ABN: 35 000 689 216

# Tomingley Gold Project

# Environmental Assessment

Major Project Application
No. PA 09_0155

*Prepared by:*

**R.W. CORKERY & CO. PTY. LIMITED**

**November 2011**

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ALKANE
RESOURCES LTD

# Tomingley Gold Project

# Environmental Assessment


**Prepared for:**

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Ref No. 616/05

November 2011

## TERMINOLOGY REFERRING TO GOVERNMENT AGENCIES

Throughout the planning for the proposed Tomingley Gold Project, a number of NSW government agencies have been amalgamated/re-named, etc. The following convention has been used throughout this document when referring to government agencies.

1. For referencing publications issued by government agencies, use is made of the Agency's title at the date of publication.
2. For reference to meetings with, and correspondence to or from government agencies, use is made of the Agency's title at the date of the meeting or correspondence.
3. For reference to Agencies for ongoing involvement with the proposed Tomingley Gold Project, including the consideration of the *Environmental Assessment,* reference is made to the current title of the Department, i.e. particularly those below that changed titles in April 2010.

| Previous Title | Current Title |
|---|---|
| Department of Environment and Climate Change and Water (DECCW) | Office of Environment and Heritage (OEH) (a division of the Department of Premier and Cabinet) |
| Industry and Investment NSW (Mineral Resources) | NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) – Division of Resources and Energy (DR&E) |
| Industry and Investment NSW (NSW Agriculture) | NSW Department of Primary Industries (Agriculture) |
| NSW Office of Water (Previously within DECCW and Department of Water and Energy) | NSW Office of Water (now within the Department of Primary Industries which is under the NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS)) |
| Department of Planning | Department of Planning and Infrastructure |
| Land and Property Management Authority (LPMA) | NSW Department of Primary Industries (Crown Lands) |

# Author's Certification

**for the submission of an Environmental Assessment prepared in accordance with the *Environmental Planning and Assessment Act 1979* (Part 3A – Section 75).**

**(a) EA prepared by:**

| | |
|---|---|
| name: | Alex Luke Irwin |
| qualifications: | B.Sc. (Hons) |
| address: | 62 Hill Street<br>ORANGE NSW 2800 |

**(b) Planning Approval application by:**

| | |
|---|---|
| applicant name: | Alkane Resources Ltd |
| applicant address: | 65 Burswood Road<br>BURSWOOD WA 6100 |

**(c) Application Number:** 09_0155

**(d) Address/land details**

| | |
|---|---|
| properties to be developed | Newell Highway, Tomingley, NSW |
| Land Description: | **Mine Site**<br>Lot 1* DP254193, Lots 162* & 173* DP755093, Lots 94, 95, 103, 104, 105, 111*, 112, 122, 160, 161, 162 & 163 DP755110, Lot 1 DP824086, Lots 1,2 & 3 DP1151198. Also includes Road Reserve associated with Newell Highway.<br>**Water Pipeline Route**<br>Lot 185 DP43458, Lot A 380855, Lots 7003 & 7004 DP1032703, Lots 70, 74, 81, 104 & 111 DP755110 and Lot 18 DP755119. Also includes Road Reserves associated with the Mitchell Highway, Webb's Siding Road, Dappo Road, Bootles Road, Pinedene Road, Narromine-Tomingley Road and Tomingley West Road and the easement for the Main Western Railway and unnamed Crown roads.<br>Note *: refers to part lot only |

**(e) Project Outline:**

The Tomingley Gold Project would involve the mining of gold ore from four open cut and one underground mine, together with construction and operation of associated infrastructure, including waste rock emplacements, a processing plant and office area, residue storage facility, water management structures, amenity bunds, internal roads, a 46km water pipeline and underpass of the Newell Highway. The Project would have a life of 10 to 12 years.

**(f) Assessment of Environmental Impact:**

The assessment of environmental impacts of this project includes the matters referred to in Director-General's Requirements provided to the Proponent on 9 September 2009 under Section 75F of the *Environmental Planning and Assessment Act 1979*.

**(g) Declaration:**

I, Alex Luke Irwin, hereby declare that I have overseen the preparation of the contents of this assessment and to the best of my knowledge:

- it has addressed the Director-General's Requirements as provided by the Department on 9 September 2009;
- the assessment contains all available information that is relevant to the environmental assessment of the project; and
- the information contained in the statement is neither false nor misleading.

Signature: ____________________

Name: Alex Irwin Date: 11 November 2011

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# CONTENTS

# CONTENTS

# CONTENTS

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# Executive Summary

## INTRODUCTION

This *Environmental Assessment* has been prepared by R.W. Corkery & Co. Pty. Limited to accompany an application for project approval by Alkane Resources Ltd ("the Proponent") to develop and operate the Tomingley Gold Project ("the Project"). The Project would comprise four open cut mines, an underground mine, a processing plant, three waste rock emplacements and a residue storage facility, as well as ancillary activities and associated infrastructure, including construction of a water supply pipeline.

All areas of proposed disturbance associated with the Project are contained within the "Project Site" which comprises two areas identified on **Figure A**.

1. The Mine Site - comprising an area of approximately 776ha that would incorporate all areas of proposed Project-related disturbance associated with the mining, processing, waste rock management and related activities. The Mine Site is located immediately south of the village of Tomingley and 15km to the north of Peak Hill.
2. The Tomingley Narromine Water Pipeline - comprising a corridor approximately 46km long and 5m wide within road and rail reserves between the Mine Site and the "Woodlands" property approximately 7km east of Narromine.

The Project is classified as a "Major Project" in accordance with Paragraph 5, Schedule 1 of *State Environmental Planning Policy (Major Development) 2005* and consequently the Minister for Planning is the approval authority. As a Major Project, it will be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

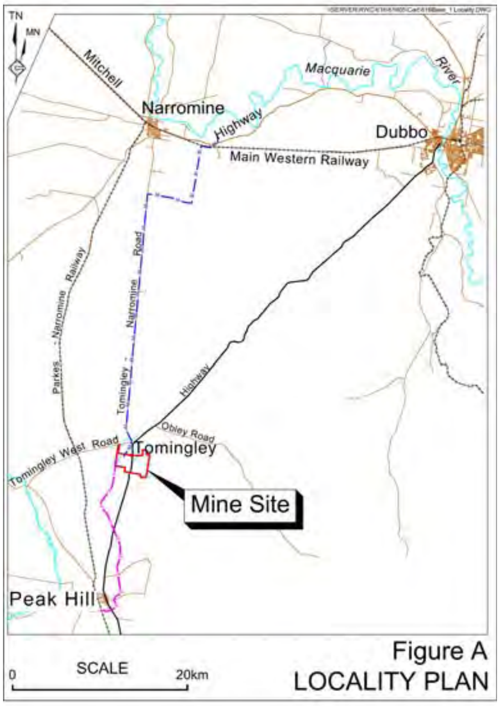



Figure A
LOCALITY PLAN

This *Environmental Assessment* has been prepared in accordance with the requirements of Section 75H of Part 3A of the EP&A Act.

This summary introduces the Proponent, provides relevant background to the Project, and presents an overview of the Project design, operational safeguards and predicted Project-related impacts on the surrounding environment.

## THE PROPONENT

The Proponent, Alkane Resources Ltd, is an Australian, publicly listed mining and exploration company which has been in existence since 1969 and has approximately 5 400 shareholders. The Company has a long term involvement and ongoing commitment to the Central West of New South Wales and has substantial investment in the people and resources of the region. Alkane Resources Ltd developed and operated the Peak Hill Gold Mine on the outskirts of Peak Hill from 1996 to 2005 and has now largely rehabilitated that mine site.

## BACKGROUND

There has been a long history of mining and exploration for gold in the local area.

Gold was first discovered and mined from the Tomingley Goldfield in the 1880s. A number of underground mining operations were operated here and in the McPhail area, immediately south of the Mine Site through the 19$^{th}$ and 20$^{th}$ centuries. The last economic 'mining' activities of the Tomingley / McPhail area was completed in the late 1990s and involved the re-treatment of tailings from the McPhail Mine.

In 2001, the Proponent commenced exploration and identified first the Wyoming One deposit (2001), followed by the Wyoming Three deposit in 2002, the Caloma deposit in 2006 and the Caloma Two deposit in 2010.

The measured resource within the Mine Site is approximately 4.9Mt @ 2.03g/t with further indicated resources of 1.4Mt @ 2.06g/t and inferred resources of 4.0Mt @ 1.5g/t. Based on these identified resources the Proponent concluded that the Project represents a viable development.

## PROJECT DESCRIPTION

The Project would include the following components (**Figure B**).

- Establishment of infrastructure required for the Project, including a water supply pipeline between the Mine Site and the "Woodlands" property 7km east of Narromine, an underpass beneath the Newell Highway, and vegetated amenity bunds.
- Extraction of waste rock and ore material from four open cut areas, namely: Wyoming One, Wyoming Three, Caloma and Caloma Two.
- Extraction of waste rock and ore material from an underground extension of Wyoming One Open Cut.
- Construction of three waste rock emplacements.
- Construction and use of various haul roads and a run-of-mine (ROM) pad.
- Construction and use of a Processing Plant and Office Area, incorporating a crushing and grinding circuit, a standard carbon-in-leach (CIL) processing plant, site offices and associated infrastructure.
- Construction and use of a residue storage facility (RSF).
- Construction and use of ancillary infrastructure, including the Main Site Access Road and intersection with Tomingley West Road.
- Construction and maintenance of soil stockpiles.
- Construction of various surface water management structures to control surface water flows.
- Construction and use of dewatering ponds to store water accumulating in and pumped from the open cuts.

Disturbance associated with the mining and associated activities would be progressively rehabilitated to create a geotechnically stable final landform, suitable for a final land use of nature conservation, agriculture, tourism and/or light industry.

The following provides an outline of the proposed Project operations.

### Site Establishment and Construction

In order for mining, processing and product transportation to be undertaken, the following infrastructure and other site features would first be established.

- Construction of a water supply line between the Mine Site and a licensed production bore (or bores) located on a private property near.

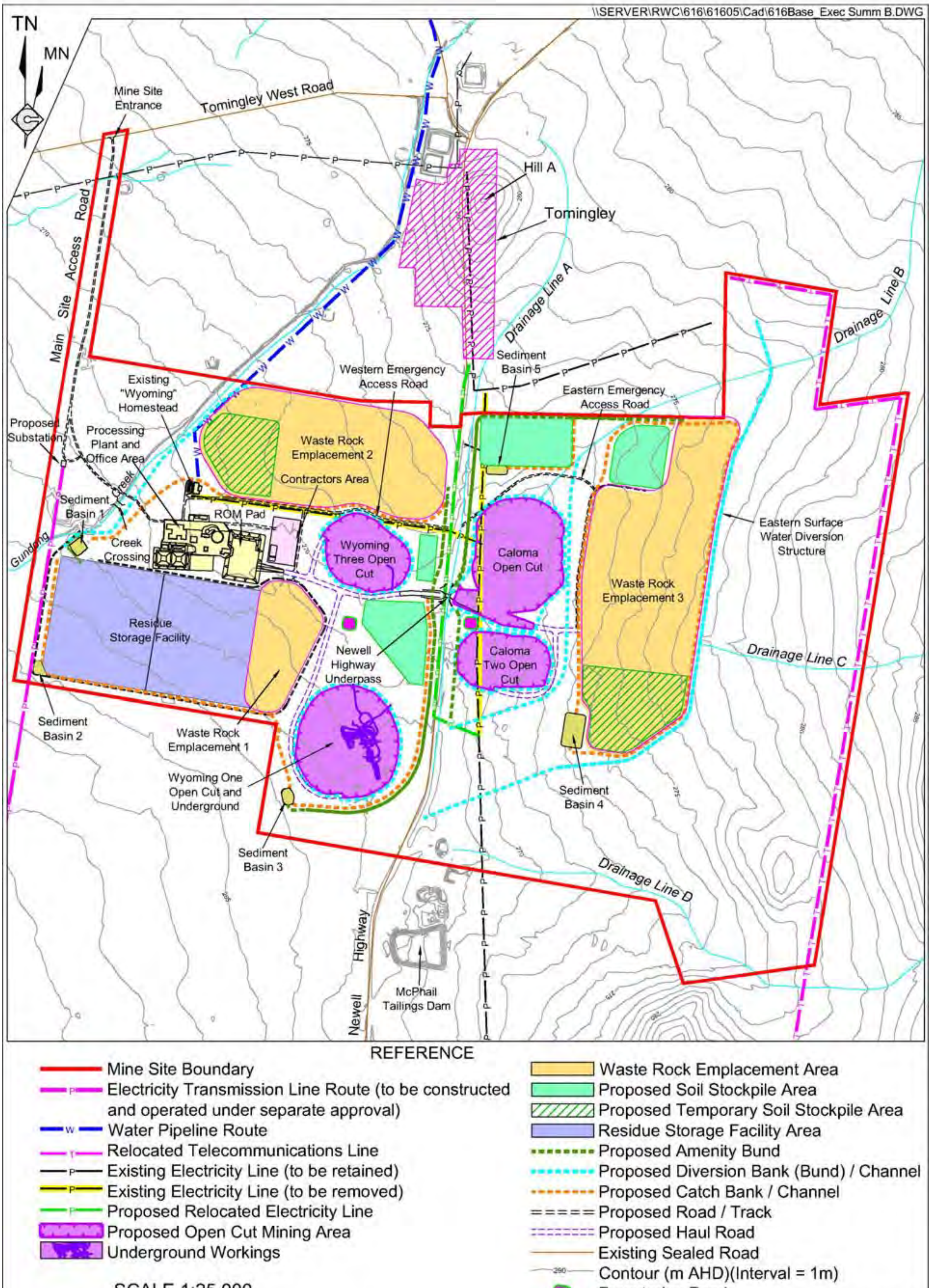



Figure B
MINE SITE LAYOUT

- Construction of a 66kV electricity transmission line and distribution network.
- Construction of an underpass beneath the Newell Highway.
- Construction of an access road to the Mine Site ("Main Site Access Road") and intersection with the public road network.
- Construction of a range of amenity bunds and surface water diversion structures.
- Construction of a range of water management and retention structures within the Project Site.

Complete site establishment, i.e. complete construction of all Mine Site infrastructure and facilities, is anticipated to take 12 months although it is noted that mining and processing would be undertaken concurrently for a period towards the end of the site establishment phase.

## Site Preparation

During vegetation clearing operations, larger vegetation would be removed using a bulldozer with its blade positioned just above the surface. Groundcover vegetation would then be removed with the topsoil to maximise the retention of the seed bank and nutrients within the soil, as well as to minimise opportunities for erosion and dust lift-off between removal of the larger vegetation and soil stripping.

With the exception of areas of sodic soil, all available topsoil material would be recovered from areas to be disturbed using bulldozers and/or scrapers. Enough subsoil would also be recovered to provide for rehabilitation of the progressively created final landform. The soil would either be transferred directly to other areas of the Mine Site for respreading, e.g. the outer face of the RSF embankment, or placed in stockpiles of up to 5m in height (3m subsoil covered by 2m topsoil).

## Mining Operations

**Figure B** presents the layout of the proposed open cuts and underground mine.

### ***Open Cut Mining***

- ***Grade Control Drilling***. This drilling would be undertaken ahead of planned mining to more precisely define the boundary between ore, low grade ore and waste material. All grade control samples would be transported to an off-site laboratory for analysis.
- ***Extraction of Friable Material***. Friable material would either be lightly fragmented using drill and blast methods and extracted using an excavator, or alternatively, ripped and pushed up using a bulldozer. Extracted material would be loaded into haul trucks for transportation to the ROM pad, a low grade stockpile, waste rock emplacement or bund. The Proponent anticipates that friable material will be present from the base of the subsoil to a depth of between 5m and 60m below the surface.
- ***Drill and Blast Operations***. Blast holes would be drilled, using up to three hydraulic drill rigs equipped with dust and noise suppression equipment, into the material that cannot be excavated using a bulldozer or excavator alone. Following completion of each blast, boundaries between ore and waste rock material would, if required, be identified and marked. Fragmented material would then be loaded into trucks by hydraulic excavator and transported to one of the waste rock emplacements, or the ROM pad. All drill and blast operations would be supervised by a suitably qualified and experienced blasting engineer or shot-firer.

***Underground Mining***

**Figure C** presents an overview of the proposed underground development. The Proponent would establish a portal in the lower section of the Wyoming One Open Cut and develop a decline to permit access to those sections of the Wyoming One ore body that cannot be economically extracted using open cut mining methods.

- ***Portal Construction and Underground Infrastructure Development***. The wall above the portal entrance would be stabilised using a combination of rock bolts, cable bolts and shotcrete. Additional roof and wall support, including rock bolts, spiling bars, cable bolts and/or shotcrete, may be required in the near surface sections of the decline.

  Once the portal is established, infrastructure and services required for underground operations would be installed.

- ***Underground Workings Development and Construction***. The decline, development headings and ore drives would be developed using drill and blast techniques. A jumbo, or underground drill rig, would drill a pattern of holes, these holes would be loaded with pre-packaged bulk explosives and detonators, and the in situ material fragmented.

  Fragmented material would be extracted using an underground loader or load-haul-dump (LHD) unit. The LHD unit would be used to load underground haul trucks or transport the fragmented material to a loading bay for later reclamation.

- ***Underground Stoping Operations***. Underground mining of ore material would be undertaken using a long hole open stoping mining method.

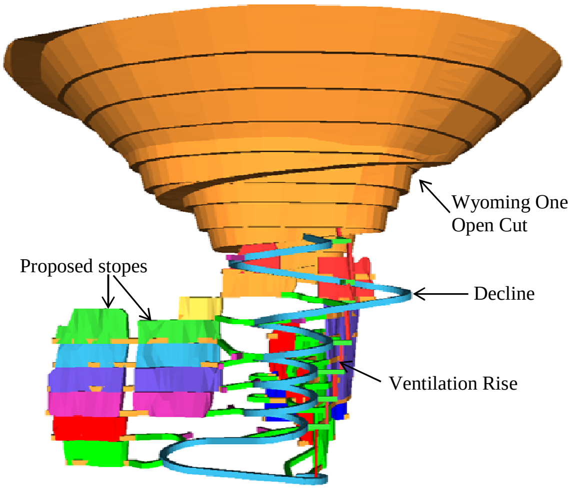



**Figure C**
**MINING METHOD**

- Development drives would be established at approximately 20m vertical intervals within the ore zone. A series of holes would then be drilled in rings from each drive, sequentially loaded with explosives and the ore material blasted. The fragmented material would then be removed from the stope or open void using a LHD unit. Between stopes, pillars (vertical) and sills (horizontal) of unmined material would be left to provide support and prevent ground collapse.

- ***Stope Backfilling Operations***. In order to ensure stability of sections of the proposed underground mine once mining operations have been completed in those sections, mined-out stopes would be backfilled using waste rock material sourced preferentially from concurrent underground development.

## Processing Operations

The gold bearing ore would be crushed, ground, concentrated, leached and recovered to produce gold doré (a semi-purified gold bar). The processing operations would require the use of cyanide to leach the gold from the ore.

Following the removal of the gold from the crushed and ground ore, a slurry by-product (or residue) would remain for disposal.

## Residue Management

The residue would be concentrated and pumped to a thickener where the cyanide concentration would be reduced through addition and removal of water. The slurry would then be pumped to the residue storage facility (RSF) to be constructed to the immediate south of the Processing Plant and Office Area (see **Figure B**). The RSF would comprise two cells of approximately 21ha each with a common embankment and following provides the indicative design criteria for the RSF.

1. Maximum area of disturbance - approximately 42ha.
2. Maximum embankment height – approximately 15m above the natural surface.
3. Slope of outer face of the embankment – approximately 1:3 (V:H).

The floor, walls and internal face of the embankment would achieve a permeability of 1 x $10^{-9}$m/s through the lining of the internal surfaces with compacted clay sourced from the Mine Site.

A central decant tower would be provided within each cell allowing for the return of water to the processing circuit. This would be constructed of pre-cast pipe sections which would be progressively stacked on top of each other, with rock placed around, as the RSF is progressively raised.

## Transportation

All vehicles would normally access the Mine Site via the Tomingley West Road and the Main Site Access Road. During periods of heavy or sustained rainfall, Tomingley West Road may become covered by water and to ensure continuity of access to the Mine Site, the Proponent would upgrade and maintain the existing access track to the “Wyoming” homestead, from the Newell Highway, as the Western Emergency Access Road. In addition, an Eastern Emergency Access Road would be constructed and maintained from the Mine Site on the eastern side of the Mine Site to the Newell Highway.

The average traffic levels that would be generated during the construction and operational phases of the Project are as follows.

| Project Phase | Light Vehicles | Heavy Vehicles | Total Vehicles |
|---|---|---|---|
| Construction | 180 | 20 | 200 |
| Operations | 136 | 8 | 144 |

## Project Life and Hours of Operation

The Proponent anticipates that the life of the Project would be 10 to 12 years. Operating 7 days per week, the proposed hours of operation would indicatively be as follows.

| Activity | Proposed Hours of Operation |
|---|---|
| Vegetation clearing and topsoil stripping | Daylight hours |
| Construction operations | 24 hours per day |
| Open cut mining operations | 24 hours per day |
| Underground mining operations | 24 hours per day |
| Blasting operations | 9:00am to 5:00pm (Monday to Saturday) |
| Maintenance operations | 24 hours per day |
| Processing operations | 24 hours per day |
| Rehabilitation operations | 7:00am to 10.00pm |

## Employment

The Proponent estimates that the Project would provide approximately 100 full-time equivalent positions during site establishment phase and up to 90 full-time equivalent positions during the operational phase.

## Site Rehabilitation and Decommissioning

The Proponent would adopt a progressive approach to the rehabilitation of disturbed areas within the Mine Site to ensure that, where practicable, areas where mining-related activities are completed are quickly shaped and revegetated to provide a stable landform. The progressive formation of the post-mining landform and the establishment of a vegetative cover would also minimise the potential Project-related visual amenity and air quality impacts.

The post-mining landform would include the following components.

- Three shaped and covered waste rock emplacements with undulating upper surfaces, outer faces with maximum slopes of approximately 18º (1V:3H). The final landform of Waste Rock Emplacement 1 would merge with a shaped and covered RSF.
- Four appropriately bunded, fenced and signed open cuts.
- The vegetated amenity bunds and surface water infrastructure, including sediment basins would be retained.

The final land use of the Mine Site would incorporate native vegetation conservation, sustainable agriculture and possibly other land uses which could take advantage of the retained infrastructure. Central to the final land use would be the protection, enhancement and conservation of remnant native vegetation as part of a biodiversity offset strategy developed for the Project.

# ISSUE IDENTIFICATION AND PRIORITISATION

In order to undertake a comprehensive *Environmental Assessment* of the Project, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the wider community. These issues (and potential impacts) were identified through a program of community and government consultation, preliminary environmental studies and literature review. This was followed by an analysis of the risk posed by each potential impact in order to prioritise the assessment of the identified environmental issues within the *Environmental Assessment*.

## Consultation

Consultation with the local community involved:

- individual discussions with the landowners / residents of Tomingley and surrounding areas; and
- two community meetings.

The Proponent and its consultants also regularly consulted with various government agencies and authorities throughout the planning phase of the Project.

## Issue Prioritisation

Considering the environmental issues raised throughout the consultation process, an analysis of environmental risk for each potential environmental issue in the absence of any mitigation measures was then completed. Through a review of the allocated risk ratings and the frequency with which each issue was identified, the relative priority of each issue was determined. The following order of priority of environmental issues has been determined.

1. Noise
2. Surface water
3. Groundwater
4. Biodiversity
5. Aboriginal heritage
6. Non-Aboriginal heritage
7. Visual amenity
8. Air quality
9. Blasting
10. Traffic
11. Soil and land capability
12. Hazards
13. Socio-economic climate

# ENVIRONMENTAL SAFEGUARDS AND IMPACTS

The components and features of the existing environment within and surrounding the Project Site have been studied in detail and the Project designed to avoid or minimise impacts on that environment. A brief overview of the main components of the surrounding environment, the proposed safeguards and the assessed level of impact are set out below.

## Noise

The sources of noise around the Project Site are typical of a rural environment, e.g. farming activities, insect noise, livestock, wind through vegetation and vehicles on local roads, with significant contribution during the day time by traffic on the Newell Highway.

Noise monitoring undertaken in April 2009 confirmed background noise levels ($L_{A90}$[1]) ranging from <30dB(A) up to 40dB(A), depending on the proximity of the residence to the Newell Highway and time of day.

Following a review of the background noise levels, the residences were grouped based on proximity to the Mine Site and existing noise sources. The criteria for noise generated by the Project were than established as follows.

- site establishment and mine operations – background noise level + 5dB(A) ($L_{Aeq(15min)}$).
- night-time sleep disturbance – background noise level + 15dB(A) ($L_{Amax}$).
- road traffic noise - 60dB(A) (daytime) and 55dB(A) (night-tine) ($L_{Aeq(1hr)}$).

Following initial noise modelling, it was identified that noise levels received at many residences could exceed the nominated noise criteria. The Proponent considered various options for mitigating noise generated by the Mine Site, and has committed to implementing the following.

- Frequency modulated reversing alarms would be installed on all mobile equipment.
- Land preparation operations, including vegetation clearing and soil stripping, would be undertaken during the daytime only.
- When noise enhancing conditions prevail, waste rock placement on Waste Rock Emplacements 2 and 3 would be undertaken behind a 15m high acoustic bund constructed along the northern margin of the emplacement.
- The noisier equipment, including bulldozers, excavators and haul trucks, would be preferentially operated in the southern section of the Mine Site, as close as possible to the acoustic bunds on Waste Rock Emplacements 2 and 3 and in the deepest sections of the open cuts during the evening and night.
- The front-end loader on the ROM Pad would be operated behind stockpiled ore or purpose-built earth bunds.
- The dominant noise sources of the processing operations would be enclosed to achieve a sound power level reduction of at least 8dB.
- Equipment would be progressively relocated or stood down as noise levels received at residences surrounding the Mine Site increase.

Noise modelling, incorporating these mitigation measures, demonstrates that with limited exception, noise levels would comply with the intrusiveness criteria during the day time and evening periods. Elevated noise levels up to 4dB above the intrusiveness criteria are predicted (during

[1] The noise level which is exceeded for 90% of the time at a given location.

the day time) at only three residences during the initial 3 month construction period.

Exceedances of the intrusiveness criteria during the night time have been reduced, both in the size of the exceedance and frequency of occurrence, as far as reasonably and feasibly possible. Critically, the scale of exceedance has been reduced to no more than 2dB, a difference unlikely to be noticeable to most people, at most residences. Furthermore, the period of time when exceedances are predicted is generally restricted to a period from the end of the 1st year to the beginning of the 3rd year of the Project.

Compliance with sleep disturbance and road traffic noise criteria is predicted by the modelling.

To ensure noise levels do not exceed the modelled predictions, the Proponent would implement real-time noise monitoring at the potentially most affected location(s). This monitoring would provide an accurate real-time record of the noise levels being received and identify when restrictions or modifications to operations are required.

The Proponent has committed to implementing further noise mitigation controls at residences, on request of the resident, where the measured noise levels exceed criteria by more than 2dB.

### Surface Water

The Mine Site is located within the catchment of Gundong Creek, bordered to the north by Fiddlers and Tomingley Creeks and to the south by Bulldog Creek, within the wider Bogan River catchment.

Gundong Creek has a significant catchment upslope of the Mine Site, although flows are highly variable and intermittent. Significant rainfall events in the upstream catchment can generate over-bank flows in Gundong Creek in the vicinity of the Mine Site, particularly over the western section of the Mine Site.

The Proponent has provided for the construction and maintenance of surface water management structures on the Mine Site, including catch banks, culverts and sediment basins, to ensure that:

- changes to the hydrology of all Mine Site catchments are avoided to minimise reduction in environmental flows and availability to downstream water users;
- Mine Site operations, in particular residue management, have a neutral or beneficial impact on surface water quality when compared to the existing (i.e. pre-development) conditions in the receiving waters;
- the capture and use of surface water remains within the Proponent's harvestable rights;
- any changes to peak flows, flow volumes or water quality do not have a detrimental effect on downstream ecology or the stability of drainage lines; and
- Runoff is maintained within the original catchments of the Mine Site.

Considering the construction and maintenance of the proposed surface water management structures, modelling was undertaken to predict the impact of the Mine Site operations on the quality and quantity of water exiting the Mine Site. The modelling results predicted that mean annual loads of all pollutants would decrease during the life of the Project. A small reduction in flows (0.5%) was predicted, however, a reduction of this order is unlikely to impact on the function of the natural system downstream of the Mine Site.

Modelling of potential impacts on local flooding conditions identified that a very minor increase in 1 in 100 ARI flood levels (38mm) may occur to the north of the Mine

Site as a result of the Project. The spatial extent of any change to flood levels would remain almost exclusively on the Mine Site. Modelling also confirmed that the Eastern Surface Water Diversion Structure (see **Figure B**) would be capable of diverting flows generated by a 1 in 100 year ARI flood around the Caloma Open Cut and WRE 3.

## Groundwater

A review of groundwater bore records and targeted assessment has determined that groundwater is available in the following aquifers within and surrounding the Mine Site.

- **Shallow Alluvium.** Occurring less than 20m deep and associated with drainage lines surrounding the Mine Site, e.g. the alluvium surrounding Gundong Creek. These aquifers are likely to be recharged locally, primarily from surface water infiltration and water quality is of relatively good quality.
- **Deep Alluvium**. Occurring more than 10km to the northwest and west of the Mine Site and up to 100m below ground level.
- **Fractured Rock**. There are likely to be several fractured rock aquifer systems located within 20km of the Mine Site.

The Project is unlikely to have any adverse impact on the groundwater contained within the shallow alluvium of Gundong Creek as no groundwater has been encountered in any of the exploration holes drilled within the Mine Site. Furthermore, the alluvium of the Mine Site and surrounding areas is located within well-defined and unconnected palaeochannels. Therefore, even if groundwater was drained from alluvium adjacent to the open cuts the effects of this dewatering would only propagate to the paeleochannel boundary.

Modelling undertaken to quantify the likely impact on the deeper fractured rock aquifers predict drawdown would be limited to a maximum of between 2.3 and 5.6km from the Wyoming One underground workings. Based on the understanding that the rock mass below the Mine Site is tight, drawdown is expected to be at the lower end of this range.

The level of drawdown predicted is unlikely to have an adverse impact on local groundwater or groundwater users as:

- there are no registered users of groundwater from deep fractured rock aquifers located within 10km of the Mine Site; and
- groundwater within the fractured rock aquifer(s) surrounding the Mine Site is highly saline and therefore has limited potential for beneficial re-use; and
- there are no known groundwater dependent ecosystems within the range of influence of the mining operations.

Water levels within the open cut would rise following cessation of mining operations. The final water level within the open cuts is expected to be between 193m and 207m AHD, i.e. 3m to 17m below the pre-mining groundwater level of 210m AHD.

## Ecology

An ecological assessment completed for the Project identified that the majority of the Mine Site contains cleared land dominated by exotic pastures and farmland. Approximately 155.6ha of remnant native vegetation remains within this largely cleared landscape, with approximately 21.6ha to be cleared for the Project. The cleared vegetation comprises:

- 2.7ha of Inland Grey Box – Poplar Box – White Cypress Pine tall woodland scattered across the Mine Site (which meets the classification of the NSW and Commonwealth listed Inland Grey Box Woodland EEC);

- 0.9ha of Fuzzy Box – Inland Grey Box community in the vicinity of the Wyoming One Open Cut (which meets the classification of the NSW listed Fuzzy Box on Alluvials EEC); and
- 18.0ha of Belah / Black Oak Western Rosewood, Wilga Woodland community in the vicinity of the Caloma Two Open Cut and Waste Rock Emplacement 3.

No threatened flora was identified within the Project Site. Of the 134 species of fauna identified within the Project Site, two species listed as threatened under the TSC Act (Grey-crowned babbler and Superb parrot), one listed under the EPBC Act (Rainbow bee-eater) and three species listed as having ‘preliminary determinations as threatened’ under the TSC Act (Little eagle, Spotted harrier and White-browed woodswallow) were identified.

An assessment of significance was completed for the EEC’s and threatened fauna identified, as well as other threatened species and communities considered as being potentially impacted by the Project. In each case, and after consideration of the many commitments made by the Proponent with respect to impact avoidance, minimisation and mitigation, the assessment determined that the Project would not have a significant impact such that viable local populations of these species and communities, or any other listed species or communities, are likely to be placed at risk of extinction.

The assessment of significance also considered the implementation of the proposed Tomingley Gold Project Biodiversity Offset Strategy (TGP BOS). The TGP BOS incorporates the following principal elements (see **Figure D**).

- Protect and conserve 78.5ha of remnant native flora on the Mine Site and immediate surrounds.
- Protect and enhance a further 61.0ha of land adjoining these remnants.
- Retain and vegetate drainage features and sediment basins in the final landform to act as fauna habitat.
- Rehabilitate and manage the final landform to further extend areas of native vegetation in the landform.

Importantly, the implementation of the TGP BOS would ensure that the Project meets the “No Net Loss” biodiversity benchmark nominated by the Office of Environment and Heritage.

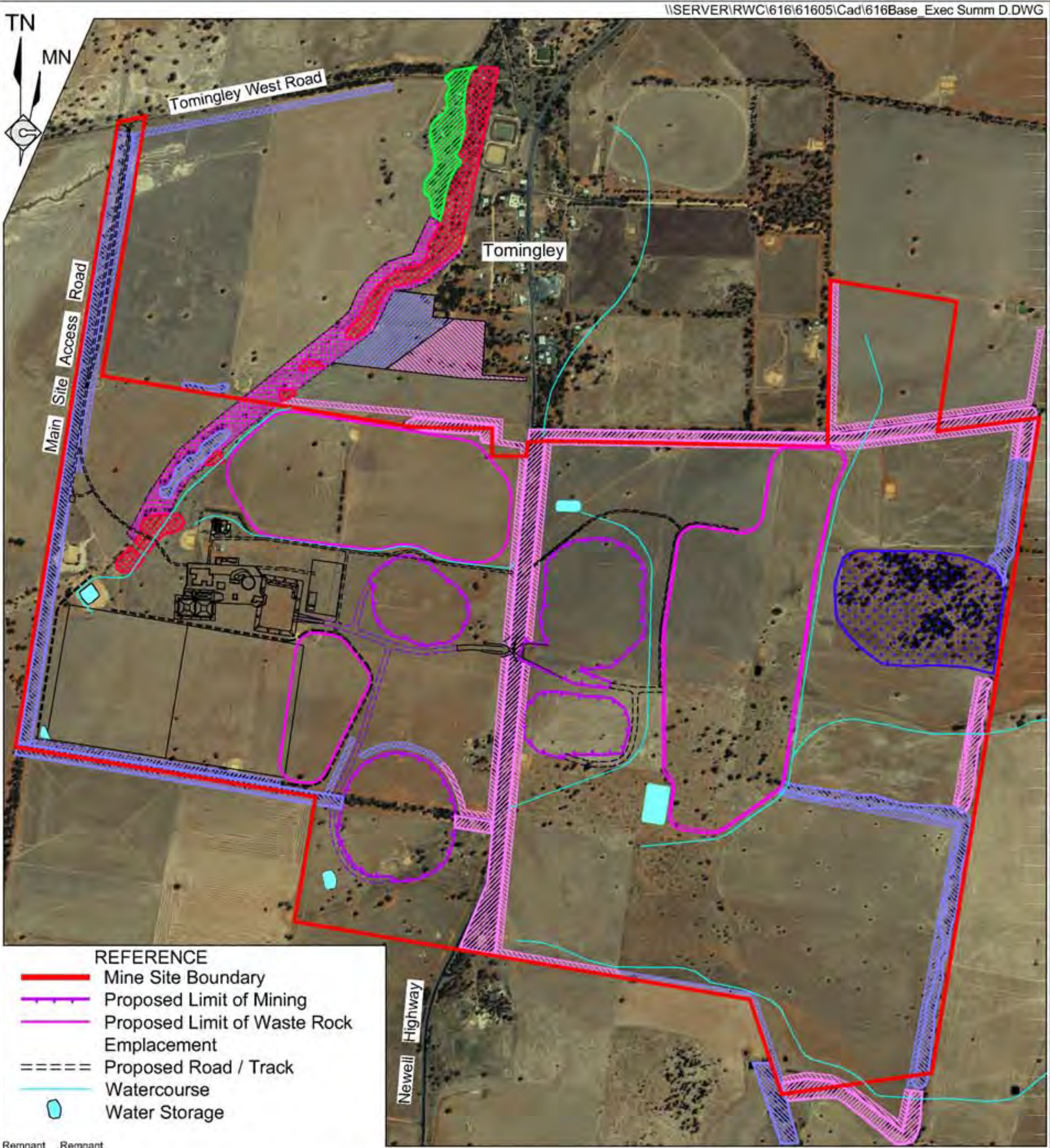
### Aboriginal Heritage

The Project has the potential to impact on Aboriginal sites as a consequence of surface disturbing activities. Following consultation with registered Aboriginal community stakeholders, a field survey to identify the type and distribution of Aboriginal sites was undertaken.

In total, 57 Aboriginal sites were identified, including:

- 51 modified trees (40 scarred trees, 9 possibly scarred trees, 1 resource gathering tree and 1 carved tree);
- three open artefact sites (one with a potential archaeological deposit (PAD));
- two isolated finds; and
- one ceremonial / dreaming site.

Of these sites, a modified (possible carved) tree identified on the Mine Site was considered as having high cultural significance to the local Aboriginal community. Impact to this site, and second scarred tree, would be unavoidable given the location of these within the footprint of the open cuts. Specific management measures involving further investigation to determine whether one of these trees is a carved tree, additional site investigation surrounding the tree if determined to be a carved tree, excavation and removal of the trees to a specified keeping place, have been proposed, discussed and accepted in principle by the local Aboriginal community.




| | Community | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Area to be Disturbed (ha) | 2.7 | 0 | 0.9 | 0 | 18.0 | 0.7 |
| Remnant to be Conserved (ha) | 21.1 | 13.1 | 5.1 | 4.9 | 34.3 | 0 |
| Remnant Extension (Protection & Ameliorative Planting) (ha) | 21.5 | 13.5 | 26.0 | 0 | 0 | 0 |

**Note:** Areas of referenced vegetation on land not owned or under agreement with the Proponent do not form part of the Biodiversity Offset Strategy

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Source: OzArk (2011) - Figure 13

Figure D
BIODIVERSITY OFFSET STRATEGY

A further four sites on the Mine Site, two scarred trees and two open scatters, occur in close proximity to proposed Mine Site activities and would be identified as sensitive sites and protected from inadvertent damage.

One open scatter and PAD was identified on the alignment of the water pipeline. The Proponent subsequently completed test excavations along the alignment of the water pipeline through the PAD, recovering a total of 121 artefacts, predominantly small, unmodified flakes, a by-product of stone tool manufacture.

Specific management measures have been proposed for construction of the water pipeline through the PAD, and assuming the implementation of these and acknowledging the low scientific significance of the PAD (due to low artefact density, shallow deposit with a high likelihood of prior disturbance), impacts on this site are assessed as acceptable.

The Proponent has also committed to preparing and implementing, in consultation with the local Aboriginal community, a Cultural Heritage Management Plan. A copy of a draft Cultural Heritage Management Plan has been provided to the registered Aboriginal stakeholders for the Project, with no objections to the nominated management measures and operational safeguards received.

### Non-Aboriginal Heritage

A non-Aboriginal survey was undertaken concurrently with the Aboriginal heritage field survey. A total of eight items of non-Aboriginal heritage significance were identified during the non-Aboriginal heritage survey, six within the Mine Site and two along the alignment of the water pipeline route. Only two of these sites require removal as a result of the Project, the remaining would be protected in situ or removed for safekeeping.

An assessment of historic significance was completed, with none of sites being identified as of high significance. This assessment of historic significance notwithstanding, the Proponent has committed to completing an assessment and archaeological investigation of the remains of a dwelling and associated material associated with one of the sites, and preparing an archival photographic record of the agricultural machinery which makes up the other site.

On the basis of the limited historic significance of the sites to be disturbed, and considering the management and mitigation measures that would be implemented, it is assessed that the Project would not result in significant impacts to the non-Aboriginal heritage record in the vicinity of the Project.

### Visual Amenity

The existing visual amenity surrounding the Project Site is typical of rural areas in the central west of NSW, with the outlook from most rural residences and other vantage points including remnant native vegetation, land used for agriculture, roads or other infrastructure.

The following measures to be implemented to minimise potential visual amenity-related impacts would include:

- Construction of a vegetated amenity bund adjacent to the eastern and western boundary of the Newell Highway.
- Progressive rehabilitation of the waste rock emplacements using locally occurring native species.
- Progressive reshaping and rehabilitation of areas no longer required for mining related purposes.
- Placement and use of night time lighting which is directed away from surrounding vantage points and minimises glow affects.

The visual amenity in the vicinity of the Mine Site would be altered through the addition of three waste rock emplacements and the RSF. However, the impacts of that change to the existing visual amenity would be minimised as far as practicable through the implementation of the nominated mitigation measures.

### Air Quality

Dust generating activities associated with the Project have been identified and quantified through dispersion modelling. The modelling results indicate that the potential impact on air quality at surrounding residences would be minor and would not exceed the recommended annual air quality goals.

For the life of the Project, it has been estimated that approximately 0.38Mt $CO_2$-e would be released annually, corresponding to an approximate annual contribution of <0.035% against baseline 2008 NSW greenhouse gas emissions.

### Blasting

Modelling of the likely air overpressure and ground vibration resultant from mine-related blasting was completed for the Project. The results of this modelling indicate that through the implementation of appropriate blast design and controls, compliance with the relevant criteria for both air overpressure and ground vibration (both for residential locations and the proposed Newell Highway underpass) would be achieved.

### Transportation

The Proponent proposes to construct a new intersection between the Main Site Access Road and Tomingley West Road. The Proponent has also proposed to provide for road upgrades on Tomingley West Road.

A comparison of measured traffic volumes with the predicted traffic levels illustrates the following.

- The Project would result in an increase in traffic levels of between 3.2% and 5.1% on the Newell Highway (a negligible increase well within the capacity of this major transport route).
- The Project would result in an increase in traffic levels of between 7.2% and 16.5% on the Tomingley - Narromine Road (overall traffic volume of less than 600 vehicles per day).
- The Project would increase traffic on Tomingley West Road, however, overall traffic volumes would remain less than 300 vehicles per day.

Overall, the Project would not generate major increases in local or regional traffic and consequently the impact on the local road network and traffic would be low.

### Soils and Land Capability

Based on the results of preliminary survey, the observed soil profiles and laboratory analyses, six soil units were identified within the Mine Site.

The use of appropriate soil stripping, handling and stockpiling procedures, together with appropriate erosion controls would result in a minimal impact to soils within the Project Site.

A soils assessment also concluded that the final landform should be able to achieve land stability similar to the existing landform.

### Socio-economic Setting

The Project would provide several economic benefits to the local and regional socio-economic setting, including the following.

- Direct full-time employment for approximately 100 full-time equivalent positions during the site establishment and up to 90 full-time equivalent positions during the operational phase of the Project.

- Preference when engaging new employees would be given, where practicable, to candidates who live within the local area over candidates with equivalent experience and qualifications based elsewhere and ensure that the mining and other contractors do so as well.
- The employment of the local Aboriginal community in the workforce would be encouraged.
- Participation of locally based employees and contractors in appropriate training or education programs would be encouraged and supported.
- Support to community organisations, groups and events would be provided, as appropriate.
- Excess water from the water supply bores and pipeline would be made available to Narromine Shire Council for supply to the residents of Tomingley.

Increased employment opportunities associated with the Project would have additional flow-on benefits including:

- the provision of new employment would provide an impetus to other local businesses; and
- the injection of approximately $28.6 million per year into the local and regional economy, with an additional approximately $20.4 million into the State and Federal economies.

The design of the final landform has also taken into account possible future land uses for the Mine Site. Through consideration of current land uses in the local area, infrastructure that would be available and a requirement to offset impacts to local biodiversity, the Proponent has provided a conceptual landform which provides for the extension and linkage of remnant native vegetation, continuation of sustainable agriculture and possible introduction of some other land uses which could take advantage of the power and water supply to the site. By designing the final landform in this way, the Proponent is providing for the continued contribution of this land to the socio-economic setting.

It is further noted that the Proponent remains accountable for managing the Project in a manner that complies with the nominated environmental criteria and meets reasonable community expectations. A comprehensive monitoring program would be established to demonstrate compliance with environmental criteria, and liaison with both official and unofficial community representation would continue to address community concerns as they arise.

## PROJECT EVALUATION AND JUSTIFICATION

The Tomingley Gold Project has been evaluated and justified principally through consideration of its potential impacts on the environment and potential benefits to the local and wider community.

In evaluating the Project it is concluded that, with the implementation of the proposed operational controls, safeguards and/or mitigation measures, the residual risk posed by each possible environmental incident or impact are reduced from original levels. With limited exceptions, the residual risk was classified as either moderate or low, and therefore acceptable. Further, the design of the Project has addressed each of the sustainable development principles, and on balance, it is concluded that the Project achieves a sustainable outcome for the local and wider environment.

The Project and associated activities have been assessed in terms of a wide range of biophysical, social and economic issues. Potential residual impacts can be justified in terms of the positive economic and social benefits to the Narromine, Parkes and Dubbo local government areas, NSW and Australia, the market opportunities for gold exports and the principles of ecologically sustainable development.

## CONCLUSION

The Project has been, to the extent feasible, designed to address all issues raised by the local community and all levels of government, as well as the principles of ecologically sustainable development.

The Proponent has identified the need for the Mine Site to continue to contribute to the socio-economic setting of the local area and allows for a combination of biodiversity conservation, sustainable agriculture and possibly some other land use which could take advantage of the power and water supply to the site.

In light of the conclusions included throughout the *Environmental Assessment*, it is assessed that the Project could be constructed and operated in a manner that would satisfy all relevant statutory goals and criteria, environmental objectives and reasonable community expectations.

The *Environmental Assessment* supported by the range of specialist consultant studies has established that if the Project proceeds, it would:

1. satisfy ecologically sustainable development principles;
2. operate with risks to the local environment minimised to the greatest extent practicable through Project design and implementation of a range of environmental controls and safeguards;
3. have a minimal and manageable adverse impact on the biophysical environment;
4. have a substantial positive impact on the local and wider regional and NSW socio-economic environment;
5. contribute to the continued economic activity of the local area; and
6. provide a site suitable for future agricultural activities incorporating areas for long term nature conservation.

# Key Project Components and Statistics

| **Key Project Components** | |
|---|---|
| Project Summary | Develop a gold mine site consisting of four open cuts and one underground mine which includes:<br>• Extraction and processing of up to 1.5 million tonnes of gold-bearing ore per year.<br>• Establish four open cut mines, one underground mine, a processing plant, three waste rock placements, run-of-mine pad, residue storage facility as well as ancillary activities and associated infrastructure including construction<br>• Limited truck transportation on the local road network (for the delivery of equipment and consumables).<br>• Rehabilitation of the disturbed areas. |
| **Key Statistics** | |
| Project Site Area | 776ha (total area of disturbance of approximately 300ha including 21.6ha of native vegetation) |
| Total Resource | 10.3 million tonnes |
| Main Products | Gold dore |
| Mining Rate | Up to 1.5 million tonnes of ore per year. |
| Project Life | 10 years. |
| Extraction Methods | Open cut:<br>• Weathered materials ripped and pushed using a bulldozer and extracted with an excavator and off-road trucks.<br>• Competent materials lightly fragmented by blasting and extracted with an excavator and off-road trucks.<br>Underground operations:<br>• Long hole open hole stoping methods. |
| Processing | Mined ore would be processed through the on-site Processing Plant and would comprise components of crushing, grinding, cyanide leaching operations and gold recovery. |
| Stockpiles | Excavated soils (excluding sodic soils) to be stockpiled and used in rehabilitation activities. Cleared groundcover vegetation to be stockpiled on-site and reused as vegetated areas in rehabilitation stages. |
| Final Landform and End Land Use | Progressive rehabilitation to create a shaped and geotechnically stable final landform suitable for end land use of sustainable agriculture, nature conservation and/or appropriate light industry. |
| Biodiversity Offset | Conservation of 78.5ha of remnant native flora and enhancement and protection of a further 61.0ha of low condition land adjoining the remnants to be conserved. |
| Revegetation | Progressive approach to the rehabilitation of disturbed areas within the Mine Site |
| Employment | Approximately 100 full-time equivalent positions during site establishment phase and up to 90 full-time equivalent positions during the operational phase. |
| Capital Investment Value | $65.6 million[1] |
| Hours of Operation | • Construction operations, open cut mining operations, underground mining operations, maintenance operations and rehabilitation operations – 24 hours per day.<br>• Vegetation clearing and topsoil stripping – Daylight hours.<br>• Blasting operations – 9:00am to 5:00pm (Monday to Saturday)<br>• Rehabilitation Operations – 7:00am to 10:00pm |

Note 1: Revised from estimated Capital Investment Value quoted in the application for project approval (23 July 2009) (see **Appendix 1**) following consideration of the Department of Planning Circular PS 10-008 "*New Definition of Capital Investment Value*").

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# Section 1

# Introduction

## PREAMBLE

*This section introduces the proposed Tomingley Gold Project ("the Project") and includes:*

- *an outline of the scope of the Environmental Assessment;*
- *details about the Proponent, Alkane Resources Ltd;*
- *relevant background to the Project including a review of the history of mining and exploration in the area surrounding the Project Site and an overview of the Project resources and reserves;*
- *the format of the Environmental Assessment; and*
- *identification of the personnel involved in the Project design, document preparation and specialist consultant investigations.*

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## 1.1 SCOPE

This *Environmental Assessment* has been prepared by R.W. Corkery & Co. Pty. Limited to support the application for project approval (application number MP 09_0155) of Alkane Resources Ltd ("the Proponent") to construct and operate the Tomingley Gold Project ("the Project"). The Project, which is to be located near Tomingley in central western NSW (see **Figure 1.1**), would comprise four open cut mines, an underground mine, a processing plant, three waste rock emplacements and a residue storage facility, as well as associated infrastructure, most notably a water supply pipeline to the processing plant. All areas of proposed disturbance associated with the Project are contained within the "Project Site" described in more detail in Section 1.3.1. A copy of the application for project approval is included as **Appendix 1**.

The Project is classified as a "Major Project" in accordance with Paragraph 5 of Schedule 1 of *State Environmental Planning Policy (Major Development) 2005* ("Major Development SEPP"). As a result, project approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) is required. The Minister for Planning and Infrastructure is the approval authority and an *Environmental Assessment* is required to be submitted to support the application. This document has been prepared in satisfaction of that requirement and in accordance with the requirements of Section 75H of the EP&A Act.

It is noted that the Project requires the construction and operation of an Electricity Transmission Line from Peak Hill to the site of the mining and processing operations. However, as the Electricity Transmission Line would be owned and operated by Essential Energy (formerly Country Energy), application has been made for this 'activity' under Part 5 of the EP&A Act. Reference to the Electricity Transmission Line is retained in the documentation where this information provides relevant information or context to the description or assessment of the Project. It is also noted that specialist assessments in the fields of ecology and cultural heritage (Parts 4 and 5 of the *Specialist Consultant Studies Compendium*) contain reference to, and assessment of, the Electricity Transmission Line (as the assessment of the Project and Electricity Transmission Line was completed as a single assessment in each case).

The application for project approval is made possible by virtue of the fact that mining and ancillary activities, including construction of a water supply pipeline, are permissible under Clause 9 of the *Narromine Local Environment Plan 1997* and Clause 9 of the *Parkes Local Environment Plan 1990.*

The information provided in this document is presented to a level of detail which adequately addresses all relevant issues identified by the various stakeholders including government agencies, surrounding residents and the local community (refer to Section 3 and **Appendix 2**). Emphasis has been placed upon comprehensively addressing the key issues and limiting coverage of those issues that are not central to the determination of the project approval application.

## 1.2 THE PROPONENT AND THE PROJECT SITE

### 1.2.1 The Proponent

Alkane Resources Ltd is an Australian, publicly listed mining and exploration company which has been in existence since 1969 and has approximately 5 400 shareholders. The Company has a long term involvement and ongoing commitment to the Central West of New South Wales and has substantial investment in the people and resources of the region. Alkane Resources Ltd developed and operated the Peak Hill Gold Mine on the outskirts of Peak Hill from 1996 to 2005 and has now largely rehabilitated that mine site.

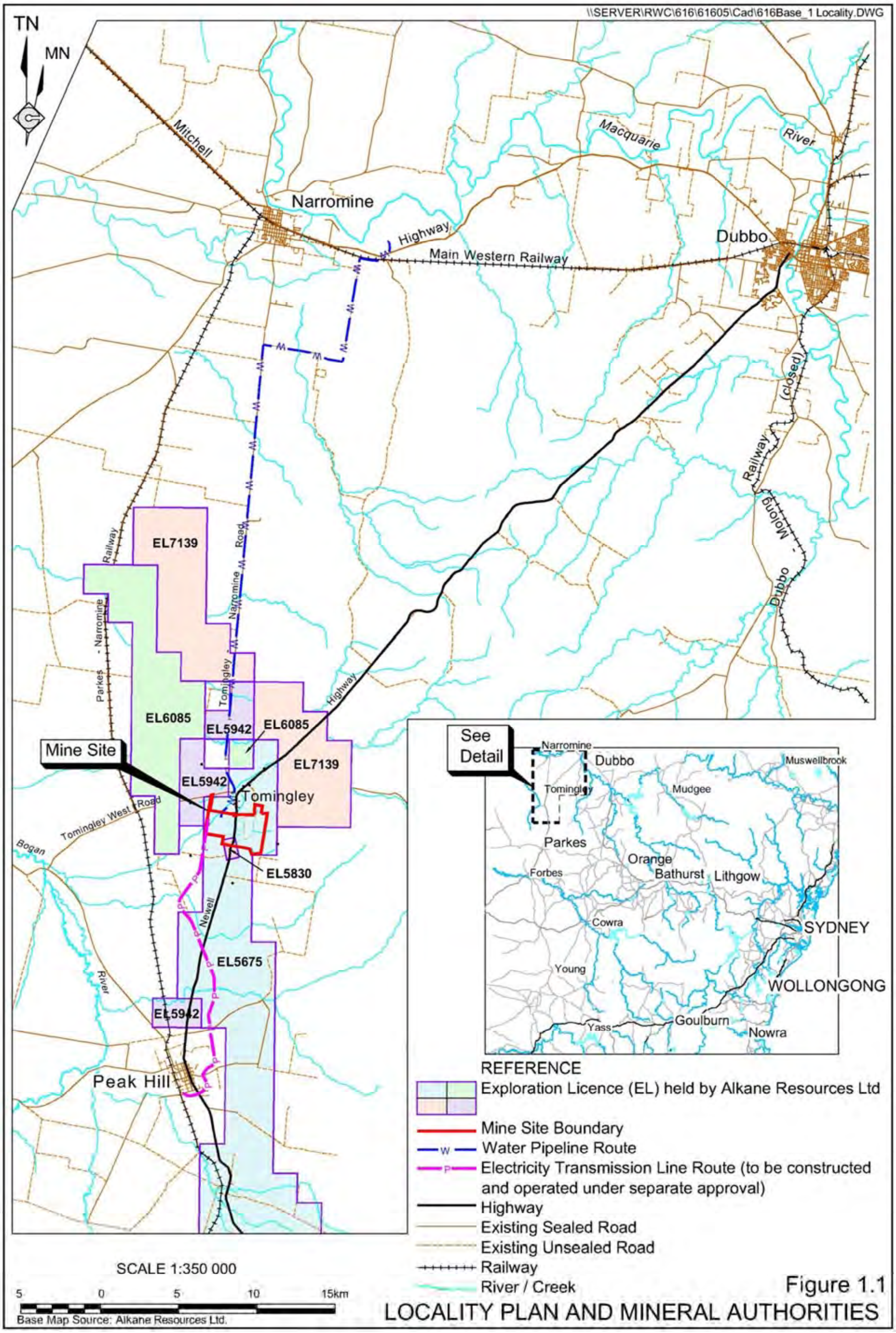


Figure 1.1
LOCALITY PLAN AND MINERAL AUTHORITIES

### 1.2.2 The Project Site

The Project Site comprises two areas.

1. The Mine Site - comprising an area of approximately 776ha that would incorporate all areas of proposed Project-related disturbance associated with the mining, processing, waste emplacement operations and related activities (**Figure 1.2**). The Proponent has negotiated options to purchase all land within the Mine Site that it does not currently own.
2. The Water Pipeline Route - comprising a corridor approximately 46km long and 5m wide within road and rail reserves associated with:
   – the Mitchell Highway;
   – Webbs Siding Road;
   – Sunnyside Lane;
   – Bootles Road;
   – Pinedene Road;
   – Narromine-Tomingley Road;
   – Tomingley West Road; and
   – Main Western Railway

   In addition, the pipeline would cross two portions of private land at the northern and southern ends of the route, namely the "Woodlands" and "Wyoming" properties respectively (**Figures 1.3** and **1.4**).

**Table 1.1** identifies the land parcels within each of these areas comprising the Project Site.

The Electricity Transmission Line Route, which is to be assessed separately under Part 5 of the EP&A Act, comprises a corridor approximately 19.2km long and 30m wide and would incorporate all areas of the proposed electrical easement for the proposed power transmission line from Peak Hill to the Mine Site (**Figure 1.5**).

**Table 1.1**
**Project Site Land Titles**

| Lot | DP | Lot | DP | Lot | DP |
|---|---|---|---|---|---|
| **Mine Site (see Figure 1.2)** | | | | | |
| 1 | 254193* | 105 | 755110 | 162 | 755110 |
| 162 | 755093* | 111 | 755110* | 163 | 755110 |
| 173 | 755093* | 112 | 755110 | 1 | 824086 |
| 94 | 755110 | 122 | 755110* | 1 | 1151198 |
| 95 | 755110 | 160 | 755110 | 2 | 1151198 |
| 103 | 755110 | 161 | 755110 | 3 | 1151198 |
| 104 | 755110 | | | | |
| Road Reserve associated with Newell Highway<br>Crown roads (unnamed) | | | | | |
| **Water Pipeline Route** | | | | | |
| 185 | 43458 | 70 | 755110 | 104 | 755110 |
| A | 380855 | 74 | 755110 | 111 | 755110 |
| 7003 | 1032703 | 81 | 755110 | 18 | 755119 |
| 7002 | 1032703 | | | | |
| Road Reserves associated with the Mitchell Highway, Webb's Siding Road, Dappo Road, Bootles Road, Pinedene Road, Narromine-Tomingley Road and Tomingley West Road and the easement for the Main Western Railway. Crown roads (unnamed) (see **Figures 1.3** and **1.4**). | | | | | |
| Note: * Indicates part lot. | | | | | |

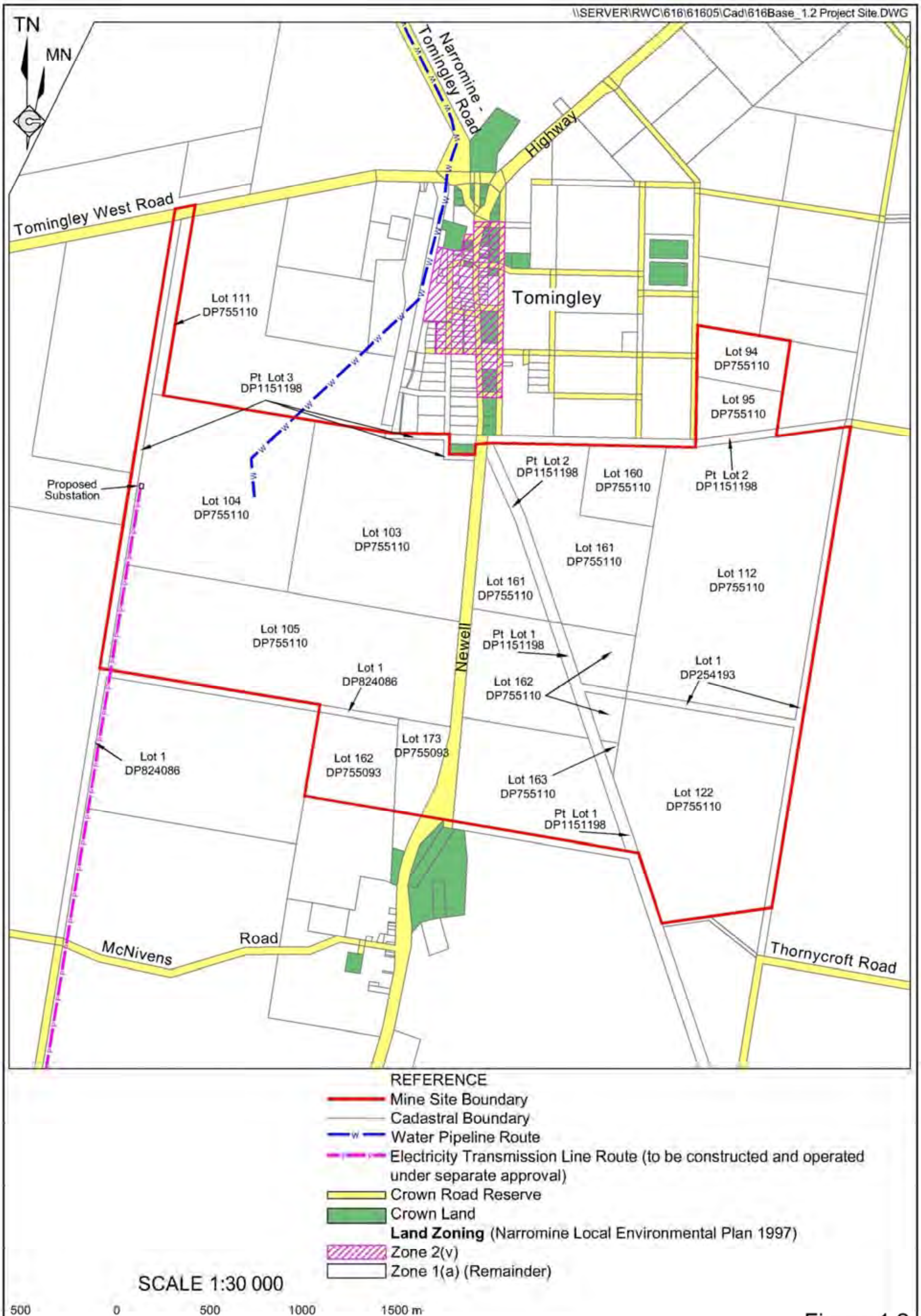


Figure 1.2
MINE SITE AND LAND ZONING

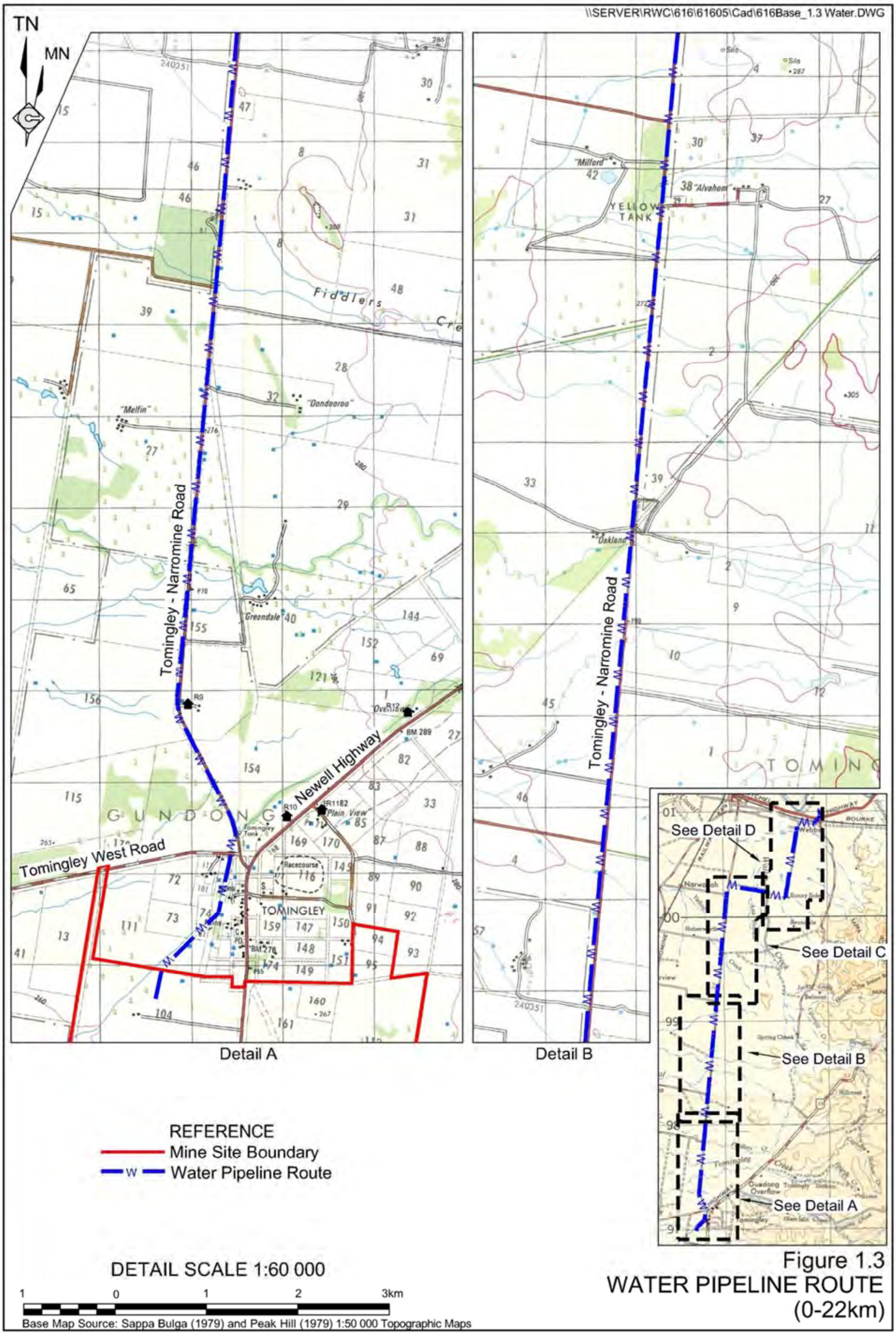


Figure 1.3
WATER PIPELINE ROUTE
(0-22km)

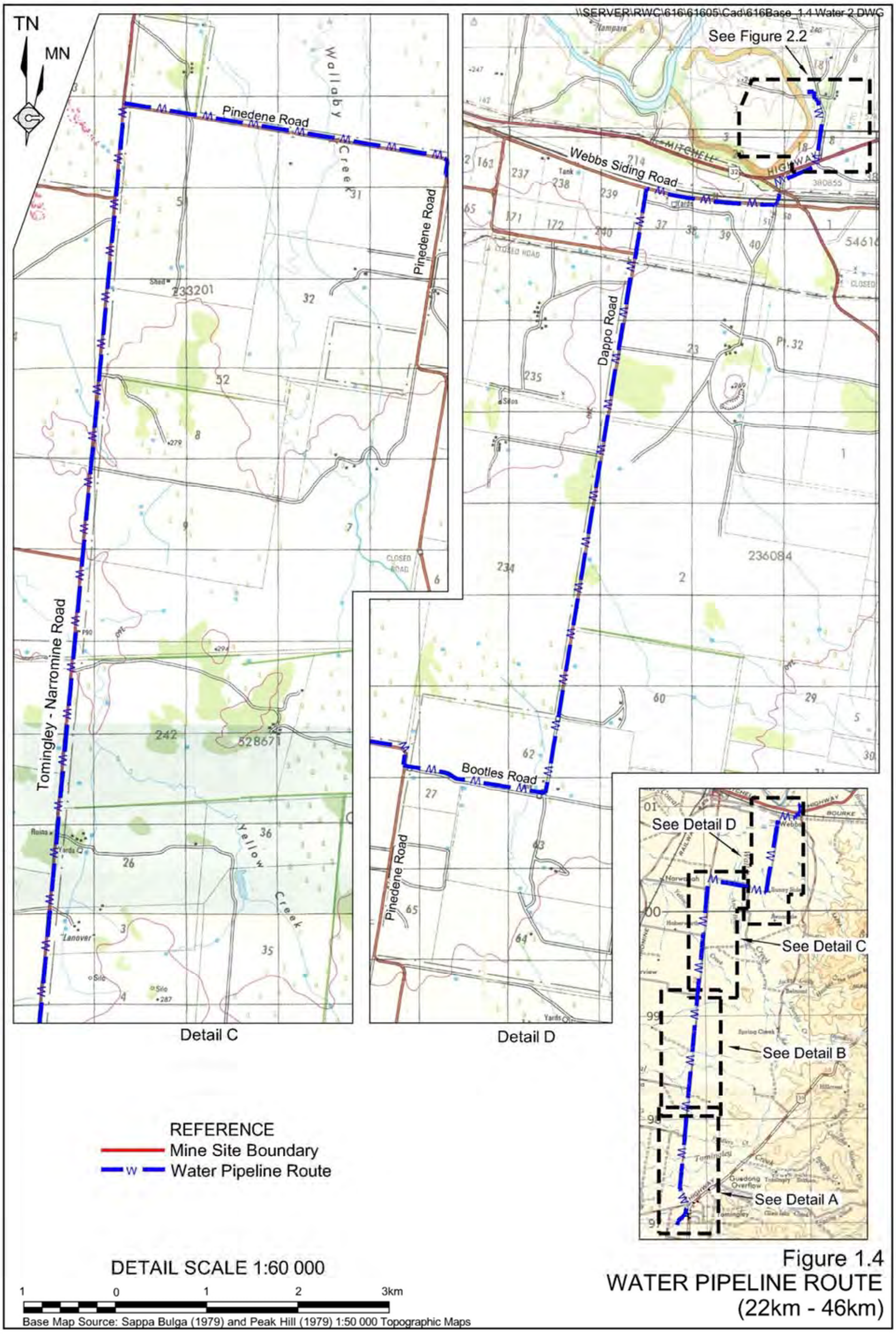


Figure 1.4
WATER PIPELINE ROUTE
(22km - 46km)

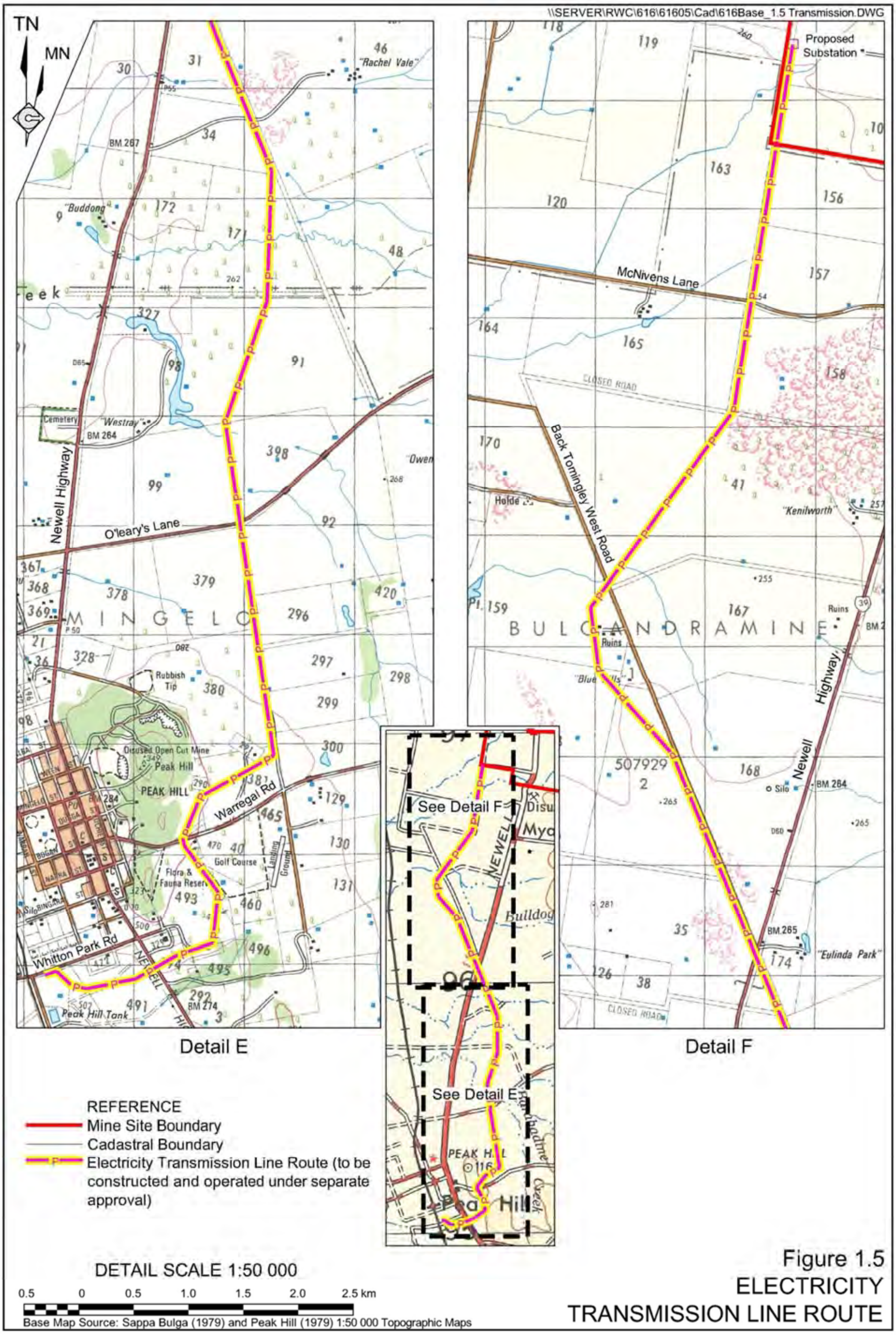


Figure 1.5
ELECTRICITY
TRANSMISSION LINE ROUTE

# 1.3 BACKGROUND TO THE PROJECT

## 1.3.1 Existing Mineral Authorities

**Figure 1.1** and **Table 1.2** present the mineral authorities that cover and surround the Mine Site. In summary, the Mine Site is covered by the northern sections of EL5675 and EL5830.

The process to renew EL5830 and EL6085 is currently underway.

The Proponent will lodge an application for a mining lease over the Mine Site. With the exception of an area surrounding the Main Site Access Road and an area to the northeast of Waste Rock Emplacement 3 (see Section 2.1.2), the entire Mine Site is within the Mining Lease Application area. There is no requirement for a mining lease over the Electricity Transmission Line Route or the Water Pipeline Route.

**Table 1.2**
**Mineral Authorities[2]**

| Authority | Act year | Date Granted | Expiry Date | Mineral Groups[1] |
|---|---|---|---|---|
| **Exploration Licences** | | | | |
| EL5942 | 1992 | 03 May 2002 | 02 May 2012 | 1 |
| EL5830 | 1992 | 05 April 2001 | 04 April 2011[3] | 1 |
| EL5675 | 1992 | 17 January 2000 | 16 January 2012 | 1 |
| EL6085 | 1992 | 20 May 2003 | 20 May 2011[3] | 1 |
| EL7139 | 1992 | 14 May 2008 | 14 May 2012 | 1 |
| Note 1: Mineral groups as defined under the *Mining Act 1992*.<br>Note 2: All authorities are held by Alkane Resources Ltd.<br>Note 3: Applications to renew have been lodged with DTIRIS. | | | | |
| Source: Alkane Resources Ltd | | | | |

## 1.3.2 Previous Mining and Exploration Operations

There has been a long history of mining and exploration for gold in the vicinity of the Mine Site. This sub-section provides a brief overview of previous mining-related operations.

Gold was first discovered at Tomingley in 1879, with the Tomingley Goldfield proclaimed on 19 June 1882 and the village of Tomingley proclaimed on 15 June 1894. A number of underground mining operations were located adjacent to the village and in the McPhail area, immediately south of the Mine Site. One of these, the Myall United Gold Mine, produced approximately 70 000 ounces of gold over a 30 year period from 1883.

In 1913, mining ceased at McPhail, with tailings and slimes re-treated until 1924. These materials were again re-treated in the late 1990s by Tailings Treatment Pty Ltd during which time a new tailings dam, namely the McPhail Tailings Dam, was constructed.

In 2001, the Proponent entered into an agreement with Compass Resources NL in relation to EL 5675 and Golden Cross NL in relation to EL 5830 to earn 100% of both tenements. Initial scout drilling programs to identify and test the basement geology beneath approximately 10m to 30m of cover material were centred on the interpreted strike extensions of the Myall United Mine and as follow up of results from shallow drilling completed by earlier explorers.

In 2001, the Proponent identified the Wyoming One deposit, followed by the Wyoming Three deposit in 2002, the Caloma deposit in 2006 and the Caloma Two deposit in 2010.

### 1.3.3 Resources

A description of the regional and local geology and the mineralisation associated with each of the deposits is presented in Section 4.1.4. This section provides an overview of the estimated resources and reserves that have been defined within the Mine Site.

Resource estimates were prepared for Wyoming One, Wyoming Three and Caloma One deposits, in accordance with the requirements of the JORC Code (JORC, 2004), by Lewis Mineral Resource Consultants Pty Ltd in January and July 2009. The results of these estimates for gold grades above 0.75g/t gold are presented in **Table 1.3**. A resource calculation has yet to be completed for the Caloma Two deposit, however, initial estimates indicate a resource of approximately 500 000t.

**Table 1.3**
**Ore Resources**

| DEPOSIT | MEASURED | | INDICATED | | INFERRED | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tonnage (t) | Grade (g/t) | Tonnage (t) | Grade (g/t) | Tonnage (t) | Grade (g/t) | Tonnage (t) | Grade (g/t) | Ounces |
| Caloma One | 2 048 000 | 2.04 | 440 000 | 1.71 | 1 372 000 | 1.36 | 3 859 000 | 1.76 | 218 500 |
| Wyoming Three | 630 000 | 1.87 | 58 000 | 1.73 | 154 000 | 1.25 | 842 000 | 1.75 | 47 300 |
| Wyoming One | 2 226 000 | 2.07 | 882 000 | 2.25 | 3 477 000 | 1.62 | 6 587 000 | 1.86 | 393 200 |
| **Total** | **4 904 750** | **2.03** | **1 380 050** | **2.06** | **5 003 620** | **1.54** | **11 288 420** | **1.82** | **658 900** |
| Source: Lewis Mineral Resource Consultants Pty Ltd | | | | | | | | | |

Within these total resources an Open Pit Ore Inventory has been calculated by Mining One Pty Ltd for each deposit, based on specific economic, mining dilution and engineering criteria. These inventories are presented in **Table 1.4**.

**Table 1.4**
**Summary of Open Pit Ore Inventory**

| DEPOSIT | MEASURED | | INDICATED | | INFERRED | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tonnage (t) | Grade (g/t) | Tonnage (t) | Grade (g/t) | Tonnage (t) | Grade (g/t) | Tonnage (t) | Grade (g/t) | Ounces |
| Caloma | 1 736 740 | 1.98 | 321 125 | 1.70 | 851 568 | 1.41 | 2 909 433 | 1.78 | 166 506 |
| Wyoming Three | 536 872 | 1.59 | 16 456 | 1.42 | 85 457 | 1.51 | 638 785 | 1.57 | 32 329 |
| Wyoming One | 1 723 388 | 1.54 | 197 731 | 1.41 | 413 846 | 1.28 | 2 334 965 | 1.48 | 111 187 |
| **Total** | **3 997 000** | **1.74** | **535 312** | **1.58** | **1 350 871** | **1.38** | **2 909 183** | **1.64** | **310 022** |
| Source: Mining One Pty Ltd | | | | | | | | | |

Sterilisation drilling completed in 2009 (incorporating analyses of earlier exploration drilling) has confirmed that the locations of the proposed surface processing and office infrastructure, waste rock and residue management facilities do not occur over mineable gold resources. Notably, as a result of the sterilisation drilling, the Caloma Two resource was identified resulting in the inclusion of the Caloma Two Open Cut and modification to Waste Rock Emplacement 3 as part of final Project design. Section 4.1.4.4 provides a more detailed summary of the sterilisation drilling completed on the Mine Site.

## 1.4 ENVIRONMENTAL ASSESSMENT FORMAT

The *Environmental Assessment* includes six sections of text, a reference section, glossary and a set of appendices. The information presented in this document covers all aspects of the planning, development, operation, rehabilitation and environmental monitoring of the Project at a level of detail reflecting the environmental risk posed by each issue. The issues and their relevant importance to the assessment of the Tomingley Gold Project have been identified through consultation with government agencies, surrounding residents and the local community, and specialist consultant assessments.

The format of the *Environmental Assessment* is as follows.

**Section 1:** (this section) introduces the Tomingley Gold Project, the Proponent, the Project Site and the mineral authorities held by the Proponent. Background information in relation to previous mining and mineral exploration operations and the estimated resources within the Mine Site are provided. The section concludes with information on the structure of the document and management of investigations.

**Section 2:** describes the Proponent's objectives and proposed infrastructure establishment, open cut and underground mining operations, waste rock management, processing operations, residue management, rehabilitation and ancillary activities.

**Section 3:** provides a description of the process used to identify and prioritise the key issues for assessment with reference to the Director-General's Requirements, stakeholder consultation, specialist consultant assessments. The section also provides a general environmental risk analysis undertaken to establish the assessment priority of the key issues based on the specific environmental risk(s) posed by each.

**Section 4:** commences by describing the setting of the Project Site with reference to aspects of the local environment likely to influence the level of impact on other environmental aspects. The section then presents a description of a range of environmental features of the local environment that may or would be influenced by the Project, i.e. the key environmental issues. The order of presentation of those issues and level of detail reflects the level of priority attributed to each key issue. The operational safeguards and controls, and where appropriate, the management procedures that have been incorporated into the Project design to protect the local environment, are also presented. This section also analyses the potential impact the Project would have on the physical, biological and social environment once the proposed safeguards and procedures are adopted.

**Section 5:** provides a draft Statement of Commitments the Proponent would implement with respect to environmental management and monitoring for the Project.

**Section 6:** provides a conclusion to the document which justifies the Project in terms of biophysical, economic and social considerations and ecologically sustainable development and records the consequences of not proceeding with the Project.

**References:** lists the various source documents referred to for information and data used during the preparation of the *Environmental Assessment*.

**Glossary:** presents a list of the acronyms, symbols and units and technical terms used throughout the *Environmental Assessment*.

**Appendices:** present the following additional information.

1. A copy of the Proponent's major project application.
2. An itemised and tabulated summary of the Director-General's requirements, including the requirements provided by the various government agencies consulted, and reference to the section within the *Environmental Assessment* or *Specialist Consultant Studies Compendium* where each is addressed.
3. A risk screening and preliminary hazard analysis completed in accordance with the requirement of State Environmental Planning Policy (SEPP) 33.

A two volume *Specialist Consultant Studies Compendium* has been placed on exhibition with the *Environmental Assessment*. The contents of these reports are summarised into the appropriate section(s) of the *Environmental Assessment*.

## 1.5 MANAGEMENT OF INVESTIGATIONS

The preparation of this document has involved a study team managed by Mr Mitchell Bland (MEcon BSc (Hons), Geol, LLB), Principal Environmental Consultant with R.W. Corkery & Co Pty. Limited and Mr Alex Irwin (BSc (Hons)), Senior Environmental Consultant with the same Company. Internal peer review was undertaken by Mr Rob Corkery (BApplSc (Hons), MAppl Sc), Principal with the same Company.

Several professional staff within Alkane Resources Ltd assisted with the preparation of this document including, but not limited to:

- Mr Ian Chalmers (MSc) - Managing Director;
- Mr Terry Ransted (BAppSc) - Chief Geologist; and
- Mr Mike Sutherland (BSc, GCComRel) - General Manager NSW.

Ms Fiona Morgan (BE (Hons)) Lead Mechanical Engineer with Mintrex (the consulting division of Holtfreters Pty Ltd) was the Project Manager for the *Tomingley Gold Project Feasibility Study* and has coordinated the provision of technical advice and input.

Finally, strong emphasis has been placed upon a multi-disciplinary team approach to the design of the Project, the description of the existing environment, identification of key environmental issues, development of appropriate safeguards and assessment of impacts. The following consultancy firms were commissioned by the Proponent to prepare nominated specialist consultant studies for the Project.

- Ecology and Heritage – OzArk Environmental and Heritage Management Pty Ltd.
  - Dr Jodie Benton (PhD, BA (Hons)) and Mr Phil Cameron (BSc, AssDip AppSci).
- Noise and Blasting – SLR Consulting Pty Ltd.
  - Messrs Dick Godson (MSc (Eng), MIEAust, CPEng), Mark Blake (BE (Mech)) and Ryan Wakeling (MSc Design Science (Audio Design).

- Air Quality and Greenhouse Gases – PAE Holmes.
  - Ms Judith Cox (BEng (Hons)).
- Soils and Land Capability – Sustainable Soils Management Pty Ltd.
  - Dr Pat Hulme (PhD BSc Ag (Hons)) and Mr David Duncan (BApplSc-Ag).
- Surface Water – SEEC.
  - Messrs Jason Armstrong (AssDipCivil) and Andrew McLeod (B.Sc (Hons).
- Groundwater – The Impax Group.
  - Mr James Morrow (BEng Env (Hons)) of The Impax Group.
  - Mr Duncan Irvine (BSc) of Australasian Groundwater and Environmental Consultants Pty Ltd.
- Traffic and Transportation – FJF Group Pty Ltd.
  - Mr Frank Foley (BEng (Mech) (Hons)).

# Section 2

# Description of the Project

## PREAMBLE

*This section describes the proposed Tomingley Gold Project including:*

- *the objectives of the Project;*
- *an overview of the Project and the approvals required;*
- *the infrastructure that would be established and/or relocated;*
- *the site preparation that would be undertaken;*
- *the proposed mining and processing operations and management of waste rock and processing residue;*
- *ancillary activities that would be undertaken; and*
- *the proposed re-establishment of native vegetation communities in areas that are currently cleared and rehabilitation of areas that would be disturbed throughout the life of the Project.*

*The Project is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of the activities proposed, how the various activities would be undertaken and to enable an assessment of the potential impacts on the surrounding environment. The boundaries of the various components described throughout this section and dimensions information are indicative only.*

*Details of the safeguards and management measures that the Proponent proposes to implement to minimise or negate the potential impacts on components of the surrounding environment are provided in Section 4 of this document.*

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# 2.1 INTRODUCTION

## 2.1.1 Project Objectives

The Proponent's objectives in constructing and operating the Tomingley Gold Project would be to:

- safely and economically mine the identified gold reserves;
- operate the Project in a manner that would minimise surface disturbance and impacts on surrounding residents and the local environment;
- implement a level of management control and mitigation measures that ensures compliance with appropriate environmental criteria and reasonable community expectations;
- develop and operate the Project in compliance with all relevant statutory requirements;
- establish a facility that can process the currently identified and any additional mineral resources that may be identified within or in the vicinity of the Mine Site;
- minimise waste and maximise the efficiency of the operation during the life of the Project;
- create a final landform that is suitable for a post-mining land use that would be determined in consultation with the local community and could include a combination of nature conservation, agriculture, tourism or light industry;
- restore and enhance existing remnant native vegetation and re-establish areas of native vegetation over currently cleared sections of the Mine Site;
- provide for the ongoing monitoring of local environmental parameters such as water, noise, air quality and biodiversity;
- continue to maintain an open and honest relationship with the surrounding community;
- work cooperatively with the surrounding community to build socio-economic capacity within communities surrounding the Project Site; and
- achieve the above objectives in a cost-effective manner to ensure security of employment and the continued economic viability of the Proponent.

