Peak Hill would receive annual increments of less than 2.0 g/m²/month. In subsequent years, dust deposition at all locations including the nearest residences would decline even further because of the increasing depth of the open cut and hence increasing retention rates.

Further to the north, the waste emplacement would not adversely affect amenity despite constituting the largest source of atmospheric dust emissions. The high level of dust control to be implemented at the crushing plant and gold recovery plant would ensure that the emission of atmospheric dust from that part of the project would not adversely affect the surrounding area or the individual rural residences located to the south and east of the Project Site.

5.6.3 Predicted Levels and Impacts - Total Suspended Particulates

The trends displayed by the dust deposition contours are also reflected in the contour maps of concentrations of total suspended particulates shown in **Figure 5.1.**

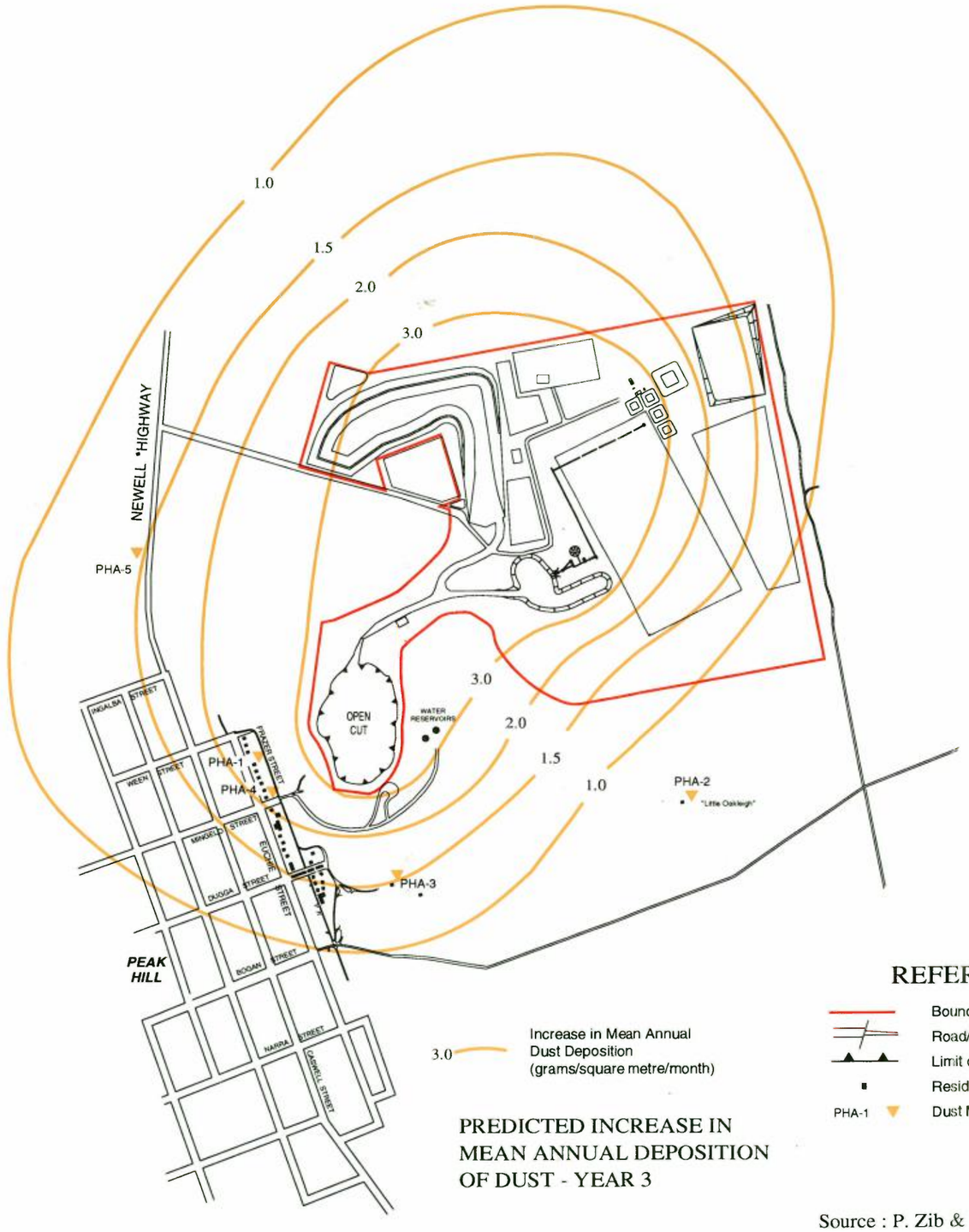
The increments in mean annual concentrations of total suspended particulates in the air at the nearest residences in Peak Hill were predicted to remain below 30 $\mu g/m^3$ in the worst year (Year 3) and would further decline thereafter.

Unlike the amenity-based criteria for the assessment of dust deposition, the guideline values for total suspended particulates are not incremental but total levels. For the total concentration to reach the acceptable maximum of 90 $\mu g/m^3$, the existing levels of suspended particulates in the air at the locations of maximum increments would have to be at least 60 $\mu g/m^3$. There is not sufficient experimental data to determine, even approximately, the current mean annual concentration at Peak Hill. However, a mean annual concentration of 30 $\mu g/m^3$ is often quoted as being consistent with air quality in those areas in which the annual deposition rates are approximately 1.5 g/m²/month such as at Peak Hill.

If it is assumed that a similar level exists of 30 $\mu g/m^3$ at Peak Hill, the total annual concentration of suspended particulates in the air at the nearest residence would be about 60 $\mu g/m^3$ or less in Year 3 with even lower concentration levels experienced in the preceding and subsequent years of operation.

PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL



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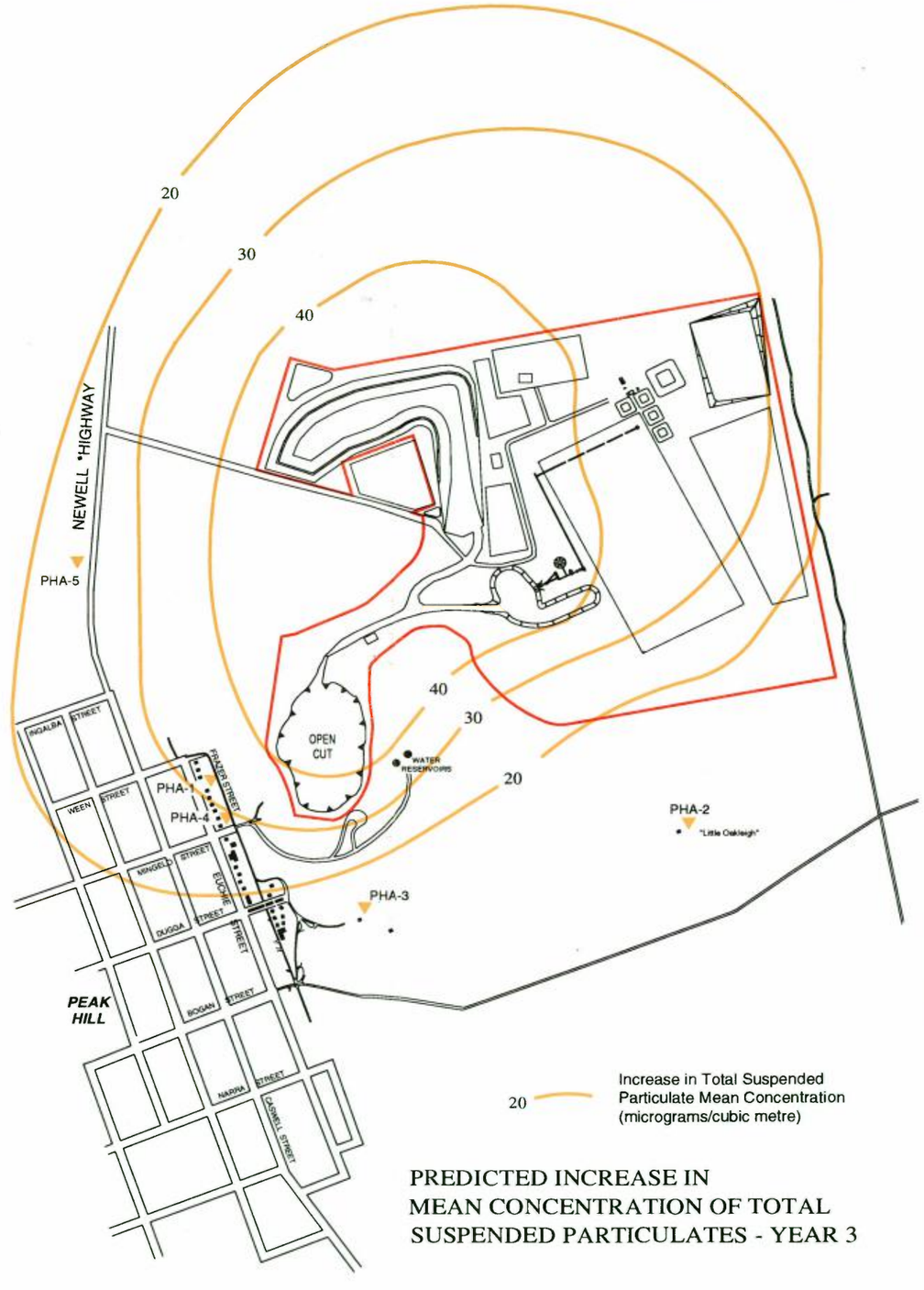

3.0 Increase in Mean Annual Dust Deposition (grams/square metre/month)

PREDICTED INCREASE IN MEAN ANNUAL DEPOSITION OF DUST - YEAR 3

REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Mining
- Residence
- PHA-1 Dust Monitoring Site

20 Increase in Total Suspended Particulate Mean Concentration (micrograms/cubic metre)

PREDICTED INCREASE IN MEAN CONCENTRATION OF TOTAL SUSPENDED PARTICULATES - YEAR 3

Source : P. Zib & Associates (1993)

SCALE 1:15000

200 0 250 500 750m

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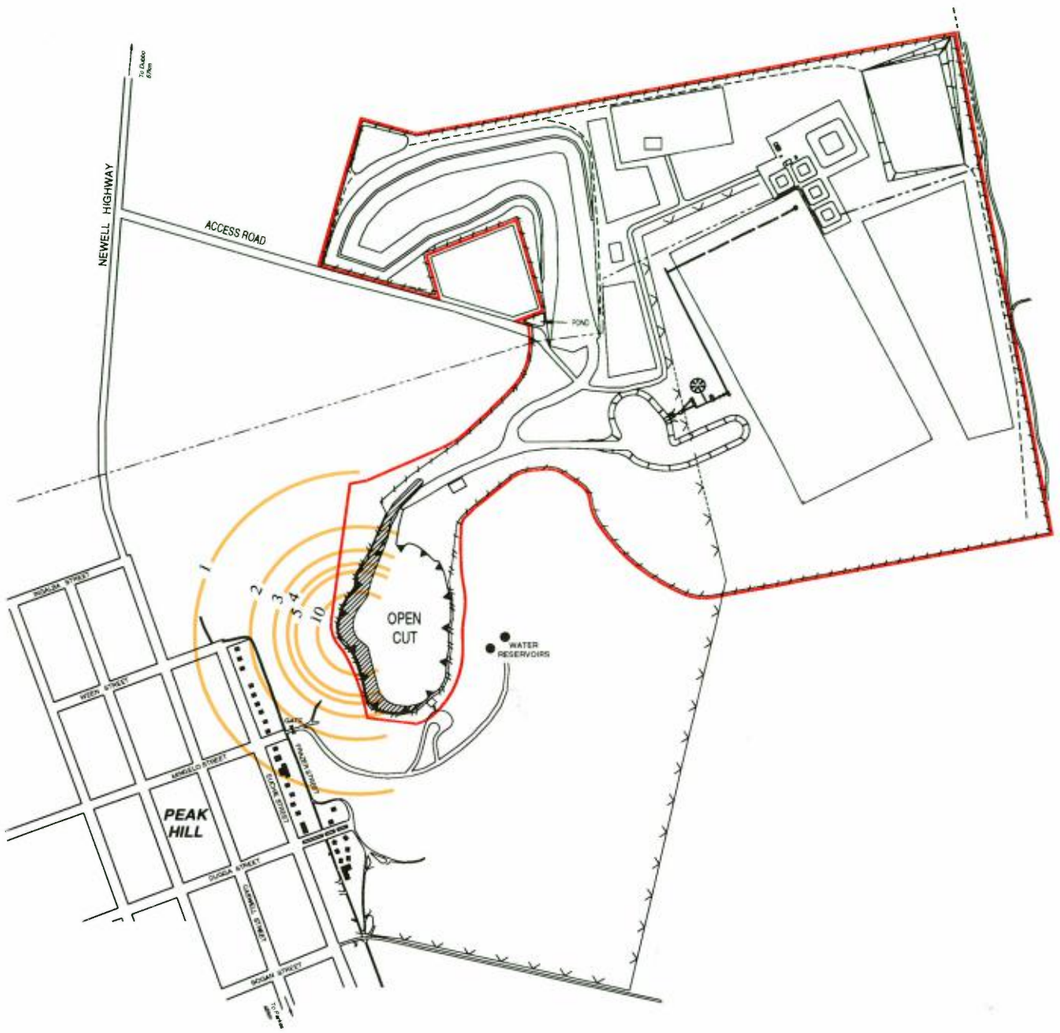
May, 1993

Figure 5.1
PREDICTED AIR QUALITY

PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL



3 Ground Vibration Intensity (mm/s)

PREDICTED GROUND VIBRATION INTENSITY

105 Airblast Vibration Contour (dBl)

PREDICTED AIRBLAST VIBRATION INTENSITY

TN

REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Mining
- Residence
- Powerline (overhead)
- Powerline (underground)
- Raw Water Pipeline

Source : Golder Associates Pty Ltd (1993)

SCALE 1:12500

200 0 200 400 600m

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REPORT No. 203 / 3
May, 1993

Figure 5.2
PREDICTED BLASTING IMPACTS

5.6.4 Temporary Open Cut Bund Wall Construction and Short-Term Dust Episodes

Temporary increases in ambient dust levels may be expected during the four (4) week bund construction period, particularly when accompanied by adverse weather conditions such as dry weather and easterly to northerly winds and, in extreme cases, dust nuisance approaching the USEPA preliminary standard could be experienced at locations within a few hundred metres downwind of scraper operation. The elevated position of the construction operation and the proximity to the residential area would accentuate the potential for a dust episode.

However, the implementation of the controls outlined in Section 4.2, notably:

- the cessation of scraper operation in north to easterly winds when the ground and the material are sufficiently dry to continue generating atmospheric dust of significant proportions; provision for installation of water sprays to wet the freshly disturbed surface and the deposited dry material to prevent dust emission due to wind erosion in sufficiently strong winds after the scraper operation has ceased;

- mulching and revegetation of the surface of the bund immediately on completion; and

- provision for corresponding monitoring of dust levels in the residential area and of wind conditions at the Project Site, would ensure the construction of the bund wall does not create unacceptable dust levels in the residential area, albeit for a relatively short period of time.

5.6.5 Conclusion

The safeguards outlined in Section 4.2 have been designed to ensure that dust levels within Peak Hill remain within acceptable limits throughout the life of the project. Higher than normal dust levels, however, may occasionally occur at the closest residences to the Project Site in adverse weather conditions associated with dry weather and north to north-easterly winds.

The highest potential for such episodes to occur would be during the four (4) week open cut bund overburden period. However this activity would be of relatively short duration, and ceased under unfavourable weather conditions.

The wetting of or use of dust suppressants on roads, spraying of ore at the crusher and other procedures to be adopted by the Company should ensure that the impact from dust and other potential contaminants during the project are contained within acceptable levels.

5.7 BLASTING

5.7.1 Introduction

In order to ensure that flyrock, air vibration, ground vibration and dust are limited to a level which is compatible with the safety and comfort of human beings, and the continued integrity of nearby dwellings, structures and facilities, the blast designs and operational procedures that would be used on the Peak Hill Gold Project incorporate in full the recommendations of blasting specialists Golder Associates Pty Limited.

5.7.2 Ground Vibration and Airblast Overpressure Limits

The limiting criteria for the control of blasting impact at surrounding residences are presented in **Table 5.2**. The ground vibration limit of 5 mm/s is 50 per cent lower than the 10 mm/s structural damage criteria recommended in Australian Standard AS 2187 for residential buildings. The ground vibration limit adopted for the water reservoirs and pipeline easement is 20 mm/s (that is, 80 per cent of the ground vibration limit recommended by the Standards Association of Australia for commercial or industrial buildings or structures of reinforced concrete or steel construction).

Table 5.2 also identifies the air blast overpressure limits specified by the Environment Protection Authority for varying times during the day, and days of the week. The most liberal limit for airblast overpressure of 115 dB(Linear) during the hours of 9.00 am to 3.00 pm Monday to Saturday, is, by international standards, a very low limit.

TABLE 5.2

Limiting Criteria for the Control of Blasting Impact at Residences

Timeband	Airblast overpressure (dB Linear)	Ground Vibration Peak Particle Velocity (mm/sec)
Monday - Saturday		
9.00 am - 3.00 pm	115	5
6.00 am - 9.00 pm	105	2
3.00 am - 8.00 pm	105	2
Sunday, Public Holiday		
6.00 am - 8.00 pm	105	2
Any Day		
8.00 am - 6.00 pm	95	1

An exceedance of the above limits are permitted by the EPA on up to 5 per cent of blasts providing the airblast overpressure does not exceed 120 dB(L) and ground vibration does not exceed 10 mm/s on any blast.

5.7.3 Predicted Levels

In the absence of vibration data recorded at the site of the proposed open cut, only general imperical equations can be applied to predict ground and air vibration intensities at various distances from blast. The predictive equations used for ground and air vibrations and the results obtained are presented below.

Ground Vibrations

Golder Associates Pty Limited have predicted ground vibration intensities at varying distances from proposed blasts using the following conservative general predictive equation developed for bench blasts in hard rock quarries.

$$V = 1143 \left[\frac{\sqrt{W}}{D} \right]^{1.6} \quad \ldots\ldots\ldots (4)$$

Where V is the instantaneous resultant of the three (3) mutually perpendicular components of peak particle velocity of ground motion (measured in mm/s);

W is the maximum charge weight per delay (measured in kg); and

D is the blast to structure distance (measured in metres).

