



ASSESSMENT REPORT 14

**PROPOSED TAILINGS DAM AND ASSOCIATED
INFRASTRUCTURE ON MINERAL
LEASES 1106 AND 1107 (WOODCUTTERS MINE)**

**ENVIRONMENTAL ASSESSMENT REPORT
AND RECOMMENDATIONS**

by the

**ENVIRONMENT PROTECTION UNIT
CONSERVATION COMMISSION OF THE NORTHERN TERRITORY**

JULY 1992

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SUMMARY AND RECOMMENDATIONS

An Environmental Impact Statement (EIS) on a proposal by Nicron Resources to construct and operate a new tailings dam at Woodcutters Mine has been subject to assessment under the NT *Environmental Assessment Act*, which is administered by the Conservation Commission.

This report outlines the assessment process, details the main issues associated with the proposal, and summarises the commitments made by the developer to minimise environmental impacts and manage the environment.

The Conservation Commission considers that Nicron Resources has met the requirements of the Administrative Procedures of the *Environmental Assessment Act* and that the EIS has addressed the minimum requirements outlined in the EIS Guidelines for the proposed dam. It is concluded that the proponent has adequately addressed the major potential environmental impacts associated with this development and subject to implementation of the safeguards detailed in the EIS and recommendations outlined below, there are no significant outstanding environmental issues which should prevent the development from proceeding.

Summary of Recommendations

Recommendation 1

That the proponent be required by the Department of Mines and Energy to adhere to all safeguards and monitoring arrangements listed in Table 2 and 3 of this report and commitments outlined in the EIS.

Recommendation 2

That the results of quality control audits and performance testing for the proposed dam which the proponent has undertaken to commission, also be provided to the Department of Mines and Energy, the Conservation Commission and be available to the public on request.

Recommendation 3

That when detailed plans of construction methods and materials for the tailings dam are submitted for approval, the Department of Mines and Energy in consultation with the Power and Water Authority, assess the need for a filter zone in the dam design to protect the integrity of the clay core.

Recommendation 4

That if during the operational life of the proposed dam, topsoil is spread over external dam batters to assist in revegetation, the proponent be required by the Department of Mines and Energy to flatten external batter angles to a slope of at least 1:3.

FIGURES

- FIGURE 1 LOCATION OF WOODCUTTERS MINE, NORTHERN TERRITORY
- FIGURE 2 SITING OF PROPOSED TAILINGS DAM, WOODCUTTERS MINE

TABLES

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- TABLE 2 SUMMARY OF IMPACTS, SAFEGUARDS AND PREDICTED EFFECTS FOR PROPOSED TAILINGS DAM ON MINERAL LEASES 1106 AND 1107, WOODCUTTERS MINE
- TABLE 3 SUMMARY OF ENVIRONMENTAL MONITORING FOR PROPOSED TAILINGS DAM ON MINERAL LEASES 1106 & 1107, WOODCUTTERS MINE

Recommendation 5

That the proponent be required by the Department of Mines and Energy to continue use the draft National Water Quality Guidelines (ANZECC) as the basis for monitoring the quality of water leaving the minesite, until such time as the Director of Water Resources establishes specific water quality standards for the Northern Territory.

Recommendation 6

That the proponent be required by the Department of Mines and Energy to produce a draft management plan for the polishing pond and natural wetland systems on the mine site which addresses the methodologies and objectives for maintenance of these systems. The draft management plan should be submitted to Department of Mines and Energy, Conservation Commission of the NT and Department of Health and Community Services for comment prior to approval by the Department of Mines and Energy.

Recommendation 7

That the proponent be required by the Department of Mines and Energy to undertake a mosquito monitoring programme at the minesite of at least 12 months duration in accordance with and to the satisfaction of Department of Health and Community Services' requirements. The proponent should further consult with the Department of Health and Community Services regarding appropriate measures to minimise mosquito breeding habitats at the minesite.

Recommendation 8

That the proponent be required to consult with the Department of Mines and Energy at the earliest possible stage regarding any additional soil conservation measures required if construction of the proposed dam proceeds into the wet season

Recommendation 9

That the proponent should continue to liaise with local aboriginal groups prior to, during and after construction of the proposed dam.

Recommendation 10

That the proponent be required by the Department of Mines and Energy to incorporate a monitoring programme into the detailed rehabilitation plan for the proposed tailings dam in order to determine the long term stability of the rehabilitated landform and effects on local surface and groundwater quality.

Recommendation 11

That the proponent should consult with the Conservation Commission during the preparation of the detailed rehabilitation and monitoring plan for the existing tailings dam at Woodcutters Mine, prior to its submission to the Department of Mines and Energy for approval.

Recommendation 12

That the proponent be required by the Department of Mines and Energy to develop and implement a pilot sampling programme for heavy metals in benthic organisms and fish in Woodcutters and Coomalie Creeks, in consultation with the Conservation Commission. The results should be reported to the Department of Mines and Energy and the Conservation Commission.

Recommendation 13

That the Department of Mines and Energy produce annual reports summarising and interpreting the results of all monitoring commitments in the EIS and Table 3 of this report (both on and off the Woodcutters mine site) and that these reports be available to other Government agencies and the public on request.

1.0 INTRODUCTION AND BACKGROUND

This report examines a proposal by Nicron Resources Ltd (the proponent) to construct a tailings dam and associated works on Mineral Leases 1106 and 1107 to impound wastes originating from Woodcutters Mine in the Coomalie Region, NT (Figure 1).

On 18 February 1992, the Minister for Conservation wrote to the Minister for Mines and Energy requesting him to supply a report on the proposal in accordance with Clause 7 of the Administrative Procedures under the *Environmental Assessment Act*. The review of this report raised a number of concerns relating to dam design and the potential for release of contaminants into the environment. As a result, on 25 February 1992, the Minister for Conservation directed Nicron Resources to prepare an Environmental Impact Statement (EIS) on the proposal so that the outstanding issues could be further investigated and assessed. The Conservation Minister also issued detailed guidelines to assist in the preparation of the draft EIS.

The draft EIS for the tailings dam was submitted to the Minister for Conservation on 1 May 1992 and was available for public and government review between 6 May 1992 and 2 June 1992. All comments were forwarded to the proponent for consideration in preparation of the final EIS, which was submitted on 16 June 1992.

1.1 DESCRIPTION OF PROPOSAL

Construction and operation of the tailings dam and associated infrastructure are described in detail in the EIS. Briefly, the proposal is to construct and operate a new tailings dam and tailings delivery system on Mineral Leases 1106 and 1107 in the Coomalie district, approximately 80km south of Darwin. The leases adjoin the existing mineral leases held by Nicron Resources as part of the Woodcutters Lead-Silver, Zinc Mine. The proposed tailings dam will impound approximately 1.2 million m³ of tailings material generated from expansion of Woodcutters mining operations over the next 10 years.

The proposed dam has a surface area of approx. 30 ha and dam wall height varies from 1.5 to 10m. The dam has been designed to minimise leakage and incorporates a clay core in the wall and floor and a seepage collector system to collect seepage and return it to the dam. Two tailings lines will be laid between the mill and the dam and tailings delivered via off shoots around the circumference of the dam. A return water line will also be constructed to deliver water from the tailings dam to the mill where it is recycled.

Construction will be in 2 phases, the first will construct the dam wall to RL 1068.8 in order to impound approx. 400,000 m³ of tailings and construct all associated infrastructure. The second phase will elevate the dam wall to RL 1072 and increase tailings impoundment to 1.2 million m³. Construction of phase 1 is proposed to commence by mid July 1992 and will take approx. 4 months to complete. The dam is expected to become operational by mid November 1992. Tailings will initially be deposited at the southern end of the dam and entire coverage of the dam with tailings is expected within the first 12 months of operation.

1.2 ALTERNATIVES TO THE PROPOSAL

The major alternatives to a new tailings dam include:

- . Raising the existing dam height by approximately 9m
- . Depositing tailings in the open pit of the mine
- . Depositing tailings in worked out mine stopes.

These alternatives were not favoured by the proponent as they were considered to be incompatible with current mining operations and methods, and would create more significant waste water management problems and potential environmental impacts. This conclusion is supported and providing the new tailings dam is constructed and operated in accordance with the EIS, it is the most environmentally acceptable option for disposal of tailings, given the present operations at Woodcutters mine.