## 2.1.2 Project Overview and Mine Site Layout

The Project would include the following components (**Figure 2.1**).

- Establishment of infrastructure required for the Project, including a water supply pipeline, an underpass beneath the Newell Highway, and vegetated amenity bunds.

- Extraction of waste rock and ore material from four open cut areas, namely:
  - Caloma Open Cut (approximately 19ha);
  - Caloma Two Open Cut (indicative design approximately 9ha);
  - Wyoming Three Open Cut (approximately 10ha); and
  - Wyoming One Open Cut (approximately 19ha).
- Extraction of waste rock and ore material from the Wyoming One Underground.
- Construction of three waste rock emplacements covering a combined area of approximately 129ha.
- Construction and use of various haul roads, including an underpass under the Newell Highway, and a run-of-mine (ROM) pad.
- Construction and use of a processing plant and office area, incorporating a crushing and grinding circuit, a standard carbon-in-leach (CIL) processing plant, site offices, workshops, ablutions facilities, stores, car parking, and associated infrastructure.
- Construction and use of a residue storage facility (approximately 49ha).
- Construction and use of an approximately 46km water pipeline, from a licensed bore located approximately 7km to the east of Narromine, to the Mine Site (**Figures 1.3** and **1.4**).
- Construction and use of a transformer and electrical distribution network within the Mine Site (from the 20km of 66kV electricity transmission line from Peak Hill to the Mine Site to be constructed under separate approval) (**Figure 1.5**).
- Relocation of existing items of infrastructure, including a 22kV power line which currently passes over the area of the Caloma and Caloma Two Open Cuts.
- Re-routing (node to node) of a 4.2km section of a Nextgen Network fibre optic cable (telecommunications line).
- Construction and use of ancillary infrastructure, including the Main Site Access Road and intersection with the Tomingley West Road.
- Construction of soil stockpiles (for use in rehabilitation works).
- Construction of the Eastern Surface Water Diversion Structure to divert surface water flows to the east of mining and waste rock emplacement activities. Additional surface water management structures would be constructed within the Project Site to control surface water flows within the Mine Site (**Figure 2.5**).
- Construction and use of dewatering ponds to store water accumulating in and pumped from the open cuts.

Disturbance associated with the mining and associated activities would be progressively rehabilitated to create a geotechnically stable final landform, suitable for a final land use of nature conservation, agriculture, tourism and/or light industry.

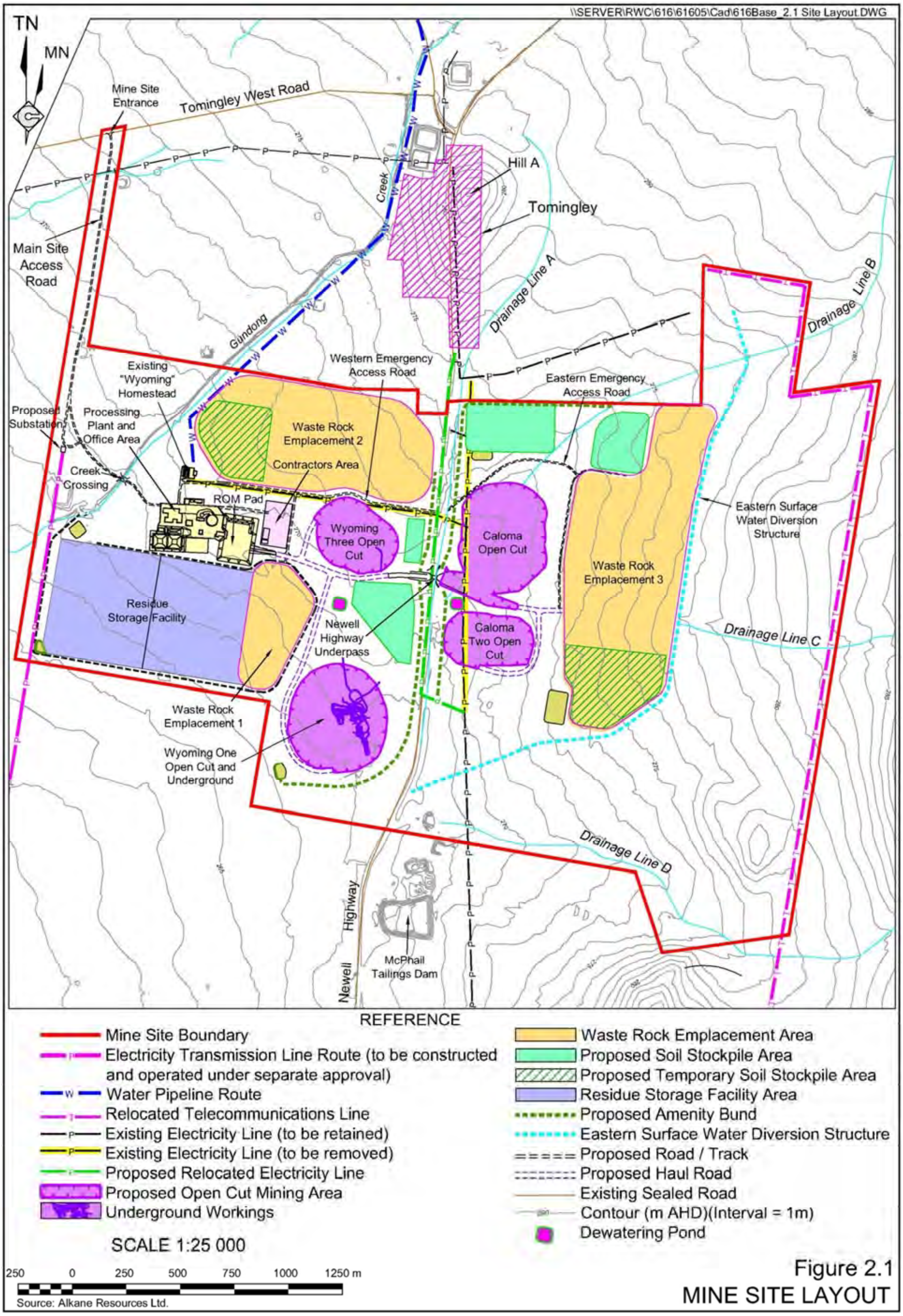


Figure 2.1
MINE SITE LAYOUT

It is noted that the design of the proposed Caloma Two Open Cut is an indicative design only, with additional drilling required to further define the mineralisation. As a result, the indicative design for the Caloma Two Open Cut presented in this document represents the maximum area that would be developed. The development of this maximum impact footprint has been taken into account in all other aspects of the Project, including the required capacity, layout and design of the waste rock emplacements and residue storage facility. Approval is sought for the proposed design, acknowledging that the final design of the open cut would be the same size or smaller than that displayed on **Figure 2.1**.

In addition, throughout the life of the Project, the Proponent proposes to undertake additional exploration drilling to further identify mineralisation. Should further mineable mineralisation be identified, and once sufficient information is available to adequately identify the proposed activities, a subsequent application for approval to extract these resources may be prepared.

### 2.1.3 Approvals Required

The Project would require project approval from the Minister for Planning and Infrastructure under Part 3A of the *Environmental Planning and Assessment Act 1979*. The application for project approval was made on 23 July 2009 (application number MP 09_0155). In addition, the following licences, leases, permits, agreements and approvals would be required to allow commencement of the Project.

1. An Environment Protection Licence issued by the NSW Office of Environment and Heritage (OEH) under Section 47 of the *Protection of the Environment Operations Act 1997* would be required for the proposed activities.
2. A Mining Lease issued by the Department of Trade and Investment, Regional Services and Infrastructure – Division of Resources and Energy (DTIRIS-DR&E) under the *Mining Act 1992*. The Proponent currently holds Exploration Licences 5675 and 5830 over the relevant sections of the Mine Site and will submit a Mining Lease Application (MLA) coinciding with the majority of the area covered by the Mine Site.
3. A dewatering licence issued by the NSW Office of Water (NOW) under Part 5 of the *Water Act 1912* would be required to account for the removal of groundwater in-flow into each of the proposed open cuts. An exemption to the current groundwater embargo under Order 2 of the *NSW Groundwater Shortage Zone Embargo* was sought on 23 October 2009.
4. A *Water Access Licence* (WAL) and Water Use Approval issued by NOW under Part 5 of the *Water Act 1912* would be required to permit extraction of water from the proposed water supply bores. The Proponent has a Call Option with the owner of "Woodlands" to purchase a 1 000ML share of WAL 20270 to the Lower Macquarie Zone 6 Groundwater Source.
5. One or more licences issued by NOW under Part 5 of the *Water Act 1912* would be required for each of the three existing and any additional proposed groundwater monitoring bores. The Proponent already holds licences for Monitoring Bores 2, 5 and 6.
6. A licence issued by NOW under *Part 8* of the *Water Act 1912* would be required for the construction of bunding to the southeast of Gundong Creek which could affect the nature of local flooding off the Mine Site.

7. A Section 138 Permit, issued by the Narromine Shire Council under the *Roads Act 1993*, would be required for all works (as described by Section 138 of the *Roads Act 1993*) affecting classified roads, namely:
   - Newell Highway (State Highway 17);
   - Mitchell Highway (State Highway 7); and
   - Tomingley-Narromine Road (Main Road 89).
8. A licence agreement between Australian Rail Track Corporation Ltd (ARTC) and the Proponent to construct a horizontal borehole beneath the Main Western Railway Line to carry the proposed water pipeline. The bore would be constructed in accordance with the requirements of Australian Standard AS 4799.
9. An approval from the NSW Dams Safety Committee for the design and construction of a residue storage facility.
10. A Licence issued by Workcover Authority of New South Wales for the storage and use of explosives, cyanide and other reagents within the Mine Site. This licence is typically only granted after the Department of Trade & Investment, Regional Infrastructure and Services – Division of Resources & Energy (DTIRIS-DR&E) approves a Security Plan for the storage and handling of explosives (including explosive precursors).
11. A high voltage Connection Agreement with County Energy which holds an electricity distributor's licence under the *Electricity Supply Act 1995*.
12. Approval from Country Energy to relocate a distribution asset.

It is noted that a *Works Authorisation Deed* was executed by Alkane Resources Ltd and the RTA effective from 12 May 2011. A *Works Authorisation Deed* is the agreement by which all works (as per the definition provided for in Section 138 of the *Roads Act 1993*), including the underpass of the Newell Highway pipeline and transmission line crossings of classified roads and works connecting to classified roads, will be administered by the RTA (including the design, construction, alteration, maintenance and demolition of those works). The terms of the *Work Authorisation Deed* also govern any other works as provided for in Section 138 of the *Roads Act 1993*, not expressly referred to in the *Work Authorisation Deed*, such as the connection of the proposed emergency roads to the Newell Highway.

In the event of any inconsistency between information provided in this *Environmental Assessment* and the executed *Work Authorisation Deed*, the terms of the *Work Authorisation Deed* will prevail.

## 2.2 SITE ESTABLISHMENT AND SERVICES RELOCATION

### 2.2.1 Introduction

In order for mining, processing and product transportation to be undertaken on the Mine Site, various infrastructure and other site features would be required to be established. The various site establishment activities described in the following sub-sections are as follows.

- Construction of a water supply line between the Mine Site and a licensed production bore (or bores) located on a private property near Narromine (see Section 2.2.2).

- Construction of a 66kV electricity transmission line and distribution network (see Section 2.2.3)[1].
- Construction of an underpass beneath the Newell Highway (see Section 2.2.4).
- Construction of an access road to the Mine Site and intersection with the public road network (see Section 2.2.5).
- Construction of a range of amenity bunds, surface water diversion and retention structures (see Section 2.2.6).

Site establishment would also include the construction of various infrastructure and facilities associated with processing operations (Section 2.6), processing residue management and storage (Section 2.7), internal movement of vehicles and mobile equipment (Section 2.9), and administrative and maintenance facilities (Section 2.10). The infrastructure and facilities associated with these activities are included in the relevant referenced sub-sections.

Complete site establishment, i.e. complete construction of all Mine Site infrastructure and facilities, is anticipated to take 12 months although it is noted that mining and processing would be undertaken concurrently for a period towards the end of the site establishment phase.

Those public services that would be relocated are as follows.

- A 22kV electricity transmission line (see Section 2.2.7)[2].
- A Nextgen Network fibre optic cable adjacent to the Newell Highway (see Section 2.2.8).

### 2.2.2 Water Supply Bores and Water Pipeline

#### 2.2.2.1 Water Supply Bores

The Proponent would draw its principal water supply from a licensed production bore (or bores) located on private property, "Woodlands", located approximately 7km to the east of Narromine. A licensed and equipped test bore (close to the production bore) would be used as a back-up supply during maintenance of the production bore.

The owner of "Woodlands" has obtained the appropriate licences required for the construction and operation of the test and production water supply bores. The Proponent has a Call Option with the owner of "Woodlands" to purchase a 1 000ML share of his Water Access Licence to the Lower Macquarie Zone 6 Groundwater Source.

#### 2.2.2.2 Water Supply Pipeline

During the site establishment stage of the Project, the Proponent would construct and operate a water pipeline to the Mine Site from the "Woodlands" bore(s). With the exception of those sections of the route within the "Woodlands" property at the northern end of the pipeline and "Wyoming" property at the southern end of the pipeline, the pipeline route would be entirely within road and railway reserves. On the "Woodlands" property, an easement approximately 750m long and 10m wide (0.85ha) would be created from the Mitchell Highway road reserve along the "Woodlands" access road to the bores (**Figure 2.2**).

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[1] Approval for the construction and operation of the 66kV electricity transmission line and distribution network is being sought separately from Essential Energy under Part 5 of the EP&A Act.

[2] Approval for the relocation and operation of the 22kV electricity transmission line is being sought separately from Essential Energy under Part 5 of the EP&A Act.

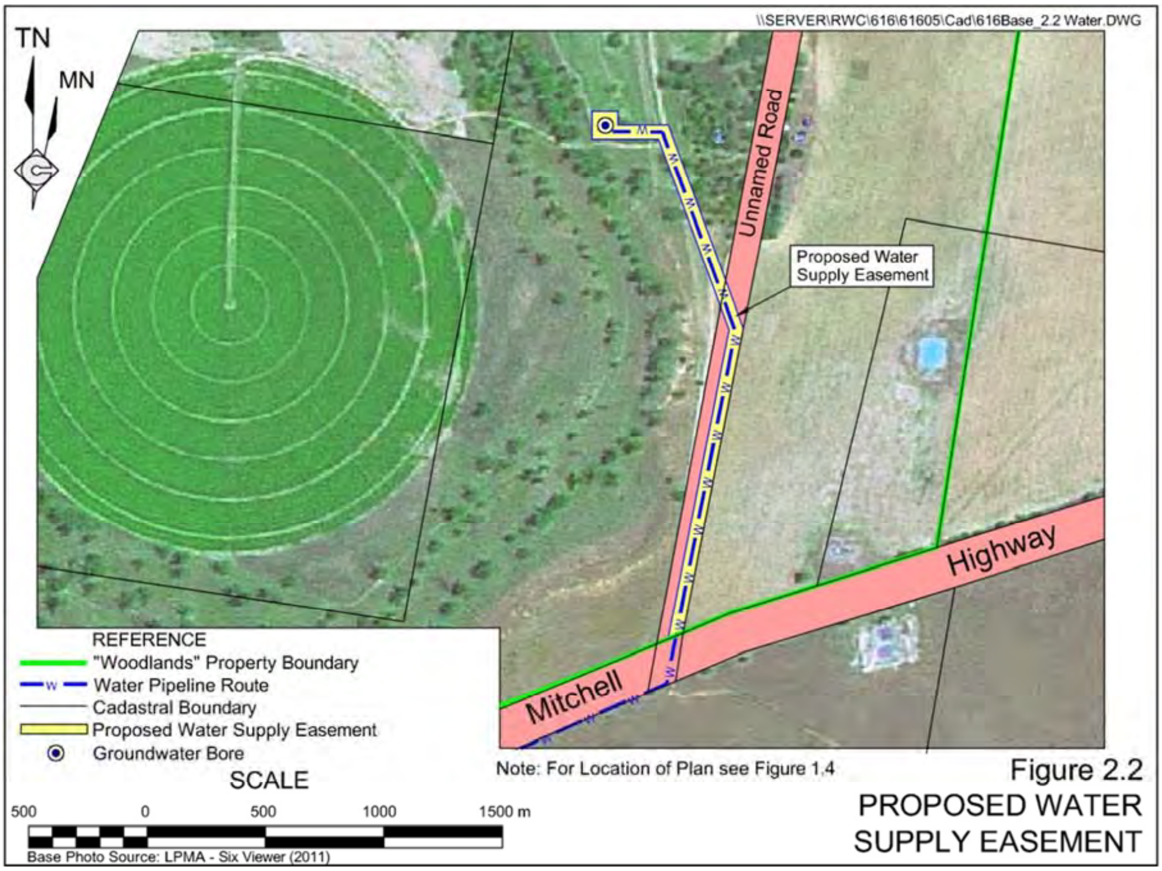



Figure 2.2
PROPOSED WATER SUPPLY EASEMENT

The water pipeline would be constructed of 315mm to 280mm external diameter polyethylene pipe. With the exception of each end of the pipeline and any outlets that may be constructed along the pipeline route, the pipeline would be buried up to 1m below surface. All joins in the pipeline would be butt fusion welded and tests would be undertaken to ensure the integrity of each join before it is buried.

The trench for the pipeline would be excavated using trenchers, mini-excavators and/or backhoes. All equipment would be selected to minimise the disturbance footprint of the trench construction. The trench would be approximately 1.4m deep and 0.6m wide. With the exception of small sections in the vicinity of joins in the pipe, generally no more than 200m of the excavation would be open and unprotected at any one time. In the vicinity of joins in the pipe, small sections of the excavation would remain open to permit pressure testing of all joins in the pipe. While this is occurring, all open sections of the trench would be fenced to prevent any unauthorised or accidental access by persons, livestock or native fauna and appropriately signposted. Once pressure testing is complete, the open sections of the trench would be backfilled and the area of disturbance rehabilitated as soon as practicable. Should other sections of the excavation be required to be left open for any purpose, they would also be fenced and signposted.

The Proponent notes that the proposed water supply pipeline would cross the Mitchell Highway, Main Western Railway Line, sealed and unsealed local roads, several private farm access roads and four identifiable drainage lines. The crossings beneath the highway, local roads, railway and creeks would be constructed using horizontal drilling techniques. This would be undertaken using a drill rig at an appropriate set back from the road, rail line or drainage line to be crossed. The appropriate set back from drainage lines would be 40m with the set back from roads and rail line to be determined in consultation with the relevant authority in each case. The resulting drill hole would be cased to allow later placement of the water supply pipeline. In the case of drainage lines, the drill rig would be setback at least 40m from the top bank of the drainage line. In addition, no significant ground disturbance such as access tracks would be permitted within 20m of the top bank of any drainage line along the alignment of the pipeline.

The Proponent anticipates that it will require less than 1 000ML per year to be drawn from the "Woodlands" bore(s) for operational purposes. Based on the estimated water requirements for the Project (see Section 2.10.3.5), the potential exists for some surplus water to be provided to Tomingley village for stock and domestic use. In addition, following completion of the Project, the pipeline would remain in place and would potentially be available for other classes of development. To accommodate availability of water to future developments, water take-off points may be constructed along the water supply pipeline following completion of the Project and granting of all required approvals and licences.

### 2.2.3 Electricity Transmission Line, Substation, Transformer and Distribution Network

The Proponent would commission the construction of approximately 20km of 66kV electricity-transmission line from an existing Essential Energy operated substation on the southern edge of Peak Hill to a proposed transformer within the Mine Site (**Figure 2.1**). As noted in Sections 2.1 and 2.2.1, the Electricity Transmission Line, which traverses both freehold land and road reserves, would be constructed under approval to be obtained in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979.* The Proponent has negotiated appropriate arrangements with the majority of landowners, occupiers and relevant public authorities to establish the required electricity easement. The electricity transmission line would be constructed in accordance with Essential Energy's *High Voltage Connection Requirements* (CEPG8079 Issue 2).

The Proponent would construct and operate a 66kV to 11kV substation and transformer within the Project Site (**Figure 2.1**). The substation and transformer would comply with Australian Standard AS 2067 - *Switch Gear Assemblies and Ancillary Equipment for Alternating Voltages above 1kV* and would be enclosed within a 2.5m high security fence and appropriate signage would be installed.

Following construction, ownership, operation and maintenance responsibilities for the proposed electricity transmission line would pass to Essential Energy, under approval obtained under Part 5 of the EP&A Act. Essential Energy may continue to operate the line beyond the life of the Project.

Power would be distributed to the processing plant, offices, workshops and other areas by a combination of overhead and underground power lines.

### 2.2.4 Newell Highway Underpass

#### 2.2.4.1 Introduction

The Caloma and Caloma Two Open Cuts are located to the east of the Newell Highway which separates these open cuts from the major Project-related infrastructure, particularly the processing plant and site offices, located to the west of the highway. Notably, the Newell Highway is the principal north-south road transportation route through central NSW and is the principal inland route between Melbourne and Brisbane. As a result, it would not be appropriate for mining-related vehicles to cross the highway and interact with traffic using the highway. The Proponent therefore proposes to construct an underpass beneath the Newell Highway to allow light and heavy mining-related vehicles to travel beneath the highway (see **Figure 2.3**).

#### 2.2.4.2 Underpass Design and Construction Parameters

The underpass would be constructed during the site establishment stage of the Project. **Figure 2.4** presents an indicative cross section and long section through the proposed underpass. In summary, an arch structure would be constructed to allow Project-related vehicles to pass beneath the Newell Highway. The highway underpass arch would be designed to meet the requirements of the Austroads "*Guide to Road Design*" (Austroads, 2009) and be based on a concrete arch structure or precast concrete arches to Australian Standards or Roads and Traffic Authority (RTA) standards. The structure would have the following indicative design parameters.

- Maximum clearance above haul road – 9.15m.
- Width at base of arch – 9.8m.
- Haul truck clearance envelope – 10.6m wide x 7.0m high.
- Tunnel length at base – 45m.
- Distance between top of arch and Newell Highway road surface – 1.5m.

Construction of the underpass would require the construction of a temporary diversion of the Newell Highway, excavation and then re-construction of approximately 30m to 50m of the Newell Highway on its current alignment. Additionally, tapered widening of the edge of the highway would be required for approximately 50m each side of the underpass and re-instatement works would be required where the temporary side track connects to the highway (see Section 2.2.4.3). Where the highway crosses the underpass, it would be constructed in accordance with the RTA *Road Design Guide* to the following design parameters.

- Two lanes of approximately 3.5m width.
- A central median of approximately 1.2m width.
- Two sealed shoulders of approximately 2m width.
- Safety barriers to Australian Standard *AS 5100 – Bridge Design*, where appropriate.
- Pavement design to the satisfaction of the RTA.
- Appropriate verges and road side drainage.

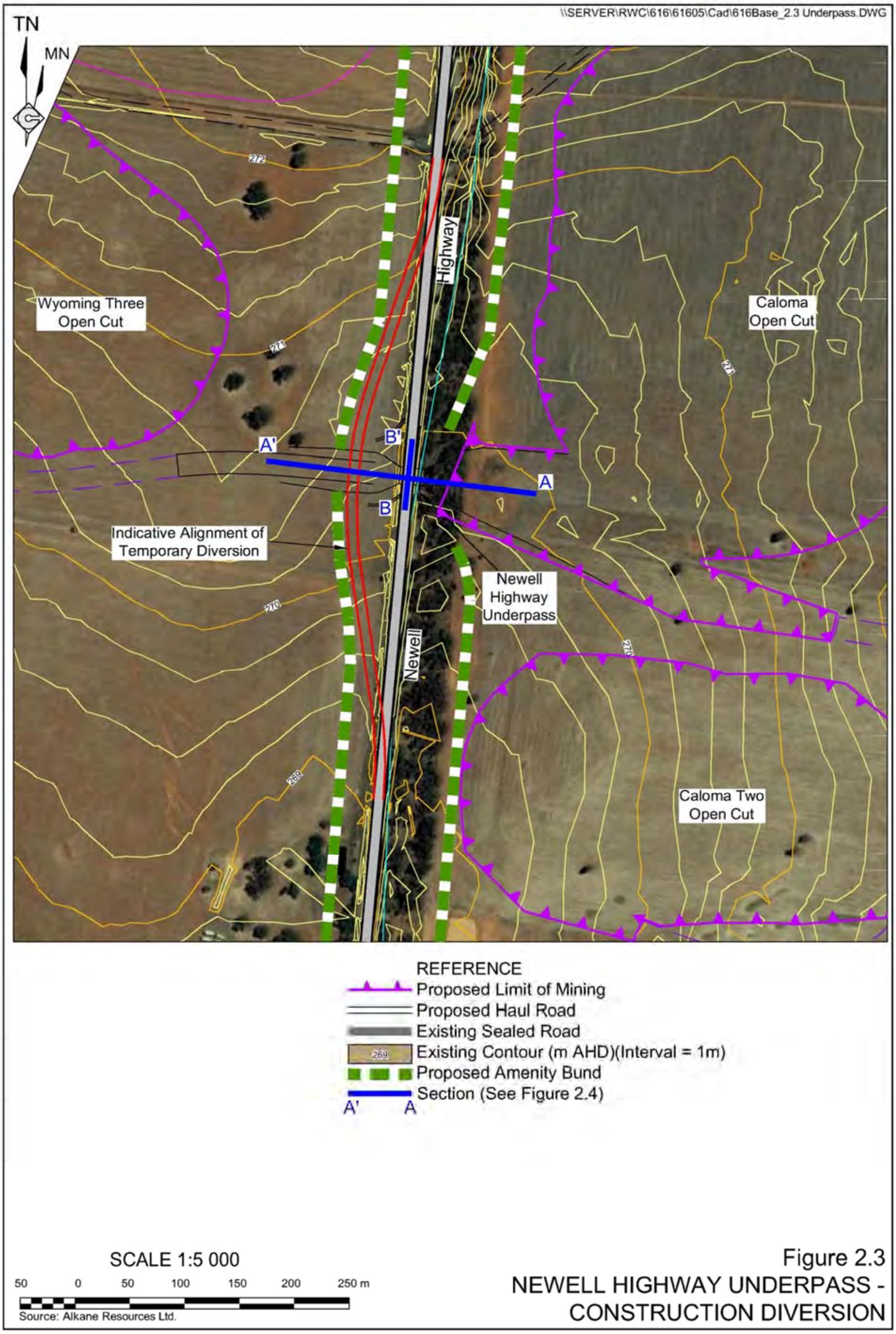



Figure 2.3
NEWELL HIGHWAY UNDERPASS - CONSTRUCTION DIVERSION

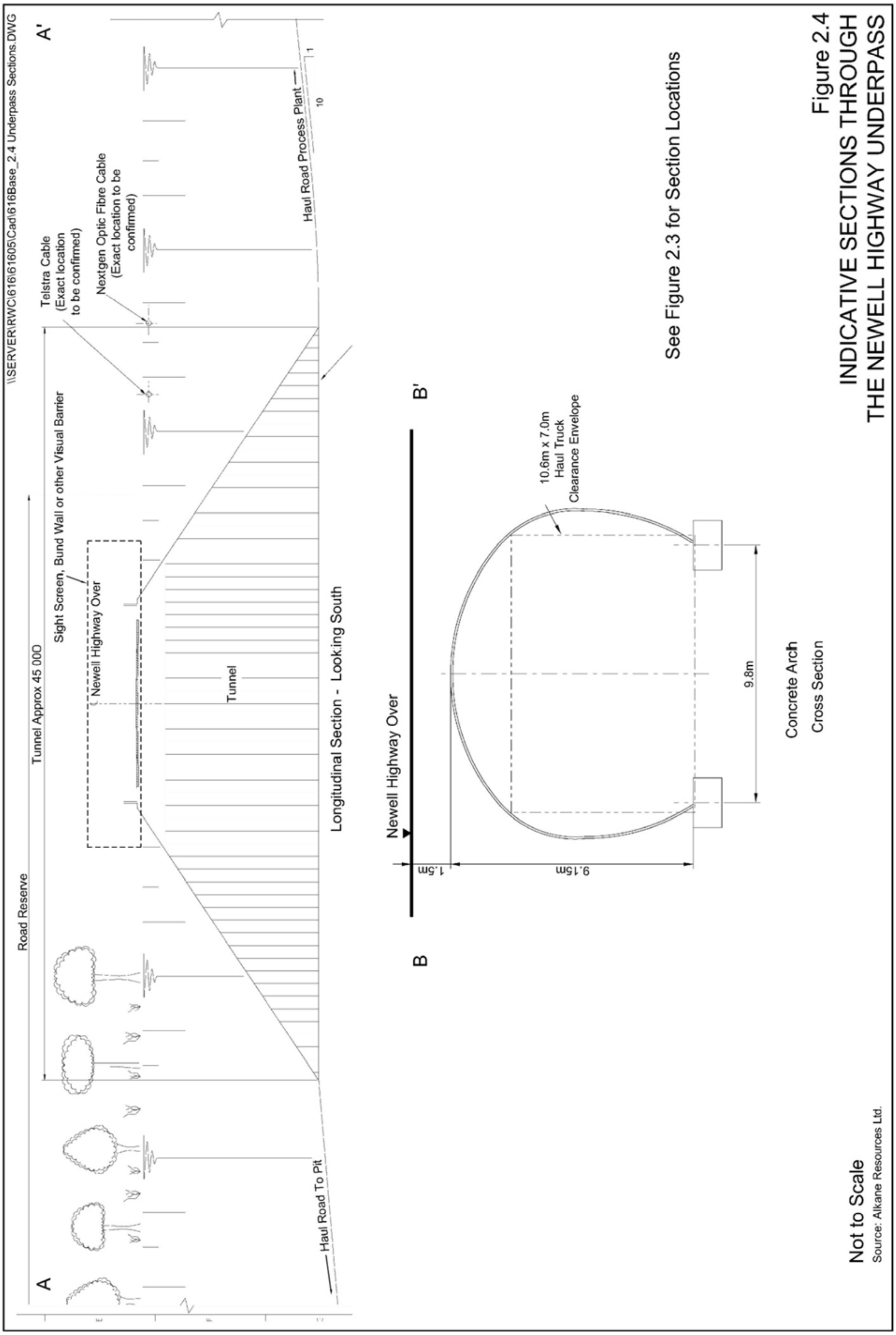



Figure 2.4
INDICATIVE SECTIONS THROUGH
THE NEWELL HIGHWAY UNDERPASS

The underpass would be constructed in such a manner that the haulage ramp from the Caloma Open Cut would merge with the eastern end of the underpass such that the grade of the ramp and eastern approach to the underpass would be relatively constant. As a result, vehicles travelling from the Caloma and Caloma Two Open Cuts to the processing plant would not reach the elevation of the natural surface until they have passed through the underpass.

#### 2.2.4.3 Construction of the Underpass

The underpass would be constructed by a suitably qualified and experienced roads construction contractor approved by the RTA. The Proponent anticipates that construction of the underpass would require approximately 14 weeks.

During construction of the underpass, a temporary side track or construction diversion would be provided to divert traffic around the construction site (**Figure 2.3**). The side track would be constructed for two-way traffic in accordance with RTA requirements and the following indicative design parameters.

- Design speed 90km/h for a signposted 80km/h speed zone throughout in accordance with Austroads (2009).
- Minimum 9m width seal and verge with edge line markings.
- Pavement design to RTA approval with minimum 400mm pavement thickness.
- Provision for oversized loads up to 8m wide.

The Proponent would prepare, in consultation with the Roads and Traffic Authority, a *Construction Road Traffic Management Plan* prior to commencing construction of the side track.

Once no longer required, the Proponent would rehabilitate those sections of the footprint of the side track not required for mining-related purposes.

#### 2.2.4.4 Operation of the Underpass

Following completion of construction operations, the speed limit on the Newell Highway would return to 100km/hr.

The Proponent would prepare and implement a *Mine Site Traffic Management Plan* for Project-related traffic within the Mine Site. This would include measures to ensure safe operation of the underpass. These measures would include the following.

- A speed limit of 40km/hr will be enforced.
- A one-way traffic system that would ensure that haul trucks do not pass within the underpass.
- A warning system to alert drivers of haul trucks approaching the underpass with the truck trays elevated.

### 2.2.5 Main Site Access Road and Intersection

The Proponent would construct a new private road from the Tomingley West Road to the Processing Plant and Office Area (the ‘Main Site Access Road’) (**Figure 2.1**). The road would be located adjacent to the western boundary of the Mine Site and would require construction of an intersection between the Main Site Access Road and the Tomingley West Road, as well as a crossing over Gundong Creek.

The Main Site Access Road would be an all-weather, unsealed two lane road suitable for use by light and heavy vehicles and be sufficiently wide that two loaded semitrailer trucks can pass safely. The road would be elevated approximately 0.3m above the natural ground surface and appropriate road-side drainage would be constructed in accordance with the requirements of *Managing Urban Stormwater – Soils and Construction – Volume 2C Unsealed Roads* published by the Department of Environment and Climate Change in 2008 (DECC, 2008a).

The intersection with the Tomingley West Road would be constructed to the standard identified in Part 4 of Austroads (2009) for rural property access, with the major movements being left-in and right-out. The intersection would be sealed and an approximately 50m length of the Main Site Access Road adjacent to the intersection would also be sealed. The sealing of the section of the access road closest to the Tomingley West Road would assist in minimising the tracking of mud and fine materials from the Mine Site onto the Tomingley West Road.

The Main Site Access Road would cross Gundong Creek, an ephemeral creek with a catchment of approximately $9.1km^2$, at a point 200m west of the Processing Plant and Office Area (**Figure 2.5**). A detailed description of Gundong Creek is provided by Section 4.3.2.2. The crossing has been located to ensure that existing stands of vegetation are retained. The crossing would comprise three, 1.5m wide x 0.9m deep box culverts (in accordance with the recommendations of SEEC, 2011). These culverts would fit within the existing creek bed without the requirement for excessive earthworks of the creek bed and banks, and would have capacity close to the full bank stream flow before overtopping. Inlet and outlet erosion protection to the creek bed and banks would also be incorporated into the design. All disturbed areas would be stabilised and rehabilitated as required to restore the integrity of the riparian corridor. Additionally, the road profile has been designed to facilitate grades suitable for heavy vehicles over the Mine Site bund.

A profile of the proposed Main Site Access Road crossing of Gundong Creek is included in *Appendix 6* of SEEC (2011) identifying the gradients and placement of the culverts in the existing channel. The impact of this profile design on local flooding is considered in Section 4.3.5.3, and indicates that any change in flood height will be almost completely restricted to the Mine Site and would not have a detrimental effect on adjoining landholders. The crossing design would achieve the assessment objectives of the NSW Office of Water '*Guidelines for Controlled Activities*' (see *Appendix 7* of SEEC, 2011).

In the event of a rainfall event in excess of the design criteria of the Main Site Access Road or a flood event that covers the Tomingley West Road, the Main Site Access Road would not be used. An alternative emergency site access road, namely the existing "Wyoming" property access road, would be maintained to allow personnel to access the Mine Site directly from the Newell Highway without the requirement to cross Gundong Creek (**Figure 2.1**).

### 2.2.6 Amenity Bunds and Surface Water Control Structures

#### 2.2.6.1 Introduction

The Proponent has identified that in order to manage visual amenity of the Mine Site from surrounding vantage points and surface water-related aspects of the surrounding environment, a range of amenity bunds and surface water control structures would be required **(Figure 2.5)**.

The amenity bunds would screen the mining activity from passing traffic on the Newell Highway and residents of Tomingley (see Section 4.8.3). Bunds constructed for the purpose of providing acoustic attenuation of Mine Site activities are discussed separately in Sections 2.5.4 and 4.2.5.

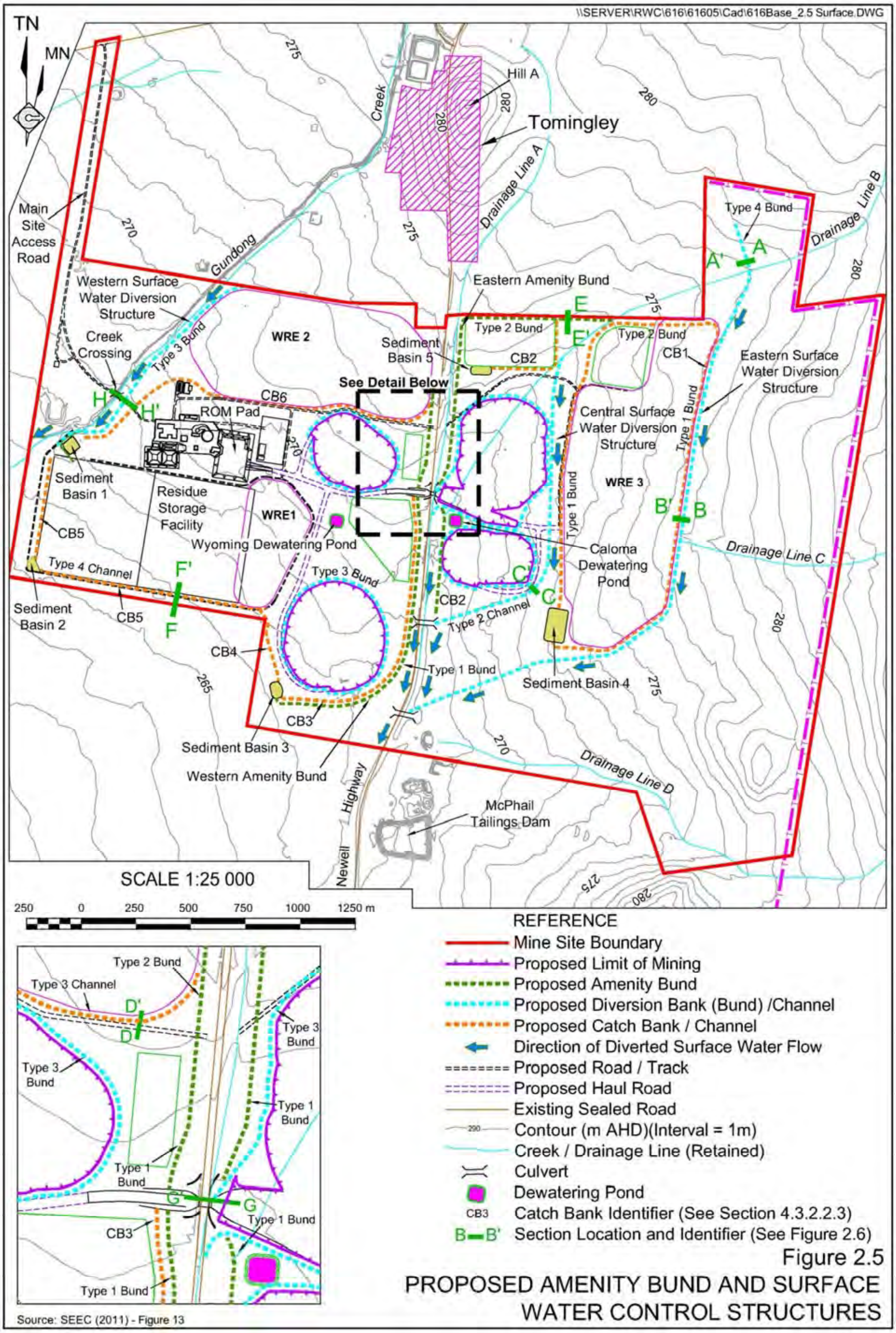



Figure 2.5
PROPOSED AMENITY BUND AND SURFACE WATER CONTROL STRUCTURES

The surface water control structures to be constructed would include the following.

- Diversion banks and channels for diverting surface water from undisturbed sections of the Mine Site away from disturbed sections.
- Catch banks and channels for containing potentially sediment- or salt-laden water within the disturbed sections of the Mine Site.
- Sediment basins for retaining potentially sediment-laden water for a sufficient period until it may be discharged in accordance with the site's Environment Protection Licence.

During construction of the amenity bunds and surface water control structures, soil would initially be removed as described in Section 2.3.3.3. Channels and basins would be excavated with the removed subsoil and waste rock removed used to construct the associated bund. Where no channel is required, or where supplementary material is required, the bunds would be constructed using subsoil and/or waste rock material excavated from the open cuts. Each of the structures would then be shaped, erosion protection works installed (where required), subsoil and topsoil spread and the final landform revegetated. Each of the amenity bunds and surface water control structures would be retained in the final landform and have been designed to be stable in the long term.

The Proponent anticipates that the initial revegetation program for the amenity bunds and surface water control structures would be used as a trial for later, larger-scale revegetation programs within the Mine Site.

Section 2.2.6.2 provides the design and construction details for the surface water control structures identified on **Figure 2.5**. Section 2.2.6.3 provides the design and construction details for the amenity bunds.

#### 2.2.6.2 Surface Water Control Structures

#### Design and Construction

**Figure 2.5** presents the location of each of the proposed surface water control structures. In summary, four classes of bunds (referred to as Types 1, 2, 3 and 4 bunds) and four classes of channels (referred to as Types 1, 2, 3 and 4 channels) have been identified. Cross-sections A-A' to H-H' (identified on **Figure 2.5**) of **Figure 2.6** provide an overview of the design parameters of each of the proposed bunds and channels. These have been designed by Mintrex who state that each has been designed to divert surface waters to an Annual Recurrence Interval rainfall event of 1 in 100 years (Mintrex, 2009).

The following sub-sections provide an overview of the key surface water control structures of the Mine Site.

#### Eastern Surface Water Diversion Structure

The Eastern Surface Water Diversion Structure would be constructed to divert surface water flows from the northeast, east and southeast of Waste Rock Emplacement 3 to the south of the proposed areas of disturbance. As illustrated on **Figure 2.6**, it would comprise a combination of a Type 1 and Type 4 bund and a Type 1 channel. It is noted that the depth of the Type 1 channel would vary along the length of the channel to a maximum of 3.4m deep. The eastern toe of Waste Rock Emplacement 3 would be constructed in a manner that is consistent with the proposed design of a Type 1 bund.

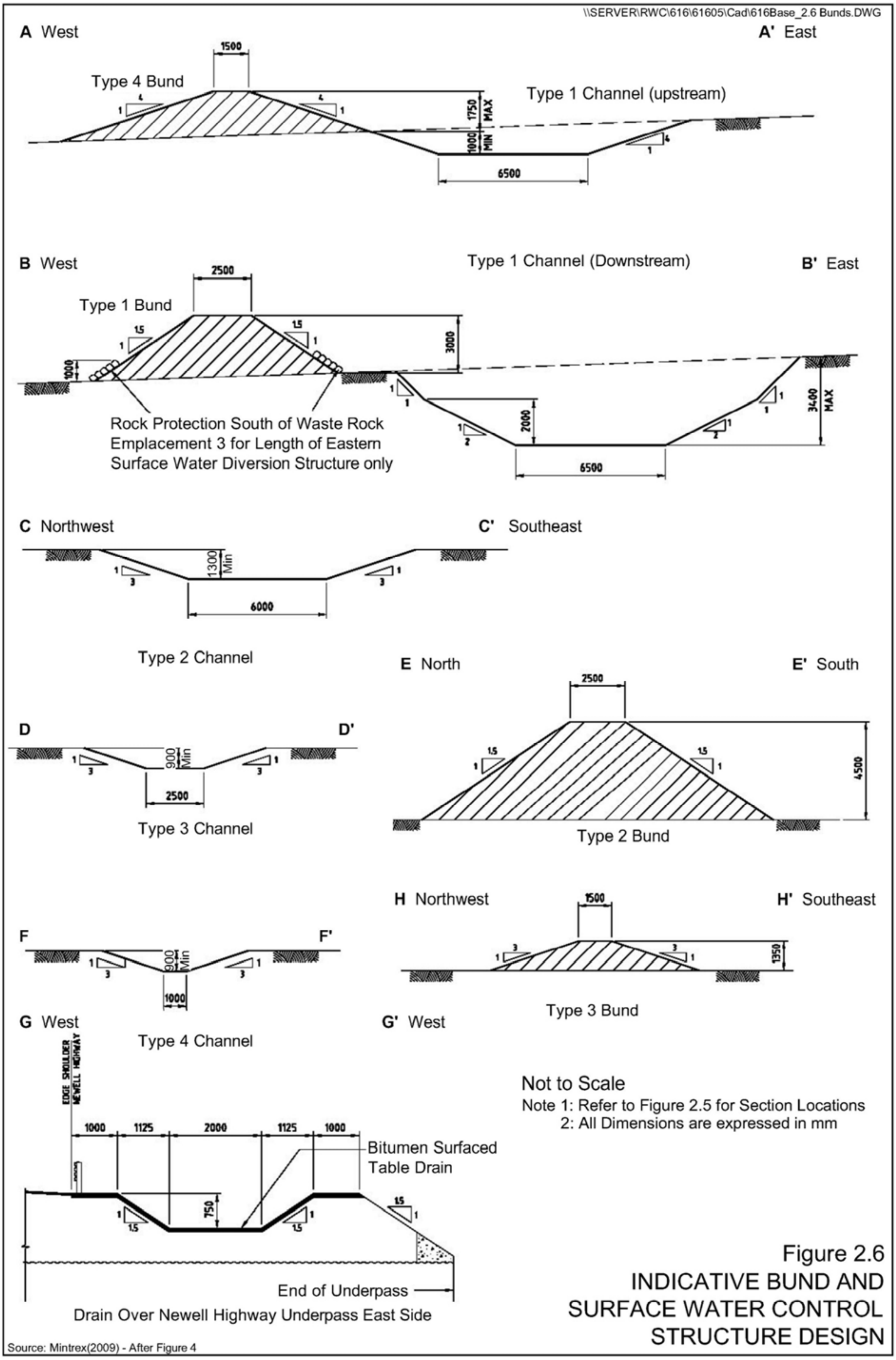



Figure 2.6
INDICATIVE BUND AND SURFACE WATER CONTROL STRUCTURE DESIGN

This structure would provide protection to the open cuts to prevent a sudden in-rush of water and would ensure that clean surface water, namely surface water from undisturbed sections of the Mine Site and surrounding areas is separated from potentially sediment-laden water, namely surface water from disturbed sections of the Mine Site. An assessment of the surface water aspects of the environment is provided in Section 4.3.5.

### Other Bunds and Channels

Cross-section C-C' (**Figure 2.6**) provides the design features of a Type 2 channel structure which would be constructed between the Caloma Open Cut and Waste Rock Emplacement 3 to divert surface water away from disturbed sections of the Mine Site (**Figure 2.5**). The Type 2 channel would be approximately 1.3m deep, with a width at the base of approximately 6m and side slopes of approximately 1:3 (V:H).

Cross-section D-D' (**Figure 2.6**) provides the design features of a Type 3 channel which would be constructed to the north of the Emergency Access Road to divert surface water from the northern section of the Mine Site, in particular Waste Rock Emplacement 2, to Sedimentation Basin 1 (SB1) (**Figure 2.5**). The Type 3 channel would be approximately 0.9m deep, with a width at the base of approximately 2.5m and side slopes of approximately 1:3 (V:H).

Cross-section H-H' (**Figure 2.6**) provides the design features of a Type 3 bund which would be constructed in the following locations (**Figure 2.5**).

- Surrounding each of the proposed open cuts, including adjacent to the haul road passing through the Newell Highway Underpass.
- Between the southern end of the Western Amenity Bund and Waste Rock Emplacement 1.
- To the east of Gundong Creek (Western Surface Water Diversion Structure).

The Type 3 bunds would be between approximately 1.3m and 1.4m high, have side slopes of approximately 1:3 (V:H) and a crest width of approximately 1.5m and would divert surface water away from and/or retain potentially sediment-laden water within disturbed sections of the Mine Site. In addition, these bunds would prevent inadvertent vehicular access to the upper crest of the open cuts.

Cross-section F-F' (**Figure 2.6**) provides the design features of a Type 4 channel which would be constructed in the following locations (**Figure 2.5**).

- To the west of Wyoming One Open Cut to divert potentially sediment-laden water to Sediment Basin 3. To the south and west of the RSF to divert potentially sediment-laden water to Sediment Basin 2.
- Down slope of the soil stockpile to the north of Caloma Open Cut to divert potentially sediment-laden water to Sediment Basin 5.

The Type 4 channels would be approximately 0.9m deep, with a width at the base of approximately 1m and side slopes of approximately 1:3 (V:H). These structures would allow surface water in the vicinity of the RSF to be kept separate from surface water from other sections of the Mine Site.

A bitumen surfaced table drain (Cross-section G-G' of **Figure 2.6**) would be constructed on the eastern side of the Newell Highway over the proposed underpass to permit surface water to flow within the road reserve to the south of the underpass (**Figure 2.5**).

### Sediment Basins

Five sediment basins would be constructed within the Mine Site as indicated on **Figure 2.5**. The capacity of these basins has been determined by SEEC (2011) who undertook the surface water assessment for the Project (Part 2 of the *Specialist Consultant Studies Compendium*). SEEC (2011) state that the capacity of each basin have been determined in accordance with the requirements of Landcom (2004) and DECC (2008b) for the 5-day, 90$^{th}$ percentile rainfall depth. The calculated basin capacities are as follows.

- Sediment Basin 1 – 19 700$m^3$.
- Sediment Basin 2 – 2 900$m^3$.
- Sediment Basin 3 – 7 000$m^3$.
- Sediment Basin 4 – 14 880$m^3$.
- Sediment Basin 5 – 1 840$m^3$.

The sediment basins would be managed in accordance with the recommendations presented in *Section 7.3.1* of SEEC (2010). In summary, these measures would include the following.

- The sediment basins would be generally maintained in an empty state, with in-flowing water preferentially used within the Mine Site, as far as practicable, for operational purposes such as dust suppression and processing operations.
- If required, water would only be discharged from the sediment basins when the concentration of suspended sediment is less than that specified in the Environment Protection Licence.
- A sediment storage zone would be maintained within each basin and accumulated sediment would be removed, as required.
- All sediment basins would be inspected regularly and following any rainfall event exceeding 5mm.

### Mine Dewatering Ponds

Two mine dewatering ponds would be constructed as shown on **Figure 2.5**. These ponds would only receive water pumped from the open cut or underground mining operations, as required. Given the saline nature of the groundwater, each dewatering pond would be constructed using clay of low to medium plasticity which, when compacted, has a permeability of less than 1 x $10^{-9}$m/sec (classified as very low permeability). These ponds would not receive surface water flows. The accumulated water within the dams would not be discharged and would be used for mining-related purposes within the Mine Site Amenity Bunds

## 2.2.6.3 Amenity Bunds

Type 1 and Type 2 bunds (**Figure 2.6**) would be constructed to the east and west of the Newell Highway and to the north of the Caloma Open Cut (**Figure 2.5**). Type 1 bunds (see cross section B-B’ of **Figure 2.6**) constructed to a height of 3m would be located to the south of the emergency access road from both the Caloma and Wyoming sides of the Mine Site. Type 2 bunds would be constructed to the north of these emergency access roads to where the bund joins Waste Rock Emplacement 2 (on the western side of the Mine Site) and Waste Rock Emplacement 3 (on the eastern side of the Mine Site). The bunds would be constructed in a manner that would, together with the topsoil stockpiles and Waste Rock Emplacements 2 and 3, limit the visual and noise impacts of the Project on surrounding residents and limit the visibility of the Mine Site for motorists travelling on the Newell Highway.

It is noted that Waste Rock Emplacements 2 and 3 would initially be constructed with a northern face that would act as an amenity bund approximately 15m high. In line with the design provided by **Table 2.5** (Section 2.5.3), the initial amenity bund component of these two waste rock emplacements would have outer slopes of 1:3(V:H). The inner slopes (which would not be visible from vantage points off the Mine Site) would be retained at the angle of repose of the waste rock.

### 2.2.7 Relocation of Power Lines

As indicated on **Figure 2.1,** a 22kV electricity transmission line is currently located in close proximity to the proposed Caloma and Caloma Two Open Cuts and would be relocated.

In summary, approximately 1.8km of the 22kV line would be constructed from a point on the northern boundary of the Mine Site along the western side of the Newell Highway to a point approximately 550m north of southern Mine Site boundary. The relocated line would, with two exceptions, be located on property that owned by the Proponent. The line would, however, be required to cross the Newell Highway twice. Approximately 1.7km of the existing 22kV line would be removed as indicated on **Figure 2.1**.

In addition, approximately 1.3km of the existing line which supplies the "Wyoming" homestead in the vicinity of the Wyoming Three Open Cut would be removed. This line would not be relocated.

### 2.2.8 Relocation of Telecommunication Cables

The following telecommunication cables are located within the Mine Site.

- Nextgen Network Pty Limited Fibre Optic Cable - buried inside "Wyoming" property boundary on the western side on the Newell Highway (Route SB2, Section R1:02).
- Telstra copper cable buried within the "Wyoming" property boundary (west of the Newell Highway).
- Disused Telstra copper cable buried in the eastern section of the Newell Highway road reserve.

These cables would be disturbed during construction of the Newell Highway underpass. As a result, the Proponent proposes to relocate an approximately 7.2km section of the Nextgen Network cable as indicated on **Figure 2.7** prior to commencing construction operations for the Newell Highway underpass. The Proponent has consulted with Nextgen Network and has confirmed that the cable would be relocated by an appropriately experienced and licensed contractor and the relocated cables would be installed to the appropriate standard.

The Telstra cable located within the "Wyoming" property boundary would be relocated during the construction of the Newell Highway underpass. The disused Telstra cable would not be relocated. The Proponent has consulted with Telstra Network Integrity (Asset Re-location) in relation to this matter. It is expected that following inspection of the abandoned Tomingley–McPhail buried copper line, written permission to terminate the line north of the proposed underpass will be provided as it is highly unlikely this line would ever need to be re-activated.

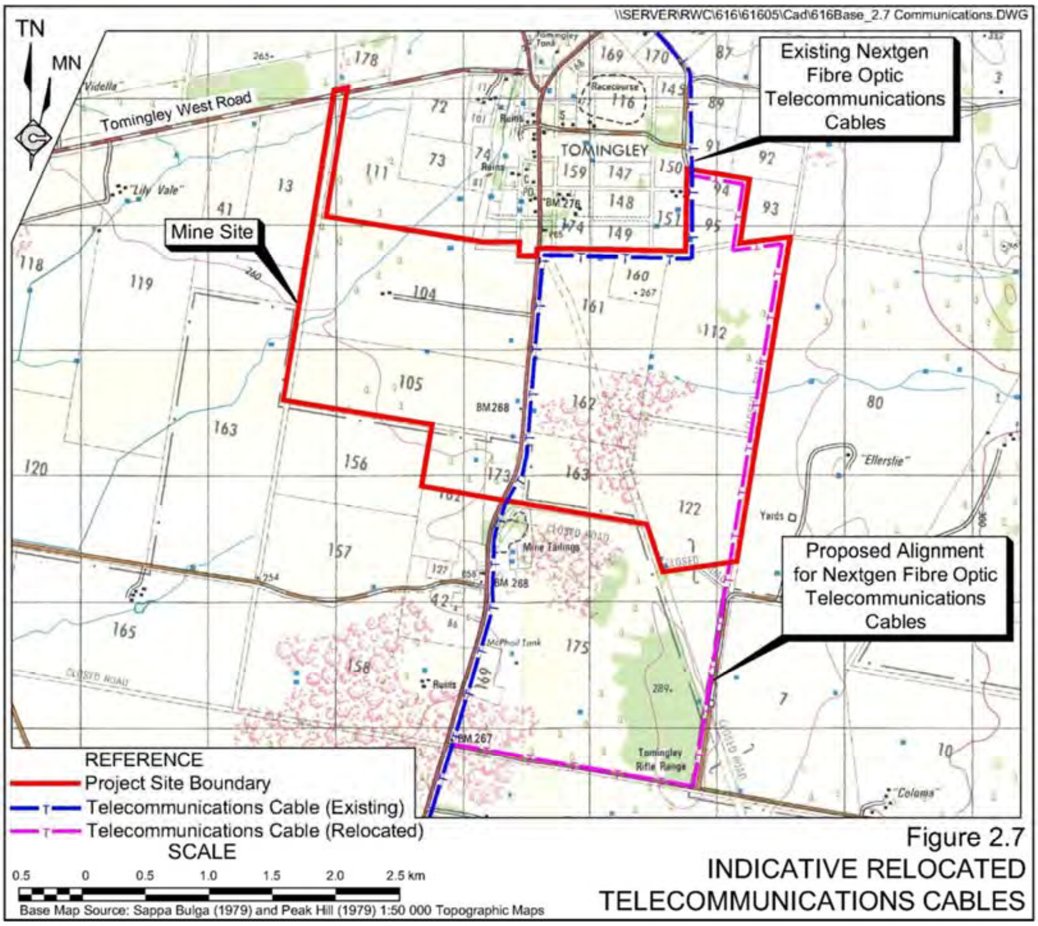



Figure 2.7
INDICATIVE RELOCATED TELECOMMUNICATIONS CABLES

## 2.3 SITE PREPARATION

### 2.3.1 Introduction

This section describes the activities that would be undertaken in preparation for mining operations, namely, removal of vegetation and soil stripping and stockpiling operations.

### 2.3.2 Vegetation Clearing

A large proportion of the Mine Site was cleared of native vegetation between the 1880s and the 1980s. However, of the approximately 156.3ha of remnant vegetation remaining within the Mine Site, approximately 21.6ha would need to be cleared of remnant native vegetation for the Project, comprising:

- approximately 2.7ha of Inland Grey Box – Poplar Box – White Cypress Pine tall woodland scattered across the Mine Site;
- approximately 0.9ha of Fuzzy Box – Inland Grey Box community in the vicinity of the Wyoming One Open Cut; and
- approximately 18.0ha of Belah / Black Oak Western Rosewood, Wilga Woodland community in the vicinity of the Caloma Two Open Cut and Waste Rock Emplacement 3.

It should be noted that the density of mature trees within the Belah/Black Oak Western Rosewood, Wilga Woodland community within the disturbance footprint has been extensively reduced and modified by historic ringbarking activities.

Approximately 0.7ha of planted Mugga Ironbark would also require clearing from within the footprint of Waste Rock Emplacement 2. Approximately 12.9ha of River Red Gum riverine woodland occurring in the vicinity of the Main Site Access Road and Waste Rock Emplacement 2 would remain undisturbed.

During vegetation clearing operations, larger vegetation would be removed using a bulldozer with its blade positioned just above the surface. It is noted that two modified trees with Indigenous heritage significance were identified during the Aboriginal heritage field survey (see Section 4.6.7.5). These trees would be removed and retained in accordance with the procedures identified in Section 4.6.8.

All other tree trunks would be stored for later use in rehabilitation activities. Wherever possible, available seed would be harvested prior to clearing.

Ground cover vegetation would be removed with the topsoil to maximise the retention of the seed bank and nutrients within the soil, as well as to minimise opportunities for erosion and dust lift-off between removal of the larger vegetation and soil stripping.

## 2.3.3 Soil Stripping

### 2.3.3.1 Introduction

Soil materials within those sections of the Mine Site that would be disturbed have been assessed by Sustainable Soils Management. A full description of the soils assessment is provided in SSM (2011) (Part 8 of the *Specialist Consultant Studies Compendium*) and summarised in Section 4.12.3. The following sections identify the soil categories identified within and surrounding the Mine Site, the proposed maximum stripping depths, the volumes of soil that would be available for use during rehabilitation and the procedures that would be used during soil stripping and stockpiling operations.

### 2.3.3.2 Soil Units, Stripping Depths and Inventory

Six soil units have been identified within and surrounding the Mine Site as follows (**Figure 2.8**).

- Red Dermosol – This soil unit is characterised by a red, silty clay loam topsoil over a light clay subsoil.
- Grey Dermosol – This soil unit is characterised by a variety of sandy and silty material in layers up to 30cm, deposited as alluvial material from Gundong Creek.
- Brown Dermosol – This soil unit is similar to the Red Dermosol, however, an electrical geophysical survey indicated that this material had a very low conductivity.
- Sodic Dermosol – This soil unit is characterised by a silty clay loam topsoil over an alkaline, light grey subsoil.
- Sodic Gilgaied Dermosol - This soil unit is characterised by a strongly alkaline, uniform soil profile that has been extensively gilgaied.
- Rudosol – This soil unit is characterised by thin loamy soil with minimal profile development.

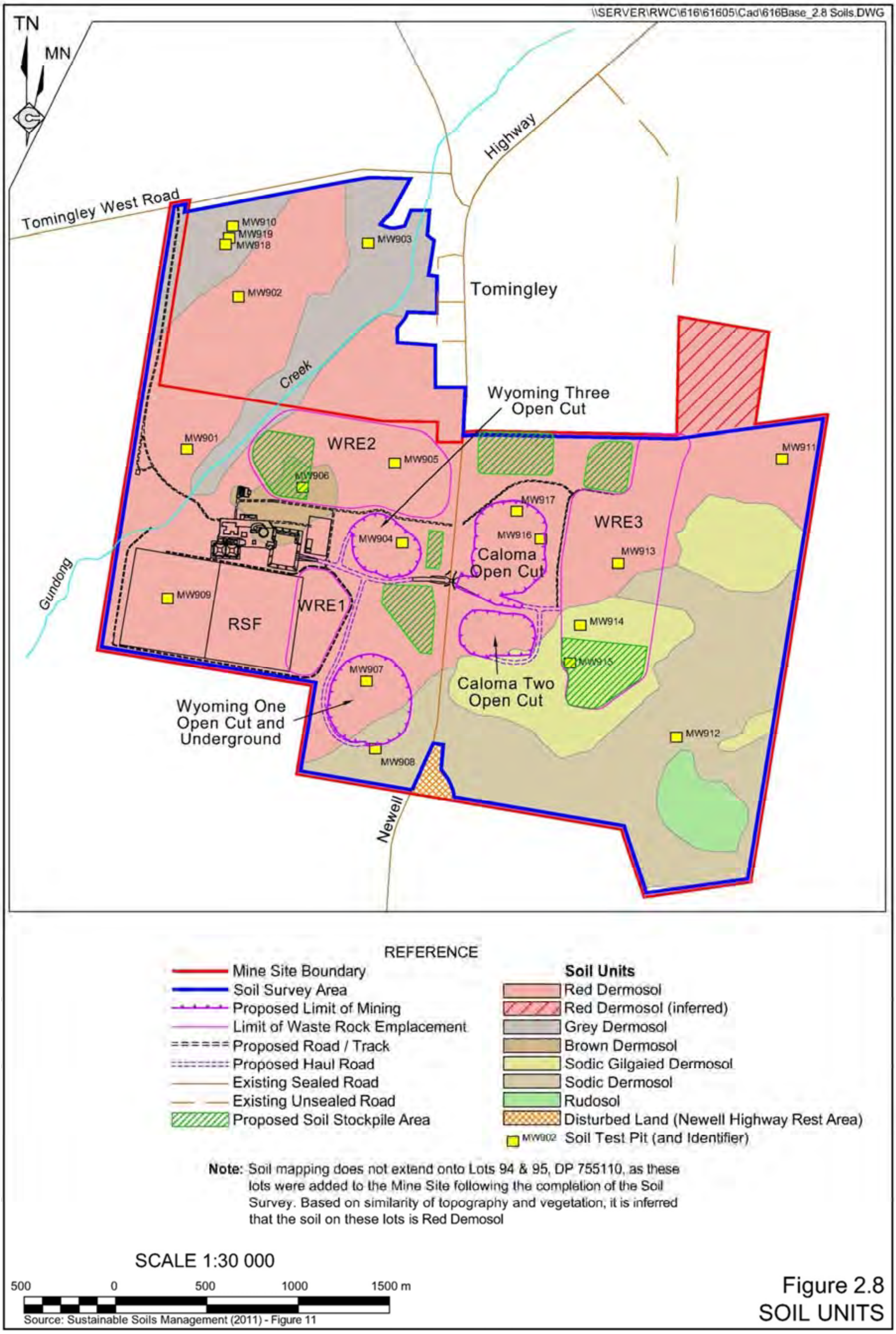



Figure 2.8
SOIL UNITS

It is noted that soil mapping does not extend onto Lots 94 and 95, DP755110 (**Figure 1.2**) as these two lots were added to the Mine Site following the completion of the soil survey. However, based on the similarity of topography and vegetation on the land to the immediate south, it is inferred that this soil is also Red Dermosol (the main soil type which occurs across the Mine Site).

**Table 2.1** presents the available stripping depths and approximate volumes of each soil unit that could be stripped and available for rehabilitation operations based on recommendations provided in SSM (2011). It is noted that no rudosol soils would be disturbed through the life of the Project.

**Table 2.1**
**Indicative Soil Inventory**

| Soil Unit | Area to be disturbed (ha) | Topsoil | | Subsoil | |
|---|---|---|---|---|---|
| | | Proposed Maximum Stripping Depth (cm) | Maximum Available Volume ($m^3$) | Proposed Maximum Stripping Depth (cm)[1,2] | Maximum Available Volume ($m^3$)[3] |
| Red Dermosol | 142 | 30 | 426 000 | 20 to 70 | 639 000 |
| Grey Dermosol | 0.4 | 20 | 800 | - | - |
| Brown Dermosol | 16.0 | 50 | 80 000 | - | - |
| Sodic Dermosol | 20.0 | - | - | - | - |
| Sodic Gilgaied Dermosol | 2.7 | - | - | - | - |
| Total | 181.1 | | 506 800 | | 639 000 |

Note 1: Below Base Of Topsoil.
Note 2: Maximum Stripping Depth Determined By Presence of Mottling.
Note 3: Assumes average depth to mottling is 45cm.
Source: Modified after SSM (2010) – Table 10

It is noted that, with the exception of soil material placed on benches, the footprints of the proposed open cuts would not be rehabilitated. As a result, the volume of soil materials required for rehabilitation purposes would be significantly less than the maximum available volume.

The Proponent estimates that approximately 410 000$m^3$ of topsoil would be required for rehabilitation operations. As a result, the Proponent proposes to strip topsoil materials to the following approximate depths.

- Roads, buildings, processing plant – up to 30cm.
- Open cuts, waste rock emplacements, RSF, ROM pad and other processing infrastructure footprints – up to 30cm.
- Bunds and surface water diversion structures – 20cm.

The Sodic Dermosol and Sodic Gilgaied Dermosol soils, as identified on **Figure 2.8**, would not be stripped where these are to be overlain by Waste Rock Emplacement 3, internal roads or bunds associated with surface water control structures. Where stripping is required to develop Caloma Two and Wyoming One Open Cuts or the Eastern Surface Water Diversion Structure channel, the stripped soil would be placed within the appropriate waste rock emplacement.

Once the topsoil is stripped from the Red Dermosol soil type, subsoil would be stripped to a depth of 70cm below the natural land surface, or a depth where mottled soil is observed.

#### 2.3.3.3 Soil Stripping Procedures

During soil stripping operations, the following procedures would be implemented.

- Strip soil material to the depths identified in Section 2.3.3.2.
- Strip both topsoil and subsoil within the footprints of the proposed open cuts, waste rock emplacements, RSF, amenity bunds and the eastern surface water diversion structure.
- Strip topsoil only within the footprints of all other areas of disturbance.
- Ensure that soil materials are not stripped when in either excessively dry or wet.
- Grade or push soil into windrows using graders or dozers for later collection by elevating scrapers or loading into trucks by front-end loaders to minimise compaction of soil materials.
- Use soil materials immediately in areas undergoing progressive rehabilitation, where practicable. Where this is not practicable, place soil transported by truck directly into storage or place soil transported by scrapers in thick "lifts" to minimise compaction.

#### 2.3.3.4 Soil Stockpile Management

**Figure 2.8** identifies six soil stockpile areas within the Mine Site. These would be located as follows.

- To the southeast of the Wyoming Three Open Cut.
- To the north of the Caloma Open Cut.
- To the northwest of Waste Rock Emplacement 3.
- In the southern section of Waste Rock Emplacement 3 (temporary stockpile).
- In the western section of Waste Rock Emplacement 2 (temporary stockpile).

In addition, soil materials would be effectively stockpiled in the construction of amenity and other bunds within the Mine Site.

The soil stockpiles within the footprints of Waste Rock Emplacements 2 and 3 would be temporary stockpiles and would be utilised during the life of the Project for progressive rehabilitation. The soil stored within the temporary stockpiles would be used preferentially for Mine Site rehabilitation with the remaining soil stockpiles only used once the soil contained within the temporary stockpiles is exhausted. Soil material 'stockpiled' within the amenity bunds would not be used during rehabilitation operations.

The following soil stockpile management procedures would be implemented.

- Minimise, as far as practicable, the operation of machinery on soil stockpiles to minimise compaction.
- Ensure that soil stockpiles have a maximum height of 5m comprising a maximum of 3m of subsoil, overlain by a maximum of 2m of topsoil.
- Leave the surface of the stockpile with an even but roughened surface to assist in erosion control and seed germination and emergence.
- Establish an appropriate vegetative cover on all soil stockpiles to be retained for more than 3 months.

# 2.4 MINING OPERATIONS

## 2.4.1 Introduction

Project approval is sought for the extraction of ore and waste rock from within the Caloma and Caloma Two, Wyoming Three and Wyoming One Open Cuts. This section provides an overview of the layout of each of the open cuts, a description of the proposed mining methods, mining rate and sequence and the equipment that would be used during mining operations.

## 2.4.2 Layout of the Proposed Open Cuts

**Figure 2.9** presents an overview of the layout of each of the proposed open cuts.

### Caloma Open Cut

The footprint of the Caloma Open Cut would be an irregular ellipse, with a long axis of approximately 580m and a width of approximately 400m. The maximum depth of the open cut would be approximately 180m below the natural land surface. One branch of the access ramp would be constructed in such a manner to enable vehicles using the ramp to enter the Newell Highway underpass from the east without first climbing to the natural surface. The other branch of the access ramp would permit transportation of waste rock from the open cut to Waste Rock Emplacement 3.

### Caloma Two Open Cut

If proven viable, the estimated footprint of the Caloma Two Open Cut would be an irregular ellipse, with a long axis of approximately 400m and a width of approximately 250m. The maximum depth of the open cut would be approximately 100m below the natural land surface. Ore and waste rock material would be transported to the surface via a single haul road. Ore material would then be transported via the Caloma Open Cut access ramps to the processing plant.

### Wyoming Three Open Cut

The footprint of the Wyoming Three Open Cut would be an irregular, east-west orientated ellipse with a long axis of approximately 420m and a width of approximately 270m. The maximum depth of the open cut would be approximately 100m below the natural land surface.

### Wyoming One Open Cut

The footprint of the Wyoming One Open Cut would be an irregular ellipse with a long axis orientated northwest of approximately 475m and a width of approximately 430m. The maximum depth of the open cut would be approximately 180m below the natural land surface.

## 2.4.3 Open Cut Mining Method

### 2.4.3.1 Introduction

This sub-section provides a summary of the open cut mining methods that would be employed throughout the life of the Project. These methods would be broadly similar in each of the proposed open cuts and are shown schematically in **Figure 2.10**.

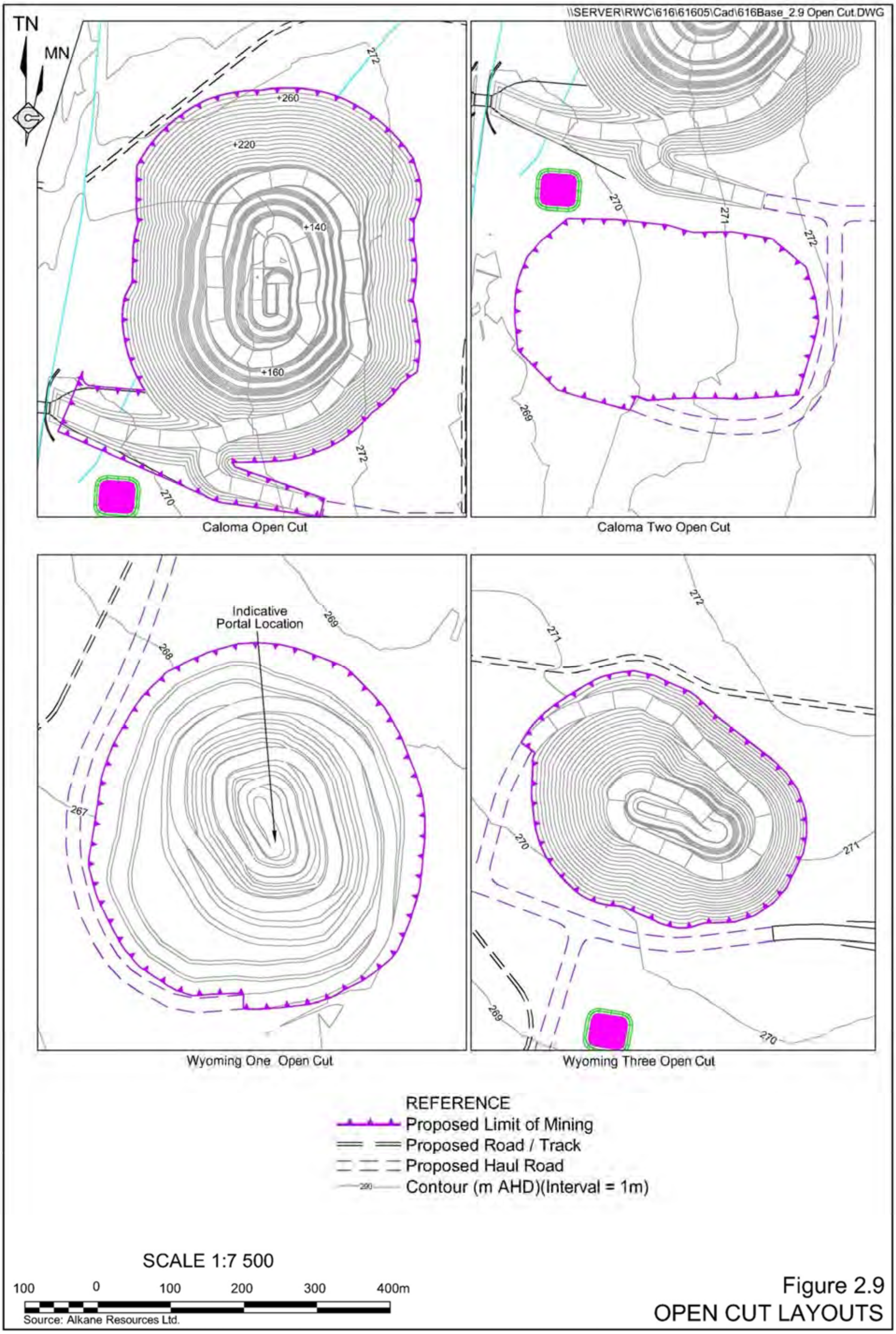



Figure 2.9
OPEN CUT LAYOUTS

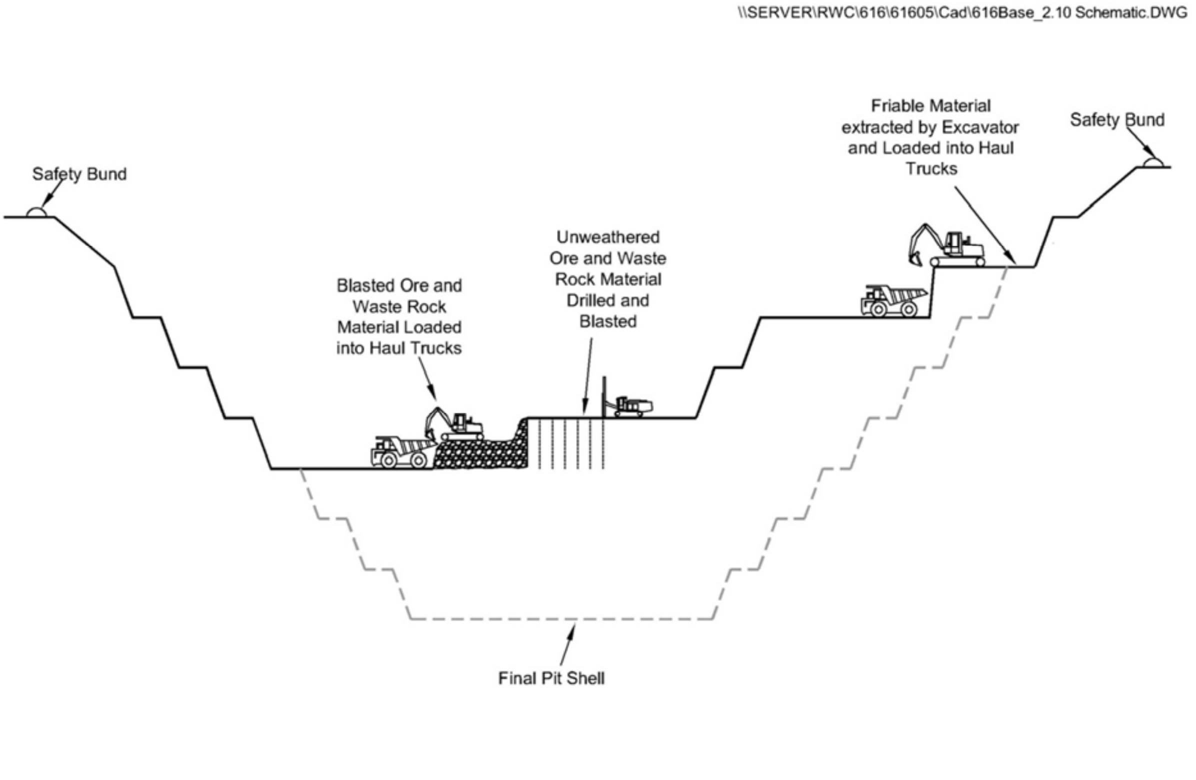



Figure 2.10
SCHEMATIC OPEN CUT MINING METHOD

#### 2.4.3.2 Grade Control Drilling

Grade control drilling would be undertaken in all areas of the open cuts with the exception of the unmineralised overburden. This drilling would be undertaken well ahead of planned mining to more precisely define the boundary between ore, low grade ore and waste rock. Grade control drilling in friable material, namely material that can be freely extracted may be undertaken using an aircore or reverse circulation drill rig. Grade control within non-friable material is anticipated to be undertaken using reverse circulation grade control drilling methods.

All grade control samples would be transported to an off-site laboratory for analysis.

#### 2.4.3.3 Extraction of Friable Material

Following removal of vegetation and soil material as described in Sections 2.3.2 and 2.3.3, mining would commence with the removal of friable material, including both cover material and weathered basement rocks. This material would either be lightly fragmented using drill and blast methods (see Section 2.4.3.4) and extracted using an excavator, or alternatively, ripped and pushed up using a bulldozer. Extracted material would be loaded into haul trucks for transportation to the ROM pad, the low grade stockpile, waste rock emplacement or bund. The Proponent anticipates that friable material will occur from the base of the subsoil to a depth of between 5m and 60m below the surface.

### 2.4.3.4 Drill and Blast Operations

Drill and blast methods would be used to fragment material that cannot be excavated using a bulldozer or excavator alone. All drill and blast operations would be supervised by a suitably qualified and experienced blasting engineer or shot firer. Blast holes would be drilled using up to three hydraulic drill rigs equipped with dust and noise suppression equipment. **Table 2.2** provides for the indicative blast design parameters to be applied on the Mine Site.

**Table 2.2**
**Indicative Blast Design Parameters**

| | Friable Material | Unweathered Material |
|---|---|---|
| Blasthole Diameter | 89mm | |
| Blasthole Depth | 5.5m to 11.0m | |
| Blasthole Spacing | 4m x 4m | 3m x 3m |
| Depth of Stemming | 1.9m | |
| Area of Blast | 1 600m$^2$ | 900m$^2$ |
| Size of Blast | 8 000m$^3$ | up to 25 000m$^3$ |
| Bulk Explosive Type | ANFO | |
| Powder Factor | 0.25kg/bcm | 0.80kg/bcm |
| Maximum Instantaneous Charge (MIC) | Up to 68kg (generally 30kg) | |
| Initiation System | Nonel | |
| Note: bcm = bank cubic metre | | |
| Source: Alkane Resources Ltd | | |

The Proponent would ensure that all relevant blasting criteria are achieved at surrounding non Project-related residences and other sensitive receivers. The Proponent would also ensure that flyrock does not pose a threat to motorists using the Newell Highway or to neighbouring properties through appropriate management of blasting operations. This would be achieved through appropriate orientation of blasts away from the highway. Section 4.10.5 and *Part 1* of the *Specialist Consultant Studies Compendium* provide further detail on the management of blasts to limit the generation of fly rock.

Detonators and boosters would be stored within magazines within a designated Magazine Area. This area would be constructed in accordance with Australian Standard *AS2187 – Explosives Storage, Transport and Use*. The Magazine Area would be secured by a 1.8m high security fence topped with barbed wire and a lockable gate. In addition, the Magazine Area would be the subject of regular inspection by security personnel. The Magazine Area would be likely to be transportable structures, which would be constructed, secured, maintained and permitted in accordance with the relevant guidelines.

Blasting would be undertaken between the hours of 9:00am to 5:00pm, Monday to Saturday. No blasting operations would be undertaken on Sundays or Public Holidays[3].

Signs advising employees, contractors and visitors to the Mine Site of the date and time of the next blast would be positioned at the entrance to the Mine Site from the Tomingley West Road and at other appropriate locations within and surrounding the Mine Site. Signage would also be erected adjacent to the Newell Highway, within Tomingley village and in the vicinity of the truck stop immediately south of the Mine Site to identify blasting as an activity which occurs on a daily basis. In addition, the Proponent would consult with surrounding residents to determine the most appropriate method to notify them of blast times and would implement the agreed notification methods.

[3] It is possible that blasting outside of the nominated hours of operation may be required to alleviate a safety hazard, e.g. caused by a mis-fire, or at the request of DTIRIS.

#### 2.4.3.5 Load and Haul Operations

Following completion of each blast, boundaries between ore and waste rock material would, if required, be identified and marked on the ground using paint, tape or similar materials. Fragmented material would then be loaded into haul trucks using a hydraulic excavator and transported to one of the waste rock emplacements, or the ROM pad.

### 2.4.4 Underground Mining Method

#### 2.4.4.1 Introduction

The Proponent would establish a portal in the lower section of the Wyoming One Open Cut and develop a decline to permit access to those sections of the Wyoming One ore body that cannot be economically extracted using open cut mining methods. Ore material would be removed using a long hole open stoping mining method. This sub-section provides a summary of the proposed underground mining methods.

#### 2.4.4.2 Formation of the Portal and Underground Infrastructure

Once a suitable point for the establishment of the portal has been identified within the Wyoming One Open Cut, the wall above the portal entrance would be stabilised as required using a combination of rock bolts, cable bolts and shotcrete.

Once stabilised, the portal and subsequently the decline would be constructed using methods similar to those described in Section 2.4.4.3. Additional roof and wall support, may be required in the near surface sections of the decline. This may include rock bolts, spiling bars, cable bolts and/or shotcrete.

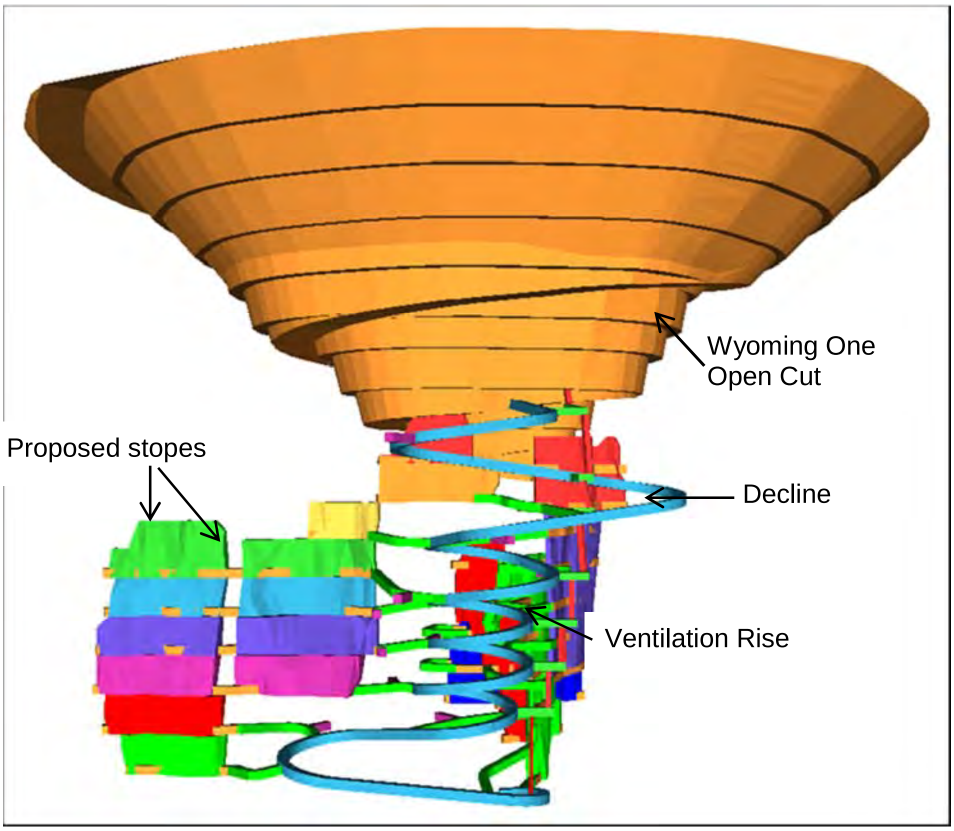
Once the portal is established, infrastructure required for underground mining operations would be installed. This would indicatively include the following.

- Underground power, including a transformer to reduce the voltage of the distributed electricity to 1 000V, suitable for use underground.
- Temporary ventilation, including one or more vent fans located adjacent to the portal.
- Mine water supply to provide water for underground mining operations.
- A tag board and associated surface safety and communication equipment and infrastructure.
- One or more air compressors.

#### 2.4.4.3 Decline and Development Design and Construction

**Figure 2.11** presents an overview of the proposed underground development. In summary, the decline would have the following indicative design parameters.

- Height – approximately 5.0m.
- Width – approximately 5.0m.
- Gradient – approximately 1:7 (V:H).
- Maximum depth of development – approximately 360m below surface or 210m below portal level (180m below the base of the Wyoming One Open Cut).




Source: Mintrex

**Figure 2.11 Proposed Underground Development**

Development headings and ore drives, namely those drives that would permit access to individual mining areas, would have the following indicative design parameters.

- Height – approximately 4.5m.
- Width – approximately 4.5m.

Once the portal has been established and the required infrastructure installed, underground development would commence. Initially, this would require development of the decline using a single heading. However, once decline development reaches the initial ore extraction level, development on multiple headings would be undertaken.

The decline, development headings and ore drives would be developed using drill and blast techniques. A jumbo, or underground drill rig, would drill a pattern of holes, the spacing and length of which would be determined by the mining contractor. Once drilling has been completed, these holes would be loaded with pre-packaged bulk explosives and detonators, and the in situ material fragmented.

Blasting would only be undertaken once the proposed mine has been evacuated, typically at meal breaks or shift changes.

Fragmented material would be extracted using an underground loader or load-haul-dump (LHD) unit. The LHD unit would be used to load underground haul trucks or transport the fragmented material to a loading bay for later reclamation. If required, the LHD unit may be remotely operated.