Such an approach represents a worst case scenario because it does not allow for attenuation which occurs when vibrations move from one geological structure to the next such as would be the case at Peak Hill (See **Figure 3.1**).

Ground vibrations were estimated at distances of 60 m (the minimum possible distance from a blast to the closest water reservoir) and 200 m to 500 m (the range of blast to residence distances for dwellings in Euchie Street and Frazer Street).

Figure 5.2 shows the ground vibration contours for a final-wall blast in which one hole detonates per delay. A final wall blast is a free-face blast and as such represents a worst case scenario.

In summary:

- the ground vibrations resulting from the nearest possible blast to the residences in Euchie Street would result in a ground vibration of 2.3 mm/sec or less than 50 per cent of the limit identified in **Table 5.2** (**Figure 5.2**); and

- the estimated maximum ground vibration level at the reservoirs and pipeline from the closest blasts (a distance of 60 m) would be 16.1 mm/s or 64 per cent of the vibration limit recommended by the Standards Association of Australia for commercial and industrial buildings.

Notwithstanding the conservative nature of the predictive equations used, the above vibration levels would comply with relevant criteria and be unlikely to cause complaints from adjacent residents or damage to the reservoir or pipeline structure.

Given that the human threshold for vibration sensitivity is 0.5 mm/s, the predicted ground vibration of 2.3 mm/sec at the nearest residence would be felt by some residents. However, by way of comparison, the vibrations felt by a person standing on the footpath in Caswell Street or in a building facing Caswell Street when a semi-trailer passes would be equal or greater than the 2.3 mm/s predicted for blast-induced ground vibration.

Air Vibrations

Airblast overpressure (dB(L)) at a given distance (D) from a blast is given by the following equations:

For free face blasts:

$$dBL = 165 - 27 \log\left[\frac{D}{\sqrt[3]{W}}\right] \quad \ldots\ldots\ldots (2)$$

and for paddock blasts:

$$dBL = 160 - 28 \log\left[\frac{D}{\sqrt[3]{W}}\right] \quad \ldots\ldots\ldots (3)$$

Using the above equations, Golder Associates have predicted airblast overpressures at a distance of up to 500 m from blasts using one blast hole per delay. **Figure 5.2** shows the airblast contours predicted for a free face (or worst case scenario) blast initiated at the western margin of the open cut and at closest proximity to the residences in Euchie Street. The predicted worst case airblast overpressure of 114 dB(L), complies with the 115 dB(L) limit normally set by the Environment Protection Authority and is not likely

to annoy or alarm neighbours. However, many of the residents within Peak Hill would be aware of the blast. Nevertheless, strict implementation of the controls identified in Section 4.6 would be necessary to ensure continued compliance.

The blasting notification system to be employed by the Company, particularly the blast siren, would also minimise the likelihood of any impulsive effects of the initiation of blasts, particularly on the residents of Frazer Court Hostel.

The independent survey which would be undertaken prior to any blasting occurring to assess the structural and superficial condition of buildings on the eastern side of Euchie Street between Ween and Dugga Streets and in Frazer Street would ensure any claims for blast damage can be assessed expeditiously. In the event of blast related damage, the Company would make good that damage.

Shallow prospecting pits in the area of Euchie and Caswell Streets between Mingelo and Ween Streets, representing remnants of former mining in the area have been identified. However, given that estimated ground vibrations resulting from blasting (**Figure 5.2**) at the closest residence to the open cut (i.e. 2.3 mm/s) are of a lesser magnitude than those created by passing heavy vehicles on the Newell Highway, and the relative infrequency of blasting (compared with passing heavy vehicles), blasting induced subsidence in those areas of former mining is considered highly unlikely.

The blasting notification system to be employed is described in Section 4.6.

5.7.4 Dust

When a blast is fired, some dust is created from the partial or complete ejection of the stemming column, the escape of explosion gases through discontinuites and cracks in the face and from impacts between rock fragments and between rock fragments and the floor of the bench. Through the implementation of the controls and operational procedures identified in Section 4.6, blast-induced dust would remain in suspension in the atmosphere at a given location for only a short period of time.

5.7.5 Flyrock

Consistent implementation of the blasting designs and controls as identified in Section 4.6 and Golder (1993) would restrict flyrock to approximately 50 m in front of initial blasting faces and 10 m behind newly created faces.

5.8 NOISE LEVELS

5.8.1 Criteria for Assessment

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the Environment Protection Authority which administers the Noise Control Act, 1975. In implementing its environmental noise control policy, the Environment Protection Authority has two broad objectives:

(i) that the noise from any single source does not intrude greatly above the prevailing background noise level; and

(ii) that the background noise level does not exceed the level appropriate for the particular locality and land use.

In order to limit the potential offensiveness of noise from a specific source, any exceedance of the background noise level should generally not be more than 5 dB(A). A 5 dB(A) exceedance of the background noise level would be audible to a person with normal hearing sensitivity under reasonable listening conditions. The increase is determined by comparing the L_{10} noise level at the receptor with the potentially intrusive noise occurring with the L_{90} value determined in its absence.

When dealing with construction noise however, the EPA recognises that a higher level of noise is likely to be tolerable to receptors in view of the relatively short duration of the works. As a result, the EPA has published guidelines in its Environmental Noise Control Manual for the control of construction site noise. In summary, the EPA's approach to the control of construction noise involves the following:

(i) <u>Level Restrictions</u>

For construction periods of up to four (4) weeks duration, the L_{10} when measured over a period of not less than 15 minutes when the construction site is in operation should not exceed the background level by more than 20 dB(A). For construction periods of between 4 and 26 weeks, the L_{10} noise level should not exceed the L_{90} level by more than 10 dB(A) and for construction periods greater than 26 weeks, the L_{10} noise level should not exceed the L_{90} level by more than 5 dB(A).

(ii) Time Restrictions

Monday to Friday	7.00 am to 6.00 pm
Saturday	7.00 am to 1.00 pm (inaudible at residential premises)
	8.00 am to 1.00 pm (audible at residential premises)

No work on Sundays or public holidays.

(iii) Silencing

All practical measures should be used to silence construction equipment particularly in instances where extended hours of operation are required.

Based on the minimum daytime background noise levels and the EPA's recommended procedures, the L_{10} noise level design goals presented in **Table 5.3** have been adopted as the appropriate assessment criteria for noise emissions from the construction works to the facade of any potentially affected receiver (compared to the L_{90} "background" level).

TABLE 5.3

Airborne Noise Emission Design Goals - Construction

Duration of Construction	Background Level L_{90} - dB(A)	Design Goal L_{10} - dB(A)
Up to 4 weeks	35	55
5 to 26 weeks	35	45
Greater than 26 weeks	35	40

In relatively undeveloped rural areas, the existing background levels can be quite low. When development is permitted to proceed in such areas (e.g. in view of its social worth or as a result of government decisions on resource use and infrastructure development), the land use designation may change and there would often be a corresponding change in the noise climate.

To assist in balancing the individual and community effects and benefits arising from such situations, the EPA has drafted a schedule of recommended background noise levels for various land use categories. An extract from the schedule relating to residences in rural areas is shown in **Table 5.4**.

TABLE 5.4

EPA Recommended Outdoor Background Noise Levels

Zoning Description	Time Period*	Recommended Limit - L_{90}	
		Acceptable	Maximum
Residences in rural areas	Day Night	45 dB(A) 35 dB(A)	50 dB(A) 40 dB(A)

* For Monday to Saturday, "day" is defined as 7.00 am to 10.00 pm
For Sundays and public holidays, "day" is defined as 8.00 am to 10.00 pm

Table 5.5 presents the background noise levels adopted for noise impact assessment. Based on the noise results typically encountered (See **Table 3.6**). The corresponding recommended design goals for mining and ore processing at the receiver locations PHN-1, PHN-4, PHN-5 ("Little Oakleigh") and PHN-6 (Newell Highway Residence) as shown on **Figure 3.4** are also presented in **Table 5.5**.

TABLE 5.5

Background Noise Receiver Levels and Design Goals - Mining and Processing Operations

Receiver Location *	L_{90} Day (dB(A))	Design Goal Day (dB(A))	L_{90} Night (dB(A))	Design Goal Night (dB(A))
PHN-1	35	40	30	35
PHN-4	35	40	30	35
PHN-5	35	40	30	35
PHN-6	40	45	30	35

Note: For Sundays and Public Holidays, the 7.00 am (night-time limit - See Table 5.4) is extended to 8.00 am

* See Figure 3.4

5.8.2 Major Sources of Noise Emissions

The major sources of noise emissions can be sub-divided into three (3) distinct phases for the purposes of noise impact assessment:

1. construction;
2. mining; and
3. processing.

During the construction phase, temporary open cut bund construction adjacent to Peak Hill township using either scrapers and a bulldozer or an excavator, dump trucks and a bulldozer with a grader and water truck operating on site would be the principal noise sources.

During mining operations, the major sources of noise would be the mobile mining equipment and off-road trucks. The contributed noise from processing activities is inconsequential. Similarly, reversing alarms and blast warning sirens, though constituting additional sources of noise, are not of major significance in terms of impact assessment.

During processing operations after 6.00 pm (after the cessation of mining operations) the principal noise sources would be the crushing/agglomerating/stacking and mobile plant, with minor contributions from pumps and electric motors.

5.8.3 Assessment of Impacts

Evaluation of Noise Emission Levels

The Peak Hill Gold Project noise model calculated the maximum contributed noise emission levels (approximately equivalent to L_1) in octave bands from each source to the receiver locations considered potentially most affected by the proposal (i.e. sites

PHN-1, PHN-4, PHN-5 and PHN-6). For plant and equipment items of the number and nature as those at the Project Site, the L_1 noise levels usually exceed the L_{10} noise levels by approximately 3 dB(A) to 4 dB(A). All calculations were based on "neutral" atmospheric conditions (i.e. 20°C, 70 per cent relative humidity, 0°C/100 m temperature gradient and 0 m/s wind speed).

Construction

The noise emissions from two (2) scrapers, one (1) bulldozer, one (1) grader and one (1) water truck operating throughout the four (4) week bund construction period were evaluated to receiver locations PHN-1, PHN-4, PHN-5 and PHN-6 (**Figure 3.4**). Noise emissions from an excavator; bulldozer and two (2) dump trucks in lieu of the scrapers and dozer were not modelled, the former situation being considered to represent the worst case scenario.

The calculated L_{10} construction noise levels at each receiver location, together with the corresponding design goals are shown in **Table 5.6.**

From the results shown in **Table 5.6,** it is apparent that the recommended L_{10} design goals for construction noise impact assessment are achieved in all cases.

TABLE 5.6

Calculated L_{10} Noise Level Emissions - (Construction Duration 4 weeks)

Receiver Location *	Noise Level Emission (L_{10})	Design Goal
PHN-1	53 dB(A)	55 dB(A)
PHN-4	49 dB(A)	55 dB(A)
PHN-5	20 dB(A)	55 dB(A)
PHN-6	40 dB(A)	60 dB(A)

* See Figure 3.4

Mining and Processing Operations

The noise emissions from mobile plant and equipment operating throughout the mining operations and incorporating implementation of the controls identified in Section 4.4, were evaluated for two (2) scenarios:

Scenario 1: Years 1 and 2 mining - corresponds to the period when the open cut bund wall would be in place; and

Scenario 2: Years 3 to 5, for the period when noise attenuation relies on the intervening open cut wall.

Separate calculations were also performed for daytime and night-time operations. This approach was adopted since the plant items which operate on a day/night basis were regarded as unlikely contributors to noise emission levels received at nearby residences when compared with the large mobile equipment and processing plant operating throughout the day. However, it was recognised that this may not be the case at night time when background and ambient noise levels at receivers would be considerably lower. In addition, the potential extended hours of operation for processing plant necessitates that impact assessment is undertaken for evening and night time work.

In the case of daytime operation of mobile plant, the various noise sources were input to the computer model in what were considered to be their respective typical "worst case" operating positions on the Project Site. By repeating this process for the scenarios considered, a high degree of confidence was established that a conservative assessment had been developed through the computer modelling.

The results of modelling of the significant noise level contributions of all major plant and equipment operating throughout typical daytime mining activities at Sites PHN-1, PHN-4, PHN-5 and PHN-6 (**Figure 3.4**) are summarised in **Table 5.7** together with relevant design goals.

Separately calculated contours of noise levels received in the surrounding township during Years 1 and 2 and Years 3 to 5 of mining operations are presented in **Figure 5.3** and indicate that all residential premises fall outside the 40 dB(A) contour and thereby satisfy the design goals for assessment purposes.

TABLE 5.7

L_{10} Noise Level Emissions and Design Goals (dB(A)) - Daytime Mining and Processing Operations

Receiver Location	Year		Design Goal
	1-2	3-5	0700 - 1800
PHN-1	35	39	40
PHN-4	34	34	40
PHN-5	36	36	40
PHN-6	39	38	45

Similarly, the noise level contributions due to the evening and night-time operation of processing plant, and an associated front-end loader are presented in **Table 5.8.**

TABLE 5.8

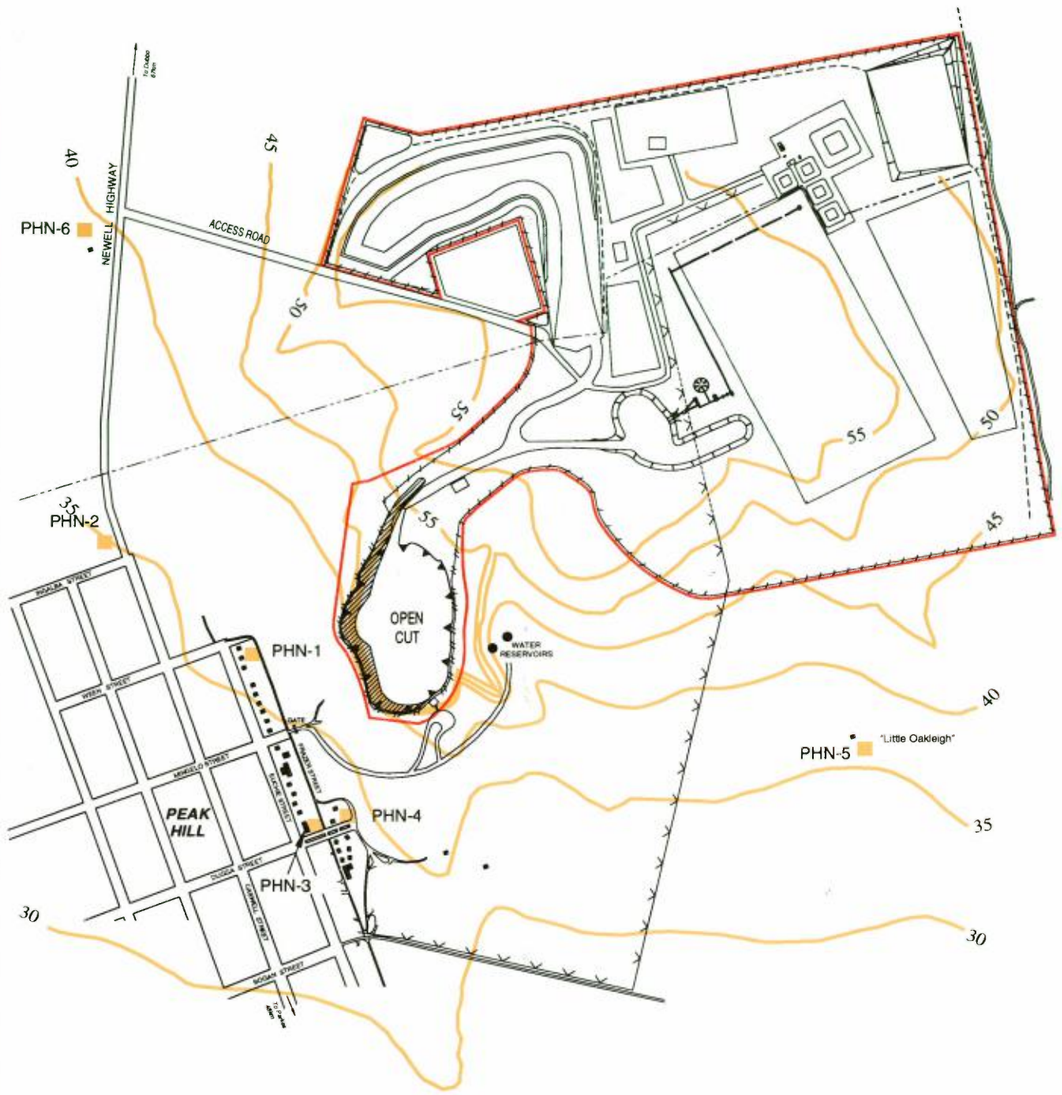
L_{10} Noise Level Emissions and Design Goals (dB(A)) - Evening and Night-time Processing Operations

Receiver Location	All Stages	Design Goal	
		1800 - 2200	2200 - 0700
PHN-1	27	40	35
PHN-4	22	40	35
PHN-5	35	40	35
PHN-6	32	40	35

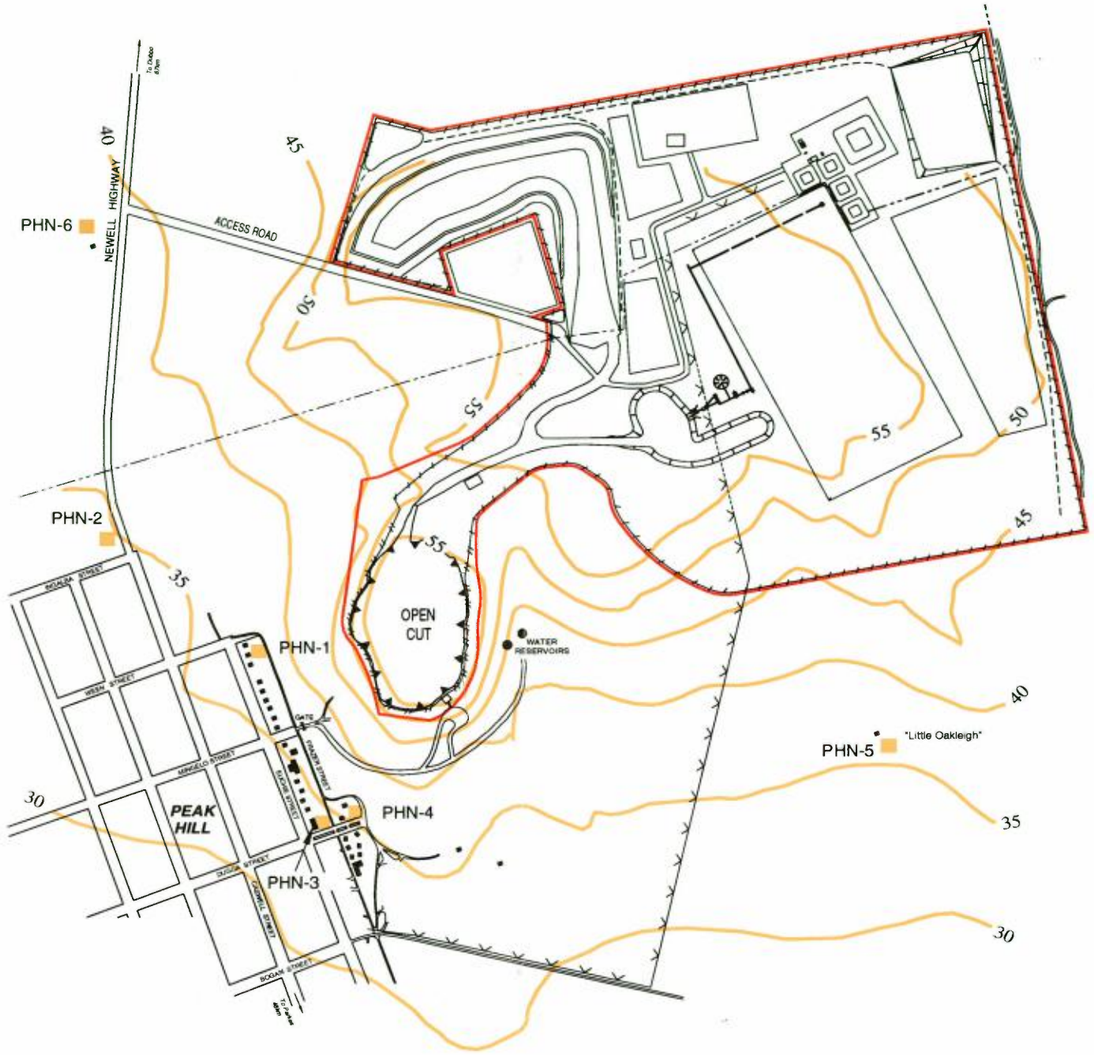
From the results presented in **Table 5.7** and **Table 5.8**, and the contours presented in **Figure 5.3**, it is evident that the recommended assessment criteria for both daytime and night-time operations are achieved throughout all the stages of mining and processing activity examined.