Alternative sites for a new tailings dam were given cursory treatment in the EIS since the proposed site minimises transport distances to the mill.

1.3 EXISTING ENVIRONMENT

Figure 1 shows the general location of Woodcutters Mine in the NT. Figure 2 indicates the general layout and features of the area potentially affected by the proposed tailings dam and the surrounding lands. The draft EIS describes the existing environment in some detail. Main features include:

- . Nicron Resources own the proposed site for the tailings dam under freehold title;
- . The Finnis River Land Claim adjoins the affected area to the west;
- . The area is dominated by the existing mining facilities and operations which include the current tailings dam, mine pit, waste rock dump, processing plant, and office buildings. The area to be affected by the proposed tailings dam is immediately south of the existing tailings dam;
- . Vegetation in the area immediately affected by construction activities comprises 28 ha of highly disturbed grassland, previously used for agricultural development, and 15 ha of open woodland which has previously been disturbed by grazing activities. Studies have not identified any flora and fauna of particular conservation significance on the site;
- . Drainage at the site flows approximately southwest into Woodcutters Creek which runs roughly north - south along the western boundary of the site. Woodcutters Creek joins Coomalie Creek just south of the dam site;
- . As a result of water discharges from existing mining operations, water flow in Woodcutters Creek is sustained throughout the dry season resulting in the formation of an extensive wetland system downstream of the mine site;
- . Surface water quality in Woodcutters and Coomalie Creeks is influenced by natural run-off from surface copper, lead and zinc anomalies, agricultural run-off, mine water discharges, and groundwater discharges in the catchment.

Sampling data for solute and heavy metal concentrations at various locations in the Woodcutters - Coomalie Creek catchments are presented in the EIS;

The EIS provides no detailed data on existing groundwater quality but includes summaries of DME data. Solute levels in groundwater surrounding the existing tailings dam have steadily increased since commencement of mining operations; and

Soils are duplex, consisting of silty clay loams and medium clays with clay content increasing with depth.

1.4 REVIEW OF THE DRAFT EIS

A total of 11 responses were received on the draft EIS, 3 from members of the public or public organisations, and 8 from NT Government organisations. Table 1 provides a broad summary of the comments and issues raised in these responses. Further details can be found in the final EIS.

The major areas of concern raised during review of the draft EIS were as follows:

The proposed construction timetable could not be achieved and some construction is likely during the early wet. Concern was expressed that the delays may alter current tailings management and that undue haste during construction may lead to a poorly constructed dam with consequent adverse impacts on the environment;

The need for a sand filter or geotextile membrane in dam design to separate the clay core from the rock fill used in dam wall construction;

The need for external batters of dam wall to have slopes of 1:3 or 1:4 rather than 1:2 to provide for adequate stabilization and long term rehabilitation of the dam site;

Reliance on the existing seed bank in topsoil to be used for revegetation of external dam batters is unsatisfactory;

The proposed dome structure for the rehabilitated dam may cause problems. The structure may require subdivision into subcatchments;

The proposed monitoring programme should include sampling of stream sediments, and aquatic fauna;

Water quality criteria or goals eg (ANZECC) were not established; and

The narrow scope of the draft EIS in dealing only with the construction of the new tailings dam rather than the effects of mine expansion and alterations to water / waste management programmes, and decommissioning / rehabilitation of the existing dam.

1.5 REVIEW OF THE FINAL EIS

The final EIS was circulated to all NT Government and public respondents who made comment on the draft EIS.

The EIS adequately addressed the majority of comments made on the draft EIS. The remaining concerns or areas not resolved in the final EIS are outlined in Section 2 below.

2.0 ENVIRONMENTAL ASSESSMENT AND ISSUES

Table 2 provides a summary of the potential environmental impacts, proposed safeguards and predicted environmental impacts for the proposed development. The table includes information taken from the final EIS and also from comments received on the draft EIS.

Table 3 provides a summary of the proposed environmental monitoring programme for the tailings dam and includes commitments by the proponent and additional monitoring requirements arising from the environmental assessment of the proposal.

It is considered that the majority of potential environmental impacts will be satisfactorily mitigated through implementation of the safeguards listed in Table 2. The recommendations detailed below arise from matters which were not satisfactorily resolved in the final EIS as well as measures recommended to be implemented by the proponent and various NT Government agencies in order to further mitigate and manage environmental impacts.

2.1 IMPLEMENTATION OF SAFEGUARDS

This proposal has been assessed on the basis of commitments provided by the proponent in the EIS. It is therefore essential that these commitments and any additional environmental safeguards arising from the assessment be included as requirements on the project should it be approved to proceed.

Recommendation 1

That the proponent be required by the Department of Mines and Energy to adhere to all safeguards and monitoring arrangements listed in Table 2 and 3 of this report and commitments outlined in the EIS.

2.2 DESIGN AND CONSTRUCTION

The major issues arising from the assessment include:

a) Adherence to design standards

The possibility of an accelerated construction time frame raises concerns regarding adherence to design standards. Whilst the safeguards proposed for quality control during construction are considered adequate, the proponent and DME will need to rigorously enforce these safeguards and maintain a high degree of vigilance to ensure the dam is

constructed to design standards. Otherwise, the consequences may be similar to that for the present tailings dam which has serious leakage problems.

Recommendation 2

That the results of quality control audits and performance testing for the proposed dam which the proponent has undertaken to commission, also be provided to the Department of Mines and Energy, the Conservation Commission and be available to the public on request.

b) Protection of the clay core

The clay core is integral to minimising leakage from the proposed dam. The Power and Water Authority have suggested that a filter zone may be necessary to protect the physical integrity of the clay core. The proponent considers that a filter is unnecessary due to the size of the dam, the lack of free water against the upstream face of dam wall, characteristics of the clay, and the protective barrier formed by tailings beaches. Given the importance of the clay core in minimising the environmental release of contaminants and therefore its need to be adequately protected, the requirement for a filter zone should be closely examined by DME when the proponent submits for approval, further details of the dam design, construction methods and physical characteristics of construction materials.

Recommendation 3

That when detailed plans of construction methods and materials for the tailings dam are submitted for approval, the Department of Mines and Energy in consultation with the Power and Water Authority, assess the need for a filter zone in the dam design to protect the integrity of the clay core.

c) Design of external batters to facilitate stabilisation

The proponent has not clearly indicated in the EIS whether topsoil will be spread over the external dam batters in order to revegetate these areas during the operational phase of the dam. If this is undertaken the external batter angle will need to be flattened to a slope of at least 1:3 to achieve adequate stabilization.

Recommendation 4

That if during the operational life of the proposed dam, topsoil is spread over external dam batters to assist in revegetation, the proponent be required by the Department of Mines and Energy to flatten external batter angles to a slope of at least 1:3.

d) Possible referral of the proposal to the Australian National Committee on Large Dams (ANCOLD)

A number of comments raised the possibility of referral and review of the proposed dam by ANCOLD, an advisory body which registers large dams and advises on dam safety. ANCOLD has no statutory role in the approval of dams in the Northern Territory. The

environmental assessment process has adequately addressed the safety of the proposed dam and nothing further would be gained by referral of the proposal to ANCOLD.

2.3 POLLUTION OF LAND AND SURFACE / GROUNDWATER

Major issues raised in the assessment include:

- a) Leakage of tailings water from the dam leading to contamination of local groundwater;
- b) Overtopping or rupture of the dam leading to contamination of local surface waters;
- c) Spill of tailings during delivery to the dam leading to contamination of soils;
- d) Wind erosion of tailings beaches leading to contamination of surrounding land;
- e) Release of acid leachate containing heavy metals into local surface and ground water;
- f) Contaminated run-off from the site;
- g) Ingestion of heavy metals by wildlife foraging at the dam site;
- h) Disposal of construction wastes;
- h) Long term heavy metal contamination of dam site after decommissioning and release of heavy metals into local surface and groundwaters; and
- i) Acceptable water quality criteria for receiving waters.

The safeguards proposed in Table 2 are considered adequate to ensure that the proposal does not significantly alter soil and water quality.

Concern was also raised regarding the lack of water quality criteria for water leaving the mineral leases in order to maintain acceptable water quality in Woodcutters and Coomalie Creeks.

Recommendation 5

That the proponent be required by the Department of Mines and Energy to continue use the draft National Water Quality Guidelines (ANZECC) as the basis for monitoring the quality of water leaving the minesite, until such time as the Director of Water Resources establishes specific water quality standards for the Northern Territory.