Once loaded into haul trucks, fragmented waste rock would be transported to the surface and placed either within the lower sections of the Wyoming One Open Cut or Waste Rock Emplacement 1. Once mining operations have progressed sufficiently, waste rock material may be placed within completed stopes to assist with the geotechnical stability of the stopes. The Proponent anticipates that approximately 77 000t of waste rock would be transported to the Wyoming One Open Cut, with a further 50 000t of material placed within Waste Rock Emplacement 1.

Fragmented ore material would be transported to the ROM pad.

#### 2.4.4.4 Ventilation and Emergency Egress

Once the portal is established, suitable ventilation would be required. Initially, this would be provided using a temporary ventilation fan located at the portal which would pump air to the decline face using flexible ventilation ducting. Return air would flow back up the decline. As the decline progresses, the temporary ventilation infrastructure would be advanced to ensure adequate ventilation in all sections of the advancing decline.

Once the decline has been advanced sufficiently, a ventilation access drive would be established and a near vertical ventilation rise or shaft would be constructed. The ventilation rise would have a diameter of approximately 1.8m and would be constructed on a bench within the Wyoming Open Cut.

Construction of the ventilation rise would involve a raise-bore drill rig which would drill an initial pilot hole. The pilot hole would then be progressively widened from the bottom up, with the drill cuttings permitted to fall to the bottom of the hole where they would be collected from the vent drive. As the decline is developed, the ventilation rise network would be progressively extended.

The ventilation rise would have two ventilation fans installed underground. As a result, surface noise emissions associated with the ventilation rise would be negligible. The ventilation system would have an indicative capacity of approximately $100m^3$/second. The decline would be the only air intake for the mine.

In addition, the vent rise would be fitted with appropriate emergency egress infrastructure, including ladderways and platforms. Other mine services such as power and water may also be installed within the vent rise or the access decline.

#### 2.4.4.5 Underground Stoping Operations

Underground mining of ore material would be undertaken using a long hole open stoping mining method. This mining method is particularly well suited to relatively narrow, near vertical ore bodies. **Figure 2.12** presents a schematic overview of this mining method and the following provides a brief description of the method.

During mining operations, a number of development drives would be established at approximately 20m vertical intervals within the ore zone. A series of holes would then be drilled in rings from each drive. These rings would then be sequentially loaded with explosives and the ore material blasted. The fragmented material would then be removed from the stope or open void using a LHD unit, operated remotely, where required. Between stopes, pillars (vertical) and sills (horizontal) of unmined material would be left to provide support and prevent ground collapse. In addition, a crown pillar would remain between to the top of the underground mine and the base of the open cut.

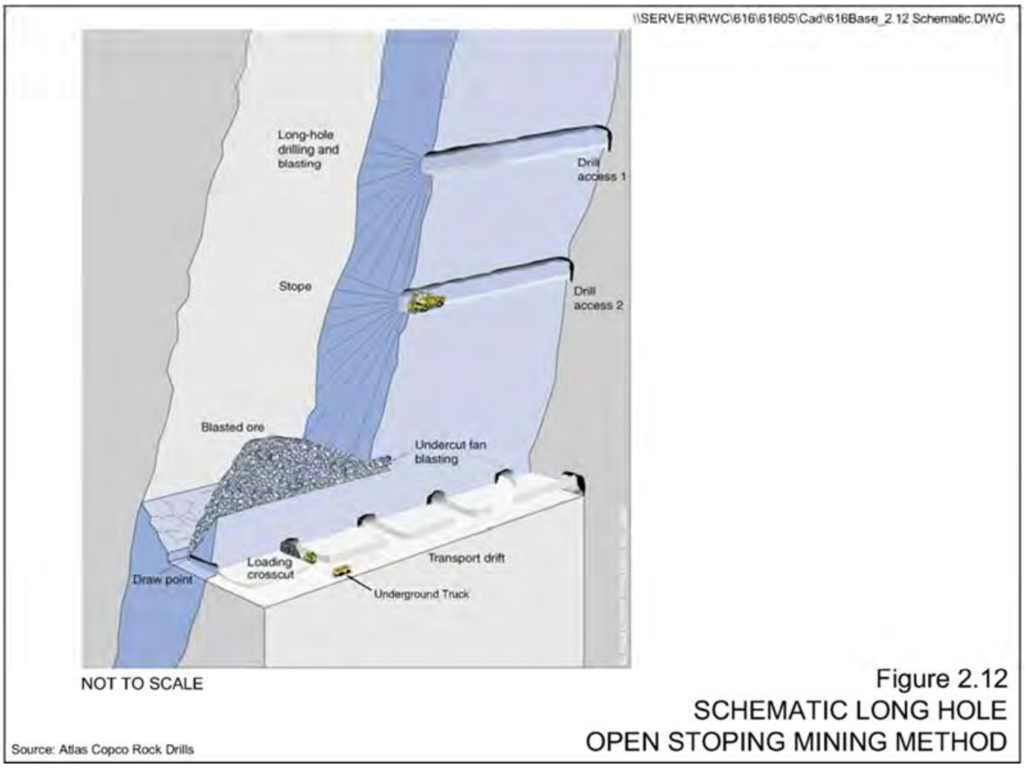



Figure 2.12
SCHEMATIC LONG HOLE
OPEN STOPING MINING METHOD

The Proponent would develop a range of stopes to permit extraction of the ore material. The detailed design of each stope would be determined following completion of additional drilling during development operations to better define the boundary between classes of material. The mine design would be developed to ensure that there would be no surface subsidence within the Project Site.

#### 2.4.4.6 Stope Backfilling Operations

In order to ensure stability of sections of the proposed underground mine once mining operations have been completed in those sections, mined-out stopes may be backfilled using waste rock material sourced preferentially from concurrent underground development. Additional waste rock material would be transported from surface, as required.

This material would be transported to a drive in the vicinity of the top of the stope using an underground haul truck. The material would be stockpiled in the drive and then pushed or tipped into the stope using a LHD unit. During such operations, the loader may, where required, be operated remotely.

Where required, the strength of the material used during backfilling operations may be increased through the use of cement mixed with the waste rock. In addition, where required to ensure stope stability, waste rock material may be concurrently placed into one end of a stope while mining is progressing at the other end.

### 2.4.5 Mining Rate and Sequence

**Table 2.3** presents the proposed mining rate for the life of the Project (which accounts for the production of approximately 500 000t of ore and 500 000t of waste rock from Caloma Two Open Cut). In addition, **Figure 2.13** presents an indicative outline of the mining sequence.

**Table 2.3**
**Indicative Mining Rate**

| Year | Ore (t) | Waste Rock (t) | | Total (t) |
|---|---|---|---|---|
| | | Open Cut | Underground | |
| 1 | 169 058 | 1 795 701 | 0 | 1 964 759 |
| 2 | 1 502 037 | 17 638 772 | 0 | 19 140 809 |
| 3 | 1 206 742 | 13 509 385 | 0 | 14 716 127 |
| 4 | 1 391 368 | 7 812 788 | 0 | 9 204 156 |
| 5 | 1 339 849 | 3 694 680 | 0 | 5 034 529 |
| 6 | 291 341 | 128 115 | 0 | 419 456 |
| 7 | 204 491 | 0 | 157 434 | 361 925 |
| 8 | 352 624 | 0 | 203 384 | 556 008 |
| 9 | 105 090 | 0 | 100 110 | 205 200 |
| **Total** | **6 562 600** | **45 040 369** | | **51 602 969** |

Note 1: Year 1 includes 1 month pre-strip for construction of facilities
Source: Alkane Resources Ltd

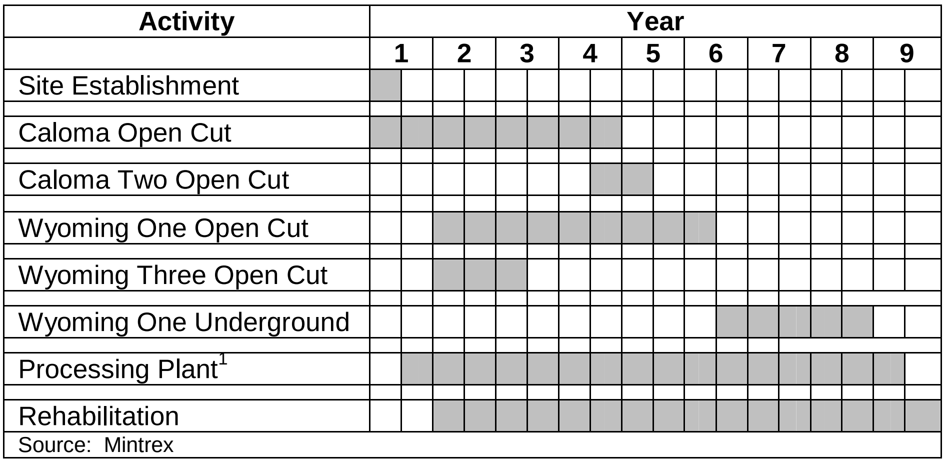



**Figure 2.13**
**INDICATIVE MINING SEQUENCE**

### 2.4.6 Mining Equipment

**Table 2.4** presents an overview of the indicative mining fleet that would be used during mining operations within the Mine Site. In addition to the equipment identified in **Table 2.4**, a number of light and other vehicles would be used during mining operations.

## 2.5 WASTE ROCK MANAGEMENT

### 2.5.1 Introduction

During mining operations, material that contains insufficient gold to justify immediate processing or stockpiling for later processing, would be either placed within one of three waste rock emplacements, or used to construct amenity bunds and site infrastructure (**Figure 2.1**). This section provides an overview of the characteristics of the waste rock material (Section 2.5.2), as well as the design of the waste rock emplacements (Section 2.5.3) and the procedures that would be implemented during placement operations (Section 2.5.4).

**Table 2.4**
**Indicative Mining Fleet**

| Equipment No | Indicative Number | Use | Proposed Hours of Operation[1] |
|---|---|---|---|
| **Major Equipment – Open Cut Mining** | | | |
| Excavator (Hitachi EX 1200) | 1 to 3 | Extraction of ore material and waste rock | 24 hours, 7 days per week |
| Excavator (Hitachi ZN 870) | 1 | | |
| Truck (Cat 777) | Up to 8 | Transportation of ore material and waste rock | |
| **Major Equipment – Underground Mining** | | | |
| Twin Boom Jumbo Drill (various) | 2 | Drilling blast holes for the development of drives | 24 hours, 7 days per week |
| Production drills | 2 | Drilling blast holes for underground stopes | |
| 40t to 50t capacity haul truck | 1 | Haulage of ore and waste rock within the underground or from underground to surface | |
| Load Haul Dump Unit | 2 | Stope bogging and loading to trucks | |
| Service vehicles | 2 | Servicing and refuelling of underground mining fleet | |
| **Support Equipment** | | | |
| Blast Hole Drill Rig (Atlas Copco L6) | 1 to 2 | Drilling blast holes | 24 hours, 7 days per week |
| Bulldozer (Cat D10) | 1 to 3 | Stripping soil, shaping of waste rock emplacements, clearing of benches, general site maintenance | |
| Grader (Cat16M) | 1 to 3 | | |
| Front-end loader (Cat 998) | 1 | Management of ROM material, loading of haul trucks | |
| Service Truck | 1 | Equipment servicing and refuelling | |
| Watercart (Cat 769) | 1 to 2 | Dust suppression | |
| Explosives Delivery Vehicle | 1 | Explosives delivery | Daylight hours only |
| Diesel Generators & Lighting Plants | variable | Pump sump, mobile lighting towers, other power supply as required | Variable |
| Note 1: Hours of operation of some equipment may be restricted during the life of the Project. See Section 4.2 for further detailed discussion. | | | |
| Source: Alkane Resources Ltd | | | |

## 2.5.2 Waste Rock Characteristics

Four representative samples of non-oxidised material from drill holes within the Wyoming One and Caloma Open Cut pit shells but outside the ore envelope were analysed for net acid generation potential (NAGP) by the ALS Laboratory Group. Each of the samples returned a negative NAGP, indicating that the waste rock from those open cuts would not generate an acidic leachate once placed within the relevant waste rock emplacements. Waste rock material within Wyoming Three and, if mined, Caloma Two is oxidized material and would not generate acid.

### 2.5.3 Waste Rock Emplacement Design

**Figure 2.14** presents the layout of each of the waste rock emplacements and **Table 2.5** presents the indicative design criteria for each.

**Table 2.5**
**Indicative Waste Rock Emplacement Design Criteria**

| Design Criteria | Waste Rock Emplacement | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Area (ha) | 14 | 39 | 40 |
| Maximum height (m) | 30 | 40 | 40 |
| Lift heights (m) | 10 | 10 | 10 |
| Number of lifts | 3 | 4 | 4 |
| Berm widths (m) | 5 | 5 | 5 |
| Final Slope (V:H) | 1:3 | 1:3 | 1:3 |
| Final Design Volume (million $m^3$) | 1.04 | 14.30 | 14.32 |
| Anticipated Volume Required (million $m^3$) | 1.04 | 12.99 | 13.00 |
| Source: Alkane Resources Ltd | | | |

The waste rock emplacement layouts and design criteria presented in **Figure 2.14** and **Table 2.5** represent the maximum footprint and height of these structures and accounts for the production of approximately 500 000t (300 000$m^3$) from Caloma Two Open Cut. Should less waste rock be removed from the open cuts and underground, or proportion used for backfilling underground stopes increased, the height (and possibly area) of these structures could be reduced.

Water management structures, would be constructed during shaping of each emplacement to reduce the risk of erosion both during and following the mine's operational life. In summary, these structures would comprise 5m wide berms at approximately 10m vertical intervals with slopes of approximately 1:200 (V:H) and, where required, engineered high slope sections or 'drop structures' to transfer surface water from the contour banks to the dirty water management system or, following completion of rehabilitation operations, to natural drainage.

### 2.5.4 Waste Rock Emplacement Procedures

Waste rock material removed from the open cut areas may be divided into two categories, namely:

- friable or weathered material; and
- unweathered material.

Waste rock material would be transported to the appropriate waste rock emplacement using off-road haul trucks. Waste rock material from the Caloma (and Caloma Two), Wyoming Three and Wyoming One Open Cuts would typically be placed within Waste Rock Emplacements 3, 2 and 1 respectively. Minor quantities of waste rock may also be used to construct other infrastructure within the Mine Site, including the amenity bunds, RSF, ROM pad, surface water diversion structures, haul roads, etc.


Figure 2.14
INDICATIVE WASTE ROCK EMPLACEMENT LAYOUT

Waste rock produced by underground mining would be primarily used to backfill completed stopes underground. Prior to the commencement of stope backfilling, i.e. during decline and drive development, the waste rock would either be placed within the Wyoming One Open Cut (below the 115m AHD elevation of the underground portal) (77 000t), or temporarily stored at surface near the top of the open cut pit ramp (50 000t). Ultimately, the waste rock placed within and outside of the open cut would be reclaimed and used to backfill the underground stopes. In fact, mine planning has estimated that a further 61 000t of waste rock would be reclaimed from one of the waste rock emplacements to make-up a calculated deficit. Additional 'in-pit' placement of waste rock on the Mine Site, i.e. within the completed open cuts has been considered, however, this would potentially sterilise resources that may be available for future development. Section 6.1.6 considers the in-pit placement of waste rock alternative in more detail.

The Proponent may use small quantities of waste rock material as a road base within the Mine Site. There is potential that road base material produced from the waste rock could be marketed for use outside the Mine Site. However, this does not form part of this application, and should a market for this material be identified, a modification to the project approval (should it be granted), or a separate development consent/project approval would be sought.

**Figure 2.15** presents an overview of the methods that would be employed during construction of the waste rock emplacement. In summary, waste rock material would initially be 'paddock dumped,' within the proposed footprint of each waste rock emplacement. The piles of waste rock material would be pushed flat using a bulldozer prior to construction of the next layer. Subsequent layers would be built by establishing a tip head on the active emplacement face. The emplacements would be constructed in 10m lifts, typically from the outer margins of the emplacement towards the centre, allowing for the final face angle for each lift of 1:3 (V:H). Between each lift, a 5m wide berm with a 1:20 (V:H) or 5% backslope and a 1:200 (V:H) or 0.5% longitudinal grade would be constructed. The waste rock emplacements would be compacted during construction by heavy vehicles travelling across the surface of the emplacement.

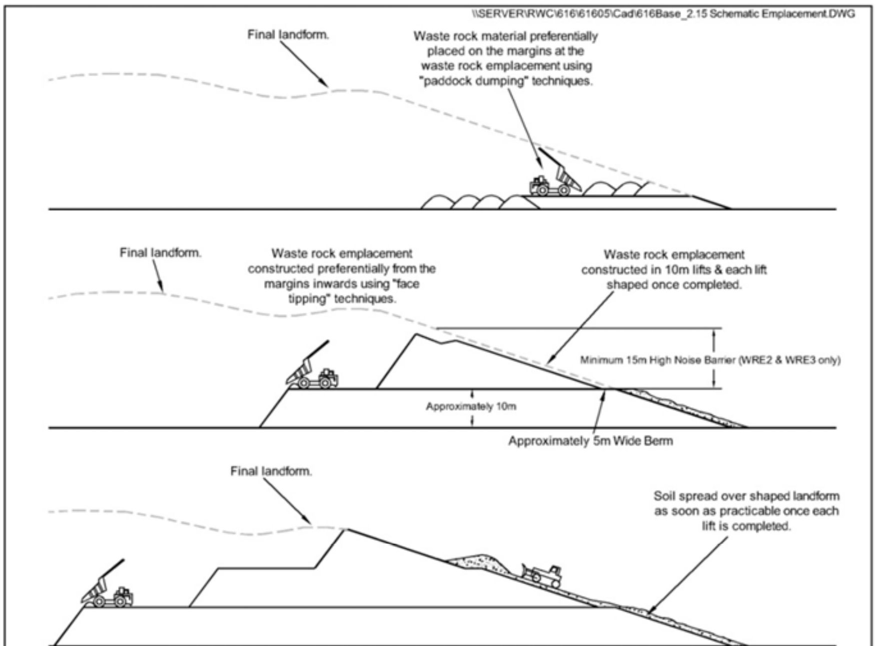


Figure 2.15
INDICATIVE WASTE ROCK EMPLACEMENT CONSTRUCTION

In general, the northern perimeter of Waste Rock Emplacements 2 and 3 would be constructed to maintain a 15m high acoustic barrier between the village of Tomingley to the north and waste rock placement operations. The progressively more elevated northern acoustic barrier would only be constructed during the daytime, namely between 7:00am and 6:00pm. This would avoid the operation of mobile equipment in the most exposed locations of the Mine Site (to Tomingley) during periods when noise enhancing meteorological conditions may prevail, i.e. inversions. The Proponent would also review operations when winds from the southern quadrants prevail, with equipment potentially relocated during these conditions to minimise the noise levels received at residences within Tomingley. Section 4.2.5 provides more detailed descriptions of the proposed noise management strategy to be implemented by the Proponent.

Waste rock initially placed within Waste Rock Emplacement 1 would be used during rehabilitation operations to cap the RSF. Extraction of that material would be undertaken prior to final shaping and rehabilitation of Waste Rock Emplacement 1.

Following completion of construction of the outer section of each lift, the outer face of the emplacement would be progressively shaped and covered with friable waste rock material. Approximately 50cm of subsoil and 20cm of topsoil would then be spread over the emplacement and the emplacement progressively revegetated. Rehabilitation operations are described more fully in Section 2.14.

## 2.6 PROCESSING OPERATIONS

### 2.6.1 Introduction

Ore material would be processed within the on-site processing plant. This section provides a brief description of the layout of the processing plant, together with the ROM stockpiling, crushing and grinding, carbon-in-leach and gold extraction operations. This section also provides an overview of the proposed cyanide management procedures that would be implemented.

### 2.6.2 Processing Plant and Office Area Layout

**Figure 2.16** presents the layout of the Processing Plant and Office Area which comprise the following components.

- ROM Pad.
- Crushing and screening infrastructure including:
  - Primary crushing building;
  - screening building;
  - Surge bin and surge stockpile; and
  - conveyors.
- Processing plant (including grinding circuit, leach circuits and reagent storage areas).
- Raw water, process water and settling dams.
- Potable water processing plant.
- Transformer and electrical switch room.
- Workshops, laboratory and ablutions facilities.
- Administration office[4].

[4] The Administration Office is to utilise the existing “Wyoming” residence and as a result has been separated from the rest of the processing and office infrastructure. For the purpose of this assessment, reference to the Processing Plant and Office Area includes the administration office and car park.

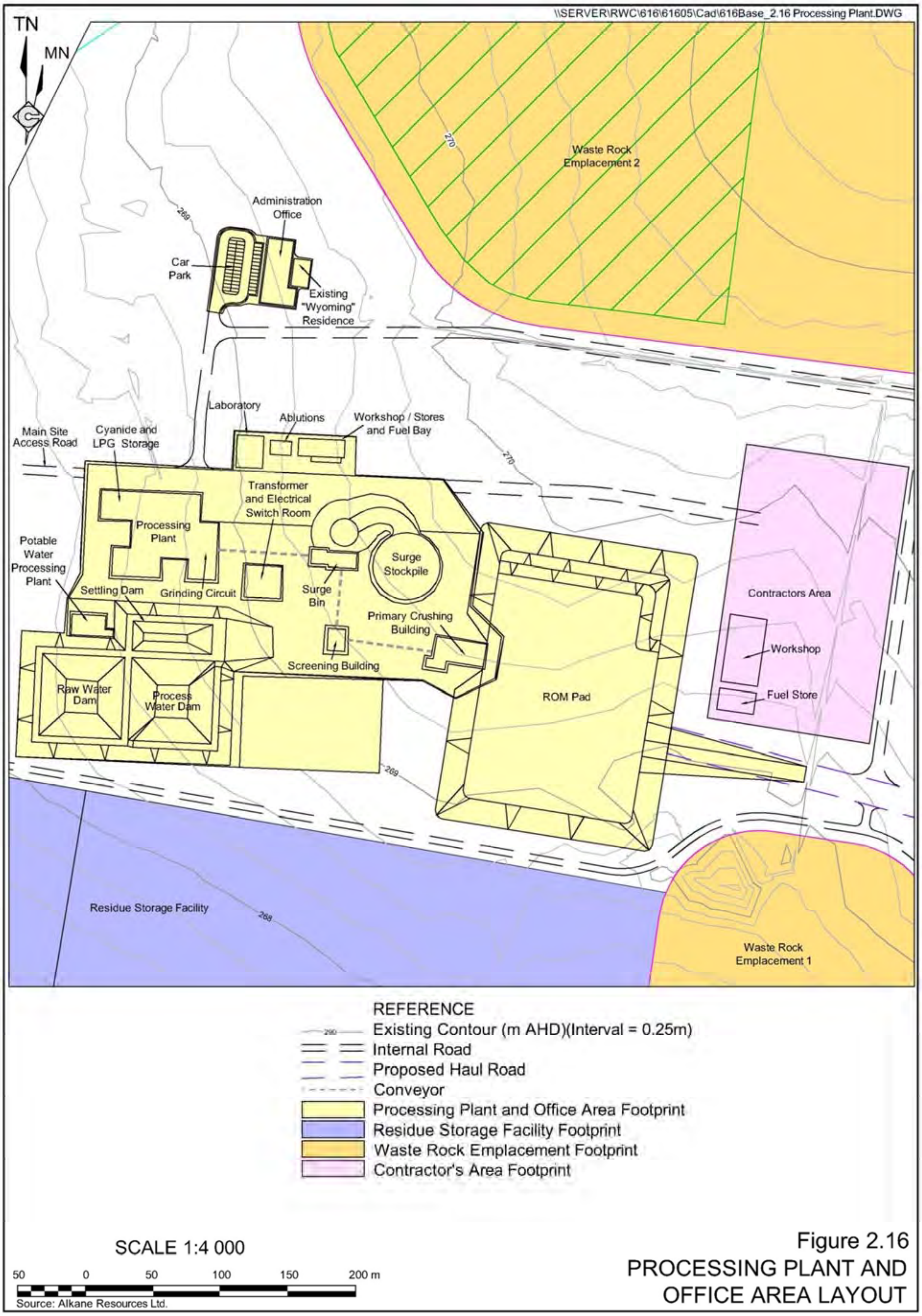



Figure 2.16
PROCESSING PLANT AND OFFICE AREA LAYOUT

## 2.6.3 Processing Operations

### 2.6.3.1 Introduction

The following sub-sections provide a description of the process to be followed to recover the gold from the ROM ore material. Section 2.6.3.2 provides a summary of the operations to initially reduce the size of the ore for processing and gold recovery. Section 2.6.3.3 provides a summary of the processing operations that would be undertaken to recover the gold from the crushed and ground ore.

### 2.6.3.2 ROM Stockpiling, Crushing and Grinding Operations

Ore material would be transported to the ROM pad by haul trucks. This material would be stockpiled within the ROM pad according to ore characteristics. A front-end loader would then be used to blend the material and deliver it to the ROM coarse ore feed bin within the primary crushing building. Occasionally, oversize material would be broken using a hydraulic rock breaker on the ROM pad. When undertaken, the Proponent would ensure that this occurs on the southern side of a stockpile of ore at least 5m high.

From the ROM coarse ore feed bin, material would drop into a primary jaw crusher which would reduce the size of the material to a nominal 80% passing 100mm. It is anticipated that the primary crusher would have a design throughput of 170t per hour. A rock breaker installed adjacent to the crusher (and within the primary crushing building) would break any oversized rocks that lodge in the primary jaw crusher and would otherwise not pass through.

The crushed material would pass to a series of conveyors which would deliver it to a classifying screen within the screening building. This screen would allow material with a diameter smaller than 23mm to pass through the screen. Oversize material would be delivered to a secondary crusher to further reduce the size of the material, which would then be conveyed back to the classifying screen.

Undersize material from the classifying screen would be delivered to a surge bin, which when full, would overflow to a conveyor feeding an on-ground surge pile. This surge pile would provide feed for the processing plant when the crushing circuit is not operational as a result of breakdowns or planned maintenance shutdowns.

Material from the surge bin or surge stockpile would be conveyed to the grinding circuit within the processing plant where a ball mill with a diameter of 5m and a grinding length of 8.2m. The ore would be combined with water and steel balls with the revolving motion able to further reduce the size of the ore. The overflow from the ball mill (crushed ore and water mix) would flow to a trommel, or a rotating screen, where the material would be further classified. Material with a diameter greater than 12mm would be returned to the surge bin. Undersize material would be passed to a series of cyclones to separate the material based on density which will determine to which part of the gravity and leach circuit the material would report (Section 2.6.3.3) for gold recovery.

### 2.6.3.3 Gravity and Leach Circuit

Cyclone underflow, namely larger or denser material, would flow to a gravity concentrator which would further separate the denser material from less dense material. The densest material would flow to a holding tank for intensive leach processing to extract the gold. The less dense cyclone underflow material would be returned to the ball mill (described in Section 2.6.3.2). Cyclone overflow, namely smaller or less dense material, would flow to the standard CIL process.

### Intensive Leach Process

The intensive leach process (otherwise referred to as an InLine Leach Reactor) is an intensive cyanidation process (operated at higher temperature and pressure to a standard carbon-in-leach [CIL] circuit) designed to treat small volume gravity gold concentrates. Although the intensive leach process can be operated as a continuous process, it would be operated as a batch processing plant for the Project. The de-watered concentrate would be injected into a tank where it would be exposed to a high oxygen, high cyanide solution. The cyanide would dissolve the gold into solution. Residence time would be predicted in the laboratory and set by reactor volume and solids feed rate. Barren solids would be removed from the circuit via a de-watering cone and de-watering screen. The pregnant solution would be pumped from the tank to the electrowinning circuit for gold recovery. Barren solution would be recirculated to optimise the use of reagents.

### Standard CIL process

The standard cil leach circuit would comprise six tanks with an indicative capacity of approximately 1 000m$^3$ each to allow ground material to be held in the tanks for approximately 24 hours. The gold would be recovered using cil technology which involves the addition of sodium cyanide, lime and other additives to the slurry of ground material and water in a series of agitated tanks containing activated carbon. In each tank, the additives would be managed to maximise the recovery of gold. The cyanide would dissolve the gold into solution. The dissolved gold would be recovered from the solution through adsorption onto pores of the carbon granules. The gold-loaded carbon would then be collected using a screen within each tank.

The carbon would be introduced into the last tank and advanced through the tanks in the opposite direction to the slurry to the first tank, becoming increasingly “loaded” with gold as it progresses. The gold-loaded carbon would then be transferred to an elution column which would contain a strong solution of caustic and cyanide heated by an LPG gas-fired heater. This step reverses the adsorption process. The gold would be then removed from the solution by electrowinning. Carbon stripped of gold would be returned to the leach circuit for re-use.

The leach circuit would be constructed within a concrete bunded area with sufficient volume to contain 110% of the volume of the largest tank, or approximately 1 080m$^3$. All surface water flows within the bunded area would be directed to a sump and pumped back into the CIL tanks.

### Gold Production

Gold sponge, namely a product from the electrowinning cell, would be smelted on site in a gas-fired furnace to produce gold doré, stored briefly and then collected by a security company for transportation to a gold refinery.

### Residue Management

The remaining slurry would then be concentrated and washed using a counter current decant system utilising two 14.6m diameter thickeners. Residue would then be pumped from the last leach tank to the first thickener and, once excess water has been removed for re-use, raw water and decant water would be added to reduce the cyanide concentration in the slurry before it is pumped to the second thickener. Once excess water has again been removed for re-use, the residue would be pumped to the residue storage facility (RSF). Reclaim water would be collected in two decant towers within the RSF and pumped directly to the process water dam.

The document *Priority Existing Chemical Assessment Report No 31 – Sodium Cyanide* published by the Commonwealth Department of Health and Aging in February 2010 identifies that where appropriate management measures are implemented, incidents of fauna mortality are rare where the WAD cyanide concentration is less than 50ppm. Cyanide speciation test work on Tomingley ores indicates that plant cyanide levels may be managed to reduce concentrations of WAD cyanide complexes in the residue stream to less than 50ppm. However, in order to enable a high degree of certainty in relation to management of cyanide levels in material discharged to the RFS, a second, counter current decant thickener has been included in the circuit as described previously.

The Proponent would implement the following to restrict access by fauna to potentially cyanide-contaminated water.

- Construction of animal-proof fences around the RSF and processing plant site.
- Monitoring of the levels of weak acid dissociable (WAD) cyanide in the residue at the residue discharge point, within the RSF and the Process Water Dam and in selected surface and groundwater monitoring locations within and surrounding the Mine Site (monthly to quarterly). The Proponent anticipates that results from the weekly monitoring program would be returned within 72 hours.
- Limitation of the area of free water within the RSF to minimise its attractiveness to water and other birds and other fauna.
- Alternate water storages, i.e. farm dams and sediment basins, would be maintained on the Mine Site to provide alternate watering points for birds.
- Regular inspection of the RSF and other areas of the Mine Site for fauna deaths. Where such deaths are identified, the Proponent would ensure testing to identify the cause of death and, if required, would implement further controls to manage cyanide within the Mine Site. These controls would be developed in conjunction with relevant government agencies.

### 2.6.4 Reagent Management

The processing plant would primarily use the following reagents and the Proponent would implement the following measures to ensure that environmental risks associated with each reagent is minimised to the greatest extent possible.

- Sodium Cyanide

  Sodium cyanide would be delivered in solid form in 22t capacity isotainers (sealed tanks designed for the transport and management of potentially harmful substances). Water would be circulated through the isotainer to dissolve the sodium cyanide which would then be transferred to one or more liquid storage tank(s) with an indicative capacity of 5 000L. The isotainer would remain in place until all the solid sodium cyanide is consumed, after which, it would be replaced with a new isotainer. The liquid storage tank and isotainer would be contained within concrete bunds with a capacity of 110% of the volume of the liquid storage tank.

Systems would be implemented to ensure that environmental and occupational health and safety risks associated with transportation, handling, storage and use of the sodium cyanide are minimised to the greatest extent possible. These procedures would be embodied in a *Reagent Management Plan* that would be prepared prior to commencement of processing operations. It is anticipated that this plan would be incorporated into the Mining Operations Plan that would be required for the Project and would require the approval of DTIRIS-DR&E, OEH, as well as WorkCover.

- Caustic Soda

  Caustic soda would be delivered to the Mine Site by road in liquid form in road tankers and stored in a $24m^3$ caustic storage tank located in the same bunded containment area as the cyanide dissolving and cyanide storage tanks. Care would be taken to ensure that the liquid is stored appropriately with other compatible chemicals. The *Reagent Management Plan* would identify management measures that would be implemented to ensure the appropriate transportation, handling, storage and use of this material.

- Hydrochloric Acid

  Concentrated hydrochloric acid would be delivered by road in liquid form in 1 000L sealed containers held inside shuttle bins. The containers would be unloaded into a $24m^3$ tank located in a concrete containment bund adjacent to, but separated from, the cyanide plant. Care would be taken to ensure that the liquid is not stored inappropriately with other chemicals. The *Reagent Management Plan* would identify the management measures to ensure the appropriate transportation, handling, storage and use of this material.

- Activated Carbon

  Activated carbon comprising burnt coconut husks would be delivered by road in one tonne bulka-bags. No particular management measure would be required for this material as it is does not pose an environmental or safety risk.

## 2.7 RESIDUE MANAGEMENT

### 2.7.1 Introduction

Following completion of processing operations, the residue (in the form of slurry from which the majority of the gold has been removed) would be pumped to the RSF. This section provides an overview of the proposed design of the RSF and the procedures that would be used during residue placement to ensure appropriate densities and compaction are achieved within the RSF.

## 2.7.2 Residue Storage Facility

### 2.7.2.1 Introduction

The Proponent engaged the following specialist consultancies to assist with the geotechnical assessment and design of the RSF.

- D.E. Cooper & Associates Pty Ltd prepared the *Tomingley Gold Project Residue Management Design Report* (Cooper and Associates, 2009) which outlines the design, construction methodology, post construction testing and operation of the RSF. Included as an appendix to Cooper and Associates (2009) was a geochemical and waste characterisation report prepared by Graeme Campbell & Associates.
- Mining One undertook a geotechnical assessment of the RSF footprint based on 25 soil test pits excavated to 2.6m depth and the top 15m of cored bore holes within the Wyoming One Open Cut footprint, from where the material for construction of the embankments would be sourced. The resulting report is entitled *Tomingley Gold Project Feasibility Study Factual Geotechnical Report For Residue Storage Facility* (Mining One, 2009).

### 2.7.2.2 Design of the Residue Storage Facility

The proposed footprint of the RSF is presented on **Figure 2.1** and **Figure 2.17**. Key features of the RSF include the following.

- Area - two cells with a combined area of 42ha.
- Crest elevation – 280.5m AHD.
- Crest width – 6m.
- Slope of outer face – 1:3 (V:H).
- Slope of inner face – 1:1.5(V:H).
- Key trench – up to 2m deep, base 3m wide, side slopes = 2:1 (V:H).
- Maximum elevation of residue – 280.0m AHD.

**Figure 2.17** also provides a schematic cross section through one of the residue storage cells.

As indicated on **Figure 2.17**, the eastern embankment of the RSF would be effectively created by Waste Rock Emplacement 1. However, those sections of the eastern embankment to be constructed prior to the construction of Waste Rock Emplacement 1 would provide for the key features identified above as the minimum standard.

The RSF would comprise two cells of approximately 21ha each with a common embankment. Each cell would be equipped with a centrally located decant tower which would enable water released from the residue and incident rainwater to be returned to the processing plant for re-use. The Proponent anticipates that the RSF would be a "prescribed" dam and would be listed in Schedule 1 of the *Dams Safety Act 1978.*

An allowance has been made for a 2m deep key trench adjacent to the outer embankments.

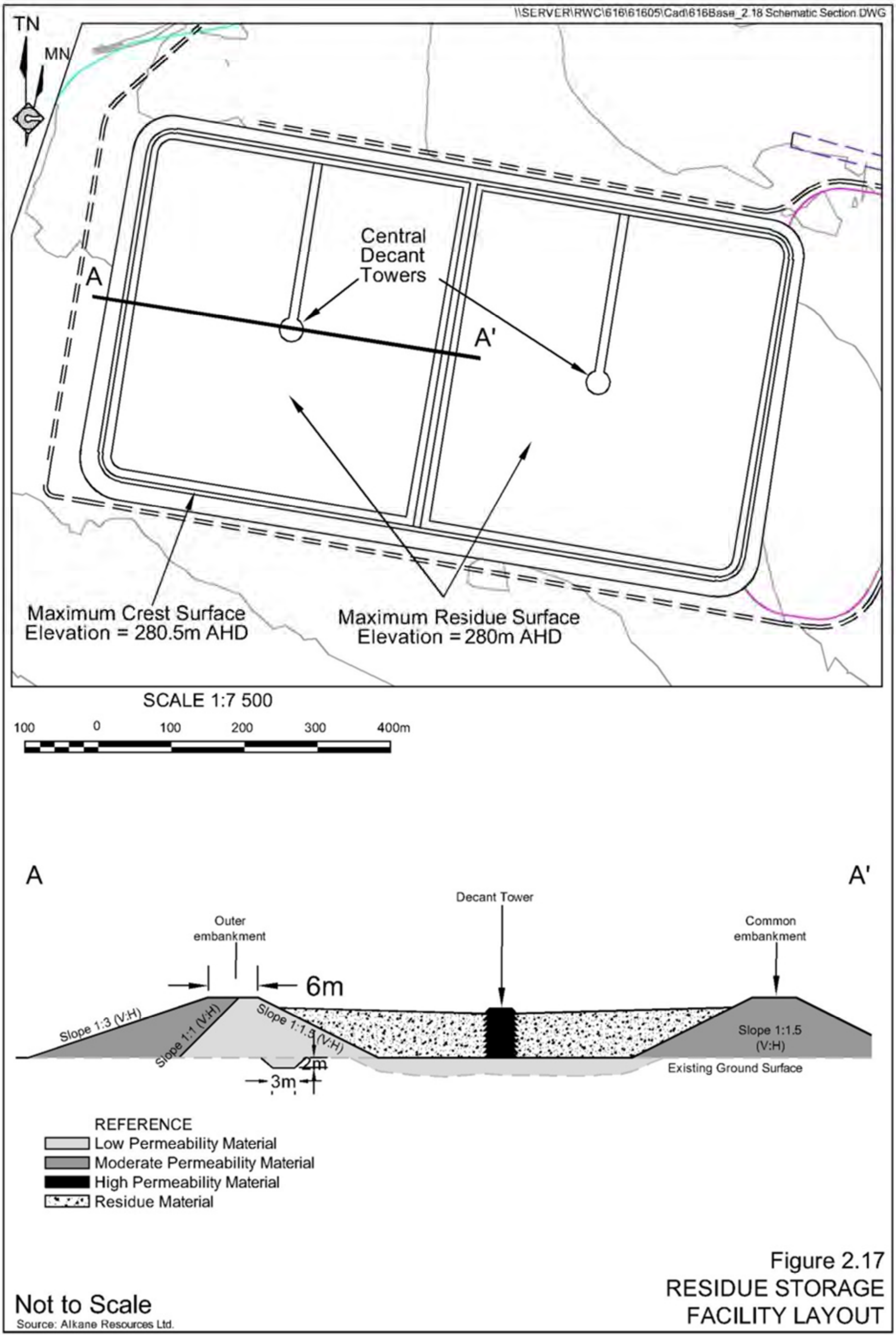



Figure 2.17
RESIDUE STORAGE FACILITY LAYOUT

### 2.7.2.3 Geotechnical and Hydrological Assessment

Mining One (2009) stated that the foundations of the proposed embankments comprise stiff clay with some traces of sand. The clay becomes more competent with depth and has a high bearing capacity. The only preparation required before construction of the embankments would be to strip the topsoil and lightly rip, moisture condition and compact the foundation areas.

Material sourced from the upper sections of the Wyoming One or Wyoming Three Open Cuts would be used during construction of the initial sections of the embankments. This material had been classified under the Unified Soil Classification as an inorganic clay to sandy clay of low to medium plasticity which, when compacted, has a permeability of less than $1 \times 10^{-9}$m/sec (classified as very low permeability). The material sourced from extraction of the key trench adjacent to the outer embankments would be suitable for use during construction of the embankments of the RSF.

Ultramafics Pty Ltd (2009) undertook a hydrological investigation of the RSF footprint based on falling head test data gathered by The Impax Group. Five boreholes to 25m depth were drilled within the RSF footprint and no water was encountered in any of the holes. The permeability of the strata up to 25m below the surface ranged from $2 \times 10^{-10}$ m/s to $2 \times 10^{-9}$ m/s. Cooper and Associates (2009) states that assuming that the amount of water held within and on the surface of the deposited residue is minimised, seepage losses from the storage should be insignificant.

### 2.7.2.4 Construction of the Residue Storage Facility

#### Construction Requirements and Schedule

The RSF would be constructed in stages, with the initial stage of the facility providing adequate storage capacity for the first 12 to 15 months of processing operations, i.e. to contain approximately one million tonnes of residue. The embankments would be constructed from selected waste rock material extracted from within the upper sections of the Wyoming One Open Cut. As processing operations continue, the embankments would be progressively raised throughout the life of the Project to maintain adequate freeboard and ensure the facility would contain all residue and associated reclaim water and incident rainfall.

The initial height of the Stage 1 embankments would be approximately 5.5m. The final maximum height would be approximately 15m. The eastern side of the RSF would be buttressed by Waste Rock Emplacement 1 (see **Figure 2.14**).

The floor of the RSF would be compacted to achieve a permeability of $<1 \times 10^{-9}$m/s for depth of at least 900mm. Where this is not achievable, due to the physical characteristics of the in situ material, clay from elsewhere within the RSF footprint (or from the footprint of the Wyoming One or Wyoming Three Open Cuts) would be used to line the RSF floor (at least 900mm in depth). Clay, either from the footprint of the RSF or Wyoming One and Three Open Cuts, would be used to line the internal walls of the RSF. The thickness of this compacted clay liner would be at least 900mm.

A central decant tower would be provided within each cell. This would be constructed of pre-cast pipe sections which would be progressively stacked on top of each other, with rock placed around, as the RSF is progressively raised.

### Quality Assurance / Quality Control

As a Prescribed Dam under the NSW *Dams Safety Act 1978*, the RSF would be designed, constructed and operated to meet the requirements of the NSW Dams Safety Committee (DSC). These requirements are extensive and detailed, however, broadly require the RSF to be designed in accordance with current good practice as set out in the various Australian National Committee on Large Dams (ANCOLD) Guidelines.

In regard to construction, the DSC requires:

> "*the dam designers to be integrally involved during construction of tailings dams and to approve any design changes made during construction. This involvement is to be signed-off formally by the Owners representative in a Construction Certificate to be provided to the DSC. Work-as-Executed Drawings and a Construction report are to be provided to the DSC at the same time.*"

Detailed design of the RSF would be completed following the issue of project approval and would include the Technical Specification for RSF construction. The Technical Specification will include a section setting out quality assurance/quality control (QA/QC) requirements in regard to construction material properties and compaction. The contractor responsible for the construction of the RSF would be required to complete a QA/QC Plan to confirm the satisfaction of the Technical Specification requirements. The QA/QC data would be progressively reviewed by the designers during construction, and would be incorporated in the final RSF Construction Report.

QA/QC requirements to be established and applied to earthworks would include the following requirements.

- All fill material would be tested to ensure compaction to the correct moisture content. Samples for moisture content testing shall be taken in accordance with the requirements of AS 1289.1-1991.
- The minimum frequency of testing would be 1 test per 5 000m$^2$ of each layer of fill.
- Fill material not compliant with the required moisture content limit specifications would be reworked and watered/dried as required.
- Compaction testing of the fill material would be carried out immediately following compaction of homogenous lots.
- Test lots would be determined by the earthworks contractor and approved by the superintendent or construction manager.
- Acceptance of results to specified permeability requirement ($<1x10^{-9}$m/s) required before further placement of fill to be carried out.
- The minimum frequency of testing would be 1 test per 5 000m$^2$ of each layer of fill. A higher frequency of testing would be implemented if a significant number of test results fail to meet the specification requirements or the material is showing significant variability.

#### 2.7.2.5 Operation of the Residue Storage Facility

Throughout the life of the Project, residue material would be discharged into two cells, with the active discharge cell rotated on a pre-determined basis. The material would be discharged from spigots (discharge points) on a peripheral pipeline. The spigots would be regularly spaced around the perimeter of the each cell and the residue slurry would be discharged from six to eight spigots at any one time. The active spigots would be regularly changed to allow an even build-up of residue solids over the whole area of each cell. The residue would be largely unsaturated except for a very small area around the decant tower in the active cell. Each cell would have the opportunity to dry when the discharge of residue is changed to the adjacent cell. This placement procedure would allow for an appropriate residue density to be established ensuring the ongoing stability of the RSF.

In addition, the management measures identified in Section 2.6.4 would be implemented to limit the potential for fauna to access potentially cyanide-contaminated reclaim water.

## 2.7.3 Residue Volume

It is anticipated that throughout the life of the Project approximately 3 900 000m$^3$ of solid residue material would be produced. The proposed RSF has a capacity to store approximately 4 800 000m$^3$ of material. As a result, the proposed RSF would cater for all residue material produced throughout the life of the Project. It is noted that potential exists for additional ore material to be mined throughout the life of the Project. As a result, the RSF has been designed with surplus capacity to cater for these eventualities.

## 2.7.4 Residue Characteristics

### 2.7.4.1 Geological Characteristics

The residue material would be derived from ore material which has been crushed and ground and had the gold removed. The primary ore material is composed of commonly occurring minerals, including quartz, feldspar, ankerite (a carbonate mineral), muscovite mica and traces of pyrite and arsenopyrite and calcite. There are no known naturally-occurring hazardous minerals such as asbestos-related minerals within the ore material. As a result, there would be no such minerals within the residue material.

### 2.7.4.2 Geotechnical Characteristics

Samples of the residue from friable (oxide) and unweathered (primary) ore have been tested by Graeme Campbell & Associates Pty Ltd through the laboratory of SGS Australia to determine residue settling characteristics, the likely final desiccated density and permeability. In practice, the processing plant would be fed with a combination of weathered and unweathered material, with the ratio changing throughout the life of the Project.

A combined ore feed would result in final residue density of between approximately 0.85t/m$^3$ and 1.31t/m$^3$. The desiccated (dry) density of the residue is expected to be approximately 1.56t/m$^3$ for weathered material and approximately 1.7t/m$^3$ for unweathered material.

An average in situ density of 1.45t/m$^3$ has been used when determining the required capacity of the RSF storage.

### 2.7.4.3 Geochemical Characteristics

The geochemical characteristics of the residue material were assessed by Amdel Mineral Laboratories Pty Ltd to determine the net acid generation potential of the residue material. In summary, when rock material containing naturally-occurring sulphide minerals is exposed to oxygen, the sulphide minerals can oxidise to form a low pH or acidic leachate. That testwork determined the following.

- Oxidised material within the Mine Site is non-acid forming.

- Primary or non-oxidised material within the proposed open cuts and underground mines contains minor concentrations of sulphide material. However, sufficient amounts of acid neutralising minerals e.g. ankerite and calcite are present to ensure that the non-oxidised material would not be acid forming.
- Ore material within the Project Site contains small amounts of naturally occurring arsenopyrite, a mineral composed of iron, arsenic and sulphur. During weathering of the mineralised material, arsenopyrite oxidises to a range of secondary arsenic-bearing minerals. Following processing operations, arsenopyrite and the secondary minerals would be encapsulated within the RSF. Kinetic-testing of representative samples of tailings from the various ores has been completed by Graeme Campbell & Associates Pty Ltd (GCA, 2011) to identify species of secondary minerals that could be formed during oxidation of the primary arsenopyrite and whether the contained arsenic is likely to be able to be mobilised within the RSF.

  The results of GCA (2011) confirm that the tailings samples from the oxide ores contain "pools" of arsenic forms, e.g. Fe/Ca-arsenates of complex and variable composition, however, these should consolidate within the RSF to a tightly-compacted state, and therefore exhibit a very low hydraulic conductivity. Other ore samples from the Caloma resource were characterised by low arsenic solubility during circum-neutral weathering.

## 2.8 NON-PRODUCTION WASTE MANAGEMENT

**Table 2.6** lists the non-production wastes that would be generated throughout the life of the Project and briefly describes how each class of waste would be stored or managed on site and subsequently removed from the Mine Site.

## 2.9 TRANSPORTATION

### 2.9.1 Introduction

This section describes the proposed transportation both within and surrounding the Mine Site. The Proponent would prepare a *Transportation Management Plan*, incorporating management measures to minimise the risk of potential safety- and environmental-related impacts associated with transportation prior to commencing mining operations.

### 2.9.2 Mine Site Transportation

#### 2.9.2.1 Site Access

Construction of the proposed Main Site Access Road and intersection with the Tomingley West Road is described in Section 2.2.5.

All vehicles would normally access the Mine Site via the Tomingley West Road and the Main Site Access Road. However, the Proponent notes that that this route requires vehicles to cross Gundong Creek twice, once on the Tomingley West Road and once within the Mine Site (**Figure 2.1**).

**Table 2.6**
**Non-Production Waste Management**

| **Waste Type** | **Storage/Management** | **Removal** |
|---|---|---|
| General waste (including food scraps) | Covered bins or skips located within lunch rooms, offices, outside workshops and elsewhere as required. Where these bins would be located in open areas, they would be fitted with animal-proof lids. | Collected on a regular basis by a licensed waste contractor and transported to a licensed waste disposal facility. |
| General Recyclables | Covered bins located within lunch rooms, offices and elsewhere as required. Where these bins are located outside a closed building they would be fitted with animal-proof lids. | Collected on a regular basis by a licensed recycling contractor and transported to an appropriate recycling facility if such a contractor and facility is available in the area. |
| Waste oils and greases | Placed within bunded tank(s) within the workshop area. Where required, smaller, temporary storage containers may be positioned close to work areas, with the contents of those container transferred to a larger storage tank prior to collection. | Collected on a regular basis by a licensed waste contractor and transported to an appropriately licensed facility for recycling. |
| Batteries | Used batteries would be placed within a covered and marked used battery storage area until removed from site. | Used batteries would be collected on a regular basis by an appropriate contractor and recycled. |
| Tyres | Tyres would be placed within a marked used tyre storage area until removed from site or used for another purpose. | Tyres would be re-used on site for construction of retaining walls, erosion protection, traffic control or would be removed from site for re-use elsewhere or recycling. If re-use or recycling is not practicable, then used tyres would be encapsulated within the waste rock emplacements. |
| Scrap Steel/Metal | Stored in a specified area within the workshop area or elsewhere as required. | Collected on a regular basis by a scrap metal recycler. |
| Waste water | Waste water from the ablutions facilities and lunchrooms would be treated using an appropriate waste water treatment plant approved by Narromine Shire Council. The unit would be fully containerised and only require an in-ground transfer tank. Treated waste water would be suitable for process water. When required, solids from the treatment facility would be periodically removed during regular servicing operations and transported to a licensed disposal facility. | |

It is also noted that at times the Tomingley West Road is covered with water during and immediately following extreme rainfall events. As a result, the Proponent would upgrade and maintain the existing access track to the "Wyoming" homestead, from the Newell Highway, as the Western Emergency Access Road. In addition, the Eastern Emergency Access Road would also be constructed and maintained from the Mine Site on the eastern side of the Newell Highway to the Newell Highway. These access roads would permit direct access to the Newell Highway during periods when access to the Mine Site via the Main Site Access Road or Newell Highway Underpass (for the eastern section of the Mine Site) is unsafe or not available (**Figure 2.1**).

The Proponent would maintain locked security gates at the intersection of the Newell Highway and these emergency access roads and would, where appropriate, ensure that traffic controllers are positioned at the intersection to ensure that safe operation of the intersection during any periods of use.

#### 2.9.2.2 Internal Haul Road Network

A range of internal haul roads and other roads would be constructed during and following site establishment. These would include the following (**Figure 2.1**).

- A haul road from the Caloma Open Cut (and Caloma Two Open Cut), via the Newell Highway underpass, to the ROM pad (Caloma – ROM pad Haul Road).
- Haul roads from the Wyoming One and Wyoming Three Open Cuts to the Caloma – ROM pad Haul Road.
- Haul roads from each of the open cuts to the respective waste rock emplacements.
- A range of temporary haul roads within the proposed open cuts and waste rock emplacements.

The internal haul roads would be designed, constructed and/or maintained in accordance with the document *Managing Urban Storm Water – Volume 2C – Unsealed Roads* published by the then Department of Environment and Climate Change in 2008 (DECC, 2008a). In summary, the haul roads would be constructed to the following parameters.

- The width of the haul roads would be a minimum of three times the width of the largest haul truck. Typically, total haul road width would be approximately 20m wide, for dual access roads.
- A safety bund, a minimum of half the wheel height of the largest vehicle likely to travel the road, would be positioned on the downslope side of all haul roads where they are located adjacent to or traverse steep slopes.
- Haul roads would typically be constructed with a gradient of no more than 1:7 (V:H).
- In order to maintain all weather access, the surfaces would be sheeted with suitable waste rock materials recovered during the mining activities.
- The roads would be routinely maintained and watered to suppress the generation of dust.
- All haul roads would be constructed in a manner that would avoid excessive erosion during rain events. Surface runoff from these haul roads would be contained as part of the overall dirty water management system.

#### 2.9.2.3 Site Access and Light Vehicle Road Network

A range of access tracks would be constructed within the Mine Site. These tracks would include the Eastern and Western Emergency Access Roads (**Figure 2.1**). Other access tracks would permit access to the RSF, waste rock emplacements and other sections of the Mine Site. These access tracks would also be constructed generally in accordance with the document *Managing Urban Storm Water – Volume 2C – Unsealed Roads* (DECC, 2008a) and would be maintained in a manner that would minimise the potential for erosion and sedimentation and dust lift off.

#### 2.9.2.4 Separation of Mine and Non-mine Traffic

Vehicular access to the 'operational' sections of the Mine Site would be restricted through implementation of barricade systems and gates. Access to those sections of the Mine Site would be restricted to approved heavy and light vehicles and approved drivers. Where non-approved vehicles or drivers require access to the Mine Site, they would be escorted.

### 2.9.3 External Transportation

#### 2.9.3.1 External Road Network

The Proponent anticipates that there would be three principal transportation routes to access the Mine Site as follows (**Figure 1.1**).

- To/from Narromine via Tomingley-Narromine Road and Tomingley West Road.
- To/from Dubbo via Newell Highway, Tomingley-Narromine Road and Tomingley West Road.
- To/from Peak Hill and Parkes via Newell Highway, Tomingley-Narromine Road and Tomingley West Road.

Both the Newell Highway (State Highway 17) and the Tomingley-Narromine Road (Main Road 89) are State roads. Tomingley West Road is a local road maintained by Narromine Shire Council.

#### 2.9.3.2 Proposed Upgrade to the Tomingley West Road

The surrounding road network is described in detail in Section 4.11.2.2 and Part 7 of the *Specialist Consultant Studies Compendium*. In summary, the Tomingley West Road is a two lane, two way road with a central sealed carriageway of between 3.5m to 4.0m wide. The Proponent recognises that this layout would not be adequate as the main access route for the Project and would undertake, in consultation with Narromine Shire Council, to widen the sealed section of the road between the Main Site Access Road and the Tomingley-Narromine Road.

#### 2.9.3.3 Traffic Types and Levels

Traffic types associated with the Project would include the following.

- Light vehicles: including passenger vehicles, light trucks and buses.
- Heavy vehicles: including rigid trucks and semi-trailers delivering consumables, processing reagents and supplies.
- Oversize and overweight vehicles: delivering components of the processing plant and mobile fleet. The Proponent would ensure, where practicable, that all oversize and overweight vehicles would have the appropriate permits and approvals and would be appropriately escorted, when required. It is noted, however, that obtaining of required permits and approvals is typically the responsibility of the road transportation contractor.

**Table 2.7** presents the anticipated Project-related traffic levels for each of the principal transportation routes identified in Section 2.9.3.1 during site construction and operation of the Project.

**Table 2.7**
**Anticipated Daily Traffic Movements[1]**

| Route | Light Vehicles | Heavy Vehicles[2] |
|---|---|---|
| **Project Construction** | | |
| Newell Highway | 120 | 14 |
| Tomingley – Narromine Road[3] | 60 | 6 |
| Tomingley West Road | 180 | 20 |
| **Project Operation** | | |
| Newell Highway | 102 | 6 |
| Tomingley – Narromine Road[3] | 34 | 2 |
| Tomingley West Road | 136 | 8 |
| Note 1: Two vehicle movements = one return trip<br>Note 2: Includes over size and overweight vehicles.<br>Note 3: North of the intersection with the Tomingley West Road | | |
| Source: Alkane Resources Ltd | | |

The existing traffic levels on the roads surrounding the Mine Site are presented in Section 4.11.2.3.

#### 2.9.3.4 Alternative Modes of Transportation

Road transportation of the gold doré of the Project is the only feasible method of transportation given the relatively low volume of material produced.

## 2.10 FACILITIES AND SERVICES

### 2.10.1 Introduction

The Project would include construction and use of a range of facilities and services. A description of the principal infrastructure that would be established for the Project is provided in Section 2.2. This sub-section provides a description of the other facilities and services that would be required.

### 2.10.2 Facilities

An Administration Office area, which forms part of the Processing Plant and Office Area, would be constructed during the site establishment phase of the Project. **Figure 2.16** presents an indicative layout of the office area which would comprise the following components.

- The existing "Wyoming" homestead which would be used for exploration or training offices.
- The existing "Wyoming" shearing shed, which has a concrete floor and a raised timber board which would be used for a general site muster area or storage area.
- A series of demountable buildings that would contain the Proponent's site office, ablution facilities, first aid room, security and meeting rooms.
- An unsealed car park with capacity for 42 vehicles.

As noted in Section 2.6.2 as shown on **Figure 2.16**, the Proponent would establish a workshop area within the Processing Plant and Office Area. The workshop area would comprise the following components.

- Workshop building(s), including a concrete sealed floor and vehicle inspection bays. A small bund or drain around the perimeter of the building would contain potentially contaminated runoff and an oil/water separator would be incorporated in the drainage plan.
- A stores facility.
- A hardstand area comprising an unsealed area for storage of excess equipment awaiting use or removal from site, or parking of mobile equipment.
- A fuel bay and refuelling area incorporating a concrete bunded storage area containing fuel tanks, unused oil and grease, waste oil tank and a concrete sealed refuelling area. All potentially contaminated surface water runoff would be directed to an oil/water separator.

A Contractor's Area would be established to the east of the ROM Pad (**Figure 2.16**). This area would indicatively include the following.

- A transportable building for use as the contractor's office and crib room.
- A workshop building, including a two-bay open-front workshop with concrete floor, apron and workshop office, a basic stores facility (containers) plus fenced storage area, fuel and oils storage facilities (self-bunded tanks) and waste oil management facilities.
- An ablutions facility.

## 2.10.3 Services

### 2.10.3.1 Electricity Supply

Power for the processing plant and the various buildings within the Mine Site would be provided by a distribution system from the proposed substation described in Section 2.2.3. The distribution network would be partially above ground and partially buried.

Power for mine dewatering pumps and mobile lighting towers would be supplied by diesel generators. Lighting in the vicinity of the processing plant and workshops would be provided by mains-powered lights. All lights would, where practicable, be orientated away from surrounding residences and the Newell Highway.

The Proponent estimates that once the processing plant and remaining Project-related activities are being undertaken at the proposed rate, the annual power consumption within the Mine Site would be approximately 32.16GWhr.

If haul trucks are required to pass beneath any overhead power lines, the power lines would be elevated to a height where the haul trucks can pass safely beneath them.

### 2.10.3.2 Communications

The site office would be serviced by telephone and data lines. In addition, communications within the Mine Site would be via two-way radio and/or mobile phone.

### 2.10.3.3 Hydrocarbons

All diesel fuel for the mobile equipment would be stored in above ground tanks with a total indicative capacity of 100 000L. These tanks would be either self-bunded or located within a bunded fuel bay in the vicinity of the workshop within the Contractor's Area (**Figure 2.16**). Bunding, if required, would be sized to meet the OEH containment requirements and *AS 1940:2004 - Safe storage & handling of flammable & combustible liquid*s.

A sealed refuelling area would be located adjacent to the fuel bay with all drainage from both areas directed to an oil/water separator. All haul trucks and graders and some light vehicles would utilise the refuelling area while the excavators, bulldozers and generators would be refuelled at their work site using a mobile fuel tanker.

Any bulk oils, greases and waste oils would also be stored within this bunded fuel bay or alternative appropriately bunded areas.

It is anticipated that the Project would require on average approximately 590 000L of diesel per month. This consumption, however, is expected to vary between approximately 121 000L and approximately 1.8ML per month. Anticipated diesel consumption throughout the life of the Project would be approximately 2.19ML of diesel throughout the life of the Project.

In addition, between approximately 30 000L and 40 000L of LPG would be used per month within the processing plant for heating reagents during processing operations, or approximately 2 200 000L throughout the life of the Project. The LPG would be stored within six 7 500L tanks within the same compound as the cyanide within the Processing Plant and Office Area (**Figure 2.16**).

### 2.10.3.4 Potable Water

Potable water and water for the ablutions facilities would be sourced from the proposed water pipeline and would be appropriately treated within the Potable Water Processing Plant before being used (**Figure 2.16**).

### 2.10.3.5 Operational Water

Operational water requirements, namely water for processing operations, dust suppression and workshop wash-down purposes would vary depending on ore production rates (up to 1.53Mtpa) and meteorological conditions. Considering maximum production rates and the Proponent's experience of dust suppression requirements at the nearby Peak Hill Gold Mine, water requirements could be as high as follows.

- Processing: 878ML/yr.
- Dust suppression and wash down: 60ML/year.

Water for processing and wash down purposes would be preferentially sourced from recycled water from each of those facilities. Make-up water would be sourced from the water supply pipeline.

Water for dust suppression purposes would preferentially be sought from the surface water containment structures within the Mine Site, including any in-pit sumps constructed to collect incident rainfall and groundwater inflows, if any. Make-up water would be sourced from the water supply pipeline. Section 4.3.5.5 and Part 2 of the *Specialist Consultant Studies Compendium* present a site water balance for the Mine Site.

#### 2.10.3.6 Sewage and Waste Water

Sewage from ablutions facilities within the Mine Site would be treated through an appropriately licenced waste water treatment system. Solids removal would be serviced by a licensed waste collection and disposal contractor, as required.

## 2.11 PROJECT LIFE AND HOURS OF OPERATION

### 2.11.1 Project Life

Based upon the expected total quantity of ore material as identified in Section 1.4.3 and on the proposed mining rate described in Section 2.4.5, the Proponent anticipates that construction operations may take up to 12 months and mining operations would require approximately nine years to complete (see **Table 2.3**). In addition, following completion of mining operations, site decommissioning and rehabilitation operations may take up to 12 months, with further monitoring and limited management to continue after that. As a result, the proposed project life would be approximately ten years.

The Proponent, notes that throughout the life of the Project, the Company plans to explore for possible extensions to known mineralisation or additional mineralisation within or surrounding the Mine Site. Further ore reserves indicated by this program may extend the life of the mining operation. Separate applications for approval to extract that material would be made at that time.

### 2.11.2 Hours of Operation and Workforce Rosters

**Table 2.8** presents the proposed hours of operation for each of the relevant components of the Project.

**Table 2.8**
**Proposed Hours of Operation**

| Activity | Proposed Days of Operation | Proposed Hours of Operation |
|---|---|---|
| Vegetation clearing and topsoil stripping | 7 days per week, during each campaign | Daylight hours |
| Construction operations | 7 days per week for a period of approximately 6 to 12 months | 24 hours per day |
| Open cut mining operations | 7 days per week | 24 hours per day |
| Underground mining operations | 7 days per week | 24 hours per day |
| Blasting operations | Monday to Saturday | 9:00am to 5:00pm[1] |
| Maintenance operations | 7 days per week | 24 hours per day |
| Processing operations | 7 days per week | 24 hours per day |
| Rehabilitation operations | 7 days per week | 7:00am to 10.00pm |
| Note 1: Unless required for misfire re-blast, emergency or safety reasons. | | |
| Source: Alkane Resources Ltd | | |

All mining and processing operations would be undertaken on a continuous roster, seven days per week. It is noted that in order to satisfy intrusiveness noise criteria under the NSW Industrial Noise Policy (INP) (Environment Protection Agency, 1999), restrictions on the number and location of equipment operating between the hours of 10:00pm to 7:00am would be implemented. The relevant noise criteria and proposed operational restrictions are discussed in Section 4.2.

It is envisaged that all operational personnel would be resident locally (Parkes, Peak Hill, Tomingley, Dubbo) and the bulk of the workforce would be sourced locally. To this end, it is envisaged that senior and middle management would operate on a five or six day week. All other personnel would operate on a twelve hours rotational shift basis and 2:1 weekly roster.

## 2.12 EMPLOYMENT AND ECONOMIC CONTRIBUTIONS

The Proponent estimates that the Project would make the following employment and economic contributions to the surrounding communities.

- Approximately 100 full-time equivalent positions during the construction phase of the Project.
- Approximately 85 to 90 full-time equivalent positions during the operational phase which would be divided approximately equally be between employees of the Proponent and the mining contractor. A peak work force of up to 125 to 130 people would be required in the initial open cut mining phase, i.e. during Year 2.

In addition, **Table 2.9** presents the economic contribution of the Project to the local and regional, NSW and Federal economies.

**Table 2.9**
**Economic Contribution Attributable to the Tomingley Gold Project**

| | Annual | Life of the Project |
|---|---|---|
| **Local and Regional Economy** | | |
| Wages and salaries (employees and contractors) | $13,142,000 | $95,280,000 |
| Local services and suppliers (deliveries, local earthmoving, maintenance, etc.) | $15,442,000 | $111,951,000 |
| Council rates and community contribution | $35,000 | $254,000 |
| **State and Federal Economy** | | |
| State and National services and suppliers (mining contractor less contractor wages, national suppliers, etc.) | $18,513,000 | $134,220,000 |
| NSW government royalty | $1,849,000 | $13,405,000 |
| **Total** | **$48,981,000** | **$355,110,000** |
| Source: Alkane Resources Ltd | | |

## 2.13 SAFETY AND SECURITY

### 2.13.1 Public and Employee Safety

The Proponent recognises that the proximity of the Mine Site to the Newell Highway and Tomingley would necessitate the implementation of procedures and controls to protect the safety of the public.

Measures would be implemented to ensure the safety of visitors, contractors and employees, as well as ensuring the security of facilities and equipment from unauthorised access. It is the Proponent's policy that each person employed on, or visiting the Mine Site would be provided with a safe and healthy working environment. In order to achieve this, the Proponent would implement a recruitment, induction and training program to:

- ensure compliance with statutory regulations and maintain constant awareness of new and changing regulations;

- eliminate or control safety and health hazards in the working environment in order to achieve the highest possible standards for occupational safety in the mining industry;
- ensure the suitability of prospective employees through a structured recruitment procedure;
- provide relevant occupational health and safety information and training to all personnel;
- develop and constantly review safe working practices and job training;
- conduct regular safety meetings and provide an open forum for input from all employees;
- provide effective emergency arrangements for all employees, visitors and general public protection;
- maintain good morale and safety awareness through regular employee assessment and counselling; and
- ensure all contractors adopt and maintain Proponent's policy objectives and safety standards at all times.

Central to all aspects of site public and employee safety would be the following.

- The adoption of a pro-active approach to employee and public safety.
- Strict compliance at all times with the requirements of the following.
  - *Mine Health and Safety Act 2004.*
  - *Mine Health and Safety Regulation 2007.*
  - *General Rule 2000.*
  - *Occupational Health and Safety Act 2000.*
  - *Occupational Health and Safety Regulation 2001.*
  - *Occupational Health and Safety (Dangerous Goods) Act 2003.*
  - *Explosives Act 2003.*
  - *Explosives Regulation 2005.*
  - *Dams Safety Act 1978.*
  - All other relevant legislation and Australian Standards.
- An *Occupational Health and Safety Policy* to cover all component activities at the mine.

Specifically, the following safety and security measures would be implemented.

- A Mine Safety Management Plan, including a Contractor Safety Management Plan, would be prepared in accordance with the requirements of the *Mine Health and Safety Act 2004*.

- A fence would be erected around the perimeter of the active sections of the Mine Site, including adjacent to the Newell Highway. The form of the fencing would be determined in consultation with DTIRIS-DR&E and would be identified in the *Mining Operations Plan*.
- A safety bund (Type 3 bund – see Section 2.2.6.3) approximately 1.3m to 1.4m high would be constructed around the perimeter of each of the proposed open cuts. This bund would remain in place following completion of mining-related activities. A service track to allow vehicular access around the perimeter of the open cuts would be constructed between the safety bund and the security fence.
- The Main Site Access Road would be the only regular vehicular access point to the operational sections of the Mine Site. All visitors would be required to report to the site office. Security/warning signs would be positioned at strategic locations around or within the Mine Site indicating the presence of earthmoving and mining equipment, deep excavations and steep slopes. The positioning of signs would depend on the location of the mining activities at any one time.
- Signs identifying blasting procedures and times would also be installed adjacent to the Main Site Access Road, adjacent to the Newell Highway and in the vicinity of the truck stop immediately south of the Mine Site.
- Employee and contractor inductions would include safe working practices and regular follow-up safety meetings and reviews.
- Toolbox meetings would be held regularly and would include a review of safety-related matters.
- Regular drug and alcohol testing would be undertaken in accordance with the Proponent's *Drug and Alcohol Policy*.
- Where internal haul roads are adjacent to steep slopes, windrows along the down slope margins of those haul roads would be constructed to a minimum of half the wheel height of the largest item of mobile equipment on site.
- Appropriate controls with respect to the storage and use of explosives would be identified in an *Explosives Storage and Management Plan* which would be prepared prior to commencement of blasting operations.
- The blasting engineer or shotfirer would use appropriate blasting procedures to contain all fly rock within the design blast envelope and minimise the generation of excessive ground and air vibrations (see Section 2.4.3.4).
- Appropriate controls with respect to the storage and use of processing reagents would be identified in a *Reagent Management Plan* which would be prepared prior to commencement of processing operations.
- Lighting plants and vehicle headlights would be directed such that the vision of motorists travelling on the Newell Highway is not adversely impacted by the Project.

- All earthmoving equipment would be fitted with appropriate safety equipment in accordance with the *Guideline for Mobile and Transportable Equipment for Use in Mines* (MDG 15) published by the DTIRIS-DR&E.

### 2.13.2 Explosive Storage

Explosive storage would be undertaken in accordance with an *Explosives Storage and Management Plan.* In summary, detonators and boosters would be stored within magazines within the Magazine Area located adjacent to Waste Rock Emplacement 1[5]. This area would be secured by a 1.8m high security fence topped with barbed wire and a lockable gate. In addition, the Magazine Area would be the subject of regular inspection by security personnel working for or contracted to the Proponent. The magazines would be likely to be transportable structures which would be constructed, secured, maintained and permitted in accordance with the relevant guidelines. Bulk explosives would be transported to the Mine Site on the day of the blast.

## 2.14 SITE DECOMMISSIONING AND REHABILITATION

### 2.14.1 Introduction

The Proponent would adopt a progressive approach to the rehabilitation of disturbed areas within the Mine Site to ensure that, where practicable, areas where mining or waste rock placement are completed are quickly shaped and vegetated to provide a stable landform. The progressive formation of the post-mining landform and the establishment of a vegetative cover would also minimise the potential Project-related visual amenity and air quality impacts at surrounding residences.

Rehabilitation activities and biodiversity enhancement plantings (offset plantings) would also occur on some areas of the Project Site that would not be disturbed by Mine Site activities or infrastructure. These plantings would be progressive and form part of the final landform.

The following sub-sections describe the Proponent's proposed approach to site decommissioning and rehabilitation and:

- outline the rehabilitation objectives of the Proponent with respect to the rehabilitation of the Mine Site (Section 2.14.2);
- provide an overview of the strategic management of rehabilitation, which includes the categorisation of rehabilitation domains, establishment of a rehabilitation hierarchy, and establishment of completion criteria, performance indicators and monitoring programs (Section 2.14.3);
- describe the proposed final land use and landform (Sections 2.14.4 and 2.14.5);
- describe the procedures to be applied to each component of the mine, water management structures and other areas of disturbance associated with the mining and processing operations (Section 2.14.6);
- describe the proposed rehabilitation maintenance procedures, post-mining management and noxious weed management (Sections 2.14.7 and 2.14.8); and
- describe the proposed Project Biodiversity Offset Strategy (Section 2.14.9).

[5] For security reasons, the exact location of the explosives magazine has not been provided on report figures.

It is noted that the Proponent proposes to undertake ameliorative plantings in some sections of the Mine Site that have been previously cleared for agricultural purposes. Refinements to the proposed rehabilitation presented in the following sub-sections would be provided in the *Mining Operations Plan* (MOP) to be prepared for the Project following project approval and then, if required, would be undertaken on the basis of operational experience gained by the Proponent, or by others at similar operations. These refinements would be reported in the relevant *Annual Environmental Management Report* (AEMR) and/or any amended MOP(s) produced by the Proponent throughout the life of the Project. It is noted that the Proponent operated the Peak Hill Gold Mine, located approximately 15km to the south-southeast of the Mine Site since between 1996 and 2002. Most of that site has now been fully rehabilitated and a large proportion of a Security Deposit has been released by DTIRIS-DR&E. The mined landscape at Peak Hill is currently operated as a tourist mine and was a finalist in the 2003 NSW Tourism Awards. **Plates 2.1** to **2.4** present views of the completed rehabilitation within the Peak Hill Gold Mine Site.

### 2.14.2 Rehabilitation Objectives

The Proponent's rehabilitation objectives are divided into three specific categories, namely:

- landform establishment;
- growth media development; and
- ecosystem development (final land use).

The specific objectives associated with each category are as follows.

**Landform Establishment**

- To stabilise all disturbed areas and minimise erosion and dust generation.
- To reduce the visual impact upon surrounding residents by early establishment of vegetation in areas where mining-related operations have been completed, i.e. on the external face of the amenity bunds and progressive rehabilitation of the waste rock emplacements as described above.
- To blend the created landforms with the surrounding topography.
- To provide a low maintenance, geotechnically stable and safe, non-polluting landform which blends with surrounding landforms and provides land suitable for the final land use of nature conservation, agriculture, tourism or light industry.

**Growth Media Development**

- To achieve a soil profile capable of sustaining the specified final land use.
- To establish native vegetation with the species diversity commensurate to each relevant ecological community.

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**Plate 2.1**: Rehabilitated slopes of Peak Hill Gold Mine Waste Rock Emplacement
(Ref: PHGM_WRE batter rehab_20110330)

**Plate 2.2**: Rehabilitated slopes of Peak Hill Gold Mine Waste Rock Emplacement viewed from distance
(Ref: PHGM_WRE_batter rehab)

**Plate 2.3**: Vegetation regrowth within the Peak Hill Gold Mine Open Cut
(Ref: BobbyBurn_Rehab_20101205)

**Plate 2.4**: Rehabilitated Table Drain at Peak Hill Gold Mine
(Ref: Table drain to NE sedpond Nov 05)

**Ecosystem Development (Final Land Use)**

- To re-instate woodland ecological communities commensurate with the remnant woodland vegetation disturbed by Project activities.
- To protect and enhance those sections of the Mine Site with remaining vegetation, focusing particularly on that vegetation that may be classified as endangered ecological communities under State or Commonwealth legislation.
- To establish an area of ameliorative plantings in some sections of the Mine Site that are not required for mining-related operations to provide habitat and generally improve the biodiversity value of the Mine Site.
- To retain areas on the Mine Site amenable to future agricultural or industrial activities.

## 2.14.3 Strategic Rehabilitation Management

### 2.14.3.1 Rehabilitation Domains

Rehabilitation domains refer to areas of related disturbance based on processes and use prior to rehabilitation and for which decommissioning and rehabilitation activities would be similar. A description of each domain is given below.

**Domain 1 – Infrastructure Areas (D1)**

This domain would include the Processing Plant and Office Area, the Contractors Area, ROM Pad, explosives magazine, the Main Site Access Road and any other miscellaneous buildings or roads.

**Domain 2 – Amenity Bunds and Surface Water Management Structures (D2)**

This domain includes all clean and dirty water dams, diversion drains, amenity bunds and associated infrastructure.

**Domain 3 – Waste Rock Emplacement Areas (D3)**

This domain would include all waste rock emplacement areas and soil stockpile locations.

**Domain 4 – Residue Storage Facility (D4)**

This domain includes the Residue Storage Facility and associated infrastructure.

**Domain 5 – Final Void Area (D5)**

The final void area would include the post-mining void and any associated access.

The rehabilitation objectives described in Section 2.14.2 relate to all rehabilitation domains.

### 2.14.3.2 Rehabilitation Hierarchy

The rehabilitation hierarchy for the Project follows a modified rehabilitation hierarchy based on DTIRIS-DR&E’s model but is aligned to the rehabilitation objectives in Section 2.14.2. A summary of each phase of the rehabilitation hierarchy is as follows.

### Decommissioning

Specific details of decommissioning completion criteria would be covered in a *Mine Closure Plan* to be prepared closer to completion of mining activities. In general, however, the decommissioning phase of the rehabilitation hierarchy involves the cessation of usage of infrastructure, as well as its demolition, removal and any remediation of the land that may be required. Specific decommissioning activities that relate to completion criteria at this stage in the rehabilitation hierarchy are outlined in Section 2.14.6.2.

### Landform Establishment

The landform establishment phase involves the earthworks required to cover and/or profile all or part of each domain to create a landform suitable for the proposed final land use and which blends with the adjacent topography. This stage would also include the construction of any drainage structures needed for the area. Specific procedures relating to landform establishment that relate to completion criteria at this stage of the rehabilitation hierarchy are outlined in Section 2.14.6.

### Growth Media Development

The growth media development phase of the rehabilitation hierarchy involves the replacement of soil over disturbed areas and preparation of the soil for revegetation including fertiliser or ameliorant application and ripping or scarifying the soil. It is also covers (similar to DTIRIS-DR&E Ecosystem Establishment phase) the revegetation of the rehabilitated landform and biodiversity offset areas with native species commensurate with the targeted final land use. Specific procedures relating to growth media development are outlined in Section 2.14.6.

### Ecosystem Development (Final Land Use)

The ecosystem development (final land use phase) of the rehabilitation hierarchy occurs once monitoring shows that there is adequate vegetation over the area. An area may be in this stage for a long period of time, depending on what the final land use outcome is. During this stage, the area would continue to be monitored and would not reach its nominated sustainable end land use until monitoring determines that the completion criteria summarised in **Table 2.10** have been met.

### 2.14.3.3 Strategic Rehabilitation Completion Criteria, Associated Performance Indicators and Monitoring Strategy

The strategic rehabilitation completion criteria, associated performance indicators and monitoring strategy for the Project are summarised in **Table 2.10**. While the rehabilitation criteria are based on the DTIRIS-DR&E model, it has been modified to align with the rehabilitation objectives outlined in Section 2.15.2 and the rehabilitation hierarchy discussed in Section 2.15.3.2. The rehabilitation criteria aim to achieve the following.

- The ongoing refinement of completion criteria and monitoring programs that would facilitate lease relinquishment following mine closure.
- Alignment with rehabilitation and biodiversity offset area objectives.
- The facilitation of continuous improvement in restoration management practices of the rehabilitation and biodiversity offset areas.

**Table 2.10**
**Strategic Rehabilitation Completion Criteria, Associated Performance Indicators and Monitoring Strategy**

Page 1 of 2

| Rehabilitation Objective | Completion Criteria | Performance Indicator | Monitoring Strategy |
|---|---|---|---|
| Landform Establishment | The landform morphology fits in with the surrounding landscape. | Slopes are at or less than 18° for waste rock emplacements and RSF.<br>Final slopes of open cut (void) walls are stable. | *Annual Environmental Management Report (AEMR)* includes up to date survey of final landforms. |
| | The rehabilitated area does not represent an erosion hazard. | Erosion does not exceed 0.3m (gully) deep. | Quarterly visual inspection by Mine Manager, Environmental Officer or other nominated (and appropriately trained) personnel. |
| Growth Media Development – Woodland Ecological Community | Appropriate native plant species richness is present for the restored ecological community. | To be determined. | Vegetation monitoring (EFA score) by ecologist to determine native plant species richness (prior to lease relinquishment). |
| | Appropriate density/structure of native overstorey species is present. | To be determined. | Vegetation monitoring (EFA score) by ecologist to determine over storey structure (prior to lease relinquishment). |
| | Appropriate density/structure of native mid storey species is present. | To be determined. | Vegetation monitoring (EFA score) by ecologist to determine mid storey structure (prior to lease relinquishment). |
| | Appropriate native groundcover is present. | To be determined. | Vegetation monitoring (EFA score) by ecologist to determine native plant species richness (prior to lease relinquishment). |
| Growth Media Development – Agricultural Land | Areas retained for future agricultural or industrial activities. | Nominated areas of the Mine Site maintained free of woodland vegetation and weed species. | Annual monitoring for weed species to be reported in *AEMR*. |
| Ecosystem Development (Final Land Use) | The area and its sustainability is consistent with the intended land use. | Establish areas of rehabilitation consistent approval conditions. Land use classifications to include:<br>• Rehabilitation of Woodland Ecological Communities.<br>• Agricultural land.<br>• Biodiversity Offset Area. | *AEMR* to quantify areas.<br>*Biodiversity Offset Management Plan* to be audited every 3 years. |

Note: EFA Score = Ecological Function Analysis Score.

**Table 2.10 (Cont'd)**
**Strategic Rehabilitation Completion Criteria, Associated Performance Indicators and Monitoring Strategy**

Page 2 of 2

| Rehabilitation Objective | Completion Criteria | Performance Indicator | Monitoring Strategy |
|---|---|---|---|
| Ecosystem Development (Final Land Use) (Cont'd) | There are no potential hazards inconsistent with the intended land use. | The site is free of safety or environmental hazards including:<br>• holes, tunnels or unstable areas;<br>• mining infrastructure or debris; or<br>• hazardous materials. | Quarterly visual inspection Environmental Officer or other nominated (and appropriately trained) personnel. |
| | The soil pH is representative of the intended land use. | pH levels are within the range generally acceptable for plant growth (5.0 to 8.5) until data from analogue sites is available. | Annual soil analyses by Environmental Officer or other nominated (and appropriately trained) personnel. |
| | Exotic weeds or vegetation is not competing or impacting on the intended land use. | Noxious weeds are not present within rehabilitation or biodiversity offset areas until data from analogue sites is available. | Annual visual inspection by Environmental Officer or other nominated (and appropriately trained) personnel. |
| | Feral pests are not impacting on the intended land use. | Feral pests are not present within rehabilitation or biodiversity offset areas until data from analogue sites is available. | Annual visual inspection by Environmental Officer or other nominated (and appropriately trained) personnel. |
| Note: EFA Score = Ecological Function Analysis Score. | | | |

Specific rehabilitation criteria and a monitoring program would be outlined in a relevant management plan to be submitted and approved after project approval. The rehabilitation criteria would be continually refined through monitoring and revised through a relevant updated management plan to be approved by DP&I and DTIRIS-DR&E.

The rehabilitation monitoring strategy for the Project would generally be in accordance with the monitoring program implemented successfully at the Peak Hill Gold Mine. The objective of the monitoring program would be to evaluate the restoration progress of the mine rehabilitation towards fulfilling ecological community land use objectives and closure criteria. The purpose of monitoring activities would be to ensure the sustainable re-colonisation and ongoing management of native flora and fauna, and to guide continual improvement of rehabilitation practises.

## 2.14.4 Final Landform

**Figure 2.18** presents the final landform. In summary, the final landform would include the following components.

- Three shaped and covered waste rock emplacements with undulating upper surfaces, outer faces with maximum slopes of approximately 18º (1V:3H) and appropriately located and designed surface water control structures to minimise the risk of erosion and sedimentation.

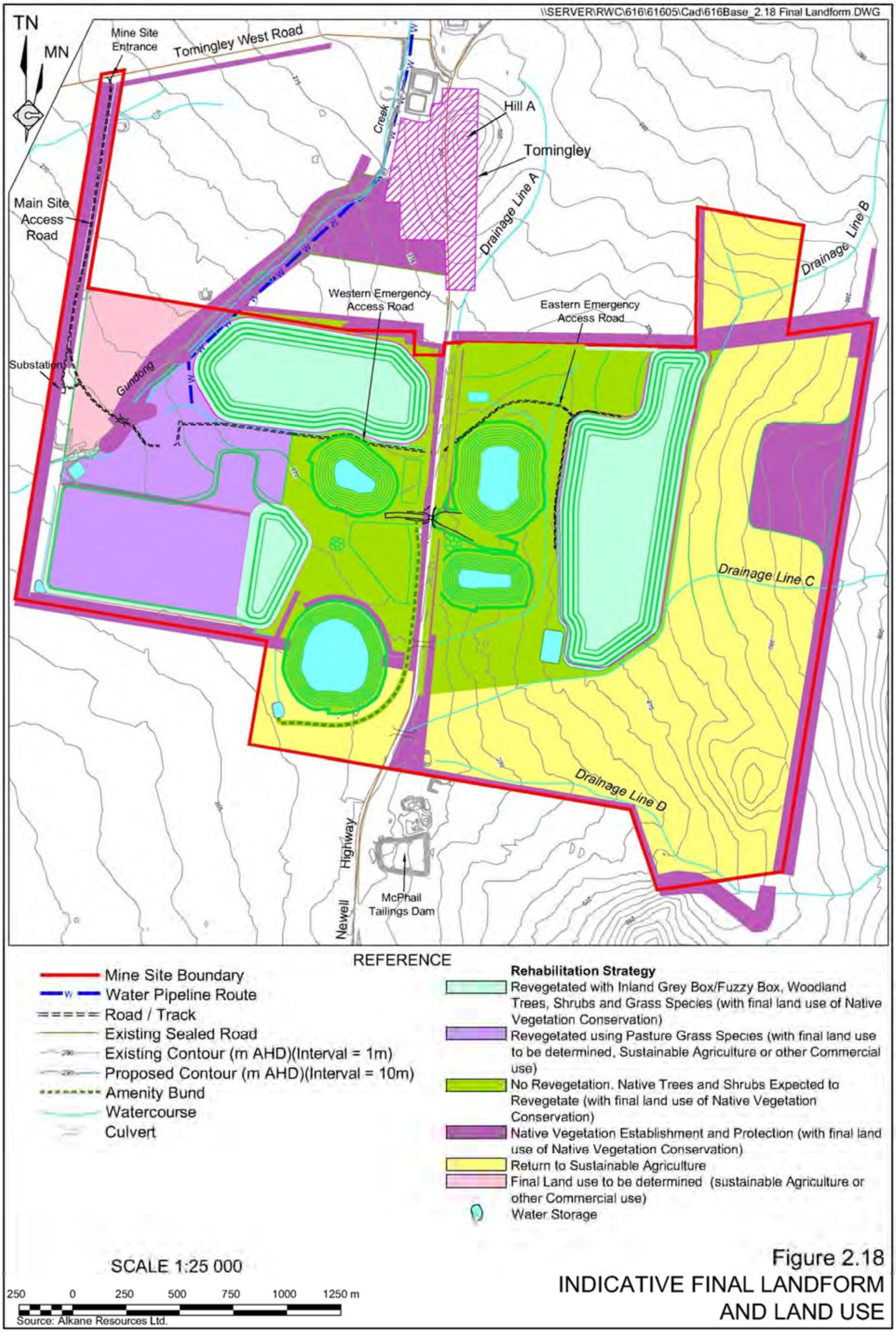



Figure 2.18
INDICATIVE FINAL LANDFORM AND LAND USE

- The final landform of Waste Rock Emplacement 1 would merge with a shaped and covered RSF. The final RSF landform would be free-draining, i.e. shed water, with the upper surface capped to create a slightly convex surface. The final walls of the RSF would be constructed at approximately 18º with appropriate surface water management structures constructed to shed water.
- Four appropriately bunded, fenced and signed open cuts.
- The vegetated amenity bunds and surface water infrastructure, including sediment basins would be retained.
- The 66kV substation would be retained.
- The water supply pipeline would be retained.
- The fate of the underpass beneath the Newell Highway would be determined in accordance with the Work Authorisation Deed executed by the Proponent and the RTA. It would be the preference for the underpass to be retained so as to make the Mine Site more amenable to future light industrial land uses, however, it is acknowledged that decommissioning and demolition of this structure may be required.

