ENVIRONMENTAL ASSESSMENT REPORT

Nelson Bay River Magnetite Mine

7km northeast of Temma

Shree Minerals Ltd

The Board of the Environment Protection Authority
July 2012

ENVIRONMENT PROTECTION AUTHORITY

Environmental Assessment Report	
Proponent	Shree Minerals Ltd
Proposal	Nelson Bay River Magnetite Mine
Location	7km northeast of Temma
NELMS no.	8568
DA number	2011/00171
File	11 22 41
Class of Assessment	2C

Assessment process milestones	
24 March 2011	Notice of Intent submitted
18 May 2011	DPEMP Guidelines issued
5 Dec 2011	Permit application submitted to Council
7 Dec 2011	Application received by Board
10 Dec 2011	Start of public consultation period
31 Jan 2012	End of public consultation period
20 June 2012	Supplementary information (Supplement 4) submitted to Board

Acronyms	
AMD	Acid and Metalliferous Drainage arising from the oxidation of sulphide minerals
BFO	Beneficiable Feed Ore (also incorrectly referred to as BSO in original DPEMP)
Board	Board of the Environment Protection Authority
Column Leach Test	a kinetic leach test up to 24 months duration used to evaluate oxidation rates, elemental solubility and leaching behaviour, lagtime to onset of AMD and evolution of AMD characteristics
DPEMP	Development Proposal and Environmental Management Plan
DPIPWE	Department of Primary Industries, Parks, Water and Environment
DSO	Direct Shipping Ore
EIA	Environmental impact assessment
EMPC Act	*Environmental Management and Pollution Control Act 1994*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
JORC Code	Code for Reporting of Mineral Resources and Ore Reserves – a standard endorsed by the Australasian Joint Ore Reserves Committee (JORC)
K-NAG	Kinetic NAG (testing to estimate the time lag between exposure of PAF material and onset of generation of acid)
LUPA Act	*Land Use Planning and Approvals Act 1993*
MRT	Mineral Resources Tasmania
NAF	Not acid forming
NAG	Single Addition Net Acid Generation (analysis according to AN216)
PAF	Potentially acid forming
ROM	Run of Mine
SD	Sustainable development
UC	Uncertain

Report summary

This report provides an environmental assessment of Shree Mineral's proposed Nelson Bay River Magnetite Mine.

The proposal involves the development of a new iron ore (haematite and magnetite) mine and mineral processing operation on Crown Land adjacent to Nelson Bay River approximately 7 km northeast of Temma in northwest Tasmania. The proposal is to target approximately 4 million tonnes of this resource over a ten year period.

This report has been prepared based on information provided by the proponent in the Development Proposal and Environmental Management Plan (DPEMP) and DPEMP Supplement. The advice of relevant Government Agencies and the public has also been sought and considered as part of this assessment.

On 2 April 2012, the Director requested that the applicant submit supplementary information to address public, government agency (including DPIPWE) and Council comments on the DPEMP. The DPEMP supplementary information (Supplement 4) was submitted by the applicant on 20 June 2012.

Background to the proposal and details of the assessment process are presented in Section 1 of this report. Section 2 describes the context of this assessment. Details of the proposal are contained in Section 3. Section 4 reviews the need for the proposal and considers the project, site and design alternatives. Section 5 summarises the public and Agency consultation process and the key issues raised in that process. The detailed evaluation of key issues is contained in Section 6. Section 7 identifies other environmental issues and the report conclusions are contained in Section 8.

Appendix 1 contains a tabular evaluation of other environmental issues referred to in Section 7. Appendix 2 contains a summary of issues raised in the consultation process. Appendix 3 contains environmental permit conditions for the proposal. Attachment 2 of the permit conditions contains the table of commitments from the DPEMP.

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1 Approvals process

An application for a permit under the *Land Use Planning and Approvals Act 1993* (LUPA Act) in relation to the proposal was submitted to Circular Head Council on 5 December 2011.

The proposal is defined as a 'level 2 activity' under Schedule 2 Subsection (2)(e) of the *Environmental Management and Pollution Control Act 1994* (EMPC Act), being a Mineral Works; the conduct of works for processing mineral ores, sands or earths processing 1 000 tonnes or more per year of raw materials. Section 25(1) of the EMPC Act required Council to refer the application to the Board of the Environment Protection Authority (the Board) for assessment under the Act. The application was received by the Board on 7 December 2011.

The Board required that additional information to support the proposal be provided in the form of a Development Proposal and Environmental Management Plan (DPEMP) prepared in accordance with guidelines jointly issued by the Board and Circular Head Council. The final guidelines were issued to the proponent on 18 May 2011.

Several drafts of the DPEMP were submitted to the EPA for comment prior to its formal submission. A final DPEMP was submitted to Council with the permit application. The DPEMP was released for public inspection for a 42 day period commencing on 10 December 2011. Advertisements were placed in the Advocate and on the EPA web site. The DPEMP was also referred at this time to relevant government agencies for comment. Two public submissions were received.

On 5 April 2012, the Director requested that the proponent prepare a DPEMP Supplement to address public, government agency (including DPIPWE) and Council comments on the DPEMP. The DPEMP Supplement (Supplement 4) was submitted by the proponent on 20 June 2012.

The proposal has been determined to be a 'controlled action' under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The matters protected by Part 3 of the EPBC Act are Sections 18 and 18A (listed threatened species and communities) and Sections 20 and 20A (listed migratory species). The Australian Government has advised that proposal will be assessed using an environmental impact statement under Part 8 of the EPBC Act. *i.e.* it is <u>not</u> being assessed under the bilateral agreement between the Commonwealth and Tasmania.

2 SD objectives and EIA principles

The proposal must be considered by the Board in the context of the sustainable development objectives of the Resource Management and Planning System of Tasmania (RMPS), and in the context of the objectives of the Environmental Management and Pollution Control System (EMPCS) established by the EMPC Act. The functions of the Board are to administer and enforce the provisions of the Act, and in particular to use its best endeavours to protect the environment of Tasmania, and to further the RMPS and EMPCS objectives.

The Board must undertake the assessment of the proposal in accordance with the Environmental Impact Assessment Principles defined in Section 74 of the EMPC Act.

3 The proposal

The proposal involves the development of a new iron ore (haematite and magnetite) mine and mineral processing operation.

The main characteristics of the proposal are summarised in Table 1. Further description of key aspects of the proposal, which are necessary to understand the environmental impacts are provided in section 3.2 while a detailed description of the proposal is provided in Section 2 of the DPEMP.

3.1 Key Proposal Characteristics

Table 1: Summary of key proposal characteristics

Activity	
A new iron ore (haematite and magnetite) mine and mineral processing operation. The proposal is to target approximately 4 million tonnes of this resource over a ten year period. The DPEMP estimates the total resource at 12 million tonnes and states an intention to "target the rest of the resource" while mining the initial 4 million tonnes. Two open cut pits are proposed: • There is an extended near-surface oxidised ore body comprising hematite which requires only crushing and screening prior to shipping. This is referred to as the Direct Shipping Ore (DSO) pit and will be developed first. According to the DPEMP it will be around 35-40 metres deep but may extend to approximately 60 metres depth if the resource extends beyond the originally estimated depth. • The other pit is the main pit which targets the main magnetite ore body to a depth of 225m. The top 20m (approximately) of this is Beneficiable Feed Ore (BFO) which requires only dry magnetic separation in addition to crushing and screening prior to shipping. The balance of the ore body also requires wet magnetic separation, filtration and drying which necessitates the construction of a tailings dam.	
Location and planning context	
Location	Adjacent to Nelson Bay River approximately 7 km northeast of Temma in northwest Tasmania, as shown in Figure 1.
Land zoning	Forest Resource Zone and Conservation Zone (corresponding to the boundary of the Arthur Pieman Conservation Area).
Land tenure	Crown Land, partially within the Arthur Pieman Conservation Area.
Mining lease	ML 3M/2011 – Vicinity of Nelson Bay River (not yet granted)
Lease area	Lease area: 778 ha. Estimated disturbance footprint: 152 ha.
Bond	Yet to be determined
Existing site	
Land Use	Currently none, but site is accessible by existing vehicle track and has been previously subject to mineral exploration activity.
Topography	Relatively flat as the site is located on an old peneplain. East and West Creeks occupy shallow valleys, Nelson Bay River has incised a steep-sided valley to a depth of 30-40m.
Geology	The resources at the site consist of approximately 1.0 km in strike length of hematite-goethite mineralisation within an ultramafic dyke. The overburden consists of Proterozoic sediments.
Soils	A variable layer of peat generally occurs at the surface.

Hydrology	The floor of the ultramafic dyke is considered to be competent, no significant groundwater inflows are anticipated.
Fauna	A range of state and EPBC listed threatened fauna species have been recorded, or may potentially occur, within 5km of the mine site.
Flora	A range of vegetation communities from heathland and wet scrub to forest occur on the site. A range of state and EPBC listed threatened flora species have been identified within 5km of the mine site.
Local region	
Climate	Rainfall approximately 1,300mm per annum. The prevailing winds are north westerly to south westerly.
Surrounding land and uses	Forestry activities occur in the area, including a plantation across the river from the proposed site.
Species of conservation significance	Most notable are three orchid species with EPBC listing of "critically endangered".
Proposed infrastructure	
Major equipment	• DSO pit (depth: approx 40m). • Main pit (depth: 225m). • Tailings Dam (40ha). • Waste rock dump (14Mm^3). • Recycle dam. • Acid neutralisation plant. • Plant for crushing, screening and dry magnetic separation. • Plant for wet magnetic separation.
Other infrastructure	• Rock dump collection drain and settling dam. • Oil & grease pit. • Access roads. • Workshop, ablutions, office. • Sewage treatment plant. • Diesel generators. • Explosives magazine.
Transport	The product will be trucked to Burnie or Port Latta for export.
Inputs	
Water	Sufficient water is available from dewatering the two pits.
Energy	Diesel generators on site.
Other raw materials	Fuel oil, lime or dolomite (for acid neutralisation), chemicals, paints, explosives.
Wastes and emissions	
Liquid	During construction phase: surface runoff. During operational phase: To West Creek: runoff from waste rock dump. To East Creek: overflow from recycle dam (primarily the excess groundwater inflow to the pits). Both creeks drain into Nelson Bay River within 1km of the discharge points.
Atmospheric	Dust.

Solid	General litter. General inert wastes to be collected periodically.
Noise	From crushing and screening equipment, heavy equipment on site, and vehicles on site and going to and from the site.
Greenhouse gases	Greenhouse gases (predominantly carbon dioxide) will be generated as a result of vehicle, machinery and generator emissions. In addition there is likely to be some burning of cleared vegetation during the construction phase.
Commissioning and operations	
Operating hours	No restrictions are proposed. Offsite transport of mine product will be confined to daylight hours.
Project timetable	Not specified.

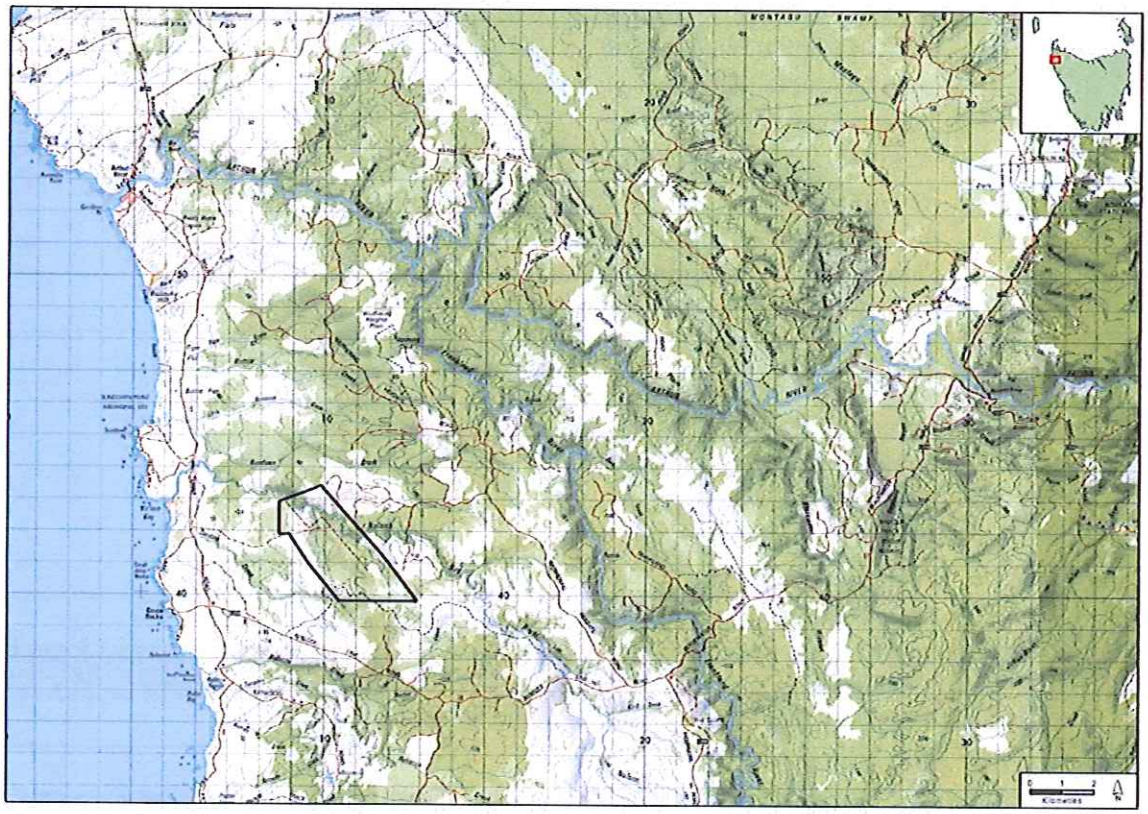


Figure 1: Proposed location (Figure 1 of the DPEMP)

