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Lucky Draw Gold Project : environmental impact statement

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RENISON GOLDFIELDS CONSOLIDATED LIMITED

THE LUCKY DRAW GOLD PROJECT

BURRAGA, NSW

Environmental Impact Statement



Prepared by:  R.W. CORKERY & CO. PTY. LIMITED

RENISON GOLDFIELDS CONSOLIDATED LIMITED

LUCKY DRAW GOLD PROJECT

ENVIRONMENTAL IMPACT STATEMENT

Prepared by:

R.W. Corkery & Co. Pty Limited
Geological and
Environmental Consultants
P.O. Box 80
ORANGE NSW 2800

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

On behalf of:

Renison Goldfields
Consolidated Limited
24th Floor, Gold Fields House
1 Alfred Street
SYDNEY NSW 2000

Telephone: (02) 2 0512
Facsimile: (02) 235 0603

March, 1988



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

This Statement has been prepared on behalf of Renison Limited, being the applicant making the development application referred to below.

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

The open cut mining and treatment of gold bearing ore.

The development application relates to the land described as follows:

	County:	Georgiana				
	Parish:	Burruga				
MLA 310:	Portion:	24	Vol:	2398	Folio:	199
	Portion:	56	Vol:	1958	Folio:	38
	Portion:	105	Vol:	4481	Folio:	154
MLA 316:	Portion:	106	DP:	753020		
ACCESS ROAD:	Portion:	92	DP:	753020		
	Portion:	93	DP:	753020		

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 W. Corkery, B.Sc., M. Appl. Sc., P.O. Box 80 ORANGE NSW 2800
--	---

Certificate

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

Robert W. Corkery
.....
Signature

28th March, 1988
.....
Date

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SUMMARY

SUMMARY

THE PROJECT SITE

The Project Site is located within Evans Shire 68 km south of Bathurst and 5 km northeast of Burruga. The site comprises two Mining Lease Applications which cover a total area of 268 ha of Company owned land and a small length of Shire Road No. 30 (Moss Grove Road). The Project Site also incorporates two small portions of crown land currently held under permissive occupancy for grazing.

The Project Site lies to the east of the site where the township of Burruga was first settled. Burruga is an Aboriginal word for "bad water". No mining has previously been undertaken on the site.

THE PROPONENT

Renison Goldfields Consolidated Limited (RGC), a mining and minerals exploration group, was formed in 1981 by the merger of four listed public companies - Associated Minerals Consolidated Limited (formed in 1953), Consolidated Gold Fields Australia Limited (formed in 1960), Renison Limited (formed in 1960) and the Mount Lyell Mining and Railway Company Limited (formed in 1903), which are now wholly owned subsidiaries.

RGC is owned 51 per cent by the Australian public and 49 per cent by Consolidated Gold Fields PLC (CGF) of the UK and has been granted naturalised status under the Federal Government's foreign investment guidelines.

RGC's main mining and exploration activities are in Australia, USA, Phillipines, Indonesia and Papua New Guinea.

THE PROJECT

The Company proposes to develop and operate an open cut mine over a four year period to recover an estimated 1.2 million tonnes of gold bearing ore. Approximately 4.8 million tonnes or 2.1 million m³ of waste rock or overburden will need to be mined from the 350m x 250m x 80m deep open cut.

The ore will be transported by dump truck to the nearby treatment plant whilst the waste rock will initially be used for on-site construction purposes (tailings dam, sedimentation dams, access pads etc). The remaining waste rock will be placed in a waste rock emplacement surrounding the open cut. Some material selectively placed in the waste rock emplacement will be defined as low grade ore and if not retrieved throughout the life of the project, will be rehabilitated along with the remainder of the waste rock emplacement.

The treatment plant comprises a two stage crushing circuit, a ball mill for final grinding and a carbon-in-pulp plant to recover the gold from the finely ground ore. Some additional equipment will be installed to produce dore or unrefined gold bullion on-site.

The power requirement for the project of 1.5 MW will be drawn from an upgraded 11 KV line from Bathurst via Rockley. Makeup water will be obtained from the Burruga Dam and on-site sources at a rate of 40 Ml/month. The proportion of water required from Burruga Dam will decrease gradually through the life of the project as surface water collection and groundwater inflows to the open cut increase.

Once approved, the project will take an estimated nine months to construct and commission. A four year project life is predicted based on currently defined ore reserves. Employment levels during construction will peak at approximately 75 persons whilst the permanent workforce will be in the order of 65 persons. A proportion of the total workforce will be employed by contractors.

The waste rock emplacement will be constructed progressively in 5 m high layers whereby the outer surface of each layer can be progressively rehabilitated.

Tailings will be pumped to a single dam to be constructed about 1 km north of the treatment plant. The dam will be constructed in three stages. Reworking and compaction of the clays on the floor of the dam will be required in addition to the provision of a clay layer on the inner surface of the dam wall.

Rehabilitation of the waste rock emplacement involves progressive revegetation of the completed surface. Once the surface of the tailings dam is sufficiently strong, after drying, sufficient waste rock will be placed over the surface to provide a free draining landform which will be topsoiled, grassed and selective tree lots established. The open cut will remain an open void filled with good quality water to within 15 m of the surface. The upper bank will be reduced in slope and the perimeter made safe.

ENVIRONMENTAL CONSTRAINTS

The following environmental constraints have been identified and their implications noted:

1. A total of ten residences and Burruga township (60 persons) lie within 5 km of the Project Site. The closest residence ("Ben Ledi") 2.4 km from the treatment plant and open cut: The project should ensure noise, ground vibration and dust levels are acceptable to all surrounding residents.
2. The Project Site lies on the watershed between the Thompsons Creek and Hackney Creek. Burruga township and many district residents obtain their water supply from the Burruga Dam which is located on Thompsons Creek, 3.5 km from the Project Site: Hence, all potential sources of contaminated water should be sited outside the catchment of Thompsons Creek and the Burruga Dam.

3. Hackney Creek is a spring fed perennial creek, with good water quality. It joins Thompsons Creek downstream from the Burruga Dam and then flows towards the Abercrombie River and Wyangala Dam: All discharges from the Project Site should not adversely affect the quality of water in Hackney Creek beyond what is permitted by the State Pollution Control Commission.
4. Ground water is present within the area proposed for the open cut (water table 11-20m deep) and tailings dam (water table 7-8m deep). Water quality is generally good. The closest bore is 3.5 km south of the Project Site. Springs are common around the Project Site: Provision needs to be made for dealing with inflows to the open cut, potential for ground water pollution, and affecting nearby springs.
5. Much of the Project Site is underlain by sandstones of the Triangle Group: All dams containing contaminated water should be clay lined to minimize seepage.
6. The soil resources on the site have mature profiles and are sufficiently fertile and stable. Soils developed on the granite display greatest erosion potential: Soils need to be managed through correct stockpiling, respreading and drainage controls.
7. Existing noise levels are low and reflect the rural nature of the surrounding countryside: Noise levels from operating plant and equipment will need to be kept well within the criteria of the State Pollution Control Commission.
8. The high elevation of the site makes the site visible in most directions: Visual control measures are required where possible to reduce this impact.

9. The local road network reflects the rural nature of the district and their low usage. With the exception of much of the road to Bathurst, the roads are unsealed: Care will be necessary to avoid road damage, especially during the construction period, and maximum use made of sealed access roads.
10. The prevailing winds are strongest from the northwest to southwest quadrant for most of the year. Northeast to southeast winds dominate in summer: The exposed nature of the site to prevailing winds will necessitate effective dust control measures.
11. Remnants of woodland vegetation remain on the site, however, the site is mostly cleared grazing country. Limited native fauna and birds occur on the site. Trout are present within Hackney Creek and Thompsons Creek: Discharges from the site should not affect stock or trout.
12. Surrounding land uses are either grazing or private pine plantations: Care is required avoid negative impacts upon the surrounding land uses.
13. Existing services require upgrading to meet project development requirements.

ENVIRONMENTAL IMPACTS

The principal impacts of the project are expected to be:

1. Groundwater levels within 1.5 km of the open cut will be temporarily lowered. This will affect a few local springs but no bores.

2. Water quality in Thompsons Creek will not be affected by the project. Only overflow from one sedimentation dam is possible. Any discharges or seepages into Hackney Creek will satisfy the water quality requirements of the State Pollution Control Commission.
3. The topography will be changed as a result of the tailings dam, waste rock emplacement and open cut.
4. Dust levels during a limited construction and earthworks period may increase, but air quality over the mine life will remain similar to existing levels.
5. The project's activities will be able to be heard by some residents under unfavourable meteorological conditions, however, all requirements of the State Pollution Control Commission will be satisfied.
6. Blasting will be heard at a number of residences in the Burraga district. No residence will be adversely affected by ground vibration. Comfort and structural criteria for blasting effects will be satisfied at all residences.
7. The project, especially the treatment plant, will be visible by day and night.
8. The project will have a noticeable economic impact on the Bathurst-Rockley-Burraga district. Wages and Company spending will generate indirect employment and further growth in the district.
9. Increased traffic levels on local roads (30 to 90 per cent) will occur throughout the life of the project.
10. Existing services will be upgraded for the mine project. The upgrading will generally improve the reliability of services throughout the district.

CONCLUSION

The Lucky Draw Gold Project will result in a number of changes to the local environment. The Company will adopt a wide range of design and operational safeguards to ensure the changes are within accepted limits. The project will become a relatively important component in the local economy for the next four years and once again place Burruga as an important mining centre in New South Wales.

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 to Evans Shire Council by Renison Limited, a subsidiary company of Renison Goldfields Consolidated Limited.

The Proponent, Renison Limited, hereafter referred to as "the Company" proposes to develop an open cut gold mine and treatment plant to produce dore or unrefined gold bullion.

The Company has lodged two Mining Lease Applications (MLA's 310 and 316) over a 268.4 ha area 5 km northeast of Burruga (see Figure 1.1).

Obtaining Development Consent for the project from Evans Shire Council is a pre-requisite for the Department of Mineral Resources to grant the Company a Mining Lease over the area concerned. Mining within a Mining Lease is a designated development within Schedule 3 of the Environmental Planning and Assessment Regulation, 1980.

This Statement will also serve as a basis for applications to the State Pollution Control Commission for licences and approvals required to operate the mine and treatment plant.

1.2 FORMAT OF THE IMPACT STATEMENT

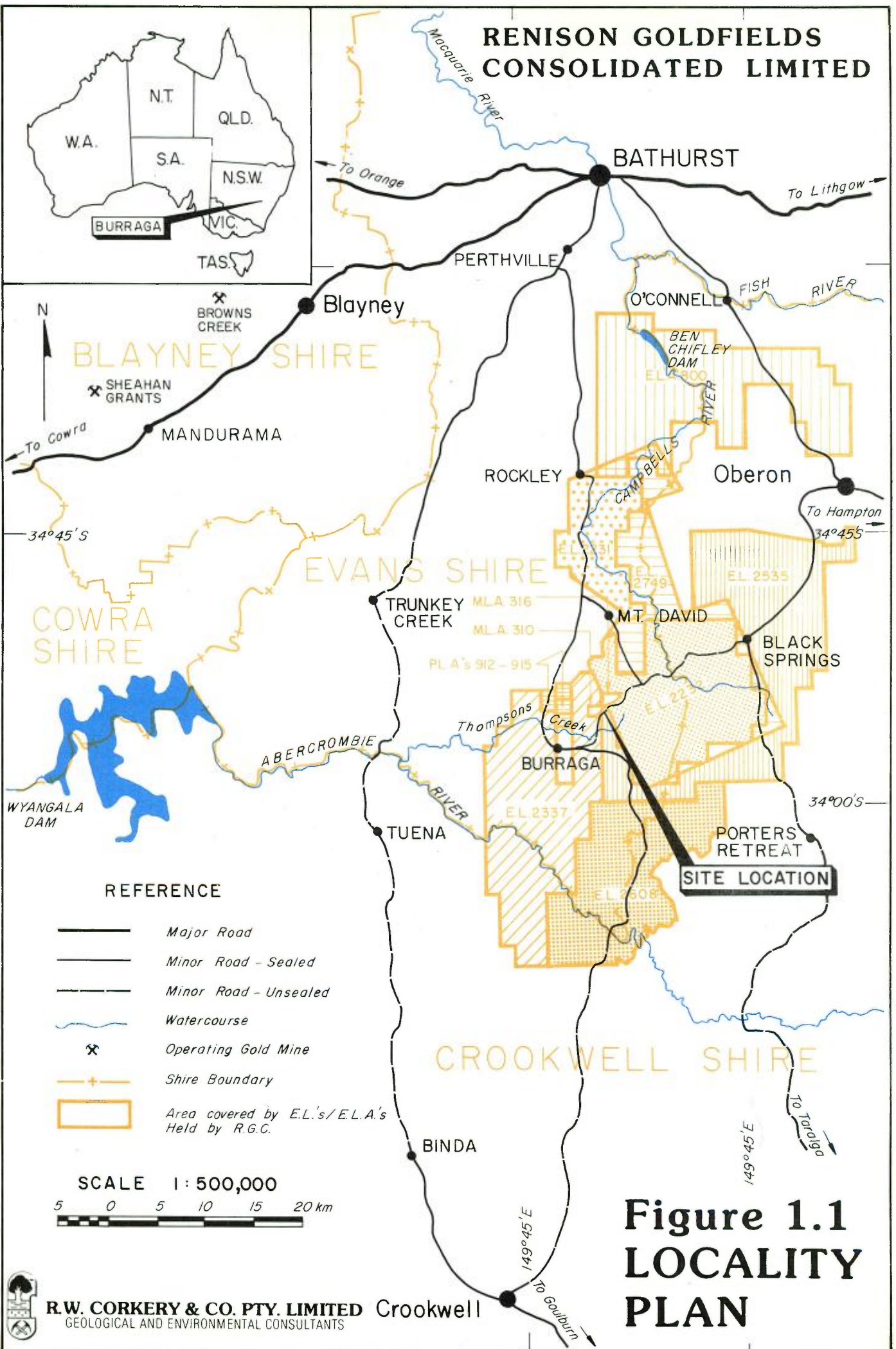
This Environmental Impact Statement has been written in six sections with a set of appendices. The requirements of Clause 34 of the Environmental Planning and Assessment Regulation, 1980 and the Director's letter (Appendix 1) have been incorporated into the most appropriate sections of the Statement. The 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 Burraga.
- Section 2:** Outlines the Company's objectives and proposed plans for the mining and treatment of the defined gold bearing ore. The proposals for waste disposal and site rehabilitation are also examined. Alternatives for various components of the project are also outlined.
- Section 3:** Describes the existing environment around the project site. Potential constraints imposed by the existing environment are identified.
- Section 4:** Presents the safeguards that have been incorporated into the mine plan and the design of the treatment plant to protect the environment.
- Section 5:** Analyses the impact the safeguarded project will have on the environment around Burraga.
- Section 6:** Justifies the project in terms of environmental, economic and social considerations and examines the consequences of not proceeding with the project.
- Appendices:** Present correspondence from the Department of Environment and Planning, floristic and fauna lists, information on materials characterisation, the Energy Statement, and baseline monitoring data.



RENISON GOLDFIELDS CONSOLIDATED LIMITED



- REFERENCE**
- Major Road
 - Minor Road - Sealed
 - - - Minor Road - Unsealed
 - ~ Watercourse
 - ✕ Operating Gold Mine
 - +— Shire Boundary
 - ▭ Area covered by E.L.'s/E.L.A.'s Held by R.G.C.



**Figure 1.1
LOCALITY
PLAN**

1.3 THE PROPONENT

Renison Goldfields Consolidated Limited (RGC) is a mining and minerals exploration group. RGC was formed in 1981 by the merger of four listed public companies - Associated Minerals Consolidated Limited (formed in 1953), Consolidated Gold Fields Australia Limited (formed in 1960), Renison Limited (formed in 1960) and the Mount Lyell Mining and Railway Company Limited (formed in 1903), which are now wholly owned subsidiaries.

RGC is owned 51 per cent by the Australian public and 49 per cent by Consolidated Gold Fields PLC (CGF) of the UK and has been granted naturalised status under the Federal Government's foreign investment guidelines.

RGC's main operations and activities include:

- (i) Mining and processing of mineral sands in Western Australia and Florida, USA;
- (ii) Mining of tin ore and production of tin concentrates at Renison Bell, Tasmania;
- (iii) Mining and production of gold at Wau, Papua New Guinea and Pine Creek, Northern Territory;
- (iv) Mining of copper ore and production of copper and pyrite concentrates at Queenstown, Tasmania;
- (v) Minerals exploration programmes in Australia, the Philippines, Indonesia, Papua New Guinea and the USA;
- (vi) Marketing and trading minerals and metals in Australia;
- (vii) Investment in Australian mining and resource securities;



(viii) Oil exploration in Australia.

1.4 BACKGROUND

The Company, through its exploration division, RGC Exploration Pty Limited, (formerly Gold Fields Exploration Pty Limited) has been undertaking exploration in the Burruga district since Exploration Licence No. 2337 was granted on 8th January, 1985. Renison Limited first applied for the area on the same day as another mining company. As a result, the Department of Mineral Resources selected the successful applicant by drawing one company's name out of a hat, hence the prospect name "Lucky Draw".

The Lucky Draw project site was first discovered in 1985 as a result of one of the Company's geologists collecting rock samples for geochemical analysis. Several mineralised samples were collected from the small area where the resource is now known to crop out.

The Company established a field office at the former "Mossgrove" homestead in 1985, and has established a base in the township of Burruga since 1986 in order to concentrate its efforts upon the Lucky Draw project. All pre-feasibility studies to date have supported the development of a mine on the site. Expenditure to date upon the Lucky Draw project site is approximately \$2 million.

1.5 HISTORY OF MINING AT BURRAGA

Burruga has been a centre of copper mining activity for over a century with the initial development of the Burruga Copper Mine, or Thompsons Creek Mine, in the late 1870's. The Lucky Draw project site, located approximately 8 km northeast of the old Burruga Copper Mine, has not been the subject of any previous mining activities.



The Burruga Copper Mine first opened in 1878 and was in full production from 1899 to 1908, closed from 1909 to 1912, reopened in 1913 and closed again in 1915. During the production period 1899 to 1916, the 413,035 tonnes of ore assaying 3 per cent copper produced 12,261 tonne of copper. In 1916 the mine was acquired by the Abercrombie Copper Mining Company which worked the mine in 1917 and 1918 and produced around 20,320 tonnes of ore at 3.1 per cent copper grade during this period.

Between 1919 and 1926 the mine was again closed, and during 1927 a small parcel of ore was won. No further mining activity took place until 1961 when a total of 36.5 tonnes of copper and 30.2 kg of silver were produced by the Excelsior Mining Company. No further ore has been won from the mine since 1961.

During the productive life of the mine the principal access was by underground methods via the main incline adit. The ore bodies were worked on 14 levels to a depth of 215 m below the main adit portal.

1.6 MANAGEMENT OF THE INVESTIGATIONS

The bulk of the investigations and report writing have been undertaken by Mr Robert W. Corkery, B.Sc., M.Appl.Sc., principal of R.W. Corkery & Co. Pty Limited. Some data collection, report writing and project review was undertaken by Ms Margot Jamieson, B.Sc.(Hons) and Mr Greg Summerhayes, B.Appl.Sc., M.Env.Sc., also of R.W. Corkery & Co. Pty. Ltd. Considerable assistance has been provided in the preparation of the Statement by a range of Company personnel and consultants both for the Company and R.W. Corkery & Co. Pty Limited. These include:

Kinhill Engineers Pty Ltd - for matters relating to water management and tailings disposal;

Minproc Engineers Pty Ltd - for matters relating to the treatment plant and site layout;



Australian Groundwater Consultants Pty Ltd - for matters relating to hydrogeology and the project's impact on the groundwater;

Richard Heggie Associates Pty Ltd - for matters relating to noise and blasting;

Mount King Ecological Studies - for a flora and fauna study;

D.J. Douglas & Partners Pty Ltd - for geotechnical testing and site investigations for the tailings dam.

Mr L. Kinsley - for matters relating to water supply.

During the course of the preparation of the Statement, a range of Government Authorities were approached and the relevant components of the project discussed with each. Those marked * provided comments on a draft copy of the Statement. Representatives of many of the authorities also attended a "Planning Focus" seminar held at Bathurst and the Project Site on the 3rd March, 1988.

Department of Environment & Planning* (Sydney)
Evans Shire Council* (Kelso)
Department of Mineral Resources (Sydney*/Orange*)
Soil Conservation Service* (Bathurst)
Department of Industrial Relations* (Orange)
Department of Agriculture (Orange)
National Parks & Wildlife Service (Bathurst)
State Pollution Control Commission* (Bathurst)
Telecom (Bathurst)
Department of Water Resources* (Forbes)
Department of Education (Bathurst)
Commonwealth Employment Service (Bathurst)
Electricity Commission of New South Wales (Sydney)
Forestry Commission (Bathurst)
Southern Mitchell County Council (Bathurst)
Technical and Further Education (Bathurst).



SECTION 2

DESCRIPTION OF THE PROJECT

SECTION 2

DESCRIPTION OF THE PROJECT

2.1 OUTLINE OF THE PROJECT

The Lucky Draw Project Site is located within Evans Shire approximately 5 km northeast of Burruga adjacent to the Burruga-Oberon Road (SR 31). Figure 2.1 places the Project Site in its local setting.

Figure 2.2 presents the overall site layout showing the main components to be developed throughout the life of the project. The Project Site referred to throughout this Statement comprises the area covered by Mining Lease Applications 310 and 316 and two small portions of crown land (Portions 92 and 93) adjoining the southeast corner of MLA 310.

The project essentially involves the open cut mining of gold-bearing ore and associated waste rock, the treatment of the ore and the disposal of the waste rock and finely ground rock (tailings).

The project has an estimated life of four years. The Company will undertake the management and operation of the treatment plant and will engage contractors to undertake the mining component of the project.

This section examines all components of the project in sufficient detail to enable the environmental impacts to be adequately addressed and assessed in later sections.

2.2 MINING TENEMENTS

The Company has lodged applications with the Department of Mineral Resources for two Mining Leases to undertake the mining and treatment of gold bearing ore and storage of waste materials. Both leases with their dimensions and exact locations are shown on Figure 2.3.



Mining Lease Application 310

Mining Lease Application 310 covers an area of 83.4 ha and embraces all of Portions 24, 56 and 105 in the Parish of Burruga and County of Georgiana. All land within Mining Lease Application 310 is owned by RGC (New South Wales) Limited. Mining Lease Application 310 was lodged with the Department of Mineral Resources on the 1st December, 1987 and its receipt gazetted on the 11th December, 1987.

Mining Lease Application 316

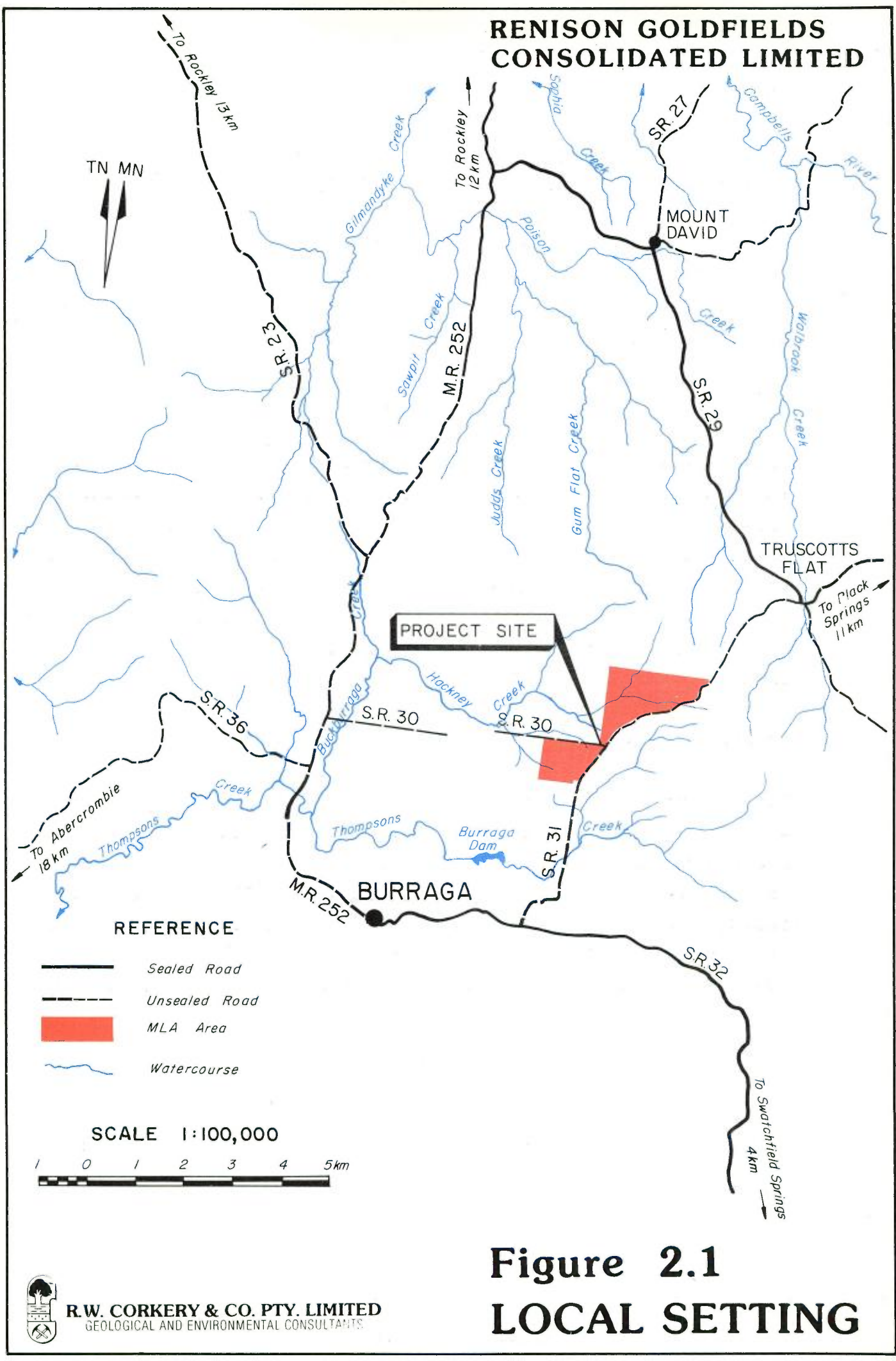
Mining Lease Application 316 covers an area of approximately 185.1 ha and occupies all of Portion 106 and a 124 m section of Shire Road 30 (known locally as "Moss Grove Road"). All land within MLA 316 is owned by Renison Limited and RGC (New South Wales) Limited with the exception of the 124 m section of SR 30. MLA 316 was lodged with the Department of Mineral Resources on the 19th January, 1988 and its receipt gazetted on the 5th February, 1988.

Exploration Licences




The Company holds a total of six current Exploration Licences and has lodged one Exploration Licence Application and four Prospecting Licence Applications for Group 1 minerals in the Burruga-Oberon district (see Figure 1.1). The Project Site is located on the boundary of two of the Company's Exploration Licences (EL's 2232 and 2337). The expiry date for these licences is 22nd May, 1988 and 7th January, 1989 respectively.



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REFERENCE

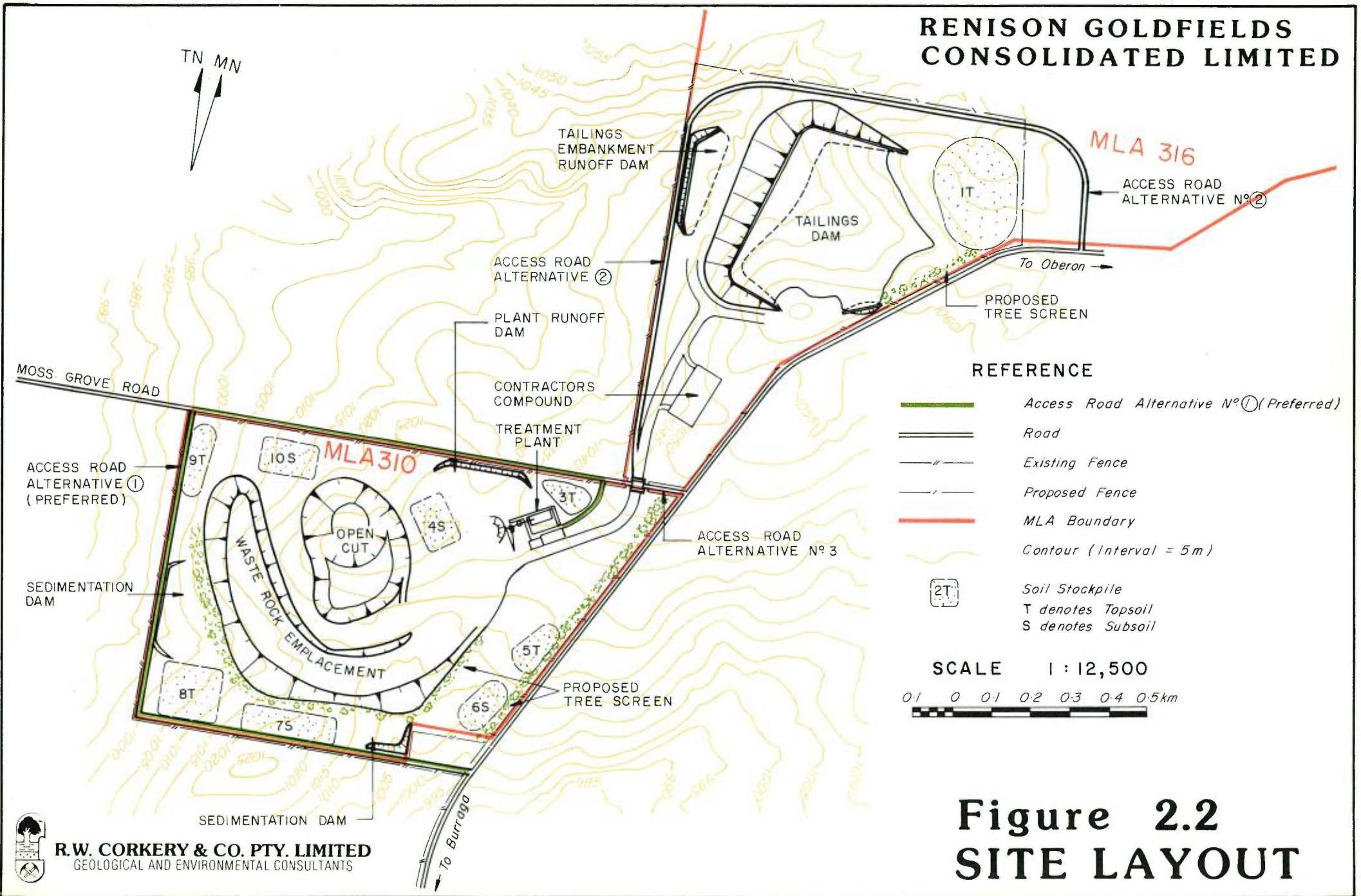
-  Sealed Road
-  Unsealed Road
-  MLA Area
-  Watercourse

SCALE 1:100,000



Figure 2.1 LOCAL SETTING

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**Figure 2.2
SITE LAYOUT**



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2.3 THE ORE BODY

The main ore body is tabular in form (250m x 150m) and comprises two pods built up of numerous lenses of mineralisation. The southern pod crops out at the surface and is largely oxidised. The northern pod plunges under cover up to 40 m below the surface, and contains oxidised mineralisation to a depth of 30 to 40m and unoxidised or fresh mineralisation to the maximum depth of 70 to 80m. Another smaller pod of mineralisation, referred to as the western pod is separated from the main deposit by a fault. Its exact boundaries are not yet defined, hence, reserve estimates could increase marginally. Figure 2.5 displays sections through the proposed open cut highlighting the pods of mineralisation.

The Company estimates that present reserves of economic gold bearing ore on the Project Site are 1.2 million tonnes with a grade of 3.5 g/t. This estimate is largely based on the results of a diamond drilling programme comprising 31 holes totalling approximately 2460 m. In order to mine this quantity of ore approximately 4.8 million tonnes or 2.1 million m³ of waste rock needs to be mined.

The gold within the ore body occurs as finely disseminated native gold with particles generally less than 0.1mm.

2.4 MINING METHOD

2.4.1 Outline of Method

The Company will use conventional open cut methods to remove the ore from the mine. The open cut will be developed in a series of benches with a haul road from the base of the open cut to its opening to the southeast. Figure 2.4 displays the final open cut layout and the location of the benches and proposed haul road. Figure 2.5 shows in section the proposed limits of the open cut. The open cut will have final dimensions of approximately 350m x 250m and a depth of 70 to 80m at its northern end. The southern end will have a final depth of approximately 40m.