Final land uses would be determined in consultation with the community and the relevant government agencies, e.g. Department of Primary Industries, DTIRIS, DP&I, OEH and the RTA, prior to decommissioning of the Project. It is likely, however, that sections of the Mine Site would be revegetated throughout the life of the Project. As a result, the final land uses within the Mine Site would include sections that may be used for nature conservation, agriculture, tourism, light industry or some other land use identified by the community as an appropriate land use for the site.

### 2.14.5 Final Land Use

In proposing a final land use for the Mine Site, the Proponent has considered the current land use on the “Wyoming” and surrounding properties, the infrastructure that would be developed on the Mine Site and the proximity of the Mine Site to other industry.

Land uses considered included:

- a return to agriculture;
- the development of other industry;
- the development as a tourist site; and/or
- the conservation of biodiversity.

A return to agriculture on the Mine Site would have practical application as the Project has been designed to have minimal impact on local surface water, with additional water storing infrastructure retained which would be of value to grazing. This land use would also ensure that the Mine Site retains an economic value post-completion of the Project. It is noted that certain elements of the Project may not be compatible with agricultural activities, e.g. the rehabilitated RSF and open cut voids. This notwithstanding, such features would have limited value to any potential future land use and would be managed in such a way as to ensure no hazard is created.

The Project would also provide for infrastructure on the Mine Site potentially suited to other industry, e.g. available electricity supply and sub-station, roads and hard stand surfaces, buildings, power generating infrastructure and water delivery and storage infrastructure. However, as the future use of the site by other industry could be constrained by the distance from the Mine Site to larger regional centres such as Dubbo or Parkes, the site may be unsuitable to those industries requiring regular transport to and from the site.

The development of the Mine Site, or a portion of the Mine Site, for tourism has also been considered. The nearby Peak Hill Gold Mine has been developed as a tourist site, with look-outs and interpretive signs erected to provide the visitor with an understanding of the history of the site, environmental management undertaken, and cultural and ecological aspects protected. Given the close proximity of the Mine Site to Peak Hill Gold Mine, it is feasible that it could be incorporated into a mining 'tourist trail'. However, the similarity of the likely final landform on the Mine Site to that at Peak Hill Gold Mine reduces the potential uniqueness of the site as a tourist destination and thereby the viability of such a land use.

The development of land for conservation is also considered a practical final land use, as once established this would require minimal ongoing management (which could be undertaken in conjunction with concurrent agricultural activities) and would be positively affected by the significant distance to larger regional centres of Dubbo and Parkes (reducing the potential for encroachment by other development).

On the basis of the above, it has been proposed that the Mine Site be returned to an agricultural land use with sections excised for re-establishment and conservation of woodland vegetation. The Proponent is currently investigating alternative land use to agriculture and should this prove feasible will incorporate this into a Mine Closure Plan (and separate development application if relevant to the land use proposed). Section 2.15.8 provides further detail on the Proponent's proposed development and management of an area of the Mine Site to be devoted to conservation.

### 2.14.6 Rehabilitation Methods and Procedures

#### 2.14.6.1 Introduction

Following receipt of project approval, and as a component of a Mining operations plan for the Mine Site, the Proponent would prepare a detailed rehabilitation plan for the Project. This would provide the agreed final landform and land uses (including any land excised for biodiversity offsetting purposes), detailed progressive rehabilitation schedule and specific revegetation species mix to be used as part of direct seeding and ameliorative planting over the Mine Site. The following sub-sections provide a summary of the methods that the Proponent would adopt for each of the identified rehabilitation domains to meet the objectives described in Section 2.14.6.2, and achieve the conceptual final landform described in Section 2.15.4 and the principal land uses described in Section 2.15.5 (see **Figure 2.18**).

#### 2.14.6.2 Decommissioning Activities

Decommissioning activities would be undertaken upon cessation of mining and processing activities. The following structures and facilities would be decommissioned and removed prior to final rehabilitation of the Mine Site.

- The Processing Plant and Office Area.
- Various fuel storage, workshops, offices and ablutions structures.
- Roads not to be maintained in the final landform.

Items of infrastructure that would not be decommissioned and remain available for future land use are likely to include the following.

- Water supply pipeline.
- 66kV substation, electricity transmission line, transformer and power lines.
- Site buildings, including the office and workshops.
- Main Site Access Road from Tomingley West Road and the western emergency access road.

### Processing Plant and Office Area (Domain D1)

Prior to the cessation of mining and processing activities, the Proponent would attempt to identify a buyer for the processing plant (in its entirety or in part). Should the Proponent successfully negotiate the sale, the various buildings and processing infrastructure would be deconstructed.

Should relocation or sale not eventuate, the structure would be separated into smaller sections with parts on-sold as scrap metal and any useable elements transported to a storage facility off site.

### Miscellaneous Buildings and Structures (Domain D1)

The majority of buildings and structures erected/constructed on the Project Site would be demountable and therefore would simply be dismantled, washed down with high powered water sprays and transported off site.

Hydrocarbon storage facilities (for diesel, LPG and oils) would be pumped out. A thorough assessment of the soil directly below and surrounding the storage facilities and refuelling area(s) would be conducted to ensure any contaminated soil would be identified. Any contaminated soil classified as "*Restricted Solid Waste*" (under NSW Waste Classification Guidelines, DECCW 2009) would be excavated for treatment on site within a specific bioremediation area or disposed of at an appropriately licensed facility. The fuel storage facility would be on-sold or re-used at another site.

All concrete footings and foundations of buildings or structures to be dismantled or demolished would be broken up and removed or covered and all areas to be rehabilitated would be re-profiled to mimic pre-mining levels.

### Roads (Domain D1)

The Proponent intends to remove the majority of Mine Site roads (some roads may be retained to provide ongoing access to the Project Site lands). The Mine Site roads to be removed would be decommissioned (and rehabilitated) as follows.

i) The roads would be closed, with a lockable gate constructed or maintained to prevent access.

ii) The compacted surface would be ripped, removed by truck and disposed of within one of the waste rock emplacements.

iii) All compacted sub-base and base-course material would be ripped, excavated and disposed of within one of the waste rock emplacements or recycled, if appropriate.

The roads would be rehabilitated through further ripping, the respreading of topsoil and reseeding with pasture species or native tree and shrub species depending on the land use designated for that section of the road.

### 2.14.6.3 Infrastructure Areas (Domain D1)

Once infrastructure decommissioning has been completed, the remaining infrastructure would be rehabilitated as follows.

- Any internal haul roads and other access tracks, with the exception of those specifically noted in Section 2.15.6.2, would be ripped, covered with previously stockpiled topsoil and seeded with locally occurring tree, shrub or grass species (dependent on the intended final land use). Section 2.15.6.8 provides details as to the indicative revegetation activities to be completed over this and other rehabilitation domains of the Mine Site.
- Remaining hardstand areas would be scraped to remove and material not appropriate for rehabilitation, ripped, and covered with previously stockpiled topsoil. Revegetation would be undertaken as described generally in Section 2.15.6.8.
- Appropriate drainage controls would be installed.

### 2.14.6.4 Amenity Bunds and Surface Water Management Structures (Domain D2)

Section 2.2.6 identifies the amenity bunds and surface water management structures that would be constructed during the site establishment phase of the Project. These structures would be retained in the final landform with rehabilitation limited to the removal of any accumulated silt or sediment, minor profiling activities as required and revegetation using the indicative methods and species list described in Section 2.15.6.8.

In summary, the amenity bunds would be progressively rehabilitated using shrub and grass species that would be representative of the Inland Grey Box and Fuzzy Box Woodland Endangered Ecological Communities. Trees would only be planted at the toe of bunds as they have the potential to reduce the vegetation cover on the batters through competition for moisture. The surface water drainage structures would be revegetated with a mixture of introduced and native grass species (annual and perennial).

### 2.14.6.5 Waste Rock Emplacements (Domain D3)

Completed sections of the waste rock emplacements would be progressively shaped as soon as practicable after they are no longer required for mining-related purposes. Remaining sections of the waste rock emplacements would be shaped following completion of mining operations.

During shaping operations, contour banks would be constructed on the rehabilitated landform. These structures would direct water at non-erosive velocities from the emplacement to the natural landform or to high-slope, drop-down structures such as flumes. These drop-down structures would be constructed on the slopes of the final landform to direct the surface water flows collected by the contour banks initially to the dirty water management system and then, following completion of rehabilitation operations, to natural drainage lines. Detailed plans showing surface water structures would be provided in the Mining Operations Plan prepared for the Project.

Soil would be placed on the shaped landform in accordance with the following procedures.

- Where required, weathered overburden material would be placed on the surface of the area to be rehabilitated to prevent large rocks from protruding from the final landform and provide a growth medium/water retention material during revegetation.
- Soil material would be placed on the shaped landform. The thickness this material would be determined by the area to be rehabilitated and the volume of soil material available for rehabilitation operations.
- The surface of the shaped landform would be left even but roughened. This would assist in maintaining soil stability, maximising seed retention and germination and minimising erosion.
- If required, artificial covers such as bitumen impregnated straw or mulches would be used to stabilise the soils on the shaped landform.
- The shaped landform would be revegetated with an appropriate species mix to be determined by an appropriately qualified and experienced rehabilitation consultant. **Table 2.11** presents an indicative species list that would be used during rehabilitation operations.

**Table 2.11**
**Indicative Rehabilitation Native Species List**

| Scientific Name | Common Name | Scientific Name | Common Name |
|---|---|---|---|
| *Eucalyptus microcarpa* | Inland Grey Box | *Acacia pendula* | Myall |
| *Eucalyptus conica* | Fuzzy Box | *Acacia deanii* | Dean's Wattle |
| *Eucalyptus populnea* | Bimble Box | *Acacia decora* | Western Golden Wattle |
| *Eucalyptus camaldulensis* | River Red Gum | *Acacia hakeoides* | Hakea Wattle |
| *Allocasuarina leumanii* | Buloke | *Acacia implexa* | Lightwood |
| *Callitris glaucophylla* | White Cypress Pine | *Acacia salicina* | Cooba |
| *Pittosporum phillyroides* | Butterbush | *Dodonea viscosa* | Hopbush |
| *Brachychiton populneus* | Currajong | *Daviesia genistifolia* | Broom Bitter-pea |
| *Hakea tephrosperma* | Needlewood | *Enchylaena tomentosa* | Ruby Saltbush |
| *Hardenbergia violacea* | False Sarsparilla | *Rhagodia nutans* | Climbing Saltbush |
| *Austrostipa scabra* | Rough Speargrass | *Themeda australis* | Kangaroo Grass |
| *Austrodanthonia sp.* | Wallaby Grass | *Chloris sp.* | Umbrella Grass |
| *Bothriochloa macra* | Redgrass | *Microlaena stipoides* | Weeping Grass |
| *Cymbopogon refractus* | Barbed-Wire Grass | *Paspalidium jubifllorum* | Warrego Summer Grass |
| Source: Landscape Strategies Australia (2009) | | | |

The soil stockpile areas from which the soil would be stored and then sourced for rehabilitation would be ripped, covered with a layer of topsoil and revegetated in accordance with the general strategies described in Section 2.15.6.8.

The Proponent would undertake a program of collecting seed from native vegetation within and surrounding the Mine Site for use during rehabilitation and enhancement operations. In addition, the Proponent would also undertake revegetation trials to determine the most appropriate mechanism and species mix for rehabilitation within the Mine Site. Details of the trials would be included in the AEMR.

#### 2.14.6.6 Open Cut Areas (Domain D4)

Prior to the commencement of mining operations within each open cut, a 1.3m to 1.4m high safety bund (Type 3 bund – see Section 2.2.6.2) would be constructed around each open cut area. Following completion of mining operations, the haul ramps would be blocked using large rocks or bunds to prevent vehicular access to the open cuts. No planned revegetation of the open cuts would be undertaken, though it is likely vegetation could re-establish on the benches of the open cuts through natural revegetation (as has occurred at the Peak Hill Gold Mine located approximately 15km to the south-southwest of the Mine Site [**Plate 2.3**]).

The final depth of the open cuts would be below the local groundwater table and therefore, groundwater would seep into and accumulate within the retained voids. Initially, the water quality within the final voids would be similar to that of the local groundwater, however, as a consequence of local evaporation exceeding rainfall, the salinity of the water within the void would gradually increase. Section 4.4.4.3 provides a brief discussion as to possible fuinal salinity concentration.

The water held within the final voids would be isolated from the surface water drainage system of the final landform as the final water level would remain well below the lowest point of the surrounding final landform, i.e. the rim of the open cut. Access to the voids would be prevented through the construction of the safety bund noted above, which would be allowed to revegete naturally. The potential for impact on downstream waters would therefore be minimal.

The salinity concentration of the water accumulating in the void would be sampled and analysed for a period to be established in a Water Management Plan for the Project to establicsh the actual quality of the accumulating water. Management of the final voids, and the water to be stored within these is discussed further in Section 4.4.4.3.

#### 2.14.6.7 Residue Storage Facility (Domain D5)

The RSF would, following completion of processing-related operations, be allowed to dry out and settle. During that period, surface water and groundwater monitoring as identified in Section 4.4.8 would continue. Once the RSF has settled sufficiently and water quality is confirmed as acceptable, the RSF would be capped with a layer of impermeable clay to form a free draining landform, i.e. water shedding. Further layers of subsoil and topsoil would be placed over the clay, with appropriate drainage installed to direct surface flows to designated drop-down structures.

The external batters of the RSF would also be covered with a layer of subsoil followed by topsoil, and then revegetated with a combination of the native grass and shrub species nominated in Section 2.15.6.8.

#### 2.14.6.8 Indicative Mine Site Revegetation Strategy

Revegetation of the Mine Site would be undertaken as either;

- revegetation of the rehabilitated final landform; or
- ameliorative planting of native species as a component of a Biodiversity Offset Strategy.

This sub-section focuses on the revegetation of the rehabilitated final landform. Section 2.14.8 provides the Proponent's proposed Biodiversity Offset Strategy which includes ameliorative planting of native species.

Over the major areas of disturbance, i.e. on the batters of the waste rock emplacements and RSF, and various amenity bunds, a mixture of native and introduced species of grasses and legumes would be used for rapid stabilisation of batters. The Proponent has 14 years of experience with rehabilitation techniques at the Peak Hill Gold Mine to guide techniques. Once stabilisation of the final landform is confirmed, these areas would be seeded with a native species mix containing species representative of the Inland Grey Box Woodland and Fuzzy Box Woodland Endangered Ecological Communities as well as other locally occurring species.

**Table 2.11** presents an indicative list of species that would be used during ameliorative and rehabilitation planting programs. The indicative species list includes both tree, shrub and grass species and would be refined with experience and the actual species used would be presented in the AEMRs that would be prepared for the Project.

It is recognised that the exact grass, shrub or tree species to be used in Mine Site rehabilitation may vary over the five domains dependent on final landform and function, e.g. vegetation to be used in the rehabilitation of a drainage line will vary to that used on the upper surface of a waste rock emplacement. As noted in Section 2.15.6.1, more specific detail on the exact species mix to be used, and the planting techniques to be implemented, would be provided as the Rehabilitation Management plan component of a Mining Operations Plan to be prepared following receipt of project approval.

### 2.14.7 Rehabilitation Management and Monitoring

The Proponent's commitment to effective rehabilitation would involve an ongoing monitoring and maintenance program following completion of mining-related operations. Areas being progressively rehabilitated would be regularly inspected, including during AEMR meetings. During these inspections the following would be noted.

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover.
- Success of initial cover crop or grass cover establishment.
- Success of tree and shrub plantings.
- Natural regeneration of native species.
- Adequacy of drainage controls.
- General stability of the rehabilitated areas.

Post-mining rehabilitation remediation and enhancement activities would include but not be limited to the following.

- Where rehabilitation success appears limited, maintenance activities would be initiated. These may include re-seeding and where necessary, re-topsoiling and/or the application of specialised treatments.
- If drainage controls are found to be inadequate for their intended purpose, or compromised by wildlife or native vegetation, these would be replaced.

- Temporary fences would be installed to exclude native fauna, if grazing appears to be excessive.
- In the event areas of excessive erosion and sedimentation are identified, remedial works such as importation of additional fill, subsoil or topsoil material, or redesigning of water management structures would be undertaken.
- Appropriate noxious weed control or eradication methods and programs would be undertaken in consultation with the Department of Primary Industries – NSW Agriculture (DPI-Ag) and / or the local Noxious Weeds Inspector.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance. Rather, maintenance would continue until such time as the objectives outlined in Section 2.14.2 are achieved to the satisfaction of the relevant government agencies.

## 2.14.8 Offset Strategies

### 2.14.8.1 Summary of Impacts

The development of the Project as proposed would require the clearing of approximately 21.6ha of remnant vegetation including:

- approximately 2.7ha of Inland Grey Box – Poplar Box – White Cypress Pine tall woodland (considered a component of the NSW Inland Grey Box Woodland EEC and referred to hereafter as the Inland Grey Box EEC);
- approximately 0.9ha of Fuzzy Box – Inland Grey Box community (considered a component of a Fuzzy Box on Alluvials EEC and referred to hereafter as the Fuzzy Box EEC); and
- approximately 18.0ha of Belah / Black Oak Western Rosewood, Wilga Woodland community[6].

### 2.14.8.2 Biodiversity Offset Requirements

In December 2010, the then Department of Environment, Climate Change and Water (DECCW) issued an interim policy on assessing and offsetting biodiversity impacts of Part 3A developments (DECCW, 2010[7]). This policy seeks to provide a consistent and transparent approach to impact assessment and offsetting for projects assessed under Part 3A of the EP&A Act. This policy also provides the basis for aligning NSW and Commonwealth assessment and offsetting processes by providing an assessment pathway that is likely to satisfy both NSW and Commonwealth requirements.

Under this policy, the Proponent is required to:

- describe, quantify and categorise the biodiversity values and impacts of a proposal;

[6] The density of mature trees within the Belah/Black Oak Western Rosewood, Wilga Woodland community within the disturbance footprint has been extensively reduced and modified by historic ringbarking activities

[7] It is noted that the nominated expiry date for the interim policy, June 2011, has passed. No formal policy position from the OEH has been subsequently provided.

- identify, for benchmarking purposes, the offsetting that would be required to meet the improve or maintain standard; and
- provide the information for calculating offsets under this policy.

The interim policy of OEH relies on the use of the Biobanking Assessment Methodology (BBAM) for the purpose of quantifying and categorising the biodiversity values and impacts of Part 3A proposals. The nominated offset strategy is then considered against benchmark requirements for the level of disturbance proposed (generated by BBAM) to determine whether it meets one of the following biodiversity outcomes.

- Improve or maintain. The benchmark offsets nominated by BBAM are achieved.
- No net loss. With the exception that 'red flag' areas, e.g. EECs or threatened flora, are not protected, the benchmark offsets nominated by BBAM are achieved
- Mitigated net loss. The nominated offset does achieve the benchmark nominated by BBAM, however, a lesser quantum is justified on the basis of other factors.

The OEH interim policy acknowledges that it may not be feasible or appropriate to apply the BBAM in all cases. In such cases, the OEH interim policy states that "*offsets are to be negotiated on a case by case basis and in accordance with DECCW's offsetting principles*". The referenced "DECCW offsetting principles" are those provided in the *Principles for the use of Biodiversity Offsets in NSW* presented as Appendix II of the *Guidelines for Biodiversity Certification of Environmental Planning Instruments – Working Draft* published by the then Department of Environment and Climate Change (DECC, 2008c). DECC (2008e) requires that, in order to adequately compensate for the disturbance, the offset must:

1. address impacts remaining after mitigation or prevention measures have been undertaken;
2. meet all regulatory requirements;
3. never reward ongoing poor performance;
4. complement other government programs such as national parks and reserves;
5. be underpinned by sound ecological principles;
6. aim to result in a net improvement in biodiversity over time;
7. be enduring, i.e. they must offset the impact of the development for the period that the impact occurs;
8. be agreed upon prior to the impact occurring;
9. be quantifiable, i.e. the impacts and benefits must be reliably estimated;
10. be targeted, i.e. they must offset the impacts on a "like for like or better" basis;
11. be located appropriately, i.e. they must offset the impact in the same region;
12. be supplementary, i.e. beyond existing requirements and not already funded by another scheme; and
13. be enforceable, i.e. through development consent conditions, licence conditions, covenants or a contract.

Also considered are the guiding principles of the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) which require that the offset should meet the following principles (DEWHA, 2007).

1. Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.
2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.
3. Environmental offsets should deliver a real conservation outcome.
4. Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.
5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are ‘like for like’.
6. Environmental offsets should be located within the same general area as the development activity.
7. Environmental offsets should be delivered in a timely manner and be long lasting.
8. Environmental offsets should be enforceable, monitored and audited.

#### 2.14.8.3 The Proposed Biodiversity Offset Strategy

The proposed biodiversity offset strategy for the Project (“TGP BOS”) has been developed in collaboration with OzArk Environment and Heritage Management (“OzArk”), ecological consultants to the Proponent. The development of the TGP BOS considered the scale of the impacts proposed, the NSW and Commonwealth requirements for biodiversity offsets, as well as local factors such as land use both current and future.

Based on these principal considerations, the focus of the TGP BOS is the protection, enhancement and long-term conservation of the existing remnant native vegetation on the Mine Site and surrounding lands. Particular focus has been given to enhancing and conserving those remnants of Inland Grey Box EEC and Fuzzy Box EEC occurring on and immediately surrounding the Mine Site. **Figure 2.19** illustrates the critical features of the proposed TGP BOS which can be summarised as follows.

- Approximately 21.1ha of remnant Inland Grey Box EEC in Moderate to Good Condition (as defined by BBAM) would be protected and conserved. Remnant vegetation is predominantly thin strips of vegetation along road reserves and isolated patches along drainage lines within farmed paddocks (remnant patch width does not exceed 30m).

  The TGP BOS proposes to protect these remnant areas from degradation that could result from competing land uses, e.g. grazing. Where remnant vegetation is present and in Low Condition (as defined by BBAM), the extant remnants will be enhanced by supplementary seeding and/or planting. The TGP BOS also provides for the extension of these remnant areas of Inland Grey Box EEC as follows.

– The remnant that is aligned along the Main Site Access Road and along the western and southern boundary of the Mine Site would be extended (on to the Mine Site) by 20m (resultant width of the patch would be no narrower than 50m). The extended remnant area would be surveyed, marked and fenced as required. Initially, natural remediation and revegetation would be encouraged, however, supplementary seeding and tree planting would be undertaken, as required.

– Within this same 20m extension (onto the Mine Site), survey, fencing and supplementary revegetation would also be implemented where strips of Inland Grey Box EEC occur on the western section of the Mine Site. As noted above, the width of the remnant would not be smaller than 50m.

– Habitat corridors would be created through the extension of the existing native vegetation remnants around Wyoming One Open Cut and along the southern boundary on the western section of the Mine Site. These 20m strips would be surveyed, protected from competing land use (by fencing if necessary) and enhanced by supplementary seeding and/or tree planting, as required.

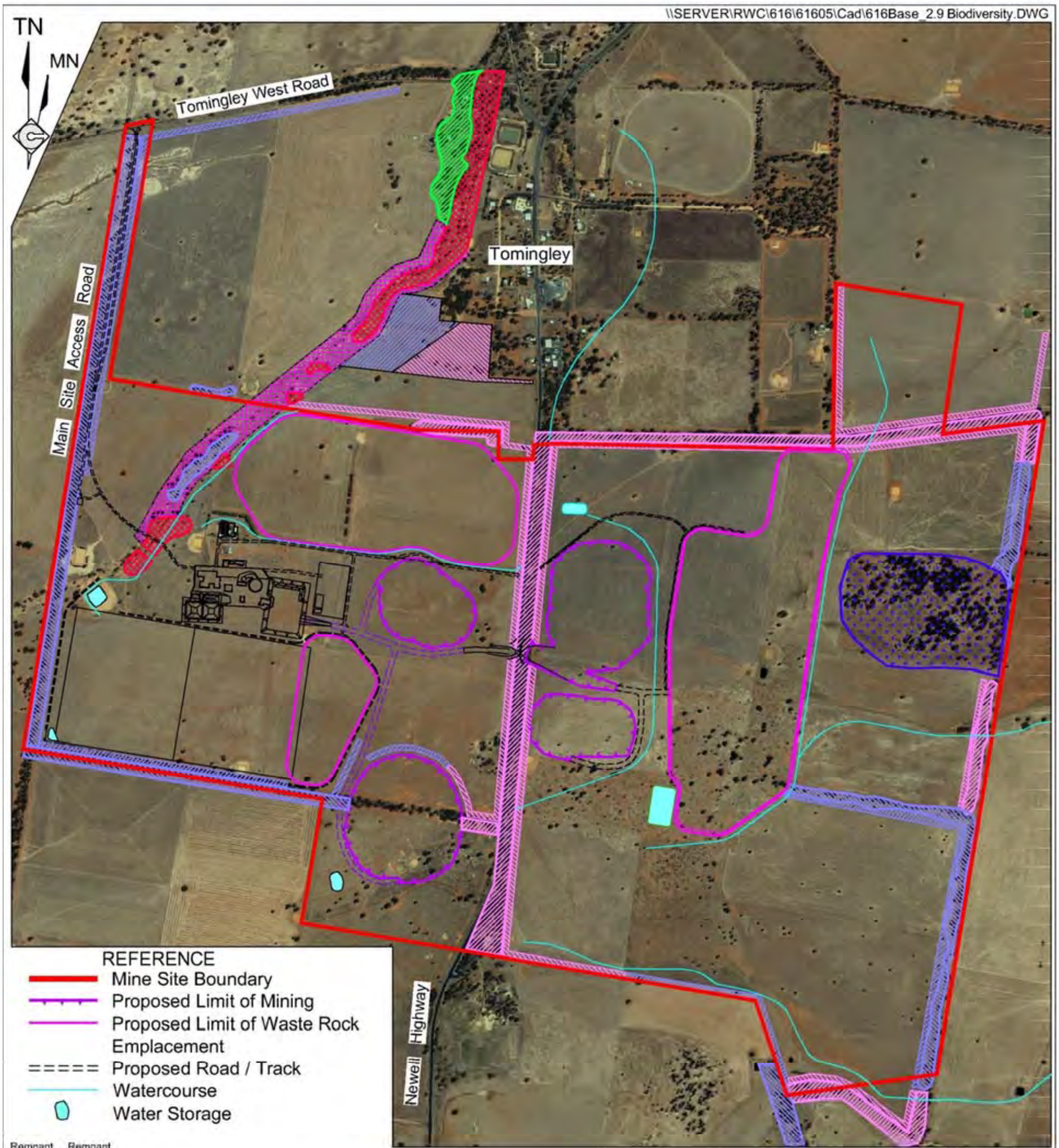
– Planting of vegetation indicative of the Inland Grey Box EEC would be undertaken on land bounded to the north and east by Tomingley village, to the west by Gundong Creek and to the south by an existing strip of Fuzzy Box EEC vegetation. As noted earlier, where Low Condition remnants are located adjacent to a Moderate to Good remnant the aim of habitat restoration is to achieve widths no less than 50m.

In total 21.5ha of Inland Grey Box EEC remnant extension and enhancement is proposed by the TGP BOS. In total 42.6ha of Inland Grey Box EEC including all structural layers would be protected within the Mine Site. Notably, under existing (pre-mining conditions) at least 24.7ha of this vegetation lacks substantive grassy or shrub layers.

- Approximately 5.1ha of remnant Fuzzy Box EEC in Moderate to Good condition would be protected and conserved as described above for the Inland Grey Box EEC remnants (this includes remnants contained within the Newell Highway easement but excludes the small southern-most remnant which occurs on land not under the control of the Proponent). The TGP BOS also provides for the extension of these remnant areas of Fuzzy Box EEC as follows.

– The remnants aligned along the Newell Highway, around the boundary of the western section of the Mine Site and onto the eastern section of the Mine Site in the vicinity of Wyoming One Open Cut would be extended by 20m (remnant width would be in the order of 60m). The extended remnant area would be surveyed, protected and enhanced as described for the Inland Grey Box EEC remnants.

– An additional 20m wide strip of Fuzzy Box EEC would be established on the eastern and southern boundaries of Lots 94 and 95, DP755110, extending to the east and then north (achieving remnant width of no narrower than 50m). This would be surveyed, protected and enhanced as described for the Inland Grey Box EEC remnants.




Remnant to be Conserved / Remnant Extension Zones

**Community 1** - Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams (Benson 76)
**Community 2** - River Red Gum riverine woodland forest (Benson 78)
**Community 3** - Fuzzy Box - Inland Grey Box on alluvial brown loam soils (Benson 201)
**Community 4** - Poplar Box - Belah woodland on clay alluvial plains (Benson 56)
**Community 5** - Belah / Black Oak Western Rosewood, Wilga Woodland (Benson 57)
**Community 6** - Mugga Ironbark (Planted)

| | Community | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Area to be Disturbed (ha) | 2.7 | 0 | 0.9 | 0 | 18.0 | 0.7 |
| Remnant to be Conserved (ha) | 21.1 | 13.1 | 5.1 | 4.9 | 34.3 | 0 |
| Remnant Extension (Protection & Ameliorative Planting) (ha) | 21.5 | 13.5 | 26.0 | 0 | 0 | 0 |

**Note:** Areas of referenced vegetation on land not owned or under agreement with the Proponent do not form part of the Biodiversity Offset Strategy

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Source: OzArk (2011) - Figure 13

Figure 2.19
BIODIVERSITY OFFSET STRATEGY

- Planting of vegetation indicative of the Fuzzy Box EEC would also be undertaken on land bounded to the north and east by Tomingley village, to the west by Gundong Creek and to the south by an existing strip of Fuzzy Box EEC vegetation (achieving remnant width of no narrower than 50m).

In total 26.0ha of Fuzzy Box EEC remnant extension and enhancement is proposed by the TGP BOS. In total, 31.1ha of Fuzzy Box EEC including all structural layers would be protected within the Mine Site. Notably, under existing (pre-mining conditions) at least 6.0ha of this vegetation lacks substantive grassy or shrub layers.

- Approximately 13.1ha of River Red Gum riverine woodland forest, occurring along Gundong Creek, would be protected and conserved as described above for the Inland Grey Box and Fuzzy Box EEC remnants. The TGP also provides for the extension of this remnant area as follows.
  - A 50m wide area would be protected either side of the creek channel. This would be surveyed, marked (and fenced as necessary) and protected from competing land uses.
  - Initially, natural remediation and revegetation would be encouraged, however, supplementary seeding and tree planting would be undertaken as required.

  In total 13.5ha of River Red Gum riverine woodland forest remnant extension and enhancement is proposed by the TGP BOS. In total, 26.6ha of Fuzzy Box EEC including all structural layers would be protected within the Mine Site.
- Approximately 4.9ha of Poplar Box – Belah woodland on clay alluvial plains and 25.5ha of Belah / Black Oak Western Rosewood Wilga woodland would be conserved on and immediately surrounding the Mine Site.
- 17.2ha of Belah/Black Oak – Western Rosewood – Wilga woodland of central NSW (Benson 57) in Moderate to Good Condition and 17.2ha of Benson 57 in Low Condition would be protected and enhanced by natural recovery.
- The sediment basins and drainage lines established for the Project would be retained and revegetated incorporating native vegetation such as rushes, sedges, grasses and trees common to watercourses and storage areas.
- The proposed final land uses of the Mine Site (see **Figure 2.18**) are also an important component of the TGP BOS, with significant areas identified as '*Native Vegetation Establishment and Protection*'. Remaining areas are identified as being returned to '*Sustainable Agriculture*'.

**Table 2.12** provides a summary of the vegetation to be disturbed, conserved and extended/enhanced on and surrounding the Mine Site.

Assessment of the suitability of the proposed TGP BOS is considered by OzArk (2011a) with a summary of this assessment included in Section 4.5.7.4.

**Table 2.12**
**Proposed Tomingley Gold Project Biodiversity Offset Strategy**

| | Community[1] | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **Area to be Disturbed** | 2.7 | 0 | 0.9 | 0 | 18.0 | 0.7 |
| **Remnant Conservation and Enhancement** | 21.1 | 13.1 | 5.1 | 4.9 | 17.2 | 0 |
| **Remnant Extension (and Enhancement)** | 21.5 | 13.5 | 26.0 | 0 | 17.2 | 0 |
| **Total Offset (Remnant Conservation + Enhancement)** | 42.6 | 26.6 | 31.1 | 4.9 | 34.4 | 0 |

Note 1:
- Community 1: Inland Grey Box EEC.
- Community 2: River Red Gum riverine woodland forest.
- Community 3: Fuzzy Box EEC.
- Community 4: Poplar Box – Belah woodland on clay alluvial plains.
- Community 5: Belah / Black Oak Western Rosewood, Wilga Woodland community.
- Community 6: Mugga Ironbark (planted).

Source: Modified after OzArk (2011a) – Table 19

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# Section 3

# Consultation, Issue Identification and Prioritisation

## PREAMBLE

*This section describes how the environmental issues assessed in the Environmental Assessment were identified and prioritised. In summary:*

(i) *a comprehensive list of all relevant environmental issues was assembled through consultation with the local community and local and State government agencies, completion of preliminary environmental studies and a review of relevant legislation, planning documents and environmental guidelines;*

(ii) *a review of the Project design and local environment was undertaken to identify risk sources and potential environmental impacts for each environmental issue;*

(iii) *an analysis of unmitigated risk for each potential environmental impact was then completed with a risk rating assigned to each impact based on likelihood and consequence of occurrence; and*

(iv) *through a review of the allocated risk ratings and the frequency with which each issue was identified, the relative priority of each issue was determined, with this priority used to provide an order of assessment and breadth of coverage within Section 4.*

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# 3.1 INTRODUCTION

In order to undertake a comprehensive *Environmental Assessment* of the Project, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the wider community. To ensure this has occurred, a program of community and government consultation and a review of environmental planning documentation was undertaken to identify relevant environmental issues and potential impacts. This was followed by an analysis of the risk posed by each potential impact in order to prioritise the assessment of the identified environmental issues within the *Environmental Assessment*.

It should be noted that the Proponent has demonstrated a commitment to open communication with the local community since discovery of mineralisation at Tomingley. An initial open community meeting held to inform the community of the exploration and feasibility study progress was held at the Tomingley Memorial Hall on 26 June 2003.

# 3.2 CONSULTATION

## 3.2.1 Community Consultation

### 3.2.1.1 Introduction

Community consultation associated with the current application comprised the following components described in the following subsections.

- An initial community information session – April 2009 (see Section 3.2.1.2).
- A second community information session – February 2011 (see Section 3.2.1.3).
- Targeted community consultation, focusing particularly on those residents of Tomingley expected to receive noise emissions higher than the relevant criteria (see Section 3.2.1.4).
- Aboriginal community consultation (see Section 3.2.1.5).

In addition, the Proponent has maintained an open and transparent relationship with the community surrounding the Mine Site with a range of formal and informal discussions held with individual community members and the Aboriginal community since the initial 2003 community meeting.

### 3.2.1.2 First Community Information Session

The first community information session was held at the Tomingley Community Hall on 20 April 2009 from 7:00pm to 8:45pm. Information about the session was distributed prior to the meeting by letter drop to Tomingley residents and immediate neighbours of the Mine Site. The session was attended by approximately 80 community members, including a number of representatives of Narromine and Parkes Shire Councils.

During the session, Mr Ian Chalmers, Managing Director of Alkane Resources Ltd, gave an overview of the Project as it was then understood. Following the presentation, an opportunity was provided to ask questions and provide comments. **Table 3.1** presents an overview of the issues raised at the session and where each is addressed in this document. In addition to the issues and questions raised by the community, representatives of both Narromine and Parkes Shire Councils expressed general support for the Project and commended the Proponent on the community consultation that had previously been undertaken.

**Table 3.1**
**Initial Community Information Session – Issues Raised**

| Issue Raised | EA Section(s) |
|---|---|
| Hours of Operation | 2.11.2 |
| Visual and light pollution | 4.8.3 |
| Noise impacts | 4.2.3 to 4.2.7 |
| Use of cyanide and associated environmental impacts | 2.6.3.3, 2.6.4 & 4.5.7.3.3 |
| Dust emissions from the Project | 4.9.4 to 4.9.8 |
| Power supply | 2.10.3.1 |
| Third party access to water supply pipeline | 2.2.2.2 |
| Surface water flows. | 4.3.3 to 4.3.6 |

#### 3.2.1.3 Second Community Information Session

During the initial community information session, a commitment was made to hold a second information session once the required environmental studies had been completed. This session was held at the Tomingley Community Hall on 11 February 2011. Similar issues to the first meeting were discussed, however, management of noise on the Mine Site was presented to the community in greater detail.

#### 3.2.1.4 Targeted Community Consultation

At the second community information session, attendees were asked to complete a registration form, including a check box identifying whether they would like to be contacted to arrange a time for further individual consultation in relation to the Project. In addition, registration forms were left at the Crossroads Hotel in Tomingley with contact details of the Proponent and their consultants for interested parties to similarly request further consultation. 51 registration forms were completed at the second information session, of which 18 requested that they be contacted for further individual consultation.

Following the second information session, R.W. Corkery & Co Pty Limited telephoned all those who requested to be contacted, as well as those residents whose properties were predicted to experience noise levels in excess of the relevant noise criteria. A range of days and times were offered, including evenings and weekends. Not all those who originally requested to be consulted took up the offer.

- The following individuals were consulted individually during the targeted consultation program. Dates and times of the meetings are presented in parentheses Dot Stewart (9:00am, Friday 18 February 2011).
- Christine Cox and Barry Unger (10:00am, Saturday 19 February 2011).
- Chris Sonter (11:00am, Saturday 19 February 2011).
- John and Diana Hopkins (1:00pm, Tuesday 22 February 2011).
- Peter and Helen Laffey (9am, Wednesday 23 February 2011).
- Christine Peckham (4:00pm, Tuesday 22 February 2011).
- Ben Rees (6:30pm, Tuesday 22 February 2011).
- Wes and Sally Boucher (7:00pm, Tuesday 22 February 2011).

**Table 3.2** presents the issues raised during the targeted consultation and where each issue is addressed.

**Table 3.2**
**Targeted Consultation – Issues Raised**

| Issue Raised | EA Section(s) |
|---|---|
| Noise impacts and management measures | 4.2.3 to 4.2.7 |
| Visual amenity impacts – direct and indirect (night-time light spill) | 4.8.3 |
| Dust and associated impacts | 4.9.4 to 4.9.8 |
| Revegetation, screen plantings and species selection | 2.14.4 |
| Avifauna-related impacts | 4.5.8 |
| Property values and general loss of amenity | 4.14.3 |
| Mine Site security fencing | 2.13.1 |
| Modifications to surface water flows and flooding patterns | 4.3.5 |
| Community contributions and sponsorship | 2.12 |
| Ongoing community consultation protocols and operation/membership of the Community Consultative Committee | 4.14.2 |
| Noise and dust monitoring. | 4.2.7 and 4.9.8 |

During the targeted consultation, the Proponent made the following commitments which are reproduced in the draft Statement of Commitments presented in Section 5.

- Undertake a detailed survey prior to construction of amenity bunding north of the Caloma Open Cut and adjust surface water management structure design to ensure no significant changes to current flooding patterns (Commitment 5.1).
- Construct perimeter security fence as early as possible during construction operations to limit the potential for inadvertent or unauthorised access to the operational sections of the Mine Site (Commitment 2.4).
- Cooperate with surrounding landholders with early establishment of screen plantings (Commitment 7.25).
- Share flora, fauna and heritage survey information with interested stakeholders (Commitment 7.27).
- Develop specific community consultation protocols for individuals surrounding the Mine Site (Commitments 17.1 to 17.4).
- Ensure regular consultation with surrounding community to provide an overview of Project status, monitoring results and forward plans (Commitments 17.1 to 17.4).
- Establish a Community Consultative Committee with members drawn from the surrounding community and Parkes and Narromine Shire Councils (Commitment 17.1).

#### 3.2.1.5 Aboriginal Community Consultation

Consultation with the registered Aboriginal stakeholders and other relevant members of the Aboriginal community is described in detail in Section 4.6.3. In summary, the Proponent consulted with the following organisations and individuals during preparation of the *Environmental Assessment* and associated documentation.

- Narromine LALC (NLALC);
- Peak Hill LALC (PHLALC);
- Little Burning Mountain Aboriginal Corp (LBMAC);
- Mooka Traditional Owner Corporation (MTOC);
- Wiradjuri Council of Elders (WCE);
- Trevor Robinson (individual);
- Peter Peckham (individual);
- the Bogan River Peak Hill Wiradjuri Aboriginal Corporation (BPHWAC); and
- Bulgandramine Youth Development Aboriginal Corporation (BYDAC).

Consultation with the local Aboriginal community included the following.

- Advertisement for expressions of interest in participating in the cultural heritage assessment for the Tomingley Gold Project as required by the *Interim Community Consultation Requirements for Applicants* (DEC, 2005a), the active consultation guidelines at the time of initial consultation.
- Exchange of letters and written documentation, including a draft of the Aboriginal Heritage Assessment, outlining the Project and the results and recommendations arising from the heritage assessment.
- A series of meetings on 9 September 2010, 14 September 2010 and 17 September 2010, held to discuss specific Aboriginal site management issues, as well as ongoing protocols for consultation and negotiations between the Proponent and the Aboriginal community. These meetings led to the establishment of the Peak Hill Wiradjuri Reference Group, a representative group of six registered Aboriginal organisations, and the signing of a Community Engagement Protocol (on 15 June 2010).
- A range of one-on-one and community meetings with the Upper Bogan River Wiradjuri community on 27 July 2009, 5 August 2009, 9 September 2009, 17 September 2009, 18 February 2011, 22 February 2011 and 23 February 2011. These meetings were principally to discuss the results of the Aboriginal heritage survey and identify appropriate management measures for sites of Aboriginal heritage significance that would be disturbed by the Project.
- A range of informal discussions between representatives of the Proponent and members of the Aboriginal community regarding potential community development projects.

The above consultation resulted in the following.

- Establishment of a formal (documented) Community Engagement Protocol between the Proponent and six registered organisations of Peak Hill Upper Bogan River Wiradjuri (signed 15 June 2010).
- Engagement of Traditional Owners (men and women) in physical cultural heritage survey work for the Mine Site, Electricity Transmission Line Route and Narromine-Tomingley Water Supply Pipeline Route.
- Design of management measures to ensure that identified items of Aboriginal heritage significance, including the identified carved tree, are appropriately managed.
- Identification of the potential to discover additional sites of Aboriginal heritage significance within the proposed areas of disturbance.
- A commitment by the Proponent to ensure that appropriate community programs would be developed and implemented to ensure that benefits for the Aboriginal community associated with the Project continue beyond the life of the Project.

The principal issue of concern raised during consultation with the Aboriginal community was the management of items of Aboriginal heritage significance and access to any socio-economic benefits that may flow from the Project.

#### 3.2.1.6 Additional Community Consultation

In addition to the information sessions and targeted consultation, the Proponent undertook the following consultation with the community.

- Informal discussions have been held with Project neighbours and residents within Tomingley. The Proponent has maintained an "open door" policy for the community and has ensured that community questions or issues are responded to as soon as practicable once raised.
- The Proponent hosted a display in the respective pavilions at the Peak Hill and Narromine Shows in August and September 2009 and 2010. Those displays were staffed by employees of the Proponent and provided an opportunity for members of the wider community to ask questions and receive information in relation to the Project.
- The Proponent has consulted with all the landholders that would be impacted by an easement for the Electricity Transmission line. Appropriate compensation to individual landholders has been calculated by a licensed valuer.

## 3.2.2 Government Agency Consultation

### 3.2.2.1 Introduction

The Proponent has undertaken a range of consultation with government agencies in relation to the Project, including the following.

- A Conceptual Project Development Plan Meeting.
- A Planning Focus Meeting.
- Targeted consultation and negotiation.

### 3.2.2.2 Conceptual Project Development Plan Meeting

A Conceptual Project Development Plan was presented to Industry and Investment NSW at their Sydney offices on 18 April 2009. Issues identified at that meeting, and where they are addressed in this document, are presented in **Table 3.3**.

**Table 3.3**
**CPDP Meeting – Issues Raised**

| Issue Raised | EA Section(s) |
|---|---|
| Existing and proposed mineral authority boundaries | 1.3.1 |
| Final landform | 2.14.4 |
| Open cut design | 2.4.2 & 2.4.3 |
| Mining techniques | 2.4.3 & 2.4.4 |
| Safety and security issues | 2.13 |
| *Narromine Local Environment Plan 1997* and land zoning | 1.1 |
| Current and final land use | 4.14.3.1 |

### 3.2.2.3 Planning Focus Meeting

A Planning Focus Meeting was held for the Project on 12 August 2009 at the Tomingley Memorial Hall. The meeting was attended by representatives of the following government agencies.

- The Department of Planning & Infrastructure (DP&I) (as the then Department of Planning).
- The Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) (as the then Industry & Investment NSW).
- The NSW Office of Environment and Heritage (OEH) (as the then Department of Environment, Climate Change and Water).
- The NSW Office of Water (NOW).
- Central West Catchment Management Authority (Central West CMA).
- Land and Property Management Authority (LPMA).
- Roads and Traffic Authority (RTA).
- Narromine Shire Council.
- Parkes Shire Council

During the meeting, Mr Ian Chalmers gave an overview of the Project, as it was then understood and the attendees inspected the Mine Site. The meeting concluded with the various government agencies providing verbal advice in relation to their requirements for the *Environmental Assessment*. Formal written requirements were provided to the Department of Planning following the meeting. These, together with the Director-General's Requirements (DGRs), were provided by Department of Planning to the Proponent on 9 September 2009.

Following a review of the Project during 2010, the Project, as it was presented at the planning focus meeting, was amended to include the Caloma Two Open Cut, the Wyoming One Underground and revised layouts for Waste Rock Emplacements Two and Three. As a result, a *Preliminary Environmental Assessment – Addendum* was prepared and provided to the above government agencies on 22 December 2010, with a request to provide revised Director-General's Requirements. Revised requirements were provided by the following agencies.

- OEH (as DECCW) (23 December 2010).
- DTIRIS (as I&I NSW) (14 January 2011).

A précis of the requirements and where each required address in the document are presented in **Tables A2-1** to **A2-3** of **Appendix 2**.

#### 3.2.2.4 Targeted Consultation and Negotiation

Additional consultation with the following government agencies and organisations has also been undertaken.

**NSW Office of Water (Dubbo)**

The following consultation was undertaken with NSW Office of Water (NOW) in relation to the Project.

- Water supply bores.
  - 21 January 2009. Sue Hamilton, Janette Nestor, Jerry Smit (NOW) met with Mike Sutherland (of the Proponent), James Morrow (The Impax Group) and Stuart Boland on 21 January 2009 to discuss issues surrounding subdivision of a Water Access Licence (WAL) held by Mr Boland in relation to his property "Woodlands" and location of the proposed water supply bores for the Project.
  - 21 January 2009. Sue Hamilton, Janette Nestor (NOW), Bill Caton, Allister Rodgers (Aboriginal Elders) met with Mike Sutherland (of the Proponent), James Morrow (The Impax Group) and Stuart Boland at the proposed bore site on "Woodlands" on 21 January 2009 and agreed on a site for the proposed production bore.
  - 18 September 2009. Sue Hamilton (NOW), Ian Chalmers, Mike Sutherland (of the Proponent), James Morrow (The Impax Group), James Ryan, Mark Campbell, Hari Haridharan (NOW) met to discuss water supply from Zone 6 of the Lower Macquarie aquifer. A 14 day pump test to confirm sustainable yield was to be undertaken.
  - It is noted that subdivision of the WAL licence and construction of the proposed bore(s) does not form a component of this application.

- Groundwater assessment
  - 16 December 2010. Sue Hamilton, Tim Baker, Hari Haridharan NOW), James Morrow (The Impax Group), Mike Sutherland, David Meates, Terry Ranstead (of the Proponent) and Mitchell Bland (RWC) held a teleconference to discuss the groundwater assessment undertaken to date and what, given the extensive geological information held by the Proponent, would be an appropriate assessment pathway for the groundwater assessment.
  - 25 January 2011. Sue Hamilton (NOW) provided the Proponent with a review of the groundwater assessment discussed in December 2010. In this preliminary review, clarification was sought in regard to the following issues.
    - The occurrence and characteristics of alluvial sediments on the Mine Site.
    - Monitoring bore details including, locations, water level data, testing, casing diameter, bore logs, and licencing details.
    - The occurrence of previous mine workings and analysis as to impact of these on dewatering.
    - Additional air-lift testing of bores.
    - Additional information on exploration hole data (>100m below surface).
    - Model development and methods.

### Roads and Traffic Authority (RTA)

Phil Standen, Jeff Hall, Fiona Nobes, Mark Arrow (RTA) and Michael Sutherland (of the Proponent) met in Parkes on 27 August 2009 to discuss the proposed Newell Highway Underpass, roadworks and Works Approval Deed. A Works Authority Deed was negotiated following that meeting.

### Essential Energy (EE) (previously Country Energy)

Brendan Brewer (EE) and Michael Sutherland (of the Proponent) met at Peak Hill sub-station on 29 January 2009 to discuss electricity transmission line route to the Mine Site. A High Voltage Connection Application, together with all fees, to Country Energy for the Project was made on 6 March 2009.

On 28 February 2011, Michael Sutherland (of the Proponent) contacted Brendan Brewer to provide EE with an update as to the status of the Project and discuss the assessment of the proposed electricity transmission line under the EP&A Act. To that point, the assessment of the proposed electricity transmission line had been incorporated into the application for project approval under Part 3A of the EP&A Act. Advice was provided by Brendan Brewer (EE) by email on 2 March 2011 suggesting that in order for EE to own and operate the electricity transmission line, the line will have to be obtained, approved and built in accordance with EE's policies and procedures, i.e. under Part 5 of the EP&A Act. Based on this advice, the Proponent has commenced the preparation of a separate application under Part 5 of the EP&A Act for the construction and operation of the proposed electricity transmission line between Peak Hill and the Mine Site.

#### Narromine Shire Council (NSC)

A number of meetings were held with Narromine Shire Council in relation to the Project, including the following.

- Vas Roberts (NSC) and Michael Sutherland (of the Proponent) met to discuss subdivision of a 33.5ha parcel of "Dunoon" on 13 February 2009.
- NSC convened a meeting at Tomingley School to discuss *Regional Land Use Strategy* and in particular building restrictions within the village due to historic mining. Michael Sutherland attended the meeting.
- Michael Sutherland provided a Project update to Narromine Shire Councillors on 20 April 2010 in Narromine Council Chambers.

#### Land and Property Management Authority

Greg Campbell of the Land and Property Management Authority and Mike Sutherland met to discuss road closures within the Mine Site on 21 July 2010.

#### Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC)

The Project has not been referred to DSEPWPaC, and no additional consultation undertaken, on the basis that the proposed activities do not represent a controlled action likely to result in significant impact to any matter of national environmental significance (see Section 4.5.8.5).

## 3.3 REVIEW OF PLANNING LEGISLATION AND ENVIRONMENTAL GUIDELINES

### 3.3.1 Introduction

A number of planning instruments apply to the Project. These planning instruments were reviewed to identify any environmental aspects requiring consideration in the *Environmental Assessment*. In addition, the DGRs identified a number of guideline documents to be referenced / reviewed during the preparation of the *Environmental Assessment* (**Appendix 2**).

A brief summary of each relevant planning instrument is provided in Sections 3.3.2 to 3.3.4. The application and relevance of planning instruments related to specific environmental issues have been assessed in the relevant specialist consultant assessments. Section 3.3.5 briefly outlines the approach taken to referencing and reviewing environmental guideline documents.

### 3.3.2 State Planning Issues

#### 3.3.2.1 State Environmental Planning Policy (Major Development) 2005

Clause 6 of the State Environmental Planning Policy (Major Development) 2005 (Major Development SEPP) identifies that development of the kind specified in Schedule 1 of the SEPP is declared to be a 'Major Project'. Paragraph 5(1)(b) of Schedule 1 identifies development for the purposes of mining-related works with a capital cost of more than $30 million as development to which the Major Development SEPP applies. The Proponent estimates that the capital cost for the Tomingley Gold Project would exceed $30 million and as a result, the Project requires assessment and determination under Part 3A of the *Environmental Planning and Assessment Act 1979*.

#### 3.3.2.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) was gazetted on 17 February 2007, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries. The aims of the Mining SEPP are as follows.

a) *"To provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State.*

b) *To facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources.*

c) *To establish appropriate planning controls to encourage ecologically sustainable development through the Environmental Assessment, and sustainable management, of development of mineral, petroleum and extractive material resources."*

Part 3 of the Mining SEPP sets out a number of matters that must be considered when determining an application for project approval for a mining project. **Table 3.4** presents a summary of each element requiring consideration and a reference to the section in this *Environmental Assessment* where each element is addressed.

#### 3.3.2.3 State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) identifies, amongst other things, the matters to be considered in the assessment of development adjacent to particular types of infrastructure.

**Electricity Infrastructure**

Clause 45 of the Infrastructure SEPP identifies that where development would be carried out within or immediately adjacent to an easement for electricity purposes, the determining authority must give written notice to the electricity supply authority, inviting comments about potential safety risks and take into consideration any response received. The Proponent notes that the Project would require the relocation of a 22kV power transmission line that passes through the footprint of the proposed Caloma and Caloma Two Open Cuts and construction of an electricity sub transmission line (**Figure 2.1**). As a result, the determining authority would be required to consult with Country Energy in relation to the Project.

The Proponent has undertaken discussions with Essential Energy in relation to both the construction of the proposed transmission line and the relocation of the distribution line (see Section 3.2.2.4).

The Proponent submitted a Connection Inquiry to Country Energy (now Essential Energy) on 16 June 2008. A Connection Investigation Agreement has been negotiated between Essential Energy and the Proponent.

### Pipeline Infrastructure

Clause 55 of the Infrastructure SEPP identifies that where development would be carried out within or immediately adjacent to a licensed gas pipeline, the consent authority must:

a. be satisfied that the potential safety risks or risks to the integrity of the pipeline that are associated with the development or modification to which the application relates have been identified, and

b. take those risks into consideration.

The alignment of the proposed Tomingley - Narromine Water Pipeline crosses a Natural Gas Pipeline operated by East Australia Pipeline Limited (a wholly owned subsidiary of the Australian Pipeline Trust [APA Group]) approximately 500m southwest of the "Woodlands" front gate. This high-pressure gas pipeline is buried (at a depth of between 70cm and 150cm) between the Mitchell Highway and the Main Western Railway.

**Table 3.4**
**Application of SEPP (Mining, Petroleum Production and Extractive Industries) 2007**

Page 1 of 2

| Relevant SEPP Clause | Description | EA Section |
|---|---|---|
| 12: Compatibility with other land uses | Consideration is given to:<br>- the existing uses and approved uses of land in the vicinity of the development;<br>- the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and<br>- any ways in which the development may be incompatible with any of those existing, approved or preferred land uses.<br>The respective public benefits of the development and the existing, approved or preferred land uses are evaluated and compared.<br>Measures proposed to avoid or minimise any incompatibility are considered. | 4.14.3.1 |
| 13: Compatibility with mining, petroleum production or extractive industry | Consideration is given to whether the development is likely to have a significant impact on current or future mining, petroleum production or extractive industry and ways in which the development may be incompatible. | NR[1] |
| | Measures taken by the applicant to avoid or minimise any incompatibility are considered. | NR[1] |
| | The public benefits of the development and any existing or approved mining, petroleum production or extractive industry must be evaluated and compared. | 4.14.3.2 |
| 14: Natural resource and environmental management | Consideration is given to ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure: | |
| | - impacts on significant water resources, including surface and groundwater resources, are avoided or minimised; | 4.3.5 & 4.4.7 |
| | - impacts on threatened species and biodiversity are avoided or minimised; and | 4.5.6 |
| | - greenhouse gas emissions are minimised and an assessment of the greenhouse gas emissions (including downstream emissions) of the development is provided. | 4.9.7.2 |
| 15: Resource recovery | The efficiency of resource recovery, including the reuse or recycling of material and minimisation of the creation of waste, is considered. | 2.5, 2.7 & 2.8 |

**Table 3.4 (Cont'd)**
**Application of SEPP (Mining, Petroleum Production and Extractive Industries) 2007**

Page 2 of 2

| Relevant SEPP Clause | Description | EA Section |
|---|---|---|
| 16: Transportation | The following transport related issued are considered. | |
| | - The transport of some or all of the materials from the site by means other than public road. | 2.9.3.4 |
| | - Limitation of the number of truck movements that occur on roads within residential areas or roads near to schools. | 4.11.4 |
| | - The preparation of a code of conduct for the transport of materials on public roads. | 4.11.4.8 |
| 17: Rehabilitation | The rehabilitation of the land affected by the development is considered including: | |
| | - the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated; | **Figure 2.18** |
| | - the appropriate management of development generated waste; | 2.14.6 |
| | - remediation of any soil contaminated by the development; and | 2.14.6 |
| | - the steps to be taken to ensure that the state of the land does not jeopardize public safety, while being rehabilitated or at the completion of rehabilitation. | 2.13.1 & 2.14.6 |
| Note 1: NR = Not relevant. | | |

The Proponent has consulted with the APA Group (Young Control Office) regarding the proposed works. APA Group noted that no specific licence is required to cross the gas pipeline, however, inspection of the detailed construction design and methodology by APA Group personnel would be required. In addition, supervision of the construction works in the vicinity of the pipeline by APA Group personnel would also be a requirement.

### Road Infrastructure

Clause 101 of the Infrastructure SEPP identifies that where a development has a frontage to a classified road, development consent must not be granted unless the consent authority is satisfied that:

- vehicular access to the land is provided by a road other than the classified road;
- the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the design of the vehicular access to the land, the emission of smoke or dust from the development or the nature, volume or frequency of vehicles using the classified road to gain access to the land; and
- the development is of a type that is not sensitive to adverse impacts from the classified road.

The Newell Highway is defined as a classified road. Access to the Mine Site, with the exception of emergency access, would be via Tomingley West Road which is not a classified road. In addition, the Project would, with the exception of required diversions during construction of the underpass, not result in adverse impacts on the operation of the Newell Highway. Similarly, the Newell Highway would not result in adverse impacts on the operation of the Project.

#### Telecommunication Infrastructure

Clause 115 of the Infrastructure SEPP identifies that development for the purposes of telecommunications facilities, may be carried out by any person with consent on any land. The Project would require relocation of a number of telecommunication cables, including a fibre optic cable operated by NextGen (see Section 2.2.8).

#### Railway Infrastructure

Finally, Clause 86 of the Infrastructure SEPP identifies that the determining authority for any development which involves the penetration of ground of more than 2m within a rail corridor must within give written notice within 7 days of the application to the chief executive officer of the rail authority for the rail corridor and take into consideration any response that is received within 21 days after the notice is given. The Project would require a horizontal borehole to be drilled under the Main Western Railway (controlled by ARTC) to accommodate the proposed water pipeline.

### 3.3.2.4 State Environmental Planning Policy (Rural Lands) 2008

The aims of State Environmental Planning Policy (Rural Lands) 2008 (Rural Lands SEPP), as considered relevant to the Project, are to:

*(a) facilitate the orderly and economic use and development of rural lands for rural and related purposes; …………*

*(c) implement measures designed to reduce land use conflicts;*

*(d) identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations; ……..*

Specifically, and as described in Clause 12, the Rural Lands SEPP aims to provide for the protection of agricultural land:

*i) that is of State or regional agricultural significance, and*

*ii) that may be subject to demand for uses that are not compatible with agriculture, and*

*iii) if the protection will result in a public benefit.*

The Project is considered with respect to these aims.

- The land that would be affected by the Project (including the water pipeline) has not been identified as State or regional significant agricultural land by *Schedule 2* of the Rural Lands SEPP.
- The Project would require a relatively small proportion of the agricultural land in the locality and, as demonstrated at numerous other mine sites where agricultural activities are undertaken concurrently within mining, would not be incompatible with continued agricultural land use on and surrounding the Project Site.
- The protection of the land that is the subject of the Project would not provide any public benefit. In fact, the employment and local economic stimulus that would be generated by the Project would be of far greater public benefit than the current grazing.

As a result, the Rural Lands SEPP is not considered further in this document.

#### 3.3.2.5 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

Hazardous and offensive industries, and potentially hazardous and offensive industries, relate to industries that, without the implementation of appropriate impact minimisation measures, would, or potentially would, pose a significant risk in relation to the locality, to human health, life or property, or to the biophysical environment.

In accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33), the hazardous materials to be held or used with the Project Site are required to be identified and classified in accordance with the risk screening method contained within the *Appendix 4* of *Applying SEPP 33 Consultation Draft July 2008* (DoP, 2008b). Hazardous materials are defined within that document as substances falling within the classification of the *Australian Code for the Transportation of Dangerous Goods by Road and Rail* (Dangerous Goods Code) (Department of Infrastructure, Transport, Regional Development and Local Government, 2009).

The Proponent notes that the potentially hazardous goods that would be used or stored within the Mine Site would include the following.

- Diesel and other hydrocarbons that would be stored and used in accordance with a comprehensive *Hydrocarbon Management Plan*.
- Liquid Petroleum Gas that would be stored on the Mine Site and used in the gas-fired heater of the elution column of the processing plant.
- Reagents, including sodium cyanide, caustic soda and hydrochloric acid, to be used within the processing plant. These materials would be transported, stored, used and disposed of in accordance with industry best practice and a *Reagent Management Plan*.

**Appendix 3** presents a risk screening undertaken in accordance with the requirements of the above document. That risk screening indicates that the Project may be potentially hazardous based on the use, storage and transportation of sodium cyanide. As a result, a preliminary hazard analysis (PHA) has been undertaken and is also presented in **Appendix 3**.

The completion of the PHA identified that with the preparation of material and incident specific reagent and emergency management plans, implementation of effective communication and training, construction and use of appropriate structures or equipment to store or transport the materials and strict enforcement of restricted access to areas of potentially hazardous material storage, the risk associated with the transport, storage and use of the sodium cyanide would be tolerable, i.e. the associated risk would be acceptably low.

#### 3.3.2.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection

The Narromine and Parkes Local Government Areas (LGA) are identified in Schedule 1 of State Environmental Planning Policy No. 44 – Koala Habitat Protection SEPP 44) as LGA's that could provide habitat for Koalas. SEPP 44 requires an investigation be carried out to determine if core or potential Koala habitat is present on the areas of the Project Site likely to be disturbed. Core Koala habitat comprises land with a resident population of Koalas whereas potential Koala habitat comprises land with native vegetation with known Koala feed trees constituting at least 15% of the total number of trees present on a site. A review of previous recordings of Koala occurrence and local vegetation completed by OzArk (OzArk, 2011b) has confirmed that the Tomingley Narromine Water Pipeline represents potential Koala habitat for dispersing or transient individuals. Section 4.8.5.5 reviews the Project against Clauses 7, 8 and 9 of SEPP 44.

#### 3.3.2.7 State Environmental Planning Policy No. 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) requires that consent for any development cannot be granted unless the consent authority has considered whether the land is contaminated. If the land is contaminated, the consent authority must be satisfied that:

*(a) the land is suitable in its contaminated state (or would be suitable, after remediation) for the purpose for which the development is proposed to be carried out; and/or*

*(b) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, the land would be remediated before the land is used for that purpose.*

The prior land use history of the Mine Site is one primarily of agricultural operations and mineral exploration, neither of which is likely to result in contamination of the land. As a result, the Proponent is satisfied that no contaminated land occurs on the Project Site. SEPP 55 is therefore not considered further in this document.

### 3.3.3 Regional Planning Issues

#### 3.3.3.1 Regional Planning Policies

No regional planning policies apply to the Project Site.

#### 3.3.3.2 Regional Planning Guidelines

The Central West Catchment Management Authority (Central West CMA) Catchment Action Plan 2006 – 2016 (CAP 2006 – 2016) represents a regional strategy document which should be considered in the planning and assessment of any development within the area managed by the Central West CMA. The CAP 2006 – 2016 is the strategic document that outlines the direction for actions within the catchment over the 10 year period 2006 to 2016. It sets the framework for this by specifying catchment and management targets that address key natural resource management issues in the catchment. **Plate 3.1** provides a one page summary of these targets (as issued by the Central West CMA).

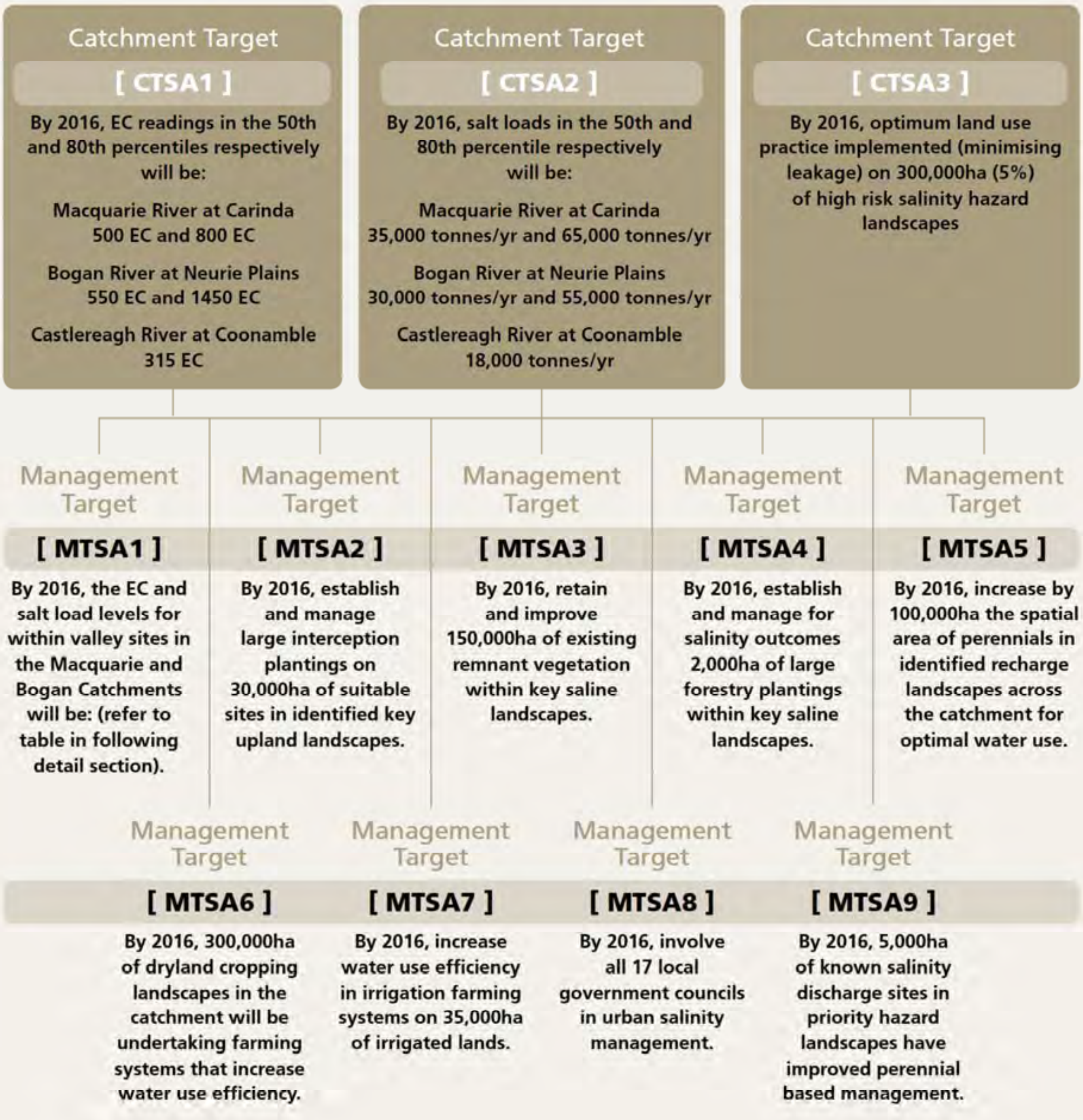
### 3.3.4 Local Planning Issues

#### 3.3.4.1 Local Environment Plans

The Mine Site and Tomingley-Narromine Water Pipeline route occur within the Narromine Local Government Area (LGA). The permissibility of Project is therefore governed by the *Narromine Local Environment Plan 1997* ("Narromine LEP").

The Mine Site is zoned Zone 1(a) under the Narromine LEP (**Figure 1.2**). Clause 9 of the Narromine LEP identifies that the objectives of Zone 1(a) (General Rural) are as follows.

- *"to provide for an area of open rural character comprising agriculture, other primary industries and development consistent with a rural location,*




Source: Central West CMA (2006)

**Plate 3.1**
**CENTRAL WEST CMA CATCHMENT ACTION PLAN 2006 – 2016 TARGETS**

- *to prevent the development of prime agricultural land for purposes other than agriculture,*
- *to facilitate farm adjustments and encourage amalgamations of land to increase holding size,*
- *to provide for development of land for non-agricultural purposes in accordance with the need for that development if the development is not detrimental to productive and sustainable agriculture,*
- *to encourage the development of intensive agriculture enterprises which meet sustainable natural resource management principles,*

- *to protect agricultural enterprises from operational restraints caused by land use conflicts, especially those arising from pressure to maintain a level of amenity more appropriate for residential and hobby farming,*
- *to provide for dwelling-houses on holdings where such a use is justified considering the economic, environmental and socially sustainable nature of agriculture on the holdings,*
- *to permit supporting and compatible value-adding industries within the zone where not detrimental to existing or potential agricultural activities."*

Mining is permissible with consent within 1(a) zone.

Narromine Shire Council is currently working with Department of Planning and four adjoining Councils on Western Council's Sub Regional Land Use Strategy (GHD, 2009). This document acknowledges the Tomingley Gold Project and identifies several actions for Narromine Shire Council to facilitate this development within the Local Environment Plan.

The Tomingley-Narromine Water Pipeline route primarily occurs within road reserves, with minor sections of the route occurring within railway reserves or, in the northern and southern-most sections, within private land. The entire route is zoned Zone 1(a) under the Narromine LEP. Construction of infrastructure is permissible with consent within this zone.

#### 3.3.4.2 Development Control Plans

There are no development control plans that apply to the Project.

#### 3.3.4.3 Other Local Planning Issues

The Proponent expects to negotiate an agreement with Narromine Shire Council to contribute to the maintenance (and upgrade) of Tomingley West Road , which would be used by Project-related traffic. All other roads used to access the Mine Site are State roads and not subject to contribution requirements under the EP&A Act.

### 3.3.5 Environmental Guidelines

The DGRs require that in assessing the identified key assessment requirements, reference be made to one or more guideline documents. In addition, a number of the government agencies consulted in relation to the Project required reference to other environment guideline documents. **Table A2.2** of **Appendix 2** identifies each of these guidelines and identifies the relevant section of the *Environmental Assessment* or part of the *Specialist Consultant Studies Compendium* where they are considered and/or addressed.

## 3.4 IDENTIFICATION OF ENVIRONMENTAL ISSUES

Based on the results of the consultation undertaken and a review of relevant planning instruments and environmental guidelines, together with the preliminary results of the specialist consultant studies, the following issues of relevance to the Project have been identified.

- Air Quality.
- Aboriginal Heritage.
- Blasting/vibration.

- Biodiversity.
- Groundwater.
- Hazards (including Land Contamination, Waste Management and Bushfire).
- Noise.
- Socio-economic Climate (including Land Use).
- Soil and Land Capability.
- Surface Water/Erosion and Sedimentation.
- Traffic.
- Visual Amenity.

## 3.5 ANALYSIS OF ENVIRONMENTAL RISK AND ISSUE PRIORITISATION

### 3.5.1 Analysis of Environmental Risk

On identification of the environmental issues associated with the Project, a review of the Project design, the local environment and other factors was undertaken to identify the sources of potential environmental impacts and the risk associated with each. This sub-section presents an analysis of risk associated with each environmental issue in accordance with Australian Standards HB 203:2006 and AS/NZS 4360:2004 and through consideration of the likelihood and potential consequence(s) of the environmental impacts.

Risk is the chance of something happening that will have an impact upon the objectives or the task, which in this case is development and operation of the Project without impact on the local environment. Risk is measured in terms of consequence (severity) and likelihood (probability) of the event happening. For each identified environmental issue, the potential environmental impacts have been allocated a risk rating based on the potential consequences and likelihood of occurrence.

The allocation of a consequence rating was based on the definitions contained in **Table 3.5**. It is noted that the assigned consequence rating represents the highest level applicable, ie. if a potential impact is assigned a level of <u>4 - Major</u> based on impact to the environment and <u>2 - Minor</u> based on area of impact, the consequence level assigned would be <u>4 - Major</u>.

The likelihood or probability of each impact occurring was then rated according to the definitions contained in **Table 3.6**.

The risk associated with each environmental impact was assessed without the inclusion of any operational controls or safeguards in place and is based on the qualitative assessment of consequence and likelihood, a risk ranking of either; low, medium, high or extreme was assigned to each potential impact based on the matrix presented in **Table 3.7**.

The four risk rankings are defined as follows.

Low (L): requiring a basic assessment of proposed controls and residual impacts. Any residual impacts are unlikely to have any major impact on the local environment or stakeholders.

Moderate (M): requiring a medium level assessment of proposed controls and residual impacts. It is unlikely to preclude the development of the Project but may result in impacts deemed unacceptable to some local or government stakeholders.

High (H): requiring in-depth assessment and high level documentation of the proposed controls and mitigation measures. Ultimately, this level of risk may preclude the development of the Project.

Extreme (E): requiring in-depth assessment and high level documentation of the proposed controls and mitigation measures and possible preparation of a specialised management plan. Unless considered to be adequately managed by the controls and/or management plan, this level of risk is likely to preclude the development of the Project

**Table 3.5**
**Qualitative Consequence Rating**

| Level | Descriptor | Description |
|---|---|---|
| 5 | Catastrophic | • Massive and permanent detrimental impacts on the environment.<br>• Very large area of impact.<br>• Massive remediation costs.<br>• Reportable to government agencies.<br>• Large fines and prosecution resulting in potential closure of operation.<br>• Severe injuries or death. |
| 4 | Major | • Extensive and/or permanent detrimental impacts on the environment.<br>• Large area of impact.<br>• Very large remediation costs.<br>• Reportable to government agencies.<br>• Possible prosecution and fine.<br>• Serious injuries requiring medical treatment. |
| 3 | Moderate | • Substantial temporary or minor long term adverse impact to the environment.<br>• Moderately large area of impact.<br>• Moderate remediation costs.<br>• Reportable to government agencies.<br>• Further action may be requested by government agency.<br>• Injuries requiring medical treatment. |
| 2 | Minor | • Minor detrimental impact on the environment.<br>• Affects a small area.<br>• Minimal remediation costs.<br>• Reportable to internal management only.<br>• No operational constraints posed.<br>• Minor injuries which would require basic first aid treatment. |
| 1 | Insignificant | • Negligible and temporary detrimental impact on the environment.<br>• Affects an isolated area.<br>• No remediation costs.<br>• Reportable to internal management only.<br>• No operational constraints posed.<br>• No injuries or health impacts. |

Source: modified after HB 203:2006 (Standards Australia, 2006) - Table 4(B)

**Table 3.6**
**Qualitative Likelihood Rating**

| Level | Descriptor | Description |
|---|---|---|
| A | Almost Certain | Is expected to occur in most circumstances. |
| B | Likely | Will probably occur in most circumstances. |
| C | Possible | Could occur. |
| D | Unlikely | Could occur but not expected. |
| E | Rare | Occurs only in exceptional circumstances. |
| Source: HB 203:2006 (Standards Australia, 2006) - Table 4(A) | | |

**Table 3.7**
**Risk Rating Matrix**

| Likelihood | Consequences | | | | |
|---|---|---|---|---|---|
| | Insignificant 1 | Minor 2 | Moderate 3 | Major 4 | Catastrophic 5 |
| A (Almost Certain) | H | H | E | E | E |
| B (Likely) | M | H | H | E | E |
| C (Possible) | L | M | H | E | E |
| D (Unlikely) | L | L | M | H | E |
| E (Rare) | L | L | M | H | H |
| Note: Rating modified after HB 203:2006 (Standards Australia, 2006) - Table 4(C) | | | | | |

**Table 3.8** provides an overview of risk sources and potential environmental impacts associated with the Project. This information is provided to inform the risk analysis presented in **Table 3.9.**

**Table 3.9** provides an assessment of the unmitigated risk, namely the risk level in the absence of management and mitigation measures identified in Section 4, for each potential environmental impact identified in **Table 3.8**. The assessment of risk is based on the classifications and definitions provided in **Table 3.5** to **Table 3.7**. Where appropriate, and to provide a more realistic assessment of the risks posed by the various environmental issues, the environmental impacts have, in places, been further defined using either a level, range or scale of impact providing for the various circumstances which may apply. **Table 6.2** in Section 6.2.1 provides an analysis of risk following the implementation of the proposed management and mitigation measures.

### 3.5.2 Issue Prioritisation

Based on the issues identified and the risk ratings allocated to the potential environmental impacts of these, and a review of the issues considered 'key assessment requirements' of the DGRs, the following order of priority of environmental issues has been determined. This order of priority provides for the order of assessment in Section 4.

1. Noise.
2. Surface Water/Erosion and Sedimentation.
3. Groundwater.
4. Biodiversity.
5. Aboriginal Heritage.

6. Non-Aboriginal Heritage
7. Visual Amenity.
8. Air Quality.
9. Blasting.
10. Traffic.
11. Soil and Land Capability.
12. Hazards (including Waste Management, Land Contamination and Bushfire).
13. Socio-economic Climate (including Land Use).

It is noted that the inclusion of "Socio-economic Setting" at N$^{o}$ 13 is not a direct consequence of the environmental risk analysis. Rather, it is included at N$^{o}$ 13 to enable all other issues to be considered prior to the consideration of the socio-economic setting as this issue invariably is inter-related with many of the preceding issues. It is also noted that the issues associated with "Land Use" and "Land Contamination and Waste Management" are considered as part of the assessment of other issues such as water resources, soils, hazards and socio-economic setting.

The sources of potential environmental impacts nominated as having an associated high or extreme risk are discussed within relevant subsections within Section 4. All other issues generally allocated a "moderate" or "low" level of priority, have been addressed to the level considered appropriate throughout the *Environmental Assessment*.

