EIS 503

AB019158

Environmental impact statement : Mitchell's Creek gold tailings retreatment , Bodangora, NSW

ENVIRONMENTAL IMPACT STATEMENT

MITCHELL'S CREEK GOLD TAILINGS RETREATMENT
BODANGORA, NSW

Prepared for

CLUFF MINERALS (AUSTRALIA) PTY LIMITED

by Tony Smith, B.Eng (Met.)

May, 1986

FORM 4

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

This Statement has been prepared on behalf of Cluff Minerals (Australia) Pty. Limited being the applicant making the development application referred to below.

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

Loading, transportation and re-processing of gold bearing tailings.

The development application relates to Mining Purposes Lease Application Number 73, Dubbo, over the land described as follows:

County Bligh
Parish Nanima: Portions 14, 17, Portion 83 (R61220 for commonage), general cemetry and R25177 for temporary common, Portion 134 and public roads, Portion 132 (R71205 for gravel pit).

In addition: Public Roads vested in Wellington Shire Council

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, Qualification and Address of person who prepared Environmental Impact Statement	Anthony Gerard Smith, B.Eng (Met). "Eden" Bodangora N.S.W. 2820

Certificate

1, Anthony Gerard Smith of "Eden", Bodangora, 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.

A. G. Smith
Signature

28-7-86
Date

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SECTION 1 INTRODUCTION

Cluff Minerals (Australia) Pty Limited ('the Company') proposes to establish a gold tailings retreatment plant at Bodangora, New South Wales (see Figure 1) to process material from the old Mitchell's Creek and Dick's Reward mines. These mines were worked by gold mining companies until 1919 using underground methods, and the tailings dumps (and residue from processing of ore) have been retreated subsequently, with the most recent retreatment taking place in the early 1970s. With improved techniques and the increased price of gold, sufficient gold can be recovered from the tailings to warrant further retreatment based on currently available information.

The pilot production program undertaken to precisely define production parametres has commenced and is proceeding as planned. Production from the first pilot dam amounts to over 6 kg of bullion which is up to expectations and no particular problems have been noted, nor has any complaint been received from local residents.

Exploration will also continue on the surrounding exploration licences, and it is hoped to identify further reserves for treatment. The company has purchased the property on which the tailings are situated to assist with development of the project.

The proposal is a Designated Development under Schedule 3(r) of the New South Wales Environmental Planning and Assessment Act 1979 and the Regulation, 1980 and requires the preparation and submission of an Environmental Impact Statement ('EIS') to the Wellington Shire Council to obtain development consent. Other regulatory authorities that will have an interest in the project are the Department of Environment and Planning, the Department of Mineral Resources, the State Pollution Control Commission and the Soil Conservation Service. The approval of the State Pollution Control Commission is required under Schedule 17(I) of the State Pollution Control Commission Act as it related to the provisions of the Clean Air, Clean Waters and Noise Control Acts.

This document has been prepared in accordance with the requirements of the Environmental Planning and Assessment Act ('EPA Act') regarding the form and content of Environmental Impact Statements.

1.1 Mining proposal

The company proposes to establish a gold tailings retreatment operation which will process up to 240,000 tonnes annually. The project ('the Project') will consist of dams for vat leaching of the tailings and a treatment plant with related facilities and services.

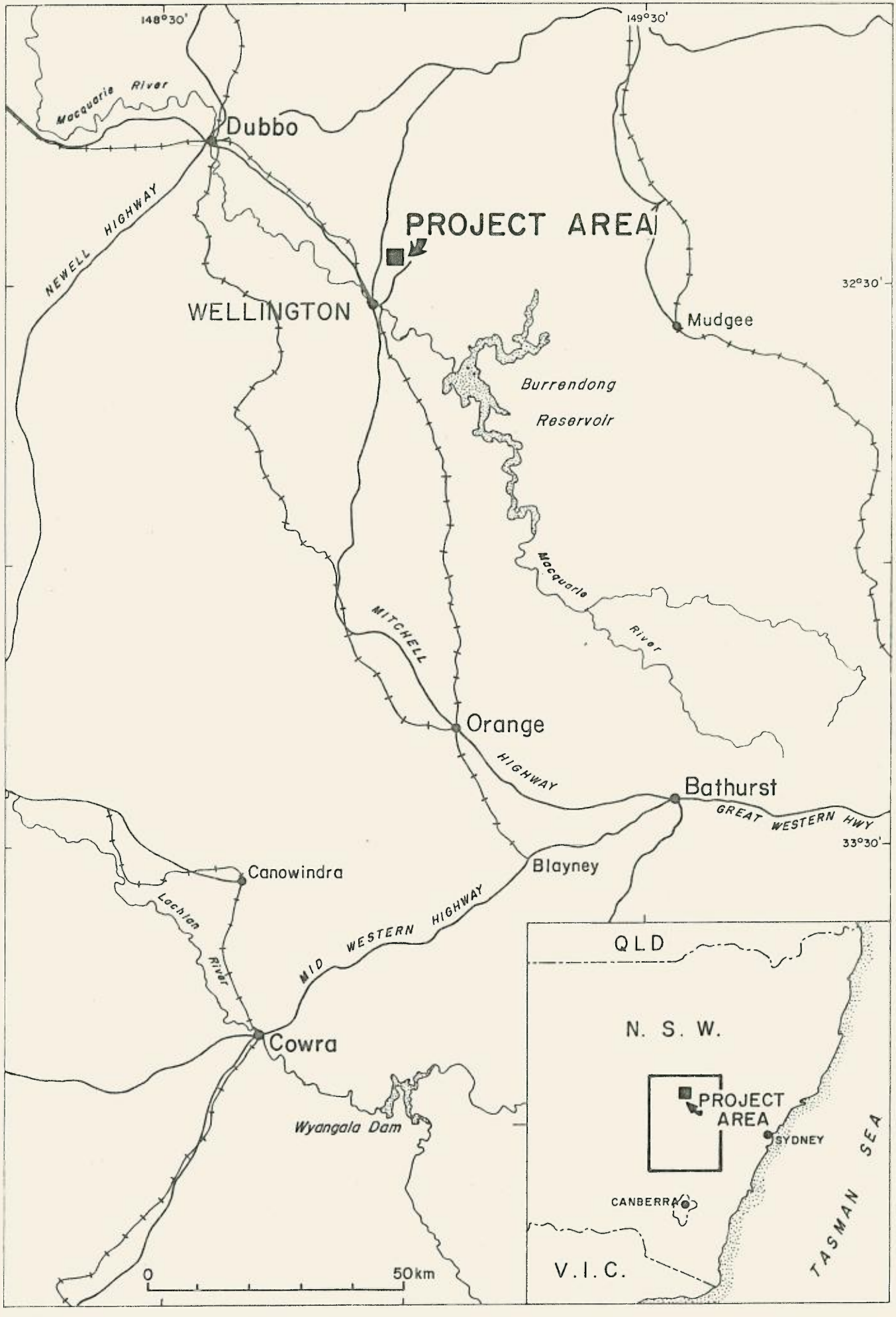


Figure 1. Locality Plan

With present planning and layout based on a production rate of 240,000 tonnes per annum it is envisaged mining will be completed in one year.

The company has expended approximately $400,000 to date on activities related to the project, and anticipates spending an additional $1,000,000 for labour, plant, equipment, materials and earthworks over the life of the project.

1.2 Organisation of the Statement

This EIS consists of four sections following the Introduction, including:

Section 2 - Project description
Section 3 - Description of existing environment
Section 4 - Environmental interaction and assessment of impact
Section 5 - Project justification

1.3 The company

Cluff Minerals (Australia) Pty Limited is engaged in gold and minerals mining and exploration mainly in New South Wales and Victoria, and is a wholly-owned subsidiary of Cluff Oil (Pacific) Limited a public limited company incorporated in New South Wales.

1.4 Project investigation and Environmental Impact Statement Preparation

The initial project study, site mapping and sampling was performed by Mr L.C. Noakes (OBE, BA, FIMM), a director of Cluff Oil (Pacific) Limited. Final sampling, testing, process design and EIS preparation was performed by Mr A.G. Smith (BE (Met)), manager of the project.

Assistance with information in the EIS was obtained from:

Warman International Pty Limited (Research and Development), who performed metallurgical testwork for the project.

Australasian Mining Title Services, who assisted in lease application.

Minchem Pty. Ltd., who performed metallurgical testwork.

Comments on the first draft of the EIS by the Wellington Shire Council, Department of Mineral Resources and State Pollution Control Commission are acknowledged and appreciated.

SECTION 2 PROJECT DESCRIPTION

2.1 Mining tenements

The company began testing of the tailings in 1981 after the granting of Exploration Licence 1684. The proposed operation involves only tailings and no 'below surface' mining; therefore, the company has applied for a mining purposes lease (number 73 Dubbo) over the area shown in Figure 2.

2.2 Mineralisation

Table 2.1

Estimated geological reserves (October, 1985)

Mitchell's Creek tailings

	Tonnage	Head grade (g/t)
High grade	3,000	7.2
Medium grade	52,000	2.7
Low/medium grade	63,000	2.1
Low grade	123,000	1.35
	241,000	1.88

Dick's Reward mullock

Fines	15,000	3.8

2.3 Process employed

2.3.1 Testwork

The tailings have been extensively sampled by augering, grinding, classification, agitation, leaching and column leaching tests have been conducted on individual and composite samples by Warman International Limited, Cluff Minerals (Australia) Pty Limited and others. These metallurgical tests have established the principal design parameters of the process method, cyanide and lime concentrations and period of contact, with cyanide for maximum economic extraction of gold, and these results are being verified by pilot scale tests.

Dam leaching has been chosen as the likely processing method for the tailings, since it has major economic advantages over other processes. These are:

(i) lower capital costs;

(ii) lower operating costs; and

(iii) higher effective production rates

One of the effects of lower running costs is the economic viability of treating the low grade portions of the dumps, assuming the continuity of favourable gold prices. The low grade material totals half the resource in tonnage. The major disadvantage of dam leaching is the somewhat lower gold recoveries, but present indications are that this is far outweighed by the above points.