PEAK HILL GOLD PROJECT

ASSOCIATED GOLD FIELDS NL
AND ALKANE EXPLORATION NL



YEARS 1 & 2



YEARS 3 to 5

TN

REFERENCE

- Boundary of Project Site
- Road/Track
- Limit of Mining
- Residence
- Powerline (overhead)
- Powerline (underground)
- Raw Water Pipeline
- PHN-1 Noise Monitoring Site
- 40 Noise Emission Contour (dBA)

Source : Richard Heggie Associates Pty Ltd (1993)

SCALE 1:12500

200 0 200 400 600m

R.W.CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS
REPORT No. 203 / 3
May, 1993

Figure 5.3
PREDICTED NOISE LEVELS

Road Traffic Noise

On public roads of existing traffic flows greater than 1 000 vehicles per day, the EPA advocates the use of the CORTN method to asses the L_{10} (18 hours) daytime and L_{10} (6 hours) night-time noise levels for existing traffic flows and increased traffic flow resulting from a development, with particular emphasis on the increase in the percentage of heavy vehicles.

The criteria generally recommended are that the increases in the L_{10} (18 hours) daytime and L_{10} (6 hours) night-time noise levels due to traffic from an operation do not exceed 2 dB(A). Also, that the overall maximum L_{10} (18 hours) daytime and L_{10} (6 hours) night-time traffic noise levels do not exceed 63 dB(A) and 58 dB(A) respectively.

Traffic flow data and predictions were presented in Section 3.15 for the Newell Highway.

When compared with the projected daily traffic volumes for the years 1995 and 2000, and the percentage of heavy vehicles, the additional vehicles generated by the proposed development would create no perceptible increase in the existing levels of road traffic noise.

5.9 FLORA AND FAUNA

5.9.1 Flora

Development of the Project Site would result in the clearing of approximately 13 ha of regenerating disturbed eucalypt woodland. Much of the hill, in particular that in the vicinity of the proposed open cut and the Council gravel pit, is already heavily degraded, only lightly timbered and exhibits severe weed infestation. The most extensive tree clearing would be required in the highly disturbed northern section of the site (Habitat 1 - **Figure 3.5**), with only minimal disturbance occurring in the remnant regenerating woodland (Habitat 2 - **Figure 3.5**), although this area too has been subject to a considerable amount of deforestation in the past. Similarly, the pipelines route from Bogan Weir to the Project Site and from the "Westray" impoundment to the Project Site comprise predominantly degraded cleared agricultural land with weed infestation and cleared agricultural land, respectively.

Although remnant woodlands such as that found on Peak Hill are becoming increasingly scarce in central western New South Wales, Goldney (1993) noted that the flora and fauna found on the hill in general, and the Project Site in particular is better represented in the nearby Hervey Ranges State Forest and the Curembenya Nature Reserve. Goldney (1993) considered that the establishment of a mine would have a moderate but acceptable impact on the site.

5.9.2 Fauna

In satisfaction of the requirements of Endangered Fauna (Interim Protection) Act, 1991, the impacts on fauna on the proposed Peak Hill Gold Project have been assessed by Dr David Goldney.

A full assessment as identified within Section 4(a) of Schedule 2 of the Act is presented in Goldney (1993).

In summary, Goldney concluded that in spite of two (2) sightings of species listed on Schedule 12 of the National Parks and Wildlife Act, 1974 within the study area, the effects of the proposal on the Painted Honeyeater and the Swift Parrot would be marginal to non-existent. Goldney based his conclusion on:

- the highly disturbed nature of the habitat within the Project Site and the similar and more pristine habitat available in the Hervey Range and Currembenya areas to the east;
- the absence of evidence of a population. Rather, the two (2) single sightings were considered to reflect transiency rather than residency; and
- the absence of critical habitat within the Project Site.

5.10 ARCHAEOLOGICAL ASPECTS

Archaeological studies on the Project Site have been undertaken by Anutech Pty Limited on behalf of Peko Wallsend Limited. The results of these surveys were presented in Section 3.9.

5.10.1 Pre-European Settlement

The absence of archaeological sites and artefacts on the Project Site would result in the proposal having no impact on the local aboriginal history. However, in the unlikely event that any sites or artefacts are encountered, the Company would notify the New South Wales National Parks and Wildlife Service prior to taking further action. Similarly, any sites encountered during the installation of the Bogan Weir pipeline, the Sewage Treatment Plant surge pond and Sewage Treatment Plant to Project Site pipeline, or the "Westray" - Project Site pipeline would be reported to the National Parkes and Wildlife Service.

5.10.2 Mining History

The proposed development would result in the removal of a number of mining relics which are scattered on the western side of the hill. The "glory holes" which are a tourist attraction within the town would also be lost during the mining of the ore body. However, the smaller holes to the south of the proposed open cut area, e.g. the Crown Workings, would be developed as a tourist amenity. The collection of any surface items of historical significance and their placement at the site of the proposed tourist

lookout and adjacent to a board describing the history of mining at Peak Hill would also significantly reduce any impact.

Creation of an open cut in close proximity to a town may also have a positive impact. During the life of the mine, tourists would be able to view an operating mine as well as aspects of historical mining.

5.11 ZONING LAND USE

5.11.1 Zoning and Planning Instruments

The Project Site lies within an area Zoned Rural 1(a) under the Parkes Local Environmental Plan, 1990, and as such is a permissible land use with consent of Council. Parkes Shire Council has no plans to extend the current 2(v) Zoning **(Figure 3.6)** east of its current location.

The Proposal and the measures to mitigate impact are consistent with the objectives of the Parkes Local Environmental Plan, 1990.

5.11.2 The Site's Land Use

The project would result in the permanent loss of a number of former glory holes, and hence one of Peak Hill's current tourist attractions. However, the new and larger open cut would likely also be of interest to tourists. A viewing platform overlooking the new open cut, serviced by a sealed road and a bus turnaround, and incorporating a permanent sign outlining the mining history of Peak Hill, together with the improved and safer access to the smaller historical holes to the south of the open cut, would provide continuity of this amenity. Removal of rubbish currently littering the area would greatly improve the aesthetic quality of the area.

The project would also result in temporary loss of access to a section of the hill for trail bike riders.

Rehabilitation of the north-eastern section of the site with trees and grasses and the retention of the runoff pond and waste rock sedimentation pond would result in the recolonisation of this presently degraded area by fauna, particularly macropods and birds. The land would also be suitable for light grazing. The Council presently uses a portion of this site as a gravel pit which would need to be relocated if the development proceeds.

Rehabilitation and soil managment procedures to be employed would enable the return of all but 35 ha of existing Class III agricultural land to a level of productivity similar to that prior to the development. The remaining 35 ha comprising the waste rock emplacement and leach heaps would be re-classified to Class V land and would be suitable for grazing use.

5.11.3 Surrounding Land Uses

The proposed development would not affect activities on adjacent land. While noise levels associated with the project may deter stock in adjoining paddocks from approaching the site initially, they would adapt to the new environment fairly quickly.

Similarly, the effects of blasting on stock would be negligible: research conducted into the effects of sonic booms from aircraft concluded that for sonic booms in the range of 125 dB to 136 dB (levels well in excess of the 115 dB(L) EPA limit), the reactions of sheep and horses to sonic booms were slight (R. Godson pers comm).

Access to the town's rubbish dump and public safety at the intersection with the Newell Highway would be improved through the upgrading of the access road and intersection.

5.11.4 Public Safety and Property

Implementation of the controls outlined in Section 4.6 and 4.8 would ensure the safety of Company employees, the residents of Peak Hill, and visitors to the Mine Site. The controls would also guarantee the safety of public and privately-owned property from project-associated damage.

5.12 PARKES RADIO TELESCOPE

The distance between the Project Site and the radio telescope is sufficient to negate any impact ground vibration and blast overpressure might have on the telescope.

In general, the design and operational safeguards to be incorporated in the project and outlined in Section 4.10 should serve to eliminate the impact of the mining operation on the radio telescope. Welding, particularly during the construction period, may cause interference radiation problems.

5.13 SOCIO-ECONOMIC FACTORS

5.13.1 Population

The operating project would result in a minor increase in the population of the Peak Hill district as approximately 10 to 20 specialist personnel (and their families) would need to be hired from outside the local area. However, as the remainder of employees are expected to be recruited locally, a significant population increase is unlikely.

During the pre-production phase, the Company and contracted workforce would range between 6 and 30, of which a proportion would be expected to be recruited from within the Peak Hill/Parkes District.

5.13.2 Employment

The provision of up to 30 jobs during the construction period and 40 permanent jobs for the five (5) year life of the project offers substantial employment opportunities for local residents in an area of very high unemployment.

In addition, a considerable level of indirect employment would be generated by the project, particularly in the wholesale/retail, accommodation, recreational and other service industries.

5.13.3 Impact on the Residents of Frazer Court Hostel

The design and planning for the Peak Hill Gold Project has, from the outset, recognised the necessity and importance of incorporating a level of safeguards which would ensure no unacceptable loss of amenity to any residents in Peak Hill.

Special attention has been paid to the requests of the management of Frazer Court Hostel and the Self-Care units adjacent to the Project Site.

The safeguards recommended by the Company's specialist consultants have been adopted and, together with the monitoring procedures outlined in Section 4.11 would ensure impacts remain at acceptable levels at all times.

5.13.4 Impact on Community Facilities

Development of the proposed project, and the attendant small increase in population during both the pre-production and production phases would have a marginal impact on community facilities. Accordingly, the Company has agreed to donate $15 000 to the Shire to assist in the upgrading of recreational facilities. Additional input by the Company which would improve community facilities or their use would include:

- a sealed access road to the water supply reservoirs, if required;
- provision of improved tourist access to Peak Hill workings and a safe viewing platform;
- upgrading the access to the solid waste depot; and
- assisting in the rehabilitation of disturbed and degraded areas on Peak Hill.

The Company's presence could also have indirect benefits, for example:

- the maintenance of school facilities and teacher numbers through increased enrolments; and
- the maintenance of medical facilities within the town at the time when there is increasing pressure to centralise medical and hospital facilities.

5.13.5 Economic

The project would provide a boost to the financial status of some residents and businesses in the Peak Hill district. Much of the Company's annual wage bill of $1.5 to $2.0 million would be spent locally on accommodation, food, entertainment and other services.

5.13.6 Cumulative Impact

Though significant on a local scale, by comparison the Project is small when compared with the Northparkes Project, located approximately midway between Parkes and the Project Site. The only other mining venture of note within Parkes Shire, the Parkes Gold Mine, has ceased mining and is currently only processing stockpiled ore.

Given that the proposed project would essentially be replacing the production of the Parkes Gold Mine, there is more than an adequate pool of available labour and there has been a steady decline in population and services in rural areas due to the rural downturn, any cumulative effect created by the Project could only be seen as positive.

5.14 VISUAL

Peak Hill is an obvious topographic feature in the Peak Hill district. As such, various aspects of the proposed operation would be visible from different parts of the surrounding countryside. A combination of topography and relatively dense vegetation would serve to effectively screen the northern and northeastern side of the Project Site from the town.

Although the temporary bund wall would effectively screen the majority of the open cut and associated activities during the first two (2) to three (3) years of operations, the upper limits of the bund wall itself would be partially visible above the tree screen from many parts of Peak Hill township. Rehabilitation of the wall with grasses, and the planting of additional trees on the area between the bund and town, would alleviate the impact of this structure in the short term. Depending on the specific location within the town, the uppermost exposed parts of the open cut would either be totally or partially visible. However, as the exposed rock surface gradually weathers to a mottled grey and brown coloration, any visual impact would be reduced accordingly. The Company's proposal to revegetate the upper benches which are visible from Peak Hill together with the natural re-establishment of vegetation on the benches and batters, as is the case with the existing glory holes, would further reduce any visual impact.

The waste rock emplacement would be visible to residents on the Newell Highway north of the town and to motorists travelling south on this road towards Peak Hill as would other aspects of the project in the northeastern section of the Project Site such as the leach heaps and several buildings. Progressive development of the waste rock emplacement and leach heaps during the project would make these structures increasingly obvious to those residents on the highway and motorists. The long term visual impact of the waste emplacement and the leach heaps would be lessened by

rehabilitation, screen plantings and final shaping of the structures to blend with the local topography.

The north-eastern section of the Project Site and the crushing plant would be visible to motorists on Warrigal Road and from residences south and south-east of the site. This is particularly so for residents at "Little Oakleigh". In the long term, the view of the Project Site from the southeast would be one of fewer trees but a less degraded area.

5.15 TRANSPORTATION

The project would result in an increase of less than 2 per cent in traffic on the Newell Highway within Peak Hill and less than a 0.2 per cent increase in heavy vehicle movements. The majority of light vehicle movements and all heavy vehicle movements would be between the hours of 6.30 am and 6.00 pm. Such low levels are unlikely to have an appreciable detrimental impact on local road conditions.

Public access to the town's solid waste depot would be significantly improved and made safer by the creation of a northbound overtaking lane and widened tapers at the intersection of the Newell Highway and the depot access road. Sealing the access road would further improve accessibility under all weather conditions.

Tourist access to the current and historical mining operations would also be significantly improved with the construction of a sealed access road and bus turnaround. In addition, sealing of the road to the water reservoirs would improve access of service vehicles to the town water supply.

5.16 SERVICES

Power and telephone facilities and potable water can be supplied to the Project Site without detrimental impact on consumers in Peak Hill. Raw water supplies from the sewage treatment plant, and the Bogan Weir would be via new pipelines and a surge pond which, on completion of the Project, would revert to Shire ownership. Water would therefore still be available in close proximity to the town rubbish dump for fire control. Raw water supplies from the "Westray" impoundment would also be via a new pipeline which, within "Westray", would revert to the landowner on Project completion.

SECTION 6

Evaluation of the Project

SECTION 6

EVALUATION OF THE PROJECT

6.1 JUSTIFICATION OF THE PROJECT

Clause 34(f) of the Environmental Planning and Assessment Regulation, 1980 requires this Statement to justify the proposed development in terms of environmental, economic and social considerations.

6.1.1 Environmental Considerations

The Company's development, involving the mining and processing of gold-bearing ore, would be adequately safeguarded during the operation to ensure the environment in and around Peak Hill would not be adversely affected.

Although some impacts would occur and residents would be aware of the activities from time to time, it has been determined that the level of these impacts is within specified criteria or acceptable community standards.

The principal impacts the project would have on the local environment are as follows:

(i) noise levels from the pre-production and mining phases would be apparent but not excessive and would comply with Environment Protection Authority criteria.

During Years 1 to 3, noise from the mining operation would be reduced to acceptable levels due to the existence of a temporary bund wall generally located within the confines of the open cut.

With the exception of the crushing plant, noise generating activities would be limited to 7.00 am to 6.00 pm, Monday to Saturday.

The crushing plant would normally operate between 7.00 am and 10.00 pm but may operate for longer hours during periods of peak production subject to proven compliance with appropriate noise criteria;

(ii) the impacts of blasting at the adjacent residences and at the town's water supply reservoirs, though apparent to varying degrees, would comply with the statutory limits at all times. Flyrock from infrequent free face blasts would be limited to 50 m in front of the blast face and 10 m behind newly created faces and dust would remain in the atmosphere for a few seconds only.

Residences in Euchie Street could experience ground vibrations of 2.3 mm/s and airblast overpressures of 114 dBL from free face blasts which, though apparent, would not be a cause of annoyance, disturbance or damage. The maximum ground vibration at the reserviors of

16.1 mm/s from free face blasts approximates 64 per cent of the recommended limit.