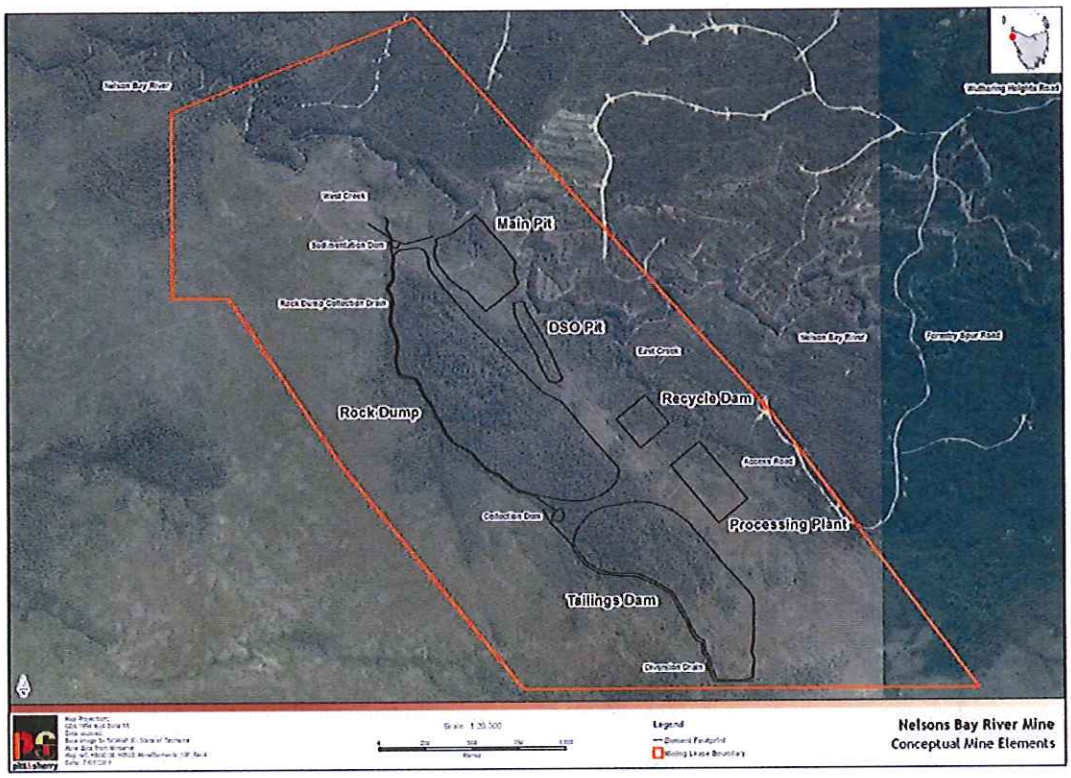


Figure 2: Proposed mining lease showing principal mine elements (end-of-mine life footprint) **(Figure 3 of the DPEMP).**

3.2 Other Proposal Characteristics

This section provides further description of key aspects of the proposal, which are necessary to understand the environmental impacts and proposed permit conditions.

3.2.1. Geology

There is no evidence of a significant, usable volume of alkaline rock within the excavated areas (DPEMP page 36). This severely constrains the options available for neutralising PAF material.

The DPEMP (Appendix H) states that waste rock analysis conducted within the defined resource zone does not generally extend to other waste rocks outside of the ore zone.

The DPEMP (Appendix K) shows that waste rock is comprised predominantly of siltstone and sandstone. For example, Figure 3 which also identifies a component of the waste rock as PAF material.

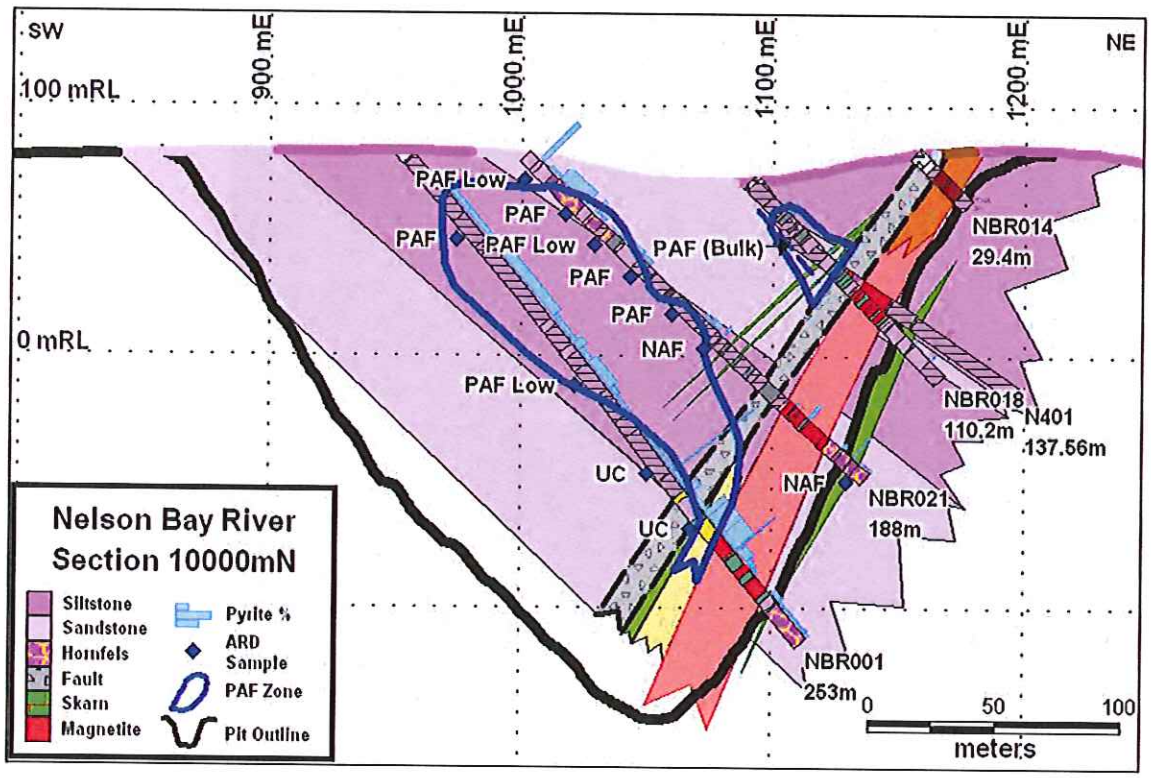


Figure 3: Example of Main Pit cross-section **(DPEMP Appendix K: Main Pit Section 10000mN).**

3.2.2 Staging of Development

From the environmental impact perspective the project can be divided into two stages, with the environmental impacts of greatest concern confined to stage 2.

- Stage 1 comprises the mining of the DSO Pit and the upper part of the ore body (the BFO component) from the Main Pit. This requires only dry processing (crushing and [for BFO] magnetic separation). The relatively shallow pits will generate only a limited volume of waste rock.
- Stage 2 comprises the extraction of magnetite from the Main Pit and associated (wet) processing including construction of the tailings dam. Importantly, most of the waste rock is generated as the Main Pit gets deeper and groundwater inflows (which comprise most of the effluent stream) will increase with depth.

In more detail the two stages are defined as follows (First DPEMP Supplement pages 15 and 16):

Stage 1:

- Construction of access road
- Construction of hardstand for crusher and ROM stockpile
- Construction of office and amenities block
- Construction of (initial cell(s) of) recycle dam
- Installation of initial neutralisation plant
- Construction of haul road
- Commencement of NAF rock dump
- Removal of DSO pit vegetation and overburden
- Extraction of DSO from DSO pit
- Storage of any DSO pit PAF waste rock inside DSO pit
- Crushing and screening of DSO

- Trucking of DSO to port
- Removal of main pit vegetation and overburden
- Construction of additional cell(s) of recycle dam
- Upsizing of neutralisation plant
- Extraction of BFO from main pit
- Continuation of NAF rock dump
- Storage of any BFO PAF waste rock inside DSO pit
- Beneficiation of BFO ore by crushing, screening and dry magnetic separation
- Trucking of BFO to port.

Stage 2:

- Construction of additional cell(s) of recycle dam
- Upsizing of neutralisation plant
- Construction of processing plant
- Construction of tailings dam
- Extraction of magnetite from main pit
- Continuation of NAF rock dump
- Storage of any magnetite PAF waste rock inside DSO pit
- Processing of magnetite ore
- Trucking of magnetite product to port.

3.2.3 Water Management

The following diagrams are extracted from the second supplement. They are essential to understanding the environmental implications of the project.

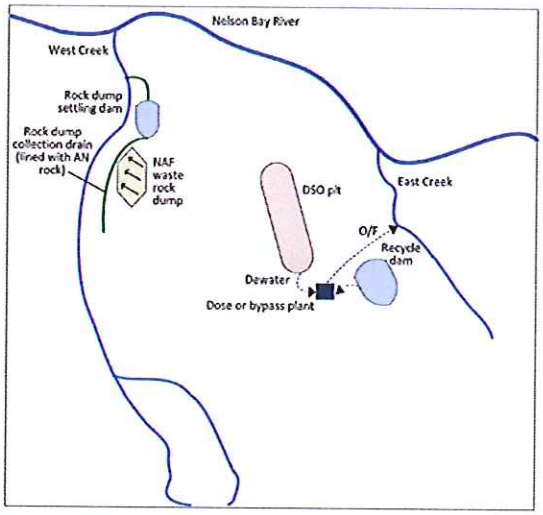
It is important to note that:

- Figure 4 is schematic – it is not to scale – refer to Figure 2 for the actual location of the project components.
- Water budgets are provided in the DPEMP for each of the stages shown in Figure 4 but only the key one for the main magnetite processing stage is reproduced (Figure 5) in this assessment report.
- The DPEMP (page 58) refers to the possibility (if necessary) of recirculating water from the NAF waste rock dump settling dam to the acid neutralising plant and recycling dam. This is shown in Figure 5 but not in Figure 4.

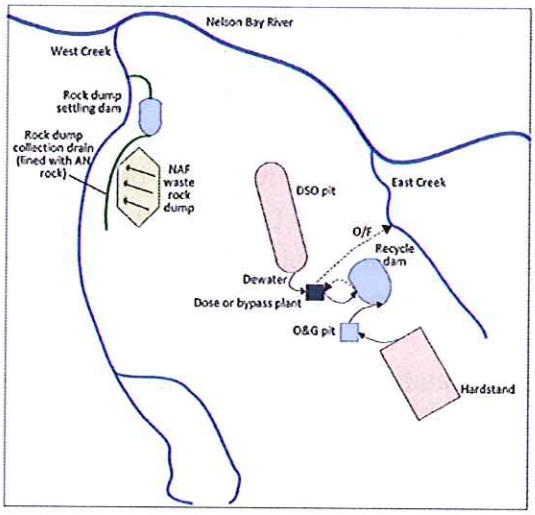
Key points:

- Figure 5 shows that discharge from the mine comprises 53% of the flow from West Creek into Nelson Bay River and 30% of the flow from East Creek into Nelson Bay River.
- The proximity of the discharge points in both East and West Creeks to Nelson Bay River means that there is minimal opportunity for mixing/dilution between discharge from the mine and entering Nelson Bay River.
- Following closure, all effluent is discharged into West Creek. A settling pond has some potential to minimise the discharge of suspended solids but there is no provision for adjustment of the chemical properties of the effluent (*e.g.* pH and/or dissolved metals). In particular, if the NAF waste rock dump contains sufficient PAF material to generate acid leachate, there is no possibility of active neutralisation, and little opportunity for dilution prior to this effluent being discharged into Nelson Bay River.