2.4 WATER MANAGEMENT

The major issues are

a) *Increase in release of pit water compared to present levels*

Release of pit water will increase under the proposed water management system. However, the increase is small and is not considered significant in the context of past releases when pit dewatering was higher. Existing water quality in Woodcutters and Coomalie Creeks is unlikely to be affected by this small increase.

b) *Effectiveness and management of the natural and artificial wetlands and integration of other objectives such as mosquito management*

The management of artificial and natural wetlands on the minesite which are used to treat pit water before release into Woodcutters and Coomalie Creeks, remains of concern. Although this is somewhat peripheral to the construction and operation of the new tailings dam it is relevant in that the proposed tailings dam and existing wetlands form an integral part of the overall water management system for the mine. Concerns remain that the wetlands system is managed in an ad-hoc manner which does not integrate or prioritise other objectives such as mosquito management, continued maintenance of biotic components under altered water budgets and water quality, attractiveness to wildlife etc. Opportunities exist for water management practices to co-exist with other objectives through modifications to the physical nature of the polishing pond such as formalisation of the banks, although due to its close proximity such modifications can not be undertaken prior to the rehabilitation of the existing tailings dam.

Recommendation 6

That the proponent be required by the Department of Mines and Energy to produce a draft management plan for the polishing pond and natural wetland systems on the mine site which addresses the methodologies and objectives for maintenance of these systems. The draft management plan should be submitted to Department of Mines and Energy, Conservation Commission of the NT and Department of Health and Community Services for comment prior to approval by the Department of Mines and Energy.

Recommendation 7

That the proponent be required by the Department of Mines and Energy to undertake a mosquito monitoring programme at the minesite of at least 12 months duration in accordance with and to the satisfaction of Department of Health and Community Services' requirements. The proponent should further consult with the Department of Health and Community Services regarding appropriate measures to minimise mosquito breeding habitats at the minesite.

2.5 VEGETATION CLEARANCE

There are no outstanding issues regarding the clearance of vegetation at the dam site and the loss of 15 ha of previously disturbed woodland is considered acceptable. The safeguards proposed in Table 2 should ensure that vegetation clearance is kept to a minimum.

2.6 SOIL EROSION

The major issue arising from the assessment is the potential for excessive soil loss at the construction site due to removal of vegetation and topsoil and extensive physical disturbance, and resultant increase in sediment loads in Woodcutters and Coomalie Creeks.

The proposed safeguards outlined in Table 2 are adequate to ensure soil stabilisation providing construction is completed during the dry season. The revised construction timetable indicates that construction may proceed into the early wet season and the proponent has indicated that should this occur it will consult with relevant government authorities regarding further soil conservation measures.

Recommendation 8

That the proponent be required to consult with the Department of Mines and Energy at the earliest possible stage regarding any additional soil conservation measures required if construction of the proposed dam proceeds into the wet season

2.7 LOCAL AMENITY

The issues are

- . increased risk of fire
- . reduction in air quality from burn-off of cleared vegetation
- . construction noise
- . visual intrusion of completed dam

There are no outstanding issues. The proposed safeguards outlined in Table 2 are adequate to ensure the proposal will have minimal impact on local amenity.

2.8 HISTORICAL AND ARCHAEOLOGICAL SITES

No registered archaeological or historic sites have been identified as being affected by the proposal. In the event that a previously unknown site is found during construction, the statutory provisions of the *Heritage Conservation Act* will ensure that it is properly assessed.

2.9 ABORIGINAL ISSUES

The proponent has applied for an Authority Certificate from the Aboriginal Areas Protection Authority which will ensure that local aboriginal groups are adequately consulted regarding the effects of the proposal on any sacred sites.

Concerns were also raised by the Northern Land Council regarding consultation with local aboriginal groups and the effect of the proposal on their traditional affiliations and religious beliefs associated with land and water. The proponents response in the EIS does not adequately demonstrate that sufficient consultation has taken place.

Recommendation 9

That the proponent should continue to liaise with local aboriginal groups prior to, during and after construction of the proposed dam.

2.10 REHABILITATION

A) Proposed Dam

The proponent has outlined general plans for rehabilitation of the proposed tailings dam which are considered adequate. Provision of more detailed rehabilitation plans is unnecessary at this stage of the development since the dam will have an operating lifespan of 10 years and detailed rehabilitation plans should reflect the methods and technologies available at that time. However, the long term rehabilitation and continued stability after decommissioning, of any tailings dam continues to be of concern and will require ongoing monitoring and remedial works where necessary. The proponent has given no commitment in the EIS to ongoing monitoring of the proposed dam once it is rehabilitated.

Recommendation 10

That the proponent be required by the Department of Mines and Energy to incorporate a monitoring programme into the detailed rehabilitation plan for the proposed tailings dam in order to determine the long term stability of the rehabilitated landform and effects on local surface and groundwater quality.

Nicron Resources have an existing bond lodged under the *Mining Act* for the present mining operations at Woodcutters Mine. Given the commitment in the EIS to rehabilitation of the existing dam, it is considered that the current bond is adequate incentive for the rehabilitation of the proposed tailings dam.

B) Existing Dam

Considerable public concern was expressed regarding rehabilitation of the existing tailings dam and ongoing management of leachate. The proponent has indicated that detailed rehabilitation plans, consistent with the broad rehabilitation plan for the proposed dam, will be prepared and submitted to DME for approval. The Conservation Commission has expertise which would be of assistance in preparation of the detailed rehabilitation and monitoring plans for the existing tailings dam.

Recommendation 11

That the proponent should consult with the Conservation Commission during the preparation of the detailed rehabilitation and monitoring plan for the existing tailings dam at Woodcutters Mine, prior to its submission to the Department of Mines and Energy for approval.

2.11 MONITORING AND ACCOUNTABILITY

The monitoring programme proposed in the EIS and summarised in Table 3 is generally considered satisfactory. However, additional baseline information on heavy metal levels in aquatic biota would assist the proponent and overseeing authorities in gaining a better understanding of potential pathways for heavy metals released from the mining operations and enable assessment of the need for ongoing, regular monitoring.

Recommendation 12

That the proponent be required by the Department of Mines and Energy to develop and implement a pilot sampling programme for heavy metals in benthic organisms and fish in Woodcutters and Coomalie Creeks, in consultation with the Conservation Commission. The results should be reported to the Department of Mines and Energy and the Conservation Commission.

The past lack of availability of monitoring data, both on and off the minesite, has heightened public scepticism over the adequacy of environmental controls at Woodcutters mine. Public availability of reports summarising and interpreting the monitoring results would assist in allaying the fears of the general public and in particular the local community and surrounding landholders. The Department of Mines and Energy, as the responsible authority, is in the best position to produce reports since it routinely receives and assesses monitoring data from Nicron Resources and also undertakes its own monitoring.

Recommendation 13

That the Department of Mines and Energy produce annual reports summarising and interpreting the results of all monitoring commitments in the EIS and Table 3 of this report (both on and off the Woodcutters mine site) and that these reports be available to other Government agencies and the public on request.

2.12 CONCLUSION

It is concluded that Nicron Resources have met the requirements of the Administrative Procedures of the *Environmental Assessment Act* and that the EIS for the proposed dam addresses the minimum requirements outlined in the EIS Guidelines.

It is considered that the proponent has adequately addressed the major potential environmental impacts associated with this development and subject to the implementation of the safeguards summarised in Table 2 and recommendations outlined in Section 2 of this report there are no significant outstanding environmental issues which would prevent the development from proceeding.