Where possible during the early stages of mining, the rock will be ripped by bulldozer in preference to blasting. When the rock becomes too hard for ripping, mining will involve the drilling of a pattern of drill holes, loading with explosives, blasting and loading of broken rock into dump trucks for transportation to either the primary crusher or waste rock emplacement. Drilling will be undertaken well in advance of the blasting programme to enable the drill cuttings to be assayed for gold. The gold content of the rock cuttings will determine whether the broken rock is transported to the treatment plant or the waste rock emplacement. Provision will be made at the closest point of the waste rock emplacement to place or store low grade ore (see Figure 2.9).

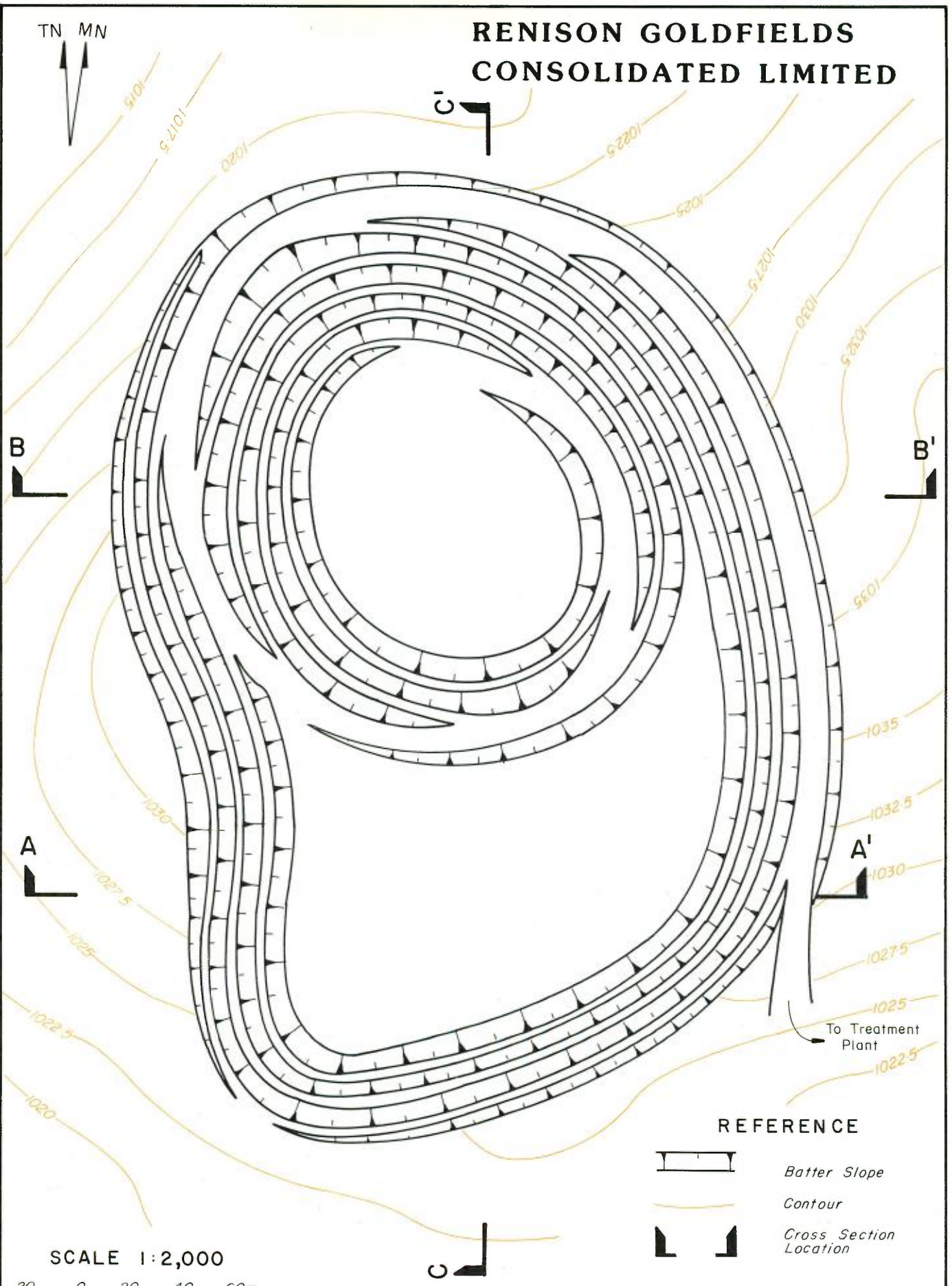
2.4.2 Sequence of Mining

The mining operation will commence with the removal of all trees from the mine area. These will be pushed beyond the boundary of the open cut and after all timber and firewood is salvaged, the remainder will be burned on site (subject to local bushfire permits - if applicable). The thin veneer of soil on the northern side of the mine area will be pushed up and transported to the topsoil stockpile to the northwest of the open cut (see Figure 2.2). It is noted that much of the soil on the southern end of the open cut contains significant gold grades and will be removed as ore.

During the construction period, waste rock will be required to provide material for construction of roads, the treatment plant site and the tailings dam. Initial mine production will concentrate on the southern end of the open cut, where the ore body outcrops. The open cut will descend relatively evenly over its full area during operations in order to maintain a constant stripping ratio.



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SCALE 1:2,000



NOTE: FOR CROSS SECTIONS SEE FIGURE 2.5

REFERENCE



Batter Slope



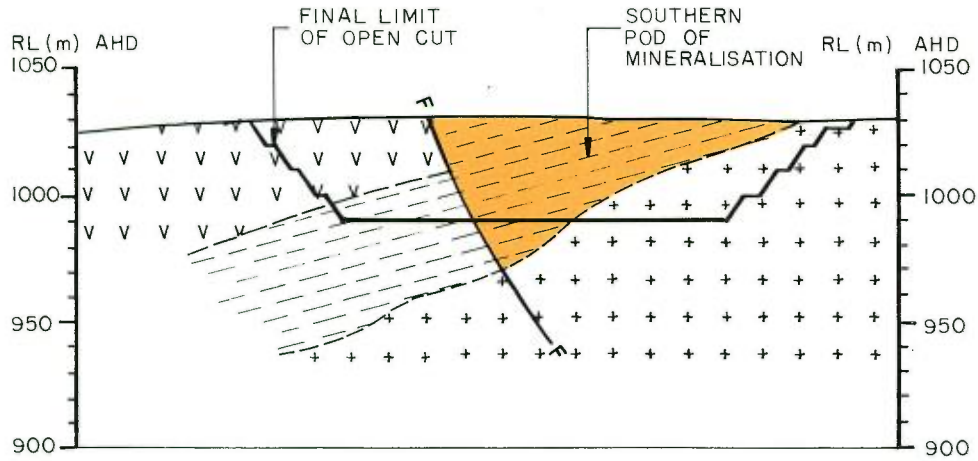
Contour



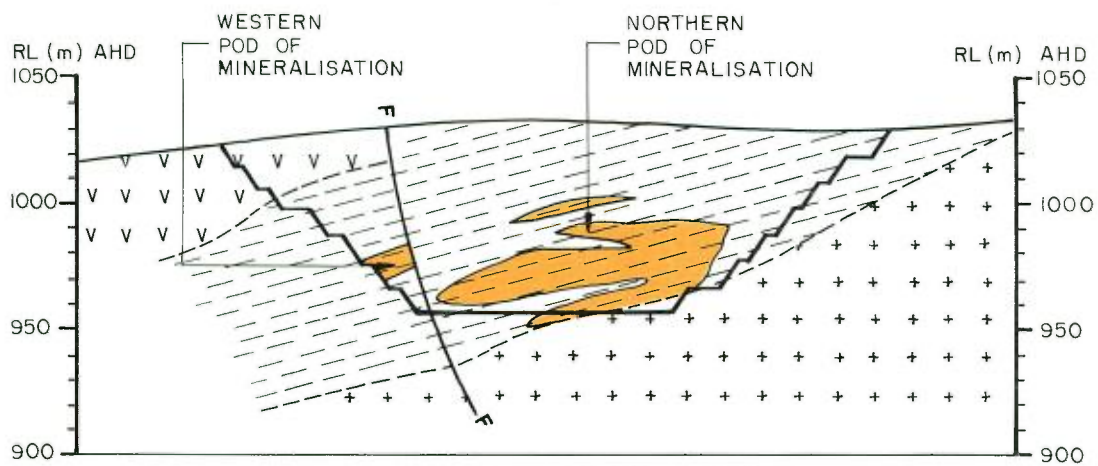
Cross Section Location

**Figure 2.4
OPEN CUT LAYOUT**

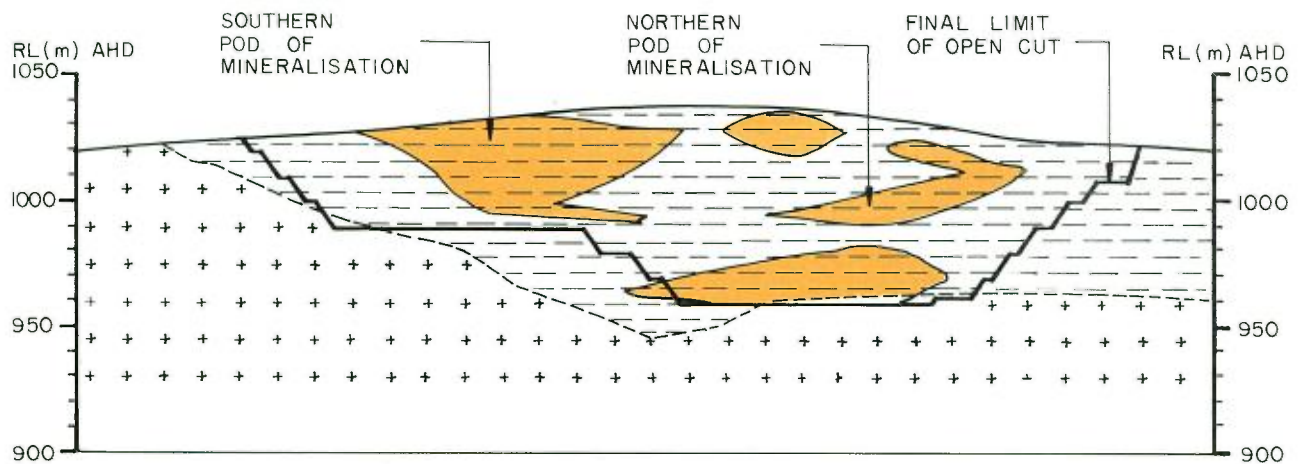
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SECTION AA'



SECTION BB'



SECTION CC'

REFERENCE

- V V V *Rockley Volcanics*
- + + + *Burraga Granite*
- / / / *Triangle Group Metasediments*
- Mineralised Schists*
- F — F *Fault*

Note: See Figure 2.4 for location of sections.

Figure 2.5 SECTIONS THROUGH OPEN CUT



2.4.3 Rate of Mining

The Company proposes to remove approximately 830 tonnes of ore and 3320 tonnes of waste rock daily from the open cut. It is the intention to keep this ratio constant throughout the life of the project, however, if necessary either ore or waste rock will be removed preferentially.

2.4.4 Stockpiling

The Company proposes to construct a relatively small stockpile area adjacent to the feed hopper for the jaw crusher. They intend to maintain an ore stockpile of at least 3,500 tonnes or four days production through the jaw crusher.

Provision will be made within the waste rock emplacement for the stockpiling of low grade ore for possible future treatment in the plant.

2.4.5 Open Cut Design Criteria

The open cut design criteria have been established following a preliminary assessment of ore distribution, geotechnical aspects and likely equipment to be used in the operation. The following criteria are proposed, subject to final geotechnical recommendations:

Bench height (operating)	5 m
Final bench height	10 m
Berm	5 m
Final bench face angle (except top bench)	75°
Top bench face angle	30°
Overall pit slope (max)	55°
Haulage road - gradient	1 in 10
- width	15 m
Specific gravity - ore	2.65
- waste	2.65



2.4.6 Equipment

The Company expects the successful contractor will utilize equipment of a similar size and number as set out in Table 2.1. Not all equipment will be operating at once as some are expected to be back-up equipment.

TABLE 2.1
MINING EQUIPMENT LIST

Equipment	No.	Use/Duties
Dump trucks (35-50 tonne capacity)	4	Ore/waste haulage.
D-9 Bulldozers	2	Ripping/excavation.
Front-end loader (e.g. CAT-988)	1	Loading hopper, tidying up.
Drill and Compressor	1	Grade control and production drilling.
Excavator (2-3 m ³ bucket capacity)	1	Loading trucks in open cut.
Grader (e.g. CAT-14G)	1	Road maintenance.
Water truck	1	Dust suppression.
Service trucks	2	General duties.
Lighting plants	3	Lighting around open cut.
Sundry vehicles	2	General duties.



2.4.7 Hours of Operation

Table 2.2 lists the proposed hours of operation for the range of mining activities at the Project Site.

TABLE 2.2
PROPOSED HOURS OF OPERATION - MINING

Activity	Days/Week	Proposed Working Hours
Soil removal	6	7.00 am - 7.00 pm
Drilling	6	7.00 am - 10.00 pm 24 hrs/day*
Blasting	6	9.00 am - 5.00 pm
Ore loading and transportation	6	7.00 am - 7.00 pm
Waste loading and transportation	7	24 hrs/day**

* Drilling will only be extended to 24 hrs/day once the developed rim of the open cut provides sufficient shielding to reduce noise levels.

** This activity will not be constant, however, the extended hours are sought to provide flexibility, especially during periods when volumes of waste rock need to be removed from the open cut.



2.5 TREATMENT PLANT

2.5.1 Selection of Site

A range of alternative sites were examined for the site of the treatment plant. The site shown on Figure 2.2 has been chosen for the following reasons:

- (i) The site is close to the open cut.
- (ii) It has suitable topography.
- (iii) Minimal earthworks are required to ensure that drainage from most of the plant site flows towards Hackney Creek.
- (iv) It lies close to the access road.
- (v) It is located on non-prospective areas for further mineral discoveries.

Alternative sites considered north of the preferred site did not satisfy the above criteria, primarily relating to (i) and (ii). Plates 1 and 2 show the proposed site for the treatment plant.

2.5.2 Site Preparation

Site preparation for the treatment plant will involve stripping of topsoil and subsoil and placing it in stockpiles around the plant itself (see Figure 2.2). Sufficient excavation will be undertaken on the site of the leaching and adsorption tanks to create a pad 80 m x 50 m to ensure runoff from this area of the plant flows into the Hackney Creek catchment. Excavations for the plant site will vary in depth from 0 to 2.5 m and all slopes created will be battered to 1:3 (vert:hor), topsoiled, seeded and fertilized. The material excavated (weathered granite) will be used on site for road construction purposes. Additional water management controls will be installed during the site preparation. These are detailed in Section 4.4.3.





PLATE 1: A view to northwest from the proposed eastern rim of the open cut towards the treatment plant site. (Ref: 93A/9)

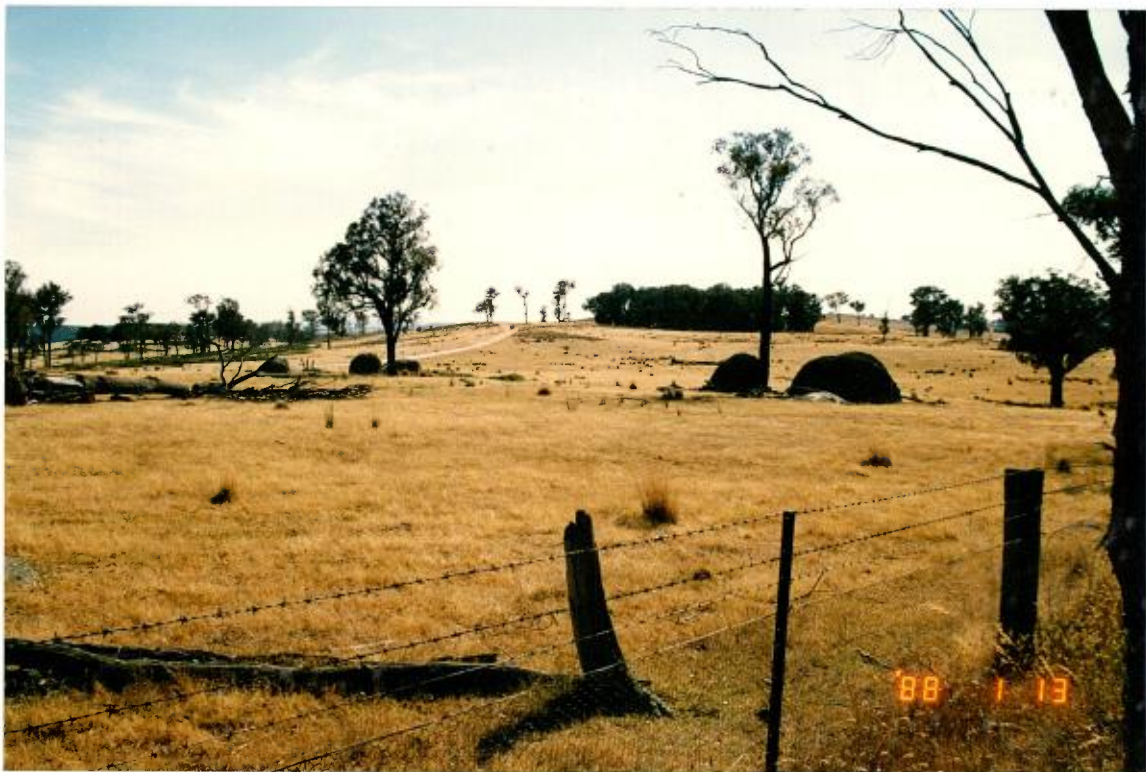


PLATE 2: A view to the southwest from Moss Grove Road towards the proposed site of the treatment plant in the foreground and open cut in the middle distance. (Ref: 93/6)

2.5.3 Outline of Process

The treatment plant to be constructed on site has been designed to receive run-of-mine ore and produce a dore or unrefined gold bullion product. Figure 2.6 displays a simplified flowsheet for the plant. The plant essentially comprises a size reduction plant and a carbon-in-pulp (C.I.P.) plant. This type of plant is typical of most gold mining operations throughout Australia and the technology utilised has been developed over many years. Similar plants are installed at the Browns Creek and Sheahan Grants mines near Blayney (see Figure 1.1).

Essentially the plant involves two stage crushing, single stage closed circuit wet ball milling and a carbon-in-pulp leaching and adsorption circuit. The plant will have a design capacity of 300,000 tonnes per year. Crushing will be undertaken at a rate of 140 tonnes per hour and milling at a rate of 37.5 tonnes per hour. The greater throughput is necessary for the crushing component of the plant since it only operates intermittently to satisfy noise criteria whereas the quieter milling system is able to operate 24 hours a day.

2.5.4 Layout

Figure 2.7 displays the proposed layout of the treatment plant. Essentially, the receival hopper and storage bin have been positioned as close as possible to the exit from the open cut.

The wet processing components of the plant (ball mill, leach and adsorption tanks) have been located on a pad (1035 m AHD) which is to be constructed below the level of the rest of the plant. This is to ensure that any potential contaminated runoff will be contained in a plant runoff dam within the Hackney Creek catchment.



The offices, workshop, warehouse and open storage area will be positioned in the more elevated parts of the site.

2.5.5 Operation

The two stage crushing plant will receive run-of-mine ore (<0.6 m) and crush it to nominally -13 mm product. Feed to the plant enters either by direct dumping from trucks or by front-end loader using ore recovered from the ore stockpile.

The ore will be dumped into a 100 t capacity bin from a steel bridge structure connecting the bin with an elevated crusher feed ramp (see Figure 2.8).

A variable capacity vibrating primary feeder will convey the run-of-mine ore from the primary feed bin into a 1067 mm x 760 mm heavy duty double toggle jaw crusher. After screening, the oversize is fed through a cone crusher which receives ore from the surge hopper. Product screen undersize flows directly into the 1800 tonne live capacity fine ore bin.

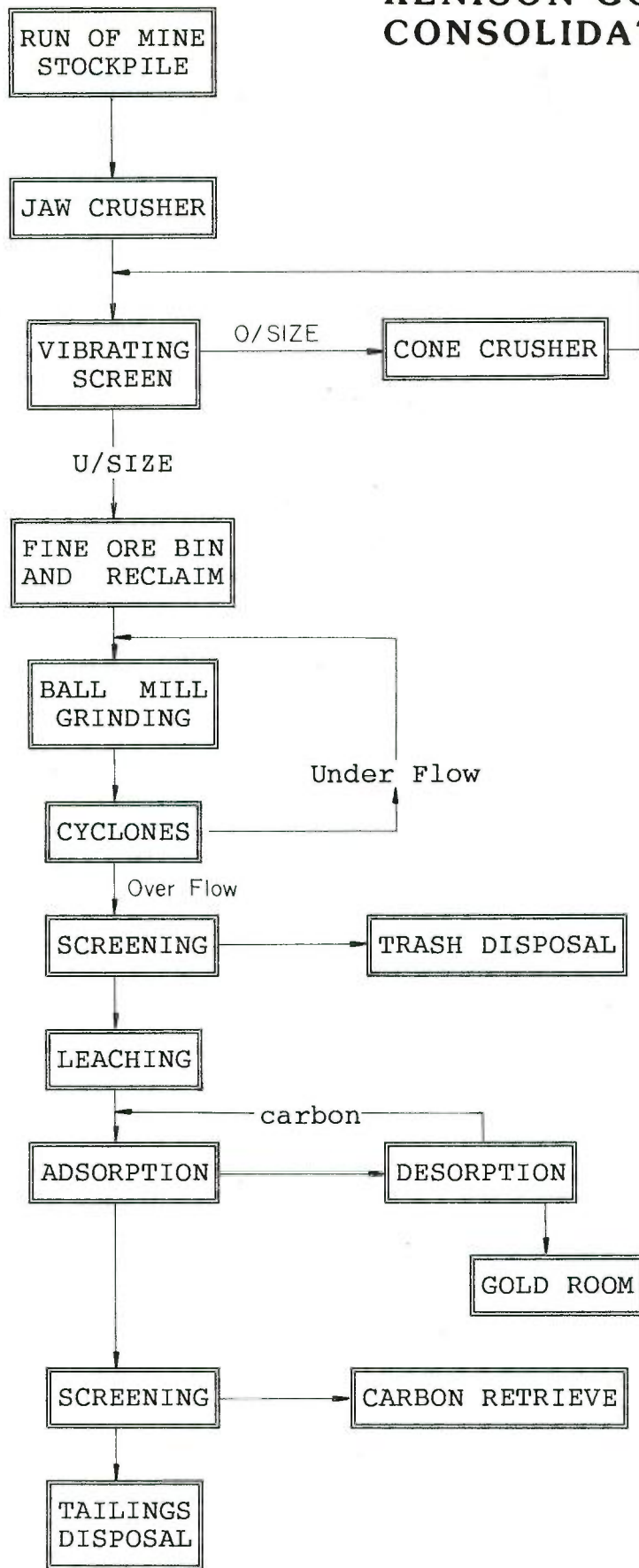
The ball mill-cyclone grinding circuit is designed to reduce nominally - 13 mm fine ore to 80 per cent passing 75 um.

Crushed ore discharged to the fine ore bin is recovered by a 2400 mm stockpile activator feeding onto the ball mill feed conveyor.

Conveyor CV3 is used as the principal addition point for lime and mill balls into the grinding circuit. Quick lime is added to the mill feed conveyor via variable speed screw conveyors from separate bulk storage bins. A furrow and plough is provided which turns these reagents into the feed ore. Balls are then added via an automatic ball charger which indexes new balls to the feed conveyor.



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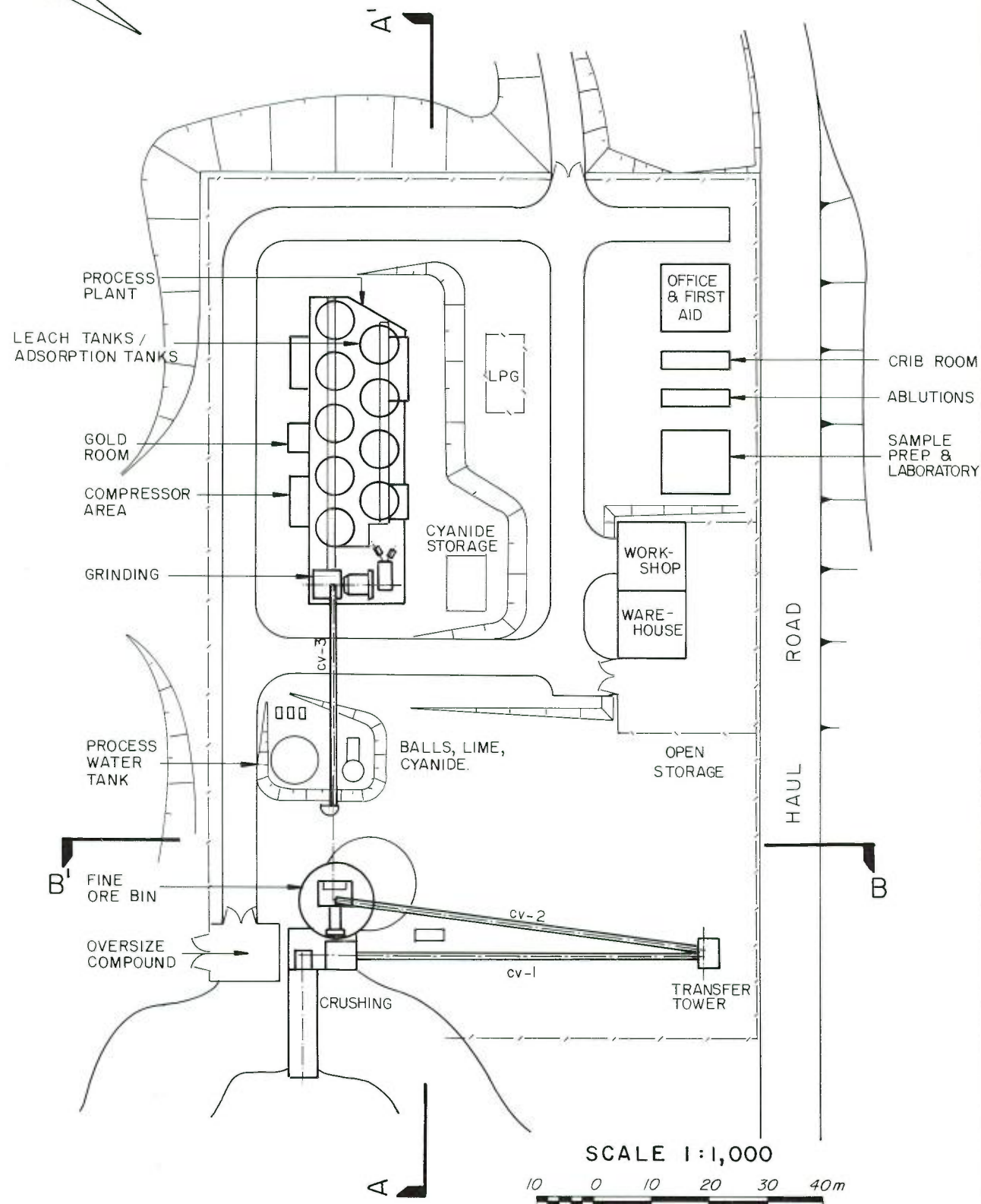
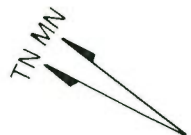
Source: Minproc Engineers Pty Ltd

**Figure 2.6
TREATMENT
PLANT FLOWSHEET**



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See Figure 2.8 for Sections

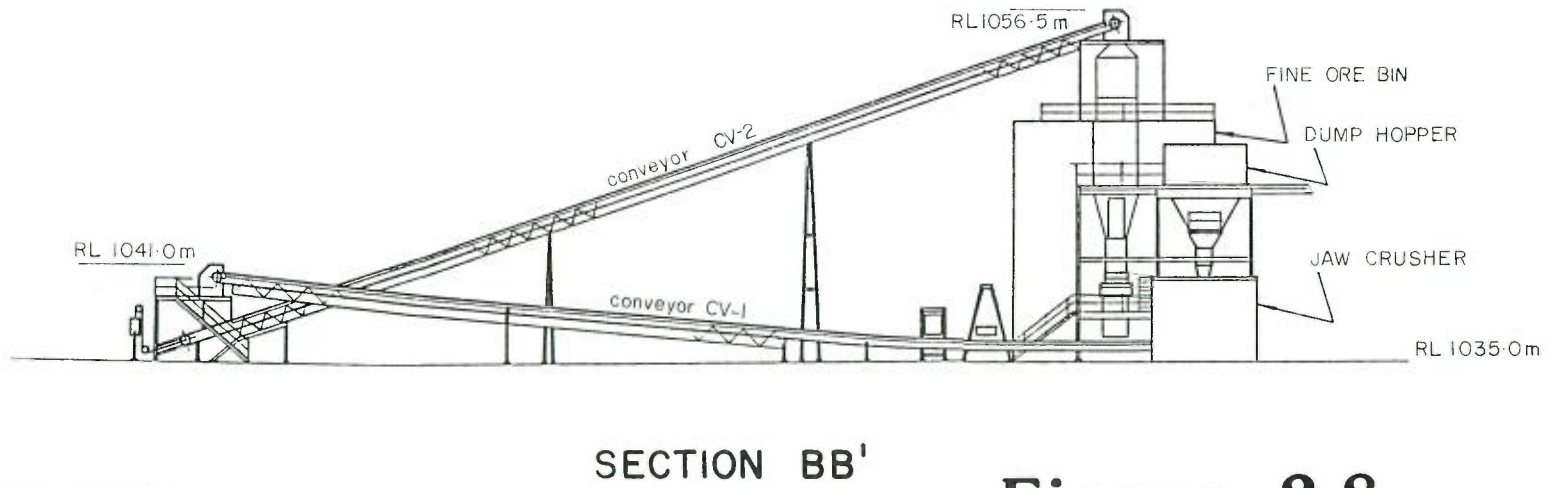
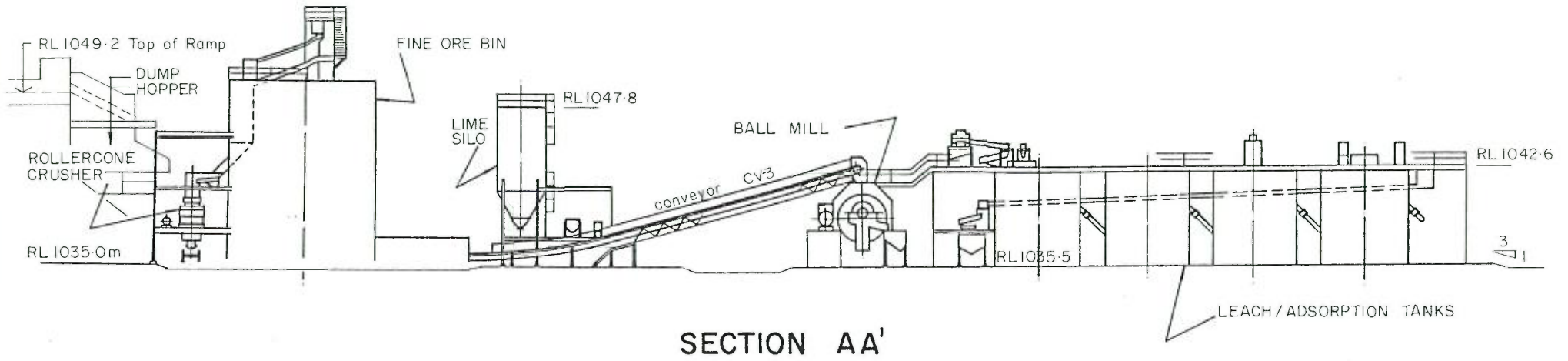
SOURCE : MINPROC ENGINEERS PTY. LTD.

Figure 2.7 TREATMENT PLANT LAYOUT



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See Figure 2.7 for Section Locations

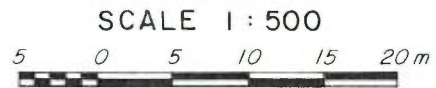


Figure 2.8 TREATMENT PLANT SECTIONS



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GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

SOURCE: MINPROC ENGINEERS PTY. LTD.

Crushed ore reclaimed from the fine ore bin is conveyed and discharged into a 3260 mm x 4200 mm long ball mill in which the ore is ground.

Optimum gold recovery is achieved with a leach residence time of 36 hours at the design feed rate of 37.5 tonnes per hour and a feed density of 40 per cent solids. The adsorption circuit is designed to recover gold from solution in the requisite time and to bring gold in solution to acceptable values. The leaching and adsorption circuit comprises nine equally sized agitated tanks, each 7.2 m diameter by 7.3 m high, arranged in two staggered rows. The leaching and adsorption stages have a total capacity of 2,484m³ of slurry.

Essentially the gold is leached from the slurry by sodium cyanide and the gold is in turn adsorbed onto activated carbon particles from where it is recovered.

The gold is desorbed from the activated carbon by means of a sodium hydroxide/sodium cyanide solvent at a temperature of about 130°C following which the gold bearing solution is electrolysed to produce a gold rich cathode. The cathode is smelted and cast into gold bullion for despatch to precious metals refineries.