2.3.3 Dam leaching and bullion production

The overall process flow sheet is shown in Figure 3. The process of dam (or vat) leaching involves building of earthen dams, lining them with plastic and drainage pipes, filling the dam with tailings and top flooding with appropriate water containing dilute concentrations of cyanide and lime. The solution percolates through the tailing sands, dissolving the gold, and is pumped from the drainage pipes through activated carbon absorption columns. The granular carbon absorbs the gold, and the barren solution is returned to the top of the dam to continue the process. All the economically recoverable gold is extracted within three to four weeks.

Once the carbon in the absorption column is loaded to capacity with gold it is transported to the processing building for de-absorption. The gold is chemically stripped from the carbon, where it is electrowon onto steel wool. The latter is smelted to produce an impure bullion (a mixure primarily of gold, silver and copper), which is shipped to the refinery.

2.3.4 Rock screening operations

The waste ore dumps from Dick's Reward have been tested for gold values. Indications are that the fine material (- 6 mm) is of economic grade. Although final testwork and a feasibility study has not been completed initial indications are that it is possible to screen out the coarse rock (low grade) and treat the fines by dam or heap leaching. The option of crushing the coarse fraction appears less favourable, but still may prove economic with favourable gold prices. The company wishes to leave these options open until testwork is complete and the economic viability of the main tailings retreatment is proven. A process flow sheet of possible methods of gold recovery is given in Appendix 2.

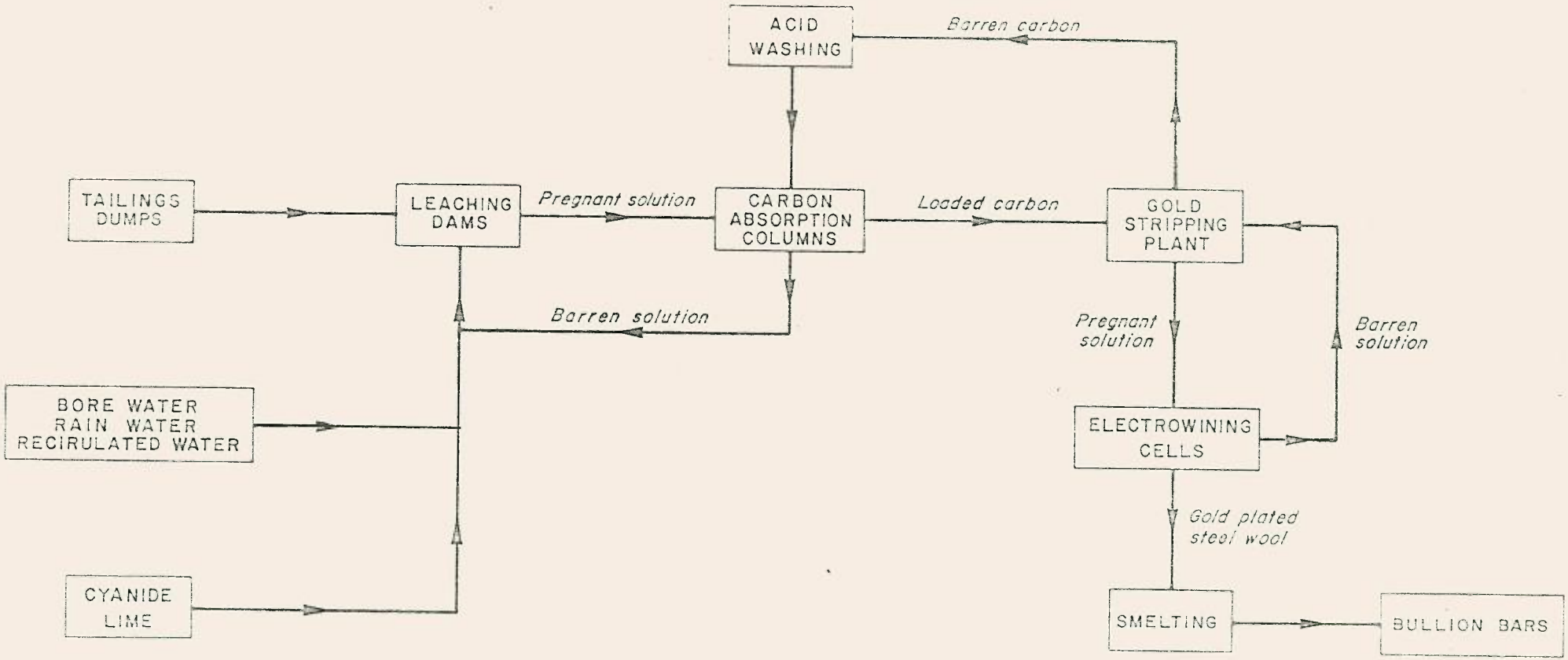


Figure 3. Process flow sheet

2.4 Mining and dam construction

2.4.1 Site clearing

Vegetation over the existing dumps is very sparse, and no major clearing operation is planned. Several areas of peppercorn trees exist on the fringe of the dumps, but the majority of these will be left in place (refer photographs 1 -4). A number of minor trees will have to be removed.

2.4.2 Staging

The project schedule in Table 2.2 shows the proposed staging of the construction and operation activities for the project. Construction of facilities for the pilot program has been completed and gold production will be able to commence immediately after obtaining approval.

2.4.3 Dam design and construction

The most economic and environmentally sound method for construction is as follows:

(a) Surface soil is removed adjacent to the existing dumps and stockpiled nearby for the revegetation programme.

(b) The first section of the leach dam is constructed from the underlying soil, the banks being formed by a bulldozer using clay excavated from the base of the dam to form a stable compacted dam wall. This end is placed close to the existing dumps.

(c) The plastic lining (200 micron virgin polyethyene) and drainage pipes are laid in this first portion of the dam and it is then filled with tailings. This then uncovers new ground where the original tailings were, and the new dam continues construction on this ground. More plastic piping is laid.

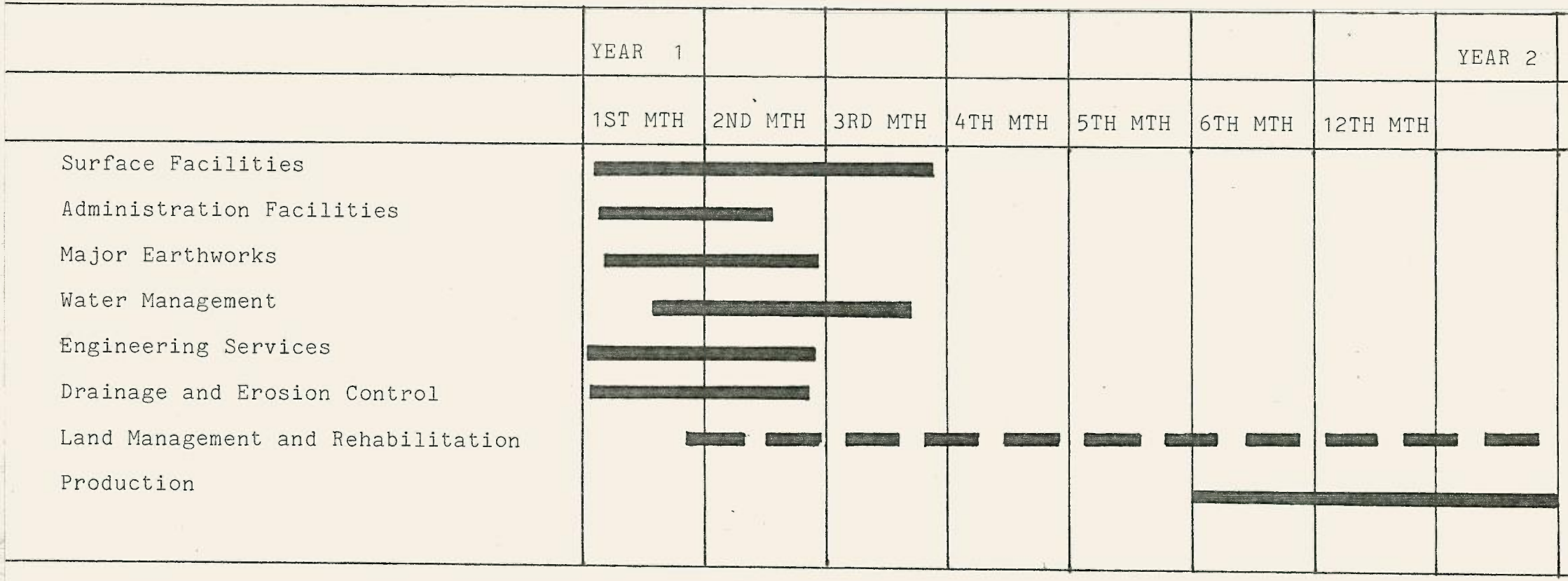
(d) The process continues until the dam is completed and lies almost back in the original position of the old tailings. This means that little of the adjacent land has been disturbed, and travel times for the front end loader have been minimised.

(e) The next dam can begin construction in a similar manner, but can share the existing side wall of the previous dam.

(f) After gold extraction from each dam is completed it is drained and left for one to two months. During this time a small amount of gold may become liberated, so the dam is then reflooded and pumped again for several days.

TABLE 2.2

PROJECT SCHEDULE



(g) The dam is then drained and left for rehabilitation by way of resoiling and stabilisation with grasses for grazing.

(h) Liquor drained from the dams is reused in later dams being simply pumped from dam to dam as it will still contain a small amount of cyanide useful in leaching. The drained solution is directly pumped to the next dam for reuse.

Only two dams will be in operation at any one time. One is leaching while the second is under construction.

Figure 4 shows the proposed layout of the leaching dams. Figure 5 shows a typical cross section of a leaching dam wall.

2.5 Surface facilities

2.5.1 Absorption area

Beside each dam will be a small single cylinder diesel pump drawing clear pregnant solution from the drainage system. The solution is pumped at low pressures through the carbon absorption columns to recover the gold. The barren solution is returned to the top of the dam (Figure 6).

2.5.2 Cyanide and lime mixing

Cyanide and lime will be dissolved on the initial flooding of the leaching dam. This will be accomplished by simply adding the lime, followed by cyanide, to the dams and allowing natural circulation of the flooding water to dissolve them. This method has proven most effective during the initial pilot program and also eliminates any possibilities of leakage from any separate mixing area.