Airblast overpressure from the more frequent paddock blasts at the nearest residences would approximate 110 dBL;

(iii) the project development would necessitate the removal of approximately 13 ha of highly disturbed woodland to enable the development of the open cut and associated haulroads, the ROM stockpile area and the southern-most portion of the waste rock emplacement. The project would also necessitate the removal of an additional 100 ha of Class III agricultural land from production for the five (5) year project duration. Approximately 35 ha comprising the rehabilitated waste rock emplacement and leached heaps would be downgraded to Class V agricultural land by virtue of the steepness of slopes and hence, susceptibility to erosion, and their unsuitability to any form of cultivation. The visual impact of vegetation removal in the area of the open cut would be reduced in the short term by temporary bund construction and revegetation, and in the longer term by the Company's site rehabilitation programme;

(iv) development of the open cut and, in particular, the one (1) month duration for the construction of the temporary open cut bund wall, may result in short term episodic declines in local air quality during periods of adverse meteorological conditions. The first few rows of houses to the west and south-west of the Project Site would be potentially most affected should winds prevail from the east and north-east. Specific dust controls (including shut-down provisions) would therefore be adopted under adverse weather conditions to maintain suspended dust levels within the USEPA primary standard and so eliminate any suggestion of health risk. In the event of a protracted dry period and insufficient water for both dust suppression and processing activities, the available water would be preferentially used for dust suppression;

(v) the local road network would carry a marginal increase in traffic during both the pre-production and mining phases. The increase in traffic would generally be within the hours of 6.45 am to 6.45 pm Monday to Saturday when normal traffic movements within and about the town are greatest. The Company would finance the sealing of the solid waste depot access road, the improvements to the intersection of the waste depot access road and the Newell Highway, the provision of a sealed access road and bus turnaround to the new open cut lookout and a sealed road to the water reservoir; and

(vi) the project would result in a significant and unavoidable modification of what is an already-modified landform on the Project Site. The existing glory hole would be enlarged vertically and laterally and the waste rock emplacement and leach heaps would form elevated plateaux in what is predominantly gently sloping cleared agricultural land. However, their

low external batter slopes, combined with final landscaping and revegetation, would result in their blending in with the natural slopes on Peak Hill.

The project would incorporate progressive rehabilitation to leave the site safe, erosion free, free-draining (with the exception of the runoff pond, waste rock sedimentation pond and fire pond) and revegetated.

Existing waste dumps, slag and miscellaneous rubbish would be removed from the Project Site resulting in an improvement to the aesthetics of the present site. Old exploration holes and shafts located throughout the Project Site, which currently pose a potential public safety hazard, would be filled in or fenced off during the life of the project.

(vii) The Project's requirement of 255 ML water annually for treatment and dust suppression activities would be sourced from harvested Project Site runoff, the Sewage Treatment Plant, the Bogan Weir and the "Westray" impoundment. Sewage Treatment Plant effluent would provide 114 ML of the annual 255 ML requirement, with the balance being sourced from a combination of the remaining sources.

The Company would restrict access to Bogan Weir waters to those periods when the water level in the Weir was within 1.5 m of top water level, thereby guaranteeing a minimum 115 ML would be available to agricultural users.

A further 5.8 ML would be required annually for potable water supplies and would be supplied from the Peak Hill water supply system without impact on existing usage.

The Company is keen to maintain good relations with nearby landowners and residents of the Peak Hill area. They realise that this would naturally involve the Company maintaining its commitment to a high environmental standard at all times throughout the life of the project.

6.1.2 Economic Considerations

As a result of the project's development, there would be significant benefits earned by the Company (and its shareholders and employees) as well as by the local community and state and federal governments.

(i) Peak Hill and District

The Company's proposed operation would generate considerable employment opportunities for local persons both during the pre-production and production phases. Although professional people employed during the pre-production period would be transferred from the designer's off-site office, other workers would be employed locally, where appropriate skills are available.

Approximately 20 to 30 of the total of 40 operational positions would be expected to be filled by residents within Peak Hill or Parkes Shire. It is the Company's philosophy to become part of the community and employ locally as much as possible. There would also be considerable indirect employment generated in Peak Hill and Parkes and beyond through the "multiplier" effect, a multiplier of two (2) being typical of a mining project.

The creation of a new development and resulting jobs would have an invigorating effect in the local community and would tend to offset the recent decline in returns on wheat and wool. The Company has had very encouraging and positive feedback from the majority of local people and also interest groups canvassed, such as the local aboriginal and business communities.

Mining of gold would also add considerable stability and diversification to the district's income and workforce and would better equip the district to accommodate cyclical downturns in rural income over the next five (5) years. Essentially, a greater stability of employment would result. Many employees would learn new skills during both on-site and off-site training.

The Company's operation would provide between $1.5 to $2.0 million annually in employee wages, much of which would be spent locally. This would augment the Company's interaction with local industry, and, with additional spending on services, would be of considerable benefit to the district.

The increase in population in Peak Hill and a higher level of employment may also encourage the maintenance of existing levels of services, e.g. schools, medical practitioners, hospital.

Construction of the pipeline from the Bogan Weir to the town could provide an alternative water supply to the town during emergency situations and lessen the pressure on the existing pipeline supply from Parkes.

Provision of upgraded tourist facilities and the ability for visitors to view modern and historic mining activity side by side in close proximity to the town would encourage tourist visits and the attendant economic flow-ons to Peak Hill.

There would be almost negligible short term loss of rural income from the area of cleared agricultural land to be impacted by the proposal. In the longer term, the reclassification of approximately 35 ha Class III agricultural land to Class V land would be compensated in part by the provision of additional stock watering facilities within Portion 380.

(ii) New South Wales

The New South Wales Government would benefit directly from the employment generated with its associated payroll tax and other charges and flow-ons. There would also be approximately $200 000 gold royalty paid annually to the State Government.

Approximately $3 million would be spent on project development and construction during the pre-production phase. This would be expended on construction materials, contractor's profit, wages, services and other flow-on benefits. It is expected that most of this would be expended in New South Wales.

A total of up to $6 million per annum would be spent on consumables, supplies and services for the Project, most of which would be provided by NSW industry.

The creation of new jobs in the Peak Hill district would help stem the flow of people from country areas to larger towns and cities as has been the trend in Parkes Shire for the last decade.

(iii) Australia

The Commonwealth would also significantly benefit from the employment generated as well as P.A.Y.E., Fringe Benefits and Company taxes levied. Additionally, over the life of the project, export revenue to be earned for Australia would be about $35 to $40 million based on current gold prices.

6.1.3 Social Considerations

The principal social considerations that would arise from the project would be as follows:

(i) short term employment of approximately 30 persons during the pre-production phase;

(ii) direct employment of up to 40 workers and increased indirect employment during the mining (production) phase;

(iii) boosting of indirect employment and local services by the mine's presence;

(iv) increased stabilisation of the district workforce and income through employment diversification which would supplement the currently declining rural industry; and

(v) a possible extension to the current mineable reserves and increase in the life of the project beyond five (5) years due to continued exploration activities, thus maintaining employment opportunities in the region.

6.2 CONSEQUENCES OF NOT PROCEEDING WITH THE PROJECT

The consequences of not proceeding with the Peak Hill Gold Project are manifold and include:

(i) the loss of a viable mining project which would have been of considerable value to the Peak Hill district, Parkes Shire, New South Wales and Australia;

(ii) the loss of thirty (30) direct jobs (including many for local residents) during the pre-production (construction phase);

(iii) the loss of forty (40) direct jobs (including approximately twenty (20) to thirty (30) for local residents); the loss of the Company's contribution to the up-grading of recreational facilities and the loss of the multiplier effect of approximately two (2) indirect jobs created for each direct mining job created and which would otherwise help offset the current decline in rural income in the Peak Hill/Parkes district and Australia generally;

(iv) the Company's shareholders would not obtain a return on their investment and would lose the value of all exploration and feasibility study costs expended on the project. Additionally, Commonwealth taxes, State Government taxes and charges and Council charges and other flow-ons would not eventuate;

(v) the loss of approximately $35 to $40 million in export revenue over the life of the project to help offset at least in part, Australia's foreign debt;

(vi) the loss of approximately $3 million of construction expenditure and associated employment;

(vii) the loss of an opportunity to rehabilitate the existing disturbed site at the old Peak Hill Gold Mine;

(viii) the loss of an up-graded reservoir access road facility;

(ix) the access road to the solid waste depot would not be upgraded nor would safety aspects at the intersection of the depot access road and the Newell Highway be improved;

(x) creation of improved, diversified and safe tourist facilities at the Peak Hill Gold Mine would not eventuate;

(xi) the existing degraded areas on Peak Hill would not be rehabilitated nor the rubbish be removed;

(xii) an additional water supply line from the Bogan Weir to Peak Hill would not be made available, nor would the gravity mains from the Peak Hill reservoir be up-graded; and

(xiii) the additional social and economic benefits outlined in Section 6.1 would not eventuate.

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REFERENCES

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GLOSSARY OF TECHNICAL TERMS AND SYMBOLS

GLOSSARY OF TECHNICAL TERMS AND SYMBOLS

Terms

A horizon - upper part of soil profile containing organic matter

agglomeration - the binding of fine particles to coarser material using cement

air pollutant - a substance in the atmosphere, resulting from the activity of man or from natural processes, causing adverse effects to man and the environment (also called "air contaminant")

air pollution - presence of air pollutants

airblast overpressure - a shock wave from the blast transmitted through the air, normally measured in dB (Lin)

alluvial - sediment deposited by flowing water

alluvium - a general term for material deposited by rivers

ambient air quality - the quality of the ambient air near ground level, expressed as concentrations or deposition rates of air pollutants - also expressed as existing air quality

ameliorant - substance used to improve the physical or chemical condition of, for example, soil.

ammonia (NH_3) - a product from the chemical breakdown of cyanide

andesite - volcanic rock resembling basalt

arboreal - pertaining to tree habitats

Argillic alteration - enrichment in clays

assay - a chemical analysis

attenuation - reduction in sound pressure levels between two locations

average annual daily traffic (AADT) - unit of assessment of traffic flow along a road

B horizon - subsoil material located below the A horizon material and above the parent rock.

background dust level - dust level in the absence of mining and processing activities

background noise levels - noise level in the absence of mining and processing activities

barren - in the heap leach context refers to solution not containing dissolved gold

barren pond - pond containing barren process solution

base-course - road material placed on sub-base to receive bitumen seal

baseline monitoring - monitoring performed prior to site development

batter - the inclined face between two near horizontal surfaces

bench - a horizontal platform in the face or wall of a quarry or mine

blast face - the face of a bench which has been drilled, loaded with explosives, and when detonated the blast, yields the broken rock for processing

blasting - the operation of breaking rock by means of explosives

bulldozer - an item of tracked mobile earth moving equipment fitted with a front blade and with rear rippers used for pushing and ripping soil and rock

bund - embankment of clay or weathered rock emplaced for visual or acoustic screening or wall of earth or concrete used to contain liquid spillages

burden distance - distance between rows of blast holes measured at rightangles to the free face of a free face blast

carbon-in-pulp (CIP) treatment - a method of gold extraction from cyanide solutions using carbon, in a finely ground ore slurry, as a precipitating agent

catchment - the area determined by topographic features within which rainfall will contribute to runoff at a particular point

cathode - the negative electrode of the electrolytic cell

chloride - the univalent negative ion of the element chlorine

colluvial - unconsolidated sediment deposited by surface runoff

comfort criteria - controlling limits of ground vibration and airblast overpressure from blasting above which they may be offensive or interfere with the comfort or response of a person

cone crusher - a type of crusher for reducing rock fragment size by means of appropriately positioned and spaced rotating or oscillating cones

contour bank - an earth bank constructed across a slope parallel to contours

convective - vertical movement of air in response to the heating of the ground

conveyor - A device fitted with an endless rubber belt used for moving crushed rock within the processing plant

crusher fines - material finer than 3 mm produced in the crushing plant

crushing - the mechanical process of reducing rock size usually by pressure or impact

cut-off grade - the lowest grade of mineralised material considered in the calculation of grade in a given deposit

cyanide pellets - a compressed form of cyanide as delivered to the mine site

"dalmatic" type dust collection system - dust collection system which collects dust and, in pulses, places the collected dust under the crushed ore on the discharge conveyor belt

damage criteria - ground vibration and airblast overpressure levels from blasting just great enough to minimise the risk of threshold or cosmetic surface cracks or window breakage respectively

dip - the angle that rock strata make with a horizontal surface

dispersion model - a set of mathematical equations relating the release of air pollutant to the corresponding concentrations in the ambient atmosphere or deposition on the surface

diversion bank - an earth bank constructed to divert water

dore bullion - the product obtained from the electrical/physical treatment of gold-bearing cyanide solution; dore bullion contains impurities such as silver

drill core - the cylindrical sample of rock recovered by means of diamond drilling

drill hole cuttings - fine rock material brought to the surface during blast hole drilling

dust - particles of mostly mineral origin generated by erosion of surfaces and the mining and handling of materials

dust concentration - the amount of a substance, expressed as mass or volume, in a unit volume of air

dust suppressant - any substance used to prevent dust disturbance

electrowinning process - recovering metal from solution by the use of electrodes

elution - washing process

environmental constraints - limitations on a project by components of the environment

ephemeral - refers to streams which do not flow the whole year through - also known as intermittent streams

excavator - item of earth moving equipment either tracked or wheeled fitted with a bucket on an articulated boom and used for digging material from a face in front of, or below the machine

Exploration Licence (EL) - tenement for mineral exploration in New South Wales

face - sub-vertical mine feature generally forming limits of benches

fallout - the sedimentation of dust or fine particles in the atmosphere

fault - a fracture in rock along which there has been observable displacement

fill - material imported and emplaced to raise the general surface level of a site or material placed in a stope

flyrock - rock that is propelled into the air by the force of an explosion. Usually comes from pre-broken material on the surface or upper free face

foliation - the laminated structure occurring in rocks

fragmentation - the extent to which rock is broken into small pieces by blasting

free cyanide - cyanide in a chemically available and generally toxic form; the cyanide ion (CN^-) and molecular hydrogen cyanide (HCN)

"free digging" material - ore and waste which can be excavated without prior blasting

free face blasting - form of blasting in which the blast pattern has free faces on one or more sides

fresh rock - rock unaffected by weathering processes

geochemical - chemical aspects of the composition of the earth's crust

geological reserves - the measured total quantity of in-situ mineralisation in a deposit, prior to consideration of mining parameters

geotechnical - aspects of soil and rock behaviour related to their physical and mechanical properties

"glory hole" - a surface expression of underground mine workings with slope factures into the hole

grader - an item of earthmoving equipment, rubber tyred and fitted with a centrally mounted blade used to shape and trim the ground surface

ground vibration - motion of the ground caused by blasting

groundwater - sub-surface water contained in voids such as fractures and cavities in rocks and inter-particle spaces in sediments

HDPE - high density polyethylene

haul road - road used in mine for haulage of ore to the crusher and waste to waste rock emplacement

heap leach - a process involving the application of a weak sodium cyanide solution onto a heap of crushed ore

heavy metals - normally trace metals which occur in ore deposits and may be environmentally hazardous

highly weathered rock - rock affected by considerable weathering to the extent that it crumbles easily

hydraulic drill - hydraulically operated piece of equipment used to drill blast holes

hydroseeding - the application of a mixture of seed, fertiliser and mulch in water to disturbed surfaces

intermediate pond - pond collecting water from the secondary leach cycle

inversion - generally used in meteorology with respect to an increase of temperature with height in contrast with the usual decrease of temperature with height in the troposphere. An inversion layer is distinguished by its large stability, which limits the turbulence and therefore the dispersion of pollutants.

jaw crusher - a crusher which uses the pressure applied to the rock between a fixed and moving plate to reduce rock size

launder - drain

leach - to dissolve metals or minerals out of ore

lithic - composed of rock fragments

metamorphism - process by which rocks are altered due to heat and pressure

metamorphosed rocks - rocks changed from their original composition and/or texture by heat and/or pressure.

microcrystalline - composed of microscopic-sized crystals

mineralisation - the process by which minerals are introduced and concentrated within a host rock, and the product of this process

MLA - mining lease application

monitoring - the regular measurement of components of the environment to establish that environmental standards are being met

motor control centre - electrical control panel

nuisance dust - relatively large dust particles which settle out - not detrimental to health

off-road dump truck - a truck specifically designed for hauling and tipping soil or rock within the mine or similar situation

operational constraints - limitations upon a project by equipment or machinery

overburden (waste rock) - in the mining context refers to non-economic material to be removed to allow access to the resource

overflow pond - the pond collecting any overflow that may occur from the barren, intermediate, raw and pregnant ponds

oversize material - rock too large to be accepted by the processing plant

oxidation - the process of combining with oxygen

oxide (ore) zone - the portion of a mineral deposit which has been affected by meteoric waters causing, for instance, the alteration of sulphides to oxides and carbonates