**Table 3.8**
**Risk Sources and Potential Environmental Impacts**

Page 1 of 4

| Environmental Issue | Risk Source (s) | Receptor/Surrounding Environment | Potential Consequences | Potential Environmental Impacts |
|---|---|---|---|---|
| Groundwater | • Pollution of groundwater due to leaching of contaminants from the RSF.<br>• Pollution of groundwater due to hydrocarbon leaks or spills. | • Local aquifer(s), including alluvial and fractured rock aquifers.<br>• Surrounding landholders utilising bores or pumps. | • Decreased groundwater quality.<br>• Detrimental impact on beneficial uses of groundwater. | • Reduced groundwater quality leading to reduction in beneficial uses of the water and therefore availability to existing groundwater users. |
| | • Reduction of groundwater levels due to mining intercepting aquifers. | • Local aquifer(s), including alluvial and fractured rock aquifers.<br>• Groundwater bores of adjoining land owners (if within area of impact).<br>• Groundwater dependent ecosystems (if present). | • Reduction in the quantity of water stored in local aquifer(s).<br>• Decrease in availability of groundwater to adjoining land owners and/or groundwater dependent ecosystems. | • Reduction in the volume of water contained within the affected groundwater aquifer (drawdown of water table).<br>• Reduced yields of local groundwater bores.<br>• Reduced viability of groundwater dependent ecosystems. |
| | • Reduction in contribution to surface water flows. | • Local streams, and springs. | • Changes to local hydrological regime and surface flows. | • Reduced surface flows to Gundong and other creek catchments of the Bogan River.<br>• Reduced viability of groundwater dependent ecosystems. |
| Surface Water/Flooding/ Erosion and Sedimentation | • Reduction in environmental flows as a result of on-site capture of water. | • Downstream water users.<br>• Local flora and fauna. | • Reduced flows to downstream water users.<br>• Reduced availability of water to local flora and fauna | • Reduced availability of water to downstream users.<br>• Reduced environmental flows.<br>• Stress to, and possible reduction in viability of native vegetation.<br>• Degradation of aquatic habitats. |
| | • Discharge of dirty, saline or contaminated water. | • Local creeks and tributaries.<br>• Soils and vegetation. | • Decreased water quality.<br>• Contamination of soil resources. | • Pollution of downstream waters.<br>• Stress to, and possible mortality of flora and/or fauna.<br>• Reduced soil quality and associated reduction in viability of productive post-mining land use. |
| | • Discharge of contaminated water containing cyanide from the RSF. | • Local and regional catchment ecosystem. | • Introduction of a toxic compound to the environment.<br>• Contamination of soil and water resources. | • Pollution of downstream waters.<br>• Stress to, and possible mortality of flora and/or fauna.<br>• Reduced soil quality and associated reduction in viability of productive post-mining land use. |
| | • Changes to hydrology of creeks and drainage lines. | • Local creeks and drainage lines. | • Reduced flows.<br>• Changed alignment of hydrological flow. | • Reduced environmental flows within the Bogan River catchment.<br>• Increased erosion potential resultant from changed alignment of flow.<br>• Reduction in the quality of aquatic habitat. |
| | • Changes to the flood regimes of Gundong Creek. | • Gundong Creek and associated communities and ecosystems. | • Changes to frequency or intensity of local flooding. | • Increased erosion potential within Gundong Creek catchment.<br>• Changes to vegetation community structure and habitat value.<br>• Reduced viability of land uses on affected properties as a result of changes to flooding regime. |
| | • Erosive actions of water in undisturbed sections of the Mine Site<br>• Erosive actions of water on disturbed sections of the Mine Site, including waste rock emplacement batters, prior to rehabilitation operations. | • Mine Site soils. | • Loss of soil resource. | • Excessive soil erosion.<br>• Sedimentation of surrounding drainage lines and land.<br>• Reduced success of Mine Site rehabilitation. |
| Biodiversity (Flora and Fauna) | • Direct impacts on native flora and fauna - clearing of vegetation. | • Vegetation within Project Site and area of influence.<br>• Threatened species, populations and endangered ecological communities identified, known to occur, or considered as potentially occurring within the Project Site. | • Removal of habitat.<br>• Removal/mortality of threatened species, populations and endangered ecological communities from the Project Site.<br>• Reduction in the potential for future immigration of threatened species, populations and endangered ecological communities to the Project Site. | • Loss of, or alteration to, existing habitats.<br>• Removal or mortality of individual species.<br>• Local or regional reduction in distribution of threatened species, populations and endangered ecological communities.<br>• Possible local extinction of threatened species, populations and endangered ecological communities. |
| | • Direct impacts on native flora and fauna - road kill. | • Local fauna. | • Injury / mortality of fauna. | • Mortality of individual species.<br>• Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. |

**Table 3.8 (Cont'd)**
**Risk Sources and Potential Environmental Impacts**



| Environmental Issue | Risk Source (s) | Receptor/Surrounding Environment | Potential Consequences | Potential Environmental Impacts |
|---|---|---|---|---|
| Biodiversity (Flora and Fauna) (Cont'd) | • Direct impacts on native fauna - pooling of contaminated water on the RSF. | • Local fauna (particularly avifauna). | • Ingestion of process water (containing cyanide) by local fauna and avifauna. | • Mortality of individual species.<br>• Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. |
| | • Indirect impacts on flora, fauna and fauna habitat, e.g. noise, dust etc. | • Local flora and fauna. | • Reduction in habitat quality. | • Alteration to, existing habitats.<br>• Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. |
| Aboriginal Heritage | • Removal or destruction of known Aboriginal sites and/or artefacts within the Project footprint (including Tomingley Narromine Water Pipeline route) | • Local archaeological setting. | • Damage or destruction of Aboriginal artefacts or site. | • Damage or destruction of Aboriginal artefacts. |
| | • Removal or destruction of currently unidentified Aboriginal sites and/or artefacts due to Project Site extraction and associated activities. | • Local archaeological setting. | • Damage or destruction of Aboriginal artefacts or site. | • Damage or destruction of Aboriginal artefacts. |
| European Heritage | • Removal or destruction of sites of heritage significance due to Project activities. | • Local archaeological setting. | • Loss or damage to heritage sites. | • Destruction of items of heritage significance. |
| Noise | • Increased noise levels resulting from operation of mobile equipment, crushing and screening equipment and product transportation. | • Surrounding residents, land owners and native fauna. | • Decreased amenity.<br>• Impacts on the health and well-being of local residents.<br>• Decreased land values.<br>• Detrimental effects on local fauna | • Increased noise levels associated with Project activities (≤5dBA above noise criteria) causing annoyance, distractions, i.e. amenity impacts.<br>• Increased noise levels associated with Project activities (>5dBA above noise criteria) causing more significant amenity impacts.<br>• Sleep disturbance as a result of maximum noise levels.<br>• Increased noise levels associated with the Project leading to impacts on local fauna assemblage. |
| Blasting | • Ground vibration from mine blasting.<br>• Airblast Overpressure from mine blasting (air vibration)<br>• | • Houses and building structures in Tomingley.<br>• Newell Highway.<br>• Historic underground mine workings.<br>• Surrounding landowners.<br>• Livestock.<br>• Other infrastructure and equipment. | • Damage to residences, buildings and other structures.<br>• Reduced local amenity.<br>• Local livestock losses during breeding (lambing/foaling/calving). | • Structural damage to buildings, structures and other infrastructure, e.g. telecommunication cables.<br>• Subsidence of land in the village of Tomingley (as a consequence of collapse / subsidence of historic Tomingley Mine workings).<br>• Nuisance/amenity impacts on surrounding landowners / residents.<br>• Loss of income to livestock producers.<br>• Disrupted communication services. |
| | • Fugitive fly rock from blasting. | • Houses and building structures in Tomingley.<br>• Newell Highway.<br>• Mine Site personnel and general public. | • Injury or damage caused by fly rock.<br>• Disruption to traffic on the Newell Highway. | • Personal injury.<br>• Disrupted traffic on the Newell Highway. |
| Air Quality – Dust, Odour and Greenhouse Gas | • Dust generation resulting from:<br>– vehicle movements on unsealed roads;<br>– fixed plant, including crushing operations;<br>– blasting operations; and<br>– wind action on disturbed areas, overburden emplacements and stockpiles. | • Surrounding residences and buildings.<br>• Surrounding native vegetation.<br>• Local residents.<br>• Newell Highway | • Increased deposited and suspended particulates.<br>• Health-related complaints.<br>• Reduced visual amenity<br>• Reduced visibility for highway traffic | • Nuisance/amenity impacts from dust deposited on window sills, cars, surfaces etc.<br>• Adverse health impacts (if $PM_{10}$ levels are excessive).<br>• Stress of native vegetation, and indirect impacts on fauna habitat.<br>• Reduced road safety. |
| | • Greenhouse gas emissions. | • Local and global air-shed | • Increased greenhouse and other gas emissions. | • Increased contribution to greenhouse effect. |
| Traffic and Transport (off site) | • Road construction activities, e.g. entrance to the Mine Site and Newell Highway Underpass. | • Local landforms and road network.<br>• Local and highway traffic. | • Impacts associated with road construction (noise, dust, ecology, heritage etc.).<br>• Alterations to contours which can impact surface water flows during flooding (particularly down Tomingley West Road).<br>• Minor traffic delays during construction of intersection and underpass. | • See "*air pollution*", "*flora and fauna protection*" and "*noise*" and "*Aboriginal heritage*" above.<br>• Temporary inconvenience to commuters (if delayed for road works).<br>• Change to existing floodways |

**Table 3.8 (Cont'd)**
**Risk Sources and Potential Environmental Impacts**



| Environmental Issue | Risk Source (s) | Receptor/Surrounding Environment | Potential Consequences | Potential Environmental Impacts |
|---|---|---|---|---|
| Traffic and Transport (off site) (Cont'd) | • Increased traffic levels due to movement of workforce and contractors. | • Local and regional road network. • Existing road users. | • Increased vehicle movements (especially heavy vehicles) on local roads. | • Increased traffic congestion and or traffic delays. • Elevated risk of accident/incident on local roads. |
| | • Increased heavy vehicle movements. | | | • Road pavement deterioration. |
| | • Transportation of oversize of overweight loads. | | • Potential damage to the road network due to oversize or overweight loads. | • Road pavement deterioration. |
| | • Transportation of dangerous or hazardous goods. | | • Transport incident involving dangerous or hazardous goods. | • Water or land contamination as a result of a spill of dangerous or hazardous goods. |
| Visual Amenity | • Changes in visual characteristics of the Mine Site. • | • Surrounding residents. • Highway motorists. | • Clearing of native vegetation and visibility of the Mine Site activities, e.g. earthworks, stockpiles, processing plant. • Mine 'glow'. | • Changes to local visual amenity for the life of the Project. • Unsightly landform at the completion of the Project. • Reduced night time amenity caused by lighting. • Distraction to traffic resulting in accidents/incidents. |
| Soil Resources | • Reduction in soil quality through poor soil stripping, stockpiling or spreading practices. | • Mine Site soils. | • Structural damage to soils through poor soil management practices. • Reduced biological activity of soils. | • Insufficient soil quantities for rehabilitation. • Reduced soil quality resulting in poor rehabilitation or inability to achieve nominated final land capability.. • Increased erosion hazard compared with original landform |
| | • Increased erosion or erosion potential of soils. | • See "erosion and sedimentation" above. | • See "erosion and sedimentation" above. | • See "erosion and sedimentation" above. |
| Rehabilitation and Final Landform | • Temporary and permanent changes to the landform of the Project Site. | • Project Site land surrounding land owners and/or residents. | • Reduced productivity of land for agricultural production. • Alteration to local land use and change to local biodiversity. | • Altered final landform not compatible with activities/lifestyle of adjoining land owners. • Reduced productivity of land for agricultural production as post-mining land use. • Increased local biodiversity. |
| | • Unstable or eroding final landform. | | • Removal of valuable topsoil resources from the rehabilitated landform. | • Increased sedimentation of drainage from the Mine Site. • Reduced stability of the final landform. |
| Waste Management | • Production of contaminating or polluting materials, eg. waste oils, saline water, tailings, general rubbish. | • Mine Site land and water resources. • Downstream land and water resources. • Local and regional groundwater. • Local waste receival depots | • Contamination of surface water. • Contamination of groundwater. • Contamination of land. • Reduced visual amenity. • Increased pressure on waste management facilities, e.g. landfills. | • Hydrocarbon or other pollutant contamination of surface water. • Hydrocarbon or other pollutant contamination of groundwater. • Contamination of local water and/or soil resources by leaking or spilt residue. • Reduced amenity of Project Site due to poor rubbish, litter management. |
| | • Acid Mine Drainage from mineralised waste rock | | • Contamination of downstream surface water. • Contamination of groundwater. • Contamination of downstream lands. | • Reduced viability of remnant or rehabilitated vegetation. • Stress to, or mortality of local flora and fauna. • Reduced productivity of land. |
| Land Contamination | • Extraction exposing previously contaminated materials. | • Areas receiving contaminated material (including surface waters). | • Transfer of contaminated materials to non-contaminated areas. | • Transfer of contaminated material. • Surface water contamination. |
| Bushfire | • Initiation of fire on the Mine Site and spread to adjoining properties. | • Mine Site personnel and equipment. • Mine Site and adjoining land (stock, crops, property). | • Health and safety impacts to project personnel. • Damage to Project Site equipment. • Damage to adjoining properties (including livestock and crops) and/or native vegetation. | • Injury or health impacts on project personnel. • Operational constraint posed by damaged equipment. • Destruction/damage of native vegetation and fauna habitat. • Loss of livestock, crops and property on neighbouring land |
| Socio-Economic Impacts | • Alteration of social activities or employment due to employment generation and capital expenditure. | • Local community and businesses. • Local Government (mainly NSC and to a lesser extent PSC). | • Reduced unemployment and increased local spending. • Additional population for schools and community services. • Reduced community self-relience (due to Proponent contributions) • Rental opportunities for vacant farm houses | • Increased economic activity and related social impacts attributable to reduced unemployment • Loss of local farm workers and tradespeople to work on the mine. • Increased resilience in local community through diversitfication and capacity building. |

**Table 3.8 (Cont'd)**
**Risk Sources and Potential Environmental Impacts**



| Environmental Issue | Risk Source (s) | Receptor/Surrounding Environment | Potential Consequences | Potential Environmental Impacts |
|---|---|---|---|---|
| Socio-Economic Impacts (Cont'd) | • Perceived or real impacts on local amenity of neighbouring properties. | • Surrounding property owners. | • Reduced property values.<br>• Increased property values.<br>• Reduced amenity value of landholdings. | • Reduced quality of life (actual or perceived).<br>• Immigration of some workers and families wanting to live closer to the Project. |
| Source: Modified after HB203:2006 (Standards Australia, 2006) - Table 3 | | | | |

## Table 3.9
## Analysis of Unmitigated Environmental Risk



| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Consequence of Occurrence if not Mitigated | Likelihood of Occurrence if not Mitigated | Unmitigated Risk Rating |
|---|---|---|---|---|
| **Groundwater** | | | | |
| Pollution of groundwater due to leaching of contaminants from the RSF | Reduced groundwater quality leading to reduction in beneficial uses of the water and therefore availability to existing groundwater users | 4 | D | H |
| Pollution of groundwater due to hydrocarbon spills | Contamination requiring minor recovery works. | 3 | D | M |
| | Contamination requiring major recovery works. | 4 | D | H |
| Reduction of groundwater levels due to mining intercepting aquifers | Reduction in the volume of water contained within the affected groundwater aquifer (drawdown of water table). | 2 | A | H |
| | Reduced yields of local groundwater bores. | 2 | C | M |
| | Reduced viability of groundwater dependent ecosystems. | 2 | E | L |
| Reduction in groundwater bore yields | Reduced yields in the groundwater bores of the Gundong Creek Alluvium. | 3 | E | M |
| | Reduced yields in the groundwater bores of the fractured rock aquifers. | 2 | C | M |
| Reduction in contribution to surface water flows. | Reduced surface flows to Gundong and other creek catchments of the Bogan River. | 2 | D | L |
| | Reduced viability of groundwater dependent ecosystems. | 3 | E | M |
| **Surface Water / Flooding / Erosion and Sedimentation** | | | | |
| Reduction in environmental flows as a result of on-site capture of water. | Reduced availability of water to downstream users. | 2 | C | M |
| | Reduced environmental flows. | 2 | D | L |
| | Stress to, and possible reduction in viability of native vegetation. | 2 | D | L |
| | Degradation of aquatic habitats. | 3 | E | M |
| Discharge of dirty, saline or contaminated water. | Pollution of downstream waters. | 3 | C | H |
| | Stress to, and possible mortality of flora and/or fauna. | 3 | C | H |
| | Reduced soil quality and associated reduction in viability of productive post-mining land use. | 2 | C | M |
| Discharge of contaminated water containing cyanide from the RSF. | Pollution of downstream waters. | 3 | C | H |
| | Stress to, and possible mortality of flora and/or fauna. | 3 | C | H |
| | Reduced soil quality and associated reduction in viability of productive post-mining land use. | 2 | C | M |

**Table 3.9 (Cont'd)**
**Analysis of Unmitigated Environmental Risk**



| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Consequence of Occurrence if not Mitigated | Likelihood of Occurrence if not Mitigated | Unmitigated Risk Rating |
|---|---|---|---|---|
| Surface Water / Flooding / Erosion and Sedimentation (Cont'd) | | | | |
| Changes to hydrology of creeks and drainage lines. | Reduced environmental flows within the Bogan River catchment. | 1 | B | M |
| | Increased erosion potential resultant from changed alignment of flow. | 2 | B | H |
| | Reduction in the quality of aquatic habitat. | 3 | E | M |
| Changes to the flood regimes of Gundong Creek. | Increased erosion potential within Gundong Creek catchment. | 2 | C | M |
| | Changes to vegetation community structure and habitat value. | 2 | D | L |
| | Reduced viability of land uses on affected properties as a result of changes to flooding regime. | 2 | C | M |
| Erosive actions of water in undisturbed sections of the Mine Site | Excessive soil erosion. | 2 | C | M |
| | Sedimentation of surrounding drainage lines and land. | 2 | C | M |
| Erosive actions of water on disturbed sections of the Mine Site, including waste rock emplacement batters, prior to rehabilitation operations. | Excessive soil erosion. | 2 | C | M |
| | Sedimentation of surrounding drainage lines and land. | 2 | C | M |
| | Reduced success of Mine Site rehabilitation. | 3 | C | H |
| Biodiversity (Flora and Fauna) | | | | |
| Direct impacts on native flora and fauna - clearing of vegetation. | Loss of, or alteration to, existing habitats. | 3 | A | E |
| | Removal or mortality of individual species. | 3 | A | E |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | 4 | E | H |
| | Possible local extinction of threatened species, populations and endangered ecological communities. | 4 | E | H |
| Direct impacts on native flora and fauna - road kill. | Mortality of individual species. | 2 | C | M |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | 3 | D | M |
| Direct impacts on native fauna - pooling of contaminated water on the RSF. | Mortality of individual species. | 3 | C | H |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | 3 | D | M |
| Indirect impacts on flora, fauna and fauna habitat, e.g. noise, dust etc. | Alteration to existing habitats. | 3 | D | M |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | 3 | E | M |

**Table 3.9 (Cont'd)**
**Analysis of Unmitigated Environmental Risk**



| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Consequence of Occurrence if not Mitigated | Likelihood of Occurrence if not Mitigated | Unmitigated Risk Rating |
|---|---|---|---|---|
| **Aboriginal Heritage** | | | | |
| Removal or destruction of known Aboriginal sites and/or artefacts within the Project footprint (including Tomingley Narromine Water Pipeline route) | Damage or destruction of Aboriginal artefacts. | 3 | B | H |
| Removal or destruction of currently unidentified Aboriginal sites and/or artefacts due to Project Site extraction and associated activities. | Damage or destruction of Aboriginal artefacts. | 3 | C | H |
| **European Heritage** | | | | |
| Removal or destruction of sites of heritage significance due to Project activities. | Destruction of items of heritage significance. | 1 | B | M |
| **Noise** | | | | |
| Increased noise levels resulting from operation of mobile equipment, crushing and screening equipment and product transportation. | Increased noise levels associated with Project activities (≤5dBA above noise criteria) causing annoyance, distractions, i.e. amenity impacts. | 2 | B | H |
| | Increased noise levels associated with Project activities (>5dBA above noise criteria) causing more significant amenity impacts. | 3 | B | H |
| | Sleep disturbance as a result of maximum noise levels. | 3 | B | H |
| | Increased noise levels associated with the Project leading to impacts on local fauna assemblage. | 2 | C | M |
| **Blasting / Vibration** | | | | |
| Ground vibration from mine blasting.<br><br>Airblast Overpressure from mine blasting (air vibration) | Structural damage to buildings, structures and other infrastructure, e.g. telecommunication cables. | 4 | C | E |
| | Subsidence of land in the village of Tomingley (as a consequence of collapse / subsidence of historic Tomingley Mine workings). | 4 | D | H |
| | Nuisance/amenity impacts on surrounding landowners / residents. | 2 | C | M |
| | Loss of income to livestock producers. | 3 | E | M |
| | Disrupted communication services. | 2 | D | L |
| Fugitive fly rock from blasting. | Personal injury. | 5 | E | H |
| | Disrupted traffic on the Newell Highway. | 3 | C | H |

**Table 3.9 (Cont'd)**
**Analysis of Unmitigated Environmental Risk**

Page 4 of 6

| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Consequence of Occurrence if not Mitigated | Likelihood of Occurrence if not Mitigated | Unmitigated Risk Rating |
|---|---|---|---|---|
| **Air Quality – Dust, Odour and Greenhouse Gas** | | | | |
| Dust generation resulting from:<br>- vehicle movements on unsealed roads;<br>- fixed plant, including crushing operations;<br>- blasting operations; and<br>- wind action on disturbed areas, overburden emplacements and stockpiles. | Nuisance/amenity impacts from dust deposited on window sills, cars, surfaces etc. | 2 | C | H |
| | Adverse health impacts (if $PM_{10}$ levels are excessive). | 3 | C | H |
| | Stress of native vegetation, and indirect impacts on fauna habitat. | 2 | D | L |
| | Reduced road safety. | 3 | E | M |
| Greenhouse gas emissions. | Increased contribution to greenhouse effect. | 2 | C | M |
| **Traffic and Transport** | | | | |
| Road construction activities, e.g. entrance to the Mine Site and Newell Highway Underpass. | See "*air pollution*", "*flora and fauna protection*" and "*noise*" and "*Aboriginal heritage*" above. | | | |
| | Temporary inconvenience to commuters (if delayed for road works). | 2 | C | M |
| | Change to existing floodways | 2 | C | M |
| Increased traffic levels due to movement of workforce and contractors. | Increased traffic congestion and or traffic delays. | 2 | D | L |
| | Elevated risk of accident/incident on local roads. | 4 | E | H |
| Increased heavy vehicle movements. | Road pavement deterioration. | 2 | C | M |
| Transportation of oversize of overweight loads. | Road pavement deterioration. | 2 | C | M |
| Transportation of dangerous or hazardous goods. | Water or land contamination as a result of a spill of dangerous or hazardous goods. | 3 | D | M |
| **Visual Amenity** | | | | |
| Changes in visual characteristics of the Mine Site. | Changes to local visual amenity for the life of the Project. | 2 | A | H |
| | Unsightly landform at the completion of the Project. | 2 | A | H |
| | Reduced night time amenity caused by lighting. | 2 | C | M |
| | Distraction to traffic resulting in accidents/incidents. | 3 | E | M |

**Table 3.9 (Cont'd)**
**Analysis of Unmitigated Environmental Risk**



| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Consequence of Occurrence if not Mitigated | Likelihood of Occurrence if not Mitigated | Unmitigated Risk Rating |
|---|---|---|---|---|
| Soil Resources | | | | |
| Reduction in soil quality through poor soil stripping, stockpiling or spreading practices. | Insufficient soil quantities for rehabilitation. | 2 | D | L |
| Reduction in soil quality through poor soil stripping, stockpiling or spreading practices. | Reduced soil quality resulting in poor rehabilitation or inability to achieve nominated final land capability. | 3 | C | H |
| Reduction in soil quality through poor soil stripping, stockpiling or spreading practices. | Increased erosion hazard compared with original landform. | 2 | C | M |
| Increased erosion or erosion potential of soils. | See "erosion and sedimentation" above. | | | |
| Hazards - Waste Management | | | | |
| Production of contaminating or polluting materials, eg. waste oils, saline water, tailings, general rubbish. | Hydrocarbon or other pollutant contamination of surface water. | 3 | C | H |
| Production of contaminating or polluting materials, eg. waste oils, saline water, tailings, general rubbish. | Hydrocarbon or other pollutant contamination of groundwater. | 3 | D | M |
| Production of contaminating or polluting materials, eg. waste oils, saline water, tailings, general rubbish. | Contamination of local water and/or soil resources by leaking or spilt residue. | 3 | D | M |
| Production of contaminating or polluting materials, eg. waste oils, saline water, tailings, general rubbish. | Reduced amenity of Project Site due to poor rubbish, litter management. | 2 | C | M |
| Acid Mine Drainage from mineralised waste rock | Reduced viability of remnant or rehabilitated vegetation. | 3 | E | M |
| Acid Mine Drainage from mineralised waste rock | Stress to, or mortality of local flora and fauna. | 3 | E | M |
| Acid Mine Drainage from mineralised waste rock | Reduced productivity of land. | 3 | E | M |
| Hazards - Land Contamination | | | | |
| Extraction exposing previously contaminated materials. | Transfer of contaminated material. | 3 | E | M |
| Extraction exposing previously contaminated materials. | Surface water contamination. | 3 | E | M |
| Hazards - Bushfire | | | | |
| Initiation of fire on the Mine Site and spread to adjoining properties. | Injury or health impacts on project personnel. | 4 | E | H |
| Initiation of fire on the Mine Site and spread to adjoining properties. | Operational constraint posed by damaged equipment. | 3 | E | M |
| Initiation of fire on the Mine Site and spread to adjoining properties. | Destruction/damage of native vegetation and fauna habitat. | 2 | E | M |
| Initiation of fire on the Mine Site and spread to adjoining properties. | Loss of livestock, crops and property on neighbouring land | 3 | E | M |
| Socio-Economic Impacts (including Land Use) | | | | |
| Temporary and permanent changes to the landform of the Project Site. | Altered final landform not compatible with activities/lifestyle of adjoining land owners. | 3 | C | H |
| Temporary and permanent changes to the landform of the Project Site. | Reduced productivity of land for agricultural production as post-mining land use. | 3 | C | H |
| Temporary and permanent changes to the landform of the Project Site. | Increased local biodiversity. | Positive Impact | | |
| Unstable or eroding final landform. | Increased sedimentation of drainage from the Mine Site. | 3 | C | H |
| Unstable or eroding final landform. | Reduced stability of the final landform. | 3 | D | M |

**Table 3.9 (Cont'd)**
**Analysis of Unmitigated Environmental Risk**



| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Consequence of Occurrence if not Mitigated | Likelihood of Occurrence if not Mitigated | Unmitigated Risk Rating |
|---|---|---|---|---|
| Socio-Economic Impacts (including Land Use) (cont'd) | | | | |
| Alteration of social activities or employment due to employment generation and capital expenditure. | Increased economic activity and related social impacts attributable to reduced unemployment | Positive Impact | | |
| | Loss of local farm workers and tradespeople to work on the mine. | 2 | C | M |
| | Increased resilience in local community through diversification and capacity building. | Positive Impact | | |
| Perceived or real impacts on local amenity of neighbouring properties. | Reduced quality of life (actual or perceived). | 3 | C | H |
| | Immigration of some workers and families wanting to live closer to the Project. | 2 | C | M |

Consequence of Occurrence: 1 = Insignificant; 2 = Minor; 3 = Moderate; 4 = Major; 5 = Catastrophic
Likelihood of Occurrence: A = Almost Certain; B = Likely; C = Possible; D = Unlikely; E = Rare
Risk Rating: E = Extreme; H = High; M = Moderate; L = Low

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# Section 4

# Assessment and Management of Key Environmental Issues

## PREAMBLE

*This section of the Environmental Assessment provides relevant background information relating to the environmental aspects identified in Section 3. The following sub-sections provide information related to the existing environment and the proposed mitigation measures and management procedures that would be implemented throughout the life of the Project with respect to the following environmental issues.*

- *Noise.*
- *Surface water.*
- *Groundwater.*
- *Biodiversity.*
- *Aboriginal heritage.*
- *Non-Aboriginal heritage.*
- *Visual amenity.*
- *Air quality*
- *Blasting and vibration.*
- *Traffic and transportation.*
- *Soils and land capability.*
- *Hazards.*
- *Socio-economic setting.*

*A detailed assessment of the likely residual impacts, and where relevant, programs to monitor the potential environmental impacts, are also outlined.*

*Information is presented in sufficient detail to enable readers to fully understand the potential impacts of the Project, should it be approved. The extent of detail provided reflects the potential likelihood and severity of impacts and the priority for each environmental issue determined in Section 3.*

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# 4.1 BACKGROUND

## 4.1.1 Introduction

The descriptions of various environmental aspects of the Project throughout this section are reliant upon a range of background information common to many of the key environmental issues. In this sub-section, background information is provided on the topography, climate, land ownership and residences, land uses and the community surrounding the Mine Site.

## 4.1.2 Topography and Drainage

### 4.1.2.1 Regional Topography and Drainage

The Mine Site is located to the northwest of the Herveys Range on the western slopes of the Great Dividing Range (**Figure 4.1**). The Herveys Range forms a north/south orientated range with maximum slopes of approximately 1:1 (V:H). The highest point of the range is a number of unnamed peaks located to the east of Peak Hill, approximately 15km to the southeast of the Mine Site, with elevations of up to 775m AHD.

To the east of the Herveys Range, undulating topography varies in elevation from 500m AHD to 1 250m AHD. In contrast, the western side of the range is characterised by generally flat plains with elevations between 220m AHD and 400m AHD and average slopes of approximately 1:300 (V:H).

The Mine Site is located within the catchment of the Bogan River (**Figure 4.1**). Poorly defined ephemeral drainages on the western side of the Herveys Range flow to the Bogan River located approximately 11km to the southwest of the Mine Site. Similar drainages to the northeast of the range direct runoff to the Macquarie River, located approximately 37km to the north of the Mine Site. Both the Bogan and Macquarie Rivers flow in a generally northwesterly direction before merging with the Darling River approximately 80km upstream and 60km downstream of Brewarrina respectively.

### 4.1.2.2 Local Topography and Drainage

The topography surrounding the Mine Site is presented on **Figure 4.2**. The most prominent topographic feature in the vicinity of the Mine Site, with an elevation of approximately 450m AHD, is an isolated hill located approximately 4km to the east of the Mine Site. Maximum slopes associated with this hill are up to approximately 1:2 (V:H).

Typically, the area to the east and southeast of the Mine Site is undulating, with low hills with elevations of up to approximately 373mAHD and slopes typically between 1:10 (V:H) and 1:50 (V:H). To the north, west and south of the Mine Site, the topography is typically flat to very gently undulating, with elevations between approximately 250m AHD and 260m AHD and slopes of approximately 1:200 (V:H) or less.

Surface water drainage lines surrounding the Mine Site are typically indistinct, ephemeral and flow to the west. Gundong Creek flows southwest, rising north of Tomingley, before passing through the northwestern section of the Mine Site. The section of the creek within the Mine Site is considered to be an artefact of mining or agriculture-related related activities in the 19th Century (see Section 4.3.2.2), i.e. that section of Gundong Creek is not natural.

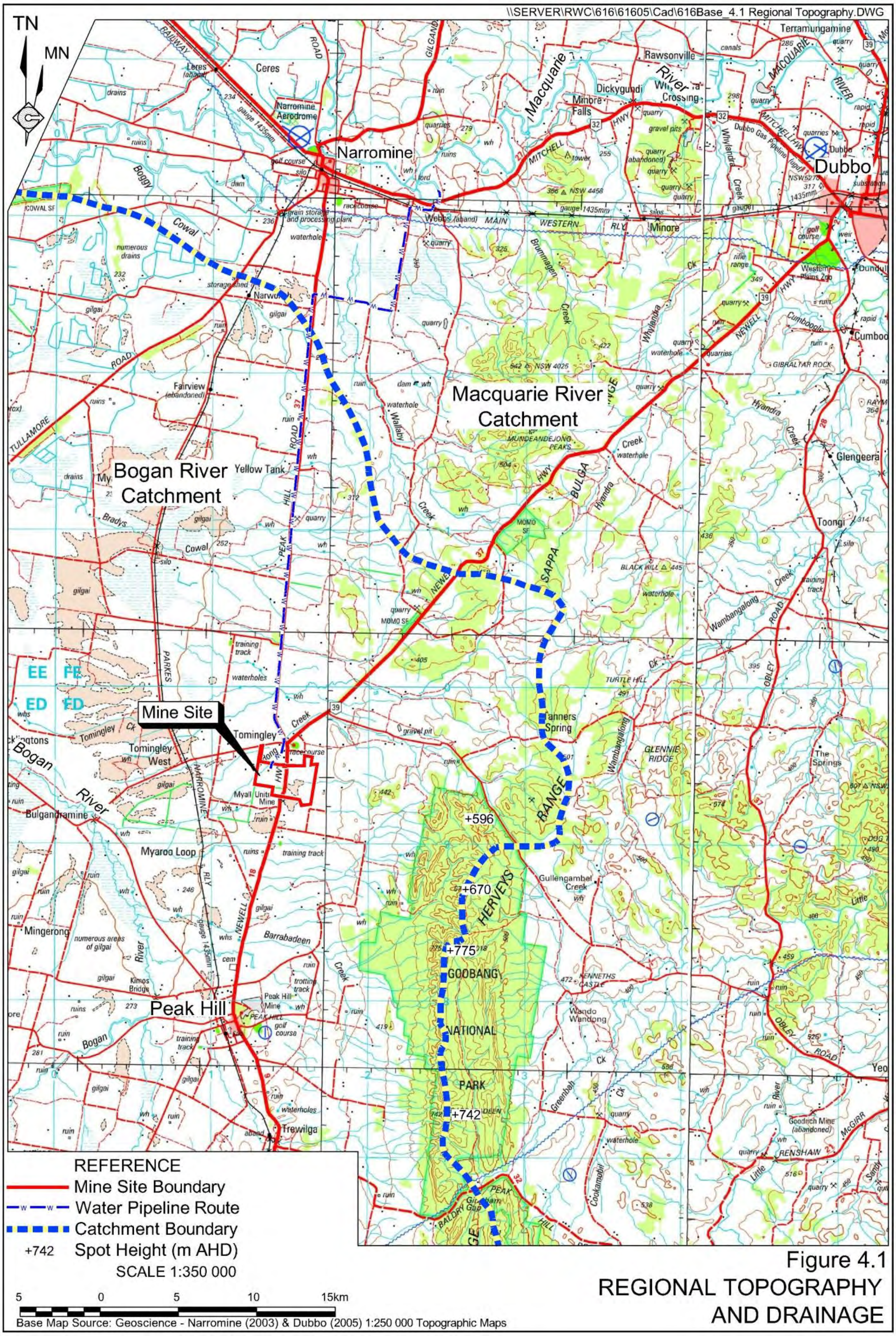



Figure 4.1
REGIONAL TOPOGRAPHY AND DRAINAGE

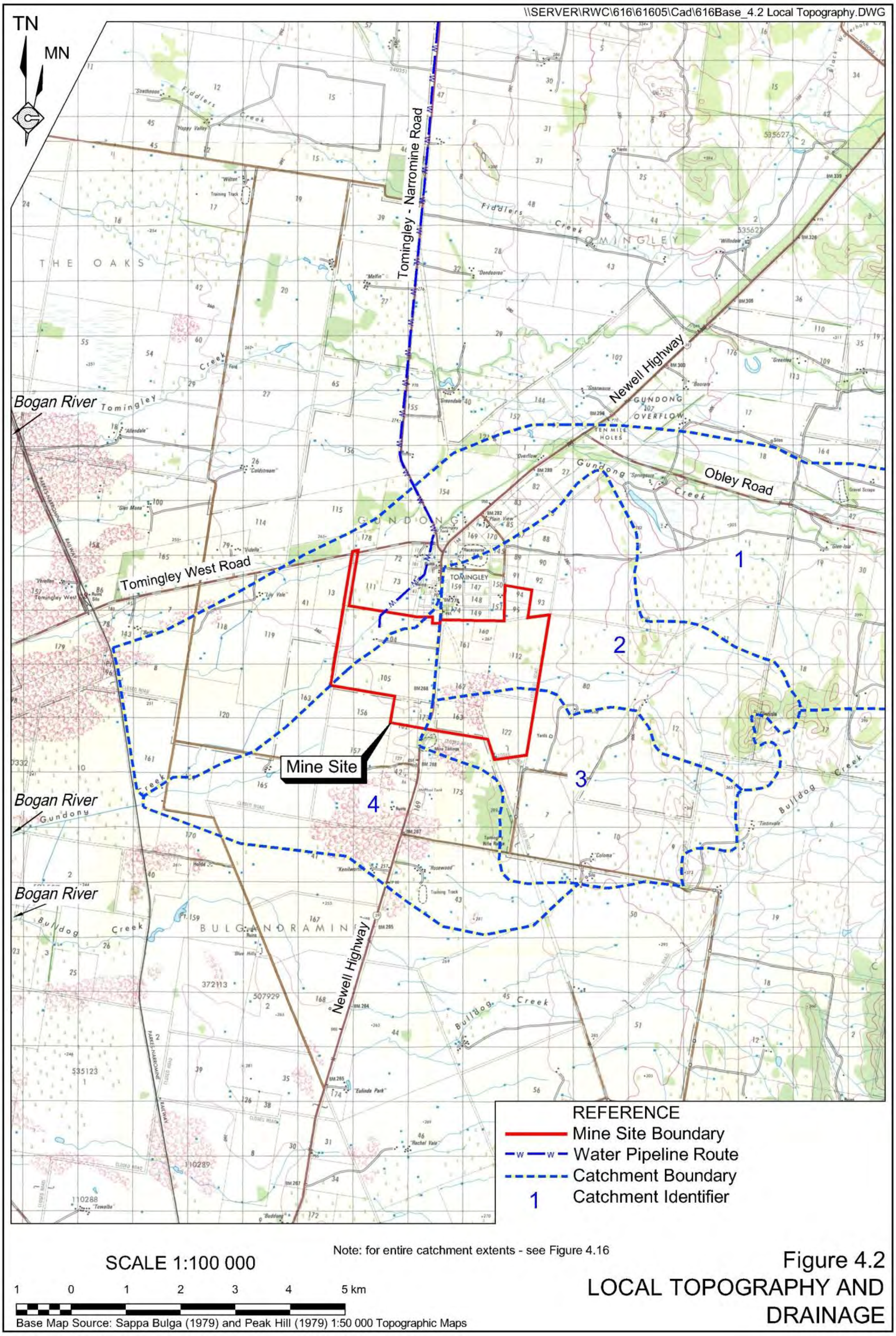



Figure 4.2
LOCAL TOPOGRAPHY AND DRAINAGE

Other named creeks in the vicinity of the Mine Site include Fiddlers and Tomingley Creeks to the north and Bulldog Creek to the south. Each of these, together with Gundong Creek, flow to the west and southwest and merge with the Bogan River approximately 11km to the west of the Mine Site.

#### 4.1.2.3 Mine Site Topography and Drainage

The topography within and immediately surrounding the Mine Site is presented on **Figures 4.3** and is characterised by very gentle slopes to the southwest. The highest point within the Mine Site, with an elevation of approximately 284m AHD, is along the eastern boundary, with the lowest elevation occurring in the southwestern corner at an elevation of approximately 265m AHD. The maximum slope within the Mine Site occurs in the southeastern section with slopes of approximately 1:40 (V:H), while in the southwestern corner, the slope is approximately 1:325 (V:H). Within the Mine Site, on the eastern side of the Newell Highway, an area of gilgai is present which creates a hummocky micro-relief pattern and an area of poor runoff transmission.

Gundong Creek traverses the northwestern section of the Mine Site, while a number of unnamed, poorly defined drainage lines occur within and immediately to the north and east of the Mine Site (**Figure 4.3**). For ease of reference, these have been termed Drainage Lines A, B, C and D. These drainage lines are open and indistinct. Water flow within each drainage line typically occurs as sheet flow, with no distinct channel structures associated with the drainage lines. These drainage lines flow to the southwest, south and west. The natural drainage has been disrupted by the construction of the Newell Highway. Water captured within these drainage lines flows along the eastern side of the highway before flowing below the highway through one of two culverts (**Figure 4.3**). This water then flows to a series of farm dams and towards Gundong Creek.

The Mine Site and surrounding areas may be divided into four catchments as indicated on **Figures 4.2** and **4.3**. Section 4.3.2.2 provides a detailed description of each of these catchments.

### 4.1.3 Climate

#### 4.1.3.1 Introduction

Climatic conditions have the potential to influence a range of potential Project-related impacts on surrounding residents and the environment. This section provides a brief overview of the climatic conditions surrounding the Mine Site, focusing particularly on those aspects of the climate that are likely to influence the potential Project-related environmental impacts.

#### 4.1.3.2 Temperature and Humidity

Temperature and humidity data have been sourced from the Bureau of Meteorology weather station at the Peak Hill Post Office (Station Number 050031) located approximately 15km to the south of the Mine Site. Temperature and relative humidity data have been collected at that station since 1965 and 1967 respectively.

**Table 4.1** presents a summary of the mean monthly maximum and minimum temperatures and the 3pm relative humidity at the Peak Hill Post Office.

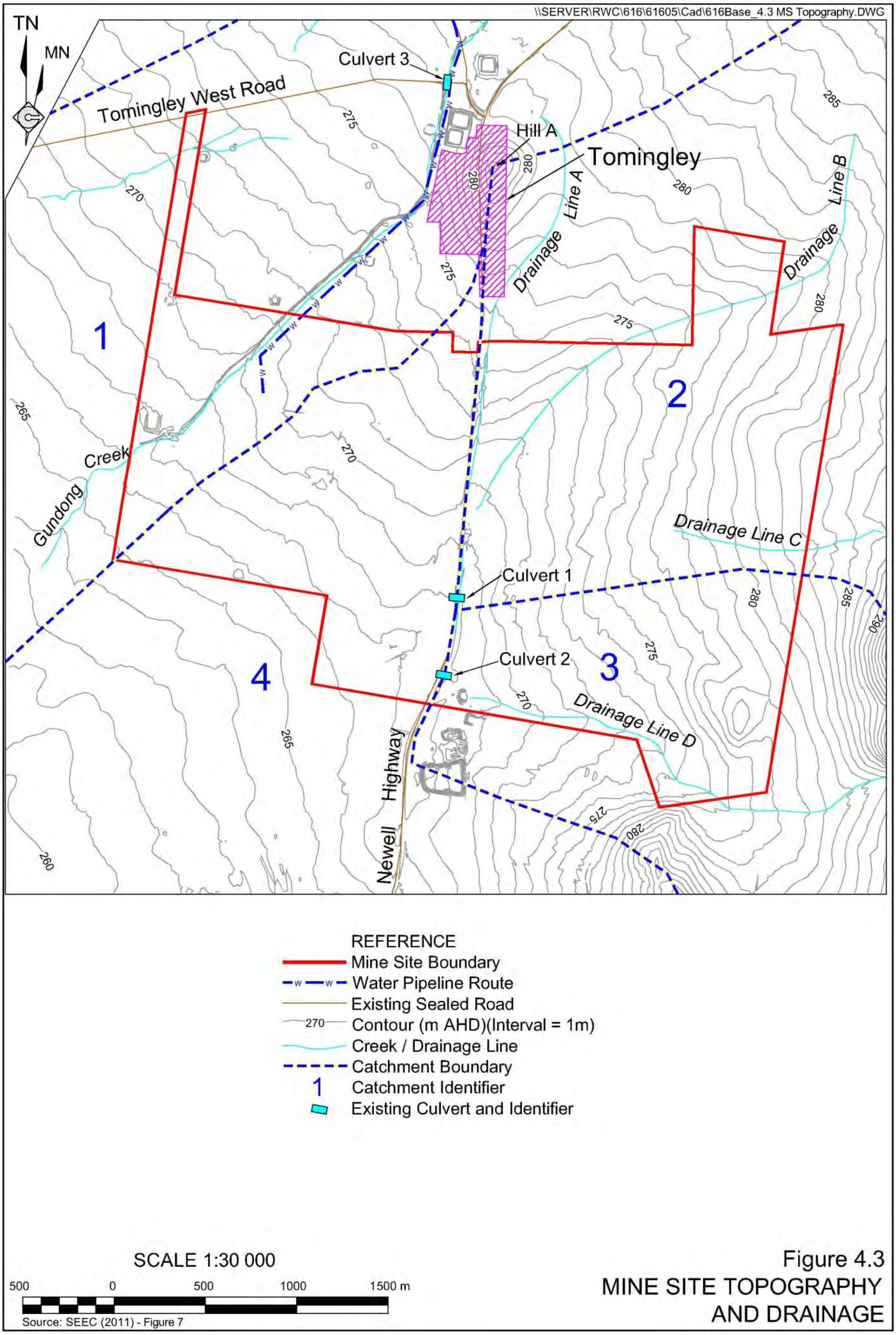



Figure 4.3
MINE SITE TOPOGRAPHY AND DRAINAGE

**Table 4.1**
**Mean Monthly Temperature and 3pm Relative Humidity**

| | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean maximum temperature (°C) | 33.1 | 32.5 | 29.4 | 25.1 | 20 | 16.2 | 15.2 | 16.9 | 20.4 | 24.6 | 28 | 31.4 |
| Mean minimum temperature (°C) | 19.1 | 19.2 | 16.3 | 12.2 | 8.8 | 6 | 4.7 | 5.8 | 7.9 | 11.4 | 14.2 | 17.2 |
| Mean 3pm relative humidity (%) | 32 | 36 | 38 | 41 | 53 | 61 | 59 | 50 | 44 | 39 | 36 | 31 |
| Source: Bureau of Meteorology – Peak Hill Post Office (Station Number 050031) | | | | | | | | | | | | |

On average, January is the hottest month, with a mean maximum temperature of 33.1°C and a mean minimum temperature of 19.1C, while July is the coldest month, with a mean maximum temperature of 15.2°C and a mean minimum temperature of 4.7°C.

### 4.1.3.3 Rainfall and Evaporation

Rainfall data have been collected by the Bureau of Meteorology at the following three stations surrounding the Mine Site.

- Peak Hill Post Office (Station Number 050031).
- Wyanga (Borcoo) (Station Number 051008).
- Tomingley Gundongs (Station Number 05139).

Annual average rainfall at each of the above rainfall stations is recorded as follows.

- Peak Hill Post Office – 559mm/year.
- Wyanga (Barcoo) – 499mm/year.
- Tomingley (Gundongs) – 557mm/year.

A review of the three rainfall data sets was completed by SEEC (2011) (as part of an assessment of surface water management of the Project) and assessed the Peak Hill rainfall data to be the most appropriate for the Project Site. Rainfall data has been recorded at the Peak Hill site since 1890. **Table 4.2** presents the mean monthly rainfall recorded at Peak Hill. This data indicates that mean monthly rainfall varies from 37.6mm in September to 59.6mm in January. Annual average rainfall is approximately 559mm per year, with October to March being marginally wetter, on average, that the remainder of the year.

The closest Bureau of Meteorology station that recorded evaporation was the Wellington Research Station (Station number 065035), located approximately 68km to the east of the Mine Site. The station commenced operation in 1946 and was closed in February 2005. **Table 4.2** presents the average monthly evaporation recorded at that station. That data indicate that annual average evaporation is approximately 1 803mm and that average monthly evaporation exceeds the average rainfall in all months.

**Table 4.2**
**Mean Monthly Rainfall and Evaporation**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall (mm)[1] | 59.6 | 50.0 | 49.2 | 42.2 | 44.9 | 42.9 | 44.5 | 43.4 | 37.6 | 48.6 | 47.2 | 49.2 | 559.3 |
| Evaporation (mm)[2] | 272.8 | 223 | 195.3 | 126 | 77.5 | 48 | 52.7 | 74.4 | 102 | 158.1 | 207 | 266.6 | 1803.4 |
| Note 1 – Source – Bureau of Meteorology Peak Hill Station<br>Note 2 – Source – Bureau of Meteorology Wellington Research Station | | | | | | | | | | | | | |

#### 4.1.3.4 Wind and Atmospheric Stability

Wind speed and atmospheric stability are used during the assessment of anticipated air quality and noise impacts. PAEHolmes (2011), who undertook the air quality assessment for the Project, reviewed meteorological data from the closest suitable meteorological station to the Mine Site, namely the Peak Hill Gold Mine Meteorological Station operated by the Proponent. Data from calendar year 2003 was selected as the most representative year of meteorological data from the site.

A review of the meteorological data indicated that calm conditions (winds less than 0.5m/s) were recorded at the weather station for 24.6% of the time during 2003. PAEHolmes (2011) suggest that this was an unusually high proportion of calm conditions. To account for this, PAEHolmes (2011) created a synthetic 2003 meteorological data set for the Mine Site using The Air Pollution Model (TAPM) developed by CSIRO. Section 4.2.1 of PAEHolmes (2011) provides a detailed description of this model. The model incorporated wind observations from the Peak Hill Gold Mine Meteorological Station and **Figure 4.4** presents the annual and seasonal wind roses generated by TAPM for 2003.

SLR (2011), who undertook the noise and blasting assessment for the Project, note that the use of TAPM meteorological data for noise assessment is not appropriate as the model overestimates atmospheric stability and as a result provides an inaccurate estimate of the frequency and strength of temperature inversions. As a result, SLR (2011), following a detailed review of the Peak Hill Gold Mine measured meteorological data and the data generated by the TAPM model, selected the measured data for use during the noise assessment. **Table 4.3** presents the frequency of occurrence of the Pasquill Gifford stability categories during winter night-times from the Peak Hill Gold Mine measured data for 2003, where Class A represents the least stable conditions and Class F represents the most stable conditions.

**Table 4.3**
**Frequency of atmospheric stability classes**

| Pasquill Gifford stability class | Frequency (%) |
|---|---|
| A | 0.0% |
| B | 0.0% |
| C | 0.0% |
| D | 24.9% |
| E | 20.7% |
| F | 38.1% |
| G | 16.3% |
| Source: SLR (2011) – Appendix B | |

### 4.1.4 Geology

#### 4.1.4.1 Regional and Local Geology

The Mine Site is located in the early Palaeozoic Lachlan Orogen which is composed of a complex association of sedimentary, volcanic and intrusive rocks of early Cambrian to early Devonian age. The Lachlan Orogen has been divided into three provinces, based on a structural and lithostratigraphic criteria, which have been designated the Western, Central and the Eastern Belts. The Mine Site is located within the Eastern Belt (or the Macquarie Arc) which contains the magmatic and fore arc environments and hosts a number of economic porphyry-epithermal bodies.


Source: PAEHolmes (2011) – Figure 8

**Figure 4.4**
**ANNUAL AND SEASONAL WIND ROSES – 2003**

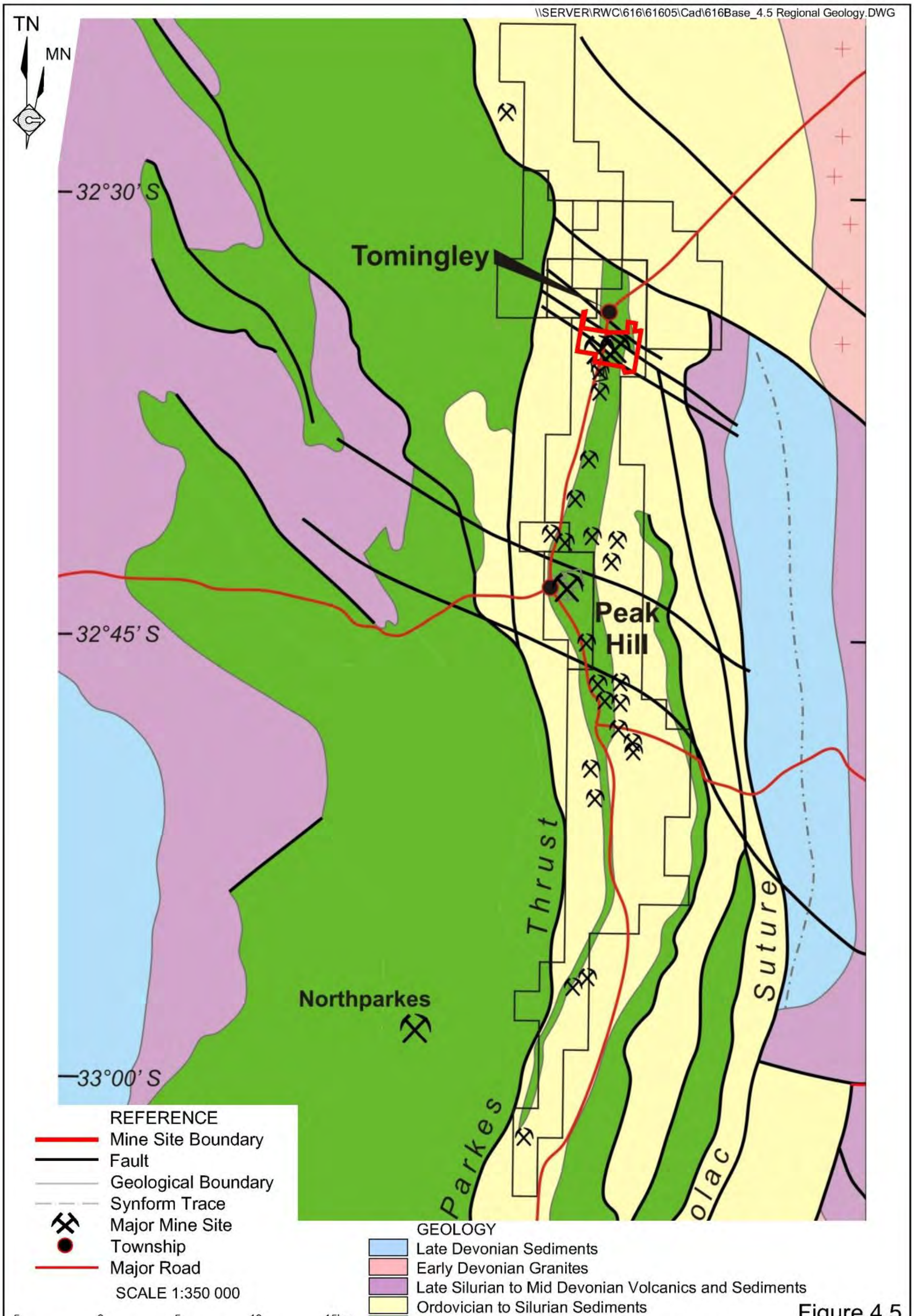



Figure 4.5
REGIONAL GEOLOGY

Within the Macquarie Arc, several individual belts of mafic to intermediate volcanic, intrusive, volcaniclastic and turbiditic rocks have been identified. These sequences are segmented by a number of generally north–south to north-northwest trending arc-parallel structures, many of which are thought to be thrust faults or major strike-slip faults. The volcanic belts comprise Ordovician to early Silurian rocks of predominantly mafic to andesitic composition and display a spectrum of rock types including lavas, breccias, volcaniclastic sandstone and siltstone, and monzonitic to dacitic intrusions.

The Mine Site is located near the northern end of a narrow belt of Ordovician to early Silurian-aged submarine volcanic and shallow intrusive rocks of the Junee-Narromine Volcanic Belt within the Macquarie Arc, just east of the interpreted Parkes Thrust (**Figure 4.5**). This structure separates the flat lying Goonumbla volcanic complex in the west from a thin slice of north-south trending andesitic volcanics (Mingelo volcanics) identified by regional aeromagnetic data. The late Ordovician Mingelo volcanics are overlain by sediments thought to be equivalents of the early Silurian Cotton formation.

#### 4.1.4.2 Local Basement and Mine Site Geology

Within the Mine Site, the basement geology is dominated by the late Ordovician (Mingelo) Volcanics (**Figure 4.6**). The sequence comprises andesitic volcanic units dominated by coarse volcanic to volcaniclastic breccias, andesitic lavas, volcaniclastic sandstones and siltstones intruded by sub-volcanic feldspar porphyries. The relationship between the Mingelo Volcanics to the east and the interpreted slightly younger siltstones and sandstones of the Cotton Formation to the west is not well understood.

The basement geology is almost entirely covered by alluvial sequences of clays, sand and gravel (including an approximately 6m to 15m thick layer of clay to sandy clay interpreted as sheet wash from nearby Devonian granites, underlain, in places, by up to 30m of mottled alluvial clays with minor pebble beds of estimated Tertiary age). This cover ranges up to 50m thick over in the central part of the Wyoming mineralisation. Overlying the clays, sands and gravels is a near surface layer of loamy soil.

The gold deposits of the Mine Site are hosted within volcaniclastic sediments, lavas and shallow intrusive porphyritic rocks (the identified locations of which are provided on **Figure 4.6**). The volcanic units are trachy-andesite to basaltic trachy-andesite in composition with very rare detrital quartz in the volcaniclastic rocks which are dominated by well bedded sandstones and siltstones with minor breccias, lithic conglomerates and black mudstones. The dominant sandstones and siltstones have a primary composition of plagioclase and augite but are now largely altered to sericite, carbonate, chlorite, albite with rare primary quartz.

#### 4.1.4.3 Deposit Geology

The Wyoming deposit presents as an andesitic volcaniclastic sequence which strikes north-northwest and dips steeply east. On the eastern side of the Wyoming One feldspar porphyry, the bedding also youngs to the east, however, there is limited evidence west of the porphyry that the sequence there youngs west. Bedding orientations and some bedding-cleavage relationships suggest that if there is a fold closure in the region of the Wyoming One porphyry then it is a north-northwest plunging anticline. The current boundaries of the porphyry indicate a shallow southerly plunge but this may reflect the original geometry of the intrusion rather than a structural overprint. Foliation measurements largely parallel bedding and are interpreted as an axial plane cleavage.

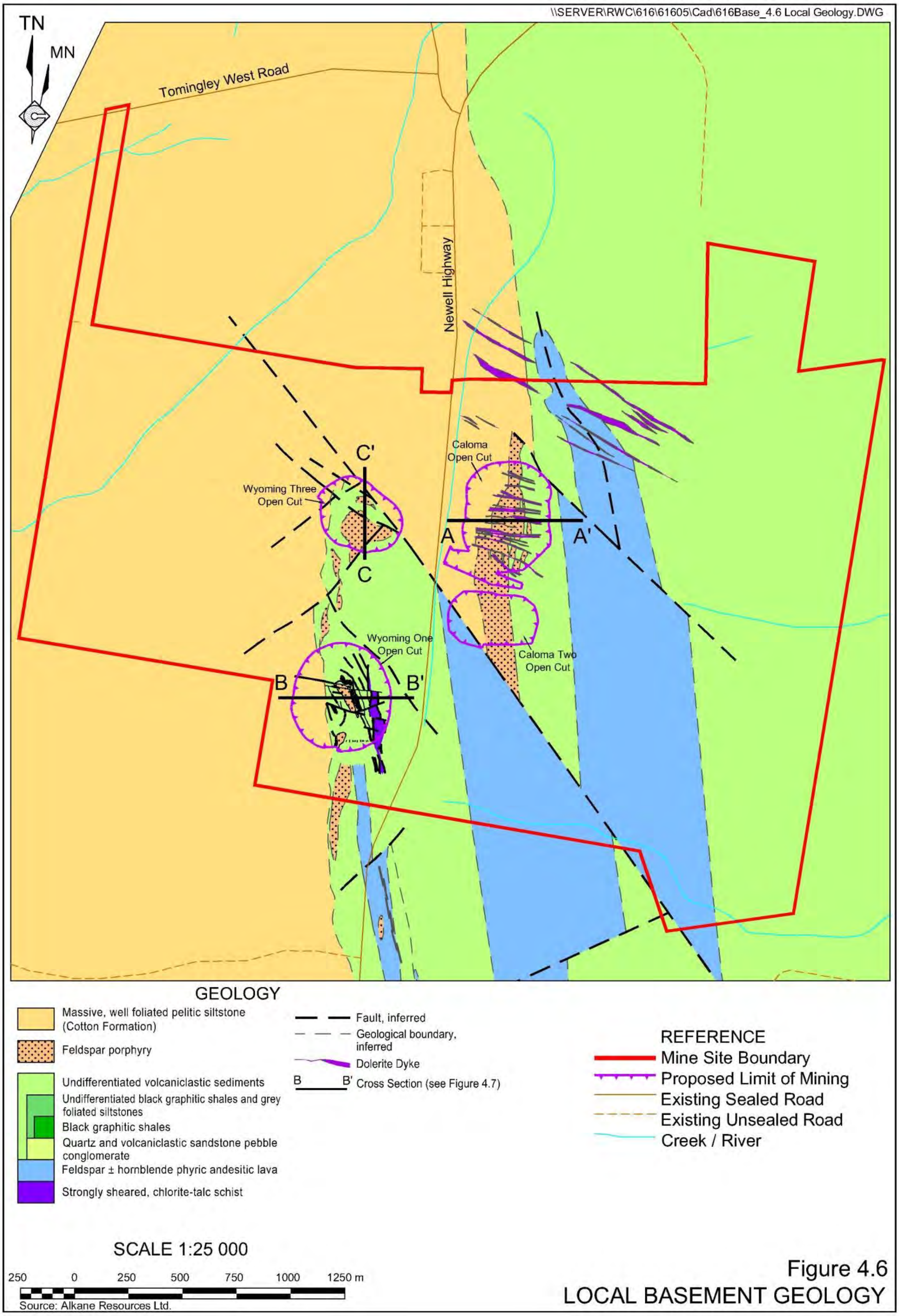



Figure 4.6
LOCAL BASEMENT GEOLOGY

Within the massive feldspar porphyry, brittle fracture is dominant and a number of vein directions are evident. There are at least two generations of veins within the Wyoming One porphyry:

1. an early fine-grained, chalcedonic, barren generation (V1) with no associated alteration; and
2. a coarse grained, gold-bearing, quartz-carbonate generation (V2) which cross-cuts V1 and is associated with variable amounts of carbonate-sericite alteration.

Vein orientations are predominantly north-northeast dipping and this is much more apparent at shallower depths. Major structures are orientated west-northwest, exemplified by the near vertical fault that defines the northern end of the porphyry („376‟ structure) and several sub-parallel vein sets within the porphyry.

At Caloma, the contact between the Cotton Formation and the Mingelo Volcanics strikes north and dips west at 45°-70° west. Lack of core drilling has limited the structural interpretation.

**Figure 4.7** presents a series of cross sections through the Caloma, Wyoming Three and Wyoming One Open Cuts illustrating deposit geology. The following provides a more detailed description of the deposit geology at Wyoming One, Wyoming Three and Caloma.

### Wyoming One

Gold mineralisation at Wyoming One is distributed both around and within a sub-vertical, south plunging feldspar ± augite-phyric sill (see cross section C of **Figure 4.7**). The deposit has been separated into four distinct mineralised zones.

- *Porphyry zone*. The bulk of the Wyoming One deposit is hosted predominantly within the feldspar±augite-phyric intrusion and in the near surface covers an area of 60m by 150m, and averages 1.5g/t to 2.0g/t gold. Gold mineralisation is characterised by strong quartz±carbonate±albite±pyrite±arsenopyrite veins within intense sericite–carbonate–albite–quartz (± chlorite ± pyrite ± arsenopyrite) alteration.
- *„376'/'831' structures.* The northern contact of the Wyoming One porphyry is sharply terminated by a west-northwest striking, quartz-vein dominant, high-grade gold zone (>5g/t gold) termed the „376‟ structure. The structure ranges from 2m to 10m wide, extends about 100m east-west, and contains up to 20% quartz in veins or as quartz-arsenopyrite breccia. The „376‟ structure is interpreted to represent a dilated fault plane. The best grades and thicknesses appear to be restricted to where the structure is in contact with the porphyry. The zone is characterised by an intense sericitic selvage within the sediments to the north. The porphyry contact plunges to the south away from the „376‟structure at depth and deeper drill holes suggest the structure may pinch out at depth. The „831‟structure is a parallel structure situated about 25m south of the „376‟ zone. Dilation within the „831‟ does not appear to develop until about 225m below the surface, from where it exhibits similar characteristics to the upper portions of the „376‟ mineralisation.
- *Hangingwall/north/footwall zone*. The hangingwall zone (HWZ) lies approximately 30m east of the porphyry contact and is probably stratigraphically controlled by a fine-grained carbonaceous mudstone. This linear zone extends over a strike length of at least 300m and widths up to 10m to 15m. In the north the HWZ appears to converge with the porphyry contact suggesting a mild discordance of the intrusive. High grade mineralisation (>5g/t gold) within the HWZ is characterised by coarse arsenopyrite and minor pyrite up to 10 mm in size.

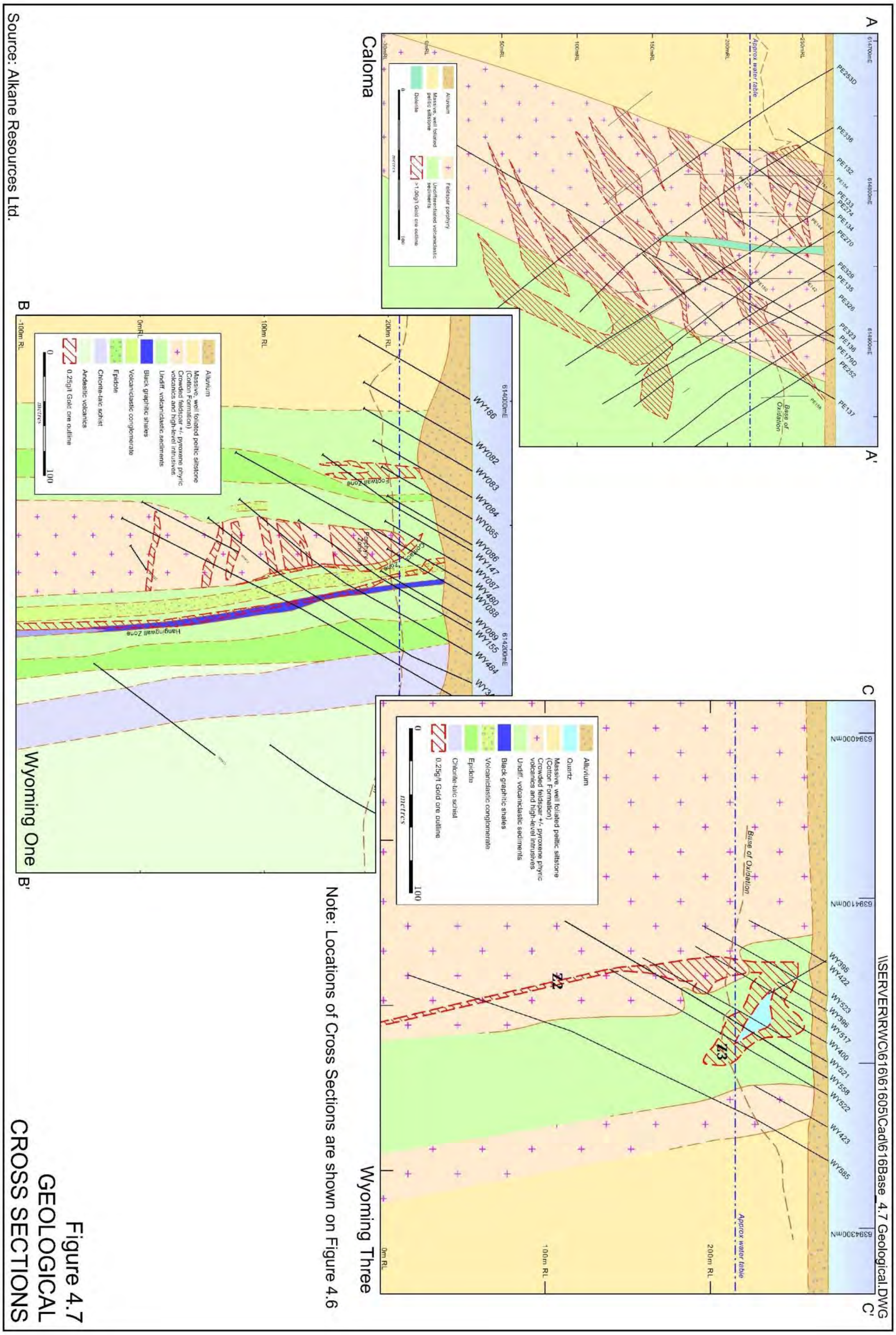



Figure 4.7
GEOLOGICAL
CROSS SECTIONS

- *Contact zone*. The contact zone is characterised by high grade gold mineralisation hosted within volcaniclastic sediments on the immediate eastern contact of the feldspar porphyry. Within the shallow sections of the deposit this zone is over 10m thick, extends 100m north-northwest and is frequently associated with grades >5g/t Au. The contact mineralisation and alteration is essentially identical to that of the porphyry zone.

### Wyoming Three

Gold mineralisation at Wyoming Three also shows a strong spatial relationship with feldspar porphyritic rocks (see cross section B of **Figure 4.7**). In contrast to Wyoming One, pervasive alteration is limited or absent with mineralisation hosted within structurally controlled quartz±carbonate±chlorite±pyrite± arsenopyrite veining. Minor sericite alteration selvages and restricted zones of chlorite „spotting‟ are observed.

Mineralisation is localised within three to four separate quartz-rich lodes which strike about 105$^{o}$ and dip steeply to the north, and appear to be controlled within an anastomosing shear zone about 50m wide. This structure has been traced over several hundred metres but is only mineralised over 250m. The lodes grade 2.0g/t gold to 2.5g/t gold and are hosted within both the feldspar-phyric and aphyric volcanics as well as fine-grained volcaniclastic siltstones.

### Caloma

Mineralisation at Caloma is hosted by a high level plagioclase-augite phyric sill similar to those at Wyoming (see cross section A of **Figure 4.7**). The sill is at least 1 100m long, 70m to 150m wide, strikes north and dips 45$^{o}$ to 70$^{o}$ west. Mineralisation occurs as multiple stacked quartz lenses or lodes striking predominantly north to north-northwest, dipping 30$^{o}$ west. The mineralisation is associated with sericite–carbonate–albite–quartz (± chlorite ± pyrite ± arsenopyrite) alteration similar to that at Wyoming One.

To date 11 „lenses‟ have been identified extending over variable strike lengths and having variable down dip extents. In almost all instances mineralisation is terminated at the contact with the Cotton Formation siltstones however irregularly extends into the footwall siltstones and volcanics where the lenses tend to have a „horse tailing‟ appearance.

## 4.1.4.4 Sterilisation Drilling

A program of air core drilling was undertaken in mid-2009 to assess the potential for additional mineralisation below areas of proposed infrastructure. Drilling results from previous exploration drilling campaigns was also analysed as relevant. In total 245 drill holes (including pre-existing drilling) have been completed. The following provides a description of the sterilisation drilling completed over six areas designated for infrastructure, soil, processing residue or waste rock management.

- Processing Plant and Office Area. 19 vertical holes were completed at 150m intervals along three lines spaced 150m apart. All holes were drilled to approximately 12m below the alluvials/soil and all intersected weathered siltstone basement. No intersections with anomalous gold or arsenic values were recorded.

- Waste Rock Emplacement 2. 19 vertical holes were completed at 150m intervals along three lines spaced 150m apart. 17 angled holes had previously been completed in 2002 at 40m intervals along two lines spaced 100 metres apart. The angled drill holes were drilled to refusal whilst the vertical holes were drilled to approximately 12 metres below the alluvial layer. All drill holes intersected weathered siltstone, sandstone or quartz pebble conglomerate from the Cotton Formation. No anomalous gold or arsenic values were intersected.
- Wyoming Topsoil Stockpiles. 18 angled holes were completed along three lines spaced 200m. No results of significance were intersected in the holes.
- Waste Rock Emplacement 1. A single line of vertical holes was completed along the axis of Waste Rock Emplacement 1 as part of an assessment of the palaeochannel system in 2004. Anomalous gold values were intersected in several holes, however, these were of narrow width and of general low grade and are not considered significant. Additional drilling completed prior to 1999 and six vertical holes completed in 2009 identified isolated gold values of up to 1.68g/t, however, these results were not replicated and are not considered to represent an additional mineable deposit.
- Residue Storage Facility. 28 vertical drill holes were completed at 100m intervals along lines approximately 200 metres apart. Anomalous gold values were intersected in two drill holes, with the best result being 0.41ppm over one metre. Neither intercept is considered significant.
- Waste Rock Emplacement 3 and Caloma Topsoil Stockpiles. A series of angled drill holes at 40m intervals were completed along lines approximately 200m apart. Results indicated the presence of an additional deposit at the southern end of the waste rock emplacement leading to the establishment of the Caloma Two deposit. The waste rock emplacement and topsoil stockpiles were subsequently modified to enable the inclusion of the Caloma Two Open Cut into the Project design.

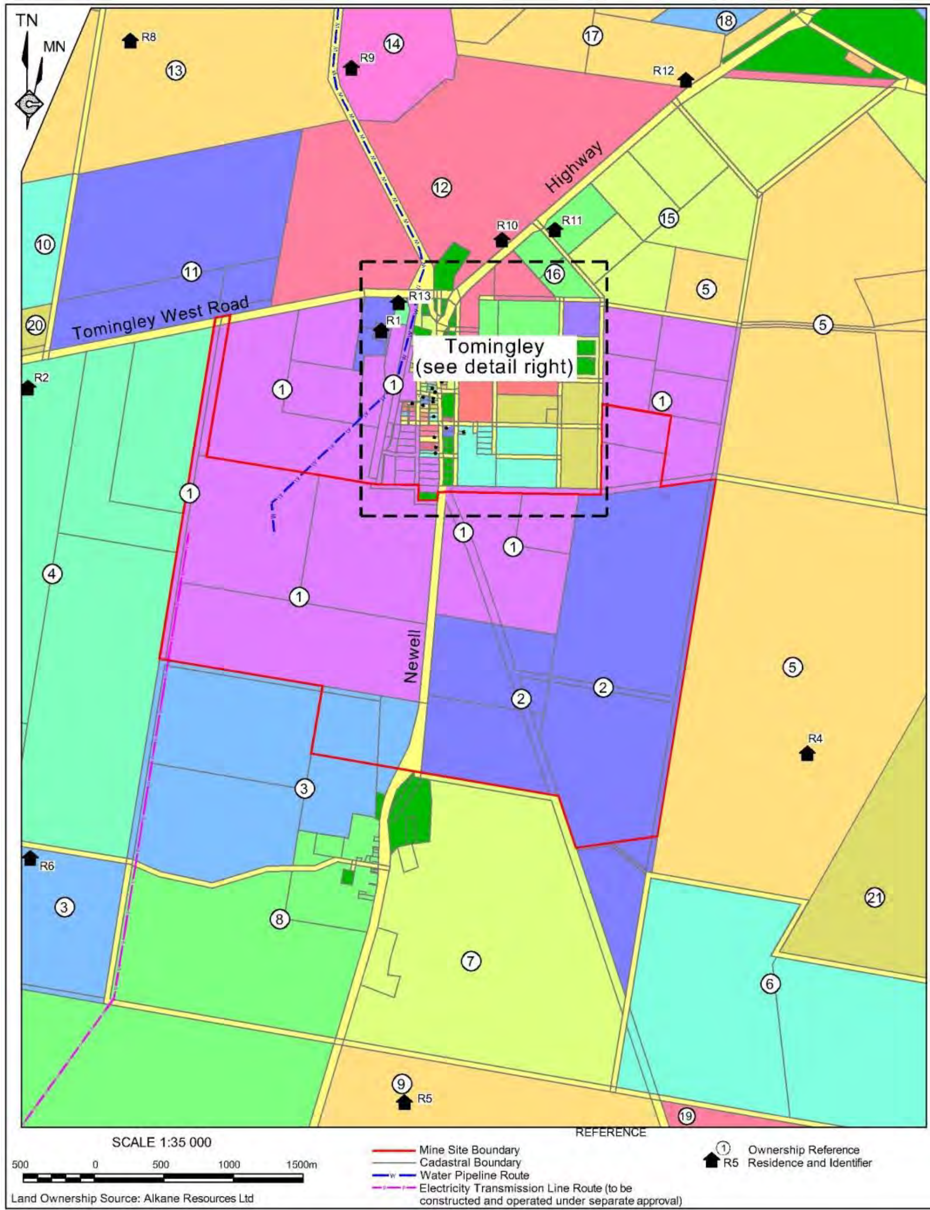
## 4.1.5 Surrounding Land Ownership, Residences and Land Use

### 4.1.5.1 Land Ownership and Residences

**Figure 4.8** presents the land ownership surrounding the Mine Site.

The Tomingley-Narromine Water Pipeline Route, with the exception of three short sections, occurs entirely within road reserves. Those sections of the route that do not occur within road reserves include the following.

- A section of the northern portion of the route from the Mitchell Highway to the bore sites. That section of the Water Pipeline Route occurs on Lot 18, DP755119 (of the "Woodlands" property) on land owned by Mr Stuart Boland.
- A section of the northern portion of the route from the where the Water Pipeline Route passes beneath the Main Western Railway. That land is controlled by ARTC.
- A section of the southern portion of the route from the Tomingley West Road to the discharge point at the Raw Water Dam. That section of the Water Pipeline Route occurs on land over which the Proponent has an option to purchase.




\\SERVER\RWC\616\61605\Cad\616Base_4.8 Ownership.DWG

| Reference | Land Owner* | Reference | Land Owner* | Reference | Land Owner* |
|---|---|---|---|---|---|
| | Crown Land | 20 | Estate of C. & S. Canon | 42 | R. & K. Dart |
| | Preserved Land | 21 | R. Hando | 43 | M.C. Newton |
| | Road Reserve | 22 | C. Sonter | 44 | M. Prasad |
| 1 | J. Pearse | 23 | A. Watsford | 45 | N. Heywood |
| 2 | G. & C Pugh | 24 | E. Buckley | 46 | L. & D. Millgate |
| 3 | M. McNiven | 25 | R.A. Ploog | 47 | Tomingley Memorial Hall |
| 4 | M. & W. Bourchier | 26 | G. Dart | 48 | Narromine Shire Council |
| 5 | K. Strahorn | 27 | S. Kumar & N Navedith | 49 | L. Bunning |
| 6 | P.& T. Clark | 28 | J. & D. Dart | 50 | Narromine Shire Council |
| 7 | J. Strahorn | 29 | S. Shipley | 51 | I Knight |
| 8 | M. & R. Bourchier | 30 | R. Ferguson | 52 | M. Talikka |
| 9 | G. & L. Hando | 31 | R. & S. Smith | 53 | C. Cox |
| 10 | J. Perry | 32 | P. Mayoh | 54 | M. Wilkie |
| 11 | J. & K Kneale | 33 | P. Duggan & M. Fitzgibbon | 55 | G. Wilkie |
| 12 | C.G. Millgate | 34 | M. & D. Kelly | 56 | N. & B. Harper |
| 13 | K. Pearse & K. Thorton | 35 | B. Rees | 57 | R. & K. Dart |
| 14 | K. Wynne & T. Robinson | 36 | J. Harbor | 58 | Tomingley Racecourse |
| 15 | P. & S. Strahorn | 37 | Peak Hill Aboriginal Land Council | 59 | Narromine Shire Council |
| 16 | R. Bradbury | 38 | M. Clarke | 60 | R. & D. Hopkins |
| 17 | D. McGaw | 39 | M. Clarke & L. Buntrock | 61 | R. Jones |
| 18 | S. Dennis | 40 | M. Casey | 62 | Hyland Haulage Pty Ltd |
| 19 | J. Gratton | 41 | E. Haycock | | |

Land Ownership Source: Alkane Resources Ltd.

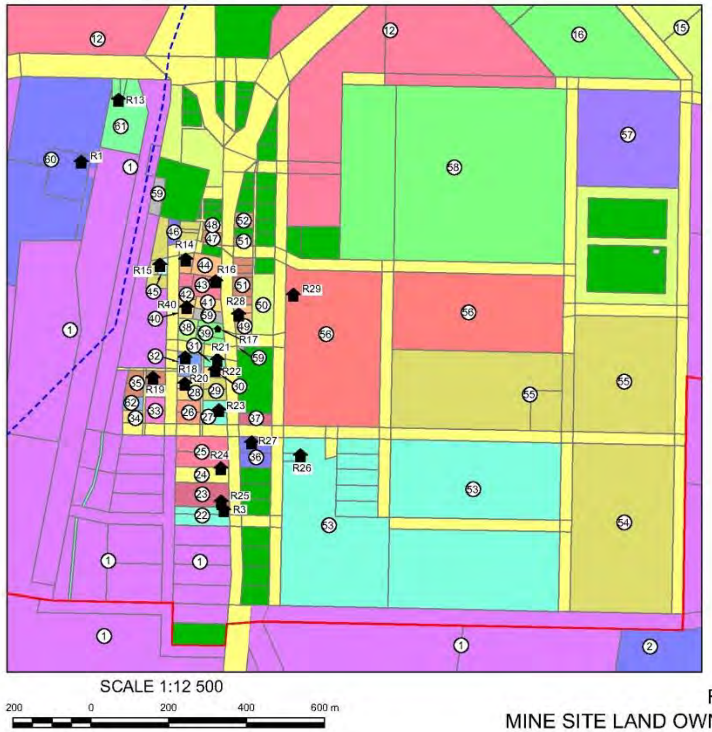



Figure 4.8
MINE SITE LAND OWNERSHIP
AND RESIDENCES

**Figure 4.9** presents the residences surrounding the Mine Site. It is noted that a number of other buildings, including commercial, government agency, community and private buildings, surround the Mine Site. However, as there would not be classified as sensitive receivers for the purposes of the noise, blasting and air quality assessments, these structures are not identified on **Figure 4.9**.

#### 4.1.5.2 Land Use

**Figure 4.9** provides an aerial photo of the Mine Site and its surrounds. Land uses within and surrounding the Mine Site include the following.

- Residential and rural residential.
- Agriculture.
- Transportation (Newell Highway).
- Recreation (Tomingley Racecourse).
- Former mining operations, namely the McPhail Mine Tailings Dam and associated underground workings.

### 4.1.6 Surrounding Community

#### 4.1.6.1 Introduction

Information presented in the following sub-sections has been obtained from census data produced by the Australian Bureau of Statistics from the 2006 Census. The Census data relate to the census statistical area of Tomingley State Suburb (referred to hereafter as ”Tomingley”) and the combined local government areas of:

- Narromine;
- Parkes; and
- Dubbo (referred to hereafter as “the surrounding LGAs”).

**Figure 4.10** presents the location of each of these statistical collection areas. In addition, the data is compared with census data from NSW as a whole (NSW).

#### 4.1.6.2 Population and Population Growth

**Table 4.4** presents a summary of the 2006 population statistics for Tomingley, the surrounding LGAs and for NSW as a whole.

The Census data indicate that within the surrounding LGAs, the proportion of persons aged 14 years and younger (23.5%) was higher than for NSW as a whole (19.8%), while the reverse was true for Tomingley (16.1%).

By contrast, people aged 15 to 24 years in Tomingley and the surrounding LGAs (9.5% and 13.0% respectively) represented a smaller percentage of the population than NSW as a whole (13.3%). Similarly, the proportion of people residing in Tomingley and the surrounding LGAs between the ages of 25 and 54 years (39.0% and 38.8% respectively) was less than the proportion for NSW a whole (42.0%).

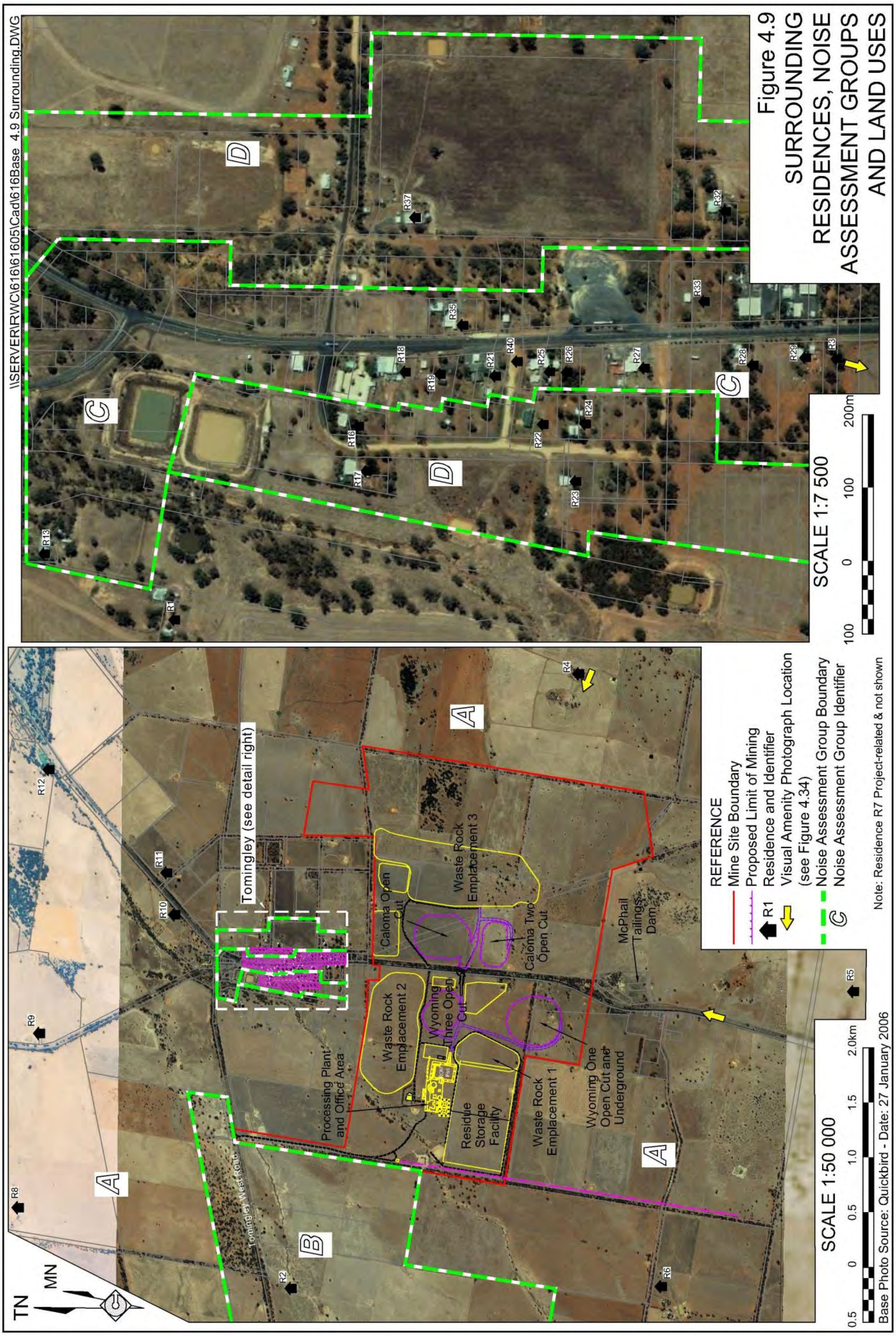



Figure 4.9
SURROUNDING RESIDENCES, NOISE ASSESSMENT GROUPS AND LAND USES

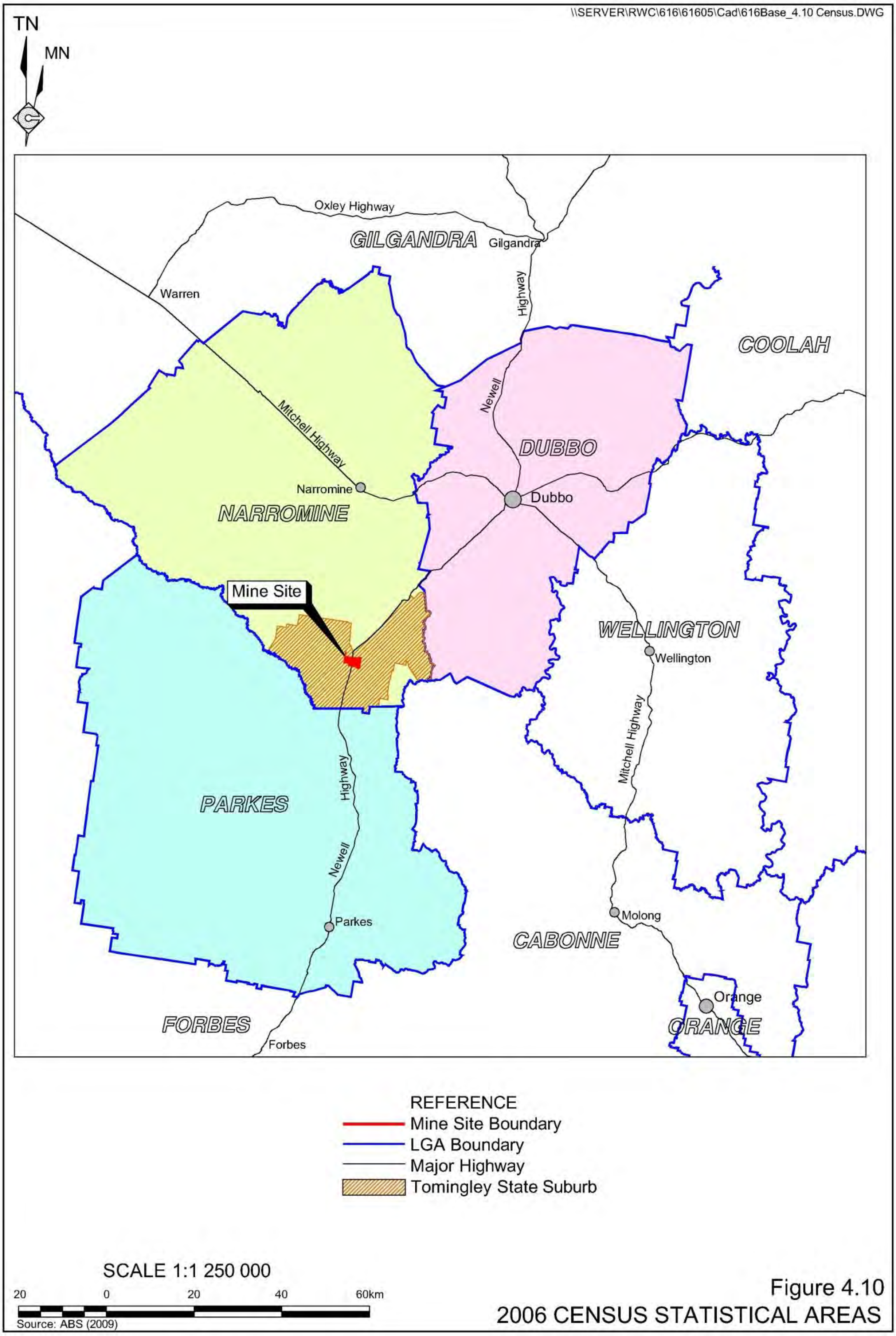



Figure 4.10
2006 CENSUS STATISTICAL AREAS

**Table 4.4**
**2006 Census Population Statistics**

| | | Tomingley State Suburb | | Dubbo, Narromine & Parkes | | NSW | |
|---|---|---|---|---|---|---|---|
| | **Age Groups** | **Persons** | **Percentage** | **Persons** | **Percentage** | **Persons** | **Percentage** |
| Children | 0-4 years | 14 | 6.1% | 4 272 | 7.28% | 420 431 | 6.4% |
| | 5-14 years | 23 | 10.0% | 9 527 | 16.24% | 878 483 | 13.4% |
| Studying or Working | 15-24 years | 22 | 9.5% | 7 611 | 12.98% | 871 717 | 13.3% |
| | 25-54 years | 90 | 39.0% | 22 772 | 38.84% | 2 753 219 | 42% |
| Approaching Retirement or Retired | 55-64 years | 47 | 20.3% | 6 238 | 10.63% | 719 551 | 11% |
| | 65 years and over | 34 | 14.7% | 8 212 | 14% | 90 5778 | 13.8% |
| | **Total Persons** | **231** | | **58 630** | | **6 549 178** | |
| Source: Australian Bureau of Statistics - 2006 Census | | | | | | | |

In addition, the proportion of people aged over 55 years in Tomingley (35%) is significantly higher than for the surrounding LGAs and NSW as a whole (24.6% and 24.8% respectively)

This data indicates that a greater proportion of people aged over 55 live within and in the vicinity of the village of Tomingley than in the surrounding LGAs or in NSW as a whole. This may be the result of a greater proportion of agricultural operations owned and operated by people with a higher average age than elsewhere, together with the lower cost of living. This may also account for the lower proportion of children living in the vicinity of Tomingley.

#### 4.1.6.3 Employment, Occupation and Industries

**Table 4.5** presents the employment statistics from the 2006 Census. This data indicates that the unemployment rate in Tomingley on the date of the census was 3.0%, significantly lower than the surrounding LGAs or NSW as a whole (4.4% and 6.0% respectively). However, the workforce participation rate for Tomingley and the local area (28.1% and 24.9% respectively) was considerably lower than for NSW as a whole (47.2%). The lower participation rate for the local area may be attributed a greater proportion of the population being of retirement age.

**Table 4.5**
**2006 Census Employment Statistics**

| | Tomingley State Suburb | | Dubbo, Narromine & Parkes | | NSW | |
|---|---|---|---|---|---|---|
| | **Persons** | **Percentage** | **Persons** | **Percentage** | **Persons** | **Percentage** |
| **Employed** | | | | | | |
| Full-time(a) | 59 | 58.5% | 10 668 | 49.4% | 1 879 628 | 61% |
| Part-time | 0 | 0% | 2 017 | 9.4% | 842 713 | 27% |
| Employed, away from work(b) | 3 | 3.0% | 550 | 2.6% | 187 103 | 6% |
| Total | 62 | 61.5% | 13 675 | 63.4% | 2 909 444 | 94% |
| **Unemployed, looking for** | | | | | | |
| Full-time work | 3 | 3.0% | 732 | 3.4% | 115 165 | 4% |
| Part-time work | 0 | 0% | 206 | 1% | 67 994 | 2% |
| Total | 3 | 3.0% | 938 | 4.4% | 183 159 | 6% |
| **Labour Force Participation** | | | | | | |
| Total labour force | 65 | | 14 613 | | 3 092 603 | |
| Total Persons | 231 | | 58 630 | | 6 549 177 | |
| Labour force participation | 28.13% | | 24.92% | | 47.20% | |
| Source: Australian Bureau of Statistics - 2006 Census | | | | | | |

**Table 4.6** presents a summary of the 2006 Census statistics relating to industry of employment. This data indicates the "Agriculture, forestry and fishing" industry employed almost two thirds of the Tomingley-based workforce (61%). In the surrounding LGAs, this was the leading industry of employment (12.6%), followed by "Construction" (11.3%), "Retail" (10.4%) and "Manufacturing" (10.3%). State-wide, "Manufacturing" and "Construction" were the principle industries (employing 12.9% and 11.7% of the workforce respectively), while "Agriculture, forestry and fishing" employed just 3.5% of the NSW workforce.