2.5.6 Supplies

Table 2.3 lists the supplies or consumable items necessary for the ongoing operation of the treatment plant. Also listed are their use, annual usage and method of storage.



TABLE 2.3
 CONSUMABLE ITEMS USED IN THE TREATMENT PLANT

Item	Use	Annual Usage		Method of Storage
		Years	Years	
		1 & 2	3 & 4	
Sodium Cyanide	Gold leaching and desorption	300 t	210 t	Sealed plywood cases adjacent to leach tanks
Caustic Soda	Assists in removal of gold from activated carbon	60 t	60 t	Lined bags
Hydro-chloric Acid	Removes inorganic elements from loaded carbon	23 t	60 t	Plastic containers
Burnt Lime	pH modifier	3600 t	300 t	40 tonne enclosed bin
Activated Carbon	Gold collection from solution	5250 kg	5250 kg	40 kg drums
Grinding Balls	Grinding	870 t	870 t	200 l drums
LPG	Gold Smelting Furnace		Minor	Approved above ground tank



2.5.7 Hours of Operation

Table 2.4 lists the proposed hours of operation for the treatment plant. Shift times have not yet been set.

TABLE 2.4
PROPOSED HOURS OF OPERATION - TREATMENT PLANT

Activity	Days/Week	Hours of Operation
CONSTRUCTION		
Earthmoving	7	7.00 am - 7.00 pm
Foundations	7	7.00 am - 10.00 pm
Fabrications	7	7.00 am - 10.00 pm
Electricals	7	7.00 am - 10.00 pm
OPERATION		
Jaw/Cone Crusher	6	7.00 am - 7.00 pm
Ball Mill	7	24 hrs/day
C.I.P. Plant	7	24 hrs/day
Gold Room	7	24 hrs/day

2.6 LIFE OF THE PROJECT

The Lucky Draw Project has an estimated life of four years based on currently proved ore reserves. The Company's extensive exploration programme in the Oberon-Burruga district may result in further ore bodies being located and either treated on site or the plant removed and re-erected elsewhere at the end of mine life. Any major extension to the life of the project would become the subject of a new Development Application to Evans Shire Council.



2.7 WASTE ROCK DISPOSAL

2.7.1 Characterisation

In order to mine the 1.2 million tonnes of ore, approximately 4.8 million tonnes or 2.1 million m³ need to be removed. Three different types of waste rock will be removed from the open cut. The bulk of the waste rock will originate from the Triangle Group and Rockley Volcanics. Details of these units are given in Section 3.3. Small quantities of Burruga Granite will be removed towards the end of the project.

The waste rock is virtually free of sulphides and metals which often cause problems with their storage. A detailed assessment of the characterisation of the waste rock is presented in Appendix 3.

Geotechnical investigations by D.J. Douglas & Partners (1987) show that the mine waste (Rockley Volcanics) contains a significant clay content which will provide a suitable impervious inner zone for the tailings dam. This material will be compacted to provide a zone with a permeability of less than 10⁻⁸ m/s.

2.7.2 Waste Rock Disposal and Management

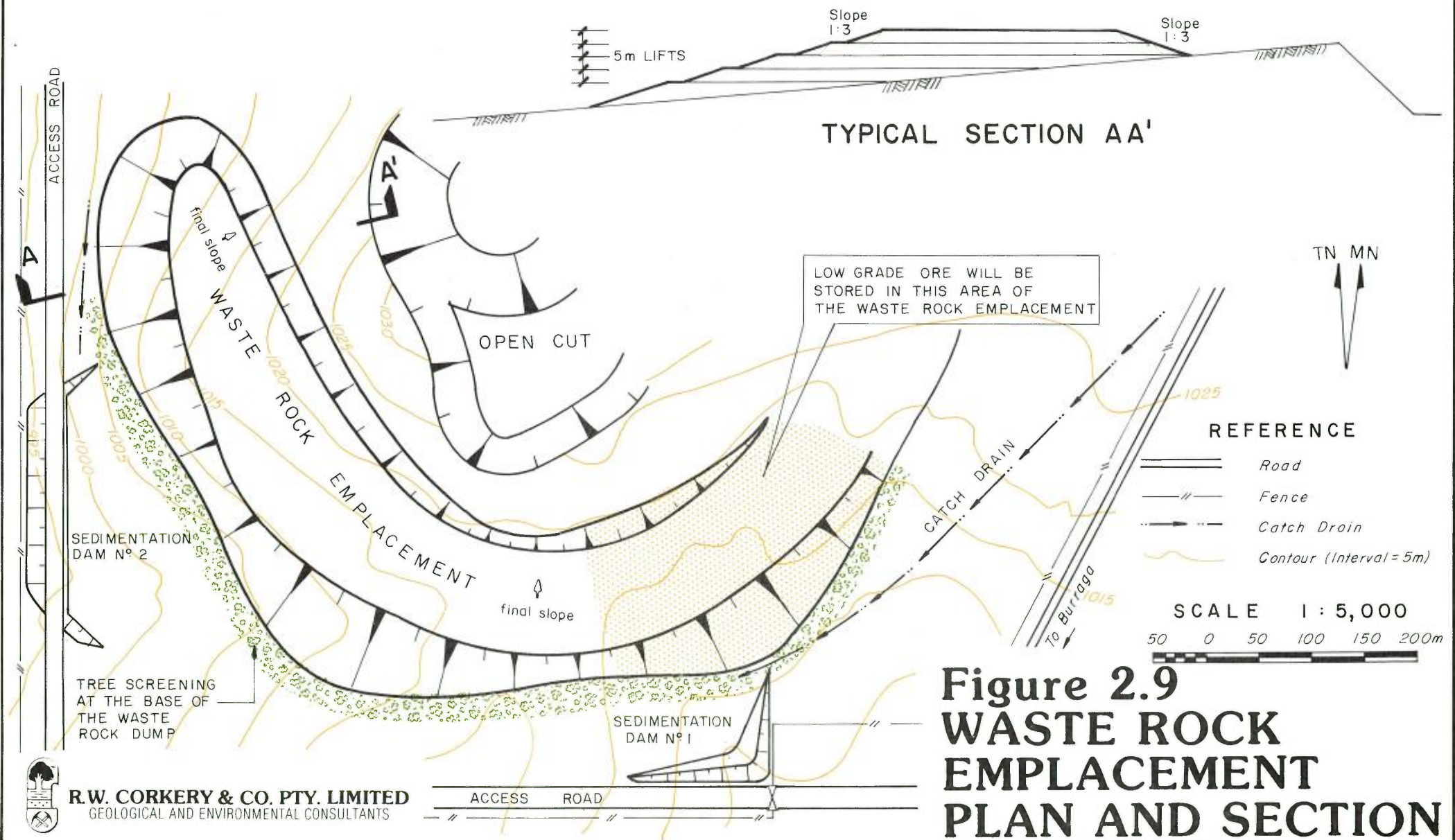
Waste rock not used in the construction of the tailings dam, sedimentation dam, roads or for any other on-site uses will be stockpiled around the perimeter of the open cut as shown in Figure 2.9. Plates 3 and 4 show views towards the proposed site for the emplacement.

The location selected provides the following advantages:

- (i) A minimum area disturbed by the whole project.
- (ii) A minimum haul distance.
- (iii) Sedimentation and runoff are controllable.



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**Figure 2.9
WASTE ROCK
EMPLACEMENT
PLAN AND SECTION**



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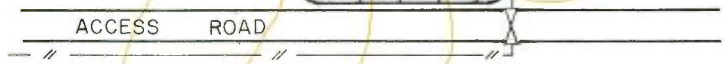




PLATE 3: A view from the southeast corner of MLA 310 towards the site of the waste rock emplacement and open cut. (Ref: 93A/3)



PLATE 4: A view to the southwest from the centre of the proposed open cut towards Burruga. The proposed site of the waste rock emplacement is located in the middle distance of the plate. (Ref: 93A/7)



PLATE 5: A view to the north across the site of the proposed wall for the tailings dam. Note: The private pine plantation to the west of the site. (Ref: 93/18)



PLATE 6: A view to the north across Burraga Dam. The pump house is in the foreground. (Ref: 93/10)

It is proposed to commence construction of the waste rock emplacement near the exit to the open cut and progressively build it in a northwesterly or clockwise direction around the open cut. Figure 2.9 shows the emplacement will be constructed in a series of lifts each 5 m thick. Once the outer surface of each lift is completed it will be topsoiled and grassed. Provision has been made for placing any low grade ore encountered during the mining operation on the eastern end of the waste rock emplacement. This section of the emplacement will be constructed in the same manner as the remainder of the emplacement.

Prior to construction of the waste rock emplacement, topsoil will be stripped from the area and stockpiled for later reuse. Perimeter drains and sedimentation dams will be constructed to prevent sediment leaving the site.

The emplacement will be constructed in horizontal layers starting from the lower outer toe. The external batter will be sloped at 1:3 (vert:hor) and will be rehabilitated progressively during the mine operation.

The emplacement will be constructed at a sufficient distance from the rim of the mine to allow fretting of the pit and still maintain a safety bench between the pit and the emplacement.

The total quantity of waste in the waste rock emplacement is estimated as $1.6 \times 10^6 \text{ m}^3$ and the top elevation of the emplacement is 1033 m (AHD).

Small quantities of domestic and some industrial wastes will be produced throughout the life of the operation. Subject to approval by Evans Shire Council, all non-putrescible wastes will be disposed of within the waste rock emplacement and all putrescible wastes will be taken to the Burruga waste disposal facility.



2.8 TAILINGS DISPOSAL

2.8.1 Characterisation

The tailings or finely ground ore without its high gold concentrations is very similar in composition to waste rock. Appendix 3 similarly addresses the characterisation of the solid component of the tailings.

The aqueous component of the tailings will have the following composition:

Cyanide 100-200 mg/l (target is 100 mg/l)

pH 10.5

Analyses of tailings liquors derived from primary ore gave the following trace metal contents:

Pb,Cd <0.05 mg/l

Zn up to 1.5 mg/l

Cu up to 3 mg/l

These trace metal levels are much less than levels found in other gold treatment tailings and are not of significance in respect of environmental control requirements (Mineral Resources Development Laboratory Report, 1988 in preparation).

2.8.2 Selection of a Tailings Dam Site

The Company considered a wide range of factors in determining the location of the tailings dam for the project. These factors included:

- (i) The dam should desirably be on the Company's freehold land.



- (ii) The dam should not be located within the Thompsons Creek catchment because Burraga's water supply is drawn from a water storage on Thompsons Creek.
- (iii) The dam should be as close as practicable to the treatment plant to ensure the economic pumping of tailings and retrieval of process water.
- (iv) The dam should be located near a watershed to avoid interference with nearby surface flows.
- (v) The dam should be located in an area where its foundations and base have sufficient low permeable material to ensure excessive seepage does not occur from the base of the dam.
- (iv) The dam should be located on land with least agricultural capability.

The tailings dam site selected satisfies all of the above criteria whereas two sites north of Hackney Creek were more distant from the treatment plant and offered no additional benefits.

2.8.3 Tailings Dam Design and Construction

Figure 2.10 displays the layout of the tailings dam in its preferred location and shows in section the main design features. Plate 5 displays the site of the proposed wall for the tailings dam. The dam will be constructed in three stages adopting the "downstream" method of construction in accordance with guidelines of ANCOLD (Australian National Committee on Large Dams). The dam will also incorporate a small saddle dam to the southeast of the main dam wall. This small dam, built to a height of approximately 3 m will enable a further 460,000 tonnes (or Stage 3) to be contained.



The topsoil from the area of the dam wall and the area covered by Stage 1 will be removed and stockpiled to the northeast of the dam. The subsoil and clay beneath the storage area will be removed and compacted to decrease its permeability sufficient enough to contain the tailings with an acceptable seepage rate. The remainder of the topsoil from the area to be covered by Stages 2 and 3 will be removed and stockpiled towards the end of the first year's operation. The subsoil and clay beneath this area will be similarly treated.

The embankment will be constructed in three stages (Figure 2.10) to suit production of both tailings and waste rock. Compaction of the dam wall will be to at least 95 per cent relative standard density in accordance with AS 1289E1.1.

A drainage blanket and rock toe as appropriate will be provided for long-term integrity of the dam. Final external surfaces will be protected from erosion by rock stabilisation using selected mine waste rock as rip rap. The inner surface of the dam wall will be lined with clay (see Figure 2.10). Table 2.5 lists the staging of the dam construction and the quantities of each construction material required for each stage. The dam will have an overall height of approximately 26m.

2.8.4 Tailings Dam Operation

Tailings will be piped in a 200 mm diameter polyethylene pipe from the treatment plant. The pipeline will follow the road to the tailings dam and will be laid on the surface except where it crosses beneath Moss Grove Road.



TABLE 2.5
STAGING OF THE TAILINGS DAM

Stage	Dam Crest (m) AHD	Tailings	Dam Earthworks		Total (m ³)	When Required
		Capacity (t)	Clay Zone (m ³)	Waste Rock (m ³)		
1	1055	360,000	28,000	170,000	198,000	Before commencement.
2	1060	400,000	18,000	251,000	269,000	Before end of Year 1.
3	1063.5	<u>460,000</u>	<u>16,000</u>	<u>300,000</u>	<u>316,000</u>	Before end of Year 3.
	Totals	<u>1,300,000</u>	<u>62,000</u>	<u>721,000</u>	<u>783,000</u>	



Tailings will be discharged from spigots along the dam embankment to form a beach sloping away from the discharge point. Disposal will be in this layers by sub-aerial techniques to maximize drying and consolidation by evaporation. Supernatant water, and rain falling on the tailings, will pond at the low point of the beach away from the embankment, and will be reclaimed from there to the plant by pump. It is the Company's intention to remove as much water from the tailings dam as soon as possible since the recirculated water is to be the principal source of water for the plant. Furthermore, its early recovery maximizes the quantity of cyanide present in the water. A minimum freeboard of 1m will be maintained in the tailings dam at all times.

2.9 SERVICES

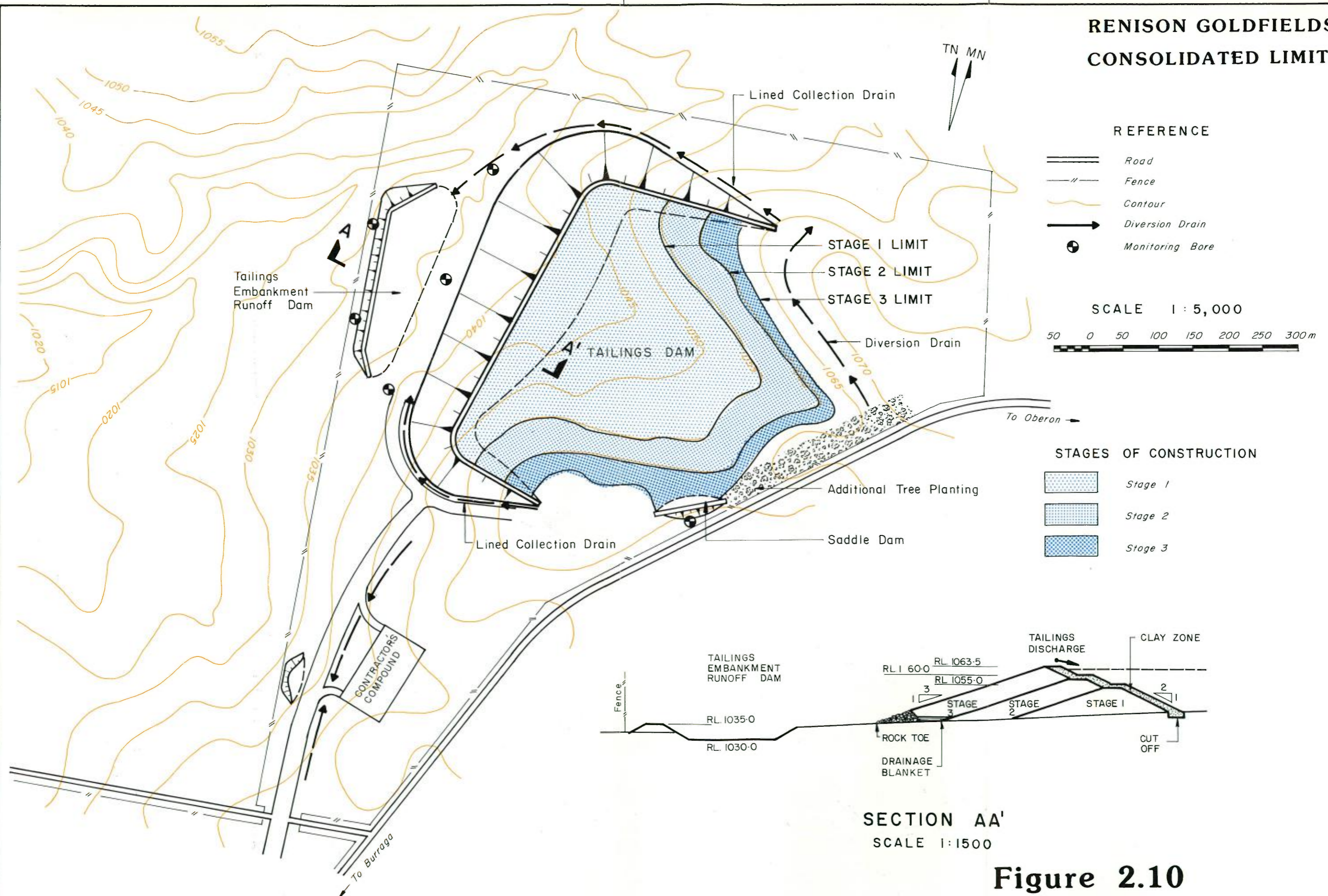
2.9.1 Power

The project's power requirements are estimated at approximately 1500 kW. Over half of this power requirement will be used to operate the ball mill.

Southern Mitchell County Council, who are responsible for the reticulation of power in the Bathurst-Burruga area, have advised the Company that they will be able to supply the above power requirement. In order to meet this requirement, the County Council proposes to upgrade the existing Rockley-Mt David-Truscotts Flat power line to 11 kV. This upgrading will involve the construction of a new single wooden pole line adjacent to the existing line and progressively removing the old line. Figure 2.11 shows the last 1500 m of the new line to the site.



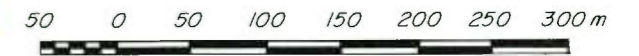
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REFERENCE

- Road
- Fence
- Contour
- Diversion Drain
- Monitoring Bore

SCALE 1 : 5,000



STAGES OF CONSTRUCTION

- Stage 1
- Stage 2
- Stage 3

SECTION AA'
SCALE 1:1500

**Figure 2.10
TAILINGS DAM
LAYOUT & SECTION**

2.9.2 Water

Requirements

Each tonne of ore requires approximately 2,500 litres of water for treatment of which approximately 30 to 60 per cent can be recycled. Make-up water replaces water lost due to evaporation or being locked up in the tailings (approximately 28 per cent).

The Company estimates that their monthly water requirements will be in the the order of 40 Ml. This assumes the following:

Process Water	37.5 Ml
Dust Suppression	2.0 Ml
Domestic Potable	.5 Ml

It is estimated that during the first year of operation the Company will need to import up to 29 Ml of water per month or 73 per cent of their make-up requirement. This assumes a start-up during summer, however requirements would be less in other seasons. In later years as the quantity of water retained on site increases there will be less dependency on outside sources of water. If years are wet as they were in 1978, there may be no need to import water to the site.

Sources of Water

Kinhill Engineers Pty. Ltd. have undertaken extensive studies to establish the relative on-site availability of water throughout the life of the mine and hence the need to import water to the site. These studies have included water balances (Table 2.6) using the four wettest years in sequence (1975-1978) and the driest year (1982).



TABLE 2.6
WATER BALANCE - LUCKY DRAW GOLD PROJECT

	Water Storage (Stage 1) Capacity Ml	Maximum Water in Dams on Site Ml	Demand from Burruga Dam Ml/month
Four Wettest Years Sequence	125	50	0 - 26
Driest Years	125	Nil	9 - 29
1 in 100 Year Storm	125	7.3	0 - 13

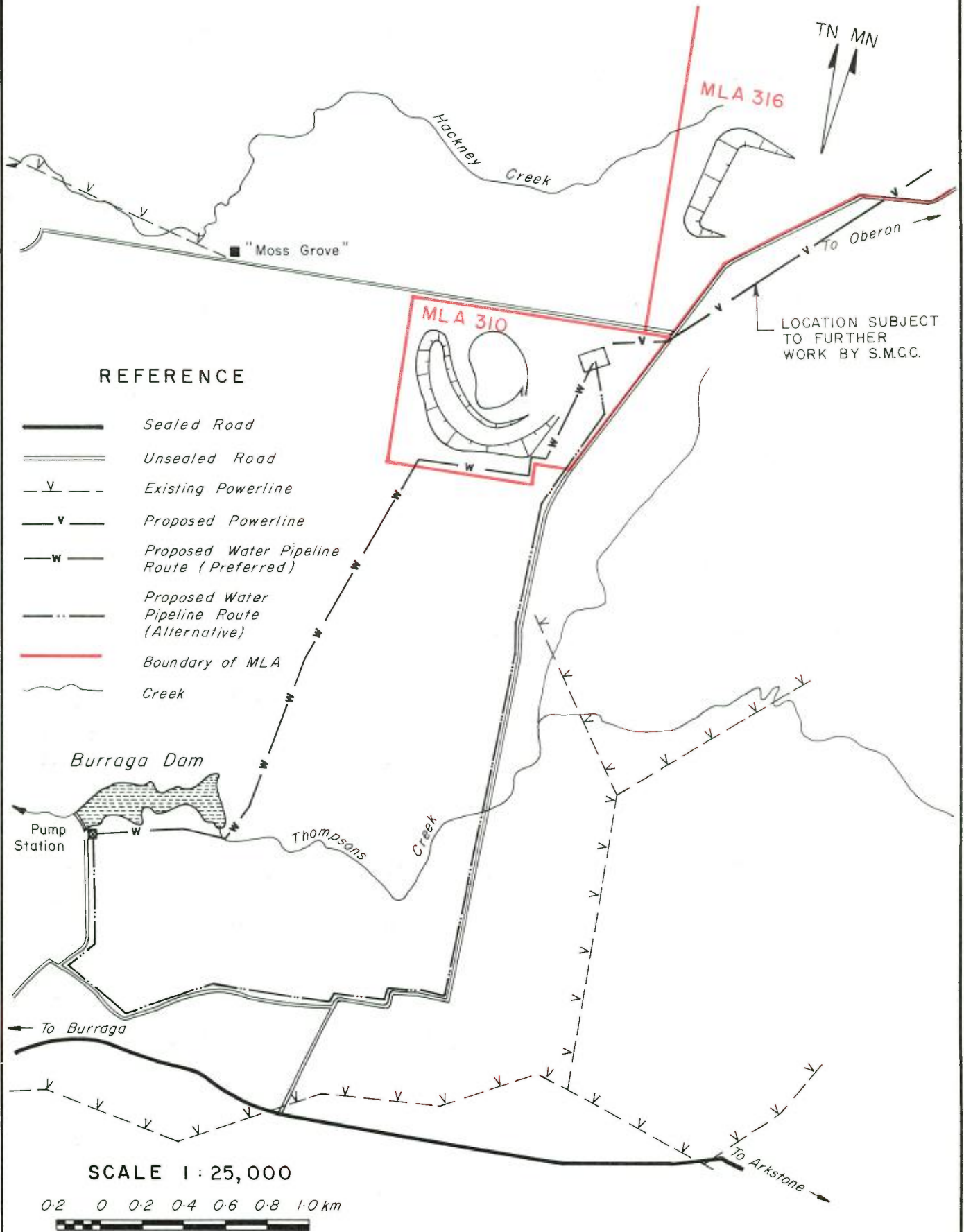
1 Ml = 1,000m³ or 1 million litres.

On-site sources of water include:

- (i) Runoff from the waste rock emplacement and surrounds. This water is to be collected within two dams on the western and southern boundary of MLA 310.
- (ii) Rain water falling to the tailings dam embankment. This water is collected in a dam at the toe of the embankment.
- (iii) Rain falling on the tailings will be retained on the tailings and returned to process.
- (iv) Runoff from the treatment plant site. This water is collected in the plant runoff dam.



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LOCATION SUBJECT TO FURTHER WORK BY S.M.C.C.



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Figure 2.11
SERVICES

- (v) Rain water falling into the open cut.
- (vi) Groundwater seepage into the open cut.
- (vii) Runoff from the roads and hardstand areas (e.g. mining contractor's compound).

The principal source of water in the Burruga area is the Burruga Dam (see Plate 6). The dam is located on Thompsons Creek approximately 3 km southwest of the plant site. The Burruga and District Community Association has no objection to the Company obtaining their project water requirements from the Burruga Dam. Water pumped from the Burruga dam will be placed into the process water tank and a storage tank for potable water if it is of suitable quality.

The Company has considered two alternative routes for pipelines from the dam to the plant site. These are shown on Figure 2.11. The preferred route traverses almost in a direct line from the dam whereas the alternative route follows the alignment of the Burruga-Oberon Road.

Irrespective of the route chosen, the pipeline will be buried approximately 900 mm below ground level including beneath creeks.

2.9.3 Telephone

The Company will require up to 10 communication lines onto the site. Telecom advises that insufficient cable is in place in the vicinity of the Project Site to provide the necessary services at present. Telecom is able to upgrade the existing cable and proposes to do so once the Company applies for the services.



2.9.4 Sewerage

The Company will install the appropriate on-site septic tanks and transpiration beds necessary for sewerage requirements on site.

2.10 EMPLOYMENT AND HOUSING

The Company expects the workforce during the construction period will increase at a regular rate for the initial three to four months to approximately 75 persons. The workforce should stabilise at this level and gradually decrease towards the completion of the construction period.

The Company envisages that a number of the construction workforce employed directly by the Company or by contractors will be from the local area. Accordingly, there may be only a limited need for temporary housing during this period. Persons engaged in construction activities who are not local residents could be easily accommodated at motels in Bathurst, Oberon or at the hotel at Rockley.

2.10.2 Operational Period

The Company estimates that they will employ approximately 40 persons for supervision and labour. The mining contractor could employ up to 25 persons depending on the number of shifts adopted. Table 2.7 provides a breakdown of the predicted workforce.



TABLE 2.7
PROPOSED WORKFORCE - LUCKY DRAW GOLD PROJECT

Supervision & Labour*

Operations Manager	1
Mill Superintendent	1
Chemist	1
Plant Foreman	1
Assayers	4
Maintenance Foreman	1
Shift Supervisors	3
Sample Preparation Personnel	4
Gold Room Assistant	1
Shift Personnel	9
Fitters	6
Boilermakers	2
Electricians	3
Storeman	1
Clerks	<u>2</u>
Total Manpower	<u>40</u>

Mining Contractor

Superintendent	1
Shift Foreman	3
Equipment operators	14
Drill and blast crew	2
Maintenance crew	<u>5</u>
Total Manpower	<u>25</u>

Total Employment 65 persons

* Employed by Company and/or contractors.



2.11 TRANSPORTATION

2.11.1 Site Access

The principal concerns in the selection of an access road are:

- (i) the need to separate employee and visitor traffic from the large dump trucks travelling between the open cut and the tailings dam site;
- (ii) the need to provide safe access to adjoining landowners to gain access to their properties.

The Company has examined four alternatives to gain access to the Project Site from the surrounding road network. Three alternatives enter from the Burruga-Oberon Road (SR31) and one from the Burruga-Bathurst Road (MR252). Figure 2.2 shows the location of Alternatives 1 to 3.

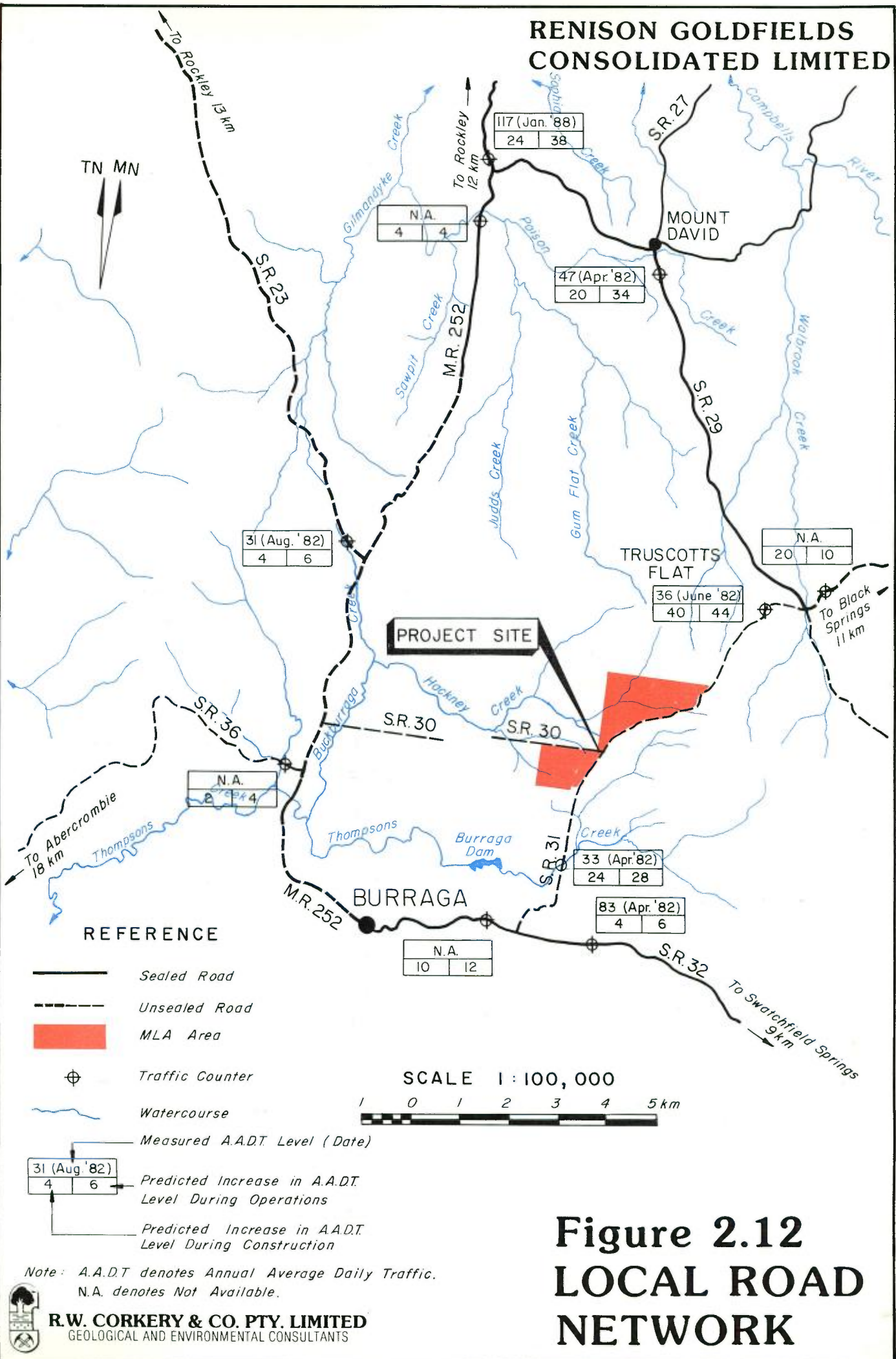
The access road would be of a high standard gravel construction and constructed with all necessary drainage controls. The road would be completed prior to the temporary closure of Moss Grove Road and the hauling of waste rock to MLA 316.

Alternative No. 1 - Preferred Route

This road enters the Project Site through Portion 92 and follows the southern and western boundary of MLA 310 and joins Moss Grove Road (SR30) at the northwestern corner of MLA 310. The use of this alternative would necessitate the temporary closure of the section of Moss Grove Road within MLA 316. Minor amendments to the alignment will be discussed with the Crown Lands Office and the adjoining landowner.



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31 (Aug. '82)		
4	6	

Predicted Increase in A.A.D.T. Level During Operations

Predicted Increase in A.A.D.T. Level During Construction

Note: A.A.D.T denotes Annual Average Daily Traffic.
N.A. denotes Not Available.

Alternative No. 2

This road enters MLA 316 from SR31 and is positioned around the northern side of the tailings dam and the western boundary of MLA 316. This alternative has been rejected since poor sight distances occur at the intersection of the access road and MR31.

Alternative No. 3

This involves a grade separation or overpass to enable the traffic on Moss Grove Road to pass over the haul road. This would be achieved by constructing a single lane bridge for Moss Grove Road traffic, with its grade line raised approximately 1m above the current road level, and the single lane haul road excavated approximately 6m below Moss Grove Road as an underpass. The haul road approaches would be excavated for 100m on each side of Moss Grove Road to provide suitable grades and drainage for the underpass.

If this alternative was adopted, detour tracks for other road users would be required during its construction.

Alternative No. 4

This alternative would involve access to the site from the Burruga-Bathurst road via Moss Grove Road and a crown reserve road that traverses the length of existing road between the open sections of Moss Grove Road. Traffic on this road would be restricted to project traffic and adjacent landowners.