2.5.3 Desorption and bullion building

The proposed main building on site (Figure 2) will house the desorption and bullion production facilities. The loaded carbon absorption columns are transported from the dam site to the desorption plant, where hot caustic and cyanide solution is used to strip the gold from the carbon. The resulting pregnant solution is then passed through the electrowinning cells, where the gold and silver is plated on the steel wool. The later is smelted for shipment to the refinery. The hot caustic and cyanide solution is reused for stripping the carbon. The failure of pipelines on the adsorbtion section is highly unlikely as the pressure rating (87 psi) is far in excess of operating pressure (5 psi). Moreover the flow from the dams is limited due to the percolation rate of the sand and would easily be contained in the contour dam collection system. As the operations are checked regularly no extended problem would occur.

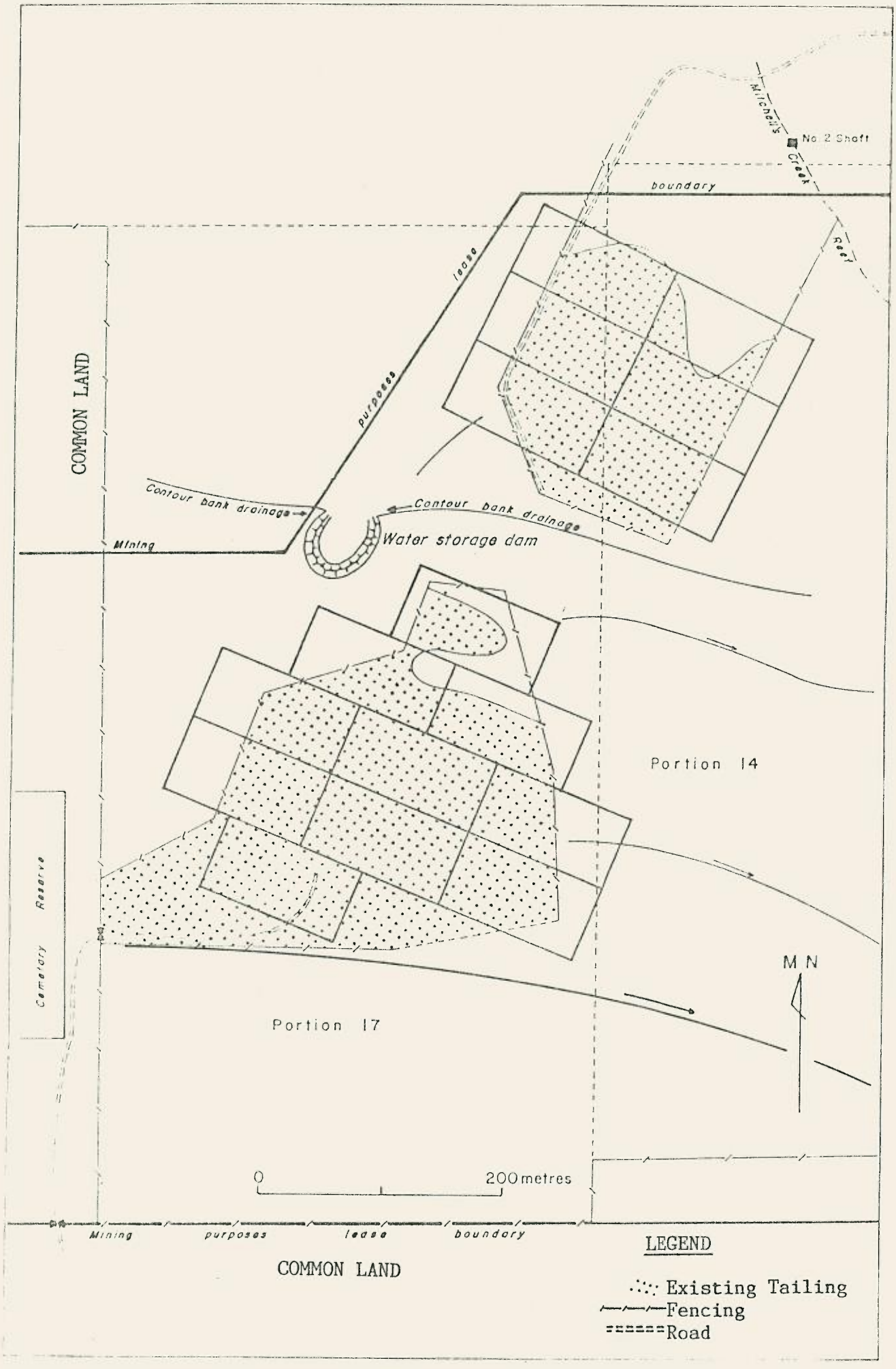
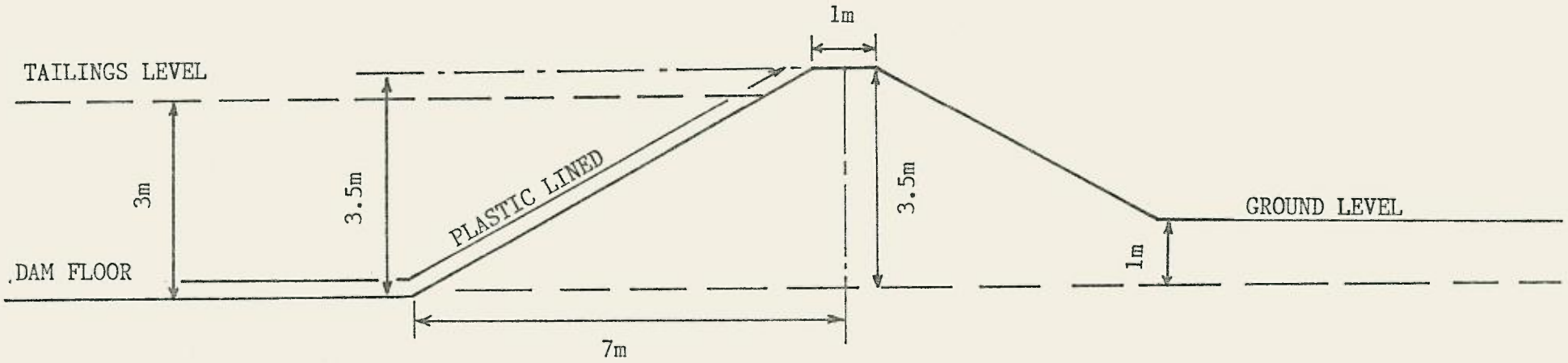


Figure 4. Proposed leaching dam sites

TYPICAL CROSS SECTION OF LEACHING DAM WALL

SCALE 1cm = 1m



NOTE: WALL IS BUILT BY BUILDING UP OF COMPACTED LAYERS BY BULL DOZER. THE WALL MATERIAL IS EXCAVATED FORM THE DAM FLOOR AND IS A CLAY BASED SOIL GIVING BOTH GOOD COMPACTION AND LOW PERMEABILITY.

FIGURE 5

2.5.4 Service facilities

Adjacent to the main building there will be an office, laboratory, ablutions and staff facilities. The main building will house a basic workshop for servicing of equipment and act as the chemical storage shed. Electricity and telephone shall be supplied from the main trunk lines located nearby.

2.5.5 Storage and handling of chemicals

Dangerous chemicals will be stored in the main building and storage areas and all operations on site will be carried out strictly in accordance with the Mines Inspection Act, 1901 to protect the safety of employees and the public. Cyanide is purchased and stored in dry form in metal drums. Apart from security at the main building a separate security fence will surround the site of the main building and adjoining facilities. Also access to the farm property is strictly controlled.

Acid washing and acid storage facilities will be located separately from cyanide storage or usage. Acid washing and neutralisation of minor acid wastes will take place in a small bunded area located away from the main desorption and bullion building.

2.5.6 First aid facilities

First aid equipment relating to cyanide poisoning will be located at the main building. This equipment shall include:

(i) An oxygen revival kit;

(ii) An oral antidote to counter ingested cyanide;

(iii) an inhalant to counter the effects of poisoning; and

(iv) eye wash bottles

An open high volume shower shall be located at the main building to facilitate rapid washing of personnel if contaminated with cyanide.

2.6 Water management

2.6.1 Process water supply

Process water for the project will be drawn from an existing dam adjacent to the tailings dumps. This dam has been enlarged to 3 megalitres and plastic lined to conserve water. It shall be supplied from an existing bore pump in the old mine shaft at a rate of 10 kilolitres per hour,and from natural run off which is collected via contour banks. A second dam and contour system exists to the south-east corner of the property. This system may be used as a back-up water supply.