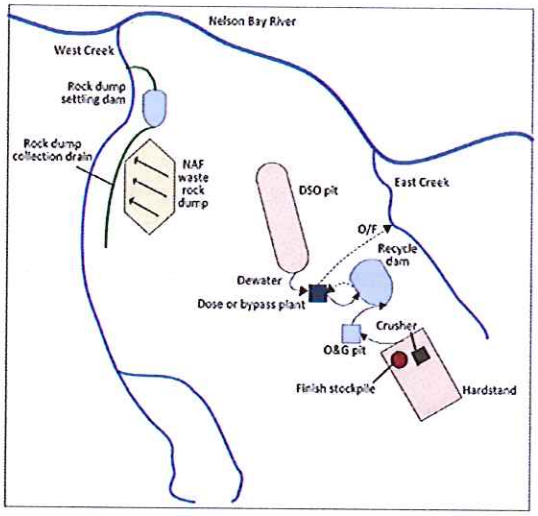
Nelson Bay River mine – water management staging



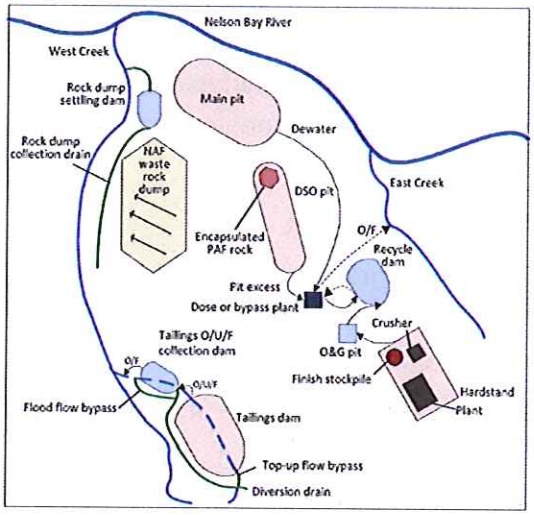
1: DSO pit overburden stripping



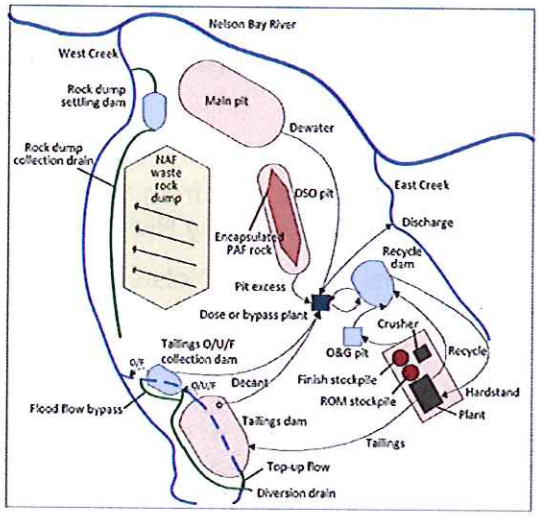
2: Hardstand construction



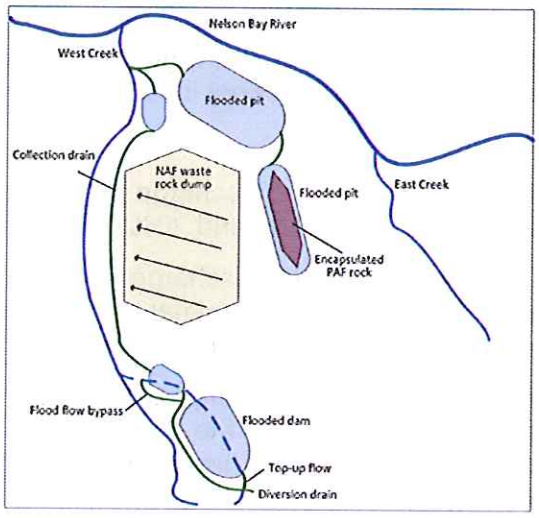
3: DSO crushing



4: Tailings dam and processing plant construction and main pit overburden stripping



5: Magnetite processing



6: Closure

Figure 4: Water Management Staging **(DPEMP Second Supplement Appendix A)**

Nominal annual water budget for magnetite processing (water staging step 5)

Mean rainfall year

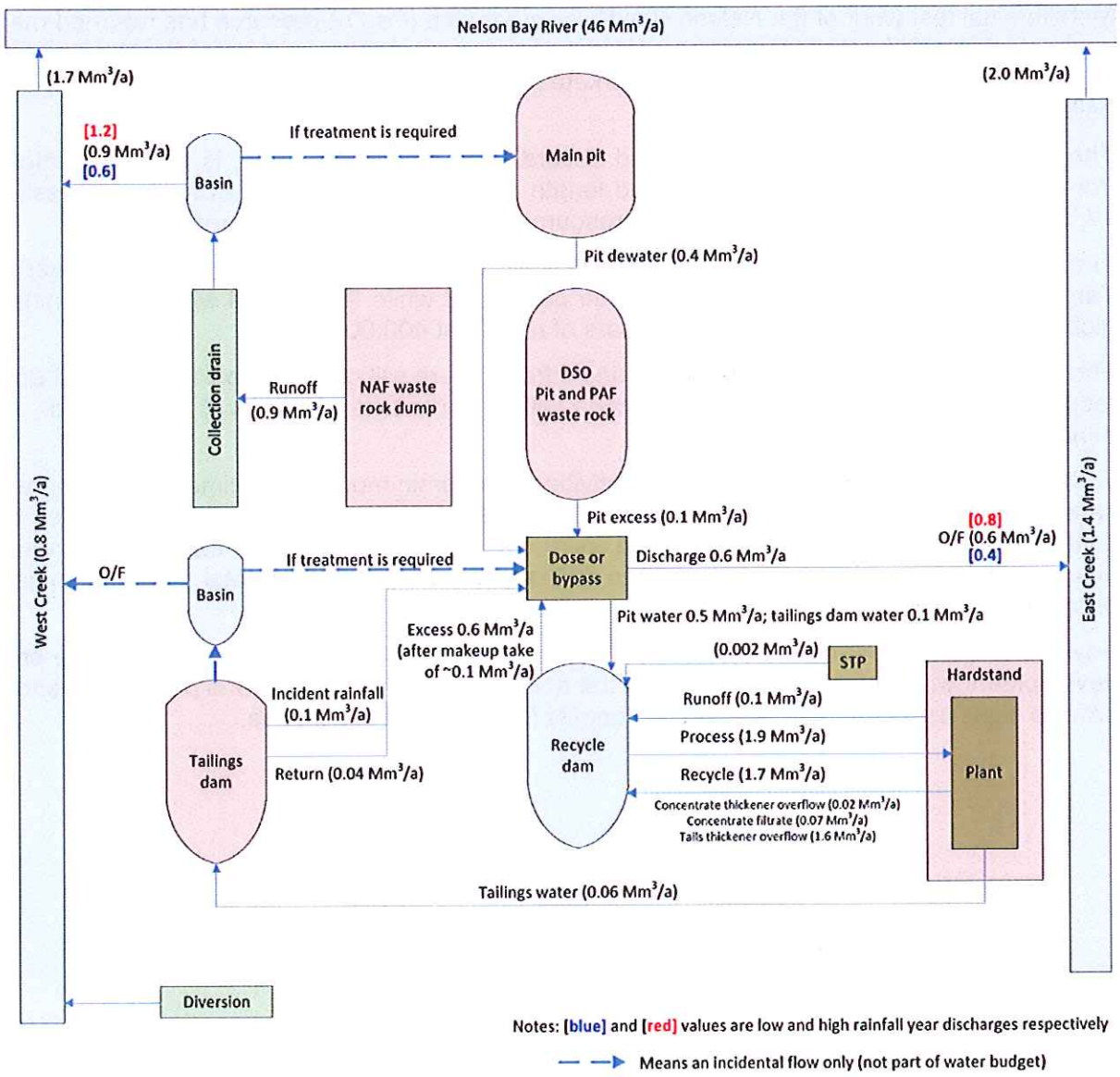


Figure 5: Water Budget for magnetite processing stage **(DPEMP Second Supplement, Appendix B, page 5).**

4 Need for proposal and alternatives (from DPEMP)

Metallurgical test work of the Nelson Bay River magnetite (Fe_3O_4) resource has returned magnetite concentrates >69% with low aluminium oxide, phosphorus sulphur and silica dioxide. The resource is ideally suited for the production of marketable concentrate for either heavy media markets or pellet production.

The present resource estimate, reported according to the JORC Code, is based on information from 24 diamond holes, with a combined length of 2,513 m. The global iron resource estimate is 12.7 Mt at 36.1% Fe including magnetite resources and goethite-hematite resources.

The current mine plan is to target approximately 4 Mt of this resource over a 10 year period. Targeting of the rest of the resource will be developed while the initial 4 Mt is being mined. The global resource could provide up to 30 years of mining at 400,000 tpa.

The construction of the processing plant and infrastructure will cost approximately $15 M and $5 M respectively. It is expected that construction will be undertaken by a local contractor(s), thereby benefiting the local community.

With its planned processing and export activities, economic modelling estimates that operating full capacity the project would employ 125 full time employees (by the company and/or through contractors), with many more employed indirectly because of flow-on effects, and result in a business turnover of approximately $70 to $88 million per annum for a total of approximately $1.5 billion over the project life.

Advice from the Department of Economic Development, Tourism and the Arts is that the proposed development will contribute to supporting the activities of the state's mineral processing sector and provide significant economic and social benefits for north-west Tasmania.

5 Public and agency consultation

A summary of the public representations and government agency/body submissions is contained in Appendix 2 of this report. The proponent's response to those issues is contained in the DPEMP Supplement.

Two representations were received. The main issues raised in the representations included:

- Threats to threatened fauna species from habitat loss, water pollution, changed flow regimes and roadkill.
- Threats to threatened flora species, in particular, three orchid species are considered to be threatened by drying of their habitat resulting from groundwater drawdown caused by the mine.
- The likelihood of post-closure acid leaching from the rock dump and tailings dam.
- The likelihood of the mine containing more potentially acid forming (PAF) material than acknowledged in the DPEMP due to inadequate drill core samples.
- The level of uncertainty about the hydro-geological conditions at the site results in poor understanding of (especially) potential groundwater inflows to the pits, with consequent uncertainties in estimates relating to water treatment/storage/discharge.
- The potential impact on local stream ecology of discharge water with different pH and chemistry.
- The possibility of the water from the DSO or main pit walls seeping into Nelson Bay River or something more catastrophic.

The DPEMP was referred to a number of government agencies/bodies with an interest in the proposal. Responses were received from the following:

- Department of Economic Development, Tourism and the Arts;
- Department of Infrastructure, Energy and Resources; and
- Department of Health and Human Services.

The following Divisions/Areas of the Department of Primary Industries, Parks, Water and Environment also provided submissions on the DPEMP:

- Parks and Wildlife Service;
- Resource Management and Conservation Division;
- EPA Division mining, water, air and noise specialists;

The DPEMP Supplement prepared by the proponent provides a response to each of the relevant environmental issues raised by the public and government agencies/bodies.

6 Evaluation of key issues

The key environmental issues relevant to the proposal that were identified for detailed evaluation in the DPEMP Guidelines were:

1. Surface and ground water quality
2. Acid and metalliferous drainage, waste rock/tailings dam management
3. Biological values of Nelson Bay River
4. Threatened flora and fauna
5. Closure strategy

Further consideration during the assessment has led to some re-prioritisation. The key issues are the inter-related ones of acid and dissolved metal levels in drainage from various sources both during mine operation and, particularly, post-closure, all of which are influenced by the volume of PAF material to be excavated. If the "pristine or nearly pristine" water quality (DPEMP, page 78) of the Nelson Bay River is protected, the biological values will be protected. It has also become apparent that the physical separation of the mine pits from Nelson Bay River is a concern. Flora and fauna issues are considered separately.

These issues are discussed individually in the following Sections. The table of final commitments from the DPEMP and all DPEMP supplements is included as Attachment 2 of the proposed permit conditions (Appendix 3 of this report).

6.1 Acid and Metalliferous Drainage (AMD)

It is considered that there are two major potential sources of acid and metalliferous drainage, the Waste Rock Dump and the Tailings Dam. This section of the assessment report focuses on the broader issues and the Waste Rock Dump, the Tailings Dam is considered separately in section 6.6.

Underlying Assumptions – Treatment of PAF material

There are essentially only two ways to deal in the long-term with PAF material which is uncovered during mining operations and which needs to remain on the site indefinitely (*e.g.* in the waste rock dump). These are:

- Isolate it from the atmosphere so that it cannot oxidise (*i.e.* above ground storage with impervious clay capping or store it underwater); or
- Mix it with an appropriate type and quantity of alkaline material so that any acid produced is immediately neutralised. If this is to be effective it needs to be done at the time that the PAF material is dumped so that the PAF and alkaline material are adequately mixed.

Note that if PAF material is incorrectly placed in the NAF rock dump, by the time that it starts generating enough acid to be detected by monitoring, it will be extremely difficult to address the problem. Extracting the PAF material from the rock dump will only be feasible if the waste rock has been tracked from mine to dump so that the location of any particular load of rock is known as accurately as possible, given the mixing that inevitably occurs during the deposition of the dump.