2.11.2 Surrounding Road Network

The Company and their employees/contractors will utilise the local network to gain access to the site from Bathurst, Oberon, and smaller centres around the Burruga district. An indication of predicted road usage throughout the construction and operational phases of the project is shown in Figure 2.12.



2.11.3 Proposed Traffic Levels

Table 2.8 lists in detail the proposed traffic levels during the construction and operational periods. Maximum levels assume three shift operations for both mining and the treatment plant and above average deliveries. Conversely, minimum levels assume periods of reduced employment and few deliveries.

During the construction period a wide range of vehicles will travel to and from the site. In the early stages there will be numerous cranes, low loaders and trucks delivering plant components to the site. Supply vehicles for fuel, concrete and parts will be regularly travelling to the site.

During the operational period of the mine an estimated maximum of 102 vehicles per day could be expected. An average of 72 vehicles per day is expected which will include employees' cars and supply trucks. Staggered arrivals and departures of employees' cars will occur due to shifts.

2.12 REHABILITATION

2.12.1 Introduction

The Company proposes to adopt a range of procedures throughout the planning and operational stages of the project to ensure that the site is progressively rehabilitated to the satisfaction of the Department of Mineral Resources and the Soil Conservation Service.

Figure 2.13 presents the final landform at the completion of the project.



TABLE 2.8
PROPOSED TRAFFIC LEVELS ASSOCIATED WITH THE PROJECT

Activity	Type of Vehicle (Capacity Given)	Frequency of Vehicle Movements	Period
CONSTRUCTION			
Plant delivery	Trucks/low loaders	4-6/day	2 months
Erection	Cranes	2/week	1 month
Supplies	Concrete trucks	20/day	1 month
	Delivery trucks	16/day	6 months
	Fuel trucks	4/week	6 months
Employees	Cars (maximum)	70/day	6 months
Sub Total	Maximum	96/day	
	Average	64/day	
	Minimum	36/day	
TREATMENT PLANT			
Supplies			
- Cyanide	Truck (12t)	2/fortnight	
- Caustic	Small truck (6t)	20/year	
- Acid	Small truck (4t)	12/year	
- Lime	Truck (20t)	4/week	
- Carbon	Small truck (6t)	2/year	
- Grinding balls	Truck (20t)	8/month	
- LPG	Truck (18t)	2/3 weeks	
Employees	Cars (maximum)*	50/day	
MINING			
Delivery trucks	Small trucks	6/day	
Fuel	Medium tanker	2/week	
Employees	Cars*	26/day	
Sub Total	Maximum	102/day	
	Average	72/day	
	Minimum	54/day	

* Staggered times of arrival and departure due to shifts.



2.12.2 Open Cut

There is no other economically acceptable option at the completion of the project than to leave the open cut as an open void.

At the completion of mining, the Company will batter the upper bench to 30° as a long term safety measure. The access road within the open cut will be blocked at its entrance with large boulders to prevent vehicular traffic from entering the open cut. Subject to the final land use and the attitude of the subsequent landowner, a range of protection measures could be taken to restrict access to the abandoned open cut from around its rim. These could include:

- (i) a bund up to 2m high around the rim; or
- (ii) a bund up to 2m high and an associated 2m deep trench on the outside of the bund.

The exact nature of the protective measures will be finalised towards the end of the project life and will be addressed as part of the annual reporting procedure for the site's Mining, Rehabilitation and Environmental Management Plan.

The pit will gradually fill with water to the pre-mining level in the order of 1015 m AHD which is about 10 to 15 m below the rim of the open cut. The water left in the open cut will be of good quality and suitable for both stock and irrigation.

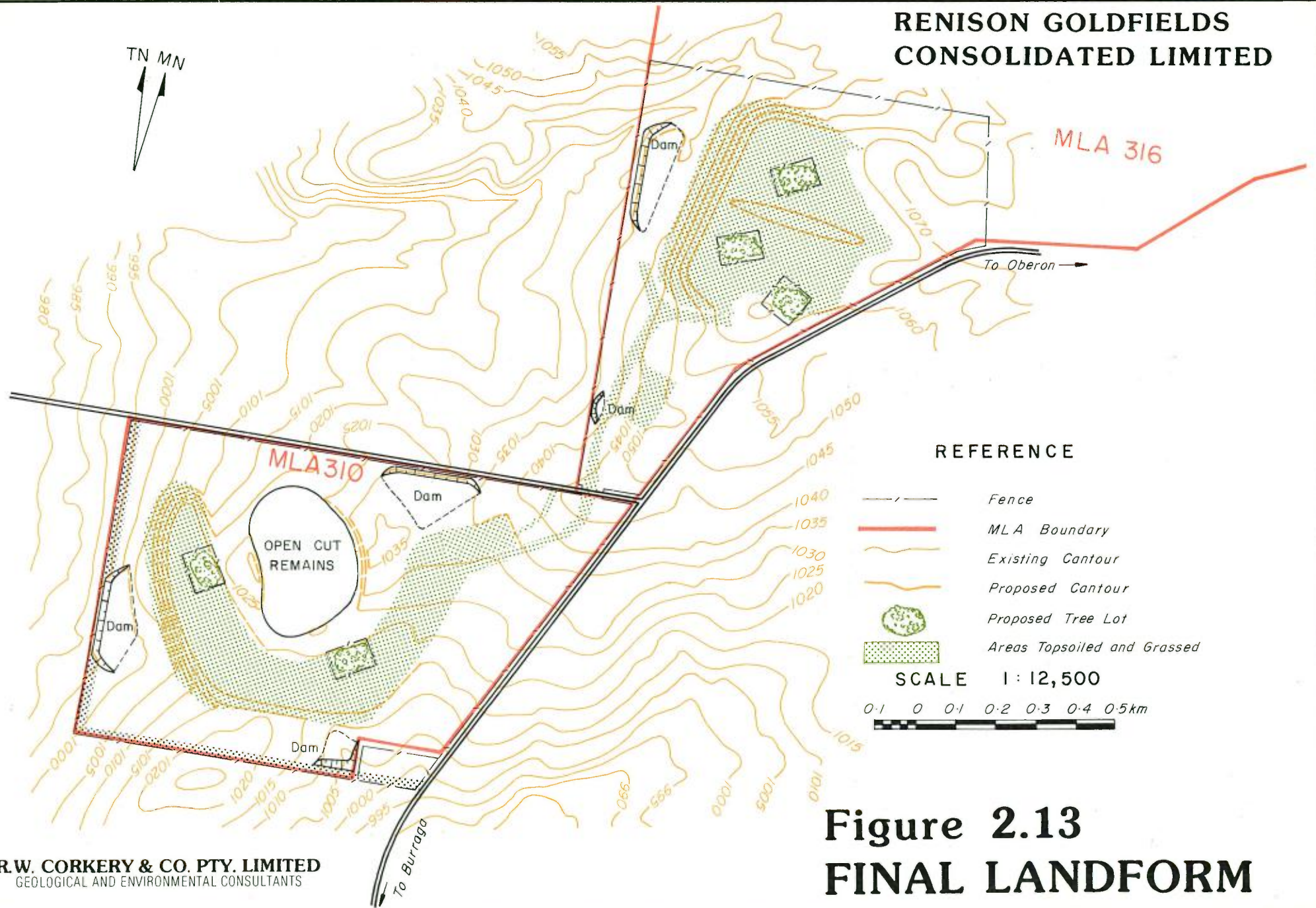
2.12.3 Tailings Dam

Rehabilitation of the surface of the tailings dam will be required to minimize infiltration of water and permit vegetation growth. In order to promote runoff, the central area will be mounded. This mound will initially need to be higher than its ultimate design level in order to allow for settlement.









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MLA 316



REFERENCE

-  Fence
-  MLA Boundary
-  Existing Contour
-  Proposed Contour
-  Proposed Tree Lot
-  Areas Topsoiled and Grassed

SCALE 1 : 12,500

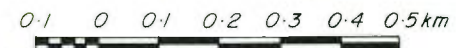


Figure 2.13 FINAL LANDFORM



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Once earthmoving equipment is able to travel on the edges of the tailings dam, waste rock from the eastern end of the waste rock emplacement will be placed on the dam surface. The surface will be progressively covered and once the required landform is created the topsoil will be replaced over the surface and grassed. The depth of waste rock placed on the dam will be dependent upon tests undertaken to establish optimum thickness.

At the completion of resurfacing, resoiling and grassing, a few tree lots will be planted across the rehabilitated surface.

2.12.4 Waste Rock Emplacement

The waste rock emplacement will be progressively rehabilitated as the project proceeds. Once the outer slope of each 5m lift is finally contoured, topsoil will be spread, and the slope seeded and fertilised. The berms on the emplacement will also be grassed in conjunction with the adjacent slope. Where appropriate, the slopes will be stabilised further by the use of hay bales. Once the full height of the emplacement is achieved, a defined track will be maintained across the top of the waste rock emplacement to ensure traffic is kept off the revegetating areas.

2.12.5 Treatment Plant Site

All buildings and plant will be removed at the completion of the project provided no alternative use is possible. All sumps will be filled in and the area levelled. This will most likely be achieved by pushing the material forming the ramp to the crusher over the areas to be levelled. The final surface will be covered with topsoil, seeded and fertilised.

2.12.6 Roads

All roads not required for the ongoing land use will be ripped, levelled, covered with topsoil, seeded and fertilized.



2.13 FINAL LAND USE

At the completion of the project, the bulk of the land will be returned to grazing. The retention of the open cut which will hold good quality water will be of considerable benefit to the long term grazing land use and perhaps other land uses.

It is perhaps conceivable that an alternative industry involved with the district's forestry operations could be established on the site. Such an industry could benefit from its close proximity to the surrounding forests and the availability of services on site.



SECTION 3

**DESCRIPTION OF THE
EXISTING ENVIRONMENT**

SECTION 3

DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 TOPOGRAPHY

The Project Site lies in the Central Tablelands of New South Wales, in an elevated area near the watershed between the Lachlan and Macquarie River Systems. The landforms around the Project Site vary from undulating to hilly, and range in elevation from 980-1150m AHD. The Thompson Creek catchment contains areas of higher elevation coinciding with the rim of the Burruga Granite. Local relief varies by 20-120m, but is generally between 50 and 70m in the immediate vicinity of the Project Site.

The Hackney Creek catchment, with slopes ranging between 7 and 30 per cent, has rougher terrain than the Thompson Creek catchment which has slope gradients between 2 and 12 per cent.

Further south in the Isabella River catchment, extremely rugged terrain is found with slope gradients in excess of 50 per cent being found.

The local landforms are comprised of undulating to rolling hills with slope percentages ranging between 7 and 12 per cent. The elevation of land within MLA 310 and MPA 316 is 990-1045 m AHD and 1060-1145 m AHD respectively.



3.2 DRAINAGE

3.2.1 Regional Drainage

The regional drainage pattern surrounding the Project Site is depicted in Figure 3.1. The Project Site is located on the eastern edge of the Lachlan River Basin system near the catchment divide with the Macquarie River system. The site straddles two small drainage catchments at the headwaters of the catchment feeding Wyangala Dam - the Hackney Creek catchment to the north and the Thompsons Creek catchment to the south. Details of the catchments and watersheds are presented in Figure 3.5.

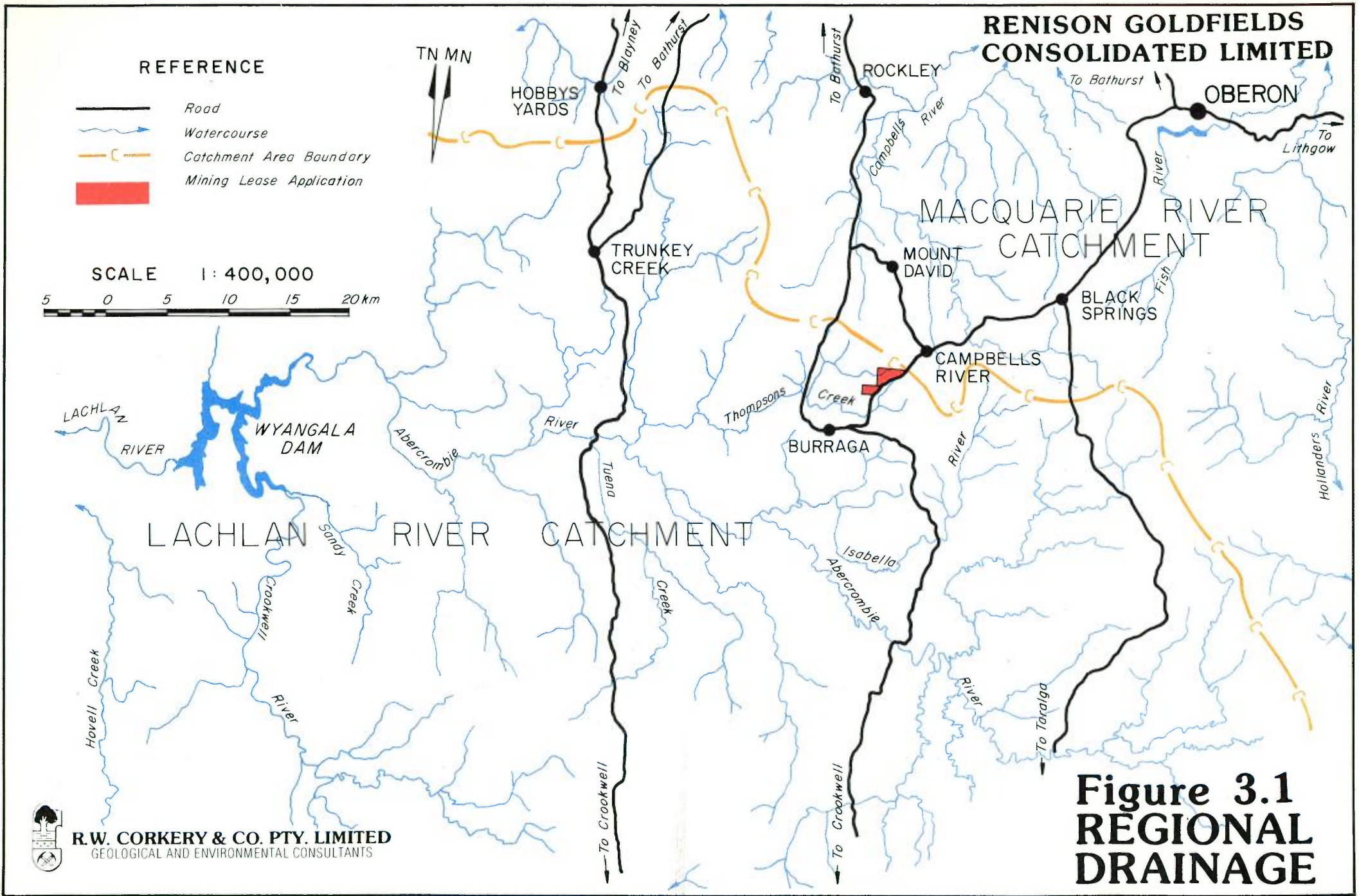
Runoff from the Project Site flows either in a westerly to northwesterly direction to Hackney Creek, or in a southerly direction to Thompsons Creek.

Hackney Creek flows generally in a westerly direction before joining Buckburruga Creek which flows in a southerly direction before flowing into Thompsons Creek downstream of Burruga Dam. Thompsons Creek then flows southwest until it joins the westerly flowing Abercrombie River which flows into Wyangala Dam.

3.2.2 Local Drainage

Because the Project Site lies on the watershed between two catchments, water does not concentrate into large flows before leaving the site. Most watercourses found within the catchment are intermittent, flowing only after rain. The only exception is Hackney Creek which appears to be spring fed. Some local dams have also been positioned so that they benefit from local springs.





**Figure 3.1
REGIONAL
DRAINAGE**

3.3 GEOLOGY

3.3.1 Regional Geology

There are three metamorphosed rock units in the Mount David-Burruga district that have implications on the development of the project. Two further rock types nearby, the Burruga Granite and Tertiary Basalts also have some influence on the Project Site.

The oldest recognised rock unit is the Triangle Group of Ordovician Age. This unit, and the Ordovician Campbells Group are conformable and almost identical in appearance. These two units are separated by the Rockley Volcanics and are indistinguishable from each other without the presence of the Rockley Volcanics. The Triangle and Campbells Groups consists of finely laminated interbedded claystones, siltstones and sandstones.

The Rockley Volcanics consist of magnesium rich andesitic/mafic flows and volcano derived debris which have been regionally metamorphosed to chlorite/pyrophyllite/talc schist. This formation represents a volcanic event which occurred during the deposition of the Triangle/Campbell Group deposition. In the Mount David-Burruga district the Rockley Volcanics are of the order of 30 m to 70 m in thickness.

A number of the rocks of the Burruga district have been folded producing a number of north-south trending synclines and anticlines. Also associated with this folding and previous earth movements was development of local jointing.

The Burruga Granite centred to the southeast of the Project Site essentially occupies the catchment of Thompsons Creek. The granite is massive, unfoliated and generally white in colour. Minor aplites and pegmatites are present as dykes and segregations near the margins of the granite.



Tertiary Basalts (<12 million years old) are present on the elevated areas to the north of the Project Site. It is thought that some of the clay soils developed on MLA 316 may have been derived from the weathering of these granites (D.J. Douglas and Partners, 1987).

3.3.2 Local Geology

The gold mineralisation within the project site is located within the Triangle Group. Figure 3.2 shows the surface geology across the Project Site.

The dominant strike of the lithologies is north-south with a gentle north-westerly dip of approximately 20°-25°. The Burruga Granite is located east of and beneath the deposit, dipping gently west on the eastern limits of the Burruga Syncline, which has been domed by the younger (Carboniferous) Burruga Granite. Sections of the proposed open cut (see Figure 2.5) show the relationship of all rock units around the Project Site.

3.4 SOILS

3.4.1 Introduction

The main soil types consist of red podzolics on the better drained upper slopes, and yellow podzolics on both lower slopes and on granitic parent material. Yellow and brown soloths occur in drainage depressions while on some of the better drained hill crests and upper hill slopes, shallow red podzolics, krasnozems and skeletal sands and loams are found. The soils have formed on in situ parent materials and colluvial/alluvial deposits on the lower slopes.

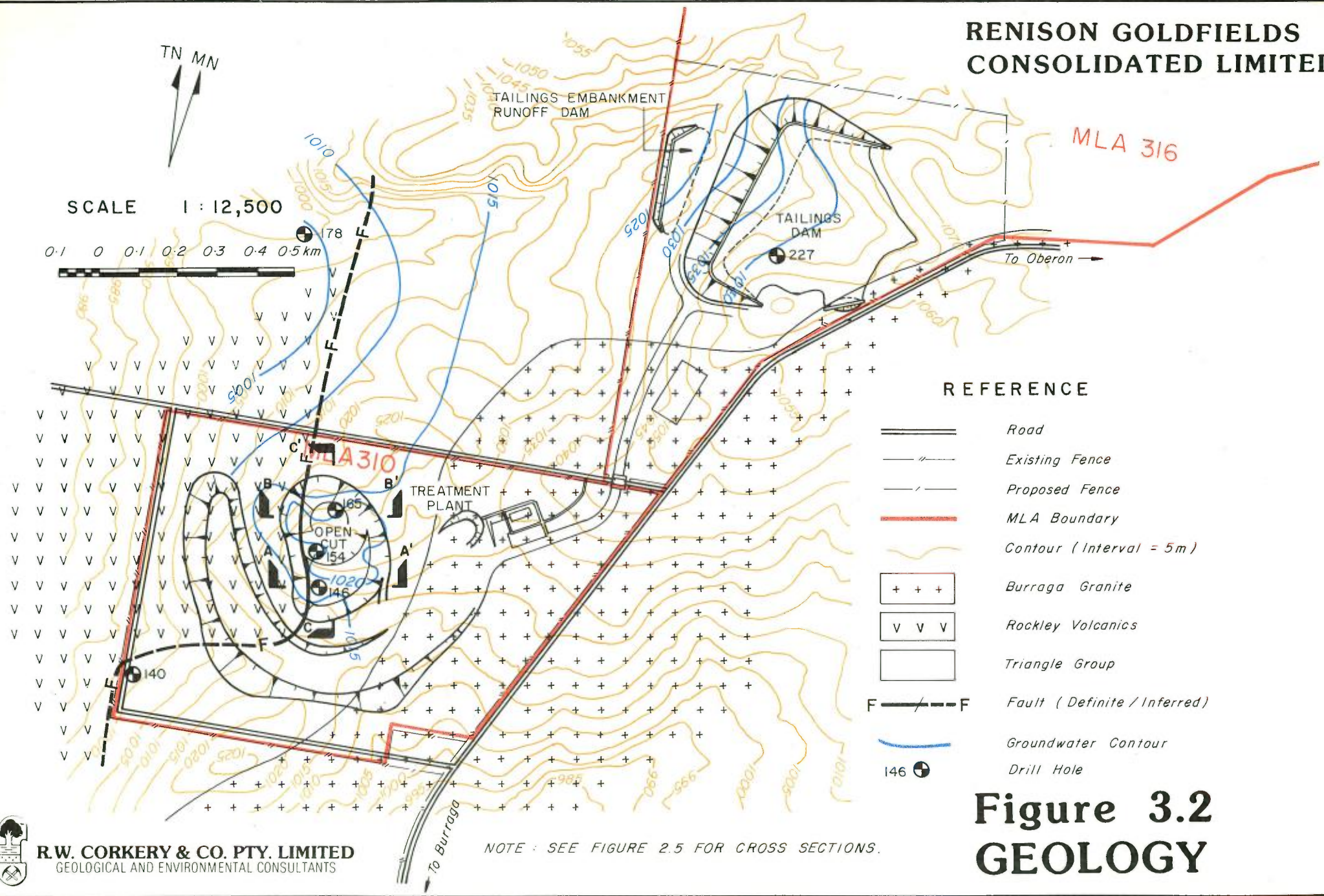


RENISON GOLDFIELDS CONSOLIDATED LIMITED

MLA 316

TN MN

SCALE 1 : 12,500



REFERENCE

- Road
- Existing Fence
- Proposed Fence
- MLA Boundary
- Contour (Interval = 5m)
- Burraga Granite
- Rockley Volcanics
- Triangle Group
- Fault (Definite / Inferred)
- Groundwater Contour
- Drill Hole

NOTE : SEE FIGURE 2.5 FOR CROSS SECTIONS.

Figure 3.2 GEOLOGY



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The Soil Conservation Service of New South Wales have mapped soil-terrain units in the Bathurst-Oberon area at a scale of 1:100,000. The Project Site falls within the Rockley soil landscape map unit which occurs in association with the Abercrombie soil landscape on the undulating hills around Rockley.

Table 3.1 lists the soil types in each component area of the Project Site.

TABLE 3.1
OCCURRENCES OF SOIL TYPES ON THE PROJECT SITE

Component Area	Soil Type
Treatment Plant	Yellow Podzolic - <u>Dominant</u> .
Open Cut	Red Podzolic - <u>Dominant</u> . Shallow kraznozems & loams - Common. Yellow Podzolic - common on lower slope positions.
Waste Rock Dumps	Yellow Podzolic - <u>Dominant</u> . Brown & Yellow Soloths - Common in depressions.
Tailings Dam/ Process Dam	Red Podzolic - <u>Dominant</u> . Krasnozem - Common. Yellow podzolic - minor.



3.4.2 General Descriptions

Red Podzolics

Red podzolics are found on upper to mid slopes in the area. The top soils are dark brown, fine sandy loams with a weak structure and pH of 5.5-6.5. Subsoils are brown, light to medium clays, with a structure which is better developed. These soils are well drained and are moderately permeable. The soils are moderately erodible and subject to sheet erosion on cleared hill slopes. They are low in nitrogen and phosphorus and are moderately fertile.

Yellow Podzolics

Yellow podzolic soils are common on mid to lower slope positions. They are moderately well drained, may have a hard setting surface and have a low to moderate water holding capacity. They are chemically not highly fertile and are low in nitrogen and phosphorus. The surface soils are moderately erodible while the subsoils have a low to moderate erodibility. These soils are highly erodible and susceptible to gully erosion, particularly when disturbed.

The topsoils are brown, fine, sandy loams with minimal structure and a pH of 5-6. They overlie a bleached weakly structured A2 horizon, which may be as deep as 40cm. The subsoil is a yellowish brown light medium clay with moderate pedality and a pH of 5.5.

Yellow/Brown Soloths

These soils are a minor soil unit in the landscape occurring in imperfectly drained depressions. They have a moderate to high water holding capacity and are moderately permeable. Chemically they have a low fertility with deficiencies in nitrogen and phosphorus. The erodibility of the surface soils is low while that of the subsoils is moderate. Once disturbed they are moderately erodible.



Brown soloth topsoils are a very dark brown fine sandy loam with very weak pedality and a pH of 5-6. An A2 horizon may occur below the topsoil.

There is a gradual change to a bright brown light sandy or clay loam with weak pedality. With depth, a finer textured sandy clay may be found with a pH of 5-5.5.

Yellow Soloths

The brown loam topsoil has a weak structure with a pH of 5.5. It overlies a sporadically bleached A2 horizon with weak structure up to a depth of 40cm. There is a clear change to a yellowish brown mottled light clay with a moderate structure and a pH of 6.

Krasnozems

Krasnozems occur on hill crests and mid slope positions. They are moderately well-drained and moderately permeable and have a moderate high water holding capacity. Chemically they are moderately fertile with no known nutrient deficiencies. Their erodibility is low to moderate at the surface and moderate in the subsoil.

The topsoils are dark brown, fine sandy loams with weak to moderate pedality and a pH of 6-6.5. There is a gradual change to a dark brownish black loam to silt loams with moderate pedality. Clay content increases with depth to a dark reddish brown clay loam to heavy clay with strong pedality and rough faced peds.

Skeletal Soils

Shallow sands, red podzolics and krasnozems occur on well drained side slopes and hill crests in the area. These soils are shallow (<60cm) have a surface pH of 5-5.6 and are chemically not very fertile.



3.4.3 Erosion Potential

The soils on the Project Site have a moderate to low resistance to soil loss. On the steeper slopes the more highly erodible soils are found and when clearing has taken place, gully erosion of drainage lines may occur. Sheet erosion occurs on the higher lands where clearing or thinning in conjunction with overstocking has taken place.

The red podzolics and krasnozems are moderately to highly erodible and subject to minor sheet erosion on cleared slopes. Yellow podzolic soils are highly erodible and susceptible to severe gully erosion when disturbed.

The yellow and brown soloths are less susceptible to soil erosion than the red and yellow podzolic soils, however, once disturbed they are still moderately erodible. The shallower soils found on hill crests and high slopes are particularly susceptible to sheet erosion especially where the land has been cleared.

Once the vegetation and topsoil of the soils are removed the soils are far more susceptible to gully and sheet erosion. Thus, it is important that all soils be adequately protected by vegetation or earthworks to ensure soil erosion is minimised. Where topsoil stock piles are to remain undisturbed for long periods (6 months or longer) vegetation should be established on them to protect against erosion.

3.4.4 Value for Rehabilitation

All soils on the Project Site area have value for rehabilitation.

The best source of nutrients for the rehabilitation programme is found in the topsoils because the surface soil layers have the highest amounts of organic matter and the highest fertility, and tend to have better structures than the subsoils. The topsoil should therefore be removed prior to development and stockpiled in low mounds (less than 1m) for subsequent respreading in the rehabilitation programme.



The usefulness of the topsoil is greatly reduced if it is contaminated with the less fertile subsoil. Thus, the topsoil and subsoil should be stripped and stockpiled separately and replaced separately. If the topsoil is very wet or very dry during respreading the structure will be damaged which will increase the risk of erosion. Where vegetation restabilisation is proposed early revegetation of exposed areas is essential. All revegetation sites should receive an adequate dressing of fertiliser at sowing to provide sufficient plant nutrients which will assist in vegetation establishment and growth.

The subsoil is also useful for rehabilitation although since it has a lower nutrient status it is unlikely to support vegetation without applications of large amounts of fertiliser. The higher clay content of the subsoil makes it a valuable sealing layer when placed between overburden material and topsoil layers due to its low permeability. When used as a sealing layer, moisture retention in the topsoil is improved making more moisture available to the establishing vegetation. In the early years of establishment of vegetation, regular topdressing with fertiliser will be necessary to ensure a vigorous growth.

3.5 METEOROLOGY

3.5.1 Source of Data

Meteorological data presented in this report has been drawn from records collected at Oberon Post Office, approximately 45 km northeast of the Project Site, the Agricultural Research Station at Bathurst and from "Ballyroe", a property immediately south of Burruga.



3.5.2 Temperature

Table 3.2 presents the average maximum and minimum temperatures at Oberon Post Office. July is the coldest month of the year with an average maximum temperature of 8.8°C and an average minimum temperature of -0.4°C. January and February are the warmest months with average maximum temperatures of 24.7 and 24.2°C respectively and average minimum temperatures of 10.8 and 11.3°C respectively.

TABLE 3.2
MEAN DAILY TEMPERATURES
OBERON POST OFFICE - °C

Month	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	25	24	22	18	13	10	9	11	14	17	20	24
Minimum	11	11	9	5	3	1	0	2	5	7	7	9

3.5.3 Rainfall

Tables 3.3 and 3.4 show the distribution of rainfall at Oberon Post Office and "Ballyroe", Burruga. Table 3.5 lists the rainfall intensity appropriate to the Burruga district.

TABLE 3.3
MEAN MONTHLY RAINFALL
OBERON POST OFFICE - MM

Month	J	F	M	A	M	J	J	A	S	O	N	D	Total
Mean	81	60	64	57	61	82	70	74	68	81	69	72	839
Raindays per month	8	7	7	7	8	11	10	10	9	9	7	7	100



TABLE 3.4
MEAN MONTHLY RAINFALL - BALLYROE, BURRAGA - MM

Month	J	F	M	A	M	J	J	A	S	O	N	D	Total
Average	74	48	65	49	49	61	70	58	81	83	52	41	731
Wet (1978)	254	0	129	10	103	100	91	22	116	57	55	161	1090
Dry (1982)	8	17	54	1	12	43	18	6	79	12	14	18	282

The wetter months of the year occur from June to January. The highest average monthly rainfall occurs in October when 81 mm and 83 mm were recorded at Oberon and Ballyroe respectively. Rainfall during the summer months, particularly in January, is of greater intensity than that in the winter months.

TABLE 3.5
RAINFALL INTENSITY - BURRAGA

Duration (h)	100 year storm	
	mm/h	mm
0.25	120	30
0.5	80	40
1.0	50	50
2.0	30	60
72.0	28	202

Source: Bureau of Meteorology



3.5.4 Temperature Inversions

Radiation inversions are the main type of temperature inversions likely to cause any noise to be enhanced. An indication of the frequency of radiation inversions is obtained by examining both the frost and fog frequencies as fogs are the result of a radiation inversion occurring while water vapour is present. Temperature inversions invariably occur on clear frosty mornings and when fogs are present. Hence, a review of Tables 3.6 and 3.7 shows that temperature inversions could be expected throughout the year though they are most likely to occur from May through to September.

TABLE 3.6
FROST FREQUENCIES
OBERON POST OFFICE

Month	J	F	M	A	M	J	J	A	S	O	N	D
Average*	0	0	0	3	8	13	17	14	10	3	1	0
Highest*	0	0	2	10	21	26	30	24	22	15	4	2
Lowest*	0	0	0	0	0	5	8	0	0	0	0	0

* Numbers recorded per month



TABLE 3.7
FOG FREQUENCIES
OBERON POST OFFICE

Month	J	F	M	A	M	J	J	A	S	O	N	D
Average*	0	0	0	0	1	1	1	0	0	0	0	0
Highest*	1	2	1	2	2	2	2	2	2	1	1	1
Lowest*	0	0	0	0	0	0	0	0	0	0	0	0

* Numbers recorded per month

3.5.5 Evaporation

Table 3.8 presents the evaporation records for Bathurst. The highest evaporation occurs in January (204 mm) and the lowest in June (35 mm). The average yearly evaporation is 1332 mm. Rainfall exceeds evaporation in the winter months.

TABLE 3.8
MEAN MONTHLY EVAPORATION
BATHURST AGRICULTURAL RESEARCH STATION

Month	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	277	233	209	132	111	48	53	94	114	180	272	308
Minimum	159	136	122	86	45	35	43	48	72	75	0*	170
Average	230	196	160	104	67	41	47	65	94	135	162	241

* True total of evaporation may be greater than this.

3.5.6 Wind

Figure 3.3 displays the strength and direction of winds recorded at Oberon.



During January, February and March, winds are dominated by southeasterlies to northeasterlies. Throughout the rest of the year winds from the western sector predominate with southwesterlies being most common in the winter months.

The strongest winds occur during the winter months from a southwesterly direction. Wind direction does not vary greatly throughout the day, however, winds increase in strength in the afternoon.