FIGURE 1 LOCATION OF WOODCUTTERS LEAD-SILVER, ZINC MINE

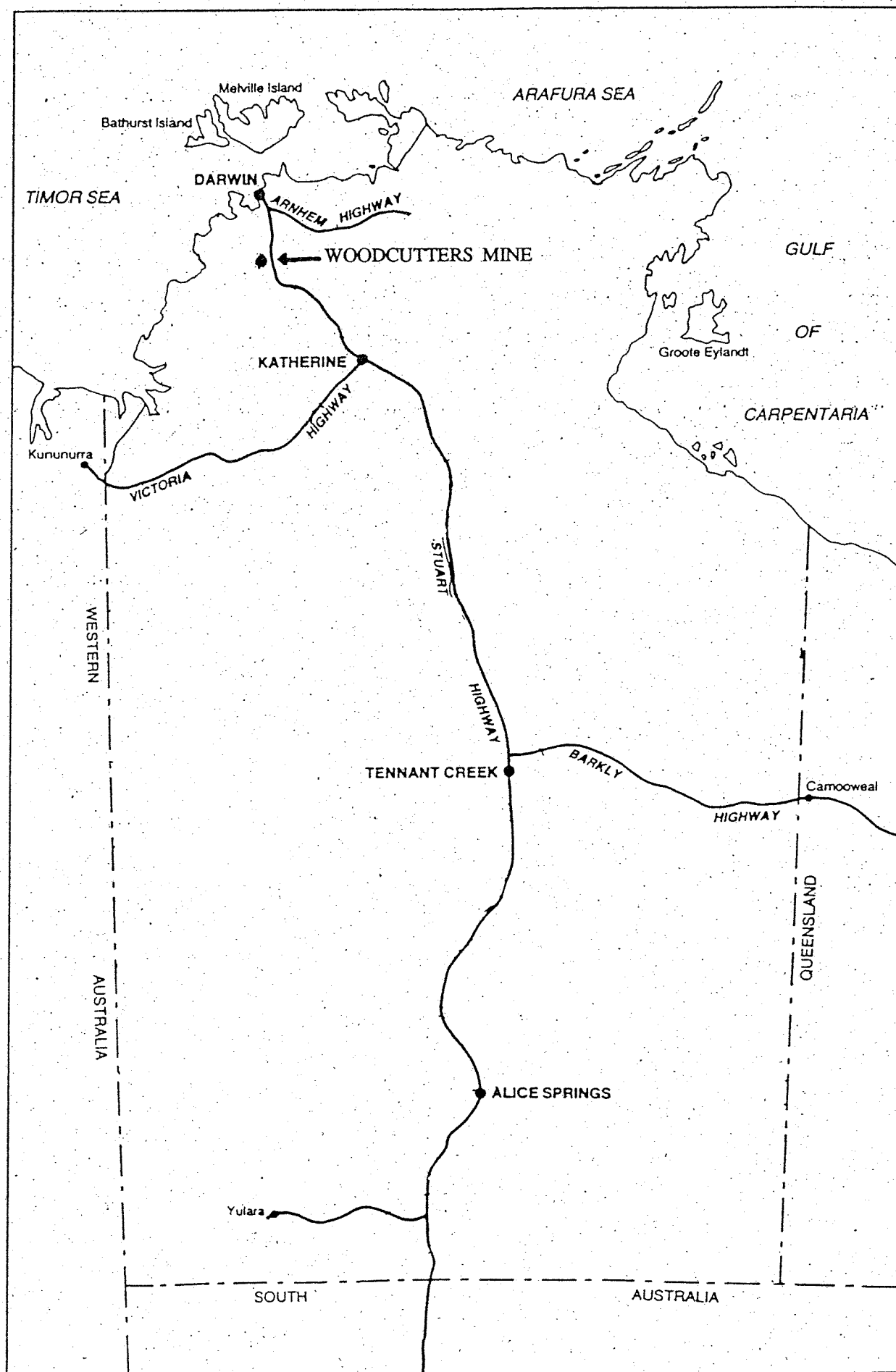


FIGURE 2: SITING OF PROPOSED TAILINGS DAM, WOODCUTTERS MINE

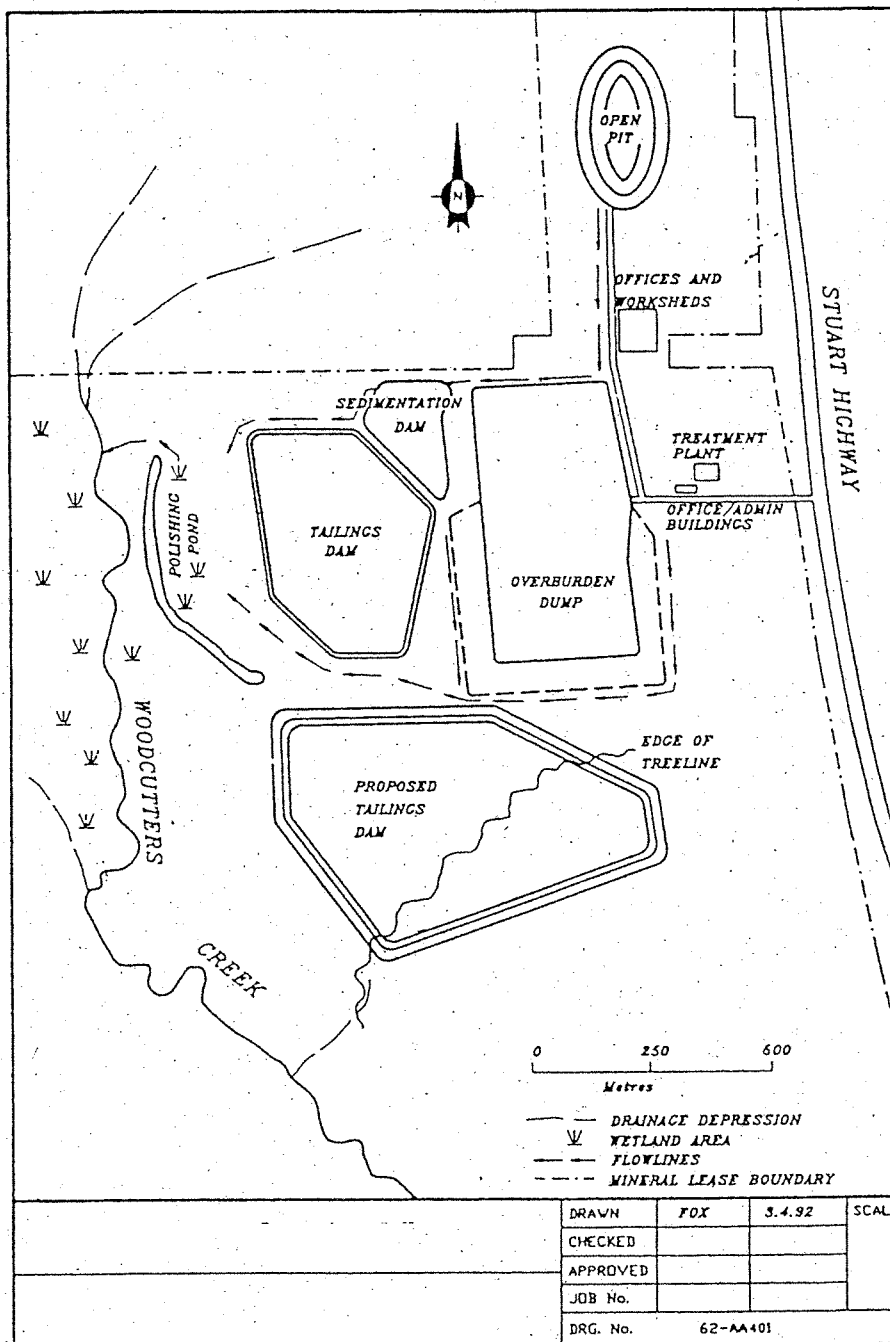


TABLE 1

SUMMARY OF MAJOR COMMENTS MADE ON DRAFT EIS FOR
WOODCUTTERS TAILINGS DAM

| ISSUE | ECNT | NLC | LUX | CCNT | DLH | DME | PAWA | DTW | DHCS | MUS | AAPA | TOTAL |
|--|------|-----|-----|------|-----|-----|------|-----|------|-----|------|-------|
| General | | | | | | | | | | | | |
| Scope of draft EIS is too narrow - should address entire waste treatment/water management at minesite; existing environmental problems at minesite and decommissioning of the existing tailings dam. | X | X | X | | | | | | X | | | 4 |
| 2. Alternatives | | | | | | | | | | | | |
| Return of tailings to mine shaft or open pit should be given greater consideration | | X | | | | | | | | | | 1 |
| 3. Project Description | | | | | | | | | | | | |
| <i>Existing Operations</i> | | | | | | | | | | | | |
| Amendment required to Figure 3.4 "current water balance" | | | | X | | | | | X | | | 2 |
| No information on nature and toxicity of flotation reagents and consumption during milling process. | | | | X | X | | | | | | | 2 |
| <i>Design and siting</i> | | | | | | | | | | | | |
| Necessity for referral to the Dam safety Committee and registration by the Australian National Committee on Large Dams (ANCOLD) | X | | X | | | | | | | | | 2 |
| External batters of 1:2 are inadequate. Slopes of 1:3 or 1:4 are necessary for revegetation of walls and consideration of long term rehabilitated landform. | | | | X | | | | | | | | 1 |
| No provision for diversion of surface run-off from open end of stage 1 dam. | | | | | | X | | | | | | 1 |
| Protection of clay core requires greater attention: eg need for a sand filter, adequacy of 0.5m layer of waste rock. | | | | X | | | X | | | | | 2 |
| <i>Construction</i> | | | | | | | | | | | | |
| Proposed time frame for construction can not be achieved. Revised construction programme should be provided and consequences of delayed construction discussed | X | | X | X | | | | | | | | 3 |