There is no suitable location on the site for above ground storage with impervious clay capping and no known alkaline rock on the site (DPEMP section 2.7.3 on page 36), and it is unlikely to be practical to import sufficient from elsewhere. This effectively constrains the proponent's options for dealing with PAF material to the "in pit" (put it in the DSO Pit and store it underwater) option as proposed in the DPEMP.

It is acknowledged that, although expensive (particularly in the absence of readily available alkaline material), acid rock drainage during the operating life of the mine (and, possibly, for a few years immediately following closure) can be actively managed by ensuring that all unacceptably acidic effluent is passed through an acid neutralising plant prior to discharge, but the only way to avoid acid drainage in the long-term following closure is to ensure that no sources of acid drainage remain on site. This can only be achieved by ensuring that all PAF material is kept permanently underwater. Note that the proximity of the mine site to Nelson Bay River and low flows in East and West Creeks means that only minimal dilution can occur before the mine effluent reaches the river.

Note that the main environmental concern relating to AMD is not the acidity *per se*, in what is already a somewhat acid environment, rather it is increased bio-availability of various metals, particularly copper, whose solubility is increased at lower pH.

Information Base

The industry best practice guidelines in *Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, Department of Industry, Tourism and Resources, 2007) recommend the collection, prior to seeking approval, of "*sufficient samples to populate a block model with a reliable distribution of net acid producing potential data on ore, waste and wallrock*"; and "*kinetic tests ... for each key lithology ...*".

The General Guidelines provided to the proponent suggested that in preparing the DPEMP, industry best practice guidelines should be referred to where appropriate. The DPEMP does not provide information on the distribution of potentially acid producing materials to the level of reliability recommended in the guidelines referred to above.

The drilling program appears to have been undertaken primarily to prove the resource, not to explore the waste rock. The drill holes were widely spaced (100 metre centres) and almost parallel to the strata of the waste rock. Hence there is significant uncertainty regarding the nature of the waste rock and distribution of PAF material (and the associated estimates in the DPEMP of the volumes of PAF material) but enough information to suggest that some PAF material is present and may be distributed through most of the waste rock types, and that (confirmed by MRT) there is some PAF material in the oxidised material near the surface (DSO Pit and approximately the top 20 metres of the Main Pit). To summarise; the data provided are sufficient to raise concern regarding both the quantity and distribution of PAF material, but insufficient to quantify either with confidence.

The drilling program has also indicated that there appears to be no alkaline rock on site and K-NAG testing has established that all the PAF material encountered starts to "go off" in less than 16 weeks, although no long-term column leach testing was undertaken to confirm the full acid producing potential of the material.

In addition it is not confirmed that there is adequate quality/quantity of clay on site for capping purposes.

Description

The site is located on the south-western side of the Nelson Bay River, and is located wholly within the Nelson Bay River catchment. Nelson Bay River is a class 1 stream under the Forest Practices Code. The proposed mine site and associated facilities are located between two north-westerly trending tributaries (class 2 drainage lines) of the Nelson Bay River, referred to as West Creek and East Creek. These tributaries both have an extensive network of sub-tributaries. West Creek will receive overflow water from the waste rock dump and tailings dam settling dams. East Creek will receive excess water from the pits and the recycle dam (via the acid neutralisation plant). Post-closure all drainage from the site will report to West Creek, reflecting the natural drainage on the site (refer figures 4 & 5 of this assessment report for diagrams of water management staging and water budget).

The Nelson Bay River has been subject to impacts from nearby forestry activities but, in contrast to some other rivers in this area, has not been subject to impacts from upstream mining operations so, according to the DPEMP (page 78), "for the purposes of this project, the PEV of Nelson Bay River catchment will be assumed to be:

> *A: Protection of Aquatic Ecosystems*
> *(i) Protection of pristine or nearly pristine ecosystems".*

Apart from a survey for the giant freshwater crayfish (none were found), no biological sampling of Nelson Bay River has yet been undertaken, so the natural values that could potentially be impacted if the above objective cannot be met are unknown.

West and East Creeks are currently relatively undisturbed small creeks. They are described as "ephemeral" in the DPEMP but both were flowing during the site visit on 10 February 2012 which suggests that they rarely cease flowing completely. The DPEMP focuses on water quality in Nelson Bay River but commits (commitment 90) to monitoring water quality in both creeks.

The risk assessment presented in the DPEMP (Appendix 3 of Appendix S) estimates the residual environmental risk of acid drainage from pyritic material not encapsulated in special cells as "high" (likelihood: unlikely; consequence: major) and the corresponding risk of heavy metal and other concentrations in Nelson Bay River is "high" (likelihood: possible; consequence: moderate).

Section 37.1 of the State Policy on Water Quality Management 1997 (Acid drainage – mines) states:

> Regulatory authorities must not approve new mining operations unless they are satisfied that:
> a) the potential for acid drainage generation has been adequately investigated; and,
> b) where there is the potential for acid drainage to develop, the proposal incorporates best practice environmental management to reduce the risk that such drainage will prevent the achievement and maintenance of water quality objectives for designated surface waters or groundwaters.

Management measures

The DPEMP (page 78) states that the "project's Water Quality Objectives (WQOs) will be developed to ensure that the PEV for Nelson Bay River is not compromised". It is assumed that the intent of this statement is that discharge from the site will be managed so that it does not compromise the existing water quality in the Nelson Bay River.

The strategy proposed in the DPEMP is to isolate all PAF material in the DSO pit where it will be covered as soon as possible to minimise oxidation and, eventually, flooded. The proposed strategy to achieve this is:

- Separate PAF material from NAF material at the earliest possible stage of mining. According to the DPEMP, visual identification is straightforward and will be informed by the block model of the mine pit.
- As a precaution, the waste rock identified as NAF will not be placed into its final location in the waste rock dump (*i.e.* the final push into position by a bulldozer) until the results of the analysis of blast hole dust have been received, and have confirmed the original PAF – not PAF identification. At this point, any PAF material which was incorrectly identified can be retrieved from the waste rock dump and placed in the DSO Pit.

Public and agency comment

Both submissions from members of the public expressed concern that the measures proposed in the DPEMP would be inadequate to prevent acid drainage impacting on the surrounding environment. One submission raised this in very general terms, the other raised many specific issues. This issue has also been the subject of a substantial amount of comment and discussion

involving a range of specialists from within EPA Division. This advice forms the basis of much of the consideration of this issue presented in this section of the assessment report.

Evaluation

Summary

The major uncertainty in this proposal is the degree of separation of PAF material which is achievable, and whether this will be adequate to protect the natural values (and PEV) of Nelson Bay River from AMD from the mine site.

This uncertainty could have been somewhat reduced by better characterisation of the waste rock (additional [more representative] drill cores and the results of column leach testing on these) but only monitoring of environmental outcomes will prove whether an acceptable standard of environmental management is achievable.

PAF isolation strategy – preconditions

For the PAF isolation strategy proposed in the DPEMP to be viable it seems that three preconditions need to be met:

1. That PAF material comprises only a small proportion of the waste rock and it is practical to separate PAF material from NAF material with sufficient precision that the PAF material which may inadvertently be deposited in the NAF rock dump will not be of sufficient quantity and/or acid generating potential to create problems when the leachate is ultimately discharged to the Nelson Bay River.
2. That the DSO Pit is large enough to contain all the PAF material generated during the life of the mine. Hypothetically, excess PAF material could be stockpiled and returned to the Main Pit following closure but there is very little spare space on the mine site, it is difficult to envisage where such a stockpile might be placed (other than over the then full DSO pit as originally proposed in the DPEMP), to say nothing of other issues arising from long-term above-ground storage of PAF.
3. The PAF coming out of the DSO pit can be contained within the DSO pit during the working of that pit or it can be adequately managed outside that pit during the life of the pit.

The EPA Division has concerns regarding all three of these preconditions, as described in more detail elsewhere in this assessment report.

Consequences of errors in PAF/NAF separation

DPEMP Supplement 4 establishes that, even in the worst case scenario of separation errors, the impacts on the pH of Nelson Bay River will be barely detectable. However, this is subject to the uncertainties in the information base described above and does not address the main environmental concern relating to acid drainage which is the elevated metal levels which are likely to result. Copper is the most likely metal to be of concern – chalcopyrite was observed in a number of samples (DPEMP, Table 15) and copper concentrations in some of the waste rock may be high enough (DPEMP, Table 12) to be problematic if mobilised.

Separation of PAF from NAF waste rock

According to the DPEMP, the bulk of the PAF material in the waste rock is in the quartz veins and skarns, in close proximity to the ore body. Effective separation of these materials should be feasible since they are relatively easy to distinguish visually and excavation around the periphery of the ore body will require close supervision for effective grade control. Of greater concern is the pyrite contained within the sedimentary components of the waste rock, well away from the ore body. This will be less apparent visually because its identification requires close scrutiny of the waste rock, rather than checking for a change of rock type, and the mine operator has less reason to subject the bulk of the waste rock to close scrutiny if the presence of pyrite has not been previously identified.

Risk analysis (acidic leachate from waste rock dump):

- The likelihood of this occurring is probably low but the DPEMP does not provide sufficient evidence to establish this – it depends on geochemistry of the waste rock (which has not been well established) and effectiveness of separation of PAF from NAF (which can only be confirmed by monitoring its actual effectiveness during mining operations).

- The consequences of this occurring are unlikely to be serious *per se* (as demonstrated in DPEMP Supplement 4) unless the increased acidity results in increased bio-availability of various metals, particularly copper.

Risk analysis (metalliferous leachate from waste rock dump):

- The likelihood of this occurring is probably low but the data provided in the DPEMP show the presence of some chalcopyrite in the waste rock and the column leach testing of representative samples of waste rock which could have established the likelihood of generation of metalliferous leachate with some confidence has not been undertaken.

- The consequence of metalliferous drainage occurring is potentially serious, in part because of the likelihood that it will not be detected until it is too late for remediation to be practical. *i.e.* the worst case scenario is long-term elevated concentrations of bio-available metals in all waters downstream of the discharge point (*i.e.* West Creek and Nelson Bay River between the confluence with West Creek and the sea) with potentially serious impacts on the biological health of these waters.

Conclusions

Recognising the uncertainty that exists with respect to the amount and distribution of PAF material associated with the proposed mining activity, a rigorous suite of restrictions and conditions is required to manage the risk of AMD.

A strongly precautionary approach is recommended to ensure that the information base is updated as more becomes known about the nature of material on the site. A range of requirements (via permit conditions) is proposed to ensure that the state of knowledge of PAF material at the site is continually improved as the project progresses, The recommended permit conditions aim to address each area of uncertainty and ensure that PAF material is properly contained and managed.

To manage the risk of AMD during the operation of the mine and into the long-term, post closure, all PAF material must be stored in the DSO Pit, since this is considered to be the only secure, long-term storage option. Permit condition **OP2** reflects this requirement.

For this strategy to be successful, all PAF material must be correctly identified and separated from NAF material destined for the waste rock dump. Permit conditions are proposed to ensure this identification and separation is properly undertaken, and then verified and reported.

To address the risk of unacceptable AMD from the waste rock dump, the proponent should be required to submit a PAF Material Separation and Verification Plan (condition **OP1**) to describe how they propose to undertake initial separation of PAF to the highest possible standard. Waste rock must not be placed in its final position in the waste rock dump until the results of blast hole analysis are available to verify the separation of the PAF material. Given the consequences of unacceptable AMD, the proponent will be required to provide verification of this procedure via an independent audit program (**OP1 - 3.4**).

To confirm that this initial separation of PAF material has been achieved, monitoring of the leachate from the NAF waste rock dump is required (condition **M2**).

Condition **OP3** would allow the Director to require the immediate cessation of deposition of material on the NAF waste rock dump, should the Director form a view that AMD from the dump presents an ongoing risk to the environment post-mine closure. This view would be formed based on any relevant evidence, which may include the results of monitoring of waste rock dump leachate. This condition would also require the proponent to provide and implement a solution to address the unacceptable risk of ongoing AMD, to the Director's satisfaction.

To facilitate this, condition **OP1 – 3.3** requires the PAF Material Separation and Verification Plan to include details of an auditable tracking system to enable material in any particular location (in three dimensions) of the waste rock dump to be related to its source location (in three dimensions) within the mine pit. The information recorded should include material lithology and characterisation (degree of PAF, or NAF).

In the event that the proponent cannot promptly address the unacceptable AMD, there may be no alternative but to cease mining and place all material which appears responsible for the unacceptable AMD into the mine pits.

In addition to the waste rock leachate monitoring results, other evidence the Director may consider in forming a view on whether AMD from the waste rock dump presents an ongoing risk to the environment may include the results of direct monitoring of the biological health of the Nelson Bay River (condition **M1**), and results of column leach tests conducted on material which is already in the waste rock dump (condition **OP1 – 3.2**).

The risk of long-term AMD from the waste rock dump will depend entirely on the success or otherwise of correctly identifying, separating and segregating PAF material from the NAF waste rock to ensure its containment within the DSO pit. To that end, if the conditions proposed are properly met, this risk is considered to be low.