"paddock blasting" - the form of blasting in which the blast pattern is entirely surrounded by solid or previously blasted rock

particulate matter - small solid or liquid particles suspended in or falling through the atmosphere - sometimes expressed by the term particulates

permeability - a material property relating to the ability of the material to transmit water

potable - water suitable for human consumption

precipitation - natural weather phenomena producing quantities of water measurable by standard methods (e.g. rainfall, snow)

pregnant - in a heap leach context refers to solution containing dissolved gold

pregnant pond - pond containing pregnant process solution

primary crusher - the crusher which reduces the mined ore from 750 mm to 150 mm

process liquors - solutions used and produced in ore treatment

processing plant - a combination of crushers, screens, conveyors used to reduce the size of the rock and separate it into various sized products

processing screen - the screen used to separate various sizes of material for further crushing or product screening

product screen - used in the final sizing of product

PVC - poly vinyl chloride

pyrite - iron sulphide (FeS_2)

pyroclastic - rock comprised of fragments ejected from a volcano

pyrophyllite - a soft mineral resembling talc

quarry - the area from which rock is extracted

quartz - the most common form of silica (SiO_2), usually clear or white

radial stacker conveyor - a conveyor that can be rotated which discharges onto the ground to form a crescent shaped stockpile of product

raw water pond - storage pond for makeup process plant water

reagent - substance used to produce or control a chemical reaction

rehabilitation - the preparation of a final landform after quarrying and its stabilisation with grasses, trees and shrubs

reserves - in the mining context refers to an estimated quantity of usable material

ripping - breaking up of ground with a bulldozer using an action similar to a rake

road base - road pavement usually made up of densely graded crushed rock in varying sizes

road grades - the longitudinal slope of a road surface commonly expressed in per cent gradient (i.e. 10 per cent is a gradient of 1 vertical in 10 horizontal)

run-of-mine (R.O.M.) - ore or overburden in condition as loaded from open cut

runoff pond - containment structure for sediment-laden runoff from the area of disturbance

salinity - the dissolved content of water expressed in terms of milligrams per litre

sandstone - general term for sedimentary rock with grain size from 0.063 mm to 2 mm - grains may be minerals or rock fragments

schistosity - a form of foliation that occurs in coarser-grained metamorphic rocks

scraper - a rubber-tyred item of earthmoving equipment which scrapes up material and deposits it in a collection "bowl", then transports and dumps the material

screening - a process which separates crushed rock into various size classes - this usually involves mechanical vibration of the rock over a series of decks fitted with steel mesh, steel plate or polyurethane or rubber mats with fixed sized apertures

secondary crusher - the crusher which reduces ore from 150 mm to 7 mm

sericite - a fine-grained variety of mica

silicified - to be converted into silica (SiO_2), or to have silica added

siltstone - general term for sedimentary rock with grain size from 0.004 mm to 0.063 mm - individual grains not discernible with unaided eye

slag - waste product from smelting

sodium chloride (NaCl) - common salt

sodium hydroxide (NaOH) - caustic soda

stemming - the fine material placed in a blast drill hole after the explosive to ensure blast force is directed laterally

sterilise - to make physically unavailable

stope - an underground excavation from which ore has been extracted

subsoil - see B horizon

sulphide - a mineral compound characterised by the linkage of sulphur with metal

surge stockpile - a stockpile of semi-processed rock used to feed later stages of the process often used to compensate for variations in feed rate of a plant

suspended solids (S.S.) - small particles of organic or inorganic material within water which contribute to lack of clarity

S.W.L - standing water level

tailings - very fine waste product from certain ore treatment processes

tenor - concentration of gold in the leachate solution

thyristor - a type of switch used to regulate current

topsoil - the surface layer of a poorly-developed or well-developed soil profile containing the main percentage of organic material - see A horizon

total cyanide - total concentration of cyanide in waters; includes free cyanide and cyanide complexed with metals

tramp iron - miscellaneous pieces of metal encountered during the crushing and screening process - are often remnants of previous mining activity or pieces such as bucket teeth broken from excavation equipment

transect - a fixed line along which observations are made of flora and fauna

trapezoidal drain - a drain with a horizontal base and inclined walls

tubestock - tree seedlings supplied with roots enclosed in soil

tuff - see pyroclastic rock

TWL - top water level

vehicle movement - a one-way trip

void - cavity created by extraction of material

volcanics - a general term applied to rock types of volcanic origin (e.g. basalt, andesite)

waste rock - rock without mineralisation

waste rock emplacement - the area set aside for disposal of low grade or waste rock materials encountered during mining

weathered rock - rock affected to any degree by the processes of chemical or physical weathering

weathering - the group of processes (e.g. action of air, rain, water, etc.) whereby rocks exposed to the weather change in character, decay and eventually crumble to soil

wet scrubbing - a conventional method of dust collection whereby the dust is deposited into water and the resultant slurry settled or re-used

wind direction - the direction from which the wind, averaged over a certain period of time, is blowing

wobbler sprinker - form of sprinkler generating large droplets

Symbols

AHD	Australian Height Datum
bcm	bank cubic metre
dB(A)	the unit of measurement of sound pressure level heard by the human ear, expressed in "A" scale
dB(Linear)	the measurement of sound pressure level in which the amplitudes of the sound signal, through all frequencies of the signal, are treated equally, i.e. not weighted
g	gram (= 0.001 kilogram)
g/m²/month	grams per square metre per month - unit for deposited dust
ha	hectare (100 m x 100 m)
kg	kilogram (=1 000 grams)
km	kilometre (= 1 000 metres)
km²	square kilometres
kVA	kilovolt amps
L	litre
L/s	litres per second
L_{10}	sound level exceeded 10 per cent of the sampling time
L_{90}	sound level exceeded 90 per cent of the sampling time; also known as background noise level
m	metre
m²	square metre
m³	cubic metre
mg/l	milligrams per litre (parts per thousand)
mm	millimetre (= 0.001 metres)
mm/s	millimetres per second
ML	megalitre
Mtpa	million tonnes per annum
pH	measurement indicating whether water or soil is acid or alkaline
t	tonnes
t/m³	tonnes per cubic metre
tpa	tonnes per annum
ug/m³	micrograms per cubic metre
us/cm	micro siemens per centimetre
'000 t	multiples of one thousand tonnes
-7 mm ore	crushed ore less than 7 mm in size

APPENDICES

APPENDIX 1

Correspondence from Department of Planning

Director's Requirements for the Environmental Impact Statement

including Summary Table of Issues

New South Wales Government

Department of Planning

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

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

Contact : V Thomson
Ext. 2077

Our reference : S90/02162/001
Your reference : 203/RWC/EEL

R W Corkery & Co Pty Ltd
PO Box 80
ORANGE NSW 2800

RECEIVED
13 SEP 1990

Dear Sir,

PROPOSED PEAK HILL GOLD PROJECT, PEAK HILL, PARKES SHIRE

Thank you for your letter of 24 July 1990 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

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

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

- Environmental protection measures and mitigating measures to meet the proximity of the development to the Peak Hill settlement;
- Potential for retention of mining heritage items or places within the development site;
- Cumulative impact of the development with other major mining projects in the Parkes Shire;
- Results of consultation with Heritage Council.

4. Attachment No. 2 is a guide to the type of information most likely to be relevant to the development you propose; not all of the matters raised therein may be appropriate for consideration in the EIS for your proposal; equally, the guide is not exhaustive.

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

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

Yours faithfully,

6/9/90

Barbara Adams
Manager, Assessments Branch
As Delegate for the Director.

DEPARTMENT OF PLANNING
ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS

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

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

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

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

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

DEPARTMENT OF PLANNING

ATTACHMENT NO. 2

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR A MINING AND PROCESSING OPERATION

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

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

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

1. Description of the proposal.

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

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the processes involved highlighting any proposed crushing or blasting, water management and treatment, chemical processing,disposal of wastes, landscaping and rehabilitation. A description should also be provided of associated operations such as the transport of materials.

Particular details that may be relevant include:

- Characteristics and economic significance of the resource.
- Quantity of materials to be mined.
- Methods of extraction/plans of operations.
- Details of treatment process.
- Type of machinery and equipment to be used.
- Expected life of the operation.
- Number of persons to be employed.
- Hours of operation.

- Details of necessary stockpiling.
- Access arrangement - truck routes, truck numbers etc.
- Site drainage and erosion controls.
- Recycling of waste water.
- Disposal of tailings and hazardous waste materials.
- Storage of chemicals and associated safety measures.
- Proposals for rehabilitation.

2. Description of the Environment.

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

3. Analysis of Environmental Impacts.

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

- Any possible siltation, sedimentation or downstream effects of the operation.
- Any likely cumulative effects of the proposed operation when considered together with other operations in the vicinity.
- Effects on flora a fauna.
- The effects on the agricultural viability of the adjoining land holdings.
- Likely noise/vibration disturbance caused by the operations, including transport operations, on nearby residences.
- Other impacts of trucking movements, including access over railways and on highways.
- Dust nuisance likely to be caused.
- Effects on water quality of nearby watercourses.
- Disposal of waste material including tailings.
- Effects on the visual environment.
- Any likely affectation of sites of Aboriginal archaeological or European heritage value (including Industrial Heritage) if located in vicinity of operations.
- The proposed end use of the site.

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

4. Contact with relevant Government Authorities.

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

- The State Pollution Control Commission in regard to air, water and noise impacts and relevant pollution control legislation requirements;
- The Department of Minerals and Energy in regard to requirements under the Mining Act.
- The Soil Conservation Service regarding appropriate erosion control and rehabilitation procedures;
- The Department of Agriculture and Fisheries if prime agricultural land or fisheries resources may be affected by the proposal; and
- The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance if Aboriginal places or relics are likely to be affected.

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

SUMMARY OF ISSUES RAISED IN DIRECTOR'S REQUIREMENTS

Requirements	Addressed in EIS
Environmental protection measures and mitigating measures	Section 4
Potential for retention of mining heritage items or places within development site	Sections 3.9.2 and 5.10.2
Cumulative impacts of development with other mining projects in Parkes Shire Council	Section 5.13.6
Consultation with Heritage Council	Section 3.11
Consultation with Parkes Shire Council	Section 1.7, Appendix 2
Description of proposal	Section 2
Description of the Environment	Section 3
Safeguards to be employed	Section 4
Analysis of Environmental Impacts	Section 5
Contact with relevant Government Authorities	Section 1.7, Appendices 1 and 2
Justification of the Proposal	Section 6.1
Energy Statement	Appendix 3
Consequences of Not Carrying Out Proposal	Section 6.2

New South Wales Government

Department of Planning

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

Telephone : (02) 391 2000 Ext: 2077
Fax No : (02) 391 2111

Contact : V. Thomson

Our reference : S90/02162/001

Your reference :

R W Corkery & Co Pty Limited
PO Box 80
ORANGE NSW 2800

Attention: Bob Corbett

Dear Sir,

RE: Proposed Peak Hill Gold Project

Thank you for your letter of 11 December, 1992 on the above project.

The previously issued Director's requirements for the preparation of an EIS are still current and need to be addressed. The extent of investigations set out in your background information is noted. Please note that our advice of 6 September, 1990 included a consideration of mining heritage items.

Yours faithfully,

18/12/92

Mike Smith
Acting Manager
Assessments & Major Hazards Branch

RECEIVED
01 MAR 1993

APPENDIX 2

Correspondence from Government Authorities:

- *Parkes Shire Council*
- *Heritage Council of NSW*
- *National Parks and Wildlife Service*
- *Department of Water Resources*
- *Central West County Council*
- *Environment Protection Authority*
- *Department of Mineral Resources*
- *Department of Conservation and Land Management (Soil Conservation Service)*
- *Department of Conservation and Land Management (Department of Lands)*
- *Roads and Traffic Authority*
- *NSW Agriculture*

Including Summary Table of Issues

Parkes Shire Council

All communications to be addressed to the Shire Clerk,
Administration Centre, P.O. Box 337, Parkes, N.S.W. 2870

Id: 407 TM:SJB M-9

Contact Person: Tom Morrissey

27th April, 1993

RW Corkery & Co Pty Ltd
PO Box 80
ORANGE NSW 2800

Dear Sir

Draft Environmental Impact Statement for Proposed Peak Hill Gold Project

Reference is made to your letter dated 22nd April, 1993 which sought a review of Council's previous letter of concerns dated 2nd October, 1990.

Following the review of the Draft Environmental Impact Statement for the Project, besides those detailed matters outlined in Council's letter dated 21st April, 1993 the following general areas are of concern to Council and should be adequately addressed in the final Environmental Impact Statement for the Project.

1. The effect of blasting on nearby buildings.
2. The effect of noise and dust from the Project on nearby residents.
3. The effect of the Project on the wellbeing of residents of the nearby aged units and hostel.
4. Concern for the integrity of the Council water services reservoir at the top of Peak Hill and the security of the Peak Hill Water Supply.
5. The safety of members of the public and property, both during and after the mining operations stop.
6. The safety of mine vehicles entering the mine access road from the Newell Highway.
7. The impact that the use of process water from the Bogan River Weir will have on the agricultural requirements of the adjacent and downstream landowners.
8. The impact of the Project on the community facilities of Peak Hill.
9. The future operations of Council's Refuse Disposal Depot.
10. The use of ground water from the pit outside the pit area.

Yours faithfully

Alan McCormack

Alan McCormack
GENERAL MANAGER/SHIRE CLERK

Telephone: Administration (068) 62 8333; Engineering (068) 62 8343; Health & Building (068) 62 8373; Tourist Centre (068) 62 8366; Gas Department (068) 62 8362; Library (068) 62 8309

Fax: Administration (068) 62 3946; Engineering (068) 62 8352; Tourist Centre (068) 62 1023; Gas Department (068) 62 5111; Works Depot (068) 62 5416; Library (068) 62 1501

Council offices are located at
2 Cecile Street,
PARKES NSW 2870.

PHONE: No. 62 1011
Telex No. AA 63719
Fax No. (068) 62 3946

All Communications to be Addressed to the Shire Clerk

REF. No. BFM:LB 5111A M-9

In your reply please quote above No.

Administration Centre,
P.O. Box 337,
Parkes, 2870

2nd October, 1990

- 3 OCT 1990

The Manager,
RW Corkery & Company Pty Ltd,
PO Box 80,
ORANGE NSW 2800

Dear Sir,

Re: Peak Hill Gold Project

I wish to advise that a report was considered by Council at its meeting held on 18th September, 1990, concerning the proposed Gold Mining Project at Peak Hill by Ashton Mining Limited.

Council resolved that you be informed of its areas of concern in relation to the project and requests that these matters be adequately addressed in the Draft Environmental Impact Statement. The areas of Council's concern include:

1. The effect of blasting on nearby buildings.
2. The effect of noise and dust from the project on nearby residents.
3. The effect of the project on the wellbeing of residents of the nearby aged units and proposed aged hostel.
4. Concern for the integrity of the Council water services reservior at the top of Peak Hill and the security of the Peak Hill Water Supply.
5. The safety of members of the public and property, both during and after the mining operations stop.
6. The safety of mine vehicles entering the mine access road from the Newell Highway.

.../2

Your consideration of these issues during the preparation of the Environmental Impact Statement would be appreciated by Council. Should you require any additional information concerning this matter please contact the Shire Engineer, Mr T. Morrissey, during normal office hours.

Yours faithfully,

B.F. Matthews,
A/SHIRE CLERK.

HERITAGE COUNCIL OF NEW SOUTH WALES

APPLICATION FOR CERTIFICATE UNDER SECTION 167, HERITAGE ACT, 1977

1001 T50 203

applicant's name and full postal address	Associated Gold Fields N.L. 129 Edward St Perth WA 6849 (Attention: Mr G. Heates)	to: The Secretary Heritage Council of New South Wales G.P.O. Box 3927, Sydney 2001 DX 15 Sydney TEL. 391 2333 applicant's reference applicant's phone no.

note (1) This application must be submitted in DUPLICATE and must be accompanied by a fee of $10.00
Cheques should be made payable to 'Heritage Council of New South Wales'

(2) A SKETCH PLAN showing the location of the property in relation to the nearest cross streets must be drawn as shown. Failure to provide a full description and a sketch will result in a delay.

Description of property. All items should be completed, as insufficient information may result in the return of the application

city, municipality or shire: PARKES SHIRE				suburb, town or village: PEAK HILL NSW	
street: Adjoining Frazer Street				side of street	house no. & or name / postcode
lot or portion: Crown	section: Land	d.p. or s.p.: on Peak Hill		county: Narromine	parish: Minigelo
vol. / book	fol. / no.	frontage	depth	nearest cross street: Mingelo & Frazer streets	
area				nature of property (whether vacant land, house etc.): Vacant-Crown Land	

New subdivisions. Details of the land before subdivision are requested as follows

subdivider's name			street	
lot or portion	section	d.p.	area or dimensions	
full name of owner of land			full name of prospective purchaser	
purpose for which information is required			signature of applicant	date

Draw sketch here -

north

See attached map (ex 1:50000 Peak Hill Topo)

R Cowbitt

CERTIFICATE UNDER SECTION 167, HERITAGE ACT, 1977

Heritage Council use only

As at the date of this certificate the information requested is shown hereunder in the section marked thus: ▷

The land described in this certificate and/or any building or work thereon:

X is NOT subject to a conservation instrument, order or notice.	IS subject to a conservation instrument, order or notice. Particulars are attached.

Issued by the authority of the Heritage Council of N.S.W.

1 - APR 1993

for Secretary
date

no. of attachments

file no.

HCER

PROUDLY PRINTED IN AUSTRALIA

81005-39179

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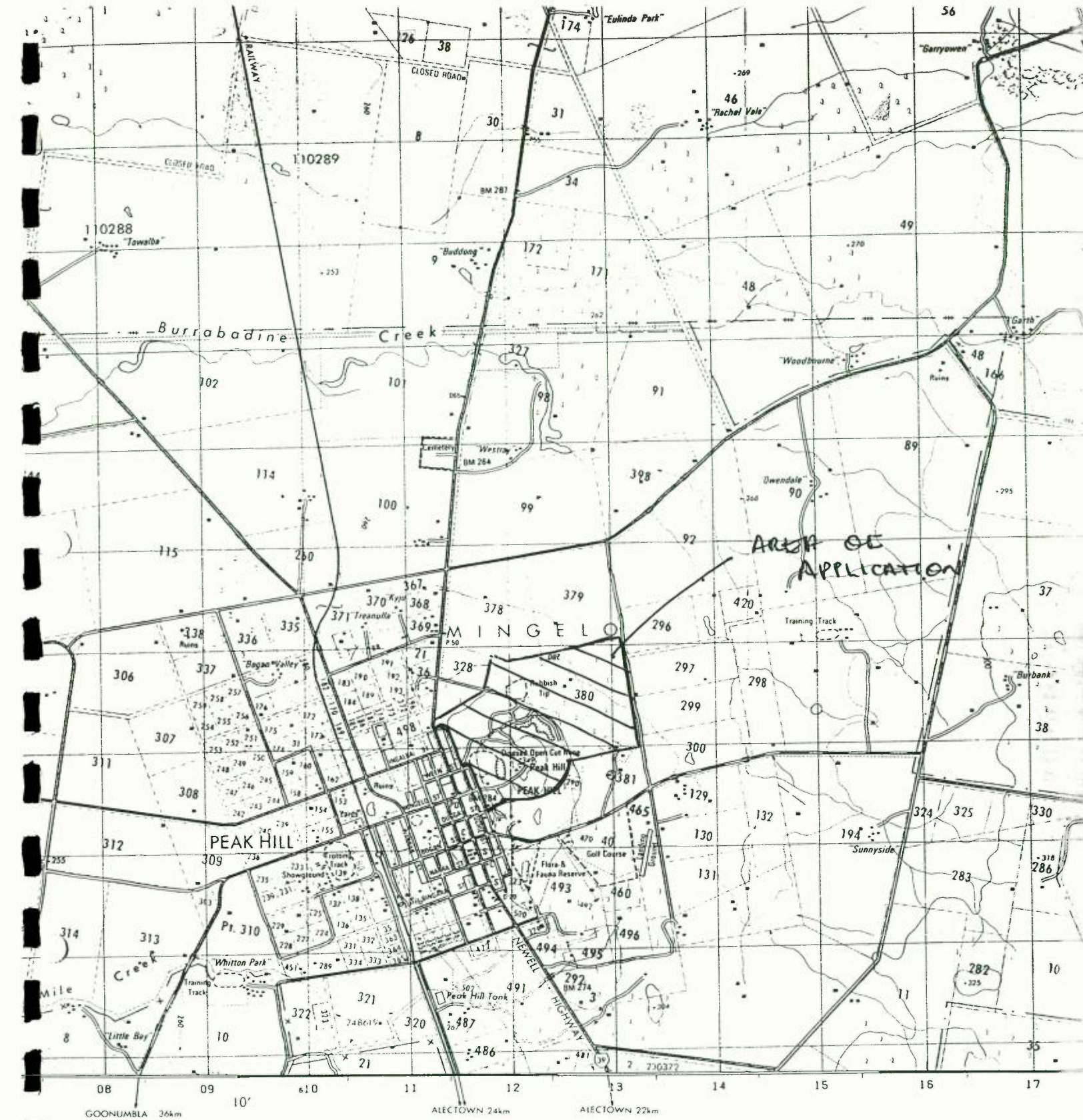
27 APR 1993



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NEW SOUTH WALES GOVERNMENT

77-998

Copies of this map are obtainable from the Central Mapping Authority of New South Wales, Panorama Avenue, Bathurst, the Department of Lands, Bridge Street, Sydney and authorised agents.