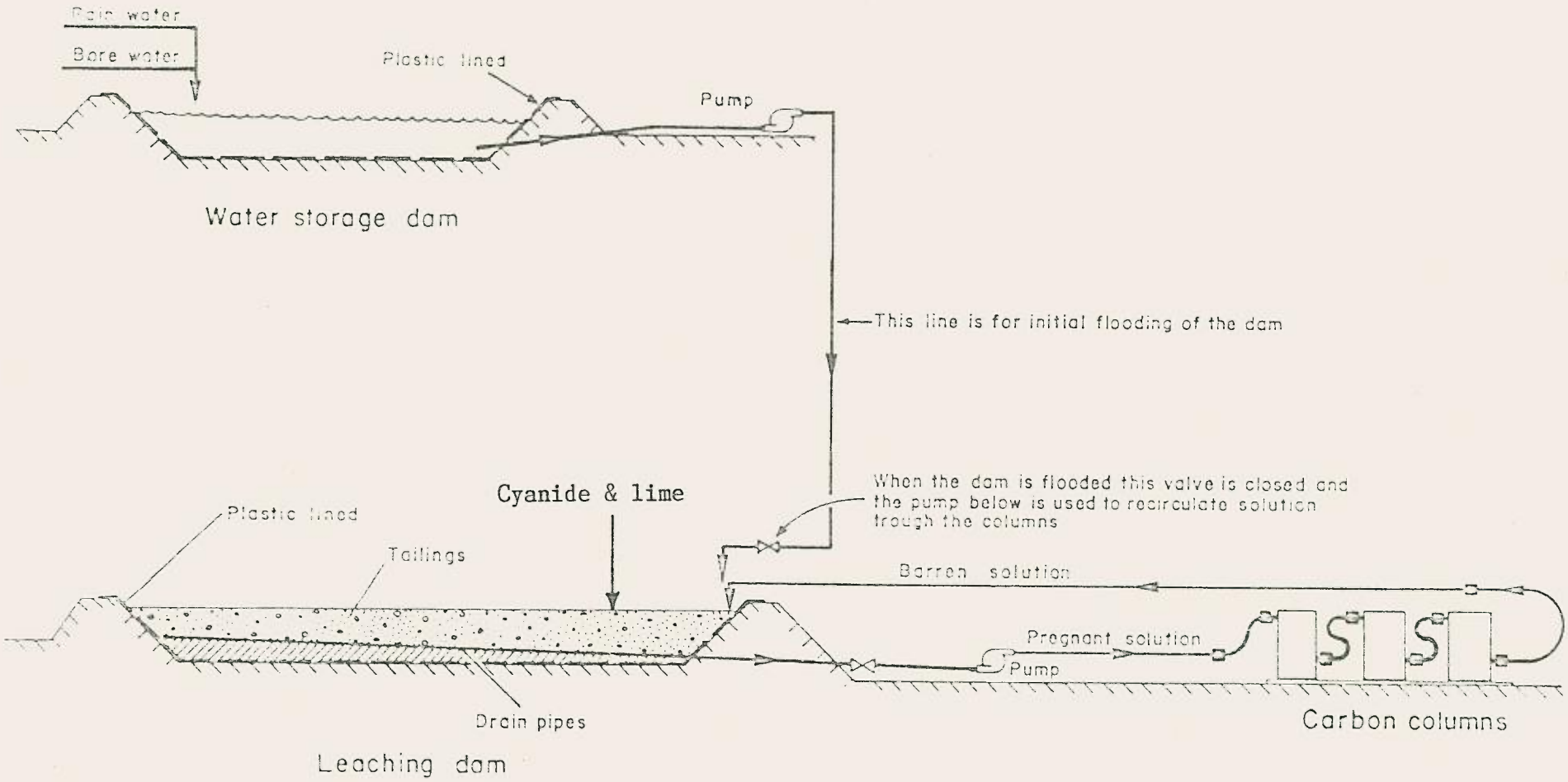


Figure 6. Schematic layout of dam leaching process

Analysis of bore water gave pH of 7.4 and a conductivity of 1000 micro ohms (660 ppm dissolved salt) thus indicating the water to be good irrigation water.

2.6.2 Fresh water supply

A fresh water supply shall be facilitated via a rain water tank located beside the main building. This shall service personnel requirements.

2.6.3 Water use and recirculation

The water requirements for the dams is approximately 30 percent of the tailings weight. Therefore, 70 megalitres of water will be required in total over the life of the project. However, the actual water supply requirements will be much less than this since the water from spent leaching dams can be reused on subsequent leaching dams.

2.7 Workforce

It is anticipated that three to four local people will be employed on a full-time basis. Casual and contract employees may also be required during construction and operation to meet excess or specialised workloads.

Staff for the project will most likely come from the Bodangora village itself. The manager of the project lives within the village as do all three employees working during the pilot stage.

2.8 Hours of operation

Mine operations will be confined to the hours of 7.00 am to 7.00 pm Monday to Saturday.

SECTION 3 DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Site description

The site is zoned as Rural A. The effects of early mining operations are clearly evident throughout the site. Tailings and mullock heaps and old treatment sites are marked on figure 2.

3.2 Landform and drainage

The project site lies on the southern side of a ridge with the few dwellings of Bodangora village approximately half a kilometre to the east. The land slopes gently to the south in the vicinity of the tailings, rising above to a ridge. Drainage is controlled by contour banks, some of which direct water to the storage dam. A lower contour and dam system exists in the south-eastern section of the property.

3.3 Land type and use

The tailings area is fenced off and is not used for any purpose. The sparse vegetation and the sandy slopes are unsuitable for grazing or cropping. The northern and upper western slopes around the tailings are rocky and only suitable for poor quality grazing. To the east, south and lower western areas from the tailings is good quality red soil grazing land. For the past five years the landowner has grown lucerne for grazing purposes. Sheep watering troughs are stationed in most of the lower blocks. Appendix IV shows a contour map of existing tailings.

3.4 Population

The population of Bodangora is approximately 30. The nearest urban centre is Wellington, some 13 km away, with a population of 5,600.

3.5 Flora and fauna

3.5.1 Flora

The existing tailings have little or no vegetation coverage. The main dumps have no coverage except for small gum trees on the north-west section of the dumps, and a few peppercorn trees exist in other areas. The majority of the trees exist on the fringe of the dumps. There is virtually no grass coverage on the main dumps, but there is some coverage by common grasses on the fringes.

3.5.2 Fauna

The main fauna known to habitate the dumps are rabbits. Birdlife common to the Wellington region would frequent the area, although large numbers have not been observed.

3.6 Historical interests

The first discovery of gold was in 1848 with major works commencing in 1889. The Mitchell's Creek mine was worked to a depth of 1,100 feet and closed in 1919 for reasons which are unclear. Cyanide retreatment of the sand tailings has been carried out in the past, e.g. 1893, 1908, 1910-1915, 1931-1940, with the last attempt in the early 1970s.

The mine site was used as a minor tourist attraction until 1973, when the old stamp battery was sold and partly re-erected at O'Brien's mine at Grenfell.

The only remaining point of interest on site is a large brick chimney and various broken foundations. The company plans no work in the area,and the old works will remain intact. Refer Appendix (1) regarding correspondence from the Department of Environment and Planning (letter dated 28 September, 1984) and the National Parks and Wildlife Service (letter dated 7 June, 1985 and our reply dated 17 June, 1985).

3.7 Aboriginal and archaeological interest

No aboriginal or archaeological relics have been identified, and due to the previous mining and farming activities any such relics would not be distinguishable. See Appendix (1), which refers to correspondence from the National Parks and Wildlife Service (letter dated 7 June, 1985) which confirms the above.

3.8 Meteorology

The meteorological data has been compiled from readings taken at the Wellington Soil Conservation Service research station, five kilometres from the mine site.

3.8.1 Rainfall

The average annual and monthly rainfalls are listed in Table 3.1

Table 3.1

Month	J	F	M	A	M	J	J	A	S	O	N	D
Mean (mm)	65	70	56	41	49	42	42	47	46	70	52	47
Rain days	6	7	6	5	7	8	9	8	7	9	7	6

3.8.2 Evaporation

The average mean monthly pan evaporation for fourteen years is set out in Table 3.2.

Table 3.2

Month	J	F	M	A	M	J	J	A	S	O	N	D
Mean (mm)	8.8	7.7	6.1	4.1	2.5	1.7	1.7	2.4	3.5	5.1	7.0	9.1

3.8.3 Temperature

The mean temperature ranges for the months of the year are shown in Table 3.3.

Table 3.3

Month	J	F	M	A	M	J	J	A	S	O	N	D
Max (C)	30.7	30.1	27.3	23.3	18.2	14.9	14.1	15.6	18.6	22.4	26.2	29.8
Min (C)	17.3	17.1	14.7	10.5	7.0	4.0	2.8	4.0	6.4	10.0	12.5	15.5

SECTION 4 ENVIRONMENTAL IMPACT AND ASSESSMENT

4.1 Landform and drainage

The company has sought the advice of the District Soil Conservationist with respect to general land rehabilitation measures (letter dated 10 March, 1986 in Appendix 1). Their subsequent site inspection led to the recommendations listed in Appendix 1.

The recommendations for changes to land form and drainage are the construction of a contour and water catchment below the tailings. Minor modifications to the existing contour system above the tailings are also included. These recommendations will be incorporated in the project together with the suggestions of the State Pollution Control Commission concerning containment of any spillage. Other rehabilitation measures are covered in subsequent sections.

4.2 Land type and use

Little change will occur to the existing land usage. Initially a small fringe area of grazing land will be used in the leaching dam construction. These will be replaced by rehabilitation of the dam area in line with the Soil Conservation Service's recommendations. Sheep are currently being run on agistment on the property.

4.3 Water management

4.3.1 Siltation and sedimentation

With the inclusion of the additional contour and dam system mentioned in Section 4.1 all water run off from site will be collected. Any settlement of silt, etc will occur in these dams and not escape from site. Due to the extensive soil erosion control little or no sediment is expected to occur. Little storm runoff is collected by the dam area. Extensive contouring controls what water falls in the area. The storage dam overflow is directed away from the leaching area.

4.3.2 Flooding

Flooding of the general area is not expected to be a problem since the catchment area above the tailings is relatively small. The water storage facility has been constructed in a proper manner with a non-erodable overflow.

The leaching dams are above the surface of the land and only gather direct rainfall. Excess freeboard will be left above the liquid level to allow for a one in one hundred year maximum rainfall. This allowance will be 200 mm, which corresponds to in excess of 2.7 mm per hour for 72 hours.

The above information was supplied by the Bureau of Meteorology in Melbourne.

4.3.3 Water pollution control

The two main possible sources of water pollution are from:

(a) chemical spillage; and

(b) seepage from a leaching dam

(a) Chemical spillage

Apart from small quantities of cyanide being used in the gold stripping building the only possibility of spillage arises from storage or transfer of cyanide. As cyanide is stored in metal drums in a dry state no real problem arises. The overall collection of surface water by existing and proposed contour and dam systems is a general safeguard against pollution. Drums of calcium hyper-chlorate will be kept on site for neutralising any cyanide spills. Fresh water storage will now be kept isolated from any contaminated water.

(b) Dam seepage

The leaching dams are plastic lined to retain the gold and cyanide bearing solutions. Although every effort is made to ensure these liners remain intact there is a small possibility that a leak may occur. This is undesirable from an economic and environmental view point; however, the following points apply:

(i) The underlying soil has a high clay content, which would prevent or retard seepage.

(ii) The leaching water is maintained at approximately 200 ppm free cyanide. This concentration would be reduced many fold if seepage into ground water occurred.

(iii) There are no water draw points or streams in the vicinity below the site.

(iv) The reactive nature of the cyanide would assist in its rapid decomposition by oxidation and recombination with components in the soil to carbon and nitrogen products.

The above consideration would indicate that dam seepage would not be a source of pollution. Extensive contouring on the site would control any seepage. Only two dams will be in operation at any one time and only one would contain solution during that period.