3.6 WATER RESOURCES

3.6.1 Surface Water

Occurrence

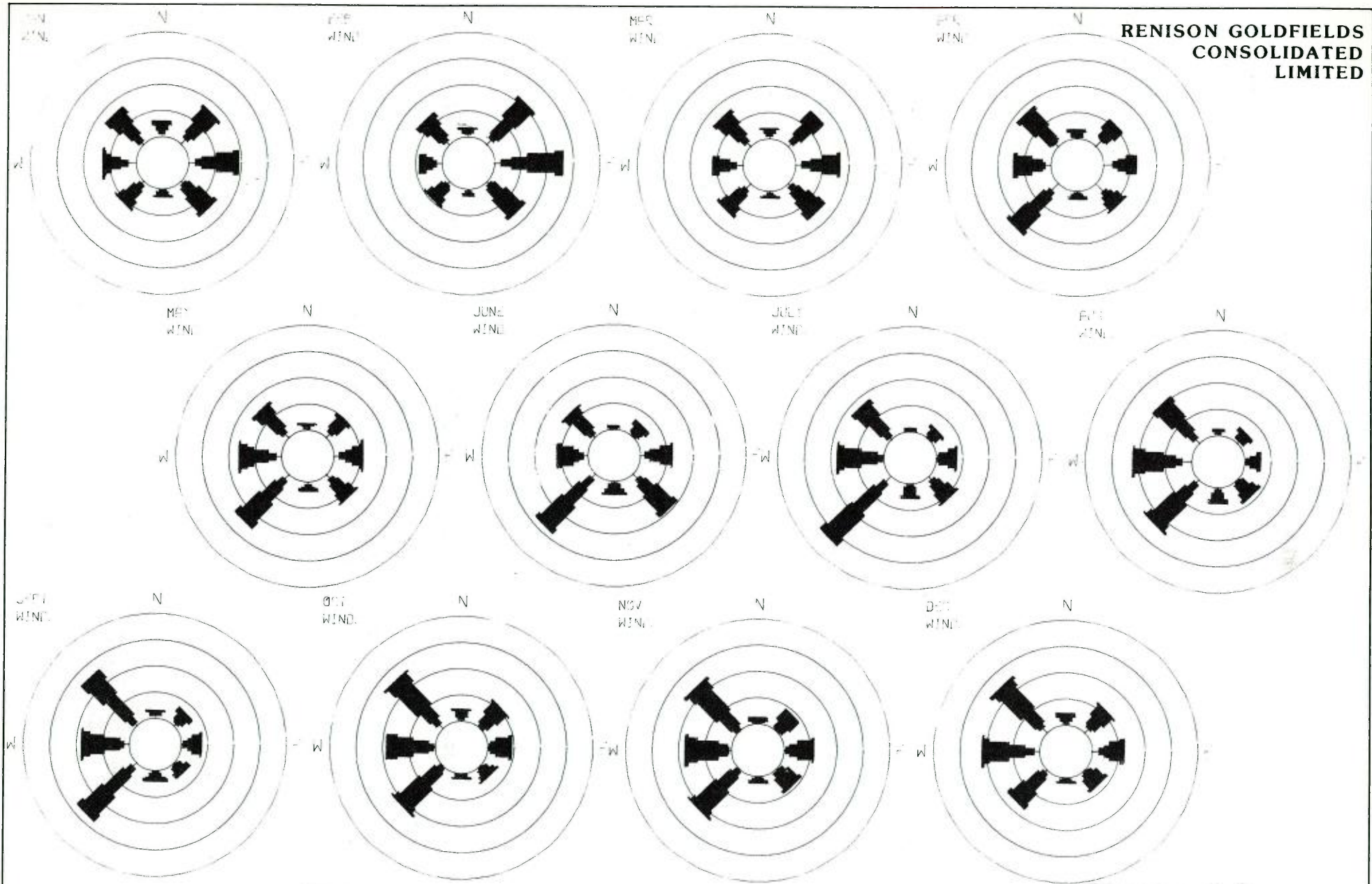
Occurrences of surface water on and surrounding the Project Site are extremely limited since the site is located on a local watershed. The only surface water present is within small farm dams positioned near springs or within Hackney or Thompsons Creeks.

Quality

A baseline water quality monitoring programme has established that water draining from the western side of MLA 310 is considerably more saline than water in both Thompsons Creek and Hackney Creek. The higher salinity levels are due to high concentrations of chloride, sulphate, magnesium and bicarbonate. These waters also have a marginally higher pH level.

Concentrations of heavy metals in surface waters around the Project Site are extremely low which reflects the mineralogy of the rock units present in the area. The virtual absence of heavy metals will enable the total breakdown of any cyanide and reduce the potential for the information of metal cyanide complexes.



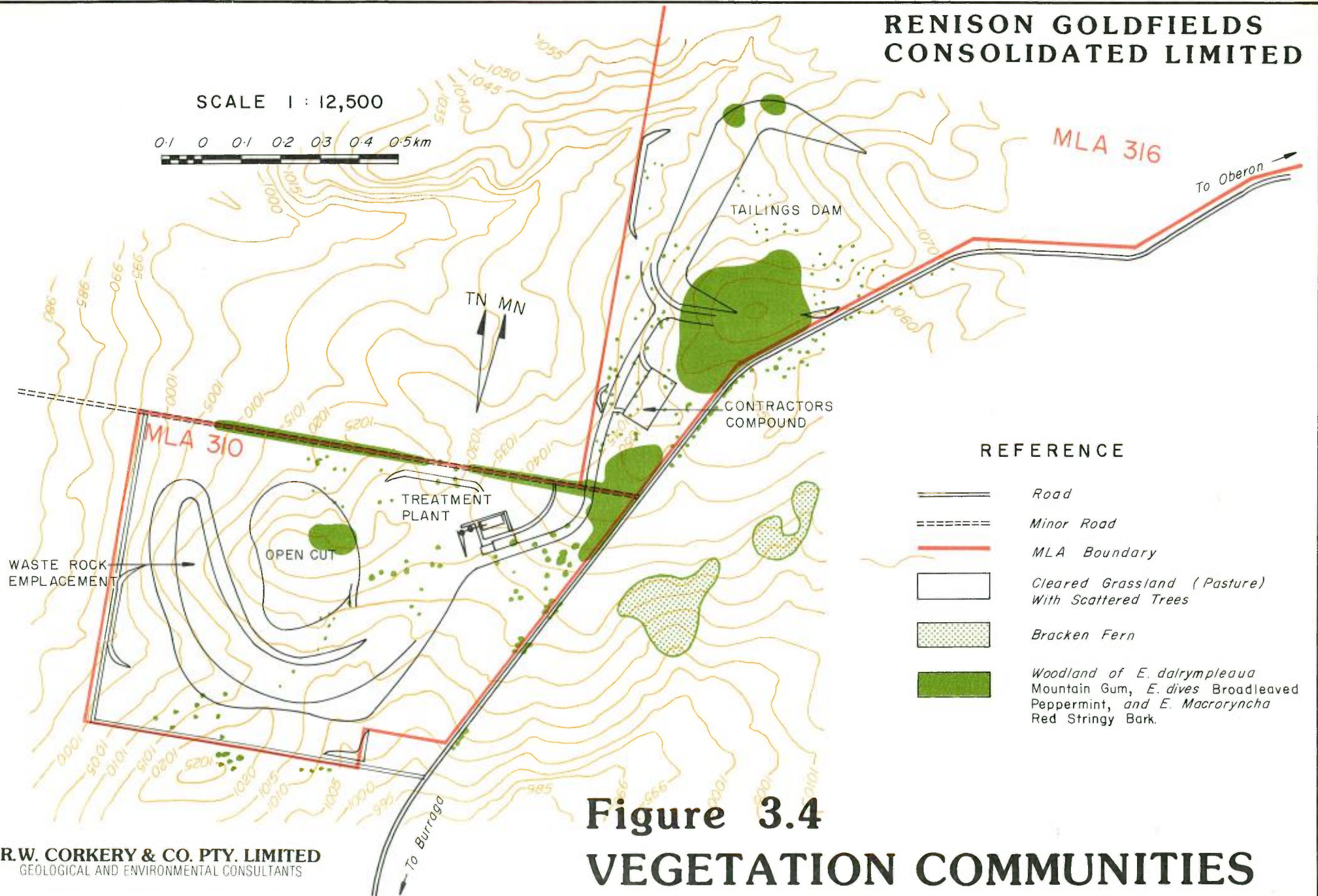


**Figure 3.3
WIND SPEED
AND DIRECTION**

RENISON GOLDFIELDS CONSOLIDATED LIMITED

SCALE 1 : 12,500

0.1 0 0.1 0.2 0.3 0.4 0.5 km



REFERENCE


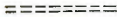


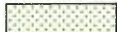

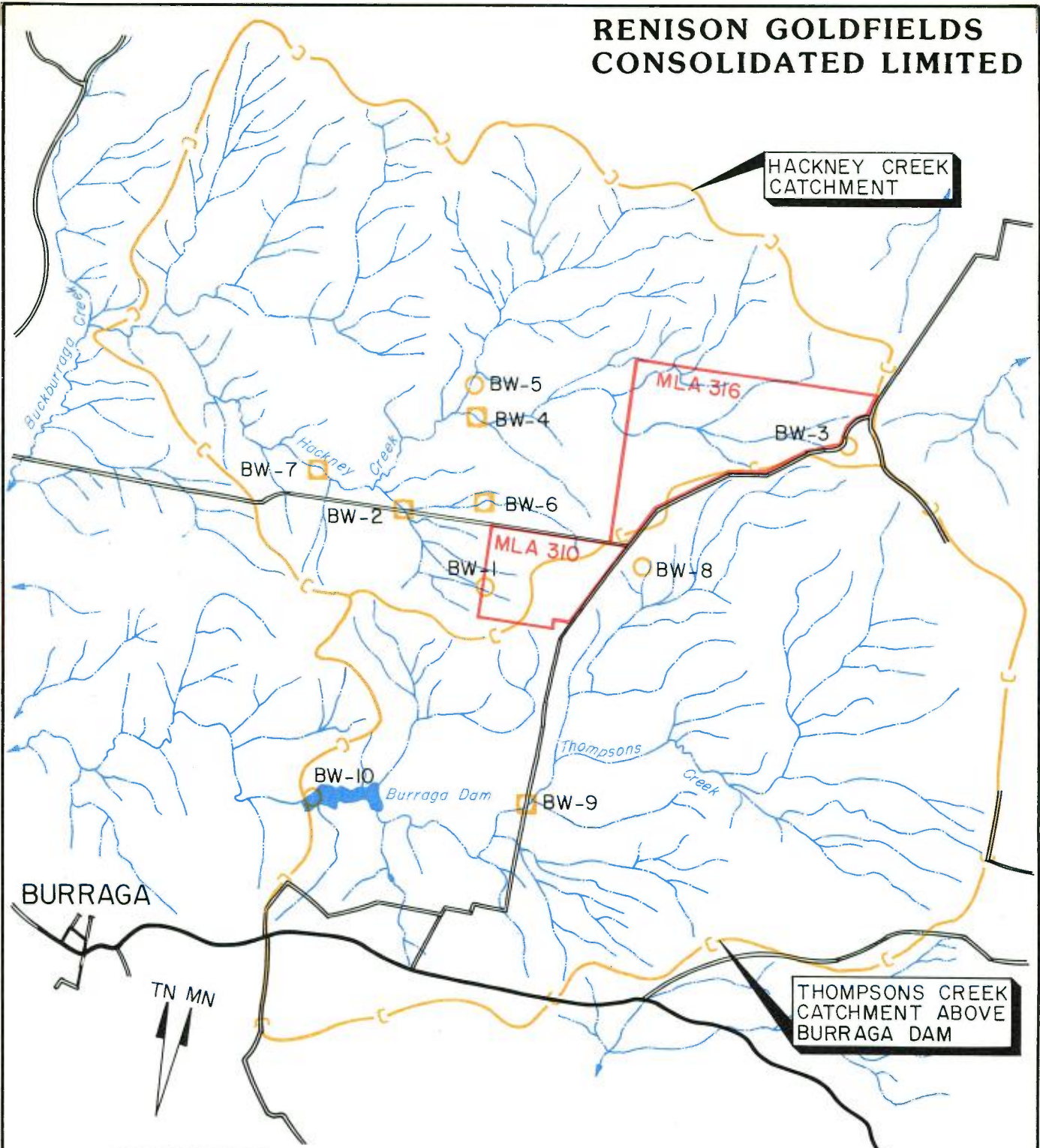
-  Road
-  Minor Road
-  MLA Boundary
-  Cleared Grassland (Pasture) With Scattered Trees
-  Bracken Fern
-  Woodland of *E. dalrympleau*, Mountain Gum, *E. dives* Broadleaved Peppermint, and *E. Macroryncha* Red Stringy Bark.

Figure 3.4 VEGETATION COMMUNITIES



R.W. CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

RENISON GOLDFIELDS CONSOLIDATED LIMITED



REFERENCE

- Sealed Road
- Unsealed Road
- Intermittent Watercourse
- Catchment Area Boundary
- Water Sampling Site
- Water and Stream Sediment Sampling Site
- MLA Boundary

SCALE 1:50,000



Figure 3.5 BASELINE ENVIRONMENTAL MONITORING SITES



R.W. CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

Water sampling site No. 10 is the Burruga dam. At the present time, the water has a noticeable odour and analyses indicate that it doesn't satisfy potable water standards (source: Evans Shire Council).

3.6.2 Underground Water

Occurrence

The rocks within the open cut are essentially impermeable with the exception of areas traversed by fractures. The Burruga Granite marks the eastern margin of the ore body and appears to represent a hydraulic barrier which limits groundwater flow towards the ore body. Monitoring of water levels within drill holes within the ore body and in the vicinity of the tailings dam has enabled the contours shown on Figure 3.3₂ to be prepared.

The water level contours indicate a groundwater mound coinciding with the surface divide in a position central to the ore body. Groundwater gradients of between 0.03 and 0.06 exist and indicate flow in a general northerly, westerly and southerly direction from the ore body. To the east, groundwater flow is impeded by the granite mass.

The reduced level of water table contours in the open cut area shows a reasonably flat surface. However, the depth to the water table varies between 11 and 20 m due to rapid changes in surface levels. In the tailings dam area the depth to the water table is between 7 to 8 m.

Springs and seeps are evident at several locations downgradient from the mine site and within Hackney Creek downstream of the tailings dam area. Four drill holes within the general area flowed freely when completed.



One bore exists within a 5 km radius, four bores within a 10 km radius and one bore approximately 13 km to the north of the mine site. Five bores show poor yields, whereas No. 50906, near the Burruga landing ground, reported a good yield, i.e. 6.3 l/sec, from a fractured aquifer between 23 and 28 m. Bore 50906 is the closest to the mine at a distance of 3.5 km.

Quality

Water sampled by Australian Groundwater Consultants Pty Ltd and also reported in Appendix 5 (Table A5.1) indicates water in the pit area is of low conductivity and slightly acid. A flowing hole approximately 300 m to the southwest of the proposed open cut recorded similar concentrations of sodium, chloride, magnesium and bicarbonate as a surface sample (BW-1), thus indicating the origin of slightly saline water west of the open cut. Electrical conductivity levels of up to 2100 umhos/cm characterize the more saline water compared to the remainder of the samples which are as low as 165 umhos/cm pH levels in the groundwater samples measured, varied from 5.1 to 6.8.

The neutral to slightly acid pH and bicarbonate content of the groundwater will enable the release of cyanide as HCN gas when the alkaline simple cyanide solutions mix with the groundwater.

3.7 BACKGROUND NOISE LEVELS

Background noise levels were monitored at four sites around the Project Site (see Figure 3.7).

- (i) Burruga Post Office;
- (ii) "Green Wattles";
- (iii) "Ben Ledi";
- (iv) "Buckburruga".



Measurements were made early morning and early afternoon. On only one occasion, the background noise level (L°) exceeded 30 dB(A) and on that occasion it was related to wind in a stand of mature pine trees. No further measurements were attempted after 6.15 pm since the calm still conditions resulted in no registrations above the 20 dB(A) limit of detection of the Bruel and Kjaer 2225 sound level meter. In conclusion, the measurements reveal the Burruga area is typical of a sparsely settled rural community.

In addition to background noise measurements, a series of measurements were taken to establish attenuation levels from the project site to the surrounding residences. A Gemco H22A drill was used as the noise source for these measurements. Maximum noise levels created by engine noise was recorded at 89 dB(A). These levels were wind assisted by approximately 4 dB(A). The sudden release of air created higher noise levels of between 111 and 114 dB(A) at 7 m. At only one residence, "Ben Ledi", could the engine noise be heard, and then it was only just audible at 29 dB(A). The air blast was readily audible at "Ben Ledi" at 48 dB(A).

3.8 AIR QUALITY

The Project Site lies in a typical rural area where air quality is affected primarily by unsealed roads and a range of agricultural activities e.g. ploughing.

3.9 VEGETATION

The project site is generally cleared and grazed. Some small stands of the original tree cover are scattered throughout the area, but these have been modified by selective tree removal and understory grazing.



The original vegetation community would have been a Woodland with dominant canopy species of Mountain Gum (Eucalyptus dalrympleana), Broad-leaved Peppermint (E. dives) and Red Stringybark (E. macrorhyncha ssp. macroryncha). However, this mix of species is only found along the roadsides where there has been limited clearing. The Red Stringybark is the most common tree within the area and is found in mono-specific stands on MLA 316. It would appear that selective logging has removed the other tree species leaving only the Red Stringybark.

The main vegetation community on the Project Site is Cleared Grassland (Pasture) which contains a variety of native and introduced grasses as well as scattered trees and shrubs. The native grasses include Tussocky Poa, Snow Grass and Wallaby Grass whilst there are introduced grasses such as Cocksfoot, Phalaris, Fescue and Clover. Large patches of Bracken Fern are scattered throughout this community and in slightly wetter areas the reed, Juncus continuous, and rush, Carex appressa, are found. Middle story vegetation occurs in both communities and includes native shrubs such as Silver Wattle, Blackwood, Guinea Flower and Hop Bitter-Pea as well as introduced Blackberry.

An inventory of plant species located within the Project Site is given in Appendix 2 and the distribution of vegetation communities within the area is shown on Figure 3.4.

3.10 FAUNA

The animal species located within the project site are representative of fauna associated with cleared and grazed land. Twenty-two species of bird were observed during field inspection, together with six mammal (only one native) and seven reptile species. More animals could be expected over a longer survey period but a range observed represents a relatively high proportion of the fauna using the area.



The avifauna consisted of several parrot species which utilise the grassland community for food (Galah, Eastern Rosella) and the trees for roosting (Sulphur-crested Cockatoo, Gang-gang Cockatoo). Other birds using the grassland habitat include the Richard's Pipit, Striated Thornbill and the Australian Kestrel. Other birds were more closely associated with the timbered habitat e.g. Yellow-rumped Thornbill, White-throated Treecreeper, Laughing Kookaburra and Noisy Miner. Three species of bird were located on dams (Maned Duck, Pacific Black Duck and Australasian Grebe).

Most of the mammalian fauna located were introduced and included cattle and sheep as well as rabbits, feral dogs and House Mice. The only native mammal located was the Wallaroo which moved between the nearby forested areas and the cleared land. There was no evidence of wombats within the Project Site area but these animals were noted along Hackney Creek. There is the possibility of the presence of Swamp Wallabies in the area (characteristic scats were noticed) and perhaps some of the smaller native mammals such as Brown Antechinus and Bush Rat. However, the sparse ground cover does not provide favourable conditions for these animals. There was some evidence for the presence of the Short-beaked Echidna. Despite an intensive spotlighting survey of the area there was no evidence of occupancy by possums and/or gliders. This does not mean that these mammals are not in the area, but that their numbers are very low.

According to the drillers working in the areas, several species of snake were encountered. These included the Tiger Snake, Copper Head, Eastern Brown Snake and Red-bellied Black Snake - all species commonly located on farming land in the region. Other reptiles included lizards such as the Eastern Blue-tongued Lizard and the Shingleback. Small Grass Skinks were commonly located within the area and several species of frog were heard at the dams e.g. Common Eastern Toadlet.



Hackney Creek and Thompsons Creek both carry rainbow and brown trout of small to reasonable size.

An inventory of fauna species observed in the area is given in Appendix 2.

3.11 ECOLOGICAL VALUE OF THE AREA

The Project Site is typical of the cleared, grazing land found in the Central Tablelands. No rare and/or endangered species were located and the possibility of locating any is remote. The land does not form part of a continuous wildlife corridor and does not contain any vegetation communities or wildlife habitats of importance. It is concluded that the ecological value of the Project Site is low.

3.12 LAND ZONING, LAND OWNERSHIP AND LAND USE

3.12.1 Land Zoning

All land within and surrounding the Project Site is zoned 1(a) Rural A under the provisions of Interim Development Order No. 1, Shire of Evans. Mining may be carried out on the land with the consent of the Evans Shire Council.

3.12.2 Site's Ownership

The Project Site is owned almost entirely by Renison Limited and associated Companies. Details are set out below.

MLA 310 (Portions 24, 56 & 105) - RGC (New South Wales) Limited

MLA 316 (Portion 106) - RGC (New South Wales) Limited
and Renison Limited



The Project Site also incorporates two small areas of crown land.

- (i) A 124m section of Shire Road 130 (Moss Grove Road).
- (ii) Portions 92 and 93. These portions are currently held under a permissive occupancy for grazing (P.O.1984/14) by Mr Leo Toole.

3.12.3 Surrounding Land Ownership and Residences

Figures 3.6 shows the ownership of land surrounding the Project Site and Figure 3.7 displays the location of residences within 5 km of the site. Figure 3.8 shows sections of the landform between four selected residences and the Project Site.

Table 3.9 lists four non-mine related residences around the Project Site and their distance to the major components of the project.

TABLE 3.9
PROXIMITY OF RESIDENCES SURROUNDING THE PROJECT SITE

Residence*	Closest Point of Open Cut (km)	Distance (km) to: Treatment Plant	Closest MLA Boundary**	General Direction
"Ben Ledi"	2.7	2.4	1.2	East
"Green Wattle"	3.6	3.7	3.0	South
"Buckburruga"	4.7	5.3	4.4	West
Burruga Township	5.0	5.4	4.2	Southeast

* Location shown on Figure 3.7.

** Only construction activities are proposed near the boundary of MLA 316 and waste rock dumping near the southern and western boundary of MLA 310.



3.12.4 Site's Land Use

The project site has been largely cleared and used for grazing though occasional timber stands have been left on the site. Grazing is by far the predominant land use in the area. This is largely a result of the terrain of the area which is generally too steep for cropping. Further details of the land capability of the Project Site are presented in Section 3.12.6.

3.12.5 Surrounding Land Uses

The district surrounding the project site is used for agricultural purposes. The majority of the land is cleared and used for the raising of sheep and cattle for production of wool, meat, hide and tallow.

The Burruga district also contains extensive privately owned Pinus radiata plantations, largely operated and managed by Timberland Forests Pty Ltd. Timber is produced on these commercial plantations for use in local and interstate wood chip and saw milling industries. Such a radiata pine plantation, administered by Timberland Forests Pty Ltd is located directly to the west of MLA 316.

Southwest of the mine site, Thompsons Creek flows into Burruga Dam which supplies the Burruga township and surrounding district with their water supply. The land immediately surrounding Burruga Dam is a designated flora/fauna reserve, whilst just upstream of the dam the land is designated as a camping reserve.



3.12.6 Land Capability

The land capability classification maps prepared by the Soil Conservation Service of N.S.W. provide a basis for assessment of the optimum use of the land around the project site. The classification is based on the assessment of the biophysical characteristics of the land, the extent to which these will limit a particular type of land use, and the current technology that is available for the management of the land. The classification also incorporates an assessment of the soil erosion hazards, with an emphasis on a "safe" level of land use, thus avoiding 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 land surrounding the Project Site falls predominantly within Classes IV and VI (1:100,000 Oberon Rural Land Capability Map, prepared by the Soil Conservation Service of N.S.W.). As outlined in this classification, Class IV and VI land is suitable for grazing but not for regular cultivation. Class IV land comprises the better quality grazing land in the state. Simple erosion measures are necessary on Class IV land to protect the land. These include practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation.

Class VI land comprises the less productive grazing land and is generally too steep or rocky for structural soil conservation measures. Good management practices are necessary and these may include limitation of livestock, broadcasting of seed, fertiliser, prevention of fire and destruction of vermin, together with retention of green timber on slopes greater than 33 per cent.

3.12.7 Agriculture Capability

The agricultural suitability map prepared by the Department of Agriculture at a scale of 1:100,000, maps the project area as Class 3 land.



This classification is an interpretive classification based on the effects of climate, topography and soil characteristics as limitations to land use for agriculture, and also on the general productive capacity for pastures suited to the area. Class 3 land is suitable for grazing and well suited to pasture improvement. It may be cultivated for an occasional cash crop or forage crop in conjunction with pasture management. Overall level of production is moderate as a result of high environmental risks which limit the frequency of gravel disturbance. It has a moderate capability for agriculture. Pasture lands are capable of sustained high levels of production although conservation measures may be required.

3.13 PRE-EUROPEAN SETTLEMENT

An officer of the National Parks & Wildlife Service has inspected the project site and has recommended that no further archaeological assessment is required. There are no known aboriginal sites in the vicinity of the Project Site.

3.14 SOCIO-ECONOMIC FACTORS

3.14.1 Introduction

The project site is located approximately 35 km southwest of Oberon. Bathurst is the main regional centre in the area and is situated 68 km north of the mine site. The surrounding rural districts are predominantly used for grazing and forestry purposes. Socio-economic data has been drawn from the Australian Bureau of Statistics June, 1986 census.

3.14.2 Population

Table 3.10 records the populations of Oberon, Bathurst and the three collection districts surrounding the Project Site. Oberon and Bathurst have populations of approximately 1,840 and 22,237 respectively. The surrounding rural areas have a population density of 1 person per 1.5-2 km².



TABLE 3.10
POPULATION AND HOUSING
OBERON-BATHURST DISTRICT, JUNE, 1986

Locality (Collector District)	Average Distance From Mine (km)	POPULATION			HOUSING	
		M	F	T	Private Dwellings Occupied	Unoccupied
Bathurst	68	11154	11083	22237	7289	622
Oberon	35	948	892	1840	622	72
232103*	12	96	70	166	62	33
232104+	10	89	76	165	51	3
232105	20	127	101	228	77	37

* The Project Site is within this district.

+ Burrage is located within this district.

Source: 1986 Census

Table 3.11 lists the age distribution of the populations referred to above.

3.14.3 Employment

Employment statistics from the 1986 June census for Bathurst, Oberon and the three collection districts around the Burrage mine are presented in Table 3.12. Approximately 8 per cent of the workforce in Bathurst and 6 per cent of the workforce in Oberon are unemployed. In the rural areas around the mine site unemployment varies from 3 per cent to 14 per cent.

Table 3.12 also lists the 1986 census of persons employed in each industry. The towns of Oberon and Bathurst have a high proportion of workers in the manufacturing, wholesale/retail and community service industries. The rural areas are naturally dominated by workers involved in agriculture and forestry.



TABLE 3.11
AGE BY POPULATION
OBERON-BATHURST DISTRICTS, JUNE, 1986

Age (Yrs)	OBERON		BATHURST		232103*		232104 ⁺		232105	
	M	F	M	F	M	F	M	F	M	F
0-4	89	80	1003	903	5	4	14	10	8	7
5-9	97	75	853	873	6	7	10	8	6	8
10-14	85	88	1058	900	15	7	7	10	17	9
15-19	81	62	1217	1052	4	8	5	6	14	8
20-24	71	71	1000	982	6	2	2	4	11	6
25-29	73	70	964	941	11	2	7	6	7	7
30-39	144	129	1752	1598	15	11	14	11	11	10
40-49	109	111	1181	1127	16	13	13	11	22	22
50-54	47	32	448	445	4	0	4	0	8	2
55-59	43	46	439	458	4	4	6	0	0	6
60-64	44	39	375	419	6	4	2	6	4	5
65-69	21	30	276	385	4	2	4	0	8	7
70-74	20	21	240	378	0	6	6	4	7	0
75+	26	36	348	622	2	2	4	4	4	2
TOTAL	950	890	11154	11083	98	72	96	80	127	99

* The Project Site is within this district.

+ Burruga is within this district.

Source: 1986 Census



TABLE 3.12
EMPLOYMENT - OBERON-BATHURST DISTRICT, JUNE, 1986

	OBERON	BATHURST	232103*	232104 ⁺	232105
Employed - male	505	5401	44	43	69
- female	265	3540	24	18	39
Total Employed	770	8941	68	61	108
Unemployed - male	23	417	0	8	2
- female	28	355	2	2	2
Total Unemployed	51	772	2	10	4
	Employment Category (% of total employed)				
Agriculture/Forestry	12	2	87	64	75
Mining	1	1	0	8	0
Manufacturing	26	14	0	0	10
Electricity/Gas/Water	1	2	0	0	0
Construction	3	6	0	4	0
Wholesale/Retail	14	18	0	0	2
Transport	8	7	0	12	6
Communication	2	3	3	4	4
Finance/Services	3	9	0	0	0
Public Administration	7	5	0	0	0
Community Services	13	24	7	8	3
Recreational/Personal	9	6	0	0	0
Not Known	1	1	3	0	0

* The Project Site is within this district.

+ Burruga is within this district.

Source: 1986 Census.



3.14.4 Housing

Table 3.10 lists the number of private dwellings occupied and the number of unoccupied dwellings. These statistics do not necessarily indicate that the unoccupied dwellings are habitable. The availability of rental in the rural areas is limited, however, a greater rental market exists in the larger centres - particularly in Bathurst.

Ample accommodation is available both in Bathurst and Oberon for temporary personnel in the form of motels, hotels and caravan parks.

3.15 VISIBILITY

The site of the proposed treatment plant is the most visible component of the site, primarily because of its location at the top of a prominent ridge. The ridge is visible from SR 31 and a range of distant residences (at least 3.5 km from the project site).

The open cut area is partially shielded at present since much of the area occurs just on the western side of the ridge.

The tailings dam area is conversely well shielded by both surrounding topography and vegetation adjacent to SR 31. Only one area along the road is sparsely planted and partial views of the tailings dam area are possible.

3.16 TRANSPORTATION NETWORK

Figure 2.1 shows the local network around the Burruga mine site. The roads to be used by traffic travelling to and from the site are as follows.



Main Road 252

This road provides access from Shire Road 31, through Burruga township to Bathurst. The road is 5-6 m wide and comprised both of gravel and bitumen. The gravel sections of the road are in poor to fair condition with the surface being rough in places. The bitumen road through Burruga is 5 m wide and in average condition. A small section of bitumen (approximately 800 m long) in very good condition is located 3 km northeast of Burruga. Current annual average daily traffic levels on MR 252 near Mt David are 117.

Shire Road 31

This road is a gravel road which provides access from the mine site into Burruga township and into Oberon. South of the mine site the road varies in width from 5 m to 8 m and is in good condition. The table drains are in reasonable condition and visibility is good. At the junction of SR 31 and MR 252, visibility to the east is poor due to a stand of trees obscuring the view. Average daily traffic counts on this road between its junction with MR 252 and the mine site are approximately 33 vehicles. While these figures are 1982 figures, the traffic level is unlikely to have changed a great deal due to the rural nature of the area.

The Oberon/Evans Shire boundary is located at Campbells River. West of this boundary, SR 31 (Evans Shire) becomes SR 45 (Oberon Shire) which joins the Black Springs-Oberon Road (MR 256).

Shire Road 30

Shire Road 30 is known locally as Moss Grove Road. It is a single lane unsealed road with two gates between SR 31 and the old Moss Grove homestead. The road is used principally by the Company's exploration geologists, however, is used periodically by employees of Timberland Forests Pty Ltd in gaining access to the pine forests adjacent to MLA's 310 and 316.



3.17 SERVICES

3.17.1 Power

Insufficient power supplies are present in the vicinity of the project site to supply the Company's requirements. Figure 2.11 shows the closest power lines to the Project Site. The main source of power for the Burruga area originates from Bathurst. The Bathurst-Rockley power line is of good standard and reliable whereas the power service beyond Rockley is of poor quality and often the reason for "black-outs" on district properties.

3.17.2 Water

The Burruga district depends upon Burruga Dam for its water supply although it is often not suitable for human consumption. Burruga Dam is a concrete gravity arch dam built about 1900 for a water supply to the town's copper mine and was later used for a fish hatchery.