| | ECNT | NLC | LUX | CCNT | DLH | DME | PAWA | DTW | DHCS | MUS | AAPA | TOTAL |
|--|------|-----|-----|------|-----|-----|------|-----|------|-----|------|-------|
| Potential for the clay core to crack during construction and associated safeguards | | | | X | | | | | | | | 1 |
| Importance of constructing the dam to design standards particularly if construction occurs partly in the wet. | | | | X | | | | | | | | 1 |
| Rehabilitation of old borrow pits, and necessity for additional sources of clay | | | | | | | | | X | | | 1 |
| <i>Operation</i> | | | | | | | | | | | | |
| Potential for cracking in the clay core and associated safeguards. | | | | X | | | | | | | | 1 |
| Clarification of tailings deposition procedures, desilting of sedimentation dam and disposal of dredged spoil | | | | X | | | | | | | | 1 |
| 4. Existing Environment | | | | | | | | | | | | |
| Possible impact of increasing conductivity and sulphate levels. | | | | | X | | | | X | | | 2 |
| Insufficient data produced to substantiate assertions on groundwater quality and sediment loads. | | | | X | | | | | | | | 1 |
| 5. Environmental Impacts | | | | | | | | | | | | |
| Planning horizon is not sufficient. | X | | | | | | | | | | | 1 |
| <i>Biophysical</i> | | | | | | | | | | | | |
| Other soil conservation measures necessary if construction occurs in wet. | | | | X | | | | | | | | 1 |
| Efficiency of seepage collection system in returning all seepage to tailings dam. | | | | X | | | | | | | | 1 |
| Influence of water management on enhanced mosquito breeding | | | | | | | | | X | | | 1 |
| <i>Socio-Economic</i> | | | | | | | | | | | | |
| Impacts on aboriginal people not addressed | | X | | | | | | | | | | 1 |
| No application received for Authority Certificate. Suggest Authority Certificate, if granted, be included in final EIS. | | | | | | | | | | | X | 1 |
| No registered archaeological sites affected but proponent must comply with provisions of <i>Heritage Conservation Act</i> | | | | X | | | | | | | | 1 |
| 6. Environmental Management Plan | | | | | | | | | | | | |
| <i>Fire Management</i> | | | | | | | | | | | | |
| Weed eradication programme necessary incorporating appropriate application of herbicides | | | | X | | | | | | | | 1 |
| No details on provision and maintenance of fire breaks, fire management of vegetation and application for burn-off permits | | | | X | | | | | | | | 1 |

| | ECNT | NLC | LUX | CCNT | DLH | DME | PAWA | DTW | DHCS | MUS | AAPA | TOTAL |
|--|------|-----|-----|------|-----|-----|------|-----|------|-----|------|-------|
| <i>Erosion Management</i> | | | | | | | | | | | | |
| Use of existing seed bank in topsoil for rehabilitation is unsatisfactory. Direct seeding and temporary irrigation is necessary. Haybales require anchoring. | | | | X | | | | | | | | 1 |
| <i>Water/Waste Management</i> | | | | | | | | | | | | |
| Clarification of inputs used in Figure 6.4 "proposed water balance" | | | | X | | | | | | | | 1 |
| Consequences and significance of increased discharges to Woodcutters Creek | | | | X | | X | | | | | | 2 |
| Use of available and feasible pollution controls avoided | | X | | | | | | | | | | 1 |
| Water quality criteria are not established eg comparison to nationally accepted (ANZECC) standards | X | X | X | | | | | | | | | 3 |
| <i>Rehabilitation</i> | | | | | | | | | | | | |
| Proposed domed top on rehabilitated landform should incorporate series of graded banks to divide surface into small subcatchments. Topsoil should be used as overburden insufficient to support vegetation | | | | X | | | | | | | | 1 |
| Bond should be provided by the company to cover rehabilitation | | X | | | | | | | | | | 1 |
| Possibility of continued seepage after dam is capped and redirection or disposal of seepage | | | | | | | | | | X | | 1 |
| <i>Monitoring</i> | | | | | | | | | | | | |
| No details provided on locations of new groundwater monitoring sites. | | | | X | | | | | | | | 1 |
| Monitoring of cyanide levels should be undertaken for surface and groundwater | | X | | | | | | | | | | 1 |
| Proposed water monitoring programme is not satisfactory and should be extended to sediment sampling, testing of benthic fauna and fish in local waterways | X | X | X | X | | | | | | | | 4 |
| Wetland Management Strategy required | X | | | | | | | | | | | 1 |
| No assurance that corrective action when monitoring results assessed as being unsatisfactory | | | | | | | | | X | | | 1 |
| <i>Appendices</i> | | | | | | | | | | | | |
| Clarification of groundwater monitoring sites and soil quality test sites | | | | X | | X | | | | | | 2 |

KEY TO ABBREVIATIONS USED FOR SUBMISSIONS MADE ON DRAFT EIS

| | |
|------|---|
| ECNT | Environment Centre of the Northern Territory |
| NLC | Northern Land Council |
| LUX | Richard Luxton |
| CCNT | Conservation Commission of the Northern Territory |
| DLH | Department of Lands and Housing |
| DME | Department of Mines and Energy |
| PAWA | Power and Water Authority |
| DTW | Department of Transport and Works |
| DHCS | Department of Health & Community Services |
| MUS | Museums & Art Galleries of the Northern Territory |
| AAPA | Aboriginal Areas Protection Authority |

TABLE 2

SUMMARY OF IMPACTS, SAFEGUARDS AND PREDICTED EFFECTS FOR PROPOSED TAILINGS DAM ON MINERAL LEASES 1106 & 1107, WOODCUTTERS MINE

| POTENTIAL IMPACTS | SAFEGUARDS | PREDICTED EFFECTS AFTER SAFEGUARDS | OVERSEEING AUTHORITY |
|--|--|---|----------------------|
| A. BIOPHYSICAL | | | |
| 1) Removal of woodland vegetation (15 ha) and loss of habitat for terrestrial fauna | a) Cleared area to be minimised to that required for construction activities b) Outer limits of area to be cleared will be flagged prior to clearing and mapped on tender document. Proponent to ensure constraints adhered to by contractor | Loss of 15 ha of partly disturbed woodland with consequent loss of habitat and displacement of fauna in immediate area. | DME |
| 2) Accelerated soil erosion at dam site due to construction activities, vegetation removal, altered drainage, and resultant increase in sediment load of Woodcutters and Coomalie Creeks | As per 1) above and a) Major construction activities completed in dry season to minimise run-off. b) Additional soil conservation measures to be undertaken (in consultation with DME if construction proceeds in wet c) External dam batters constructed to slope of 1:3 if revegetated during operational phase d) Top soil removed with seedstock intact and used in stabilisation of external dam batters and other disturbed areas e) Additional direct seeding of tree and grass species and application of fertilizers on steeper slopes and external dam batters immediately after construction. Other areas to be direct seeded if regrowth from existing seedstock is inadequate | Wet season storms are likely to result in increased erosion from site during 1992/1993. With good maintenance of sediment traps little additional sediment should reach local waterways. Sediment loads should decrease in subsequent years following stabilization of disturbed areas. | DME |

* Where a safeguard is included in the above table which was not endorsed by the proponent in the EIS, this has been indicated in bold type and explained in Section 2 of the assessment report.