4.4 Noise

The main sources of noise disturbance would be from:

(a) Earthmoving equipment; and

(b) transport to and from the mine site

4.4.1 Earthmoving equipment

The approximate distance from the nearest house is half a kilometre. Noise levels were measured at the sites marked on Figure 2 for a Fait-Allis HD16 bulldozer (D8 class) working at full load. Background levels were also measured. The sound level meter used was a Bruel and Kjaer type 2215 with a type 4230 calibrator. The readings were taken every five seconds, using the fast response mode Scale A. The time of day was 11.00 a.m. with the wind gusting from 5 to 15 km per hour from 310^{o} magnetic. The results are shown in Table 4.1.

Table 4.1

	Bulldozer working		Background
Distance	500 m	25 m	500 m
Mean	45.0 dB	85 dB	39.3 dB
Std deviation	1.6 dB		3.6 dB
High	48.0 dB		45.0 dB
Low	42.0 dB		32.0 dB
No of readings	15		26

The noise level measured would approximate to the maximums expected during the operation. Noise levels would be less than this the majority of the time since machinery would be sheltered by trees, the tailings dumps and dam walls while working. It is worth noting the agricultural machinery used in hay cutting would create much more noise at the residences than those measured for the bulldozer, and that during building of the pilot dams favourable comments have been received by the companys to the low level of noise.

4.4.2 Transport to and from the mine site

The transport of materials and personnel during the construction and running of the operation would increase the noise levels on nearby residences. However, the expected levels of daily traffic are considered reasonably low. The construction phase of two to three months' duration would involve an average of:

(a) four to five personnel travelling to and from work per day. A portion of these would be from Bodangora village; and

(b) one to two trucks per week.

During operation of the project the expected levels would be:

(a) three to four personnel per day, the majority leaving from the village; and

(b) two to threé trucks per month.

There are two approaches to the site entrance from the main highway. These could both be used to lower traffic volume past individual houses. Negligible noise will result from shipping bullion from site.

4.5 Dust

4.5.1 Earthmoving

The project involves considerable earthmoving with leaching dam construction and tailings transfer. During the dry months dust could be generated and may travel the half kilometre distance to the residences if strong winds prevail. If this situation occurs the following action will be taken to ensure no nuisance is caused:

(a) the area of works will be water sprayed to lay the dust; or

(b) the works will cease or be relocated to a suitable area which does not generate dust.

It is considered that dust is unlikely to be a problem unless the wind speed is in excess of 20 km per hour in the direction of the local residences. The following Table 4.2 shows the average percentage occurrences of wind speeds in excess of 20 km per hour from the directions of south-west, west or north-west. These are monthly averages for the past nineteen years taken by the Wellington Soil Conservation Service research station.

Table 4.2

Month	J	F	M	A	M	J	J	A	S	O	N	D
% occurrence	2	1	1	3	1	2	3	7	10	3	8	9

As can be seen the percentage occurrences of wind in excess of 20 km per hour is generally low. Also the wind speed direction and dry conditions would be required to coincide with earthworks before a potential nuisance situation occurred. The control measures mentioned above would be effective should the problem arise. Any future crushing or screening operations by the company would be done with due regard to local residents, and the appropriate regulating bodies contacted prior to commencement.

4.5.2 Transport to and from the mine site

The suitable accesses from the main road to the mine site are dirt roads and would suffer the inherent problems of dust generation in adverse conditions. However, the relatively low traffic density outlined in section 4.4.2 and the use of the different site approaches would minimise any nuisance effect.

4.6 Flora and fauna

4.6.1 Flora

The main disturbance to flora will occur when the tailings dumps are cleared. A number of small gum and pepper trees will have to be cleared to allow the operation to proceed effectively. However, the majority of trees occur on the fringe areas of the dumps and can be left intact.
Grass coverage on the dumps is minimal, and little clearing is required.

4.6.2 Fauna

The operation will destroy the many rabbit burrows which now exist in the tailings. This will have the positive effect of reducing rabbit numbers in the area.

Birdlife in the area will be at some risk as far as cyanide water is concerned. However, a number of factors will reduce the problem, e.g:

(a) the numbers of birds frequenting the site appear to be small;

(b) machinery operations and general activity around the dam areas will deter birds from visiting the site; and

(c) the general Wellington area has plentiful water supplies for birdlife by way of water storage dams, creeks and rivers.

4.7 Rehabilitation and land use

The company plans to rehabilitate the leaching dams to low density grazing lands. The advice of the District Soil Conservationist has been sought in this regard, and the recommendations are shown in Appendix (I). The company plans to follow these recommendations for operations and rehabilitation on the site. Revegetation and grading of the dams shall improve the site from a visual aspect, as will the planting of native trees adjacent to the workings.

The enlargement of the water storage capacity on the site will assist the rural productivity of the property.

Rehabilitation will be carried out to the satisfaction of the DMR once economic leaching of the tailings has ceased and will involve the following steps:

(a) Draining remaining cyanide solution from the leaching dam for use in later dams.

(b) Reshaping tailings and respreading top soil in accordance with the Soil Conservation Service recommendations.

(c) Planting and fertilising the area in accordance with the Soil Conservation Service recommendations.

All moveable plant will be removed from the site. Fencing, water dams and the main building will remain as permanent farm improvements. The Department of Mineral Resources will moniter the rehabilitation and ensure the lease conditions are fulfilled.

SECTION 5 PROJECT EVALUATION

5.1 Justification

5.1.1 Environment

Adequate control of the project will ensure there are no detrimental effects on the environment.

The guidelines set by the State Pollution Control Commission will be met, as will those from the Soil Conservation Service.

The visual and rural improvements of the area will occur by way of the rehabilitation of the dumps and improvements to the water storage capacities and farm buildings.

5.1.2 Economic

The project will benefit the economic environment directly via:

(a) employment of three to four people from the Bodangora/Wellington area;

(b) expenditure of capital in the area by way of engineering, fuel and supply services;

(c) the rural improvements as covered in Section 5.1.1;

(d) the public will benefit indirectly from the collection of royalty charges; and

(e) development of any further small deposits located in the immediate area will be possible.

5.1.3 Social

The main social benefits will come from the provision of jobs for the local people and the indirect benefits to the community outlined in Section 5.1.2.

5.2 Feasible project alternative

The main alternative project for retreating the Mitchell's Creek dumps would involve a process change to grinding, carbon-in-pulp cyanidation ('CIP'). This process alternative has been studied extensively by the company from the technical and financial viewpoint. The comparison of this

alternative for the tailings dump retreatment with dam leaching is summarised below:

(a) higher capital costs;

(b) higher running costs;

(c) lower effective production rates for a given capital expenditure;

(d) higher recoveries (10% - 20%);

(e) higher energy consumption per tonne of tailings retreated;

(f) higher noise levels; and

(g) longer hours of operation required.

The results of the above conclusions for the CIP process are:

(i) the 123,000 tonnes of low grade tailings would not be economic and, therefore, not treated;

(ii) the total gold produced would be lower due to (i) above;

(iii) the overall economic return to the company would be lower; and

(iv) the environmental impact would be greater.

Therefore, the CIP alternative is not satisfactory.

5.3 The 'No Project' Alternative

The consequences of not proceeding with the proposal would be:

(a) Cluff Minerals (Australia) Pty Limited would not benefit from a profitable mining venture;

(b) The mineral resource of the gold bearing tailings would not be exploited;

(c) the community would not benefit from direct and indirect expenditure;

(d) royalty charges would not be collected by the state government; and

(e) the visual and rural improvement to the tailings dump area would not occur.

APPENDIX I
LIST OF AUTHORITIES CONTACTED AND APPROPRIATE CORRESPONDENCE

LIST OF AUTHORITIES CONTACTED

1) Wellington Shire Council

2) Department of Mineral Resources

3) State Pollution Control Commission

4) Department of Environment and Planning

5) Soil Conservation Service

6) National Parks and Wildlife

7) Department of Health

8) Department of Labour and Industries.

New South Wales Government

Department of Environment and Planning

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

Telephone: (02) 266 7111 Ext 7580

Contact A. Stephens

Our reference 84/11343

Your reference

Managing Director,
Cluff Minerals (Australia) Pty. Ltd.,
P.O. Box 908,
NORTH SYDNEY. 2060

Dear Sir,

Proposed Retreatment of Gold and Silver Tailings Dumps at Old Mitchells Creek Mine, Bodangora.

Thank you for your letter dated 27th August, 1984 which indicates that you are consulting with the Director with regard to the preparation of an environmental impact statement (E.I.S.).

2. As development consent is necessary for the proposal and it is designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, it is necessary that an E.I.S. accompany the development application to Council and to assist in comprehension, a copy of the Director's requirements should be appended to that E.I.S.

3. The basic requirement is that an E.I.S. be prepared in accordance with Clause 34 of the Environmental Planning and Assessment Regulation, 1980, and that it bear a certificate required by Clause 26(1)(b) of the Regulation.

4. With regard to the form and content of the E.I.S. it is advised the Director requires that you take into account matters specified in the attachment to this letter. These matters are to be adequately addressed in the statement and taken into account in the determination of the proposal by Council with whom we suggest you confer. The Director has no other specific requirements and the matter should be pursued with the consent authority with respect to the proposal.

5. There are legislative requirements for the preservation of relics and aboriginal places. Where there is a possibility of these being encountered in development, the incorporation of an aboriginal archaeological survey as part of an environmental impact statement may be necessary. Where aboriginal

archaeological surveys are needed, it is a requirement that they be undertaken by persons who are professionally qualified archaeologists or anthropologists, or who are members of the Association of Consulting Archaeologists. If in doubt on this matter, a proponent should consult with the National Parks and Wildlife Service.

6. Where matters are likely to come within the scope of legislation relative to air, water and noise control as administered by the State Pollution Control Commission, the view of the Commission should be sought. If aspects of the proposal significantly affect agricultural land or agricultural industry, the views of the Department of Agriculture should also be sought and appropriately addressed in the E.I.S.

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

Yours faithfully

J. Shields 12/9/84

J. Shields
Assessments Branch
As Delegate for the Director

NEW SOUTH WALES DEPARTMENT OF ENVIRONMENT AND PLANNING

ATTACHMENT

Proposed Retreatment of Silver and Gold Tailings Dumps at Old Mitchells Creek Mine, Bodangora.