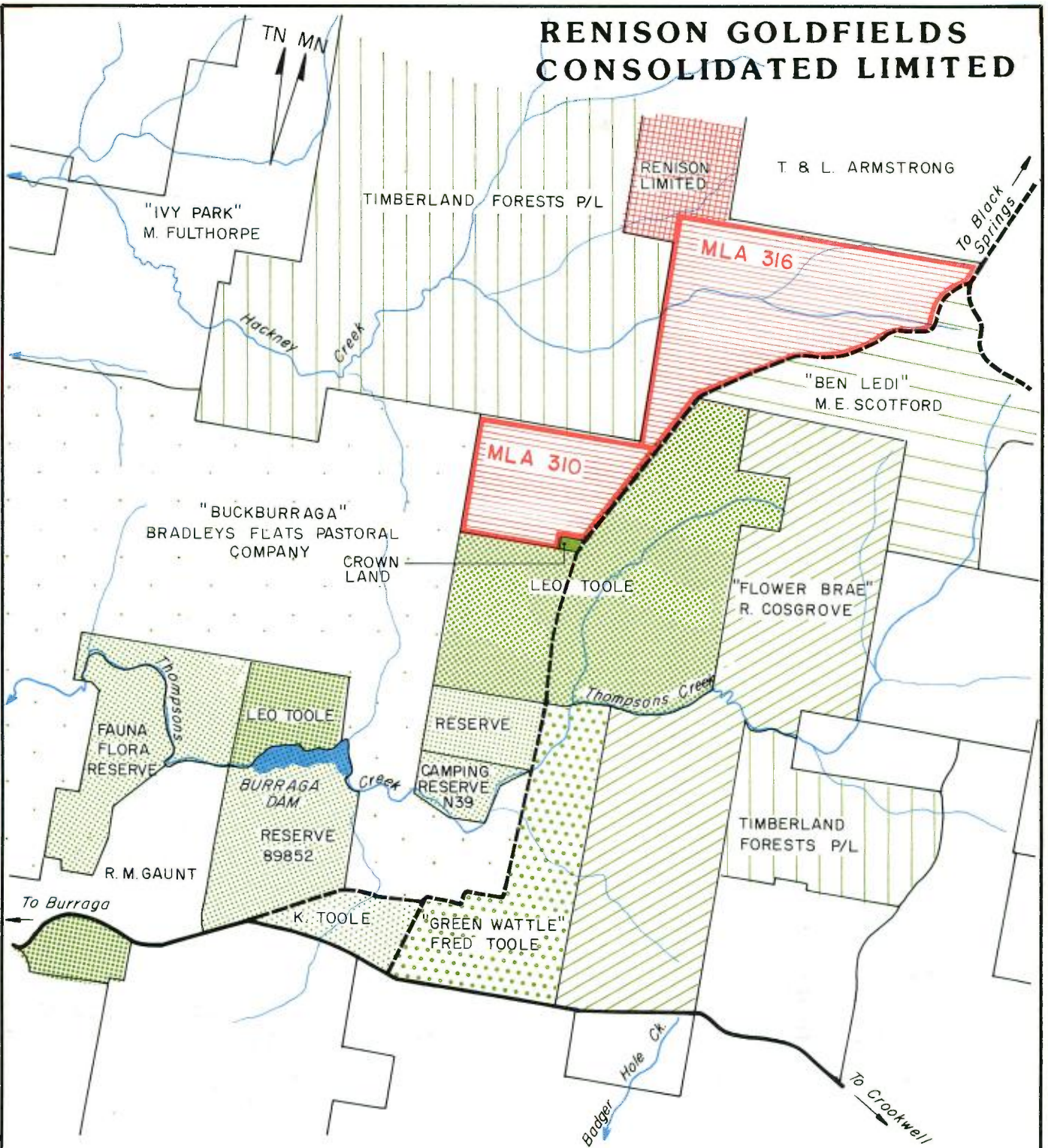
The land on which the dam is situated is currently under the control of the Lands Department while the Department of Water Resources is involved with licencing of the dam to the Burruga and District Community Association. The Burruga and District Community Association was successful in securing State Government funding to develop a water supply based on the dam. The estimated water demand of the village is 27 megalitres per annum (75,000 litres/day) however, the exact current water usage is unknown. The Public Works Department have estimated the capacity of the dam at 200 megalitres.

3.17.3 Telephone







The closest telephone line to the site follows Moss Grove Road from the Burruga-Bathurst Road. Telecom advises that insufficient cable exists near Burruga to supply the Company's communication requirements.



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REFERENCE

-  Sealed Road
-  Unsealed Road
-  Watercourse
-  Property Boundary
-  Boundary of Mining Lease Application
-  Land Owned by Associated Companies of R.G.C. (See Section 3.12.2 for Details)

SCALE 1 : 40,000

0.5 0 0.5 1.0 1.5 2.0 km



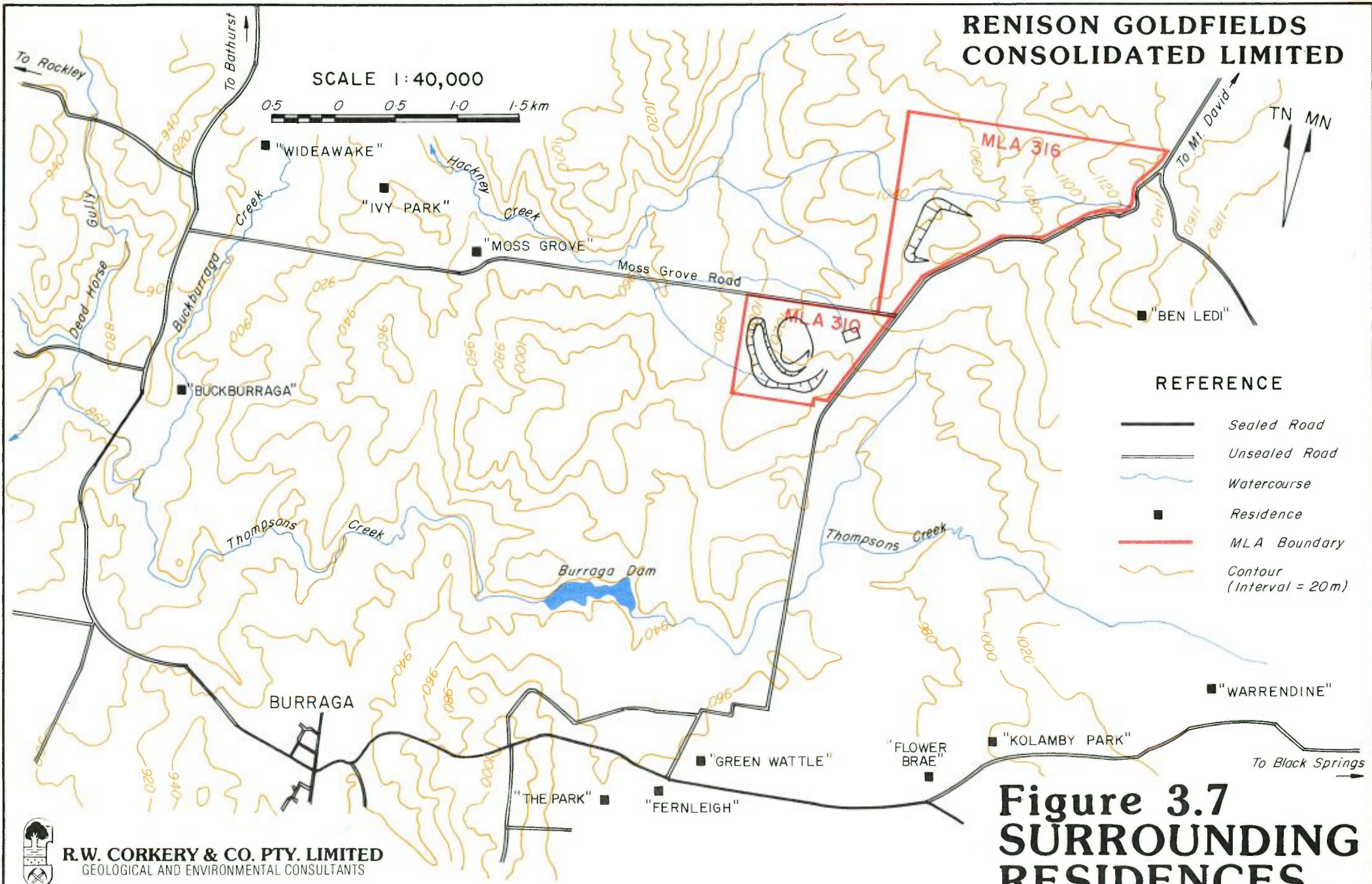
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Figure 3.6 LAND OWNERSHIP

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SCALE 1:40,000

0.5 0 0.5 1.0 1.5 km



REFERENCE

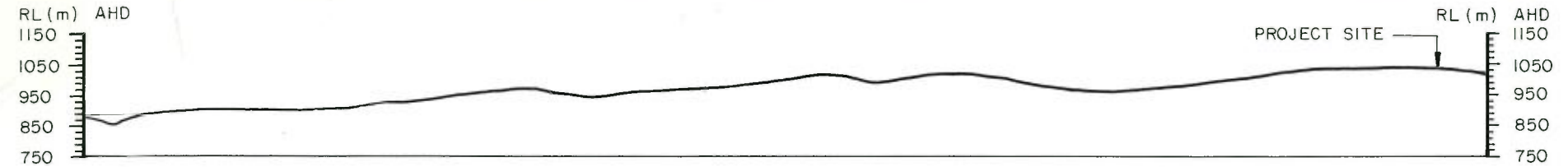
- Sealed Road
- Unsealed Road
- Watercourse
- Residence
- MLA Boundary
- Contour (Interval = 20m)

Figure 3.7 SURROUNDING RESIDENCES



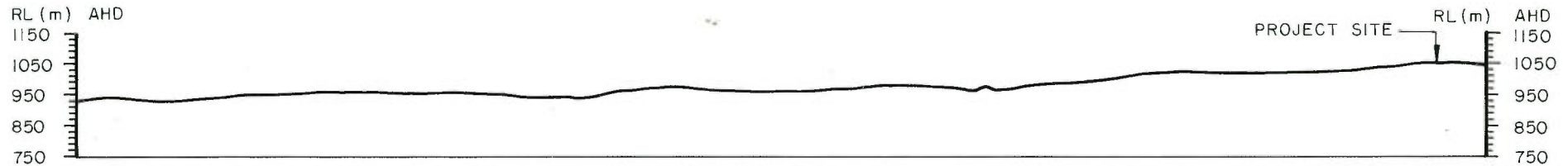
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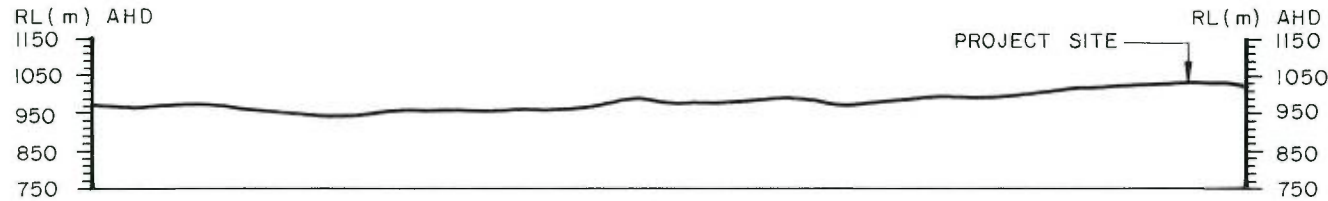
"BUCKBURRAGA"

SECTION AA'



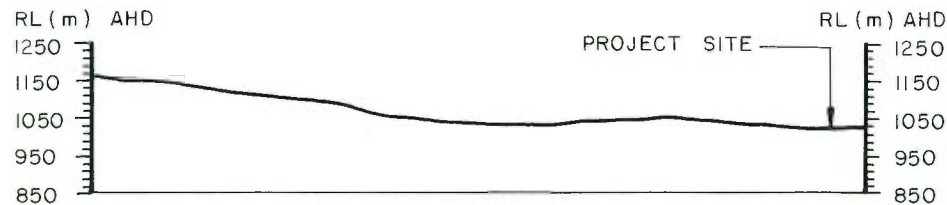
BURRAGA POST OFFICE

SECTION BB'



"GREENWATTLE"

SECTION CC'



"BEN LEDI"

SECTION DD'

SCALES

HORIZONTAL SCALE 1:25,000

VERTICAL SCALE 1:20,000

VERTICAL EXAGGERATION = 1.25

Figure 3.8 SECTIONS TO SURROUNDING RESIDENCES



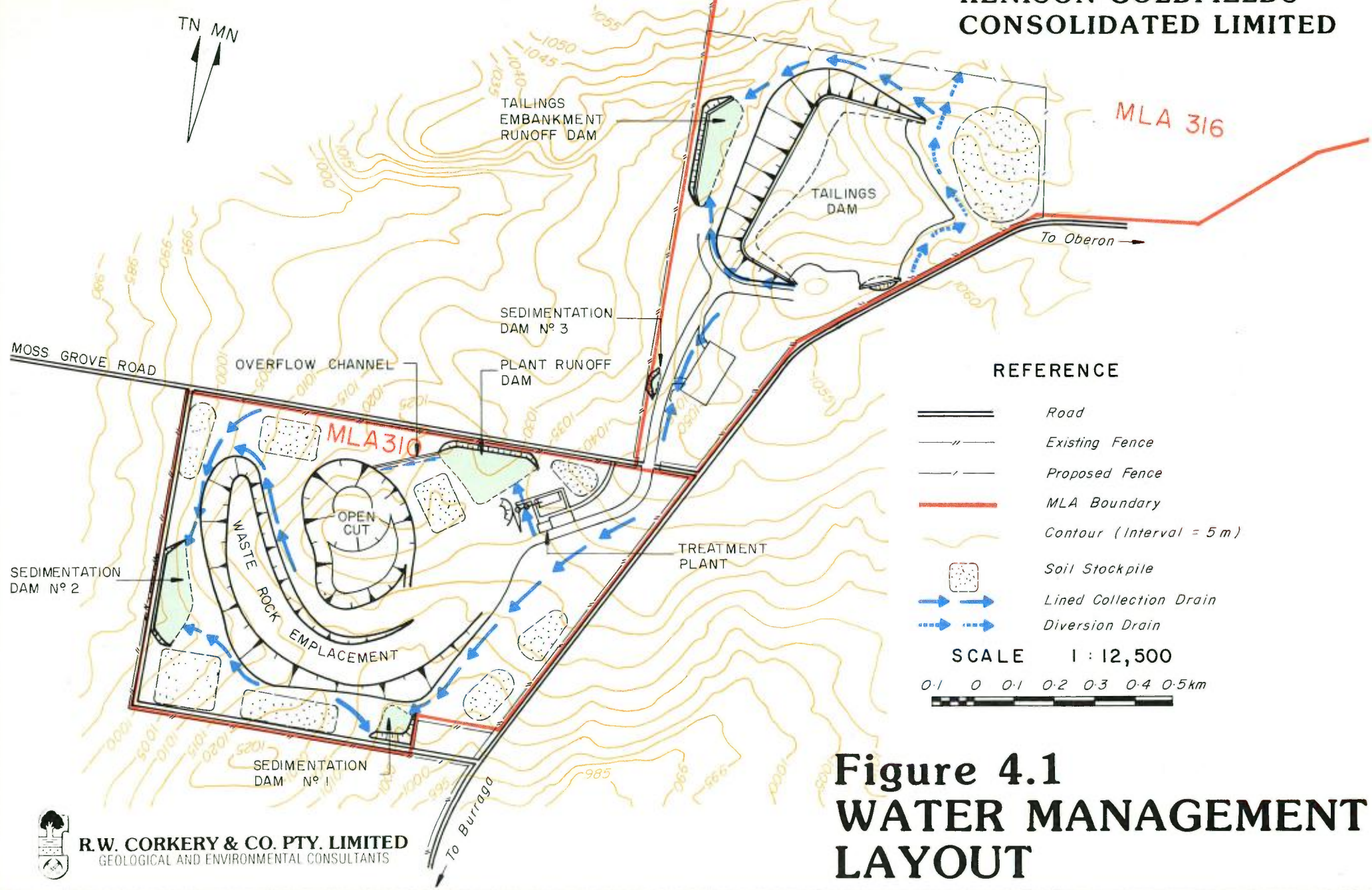
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NOTE: See Figure 3.7 for Location of Residences.

SECTION 4

DESIGN AND OPERATIONAL STANDARDS

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**Figure 4.1
WATER MANAGEMENT
LAYOUT**



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SECTION 4

DESIGN AND OPERATIONAL SAFEGUARDS

4.1 AIR POLLUTION CONTROLS

4.1.1 Nature of Contaminants

The principal potential air contaminant that could be generated by the project will be dust arising from construction activities, vehicle movement, drilling and blasting, soil stripping, crushing and the tailings dam. Other potential sources of air pollution would be:

- (i) Exhaust emissions from diesel and petrol driven equipment and motors;
- (ii) Fumes from blasting;
- (iii) Burning off pushed up timber;
- (iv) Small quantities of chemical emissions.

4.1.2 Dust Control Measures

The Company will ensure a wide range of dust controls are incorporated into their project to satisfy both accepted environmental standards of the State Pollution Control Commission and the occupational health requirements of the Department of Industrial Relations. The measures to be adopted to limit the dispersal of dust are as follows.



Construction Activities

The pushing of topsoil and excavations for the tailings dam wall and treatment plant will generate limited dust, especially if construction proceeds as planned during September-October, 1988. If weather conditions prevail which will aggravate dust generation, the areas of activity will be watered prior to its commencement.

Vehicle Movements

The dust generated by vehicle movements on the access road and haul road to the waste rock dump and tailings dam will be controlled principally by the regular maintenance of the road surface with crushed gravel on the project site, and regular watering as required. The Company has made allowance in their planning for 200 kl of water per day for road watering.

Drilling and Blasting

The air track drill will be fitted with dust collectors. Standard blasting practice will ensure dust is kept to a minimum.

Crushing and Grinding

The treatment plant will incorporate a bag house dust collection system.

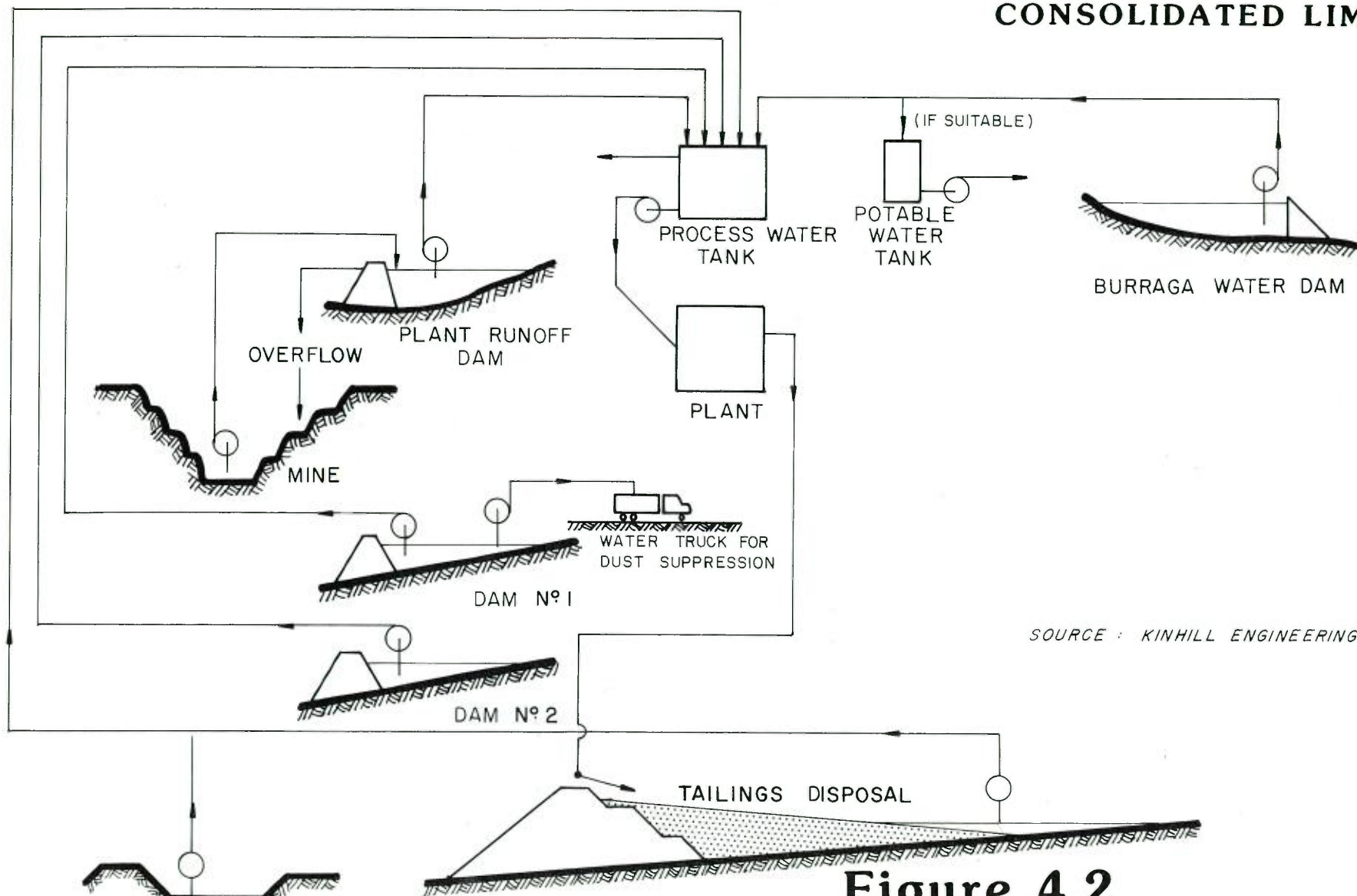
The bag house dust collectors will be positioned at the following positions:

- (i) Crusher discharge;
- (ii) Conveyor load points;
- (iii) Screens. (Note: Screens will be enclosed with rubber hoods).

Conveyors will be fitted with wind shields.



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SOURCE : KINHILL ENGINEERING PTY. LTD.

Figure 4.2 WATER MANAGEMENT FLOW DIAGRAM



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Tailings Dam

It is not expected that the surface of the tailings dam will dry out sufficiently to cause a dust problem.

4.1.3 Control Measures for Other Potential Air Contaminants

The earthmoving equipment and on site vehicles will be fitted with appropriate exhaust controls. The Company will ensure the equipment used on site by themselves and by their contractors will be properly maintained to ensure no unacceptable exhaust emissions occur.

The exhausts of earthmoving vehicles will be directed upwards and sideways so as not to impinge on the ground.

Blasting Fumes

The fumes liberated by blasting will be quietly dispersed into the local atmosphere without any hazardous gases extending beyond the open cut.

Burning Off

After all usable timber/firewood is obtained, the remaining timber will be burnt as soon as possible to ensure the natural sap assists in burning. This burning off will be undertaken during a period allowable and under suitable atmospheric conditions.

Chemicals

Odours from chemicals used in the plant such as sodium cyanide (NaCN) and sodium hydroxide (NaOH) may be detectable from time to time in close proximity to the plant.



Sodium cyanide is odourless, however, on contact with water with a low pH, hydrogen cyanide gas (HCN) is formed. The principal safeguard proposed by the Company to eliminate the formation of HCN gas is to ensure that stores of sodium cyanide are kept dry in secured areas and that the pH of the circuit water is kept at a sufficiently high level to prevent the liberation of HCN. The alkalinity of the circuit water is monitored to ensure adequate pH levels are maintained.

During the gold stripping operation, minute quantities of ammonia are evolved which are vented and readily dissipate.

4.2 WATER MANAGEMENT

4.2.1 Potential Sources of Water Pollution

Figure 4.1 shows the water management plan for the site and Figure 4.2 displays schematically the on site water management. The principal potential sources of water pollution are:

- (i) Meteoric water or rainwater collected in the open cut;
- (ii) Underground seepage of saline groundwater into the open cut from surrounding rocks;
- (iii) Surface runoff on the waste rock dump and ore stockpile;
- (iv) Surface runoff from the outside of the tailings dam;
- (v) Subsurface seepage from the tailings dam;
- (vi) Spillage of chemicals from the treatment plant;



- (vii) Spillage of fuel around the plant and contractors' depot;
- (viii) Runoff from disturbed areas on site.

All other runoff within the project site will essentially be clean runoff which will be directed around the components of the site.

4.2.2 Water Pollution Control Objectives

Surface Water

The objective in sound site water management and pollution control is to classify areas of specific operations according to anticipated water quality. Three water quality classifications have been adopted for water management purposes. These are:

- (i) "Clean" for runoff from undisturbed areas within the project site which can be diverted and released to natural drainage lines;
- (ii) "Dirty" for runoff containing suspended sediments from disturbed areas of the open cut, waste rock emplacement or facilities area which can be collected and diverted to settlement ponds prior to discharge to natural drainage lines;
- (iii) "Contaminated" for process waters and runoff which comes into contact with tailings or treatment plant process areas and must be contained on site and not released.



The objective of site water management is to maximise "clean" runoff while controlling "dirty" runoff and minimising "contaminated" site water to containable quantities. All water discharged off site will satisfy water quality criteria of the State Pollution Control Commission. Figure 4.1 displays the layout of the site's water management.

As the majority of water controlled on site is classified as "dirty", extensive use is made of sedimentation dams. Supernatant water in these dams may either be allowed to overflow through a flume decant or used for dust suppression.

Groundwater

The objectives for control of groundwater pollution apply specifically to potential infiltration of contaminated water (iii above) from the tailings dam and the plant runoff dam into the groundwater system which in turn may surface into nearby streams.

Since most materials have a certain degree of permeability, it is important that the materials present on the floor and walls of both the tailings dam and plant runoff dam are of sufficiently low permeability to ensure seepage rates are acceptably low. Low permeability will allow time for dispersion and breakdown (by biological + surface chemistry) of residual free cyanide. This would be to ensure that any seepage that reached the nearby creek system was sufficiently diluted so as not to cause levels of pollution which would exceed the requirements of the State Pollution Control Commission.

4.2.3 Water Pollution Control Measures

Figure 4.1 displays the location of each of the water pollution control measures discussed below.



Diversion Banks

A diversion bank will be constructed on the upslope site of the tailings dam once the nearby soil stockpile is stabilised. The bank will direct clean runoff towards Hackney Creek. This diversion represents the only component where "Clean" water can be diverted around the site. The bank will be no more than 1 m high and will have a grade of no more than 1:400 (Vert:Hor). Advice will be sought from the Soil Conservation Service for design and stability.

Sedimentation Dams

A set of the sedimentation dams will be installed at strategic locations around the site to collect the "dirty" runoff originating on site. Contour collection drains with gradients of 1:400 (Vert:Hor) or lined collection drains, will be constructed to direct runoff to the dams.

Dam No. 1 will collect all runoff from the eastern side of the waste rock dump and the haul road.

Dam No. 2 will collect all runoff from the western side of the waste rock dump and surrounding environs.

Dam No. 3 will collect runoff from the haulage road on MLA 316 and from the cleared area used by the mining contractor.

Table 4.1 lists the capacities and catchment area for each dam. Each dam has been designed to contain the runoff from a 1 in 100 year x 72 hour storm. All spillways for the above dams will be constructed with a design capacity of a storm event with a 1:1000 year return period. All sedimentation dams will be maintained with only small volumes of water to ensure maximum retention is possible after a rain event.



The dams will have wall heights varying from 3m (Dam No. 3) to 8m (Dam No. 1). Dam No. 2 will have a wall height of approximately 5m. The outer slope of each dam will be 1:3 (vert:hor) and inside slope 1:2.5 (vert:hor). The outer slope will be stabilised by grass sown as soon as the dam is constructed and the soil placed back on the slope.

Lined Collection Drains

A series of lined collection drains will be installed on the site where collection of dirty or contaminated water is required. The drains are lined since the velocity of water collected would normally be erosive. Energy dissipators will be provided where necessary. These may be in the form of hay bales or engineered structures.

**TABLE 4.1
SEDIMENTATION DAM CAPACITIES**

Dam	Dam Capacity (m ³)	Catchment Area (ha)	1 in 100 year x 72hr Storm Runoff (m ³)
Dam No. 1	27	12	19
Dam No. 2	25	11	18
Dam No. 3	8	4	6.5

Process Water Dams

The process water dams have been designed and placed to ensure that all contaminated water originating on the site is retained on the site. Table 4.2 lists the capacity and catchment area of each dam.



Plant Runoff Dam

The dam will collect all runoff from the areas of the treatment plant where potential exists for spillages of plant reagents. The dam will be constructed with a clay lining on the inside of the dam wall and the floor of the dam will be reworked and compacted to ensure an acceptable permeability is present. The dam will have a wall height of approximately 6m, subject to final design.

TABLE 4.2
CAPACITIES OF PROCESS WATER DAMS

Dam	Dam Capacity (m ³)	Catchment Area (ha)	1 in 100 year x 72hr Storm Runoff (m ³)
Plant Runoff Dam	25	8	10
Tailings Embankment Runoff Dam	40	13	16
Tailings Dam*			
Stage 1	60	15	24
Stage 2	80	15	24
Stage 3	120	15	24

* Allows for a minimum of 1 m of water on the tailings surface.

An overflow channel will be constructed from the dam to the open cut. This feature is to ensure that any water in excess of the design capacity is directed to the open cut and not the Hackney Creek catchment. Although it is most likely that water in this dam will only contain suspended solids, the overflow channel provides a safety precaution.



Tailings Embankment Runoff Dam

This dam will collect runoff from part of the site haul road system and from the outer surface of the tailings dam. The dam has been categorised as a process water dam as there is potential, albeit negligible, for seepage from the tailings dam into the tailings embankment runoff dam.

Tailings Dam

The tailings dam has been designed to contain all tailings produced through the life of the project. The Company has examined two methods which would ensure that seepage, albeit small, from the tailings dam does not lead to the contamination of the surrounding streams.

1. Chemical Destruction Of Cyanides

Several procedures for the removal of cyanides from solution have been utilised, including natural degradation, alkaline chlorination, ozonation, hydrogen peroxide oxidation and the INOO Sulphur dioxide/air oxidation technique. The most popular and extensively adopted process is natural degradation but when this is not considered adequate the use of alkaline chlorination is often the preferred route.

The basic chemistry when using sodium hypochlorite as the oxidising agent is as follows:



Alkaline chlorination effectively eliminates hydrogen cyanide, simple and complex cyanides, of copper, nickel, zinc and cadmium and thiocyanates, however, does not decompose ferrocyanides.

The advantages and disadvantages of using alkaline chlorination are set as follows.



Advantages

- (i) Widely used method, thus expertise is available;
- (ii) Feed to processing is already basic;
- (iii) Reaction is reasonably rapid;
- (iv) Any toxic metals which may be available are removed as metal cyanide complexes.
- (v) Adaptable for either continuous or batch operations.

Disadvantages

- (i) Reagent costs are high, particularly if complete oxidation is required;
- (ii) Requires careful control of pH to prevent formation of cyanogen chloride;
- (iii) Cyanide is not recovered;
- (iv) Ferrocyanides are not decomposed.

2. Increased Impermeability

Tests show that the clay and weathered sandstone unit underlying the tailings will have a permeability of $<10^{-9}$ m/sec particularly if recompacted. A blanket of such impermeable material will significantly reduce initial seepage rates and also marginally reduce long term seepage. Further investigations will show the extent of the existing blanket and where additional compaction is required to achieve a satisfactory uniform layer.



The Company prefers the engineering solution to reduce seepage rather than the proposal for alkaline chlorination. Despite this, further testing is being undertaken to ensure that by the time the tailings dam is to be built, its design and performance parameters are such that any seepage will be within accepted limits.

It is noted that prior to construction the dam design will need to be approved by the State Pollution Control Commission.

In addition, information on its location, height and storage capacity will be supplied to the Dam Safety Committee. If presented, as expected, the Committee will insist that the dam is designed and its construction supervised by qualified competent engineers.

4.2.4 Open Cut Dewatering

Any rainfall or groundwater infiltrating into the open cut will collect in a sump in the base of the open cut. Depending on the sump's location, water could be utilised for road watering. Any surplus water would be pumped into Sedimentation Dam No. 1 or 1.

4.3 SOIL MANAGEMENT

The Company will ensure that the soil resources on site are carefully managed by:

- (i) Separate stockpiling of the topsoil and subsoil. Table 4.1 lists data on the proposed stockpiles. All stockpiles shown on Figure 2.2 have been calculated assuming a maximum height of 1 m.
- (ii) All soil stockpiles will be seeded and fertilized during the first favourable conditions.



- (iii) The subsoil and topsoil will be replaced separately on areas to be rehabilitated.
- (iv) Adequate drainage controls will be incorporated to ensure soils are not eroded throughout the construction and operational stages of the project. The drainage controls are detailed in Section 4.2.3.
- (v) Revegetation of disturbed and rehabilitated areas as soon as is practical. It may be appropriate in some areas to undertake temporary stabilisation by sowing a cereal crop on the affected area.

TABLE 4.3
SOIL STORAGE - LUCKY DRAW GOLD PROJECT

Stockpile No.	Source of Soil	Av. Depth of Soil Removal (cm)	Volume of Soil (m ³)	Storage Area (ha)
1T	Tailings Dam	20	45,000	4.7
2T	Tailings Dam/ Runoff Dam	20	16,000	1.7
3T	Treatment Plant	10	7,500	0.8
4S	Treatment Plant	15	11,200	1.2
5T	Haul Road	15	5,800	0.6
6S	Haul Road	15	5,800	0.6
7S	Mine Waste Dump	15	18,000	1.9
8T	Mine Waste Dump	10-15	18,000	1.9
9T	Open Cut	10	10,000	1.0
10S	Open Cut	10-15	10,000	1.0

Note: No subsoil will be stockpiled from the tailings dam area since it is required for sealing purposes.