**Table 4.6**
**Industry Employment Statistics**

| | Tomingley State Suburb | | Dubbo, Narromine & Parkes | | NSW | |
|---|---|---|---|---|---|---|
| | Persons | Percentage | Persons | Percentage | Persons | Percentage |
| Agriculture, forestry & fishing | 39 | 61.9% | 1 723 | 12.6% | 55 532 | 3.5% |
| Mining | 3 | 4.8% | 347 | 2.5% | 18 322 | 1.2% |
| Manufacturing | 0 | 0% | 1 410 | 10.3% | 202 434 | 12.9% |
| Electricity, gas, water & waste services | 0 | 0% | 255 | 1.9% | 23 079 | 1.5% |
| Construction | 3 | 4.8% | 1 549 | 11.3% | 183 998 | 11.7% |
| Wholesale trade | 0 | 0% | 762 | 5.6% | 87 166 | 5.6% |
| Retail trade | 9 | 14.3% | 1 422 | 10.4% | 140 058 | 8.9% |
| Accommodation & food services | 3 | 4.8% | 595 | 4.4% | 86 433 | 5.5% |
| Transport, postal & warehousing | 0 | 0% | 1 107 | 8.1% | 111 898 | 7.1% |
| Information media & telecommunications | 0 | 0% | 179 | 1.3% | 40 119 | 2.6% |
| Financial & insurance services | 0 | 0% | 213 | 1.6% | 68 253 | 4.3% |
| Rental, hiring & real estate services | 0 | 0% | 137 | 1.0% | 25 360 | 1.6% |
| Professional, scientific & technical services | 0 | 0% | 425 | 3.1% | 115 503 | 7.4% |
| Administrative & support services | 0 | 0% | 252 | 1.8% | 43 167 | 2.7% |
| Public administration & safety | 0 | 0% | 1 033 | 7.6% | 103 620 | 6.6% |
| Education & training | 0 | 0% | 566 | 4.1% | 67 250 | 4.3% |
| Health care & social assistance | 0 | 0% | 583 | 4.3% | 67 856 | 4.3% |
| Arts & recreation services | 0 | 0% | 134 | 1.0% | 21 311 | 1.4% |
| Other services | 3 | 4.8% | 647 | 4.7% | 63 176 | 4.0% |
| Inadequately described/Not stated | 3 | 4.8% | 337 | 2.5% | 45 913 | 2.9% |
| **Total** | **63** | | **13 676** | | **1 570 448** | |

Source: Australian Bureau of Statistics - 2006 Census

The Census data also indicates that "Transport, postal and warehousing", "Public administration and safety" and "Wholesale trade" were also industries that employed a large number of people surrounding LGAs. The "Mining" sector represented the smallest State-wide industry employer but was considerably more important on a local scale, with 4.8% of Tomingley"s workforce and 2.5% of the surrounding LGAs workforce employed within the industry.

These trends reflect the generally rural nature of the area surrounding Tomingley and the surrounding LGAs and the importance of mining for communities within the Central West of NSW.

#### 4.1.6.4 Income

**Table 4.7** presents income statistics provided in the 2006 Census. That data indicates that median individual, family and household incomes in Tomingley were between 21.5% and 37.6% lower than NSW as a whole, while incomes in the surrounding LGAs were between 12% and 23.2% lower than NSW as a whole.

**Table 4.7**
**Income Statistics 2006**

| | Tomingley | Dubbo, Narromine & Parkes LGA | NSW |
|---|---|---|---|
| Median individual income ($/weekly) | 362 | 404 | 461 |
| Median family income ($/weekly) | 737 | 1 002 | 1 181 |
| Median household income ($/weekly) | 662 | 796 | 1 036 |
| Source: Australian Bureau of Statistics - 2006 Census | | | |

This difference is likely to be attributed to the fact that there are proportionally fewer people working in Tomingley than the surrounding LGAs and NSW and that, typically, wages and salaries available for workers in rural areas are lower than other areas within the State.

#### 4.1.6.5 Housing

**Table 4.8** presents a summary of the housing cost statistics for Tomingley, the surrounding LGAs and NSW as a whole. The data indicates that none of the houses in Tomingley were occupied by tenants and that the median monthly loan repayment was comparable to that for the surrounding LGAs, both of which were approximately $500 less than the NSW median. In addition, the average household size was marginally higher in the surrounding LGAs than in Tomingley or NSW as a whole.

**Table 4.8**
**Cost of Housing and Household Size Statistics - 2006**

| | Tomingley | Dubbo, Narromine & Parkes LGA | NSW |
|---|---|---|---|
| Median housing loan repayment ($/monthly) | 1 000 | 1 014 | 1 517 |
| Median rent ($/weekly) | 0 | 130 | 210 |
| Average number of persons per bedroom | 1.1 | 1 | 1.1 |
| Average household size | 2.5 | 3 | 2.6 |
| Source: Australian Bureau of Statistics - 2006 Census | | | |

#### 4.1.6.6 Community Profile

The Tomingley Gold Field was proclaimed on 19 June 1882 and the village of Tomingley was proclaimed on 15 June 1894 to service gold mining in the village and at McPhail, located 3km to the south of the village. Historical accounts from the 1880s tell of the village servicing five gold mines, three stores, two hotels and a public school with an average of 33 students. In 2011 only 20 residential dwellings remain in the village. An informal assessment of the population of the village conducted during the community consultation program indicated that the population of Tomingley is approximately 43.

Some residents are retired from farms, some work outside of Tomingley on farms, mines or in the larger centres. Others work in Tomingley in existing businesses.

Businesses operating within the village include:

- two service stations with diners (it is noted that only one service station supplies fuel);
- one motel;
- a hotel; and
- an RTA works depot.

In addition, the village has a community hall, a closed school (which is still used for meetings and other community events) and horse racing track where the annual Tomingley Races, sponsored by the Proponent, are held in April each year.

Within the Narromine LGA are the townships of Narromine, Trangie and the village of Tomingley. The Narromine LGA has well developed infrastructure supporting one high school, three primary schools, one hospital and one aged care facilities.

Parkes is the major urban centre within the Parkes LGA, with Peak Hill the secondary urban centre. With 82% of Australia"s population within 12 hours drive of Parkes, the LGA has become a national freight distribution centre. In addition, Rio Tinto has recently extended the life of the Northparkes Mine to 2024. To support the growing community, three childcare centres and six schools, as well as three aged care facilities located in Parkes.

Dubbo City LGA, supports approximately 2 100 businesses. Dubbo is a service city which has a shopping population that exceeds 120 000. There are 70 flights (serviced by Qantas and Regional Express) from Dubbo to Sydney per week. The city has six high schools, ten primary schools, and three private infant schools. The health service sector includes 3 hospitals. The city also boasts excellent sporting and cultural infrastructure.

In summary, the community surrounding the Mine Site is central to well established infrastructure, a stable economic base and a strong regional network of suppliers and support services. In addition, there are active sporting teams and other social clubs operating within the area.

## 4.2 NOISE

### 4.2.1 Introduction

The Director-General"s Requirements (DGRs) issued by the then Department of Planning (now DP&I) require that the *Environmental Assessment* include an assessment of "**noise and blasting** – *including construction, operational and road traffic noise*."

Based on the risk assessment undertaken for the Project (see Section 3.5), specific noise-related impacts that may result as a consequence of the Project (<u>without the implementation of the safeguards, controls and mitigation measures presented in this section</u>) include the following.

- Increased noise levels associated with Project activities (≤5dBA above noise criteria) causing annoyance, distractions, i.e. amenity impacts (high risk).
- Increased noise levels associated with Project activities (>5dBA above noise criteria) causing more significant amenity impacts (high risk).

- Sleep disturbance as a result of maximum noise levels (high risk).
- Increased noise levels associated with the Project leading to impacts on local fauna assemblage (moderate risk).

The noise and blasting assessment for the Project was undertaken by Messrs Dick Godson, Mark Blake and Ryan Wakeling of SLR Consulting Pty Ltd (formerly Heggies Pty Ltd). The resulting report is presented as Part 1 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "SLR (2011)". This sub-section of the *Environmental Assessment* provides a summary of the noise components of that report. Section 4.10 provides a summary of the blasting components of that report.

It is noted that noise emissions associated with construction of the water supply pipeline would be limited and short-term in nature. There would be no operational noise emissions associated with the water supply pipeline. As a result, noise emissions associated with construction and operation of the power transmission line and the water supply pipeline are not assessed.

## 4.2.2 Existing Environment

### 4.2.2.1 Introduction

Existing noise levels in the vicinity of the Mine Site are influenced by a range of sources including traffic on the Newell Highway and local roads, agricultural equipment, stock, wind in trees, insects and birds. In order to characterise the local variation in noise levels, SLR (2011) undertook attended and attended noise monitoring at seven residences surrounding the Mine Site. This sub-section provides an overview of the results of that monitoring.

### 4.2.2.2 Noise Assessment Groups

In order to characterise the local variation in noise levels, SLR (2011) identified four areas in which noise levels are likely to be similar because of the proximity of residences in each area to the various noise sources, including the Newell Highway and other roads, fauna, vegetation and topography. These four areas, referred to as noise assessment groups (NAG) for the purposes of assessing noise impacts, have been categorised as follows.

- NAG A: ambient noise influenced by both local roads and Newell Highway (Residences R1, R4, R5, R6, R8, R9, R10, R11 and R12).
- NAG B: rural setting with minimal traffic noise influence (Residence R2).
- NAG C: ambient noise highly elevated due to Newell Highway (Residences R3, R13, R18, R19, R21, R24, R25, R26, R27, R28, R29, R33, R35 and R40).
- NAG D: ambient noise elevated due to Newell Highway (Residences R16, R22, R17, R23, R32 and R37).

The locations of the four NAG"s are presented on **Figure 4.9**.

### 4.2.2.3 Unattended Noise Monitoring

Unattended background noise monitoring was conducted at the residences identified in **Figure 4.9**. **Table 4.9** presents the results of the unattended noise monitoring, together with the relevant survey periods. During the survey periods, environmental noise loggers were used to continuously record noise levels at each location during the survey period.

**Table 4.9**
**Unattended Ambient Noise Environment**

| Residence | NAG | Survey Period | Ambient ($L_{A90(15minute)}$) Level All Noise Sources[1] | | |
|---|---|---|---|---|---|
| | | | Day | Evening | Night |
| R1 | A | 30 April, 13 May to 15 May 2009 | 29 | 26 | 24 |
| R2 | B | 29 April to 1 May 2009 | 31 | 33 | 35 |
| R3 | C | 1 October to 8 October 2009 | 40 | 30 | 28 |
| R4 | A | 29 April to 15 May 2009 | 29 | 24 | 23 |
| R5 | A | 29 April to 15 May 2009 | 30 | 25 | 25 |
| R6 | A | 29 April to 15 May 2009 | 28 | 24 | 23 |
| R23 | D | 1 October to 8 October 2009 | 38 | 33 | 31 |

Note 1: Units = dB(A) re 20µPa
Note 2: NAG = Noise Assessment Group
Source: SLR (2011) – Table 6

### 4.2.2.4 Attended Noise Monitoring

In order to supplement the unattended noise logger measurements and to assist in identifying the character and duration of the ambient noise sources, operator-attended night-time noise surveys were conducted at selected residences on 29 and 30 April 2009. **Table 4.10** presents the results of the attended noise monitoring program.

**Table 4.10**
**Operator-attended Ambient Noise Survey Results**

| Residence Date / Time Meteorological Conditions | | | | | | | Primary Noise Descriptor (dB(A) re 20µPa) | | | | | Description of Noise Emissions (and Typical Maximum Levels – dB(A) ($L_{Amax}$)) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Res | NAG[2] | Time | Cloud Cover (Octa) | Wind | Temp | Relative Humidity | $L_{Aeq}$ | $L_{A1}$ | $L_{A10}$ | $L_{A50}$ | $L_{A90}$ | |
| R1 | A | 11.44pm | 0 | <1m/s | 5°C | 70% | 42 | 50 | 47 | 37 | 32 | Distant Traffic (30-34)<br>Local Heavy Traffic (48-51) |
| R2[1] | B | 12.45am | 0 | <1m/s | 3°C | 81% | 37 | 49 | 38 | 25 | 25 | Distant Traffic (20-25)<br>Drilling Rig to East (<24) |
| R3 | C | 1.05am | 0 | <1m/s | 3°C | 75% | 65 | 79 | 56 | 35 | 30 | Local Heavy Traffic (70-86)<br>Distant Traffic (30-33)<br>Trucks at Rest Stop (idle) (25-30)<br>Dog Barks (distant) (40) |
| R4 | A | 2.36am | 0 | <1m/s | 3°C | 81% | 25 | 48 | 35 | 25 | 25 | Distant Traffic (30-34)<br>Sheep (distant) (<25) |
| R5 | A | 3.06am | 0 | <1m/s | 1°C | 87% | 44 | 56 | 47 | 32 | 26 | Distant Traffic (28-57) |

Note 1: As access to the private road leading to the residence was not available at this monitoring location, the operator attended noise survey was conducted on Tomingley West Road at the front gate of the private road approximately 330m north-northeast of the unattended noise logger.
Note 2: NAG = Noise Assessment Group
Source: SLR (2011) – Table 7

#### 4.2.2.5 Rating Background Noise Level

Based on the results of the attended and unattended noise monitoring programs, collected and processed in accordance with the requirements of the NSW *Industrial Noise Policy* (INP) (see Section 4.2.3.1), **Table 4.11** presents the Rating Background Noise Levels for each of the monitored residences.

**Table 4.11**
**Rating Background Levels (dB(A) re 20 µPa)**

| Residence | NAG[2] | Rating Background Level[1] ($L_{A90(15minute)}$) Level All Noise Sources | | |
|---|---|---|---|---|
| | | Day | Evening | Night |
| R1 | A | 30 | 30 | 30 |
| R2 | B | 31 | 30[3] | 30[2] |
| R3 | C | 40 | 30 | 30[3] |
| R4 | A | 30 | 30 | 30 |
| R5 | A | 30 | 30 | 30 |
| R6 | A | 30 | 30 | 30 |
| R23 | D | 38 | 33 | 31 |

Note 1: Rating Background Level determined in accordance with the procedures specified in the INP. It is noted that where the measured background noise level is less than 30dB(A), the Rating Background Level has been adjusted to comply with the INP-specified default level of 30dB(A).
Note 2: NAG = Noise Assessment Group
Note 3: It has been determined from the attended noise monitoring results that the $L_{A90}$ noise levels measured by the unattended noise logger were controlled by local domestic activity at Residence 2. The evening and night-time Rating Background Levels at this residence have been adjusted accordingly.
Source: SLR (2011) – Table 8

## 4.2.3 Assessment Criteria

### 4.2.3.1 Operational Noise Criteria

#### 4.2.3.1.1 Introduction

The former Environment Protection Authority released the NSW *Industrial Noise Policy* (INP) in January 2000 (EPA, 2000). The INP provides a framework and process for deriving operational noise criteria for project approvals and development consents under the *Environmental Planning and Assessment Act 1979* and setting operational noise limits in Environment Protection Licences under the *Protection of the Environment Operations Act 1997*. The Project is a scheduled activity under Schedule 1 of this latter Act.

In implementing the INP the NSW Office of Environment and Heritage (OEH) has two broad objectives, namely to:

- control intrusive noise impacts, or those associated directly with the Project alone, in the short-term; and
- maintain cumulative noise levels or amenity for particular land uses, namely cumulative noise levels associated with all surrounding industrial noise sources, over the medium to long-term.

#### 4.2.3.1.2 Intrusive Noise Criteria

In controlling intrusive noise impacts, the INP states that a Project should not result in an equivalent continuous noise level ($L_{Aeq}$) at a residential receiver of more than 5dB(A) above the measured (or default) Rating Background Level (RBL). The INP states that an increase of 5dB(A) or less above the background noise levels would protect 90% of residents living in the vicinity of an industrial noise source from adverse effects of noise 90% of the time. In subjective terms, any exceedances of the INP project specific assessment criteria can be generally described as follows.

- <1dB(A) Negligible noise level increase (Not noticeable by anyone).
- 1dB(A) to 2dB(A) Marginal noise level increase (Not noticeable by most people).
- 3dB(A) to 5dB(A) Moderate noise level increase (Not noticeable by some people but may be noticeable by others).
- >5dB(A) Appreciable noise level increase (Noticeable by most people).

In view of the above, SLR (2011) recommends the establishment of noise management zones, as presented in **Table 4.12**, for assessing exceedance of noise criteria methodology for assessing noise levels which may exceed the INP project specific noise assessment criteria.

**Table 4.12**
**Project Noise Impact Assessment Zones**

| Assessment Criteria | Noise Management Zone | | Noise Affectation Zone |
|---|---|---|---|
| | Marginal | Moderate | |
| Intrusiveness $L_{Aeq(15minute)}$ | 1 to 2dB(A) above Project specific criteria | 3 to 5dB(A) above Project specific criteria | >5dB(A) above Project specific criteria |
| Amenity $L_{Aeq(period)}$ | | | |
| Source: SLR (2011) – Table 15 | | | |

#### 4.2.3.1.3 Project Specific Assessment Criteria

Based on the Rating Background Noise Levels nominated in **Table 4.11**, **Table 4.13** presents the Project-specific noise assessment criteria for each noise assessment group calculated in accordance with the INP.

**Table 4.13**
**Noise Environment for Project Assessment Purposes[1]**

| Noise Assessment Group | Rating Background Level ($L_{A90(15minute)}$) | | | Intrusive (Project-specific) Noise Criteria ($L_{Aeq(15minute)}$) | | |
|---|---|---|---|---|---|---|
| | Day | Evening | Night | Day | Evening | Night |
| A | 30 | 30 | 30 | 35 | 35 | 35 |
| B | 31 | 30 | 30 | 36 | 35 | 35 |
| C | 40 | 30 | 30 | 45 | 35 | 35 |
| D | 38 | 33 | 31 | 43 | 38 | 36 |
| Note 1: Units = dB(A) re 20µPa | | | | | | |
| Source: Modified after SLR (2011) – Tables 13 and 14 | | | | | | |

#### 4.2.3.2 Sleep Disturbance Criteria

Peak noise level events such as reversing alarms, noise from the dropping of heavy items or other high noise level events may have the potential to cause sleep disturbance. While there are no specific criteria for sleep disturbance nominated in the INP or other noise-related policy documents, OEH typically considers sleep disturbance as the emergence of the maximum (or $L_{A1(1minute)}$) noise level above the $L_{A90(15minute)}$ level at the time. Typically, this would require $L_{A1(1minute)}$ noise levels of 10dB(A) above the Project-specific noise assessment criteria for the night-time period (10.00pm to 7.00am).

A review of noise events from comparable mining operations shows that the $L_{A1(1minute)}$ levels from mobile equipment, i.e. bulldozers, haul trucks, etc., are typically no greater than 10dB(A) above the $L_{Aeq(15minute)}$ intrusive level. Accordingly, if Project-related noise levels during the night-time are less that the Project-specific noise assessment criteria then generally the OEH‟s sleep disturbance guideline criteria would also generally be met.

#### 4.2.3.3 Construction Noise Criteria

The assessment and management of on-site construction works is governed by the requirements of the INP. Off-site construction works, namely the construction of the Tomingley-Narromine Water Pipeline is governed by the OEH‟s "*Interim Construction Noise Guideline*" (ICNG) (DECCW, 2009). The ICNG recognises that higher levels of noise are likely to be tolerated by people in view of the relatively short duration of the works and recommends the following approaches to mitigating adverse noise impacts from construction sites.

The ICNG recommends that the $L_{Aeq(15minute)}$ noise levels arising from construction activities, when measured at boundary or within 30m of the residence (whichever is the lesser), should not exceed the following levels.

- Standard hours (Monday to Friday – 7:00am to 6:00pm & Saturday – 8:00am to 1:00pm).
  - Noise affected[1]: RBL + 10dB(A).
  - Highly noise affected[2]: 75dB(A)
- Non-standard hours (Monday to Friday – 6:00pm to 7:00am, Saturday – 1:00pm to 8:00am, Sundays and public holidays).
  - Noise affected[1]: RBL + 5dB(A)

These noise management levels are generally consistent with community reaction to construction noise.

Based on the measured $L_{A90(15minute)}$ RBL‟s within the four NAG‟s, the $L_{Aeq(15minute)}$ construction noise criteria within each of the NAG‟s is as follows. (The residence referenced below represents the residence within each NAG with the closest proximity to the proposed water pipeline. Achievement of the construction noise criteria at this residence would be indicative of satisfaction of the criteria at other residences within these NAG‟s.)

[1] The noise affected level represents the point above which there may be some community reaction to noise.
[2] The highly noise affected level represents the point above which there may be strong community reaction to noise.

| | Noise Affected | Highly Noise Affected |
|---|---|---|
| • NAG A (R9 – 125m): | 40 | 75 |
| • NAG B (R2 – 1 920m): | 41 | 75 |
| • NAG C (R13 – 115m): | 50 | 75 |
| • NAG D (R17 – 85m): | 48 | 75 |

#### 4.2.3.4 Road Traffic Noise Criteria

Noise emissions associated with vehicle noise within the Mine Site are assessed as operational noise. However, on public roads, Project-related road traffic noise is assessed against the requirements of the *Environmental Criteria for Road Traffic Noise* published by the then Environment Protection Authority in 1999 (EPA, 1999). That document identifies a range of assessment criteria based on the functional category of individual roads[3].

**Table 4.14** presents the relevant assessment criteria for the Project-related road traffic noise impact assessment.

**Table 4.14**
**Road Traffic Noise Criteria**

| Type of Development | Criteria $L_{Aeq(1hour)}$ Daytime | Criteria $L_{Aeq(1hour)}$ Night-time | Where Criteria Are Already Exceeded |
|---|---|---|---|
| **Collector Roads - Tomingley West Road and Tomingley - Narromine Road** | | | |
| 8. Land use developments with potential to create additional traffic on collector roads | 60dB(A) | 55dB(A) | Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria.<br>In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A) |
| **Arterial Roads - Newell Highway** | | | |
| 8. Land use developments with potential to create additional traffic on existing freeway/arterials | 60dB(A) | 55dB(A) | Where feasible, existing noise levels should be mitigated to meet the noise criteria.<br>In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A) |
| Note: Total traffic noise contribution including existing and project related vehicle movements. $L_{Aeq(1hour)}$ represents the highest $L_{Aeq}$ noise level for any hour during daytime (0700am to 10.00pm) and night-time (10.00pm to 7.00am). | | | |
| Source: SLR (2011) – After Tables 16 and 17 | | | |

### 4.2.4 Assessment Methodology

#### 4.2.4.1 Prediction of Operational Noise Emissions

Operational noise was assessed using RTA Software's Environmental Noise Model (ENM for Windows, Version 3.06). The acoustical algorithms utilised by this software have been endorsed by all State Environmental Authorities.

[3] It is recognised that the ECRTN is to be replaced by the "NSW Road Noise Policy" (RNP) on July 1 2011. The RNP would modify the application of several noise criteria. However, as the noise assessment was completed and initially submitted in May 2011, it is considered that the ECRTN remains the applicable and appropriate guideline document for this Project.

The following assumptions and inputs were used during the noise assessment.

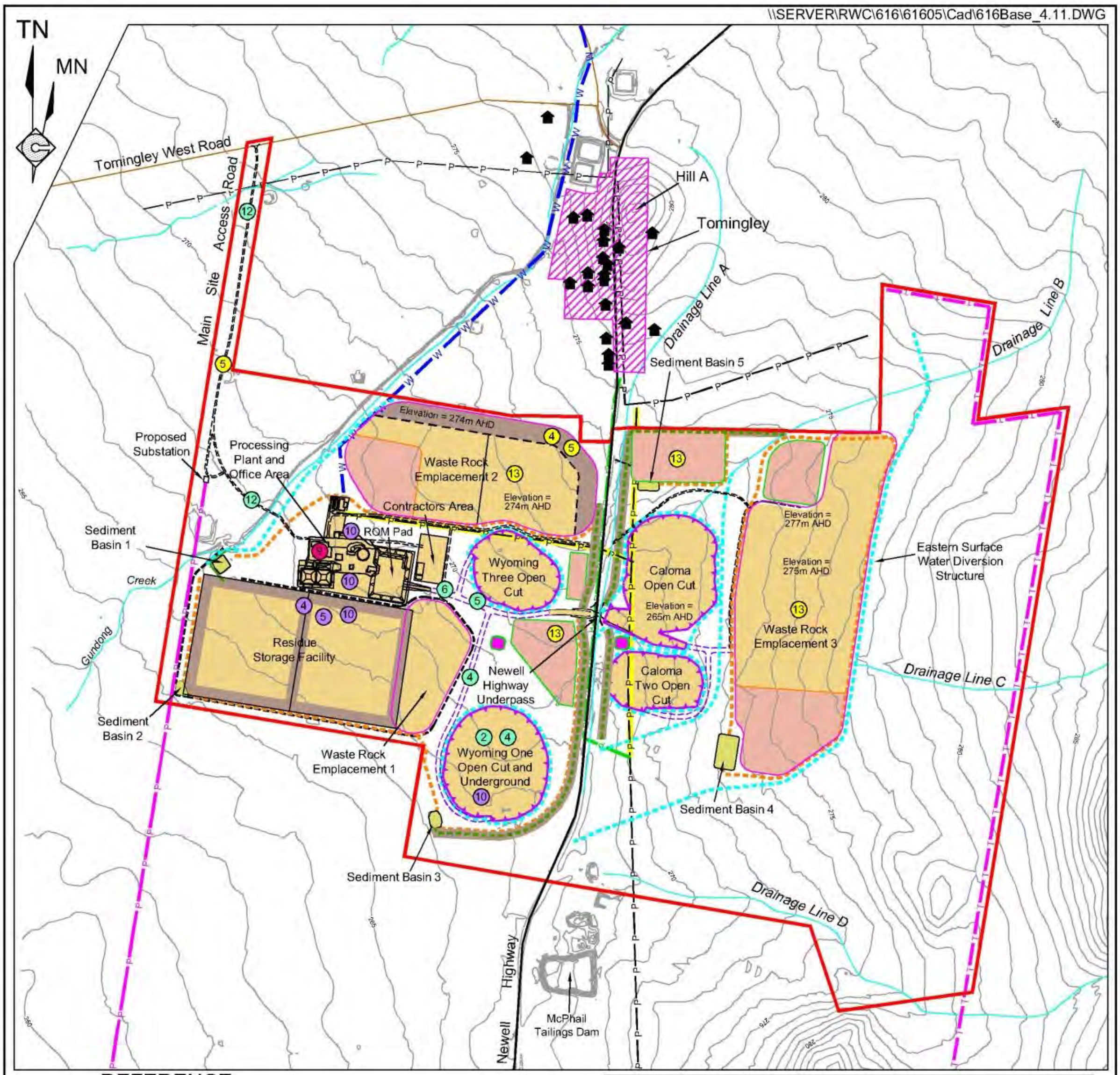
- All items of equipment identified in *Table 21* of SLR (2011) were assumed to be operating in the locations and at the times identified in **Figures 4.11** to **4.15**.
- Enclosure of the secondary crusher and screen tower to achieve a sound power level (SPL) reduction of 13dB(A). In order to achieve this level of SPL reduction, the following (or equivalent) enclosure would be constructed.
  - Double cladding comprising two layers of Colorbond with an absorptive Rockwool (or similar) layer in between.
  - Absorptive lining (Rockwool or similar) on the inside of the secondary crushing building.
  - Isolation of the screen from the rest of the screening building/enclosure in order to reduce vibration and structure borne noise.
- Rubber lining of the ball mill.
- All equipment to be used was assumed to be reasonably new, well maintained and fitted with manufacturer standard noise mitigation equipment.
- All equipment was assumed to be operating concurrently in order to simulate the overall maximum energy equivalent (i.e. $L_{Aeq(15minute)}$) intrusive noise level
- The northern face of Waste Rock Emplacement 2 was assumed to be 15m higher than the remainder of the emplacement during Scenarios 1B, 2 and 3 (see discussion for each of the relevant scenarios).
- The northern face of Waste Rock Emplacement 3 was assumed to be 5m higher than the remainder of the emplacement during Scenario 1B and 15m higher during Scenarios 2, 3 and 4 respectively (see discussion for each of the relevant scenarios).

In order of simulate mining operations during the life of the Project, five scenarios were assessed as follows (see **Figures 4.11** to **4.15**).

**Scenario 1A**: Representative of months 1 to 3 of the initial site construction operations, including the soil stripping operations, overburden removal and the construction of roads, soil stockpiles, the amenity bund associated with Waste Rock Emplacement 2, other bunds and the residue storage facility embankments (see **Figure 4.11**).

**Scenario 1B:** Representative of months 10 to 12 of the site construction and initial mining operations, including the overburden removal and initial mining operations at Caloma Open Cut and Wyoming One Open Cut and the construction of roads, soil stockpiles and Waste Rock Emplacements 2 and 3 (see **Figure 4.12**). Waste Rock Emplacement 2 and 3 bunds constructed at 15m and 5m above the remainder of the waste rock emplacement respectively.

**Scenario 2**: Representative of mining operations at around month 15 within the Caloma Open Cut and Wyoming One and Three Open Cuts, haulage of ore material to the ROM Pad and operation of crushing, screening and processing plant (see **Figure 4.13**). Waste Rock Emplacement 2 and 3 bunds constructed at 15m above the remainder of the waste rock emplacement.




REFERENCE

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

**Activities**

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

Source: SLR Consulting (2011) - Figure 6

| | Day Shift | Evening Shift | Night Shift | Equipment |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | Bulldozer (Cat D10) |
| 2 | 1 | 1 | 1 | Excavator (Hitachi EX1200 - 120t) |
| 3 | 0 | 0 | 0 | Excavator (Hitachi 2N870 - 85t)) |
| 4 | 3 | 3 | 3 | Haul Trucks (Caterpillar 777F) |
| 5 | 2 | 0 | 0 | Graders (Caterpillar 16H) |
| 6 | 1 | 1 | 1 (0) | Water Truck (Caterpillar 796) |
| 7 | 0 | 0 | 0 | Front-end Loader (Caterpillar 988G) |
| 8 | 0 | 0 | 0 | Blast Hole Rig |
| 9 | 0 | 0 | 0 | Processing Plant (Ball Mill & Screen) |
| 10 | 0 | 4 | 4 | Lighting Plants (Evening & Night-time Only) |
| 11 | 0 | 0 | 0 | Vibrating Roller |
| 12 | 2 | 2 | 2 | Road Trucks |
| 13 | 4 | 0 | 0 | Scrapers |

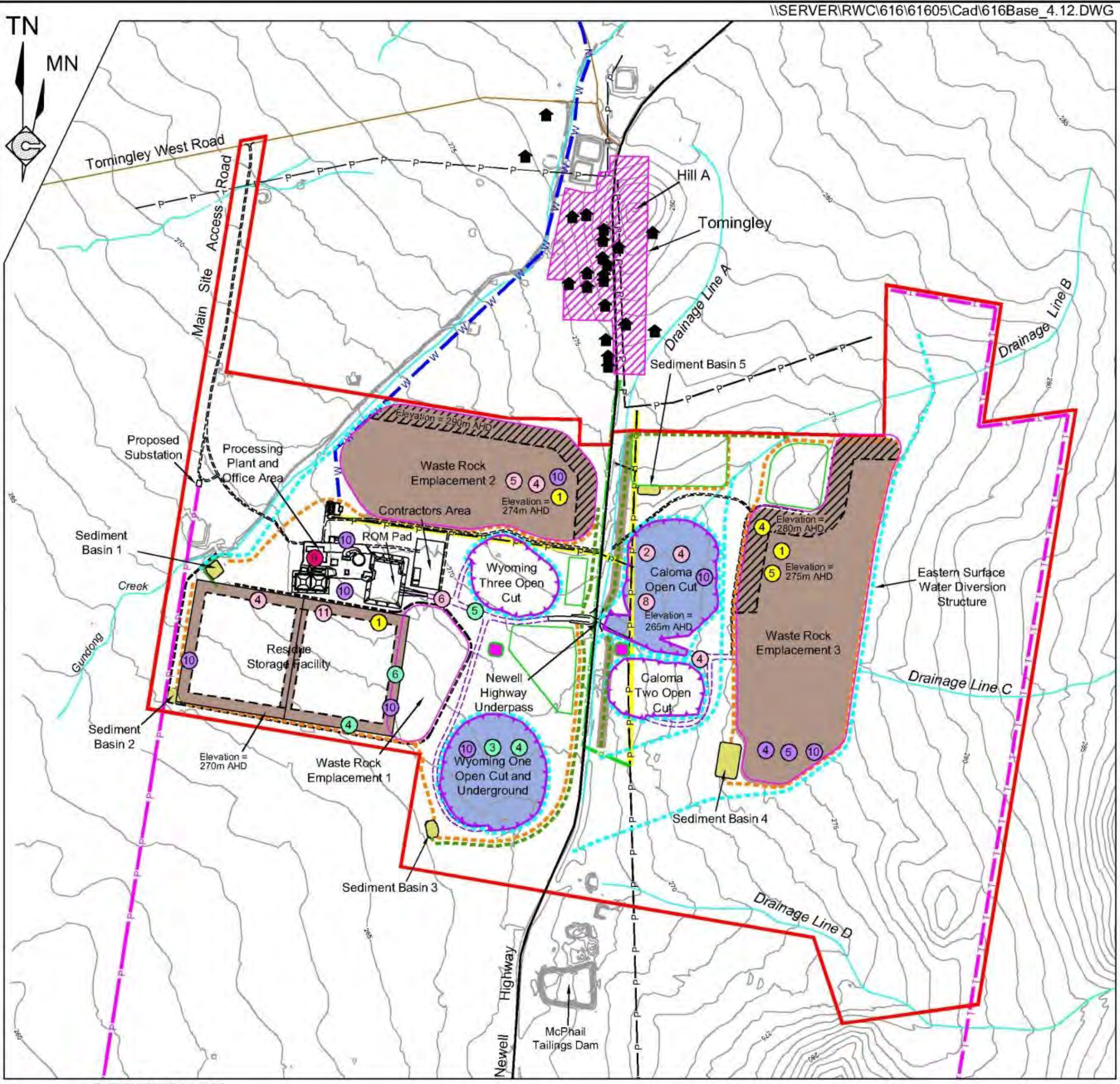
Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

**Indicative Equipment Locations**

- 1 Day Shift Only (7:00am to 6:00pm)
- 10 Evening/Night Shift Only (6:00pm to 7:00am)
- 4 24 hour Operation
- 9 Not Operating

Figure 4.11
OPERATIONAL
SCENARIO 1A - MONTHS 1 to 3

\\SERVER\RWC\616\61605\Cad\616Base_4.12.DWG




**REFERENCE**

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

**Activities**

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

| | Day Shift | Evening Shift | Night Shift | Equipment |
|---|---|---|---|---|
| 1 | 3 | 0 | 0 | Bulldozer (Cat D10) |
| 2 | 1 | 1 | 1 (0) | Excavator (Hitachi EX1200 - 120t) |
| 3 | 1 | 1 | 1 | Excavator (Hitachi 2N870 - 85t)) |
| 4 | 7 | 2 | 2 | Haul Trucks (Caterpillar 777F) |
| 5 | 3 | 3 | 0 | Graders (Caterpillar 16H) |
| 6 | 2 | 2 | 1 (0) | Water Truck (Caterpillar 796) |
| 7 | 0 | 0 | 0 | Front-end Loader (Caterpillar 988G) |
| 8 | 1 | 1 | 0 | Blast Hole Rig |
| 9 | 0 | 0 | 0 | Processing Plant (Ball Mill & Screen) |
| 10 | 0 | 8 | 8 | Lighting Plants (Evening & Night-time Only) |
| 11 | 1 | 1 | 0 | Vibrating Roller |
| 12 | 0 | 0 | 0 | Road Trucks |
| 13 | 0 | 0 | 0 | Scrapers |

Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

**Indicative Equipment Locations**

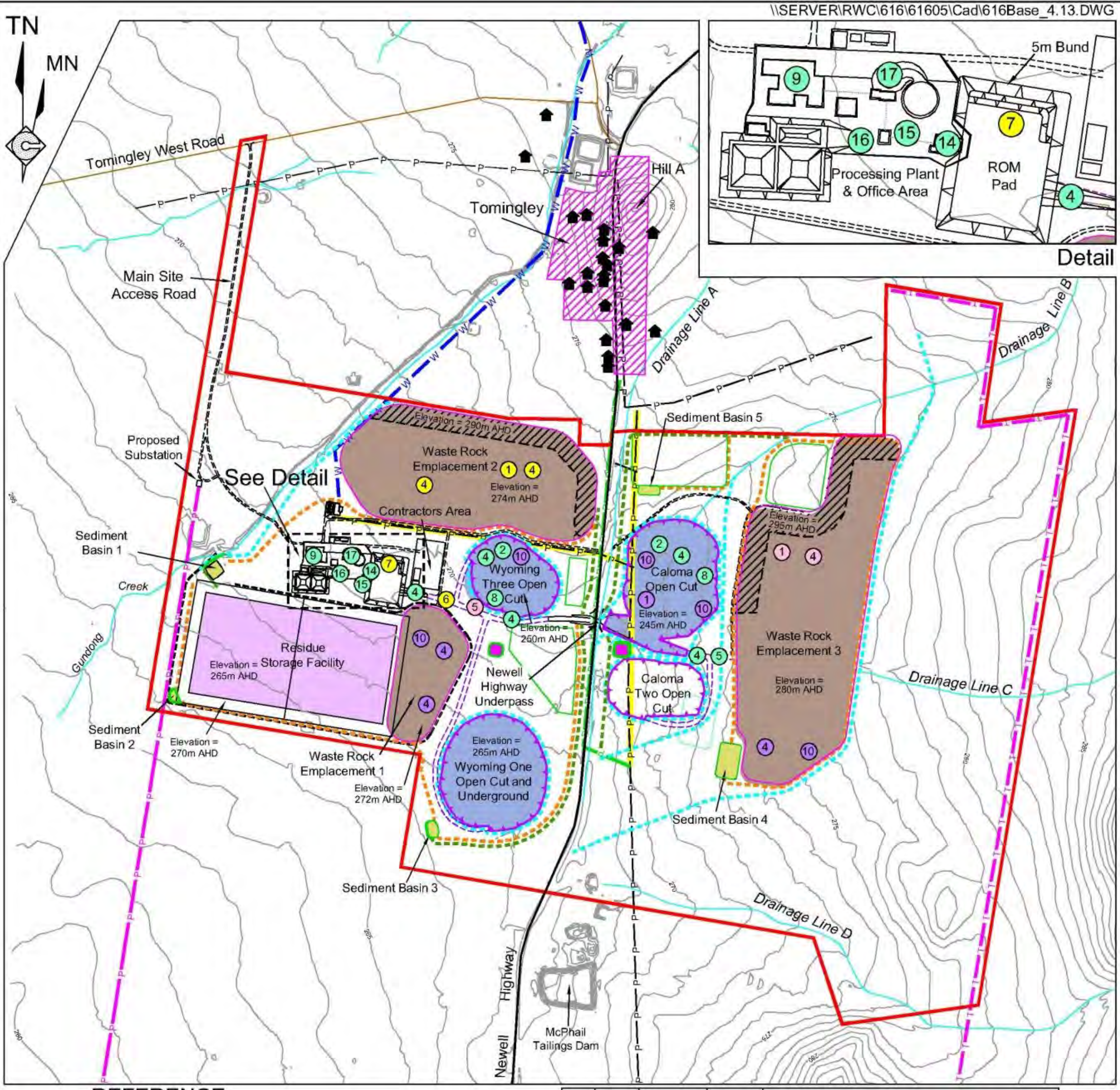
- Day Shift Only (7:00am to 6:00pm)
- Day/Evening Shift Only (7:00am to 10:00pm)
- Evening/Night Shift Only (6:00pm to 7:00am)
- 24 hour Operation
- Not Operating

SCALE 1:30 000

500 0 500 1000 1500 m

Source: SLR Consulting (2011) - Figure 7

Figure 4.12
OPERATIONAL
SCENARIO 1B - MONTHS 10 to 12




REFERENCE

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

**Activities**

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

| | Day Shift | Evening Shift | Night Shift | Equipment |
|---|---|---|---|---|
| 1 | 2 | 1 | 1 (0) | Bulldozer (Cat D10) |
| 2 | 2 | 2 | 2 (0) | Excavator (Hitachi EX1200 - 120t) |
| 3 | 0 | 0 | 0 | Excavator (Hitachi 2N870 - 85t)) |
| 4 | 8 | 6 | 6 (1) | Haul Trucks (Caterpillar 777F) |
| 5 | 2 | 1 | 1 (0) | Graders (Caterpillar 16H) |
| 6 | 1 | 0 | 0 | Water Truck (Caterpillar 796) |
| 7 | 1 | 0 | 0 | Front-end Loader (Caterpillar 988G) |
| 8 | 2 | 2 | 2 (1) | Blast Hole Rig |
| 9 | 1 | 1 | 1 | Processing Plant (Ball Mill & Screen) |
| 10 | 0 | 5 | 5 | Lighting Plants (Evening & Night-time Only) |
| 11 | 0 | 0 | 0 | Vibrating Roller |
| 12 | 0 | 0 | 0 | Road Trucks |
| 13 | 0 | 1 | 0 | Scrapers |
| 14 | 1 | 1 | 1 | Primary Jaw Crusher |
| 15 | 1 | 1 | 1 | Secondary Cone Crusher |
| 16 | 1 | 1 | 1 | Screen Tower |
| 17 | 1 | 1 | 1 | Surge Plant Screen |

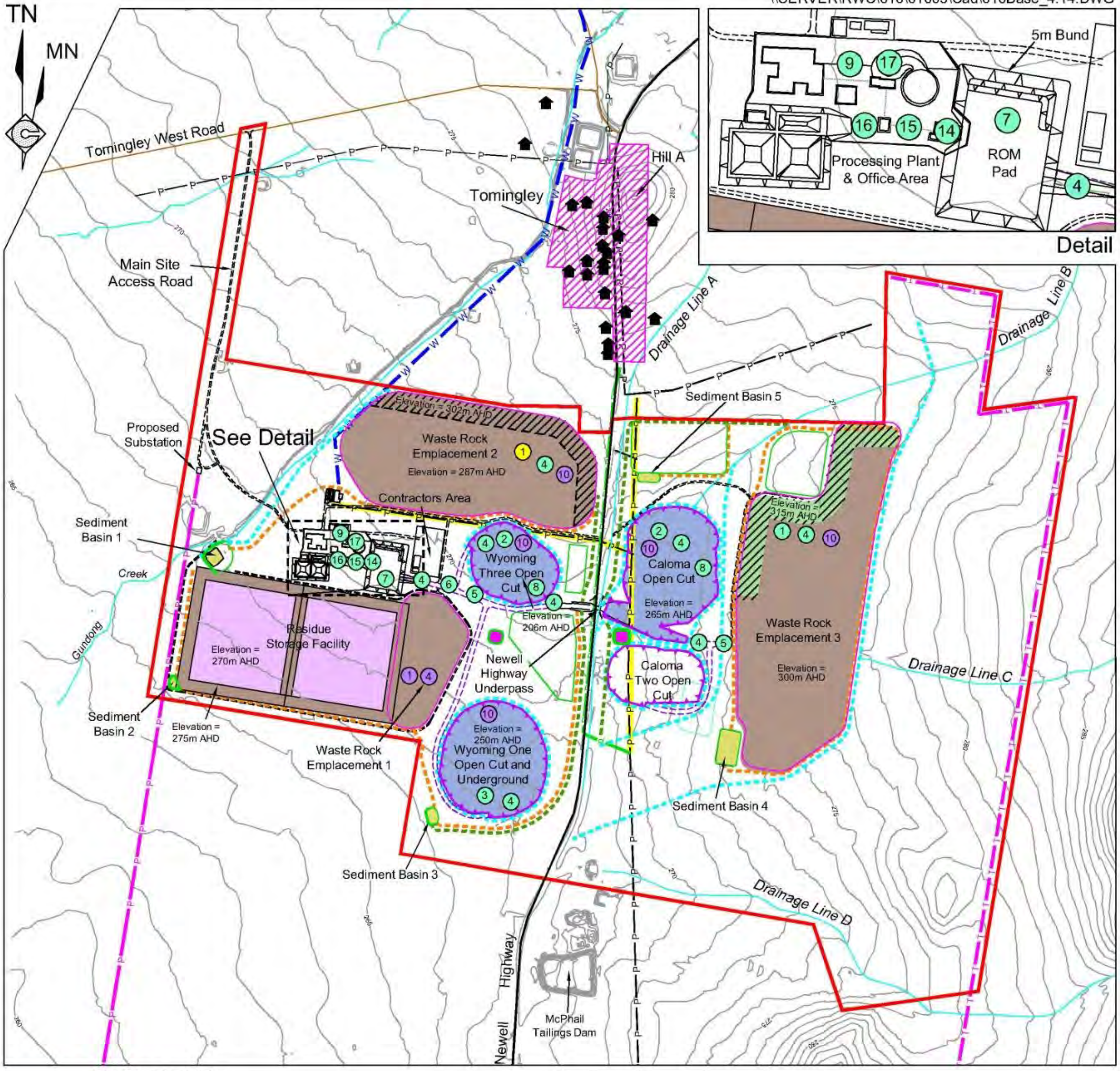
Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

**Indicative Equipment Locations**

- 1 Day Shift Only (7:00am to 6:00pm)
- 1 Day/Evening Shift Only (7:00am to 10:00pm)
- 10 Evening/Night Shift Only (6:00pm to 7:00am)
- 4 24 hour Operation

Source: SLR Consulting (2011) - Figure 8

Figure 4.13
OPERATIONAL SCENARIO 2 - MONTH 15




REFERENCE

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

**Activities**

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

| | Day Shift | Evening Shift | Night Shift | Equipment |
|---|---|---|---|---|
| 1 | 2 | 1 | 1 (0) | Bulldozer (Cat D10) |
| 2 | 2 | 2 | 2 (1) | Excavator (Hitachi EX1200 - 120t) |
| 3 | 1 | 1 | 1 | Excavator (Hitachi 2N870 - 85t)) |
| 4 | 8 | 8 | 8 (4) | Haul Trucks (Caterpillar 777F) |
| 5 | 2 | 2 | 2 (1) | Graders (Caterpillar 16H) |
| 6 | 1 | 1 | 1(0) | Water Truck (Caterpillar 796) |
| 7 | 1 | 1 | 1 | Front-end Loader (Caterpillar 988G) |
| 8 | 2 | 2 | 2 | Blast Hole Rig |
| 9 | 1 | 1 | 1 | Processing Plant (Ball Mill & Screen) |
| 10 | 0 | 5 | 5 | Lighting Plants (Evening & Night-time Only) |
| 11 | 0 | 0 | 0 | Vibrating Roller |
| 12 | 0 | 0 | 0 | Road Trucks |
| 13 | 0 | 1 | 0 | Scrapers |
| 14 | 1 | 1 | 1 | Primary Jaw Crusher |
| 15 | 1 | 1 | 1 | Secondary Cone Crusher |
| 16 | 1 | 1 | 1 | Screen Tower |
| 17 | 1 | 1 | 1 | Surge Plant Screen |

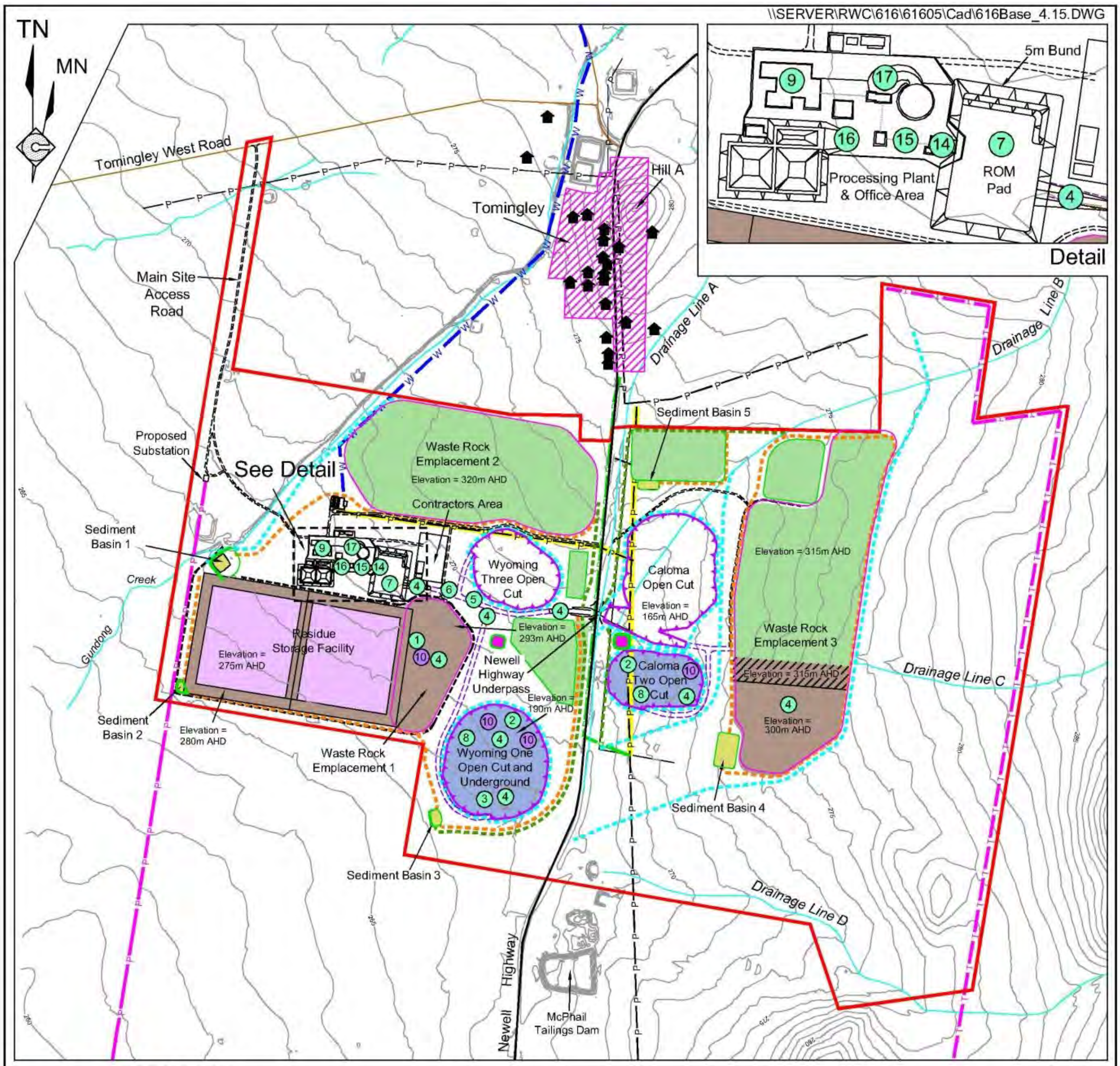
Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

**Indicative Equipment Locations**

1 Day Shift Only (7:00am to 6:00pm)
1 Day/Evening Shift Only (7:00am to 10:00pm)
10 Evening/Night Shift Only (6:00pm to 7:00am)
4 24 hour Operation

Source: SLR Consulting (2011) - Figure 9

Figure 4.14
OPERATIONAL SCENARIO 3 - END YEAR 2




| | Reference |
|---|---|
| | Mine Site Boundary |
| | Water Pipeline Route |
| | Proposed Limit of Mining |
| | Proposed Amenity Bund |
| | Proposed Surface Water Control Structure |
| | Proposed Road / Track |
| | Proposed Haul Road |
| | Existing Sealed Road |
| 290 | Contour (m AHD)(Interval = 1m) |
| | Dewatering Pond |
| | Residence |

**Activities**

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

Source: SLR Consulting (2011) - Figure 10

| | Day Shift | Evening Shift | Night Shift | Equipment |
|---|---|---|---|---|
| 1 | 1 | 1 | 1 (0) | Bulldozer (Cat D10) |
| 2 | 2 | 2 | 2 (1) | Excavator (Hitachi EX1200 - 120t) |
| 3 | 1 | 1 | 1 | Excavator (Hitachi 2N870 - 85t)) |
| 4 | 8 | 8 | 8 (4) | Haul Trucks (Caterpillar 777F) |
| 5 | 2 | 2 | 1 | Graders (Caterpillar 16H) |
| 6 | 1 | 1 | 1 | Water Truck (Caterpillar 796) |
| 7 | 1 | 1 | 1 | Front-end Loader (Caterpillar 988G) |
| 8 | 2 | 2 | 2 | Blast Hole Rig |
| 9 | 1 | 1 | 1 | Processing Plant (Ball Mill & Screen) |
| 10 | 0 | 4 | 4 | Lighting Plants (Evening & Night-time Only) |
| 11 | 0 | 0 | 0 | Vibrating Roller |
| 12 | 0 | 0 | 0 | Road Trucks |
| 13 | 0 | 1 | 0 | Scrapers |
| 14 | 1 | 1 | 1 | Primary Jaw Crusher |
| 15 | 1 | 1 | 1 | Secondary Cone Crusher |
| 16 | 1 | 1 | 1 | Screen Tower |
| 17 | 1 | 1 | 1 | Surge Plant Screen |

Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

**Indicative Equipment Locations**

- 1 Day Shift Only (7:00am to 6:00pm)
- 10 Evening/Night Shift Only (6:00pm to 7:00am)
- 4 24 hour Operation

Figure 4.15
OPERATIONAL SCENARIO 4 - END YEAR 4

**Scenario 3:** Representative of mining operations at the end of Year 2 within the Caloma Open Cut, Wyoming One and Three Open Cuts, haulage of ore material to the ROM Pad, operation of crushing, screening and processing plant and initial rehabilitation of Waste Rock Emplacement 1 (see **Figure 4.14**). Waste Rock Emplacement 2 and 3 bunds constructed at 15m above the remainder of the waste rock emplacement.

**Scenario 4:** Representative of mining operations at the end of Year 4 within the Wyoming One Open Cut and Caloma Two Open Cut, haulage of ore material to the ROM Pad, operation of crushing, screening and processing plant, and rehabilitation of Waste Rock Emplacements 2 and 3 (see **Figure 4.15**).

**Figures 4.11** to **4.15** identify indicative operating restrictions (reduction in operating mobile equipment) that would be placed on mining operations during the various assessment periods, i.e. day, evening and night, and under inversion conditions (see **Table 4.15**). These operating restrictions were developed following an iterative modelling process (which is discussed further in Section 4.2.5), however, it is noted that the same or greater level of noise mitigation may be achievable through the implementation of alternative noise attenuation measures, e.g. individual equipment noise attenuation, alternative locations of operating equipment or modified operating technique. The mobile equipment operating restrictions identified in **Figure 4.11** to **4.15** and modelled by SLR (2011), have been chosen to illustrate reasonable and feasible noise attenuation options available to the Proponent.

The meteorological parameters presented in **Table 4.15**, which represent prevailing conditions for the local area in accordance with the INP, were used during the operational noise assessment.

**Table 4.15**
**Meteorological Scenarios**

| Period | Meteorological Condition | Air Temperature | Relative Humidity | Wind Velocity | Temperature Gradient |
|---|---|---|---|---|---|
| Daytime | Calm | 18˚C | 60% | 0 m/s | 0˚C/100m |
| Evening | Calm | 12˚C | 75% | 0 m/s | 0˚C/100m |
| Night-time | Calm | 6˚C | 90% | 0 m/s | 0˚C/100m |
| Night-time | Inversion | 6˚C | 90% | 0 m/s | 3˚C/100m |
| Source: SLR (2011) – Table 22 | | | | | |

#### 4.2.4.2 Prediction of Construction Noise

The ICNG provides methodology for calculating noise levels based upon source sound power levels and distance attenuation. This methodology was adopted by SLR (2011) to predict the minimum working distance from any noise sensitive receiver required to fall below the „noise affected" and „highly noise affected" criteria presented in Section 4.2.3.3 (see *Section 10.1* of SLR, 2011, for further detail on the assessment methodology).

#### 4.2.4.3 Prediction of Road Traffic Noise Emissions

The road traffic noise assessment utilised the US Environment Protection Agency"s method for the prediction of the $L_{Aeq}$ traffic noise levels for the offset distances of the closest residences adjacent to the principal access roads surrounding the Mine Site. This assessment method takes into account the following.

- The $L_{Amax}$ vehicle noise levels for both light and heavy vehicles.
- Receiver offset distance and height.
- Pass-by duration and vehicle speed.
- Ground absorption.
- Maximum number of hourly vehicle movements.
- Truck exhaust height.
- Height and location of any intervening barriers.

The road traffic noise assessment was undertaken for the following roads surrounding the Mine Site.

- Tomingley West Road.
- Tomingley – Narromine Road (north of the intersection with Tomingley West Road).
- Tomingley – Narromine Road (south of the intersection with Tomingley West Road).
- Newell Highway (south of the intersection with Tomingley – Narromine Road).

**Table 4.16** presents the anticipated number of hourly vehicle movements used during the road traffic noise assessment for each of the assessed roads.

**Table 4.16**
**Anticipated Peak Hour Vehicle Movements**

| **Daytime Peak Hours Vehicle Movements**[1] | | |
|---|---|---|
| | **Light** | **Heavy** |
| Tomingley West Road | 32 | 4 |
| Tomingley – Narromine Road – North[3] | 8 | 1 |
| Tomingley – Narromine Road – South[4] | 24 | 3 |
| Newell Highway – North[5] | 8 | 1 |
| Newell Highway – South[6] | 16 | 2 |
| **Night-time Peak Hour Vehicle Movements**[2] | | |
| | **Light** | **Heavy** |
| Tomingley West Road | 32 | 4 |
| Tomingley – Narromine Road – North[3] | 8 | 1 |
| Tomingley – Narromine Road – South[4] | 24 | 3 |
| Newell Highway – North[5] | 8 | 1 |
| Newell Highway – South[6] | 16 | 2 |

Note 1: Daytime peak hours (assuming 7.00am and 7.00pm shift changes) - 7.00am to 8.00am, 6.00pm to 7.00pm and 7.00pm to 8.00pm.
Note 2: Night time peak hours (assuming 7.00am and 7.00pm shift changes) - 6.00am to 7.00am.
Note 3: Tomingley – Narromine Road north of the Tomingley West Road intersection.
Note 4 Tomingley – Narromine Road south of the Tomingley West Road intersection.
Note 5: Newell Highway north of the Tomingley – Narromine Road intersection.
Note 6: Newell Highway south of the Tomingley – Narromine Road intersection.

Source: Alkane Resources Ltd

### 4.2.5 Management and Mitigation Measures

During the initial mine planning phase of the Project, noise modelling was completed to quantify potential noise emissions of the Project for several scenarios without the implementation of any noise attenuation measures, and to assess the feasibility, practicality and effectiveness of implementing various noise mitigation and management measures to reduce Project noise emissions. Initial noise modelling identified exceedances of the Project-specific noise criteria within the noise affectation zone, i.e. exceedance of the Project-specific noise criteria by greater than 5dB(A) (see Section 4.2.3.1.2).

On the basis of the initial noise modelling results, consideration was given to three methods of noise mitigation.

1. Reducing the individual sound power level of the mobile equipment to be operated.
2. Reducing the sound power level of individual items of fixed plant, i.e. crushing, screening and processing plant.
3. Restricting the location or number of operating mobile equipment.

The Proponent has determined that the cost associated with attenuating individual equipment (Method 1) is economically unreasonable. That is, the costs of retro-fitting an existing mobile fleet with noise attenuating features or purchasing new mobile equipment with such noise attenuation in-built cannot be supported by Project economics.

In applying Method 2, a review of the relative contribution of the individual items of crushing, screening and processing fixed plant identified that the secondary crusher, screen tower and ball mill represented the three critical noise sources requiring mitigation. For practical reasons associated with requirements for crane and other equipment access to the processing plant, enclosure or cladding of the ball mill and associated plant was not considered feasible. As a result, the level of noise mitigation (sound power level reduction) required at the secondary crusher and screen tower was increased culminating in the application of the proposed sound power level reduction and enclosure design described in Section 4.2.4.1.

The Proponent also reviewed and modified proposed operations during the day, evening and night time (including under inversion conditions) to identify mobile fleet numbers and locations that would be likely to satisfy the Project-specific noise criteria at surrounding residences (Method 3). The following represents a summary of the proposed noise mitigation measures to be implemented by the Proponent during the life of the Project.

- Frequency modulated reversing alarms would be fitted on all mobile equipment.
- The Project mining fleet would be operated in accordance with **Figures 4.11** to **4.15** at the times indicated on those figures. **Table 4.17** provides a summary of the indicative mining fleet to be operated during the various assessment periods and meteorological conditions (as presented on **Figures 4.11** to **4.15**).
- Specifically, implement the following.
  - Undertake, land preparation operations, including vegetation clearing and soil stripping, during the daytime only.

**Table 4.17**
**Indicative Mining Fleet Operation and Restrictions**

| Item (Indicative Specification) | Maximum Number of Items Modelled | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Scenario 1A | | | Scenario 1B | | | Scenario 2 | | | Scenario 3 | | | Scenario 4 | | |
| | D¹ | E/NC² | NI³ | D¹ | E/NC² | NI³ | D¹ | E/NC² | NI³ | D¹ | E/NC² | NI³ | D¹ | E/NC² | NI³ |
| Dozer (CAT D10) | 0 | 0 | 0 | 3 | 0 | 0 | 2 | 1 | 0 | 2 | 1 | 0 | 1 | 1 | 0 |
| Excavator (Hitachi EX1200) | 1 | 1 | 1 | 1 | 1 | 0 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 |
| Excavator (Hitachi 2N870) | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Haul Truck (CAT 777F) | 3 | 3 | 3 | 7 | 2 | 2 | 8 | 6 | 1 | 8 | 8 | 4 | 8 | 8 | 4 |
| Grader (CAT 16H) | 2 | 0 | 0 | 3 | 0 | 0 | 2 | 1 | 0 | 2 | 2 | 1 | 1 | 1 | 1 |
| Water Truck (CAT 796) | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| Front End Loader (CAT 988G) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Blast Hole Rig | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Processing Plant | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Lighting Plant | 0 | 4 | 4 | 0 | 8 | 8 | 0 | 5 | 5 | 0 | 5 | 5 | 0 | 4 | 4 |
| Vibrating Roller | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Road Truck | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scraper (CAT 657) | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Primary Jaw Crusher | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Secondary Crusher | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Primary Screen | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Surge Bin for Ball Mill | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Stockpile Discharge | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note 1: Daytime operation.
Note 2: Evening and night-time calm operation.
Note 3: Night-time inversion operation.

Source: SLR (2011) – Table 21

- Preferentially operate noisy equipment during the evening and night, including bulldozers, excavators and haul trucks, in the southern section of the Mine Site, as close as possible to the acoustic bunds on Waste Rock Emplacements 2 and 3 and in the deepest sections of the open cuts where there would be an the most effective topographic barrier between the sources of mining-related noise and nearby residences.
- Construct Waste Rock Emplacements 2 and 3 from the northern margin of the emplacement towards the south to create a 15m high acoustic and visual amenity bund.
- Ensure that noisy equipment is operated in exposed locations, such as on top of the acoustic bunds or in close proximity to residences, during the daytime only and preferentially when the wind is blowing from the northwest, north or northeast.
- Progressively stand down the mining fleet during the onset of a temperature inversion, or as required in response to real-time noise monitoring.

- The front-end loader would be operated on the ROM Pad behind stockpiled ore or purpose-built earth bunds maintained on the northern side of the ROM Pad.

It is re-iterated that the restrictions to operating mobile equipment identified in **Figures 4.11** to **4.15** are indicative only. The number and arrangement of the mining fleet presented for these scenarios is based on the generation of an overall $L_{Aeq}$ sound power level for the Mine Site. The same or greater level of noise mitigation may be achievable through the implementation of alternative noise attenuation measures (other than through the restriction operating mobile equipment), e.g. individual equipment noise attenuation, alternative locations of operating equipment or modified operating technique.

- A real-time noise monitor and communication equipment would be installed at an appropriate location within the southern section of Tomingley village. Operation of this equipment and associated management procedures would be described in detail in a *Noise Management Plan* that would be prepared for the Project. In summary, however, the following procedures would be implemented.
  - Establish, in consultation with a suitably qualified and experienced noise consultant and the community, appropriate noise trigger levels at the real-time noise monitoring location that would ensure that the relevant noise criteria are not exceeded at residences surrounding the Mine Site.
  - Establish a procedure whereby appropriate personnel are notified when noise levels recorded by the real-time monitor approach the identified trigger levels.
  - Ensure when recorded noise levels approach the identified trigger levels, that equipment is progressively relocated further away from sensitive receivers, into deeper sections of the proposed open cuts or shut down, i.e. as illustrated by the restricted operations presented on **Figures 4.11** to **4.15**.
  - Ensure that a 24-hour complaints telephone line is maintained and that the surrounding community is made aware of the number. If noise-related complaints are received, ensure that prompt action is taken to identify the nature of the complaint and verify the relevant noise levels using the real-time noise monitoring equipment. Where appropriate, equipment would be progressively relocated or shut down.
- In the event of continued exceedance of Project-specific noise criteria at the real-time noise monitoring location, for which implementation of operational mitigation such as equipment relocation or restricted operation is unsuccessful in reducing the noise level received to below the Project-specific noise criteria, the Proponent would discuss the impacts of Project noise at those residences where exceedance of the Project-specific noise criteria is predicted (see Section 4.2.6.1). On request by the potentially impacted residents, the Proponent would implement contingency noise management measures (in accordance with a *Noise Management Plan*), which would include (but not necessarily be limited) to the following.
  - Completion of attended monitoring at the potentially affected residences.
  - Confirmation as to the $L_{Aeq(15min)}$ noise level received at the residence and comparison to Project-specific noise criteria.

  - If noise emissions exceed the Project-specific noise criteria by in excess of 2dB (a moderate noise level increase [which may be noticeable by some people but not by others – see Section 4.2.3.1.2]) the Proponent would offer to provide noise mitigating controls at the residence. These controls could include installation of air-conditioning, double glazed windows or noise retarding fencing.

- A *Noise Management Plan* would be prepared that includes the following.
  - Noise monitoring procedures and real-time noise monitoring trigger levels.
  - Weather station monitoring procedures and adverse weather trigger levels.
  - Measures which would be implemented in the event of exceedances in either noise or adverse weather trigger levels or receipt of a complaint.
  - Noise monitoring reporting procedures.
  - Community liaison and complaints handling procedures.

The noise mitigation measure commitments made by the Proponent are based on current demonstrated "achievable" noise emission standards. More efficient or cost-effective mitigation measures may be identified over the life of the Project and would be implemented as appropriate to achieve the same or greater level of noise mitigation.

The above noise mitigation commitments have been made to reduce noise emissions from the Project as far as reasonably and feasibly practical. Over the life of the Project, the Proponent may negotiate individually with surrounding landowners or residents as to the acceptance of noise levels greater than the current Project-specific noise criteria. Any such negotiated agreements, which would be forwarded to DP&I and OEH for ratification and record keeping purposes, would supersede the criteria nominated in the project approval or EPL.

Finally, the Proponent has indicated its commitment to maintaining open communication with surrounding landowners and residents, and responding as far as reasonably possible to issues raised over Project noise. This communication would include but not necessarily be restricted to the following.

- Notification of land owners and residents located along the proposed water pipeline prior to the commencement of construction activities.
- Regular discussions with potentially affected residents to identify if any concerns exist.
- Prompt responses to any issue of concern.
- Noise monitoring on request at potentially affected residences.
- Refinement of on-site noise mitigation measures and operating procedures where practicable.
- Discussions with respect to negotiated agreements with owners/occupiers of residences where such an agreement does not exist.

## 4.2.6 Assessment of Impacts

### 4.2.6.1 Operational Noise Assessment

#### 4.2.6.1.1 Scenario 1A – Months 1 to 3

**Table 4.18** presents the results of the operational noise assessment for Scenario 1A. Noise contours representing predicted noise levels generated by these modelling results are presented as *Figures AC1* to *AC4* of SLR (2011).

Assuming the implementation of the proposed (or equivalent) noise mitigation measures, the noise modelling predicts that compliance with the Project-specific noise criteria would be achieved during the evening and night periods.

During the daytime, exceedances of the Project-specific noise criteria of up to 4dB(A) (moderate noise exceedance – see Section 4.2.3.1.2) are predicted at two residences within NAG C (R3 and R29) and a minor noise exceedance of 1dB(A) (see Section 4.2.3.1.2) is predicted at one residence within NAG C (R28).

**Table 4.18**
**Intrusive Noise Assessment Results[3] – Scenario 1A**

| NAG[4] | Residence Reference | Daytime | | Evening | | Night-time | | |
|---|---|---|---|---|---|---|---|---|
| | | Calm | Criteria | Calm | Criteria | Calm | Inversion | Criteria |
| A | R1 | 32 | 35 | 24 | 35 | 25 | 30 | 35 |
| | R4 | 21 | 35 | 19 | 35 | 19 | 33 | 35 |
| | R5 | 24 | 35 | 25 | 35 | 25 | 27 | 35 |
| | R6 | 22 | 35 | 22 | 35 | 22 | 24 | 35 |
| | R8 | 17 | 35 | 10 | 35 | 10 | 15 | 35 |
| | R9 | 20 | 35 | 14 | 35 | 15 | 20 | 35 |
| | R10 | 25 | 35 | 19 | 35 | 19 | 25 | 35 |
| | R11 | 23 | 35 | 17 | 35 | 18 | 23 | 35 |
| | R12 | 16 | 35 | 11 | 35 | 12 | 17 | 35 |
| B | R2 | 25 | 36 | 22 | 35 | 22 | 25 | 35 |
| C | R3 | **49**[2] | 45 | 31 | 35 | 31 | 34 | 35 |
| | R13 | 30 | 45 | 23 | 35 | 23 | 28 | 35 |
| | R18 | 39 | 45 | 27 | 35 | 27 | 31 | 35 |
| | R20 | 40 | 45 | 28 | 35 | 28 | 31 | 35 |
| | R24 | 43 | 45 | 28 | 35 | 29 | 32 | 35 |
| | R25 | 41 | 45 | 28 | 35 | 29 | 31 | 35 |
| | R26 | 42 | 45 | 28 | 35 | 29 | 31 | 35 |
| | R27 | 43 | 45 | 29 | 35 | 29 | 32 | 35 |
| | R28 | **46**[1] | 45 | 30 | 35 | 30 | 33 | 35 |
| | R29 | **48**[2] | 45 | 30 | 35 | 31 | 34 | 35 |
| | R33 | 44 | 45 | 29 | 35 | 29 | 32 | 35 |
| | R35 | 40 | 45 | 28 | 35 | 29 | 30 | 35 |
| D | R16 | 38 | 43 | 26 | 38 | 26 | 30 | 36 |
| | R17 | 38 | 43 | 25 | 38 | 26 | 31 | 36 |
| | R22 | 41 | 43 | 27 | 38 | 28 | 32 | 36 |
| | R23 | 42 | 43 | 28 | 38 | 28 | 33 | 36 |
| | R32 | 43 | 43 | 28 | 38 | 29 | 32 | 36 |
| | R37 | 36 | 43 | 26 | 38 | 27 | 31 | 36 |

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**Shaded Cell**).
Note 2: Moderate Noise Management Zone 3 to 5dB(A) above project specific criteria (**Shaded Cell**).
Note 3: Units = dB(A) re 20µPa.
Note 4: NAG = Noise Assessment Group.
Source: SLR (2011) – Modified after Table 28

#### 4.2.6.1.2 Scenario 1B – Months 10 to 12

**Table 4.19** presents the results of the operational noise assessment for Scenario 1B. Noise contours representing predicted noise levels generated by these modelling results are presented as *Figures AC5* to *AC8* of SLR (2011).

Assuming the implementation of the proposed (or equivalent) noise mitigation measures, the noise modelling predicts compliance with the Project-specific noise criteria can be achieved.

**Table 4.19**
**Intrusive Noise Assessment Results[1] – Scenario 1B**

| NAG[2] | Residence Reference | Daytime | | Evening | | Night-time | | |
|---|---|---|---|---|---|---|---|---|
| | | Calm | Criteria | Calm | Criteria | Calm | Inversion | Criteria |
| A | R1 | 33 | 35 | 26 | 35 | 26 | 30 | 35 |
| | R4 | 26 | 35 | 19 | 35 | 20 | 26 | 35 |
| | R5 | 28 | 35 | 24 | 35 | 25 | 23 | 35 |
| | R6 | 25 | 35 | 20 | 35 | 20 | 24 | 35 |
| | R8 | 21 | 35 | 16 | 35 | 17 | 18 | 35 |
| | R9 | 22 | 35 | 18 | 35 | 18 | 22 | 35 |
| | R10 | 29 | 35 | 22 | 35 | 22 | 27 | 35 |
| | R11 | 26 | 35 | 20 | 35 | 20 | 25 | 35 |
| | R12 | 21 | 35 | 15 | 35 | 16 | 20 | 35 |
| B | R2 | 28 | 36 | 19 | 35 | 20 | 21 | 35 |
| C | R3 | 41 | 45 | 32 | 35 | 32 | 30 | 35 |
| | R13 | 32 | 45 | 25 | 35 | 25 | 30 | 35 |
| | R18 | 36 | 45 | 28 | 35 | 28 | 32 | 35 |
| | R20 | 37 | 45 | 28 | 35 | 29 | 32 | 35 |
| | R24 | 38 | 45 | 29 | 35 | 30 | 33 | 35 |
| | R25 | 38 | 45 | 29 | 35 | 29 | 33 | 35 |
| | R26 | 38 | 45 | 29 | 35 | 29 | 33 | 35 |
| | R27 | 39 | 45 | 30 | 35 | 30 | 33 | 35 |
| | R28 | 40 | 45 | 31 | 35 | 31 | 31 | 35 |
| | R29 | 41 | 45 | 31 | 35 | 32 | 30 | 35 |
| | R33 | 40 | 45 | 30 | 35 | 30 | 32 | 35 |
| | R35 | 38 | 45 | 29 | 35 | 29 | 32 | 35 |
| D | R16 | 34 | 43 | 27 | 38 | 27 | 32 | 36 |
| | R17 | 34 | 43 | 27 | 38 | 27 | 32 | 36 |
| | R22 | 37 | 43 | 29 | 38 | 29 | 33 | 36 |
| | R23 | 37 | 43 | 29 | 38 | 30 | 33 | 36 |
| | R32 | 41 | 43 | 30 | 38 | 30 | 31 | 36 |
| | R37 | 37 | 43 | 28 | 38 | 28 | 32 | 36 |

Note 1: Units = dB(A) re 20µPa
Note 2: NAG = Noise Assessment Group

Source: SLR (2011) – Table 29

#### 4.2.6.1.3 Scenario 2 – Month 15

**Table 4.20** presents the results of the operational noise assessment. Noise contours representing predicted noise levels generated by these modelling results are presented as *Figures AC9* to *AC12* of SLR (2011).

**Table 4.20**
**Intrusive Noise Assessment Results[2] – Scenario 2**

| NAG[3] | Residence Reference | Daytime | | Evening | | Night-time | | |
|---|---|---|---|---|---|---|---|---|
| | | Calm | Criteria | Calm | Criteria | Calm | Inversion | Criteria |
| A | R1 | 32 | 35 | 30 | 35 | 32 | 35 | 35 |
| | R4 | 24 | 35 | 21 | 35 | 24 | 24 | 35 |
| | R5 | 22 | 35 | 21 | 35 | 24 | 26 | 35 |
| | R6 | 27 | 35 | 27 | 35 | 29 | 30 | 35 |
| | R8 | 21 | 35 | 20 | 35 | 23 | 21 | 35 |
| | R9 | 24 | 35 | 22 | 35 | 25 | 26 | 35 |
| | R10 | 28 | 35 | 26 | 35 | 29 | 30 | 35 |
| | R11 | 27 | 35 | 25 | 35 | 28 | 29 | 35 |
| | R12 | 23 | 35 | 21 | 35 | 23 | 24 | 35 |
| B | R2 | 30 | 36 | 29 | 35 | 31 | 30 | 35 |
| C | R3 | 38 | 45 | 35 | 35 | **37[1]** | 35 | 35 |
| | R13 | 31 | 45 | 29 | 35 | 31 | 33 | 35 |
| | R18 | 34 | 45 | 32 | 35 | 34 | **36[1]** | 35 |
| | R20 | 35 | 45 | 33 | 35 | 35 | **36[1]** | 35 |
| | R24 | 35 | 45 | 33 | 35 | 35 | **36[1]** | 35 |
| | R25 | 35 | 45 | 33 | 35 | 35 | **36[1]** | 35 |
| | R26 | 36 | 45 | 33 | 35 | 35 | **36[1]** | 35 |
| | R27 | 36 | 45 | 34 | 35 | **36[1]** | **36[1]** | 35 |
| | R28 | 37 | 45 | 35 | 35 | **37[1]** | 34 | 35 |
| | R29 | 37 | 45 | 35 | 35 | **37[1]** | 34 | 35 |
| | R33 | 36 | 45 | 34 | 35 | **36[1]** | **36[1]** | 35 |
| | R35 | 35 | 45 | 33 | 35 | 35 | **36[1]** | 35 |
| D | R16 | 33 | 43 | 31 | 38 | 33 | 35 | 36 |
| | R17 | 33 | 43 | 31 | 38 | 33 | 36 | 36 |
| | R22 | 35 | 43 | 33 | 38 | 35 | 36 | 36 |
| | R23 | 35 | 43 | 33 | 38 | 35 | 35 | 36 |
| | R32 | 36 | 43 | 34 | 38 | 36 | 36 | 36 |
| | R37 | 34 | 43 | 32 | 38 | 34 | 35 | 36 |

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**Shaded Cell**).
Note 2: Units = dB(A) re 20µPa.
Note 3: NAG = Noise Assessment Group.

Note: Units = dB(A) re 20µPa NAG = Noise Assessment Group
**E**xceedance of Project-specific Noise Criteria identified through a shaded cell.

Source: SLR (2011) – Table 30

Assuming the implementation of the proposed (or equivalent) noise mitigation measures, it is predicted that compliance with the Project-specific noise criteria would be achieved during the day and evening periods.

Under calm night time conditions, exceedances of the Project-specific noise criteria of up to 2dB(A) (marginal noise exceedance – see Section 4.2.3.1.2) are predicted at five residences within NAG C (R3, R27, R28, R29 and R33) under calm night time conditions. Exceedances of the Project-specific noise criteria of 1dB(A) are predicted at eight residences within NAG C (R18, R20, R24, R25, R26, R27, R33 and R35) under inversion conditions.

Exceedance of the Project-specific noise criteria under both calm and inversion conditions is only predicted at two residences (R27 and R33).

#### 4.2.6.1.4 Scenario 3 - End Year 2

**Table 4.21** presents the results of the operational noise assessment. Noise contours representing predicted noise levels generated by these modelling results are presented as *Figures AC13* to *AC16* of SLR (2011).

**Table 4.21**
**Intrusive Noise Assessment Results[3] – Scenario 3**

| NAG[4] | Residence Reference | Daytime | | Evening | | Night-time | | |
|---|---|---|---|---|---|---|---|---|
| | | Calm | Criteria | Calm | Criteria | Calm | Inversion | Criteria |
| A | R1 | 30 | 35 | 30 | 35 | 29 | **36**[1] | 35 |
| | R4 | 28 | 35 | 27 | 35 | 27 | 35 | 35 |
| | R5 | 32 | 35 | 32 | 35 | 32 | **37**[1] | 35 |
| | R6 | 29 | 35 | 29 | 35 | 28 | **36**[1] | 35 |
| | R8 | 22 | 35 | 22 | 35 | 22 | 33 | 35 |
| | R9 | 23 | 35 | 23 | 35 | 23 | 33 | 35 |
| | R10 | 27 | 35 | 27 | 35 | 26 | 35 | 35 |
| | R11 | 27 | 35 | 27 | 35 | 26 | 35 | 35 |
| | R12 | 23 | 35 | 23 | 35 | 22 | 32 | 35 |
| B | R2 | 32 | 36 | 31 | 35 | 29 | **36**[1] | 35 |
| C | R3 | 35 | 45 | 35 | 35 | 34 | **38**[2] | 35 |
| | R13 | 29 | 45 | 29 | 35 | 28 | **36**[1] | 35 |
| | R18 | 32 | 45 | 32 | 35 | 31 | **36**[1] | 35 |
| | R20 | 33 | 45 | 32 | 35 | 32 | **37**[1] | 35 |
| | R24 | 33 | 45 | 33 | 35 | 32 | **36**[1] | 35 |
| | R25 | 33 | 45 | 33 | 35 | 32 | **37**[1] | 35 |
| | R26 | 33 | 45 | 33 | 35 | 32 | **37**[1] | 35 |
| | R27 | 34 | 45 | 34 | 35 | 33 | **37**[1] | 35 |
| | R28 | 34 | 45 | 34 | 35 | 33 | **37**[1] | 35 |
| | R29 | 35 | 45 | 35 | 35 | 33 | **37**[1] | 35 |
| | R33 | 34 | 45 | 34 | 35 | 33 | **37**[1] | 35 |
| | R35 | 33 | 45 | 33 | 35 | 32 | **37**[1] | 35 |
| D | R16 | 31 | 43 | 31 | 38 | 30 | 36 | 36 |
| | R17 | 31 | 43 | 31 | 38 | 30 | 36 | 36 |
| | R22 | 33 | 43 | 32 | 38 | 32 | 36 | 36 |
| | R23 | 33 | 43 | 32 | 38 | 32 | 36 | 36 |
| | R32 | 34 | 43 | 34 | 38 | 33 | **38**[1] | 36 |
| | R37 | 32 | 43 | 32 | 38 | 31 | **37**[1] | 36 |

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**shaded Cell**).
Note 2: Moderate Noise Management Zone 3 to 5dB(A) above project specific criteria (**shaded Cell**).
Note 3: Units = dB(A) re 20μPa.
Note 4: NAG = Noise Assessment Group.
Source: SLR (2011) – Table 31

Assuming the implementation of the proposed (or equivalent) noise mitigation measures, the noise modelling predicts that compliance with the Project-specific noise criteria can be achieved during the day, evening and night time (calm) periods. Under inversion conditions:

- exceedances of the Project-specific noise criteria of 1dB (negligible noise exceedance – see Section 4.2.3.1.2) are predicted at seven residences within NAG A (R1 and R6), NAG C (R13, R18 and R24) and NAG D (R37);

- exceedances of the Project-specific noise criteria of 2dB (marginal noise exceedance – see Section 4.2.3.1.2) are predicted at 12 residences within NAG A (R5), NAG B (R2), NAG C (R3, R20, R25, R26, R27, R28, R29, R33 and R35) and NAG D (R32); and
- exceedance of the Project-specific noise criteria of 3dB (moderate noise exceedance – see Section 4.2.3.1.2) are predicted at one residences within NAG C (R3).

#### 4.2.6.1.5 Scenario 4 - End Year 4

**Table 4.22** presents the results of the operational noise assessment. Noise contours representing predicted noise levels generated by these modelling results are presented as *Figures AC17* to *AC20* of SLR (2011).

**Table 4.22**
**Intrusive Noise Assessment Results[2] – Scenario 4**

| NAG[3] | Residence Reference | Daytime | | Evening | | Night-time | | |
|---|---|---|---|---|---|---|---|---|
| | | Calm | Criteria | Calm | Criteria | Calm | Inversion | Criteria |
| A | R1 | 26 | 35 | 27 | 35 | 25 | 30 | 35 |
| | R4 | 24 | 35 | 24 | 35 | 22 | 33 | 35 |
| | R5 | 33 | 35 | 34 | 35 | 30 | 35 | 35 |
| | R6 | 34 | 35 | 35 | 35 | 26 | 34 | 35 |
| | R8 | 18 | 35 | 20 | 35 | 14 | 27 | 35 |
| | R9 | 17 | 35 | 18 | 35 | 14 | 24 | 35 |
| | R10 | 22 | 35 | 22 | 35 | 20 | 28 | 35 |
| | R11 | 22 | 35 | 23 | 35 | 21 | 28 | 35 |
| | R12 | 17 | 35 | 18 | 35 | 15 | 25 | 35 |
| B | R2 | 31 | 36 | 32 | 35 | 26 | 34 | 35 |
| C | R3 | 32 | 45 | 33 | 35 | 31 | **36[1]** | 35 |
| | R13 | 23 | 45 | 24 | 35 | 21 | 27 | 35 |
| | R18 | 27 | 45 | 28 | 35 | 26 | 31 | 35 |
| | R20 | 29 | 45 | 29 | 35 | 27 | 32 | 35 |
| | R24 | 28 | 45 | 29 | 35 | 26 | 31 | 35 |
| | R25 | 29 | 45 | 30 | 35 | 27 | 33 | 35 |
| | R26 | 29 | 45 | 30 | 35 | 27 | 33 | 35 |
| | R27 | 30 | 45 | 31 | 35 | 28 | 33 | 35 |
| | R28 | 31 | 45 | 32 | 35 | 30 | 35 | 35 |
| | R29 | 32 | 45 | 33 | 35 | 30 | 35 | 35 |
| | R33 | 31 | 45 | 32 | 35 | 29 | 35 | 35 |
| | R35 | 29 | 45 | 30 | 35 | 28 | 32 | 35 |
| D | R16 | 26 | 43 | 27 | 38 | 24 | 30 | 36 |
| | R17 | 26 | 43 | 27 | 38 | 24 | 29 | 36 |
| | R22 | 28 | 43 | 28 | 38 | 26 | 31 | 36 |
| | R23 | 28 | 43 | 28 | 38 | 26 | 31 | 36 |
| | R32 | 31 | 43 | 32 | 38 | 29 | 35 | 36 |
| | R37 | 28 | 43 | 29 | 38 | 27 | 32 | 36 |

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**Shaded Cell**).
Note 2: Units = dB(A) re 20µPa.
Note 3: NAG = Noise Assessment Group.
Source: SLR (2011) – Table 32

Assuming the implementation of the proposed (or equivalent) noise mitigation measures, the noise modelling predicts compliance with the Project-specific noise criteria can be achieved at all residences except R3 under inversion conditions (a 1dB(A) exceedance).

#### 4.2.6.1.6 Summary and Discussion

On the basis of the implementation of the proposed noise mitigation measures (or equivalent), the noise modelling completed by SLR (2011) indicates that compliance with the Project-specific noise criteria is achievable at all surrounding residences during the day time and evening periods.

Under calm night time conditions, there may be a limited period approximately 15 months after the commencement of the Project when the noise levels received at five residences may exceed the Project-specific noise criteria by up to 2dB(A) (marginal noise exceedance – see Section 4.2.3.1.2).

Under inversion conditions, the number of residences exposed to noise levels exceeding the Project-specific noise criteria is increased to eight (approximately 15 months after the commencement of the Project) and 18 (approximately 2 years after the commencement of the Project). By the 4 year of the Project, only one residence is predicted to still be subject to a minor (1dB(A)) exceedance of the Project-specific noise criteria.

In achieving the noise levels predicted for each of the modelled scenarios, the noise modelling predicts that the operating mining fleet would be reduced during the evening and night-time period, and in particular when inversion conditions prevail. The actual restrictions placed on the mining fleet would reflect the results of real-time noise monitoring (see Sections 4.2.5 and 4.2.7) and as acknowledged previously, the same or greater noise emission reduction may be achieved through alternative mining fleet arrangements without the need to reduce the mining fleet as significantly. This notwithstanding, the Proponent‟s commitment to reducing noise emissions from the Mine Site, and therefore the noise level received at each surrounding residence is re-iterated.

In assessing the impact of the predicted exceedances of Project-specific noise criteria, the following has been considered.