6.2 AMD – other sources

Description

Other than the waste rock dump and tailings dam, possible sources of AMD (or other effluent likely to require treatment) include the following:

- Temporary storage of ore prior to shipment;
- The use of PAF material for construction purposes;
- The exposure of PAF material during excavation for roads or other infrastructure; and
- Wet sludge resulting from the processes of the Acid Neutralising Plant. According to the DPEMP, sludge from the Acid Neutralisation Plant will be stored in the DSO pit, however, in the event that it is not practical to deposit wet sludge into the pit until mining is completed, the sludge will require temporary storage until mining of the DSO Pit is completed.

Management measures

Commitments 7 and 8 (a Drainage Management Plan for the management of site water during operations) potentially address these concerns.

Public and agency comment

Both submissions from members of the public expressed concern that the measures proposed in the DPEMP would be inadequate to prevent acid drainage impacting on the surrounding environment. The possibility of AMD from sources other than the waste rock dump and tailings dam has also been the subject of comment from within EPA Division.

Evaluation

Care will be necessary to ensure that waste rock used for construction works such as the tailings dam wall, drains and bunds is entirely NAF.

All runoff or seepage from major elements of mine infrastructure must be collected so that it can be treated if necessary. In particular, the bund above West Creek will need to isolate West Creek from any seepage from the tailings dam and waste rock dump.

In the event that it cannot immediately be placed in the DSO pit, seepage from sludge from the ANP will need to be captured and, as necessary, treated prior to release.

Control of AMD during active mining operations may require alkaline dosing, and this may be required as soon as any PAF material is encountered, so it is essential that the recycle dam and acid neutralising plant are constructed with adequate capacity and commissioned prior to commencement of mining.

Conclusions

These potential sources of AMD (or other wastewater likely to require treatment) are not specifically addressed in the DPEMP, although the commitment to a Drainage Management Plan may address some of the issues. The consequences of the failure to capture and, as necessary, treat all such wastewater are sufficiently serious as to warrant specific permit conditions. The following permit conditions are proposed, which if complied with, should address and minimise the risks of AMD from sources other than the waste rock dump or the tailings dam:

- Condition **OP2 – 2**, which requires that unless it is demonstrated (through appropriate sampling and testing) not to contain PAF material, ore and any other material should be stored on an impervious hardstand with all drainage collected, so that any necessary treatment can be undertaken.
- Condition **CN4**, which requires that the Recycle Dam and Acid Neutralising Plant be constructed with adequate capacity and commissioned prior to commencement of mining, so that any AMD requiring alkaline dosing can be undertaken as soon as any PAF material is encountered.
- Condition **E2**, requiring all runoff or seepage from major elements of mine infrastructure to be collected so that it can be treated if necessary.
- Condition **CN1**, to ensure that any waste rock used for construction works such as the tailings dam wall, drains and bunds, is demonstrated to be entirely NAF prior to being used, and that any PAF material exposed during excavations for roads or any other infrastructure must be managed to prevent AMD.
- In the event that it is not practical to deposit wet sludge from the Acid Neutralising Plant into the pit until mining is completed, the sludge will require temporary storage (with all runoff captured) until mining of the DSO Pit is completed. This is also covered by condition **OP2**.

6.3 Quantity of PAF Material

Description

The DPEMP proposes the long-term storage of all PAF waste rock in the DSO Pit, which will be flooded following mine closure.

According to the DPEMP (Tables 5 & 16), the volumes of the DSO Pit and the PAF material are:

- Volume: 858,000 m^3

- Waste: 727,000 m^3 (85% of pit volume)
- PAF (from DSO Pit): 14,000 m^3 (2% of waste rock)
- PAF (from Main Pit): 1,662,000 m^3

Management measures

Apart from the long-term storage of all PAF waste rock in the DSO Pit, the DPEMP does not propose any specific management measures. The DPEMP asserts that the estimate of the volume of PAF material is conservative, and expresses confidence that all PAF material generated from both pits can fit within the DSO Pit.

Public and agency comment

This issue of the volume of PAF material relative to the volume available for storage in the DSO Pit was not raised in the public submissions, but has been the subject of ongoing discussion within the EPA Division.

Evaluation

Permanent underwater storage, as proposed in the DPEMP, is the only acceptable solution for PAF material which has to remain on site indefinitely (refer section 6.1).

A bulking factor of 1.2 needs to be applied to the volume of waste rock (DPEMP, page 23) so the estimated total volume required for storage of PAF material from both pits is approximately 2,000,000 m^3.

The DSO Pit requires a clay lining and ultimately needs to be flooded which will reduce the volume available for disposal of waste rock to approximately 800,000 m^3. *i.e.* it can only accommodate around 40% of the estimated volume of PAF material, and cannot quite accommodate all of its own waste rock should this be necessary (727,000 m^3 x 1.2 = 872,000 m^3).

Volume estimate: The EPA Division's analysis of the data provided in the DPEMP (which was supported by MRT) was that pyrite was more widely distributed through the waste rock than was acknowledged in the DPEMP's estimate of the volume of PAF material (the figures used above).

Mixing: DPEMP Supplement 4 acknowledges that some NAF material will inevitably end up in the PAF dump because of the mixing which will occur at the mine face as material is blasted and moved by the excavator bucket.

Identification: The volumes of pyritic material estimated in the DPEMP are based on 0.5% pyrite cut-off. Description of PAF/NAF segregation in section 2.2 of DPEMP Supplement 4 states that all rock with any visible pyrite will be treated as PAF. This suggests that some rock with <0.5% pyrite will get classified as PAF.

Separation: DPEMP Supplement 4 acknowledges that the segregation will be harder in skarn and quartz veins than in siltstones, and that there is insufficient storage space to take the precautionary approach of treating all skarn and quartz vein rock as PAF. The EPA Division is also concerned that some of the finely disseminated pyrite within the siltstone could be very hard to identify visually. These considerations emphasise the need for a precautionary approach to separation in which all questionable material is treated as PAF.

The above concerns suggest that the volume of waste rock that will need to be treated as PAF may be substantially higher than the estimate in the DPEMP.

Conclusions

Long term storage of PAF waste rock in the DSO pit is the most suitable management option for this material. Permit condition **OP2 - 1** requires the proponents to place all waste material known to contain PAF in the DSO pit. The proponents have also committed (commitment 38) to this. However, the calculations above indicate that it is very likely that the project will run out of PAF storage volume in the DSO Pit before mining of the Main Pit is completed. This condition essentially implies that mining is to cease once the storage space in the DSO Pit is exhausted.

The proponent has stated (via a letter from Shree Minerals dated 23 March 2012) that they were supportive of a permit condition which did not allow storage of PAF elsewhere (either above the ultimate flood level of the DSO pit, or elsewhere on the site), unless approval from the Director was given. It should be noted that the proposed permit condition OP2 – 1 does not provide Directorial discretion to approve storage of PAF material elsewhere than in the DSO pit, as it is considered unlikely that an appropriate alternative strategy is available or feasible.

6.4 Proximity of the Mine Pits to Nelson Bay River

Description

The northern ends of both pits are located close to the Nelson Bay River, which lies at the bottom of a steep-sided valley over 20 metres deep. According to the first DPEMP Supplement (page 18), at its closest, the crest of the DSO pit is 47 metres horizontal distance from the river while the corresponding distance for the Main Pit is 37 metres. There is potential for contamination of the river from siltation (stormwater runoff during construction of infrastructure and initial excavation of both pits) and excavated material falling down the bank. However, the greatest concern relates to the stability and permeability of the "dam walls" (created by excavation of the pits adjacent to the river valley) which will separate the pits from the river. This could result in infiltration of river water into the pits (during mining) or seepage from the flooded pit into the river following mine closure.

The risk assessment presented in the DPEMP (Appendix 3 of Appendix S) estimates the residual environmental risk of structural failure of either or both pits as "extreme" (likelihood: possible; consequence: major).

Management measures

The first DPEMP Supplement states (page 21) that "prior to opening up of the pits, detailed geotechnical drilling will be undertaken of the pit extents as part of the detailed engineering design of the pits. The results of these geotechnical investigations will be used to design the shape and extents of the pit so as to ensure that the pit walls will remain stable, both during operations and following mine closure, with appropriate recognition of the proximity of the river."

The first DPEMP supplement also states (page 21) that "the detailed design of the pits will also include appropriate construction controls to prevent erosion or drainage from disturbed ground to the river."

Public and agency comment

This issue was raised in one of the public submissions and internal EPA comments.

Evaluation

Significant seepage through the "dam wall" in either direction, in either pit, has the potential to substantially increase the environmental impacts of the project, and a collapse of either "dam wall" at any stage of the project could have major environmental and human safety consequences.

Following closure, the DSO Pit will be full of deposited PAF material which should assist its structural stability, but the main pit will remain as a water filled pit, perhaps over 200 metres deep.

It is anticipated that this concern can be adequately addressed but this may require a greater separation between pit and river than proposed in the DPEMP, which will reduce the proportion of the ore body which can be extracted.

It is also noted that, prior to closure, any significant seepage through either "dam wall", let alone a collapse, is likely to permanently terminate mining operations, so this issue is seen as one which will have to be addressed for operational reasons, irrespective of the potential environmental consequences. The greatest environmental risk appears to be the post closure, post flooding, failure of the barrier between the main pit and the Nelson Bay River.

It is agreed that appropriate construction controls to prevent erosion or drainage from disturbed ground to the river are possible but it is noted that this is a particularly difficult situation which is likely to require special attention from mine management to achieve a satisfactory outcome.

Conclusions

The proponent should be required to demonstrate that barriers remaining between the Nelson Bay River and both pits are adequately stable and sufficiently impermeable, particularly the barrier between the Nelson Bay River and the main pit, which needs to contain the water in the flooded pit indefinitely.

Permit condition **CN3** requires the proponent to demonstrate compliance with relevant geotechnical and engineering standards, through the submission of a Pit Stability Management Plan to the Director for review and approval prior to the extraction of ore. It is proposed that the Pit Stability Management Plan also undergo an independent review at the expense of the proponent.

The proponent is required to comply with Commitment 7 (management of runoff) (Permit condition **G7**).

6.5 Groundwater Inflow to Mine Pits

Description

According to the DPEMP (Appendix D – Hydrogeological Report) "estimates of groundwater inflow to the proposed Main Pit and DSO Pit are preliminary and depend on several assumptions about aquifer properties and pit design. For the near-end-of-mine-life Main Pit, annual inflow is estimated to be in the range 400 – 800ML +/-50%". *i.e.* the annual inflow is estimated to be between 200 and 1,200 ML.

Management measures

According to the DPEMP (section 2.16) "water from pit dewatering will be pumped to the acid neutralisation plant and then to the recycle dam or to the East Creek discharge. The expected DSO dewatering rate is approximately equal to the process water make-up needs. Dewatering from the main pit would be excess to this, and the excess would be discharged to East Creek."

Public and agency comment

This issue of the volume of groundwater inflow to the mine pits was raised in one of the public submissions and internal EPA comments.

Evaluation

As noted under the *Description* section above, it is acknowledged in the DPEMP that the volume of inflow into the pits cannot be estimated with much confidence, and it is possible that either of the pits will intercept a previously unknown aquifer which will increase the inflow even further. As shown in the water budget (Assessment Report, Figure 5), if the annual groundwater inflow to the main pit is 400 ML, 33% of the discharge from the project is derived from groundwater inflows to the two pits. If the annual groundwater inflow to the main pit is 1,200 ML (the upper limit of the estimate in the DPEMP) it will comprise >50% of the discharge. This water is potentially high in AMD and is likely to require significant treatment to raise the pH to a level where it can be discharged without causing environmental damage.

It is acknowledged that treatment of water from pit dewatering prior to discharge is feasible in principle, but it will require an adequately sized Recycle Dam and Acid Neutralisation Plant to be operational prior to commencement of groundwater inflow. It is also noted that both the capital and operating costs of an Acid Neutralisation Plant are significant and that lime may have to be sourced from a substantial distance.

Conclusions

Permit condition **CN4** requires the proponent to submit a Water Management Plan to the Director for approval, prior to commencement of extraction of ore, to provide background information on the hydrology of the area, and to provide details of the proposed Recycle Dam and Acid Neutralisation Plant design, monitoring, quality control, and reporting. This condition also requires that the Recycle Dam and Acid Neutralisation Plant are constructed in compliance with the approved Water Management Plan, and to be operational prior to the extraction of ore.

6.6 Tailings Management

Description

Tailings will only be produced during Stage 2 of the project when wet magnetic separation is required. According to the DPEMP (section 2.9) "all tailings samples were classified as NAF (non-acid forming)" and DPEMP section 2.13 "However, the sporadic occurrence of pyrite in quartz veins means that there is some potential for potentially acid forming material to be discharged in the tailings stream".