A comprehensive environmental impact statement should adequately cover all the matters specified in Clause 34 of the Environmental Planning and Assessment Regulation, 1980.

These matters should be clearly and succinctly outlined in the text and where appropriate supported by adequate maps, plans, diagrams or other descriptive details to enable all concerned to gain a clear understanding of the full scope of the development and its likely impact on the environment.

The following particular matters shall be included in its coverage:

1. Background information.

- Location of works.
- Broad nature and extent of works proposed.
- Land tenure, boundaries, site details in relation to environmental planning instrument zonings and any other land use constraints.

2. Detailed description of the proposal.

This description should not only describe the proposal at the site but also describe any associated operations such as winning and transport of materials, processes involved (highlighting the proposed grinding and cyanide leaching), disposal of wastes, rehabilitation, landscaping and use of the end product if likely to have environmental implications.

Particular matters to be covered include:

- Characteristics and economic significance of the resource.
- Possible availability of alternative sources.
- Methods of extraction/plans of operations.
- Type of machinery and equipment to be used.
- Expected life of the operation.
- Number of persons to be employed.
- Hours of plant operation and mining of tailings.
- Location and quantity of any necessary stockpiling.
- Access arrangements - truck routes and number of truck movements.
- Quantity of materials to be retreated.
- Noise levels.
- Proposals for rehabilitation and assurances of effective completion.

- Storage of chemicals and associated safety measures.
- Quantities and sources of water.
- Drainage controls and recycling of waste water.
- Disposal of tailings and hazardous waste materials.

3. Description of the environment.

This description 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 facets of the proposal. In this regard, physical, natural, social, cultural, archaeological and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impact of the proposed development. In particular the statement should include an industrial history of the site and identify any relics of heritage significance.

4. Assessment of environmental impact and measures to be taken to reduce the impact especially with respect to:-

- Possible siltation, sedimentation or downstream effects of the operation on nearby watercourses.
- Possible effects of flooding on the operations.
- Effects on fauna and flora.
- Effects on aquifers.
- Likely noise disturbance caused by the operations, including transport operations, on nearby residences.
- Other impacts of trucking movements.
- Dust control and any nuisance likely to be caused.
- Water treatment and other pollution control measures, particularly for the containment of hazardous wastes.
- Disposal of waste material and safety considerations.
- Landscaping measures and effects on the visual environment.
- The proposed final use of the site and likely effectiveness of rehabilitation.
- Any likely affectation of sites of aboriginal archaeological or heritage value if located in the vicinity of the operations.

5. Authorities contacted.

The names of authorities contacted should be listed. Any comments relating to specific matters of interest raised by such authorities should be declared, including those in relation to possible cumulative environmental problems that may result.

New South Wales Government

Department of Environment and Planning

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

Telephone: (02) 266 7111 Ext. 7580

Contact: A. Stephens

Our reference: 84/11343

Your reference:

The Managing Director,
Cluff Minerals (Australia) Pty. Ltd.,
P.O. Box 908,
NORTH SYDNEY. N.S.W. 2060

Dear Sir,

Proposed Retreatment of Gold and Silver Tailings Dump at Old Mitchells Creek Mine, Bodangora.

I refer to the Department's letter of 12th September, 1984 advising you of the Director's requirements for the preparation of the environmental impact statement (E.I.S.) for the above proposal.

2. Subsequent to issue of the above letter the Department's Heritage and Conservation Branch has expressed interest in the proposal and considers that the old mining site is of considerable historical interest. It believes the E.I.S. should address the historic workings and their heritage significance, and should specifically identify items of heritage value likely to be disturbed by the proposed retreatment of the tailings dumps.

3. We would be grateful if during the preparation of the EIS you liaise with the Heritage and Conservation Branch. In this regard, please contact Ms. M. Hutton (telephone (02) 266 7265).

Yours faithfully,

28/9/84

J.D. Shields
for Secretary.

New South Wales Government

National Parks and Wildlife Service

BATHURST DISTRICT

N.S.W. Government Offices
140 William Street
Bathurst, N.S.W. 2795

Our reference: Bath 27/300

Your reference:

Telephone: 33 4236
STD: 063

The Managing Director,
Cluff Oil (Pacific) Ltd.,
P.O. Box 908,
North Sydney, 2060.

7th June, 1985.

Dear Sir/Madam,

PROPOSED MINING OF TAILINGS DEPOSIT -
OLD MITCHELS CREEK MINE, BODANGORA.

An inspection of the site has been carried out. It would appear that no Aboriginal Relics remain in the area to be mined as the ground between the tailings has been ploughed extensively and the tailings would have obliterated any Aboriginal relics.

However, an interesting chimney was noted on the site. What plans have been made for the protection of the chimney? If no plans have been made and you intend removing the chimney - it is imperative that the chimney be assessed for it's historic importance. Unfortunately it was not possible to do this at the time.

We assume an Environmental Impact Statement (EIS) is being prepared, which in this case should look at the significance of the chimney and any associated structures.

The National Trust would be able to help in assessing the historical significance and protection needed. Richard McKay, the industrial archaeologist for the National Trust would be the person to contact.

We would be interested in reviewing the E.I.S. when it is available.

Yours faithfully,

M.Bate,
Ranger, Bathurst District
for Senior Ranger,
Bathurst/Forbes Districts.

June 17, 1985

Your ref: Bath 27/300

National Parks & Wildlife Service
140 William Street
BATHURST. NSW 2795

Attention: Ranger, Bathurst Area

Dear Sirs,

PROPOSED MINING OF TAILINGS DEPOSIT
OLD MITCHELLS CREEK MINE, BODANGORA

Thank you for your letter of June 7, 1985.

We believe that the chimney in question and the other old structures in the mine all relate to the old Mitchells Creek mine operation which ceased just before World War 1. Our Mining Purpose Lease at this stage does not cover either the chimney or the buildings and in any event it would not be our intention to interfer with any of these structures. As you have noted, we are currently in the course of preparing our Environmental Impact Statement and we thank you for your suggestions and assistance in this regard.

Yours faithfully,
CLUFF OIL (PACIFIC) LIMITED

Walter Penninger
Managing Director

CLUFF MINERALS (AUSTRALIA) PTY. LIMITED
AGL Centre, 111 Pacific Highway, North Sydney,
P.O. Box 908, North Sydney, NSW 2060, Australia
Telephone: (02) 957 2644 Telex AA26309

CLUFF MINERALS

PLEASE REPLY TO:

Tony Smith
'Eden'
Bodangora, NSW 2820
Telephone: (068) 45 1183

10th March, 1986

The District Soil Conservationist
PO Box 207
Wellington
NSW 2820

Dear Sir,

As you are aware my company is planning to retreat the gold bearing sands (tailings) from the old Mitchell's Creek mine at Bodangora.

I am writing to request advice regarding the rehabilitation of the gold leaching dams on completion of the project. I feel that planning rehabilitation prior to the project's commencement will ensure cost effective measures are implemented.

Please contact me at the above telephone number at Bodangora if I am able to be of assistance.

Yours faithfully,
CLUFF MINERALS (AUSTRALIA) PTY LIMITED

PP Tony Smith
Project Manager

Soil Conservation Service
P.O. Box 207, WELLINGTON. N.S.W. 2820

Our reference: 25/46

Your reference:

Telephone:
(068)452488

Mr. Tony Smith,
Cluff Minerals (Aust.)Pty.Ltd.,
"Eden",
BODANGORA. N.S.W. 2820

Dear Sir,

Re: Bodangora Gold Mine Tailings Re-Treatment

I refer to your letter of 10th March, 1986, and the subsequent on-site inspection on 13th March, 1986, dealing with rehabilitation measures for the abovementioned site.

It is recommended that the following measures and conditions be incorporated into the management and rehabilitation programmes for the site.

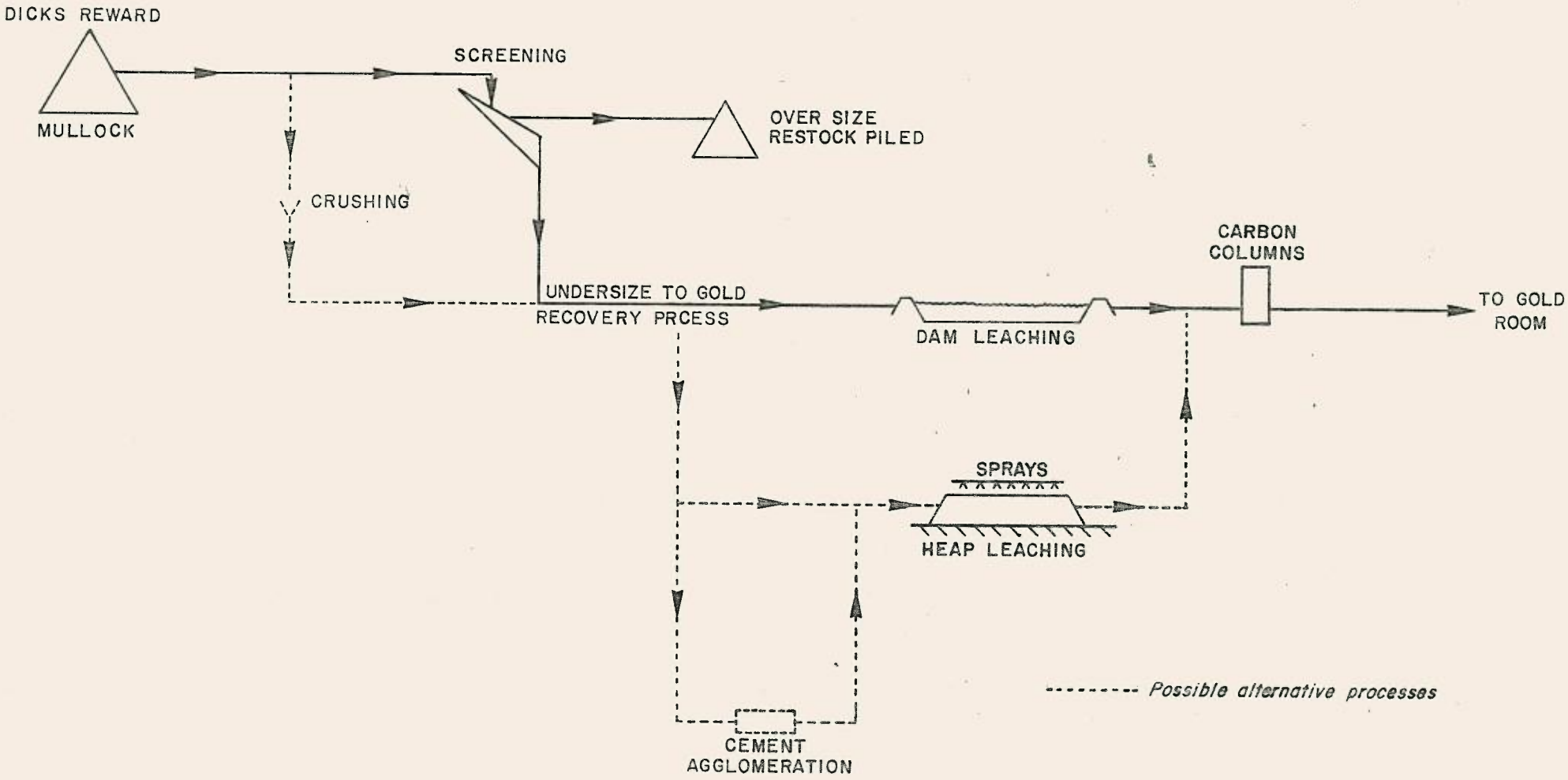
1. Direct run-on into the existing soil conservation earthworks by means of a graded bank above the pilot tailings treatment dam.
2. Strip and stockpile all topsoil material prior to construction of tailings treatment dams.
3. Maintain existing grassed waterways and exclude all livestock and vehicular traffic from these areas.
4. Construct a settlement dam, with a minimum capacity of 2,000 cubic metres, and associated graded banks below the lower tailings dump to act as the final outlet for run-off from the tailings area.
5. Upon completion of the re-treatment, re-shape the tailings to a maximum grade of 6(h): 1(v) and re-spread available topsoil on sloping sections as a first priority. Seed and fertilizer recommendations will be subject to the testing of treated tailings to determine its chemical and physical properties.
6. Existing trees growing in the vicinity of the tailing dumps should be retained where possible.