1. The proposed operations for each of the five scenarios modelled incorporate all reasonable and feasible mitigation measures that could currently be applied (see Section 4.2.5). It is possible that throughout the life of the Project there would be improvements in noise attenuation technology that may further reduce Mine Site noise emissions, however, the noise levels noted in **Tables 4.18** to **4.22** represent the lowest noise levels reasonably and feasibly achievable.

2. The predicted noise exceedances are restricted to 2dB(A) or less at all but two residential receivers (R3 during the Scenario 1 [day time] and Scenario 3 [inversion], and R29 during Scenario 1 [day time]). The acceptability of these exceedances is considered in (3) below.

   As noted in Section 4.2.3.1.2, a difference of 2dB(A) is unlikely to be noticed by most people, i.e. most people would not differentiate between a noise level of 35dB(A) and a noise level of 37dB(A). Even a 3dB or 4dB difference in noise level (the level of exceedance at R3 during Scenarios 1A and 3, and R29 during Scenario 1A) may not be noticeable to many people.

   Based on the above, little additional benefit would be obtained through achievement of the Project-specific noise criteria as those residing at the affected receivers would be unlikely to perceive this difference.

3. At most of the residential receivers for which exceedance of the Project-specific noise criteria is predicted, the period of time during which the non-compliant noise levels are predicted would be restricted.
   - Noise levels exceeding the Project-specific criteria by between 1dB(A) and 4dB(A) are predicted during the initial months at three residences. These exceedances, which only occur during the daytime, are associated with the operation of scrapers on the Mine Site. Notably, scrapers would only be operated for soil stripping which would be undertaken as a short campaign. Outside this campaign stripping program, noise levels received are predicted to be below the Project-specific noise criteria.
   - Under calm night-time conditions, there may be a limited period approximately 15 months after the commencement of the Project when the noise levels received at five residences within Tomingley may be up to 2dB(A) in excess of the Project-specific noise criteria. The exact period of time during which these negligible (not noticeable) or marginal (not noticeable by most people) exceedances above noise criteria are likely to be experienced cannot be defined exactly, however, it is instructive to note that at 12 months and 24 months following Project commencement (represented by Scenario‟s 1b and 3) compliance with the Project-specific noise criteria is predicted. Furthermore, at all but Residence R3, the predicted noise levels at each of these residences for Scenario‟s 1b and 3 is at least 3dB(A) below the Project-specific noise criteria suggesting a relatively limited period when exceedances of criteria might occur.
   - The majority of predicted exceedances occur under inversion conditions. Such conditions generally only occur during the night time when atmospheric conditions are conducive. The exact proportion of nights when inversion conditions occur has not been measured, however, based on meteorological monitoring at the nearby Peak Hill Gold Mine, a frequency during winter of between 50% and 60% of the time is suggested (SLR, 2011). The proportion of meteorological condition conducive to inversion formation during the remaining months of the year is likely to be less (and significantly less during the warmer months between October and March).
   - The period of operations when exceedances during inversion conditions are predicted is also limited over the life of the Project.
     - At one residence (R35), exceedance is only predicted under Scenario 2 conditions, i.e. for a limited period between 12 and 24 months following Project commencement.
     - At nine residences, an exceedance is only predicted under Scenario 3 conditions. As discussed for exceedances predicted for Scenario 2 only, the period of time during which exceedance may occur is likely to be restricted to a more limited period between 15 months and 4 years following Project commencement.
     - At a further eight residences where exceedances under both Scenario 2 and 3 conditions are predicted, the total period over the life of the Project when an exceedance may occur is likely to be restricted to a more limited period between 12 months and 4 years following Project commencement.

    - At Residence R3, for which exceedance of Project-specific noise criteria is predicted under Scenarios 3 and 4 conditions, the total period during which an exceedance could occur from 15 months following Project commencement extending beyond 4 years following commencement.

  - By combining the restricted periods over the life of the Project when exceedances under inversion conditions are predicted and the limited number of nights each year when an inversion may occur, the frequency of exceedance of the Project-specific noise criteria would be limited.

4. The Proponent has provided for the implementation of real-time noise monitoring and management which would enable immediate response to increasing noise emissions to prevent and (if necessary) mitigate exceedances of the Project-specific noise criteria. This should reduce the frequency of noise exceedances received at the surrounding residential receivers.

   The Proponent has also committed to implementing further noise mitigation controls at affected residences (should exceedances of the Project-specific noise criteria be exceeded by more than 2dB). Based on the noise modelling predictions, it is likely that these contingency measures would be required at Residence R3 (although the location and nature of any contingency mitigation application would be determined following assessment of real-time noise monitoring and the application of the proposed *Noise Management Plan*).

In considering the noise level predictions provide for the implementation of all reasonable and feasible mitigation measures, the reduced scale and frequency of possible exceedances of the Project-specific noise criteria, and the proposed contingency management, the limited number of exceedances of noise criteria are assessed as acceptable. On this basis, it is deemed reasonable that the following noise criteria (modified from the Project-specific noise criteria) be adopted for the Project.

- A night time noise criteria allowing for an additional 2dB(A), i.e. background noise level + 7dB(A), at all residences other than R3 and R29 for which exceedances have been predicted.
- A day time noise criteria of background noise level + 8dB(A) (48dB(A)) at residence R29 for the initial 9 months of operation, reverting to background noise level + 7dB for night time and the remaining life of the mine daytime operations (47dB(A)).
- A day time noise criteria of background noise level + 9dB (48dB(A)) at residence R3 for the initial 9 months of operation, reverting to background noise level + 8dB(A) for night time and the remaining life of the mine daytime operations (47dB(A)) (assuming the application of noise attenuation at the residence).

Furthermore, the Proponent would maintain regular, open and honest dialogue with the surrounding community, including provision of a 24-hour complaints line, to allow the community to provide feedback in relation to noise-related impacts 24-hours per day.

### 4.2.6.2 Construction Noise Assessment

The noisiest activity associated within pipeline construction was predicted by SLR (2011) to be the backfilling of the trench requiring the operation of a grader and dozer. The minimum distances required in order to achieve the construction noise criteria is predicted are presented for each NAG as follows.

| | Noise Affected | Highly Noise Affected |
|---|---|---|
| • NAG A (R9 – 125m): | 1 618 m | 29 m |
| • NAG B (R2 – 1 920m): | 1 442 m | 29 m |
| • NAG C (R13 – 115m): | 512 m | 29 m |
| • NAG D (R17 – 85m): | 644 m | 29 m |

The predicted noise levels indicate that with the exception of NAG B, the construction activities would encroach within the minimum distance required to comply with the „noise affected" construction noise criteria. However, given the duration of the associated impacts will be restricted to less than 3 weeks at any one residence, and assuming appropriate notification and equipment management measures are implemented, the impact is assessed to be acceptable. Furthermore, the distance between the construction activities and the closest residence within each NAG is well in excess of the distance (29m) at which the „highly noise affected" noise criteria is predicted to be exceeded.

### 4.2.6.3 Road Traffic Noise Assessment

**Table 4.23** presents the results of the road traffic assessment undertaken by SLR (2011).

**Table 4.23**
**Road Traffic Noise Assessment Results[1]**

| Road | Minimum Offset Distance | Road Speed (km/hr) | Criterion | | Existing | | Future | | Increase | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | Night | Day | Night | Day | Night | Day | Night |
| Tomingley West Road | 88m | 100 | 60 (1hr) | 55 (1hr) | 39.6 | 34.1 | 45.2 | 44.3 | 5.6 | 10.2 |
| Tomingley – Narromine Road (North) | 140m | 100 | 60 (1hr) | 55 (1hr) | 42.8 | 38.7 | 43.4 | 40.2 | 0.6 | 1.5 |
| Tomingley – Narromine Road (South) | 222m | 60 | 60 (1hr) | 55 (1hr) | 40.4 | 36.5 | 42.0 | 39.7 | 1.6 | 3.2 |
| Newell Highway (South) | 18m | 50 | 60 (15hr)[2] | 55 (9hr)[2] | 60.8 | 55.7 | 61.0 | 56.2 | 0.2 | 0.5 |

Note 1: Units – dB(A)
Note 2: In the event that the existing noise levels exceed the relevant criteria, the Project should not result in an increase of more than 2dB(A).
Source: SLR (2011) – Table 36

The predicted future traffic noise levels on Tomingley West Road and Tomingley – Narromine Road would remain below the $L_{Aeq(1hr)}$ criteria for these roads. Compliance with the traffic noise criteria for the Newell Highway would also be achieved given the proposed increase in traffic noise level would not exceed 0.5dB(A) (for a road where the existing traffic noise levels exceeds the nominated criteria).

### 4.2.7 Monitoring

The Proponent would prepare and implement a *Noise Management Plan* as previously discussed in Section 4.2.5. Critical features of the *Noise Management Plan* would be:

- real-time noise monitoring procedures and trigger levels;
- weather station monitoring procedures and adverse weather trigger levels;
- routine and complaint-driven attended noise monitoring procedures; and
- reporting procedures, including reporting to relevant government agencies and the surrounding community.

## 4.3 SURFACE WATER

### 4.3.1 Introduction

The Director-General‟s Requirements (DGRs) issued by the Department of Planning identify "Soil and ***Water***" as a key issue for assessment in the *Environmental Assessment*. In addition, the Director-General‟s Requirements require that the assessment of surface water include a ―... *site water balance, potential water quality impacts on the environment and other land users, including a geochemical assessment of the potential leachate impacts and a description of final void water management"*.

Based on the risk assessment undertaken for the Project (see Section 3.5), the specific surface water-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment are as follows.

- Reduction in environmental flows as a result of on-site capture of water resulting in:
  - reduced availability of water to downstream users (moderate risk);
  - reduced environmental flows (low risk);
  - stress to, and possible reduction in viability of native vegetation (low risk); and
  - degradation of aquatic habitats (moderate risk).
- Discharge of dirty, saline or contaminated water resulting in:
  - pollution of downstream waters (high risk);
  - stress to, and possible mortality of flora and/or fauna (high risk); and
  - reduced soil quality and associated reduction in viability of productive post-mining land use (moderate risk).
- Changes to hydrology of creeks and drainage lines resulting in:
  - reduced environmental flows within the Bogan River catchment (moderate risk);
  - increased erosion potential resultant from changed alignment of flow (high risk); and
  - reduction in the quality of aquatic habitat (moderate risk).

- Changes to the flood regimes of Gundong Creek resulting in:
  - increased erosion potential within Gundong Creek catchment (moderate risk);
  - changes to vegetation community structure and habitat value (low risk).
  - reduced viability of land uses on affected properties as a result of changes to flooding regime (moderate risk).
- Erosive actions of water in undisturbed sections of the Mine Site resulting in:
  - excessive soil erosion (moderate risk); and
  - sedimentation of surrounding drainage lines and land (moderate risk).
- Erosive actions of water on disturbed sections of the Mine Site, including waste rock emplacement batters, prior to rehabilitation operations resulting in:
  - Excessive soil erosion (moderate risk);
  - Sedimentation of surrounding drainage lines and land (moderate risk); and
  - Reduced success of Mine Site rehabilitation (high risk).

The surface water assessment for the Project was undertaken by Mr Andrew Macleod of Strategic Environmental and Engineering Consulting ("SEEC"). The resulting report is presented as Part 2 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "SEEC (2011)". This sub-section of the *Environmental Assessment* provides a summary of that report.

## 4.3.2 Existing Hydrological Setting and Conditions

### 4.3.2.1 Regional Drainage and Catchments

**Figure 4.1** presents the regional setting of Mine Site drainage within the catchment of the Bogan River. The Bogan River catchment forms part of the larger Macquarie-Bogan River catchment of central and central-northern NSW. Both the Bogan and Macquarie Rivers flow in a generally northwesterly direction before merging with the Darling River approximately 80km upstream and 60km downstream of Brewarrina respectively.

Poorly defined ephemeral drainage on the western side of the Herveys Range (which forms the catchment divide between the Bogan and Macquarie River catchments) flow to the Bogan River located approximately 11km to the southwest of the Mine Site.

### 4.3.2.2 Local and Mine Site Drainage and Catchments

On a local scale, the Mine Site is located within the catchment of Gundong Creek, bordered to the north by Fiddlers and Tomingley Creeks and to the south by Bulldog Creek (see **Figure 4.2**). Gundong Creek has its headwaters in the Herveys Range approximately 12km to the east of the Mine Site and flows southwest from north of Tomingley before passing through the northwestern section of the Mine Site. OzArk (2011b) note that the current alignment of Gundong Creek is not the natural alignment of this creek and the current creek alignment was formed through the cutting of a channel to supply water to vegetable gardens and mineral processing operations during the 1800s. Prior to this re-alignment, Gundong Creek formally dissipated at a place called „Ten Ponds‟ (also possibly known as „Ten Mile Holes‟) located to the northeast of Tomingley. Surface water drainage within the Gundong Creek catchment (and those that surround it) is typically indistinct and ephemeral, flowing to the west and eventually merging with the Bogan River.

Surface flow across the Mine Site into Gundong Creek has been sub-divided into four separate sub-catchments, namely Catchments 1, 2, 3 and 4 (**Figure 4.16**). A summary of each sub-catchment as it relates to the Mine Site is provided by **Table 4.24**. A more detailed description of the flows within each sub-catchment is provided by *Section 4.4.3* of SEEC (2011) (Part 2 of the *Specialist Consultant Studies Compendium*).

**Table 4.24**
**Mine Site Sub-catchments**

| Catchment | Area (ha) | | Location | Relevant Drainage Features |
|---|---|---|---|---|
| | Total | Mine Site | | |
| 1 | 10 600 | 110 | Northern portion of the Mine Site on the western side of the Newell Highway | Gundong Creek |
| 2 | 1 800 | 290 | Northern portion of the Mine Site on the eastern side of the Newell Highway | Drainage Lines A, B & C |
| 3 | 1 350 | 170 | Southern portion of the Mine Site on the eastern side of the Newell Highway | Drainage Line D |
| 4 | 1 800 | 200 | Southern portion of the Mine Site on the western side of the Newell Highway | Catchments 2 and 3 converge and flow into Catchment 4 |

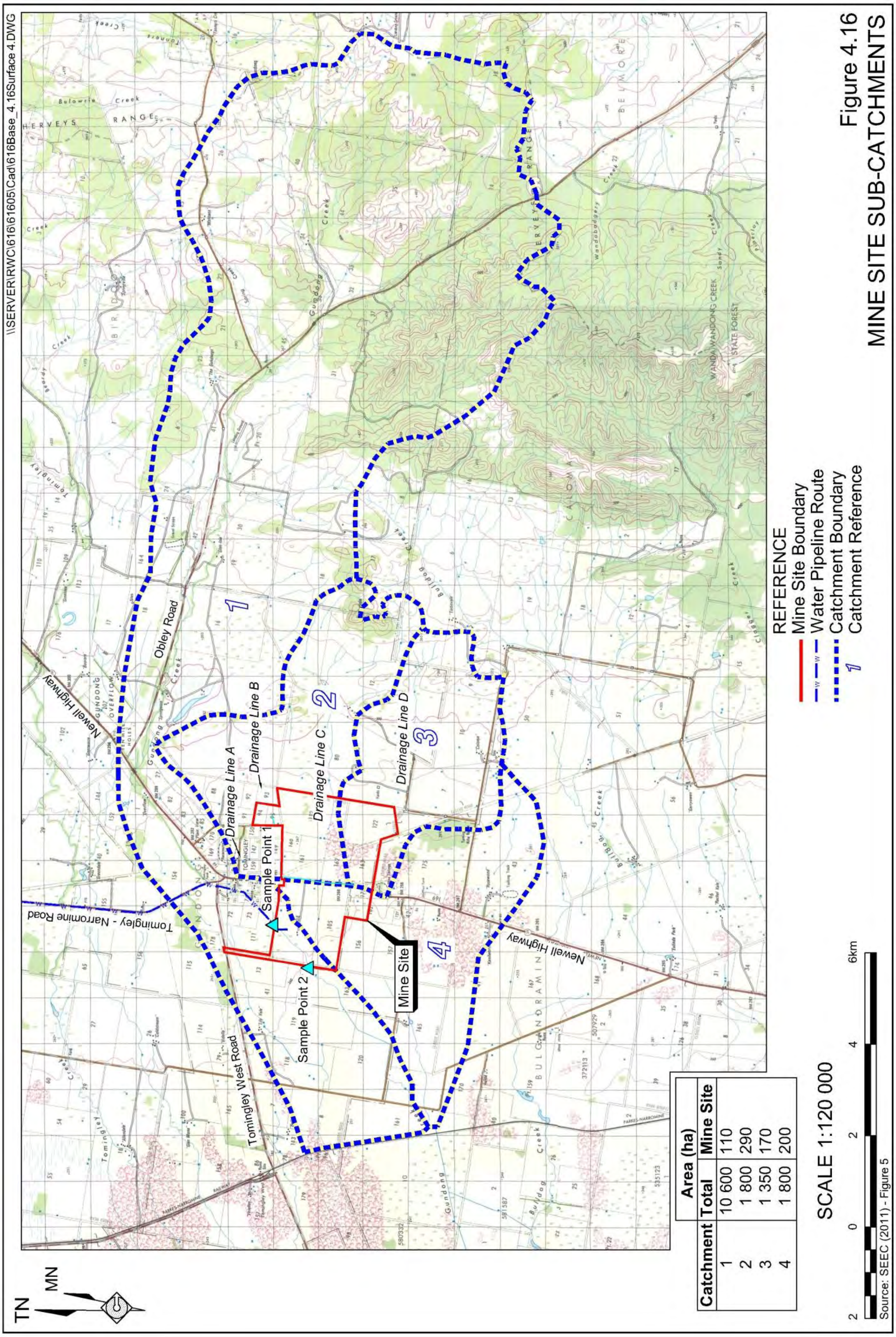
The natural flow patterns of the Mine Site are interrupted by a number of agricultural dams. While a number of these would be removed by the proposed mining and related activities, several of these would be incorporated into the water management plan for the Mine Site (see Section 4.3.4).

#### 4.3.2.3 Existing Flooding Regime

Gundong Creek has a significant catchment upslope of the Mine Site, although flows are highly variable and intermittent. SEEC (2011) considers it unlikely that flows from the entire catchment are conveyed via Gundong Creek for the following reasons.

- Approximately 3km northeast of Tomingley, at the bridge across Gundong Creek on the Newell Highway, is a feature shown on the Department of Lands mapping called the "Gundong Overflow". There are several culverts located immediately to the north of the bridge that suggest that major flows are diverted away from the Gundong Creek catchment.
- The capacity of the creek downstream of the bridge would be insufficient to convey the full peak flows from the entire catchment. It is likely that major flows would overtop the creek and sheet flow in a southwesterly direction away from the creek.
- The crossing at Tomingley West Road is insufficient to pass a 100-year ARI peak flow. Surplus run-off would overtop the crest on the western side of Tomingley West Road and flow in a southwesterly direction away from the creek.

The above notwithstanding, significant rainfall events in the upstream catchment can generate over-bank flows in Gundong Creek in the vicinity of the Mine Site, particularly over the western section of the Mine Site. Existing levies around the main centre of the Tomingley township are evidence of potential flooding in this area.




| Catchment | Area (ha) Total | Mine Site |
|---|---|---|
| 1 | 10 600 | 110 |
| 2 | 1 800 | 290 |
| 3 | 1 350 | 170 |
| 4 | 1 800 | 200 |

Figure 4.16
MINE SITE SUB-CATCHMENTS

Tomingley West Road is also subject to periodic inundation in the vicinity of the proposed Main Site Access Road and the existing crossing over Gundong Creek (see **Figure 4.3**). Flooding has also historically occurred in the vicinity of culverts crossing under the Newell Highway (see **Figure 4.3**) when flows in Drainage Lines A, B, C and D exceeded the culverts combined capacity.

#### 4.3.2.4 Surface Water Quality

Following a heavy rainfall event, surface water flowing within Gundong Creek was sampled by the Proponent from Sample Points 1 and 2 (see **Figure 4.16**) on 14 July 2010 and sent to LabMark Environmental Laboratories for analysis. The following provides a summary of the results.

- Electrical conductivity: 71µS/cm to 73µS/cm;
- Total suspended solids: <5mg/L to 106mg/L;
- Total Nitrogen: 1.6mg/L to 1.7mg/L; and
- Total Phosphorous: 0.34mg/L to 0.5mg/L.

The results illustrate the water is fresh, however, concentration of suspended solids may vary depending on the condition of the catchment and channel. Concentrations of nitrogen and phosphorous reflect the local setting where agriculture is a dominant land use.

#### 4.3.2.5 Surface Water – Groundwater Interaction

Electromagnetic survey conducted over the Mine Site by SSM (2011) suggests the possible occurrence of groundwater discharges to surface ("springs") in the northwestern corner of the Mine Site (close to the Main Site Access Road intersection with the Tomingley West Road). Further review of groundwater data collected from bores on and surrounding the Mine Site by Impax (2011) concluded, however, that the potential for existing groundwater outflows in other areas of the Mine Site was low.

Impax (2011) does, however, predict the open cuts would be likely to intercept fractured groundwater-bearing layers, with subsequent inflows into the open cut voids, requiring consideration in the development of the water management plan for the Mine Site.

#### 4.3.2.6 Water Use and Availability

When considering water availability, it is important to recognise that every property has a Maximum Harvestable Rights Dams Capacity (MHRDC). This policy entitles a landholder to capture up to 10% of the rainfall and runoff from the property and use it for any purpose without needing a licence for the dam(s). The maximum cumulative capacity of the dams allowable under this policy may be obtained by multiplying the area of land owned by the landholder by a multiplier. In this present case, the area of land that is currently owned or would be owned by the Proponent is approximately 1 023ha. The relevant multiplier is 0.05ML/ha[4]. As a result, the maximum capacity of dams that may be used under this policy within land held by the Proponent is 51.0ML.

Notably, dams or other sediment for pollution control purposes are exempt from the MHRDC consideration, unless the water captured is to be re-used on the site/property.

[4] The calculation is based on the Department of Infrastructure, Planning and Natural Resources document *Rural Production and Water Sharing Landholders Information Package (1999).*

#### 4.3.2.7 Climatic Conditions

Aspects of meteorology likely to affect surface water flows and flooding are considered in Section 4.1.3.

### 4.3.3 Surface Water Management Strategy

#### 4.3.3.1 Objectives

The primary objectives in managing surface water within the Mine Site are aimed at addressing the main surface water related risk factors of the Project (see Sections 3.5 and 4.3.1) and are as follows.

- Minimise changes to the hydrology of all catchments affected by Mine Site activities so as to minimise potential impacts on environmental (downstream) flows and downstream water users.
- Minimise changes to the pre-existing runoff and infiltration regime within the Mine Site.
- Ensure that Mine Site operations, in particular residue management, have a neutral or beneficial impact on surface water quality when compared to the existing (i.e. pre-development) conditions in the receiving waters.
- Ensure that the capture and use of surface water within the Mine Site remains within the Proponent"s MHRDC-related rights.
- Ensure that any changes to peak flows, flow volumes or water quality do not have a detrimental effect on downstream ecology or the stability of drainage lines.
- Maintain run-on and runoff within the original, natural catchments of the Mine Site.

#### 4.3.3.2 Surface Water Management Controls

##### 4.3.3.2.1 Introduction

**Figure 4.17** (which replicates much of the information presented in **Figure 2.5**) provides the indicative location of surface water management structures within the Mine Site. Notably, the recommended structures were designed to mitigate the predicted impacts on surface flows and flooding predicted by SEEC (2011). The Proponent has committed to the surface water management strategy recommended by SEEC (2011), and therefore the results of modelling and impact assessment are considered in Sections 4.3.4 and 4.3.5 (which follow this section) assuming the implementation of this strategy.

Sections 4.3.3.2.2 to 4.3.3.2.8 provide a description of the surface water management structures to be constructed and the operation of these over the life of the Project.

#### 4.3.3.2.2 Main Site Access Road

A culvert and causeway crossing would be constructed over Gundong Creek, similar to that upstream on Tomingley West Road. The crossing would be constructed based on the following.

- Three, 1.5m wide x 0.9m deep box culverts would be installed. These culverts would fit within the existing creek bed without the requirement for excessive earthworks of the creek bed and banks and would have capacity close to the full bank stream flow before overtopping.
- Inlet and outlet erosion protection to the creek bed and banks would be constructed.
- The road would be designed to facilitate grades suitable for heavy vehicles over the mine site bund.

In order to ensure access to the Mine Site is not restricted by flooding events along Gundong Creek, an alternative emergency access during flood events would be provided via the emergency site access road to the Newell Highway (**Figure 4.17**).

#### 4.3.3.2.3 Surface Water Diversion (Catch) Banks

**Figure 4.17** presents the indicative location of the proposed surface water diversion structures and bunds (catch banks) to be constructed on the Mine Site. In each case, the location and alignment of the structure is such that surface flows remain within the natural (pre-mining) catchment. An illustration of the design details of the various bund types referred to below is provide by **Figure 2.6**. The diversion structures would be subject to the following design, monitoring and maintenance requirements.

- The Western Surface Water Diversion Structure would be constructed as a Type 3 bund to isolate the Mine Site from Catchment 1 (Gundong Creek) and would divert potentially dirty water flowing from Waste Rock Emplacement 2, the processing plant and office area into Sediment Basin 1.
- The Eastern Surface Water Diversion Structure would be constructed as a Type 1 bund north of Waste Rock Emplacement 3 and a Type 4 bund for the remainder of its length. The function of the Eastern Surface Water Diversion Structure would be to divert water from Catchment 2 around the eastern section of the Mine Site. Section 2.2.6.2 and **Figure 2.6** provide further detail as to the design parameters of this structure.
- Additional diversion and catch drains/banks would be constructed as follows.
  - The Central Surface Water Diversion Structure: would be constructed as a Type 3 bund to divert water flowing within Catchment 2 around the Caloma Open Cut and discharge this to natural drainage at the junction of Catchments 2, 3 and 4.
  - Catch Bank (CB) 1: a Type 1 bund, would capture potentially sediment-laden (dirty) water flowing from the topsoil stockpile to the north of Waste Rock Emplacement 3 and Waste Rock Emplacement 3 itself and discharge this to Sediment Basin 4.

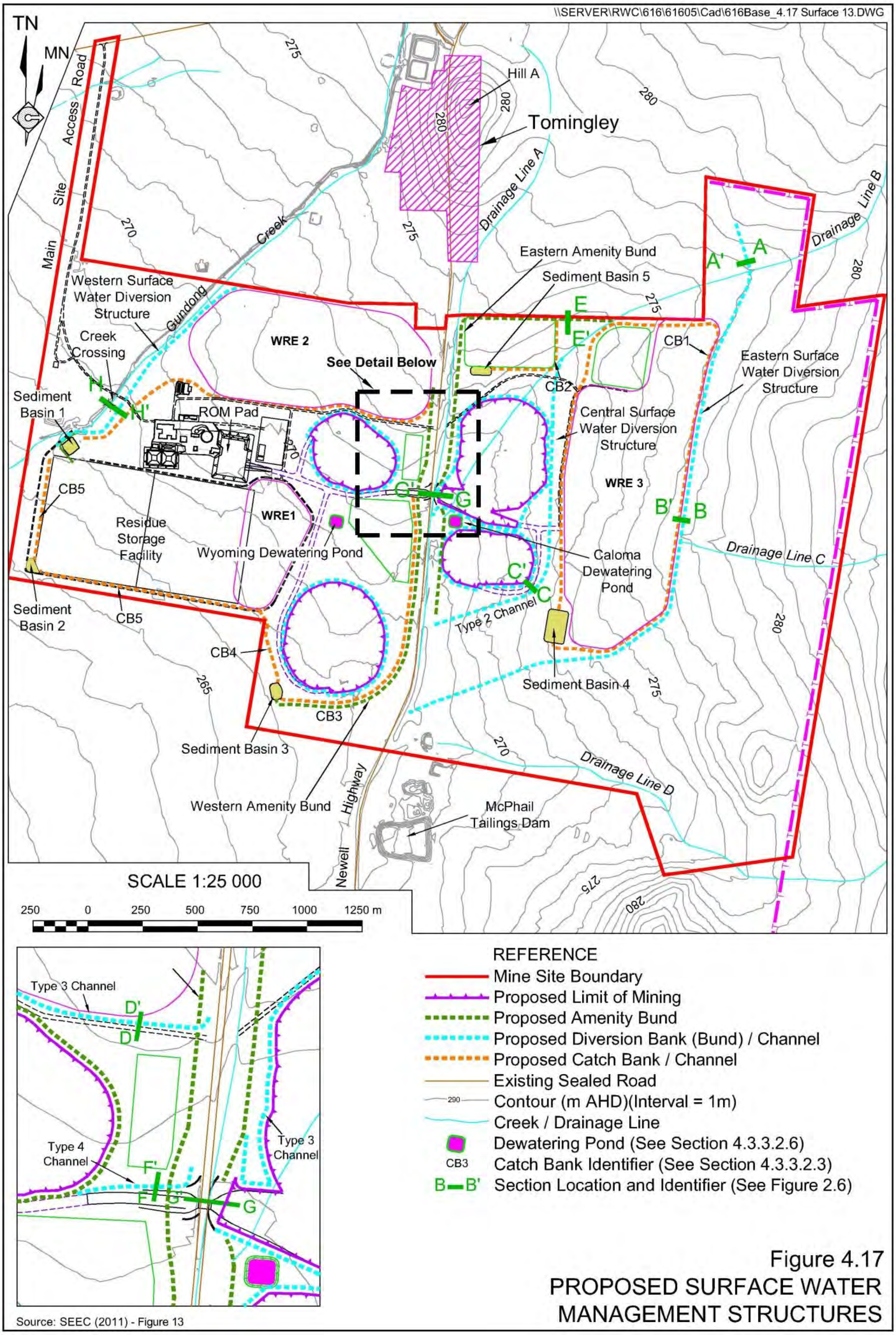



Figure 4.17
PROPOSED SURFACE WATER MANAGEMENT STRUCTURES

- CB2: a Type 1 bund: would capture potentially dirty water flowing off the topsoil stockpile to the west of Waste Rock Emplacement 3 and discharge this to Sediment Basin 4.
- CB3: a Type 1 bund: would divert potentially dirty water flowing from the southeastern portion of the western section of the Mine Site into Sediment basin 3. This structure would form the toe of the amenity bund to the west of the Newell Highway
- CB4: a Type 3 bund: would divert potentially dirty water flowing from the RSF and Waste Rock Emplacement 1 into Sediment Basin 3.
- CB5: a Type 3 bund: would divert any overflow from Sediment basin 1 and the western and southern bank of the residue storage facility into Sediment Basin 2.

- All diversion structures and catch banks would be constructed in accordance with Standard Drawing (SD) 5-5 of Landcom (2004).
- All structures would be stabilised using appropriate ground cover to achieve a C-factor of 0.1 or less (in accordance with the recommendations of Landcom, 2004). This would be achievable by establishing a 60% grass cover or equivalent, installing an appropriate rolled erosion control product or hydraulic soil stabilisers.
- Potential scour points, such as channel inlets/outlets and bends, would be identified and armoured with rock.
- Each drainage structure and bund would be inspected at least monthly, as well as immediately following any rain event that generates flow within the drains or against the bunds to identify areas of erosion, scour or damage, if any. The following actions would be implemented following the inspections, if required.
  - If areas of erosion, scour or damage are identified, these would be repaired and/or appropriate stabilising action taken as soon as practicable.
  - If potential flow constrictions that might compromise channel capacity are identified, these would be removed by channel modification or maintenance of any vegetation within the channel.

#### 4.3.3.2.4 Sediment basins

Five sediment basins would be constructed in the locations shown in **Figure 4.17**. These basins have been sized to accommodate the 5 day, 90$^{th}$ percentile rainfall event (equivalent to 35.6mm over a 5-day period) in accordance with Landcom (2004) and DECC (2008)[5]. The design features of these sediment basins are provided in **Table 4.25**. Each sediment basin would include a settling zone (the zone for settling of suspended sediment) and a storage zone (the zone for containing sediment that has settled out). The Proponent would commit to a 5-day maintenance interval for any discharges after rainfall.

[5] Although DECC (2008) suggests that sedimentation dams for a mine such the Tomingley Gold Project should be designed for the 10 day or 20 day rainfall depth, SEEC (2011) notes that this would make the required structures excessively large given the likely sediment volumes.

**Table 4.25**
**Sediment Basin Design Parameters**

| Structure | Total Catchment Area (ha) | Maximum Disturbed Area (ha) | Settling Zone Volume ($m^3$) | Storage Zone Volume ($m^3$) | Total Capacity ($m^3$) |
|---|---|---|---|---|---|
| **Sediment Basin 1** | 106 | 28 | 18 870 | 795 | 19 700 |
| **Sediment Basin 2** | 16 | 1.7 | 2 850 | 48 | 2 900 |
| **Sediment Basin 3** | 39 | 2.3 | 6 900 | 65 | 7 000 |
| **Sediment Basin 4** | 81 | 16.2 | 14420 | 460 | 14 880 |
| **Sediment Basin 5** | 10 | 2 | 1780 | 57 | 1 840 |
| | | | | **Total** | **46 320** |
| Source: Modified after SEEC (2011) – Table 14 | | | | | |

The total volume of the proposed sediment basins, namely 46.32ML, would be less than the Proponent‟s harvestable right (51.0ML) (see Section 4.3.2.6). In addition, the Proponent would ensure that the total volume of water storage on 1 023ha area used to calculate the Proponent‟s harvestable right would remain less than 51ML. As the five sediment basins fall within the Proponent‟s harvestable right, the Proponent intends to use the water captured within these for mining related purposes.

All five sediment basins would be subject to the following design, monitoring and maintenance requirements.

- Each sediment basin would be designed to contain all runoff from rain events up to 35.6mm over a five-day period (5 day 90$^{th}$ percentile rainfall event). Daily rainfall records would be collated by a mine site automatic weather station to identify maintenance periods for the sediment basins.
- Each sediment basin would be inspected fortnightly and immediately following any rain event exceeding 5mm to check capacity and integrity. If, on inspection, damage to the sediment basin is noted, these would be repaired as soon as practicable.
- Each sediment basin would be constructed with an emergency spillway designed to safely convey the 100-year Average Recurrence Interval (ARI) flow (in accordance with the recommendation of DECC, 2008b).
- Water would only be discharged from the sediment basins when it has a total suspended sediment concentration of ≤50mg/L. This could necessitate the use of flocculating agents.
- Water would be discharged within five days after the conclusion of a rain event, at or below the required water quality limit of 50mg/L.
- A marker would be installed in each sediment basin showing the boundary between the Storage Zone (the lower zone) and the Settling Zone in the basin.
- After discharging water from any sediment basin, the level of retained sediment would be inspected. If retained sediment exceeds the marked level of the Storage Zone, sediment would be removed and added to an active soil stockpile or waste rock emplacement.
- These sediment basin management procedures would be regularly reviewed to ensure ongoing efficient operation and protection of downstream water volumes, flows and quality.

#### 4.3.3.2.5 RSF, Processing Plant Water Dams and Dewatering Ponds

The Proponent would construct a number of additional water holding structures on the Mine Site, namely:

- the RSF;
- a Raw Water Dam and Process Water Dam within the Processing Plant and Office Area; and
- two dewatering ponds within the Mine Site which would store groundwater inflow pumped from the open cuts.

The water held within the RSF and Raw Water and Process Water Dams is likely to contain concentrations of cyanide and possibly trace metals exceeding acceptable levels. The water could also be saline and have a pH unsuitable for discharge. To ensure this water does not impact on the surrounding environment, these structures have been designed as nil discharge through the establishment of a suitable freeboard level. Furthermore, to ensure that potentially contaminated water does not seep from these structures (which could potentially lead to the contamination of local soils, surface and/or groundwater), the Proponent would line the structures with compacted clay to achieve a permeability of $<1 \times 10^{-9}$m/s.

Given the potentially saline nature of the groundwater, the dewatering ponds have also been designed as nil discharge structures and would be lined with compacted clay to achieve a permeability of $<1 \times 10^{-9}$m/s.

#### 4.3.3.2.6 Waste Rock Emplacement Drop-Down Structures and Energy Dissipaters

Stabilised and lined drop-down chutes or flumes would be constructed on the waste rock emplacements to minimise the potential for runoff from the waste rock emplacements to erode the surface of the structure. The drop-down chutes or flumes would be subject to the following design, monitoring and maintenance requirements.

- Each would be sized to accommodate the 20-year ARI flow event.
- Each would be stabilised by lining with rock or equivalent.
- Each would discharge onto a stable dissipation structure, constructed in accordance with SD 5-8 of Landcom (2004), to minimise the risk of scour.
- Each structure would be inspected at least monthly, as well as immediately following any rain event that generates flow within the structure, to identify any areas of erosion, scour or damage. If, on inspection, areas of erosion, scour or damage are identified, these would be repaired and/or appropriate stabilising action taken as soon as practicable.

The positioning of the drop down structures on each Waste Rock Emplacement would be provided following the preparation of more detailed mine plans and would be subject to review over the life of the Project. The locations of these drop-down structures and energy dissipaters would be provided in the initial *Mining Operations Plan* (MOP) for the Project, with any future modification to these locations provided in the relevant *Annual Environmental Management Report* (AEMR) and/or subsequent MOPs.

##### 4.3.3.2.7 Newell Highway Underpass

In order to maintain southward flows along the edge of the Newell Highway, the underpass has been designed to accommodate a table drain along the eastern side of the highway. The table drain would have the following design specifications.

- Base width ≥3m;
- Depth ≥0.5m; and
- Side slopes of 1:3 (V:H).

##### 4.3.3.2.8 Mine Site Effluent Management

In line with the recommendations of SEEC (2011), a Relocatable Waste Water Treatment Plant (RWWTP) would provide secondary treatment of sewage within the Mine Site. The waste water would be treated to a standard suitable for use within the process plant. Solid residue is expected to be minimal and would be removed as required by a suitably licensed contractor and disposed of at a suitable facility.

The installation and construction of the RWWTP would adhere to the following.

- The RWWTP would be sized according to anticipated staff and visitor numbers, and available facilities.
- The RWWTP would be maintained and regularly serviced in accordance with the manufacturer‟s recommendations.

#### 4.3.3.3 Water Harvesting and Dust Suppression

Runoff from office roofs within the Mine Site would be captured in a rainwater tank or series of tanks and would be used for ablutions.

#### 4.3.3.4 Existing Farm Dams

The Proponent would ensure that the combined volume of the existing site dams and the proposed sediment basins is less than the Proponent‟s maximum harvestable right, namely approximately 51.0ML. In the event that this is not the case, some or all of the remaining farm dams on the Mine Site would either be filled in or isolated from natural flows. This would ensure that the total water storage within the Mine Site, excluding water storages used for processing purposes, would be less than approximately 51.0ML.

### 4.3.4 Assessment Methodology

#### 4.3.4.1 Introduction

SEEC (2011) used modelling to predict, for the natural (pre-mining) and Project-affected conditions, the following surface water parameters, each of which are addressed in the following sub-sections.

- Peak flows.
- Flooding characteristics.
- Surface water quality.
- Water security.

#### 4.3.4.2 Peak Flows

Estimations for the peak runoff from Catchments 2, 3 and 4 of the Mine Site were determined using the Rational Method in accordance with Engineers Australia (2002) *Australian Rainfall and Runoff Volume 1*. Peak flows in the larger Catchment 1, of Gundong Creek, were modelled using XP-RAFTS. In both cases, the rainfall intensity for time periods between 1 and 100 years, catchment area, time of concentration and runoff coefficient were calculated and used in the modelling, with the XP-RAFTS modelling also requiring input data related to soil infiltration rate. SEEC (2011) then calculated the peak flow for each catchment prior to and following the development of the Project. Additional detail on the modelling process, with a summary of the modelled scenarios, is presented as follows.

- The peak flow for each catchment in its entirety was modelled to simulate the pre-mining development surface flows.
- The peak flow for each catchment, excluding the Mine Site, was modelled to simulate the Project-effected surface flows.
- The peak flow for the combined Catchments 2, 3 and 4 was modelled given Catchments 2 and 3 converge at two existing box culverts under the Newell Highway before entering Catchment 4 (see Section 4.3.2.2).

#### 4.3.4.3 Flooding Characteristics

Modelling of anticipated flood behaviour was conducted using the DRAINS program for Catchments 1 and 2 to assess the following.

- Catchment 1. The flood height of Gundong Creek up to and including the 1 in 100 ARI conditions[6]. The modelling considered the flood heights with and without the installation of bunds, the Main Site Access Road and crossing of Gundong Creek to assess the effectiveness of the proposed bund dimensions.
- Catchment 2. The total volume of water that might occupy the Mine Site east of the Newell Highway under 1 in 100 ARI conditions, assuming 100% blockage of the existing culverts under the highway, i.e. to determine the required capacity of diversionary structures within Catchment 2, i.e. CB1.

SEEC (2011) provides further detail on the DRAINS modelling undertaken.

#### 4.3.4.4 Water Quality

It is acknowledged that the Mine Site operations would generate potentially sediment-laden water. Modelling was conducted using MUSIC (Model for Urban Stormwater Improvement Conceptualisation), which contains algorithms based on the known performance characteristics of common stormwater quality improvement structures used in Australia. SEEC (2011) provides further detail on the MUSIC model which quantifies:

- the levels of the principal pollutants before and during the development; and
- changes in off-site levels as a result of the proposed development.

[6] SEEC (2011) has considered the full 100-year ARI peak flow for the entire Catchment 1 as a conservative figure to determine the minimum bund height even though the majority of the flows above the capacity of Gundong Creek would by-pass the Mine Site to the northwest (as discussed in Section 4.3.2.3). SEEC (2011) estimates that Gundong Creek would most likely only convey up to the 2-year ARI peak flow from Catchment 1 because excess flows above the 2-year ARI would flow overland to the northwest as previously discussed.

SEEC (2011) ran the MUSIC model for both the pre–Project (existing) and Project-effected (proposed) conditions. The Project-effected (proposed) conditions were modelled both with and without the proposed management measures identified in Section 4.3.3.2. The output statistics of model considered in assessing the effect of the operations are as follows.

- Flow (ML/yr).
- Total suspended solids (TSS) in kg/yr.
- Total phosphorus (TP) in kg/yr.
- Total nitrogen (TN) in kg/yr.
- Gross pollutants in kg/yr.

The results the Project-effected (proposed) modelling were then compared with the pre-Project modelling results to assess whether the desired neutral or beneficial impact on water could be achieved.

#### 4.3.4.5 Water Security

SEEC (2011) prepared a water balance for the Mine Site considering the operational water requirements for the Project and available water supply. The water balance considered the relative contribution to water supply from water harvested within the Mine Site, as well as the available supplementary supply that could be provided by the water supply pipeline and associated bores.

To predict the proportion of Mine Site water requirements that could be supplied by harvested surface water, SEEC (2011) used a water balance spreadsheet known as RATES. The RATES spreadsheet, calibrated using 100 years of daily rainfall data from the Peak Hill rainfall station, assumes no more than 51.0ML of water storage is available for harvesting and takes into account inherent system losses such as infiltration, surface wetting, and runoff coefficients.

The security of water supply was then assessed based on the relative surplus or deficit of water likely under various climatic conditions. Notably, the assessment of water security was conservative as it does not include the availability of a third water supply, namely dewatered groundwater within each of the proposed open cuts.

### 4.3.5 Assessment of Impacts

#### 4.3.5.1 Introduction

Potential impacts on surface water as a result of the Project, and the risk associated with each of these, were described in Section 4.3.1. An assessment of the residual impact of each of these, considering the proposed surface water management measures described in Section 4.3.3 and the results of modelling described in Section 4.3.4, is provided in the following sub-sections.

- Section 4.3.5.2 considers the impacts of the Project on peak flows (affecting environmental flows and impacts on water availability downstream of the Mine Site).
- Section 4.3.5.3 considers the impact of the Project on local flooding characteristics.
- Section 4.3.5.4 reviews the impact of the Project on water quality.

- Section 4.3.5.5 reviews the security of water supply to the Project.
- Section 4.3.5.6 considers the impact of the Project on the hydrology of each Mine Site catchment.
- Section 4.3.5.7 reviews impacts associated with effluent management.
- Section 4.3.5.8 provides an overall assessment of the Project on the water quality and flow objectives of the Bogan Rover catchment.

#### 4.3.5.2 Peak Flows

The peak flow characteristics of the Mine Site catchments are presented in **Table 4.26.**

**Table 4.26**
**Peak Flow Calculations**

| ARI (years) | Frequency Factor | Catchment Peak Flows (Mine Site-Included) ($m^3/s$) | | | | | Catchment Peak Flows (Mine Site-Excluded) ($m^3/s$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 2+3+4 | 1 | 2 | 3 | 4 | 2+3+4 |
| 1yr, tc | 0.38 | 0.037 | 2.73 | 2.311 | 2.768 | 4.919 | 0.032 | 2.612 | 2.301 | 2.566 | 4.715 |
| 5yr, tc | 0.78 | 31.3 | 9.49 | 8.025 | 9.573 | 16.949 | 31.16 | 9.029 | 7.989 | 8.884 | 16.262 |
| 10yr, tc | 1 | 46.5 | 13.914 | 11.808 | 14.046 | 24.943 | 46.3 | 13.264 | 11.756 | 13.033 | 23.868 |
| 20yr, tc | 1.26 | 69.4 | 20.549 | 17.369 | 20.675 | 36.634 | 69.1 | 19.523 | 17.356 | 19.233 | 35.147 |
| 50yr, tc | 1.71 | 109.1 | 33.422 | 28.338 | 33.67 | 59.399 | 108.7 | 31.857 | 28.213 | 31.222 | 57.042 |
| 100yr, tc | 2.14 | 117.9 | 47.227 | 40.128 | 47.755 | 84.160 | 117.3 | 45.028 | 40.059 | 44.349 | 80.617 |
| tc = Time of concentration | | | | | | | | | | | |
| Source: Modified after SEEC (2011) – Table 3 | | | | | | | | | | | |

Based on the peak flow calculations of **Table 4.26, Table 4.27** presents a comparison of the changes to peak flows that would potentially occur as a result of the Project, namely Mine Site-included flows compared with Mine Site-excluded peak flows.

**Table 4.27**
**Analysis of Peak Flow Changes**

| ARI (years) | Change to Peak Flow (%) | | | | |
|---|---|---|---|---|---|
| | Catchment 1 | Catchment 2 | Catchment 3 | Catchment 4 | Catchment 2+3+4 |
| **1yr, tc** | -13.5 | -4.3 | -0.4 | -7.3 | -4.1 |
| **5yr, tc** | -0.4 | -4.9 | -0.4 | -7.2 | -4.1 |
| **10yr, tc** | -0.4 | -4.7 | -0.4 | -7.2 | -4.3 |
| **20yr, tc** | -0.4 | -5 | -0.1 | -7 | -4.1 |
| **50yr, tc** | -0.4 | -4.7 | -0.4 | -7.3 | -4 |
| **100yr, tc** | -0.5 | -4.7 | -0.2 | -7.1 | -4.2 |
| tc = Time of concentration | | | | | |
| Source: Modified after SEEC (2011) – Table 11 | | | | | |

As illustrated by **Table 4.27**, the Project would result in a slight decrease in peak flow rates by effectively isolating the Mine Site area from the surrounding catchments, thereby reducing the overall catchment area. These results may be summarised as follows.

- **Catchment 1**. The reduced peak flow rates are generally <1% and are considered insignificant and highly unlikely to have any detrimental effect on downstream water users and ecosystems. The exception is the peak flow under 1 in 100 year conditions which is predicted to reduce by 13.5% from $0.037m^3/s$ to $0.032m^3/s$. SEEC (2011) notes that this may, in fact be a result of the relatively high initial infiltration rate used in the XP-RAFTS model. The higher reduction in flow rate notwithstanding, it would ultimately contribute to a minor reduction in total flows within the catchment (6%, see Section 4.3.5.4) and is therefore unlikely to have any negative impact on downstream users or on riparian ecology.
- **Catchments 2 and 3**. The reduction in flow is less than 5% for all modelled storm events, which is not significant.
- **Catchment 4**. Peak flow rate is predicted to be reduced by between 7.0% (under 1 in 20 year ARI conditions) and 7.3% (under 1 year and 1 in 50 year ARI conditions). Notably, the surface water management strategy provides for the continued discharge of Catchments 2 and 3 into Catchment 4 which would reduce the peak flow reduction to <5% which is unlikely to be significant for downstream users or riparian ecology.

  SEEC (2011) notes that the capacity of the existing culverts conveying flows from Catchments 2 and 3 are only capable of safely passing flows under the 1 year ARI conditions. As illustrated by **Tables 4.26** and **4.27**, the Project would actually decrease peak flow volumes under all ARI conditions and therefore the upgrading of these culverts, if required, is not considered to be the responsibility of the Proponent.

#### 4.3.5.3 Flooding Characteristics

##### Catchment 1 (Gundong Creek)

Modelling of changes in flood heights within Gundong Creek (Catchment 1), using the 100-year peak flow, are presented in **Table 4.28**. *Appendix 7* of SEEC (2011) provides the river station locations referenced in **Table 4.28**.

**Table 4.28**
**Modelled 100-year Flood Heights in Catchment 1**

| River Station | Ground Level (m AHD) | 100-year flood level under existing conditions (m AHD) | 100-year flood level after development of Mine Site (m AHD) | Change in 100-year flood level |
|---|---|---|---|---|
| **0** | 264.00 | 263.86 | 263.75 | -0.11m |
| **500** | 265.75 | 265.77 | 265.75 | -0.02m |
| **1000** | 267 | 267.63 | 267.72 | +0.09m |
| **1280** | 268.10 | 268.47 | 268.85 | +0.38m |
| **1500** | 268.90 | 269.23 | 269.25 | +0.02m |
| **2000** | 270.80 | 270.99 | 271.02 | +0.03m |
| **2500** | 272.70 | 273.14 | 273.13 | -0.01m |

Source: Modified after SEEC (2011) – Table 4

The modelling suggests the flood height would be increased by up to 38mm due to the bund constructed to the east of Gundong Creek effectively excluding the Mine Site from Catchment 1. The increase in flood height reduces back to zero upstream of the Mine Site. It is noted that while the 100-year ARI event has been used as a conservative estimate for determining the minimum height required for the earth bund, it is unlikely that Gundong Creek would support the full 100-year ARI flow as it would be diverted away from Gundong Creek well upstream of the Mine Site (see Section 4.3.2.3).

Based on the results of the flood modelling, SEEC (2011) recommends a bund accounting for a minimum flood height of 750mm plus at least 500mm of freeboard would be required for the 100-year ARI flood. This freeboard would allow for the Probable Maximum Flood and to accommodate unforseen restrictions on flows that might occur off-site and downstream of the points modelled and to allow for earth bund stability when inundated. The bund design to the east of Gundong Creek provides for a height of 1 350mm which exceeds the recommendations of SEEC (2011).

Also included in *Appendix 7* of SEEC (2011) is a plan showing the spatial extent of the more realistic 2-year ARI peak storm at the location of the proposed main site access road crossing over Gundong Creek. This plan (*Appendix 7* of SEEC, 2011) illustrates that an increase of 68mm is unlikely to impact any built structures on neighbouring properties, with the change in flooding levels restricted to the Mine Site. In addition, the township of Tomingley to the north has levees in place that appear to have sufficient freeboard to accommodate an increase of 68mm in the 100-year ARI event.

### Catchment 2

The results of modelling undertaken by SEEC (2011) calculated that approximately 46 000$m^3$ of water may potentially occupy the eastern section of the Mine Site under a 1 in the 100-year ARI event assuming complete blockage of the existing culverts under the Newell Highway. The Eastern Surface Water Diversion Structure (see **Figure 4.17**) would be designed and maintained to provide for the diversion of this volume of water around the operational areas of the Mine Site.

### 4.3.5.4 Water Quality and Annual Flow Volumes

A comparison of the pre-Project and Project-effected MUSIC modelling results is contained in **Table 4.29** which illustrates that mean annual loads of all pollutants would decrease during the life of the Project when compared with the pre-Project (present) modelling. This is due to the effectiveness of surface water management measures such as sediment basins coupled with onsite re-use of collected water within the harvestable right calculation.

The results of the MUSIC modelling predict a reduction in mean annual flows from the Mine Site area of approximately 6% (17ML/yr). Given that the Mine Site makes up only 8% of the total catchment area for Gundong Creek, this reduction represents a potential flow decrease of 0.5% per year to downstream waters. SEEC (2011) concludes that a reduction of this order is unlikely to impact surface water conditions in the natural system downstream of the Mine Site nor is it likely to significantly impact downstream users.

**Table 4.29**
**Results of MUSIC Modelling (Mean Annual Loads)**

| Scenario | Description | Flow (ML/yr) | TSS[1] (kg/yr) | TP[2] (kg/yr) | TN[3] (kg/yr) | GP[4] (kg/yr) |
|---|---|---|---|---|---|---|
| **1** | Pre-development | 277 | 24,600 | 73.9 | 578 | 3.25 |
| **2** | Post-development without surface water management | 404 | 155,000 | 105 | 651 | 6,760 |
| **3** | Post-development including surface water management | 270 | 9,550 | 30 | 333 | 2.52 |
| **2 vs 3** | Treatment Train Effectiveness | -33.1% | -93.8% | -71.4% | -48.8% | -99.9% |
| **1 vs 3** | Pre vs Post Comparison | -2.5% | -61.2% | -59.4% | -42.4% | -22.5% |

Note 1: TSS = Total suspended solids
Note 2: TP = total phosphorous
Note 3: TN = total nitrogen
Note 4: GP = gross pollution

Source: Modified after SEEC (2011) – Table 8

### 4.3.5.5 Water Balance and Security

The Project would require water for operational purposes associated with processing operations, dust suppression, watering of revegetation areas and staff use (potable/ablution purposes). The estimated quantities of water that would be required for each purpose are as follows.

- Operational Water Requirements: Mintrex estimate that the processing of 1Mt per annum would require approximately 575ML of water. At the estimated maximum production rate of approximately 1.5Mt per annum, this scales up to 878ML of water per year.
- Dust Suppression and Revegetation: Based on the Proponent"s experience at the Peak Hill Gold Mine, approximately 60ML of water would be required annually.
- Potable water requirements: Based on 65 staff with a daily use of 50L per person (NSW Department of Health, 2001), annual usage would approximate 3 250L/day or 1.2MLpa.

Water would be available from three sources, namely:

- water imported to the Mine Site via the water supply pipeline;
- harvested surface water from the proposed sediment basins; and
- dewatered groundwater stored in the dewatering ponds.

It is noted that water for processing purposes would primarily be drawn from the water supply pipeline. However, water for dust suppression purposes would, where available, be drawn from the sediment basins or the mine dewatering ponds. Where water for dust suppression purposes is not available from these sources, it would be drawn from the water supply pipeline.

**Table 4.30** presents the anticipated operational water use for the Project over the life of the Project, considering only water supply from the water supply pipeline.

**Table 4.30**
**Annual Water Demand and Assessment[1]**

| Production Rate | Water requirements (ML/yr) | | | | Excess supply (assuming 1000ML from TNWP) (ML/yr) | Water supply adequate? |
|---|---|---|---|---|---|---|
| | Processing | Potable / ablutions | Dust suppression | Total demand | | |
| **General Calculations** | | | | | | |
| **Average (1Mtpa)** | 574.6 | 1.2 | 60.0 | 635.8 | 364.2 | Yes |
| **Max (1.53Mtpa)** | 877.7 | 1.2 | 60.0 | 938.9 | 61.2 | Yes |
| **Annual Calculations** | | | | | | |
| **Year 1 (1.53Mt)** | 877.7 | 1.2 | 60.0 | 938.9 | 61.2 | Yes |
| **Year 2 (1.45Mt)** | 835.8 | 1.2 | 60.0 | 897.0 | 103.0 | Yes |
| **Year 3 (0.70Mt)** | 404.2 | 1.2 | 60.0 | 465.4 | 534.6 | Yes |
| **Year 4 (0.89Mt)** | 509.1 | 1.2 | 60.0 | 570.3 | 429.7 | Yes |
| **Year 5 (1.10Mt)** | 632.4 | 1.2 | 60.0 | 693.6 | 306.4 | Yes |
| **Year 6 (0.13Mt)** | 77.3 | 1.2 | 60.0 | 138.5 | 861.5 | Yes |

Table 1: Assessment only against 1 000ML/year supply from the proposed water supply pipeline.
Source: Modified after SEEC (2011) – Table 9

**Table 4.30** illustrates that even at the maximum rate of production, the Project-water demand can be supplied by water obtained from the water supply pipeline alone. However, water for all purposes other than potable water requirements would preferentially be sought from water harvested by the sediment basins and dewatering ponds. **Table 4.31** presents the results of the water balance assessment preferentially using water sourced from the Proponents harvestable right, including the amount of makeup water that would be required from the water supply pipeline.

**Table 4.31**
**Annual Water Demand and Assessment – Preferential Use of Surface Water Harvesting**

| Production Rate | Annual Demand[1] (ML) | Daily Water Demand (ML) | Surface water Supply | Shortfall[2] | Adequate Water Supply? |
|---|---|---|---|---|---|
| Average (1.0Mtpa) | 634.6 | 1.74 | 298.9ML (47.1%) | 335.7ML (52.9%) | Yes |
| Minimum (0.13Mtpa) | 137.3 | 0.38 | 129.3ML (94.15%) | 8.0ML (5.85%) | Yes |
| Maximum (1.53Mtpa) | 937.7 | 2.57 | 328.4ML (35.02%) | 609.3ML (64.98%) | Yes |

Note 1: Excludes the 1.2ML demand for potable and ablutions water.
Note 2: To be made up from water from the water supply pipeline.
Source: Modified after SEEC (2011) – Table 10

#### 4.3.5.6 Downstream Catchment Impacts

The proposed surface water management strategy (see Section 4.3.3) would not divert water out of, or into any downstream catchment. While Drainage Lines A, B and C would be diverted either through or around the eastern section of the Mine Site, these diversions would release flows into the existing culvert beneath the Newell Highway, i.e. into the existing discharge point for Drainage Lines A, B and C.

Apart from the very minor changes to peak flows and overall flow volumes noted in Sections 4.3.5.2 and 4.3.5.4, downstream catchments would be unaffected by the Project.

#### 4.3.5.7 Effluent Management

The Proponent would install a RWWTP that would treat waste water to a standard suitable for use within the process plant. As a result, there would be no effluent-related surface water impacts associated with the Project.

#### 4.3.5.8 Water Quality and River Flow Objectives

A series of water quality and river flow objectives have been established by OEH for the Bogan River as part of the Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000). An assessment of how the Project satisfies these objectives was completed by SEEC (2011) (see *Section 6.7* of SEEC, 2011) which confirms that the Project could be operated without adverse impact on the achievement of these objectives.

#### 4.3.5.9 Controlled Activity Requirements

Gundong Creek is a second order watercourse, therefore works or activity within 40m of the bank needs to be considered against the assessment requirements of Section 167(1) of Part 8 of the *Water Act 1912*. The works include the proposed bund to the east of Gundong Creek to be constructed to protect the Mine Site from flooding and the crossing of creek by the main site access road. The location and design of the proposed bund is provided by **Figures 2.5** and **2.6** (with accompanying text provide in Section 2.2.6.2). The location and design of the Gundong Creek crossing is provided in Section 2.2.5 and various figures throughout the *Environmental Assessment* (including **Figure 2.1**)

Importantly, the proposed bund would remain greater than 20m from the bank of Gundong Creek, thereby maintaining a Core Riparian Zone (CRZ). Furthermore, the Proponent has proposed the incorporation of the remnant vegetation and improvement of native vegetation within the CRZ as part of a proposed biodiversity offset strategy.

Reference as to how the proposed construction and operation of the proposed works within 40m of Gundong Creek meets the assessment requirements of Section 167(1) of Part 8 of the *Water Act 1912* is provided in *Appendix 7* of SEEC (2011).

### 4.3.6 Monitoring and Contingency Management

#### 4.3.6.1 Monitoring

Prior to the commencement of operations on the Mine Site and during each significant flow event, water would be collected (after rainfall events which result in local flow within Gundong Creek) from Sampling Points 1 and 2 (**Figure 4.16**).

The collected water samples would be analysed for the following parameters.

- Dissolved oxygen (% saturation).
- pH or Acidity.
- Total Suspended Solids or Turbidity (NTU).
- Total phosphorus (mg/L).
- Total nitrogen (mg/L).
- Electrical conductivity (µS/cm).

Results would be compared to the baseline results recorded following the sampling of 14 July 2010 (see Section 4.3.2.4).

Once the RSF is in use, surface water would be monitored quarterly within Sediment Basin 2 for the above parameters as well as weak acid dissociable and total cyanide to determine if any leachate from the residue storage facility is leaking into the surface water management system. Any significant variation to these parameters would be investigated and appropriate action taken, possibly in consultation with the OEH.

Water accumulating in the completed voids would also be regularly sampled and analysed to measure the salinity of the water, the concentration of potential heavy metal pollutants and the presence / absence of cyanide. Monitoring would continue post-mining until either equilibrium concentrations are established, or further assessment is completed to determine the final water chemistry.

### 4.3.6.2 Contingency Management

#### 4.3.6.2.1 Water Quality Contingency Management

Given the proposed construction and maintenance of the water diversion and storage structures within the Mine Site, there is a high level of inherent measures to prevent discharge of polluted water from the Mine Site or unanticipated impact on the flow regime of the Mine Site catchments.

However, should monitoring indicate that the concentration of suspended solids or other monitored parameters contained within discharged waters exceeds the nominated limit, expert advice would be sought to modify the treatment system to ensure future discharges achieve the water quality criteria.

Should a significant oil or fuel spill occur within the Mine Site, a series of remedial actions would be taken to ensure no discharge of hydrocarbon contaminated water occurs. These would include the following.

- Sand would be used to isolate and soak up the spill. The oil soaked sand would subsequently be disposed of to an appropriately licensed waste disposal facility.
- If a hydrocarbon slick was observed within a sediment basin or pooling within the Mine Site, a protective boom would be installed around the slick to prevent the material from being discharged.

#### 4.3.6.2.2 Water Supply Contingency Management

The water balance modelling undertaken for this assessment, suggests a high level of certainty over the security of water supply. However, should higher than anticipated demand for water eventuate or lower than anticipated supply occur, the Proponent would have the option of purchasing and piping additional water from the bore located on the "Woodlands" property. The appropriate licensing arrangements would be made should this contingency arise.

#### 4.3.6.2.3 Impact Response Protocol

The procedure to be followed in the event of unforeseen surface impacts being detected during the Project would be as follows:

- The nature of the suspected impact and all relevant monitoring data would be immediately referred to an independent qualified hydrologist for assessment.

- An assessment would be made of the potential magnitude of the impact and the level of risk.
- Alternative response and mitigation measures would be tabled for discussion with the relevant government agency(ies).
- A response / mitigation plan would be implemented to the satisfaction of the relevant government agency(ies).

## 4.4 GROUNDWATER

### 4.4.1 Introduction

The DGRs identify "Soil and **Water**" as a key issue for assessment in the *Environmental Assessment* and that the assessment include a "…a detailed groundwater model and a description of final void water management".

Based on the risk assessment undertaken for the proposal (see Section 3.5), the specific groundwater-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) include the following.

- Pollution of groundwater due to leaching of contaminants from the RSF resulting in a reduction in beneficial uses of the water and therefore availability to existing groundwater users (high risk).
- Pollution of groundwater due to hydrocarbon spills resulting in:
  - Contamination requiring minor recovery works (moderate risk); or
  - Contamination requiring major recovery works (high risk).
- Reduction of groundwater levels due to mining intercepting aquifers resulting in:
  - Reduction in the volume of water contained within the affected groundwater aquifer (drawdown of water table) (high risk);
  - Reduced yields of local groundwater bores (moderate risk); and/or
  - Reduced viability of groundwater dependent ecosystems (low risk).
- Reduction in groundwater bore yields resulting in:
  - Reduced yields in the groundwater bores of the Gundong Creek Alluvium (moderate risk); or
  - Reduced yields in the groundwater bores of the fractured rock aquifers (moderate risk).
- Reduction in contribution to surface water flows resulting in:
  - Reduced surface flows to Gundong and other creek catchments of the Bogan River (moderate risk); and/or
  - Reduced viability of groundwater dependent ecosystems (low risk).

The groundwater assessment for the Project, incorporating groundwater modelling completed by Mr Duncan Irvine of Australasian Groundwater and Environmental Consultants Pty Ltd ("AGE"), was undertaken by Mr James Morrow of The Impax Group ("Impax"). The resulting report is presented as Part 3 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Impax (2011)". This sub-section of the *Environmental Assessment* provides a summary of that report.

It is noted that there would be no groundwater intersected or any groundwater impacts associated with the proposed water pipeline. As a result, the groundwater assessment focuses only on the groundwater impacts within and surrounding the Mine Site.

## 4.4.2 Existing Environment

### 4.4.2.1 Introduction

In order to obtain an understanding of the regional and local hydrogeology within and surrounding the Mine Site, Impax (2011) completed a review of available groundwater information over a 20km radius area centred on the Mine Site. This included a review of the NOW registered groundwater bore database, supplementary information collected during preliminary groundwater studies undertaken by Coffey Geotechnics Pty Limited in 2007 and a review of the Narromine 1:250 000 Geological Series Sheet.

### 4.4.2.2 Regional Hydrogeological Setting

Impax (2011) identifies a total of 45 registered bores within the 20km radius search area centred on the Mine Site (search date: 7 January 2010). The location of the bores are shown on **Figure 4.18.**

Of the identified bores, 15 are located within 10km of the Mine Site. Seven of these located to the north and northeast of Tomingley ("the Tomingley Bores"), with depths ranging from 1.8m to 18.3m, target the alluvium associated with Gundong Creek. To the south, two bores have been drilled through clay topsoil, shale, siltstone and/or conglomerate bedrock while to the northeast, one bore has been drilled through to sandstone and basalt. A cluster of five bores are also registered at the Tomingley Service Station as monitoring bores with no record of groundwater intersection.

A further thirty registered bores were identified between 10km and 20km from the centre of the Mine Site.

The descriptive logs of the registered bores, where available, correspond generally with the information provided on the inferred geology of the Narromine 1:250 000 Geological Series Sheet. That is, the Mine Site and surrounding area is underlain by "alluvium (clay)", "shale" and "siltstone." Groundwater is typically encountered in the shale and/or siltstone at depths greater than 50m below ground level. While the boundaries of this aquifer beneath the Mine Site are not clear, similar subsurface conditions appear to extend approximately 10km to the north, and up to 20km south of the Mine Site. Impax (2011) suggests that the "Obley Granite" (approximately 10km northeast of the Mine Site), "Dulladerry Volcanics" (approximately 7km to the east of the Mine Site), "Hervey Group" (approximately 10km southeast of the Mine Site) are likely to form aquifer boundaries to the east of the Mine Site. There appear to be no defined significant aquifer boundaries to the northwest and west of the Mine Site.

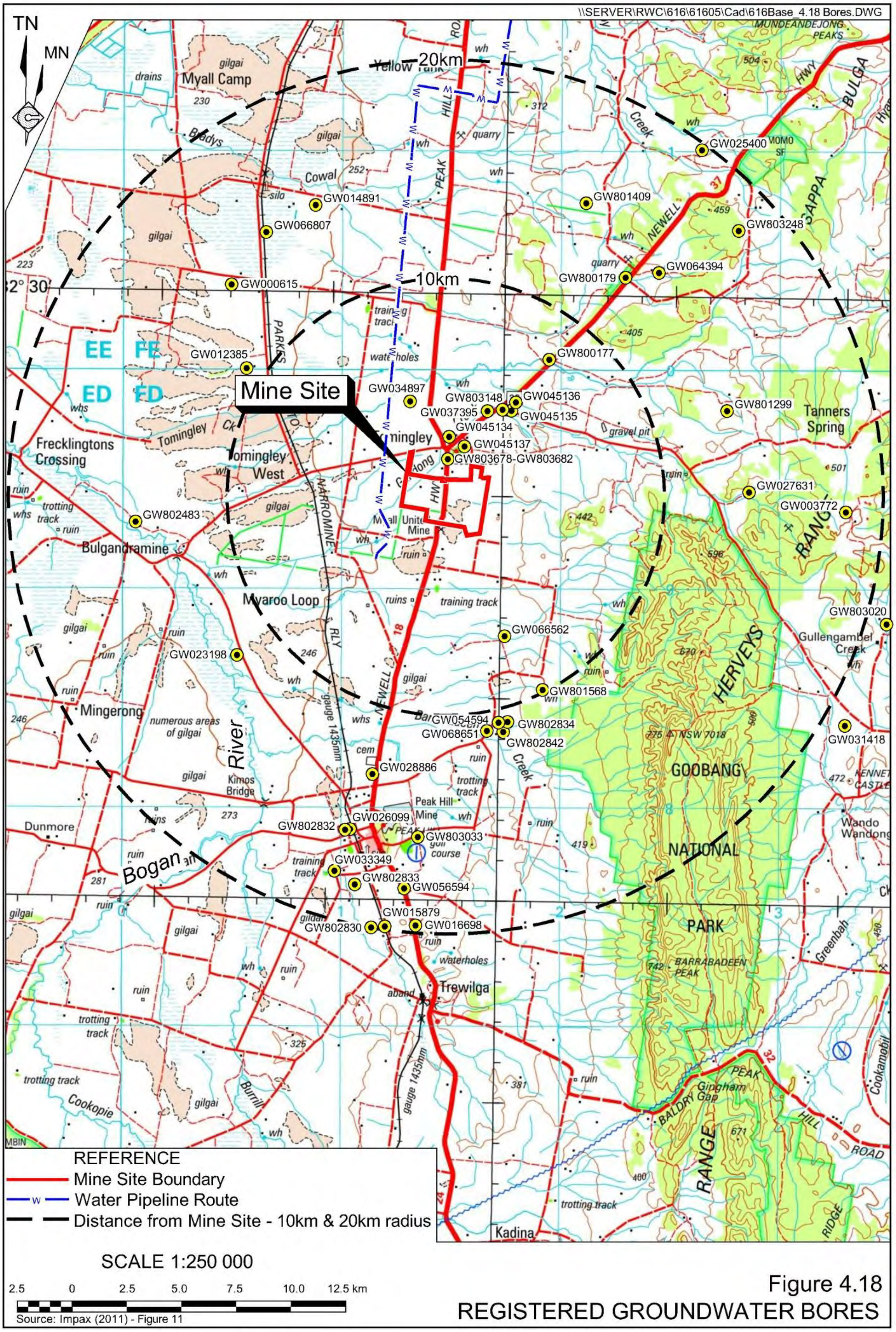



Figure 4.18
REGISTERED GROUNDWATER BORES

Impax (2011) suggests that the relative paucity of registered groundwater bores within 10km of the Mine Site indicates that the quantity and quality of groundwater in this area is limited (this is supported by analysis of groundwater quality – see Section 4.4.2.4). Many of the bores identified during the search were registered as "Test Bores" and many bores were listed as being "Abandoned". These results indicate shale and siltstones located within 10km of the Mine Site yield relatively low flow volumes of poor quality water.

#### 4.4.2.3 Mine Site Hydrogeological Setting

Preliminary groundwater studies within and surrounding the Mine Site were conducted by Coffey Geotechnics Pty Ltd between 2006 and 2008. Five groundwater bores were installed within 2km of the Mine Site (see **Figure 4.19** and **Table 4.32**). These bores were air lifted following completion and groundwater yields calculated from air lifting rates ranged from nil to 0.3L/s.

**Table 4.32**
**Mine Site Bore Construction Details**

| Bore ID | Hole Depth | Depth of Casing | Screened Interval | Bentonite Seal | Standing Water Level[1] |
|---|---|---|---|---|---|
| WYMB001 | 90m | 90m | 84-90m<br>78-81m | 60m | 40.4m btc |
| WYMB002 | 114.5m | 114m | 108-114m<br>102-105m | 71.2m | 59.5m btc |
| WYMB003 | 84m | 84m | 78-84m<br>69-72m | 42m | 53.7m btc |
| WYMB004 | 96m | 78m | 72-78m | 30m | 63.4m btc |
| WYMB006 | 90m | 90m | 84-90m<br>75-81m | 60m | 37.3m btc |
| Note 1: m btc = metres below top collar. All other depths = depth below ground. | | | | | |
| Source: Modified after Impax (2011) – Table 1 | | | | | |

Measured standing water levels in the bores ranged from 37.2m to 63.5m below ground level. Standing water levels in the bores were monitored for a period of three months following construction. Recorded standing water levels remained relatively unchanged throughout the monitoring period even though there was a significant rainfall event during the monitoring period. Based on this observation, it could be concluded that the aquifer(s) being monitored have limited connectivity with the surface.

In addition, the Proponent has drilled over 1 300 exploration drill holes within and in the vicinity of the Mine Site. Observations made during the drilling of all exploration holes have been logged and may be summarised as follows.

- Groundwater flow was not recorded in exploration holes between the surface and a depth of 50m.
- Groundwater flow was observed in approximately 7.5% of exploration holes that penetrated to between 50m and 100m below surface.
- Groundwater flow was observed in a further 10% of exploration holes that penetrated more than 100m below surface.

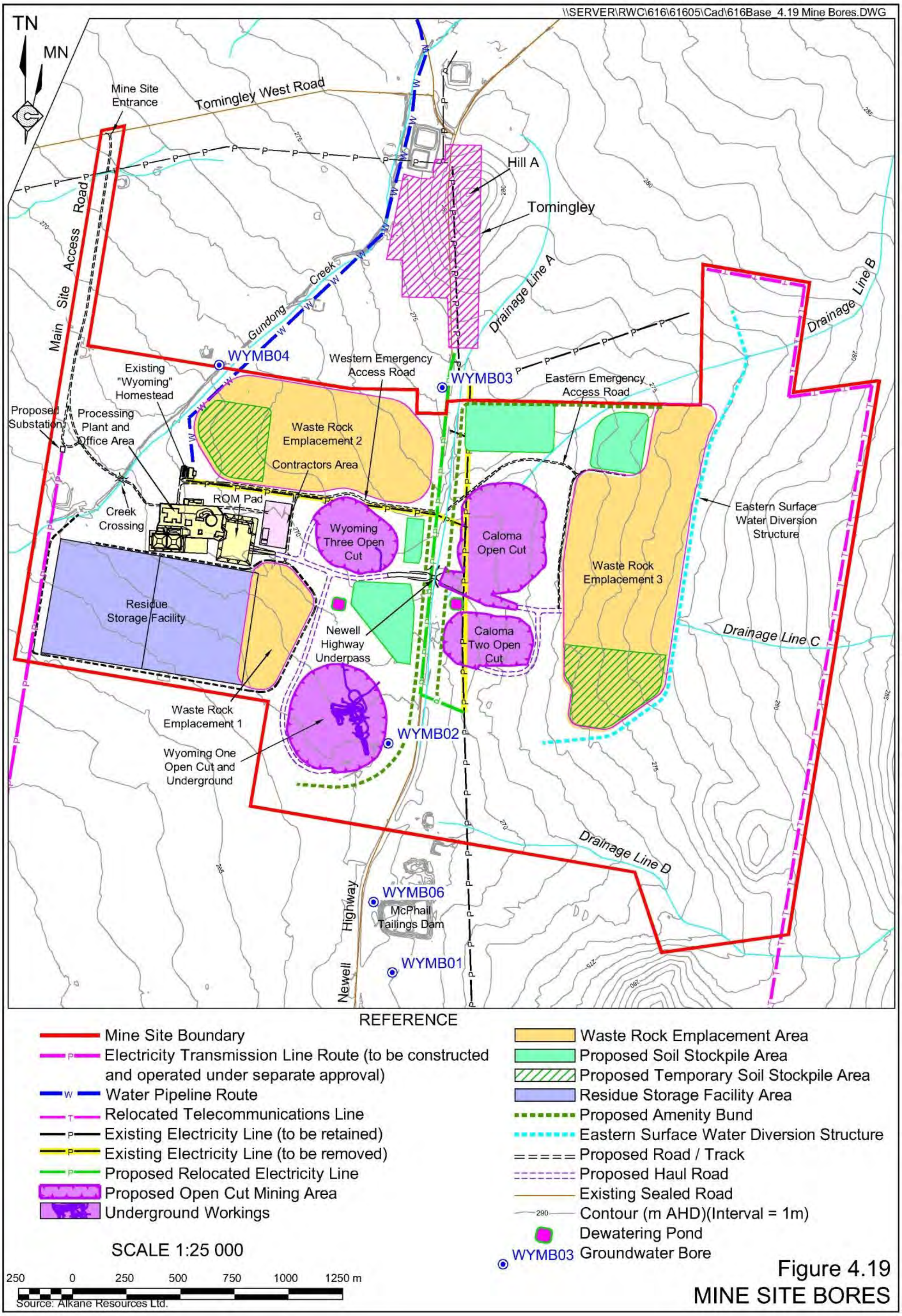



Figure 4.19
MINE SITE BORES

When encountered, groundwater was typically identified at depths between 70m and 100m below ground level and 120m and 130m below ground level and was often intersected in proximity to the identified mineralisation.

### 4.4.2.4 Groundwater Quality

An indication of groundwater quality was obtained by Coffey (2007) for the deeper groundwater sources below the Mine Site and by Impax (2011) for the shallow alluvial aquifer of Gundong Creek (targeted by the Tomingley Bores – see **Figure 4.18**).

The water quality within the five bores sampled by Coffey (2007) was generally consistent, indicating groundwater sampled from each of the deep bores had a similar origin. All sampled water was saline with an electrical conductivity (EC) range of 10 800µS/cm to 29 200µS/cm. The chemistry of water sampled from the shallow alluvium by Impax (2011) was different to that of water sampled from the deeper bores, being fresher (EC of 444µS/cm) and with a different proportion of cations and anions.

The results of water quality analyses indicate that there appears to be limited connection between groundwater in the shallow alluvium and deeper shale/siltstone aquifer(s).

### 4.4.2.5 Groundwater Availability and Use

The registered uses of bores located within 10km of the Mine Site include "monitoring bore", "test bore / public supply", "test bore", "irrigation" and "stock and domestic". Based on a review of these bores undertaken by Impax (2011), it appears very few are currently used to supply water, with some abandoned and others apparently never used for the intended “public supply” purpose.

Of those currently used, the targeted groundwater source appears to be the Gundong Creek alluvium. The restricted availability of water from the deeper aquifer below the Mine Site is supported by pump tests completed by Impax (2011) in three of the bores originally sampled by Coffey (2007). This testing indicated low pumping rates (<0.25L/s) and variable recovery of standing water level.

Between 10km and 20km from the Mine Site, there is an increase in the number of bores registered for stock and domestic use. Notably, these appear to target water held within the Obley Granite or deeper alluvial aquifers, e.g. Bogan River alluvium. Given the distance from the Mine Site, and the different source of groundwater, Impax (2011) considers these bores as unlikely to be affected by the Project.

### 4.4.2.6 Summary

Considering the available data provided by the NOW registered bore database, the Narromine 1:250 000 Geological Series Sheet and the groundwater investigations of Coffey (2007, 2008), Impax (2011) concludes that groundwater is available in the following aquifers within and surrounding the Mine Site.

#### Shallow Alluvium

Groundwater appears to occur in relatively shallow (less than 20m deep) alluvium associated with drainage lines surrounding the Mine Site, e.g. the alluvium surrounding Gundong Creek. These aquifers are likely to be recharged locally, primarily from surface water infiltration. Groundwater within these systems appears to be of relatively good quality, although yields are likely to be relatively low and dependent on the occurrence of rainfall and recent climatic conditions.

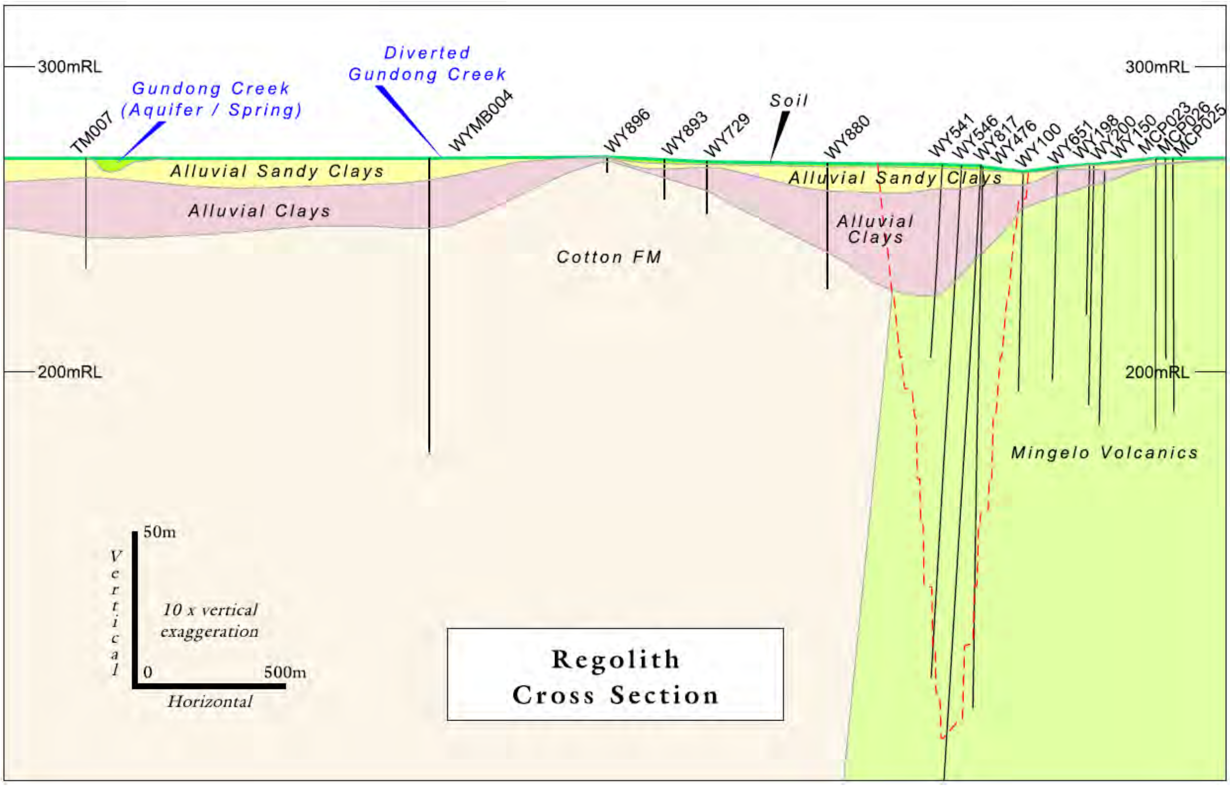
### Deep Alluvium

Deep alluvium (up to 100m below ground level) appears to be present more than 10km to the northwest and west of the Mine Site. Available data indicates that groundwater yields within these systems are relatively low and that water quality is variable. These systems may have some interaction with underlying bedrock but are likely to be primarily recharged from surface water.

### Fractured Rock

There are likely to be several fractured rock aquifer systems located within 20km of the Mine Site. The plains surrounding the Mine Site are typically underlain by shale, siltstone and chert of the "Cotton Formation", "Mingelo Volcanics". Groundwater yields in this aquifer range from nil to 3L/s but are typically less than 1.5L/s. Available groundwater quality information indicates that groundwater within this system is saline.

**Figure 4.20** presents a cross-section through the Mine Site identifying each of the three aquifers.




Source: Alkane Resources Ltd

**Figure 4.20**
**GEOLOGICAL CROSS SECTION IDENTIFYING AQUIFERS**

Other surrounding fractured rock aquifers include aquifers within the:

- "Obley Granite", located more than 10km to the northeast and east of the Mine Site;
- the "Hervey Group" sedimentary rocks, located more than 10km to the southeast of the Mine Site; and
- the "Goonumbla Volcanics", which are located more than 15km to the south of the Mine Site.

Impax (2011) suggests it is unlikely that there is any significant interaction between groundwater in the "Obley Granite", "Hervey Group" and the "Goonumbla Volcanics" hard rock aquifers, and/or the hard rock aquifers underlying the Mine Site and its surrounds.

## 4.4.3 Potential Impacts on Groundwater Quality and Availability

### 4.4.3.1 Potential Sources of Groundwater Contamination

Potential sources of groundwater contamination are as follows.

- Acid generation by the overburden and/or ore residue.

  The waste rock lithologies primarily comprise clays, shales, siltstones and sandstones, schists, feldspar porphyry and dolerite, which are considered unlikely to provide source material for acid mine drainage. Further evidence for the non-acid generating nature of the waste rock is provided by the assessment of local groundwater quality which indicates neutral to slightly alkaline water. Further, geochemical characterisation of the residue from various ore types were sent to GCA Pty Ltd for characterisation. All samples were determined to be non-acid forming.

- Leachate from the RSF.

  Leachate from the storage of residue (tailings) has potential to contain low levels of heavy metals or cyanide which could migrate from the residue storage facility and into the ground (and possibly) groundwater below.

- Fuel, oil or other hydrocarbon spills or leaks.

  Fuel spills, or undetected leaks, could potentially seep into the ground and migrate to the groundwater below.

### 4.4.3.2 Potential Impacts on Groundwater Availability

The voids created by the excavation of the open cuts and underground mine would intercept the groundwater table (currently situated approximately 60m below surface). During mining operations, accumulated groundwater (as well as incident rainfall) would be pumped or would evaporate from the open cuts and underground. Following cessation of mining operations, pumping of that water would cease, however, accumulated water would continue to evaporate. This would result in a lowering of the pressure gradient in the aquifer and a lowering of the standing water levels within the aquifer. This may subsequently impact on the yield of the groundwater bores on landholdings surrounding the Mine Site or reduced flows to surface water or groundwater dependent ecosystems.

## 4.4.4 Management and Mitigation Measures

### 4.4.4.1 Groundwater Contamination

#### 4.4.4.1.1 Hydrocarbon and Chemical Contamination

The Proponent would implement the following hydrocarbon and chemical management and mitigation measures to minimise the potential for groundwater contamination.

- Securely store all hydrocarbon and chemical products.
- Refuel all equipment within designated areas of the Mine Site, where practicable.

- Undertake all maintenance works involving hydrocarbons, where practicable, within designated areas of the Mine Site, such as the maintenance workshop.
- Direct all water from wash-down areas and workshops to oil/water separators and containment systems.
- Ensure all hydrocarbon and chemical storage tanks are either self-bunded tanks or bunded with an impermeable surface and a capacity to contain a minimum 110% of the largest storage tank capacity.

#### 4.4.4.1.2 Residue Contamination

The Proponent would implement the following residue management and mitigation measures to minimise the potential for groundwater contamination.

- Design and construct the RSF as described in Section 2.7.2.2 and in accordance with the requirements of the relevant government agencies. Key design parameters would be as follows.
  - Maximise water recovery from the residue.
  - Construct the floor and walls of the residue storage facility of clay material that would be compacted to achieve a permeability of less than $1 \times 10^{-9}$m/sec.
  - Construct a drainage channel at the base of the inside wall of the residue storage facility and directly beneath the residue inflow spigots to capture the drainage that occurs at the time of residue placement.
  - Construct central decant towers fitted with submersible pumps in the centre of each residue cell.
  - Place residue uniformly around the perimeter of the residue storage facility via several slurry spigots.
- Install piezometers around the perimeter of the residue storage facility and monitor these regularly to assess the integrity of the facility (see Section 4.4.8).