ELEVATIONS: To the nearest metre on the Australian Height Datum.

CONTROL: Geodetic Survey of New South Wales based on the Australian Geodetic Datum.

GRID: Australian Map Grid (U.T.M.) in 6° zones.
Grid lines are shown at intervals of 1000 metres from False Origin of Zone 55
Zone 55/3 Integrated Survey Grid information shown along border in grey.

PRODUCTION: Central Mapping Authority of N.S.W. and Royal Australian Survey Corps.
Aerial photography— 1974 Field revision— 1978 Printing— 1979

METEOROLOGICAL DATA: Bureau of Meteorology, Department of Science.

ACCURACY: Conforms to National Mapping Council standards.

ROADS: Depiction of roads and tracks does not necessarily indicate a public right of way. Unsealed roads may be impassable after rain.

NOMENCLATURE: Place names, as defined by the Geographical Names Act, 1966, are approved names, with the exception of Ten Mile Holes, Tomingley West railway station and Burrabadine Creek.

GRID CONVERGENCE 0 6°

TRUE NORTH, GRID NORTH AND MAGNETIC NORTH ARE SHOWN DIAGRAMMATICALLY AT THE CENTRE OF THE MAP AND THE MAGNETIC NORTH IS CORRECT FOR 1975 AND DECREASES BY 0 1° IN APPROX

New South Wales Government

National Parks and Wildlife Service
BATHURST DISTRICT

154 Russell Street
Bathurst, N.S.W. 2795

Mr B. Corbett
Senior Environmental Scientist
R.W. Corkery & Co. Pty Ltd
PO Box 80
Orange NSW 2800

Our reference: F29
Your reference: SW:sw

Telephone: (063) 31 9777
Fax: (063) 31 9644

RECEIVED
27 APR 1993

Dear Bob,

REVISED SERVICE REQUIREMENTS FOR THE PROPOSED PEAK HILL GOLD PROJECT

I refer to your telephone conversation with Ranger Steve Woodhall and subsequent letter of the same date.

Aboriginal Sites

In 1990 the Service requested that an archaeological survey of the project site be undertaken. The Draft EIS confirms that this has been undertaken. Given the summary of the findings of this survey in the Draft EIS it would appear the that the Service will have no objection to the project on Aboriginal site protection grounds. However as this office has not reviewed the archaeological report, the Service reserves the option to make further comment and recommendations at a later date when the archaeological report is released with the EIS.

The Service also requests that the proponent maintains liaison with the Peak Hill Local Aboriginal Land Council over any matters of mutual interest over the life of the project.

Flora and fauna

As mentioned in the Service's correspondence dated in relation to the draft EIS the Endangered Fauna (Interim Protection) Act came into affect in December 1991 to ensure the effects of development on the habitats of protected and endangered fauna were fully addressed with any development proposal.

Since 2 species (Swift Parrot - *Lathamus discolor*, Painted Honeyeater - *Grantiella picta*) listed on Schedule 12 of the National Parks and Wildlife Act, 1974 have been identified as occurring within the site of the mining operations, you must determine the significance of the effect of the mining operations on the habitat of these species according to the Endangered Fauna (Interim Protection) Act, 1991. The previous correspondence included information to help you in this assessment.

Should this assessment indicate that a significant impact on endangered fauna species will result from the project, the proponent is required to prepare a Fauna Impact Statement (FIS). Should an FIS be required, it should be included in the EIS for the project. Should an FIS be required I suggest you contact this office immediately to ensure that the FIS process can be incorporated into the development approval timetable with minimum disruption.

Rehabilitation

The Service suggests that planting of native vegetation species associated with the rehabilitation of the mine site should be done in a manner which maximises the habitat value to native fauna. This would include maximising the size of any native vegetation remnants and the planting of understory species. The Service would be happy to offer advice on this matter at an appropriate time in the future.

If you have any questions on the matters raised in this letter please contact Ranger Steve Woodhall on (063) 319 777.

Yours faithfully

for G Newton
A\District Manager
for Director

22 April 1993

New South Wales Government

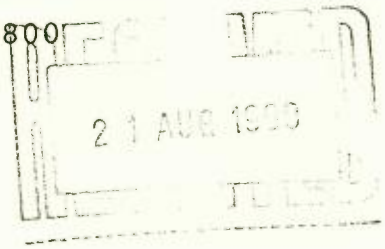
National Parks and Wildlife Service
BATHURST DISTRICT

154 Russell Street
Bathurst, N.S.W. 2795

Telephone: (063) 31 9777
Fax: (063) 31 9644

R W Corkery
PO Box 80
ORANGE NSW 2800

Our reference: F29(b)
Your reference: EC:tc



Dear Sir

RE: ARCHAEOLOGICAL SITES AT PEAK HILL

Cultural Resources has made a site search and no Aboriginal sites are recorded within the proposed development area at Peak Hill. However we have consulted with the only archaeological report relating to the general area, 'Parkes to Peak Hill 66 KV Transmission Line - Survey of Proposed Line for Aboriginal Relics' by B. Thornhill, 1977 (Report No C-715), the only recorded site within the area is a quarry-site at Trewilga (Site card 35-6-7). The report comments on the probability of sites being located north of Peak Hill, where according to local residents sites are common. As the proposed gold extraction will be taking place on a large scale in a relatively undisturbed area, Cultural Resources (Central Region) request that an archaeological assessment be carried out within the proposed development site.

If the proponent, Ashton Mining Limited would like the Service to assist in locating a consultant archaeologist then they may contact either Bronwyn Conyers or Luke Godwin at the Regional Office. (02) 895 7440.

The impact of the development on the flora and fauna should be addressed in the Environmental Impact Statement.

Thank you for the opportunity to comment on the project.

Yours sincerely

C.E. Perrers
Acting Superintendent
for Director

14 August 1990

New South Wales Government

Water Resources

R W Corkery and Co Pty Limited
PO Box 80
ORANGE NSW 2800

Telex: 63955
Facsimile: (068) 82 5060
Telephone: (068) 82 4855
Ext:
Contact Name: S Middleton
Our Reference: M/338

ATTENTION: Mr R Corbett

Dear Sir

RE: PEAK HILL GOLD PROJECT

In August 1990, the Department of Water Resources (DWR) made general comments to R.W. Corkery and Co Pty Limited on the then proposed Peak Hill Gold Project. A copy of the DWR's "General Requirements for Environmental Impact Statements" was appended to the letter.

Now, nearly three years later, the development consent process is continuing but I understand that Parkes Shire Council has queried the currency of earlier submissions.

I hereby confirm that, for the intent of the Environmental Impact Statement for the referenced project, the DWR's "General Requirements ..." are still current.

The DWR will comprehensively review the final Environmental Impact Statement when invited to do so by Parkes Shire Council. However, DWR is reasonably confident that if the issues raised in the "General Requirements ..." are adequately addressed in the EIS, then it will not object to the proposed development.

Yours sincerely

S R Middleton
Manager, Resource Assessment
Macquarie-Western Region

19.5.93

20 MAY 1993

New South Wales Government

Water Resources

R W Corkery and Co Pty Limited
PO Box 80
ORANGE NSW 2800

RECEIVED
6 AUG 1990

Telex: 63955
Facsimile: (068) 82 5060
Telephone: (068) 82 4855
Ext:
Contact Name:
Our Reference: M/338

ATTENTION: MR ROB CORKERY

Dear Rob

RE: PEAK HILL GOLD PROJECT

Your recent letter (Ref 203/RWC/EEF) to our Forbes office has been passed on to us for action.

Considering your tight schedule for the preparation and submission of an EIS for this project, I am enclosing herewith the Department's "General Requirements for Environmental Impact Statements", to at least give you something to focus on.

I will organise a review of DWR data for this area and if this reveals any particular concerns I will notify you immediately. We will certainly attend the Planning Focus Seminar in two weeks and look forward to discussing the project with you at that time.

Yours sincerely

Peter Terrill 1/8/90

Peter Terrill
Regional Environmental Officer
for
Regional Manager
Macquarie-Western Region

enc

CENTRAL WEST ELECTRICITY

Power for People

ADDRESS ALL MAIL TO:
GENERAL MANAGER
P.O. BOX 255,
PARKES, 2870

TELEPHONE: (068) 622111
FAX No. (068) 621641

OUR REF: 2218
SG:BJ
THE CENTRAL WEST COUNTY COUNCIL

29th April, 1993

RECEIVED
03 MAY 1993

Senior Environmental Scientist
R W Corkery & Co Pty Ltd
PO Box 80
ORANGE NSW 2800

ATTENTION: Bob Corbett

Dear Sir,

Re: Peak Hill Project

Further to your letter of 23rd April 1993, I can advise that Central West Electricity does not have any requirements that need to be incorporated in the Environmental Impact Statement that you have prepared for the above project.

For any additional information please contact the undersigned at this office.

Yours faithfully,

SHANE GUTHRIE,
ELECTRICAL ENGINEER

CENTRAL WEST
ELECTRICITY
Power for People

ADDRESS ALL MAIL TO:
GENERAL MANAGER,
P.O. BOX 255,
PARKES, 2870
TELEPHONE PARKES (068) 62 2111
TELEX No. AA169317 FAX No. (068) 62 1641

THE CENTRAL WEST COUNTY COUNCIL

OUR REF:
MS:BJ

7th August, 1990

R W Corkery & Co Pty Ltd
PO Box 80
ORANGE NSW 2800

Dear Sir,

Peak Hill Gold Project

Thank you for your letter dated 24th July 1990.

This Council does not have any requirements that need to be incorporated in the Environmental Impact Statement that you are preparing for the above project.

Yours faithfully,

M Siers

M. SIERS,
ASSISTANT GENERAL MANAGER

RECEIVED
03 MAY 1993

EPA

Environment
Protection
Authority
New South Wales

219 Howick Street
PO Box 1388
Bathurst
NSW 2795

Telephone .063. 32 1838
Facsimile .063. 32 2387

R W Corkery & Co. Pty Limited
P O Box 80
ORANGE NSW 2800

Our Reference: 260782 A1 TK:TK

Your Reference: 203/BC/JKg

Contact: Terry Knowles

Dear Sir,

I refer to your letter dated 24 March 1993 requesting us to review your draft Environmental Impact Statement (EIS) for the proposed Peak Hill Project and confirmation of the standing of a letter, dated 24 August 1990, from the former State Pollution Control Commission (SPCC) in response to a previous and similar proposal.

We have reviewed your EIS and believe that there are no significant errors or omissions in the assessment of and proposed control strategies for matters relating to the responsibilities of the Environment Protection Authority (EPA).

In relation to the SPCC's letter, the matters raised remain substantially valid for this proposal. The major exception relates to the permissible level of operational noise in relation to residences.

The current limit is the continuous noise, L_{A10T}, when measured for not less than five minutes within 10 metres of any residence, must not exceed the background level plus 5.0 dB(A) or 45 dB(A) between the hours of 7.00 am and 7.00 pm or 40 dB(A) between the hours of 7.00 pm and 10.00 pm or 35 dB(A) between the hours of 10.00 pm and midnight and midnight and 7.00 am on any day, whichever the lesser.

Further, the background is the measured background level, L_{A90T}, when measured for at least 5 minutes, or 30 dB(A), whichever the greater.

If you have any enquiries please do not hesitate to contact Mr Terry Knowles at the above address or by phone on (063) 321 838.

Yours sincerely

Richard Whyte
Regional Manager Central West
for Director-General

30 April 1993

New South Wales Government

State Pollution Control Commission

State Office Block
140 William Street
Bathurst 2795
P.O. Box 143, Bathurst 2795

R W Corkery & Co Pty Ltd
P O Box 80
ORANGE NSW 2800

Our reference: 260782 A1
Your reference: TK:HG

Telephone: (063) 33 4222
Facsimile: (063) 31 1683

RECEIVED
27 AUG 1990

Attention: Mr R Corkery

Dear Rob

I refer to your letters dated 24 July and 3 August 1990 concerning the Peak Hill Gold Project.

Officers of the Commission had contact, several years ago, with a proponent also planning to mine this area. The major area of concern was the impact of noise from mining and ore transport on the residents of Peak Hill. This will remain a predominant constraint but will be ameliorated by the reduced hours of operation and gold recovery by heap leaching.

The following tables set out the limits for general noise and blasting noise within the different time bands at the nearest or most affected residence.

Operational Noise

Time Band	Level, dB(A)
7.00 am - 7.00 pm	45
7.00 pm - 10.00 pm	40
10.00 pm - 7.00 am	35

For Sunday and Public Holidays, the 7.00 am time barrier is increased to 8.00 am

Construction Noise

Construction periods of four weeks or less: L_{10T15} not to exceed background by more that 20 dB(A).

Construction period of more than four weeks but less that 26 weeks: L_{10T15} not to exceed the background by more that 10 dB(A). In addition, time restrictions apply. Construction may be carried out between the hours of 7.00 am and 6.00 pm Monday to Friday, 7.00 am and 1.00 pm Saturdays if inaudible on residential premises, otherwise 8.00 am to

1.00 pm Saturdays. No construction work is to take place on Sundays or Public Holidays.

Blasting Noise

Timeband	Blast overpressure level(dB(linears))	Ground vibration peak particle velocity (mm/sec)
Monday -Saturday		
9.00 am - 3.00 pm	115	5
6.00 am - 9.00 am	105	2
3.00 pm - 8.00 pm	105	2
Sunday, Public Holiday		
6.00 am - 8.00 pm	105	2
Any Day		
8.00 pm - 6.00 am	95	1

Water Pollution

The heap leaching areas would need to be protected from the ingress of stormwaters from other areas and bunded to contain a spill equivalent to at lest 120% of the largest impoundment. The various treatment and collection ponds and pads should be lined to ensure low permeability walls and floors.

Through-wall pipelines should be avoided where possible as such structures, in earthen walls, compromises the integrity of the walls, make sealing difficult and provide an immediate drainage pathway in the event of pipeline failure.

Preference should be given to the pumping of solutions. Cyanide and chemical storage areas must be bunded to contain spills with facilities to clean up spills.

The method of adding cyanide and chemicals to the system, if powdered or granular chemicals are added by broadcasting, must be addressed regarding potential generation of dust burdened with chemicals.

Further, figure 2 of the information enclosed, shows a polluted water path, via overflows, from the pregnant solution pond to the barren solution pond to the process water pond to the stormwater pond.

The conditions in which this pathway is involved must be stated. It is expected that no surcharge to the stormwater up to and including a 1 in 100 year, 72 hour storm event, will occur.

Air Pollution

The general dust control proceedures for open cut mines, such as dust controls on blast hole drilling, blasting techniques, roadway and stockpile watering and dust supression during ore preparation, needs to be addressed.

If you have any enquiries please do not hesitate to contact Mr Terry Knowles at the above address or by phoning 063 334 424.

Yours sincerely

Richard Whyte
for Secretary
24 August 1990

Department of Mineral Resources

NEW SOUTH WALES GOVERNMENT
MINES INSPECTION BRANCH

STATE GOVERNMENT OFFICES
CNR KITE & ANSON STREETS
ORANGE NSW 2800
PO BOX 53
ORANGE NSW 2800
TELEPHONE (063) 638 305
FACSIMILE (063) 638 344

R W Corkery & Co Pty Ltd
PO Box 80
ORANGE NSW 2800

Attention: Bob Corbett

22 April, 1993

Dear Sir

Re: Proposed Peak Hill Gold Project

Following a recent visit to the prepared project site and a review of the Company's proposal, the Department considers the requirements for the preparation of the EIS (as identified in my letter of 9 October, 1990) are still current.

Yours faithfully

Ian D Freeland
REGIONAL INSPECTOR OF MINES

RECEIVED
22 APR 1993

New South Wales Government

Department of Minerals and Energy

R W Corkery & Co Pty Limited
PO Box 80
ORANGE NSW 2800 58

P.O. Box 53
ORANGE. 2800

Phone: 063/638.305
Fax: 063/638.344

9.10.1990

RECEIVED
10 OCT 1990

ATTENTION: Mr R W Corkery

REFERENCE: 203/RWC/EEe

Dear Sir,

Re: Peak Hill Gold Project

In response to your letter dated 3rd August 1990, I wish to provide the following comments:

1. **Dust.** The crushing plant would require dry dust extraction as a means of dust suppression.

2. **Blast Vibration.** Any E.I.S. should address the affect of 5 millimetres per second ground vibrations on houses, particularly the older style houses, as well as address community concerns about old underground workings in and about the town.

Re: TEL. COMM 19.10.90

3. **Noise.** The Department requires details of the proposed noise levels at nearest residences with and without the sound bund.