The Service's own plant is available to construct the settlement dam and associated graded banks, if required. The estimated cost of such work using Service personnel and equipment is $2,500. Should you require any further information, please contact the undersigned on telephone 452488.

Yours faithfully,

G. R. CHAPMAN
District Soil Conservationist

APPENDIX II



Appendix 2. Process flow sheet for Dicks Reward Mullock

APPENDIX III

LIST OF MAJOR PLANT ITEMS

1. WATER SUPPLY

A. Electric Borehole Pump for pumping water to surface

B. Diesel Pump for pumping water from storage to leaching dams

2. LEACHING PLANT

A. Six Carbon Columns and associated recirulating diesel pumps

3. STRIPPING SECTION

A. Caustic Cyanide stripping tank and associated gas heating and electrical pumping plant

B. Electromining Tank

4. BULLION SECTION

A. Gas fired smelter

5. LABORATORY

A. Atomic Absorption Spectrometer

6. EARTHMOVING

A. Bulldozer supplied by contractor

B. Front End Loaders (Terrex 7281 with 9 yard Bucket used for moving tailings and small Ford 4500 used for general work on site)

APPENDIX IV

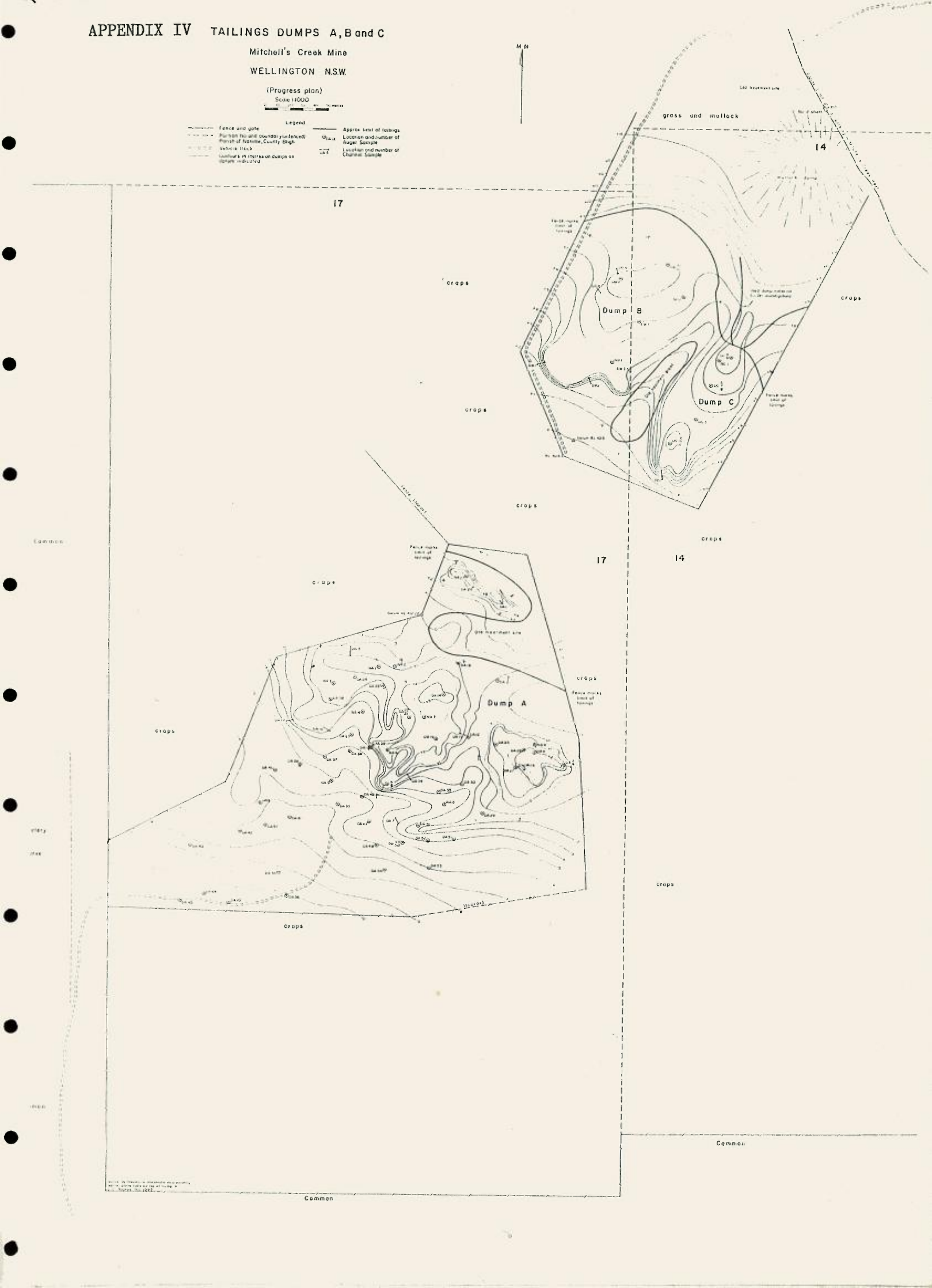
APPENDIX IV TAILINGS DUMPS A, B and C

Mitchell's Creek Mine

WELLINGTON N.S.W.

(Progress plan)

Scale 1:1000

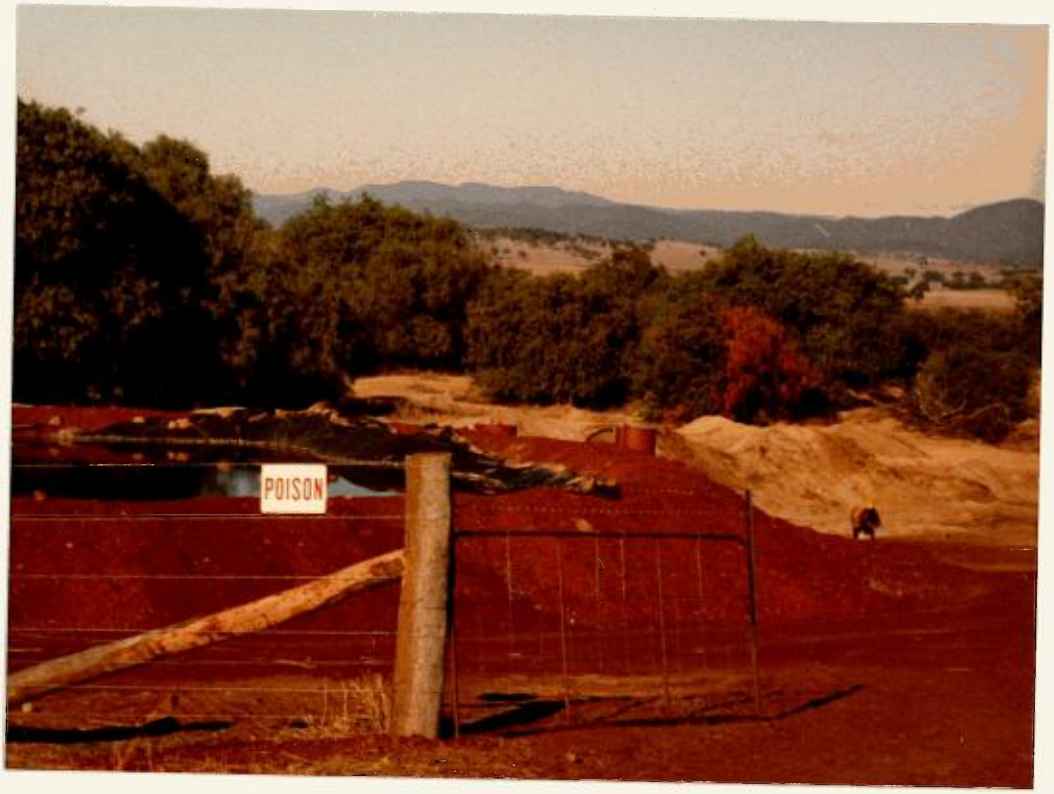


Photograph 1 - Existing environment at mine site, showing unprocessed tailings.