Sufficient soil will be stored to enable the satisfactory rehabilitation of the components outlined in Section 2.12.

4.4 SAFETY MANAGEMENT

4.4.1 Public Safety

The Company will institute a policy to ensure that no members of the public are put at risk by the activities on site. The policy will ensure that no members of the public traverse SR 30 (Moss Grove Road) during blasting. The fences around the sites will be maintained with appropriate signs advising members of the public of the dangers on site., The closest point of the open cut to SR 31 is 400 m which is essentially the limit of safety with respect to requirements by the Department of Industrial Relations.

It is noted that all of the Company's plant and installations lie closer than 400 m, hence, the Company has considerable confidence that fly rock will not be a problem at a distance of 400 m.

Chemicals transported to the site will be packaged in safe containers to ensure members of the public travelling on the district's roads would not be affected by their transportation.

4.4.2 Mine Safety

All safety requirements within the mining lease are governed by the Mines Inspection Act, 1901 and administered by the Department of Industrial Relations.

The Mines Inspection Act, 1901 stipulates the requirements for the occupational safety of employees and the general working conditions in and around the mine. The mine will be regularly inspected by the Department of Industrial Relations (Mechanical, Mine and Electrical Inspectorate). The Act requires that a competent person, acting as manager, is responsible for the control and management of the mine.



The mining contractor and all contractors on site are required to observe the requirements of the Mines Inspection Act and all directions from the manager as required. Company supervisory personnel regularly brief employees on any safety hazards and adequately train employees to avoid accidents.

Personnel safety equipment such as safety boots, safety hats, eye and hearing protection is readily available. The use of safety hats and safety boots is mandatory on the site. Eye and hearing protection is required in risk areas and their use actively policed.

4.4.3 Cyanide Compounds

The Company will adopt strict safety standards to ensure that the health and safety of employees is not endangered through the use of cyanide and other reagents used on site.

The following measures will be undertaken in the handling and use of cyanide compounds, in accordance with the requirements set by the Department of Industrial Relations:

- (i) Protective measures to avoid ingestion or inhalation of cyanide such as:
 - (a) Mixing of all cyanides in alkali solution in specially constructed covered mixing tanks with the operator standing well clear in a well ventilated area.
 - (b) Strict use of protective clothing and breathing protection in the mixing area;
- (ii) Instructions on the safe use of cyanide;
- (iii) Good personal hygiene such as the washing of hands before eating and the prohibition of any food, drink, eating and smoking in the cyanide area;



- (iv) Oberon and Bathurst District Hospitals will be advised that cyanide compounds are being used at the mine and will have appropriate emergency equipment available;
- (v) Emergency procedures will be established and specific cyanide first aid kits will be held on site;
- (vi) Cyanide compounds are stored in a secure area;

The following specific regulations relate to the storage of concentrated liquid cyanide, in particular in the leach and adsorption tanks:

- (a) Where concentrated liquid cyanide is stored in a tank or tanks in an amount which exceeds 1,000 litres, a bund shall be constructed around the tank or tanks, or a lined collection basin.
- (b) If constructed, the bund or storage pond shall be:
 - (1) Away from the tank or tanks at a distance of at least half of the height of the tallest tank;
 - (2) Capable of containing at least 120 per cent of the capacity of the largest tank.
- (c) If the lined sump is constructed, it shall be:
 - (1) Downslope of all tanks;
 - (2) Capable of containing at least 120 per cent of the capacity of the largest tank.



- (vii) Tailings disposal dams containing cyanide compounds are fenced off.

4.5 NOISE CONTROLS

4.5.1 Site Preparation

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

Normal construction noise e.g. hammering, will occur primarily between the hours of 7.00 am and 10.00 pm daily.

4.5.2 Open Cut

The main sources of noise during mining will be equipment preparing the site, drilling, blasting and loading/transportation of rock. For most of the life of the mine, it is expected that the mining operation will be restricted to two shifts a day, 6 days a week. However, during the second year it is expected that waste rock will be hauled continuously. Table 4.4 lists the equipment likely to be used in the quarrying operation, the proposed safeguards and measured spectator noise levels. Since the Company proposes to engage a contractor to undertake the mining on their behalf, they will stipulate in any contract that all equipment will be fitted with appropriate safeguards such as mufflers and engine cowling to ensure the requirements of the State Pollution Control Commission are satisfied.



4.5.3 Treatment Plant

The dominant source of noise between the hours of 7.00 am and 7.00 pm from the processing plant will be the crushers. At night between the hours of 7.00 pm and 7.00 am the main noise source at the plant will be the ball mill.

Table 4.4 also lists the main noise sources in the treatment plant, the proposed safeguards, and measured spectator noise levels.

Few additional safeguards could be undertaken around the processing plant to limit noise generation.

4.6 CONTROLS ON BLASTING

The controls to be placed on the blasting within the open cut are required to ensure that:

- (i) The generation of dust and fly rock is minimised.
- (ii) Ground vibration from blasting is limited to acceptable levels to avoid any problems with the Company's treatment plant and surrounding residences. The closest residence is 2.7 km to the closest edge of the open cut.
- (iii) Noise levels at surrounding residences are within acceptable limits.

The following safeguards will be incorporated into the Company's blasting practice:



TABLE 4.4

SOURCES OF NOISE - OPEN CUT AND TREATMENT PLANT

Noise Source	Proposed Safeguards	Noise Level dB (A) at 7m	Source of Noise Level
OPEN CUT			
Compressor	Silenced model	75	Atlas Copco Aust.
Track Drill	Specially designed hood, shield and hoses	93	Richard Heggie Associates
D8 Bulldozer	Standard muffler	85	Richard Heggie Associates
Dump Truck	Standard muffler	89	Richard Heggie Associates
Front-end loader	Standard muffler	88	Waugh & Josephson
Excavator		89	Richard Heggie Associates
TREATMENT PLANT			
Primary Crusher	Partially enclosed	92	Richard Heggie Associates
Secondary	Partially enclosed	87	Richard Heggie Associates
Ball Mill	Rubber lined	89	Richard Heggie Associates
Product Truck		86	Richard Heggie Associates



- (i) Adequate stemming of the drill holes will ensure the airblast is reduced to an acceptable level.
- (ii) The detonating system will be adequately confined either within the hole or covered with waste materials prior to blasting.
- (iii) Cracks and fissures in the rock face will be avoided so that the burden on the material to be fragmented will be even. Consequently, premature fragmentation will be avoided. The amount of explosives in each hole will be adjusted to account for the natural jointing and hence avoid over-charging.
- (iv) The type of explosive will be selected to suit the rock to be fragmented.
- (v) Ground vibration will be kept within the specified limits by:
 - (a) Keeping the material to be blasted to a suitable volume by adjusting the distance between the blast holes and the fence.
 - (b) Care will be taken in the spacing of the blast holes.
- (vi) A test blast will be carried out using the above safeguards to check fragmentation and re-evaluate site constants. The airblast overpressure and ground vibration will be monitored to ensure that the specified limits discussed in Section 5.9 are not exceeded and to assist in the design of future blasting.
- (vii) Blasting will only be undertaken during acceptable meteorological conditions.



The Company is simultaneously applying to the State Pollution Control Commission for the necessary approvals sought under Section 17 of the State Pollution Control Act.

4.7 VISUAL CONTROLS

The Company will undertake, where appropriate, tree planting, progressive rehabilitation and painting to ensure the visual impact of the project is minimised.

Due to the site's prominent location, few visual controls are possible to shield the treatment plant. The site will, however, be kept tidy and all above ground structures painted in a green hue. No controls are possible to reduce impacts from lighting to the plant.

The progressive rehabilitation of the waste rock dump will ensure that the outer surface of the dump does not become visually obtrusive.

The Company proposes to undertake limited tree planting on the eastern side of MLA 316 adjacent to SR 31 primarily in an area where the existing tree screen adjacent to the road is relatively thin. The area of the tree screen is shown on Figure 2.10. This area should be sufficiently dense within 3 years to shield the tailings dam in that area.

Tree planting is not envisaged elsewhere since the benefits would not be realised throughout the life of the project.

4.8 BUSHFIRE CONTROLS

The Company will incorporate the following controls in their project to reduce the potential of fire starting or spreading within the project site:



- (i) The Company will maintain a supply of knapsacks and McLeod tools for fire fighting purposes;
- (ii) Burning of trees will be carried out under permit from the local fire officer;
- (iii) The bulldozers and front-end loaders on site would, as required, be available to assist in preparing fire breaks;
- (iv) The Company will instruct all employees regarding potential fire hazards and both preventative and remedial measures necessary;
- (v) The Company will work closely with the local bushfire control authority to ensure strategies, etc. are developed to prevent or control any fire outbreaks.
- (vi) The Company's water tanker used for dust suppression will also be fitted with fire fighting equipment.

4.9 CONTROLS FOR THE INSTALLATION OF SERVICES

4.9.1 Power

The Southern Mitchell County Council will essentially be following the existing cleared route to upgrade the power line to the site. Only a few trees adjacent to the roadway near the site will need to be removed.

4.9.2 Water

If the preferred route for the water line is implemented, the principal controls on the installation of the pipeline will be:



- (i) All topsoil and subsoil will be separated during excavation of the trench and will be replaced in a similar manner. The disturbed area will be sown with a seed mixture approved by the landowner and fertilized.
- (ii) Where necessary, trees and shrubs will be replaced with tube stock.
- (iii) All fences would either be repaired or the installation undertaken without cutting fences.
- (iv) The pipe will be buried to a depth of at least 900 mm to ensure it does not interfere with any agricultural activities.
- (v) Installation will be undertaken over the shortest time possible and will be undertaken progressively to ensure the length disturbed at any one time is small.
- (vi) The location of the pipeline will be surveyed for future reference and marked at all fence crossings.

If the route adjacent to SR 31 is implemented the above safeguards will also apply. The only additional control will be the need to avoid removal of trees where practicable.

4.10 ENVIRONMENTAL MONITORING

4.10.1 Objectives

Environmental monitoring is undertaken to quantitatively determine the degree of impact the mining and treatment operations are having on the surrounding environment. Assessment of these results can 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.



A condition of mining leases for new mine developments is the preparation of a Mining, Rehabilitation and Environmental Management Plan. Such a Management Plan and Annual Reports provide a mechanism for presenting and reviewing the results of environmental monitoring carried out during the life of the project.

4.10.2 Water Quality Monitoring

Surface Water

The Company has undertaken a series of samples at 10 sites as pre-mine baseline data. These sites are shown on Figure 3.5. Baseline hydrogeochemistry of catchments around the ore body have also previously been examined by the Department of Mineral Resources.

Monitoring of water quality at all of these sampling sites will be undertaken by the Company quarterly throughout the first year of operation. Any reduction in sampling will be reviewed in the first annual report of the MREMP.

In addition to the above sample sites, all surface water impoundments within the granted mining lease area will be similarly monitored. Parameters to be assessed in water quality monitoring include those already measured and results presented in Table A5.1 - Append 5. The only additional parameter to be measured with the cyanide.

Subsurface Waters

A series of piezometers will be positioned below the tailings dam to monitor against potential seepage and movement of fluids into the groundwater system. These piezometers will be positioned along the base of the tailings dam wall. Two piezometers will be positioned below the dam embankment runoff pond and on the lease boundary. The location of piezometers are shown on Figure 2.10.



The piezometers will monitor to a depth of approximately 12 m. The groundwater level in the vicinity of the tailings dam is approximately 7 m.

The piezometers will be sampled bi-monthly and groundwaters analysed for the same range of parameters for surface water monitoring (see section above).

4.10.3 Noise Monitoring

The Company will undertake noise monitoring at the nearest residences during the construction phase and during full operational phases to confirm noise level predictions.

It is anticipated that such noise level monitoring results will be reported on to the State Pollution Control and to the Department of Mineral Resources as part of Annual Report requirements of the Management Plan.

Vibration and airblast overpressure levels will be monitored throughout mine life at nearest residences to confirm compliance with statutory comfort and structural criteria limits.



SECTION 5

**THE PROJECT'S IMPACT
ON THE ENVIRONMENT**

SECTION 5

THE PROJECT'S IMPACT ON THE ENVIRONMENT

5.1 TOPOGRAPHY

At the end of the mine life there will be four noticeable changes to the local topography.

- (i) A void up to 80 m deep will be left near the top of an existing ridge.
- (ii) The waste rock emplacement surrounding the open cut will be marginally higher than the existing ridge and have steeper slopes than the existing topography.
- (iii) Areas required for the treatment plant site and mining contractor's compound will be levelled, however, such changes will be relatively minor.
- (iv) A near flat topography will be created on the tailings dam at the completion of the project which is different to the existing gentle sloping valley.

The impact of the above changes will be variable, however, greatest impact is expected from the creation of the single waste rock emplacement.

5.2 DRAINAGE

The principal impacts of the project on the local drainage system are:



- (i) The retention of small quantities of water near the headwaters of Hackney Creek and Thompsons Creek. The impacts of the reduction in runoff to the streams will be negligible, especially since there are no dams within the immediate vicinity that would suffer from any reduction of surface flow.

- (ii) The impact of the diversion banks adjacent to the tailings dam will be negligible because the area served by these banks is small.

5.3 WATER RESOURCES

5.3.1 Surface Water

Occurrence

The occurrence of surface water within and around the project site will change slightly during and after the life of the project. The dams designed to collect runoff from the disturbed areas of the site and the tailings dam will marginally reduce flows in local streams, however, the impact will be negligible.

Quality

The controls set out in Section 4.2 to minimise the quantity of water to be contaminated and the high standard of design criteria for the sedimentation dams, will ensure that virtually no sediment-laden water will leave the site. The only occasion when this may occur is following extensive rains when the capacity of the dams is exceeded. The impact of any discharge at this time would be slight since all streams in the district would be carrying above average flows and concentrations of suspended solids.



No contaminated water will be released from the site principally because of the design criteria adopted for the tailings dam and the use of an emergency overflow from the plant runoff dam to the open cut.

The Company's proposal will not allow any contaminated surface water to enter the Thompsons Creek catchment. Accordingly, there will be no impact upon the quality of water in Burraga Dam.

The satisfaction of all the water quality requirements of the State Pollution Control Commission within Thompsons Creek and Hackney Creek will ensure that water quality in the Abercrombie River is not adversely affected.

5.3.2 Groundwater

Occurrence

Groundwater inflow to the open cut could lower the surrounding water table by amounts decreasing with distance from the pit. At a distance of 1.5 km and beyond the effect of mining is estimated to be too small to monitor compared to normal seasonal rainfall variations. The nearest existing groundwater user is 3.5 km from the pit and should not be affected by mining.

There will be a gradual increase in the rate of inflow into the open cut to a predicted maximum level of 270 m³/day. Throughout the life of the project the reduction in the level of the water table will result in the reduction of flow from some of the springs primarily to the Hackney Creek catchment. Any landowner disadvantaged by reduced flows from springs will be provided with water pumped from either the Company's on site dams or Burraga Dam.

At the completion of the mine life, the water table will return to existing levels and hence the springs would again flow naturally.



Marginal increases in flows could be expected in future years within Hackney Creek as seepage from the tailings dam reaches the creek system. A seepage rate from the dam has yet to be established, however, it is unlikely to noticeably increase stream flows. Seepage will gradually decrease as rehabilitation progresses. The level of seepage is naturally dependent upon the achieved permeability in the re-compacted clay layer and the underlying parent rock. The bulk of the seepage will flow down gradient within the Hackney Creek catchment. This seepage, carried with groundwater flow, is expected to be at a lower elevation than the existing creek bed and therefore is unlikely to enter the creek at the confluence of the surface drainage lines, and is more likely to enter the creek further downstream.

Significant inflow or seepage is not expected into the Thompsons Creek catchment as a result of the tailings dam. A granite subcrop will potentially prevent seepage in this direction. It will only be during Stage 2 of the tailings disposal that heads within the tailings dam will be sufficient to allow seepage in that direction.

Further testing proposed will ensure that sufficient information is known prior to the final design and construction of the tailings dam. This information will assist in minimising the impact of the tailings dam.

The proposed open cut will extend below the existing water table and pit inflows will occur. Inflow estimates based on drill hole tests give an initial rate of 90 m³/day at the end of Year 1, increasing to 270 m³/day at the end of mining in Year 4. These estimates are considered accurate to ± 50 per cent.



Quality

The existing groundwater quality is unlikely to change substantially as a result of the project. The clay lining of both the tailings dam and plant runoff dam will ensure seepage is minimised and hence the level of cyanide kept to acceptable levels when it finally reaches the creek system. The virtual absence of other metals in the tailings will also result in few changes in groundwater quality.

5.4 SOILS

The design and operational safeguards outlined in Section 4.3 will ensure the soil resources on the site are properly removed, stored and replaced. The Company's intention to maintain all soil on site in good condition throughout the project will result in negligible impact on the soil resources.

5.5 AIR QUALITY

The safeguards outlined in Section 4.1 will ensure the dust levels in the vicinity of the project site are not increased significantly above the levels typical of a rural area. Limited dust could be expected from:

- (i) Soil stripping activities (depending on season). The impact of this operation, which will be of short duration, is minor, especially since it will be comparable to nearby plowing/scarifying activities.



- (ii) Dust from local roads. The increased use of local roads will result in increased dust levels in the immediate vicinity of the roads. Hence, dust levels are likely to increase noticeably adjacent to the road between Truscotts Flat and the project site. Fortunately, no residences are within close proximity to this road, and hence, the impact of the additional traffic should be minor.

The measures outlined in Section 4.1 to control potential air contaminants other than dust should ensure the impacts from the sources are negligible.

5.6 FLORA/FAUNA

The development of the open cut and construction of tailings dam will result in the loss of some of the vegetation cover. The vegetation communities within the Project Site are distributed widely throughout the Central Tablelands and contain no rare and/or endangered plant or animal species hence, the impact from the land clearing will be slight.

The removal of small stands of woodland vegetation on both the open cut site and tailings dam site will have some impact upon the fauna of the area, primarily birds. This minor loss of habitat for birds is negligible compared with the impact upon birdlife resulting from the development of the adjacent and district pine plantations.

Hackney Creek has been modified by the removal of riverine vegetation (by clearing and stock trampling), water extraction and damming. It is still, however, an important local aquatic habitat and a principal objective of the project's environmental management and water quality monitoring is to maintain the biological integrity of this creek system.



The drawdown of underground water as a result of the mining of the open cut could marginally affect the supply of water to the dams on the nearby properties. At present these dams support a limited range of plants and wildlife. Any change in the amount of water in the dams would not have a significant impact on the regional status of the flora and fauna.

The fish, wildlife and stock within the Hackney Creek catchment will not be adversely affected by the limited long term seepage from the tailings dam since it will be ensured that levels of any contaminants in discharge satisfy the requirements of the State Pollution Control Commission.

The installation of the water pipeline along the Burruga-Oberon Road (SR 31) will result in the removal of a number of eucalypt trees. The impact of this removal will be moderate, although the Company intends to minimise the number of trees disturbed.

5.7 NOISE IMPACTS

5.7.1 Design Goals for Rural Areas

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 will often be a change in the noise climate.

To assist in balancing the individual and community effects and benefits arising from such situations, the State Pollution Control Commission has drafted a schedule of recommended background noise levels for various land use categories. An extract from the schedule relating to the two most stringent classifications is shown in Table 5.1.



TABLE 5.1
RECOMMENDED NOISE LEVELS AT RESIDENCES

Zoning Description	Time Period*	Recommended Acceptable	Limit L ₉₀ Maximum
Residences in rural areas	Day	45 dB(A)	50 dB(A)
	Night	35 dB(A)	40 dB(A)
Residences near industrial areas	Day	50 dB(A)	55 dB(A)
	Night	40 dB(A)	45 dB(A)

* For Monday to Saturday, "day" is defined as 7.00 am to 10.00 pm

The "acceptable limits" recommended by the State Pollution Control Commission for residences in rural areas for daytime operation is 45 dB(A) (maximum limit of 50 dB(A), and 35 dB(A) for night time operations (maximum limit of 40 dB(A).

The State Pollution Control Commission's overall objective is for background noise levels not to exceed the specified acceptable limit. Where the recommended acceptable level is not achievable (for technical or economic reasons), then the lowest level achievable may be permitted, provided the resultant noise levels at the receptors do not exceed the maximum noise level limit.

5.7.2 Predicted Noise Levels

The impact of the project on the local noise climate will be negligible, that is, at surrounding residences and Burraga township. Table 5.2 presents the predicted noise levels at selected residences around the project site. The levels have been prepared adopting a "worst case" situation where the following equipment was operating at one time:



- 3 x haul trucks;
- 1 x hydraulic drill & compressor;
- 1 x primary crusher
- 1 x secondary crusher;
- 1 x ball mill.

All calculations include attenuation due to hemispherical divergence, atmospheric absorption, ground cover and topographic barriers where appropriate.

TABLE 5.2
PREDICTED NOISE LEVELS

Residence	"Ben Ledi"	"Green Wattle"	"Buck-burraga"	Burraga P.O.
Noise Level dB(A)	24	19	5	8

In the event of a slight wind or a temperature inversion, the levels set out in Table 5.2 could rise by as much as 8 dB(A). These levels would still satisfy the State Pollution Control Commission criteria.

Since the worst situation on site satisfies the requirements of the State Pollution Control Commission, then all other activities will also satisfy the criteria.

The closest activity on the project site to any residence will be the use of trucks and a bulldozer during the construction of the saddle dam on the eastern side of the tailings dam. At that time, for a short period, the noise levels heard at "Ben Ledi" would be in the order of 27 dB(A) which again is well within the limits set by the State Pollution Control Commission.



5.8 BLASTING

5.8.1 Criteria for Assessment

Ground Vibration

Australian Standard 2187, Part 2-1983 "Use of Explosives" recommends the peak particle velocity from a blast should not exceed 10 mm/sec at residences. The State Pollution Control Commission suggests limits lower than the Australian Standard at 5 mm/sec between the hours of 9.00 am and 3.00 pm (Monday to Saturday) and 2 mm/sec between 6.00 am and 9.00 am and between 3.00 pm and 8.00 pm (Monday to Saturday).

Outside of these hours (including public holidays) the limit is 1 mm/sec. The State Pollution Control Commission's suggested limits are presented in Table 5.3.

The limits for ground vibration are set to ensure that surrounding homes are not damaged and nearby residents not alarmed by obvious movement of objects within their homes.

Airblast Overpressure

The State Pollution Control Commission suggests limits of 115 dB linear or unweighted decibels (approximately 85 dB(A)) for airblast overpressure or peak sound level during the hours of 9.00 am to 3.00 pm Monday to Saturday. Lower levels are set outside these hours. For comparative purposes, 85 dB(A) is similar to the noise level heard by a person slamming a car door.



TABLE 5.3
STATE POLLUTION CONTROL COMMISSION CRITERIA FOR BLASTING

Time of Blasting	Blast Overpressure Level (dB(linear))	Ground Vibration Peak Particle Velocity (mm/sec)
Monday-Saturday 9.00 am - 3.00 pm	115	5
Monday-Saturday 6.00 am - 9.00 am	105	2
3.00 pm - 8.00 pm	105	2
Sunday and Public Holidays 6.00 am - 8.00 pm	95	1
Any Day 8.00 pm - 6.00 am	95	1

5.8.2 Assessment of Impact

The distant proximity of all non-mine related residences will ensure that all criteria associated with blasting will be easily satisfied. It is likely that a number of surrounding residents will hear the blast depending on prevailing winds. The sound will, however, be comparable to a relatively quiet "thud". All local residents will be advised of the regular time of blasting to ensure there is no alarm caused.

Table 5.4 presents the predicted levels of airblast overpressure and ground vibration at selected surrounding residences. The results indicate that both criteria will be well within the limits set by the State Pollution Control Commission. The levels predicted are based on an average blast yielding 10,000 tonnes of broken rock.



TABLE 5.4
PREDICTED IMPACTS FROM BLASTING

Residence	Airblast Overpressure (dB(linear))	Ground Vibration (peak particle velocity) (mm/s)
"Ben Ledi"	102	0.4
"Green Wattle"	99	0.3
"Buckburruga"	97	0.2
Burruga Township	96	0.2

5.9 LAND USE AND ADJACENT LANDOWNERS

5.9.1 Site's Land Use

The site's land use will return primarily to grazing at the completion of the project. The open cut, when partly filled with water, will become an important part of the ongoing agricultural activities on the land. The permanent water supply will be of considerable value to stock watering on the property. Areas where there will be reduced availability for grazing will be at the slopes of the waste rock dump and the downstream side of the tailings dam. The surface of the tailings dam will provide a long term grazing site, however, its use for this purpose may be delayed, depending on the time period required to properly rehabilitate the surface of the dam.



5.9.2 Surrounding Land Uses

The proposed developments on the project site should not effect the current activities on the adjacent land. Noxious weeds and rabbit infestation will be eradicated in accordance with guidelines recommended by the Upper Macquarie County Council. Whilst it is likely that increased noise levels may deter some stock approaching the site, it is often only a matter of time before stock becomes used to the noise levels. In any case, the stock may graze near the boundary during the quieter periods of 10.00 pm to 7.00 am.

5.9.3 Surrounding Pine Plantations

The adjoining pine plantations will not be affected by the project since changes to air and water quality as a result of the project will be minor. Whichever access road is selected, the owners of the adjoining pine plantation will be provided access to their property. Access to the adjoining plantation via SR 30 would be limited only at times of blasting.



TABLE 5.5
LANDUSE AFTER PROJECT COMPLETION

Project Components	Area (ha)
Areas permanently lost to current usage	
Tailings Dam Batter	6.5
Open Cut	<u>12.5</u>
Sub Total	19.0
% of total area disturbed = 27	
Areas to be returned to current usage	
Tailings Dam Top	15.5
Treatment Plant	5.6
Waste Rock Emplacement	19.4
Roads	4.0
Contractors Compound	<u>0.8</u>
Sub Total	45.3
% of total area disturbed = 65	
Area to be returned to different usage	
Dams - Process Water Dam	2.3
- Sedimentation Dam No. 1	0.5
- Sedimentation Dam No. 2	0.5
- Sedimentation Dam No. 3	0.3
- Plant Runoff Dam	<u>1.7</u>
Sub Total	5.3
% of total area disturbed = 8	
<u>Total Area</u>	<u>69.6 ha</u>



5.9.4 Surrounding Residents

The residents surrounding the site and those within the Burruga district will become aware of the project primarily through its visibility and increased traffic levels. Some residents may be able to hear the operation under still, clear meteorological conditions.

5.10 TRANSPORTATION NETWORK

5.10.1 Introduction

In order to provide a basis for the assessment of the project's impact on the local road network, the Company has attempted to forecast both the routes and traffic movements for the life of the project. At this stage, it is apparent that Shire Road 31 will carry considerably more traffic than at present. The Company's proposal to upgrade Shire Road 31

between Truscotts Flat and Burruga to an all-weather road will ensure the potential for accidents on this section of road are minimised.

The impact on other district roads will be minimised during periods of poor weather by restricting access of the site to routes with predominantly sealed roads and satisfactory unsealed roads.

5.10.2 Traffic Movements

The project will result in increased traffic levels on the local road network particularly at times related to shift changes on the Project Site.

The projected average traffic level of 64 vehicle movements per day during construction and 72 vehicle movements per day during operation will be noticeable when compared to existing traffic levels. However, the combined total traffic levels will still be small.



During the construction period, traffic levels on Main Road 252 to Bathurst will increase on average by 28 per cent while those on Shire Road 31 to Oberon will increase by an estimated 30 to 40 per cent. The traffic on the remaining local roads will increase marginally.

During the operation of the mine and treatment plant traffic levels to Bathurst (MR 252) will increase on average by 33 per cent while the level on Shire Road 31 to Oberon will increase by an estimated 15 to 20 per cent. The vehicles will be predominantly employee's cars and supply trucks. Maximum traffic levels to and from the site will increase the above levels by as much as 40 per cent.

The greatest increase in traffic levels during both the construction period and operation of the project will occur on SR31 between Truscotts Flat and Burruga.

During the construction phase the vehicle mix will be noticeably different due to the large number of low loaders and trucks travelling to and from the site. Once operational, the traffic mix will return to levels similar to existing levels, that is, predominantly cars with a few trucks.

5.10.3 Road Surface

The increased traffic levels are not likely to adversely affect the road surface significantly under good weather conditions since the total number of vehicles using the road network will still be relatively small. Possible damage could be caused during periods of poor weather when vehicles are delivering plant components to the site or the delivery of consumables by large truck or semi-trailer as outlined in Table 2.7. The most likely damage caused by the above vehicles would be to the road shoulders (sealed roads) and the road surface on unsealed roads.



5.11 VISIBILITY

The project will be visible in its local setting. Greatest visibility will be from the Burruga-Oberon Road. A number of residents to the south of the project site near Burruga will be able to view the site. The project site will also be visible of an evening due to the large quantity of lighting required.

The project's visual impact will be reduced by implementing the safeguards outlined in Section 4.7.

Although visibility is considered a major constraint for the project, the overall visual impact is not considered major especially since the project is of a relatively short duration and considerable interest is expected in the project from local and district residents and tourists.

5.12 SOCIO-ECONOMIC FACTORS

5.12.1 Population

The project will result in minor increases in district population as the Company imports specialist personnel to operate the project. Since most of the employees are expected to be recruited locally, significant increases in population are not expected.

5.12.2 Employment

The provision of up to 75 jobs during the construction phase and 65 permanent jobs for the four year project life will provide increased employment opportunities for local persons, especially those with a farming/machinery background.

The indirect employment benefits of the increased direct employment is likely to be observed throughout the district.



5.12.3 Burraga District

The project will have considerable socio-economic impact on the Burraga district and to a lesser extent on the Rockley-Bathurst area. This impact will arise from the provision of employment with an annual wage bill of approximately \$2m. The provision of water to the project from the Burraga Dam will in turn result in increased income for the Burraga and District Community Association.

5.14 SERVICES

5.14.1 Power

The upgrading of the Rockley-Truscotts Flat 11 kV power line will not only benefit the Company as it will provide a more reliable supply to a number of district residents. In the longer term, the line will form part of a ring main which again will improve the service for district residents.

The construction of the upgraded power line adjacent to the existing line will avoid removal of any trees.

5.13.2 Water

The Company's water requirement will be easily met from the Burraga Dam without reducing the dam level and restricting current water users.

The current annual demand for water from the dam is approximately 27 megalitres which represents approximately 13 per cent of its total capacity. The Company's initial monthly water requirement.

Installation of the water pipelines from the dam to the site can be undertaken without much destruction of vegetation.



5.13.3 Telephone

The Company's telephone requirements will be supplied by Telecom without detrimental impact to other consumers. The upgrading necessary to provide the Company's communication requirements will also benefit district residents.



SECTION 6

EVALUATION OF THE PROJECT

SECTION 6

EVALUATION OF THE PROJECT

6.1 JUSTIFICATION OF THE PROJECT

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

6.1.1 Environmental Considerations

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

- (i) Increased traffic on local roads;
- (ii) Visibility of the treatment plant and waste rock emplacement;
- (iii) Increased noise levels, however, all noise levels will be within State Pollution Control Commission limits.

Safeguards adopted in both the design and operation of the project will ensure air pollution and water pollution problems will be minimised and kept within acceptable limits.

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



6.1.2 Economic Considerations

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

(i) Burraga District

The local community will benefit from the project through provision of jobs, increased local spending, upgraded telephone and power services and the Company's contribution to the purchase of water from Burraga Dam.

Much of the annual wage bill of \$2 million will be spent locally on accommodation, food, services and refreshments.

(ii) New South Wales

The State will benefit from increased employment, payroll tax and royalties.

(iii) Australia

The Commonwealth will also benefit from increased employment, taxes and improved foreign exchange.

6.1.3 Social Considerations

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

- (i) Provision of approximately 65 permanent jobs and considerable indirect employment;
- (ii) A limited need for local housing;
- (iii) Local services will be used wherever appropriate.



- (iv) It is possible that the project may draw employees from other industries in the area, e.g. farming, shearing and forestry. This in turn may attract other persons to the district.

6.2 CONSEQUENCES OF NOT PROCEEDING WITH THE PROJECT

1. An economic gold deposit, at present day prices, would remain in the ground;
2. The economic benefits outlined in Section 6.1.2 would not eventuate;
3. The Company's shareholders would not benefit from a profitable mining operation.



REFERENCES

- Bowman, H.N. (1972) Burruga Copper Mine, Burruga. A record of the Geological Survey of New South Wales, 16(2) pp.159-222.
- Miller, S., Murray, G. and Miedecke J., 1987 Design and Management of Environmentally Sound Waste Disposal Practices at Gold Mining and Processing Operations. Proceedings of Australian Mining Industry Council, Environmental Workshop, 1987, Darwin.
- Brooks, K.A. and McGlynn, J.A., 1987 Cyanide in Gold Mining Effluents - Experience in New South Wales. Proceedings of Australian Mining Industry Council, Environmental Workshop, 1987, Darwin.