4. **Pit Stability.** Given the close proximity of the pit to the town and the fact that at the conclusion of mining operations the pit will again be a tourist attraction, long term pit stability is important. The Department requires a copy of the geotechnical consultant's report prior to the draft E.I.S. phase in order that adequate time is allowed for its review of pit design.

5. **Blast Warning.** Details of the proposed blast warning procedure are required.

...../2

6. **Fencing.** Consideration should be given to extending the fence southwards in order to embrace any open and dangerous shafts and excavations. The fence around the open pit could be retained after mining has ceased in order to regulate entry to the site by tourists, particularly after dark. Such regulation and control would reduce the likelihood of accidents and may interest a local tourist organisation to develop the site to a greater extent than it is today.

The above comments are of a preliminary nature only and the Department will require time to consider the final detail when it is to hand.

Yours faithfully,

Ian D. Freeland
REGIONAL INSPECTOR OF MINES

RECEIVED
23 APR 1993

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
NSW Govt Offices
Cnr Anson & Kite Sts
PO Box 53
Orange NSW 2800
Phone (063) 63 8278
Fax (063) 61 3839

R W Corkery and Co Pty Ltd
Geological and Environmental Consultants
PO Box 80
ORANGE NSW 2800

Attention: Bob Corbett

Dear Sir

Peak Hill Gold Project

I have reviewed the Soil Conservation Service letter of 21 August 1990 in relationship to the Service's requirements in the Environmental Impact Statement for the above project.

THe requirements as set out in the referenced letter are still current. No additional issues from a soil conservation aspect need to be addressed.

If you require any further information or advice, please contact Lester Lynch, Co-ordinator Conservation, on telephone 638271.

Yours faithfully

L G LYNCH
for P J WALKER
Regional Director
23 April 1993

New South Wales Government

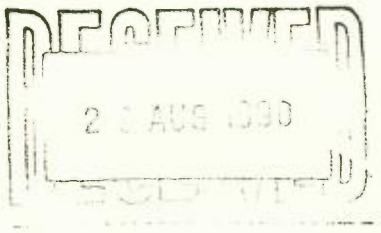
Soil Conservation Service

MACQUARIE REGIONAL OFFICE

R W Corkery & Co Pty Limited
Geological and Environmental Consultants
P O Box 80
ORANGE NSW 2800

N.S.W. Government Offices
Cnr Anson and Kite Streets
P.O. Box 53,
Orange, N.S.W. 2800

Phone: (063) 63 8278
Telex: AA 63047



Contact: I Lynch

Our Reference: R 301

Your Reference: 203/RWC/EEH

Dear Sir,

Peak Hill Gold Project

Your letter of 3rd August, 1990.

Your referenced letter requests information pertaining to the Soil Conservation Service's requirements in the Environmental Impact Statement for the Peak Hill Gold Project. In providing the list of matters which the Service wishes to see addressed, I preface the listing by stating that an Environmental Impact Statement consistent with the input and quality of those provided by your Company for the Sheahan-Grants and Browns Creek gold mines will provide the degree of documentation required.

With respect to the Peak Hill Gold Project the Service wishes to see the following matters addressed in the E.I.S.:

* project background
* outline of proposal
* proposed mining operation, site layout etc.
* mining operation, sequence etc.
* overburden placement
* waste placement
* transportation, site access
* services - water supply, sewerage (esp. if septic tanks)
* rehabilitation.

Within the above sections of the E.I.S. the following specific issues should be addressed:

* on-site and off-site impacts of all activities
* proposed monitoring program for environmental impacts
* site and locality resource inventory to address topography, geology, soils, vegetation, drainage pattern, land use
* runoff management plan to address any on flow of runoff, its diversion and any downstream impacts
* infrastructure development in construction phase - incorporation of erosion and sediment controls (often temporary) during construction of access roads, plant area, hard-stand areas etc.
* infrastructure - permanent erosion and sediment controls installed on access roads, tracks, haul roads, plant areas etc.

..../2

* septic tank effluent disposal
* mining phase - site preparation plans - topsoil and subsoil management, stockpiling for sequential reuse, preservation of viability of stockpiled materials, erosion prevention from stockpiles
* overburden and waste dumps - batter slopes, berms and berm grades, batter stabilisation, erosion and sediment control, rehabilitation
* waste dams - batter stabilisation, erosion and sediment controls, runoff inflow prevention, end use and rehabilitation.
* rehabilitation proposals - technology, final landforms, sequencing, tree/shrub/grass/legume establishment, final land use projections
* site decommissioning - reinstatement, rehabilitation
* site end use.

For any further information regarding the issues listed or other matters of concern please contact Mr Ian Lynch, Director, Environment and Research on telephone (063) 638278.

Yours faithfully

Ian Lynch
Director, Environment and Research
for A J McCarthy
Regional Director
Macquarie Region
21st August 1990.

DEPARTMENT OF
CONSERVATION AND
LAND MANAGEMENT
Cnr Anson & Kite Sts
PO Box 53
Orange NSW 2800
Phone (063) 63 8300
Fax (063) 63 8389

R W Corkery and Co Pty Ltd
Geological and Environmental Consultants
PO Box 80
ORANGE NSW 2800

Dear Sir

Investigation into the Peak Hill Gold Project

Reference is made to your letter dated 3 August 1990, and the reply of 21 August 1990 from the former Department of Lands.

Since that date, a meeting has been held on site prior to the preparation of a final Environmental Impact Statement.

Generally, the requirements of our previous letter, in regard to former Lands Department matters, in particular items 1 and 3 are still current and it would be appreciated if these matters could be covered in your final document.

Yours faithfully

P J Walker

Peter Walker
Regional Director

per:
23/4/93

Our Ref: OE90 H 288
Your Ref: 203/RWC/EEM

Contact Officer: Lester Lynch
Telephone No: (063) 638271

DEPARTMENT
OF LANDS

R.W. Corkery and Co. Pty. Ltd.,
Geological and Environmental Consultants,
P.O. Box 80,
ORANGE N.S.W. 2800.

YOUR REF.: 203/RWC/EEM
OUR REF.: OE90H288
CONTACT OFFICER: John Palmer
TELEPHONE NO.: 228-6354

28 AUG 1990

Dear Sir,

Investigation into the Peak Hill Gold Project

Reference is made to your recent letter dated 3rd August, 1990 and sent to Dubbo Lands Office regarding the above proposed project. The Department of Lands seeks to have the following issues investigated in the Environmental Impact Statement.

1. Land Status

A brief status check indicates that the amount of Crown land likely to be affected by the proposal is considerable. Principal areas of Crown land which are likely to be included are as follows:

* a large area of Vacant Crown land
* Homestead Farm 1940/2, portion 380
* Special Lease 1949/2, portion 468
* Reserve 85369 from Sale for Soil Conservation
* Reserve 78459 from Sale for Quarry
* Reserve 44725 for Trig Purposes
* Several Permissive Occupancies

A detailed map of land ownership should be included within the EIS which would identify all Crown and freehold land within the project boundary as well as that situated on the immediate boundary.

The Orange Lands Office can assist in providing parish maps and further status information (Environs of Peak Hill).

2. Heritage Significance

It would appear that the proposal embraces an area of historic mining significance. There would also be an historic relationship between the Crown land involved and the historic village of Peak Hill.

23-33 Bridge Street Sydney NSW Australia 2000 Box 39 GPO Sydney NSW Australia 2001
Telephone (02) 228 6111 Fax (02) 228 6140

Any EIS would require an assessment of the Heritage significance of the area both from the point of overall landscape and the presence of individual items/sites of heritage significance that may be contained within the area. If any item/site is of some significance, possible actions required to reduce impacts should be addressed.

In addition, the impact of the proposal to the topographic feature of Peak Hill needs to be addressed.

3. End Use/Rehabilitation

The EIS should indicate actions proposed to rehabilitate and shape the site once the project reaches the completion stage and identify possible post-mining uses of the land. To assist in this, a full vegetation survey should be undertaken over the site. Some statement should also be given as to the proposed means of controlling runoff within the site, e.g. division banks, sediment ponds and ensuring public safety during the life of the project.

All post-mining hazards would need to be identified and steps to be undertaken by the proponent to minimise risk to the public. This is especially important due to the close proximity of the proposed site to the village of Peak Hill.

The proposed development is contained within the administrative boundary of Orange Lands Office. Staff from that Office will attend the planning focus meeting once advice on a suitable date is supplied.

Any future correspondence on this matter should be forwarded to the Regional Director, Orange Lands Office, Cnr. Kite and Anson Streets, Orange 2800.

The above comments supplied for your information do not preclude the Department of Lands from commenting further on the proposed EIS or any other matter which may arise as a result of its findings.

Yours sincerely,

D. Sinclair
for Secretary.

353.5351
Mr Wagg

RECEIVED
03 MAY 1993

Roads and Traffic Authority
Western Region
Operations Branch

R T A

28 Currajong Street
Parkes
New South Wales 2870
PO Box 334
Parkes NSW 2870
DX 20256 Orange (Parkes)
Telephone (068)62 8444
Facsimile (068)62 8415

R W Corkery & Co Pty Ltd
PO Box 80
ORANGE NSW 2800

SHIRE OF PARKES. TRAFFIC GENERATING DEVELOPMENTS. PROPOSED PEAK HILL GOLD PROJECT.

Dear Sir

ATTENTION: Bob CORBETT

I refer to your letter 203/RJC/JAHa dated 28 April 1993 and attachments relating to your preparation of an Environmental Impact Statement for the proposed Peak Hill Gold Project.

The Authority has carried out a brief examination of your access proposal and would consider as the minimum treatment necessary for the turnout;

a) Provision of passing lane on the western side of the Highway formation similar to the Authority's type "AUR", right turn treatment

b) provision of widened splays on the eastern side of the Highway formation similar to the Authority's type "BAL", left turn treatment.

A copy of the Design Manager's Report and sketches indicating the above criteria are attached for your information.

Perusal of your proposed schedule of contents for the Environmental Impact State has not revealed any further issues on aspects which the Authority considers should be included in your final statement.

Yours faithfully

G E Kirchner
Operations Manager

30 April, 1993

DRINK DRIVE
You'll be sorry

STATE HIGHWAY NO 17 NEWELL HIGHWAY SHIRE OF PARKES

PROPOSED PEAK HILL MINE PROJECT - ACCESS.

Report from Design Manager.

1) Traffic volumes associated with the existing Newell Highway in the vicinity of the proposed turnout to be developed approximate 3800 vehicles per day, allowing for some local movements to be coupled with the through traffic volumes.

   To access the requirements for an appropriate access layout, adopt the 30th highest hourly volume as a criteria for the peak highway flow, viz 15% AADT.

   This figure of 570 can also be assumed as being 50% directional, thus the through peak volume in each direction for design purposes is 285.

2) Consultants for the Developer has given the following estimated traffic movements for the project:

Source	Type	Frequency
Employee	Car	60/day
Supplies	SU Truck	6-8/week
Cement	Tanker	2-3/week
Misc	Small SU	8-10/day
Fuel	Artic	4/week
LPG	Artic	2-4/month
Visitor	Car	8/day

   Given that the highest frequency for vehicular movements will be during the commencement or end of work shifts and that the employee work hours are staggered allow 20 vehicles per hour as a peak flow for vehicles entering the project

3) Evaluating the type of intersection treatment deemed necessary by the works and adopting the criteria set down in the Authority's "Road Design Guide" an appropriate form of treatment involves providing auxiliary lanes.

   If traffic volumes were projected to the year 1995 and 2000, the layout would still be applicable.

Report from Design Manager.

4) The type of layout to be adopted for the right turn movement into the side road should be based upon the criteria shown on fig 4.8.16 attached with tapers and lane lengths based upon that required by a B Double unit to pass another stationary vehicle of similar dimension.

Taper 'A'	=	120 metres
Length 'B'	=	70 metres
Width 'C'	=	7 metres

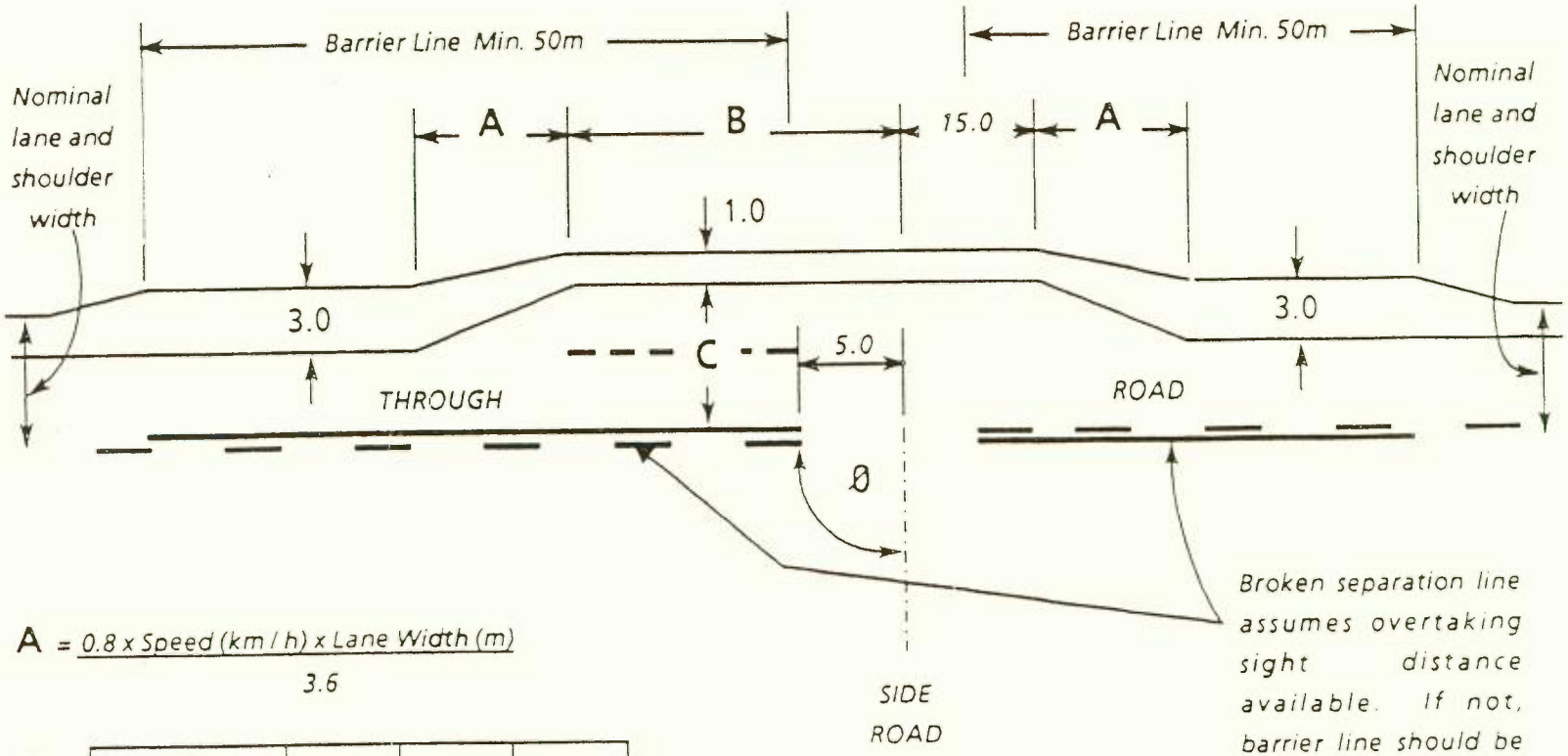
5) The treatment for the left turn treatment can be based upon the criteria shown on fig 4.8.26 attached.

The widths of pavement applicable to this type of layout allow for the passing of vehicles both entering and leaving the site simultaneously.

Lane Width	=	3.5 metres
Length 'O_1'	=	5.5 metres
Length 'O_2'	=	5.5 metres
Radius 'R_1'	=	15 metres
Radius 'R_2'	=	15 metres

6) All works associated with the provision of the turnout to the project are to be carried out to the approval of but at no cost to the Authority.