The risk assessment presented in the DPEMP (Appendix 3 of Appendix S) estimates the residual environmental risk of AMD in the Tailings Dam as "extreme" (likelihood: possible; consequence: major) while the corresponding risk of leakage from tailings into groundwater is "high" (likelihood: possible; consequence: moderate).

Management measures

According to the DPEMP (section 2.13) "as a conservative protection measure, surplus neutralising capacity will be added to the tailings stream prior to deposition in the tailings dam."

Public and agency comment

This issue of post-closure AMD from the Tailings Dam was raised in both of the public submissions and internal EPA comments.

Evaluation

The DPEMP proposes two strategies to prevent post-closure AMD from the Tailings Dam. These are the addition of surplus alkalinity, and permanent water coverage of the tailings.

The risk assessment presented in the DPEMP provides justification for concern about post-closure AMD from the Tailings Dam, and the absence of alkaline material on site (discussed elsewhere) raises concern about the practicality of the proposed alkaline dosing strategy.

The EPA Division's advice from specialists in this area of mine management (based on metallurgical test work undertaken for the Savage River Mine) is that flotation to separate pyrite from other tailings can remove approximately 74% of the total mass of pyrite and 93% of the surface area available for oxidation. Such a reduction would substantially reduce the risk of post-closure AMD and the consequence of leakage from tailings into groundwater, should this occur.

Conclusions

Permit condition **CN6** requires the proponent to submit a Tailings Management Plan to the Director for review and approval prior to commencement of operation of the processing plant. The Tailings Management Plan would be required to demonstrate that the Tailings Dam is operational and adequate for its proposed purpose, and propose a procedure for tailings management, a program of surveillance, quality control, and reporting. Following review and approval by the Director, the proponent would be required to operate in accordance with the approved Tailings Management Plan.

The permanent water cover proposed in the DPEMP is an important component of the strategy to prevent oxidation of any PAF material in the tailings. Dam leakage and/or reduced inflow could result in exposure of tailings and, if they contain PAF material, the generation of AMD with no possibility of remediation. To reduce the likelihood of this occurring, ongoing inspection of the dam is required, but the risk would be substantially reduced if the tailings were depyritised to the greatest extent possible prior to deposition. These factors are covered in permit condition **CN6**.

6.7 East and West Creeks

Description

These minor creeks are not named on standard Tasmanian topographic maps – the names East Creek and West Creek were applied for convenience in the process of considering this project.

East and West Creeks are extremely small – described in the DPEMP as ephemeral – and annual flows are estimated at 1.5 ML per annum (East Creek) and 0.8 ML per annum (West Creek).

The location of the ore body between East and West Creeks and the Nelson Bay River leaves little scope for avoiding discharge from the project into the two creeks. The possibility of piping discharge directly into the Nelson Bay River (rather than discharge into East Creek) was considered early in the project but was not pursued, since the initial evaluation suggested that this did not offer clear advantages.

Refer to the water budget (Assessment Report, Figure 5), for details of the flows reporting to each creek.

Management measures

According to the DPEMP, the discharge water will be treated as necessary prior to release so no management measures are necessary. However, there is a need to appropriately match discharge to creek flow so that discharge does not become an unnecessarily high proportion of total flow. DPEMP Supplement 1 (Appendix F, Section 4.2.2) proposes that the full length of East Creek, from the recycle dam discharge point to its confluence with the Nelson Bay River, be adopted as the discharge mixing zone.

Public and agency comment

This issue of the impact of the project on East and West Creeks was raised in both of the public submissions and internal EPA comments.

Evaluation

As shown in the water budget (Assessment Report, Figure 5), in normal conditions, mine discharge comprises 30% of the flow in East Creek and 53% of the flow in West Creek. If groundwater inflow has been underestimated (as discussed in section 6.5) these proportions will be even higher. *i.e.* there is little scope for dilution.

Water quality and aquatic biota in both East and West Creeks may be compromised for the duration of mining but neither the upstream part of their catchments nor the Nelson Bay River should be affected by the project, so recovery should be possible once mining has ceased.

Conclusions

The physical characteristics of the site mean that there are no obvious alternatives that would provide a significantly better environmental outcome to discharge other than those proposed. No specific permit conditions are proposed.

6.8 Staging of project

Description

The DPEMP seeks approval for the entire project on the basis of the information currently available, however DPEMP Supplement 1 includes a description of the two stages of mining as a "a useful descriptive delineation between DSO/BFO and magnetite mining". These are:

Stage 1:

- Construction of access road
- Construction of hardstand for crusher and ROM stockpile
- Construction of office and amenities block
- Construction of (initial cell(s) of) recycle dam
- Installation of initial neutralisation plant
- Construction of haul road
- Commencement of NAF rock dump
- Removal of DSO pit vegetation and overburden
- Extraction of DSO from DSO pit
- Storage of any DSO pit PAF waste rock inside DSO pit
- Crushing and screening of DSO
- Trucking of DSO to port

- Removal of main pit vegetation and overburden
- Construction of additional cell(s) of recycle dam
- Upsizing of neutralisation plant
- Extraction of BFO from main pit
- Continuation of NAF rock dump
- Storage of any BFO PAF waste rock inside DSO pit
- Beneficiation of BFO ore by crushing, screening and dry magnetic separation
- Trucking of BFO to port.

Stage 2:

- Construction of additional cell(s) of recycle dam
- Upsizing of neutralisation plant
- Construction of processing plant
- Construction of tailings dam
- Extraction of magnetite from main pit
- Continuation of NAF rock dump
- Storage of any magnetite PAF waste rock inside DSO pit
- Processing of magnetite ore
- Trucking of magnetite product to port.

Management measures

According to the DPEMP, the intention is to increase knowledge of both the ore body and the waste rock as mining proceeds. For example, "the existing block model for PAF material in both the DSO and main pits will be progressively refined as mining proceeds and this, together with regular geological inspections and active grade control at the mine face, will allow PAF material to be identified and separately managed to NAF material." (DPEMP section 2.4).

Public and agency comment

This issue of the staging of the project was not raised in the public comments but has been the subject of discussions between the proponent and the EPA.

Evaluation

The majority of the environmental risks of this project are likely to be associated with Stage 2, namely:

- The bulk of the PAF material is likely to be located at greater depths; and
- The processing plant and tailings dam are only required for processing of unoxidised magnetite ore from the Main Pit.

The proponent has stated (via a letter from Shree Minerals dated 23 March 2012) that they were supportive of a permit condition which did not allow storage of PAF elsewhere (either above the ultimate flood level of the DSO pit, or elsewhere on the site), unless approval from the Director was given. Permit condition OP2 – 1 therefore means that, effectively, mining must cease once the storage space in the DSO Pit is exhausted.

While such a permit condition would stop mining when storage space for PAF material is exhausted, it would be prudent to ascertain that there is a reasonable likelihood of adequate PAF storage space being available prior to the commencement of Stage 2. The proponent has indicated that additional drilling and analysis will proceed while Stage 1 is underway, so a requirement to provide additional information on the quantity and quality of PAF material likely to be encountered in Stage 2 would be a reasonable request.

In addition, the greatest unknown in relation to AMD (refer to section 6.1 of this assessment report) is the ability to achieve satisfactory separation of PAF material. Stage 2 should not be permitted to proceed until Stage 1 has progressed far enough to demonstrate that this is achievable. Since the intention is not to commence Stage 2 until Stage 1 is largely complete, this should not be a significant imposition on the proponent.

Conclusions

Permit condition **CN5** requires the proponent to submit a Stage 2 Feasibility Plan to the Board of the EPA for review and approval, prior to the commencement of construction of Stage 2. Works on Stage 2 will not be permitted until the Stage 2 Feasibility Plan is approved and works must be carried out in accordance with the approved plan. The Stage 2 Feasibility Plan would need to demonstrate that environmental impacts of Stage 1 are being managed acceptably to date, and that further data collected regarding the material expected to be encountered in Stage 2 shows that any expected environmental impacts of Stage 2 activities can be reasonably managed.

6.9 Threatened Flora

Description

No vegetation community listed under Schedule 3A of the Tasmanian *Nature Conservation Act 2002* or the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) occurs within or adjacent to the study area. There is no non-native vegetation on the site.

Threatened flora species, listed on one or both of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA) and the Tasmanian *Threatened Species Protection Act 1995* (TSPA), previously identified within 5 km of the study area are shown in Table 31 of the DPEMP.

Two threatened vascular plant species *Epacris curtisiae* – northwest heath – and *Prasophyllum pulchellum* – pretty leek-orchid – listed under the schedules of the *Threatened Species Protection Act 1995* were recorded from the study area. *Prasophyllum pulchellum* – pretty leek-orchid – is also listed under the *Environment Protection and Biodiversity Conservation Act 1999*. However, neither of these species was recorded from any of the potential disturbance areas associated with the mine.

These threatened vascular plant species are not directly threatened by the development since they do not occur within any of the potential disturbance areas. The potential threat, identified in both public submissions, is that groundwater drawdown resulting from inflow to the nearby pits will dry out their habitat.

Management measures

The proponent has undertaken that "unless prescribed burns to foster orchid populations are requested by the EPA Director on behalf of DPIPWE, there will be no disturbance of the sensitive wet heathlands to the west of West Creek, which provide known and potential habitat for threatened orchid species" (Commitment 56). Beyond this there are no other specific management measures proposed in the DPEMP.

Public and agency comment

Both public submissions expressed concern that groundwater drawdown will dry out the habitat of threatened plant species. One also expressed concern regarding the adequacy of the surveys.

Evaluation

According to DPEMP Supplement 1, the heathland soil moisture is not derived from the underlying groundwater, which lies metres below the soil surface, but will be dependent on the balance between precipitation and evapotranspiration that occurs in the upper few centimetres of the soil, where the heath plant roots are. Any changes to the height of the water table due to groundwater drawdown metres below the soil surface will be insignificant relative to the water balance in the upper few centimetres.

The targeted surveys were conducted according to normal DPIPWE standards.

The conclusion in the DPEMP that there will be no significant residual impacts on threatened flora is supported. However, it is noted that no data are provided on aquatic flora in Nelson Bay River, and if the project is unable to meet its stated Water Quality Objectives of maintaining protection of pristine or nearly pristine ecosystems, impacts on aquatic flora are likely.

Conclusions

The proponent should be required to comply with Commitment 56 (via permit condition **G7**).

6.10 Threatened Fauna

Description

Seven threatened and one migratory fauna species are considered to have suitable habitat within the area:

- Tasmanian Devil (*Sarcophilus harrisii*): listed as endangered TSPA and EPBCA;
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*): listed as rare TSPA, vulnerable EPBCA;
- Wedge-tailed Eagle (*Aquila audax* subsp. *fleayi*): listed as endangered TSPA and EPBCA;
- Tasmanian Masked Owl (*Tyto novaehollandiae* subsp. *castanops*): listed as endangered TSPA and Vulnerable EPBCA;
- White-bellied Sea-eagle (*Haliaeetus leucogaster*): listed as vulnerable TSPA;
- Azure Kingfisher (*Ceyx azurea* subsp. *diemenensis*): listed as endangered TSPA and EPBCA [previously named *Alcedo azurea* subsp. *diemenensis*];
- Tasmanian Giant Freshwater Crayfish (*Astacopsis gouldi*): listed as vulnerable TSPA and Vulnerable EPBCA; and
- Satin Fly Catcher (*Myiagra cyanoleuca*): listed as migratory EPBCA.

No Wedge-tailed Eagle or White-bellied Sea-eagle nests were located within the proposed mining area.

The DPEMP acknowledges that "approximately 152 hectares of vegetation will be cleared for the proposed mine. This vegetation is potential Devil habitat". It also acknowledges that there are several records of Spotted-tailed Quoll within 5 km of the study area and it is present in the proposed mine site area, as evidenced by an observed probable scat.

The DPEMP also acknowledges that the increased traffic generated by the mine may impact on Devils and Quolls through increased roadkill.

Management measures

According to the DPEMP, most roadkill occurs on roads with speed limits of 80 kph or greater, and 54 kph is the crucial speed for avoiding collisions in darkness. For this reason the speed limit for

mine workers and product transporters on Wuthering Heights Road from the Rebecca Road turnoff will be limited to 50 km per hour (DPEMP commitment 63).

The DPEMP states that roadkill risk is primarily a night time occurrence – the risk during daylight hours is approximately 25% of the night time risk, so a prudent risk minimisation measure would be to avoid product transport at night. The proponent has undertaken that "offsite transport of mine product will be confined to daylight hours" (DPEMP commitment 65) but has not defined "daylight hours".

The proponent has also undertaken to provide a bus to transport mineworkers, which should reduce the total volume of vehicle traffic and, hence, roadkill.

The proponent has committed (DPEMP commitments 59 & 60) to preclearance surveys for Devil and Quoll dens, and Masked Owl nests, so that disturbance due to vegetation clearance can be minimised (clearance around the den/nest will be postponed until it is vacated).

Public and agency comment

One public submission expressed concern regarding the adequacy of the surveys for threatened fauna species and suggested that roadkill projections underestimated the likely mortalities of Quolls and Devils. It was also suggested that most mine employees will use their own vehicles in preference to the provided bus.