APPENDICES

APPENDIX 1

CORRESPONDENCE FROM
THE DEPARTMENT OF ENVIRONMENT & PLANNING

- . 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 and 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 onto 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 Mineral Resources in regard to requirements under the Mining Act.
- . The Soil Conservation Service regarding appropriate erosion control and rehabilitation procedures;
- . The Department of Agriculture if prime agricultural land may be affected by the proposal; 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.



Department of Environment and Planning



R W Corkery & Co Pty Limited
PO Box 80
ORANGE NSW 2800 58

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

Telephone: (02) 266 7111 Ext. 7235
Telex: DEP NSW 176826
Fax No.: 266 7599

Contact:

V Thomson

Our reference:

Your reference: DWR87/3109

4 JAN 1988

Dear Sir

RE: Proposed Lucky Draw Gold Mine
Portions 105, 56, 24, 93, 92 and 106 Parish Burruga,
County Georgiana

Thank you for your letter of 23 November 1987 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 Evans 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:

- . Interaction with forestry operations;
- . Implications for water supply and water quality for Burruga township, Thompsons Creek and Abercrombie River;
- . Offsite transport consequences;
- . Potential bushfire hazard;
- . Potential for extended use of processing plant for processing ore from other sites.

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 Evans Shire Council and take into account any comments Council considers may apply to its determination of the proposal.

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

Yours faithfully

B. Adams 4.1.88
B. Adams
Manager
Environmental Assessments Branch
As Delegate for the Director

DEPARTMENT OF ENVIRONMENT AND 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 Environment and 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 ENVIRONMENT AND 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 Environment and Planning to properly understand the environmental consequences of the proposed development.

1. Description of the proposal.

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

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.

APPENDIX 2

FLORISTIC AND FAUNAL SPECIES LISTS

TABLE A2-1
FLORISTIC SPECIES LIST

<u>Scientific Name</u>	<u>Common Name</u>
PTERIDOPHYTA	
<u>Pteridium esculentum</u>	Bracken Fern
ANGIOSPERMS	
DICOTYLEDONS	
Apiaceae	
<u>Hydrocotyle laxiflora</u>	
Asteraceae	
<u>Cassinia quinquefaria</u>	Spreading Sneezeweed
<u>Cirsium vulgare*</u>	Spear Thistle
Boraginaceae	
<u>Echium plantagineum*</u>	Patersons Curse
Campanulaceae	
<u>Wahlenbergia communis</u>	Native Bluebell
Dilleniaceae	
<u>Hibbertia obtusifolia</u>	Guinea-flower
Fabaceae	
<u>Acacia dealbata</u>	Silver Wattle
<u>Acacia melanoxylon</u>	Blackwood
<u>Daviesia latifolia</u>	Hop Bitter-pea
<u>Trifolium</u> sp.	Clover
Myrtaceae	
<u>Eucalyptus dalrympleana</u>	Mountain Gum
<u>E. dives</u>	Broad-leaved Peppermint
<u>E. macrorhyncha</u>	Red Stringybark
Pinaceae	
<u>Pinus radiata*</u>	Monterey Pine
Polygonaceae	
<u>Acetosella vulgaris*</u>	Sheep Sorrel
Rosaceae	
<u>Rubus ulmifolius*</u>	Blackberry
Santalaceae	
<u>Exocarpos cupressiformis</u>	Native Cherry

TABLE A2-1 (Continued)
FLORISTIC SPECIES LIST

<u>Scientific Name</u>	<u>Common Name</u>
MONOCOTYLEDONS	
Cyperaceae	
<u>Carex appressa</u>	
Juncaceae	
<u>Juncus continuus</u>	
Poaceae	
<u>Avena fatua</u>	Wild Oats
<u>Agropyron scabrum</u>	Wheat Grass
<u>Dactylis glomerata*</u>	Cocksfoot
<u>Danthonia sp.</u>	Wallaby Grass
<u>Hordeum leporinum</u>	Barley Grass
<u>Nassella trichotoma*</u>	Serrated Tussock
<u>Phalaris aquatica*</u>	Phalaris
<u>Poa labillardieri</u>	Tussocky Poa
<u>Poa sieberana</u>	Snow Grass
<u>Vulpia bromoides</u>	Rats-tail Fescue

* Introduced species.

TABLE A2-2
FAUNAL SPECIES LIST

<u>Common Name</u>	<u>Scientific Name</u>
1. MAMMALS	
Short-beaked Echidna	<u>Tachyglossus aculeatus</u>
Common Wallaroo	<u>Macropus robustus</u>
House Mouse	<u>Mus musculus</u>
Rabbit	<u>Oryctolagus cuniculus</u>
Feral Dog	<u>Canis familiaris</u>
2. BIRDS	
Australian Grebe	<u>Tachybaptus novaehollandiae</u>
Pacific Black Duck	<u>Anas superciliosa</u>
Grey Teal	<u>Anas gibberifrons</u>
Maned Duck	<u>Chenonetta jubata</u>
Australian Kestrel	<u>Falco conchroides</u>
Masked Lapwing	<u>Vanellus miles</u>
Gang-gang Cockatoo	<u>Callocephalon fimbriatum</u>
Galah	<u>Cacatua roseicapilla</u>
Sulphur-crested Cockatoo	<u>Cacatua galerita</u>
Crimson Rosella	<u>Platycercus elegans</u>
Eastern Rosella	<u>Platycercus eximius</u>
Laughing Kookaburra	<u>Dacelo novaeguineae</u>
Richards Pipit	<u>Anthus novaseelandiae</u>
Superb Fairy-wren	<u>Malurus cyaneus</u>
Striated Thornbill	<u>Acanthiza lineata</u>
Yellow-rumped Thornbill	<u>Acanthiza chrysorrhoa</u>
White-throated Treecreeper	<u>Climacteris leucophaea</u>
Noisy Miner	<u>Manorina melanocephala</u>
White-winged Chough	<u>Corcorax melanorhamphos</u>
Australian Magpie-lark	<u>Grallina cyanoleuca</u>
Australian Magpie	<u>Gymnorhina tibican</u>
Australian Raven	<u>Corvus coronoides</u>

- any of these are landings? -

TABLE A2-2 (Continued)
FAUNAL SPECIES LIST

<u>Common Name</u>	<u>Scientific Name</u>
3. REPTILES	
Eastern Grass Skink	<u>Lampropholis quichenoti</u>
Eastern Blue-tongued Lizard	<u>Tiliqua scincoides</u>
Shingleback	<u>Trachydosaurus rugosus</u>
Copperhead	<u>Austrelaps superbus</u>
Eastern Tiger Snake	<u>Notechis scutatus</u>
Red-bellied Black Snake	<u>Pseudechis porphyriacus</u>
Eastern Brown Snake	<u>Pseudonaja textilis</u>

APPENDIX 3

MATERIALS CHARACTERISATION

A3.1 WASTE ROCK AND ORE GEOCHEMISTRY

Waste rock associated with the mining of the gold-bearing ore at the Lucky Draw project site consist primarily of two rock types, finely laminated metasediment of the Triangle Group and the metamorphosed Rockley Volcanics. The Burraga Granite which will be exposed near the floor and at the extreme wall of the open cut and will also contribute to waste rock materials. The waste areas within the pit will be defined by grade control drilling.

The waste rock is of similar physical characteristics to the ore. The upper oxidised material is less competent than the fresher material. When removed from the open cut the waste rock will comprise angular material varying in size from 1 m to less than 1 mm. The material is sufficiently hard and well graded to form a physically stable emplacement. Compaction of the waste rock material is expected by means of normal truck movement and dumping as the emplacement level advances. Experience at other open cut mines would suggest that such truck movements on the emplacement will achieve 95 per cent compaction on the top 1.5 m. This enables shedding of water off the emplacement, thereby reducing infiltration and potential for leachate generation.

Preliminary geochemical characterisation of the waste rock types and ore has been undertaken by assay and total rock analysis. Results of assays of Triangle Group and Rockley Volcanics rock materials are presented in Table A3.1 together with results of assays of ore material. Total rock analysis of the Burraga Granite is presented in Table A3.2. Data on crustal abundances of selected trace metals are presented in Table A3.3 for comparison.

Total sulphur percentage in the waste rock and ore provides an indication of sulphide mineral content. For waste rock, the total sulphur percentage ranges from 0.02 to 0.06. Ore material has 0.05 per cent total sulphur. Such total sulphur contents are very low and confirm mineralogical assessment of materials in hand specimen, that no sulphide minerals are present in either ore or waste rock.

The concentration of all environmentally significant trace metals in the waste rock are low or within normal crustal abundances. This again confirms that no sulphide minerals are present. Similarly the ore has low or normal concentrations of trace metals, with the exception of bismuth.

The Burruga ore type has an unusual occurrence of native bismuth, presumed to have concentrated during phases of the hydrothermal ore forming process. While the concentrations of bismuth in the ore is geochemically significant, the level is of no consequence from an environmental toxicity aspect. Bismuth concentrations in waste rock are low or within normal crustal abundances.

The carbonate content of waste rock is low which indicates these rocks will have a low acid neutralising capacity.

The analysis of waste rock materials indicates that aluminium is present in normal concentrations and bound in alumino-silicate minerals. Aluminium in this form is not prone to hydrolyses to aluminium hydroxide and hence is not expected to result in an acid response in weathering.

A3.2 Discussion: Implications For Environmental Management

The purpose of characterising waste rock and ore material is to identify potential environmental concerns and to provide criteria for design and management of waste disposal operations. The two major areas of environmental concern associated with waste disposal at modern gold mines are the potential for generation of acid in waste rock and tailings and the fate of cyanide in the tailings storage. At the Lucky Draw Project site the behaviour of cyanide in the tailings storage is not so critical because tailings materials and fluids are to be fully contained in accordance with the State Pollution Control Commission's requirements for no discharge nor release.

Miller et al (1987) has recognised as significant the following geochemical characteristics:

- (i) Acid forming potential of waste rock and tailings;
- (ii) Content of heavy metals and specific ions;
- (iii) Leaching characteristics and solubility of constituent elements under different environmental conditions;
- (iv) The fate of cyanide in the tailings, in particular the form and content of metalocyanide complexes.

Basic chemical parameters from data presented in Tables A3.1 to A3.3 have provided information on these four geochemical characteristics sufficient for environmental impact assessment.

Miller et al (1987) has shown that the relationship between total sulphur and acid neutralising capacity can identify the acid forming potential of waste materials. The waste rock materials at the project mine fall into the category of "barren waste" being devoid of sulphides and of low acid neutralising potential. On the basis of this, an assessment of Burruga mine waste materials can be undertaken without geochemical characterisation, such as batch and column leaching tests and specialised solubility and extraction procedures, which are necessary for potentially acid forming materials.

As for waste rock, acid generation in gold tailings is only an issue if the net acid producing potential is positive. Also since lime addition in cyanide processing results in an initial pH of 9.5 to 11.5 acid leachates are unlikely to occur in the short term. The absence of sulphides in the Burruga ore indicates that even in the longer term acid leachate generation of tailings is unlikely.

Miller et al (1987), and Brooks and McGlynn (1987) note that the behaviour of cyanide in the supernatant and entrained water of the tailings storage depends primarily on the form of cyanide and the nature of metal-cyanide complexes. In addition, climatic factors are important in controlling the rate of cyanide decay.

The important forms are the free cyanide and the complex cyanides. The moderately strong and strong complexes are the major concern since they are relatively stable yet can dissociate under certain conditions releasing toxic free cyanide and associated metals.

The absence of metal sulphides in the Burrage ore suggest that no complex cyanides will form in the processing and the great majority of cyanide reporting to the tailings storage will be in the form of free cyanide.

The fate of cyanide in the tailings and the engineering implications for tailings disposal and management are site specific. The important factors influencing cyanide persistence and mobility are the forms of cyanide and the ability of the tailings environment, including materials in seepage zones, to attenuate or degrade cyanide. Biological degradation of free cyanide is a significant form of destruction in the tailings mass and, more importantly, in any seepage pathways through underlying soils and aquifer materials (Miller et al, 1987).

Tailings storage management at the Project site need therefore address the persistence primarily of free cyanide and hence promote attenuation and degradation of free cyanide in potential seepage pathways.

A3.3 Summary

Assessment of the waste rock and ore materials by assay and total rock analysis indicates both waste and ore to be barren of sulphides and of low trace metal concentrations.

On the basis of these chemical characteristics, waste rock emplacements at the Burruga mine are not expected to produce acid leachates. Weathering of waste rock is unlikely to produce runoff or leachate which is hazardous to downstream water users, nor detrimental to revegetation of the emplacement.

Tailings supernatant is likely to contain predominantly cyanide concentrated in the free cyanide form, with little or no metal-cyanide complexes formed.

Management implications for the tailings storage in the short term should aim at promoting degradation and attenuation of free cyanide. In the longer term the tailings are not expected to form acid leachates and cyanide is not expected to persist. The tailings storage should, however, be rehabilitated to reduce infiltration and promote runoff and drainage.

TABLE A3.1
WASTE ROCK AND ORE GEOCHEMISTRY
Waste Rock Geochemistry - Assay by Australian Assay Laboratories Group

Rock Type	Sample No.	As	Bi	Cd	Pb	Hg	Si%	Ca%	Mg%	Al%	Fe%	S(T)%	C(T)%	CaCO ₃	Al ₂ O ₃
Triangle Group	74929	26	<10	<1	6	0.03	35.6	0.16	1.39	6.46	6.84	0.06	0.08	0.26	<0.1
Rockley Volcanics	74930	29	<10	<1	5	0.02	25.3	2.58	8.02	5.21	10.1	0.03	0.10	0.30	<0.1

Ore Geochemistry - Assay by Fox Laboratories

Rock Type	Sample No.	As	Bi	Cd	Pb	Cu	Hg	Mn	Zn	CaO%	SiO ₂ %	S%	C%	Al ₂ O ₃
Ore	74928	25	312	3.6	BLD	BLD	BLD	739	81	0.51	43.1	0.05	0.41	17.8
	74932	BLD	190	BLD	10	BLD	BLD	327	45	0.39	65.6	0.05	0.13	12.6

All units in ppm (parts per million) unless otherwise expressed as % (per cent)
BLD = Below Level of Detection

TABLE A3.2
WHOLE ROCK ANALYSIS OF THE GARNET BEARING PHASE
OF THE BURRAGA GRANITE ADJACENT TO THE MINERALISATION

SiO ₂	74.76
TiO ₂	0.01
Al ₂ O ₃	14.70
Fe ₂ O ₃	0.32
FeO	0.17
MnO	0.11
NgO	0.05
CaO	0.38
Na ₂ O	4.77
K ₂ O	4.07
P ₂ O ₅	0.06
S	0.02
H ₂ O+	0.63
H ₂ O-	0.13
CO ₂	0.13
rest	0.05

Source: A.N.U.

TABLE A3.3
CRUSTAL ABUNDANCES

Element	Lithosphere	R O C K					Soil
		Granite	Basalt	U/Mafic	Shale	Sandstone	
Arsenic	1.8 ^e	1.5 ^b	1.5 ^b	5 ^b	13 ^b 9 ^g	1 ^b 1 ^g	(5-10) ^b
Cadmium	0.15 ^c 0.2 ^e	(0.001-1.8) ^c (0.1-0.2) ^b	0.3(0.02-4) ^b	-	(0.3-11) ^c 0.8 ^b	0.02 ^g	0.4(0.05-1) ^c 0.1-0.5 ^b
Cobalt	30 ^a 25 ^e 23 ^c	(5-10) ^a (1-4.4) ^b	(30-45) ^a (37-50) ^b	110 ^b	(20-30) ^a 19 ^b	0.33 ^g	15(0.05-300) ^a 7 ^b
Chromium	200 ^a 100 ^e	(20-40) ^a 4.1 ^b	(100-300) ^a 200 ^b	3000 ^b	(100-300) ^a 90 ^d	120 ^g	200(tr-4000) ^a 37 ^b
Copper	100 ^a 55 ^e	(10-20) ^a 8 ^b	(100-200) ^a 100 ^b	47 ^b	(10-15) ^a 45 ^e 39 ^b	25 ^b 15.4 ^g	20(tr-250) ^a 20 ^b
Iron as %	-	4.2% ^g	-	-	6.5% ^b 3.9% ^g	3.2% ^b 1.9% ^g	-
Lead	16 ^a 12.5 ^e 17 ^b	20 ^a 23.6 ^b	8 ^a 3.2 ^b	0.3 ^b	15 ^a 20 ^d 2.3 ^b	10 ^b 13.5 ^g	20(tr-1200) ^a 16 ^b
Mercury	0.08 ^e 0.08 ^b	0.039 ^b	(0.007-0.021) ^b	1.3 ^b	0.4 ^d 0.4 ^b	0.03 ^b 0.06 ^g	0.1 ^f
Manganese	950 ^a 930 ^b	(200-1200) ^a 350 ^b	(1000-2000) ^a 1300 ^b	1050 ^b	400-600 ^a 600 ^b	170 ^b 392 ^g	750(tr-10,000) ^a 560 ^b
Nickel	100 ^a 75 ^e	10 ^a (6-15) ^b	150 ^a 145 ^b	(500-3500) ^b	(90-100) ^a 71 ^b 2.6 ^g	21 ^b	(tr-5000) ^a 100(5-500) ^c
Silver	0.1 ^a 0.07 ^e	0.05 ^a 0.05 ^b	0.1 ^a 0.1 ^b	0.05 ^b	0.1 ^a 0.19 ^b 0.27 ^g	0.12 ^g	(0.01-5) ^b
Zinc	50 ^a 80 ^c 70 ^e	(50-60) ^a 48 ^b	(70-130) ^a 100 ^b	56 ^b	80 ^a 120 ^b 130 ^g	105 ^b 16.3 ^g	75(tr-900) ^a (10-300) ^c 50 ^b

- No value quoted

Values quoted are in µg/g (ppm) - Average (range)

- References; a Aubert H and Pinta M (1977)
 b Wedepohl KH (1969)
 c Lepp NW (19)
 d Forstner U and Wittman GT (1979)
 e Henderson (1982)
 f Hart T (1982)
 g Matthes G (1982)

APPENDIX 4

ENERGY STATEMENT

ENERGY STATEMENT

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

1. BACKGROUND INFORMATION

The Company proposes to develop an open cut mine to extract a possible 1,200,000 tonnes of gold-bearing ore. The ore will be crushed and treated in a carbon-in-pulp treatment plant with a capacity of approximately 300,000 tonnes/year of oxidised and primary ore.

The open cut mine will be developed to a depth of approximately 70 m below the existing surface. For every tonne of ore mined there will be approximately 4 tonnes of waste rock removed which will be placed in an area surrounding the open cut to the south and west. All ground material from which the gold is extracted will be placed in a tailings dam to the north of the mine.

2. OPERATIONAL ENERGY REQUIREMENTS

2.1 Construction Period

During the erection and construction of the treatment plant, the Company will utilise temporary portable generating sets to provide electrical power. The power requirement for welding, erection, etc. during this period is estimated at 65 Kw.

The following vehicles and equipment requiring liquid fuels will be used on site:

Haulage Trucks Bulldozers Scrapers Front-end Loaders Light Vehicles Portable Generators Concrete Mixers.

The Company expects that the above vehicles will use approximately 250,000 litres of fuel during the construction period. The majority of this fuel will be used by earthmoving equipment for the construction of the tailings dam.

2.2 Open Cut Mining

It is estimated that the contractor who will undertake the mining will use approximately 1.1 million litres of diesel fuel annually for drilling, loading and transportation of the ore and waste rock.

2.3 Treatment Plant

The treatment plant will be operated primarily by electrical power supplied by the Southern Mitchell County Council via an upgraded line from Bathurst. The estimated demand will be 1.5 megawatts and annual usage will be approximately 11,000 megawatt hours.

The only other energy source within the treatment plant will be relatively small quantities of LPG which is required to operate the kiln in the gold room.

2.4 TOTAL FUEL USAGE

The annual liquid fuel usage for the project will be approximately 1.3 million litres.

3. 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 5

BASELINE MONITORING DATA

TABLE A5-1
LUCKY DRAW PROJECT - BASELINE WATER QUALITY MONITORING RESULTS*

Date Sampled	Discharge Ml/day	pH	E.C. µS/cm	HCO ₃ mg/l	Cl mg/l	SO ₄ mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	S.S. mg/l	T.A. mg/l	Filtered							Unfiltered										
													As µg/l	Cu µg/l	Pb µg/l	Zn µg/l	Fe mg/l	Mn µg/l	Cd µg/l	Bi µg/l	As µg/l	Cu µg/l	Pb µg/l	Zn µg/l	Fe mg/l	In µg/l	Cd µg/l	Bi µg/l	Hg µg/l	
BW-1 29.10.87 07.12.87	Dam Dam	7.30 7.95	1650 1600	520 640	310 273	15 25	24.0 23.0	126.00 120.00	0.90 2.20	114.0 113.0	35 ND	425.00 514.00	0.50	3.50	9.00	4.50	0.03	5.50	0.30	<0.5	1.00 0.01	6.00 <0.01	12.00 0.01	7.50 <0.05	0.20 1.05	91 0.40	0.550 <0.002	<0.5 ND	<0.1	
BW-2 29.10.87 07.12.87 20.01.88	Still Still Still	7.40 7.90 7.00	1400 1310 1400	615 568 640	140 146 165	30 45 25	4.1 21.4 47.0	119.00 193.00 104.00	2.20 2.15 4.90	74.0 37.6 86.0	8 ND 50	505.00 470.00 525.00	2.00	3.50	8.50	4.00	0.02	12.00	0.45	<0.5	2.50 0.01 <0.5	5.50 <0.01 6.00	16.00 0.01 20.00	5.50 <0.05 19.00	0.18 0.50 0.91	300 0.30 1780	1.000 <0.002 1.500	<0.5 ND <0.5	<0.1	
BW-3 29.10.87 07.12.87 20.01.88	<0.1 Still Still	5.60 7.00 5.30	595 47 95	5 16 25	5 5 5	10 10 15	0.6 0.6 4.6	1.40 3.05 2.30	0.50 1.20 0.60	6.0 3.0 7.8	6 ND 75	5.00 12.00 25.00	1.00	3.50	5.50	5.50	0.30	7.50	0.35	<0.5	2.00 0.01 <0.5	5.00 <0.01 5.50	9.00 0.01 6.00	8.00 0.05 15.00	1.42 0.95 11.10	67 0.05 980	0.650 <0.002 0.600	<0.5 ND <0.5	0.10	
BW-4 29.10.87 07.12.87 20.01.88	0.35 NK 0.4	6.00 7.10 5.90	125 105 140	25 30 40	12 16 15	12 5 10	1.6 1.6 3.8	5.10 9.65 6.60	0.40 0.60 0.30	12.0 6.0 14.0	4 ND 7	40.00 26.00 30.00	<0.5	2.00	6.00	4.00	0.12	6.00	0.20	<0.5	<0.5 0.01 <0.5	3.00 <0.01 1.50	7.50 0.01 6.50	4.50 0.05 6.50	0.39 0.50 1.43	27 <0.05 107	0.450 <0.002 0.800	<0.5 ND <0.5	<0.1	
BW-5 29.10.87 07.12.87 20.01.88	<0.1 NK NK	6.30 7.10 5.70	145 125 145	50 52 35	15 12 20	11 10 2	3.6 3.8 3.2	8.40 15.90 6.50	0.60 0.70 0.30	11.0 4.8 13.0	2 ND 3	40.00 42.00 30.00	<0.5	1.50	6.50	5.50	0.10	6.50	0.35	<0.5	<0.5 0.01 <0.5	3.50 <0.01 4.50	10.00 0.01 5.00	7.00 0.05 8.00	0.30 0.45 1.29	32 0.05 110	0.500 <0.002 0.550	<0.5 ND <0.5	0.30	
BW-6 29.10.87 20.01.88	Dam Dam	7.00 6.30	1050 265	395 85	140 30	12 15	27.0 14.0	87.00 15.00	1.20 0.80	63.0 17.0	130 2	325.00 75.00	1.50 <0.5	4.00 1.00	14.00 5.00	8.50 4.00	0.12 0.32	12.00 4.50	1.50 0.25	<0.5 <0.5	3.50 <0.5	10.00 2.00	25.00 7.50	36.00 5.50	1.29 0.86	1720 67	2.000 0.400	<0.5 <0.5		
BW-7 29.10.87 07.12.87	0.35 0.4	8.30 7.05	235 210	75 72	25 24	20 10	7.9 8.4	14.00 25.20	0.60 1.40	14.0 7.2	4 ND	65.00 60.00	<0.5	2.50	7.00	2.50	0.08	5.00	0.70	<0.5	1.00 0.01	3.00 <0.01	7.50 0.01	4.00 <0.05	0.36 0.45	36 <0.05	1.000 <0.002	<0.5 ND	0.20	
BW-8 29.10.87 07.12.87 20.01.88	Dam Dam Dam	5.70 6.75 5.50	115 100 120	10 10 15	20 24 23	10 5 9	0.8 0.6 1.0	0.50 1.30 1.60	0.10 0.15 <0.1	18.0 9.0 20.0	6 ND 5	8.00 8.00 13.00	0.50 <0.5	2.00	5.50 9.00	3.50 4.00	0.04 0.11	4.50 3.50	0.30 0.60	<0.5 <0.5	1.00 0.01 <0.5	3.00 <0.01 4.00	7.50 0.01 11.00	4.50 <0.05 9.00	0.26 0.15 0.42	11 <0.05 17	0.500 <0.002 0.750	<0.5 ND <0.5	<0.1	
BW-9 29.10.87 07.12.87 20.01.88	Still Still Still	6.20 6.90 5.40	155 160 210	30 46 15	20 24 40	14 5 11	4.1 5.4 6.5	3.10 8.00 5.10	0.80 2.25 1.40	19.0 9.0 24.0	4 ND 7	35.00 38.00 10.00	1.00 <0.5	3.50	6.50 5.00	6.00 6.50	0.37 0.70	6.00 4.00	0.30 0.50	<0.5 <0.5	2.00 0.01 <0.5	6.50 <0.01 4.50	8.50 0.01 7.50	8.00 <0.05 12.00	1.06 1.10 2.70	46 0.05 173	0.500 <0.002 1.100	<0.5 ND <0.05	0.20	
BW-10 29.10.87 07.12.87 20.01.88	Dam Dam Dam	6.40 7.45 5.90	205 200 230	50 68 60	30 27 30	13 10 9	5.1 6.4 7.4	7.80 17.70 8.80	1.40 3.35 1.40	20.0 8.6 23.0	6 ND 4	45.00 56.00 50.00	<0.5 <0.5	2.00	9.00 6.50	18.00 6.50	0.21 0.22	5.50 3.50	0.45 0.60	<0.5 <0.5	1.00 0.01 <0.5	4.00 <0.01 5.00	12.00 0.01 10.00	65.00 <0.05 115.00	0.65 0.85 0.60	22 <0.05 40	1.000 <0.002 0.850	<0.5 ND <0.5	0.30	
Drill Hole No. 227** 20.01.88		5.10	165	20	25	15	0.6	2.00	2.60	24.0	5475	15.00	<0.5	7.50	10.00	26.00	0.10	430.00	0.95	<0.5	<0.5	155.00	75.00	115.00	5.60	2400	1.300	<0.5		
Drill Hole No. 140** 20.01.88		6.80	2100	530	435	45	55.0	174.00	6.00	130.0	4	430.00	4.50	5.50	10.00	7.50	<0.01	22.00	1.00	<0.5	6.00	8.00	15.00	10.00	<0.5	31.00	1.300	<0.5		
Drill Hole No. 146** 20.01.88		6.40	530	240	35	25	8.9	47.00	4.60	28.0	80	200.00	0.50	64.00	52.00	92.00	0.14	265.00	0.50	<0.05	2.00	112.00	170.00	165.00	<0.5	940	0.750	<0.5		
Drill Hole No. 154** 20.01.88		6.50	660	335	45	13	14.0	63.00	7.30	32.0	325	275.00	0.50	29.00	30.00	125.00	0.10	465.00	0.65	<0.05	2.00	59.00	66.00	160.00	<0.5	1410	0.850	<0.5		
Drill Hole No. 165** 20.01.88		5.90	340	80	60	10	4.1	19.00	2.80	26.0	ND	20	65.00	<0.5	14.00	19.00	31.00	0.12	1760.00	0.35	<0.05	<0.5	41.00	36.00	77.00	0.38	2140.0	0.550	<0.5	
Drill Hole No. 178** 20.01.88		6.40	1000	690	55	15	53.0	55.00	6.10	115.0	ND	95	565.00	<0.05	5.00	9.50	20.00	0.05	17.00	0.65	<0.05	<0.5	6.00	11.00	82.00	0.04	56.00	1.200	<0.5	

S.S. Suspended Solids

T.A. Total Alkalinity

* All analyses by S.G.S. Australia Pty Ltd except for samples collected on the 7th December, 1987 which were collected and analysed by the Mineral Resources Development Laboratory of the Department of Mineral Resources.

** See Figure 3.2

NK Not known

TABLE A5-2
LUCKY DRAW GOLD PROJECT - STREAM SEDIMENT ANALYSIS RESULTS

Site No.	Size Fraction	BW-1		BW-2		BW-3		BW-4		BW-5		BW-6		BW-7		BW-8	
		Wt%	TMC	Wt%	TMC	Wt%	TMC	Wt%	TMC	Wt%	TMC	Wt%	TMC	Wt%	TMC	Wt%	TMC
ARSENIC	Whole		120		90		165		140		100		130		120		25
	-2mm+600 um	23	180	38	195	46	135	14	40	15	115	29	105	18	60	35	115
	-600+200 um	22	90	16	60	14	165	41	140	17	45	12	70	30	140	23	90
	-200+100 um	14	80	7	120	4	170	20	55	14	60	8	90	11	55	13	140
	-100 um	41	75	39	60	37	115	26	100	55	75	51	100	42	120	29	130
CADMIUM	Whole		<0.5		<0.5		<0.5		<0.5		<0.5		0.5		<0.5		<0.5
	-200+600 um		<0.5		1		1		1		<0.5		<0.5		<0.5		<0.5
	-600+200 um		0.5		<0.5		0.5		<0.5		1		1		0.5		<0.5
	-200+100 um		1		<0.5		0.5		<0.5		<0.5		<0.5		<0.5		<0.5
	-100 um		<0.5		<0.5		0.5		<0.5		<0.5		0.5		<0.5		<0.5
COBALT	Whole		10		45		5		<5		15		15		15		<5
	-200+600 um		20		65		<5		<5		45		20		25		<5
	-600+200 um		10		45		<5		<5		20		15		15		<5
	-200+100 um		10		35		10		<5		5		10		15		<5
	-100 um		15		35		5		<5		5		10		10		<5
COPPER	Whole		10		35		15		<5		10		10		35		<5
	-200+600 um		15		45		10		<5		25		10		75		<5
	-600+200 um		5		30		15		<5		10		5		45		<5
	-200+100 um		<5		20		20		<5		<5		<5		30		<5
	-100 um		5		20		25		<5		<5		<5		25		<5
IRON*	Whole		3.85		6.6		3.3		0.7		4		1.85		2.7		0.3
	-200+600 um		8.2		11.6		2.5		2.2		16		3.65		5		0.3
	-600+200 um		2.85		5.2		2.6		0.65		3.95		1.95		2.6		0.2
	-200+100 um		1.7		2.65		3.95		0.5		1.45		1		1.5		0.1
	-100 um		2.45		2.65		2.9		0.7		1.35		0.85		1.4		0.15
LEAD	Whole		<5		20		25		5		25		20		90		10
	-200+600 um		20		35		20		<5		15		5		150		<5
	-600+200 um		<5		20		15		5		10		10		140		<5
	-200+100 um		10		10		25		10		10		15		95		5
	-100 um		10		15		20		10		15		20		40		10
MANGANESE	Whole		380		460		150		250		1340		1080		440		20
	-200+600 um		510		500		100		410		3780		1770		680		<10
	-600+200 um		290		400		150		250		1770		1060		420		<10
	-200+100 um		210		370		260		250		880		850		330		<10
	-100 um		390		450		200		320		810		650		340		20
NICKEL	Whole		85		155		10		15		35		25		15		5
	-200+600 um		95		195		<5		10		105		40		45		10
	-600+200 um		75		125		10		15		35		30		35		<5
	-200+100 um		50		90		20		10		20		35		25		<5
	-100 um		70		90		30		5		20		35		20		<5
ZINC	Whole		35		45		65		10		40		35		45		<5
	-200+600 um		45		45		40		20		95		35		80		<5
	-600+200 um		30		40		55		5		30		30		20		<5
	-200+100 um		25		35		100		10		15		30		40		<5
	-100 um		35		35		105		10		20		25		40		<5

* = Content in %
TMC = Trace Metal Content in micrograms/gram
Source: Department of Mineral Resources