R T Wagg
Design Manager
29-04-1993.



$$A = \frac{0.8 \times \text{Speed (km/h)} \times \text{Lane Width (m)}}{3.6}$$

B =

Ø	70°	90°	110°
Length (m)	50	45	40

C (on straight) = 2 x nominal lane width

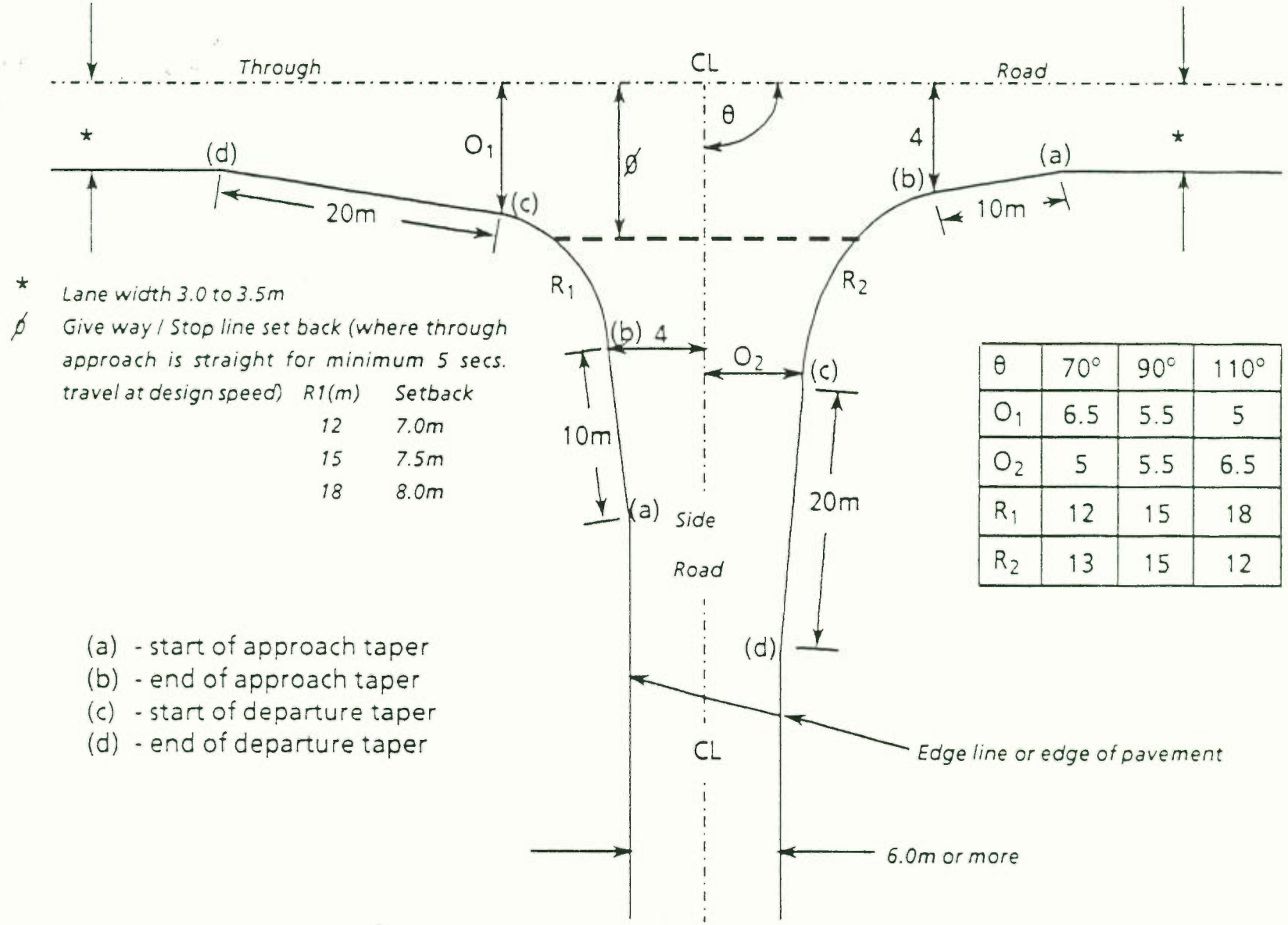
C (On curve) = 2 x (nominal lane width + corresponding widening for curve radius)

refer Section 2 Table 2.2.2

TYPE "AUR" RIGHT TURN TREATMENT

(See additional notes on Figure 4.5.3)

Figure 4.8.16



* *Lane width 3.0 to 3.5m*

ø *Give way / Stop line set back (where through approach is straight for minimum 5 secs. travel at design speed)*

R1(m)	Setback
12	7.0m
15	7.5m
18	8.0m

θ	70°	90°	110°
O_1	6.5	5.5	5
O_2	5	5.5	6.5
R_1	12	15	18
R_2	13	15	12

DETAILS OF TYPE "BAL" LAYOUTS FOR RURAL SITES.

Figure 4.8.26

RECEIVED
30 APR 1993

Central West
South East and
Illawarra Region

NSW Agriculture

161 Kite Street
Locked Bag 1
ORANGE NSW 2800

Telephone (063) 91 3590
Facsimile (063) 91 3599

Mr Bob Corbett
Senior Environmental Scientist
R W Corkery and Co Pty Ltd
PO Box 80
ORANGE NSW 2800

Your Ref: 203/RJC/JAHa
Our Ref: AJD/KG

28 April 1993

Dear Sir,

RE: Proposed Peak Hill Gold Project

The site of this proposal has been inspected by NSW Agriculture. The following comments are provided.

1. The site of the original workings is severely degraded Class V land of no agricultural potential.

2. The area proposed for the infrastructure is Class III agricultural land. The land is currently fallowed for cropping.

3. Item 4.7 in your correspondence indicates that the company does intend to conduct a rehabilitation program in the longer term. No specific details are provided on the proposed rehabilitation program for the land used for the infrastructure.

4. NSW Agriculture recognises that resources such as that existing at Peak Hill need to be exploited. The return of the land to productive agricultural use following the extraction should be part of the conditions of consent.

Yours faithfully

A J Dymock
AGRICULTURAL ENVIRONMENT OFFICER

SUMMARY OF ISSUES RAISED IN CORRESPONDENCE WITH STATE AND LOCAL GOVERNMENT AUTHORITIES

Requirements	Addressed in EIS
PARKES SHIRE COUNCIL	
Effect of blasting on nearby buildings	Sections 4.6 and 5.7
Effect of noise and dust on nearby residents	Sections 4.4; 5.8; 4.2 and Section 5.6
Effect on the well being of residents of aged units and Hostel	Sections 4.6 and 5.13.3
Integrity of Council water services and securing a Peak Hill water supply	Sections 2.4.10; 4.6; 5.7; 2.9.3; 3.6; 4.3; and 5.4
Safety of members of the public and property	Sections 2.8; 4.8; and 5.11.4
Safety of mine vehicles entering from Newell Highway	Sections 2.8; 2.12; 4.12 and 5.11.4
Impact on Bogan Weir water users	Sections 4.3.4 and 5.4.1
Impact on community facilities	Section 5.13.4
Future operations of Council's refuse disposal depot	Sections 2.7.5 and 2.14.5
Use of groundwater outside the open cut area	Section 4.3.3
NATIONAL PARKS AND WILDLIFE SERVICE	
Archaeological assessment	Sections 3.11; 4.9 and 5.10
Impact on flora and fauna	Sections 3.9 and 5.9
Rehabilitation	Section 2.13

SUMMARY OF ISSUES RAISED IN CORRESPONDENCE WITH STATE AND LOCAL GOVERNMENT AUTHORITIES

Requirements	Addressed in EIS
DEPARTMENT OF WATER RESOURCES	
General Requirements for EIS's	Sections 3.6; 4.3; 4.12 and 5.4
CENTRAL WEST COUNTY COUNCIL	
NO ISSUES	
ENVIRONMENTAL PROTECTION AUTHORITY	
Operational Noise; Construction Noise; Blasting Noise	Sections 3.7; 4.4 and 5.8
Water Pollution	Sections 3.6; 4.3 and 5.4
Air Pollution	Sections 2.4.5; 3.8; 4.2 4.6; 5.6 and 5.7
DEPARTMENT OF MINERAL RESOURCES	
Dust	Sections 3.8; 4.2; 4.6; 5.6 and 5.7
Blast Vibration	Sections 4.6 and 5.7
Noise	Sections 3.7, 4.4 and 5.8
Pit Stability	Section 2.4.10
Blast Warning	Sections 2.4.5; 4.4; 4.6; 5.7 and 5.8
Fencing	Sections 2.8; 4.8 and 5.11.4

SUMMARY OF ISSUES RAISED IN CORRESPONDENCE WITH STATE AND LOCAL GOVERNMENT AUTHORITIES

Requirements	Addressed in EIS
DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT (SOIL CONSERVATION SERVICE)	
Project background	Section 1
Outline of Proposal	Section 2
Proposed mining operation, site layout etc.	Section 2
Mining operation, sequence	Section 2
Overburden placement	Section 2
Waste placement	Section 2.7
Transportation, site access	Section 2.12
Services - Water supply, sewerage	Section 2.9
Rehabilitation	Section 2.13
On-site and off-site impacts of all activities	Section 5
Proposed monitoring programme for environmental impacts	Section 4.12
Site and locality resource inventory to address topography, geology, soils, vegetation, drainage pattern, land use	Section 3
Runoff management plan to address any on flow of runoff, its diversion and any downstream impacts	Section 4.3
Infrastructure development in construction phase - incorporation of erosion and sediment controls (often temporary) during construction of access roads, plant area, hardstand areas etc.	Sections 2.4.2; 2.4.3; 2.7.6 and 4.3

SUMMARY OF ISSUES RAISED IN CORRESPONDENCE WITH STATE AND LOCAL GOVERNMENT AUTHORITIES

Requirements	Addressed in EIS
DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT (SOIL CONSERVATION SERVICE) - Cont'd	
Infrastructure - permanent erosion and sediment controls installed on access roads, tracks, haul roads, plant areas etc.	Sections 4.3 and 4.5
Septic tank effluent disposal	Section 2.9.4
Mining phase - site preparation plans - topsoil and subsoil management, stockpiling for sequential reuse, preservation of viability of stockpiled materials, erosion prevention from stockpiles	Sections 2 and 4
Overburden and waste dumps - batter slopes, berms and berm grades, runoff inflow prevention, end use and rehabilitation	Sections 2.7.5; 2.7.6; 2.7.7; 2.7.8 and 2.13
Waste dams - batter stabilisation, erosion and sediment controls, runoff inflow prevention, end use and rehabilitation	Section 2.7
Rehabilitation proposals - technology, final landforms, sequencing, tree/ shrub/ grass/ legume establishment, final landuse projections	Section 2.13
Site decommissioning - reinstatement, rehabilitation	Section 2.13
Site end use	Section 2.13
DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT (DEPARTMENT OF LANDS)	
Detailed land ownership map	Figure 3.7 and Table 3.8
Assessment of heritage significance	Sections 3.11; 4.9 and 5.10

SUMMARY OF ISSUES RAISED IN CORRESPONDENCE WITH STATE AND LOCAL GOVERNMENT AUTHORITIES

Requirements	Addressed in EIS
DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT (DEPARTMENT OF LANDS) - Cont'd	
Actions proposed to rehabilitate and shape the site at completion and possible post-mining uses of the land; water management and public safety	Sections 2.8; 2.13; 4.3; 4.5; and 4.8
Full vegetation survey	Sections 3.9 and 5.9
ROADS AND TRAFFIC AUTHORITY	
NO SPECIFIC REQUIREMENTS	
NSW AGRICULTURE	
NO SPECIFIC REQUIREMENTS	

APPENDIX 3

Energy Statement

ENERGY STATEMENT

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

1.0 BACKGROUND INFORMATION

The Company proposes to develop an open cut mine to extract a possible 1.8 Mt of gold-bearing ore. The ore would be crushed and treated in a heap leach plant to be established on-site.

The open cut mine would be developed to a depth of approximately 75 to 105 m below the existing surface. For every tonne of ore mined there would be approximately 1.6 t of waste rock which would be placed in an area to the north-east of the open cut mine. Following treatment, the crushed and agglomerated ore from which the gold is extracted would be left on the PVC-lined leach pads, contoured, topsoiled and revegetated.

2.0 OPERATION ENERGY REQUIREMENTS

2.1 Construction/Pre-Production Phase

During the construction/pre-production phase the following fuel driven equipment and vehicles would be used:

Excavators
50 t Dump Trucks
Dozers
Grader
Scrapers
Front-end Loaders
Fuel Cart
Generator
Water Cart
Bus
Drills
4WD Vehicles.

The Company expects that the above vehicles and equipment would use approximately 300 000 L of fuel during the twenty three (23) week construction period.

2.2 Open Cut Mining

It is estimated that the contractor who undertakes the mining, would utilise approximately 650 000 L of diesel fuel annually for drilling, loading and transportation of ore and waste rock and for the ancillary services and supervision.

2.3 Processing and Services

Diesel-powered mobile equipment and personnel vehicles associated with processing and services would utilise approximately 150 000 L of fuel annually.

During the pre-production phase, an 11 kV extension of the Peak Hill town supply would be installed by the Central Western County Council. Subsequent treatment plant operations would be operated primarily by electrical power with an estimated maximum demand of 1 000 kW. The annual electrical power usage is estimated to approximate 3 000 Megawatt hours.

The only other energy source within the treatment plant would be LPG which is required to operate the heaters within the desorption circuit, and the kiln in the goldroom.

2.4 Total Fuel Usage

The annual liquid fuel usage for the project would be approximately 800 000 L.

3.0 JUSTIFICATION OF LIQUID FUEL USAGE

3.1 Open Cut Mining

There is no alternative economic method to remove the gold bearing ore and waste rock.

3.2 Treatment Plant

The Company is optimising the use of electrical power from the main grid.

APPENDIX 4

Cyanide in the Gold Mining Industry
Information Brochure

Cyanide in the Gold Mining Industry

INFORMATION BROCHURE

Issued October 1990

Prepared by Central West Committee, Chamber of Mines, Metals & Extractive Industries (NSW), Suite 902, 37 Pitt Street, Sydney 2000. Tel: (02) 247 5384

In our daily lives many of the things we use, which if not used carefully, can be very dangerous. Electricity and liquid fuels such as petrol are accepted by the public despite their potential risks. Similarly cyanide is a chemical which is accepted and safely used in many industries.

This brochure is designed to answer questions covering most aspects of cyanide use in the gold mining industry.

NEED IN THE INDUSTRY

Why does the mining industry need cyanide?

Cyanide has been in use by the mining industry for over a century for the recovery of precious metals such as gold and silver. It continues to be used as there are no equivalent or more efficient agents or methods available to replace it. The Australian gold mining industry uses in excess of 100,000 tonnes of cyanide a year. Cyanide is also used in many other industries such as steel and plastics manufacturing.

FORMS

What is cyanide?

Cyanide is a family word covering the acidic gas hydrogen cyanide (HCN) and salts of the acid, including sodium cyanide (NaCN), potassium cyanide (KCN) and calcium cyanide (CaCN). The salts are crystalline solids which readily dissolve in water, so cyanide can be found in both solid and liquid form.

Hydrogen cyanide or "prussic acid" is a colourless, flammable gas and will readily concentrate in unventilated areas. It can sometimes be detected by its faint bitter almond odour. Hydrogen cyanide is generated by contact between cyanide salts or solutions and acids or weak alkalis.

Is cyanide manufactured or does it occur naturally?

For use in industry, cyanide is manufactured under strict guidelines. Cyanide also occurs naturally in minute quantities in certain species of plants such as eucalyptus, acacia, roses, maize, sorghum, lettuce, brussel sprouts and many others. Combustion (bushfires etc) of these species results in a more toxic form of cyanide. The following table gives an indication of the diverse products containing cyanide.

ITEM	CYANIDE LEVEL
Table salt	up to 13 ppm
Coffee	up to 6 ppm
Inhaled cigarette smoke	up to 1600 ppm
Sorghum	up to 25 ppm
Lima beans	up to 31 ppm
Almonds	up to 100 ppm
Road salt	up to 350 ppm

ppm = parts per million

Source: The Management of Cyanide in the Gold Mining Industry Seminar, November 1988, Australian Groundwater Consultants P/L.

HEALTH HAZARDS

Is cyanide extremely poisonous?

Cyanides are poisonous and people working with any cyanide substance must be familiar with, and observe established safe working practices. These include rigorous use of protective clothing, strict hygiene standards and regular monitoring procedures.

Detailed safe working practices in the handling of cyanide are dealt with in a brochure issued by the Department of Minerals and Energy.

What happens if humans are exposed to cyanide?

Cyanide can be fatal if absorbed in high levels into the body by breathing of gas or dusts, absorption through the skin or by swallowing. Primarily death is caused by cyanide inhibiting body tissues utilising oxygen or, less commonly, by abnormal heart rhythm or cardiac arrest brought on by poisoning of the heart muscle.

Does cyanide build up in the body over time?

NO! Cyanides are non cumulative poisons and can be readily detoxified by the body. LOW LEVELS OF CYANIDE IN INHALED AIR, OR IN MATERIALS THAT ARE SMOKED, EATEN OR DEPOSITED ON THE SKIN DO NOT ELEVATE BLOOD CYANIDE LEVELS. THE BODY'S BUILT-IN DETOXIFICATION SYSTEM RAPIDLY TRANSFORMS CYANIDES INTO HARMLESS SODIUM THIOCYNATE WHICH IS EXCRETED IN URINE. Half of a sublethal dose of cyanide is detoxified in the body in less than 30 minutes

How many people have died from cyanide poisoning in the mining industry?

In the past eight years no accidental deaths have resulted from cyanide poisoning in the Australian gold mining industry.

SYMPTOMS OF CYANIDE POISONING

What are the symptoms of cyanide poisoning?

The following symptoms can result from other medical causes not related to cyanide poisoning. These symptoms should be investigated if they occur around cyanide areas.

Mild Poisoning Symptoms
Eye, nose, throat irritation
Burning tongue sensation
Metallic taste
Forehead pressure, head pain
Giddiness, nausea
Suffocating feeling
Weakness, heaviness of limbs

Severe poisoning symptoms
Nausea/vomiting
Gasping for breath (early)
Loss of consciousness
Convulsion
Feeble or absent breathing
Weak or absent pulse

SAFETY LIMITS

Are there any laws controlling the use of cyanide?

The transportation and the use of cyanide is covered in NSW by the Dangerous Goods, Hazardous Chemicals and Mining legislation which is strictly enforced by government agencies such as the Dept. of Minerals and Energy, Dept. of Transport and Dept. of Environment.

What are the limits on exposure to cyanide?

The following limits, considered among the strictest in the world, have been set by the Australian Health Authorities and are regularly monitored at all gold mining operations. An employee's exposure should not exceed:
(i) 5 mg of cyanide dust/powder per cubic metre of air.
(ii) 10 parts per million of hydrogen cyanide gas/vapour.

A large safety factor is built into these levels.

What precautions are taken to stop cyanide escaping?

As well as the above limits on human exposure to cyanide a limit of 0.05 parts per million is set on water effluent from mining operations.

Mines control potential cyanide escape with stringent rules on the handling of cyanide and a system of containment bunds, purpose built residue disposal dams and contaminated water recycling systems. Gold mines keep a stock of chemical which is used to rapidly degrade any cyanide which may escape.

What checks are made to ensure mines comply with government guidelines?

Gold mines are required to regularly monitor water and air quality and to report results annually to government authorities. Gold mines also undergo regular inspections by officers of the Department of Minerals and Energy and the State Pollution Control Commission to ensure compliance with regulations.

BECAUSE OF THESE STRINGENT REGULATIONS AND STRICT ENFORCEMENT OF STATUTORY LIMITS, IT IS UNLIKELY THAT THE GENERAL PUBLIC, EVEN IN CLOSE PROXIMITY TO GOLD MINING OPERATIONS, WILL EVER BE EXPOSED TO CYANIDE LEVELS ANYWHERE NEAR STATUTORY LIMITS.

FATE OF CYANIDE IN ENVIRONMENT

Is there any cyanide left after treatment and what happens to this cyanide?

All residue from the treatment of gold bearing material is directed to purpose built dams. The solid component is of little concern as the finished dam can be covered and rehabilitated ensuring no solid waste losses.

Solution residue is normally left to allow sunlight and air to degrade the cyanide or it may be chemically treated to cause degradation. Recent tests in the United States have shown there is very little cyanide available to infiltrate the ground after closure of a residue dam. It has been shown that a number of mechanisms such as volatilisation (or vapourisation), absorption into soil and microbial biodegradation significantly degrade cyanide levels.