Evaluation

Quolls and Devils

It is estimated that the 152 hectares of vegetation clearance will displace between 0.4 and 1.5 Devils and a lesser number of Quolls (population densities for Quolls are less well understood than for Devils). On this basis it is expected that a maximum of 2 Devils and 1 Quoll will be displaced by the project. A survey for active dens immediately prior to vegetation clearance should allow disturbance due to vegetation clearance to be minimised (clearance around the den will be postponed until it is vacated – commitment 60).

The increased roadkill mortality (subject to restricting product transport to daylight hours) is estimated at 1.6 Devils and 0.3 Quolls per year (first year of operation when traffic will be highest).

According to the DPEMP, the mine will not introduce any risk of increasing the spread of Devil facial tumour disease.

Eagles

No eagle nests were located within the proposed mining area and a search failed to locate any potential nest trees within 500m (or 1km line of sight) from the proposed works. The disturbed area represents a tiny proportion of an eagle territory so the project is unlikely to have a significant impact on either eagle species although the DPEMP does acknowledge the potential for increased eagle roadkill resulting from the increased traffic.

Masked Owl

According to the DPEMP, there is some possibility of nesting habitat in the vegetation to be cleared on the site. A survey for active nests immediately prior to vegetation clearance should allow disturbance due to vegetation clearance to be minimised (clearance around the nest will be postponed until it is vacated – commitment60).

Azure Kingfisher

According to the DPEMP, there are no known nest sites or records occur within 5 km of the study area and suitable habitat is considered to be marginal so the potential of occurrence is considered to be low. The species was not found during the field survey so there is no evidence to suggest that direct impacts on it will occur from the proposed mine.

Giant Freshwater Crayfish

Although Nelson Bay River itself has suitable habitat, it is at the margins of the species' range and surveys found no presence of the species in the river.

Satin Fly Catcher

This species was seen foraging at several locations in the riparian areas along the Nelson Bay River outside the proposed mine layout. There is no evidence to suggest that direct impacts on the species will occur from the proposed mine.

Conclusions

Subject to compliance with the DPEMP commitments, the impacts of the project on threatened fauna are unlikely to be significant. The proponent should be required to comply with the relevant DPEMP commitments and product transport should be restricted to daylight hours. In the absence of a definition of "daylight hours", a permit condition (**OP4**) is recommended which provides a clear definition.

However, it is noted that no data are provided on aquatic fauna in Nelson Bay River (with the exception of the survey for the Giant Freshwater Crayfish – none were found), and if the project is unable to meet its stated Water Quality Objectives of maintaining protection of pristine or nearly pristine ecosystems, impacts on aquatic fauna are likely. To address this lack of information, permit condition **M1** requires the submission for approval by the Director of a Biological Monitoring Plan, to provide water quality and biological monitoring information for East and West Creeks and Nelson Bay River.

7 Other environmental issues

In addition to the key issues, the following environmental issues are considered relevant to the proposal and have been evaluated Appendix 1.

- Greenhouse
- Weeds & disease
- Noise & dust
- Aboriginal Heritage
- Arthur Pieman Conservation Area

8 Report Conclusion

This assessment has been based upon the information provided by the proponent in the permit application, DPEMP and DPEMP Supplements.

This assessment has incorporated specialist advice provided by Divisions of DPIPWE and the, Department of Health in relation to a number of key issues.

This assessment has taken into account issues raised in public submissions.

Recognising that considerable uncertainties remain with respect to particular environmental risks associated with the proposed development, a rigorous and conservative conditioning suite is proposed to manage these risks. These conditions either impose limitations up-front (such as the confinement of PAF waste rock within the DSO pit), or require further information and confirmation that environmental risks have been mitigated or can be appropriately managed, before development of the mine can continue.

A number of checks and balances are proposed that will allow the Director to halt project activities if he or she is not satisfied that the environmental risks, both during operation of the mine, and in the long-term following mine closure, are not being managed in a way that adequately avoids environmental harm.

It is concluded that:

1. the RMPS and EMPCS objectives have been duly and properly pursued in the assessment of the proposal; and
2. the assessment of the proposal has been undertaken in accordance with the Environmental Impact Assessment Principles;

It is concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is unlikely that the RMPS and EMPCS objectives would be compromised, provided that the Permit Conditions – Environmental No. 8568 appended to this report are imposed and duly complied with, including commitments made by the proponent in the DPEMP and DPEMP Supplements, and included as attachment 2 of the proposed permit conditions (appendix 3 of this report).

Report approval

Environmental Assessment Report and conclusions, including permit conditions, accepted:

26 JUL 2012

John Ramsay
Chair
Board of the Environment Protection Authority
Meeting date: 24 July 2012

9 References

DPEMP Nelson Bay River Magnetite Mine
Prepared for: Shree Minerals
Prepared by: Dr Ian Woodward & Dr Michael Pollington (Pitt & Sherry)
28 November 2011

Supplements

Supplement Nelson Bay River Magnetite Mine
Prepared for: Shree Minerals
Prepared by: Dr Ian Woodward (Pitt & Sherry)
23 March 2012

DPEMP Supplement 2
Nelson Bay River Magnetite Mine
Prepared for: Shree Minerals
Prepared by: Dr Ian Woodward (Pitt & Sherry)
4 May 2012

DPEMP Supplement 3
Nelson Bay River Magnetite Mine
Prepared for: Shree Minerals
Prepared by: Dr Ian Woodward (Pitt & Sherry)
4 June 2012

DPEMP Supplement 4
Nelson Bay River Magnetite Mine
Prepared for: Shree Minerals
Prepared by: Dr Ian Woodward (Pitt & Sherry)
20 June 2012

10 Summary of appendices

Appendix 1	Assessment of other environmental issues
Appendix 2	Summary of issues raised by public and agency submissions
Appendix 3	Permit Conditions - Environmental, includes DPEMP Commitments at Attachment 2

Appendix 1 Assessment of other environmental issues

Issue 1

Greenhouse gas emissions

Description of potential impacts

Greenhouse gases (predominantly carbon dioxide) will be generated during the construction phase as a result of:

- Vehicle and construction machinery emissions; and
- Production of carbon dioxide associated with the burning off of cleared vegetation.

During the operational phase greenhouse gas emissions will be generated by:

- Mining machinery (excavators, drill rigs, etc) and within mine transport vehicles;
- Diesel powered generators (no mains power to the site);
- Processing plant operations;
- Concentrate transport offsite; and
- Light vehicle transport activities, both onsite and offsite.

Management measures proposed in DPEMP

- The location of the waste rock dump close to the mine site will keep emissions to the minimum practicable level.
- The location of the tailings storage facility will provide a greenhouse benefit as it will allow for gravity feed of decanted water back to the plant. No pumping will be required to reuse this water in the mill.
- Excavation areas around the waste dump area and the tailings storage facility will be actively regenerated, thereby quickly establishing a carbon sink. The mine site rehabilitation plan will involve the revegetation of mine site areas, offsetting the project carbon emissions.
- All mining equipment, machinery and vehicles will be well maintained in order to minimise the generation of greenhouse gases.
- In order to reduce onsite greenhouse gas emissions, a gravity clean tailings decant return to the mill will be used where possible.
- It is planned to construct the tailings storage facility solely from onsite clay and rock resources, thereby minimising the need for extraction and transport of offsite material to the project area.
- Cleared areas around the mining development will be actively regenerated wherever possible, thereby quickly establishing a nominal carbon sink.

Public and agency comment

None.

Evaluation

The measures proposed demonstrate the implementation of best practice regarding the minimisation of greenhouse gas generation.

Conclusion

That the proponent be required to comply with DPEMP commitments **68** to **71** (Covered by standard condition **G7**).

Issue 2
Weeds and disease
Description of potential impacts
According to the DPEMP, the area currently is essentially weed free. The potential introduction of declared and/or environmental weeds is therefore of concern. During and after the proposed works, disturbed areas will be susceptible to weed regeneration and potential future weed invasion. The potential for the introduction and spread of *Phytophthora* is a concern because susceptible species, particularly *Epacris curtisiae,* are present. The spread of weeds and plant diseases is also highly undesirable for its potential impact on threatened orchid species.
Management measures proposed in DPEMP
Standard plant hygiene measures are proposed (Commitments **38** to **41** and **43**). According to the DPEMP, these have already been implemented during the exploration phase.
Public and agency comment
PCAB advised that a Weed Management Plan should be developed which should refer to DPIPWE *Washdown Guidelines for Weed and Disease Control – Edition 1*. It should cover not only vehicle and machinery hygiene but also material hygiene (*i.e.* materials such as gravel and soil which have the potential to be disease vectors).
Evaluation
The proposed measures, supplemented by the implementation of a Weed Management Plan, are considered adequate.
Conclusion
That the proponent be required to develop a Weed Management Plan and to comply with DPEMP commitments **51** to **54** and **57** (Covered by standard condition **G7**).

Issue 3
Noise and dust
Description of potential impacts
A mine of this size requires substantial heavy equipment operations and blasting is likely to be required in the main pit below 20 metres depth so there is potential for both noise and dust impacts beyond the Land.
Management measures proposed in DPEMP
A Dust Management Plan is proposed (Commitment **1**) and standard dust management procedures are proposed. Standard noise management procedures are proposed.
Public and agency comment
None.
Evaluation
There are no near neighbours so standard measures to control noise and dust should be perfectly adequate.
Conclusion
That the proponent be required to comply with DPEMP commitments **1** to **6** (Covered by standard condition **G7**).

Issue 4
Aboriginal Heritage
Description
An Aboriginal cultural heritage survey of the area, encompassing approximately 500 ha, was undertaken in November 2010 by Cultural Heritage Management Australia. Consultation with the Aboriginal community was also undertaken at the same time.
Management measures proposed in DPEMP
In the event that any Aboriginal artefacts are discovered during the project area clearance and construction, all work will stop immediately in that area and the Manager, Aboriginal Heritage Tasmania at the Department of Primary Industries, Parks, Water and Environment will be contacted to assess the situation (commitment 58).
Public and agency comment
One public submission expressed concern about the adequacy of the Aboriginal Heritage Survey but Aboriginal Heritage Tasmania indicated that the survey results and commitments are adequate to protect Aboriginal heritage.
Evaluation
The mine is unlikely to impact on Aboriginal heritage. Any relics discovered should be managed in accordance with the Aboriginal Relics Act 1975 (refer Information Schedule **LO5**).
Conclusion
That the proponent be required to comply with DPEMP commitment **72** (Covered by standard condition **G7**).

Issue 5
Arthur-Pieman Conservation Area (APCA)
Description
The mining lease includes parts of the APCA. Parts of the Tailings Dam, Recycle Dam, Processing Plant and DSO Pit are located within the APCA.
Management measures proposed in DPEMP
According to the DPEMP (page 74), because of the very small proportion of land lost and the fact that the loss occurs on the edge of the APCA, it is anticipated that a compensatory offset will not be required.
Public and agency comment
One agency submission suggested that the Parks and Wildlife Service was entitled to seek an offset for impacts of the project on the values of the APCA. Subsequent advice from the Parks and Wildlife Service is that no offset is required because the areas to be directly impacted do not contain threatened species, and the DPEMP includes a commitment to rehabilitation as soon as possible following the completion of mining.
Evaluation
The land management agency, the Parks and Wildlife Service, is satisfied that no offset is required, subject to commitment to rehabilitation as soon as possible following the completion of mining.
Conclusion
That the proponent be required to comply with DPEMP commitment **98** relating to post-closure rehabilitation of the area.

Appendix 2 Summary of issues raised by public and agency submissions

Public Submission 1

Threatened species

With the exception of reports relating to Giant Freshwater Crayfish (*Astacopsis gouldi*), and (flawed) roadkill projections relating to Spotted-tailed quoll *Dasyurus maculatus* subsp. *maculatus* and Tasmanian devil *Sarcophilus harrisii*, no further reports of survey relating to threatened species have been sought since the initial referral documentation. It appears that the proponent seeks to reassert their position from the referral that various threatened species are not present, or are not likely to be affected by their proposal, rather than meet the requirements set in the EIS guidelines issued by the Commonwealth.

Orchid research

Correspondence from Nigel Swarts PhD (an orchid researcher hosted at the Royal Tasmanian Botanical Gardens) at the time of the initial referral has raised serious concerns with the adequacy of the survey work in regards to threatened orchid species. Nigel has done extensive survey work in the area surrounding the proposed mine, and is familiar with this ecological community. He writes: "The report recognizes the limitations in survey techniques and times of survey. That is not sufficient enough in my opinion to state that there are "no implications" to threatened flora. Orchids, as a result of their obligate requirement for a mycorrhizal fungus, occur in patchy distributions across the landscape. One survey following transect lines over 1 week is not sufficient enough to determine the extent of orchid distribution/presence at a site." and, "The report states that *P.pulchellum* occurs in the habitat category SHW and that there is no/very little impact on this habitat type from mining activities. I believe that *P. pulchellum, P. rostratum* and in particular *Pterostylis rubenachi* may be very likely to occur in the SWW habitat type and much of this habitat will be impacted by mining activities. In addition, mycorrhizal function is severely affected by changes to hydrology and the long term survival of populations adjacent to mining activities will be compromised." We have significant concerns with the failure of the proponent to provide mapping of mycorrhizal distribution. Without understanding the distribution of mycorrhizal fungus it is impossible to determine the potential for orchid species to be affected.