KEY OF ABBREVIATIONS USED FOR OVERSEEING AUTHORITIES

| | |
|------|---|
| AAPA | Aboriginal Areas Protection Authority |
| BFC | Bushfires Council |
| CCNT | Conservation Commission of the Northern Territory |
| DHCS | Department of Health and Community Services |
| DME | Department of Mines and Energy |
| DTW | Department of Transport and Works |
| PAWA | Power and Water Authority |

| POTENTIAL IMPACTS | SAFEGUARDS | PREDICTED EFFECTS AFTER SAFEGUARDS | OVERSEEING AUTHORITY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|-------------------------|---------------|----------------|----|-------|---------|----|-------|---------|----|-------|---------|----|-------|---------|----|-------|---------|----|-------|---------|---|-------|---------|----|-------|---------|-----|-----|-----|----|----|------|----|----|------|----|-----|--------|----|---|------|----|-----|--------|----|---|-------|----|-----|--------|----------|
| | <p>f) Temporary irrigation, particularly on batters and steeper slopes if construction completed prior to commencement of wet season</p> <p>g) Installation of sediment traps in drainage lines downstream of dam. Sediment traps to be checked and maintained by proponent prior to each wet season to ensure adequate capacity. If capacity insufficient traps to be excavated.</p> <p>h) Anchored haybale fences to be placed around tracks and other potential sediment sources</p> <p>i) Avoidance of drainage lines during construction</p> <p>j) Irrigation from watercarts to suppress dust during dry season</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3) Alteration to groundwater hydrology from dam leakage | <p>a) Incorporation of clay core into dam floor (1m depth) and wall (2.5m depth) in accordance with design standards in EIS, to minimise leakage</p> <p>b) Installation of seepage collector system downstream of the toe of the dam and return of seepage to dam.</p> | <p>Predicted seepage rate from dam (including dam wall and floor) is 2.7 m³/day or 985,500 L/year. Most of this is predicted to be returned to dam via seepage collection system, the remainder (unquantified) will enter local groundwater system. Monitoring will confirm efficiency of seepage collection system however, impact on local groundwater hydrology expected to be insignificant.</p> | DME/PAWA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4) Reduction in groundwater quality due to leakage from tailings dam | As in 3) above | <p>Predicted solute concentrations and loads in seepage water (assuming seepage rate is 2.7 m³/day) are as follows:</p> <table><thead><tr><th></th><th>Conc. mg/L</th><th>Load kg/day</th></tr></thead><tbody><tr><td>As</td><td><0.05</td><td><0.0001</td></tr><tr><td>Cd</td><td><0.01</td><td><0.0001</td></tr><tr><td>Cr</td><td><0.01</td><td><0.0001</td></tr><tr><td>Hg</td><td><0.05</td><td><0.0001</td></tr><tr><td>Se</td><td><0.10</td><td><0.0003</td></tr><tr><td>Sb</td><td><0.03</td><td><0.0001</td></tr><tr><td>U</td><td><0.01</td><td><0.0001</td></tr><tr><td>Cu</td><td><0.01</td><td><0.0001</td></tr><tr><td>SO4</td><td>470</td><td>1.3</td></tr><tr><td>Mg</td><td>54</td><td>0.14</td></tr><tr><td>Ca</td><td>92</td><td>0.25</td></tr><tr><td>Fe</td><td>0.2</td><td>0.0005</td></tr><tr><td>Zn</td><td>4</td><td>0.01</td></tr><tr><td>Pb</td><td>0.2</td><td>0.0005</td></tr><tr><td>Mn</td><td>2</td><td>0.005</td></tr><tr><td>Al</td><td>0.1</td><td>0.0003</td></tr></tbody></table> | | Conc. mg/L | Load kg/day | As | <0.05 | <0.0001 | Cd | <0.01 | <0.0001 | Cr | <0.01 | <0.0001 | Hg | <0.05 | <0.0001 | Se | <0.10 | <0.0003 | Sb | <0.03 | <0.0001 | U | <0.01 | <0.0001 | Cu | <0.01 | <0.0001 | SO4 | 470 | 1.3 | Mg | 54 | 0.14 | Ca | 92 | 0.25 | Fe | 0.2 | 0.0005 | Zn | 4 | 0.01 | Pb | 0.2 | 0.0005 | Mn | 2 | 0.005 | Al | 0.1 | 0.0003 | DME/PAWA |
| | Conc. mg/L | Load kg/day | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| As | <0.05 | <0.0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cd | <0.01 | <0.0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cr | <0.01 | <0.0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hg | <0.05 | <0.0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Se | <0.10 | <0.0003 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sb | <0.03 | <0.0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| U | <0.01 | <0.0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cu | <0.01 | <0.0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SO4 | 470 | 1.3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mg | 54 | 0.14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ca | 92 | 0.25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fe | 0.2 | 0.0005 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zn | 4 | 0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pb | 0.2 | 0.0005 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mn | 2 | 0.005 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Al | 0.1 | 0.0003 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| POTENTIAL IMPACTS | SAFEGUARDS | PREDICTED EFFECTS AFTER SAFEGUARDS | OVERSEEING AUTHORITY |
|--|--|---|-------------------------|
| | | As only a small (but unquantified) proportion of seepage will bypass the seepage collection system, solute loads entering groundwater should be lower than indicated above and changes to groundwater quality are expected to be insignificant. | |
| 5) Dam may not be constructed to design standards and hence actual seepage rates may be significantly greater than predicted | a) Quality control programme including lab and in situ testing to be implemented during construction phase b) Consultants to be employed to undertake regular audits of quality control programme and ensure compliance with design specifications c) Work not to specification shall be corrected by proponent to meet specification d) Performance testing to be undertaken to the satisfaction of DME prior to commissioning to operational status e) Construction phases inspected by DME as per Figure 2.2 in the EIS f) Results of quality control audits and performance testing to be provided to Dr Brian Richards (CSIRO), DME, CCNT, and available to the public on request. | Dam will be constructed to standards specified in EIS | DME |
| 6) The clay core may crack due to fluctuating water content leading to increased seepage and contamination of groundwater | As in 5) above and a) Clay core will be regularly watered during construction to maintain moisture content b) Progressive deposition of tailings against upstream face of dam to protect clay core and assist in capillary wetting of clay. c) Where necessary, use of irrigation to keep clay core moist in areas of dam not submerged or protected by tailings beaches during early operational stages | Given safeguards and physical characteristics of the clay, any cracking should be minor and should not result in increased leakage from the dam | DME |
| 7) Release of acid leachate into local groundwater and waterways | During operation, as for 3) above. After decommissioning: a) Placement of clay core in the floor and walls of dam and clay capping during | Potential for acid leachate entering local groundwaters during operational phase not quantified however, expected to be minimal given low predicted seepage rate and return of seepage to dam. | DME/PAWA |

| POTENTIAL IMPACTS | SAFEGUARDS | PREDICTED EFFECTS AFTER SAFEGUARDS | OVERSEEING AUTHORITY |
|---|--|--|-------------------------|
| | decommissioning / rehabilitation to minimise creation of oxidising conditions | After decommissioning, tailings have a high potential to generate significant quantities of acid if exposed to oxidising conditions. However, proposed rehabilitation of the dam site will inhibit oxidising conditions and provide neutralising material <i>in situ</i> . | |
| | b) Placement of dolomitic and carbonaceous overburden (as per 12) below) over tailings during rehabilitation to create neutralising conditions. | | |
| 8) Contamination of local waterways resulting from rupture or overtopping of tailings dam or deliberate release of tailings water | a) Tailings water will not be released into local waterways b) Free water in dam to be returned to mill where it is recycled c) Freeboard provision of 2.8m in dam design to accommodate 1 in 10,000 wet season. d) Water flow from a seasonal drainage channel which crosses dam site to be diverted upstream of the dam. | Nil deliberate release of tailings water. Risk of rupture or overtopping of dam is very low. | DME/PAWA |
| 9) Reduction in water and sediment quality of Woodcutters and Coomalie Creeks due to contaminated run-off from site. | a) Construction of external batters of dam wall with waste rock with low levels of heavy metals and high percentage of carbonaceous material to assist in buffering of acid production b) Construction of sediment traps downstream of tailings dam (in accordance with locational plans in EIS) to collect any contaminants bound to sediment | Immediate run off from dam batters likely to be slightly acidic (around pH 5.5). Trace metals predicted to be at very low concentrations, close to or below analytical detection limits. Effect on water quality should be minimal. | DME/PAWA |
| 10) Contamination of land at mine site resulting from spills and accidents from tailings delivery system | a) Pump spillage contained within bunded concrete area at existing concentrator b) Tailings line from mill to dam to be contained within 3m wide trench with earth bunds 0.75m high; c) Any spillage of tailings from tailings line to be recovered by machine and manually returned to dam d) Tailings line to be inspected at regular intervals to check for joint and pipe leakage and repairs and cleanup undertaken if necessary e) "No flow" alarm fitted to discharge end of tailings line to alert personnel of possible line failure and initiate clean up. | Minimal risk of contamination. If leaks occur, safeguards will ensure contamination is localised and temporary. | DME |