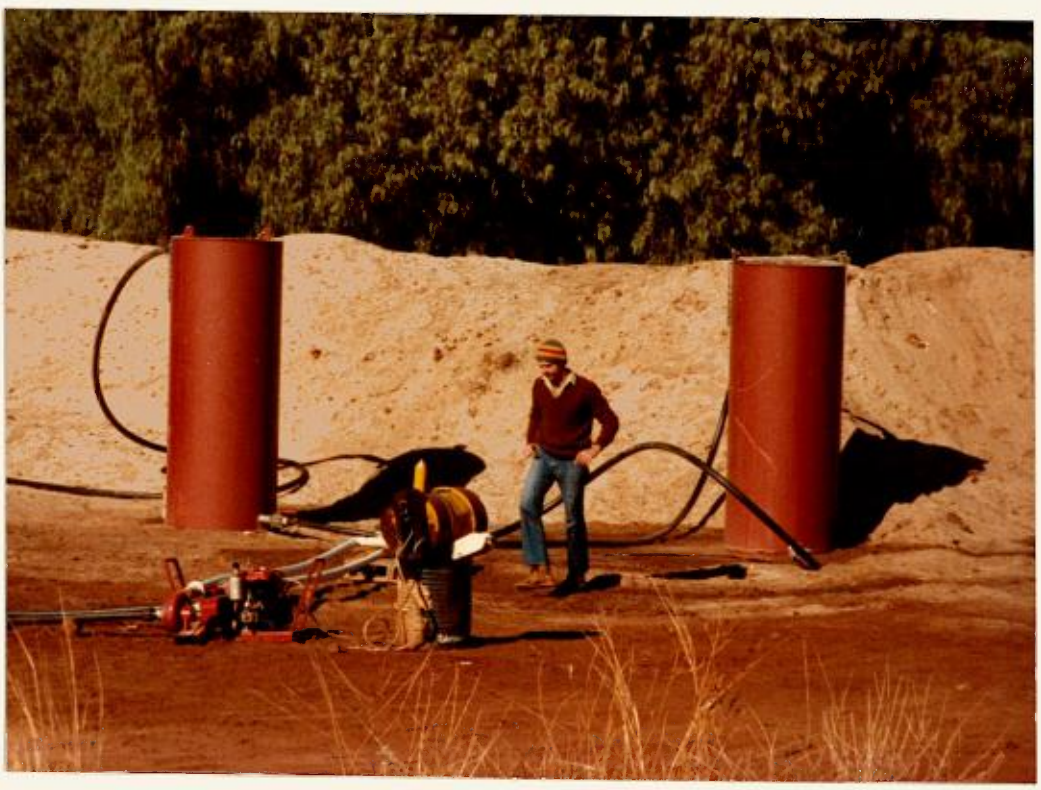
Photograph 2 - Environment surrounding old tailings dumps.

Photograph 3 - Front end loader to be used for transport of tailings.

Photograph 4 - Pilot plant leaching dam with water supply dam in distance.



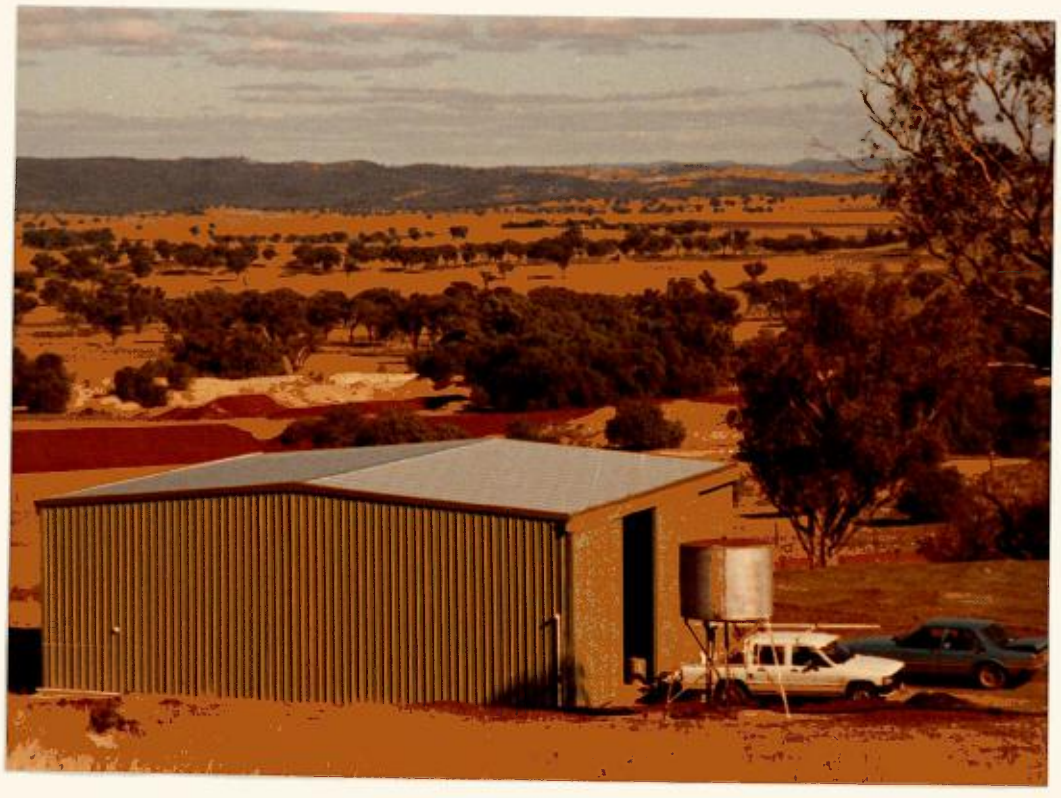
Photograph 5 - Pilot plant leaching dam showing dam wall construction.



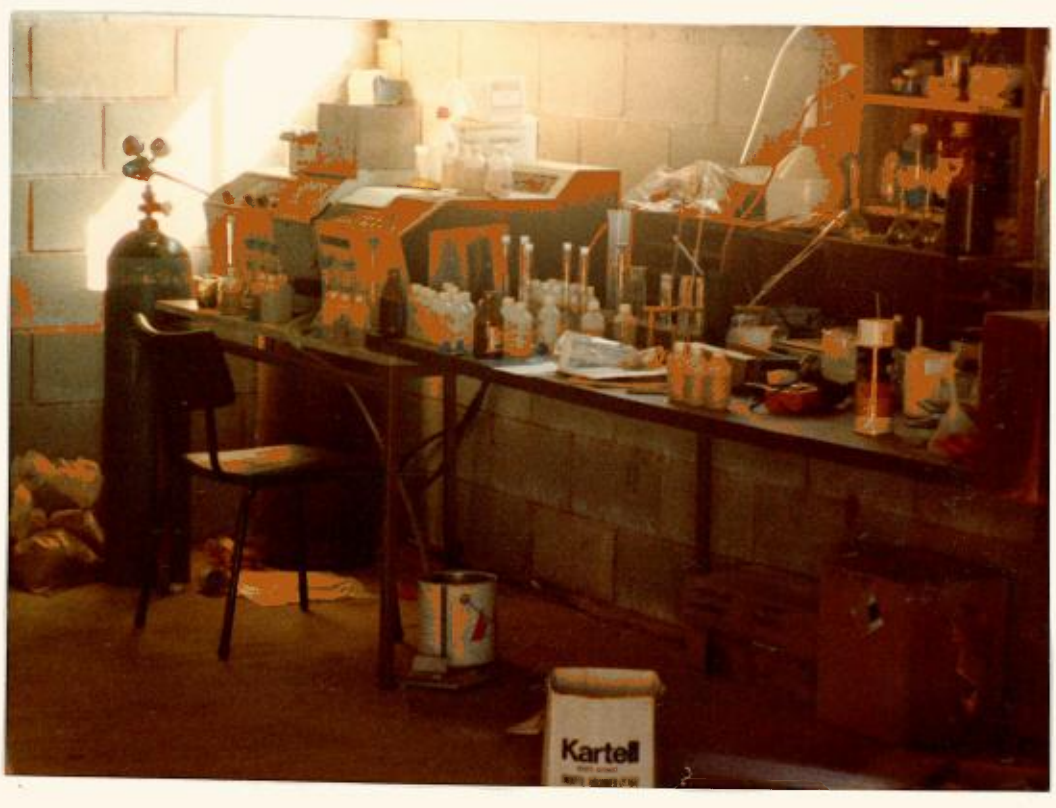
Photograph 6 - Carbon columns used to absorb gold from leaching solution

Photograph 7 - Pilot plant dam during leaching tests.

Photograph 8 - Carbon columns operating leaching tests.



Photograph 9 - Mine office, laboratory and storage shed.



Photograph 10 - Atomic absorbtion spectrometer used for monitering chemical reactions within the dams.

CLUFF MINERALS (AUSTRALIA) PTY LTD

EIS
503

Mitchell's Creek road tailings
retreatment Bodangora, NSW

CLUFF MINERALS (AUSTRALIA) PTY LTD EIS

503

Mitchell's Creek road tailings
retreatment Bodangora, NSW

Borrower's name	Date	Ext

RAECO

FIGURE 2. GENERAL PLAN OF THE MITCHELL CREEK PROJECT AND ENVIRONS

PORTION 15

OLD SHED

GATE

HOUSES

BLIGH STREET

OLD CHIMNEY

No. 2 SHAFT

BORE PUMP

MPL 73 PEG

MULLOCK

PROPOSED SITE OF NEW SHED

GATE

GARBAGE TIP

MULLOCK

DICKS REWARD AREA

GATE

GATE

MITCHELL'S

TAILINGS

DRAINAGE

CREEK

DRAINAGE CONTOUR BANK

WATER STORAGE DAM

PORTION 14

DRAINAGE CONTOUR BANK

NOISE MEASUREMENT

HOUSE

HOUSE

ISALI STREET

DICK STREET

PORTION 17

AREA

COMMON

NOISE MEASUREMENTS

MULLOCK

TAILINGS

MULLOCK

Cemetery Reserve

GATE

Area proposed for third contour and water dam system

QUARRY

DAM

GRID

MN

0 100 200 metres

Mine waste-dump tailings or mullock as noted

Building, house, shed

Mining Purposes Lease application

Road, or track