Hydrology of orchid habitat

The report (p19) refers to the area surrounding West Creek (orchid population) as being a groundwater recharge area, and therefore unaffected by dewatering of the mine pit. The report fails to address the issue of what increases in groundwater flows from the recharge areas will be facilitated as the water table is drawn down. An increase in flows away from the orchid population sites may result in drying and the subsequent acidification of soils.

Quoll and devil denning habitat

The methodology used for determining dens on the site is grossly inadequate. Current best practice involves the use of both trapping and use of remote sensor activated cameras in the vicinity, and for scopes to be used to visually inspect possible dens. Given the perilous state of both the Spotted tailed quoll and the Tasmanian devil it is essential that Environmental Impact Statements include the highest possible level of information that can be gathered. Correspondence with staff from the Tasmanian devil taskforce indicates a view that it is highly likely that dens are found on the site, and that investigations using more appropriate methodologies would be likely to confirm this.

Quoll and devil foraging habitat

The range of these species is large and overlapping, and the protection of foraging area is critical to survival of these species. The assumption that displaced animals will move to surrounding habitat relies on the further assumption that the surrounding habitat has 'spare' carrying capacity.

Devil facial tumour disease

The Tarkine remains one of the last areas free of the Tasmanian devil facial tumour disease, and as such the protection of the Tarkine is particularly important to survival of a wild population. Both these species will come under additional threats from the proposed mine as a result of the, land use change, increased vehicle traffic, and increased fire risk.

Roadkill from increased traffic

Vehicle traffic, particularly heavy vehicle traffic but also increased traffic from staff and mine operations will increase under this proposal and will account for large numbers of casualties in the Spotted tailed quoll and the Tasmanian devil population. This affect will be felt off site, as the product will be carted 150km to Burnie. The EIS highlights an increased risk on Wuthering Heights Road, however the risk extends to the total transport route. The Flora and Fauna Habitat Assessment (North Barker) referred to the impact of roadkill as being highly significant. Night traffic by heavy vehicles is of particular concern, and while the EIS notes an intention to avoid night haulage it does refer to a need to operate at night in high demand periods.

The EIS also downplays the risks of associated light vehicle traffic, and attempts to absolve the proponent of risks from increased traffic by staff through the provision of a staff bus. The experience from existing mines in Tasmania shows a large percentage of workers do not utilize the provided bus and travel independently to work. The impact on roadkill can be predicted to be even higher than the corresponding increase in traffic, due to the concentration of vehicles in the dusk and dawn periods corresponding with the end of the working day.

The risks posed by increased traffic also relate to Wedge tailed eagle, and therefore the flaws in the projections also apply to impacts on this species.

Fire risk from increased traffic

Experience also shows that fire risk will also be increased as vehicle traffic is intensified, impacting on numerous threatened species, well beyond the development site.

Green and gold frog

The EIS notes Green and gold frog *Litoria raniformis* within the surrounding area, but indicates that there was not suitable habitat on site. Site visit by Tarkine National Coalition staff identified frog habitat and unidentified frog calls. Further work should be done to identify the frogs present and the risks posed including the potential for Chytrid fungus.

Forest communities

The proposal also impacts on under-reserved forest communities. The referral notes four forest communities that are identified as not adequately reserved under the Bioregional Conservation Priority:

- Wet Eucalyptus obliqua forest over broad leaf shrubs. (WOB) - Not adequately reserved
- Wet Eucalyptus obliqua forest over Leptospermum (WOL) - Not adequately reserved
- Wet Eucalyptus obliqua forest over rainforest (WOR) - Not adequately reserved
- Dry Eucalyptus obliqua forest over woodland and forest (DOB) - Not adequately reserved

Water extraction

Water has been identified as being partially to be sources from the local environment. Again the

referral is unclear on the source and therefore it must be considered a threat to the natural environment. The referral notes that impacts on the Australian grayling *Prototroctes maraena* are unlikely due to the presence of a waterfall downstream, however any reduction of water flows will have a detrimental effect on riverine species.

Water discharges

Additionally, the discharge of effluent water (noted in the referral as only during rainfall) will impact on the drainage channels and eventually the Nelson Bay River, and potentially the marine environment at Nelson Bay itself. The toxicity, turbidity and composition of effluent are not reported in the referral and therefore must be considered a threat to riverine, marine and terrestrial species in the catchment and outflow of the Nelson Bay River.

Leaching from rock dump and tailings dam

Leaching of chemicals from rock dumps and tailings dams are also key concerns that will likely extend the impact beyond the boundary of the mine, and long after the ten year mine life. Modelling of long term leaching impacts are a notable omission from the data. Long term maintenance of tailings have been an issue at numerous Tasmanian mine sites, particularly in areas of high rainfall such as this site. Failure to be able to ensure a long term tailings solution, and indeed the failure of best practice solutions to cope with Tasmania's rainfall and climatic conditions, presents a risk to the surrounding areas within the Arthur Pieman Conservation Area and the marine environment surrounding the Nelson Bay River mouth.

Aboriginal heritage

Despite the assertions in the referral that surveys found no significant Aboriginal heritage sites, the high level of Aboriginal heritage sites in the surrounding area indicate a likely presence of artefacts and sites. Many sites are only discovered following excavations or clearing, and therefore it is foolhardy to discount the presence of such sites. The recent Jordan River (Brighton By-pass) experience demonstrates this. A visual onsite inspection is insufficient for works of the scale of those proposed. At a minimum, trial excavations under the supervision of members of the Aboriginal community should be requested.

Alternatives

The application refers to no suitable alternatives being available. TNC disputes this. The area on the northern side of the Nelson Bay River is characterized by previously logged area, with some areas of plantation. Given that no mine lease has yet to be granted, it is feasible that aspects of the mine not directly related to the actual mine pits could be located on the northern side of the river. The relocation of non-pit aspects of the mine (tailings dams, rock dumps, and processing plant) would decrease the footprint within the undisturbed southern area by around 80%, while retaining access to the Wuthering Heights Road infrastructure. While this alternative would not ameliorate all issues (and would not in itself justify a permit), the reduced footprint in undisturbed area would have a lower impact on threatened species.

Public Submission 2

(page numbers refer to DPEMP)

P.7. Mineralization is apparently open along strike and depth. However, the actual (ore and gangue) mineralogy is not clearly specified, rather just TCLP results were used....the host rocks are known to produce acid drainage. Furthermore, consideration should be given to the soil structure and chemistry which may also host pyrite and other minerals – potentially releasing pollutants when local conditions change.

P17. The Theis equation was used to estimate the groundwater 'draw-down', where assumptions

on hydraulic conductivity were made. Various other uncertainties are made, which demonstrate a general uncertainty about the hydro-geological conditions at the site ... further work such as pump testing is required to be undertaken before a clear understanding of potential groundwater inflows can be calculated and therefore how much water treatment/storage may be required.

Further assumptions were made that shallow rooted species will not be impacted by draw down; however, it is unclear whether:

a) deeper rooted plants/trees will be impacted; or
b) whether near surface saturation will be maintained if groundwater levels drop.

P24. No details (e.g. location, size, physical and chemical properties) were provided on the clay resource for encapsulating the PAF material, lining the tailings dam etc.

P26. No long term flow data of the creek to be used to top up the water cover on the tailings dam has been provided to demonstrate it will be adequate for the task. Tailings dams often have significant water losses due to seepages; this does not seem to have been factored into the assessment of maintaining a water cover, rather just evaporation. There should have been long term consideration of climate change where drier winters may become the norm, this may mean that the tailings may become exposed which could lead to potential oxidation of minerals and acid drainage generation.

P28. Top soil/peat is planned to be stored. Alternatively, consideration should be made of active management of this resource, so its properties (seed bank etc) are maintained.

P31. 20 m composites were used to assess the percentage of pyrite present ... without knowing the type of sample, eg. core, the percentage recovered and the percentage sampled, it is possible the percentage of pyrite and other minerals is not likely to be representative/comparable.

P57. It is understood that water treatment will occur to ensure the discharge water has a pH of 7 or more. The two concerns with this are:

a) how the buffering will practically occur, ie. what treatment methods have been investigated;
b) this modified water may adversely impact the receiving water which is apparently of a lower pH (and chemistry) and the local stream ecology.

P74 and P174. The report states that the proposal will have no detrimental effects on potential land use. Given the proposal permanently modifies the landscape future land use can only reasonably be considered to be limited.

P102. The North Barker survey did not include microbiology, although there is a commitment to undertake such works once the operation is approved, it would be good to demonstrate the baseline conditions prior to any approvals being given.

P104. It is understood the pit will be managed by contractors and the processing by Shree personnel, however the whole hierarchy is not clear for example who is going to do the in-pit assessment of pyrite, routine water sampling etc.

P105. There is reference to economic modelling but it is unclear who undertook this or if it has been validated.

P110. Dust suppression could pose a significant on and off-site issue for long periods of the operational life. It is unclear, if water is going to be used:

a) where will it be sourced from; and
b) will any additives (suppressants) be added?

P112. Apparently, once operational sewage and wastewater will be treated, however no details have been provided. There is also reference to using wastewater in the process where E. coli may present a risk to site operators. The specifications of the treatment plant should be known given the number of people expected to be on the site.

P114. Table 34. The elevated TSS in groundwater would appear to be an artefact of well construction or sampling – where TSS in groundwater should be very low. It is probably more

meaningful to compare dissolved concentrations rather than total metal concentrations of groundwater to surface water – otherwise potential long term impacts to groundwater on the site may not be detected.

P117. Tailing stream is to be dosed with crushed lime or dolomite:

a) lime is usually already crushed/powdered;
b) the quantities should be known so:
    1) the process can be adequately set up; and
    2) the costs can be factored into the viability of the operation.

P117. Flooding of the pits is expected to take 1-2 years for the DSO or a decade for the main pit (note this is different to Appendix X which estimates 12-20 years): this raises several questions:

a) what will the flood levels of the pits be?
b) how PAF rock in head walls will be managed to prevent acid drainage?
c) the flooded mine would seem to constitute a dam...therefore assessable by the ACDC...if so maintenance/monitoring of dams in perpetuity should be accounted for in closure costs.
d) what is the possibility of the water from the DSO or main pit walls seeping into Nelson Bay River or something more catastrophic?

P120. Biota in East Creek unlikely to be adapted to high pH water released from the operation.

P113. The report outlines that the crush size of the tailing will affect the amount of pyrite that will be released and also the amount of consolidation over time. It is not clear from the testing whether a bulk sample was used or whether it is based on limited exploration drill cores.

P134. The proposed model regarding chemicals and controlled wastes is too simplistic ... there is likely to be a range of chemicals such as degreasers ... lime, toilet cleaners, detergents etc. Fuel and oil contaminated wastes from maintenance, incidents and contaminated soils should also be considered to be controlled wastes.

P189. A mine EMS will apparently be developed in accordance with EPA requirements. It is not clear whether the proponent will develop an EMS if not required by the EPA.

P191. The proposal should demonstrate that inter/intra laboratory QC testing is appropriate rather than throw it back to the EPA. It is unclear whether the SGS was NATA accredited for all the tests it undertook or whether they can undertake leach column testing to the necessary standard.
P191. It is understood grab samples will be taken on a daily and weekly basis, this raises several issues – given the operation is only for 12 hours a day:

a) who would do this sampling;
b) why isn't continuous monitoring proposed;
c) how will tailings be monitored to determine the quantity of alkaline material to add, and
d) how other sampling assessment will be practically undertaken for instance characterising ore/waste under variable light conditions (blasting at shift change 12-1300 and 16-16700) – does this get done in the first available light such as the next day or the following week given only 5 days a week are proposed?

P194. There is a discrepancy in the proposed frequency for groundwater testing. P124 Table 42 indicates 3 monthly but P128 outlines 6 monthly.

Submission from Circular Head Council

This requested further information on a range of matters, including transport issues, which mostly relate to matters within the jurisdiction of Council, not the EPA Board.

Agency Submissions

The major points raised, of direct relevance of the EPA Board's assessment, were:

- The hydrological report acknowledges that the hydrological model is at a conceptual stage

and recommends that sufficient monitoring be undertaken to ensure that an adaptive management approach can be used if impacts are detected.

- It needs to be determined whether an offset is required for the effect on part of the Arthur Pieman Conservation Area.
- In the event that listed fauna species are found on the site during pre-vegetation clearance surveys, further advice should be sought from PCAB.

Appendix 3 Permit Conditions - Environmental