| POTENTIAL IMPACTS | SAFEGUARDS | PREDICTED EFFECTS AFTER SAFEGUARDS | OVERSEEING AUTHORITY |
|--|--|--|----------------------|
| 11) Heavy metal contamination of land surrounding dam as a result of wind erosion of tailings beaches. | a) Tailings water used for dust suppression on tailings beaches via spray irrigation system. b) Cyclic deposition of tailings. | Limited potential for contamination providing spray system is continuously used during dry season. | DME |
| 12) Long term heavy metal contamination of dam site and release of heavy metals into local surface and groundwaters after dam is decommissioned | a) Conceptual plan for rehabilitated dam includes: <ul style="list-style-type: none"> Placement of 0.5m layer of non-sulphide overburden on top of the tailings; Placement of 0.5m layer of impermeable clays on top of overburden to minimise ingress of water; Placement of 2m layer of non-sulphide overburden on top of clay; Reshaping of overburden material to create a slightly domed structure to ensure outward movement of run-off; Revegetation of site using tree and grass species. b) Detailed rehabilitation plan to be submitted to DME for approval. Further options such as division of domed structure into smaller subcatchments and placement of topsoil to be investigated when working plan is developed. | Dam site (30 ha) will remain a contaminated site and will have limited potential for other land uses. Proposed rehabilitation should minimise potential for movement of contaminants to surrounding land and waterways. | DME |
| 13) Ingestion of heavy metals by wildlife foraging at dam site | a) Dam design will discourage use of area by wildlife b) Deterrents to be used if monitoring indicates significant use by wildlife | Limited potential for wildlife to ingest toxic levels of heavy metals given lack of suitable habitat. Ongoing monitoring and implementation of deterrents (if necessary) should ensure impact is minimal. | CCNT/DME |
| 14) Increased release of water to Woodcutters Creek from pit dewatering and resultant effects on flow rates and water quality of Woodcutters and Coomalie Creeks | a) Pit water enters sedimentation pond where significant proportion of solids and heavy metals are removed b) Water from sedimentation pond enters polishing pond and natural wetland system to further remove solids and heavy metals | Discharges to Woodcutters Creek will increase from approx. 1400m ³ /day to 2100m ³ /day. Previous discharges were up to 20,000m ³ /day. Increase in discharge of pit water is not significant and given safeguards should not result in significant alteration to existing water quality. | DME/PAWA |
| 15) Increased risk of fire | Perimeter and internal fire breaks | Proposed development should not result in increased fire risk to surrounding areas | BFC (CCNT) |

| POTENTIAL IMPACTS | SAFEGUARDS | PREDICTED EFFECTS AFTER SAFEGUARDS | OVERSEEING AUTHORITY |
|---|---|--|----------------------|
| 16) Reduced air quality from burn-off of vegetation cleared during construction activities | Burn off to be undertaken with approval and permit from Bush Fires Council. | Temporary, localised reduction in air quality, consistent with general burn-off operations conducted in the dry season | BFC (CCNT) |
| 17) Noise pollution during construction | Construction activities only to occur during normal daylight working hours. | Given, proximity to Stuart Highway, noise levels are unlikely to reach nuisance levels. | DME |
| 18) Pollution from disposal of construction wastes | a) Rubbish regularly collected and disposed of in landfill site at mine site. b) Topsoil stockpiled and used in rehabilitation. | Few construction wastes expected. Impact of disposal should be minimal. | DME |
| 19) Visual impact from removal of natural vegetation, reshaping of the landform and construction of the dam. | Only potential viewshed is from Stuart Highway. Eastern wall of dam will be approx. 180 m from Stuart Highway and shielded by woodland vegetation. Eastern wall of dam relatively low (2-5m). | Dam is unlikely to be seen from Stuart Highway. | DME |
| 20) Increase in mosquito breeding areas due to water management practices resulting in freestanding water and fringing vegetation | Management practices yet to be determined (see Recommendation 7 in Section 2 of the report) | Yet to be determined | DHCS |
| B. SOCIO ECONOMIC | | | |
| 21) Effect of development on historical and archaeological sites | If previously unknown sites are found during construction, provisions of <i>Heritage Conservation Act</i> apply | No unauthorised destruction of sites will occur | CCNT |
| 22) Increased vehicular traffic during construction | Existing roads to be used | Construction activities do not involve large amount of equipment and most construction materials to be sourced on - site. Little additional traffic movement predicted on Stuart Highway. | DTW |
| 23) Effect of development on Aboriginal Sacred Sites and aboriginal affiliations with Coomalie and Woodcutters Creeks | a) Application for Authority Certificate to AAPA b) Proponent to continue liaison with aboriginal groups prior to, during and after construction of dam. | Statutory process will ensure that local aboriginals are properly consulted Continued liaison will ensure aboriginal groups are adequately informed of current developments and plans | AAPA |
| 24) Reduction in surface and ground water quality affecting downstream users of local water resources | As per 2), 4), 7), 8), 9) and 12) above. | draft National Water Quality Guidelines (ANZECC) should be met in surface and ground waters leaving mineral leases | DHCS/DME |

TABLE 3

**SUMMARY OF ENVIRONMENTAL MONITORING FOR PROPOSED TAILINGS DAM
ON MINERAL LEASES 1106 AND 1107, WOODCUTTERS MINE**

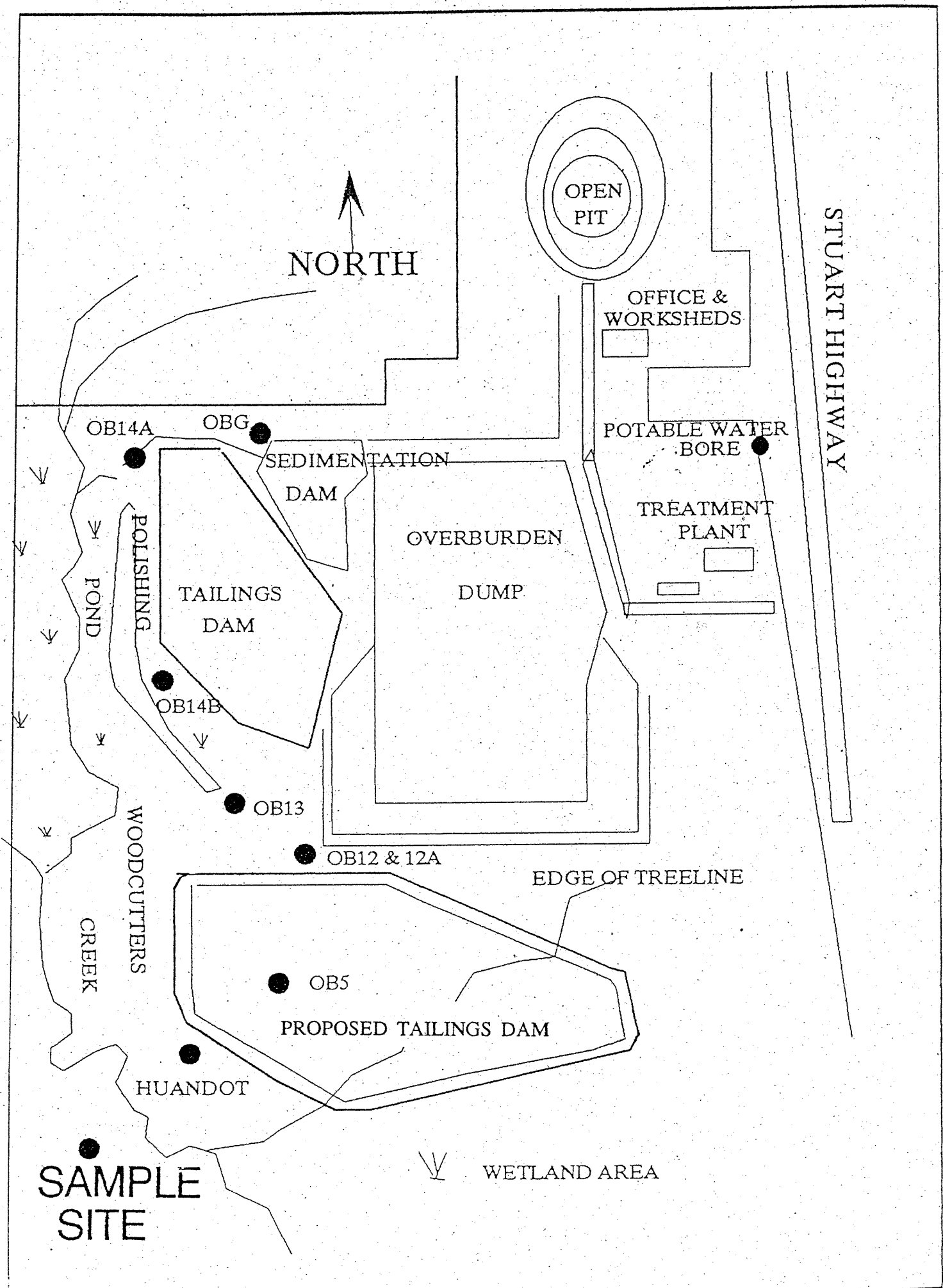
| MONITORING PROGRAMME | LOCATION | PARAMETERS | MONITORING FREQUENCY | REPORTING FREQUENCY | RESPONSIBLE AUTHORITY |
|---|---|--|-------------------------|--------------------------------------|-----------------------|
| 1) SURFACE WATER QUALITY | | | | | |
| a) Local | * Sites SP5, SP9, SP11, SP12, SP13, SP14 | pH, Electrical Conductivity, Turbidity, Flow | Weekly | Monthly | DME/PAWA |
| | * Sites SP5, SP6, SP9, SP10, SP11, SP12, SP13, SP14 | As for weekly plus Alkalinity, Mg, Ca, Na, K, SO ₄ , NO ₃ , Cl, Cd, Pb, Zn, Mn, As, Sb | Monthly | Monthly | DME/PAWA |
| | * Sites SP5, SP6, SP9, SP10, SP11, SP12, SP13, SP14 | As for monthly plus TSS, Fe, Al, Cu, Co, Ni, | Quarterly | Next available monthly report to DME | DME/PAWA |
| | * SP11 | ²²⁶ Ra | Six monthly | Next available monthly report to DME | DME |
| b) Regional | * Sites RSP1, RSP2, RSP3, RSP4, RSP5 | pH, Electrical Conductivity, Alkalinity, Mg, Ca, Na, K, SO ₄ , NO ₃ , Cl, Cd, Pb, Zn, Ni, As, Sb, Fe, Co, Cu, Al, Mn | Monthly or when flowing | Monthly | DME/PAWA |
| * See attached map for monitoring sites | | | | | |
| 2. GROUNDWATER QUALITY | * Sites 12, 12A, 13, 14A, G, 14B, Huandot | pH, Electrical Conductivity, Temp., SO ₄ , Zn, level | Quarterly | Next available monthly report to DME | DME/PAWA |
| * See attached map for monitoring sites | | pH, Electrical Conductivity, Alkalinity Ca, Mg, Na, K, Cl, HCO ₃ , CO ₃ , SO ₄ , NO ₃ , Fe, Pb, Zn, Cd, Mn, Ni, Sb, Co, As | Six monthly | Next available monthly report to DME | DME |

| MONITORING PROGRAMME | LOCATION | PARAMETERS | MONITORING FREQUENCY | REPORTING FREQUENCY | RESPONSIBLE AUTHORITY |
|---------------------------------|--|---|---|---|-----------------------|
| 5. AQUATIC BIOTA CONTIN..... | | | | | |
| b) Fish | Seepage trench, Sedimental dam, Huandot Crossing, Woodcutters Billabong, Batchelor Road Crossing (SP10) as per Appendix F in EIS | Species identification, measurement, external examination of physical condition, as per Appendix F in EIS plus additional parameters to be determined (see Recommendation 12 in report) | Biannual (March/October) | Next available monthly report to DME | DME |
| c) B e n t h i c organisms | Woodcutters and Coomalie Creek | Heavy metals (further details to be determined see Recommendation 12 in report) | Pilot study, ongoing monitoring if necessary | To be determined | DME |
| d) Mosquitos | Polishing pond, natural and artificial wetlands on mine site | To be determined (see Recommendation 7 in report) | To be determined | To be determined | DHCS/DME |

| MONITORING PROGRAMME | LOCATION | PARAMETERS | MONITORING FREQUENCY | REPORTING FREQUENCY | RESPONSIBLE AUTHORITY |
|--|--|--|------------------------|--------------------------------------|-----------------------|
| 3. OPERATION & PERFORMANCE OF TAILINGS DAM. CONT.... | | | | | |
| d) Dam water levels | Proposed dam | water level | Daily | Monthly | DME |
| e) Tailings water | Proposed dam | pH, Electrical Conductivity, temperature | Daily | Monthly | DME |
| 4. SEDIMENT QUALITY | | | | | |
| | Sediment control traps | pH, Electrical Conductivity | Weekly (when flowing) | Monthly | DME |
| | | As for weekly plus Alkalinity, Mg, Ca, Na, K, SO ₄ , NO ₃ , Cl, Cd, Pb, Zn, Ni, As, Sb, Fe, Co, Cu, Al, Mn | Monthly (when flowing) | Monthly | DME |
| | Stream sediments in Polishing pond, Wetlands, Woodcutters Billabong, left branch of Coomalie Creek | S, As, Cd, Sb, Cu, Pb, Zn, Co, Ni | Annual (October) | Next available monthly report to DME | DME |
| 5. AQUATIC BIOTA | | | | | |
| a) Aquatic plants | Polishing pond & wetland system | S, As, Cd, Sb, Cu, Pb, Zn, Co, Ni | Annual (October) | Next available monthly report to DME | DME |

| MONITORING PROGRAMME | LOCATION | PARAMETERS | MONITORING FREQUENCY | REPORTING FREQUENCY | RESPONSIBLE AUTHORITY |
|---|--|--|-----------------------|--------------------------------------|-----------------------|
| 2. GROUNDWATER QUALITY CONT... | * Potable Water Bore | As per 2) above plus ²²⁶ Ra quarterly | Monthly and quarterly | Monthly | DME |
| | Shallow and deep bores down hydraulic gradient of proposed dam (sites to be approved by DME) | Level, pH, Electrical Conductivity, Alkalinity Mg, Ca, Na, K, SO ₄ , NO ₃ , Cl, Cd, Pb, Zn, Ni, As, Sb, Fe, Co, Cu, Al, Mn | Bimonthly | Monthly | DME |
| 3. OPERATION & PERFORMANCE OF TAILING DAM | | | | | |
| a) Recycle Water | Proposed dam | pH, Electrical Conductivity, flow | Weekly | Monthly | DME |
| | | As per above and Alkalinity, turbidity, Mg, Ca, Na, K, SO ₄ , NO ₃ , Cl, Cd, Pb, Zn, Mn, As, Sb, Fe, Al, Cu, Co, Ni | Quarterly | Next available monthly report to DME | DME |
| b) Foundation piezometers | Proposed dam | Level, pH, Electrical Conductivity | Weekly | Monthly | DME |
| | | As for weekly plus Alkalinity, Mg, Ca, Na, K, SO ₄ , NO ₃ , Cl, Cd, Pb, Zn, Ni, As, Sb, Fe, Co, Cu, Al, Mn | Bi monthly | Monthly | DME |
| c) Seepage collection | Seepage collector manhole | pH, Electrical Conductivity, flow | Weekly | Monthly | DME |
| | | As for weekly plus Alkalinity, Mg, Ca, Na, K, SO ₄ , NO ₃ , Cl, Cd, Pb, Zn, Ni, As, Sb, Fe, Co, Cu, Al, Mn | Monthly | Monthly | DME |

GROUNDWATER MONITORING SITES, WOODCUTTERS MINE



SURFACE WATER QUALITY MONITORING SITES, WOODCUTTERS MINE