### 4.4.4.2 Groundwater Availability

There are a limited number of registered groundwater bores within the potential area of aquifer drawdown. Emphasis on the management of groundwater availability would therefore be placed on the monitoring of surrounding groundwater levels to verify whether there is likely to be any impact on the yields of these bores (see Section 4.4.2.5) and mitigation or compensation for any loss in groundwater availability. Replacement and/or compensatory measures would be developed in consultation with the affected landowner but may include:

- deepening of the effected bore to increase the available saturated thickness;
- drilling and installation of a replacement bore outside the area of drawdown impact;
- construction of surface water capture and containment structures such as dams or rainwater tanks to supplement reduced groundwater source; or
- transfer of groundwater drawn from a Proponent-owned bore or the void itself.

#### 4.4.4.3 Final Void Water Management

Given the open cuts are likely to be groundwater sinks, groundwater would continue to accumulate within the voids even after equilibrium is reached (see Section 4.4.6.3), i.e. to replace water lost through evaporation. Initially, the water quality within the final voids would be similar to that of the local groundwater, however, as a consequence of the evaporation exceeding rainfall, the salinity of the water within the void would gradually increase, due to the crystallisation process of evaporation.

The exact final salinity level of water within the retained void has not been calculated, however, existing research for other open cut mines, e.g. Mackie Environmental Research (2003), would suggest a salinity concentration of in excess of 15 000mg/L could be expected before an equilibrium in the system is reached (over several hundred years).

Managing the final void water would focus on preventing or restricting access to the void, as well as preventing any interaction of the water with external water sources.

- Access to the voids would be prevented through the construction of the safety bund described in Section 2.14.6.5. Signage would be installed to warn of the void and deep water and the possible fencing of the voids would be discussed with the owners of the property prior to mine closure.
- The bunding constructed around the void would prevent the flow of surface water into the void (which could otherwise attract fauna into the void).
- The depth to the final water level within the voids would prevent any interaction with local surface water.
- No water would be pumped from the final voids following the completion of mining within these. As such, any accumulating salinity or other possible contaminants would be retained within the void.
- Should hydrocarbon products or other contaminants be spilled into the void, appropriate spill remediation and recovery would be implemented. The exact procedures to be implemented would be dependent on the product spilled and follow the advice requested from and provided by OEH.
- The Proponent would sample and analyse the chemistry of the accumulated water. The exact details of water monitoring will be included in a *Water Management Plan* to be prepared following receipt of project approval and Section 4.3.6 provides an overview of likely monitoring approach.

### 4.4.5 Assessment Methodology

#### 4.4.5.1 Introduction

The open cuts and underground workings are expected to intersect groundwater which would result in a drawdown of the standing water level on and surrounding the Mine Site. At the cessation of mining, groundwater would continue to flow into the remaining open cut voids and underground workings until such time as equilibrium between the various parameters effecting flow is reached. The following sections provide a brief overview of the methodology used to predict these processes.

### 4.4.5.2 Modelling Groundwater Inflow, Aquifer Drawdown and Dewatering Requirements

#### 4.4.5.2.1 Groundwater In-flow and Aquifer Drawdown

An assessment of likely groundwater in-flow rates into the proposed open cuts and underground workings, and calculation of the possible radius of influence on groundwater levels of dewatering is provided by Impax (2011). This assessment relies on modelling undertaken by AGE using equations developed by Marinelli and Niccoli (2002) (see *Appendix 6* of Impax, 2011).

The analytical method of Marinelli and Niccoli (2000) requires a simplification of the hydrogeological environment and is used to provide a „broad" range of potential pit inflow. A more detailed discussion of this method of assessment, inputs used and assumptions made is provided by Impax (2011) (*Appendix 6* and *Section 7.3*).

#### 4.4.5.2.2 Dewatering Requirements

The volume of water accumulating within the open cuts, and therefore the dewatering requirements would be function of the following parameters.

- In-flow rate – predicted for each open cut in accordance with the methodology discussed in Section 4.4.5.2.1.
- Rainfall / runoff – estimated on the basis of open cut catchment surface area and rainfall data obtained from the most proximal Bureau of Meteorology Station.
- Evaporation – estimated based on Bureau of Meteorology and a pan evaporation factor of 0.7 (to account for the fact the final void is a deep, semi-shaded open cut and protected from winds, all of which reduce evaporation).

Impax (2011) acknowledges that it is difficult to accurately determine the amount and intensity of rainfall, and the amount of evaporation that would occur from the open cuts over the life of the Project. As such, Impax (2011) considered best, worst and average case scenarios to assess dewatering requirements of the open cuts. In the best case scenario, groundwater inflow would be low and evaporation would be high. In the worst case scenario, groundwater inflow would be high and evaporation would be low. In the average scenario, it is assumed that groundwater inflow would be approximately 10L/s and that evaporation would occur from the open cuts at a rate of 50% of the BOM pan evaporation rate. Rainfall is assumed to be average in each scenario.

### 4.4.5.3 Predicted Aquifer Recovery

As the completed open cuts would remain voids in the final landform, and dewatering would cease immediately following the removal of the last ore, the final voids would gradually fill with water until equilibrium is established. The rates of recovery of the water levels and the equilibrium water levels for the final open cuts were determined using a spreadsheet water balance model developed for each site considering the following parameters.

- The size and shape of the voids.
- Direct rainfall into the voids.
- Groundwater inflow.
- The rate of evaporation from the surface of the water accumulated in the voids.

Groundwater in-flows into the post-mining voids were estimated using the following form of the Darcy Equation:

$$Q = KiA \ \ m^3/\text{day}.$$

Rainfall and evaporation data was simulated as daily time steps for a period of 120 years.

## 4.4.6 Modelling Results

### 4.4.6.1 Mine In-flow and Drawdown Impacts

#### 4.4.6.1.1 Caloma Open Cut

Caloma Open Cut would be the largest and deepest of the four open cuts and modelling predicts this to be subject to the greatest potential inflows and drawdown impact. Groundwater inflow and drawdown is estimated to be as follows.

- Groundwater in-flows between 2L/s and 12L/s. Impax (2011) reports that given the general indication that the rock mass is tight, in-flow is likely to be at the lower end of the range (2L/s to 7L/s).
- Lateral extent of drawdown of between 1 700m and 3 900m.

Impax (2011) notes that not all water would report to the open cut sump as a significant volume would be lost to evaporation or removed with the ore or waste rock. Higher inflows may be experienced periodically when water-bearing fractures are intersected, but these inflows are likely to be short term as the fractures are expected to drain relatively quickly.

#### 4.4.6.1.2 Wyoming One Open Cut

The extents of the Wyoming One Open Cut are slightly smaller than those for the Caloma Open Cut and the modelling predicts a slight reduction in groundwater in-flow but a generally similar extent of drawdown.

- Groundwater in-flows between 2L/s and 11L/s. As for Caloma Open Cut, Impax (2011) reports it is likely that in-flow would be at the lower end of the range (2L/s to 7L/s).
- Lateral extent of drawdown of between 1 700m and 3 900m.

As for the Caloma Open Cut, Impax (2011) notes that in-flow would be variable and not all water would report to the open cut sump as a significant volume would be lost to evaporation or removed with the ore.

#### 4.4.6.1.3 Wyoming One Underground

The proposed continuation of mining by developing an underground mine from the base of the Wyoming One Open Cut would result in additional and greater impact on the surrounding groundwater regime.

- Groundwater in-flows between 3L/s and 20L/s. As for the open cuts, Impax (2011) report that it is likely that due to the general indication that the rock mass is tight, in-flow would be at the lower end of the range (3L/s to 11L/s).
- Lateral extent of drawdown of between 2 300m and 5 600m.

Impax (2011) notes that in-flows would be variable and that not all water would report to the underground sumps (as some would be lost as water vapour removed by extraction through the ventilation system).

#### 4.4.6.1.4 Wyoming Three Open Cut

The Wyoming Three Open Cut is much shallower than the Caloma and Wyoming One Open Cuts and therefore estimates of in-flow and extent of drawdown are significantly reduced.

- Groundwater in-flows between 0.3L/s and 1.5L/s.
- Lateral extent of drawdown of between 650m and 1 450m.

As for the Caloma and Wyoming One Open Cuts, Impax (2011) notes that in-flows would be variable and not all water would report to the open cut sump (as a significant volume would be lost to evaporation or removed with the ore and waste rock).

#### 4.4.6.1.5 Caloma Two Cut

Modelling of the Caloma Two Open Cut was not completed, however, due to the restricted depth of this open cut (100m below surface) compared to the other open cuts (up to 200m below surface), Impax (2011) report that the excavation of this open cut would not result in any additional impacts to groundwater.

#### 4.4.6.1.6 Cumulative Impacts

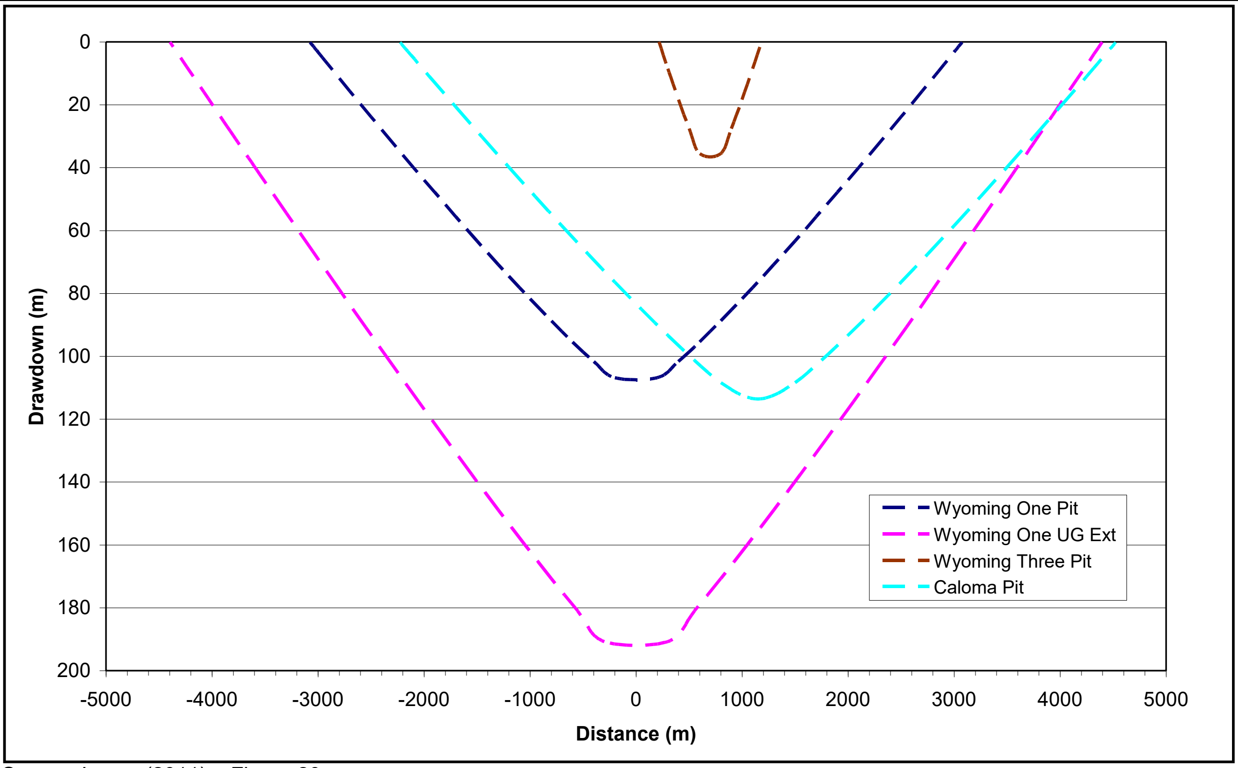
The results of modelling presented in Sections 4.4.6.1.1 to 4.4.6.1.4 consider each open cut or underground impact individually. Given the mining operations would be undertaken concurrently or consecutively, Impax (2011) notes that the modelling results would over estimate these impacts. That is, where two or more open cuts are mined concurrently, the in-flows to each open cut would be less than that predicted to each open cut individually. Similarly, if mined consecutively, inflows to the second and third open cuts would be less than those to the first mined open cut.

A review of all modelling results has been completed by AGE and reported in Impax (2011) and identifies that maximum drawdown would be governed by the depth of the underground operation, and hence would not be expected to alter significantly from that predicted for the underground mine, i.e. the predicted drawdown from each of the open cuts is generally within this larger drawdown extent (see **Figure 4.21**).

In summary, if the Wyoming One underground is kept free of water the resulting aquifer drawdown would be sufficient to dewater the adjacent open cuts. That is, the maximum rate of total groundwater inflow to all mine voids would be between 3L/sec and 20L/sec. The maximum lateral extent of the cone of depression would be between 2 300m and 5 600m from the Wyoming One Open Cut.

### 4.4.6.2 Open Cut Dewatering Requirements

**Table 4.33** presents the predicted dewatering requirements for best, average and worst case scenarios nominated in Section 4.4.5.2.2.




Source: Impax (2011) – Figure 20

**Figure 4.21**
**COMPARISON OF PREDICTED DRAWDOWNS**

**Table 4.33**
**Open Cut Dewatering Requirements**

| Evaporation Scenario | Rainfall Inflow to Open Cuts | Groundwater Inflow to Open Cuts | Losses to Evaporation | Mechanical Dewatering Rate Required |
|---|---|---|---|---|
| Best Case | 232.5ML/yr | 94.6ML/yr | -759.2ML/yr | 0ML/yr |
| Average | 232.5ML/yr | 315.4ML/yr | -379.6ML/yr | 168.3ML/yr |
| Worst Case | 232.5ML/yr | 630.7ML/yr | -0ML/yr | 863.2ML/yr |
| Source: Modified after Impax (2011) – Table 9 | | | | |

In a worst case scenario, Impax (2011) predicts that 863.2ML/yr or 27.4L/s would require dewatering. This would be significantly reduced in the average scenario (168.3ML/yr or 5.3L/s) and would not be required in the best case scenario.

In reality, groundwater in-flow, rainfall and evaporation are likely to vary significantly during the year. Therefore, it is probably that there would be some periods when pumping would be necessary and other periods where evaporation would be sufficient to remove groundwater and incident rainfall inflows to the open cuts. It is also noted that as ongoing groundwater in-flows exhaust stored groundwater from the adjacent fractured rock aquifer(s), the rate of in-flow and therefore dewatering would reduce over the life of the Project.

#### 4.4.6.3 Predicted Aquifer Recovery

Following the cessation of mining operations pumping of water from the open cuts would cease. As a result, evaporation would be expected to be the only mechanism by which water would be removed from the open cuts. In addition, the surface of water that would accumulate within the open cuts would be expected to be equal to the potentiometric surface in the deep fractured-rock aquifer immediately adjacent to the open cuts.

Modelling of aquifer recovery at the cessation of mining (see Section 4.4.5.3) completed by AGE and reported in Impax (2011) predicts that the underground and open cuts are expected to partially fill with water once mining is completed. The initial in-flow of water is expected to be relatively rapid over the initial 5 to 10 years before slowing as the larger surface area of the void reduces the rate of filling achieved by groundwater in-flow. Impax (2011) reports that water levels in the open cuts would stabilise after approximately 85 years in the deeper open cuts (Caloma and Wyoming One) and after approximately 50 years in the shallower open cuts (Wyoming Three and [by inference] Caloma Two) at between 193m and 207m AHD. This is below the pre-mining groundwater level of 210m AHD and well below the lower open cut crest levels of between 265m and 270m AHD.

Based on the above predictions of water level equilibrium, the final voids would remain as sinks to groundwater flow and should not over top or discharge water from the open cuts to the regional aquifer.

## 4.4.7 Assessment of Impacts

### 4.4.7.1 Groundwater Availability

#### Shallow Alluvium Aquifers

Impax (2011) concludes that the Project is unlikely to have any adverse impact on the groundwater contained within the shallow alluvium of Gundong Creek for the following reasons.

- No groundwater has been identified in shallow alluvium or clay material in any of the exploration holes drilled within the Mine Site. These observations indicate that there are no significant aquifers located in shallow alluvium within the vicinity of the proposed open cuts.
- The alluvium of the Mine Site and surrounding areas is located within well-defined palaeochannels. Therefore, if groundwater was drained from alluvium adjacent to the open cuts the effects of this dewatering would only propagate as far as the palaeochannel boundary (the nearest bedrock high). As such, potential dewatering of alluvium at the Mine Site (if groundwater is encountered) is not expected to propagate off the Mine Site, and is unlikely to impact on other potential users of groundwater within the underlying alluvium.

#### Deep Rock Aquifers

The modelling results predict drawdown would be limited to a maximum of between 2.3km and 5.6km from the Wyoming One underground. This drawdown would develop progressively, and based on the general indication that the rock mass is tight, drawdown is expected to be at the lower end of this range.

Water levels within the open cuts and the potentiometric surface immediately adjacent to them, would be expected to rise following cessation of mining operations. The final water level within the open cuts would be expected to be between 193m and 207m AHD, i.e. 3m to 17m below the pre-mining groundwater level of 210m AHD.

In considering the potential impact of the predicted drawdown, the following is noted.

- There are no registered users of groundwater from deep fractured rock aquifers located within 10km of the Mine Site, presumably due to the poor yields (if yielding at all) and poor quality of the water.
- Available water quality data indicates that groundwater within the fractured rock aquifer(s) surrounding the Mine Site is highly saline and therefore has limited potential for beneficial re-use. As such, it is unlikely that the groundwater resource could be developed for other future uses.

As such, the extraction of groundwater from the open cuts, and subsequent drawdown within the aquifer (even if it occurs to the maximum level predicted by the model) would not impact on any existing or future groundwater users.

#### 4.4.7.2 Groundwater Quality

The potential for the Project to impact adversely on groundwater quality is dependent upon the storage, containment and use of liquid or soluble potential contaminants on site such as hydrocarbons or other chemicals. However, the management of hydrocarbons and residue as described in Section 4.4.4.1.1, would make groundwater contamination as a result of the Project highly unlikely. In addition, it is likely that water levels within the open cuts would remain lower than the current standing water level. As a result, the open cuts are likely to be groundwater sinks, reducing the potential for contaminated or saline water to enter the aquifer from the open cuts.

#### 4.4.7.3 Final Void Water Quality

While an elevated salinity level is expected within the final void, this would be effectively isolated from the surface water drainage system of the final landform as the likely final water level of between 193m AHD and 207m AHD would be between 60m and 80m below the lowest point of the surrounding final landform. The potential for impact on downstream waters would therefore be minimal.

As discussed in Section 4.4.7.2, the risk of advective dispersion of salinity back to the aquifer would also be minimal due to the ongoing seepage into the void resultant from the evaporative process.

#### 4.4.7.4 Groundwater Dependent Ecosystems

No groundwater dependent ecosystems have been identified within or in the vicinity of the Mine Site (Impax, 2011). While it is noted that mature trees occur along Gundong Creek and that these trees may use groundwater in shallow alluvium, they are not considered to be solely dependent on groundwater for their survival and are therefore, not considered to represent a groundwater dependent ecosystem.

## 4.4.8 Monitoring

### 4.4.8.1 Objectives

The Proponent would implement groundwater monitoring during the life of the Project to achieve the following objectives.

- Establish baseline groundwater conditions at the Mine Site, from which potential future impacts can be assessed.
- Obtain data that can be used to assess mining-related impacts to groundwater levels and groundwater quality in the vicinity of the Mine Site.
- Identify unforeseen groundwater problems as early as possible to enable procedures to be changed or improved to prevent significant degradation of groundwater resources at the Mine Site.

### 4.4.8.2 Monitoring Locations

The existing groundwater bores WYMB01, WYMB03 and WYMB06 would be used to monitor potential impacts on deep fractured aquifer groundwater at the Mine Site.

In addition, a number of groundwater monitoring piezometers would be installed around the perimeter of the RSF to assess potential impacts upon shallow groundwater. These monitoring piezometers would be constructed to a depth of approximately 5m below ground level. It is anticipated that these piezometers would remain dry during the life of the Project.

### 4.4.8.3 Monitoring Schedule

The Proponent would conduct baseline monitoring of all bores prior to the commencement of mining. This would include measurement of standing water levels (SWLs), field measurement of water quality parameters (pH, electrical conductivity) and laboratory analysis of samples for major cations, major anions, metals, acidity, alkalinity and total suspended solids.

Regular monitoring of shallow monitoring wells adjacent to the residue storage facility would commence as soon as the residue storage facility was in use. Regular monitoring of deep monitoring wells would commence once mining operations commence.

All bores would be gauged on a monthly basis. If water is present, the standing water level, pH and electrical conductivity would be measured in the field and recorded.

Deep monitoring wells would be sampled on an annual basis, with samples analysed in a laboratory for major cations, major anion, metals, acidity and alkalinity.

# 4.5 BIODIVERSITY

## 4.5.1 Introduction

The DGRs identify "***Biodiversity** – including: accurate estimates of any vegetation disturbance associated with the project; impacts on threatened species, populations or ecological communities, critical habitats and native vegetation generally; and a detailed description of the measures that would be implemented to maintain or improve the biodiversity values region in the medium to long term"* as a key issue for assessment in the *Environmental Assessment*. Based on the risk assessment undertaken for the Project (see Section 3.5), the specific biodiversity impacts that may result as a consequence of the Project (<u>without the</u>

implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment would include the following.

- Direct impacts on native flora and fauna - clearing of vegetation resulting in:
  – loss of, or alteration to, existing habitats (extreme risk);
  – removal or mortality of individual species (extreme risk);
  – local or regional reduction in distribution of threatened species, populations and endangered ecological communities (high risk); and/or
  – possible local extinction of threatened species, populations and endangered ecological communities (high risk).
- Direct impacts on native flora and fauna - road kill resulting in:
  – mortality of individual species (moderate risk); and/or
  – local or regional reduction in distribution of threatened species, populations and endangered ecological communities (high risk).
- Direct impacts on native fauna - pooling of contaminated water on the RSF resulting in:
  – mortality of individual species (high risk); and/or
  – local or regional reduction in distribution of threatened species, populations and endangered ecological communities (moderate risk).
- Indirect impacts on flora, fauna and fauna habitat, e.g. noise, dust etc. resulting in:
  – alteration to existing habitats (moderate risk); and/or
  – local or regional reduction in distribution of threatened species, populations and endangered ecological communities (moderate risk).

An Ecological Assessment for the Project, addressing the assessment requirements of the DGRs was undertaken by Mr Phil Cameron of OzArk Environmental and Heritage Management Pty Ltd ("OzArk"). The resulting report is presented as Part 4 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "OzArk (2011a)".

As required by the DGRs, the assessment of OzArk (2011a) was undertaken in accordance with the draft *Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning and Assessment Act 1979* (DEC, 2005) and has considered the following guideline documents and planning policies.

- "The NSW State Groundwater Dependent Ecosystem Policy" (DLWC, 2002).
- "Policy and Guidelines – Fish Friendly Waterway Crossings" (NSW Fisheries, undated).
- State Environmental Planning Policy No. 44 – Koala Habitat Protection.

This sub-section provides a summary of OzArk (2011a) and:

- describes the local and regional biodiversity, including existing threatened species and their habitat;

- identifies biodiversity management issues and the proposed controls, safeguards, mitigation measures and offset strategies that would be implemented by the Proponent; and
- assesses the residual impact(s) of the Project on local biodiversity (assuming the implementation of the proposed controls, safeguards, mitigation measures and offset strategies).

## 4.5.2 Regional Setting

### 4.5.2.1 Central West Catchment

The Mine Site is located within the NSW Central West Catchment which comprises the Castlereagh, Bogan and Macquarie River valleys and covers approximately 92 000km$^2$. A wide diversity of landforms, vegetation species and communities occur within this catchment which is associated with six bioregions, namely:

- Sydney Basin and South-east Highlands Bioregions in the extreme upper catchment;
- South Western Slopes and Brigalow Belt South Bioregions in the mid catchment; and
- Darling Riverine Plain and the Cobar Peneplain Bioregions in the lower catchment.

As a consequence of the confluence of the eastern and western influences, the Central West Catchment has a high level of biodiversity.

There are 50 threatened flora species (22 endangered, 27 vulnerable and one species considered extinct) and 73 threatened fauna species (15 endangered and 58 vulnerable) listed in the schedules of the *Threatened Species Conservation Act 1995* (TSC Act) recorded in the Catchment or bioregion. Of these, five flora species (*Lepidium hysopifolium, Eucalyptus canobolensis, Zieria ingramii, Zieria obcordata* and *Rulingia procumbens*) and one fauna species (Purple Copper Butterfly) are considered endemic to the catchment. Of the remainder many species would rely on retention, protection and enhancement of remaining woodland remnants, grasslands and wetlands.

### 4.5.2.2 South Western Slopes Bioregion

Within the Central West Catchment, the Mine Site is located towards the northern edge of the South Western Slopes Bioregion (where it borders the Darling Riverine Plains and Brigalow Belt South Bioregions). The South Western Slopes Bioregion which is an extensive area of foothills and isolated ranges comprising the lower inland slopes of the Great Dividing Range with an area of approximately 87 000km$^2$ (DEC, 2002).

In the northern part of the South Western Slopes Bioregion, the vegetation communities are often dominated by grey box (*Eucalyptus microcarpa*) and white cypress pine (*Callitris glaucophylla*) with other tree species characteristic of the bioregion including red stringybark (*Eucalyptus macrorhynca*) on higher slopes, with black cypress pine (*Callitris endlicheri*), kurrajong (*Brachychiton populneum*), red ironbark (*Eucalyptus sideroxylon*), white gum (*Eucalyptus rossi*), yellow box (*Eucalyptus melliodora*) and Blakely"s red gum (*Eucalyptus blakelyi*). Poplar box (*E. populnea*), kurrajong (*Brachychiton populneum*), wilga (*Geijera *parviflora*) and red box (*E. intertexta*) often dominate the vegetation communities in the northwest. Myall (*Acacia pendula*), rosewood (*Heterodendrum oleifolium*) and yarran (*Acacia homalophylla*) associations are also common on the grey clays towards the edge of the Darling Riverine Plain Bioregion.

As the South Western Slopes Bioregion has been intensively cleared and cultivated, what remains is mostly fragmented vegetation. It is noted that this is a landscape that is conducive to decline of bird populations. However, woodland fragments are important for species such as the vulnerable superb parrot (*Polytelis swainsonii*) and the endangered regent honeyeater (*Xanthomyza phrygia*), as well as non-breeding swift parrots (*Lathamus discolor*). Protection and enhancement of woodland fragments is considered critical in preventing the continued decline of woodland birds.

### 4.5.3 Local Setting

A review of the NSW vegetation formation mapping of Keith (2004) and the Natural Vegetation of the NSW Wheat Belt 1:250 000 Vegetation Sheet (Metcalfe et al., 2003) was undertaken by OzArk (2011a) to provide a description of the local vegetation formations and communities.

The Mine Site primarily (90%) occurs within the Floodplain Transition Woodlands vegetation formation, with restricted areas where elevated red gravel ridges occur more closely associated with Western Peneplain Woodlands. Tomingley to the north of the Mine Site is mapped as Inland Floodplain Woodland.

A review of the Nymagee, Narromine and Dubbo 1:250 000 Vegetation Sheet identifies remnants of four vegetation communities in the vicinity of the Mine Site as follows.

- River Red Gum Forests and Woodlands – occurring within riparian corridors and floodplains on creek banks, channels, depressions, cowls and backplains, grey cracking clays and polygenetic alluvial soils. Likely species to be encountered consist of *Eucalyptus camaldulensis* (river red gum), *E. largiflorens* (black box), river cooba (*Acacia stenophylla*) and *A. salicina* (cooba).
- Poplar Box Woodlands – occurring on undulating land, flats and open depressions, red, red brown and yellow earths, grey, brown and red clays. Likely species to be encountered consist of *Eucalyptus populnea bimble* (bimbil / bimble box), *Callitris glaucophylla* (white cypress pine), *Allocasuarina luehmannii* (bulloak), *Alectryon oleifolius* (western rosewood), *Acacia colletioides* (pin bush) and *A. salicina* (cooba);
- Dwyer"s Red Gum, Ironbark and Green Mallee Woodlands – occurring on hills and ridges with gravelly to sandy red earths red brown and yellow earths and lithosols. Likely species to be encountered consist of *Eucalyptus dwyeri* (Dwyer"s mallee gum), *E. sideroxylon* (mugga ironbark), *Callitris glaucophylla* (white cypress pine) and *Allocasuarina luehmannii* (bulloak).
- Belah and Poplar Box Woodlands – occurring on undulating plains on flats and depressions, red earths, grey and brown clays. *Casuarina cristata* (belah), *Allocasuarina luehmannii* (bulloak), *Eucalyptus populnea bimble* (bimble box) and *Acacia salicina* (cooba) are commonly recorded.

Notably, vegetation mapping completed by OzArk (2011a) (using the Biometric classification system of Benson et al., 2006) largely confirmed the vegetation mapping of Metcalfe et al. (2003).

Within the locality (50km radius) of the Mine Site, OzArk (2011a) estimates that 80% to 90% of all native vegetation on flat ground has been cleared. The largest remnant areas of native vegetation occur on hills and mountains unsuitable for agriculture, e.g. Goobang National Park. Local road corridors and easements provide the most prevalent examples of remnant native vegetation on flat land in the locality, e.g. Narromine to Tomingley Road, the Newell Highway corridor and smaller regional roads.

## 4.5.4 Assessment Methodology

### 4.5.4.1 Background Research

#### 4.5.4.1.1 Previous Ecological Studies

A summary of the results of previous flora and fauna investigations conducted with the vicinity of the Mine Site are provided as follows.

**Northparkes Mine**

Located approximately 45km southwest and in a generally similar environment to that of the Mine Site, vegetation communities mapped as part of a proposal to extend the mine include the following.

- Mature white cypress pines along with some poplar box and grey box. The understorey is almost entirely introduced weed species.
- White Box - White Cypress Pine Woodland. This community is considered analogous with the Grassy White Box Woodlands which are listed as an Endangered Ecological Community (EEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

It is likely that much of the remnant vegetation may now be considered Inland Grey Box Woodland, an EEC listed under the TSC Act (listed after the date of the Northparkes Mine vegetation survey).

Threatened species recorded include the yellow-bellied sheathtail-bat, with grey-crowned babblers known to occur in the general environs of Northparkes Mine (OzArk, 2010a).

**Peak Hill Gold Mine**

Located approximately 13km south of the Mine Site, several studies have been undertaken in association with this mine. A review of these studies by OzArk (2011a) identifies the following in relation to local biodiversity.

- No species of threatened plants have been recorded at the Peak Hill Gold Mine.
- Yellow box and grey box have been recorded, suggesting that Inland Grey Box Woodland EEC and Box-gum Woodland EEC are likely to occur in the Peak Hill area.
- Swift parrot and painted honey-eaters have been recorded, however, there have been no observations of these species recently.

**Cook Engineering Services (1995): Proposed Tailings Reprocessing Operation at Tomingley, New South Wales EIS**

To the immediate south of the Mine Site, on the eastern side of the Newell Highway, Central West Environmental Services undertook an ecological assessment of a proposed tailings reprocessing operation in 1995. Vegetation communities recorded were described as Western Grey Box (*Eucalyptus microcarpa)* and Fuzzy Box *(E. conica)* and, while not mapped, are believed to be associated with the transport corridor of the Newell Highway. No threatened species of flora were identified. However, of the 25 species of birds identified, one (the grey-crowned babbler) is currently listed as threatened under the TSC Act.

**OzArk Environmental & Heritage Management (2008). Ecological Assessment: Proposed Widening of Tomingley - Narromine Road, 0 to 4.5km from Tomingley to Narromine, NSW**

Inland Grey Box Woodland, Fuzzy Box Woodland EECs and the grey-crowed babbler were recorded during this assessment of the 4.5km section of the Tomingley to Narromine Road from its intersection with the Newell Highway (which corresponds with a portion of the Tomingley Narromine Water Pipeline).

#### 4.5.4.1.2 Database Searches

OzArk undertook a search of the NSW Government BioNet database and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protected matters database on 15 June 2009) for threatened flora and fauna within the Narromine and Parkes local government areas (LGAs). The search results were verified on 18 December 2009. **Table 4.34** presents the results of the database searches for the two LGAs, a summary of which is follows.

**Flora**

- Seventeen threatened species of flora have been identified within the Narromine LGA.
- Seven threatened species of flora that have been identified within the Parkes LGA.

**Birds**

- Seventeen threatened bird species and five species of birds with preliminary determinations as threatened have been identified within the Narromine LGA.
- Twenty one threatened bird species and six species of birds with preliminary determinations as threatened have been identified within the Parkes LGA.

**Mammals**

- Five threatened species of mammals that have been identified within the Narromine LGA.
- Six threatened species of mammals have been identified within the Parkes LGA.

**Amphibians**

- No threatened species of amphibian has been recorded in either LGA.

**Reptiles**

- No threatened species of reptile has been recorded in either LGA.

**Table 4.34**
**Previously Recorded Threatened Flora and Fauna**

| Species | Common Name | Classification | Identified within | |
|---|---|---|---|---|
| | | | Narromine | Parkes |
| **Flora** | | | | |
| *Austrostipa wakoolica* | A spear-grass | E | | ✓ |
| *Dichanthium setosum* | Bluegrass | V | ✓ | |
| *Eucalyptus camfieldii* | Heart-leaved Stringybark | V | | ✓ |
| *Goodenia macbarronii* | McBarron's Goodenia[1] | V | | ✓ |
| *Philotheca ericifolia* | | V | | ✓ |
| *Pomaderris queenslandica* | | E | ✓ | |
| *Rulingia procumbens* | | V | ✓ | |
| *Swainsona recta* | | E | ✓ | |
| *Swainsona sericea* | | V | | ✓ |
| *Tylophora linearis* | | E | ✓ | ✓ |
| *Zieria ingramii* | Keith's Zieria | E | | ✓ |
| **Birds** | | | | |
| *Anseranas semipalmata* | Magpie Goose | V | ✓ | |
| *Ardeotis australis* | Australian Bustard | E | ✓ | |
| *Artamus superciliosus* | White-browed Woodswallow | P(V) | | ✓ |
| *Burhinus grallarius* | Bush Stone-curlew | E1 | | ✓ |
| *Cacatua leadbeateri* | Major Mitchell's Cockatoo | V | | ✓ |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | V | ✓ | ✓ |
| *Climacteris picumnus* | Brown Treecreeper | V | ✓ | ✓ |
| *Falco hypoleucos* | Grey Falcon | V | | ✓ |
| *Glossopsitta pusilla* | Little Lorikeet | P(V) | | ✓ |
| *Grantiella picta* | Painted Honeyeater | V | ✓ | ✓ |
| *Grus rubicunda* | Brolga | V | ✓ | ✓ |
| *Lathamus discolor* | Swift Parrot | E | | ✓ |
| *Leipoa ocellata* | Malleefowl | E | ✓ | ✓ |
| *Limosa limosa* | Black-tailed Godwit | V | | ✓ |
| *Lophoictinia isura* | Square-tailed Kite | V | | ✓ |
| *Melanodryas cucullata* | Hooded Robin | V | ✓ | ✓ |
| *Melithreptus gularis gularis* | Black-chinned Honeyeater (eastern subspecies) | V | | ✓ |
| *Neophema pulchella* | Turquoise Parrot | V | | ✓ |
| *Ninox connivens* | Barking Owl | V | ✓ | ✓ |
| *Oxyura australis* | Blue-billed Duck | V | ✓ | |
| *Polytelis swainsonii* | Superb Parrot | V | ✓ | ✓ |
| *Pomatostomus temporalis temporalis* | Grey-crowned Babbler (eastern subspecies) | V | ✓ | ✓ |
| *Pyrrholaemus saggitatus* | Speckled Warbler | V | ✓ | ✓ |
| *Rostratula benghalensis australis* | Painted Snipe (Australian subspecies) | E | ✓ | |
| *Stagonopleura guttata* | Diamond Firetail | V | ✓ | ✓ |
| *Stictonetta naevosa* | Freckled Duck | V | ✓ | ✓ |
| *Tyto novaehollandiae* | Masked Owl | V | ✓ | |
| *Xanthomyza phrygia* | Regent Honeyeater | E1 | | ✓ |
| *Hieraaetus morphnoides* | Little Eagle | P(V) | ✓ | ✓ |
| *Circus assimilis* | Spotted Harrier | P(V) | ✓ | ✓ |
| *Artamus leucorynchus* | White-breasted Woodswallow | P(V) | ✓ | |
| *Daphoenositta chrysoptera* | Varied Sittella | P(V) | ✓ | ✓ |
| *Petroica phoenicea* | Flame Robin | P(V) | ✓ | ✓ |
| **Mammals** | | | | |
| *Dasyurus maculatus* | Spotted-tailed Quoll | V | | ✓ |
| *Cercartetus nanus* | Eastern Pigmy-possum | V | | ✓ |
| *Chalinolobus picatus* | Little Pied Bat | V | ✓ | ✓ |
| *Nyctophilus timoriensis* | Eastern Long-eared Bat | V | ✓ | ✓ |
| *Phascolarctos cinereus* | Koala | V | ✓ | ✓ |
| *Petaurus norfolcensis* | Squirrel Glider | V | ✓ | |
| *Pteropus poliocephalus* | Grey-headed Flying-fox | V | | ✓ |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | V | ✓ | |

Note 1: Commonwealth listed threatened species only
V = Vulnerable E = Endangered P(V) = Preliminary determination as Vulnerable
Source: Modified after OzArk (2011a) – Tables 1 to 8

A search of the OEH Threatened Species Website database of threatened vegetation communities identifies three EECs and two Critically Endangered Ecological Communities (CEEC) known or predicted to occur within the vicinity of the Mine Site. These include the following.

- Inland Grey Box Woodland EEC.
- Fuzzy Box on alluvials EEC of South West Slopes.
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC. Weeping Myall Woodlands Endangered Community was added to the Schedules of the EPBC Act in January 2009.
- Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland CEEC.
- White Box-Yellow Box-Blakely's Red Gum EEC in NSW and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.

### 4.5.4.2 Field Survey

#### 4.5.4.2.1 Introduction

Although the studies and records summarised in Section 4.5.4.1 provide a valuable database of threatened species records within the vicinity of the Mine Site, additional field surveys were completed by OzArk in order to add to the knowledge of the locations of threatened species and EEC within the Mine Site.

#### 4.5.4.2.2 The Study Area

The study area of OzArk (2011a) (for this Project) comprised two study areas[7], namely:

- the Mine Site Study Area: comprising all areas of proposed Project-related disturbance associated with the open cut mining operations and related activities; and
- the Tomingley – Narromine Water Pipeline (TNWP) Study Area: a 5m wide and approximately 46km long corridor (predominantly located within existing road reserves) from the "Woodlands" property, Narromine to the Mine Site.

#### 4.5.4.2.3 Flora Surveys

Flora surveys were undertaken over the three study areas involving a combination of random pedestrian traverse surveys and 20m x 20m quadrat surveys (primarily to assist in the classification of each vegetation remnant as a BioMetric unit). **Figure 4.22** presents the location of the pedestrian traverse surveys within the Mine Site. Flora quadrats were located along these pedestrian traverses within the various vegetation communities.

[7] OzArk (2011a) also surveyed the Peak Hill – Tomingley Electricity Transmission Line Study Area: a 19.2km long and 30m wide corridor for the proposed electricity transmission line from Peak Hill to the Mine Site. The results of this survey are not discussed in this Environmental Assessment as a separate application is being made for the electricity transmission line under Part 5 of the EP&A Act.

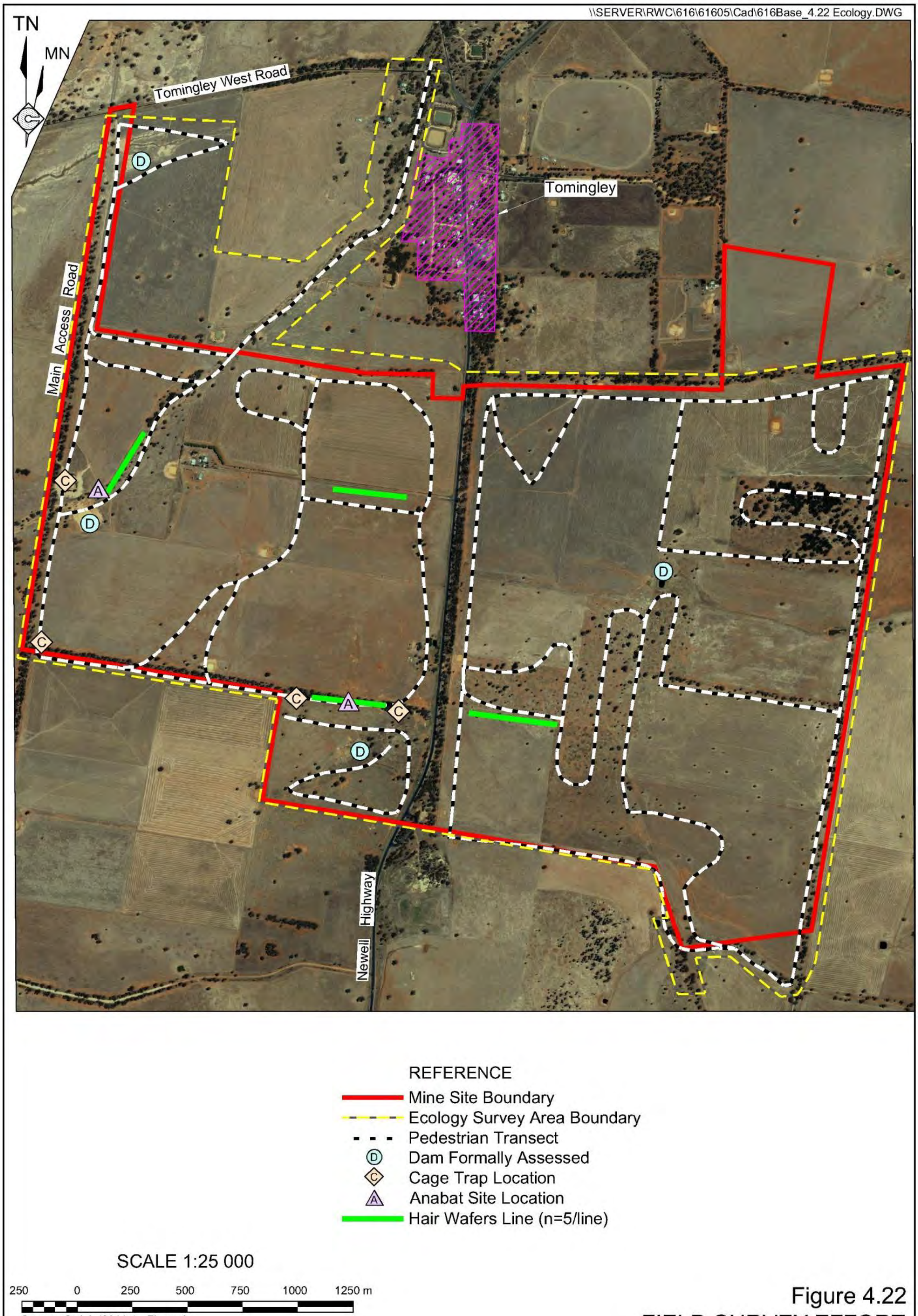



Figure 4.22
FIELD SURVEY EFFORT

During the flora surveys, individual species were identified and vegetation communities classified in accordance with the *NSW Vegetation Classification and Assessment Project* (Benson *et al.*, 2006). The health of individual trees was established in accordance with guidelines used by NSW Forests and vegetation of „low condition" was identified using the guidelines provided by *BioBanking Assessment Methodology and Credit Calculator operational manual* (DECC, 2008d).

A more detailed description of the flora survey effort is provided by OzArk (2011a – *Table 10*).

#### 4.5.4.2.4 Fauna Surveys

Field surveys for terrestrial fauna were undertaken by OzArk between May and September 2009 in order to identify the types and locations of threatened fauna within the Mine Site, as well as assess critical fauna habitat parameters. A summary of the survey effort for each study area is as follows. The locations of survey sites within the Mine Site are shown on **Figure 4.22.** A more detailed description of the flora survey effort is provided by OzArk (2011a – Table 10).

**Mine Site Study Area**

- AnaBat assessments (acoustic recordings) were undertaken over 4 nights in May 2009. Stag watching was also undertaken on the first of these nights.
- Four cage traps were set over 3 nights in May-June 2009.
- Four lines of hair tubes (total of 20) were set over 10 nights in May 2009.
- Opportunistic diurnal and nocturnal surveys (including spotlighting) were undertaken over 3 days in August and 2 days in September 2009.
- All mature trees were inspected for hollows and other habitat features and assigned a high, moderate or low habitat value (HHV, MHV or LHV respectively) based on the available habitat features.
- Dams were walked (circumnavigated) those considered as having higher potential to possess frogs were revisited during nocturnal targeted assessments. Care was taken to look for signs of fish and or the endangered river snail.
- Aquatic habitats were assessed with visual inspection, often the waterways were dry and allowed full pedestrian assessment. Habitat value was assigned following Department of Primary Industries literature *Why do fish need to cross the road?* (Fairfull and Witheridge, 2003).

**Tomingley – Narromine Water Pipeline Study Area**

- Opportunistic diurnal and nocturnal survey were undertaken over first 4.5km of Tomingley to Narromine Road in August 2008 (as part of OzArk, 2008).
- Opportunistic diurnal and nocturnal survey were undertaken over two days in July 2009, including spot checks of likely habitat areas for native fauna.
- The habitat value of all mature trees was determined by inspection for important habitat features.
- Where aquatic habitat was encountered, habitat value was assigned, in accordance with *Why do fish need to cross the road?* (Fairfull and Witheridge, 2003).

## 4.5.5 Project Site Flora and Fauna

### 4.5.5.1 Flora

#### 4.5.5.1.1 Vegetation Communities

**Mine Site Survey Area**

OzArk (2011a) estimates that approximately 82.5% of the Mine Site has been cleared, the remaining areas retaining parcels of a contiguous linear canopy of native vegetation, generally in association with paper road easements and land unsuitable for tilling. The dominant canopy species are inland grey box, fuzzy box, belah, western rosewood, white cypress pine and bimble box, with groundcover of generally poor diversity and structural complexity and very low levels of natural recruitment.

Considering the description of vegetation communities described by the *Biometric Assessment Method* (DECC, 2008d), OzArk (2011a) mapped five native vegetation communities within the Mine Site Study Area (see **Figure 4.23**).

- Community 1: Benson 76 – Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams (six remnants totalling 36.9ha). This community is a component of the NSW Inland Grey Box Woodland EEC.
- Community 2: Benson 78 – River Red Gum riverine woodland forest (several small remnants along Gundong Creek totalling 13.1ha).
- Community 3: Benson 201 – Fuzzy Box – Inland Grey Box on alluvial brown soils (five main remnants totalling 6.0ha). This community is a component of a Fuzzy Box on Alluvials EEC.
- Community 4: Benson 56 – Poplar Box – Belah woodland on clay alluvial plains (one remnants totalling 4.9ha).
- Community 5: Benson 57 – Belah / Black Oak Western Rosewood, Wilga Woodland (two remnants totalling 52.3ha).

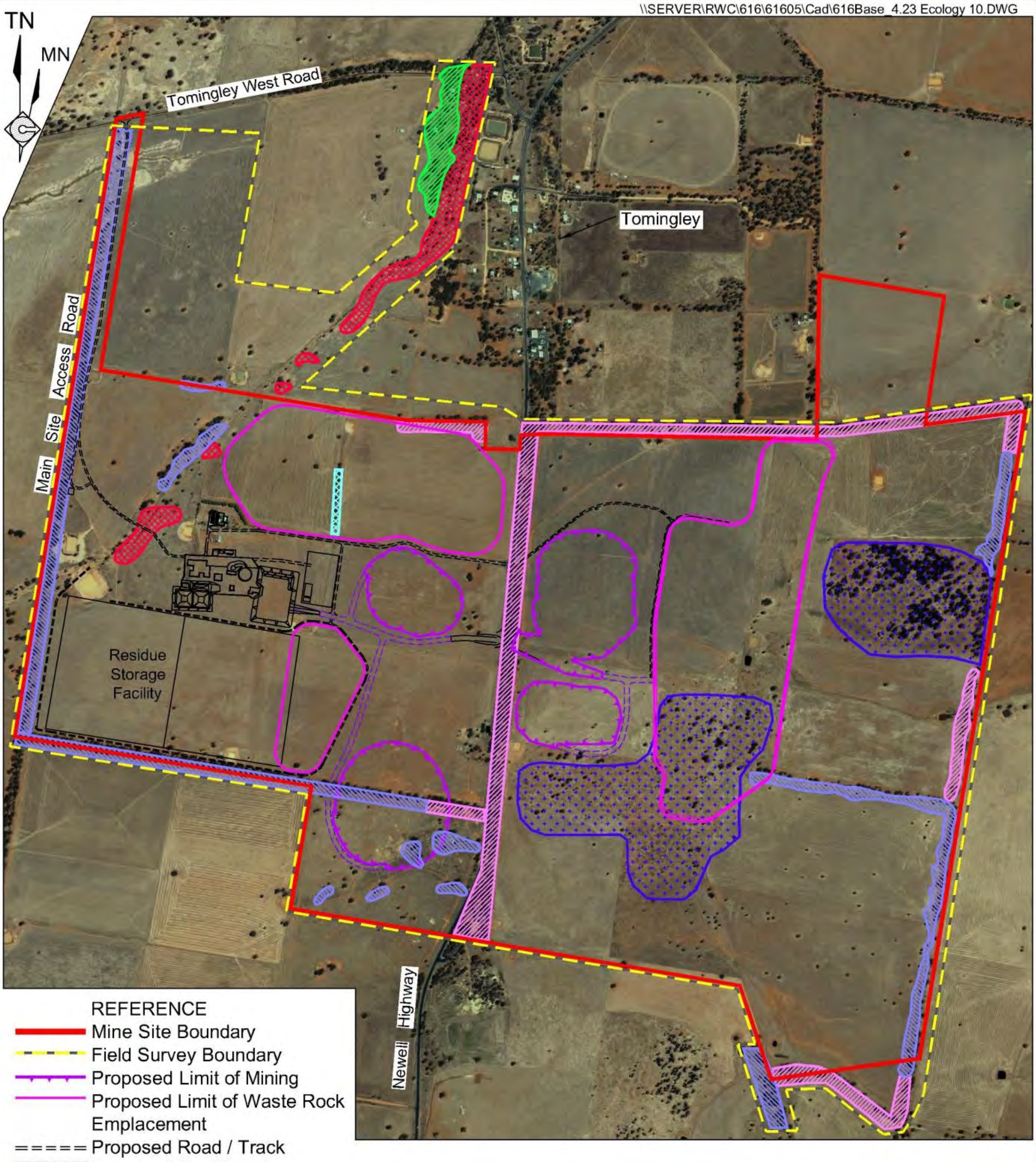
The remainder of the Mine Site Study Area comprises either a small (0.7ha) area of planted Mugga Ironbark‟s or cleared and farmed land dominated by exotic pasture.

**Tomingley – Narromine Water Pipeline Survey Area**

OzArk (2011a) estimates that approximately 95.5% of the TNWP corridor retains a contiguous, linear canopy of native vegetation.

OzArk (2011a) identifies six native vegetation communities classified in accordance with the *Biometric Assessment Method* (DECC, 2008d), as well as a seventh non-Biometric community. These are as follows.

- Benson 76: Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams (23 remnants totalling 28.6ha) (52.7% of all vegetation recorded). This community is a component of the NSW Inland Grey Box Woodland Endangered Ecological Community.
- Benson 78: River Red Gum Riverine woodlands and forests (one main remnant of 7ha) (12.4% of all vegetation recorded).




| | Community | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Total Area within Study Area (ha) | 36.9 | 13.1 | 6.0 | 4.9 | 52.3 | 0.7 |
| Area to be Disturbed (ha) | 2.7 | 0 | 0.9 | 0 | 18.0 | 0.7 |

Source: OzArk (2011a) - Figure 10
Base Photo Source: Quickbird - Date: 27 January 2006

Figure 4.23
VEGETATION COMMUNITIES

- Benson 201: Fuzzy Box – Inland Grey Box on alluvial brown soils (five main remnants totalling 33.8ha) 12.4% of all vegetation recorded). This community is a component of the NSW Fuzzy Box Woodland on Alluvials EEC.
- Benson 56: Poplar Box- Belah woodland on clay alluvial plains (five main remnants totalling 6.7ha) (12.3% of all vegetation recorded).
- Benson 217: Mugga Ironbark – Inland Grey Box – pine tall woodland (comprising two main remnants totalling 2.7ha) (4.9% of all vegetation recorded).
- Yellow Box – Blakely‟s Red Gum grassy woodland[8] (one remnant of 0.42ha) (0.77% of all vegetation recorded). This community is a component of the NSW White Box, Yellow Box and Blakely‟s Red Gum EEC.
- Cleared land (not a *BioMetric* vegetation unit). Comprising 2.5ha of cleared land, i.e. heavily mechanically disturbed, not „grassland‟ or potions of other described vegetation communities with canopies removed (4.5% of all vegetation recorded).

#### 4.5.5.1.2 Identified Flora

A complete list of the flora identified within the Project Site is provided by OzArk (2011a), a summary of which is as follows.

**Mine Site Survey Area**

OzArk (2011a) states that 124 species of flora were recorded during the assessment of which 66 (53.2%) were native and 58 (46.8%) were exotic. Native species generally dominated the ground cover of native woodland and forested areas (albeit very sparsely) where thickets of African box thorn are absent. Highly modified areas were characterised by higher diversity of introduced species, both intentional (agricultural and planted) and exotic weeds.

Identified weeds declared as noxious included galvanised burr (*Bassia birchii*) and African box thorn (*Lycium ferocissimum*) both Class 4 noxious weeds.

No plants listed as threatened were recorded.

**Tomingley – Narromine Water Pipeline Survey Area**

OzArk (2011a) states that 196 species of flora were recorded within the TNWP Study Area of which 131 (66.8%) were native and 65 (33.2%) were exotic. Inland grey box, fuzzy box, bimble box, white cypress pine, mugga ironbark and belah are the dominant canopy species. Groundcover diversity varies from poor where influenced by past and present disturbance history, e.g. road infrastructure, occasional grazing and laying of a telecommunications cable, to areas with moderate diversity and good structural integrity.

Identified weeds declared as noxious included galvanised burr (*Bassia birchii*), African boxthorn (*Lycium ferocissimum*), Bathurst burr (*Xanthium spinosum*) and Nagoora burr (*Xanthium pungens*), all Class 4 noxious weeds.

No plants listed as threatened were recorded.

[8] This community was not described by Benson *et. al*.

## 4.5.5.2 Identified Fauna

### 4.5.5.2.1 Fauna Habitats

#### Habitat Types

Five main habitat types were identified within the Project Site that are likely to be altered (impacted or enhanced) by the Project. These are as follows.

- Temperate Grassy Woodlands.
- Gilgai paddocks.
- Isolated paddock trees.
- Cleared grasslands and agricultural paddocks.
- Aquatic habitats, i.e. tanks, earth dams, drainage lines and creeks.

Each of these habitat types provides particular resource materials important to the survival of native fauna, a detailed summary of which is provided by *Table 18* of OzArk (2011a).

#### Tree Habitat Values

Mature trees were identified as being particularly important habitat elements within the Project Site due to the variety of habitat elements provided and importance to many threatened species of fauna. The habitat value of each mature tree that could be disturbed by the Project was identified by OzArk (2011a) and categorised as:

- High Habitat Value (HHV) - an old growth tree with a „rare‟ key habitat element that one or more of the region‟s threatened species could use;
- Moderate Habitat Value (MHV) - an old tree with an „infrequent‟ key habitat element that one and possibly (but less likely) more of the region‟s threatened species could use; or
- Low Habitat Value (LHV) - A tree with a „frequent‟ key habitat element that one and very rarely more of the region‟s threatened species could use.

#### Aquatic Habitats

The type and value of aquatic habitats within the Project Site were identified by OzArk (2011a) as follows.

**Mine Site Survey Area**

- Gundong Creek, an ephemeral creek, flows through the Mine Site as a man made channel with eroding banks and colonisation by river red gums. Given a lack of pools, ponds or other aquatic habitat features, it is considered a Class 4 Waterway, i.e. unlikely fish habitat.
- Sixteen dams occur within the Mine Site, although none possess aquatic or semi-aquatic vegetation other than an occasional sedge or rush.

**TNWP Survey Area**

- Creeks and drainage lines are degraded and contain sparse to moderate native aquatic vegetation. OzArk (2011a) identifies the named creeks as Class 2 waterway classifications which could provide moderate fish habitat. OzArk

(2010OzArk (2011a) note that for the majority of time the waterways do not provide opportunities for native fish species, however, after inundation they may potentially be used for the dispersal of individuals and breeding.

All natural creeks and drainage lines in the Project Site may be considered as part of the *„Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River Endangered Ecological Community'*. This community includes 21 native fish species and hundreds of native invertebrate species, many of which have not been comprehensively studied.

**Habitat Corridors**

The road reserve of the Tomingley - Narromine Road forms the basis for all wildlife corridors remaining in the locality.

Koalas have potential to use the Tomingley - Narromine Road corridor which contains between 10% and 15% bimble box (a Koala feed tree species). Vagrant, migratory and nomadic birds have been observed utilising road corridors in the locality for feeding and resting. For example, the superb parrot is a frequent visitor in the locality with nearly all sightings from road corridors.

The levels of existing disturbance combined with the thin, linear nature of the remnants within and surrounding the Project Site reduce the potential value of these remnants as wildlife corridors for ground dwelling animals within the Critical Weight Range, namely those species with a body mass of between approximately 35g and 5.5kg that are most likely to be threatened or in decline.

#### 4.5.5.2.2 Fauna of the Project Site

OzArk (2011a) records a total of 134 vertebrate fauna species (123 native and 11 introduced) within the Project Site comprising the following.

- 17 reptile species.
- 6 frog species.
- 86 bird species (83 native and three introduced), including two species listed as threatened under the TSC Act (grey-crowned babbler and superb parrot), one listed under the EPBC Act (rainbow bee-eater) and three species recorded are listed as having „preliminary determinations as threatened" under the TSC Act (little eagle, spotted harrier and white-browed woodswallow).
- 25 mammal species (17 native and 8 introduced species) including two species listed as threatened under the TSC Act (Little Pied Bat and Eastern Bentwing Bat) and one species of conservation concern (fat-tailed dunnart).

**Figure 4.24** presents the location of each of the recorded threatened species or species of conservation concern within the Mine Site. OzArk (2011a) provides a complete list of the fauna recorded within the Mine Site.

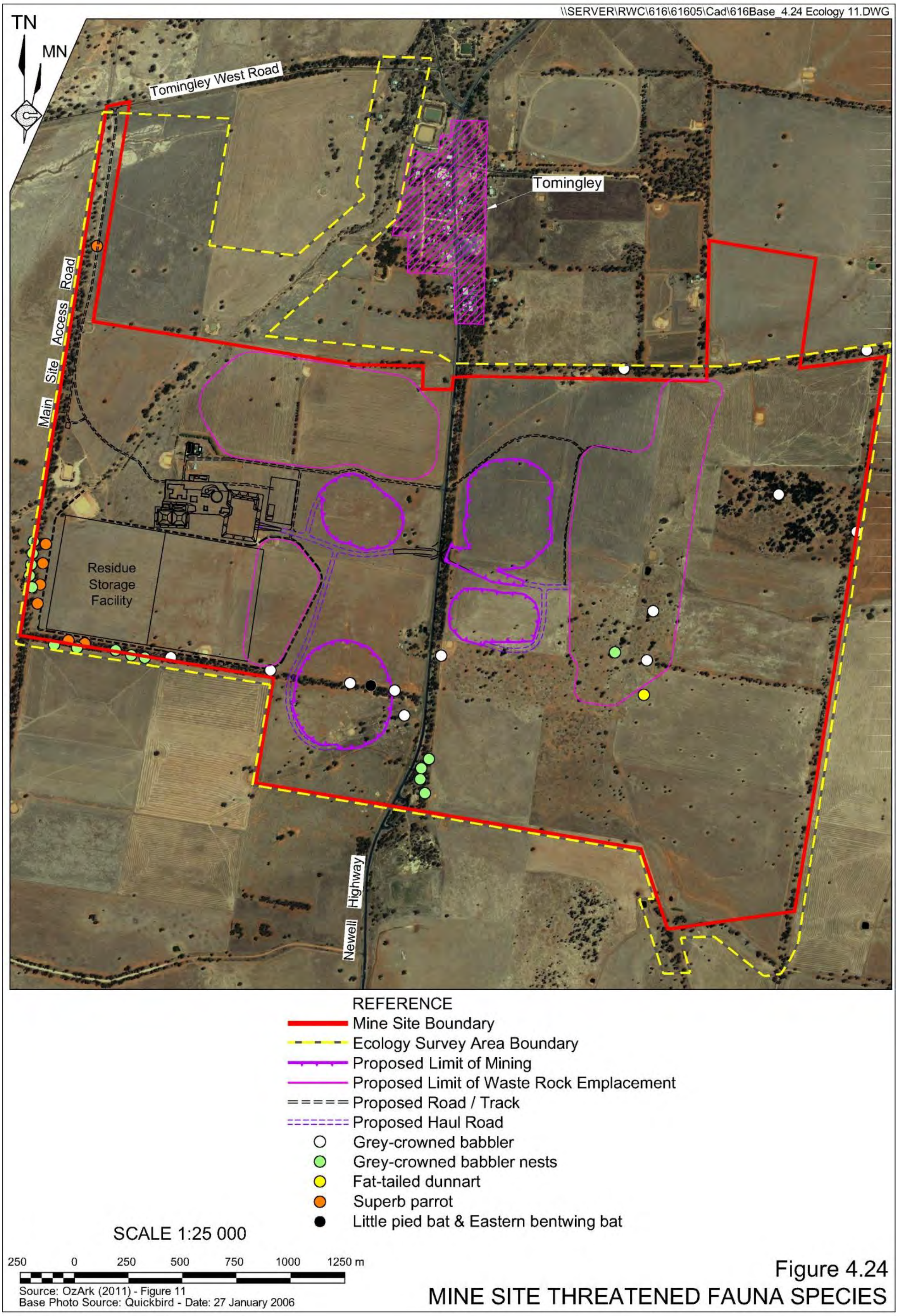



Figure 4.24
MINE SITE THREATENED FAUNA SPECIES

## 4.5.6 Potential Impacts of the Project on Flora and Fauna

### 4.5.6.1 Introduction

OzArk (2011a) undertook an assessment of potential unmitigated Project-related impacts on flora, fauna and ecological communities within the vicinity of the Project Site. This assessment did not consider any of the proposed management and mitigation measures identified in Section 4.5.7 and is summarised in this sub-section. Section 4.5.8 presents an assessment of the significance of the mitigated impacts of the Project on threatened species, populations and ecological communities, taking into account the proposed management and mitigation measures.

### 4.5.6.2 Potential Direct Impacts on Native Flora and Fauna

#### 4.5.6.2.1 Clearing of Native Vegetation

The clearing of native vegetation is considered a "key threatening process" under Schedule 3 of TSC Act, i.e. a process that threatens or could threaten the survival of native species, populations or communities. The magnitude, extent and significance of the proposed clearing is considered in Section 4.5.8.

#### 4.5.6.2.2 Alteration to Natural Flow Regimes of Rivers and Streams

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is also classified as a key threatening process under Schedule 3 of TSC Act.

While the proposed water supply pipeline would traverse several creeks and waterways, this would be undertaken in such a way as to minimise impacts on natural flows, e.g. through the use of horizontal drilling techniques and enforcement of restricted access. As such, it is considered unlikely that there would be any alteration to local hydrology that would impact on the occurrence of native species.

#### 4.5.6.2.3 Loss of Hollow-bearing Trees

In NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 mammals, 85 birds, 32 reptiles and 16 frogs (Gibbons and Lindemayer, 2002). Of these, 45 species are listed as threatened under Schedule 1 and Schedule 2 of the TSC Act.

**Table 4.35** provides a summary of the number of trees of high, moderate and low habitat value that would be disturbed. OzArk (2011a) provides a more detailed summary of the type and location of the trees occurring within the impact footprints of each Project component area.

**Table 4.35**
**Habitat Value of Trees to be Disturbed[1]**

| | Project Component | | |
|---|---|---|---|
| **Habitat Value** | **Mine Site** | **TNWP** | **Total** |
| High | 32 | - | 32 |
| Moderate | 59 | - | 59 |
| Low | 385 | - | 385 |
| **Total** | 476 | - | 476 |

Note 1: Assumes minor 1.3km deviation to avoid a remnant stand of Inland Grey Box EEC (Benson 76) containing 20 trees of MHV and 200 trees of LHV

Source: Modified after OzArk (2011a) – Section 5.4.2

OzArk (2011a) report that approximately 91 of the 476 trees to be disturbed contain hollows of some form (with the majority being young cypress or bulloak). Removal of some of these trees may result in impacts to listed threatened fauna.

#### 4.5.6.2.4 Vehicle Movements

Vehicle-related trauma to native fauna on the regions roads, particularly along the Tomingley - Narromine Road is known to kill a large number and diversity of wildlife, including threatened species (superb parrot and grey-crowned babblers). Increased numbers of vehicles along this road or the Newell Highway would increase the potential for trauma to wildlife. It is noted, however, that the traffic assessment (FJF, 2010 – presented as Part 7 of the *Specialist Consultant Studies Compendium*) determined that Project-related traffic would result in the following increases in traffic levels compared with existing traffic levels.

- Newell Highway - approximately 5.1% during construction and 3.4% during operation.
- Tomingley – Narromine Road – approximately 17% during construction and 7.7% during operation.
- Tomingley West Road - approximately three times the current traffic levels during construction and twice the current traffic during operation.

It is noted, however, that the short distance that traffic would travel on Tomingley West Road would limit the potential speed of vehicles and, hence, the risk to fauna.

### 4.5.6.3 Potential Indirect Impacts on Flora and Fauna

#### 4.5.6.3.1 Management of Processing Residue

The residue generated by the processing operations would contain ground rock (with the gold removed), water and small concentrations of reagents, including complexes of cyanide. The cyanide compounds that may impact on native biota are referred to as weak acid dissociable (WAD) cyanide. These cyanide complexes dissociate when exposed to weak acid (such as that found in the stomachs of fauna) to release the toxic cyanide ion ($CN^-$). On ingestion, the cyanide ion halts cellular respiration by inhibiting an enzyme in mitochondria called Cytochrome C Oxidase. Depending on the concentration of cyanide ingested, and tolerance of particular species, this has the potential to result in the death of native fauna which ingest residue or water containing WAD cyanide.

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) of the Commonwealth Department of Health and Ageing released the document "*Priority Existing Chemical Assessment Report No. 31 – Sodium Cyanide*" in February 2010 (NICNAS, 2010). NICNAS (2010) provides detailed discussion as to the management requirements for sodium cyanide at all stages of manufacture, transport, storage, use and disposal. With respect to cyanide containing residue, NICNAS (2010) reviews NSW policy on the licensing of discharge limits for cyanide containing residues (or tailings) and in *Section 11.10.2 (Australian wildlife protection legislation and policies)* of NICNAS (2010) (P. 238) refers to NSW policy stating:

> "*The NSW DECC review determined that for less sensitive sites (presumably sites with a low probability of wildlife habitation or exposure to process solutions containing cyanide), the limits for discharge for the tailings dam of 30mg WAD CN/L (90th percentile of time) and 50mg WAD CN/L (not to be exceeded) provide an appropriate level of confidence of achieving the goal of zero fauna deaths.*"

*Section 11.10.2* of NICNAS (2010) (P. 239) states further:

> "*The application of tailings discharge limits to existing mines in NSW is currently being considered on a site-by-site basis, in the context of the risk of fauna access.*"

Therefore, the two critical issues to consider in relation to the impact of the management of processing residue are as follows.

i. The concentration of WAD cyanide in the residue.

ii. The occurrence of native fauna, ecological characteristics (i.e. habitat preferences with respect to water) and accessibility of the residue storage facility.

Section 4.5.7.3.4 considers these issues in the context of management and mitigation measures related to minimising the potential for fauna mortality as a consequence of ingestion (or absorption) of processing residue or cyanide containing water.

#### 4.5.6.3.2 Artificial Lighting

Artificial lighting has the potential to change predator–prey relationships and species densities for a number of animals‟, i.e. large floodlights often associated with mining areas or new roads in previously unlit areas provide light that attracts insects that in turn attracts bats. These bats would then be preyed upon by other species such as owls.

Whilst this dynamic may be self-determining, a negative impact on other species may occur where they do not benefit from the increased insect numbers. Additionally there may potentially be a higher density of predators occurring in the area, thus reducing the long-term survivability of a locally occurring population of some species.

#### 4.5.6.3.3 Hydrological Changes

Changes in hydrology through road building, construction of dams or other water diversionary or retention structures may have the effect of increasing or decreasing local surface water flows. These in turn would alter ecosystem functions. It is noted that a full surface water assessment has been prepared by SEEC (2011) and a summary in presented in Section 4.3.

OzArk (2011a) considers it unlikely that any minor changes would impact native biota.

#### 4.5.6.3.4 Erosion and Sedimentation

Erosion and sedimentation resultant from surface disturbing activities have the potential to result in:

- pollution of waterways with increased nutrient load, salinity and turbidity which could adversely impact on aquatic fauna and flora; and
- a loss of valuable topsoil thus affecting the microclimate for the regions threatened species of plants and EECs.

#### 4.5.6.3.5 Operational Noise and Dust

Operational noise has the potential to disrupt breeding or neonate behaviours, particularly the regions threatened parrots, grey crowned-babblers and smaller birds such as robins resulting in abandonment and death of young. Dust has the potential to suppress plant growth and be a vector for soil borne diseases.

OzArk (2011a) consider that Project-related operational noise and dust generation would be unlikely to have a significant effect on the local biota.

#### 4.5.6.3.6 Introduced Species

Ground disturbing activities may increase weed invasion and opportunities for feral animals. OzArk (2011a) consider it unlikely that the Project would result in an increase in the occurrence of any feral or weed species locally.

### 4.5.6.4 Potential Decommissioning and Rehabilitation Impacts

On completion of the Project, the Mine Site would be decommissioned and rehabilitated. Impacts associated with decommissioning may include the following.

- Pollution resultant from contaminated water, waste materials or soil.
- Removal of structures that may have been colonised by roosting animals.
- Pollution from the neglect or failure of any structure that would remain on site.

The rehabilitation of the Project Site, however, would have potentially beneficial impacts including.

- Revegetation of disturbed areas with greater diversity of native vegetation species (including groundcover and understorey).
- Reduction in presence and persistence of weed species.
- Improved habitat quality for native fauna.

As a result, OzArk (2011a) consider it unlikely that decommissioning and rehabilitation of the Project would result adverse impacts on biota.

### 4.5.6.5 Potential Impacts on Fish Communities and Aquatic Habitats

The Project may potentially impact *Aquatic ecological community in the natural drainage system of the lowland catchment of the Lower Darling River EEC,* as a result of construction of the water supply pipeline. However, as any impacts would be discrete (horizontal drilling under named creeks and trenching through unnamed waterways), OzArk (2011a) consider it unlikely that the Project would affect waterway morphology or the multitude of habitats that play a critical role in the life cycles of the species comprising the community.

OzArk (2011a) consider it unlikely that the Project would have any significant impact on any of the threatened species of fish identified by OEH or DSEWPaC if requirements of the POEO Act and stringent soil and sediment controls are implemented during construction and operation.

### 4.5.6.6 Potential Impacts on Threatened Species, Populations and Ecological Communities

To identify those threatened species, populations. communities, wetland and or migratory species that could potentially be affected by the Project, OzArk reviewed field assessment results, literature related to the ecology of these species and the database searches documented in Section 4.5.4.1. **Table 4.36** identifies the potentially affected threatened species, populations communities, wetland and or migratory species.

**Table 4.36**
**Potentially Affected Threatened Species, Populations and Communities**

| Scientific Name | Common Name | Status | Reason |
|---|---|---|---|
| *Pomatostomus temporalis temporalis (eastern subspecies)* | Grey-crowned babbler | V TSC Act | • Known to occur in Mine Site and TNWP Study Areas.<br>• Would be affected by direct habitat removal.<br>• Would be affected by loss of water supply.<br>• Potentially affected by tailings (if contaminated water is consumed). |
| *Chalinolobus picatus* | Little pied bat | V TSC Act | • Known to occur in Mine Site Study Area and considered likely to occur in TNWP Study Areas.<br>• Would be affected by direct and indirect habitat removal.<br>• Would be affected by loss of water supply.<br>• Potentially affected by tailings (if contaminated water or insects that utilize it are consumed). |
| *Polytelis swainsonii* | Superb parrot | V TSC Act<br>V EPBC Act | • Known to occur in TNWP and Mine Site Study Areas.<br>• Perching habitat and possibly temporary feeding habitat would be affected by direct habitat removal.<br>• Would be affected by loss of water supply.<br>• Potentially affected by tailings (if contaminated water is consumed). |
| *Phascolartos cinereus* | Koala | V TSC Act | • Known to occur in TNWP Study Area (2 previous records).<br>• Considered as having potential to utilise river red gums in Mine Site along Gundong Creek.<br>• May be affected by direct habitat removal. |
| Inland Grey Box Woodlands EEC | | NSW listed EEC | • Known to occur in all study areas.<br>• Would undergo loss of area of extent by direct habitat removal. |
| Fuzzy Box on Alluvials EEC | | NSW listed EEC | • Known to occur Mine Site and TNWP Study Areas;<br>• Would undergo loss of area of extent by direct habitat removal. |
| Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River EEC | | NSW listed EEC | • All natural creeks and drainage lines are part of this community.<br>• Impacts are extremely limited as under-boring would be undertaken under all waterways.<br>• Would be affected by direct and indirect habitat removal.<br>• Would be affected by loss of water supply, potentially affected by tailings (if contaminated water or insects that utilize it are consumed). |
| Source: OzArk (2011a) – Tables 15 and 25 | | | |

The relevant assessment of significance under the TSC Act or EPBC Act, considering the controls, mitigation measures and conservation and amelioration measures nominated in Section 4.5.7, was performed for the species and communities identified in **Table 4.36**.

## 4.5.7 Management and Mitigation Measures

### 4.5.7.1 Introduction

The recommendations related to the amelioration of impacts provided by OzArk (2011a) were presented as general land management measures, those to be implemented prior to the commencement of the Project, during the operation of the Project and following the completion of the Project. In line with Step 4 of the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005), these recommendations have been presented to illustrate:

i) how impacts would be avoided (Section 4.5.7.2);

ii) how unavoidable impacts would be mitigated (Section 4.5.7.3); and

iii) how residual impacts (following mitigation) would be offset (Section 4.5.7.4).

### 4.5.7.2 Avoidance of Impacts

The design features, operational controls and management measures that have been or would be implemented to limit impacts on threatened species, communities and important habitat as follows

**Mine Site Survey Area**

- The alignment of the Main Site Access Road is within a corridor containing remnant stands of Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams (Benson 76), a component of the NSW Inland Grey Box Woodland EEC. However, the road has been designed in a manner that would follow the existing farm track and would avoid as many mature trees as practicable.
- The location of the Mine Site activities and infrastructure has been located so as to avoid the majority of remnant native vegetation. Of the 156.5ha of remnant native vegetation identified within the study area, only 21.6ha (13.8%) would be directly disturbed by Mine Site activities or infrastructure. Notably, the majority of this disturbance (18.0ha) would occur within the Belah / Black Oak Western Rosewood, Wilga Woodland community. Only 2.7ha (7.3%) and 0.9ha (2.9%) respectively of the remnant areas of the Inland Grey Box Woodland EEC and Fuzzy Box on Alluvials EEC would be disturbed.
- Furthermore, the location of the ancillary activities to mining, i.e. waste rock emplacements, processing and administrative facilities, water management infrastructure, etc. have been located so as to avoid disturbance to all but approximately 476 paddock trees, only 32 of which are considered to have high habitat value.
- Disturbance to trees on the Mine Site would avoid all but one known nesting location for grey-crowned babblers. Notably, ten observed trees within nests on the western side of the Newell Highway and four observed trees within nests on the eastern side of the Newell Highway would be avoided and protected (see **Figure 4.24**). In order to ensure these trees with nests are protected, they would be fenced using high visibility fencing to provide a 25m exclusion area around these trees.

**TNWP Survey Area**

- The alignment of the TNWP would be modified slightly over a 1.3km section towards the northern end of the TNWP (see OzArk, 2010a for this location) to avoid disturbance to a stand of vegetation which is categorised as a remnant of the Inland Grey Box Woodland EEC.

**All areas within the Project Site**

- Areas of ground disturbance would be clearly marked prior to commencement of activities and disturbance restricted to these areas.
- To avoid disturbance to new or unobserved nests or roosting sites of threatened fauna, e.g. grey-crowned babbler, vegetation clearing procedures or protocols would be established. These procedures or protocols would involve:
  - education of the workforce as to vegetation clearing requirements and potential impact on threatened species as part of an induction;
  - provision of information, e.g. OEH threatened species fact sheet, regarding the occurrence and appearance of threatened species and nests or roosting sites; and
  - actions to follow if a threatened species or nest/roosting site is identified.

### 4.5.7.3 Mitigation of Impacts

#### 4.5.7.3.1 Summary of Residual Impacts

Despite the measures described in Section 4.5.7.2, some impacts on biota surrounding the Project would be unavoidable. These would include the following

**Mine Site Survey Area**

- Removal of approximately 476 paddock trees of which 32 have high habitat value and 59 have moderate habitat value.
- Removal of one tree containing roosting and breeding nests for a local family of Grey-crowned babblers.
- Disturbance to:
  - approximately 18ha of sparse Belah / Black Oak Western Rosewood, Wilga Woodland (Benson 57 not an EEC);
  - approximately 0.9ha of Fuzzy Box EEC; and
  - approximately 2.7ha of Inland Grey Box EEC.

**TNWP Survey Area**

- Minor earthworks adjacent to creeks and drainage features.
- Disturbance to approximately 200 small, regrowth trees of low habitat value would be avoided by a 1.3km diversion of the TNWP route.

#### 4.5.7.3.2 Management Measures – Grey-crowned Babbler Nest

It is noted that the tree within the footprint of Waste Rock Emplacement 3 containing the grey-crowned babbler roosting and breeding nests is used by the grey-crowned babbler family identified as Family #1 by OzArk (2011b) which also use a number of nests to the south which would remain undisturbed and protected.

In order to further minimise the potential impact on the local grey-crowned babbler population, the Proponent has committed to the following management measures.

- Clearing of the nest containing tree would be undertaken outside grey-crowned babbler breeding season, i.e. April to September. Pre-clearance surveys would be undertaken prior to clearing to confirm nests are not being used (see Section 4.5.7.3.3).
- If nesting or roosting babblers are identified, clearing would be delayed until nests are vacated. If roosting babblers persist, a suitably qualified and experienced ecologist would be engaged to remove the animal(s) and/or nest/roosting habitat prior to clearing.

#### 4.5.7.3.3 Management Measures – Vegetation Clearing

In order to mitigate the unavoidable impacts resulting from vegetation clearing, the Proponent would implement the following design features, operational controls and management measures.

- Clear sufficient vegetation for the subsequent 12 months of mining operation only.
- Directly transfer stripped soil materials onto rehabilitation areas where practicable to maximise the opportunity for retention of the natural seed stock, and thereby maximise the revegetation of the final landform with endemic species.
- Undertake a program of weed control prior to soil stripping activities and following re-vegetation to ensure native plants are not overgrown during their early periods of growth.
- To reduce risk of impact to tree dependent microbats, clearing of substantive trees would be scheduled between April and September.
- Undertake all clearing of trees in accordance with a *Vegetation Clearing Protocol* (VCP). The VCP would require clearing of mature trees to be undertaken as follows.
  - Check all trees for the presence of nesting or roosting fauna before felling or pushing then start tree removal immediately after visual inspection.
  - When a tree with hollows requires removal, the tree is to be gradually nudged at intermittent intervals so that any animal occupying a habitat tree has the chance of vacating the area after the initial disturbance period.

- Salvage tree trunks, major limbs and, if practicable, minor branches for use in rehabilitation of the Mine Site or amelioration areas. If material is stockpiled, signs would be erected noting the significance and importance of this material for future rehabilitation and habitat creation.
- Implement an erosion and sediment control plan for all areas of disturbance likely to generate sediment or be subject to erosion.
- Revegetate the Mine Site as described in Section 2.14 and in accordance with a *Mining Operations Plan* or *Rehabilitation and Environmental Management Plan* to be prepared prior to the commencement of activities on the Mine Site.

#### 4.5.7.3.4 Management Measures – Residue Storage Facility

The operation of the residue storage facility has also been identified as potentially impacting on native biota. As identified in Section 4.5.6.3.1, the potential for impact is directly related to the concentration of WAD cyanide of the residue and the likely accessibility of the residue storage facility to native fauna. The following management measures are consistent with the *Principles of the International Cyanide Management Code* (ICMI, 2011) and would be implemented to manage residue material and cyanide within the residue storage facility.

- The residue storage facility would be managed without a central decant pond. That is, on deposition of tailings, water would travel towards the central decant tower (either as surface or sub-surface flow), enter the decant tower and flow by gravity back to the processing plant. There would be no pooling of water at the decant which (by minimising the standing water within the RSF) would minimise the perceived habitat value to birds and other wildlife.
- Implement measures to restrict or prevent access of biota to the residue storage facility. These would include.
  - Construct fencing using a combination of a large (tall >1.8m) chain mesh fence (to exclude large mammals) with a fine mesh skirt at its base (to exclude small mammals and reptiles).
  - Cover any minimal areas of standing water with floating plastic balls (to deter birds and arboreal mammals from landing on the water surface).
- Alternative water sources would be maintained on the Mine Site, e.g. sediment basins and farm dams. The attractiveness of these water bodies would be maximised by the establishment of aquatic and edge species to attract bird species to these areas and away from any standing water within the RSF.

In order to determine the nature and scale of additional management measures for the residual storage facility, e.g. WAD cyanide concentration limits, the „sensitiveness" of the site needs to be considered. Critically, the construction of the proposed fence around the base of the residue storage facility would prevent access of terrestrial fauna. The operation of the residue storage facility without significant areas of standing water, with measures in place to cover any standing water, and maintenance of other more recognisable and attractive water bodies on the Mine Site would minimise the potential for birds and arboreal mammals to utilise the residue storage facility as a resource (drinking water) or habitat (standing water).

Furthermore, the threatened fauna species identified on the Mine Site are unlikely to utilise the residue storage facility based on the following ecological preferences of these species.

- The grey-crowned babbler is unlikely to forage on the residue storage facility as it prefers to forage for insects and other invertebrates on the ground among leaf litter, around fallen trees and from the bark of shrubs and trees. The residue storage facility would not provide this foraging habitat and is unlikely to be home to insects and other invertebrates given the lack of standing water or other resources likely to attract these species.
- The Superb Parrot is unlikely to forage on the residue storage facility as it feeds mainly on the ground, and sometimes in the foliage of trees, on the seeds of grasses and other plants, fruits and berries, nectar, flowers and some insects. The residue storage facility would not provide this foraging habitat. Furthermore, the retained an improved vegetation of the Mine Site, constructed water bodies and areas of rehabilitation are likely to provide far more favourable foraging habitat.
- Rainbow Bee-eaters feed on insects, mainly catching bees and wasps, as well as dragonflies, beetles, butterflies and moths. Due to a lack of standing water and vegetation, the residue storage facility would not attract significant populations of insects and other invertebrates. Furthermore, the retained and improved vegetation within the Mine Site, constructed water bodies and areas of rehabilitation are likely to provide far more favourable foraging habitat. The White-browed woodswallow has similar ecological preferences and is therefore unlikely to utilise the residue storage facility.
- The Little Eagle searches for prey on the wing or from a high exposed perch, taking prey from the ground, the shrub layer or the canopy. The prey sought, e.g. rabbits, other live mammals and insects would not occur on the residue storage facility in significant numbers. The Spotted Harrier is similarly unlikely to utilise the residue storage facility due to a lack of standing water and prey species such as ground birds such as quail and pipits, mice, rats, rabbits and lizards.
- The Little pied bat and Eastern Bent-wing bat feed predominantly on insects. As discussed for several of the threatened bird species considered, the residue storage facility is not likely to be a source of significant populations of insects and therefore unlikely to be frequented by these or other micropteran bats.

Therefore, based on the measures proposed to directly prevent access to the residue storage facility, reduce the availability of or obscure resources such as standing water and increase the attractiveness of other resources sites on the Mine Site, e.g. water bodies and remnant vegetation, access to the cyanide containing residue and water would be restricted. The ecology of the locally identified threatened fauna has also been reviewed and given the lack of standing water and foraging resources on the residue storage facility, none of these species are likely to seek out the residue storage facility. Based on the above, the site is not considered sensitive to wildlife on the basis that exposure to process solutions containing cyanide would be restricted and the risk of fauna access is minimised.

On the basis of the residue storage facility being a non-sensitive site, the Proponent commits to the following additional management and mitigation measures.

- The WAD cyanide concentration reporting to the RSF would not exceed 50mg/L, with a 90th percentile concentration limit of 30mg/L.
- The presence of standing water on the surface of the residue storage facility would be closely monitored, with plastic balls (or other coverage of the standing water) deployed as required.
- The concentration of WAD cyanide discharged to the residue storage facility would be monitored daily.
- In the event that terrestrial or arboreal fauna still gains access to the residue storage facility, the following additional measures would be reviewed and implemented if likely to be effective.
  - Use of a rotating spot light on a random sequence at night, ensuring that the spotlight does not adversely impact on the visual amenity of surrounding residents.
  - Use of hydrogen guns to „scare" any populations of birds from the residue storage facility in consultation with the community who may be affected by the noise of the guns.
- Monitoring of fauna occurrence and/or mortality within or in the vicinity of the residue storage facility would be undertaken in accordance with the recommendations of OzArk (2011a). A summary of the proposed fauna monitoring program is as follows.
  - Routine wildlife utilisation and mortality observations would be undertaken weekly. The frequency would increase to daily if dead fauna observed on or immediately surrounding the residue storage facility.
  - Monitoring would be undertaken for at least 30 minutes within 3 hours of sunrise.
  - The monitoring would be completed by mine personnel after receiving appropriate training from a qualified ecologist, zoologist or wildlife biologist.
  - Weather conditions at the time of survey would be recorded as would an estimation of the extent of the supernatant on top of the tailings (as a total percentage of tailings dam area) and the percentage of solids in discharged tailings for that day.
  - All observations of wildlife visitations to the residue storage facility would be recorded. Habitat utilisation would be recorded as either supernatant, i.e. standing water, bare ground (dam walls), wet slurry, aerial (above the tailings), dry tails or feeding on carcasses.
  - The locations of any carcasses would be recorded. If a carcass is encountered, photographs should be taken, if possible, of any new or unidentified carcass species to facilitate the confirmation of susceptible species. On subsequent surveys, personnel would identify and record the fate of carcasses, either as removed by scavengers or subsequent entombment under tailings.

- Any fauna mortality would be reported to OEH, including and proposed additional management to minimise potential for further fauna mortality.
- Additional mitigation measures would be investigated and implemented in the event of unacceptable wildlife mortality.

#### 4.5.7.3.5 Management Measures – Landscape Management Plan

In accordance with the recommendations of OzArk (2011a), the Proponent would develop and implement a *Landscape Management Plan* (LMP) for the Mine Site. The LMP would identify procedures and strategies for managing existing and rehabilitated native vegetation and habitat, with particular reference to threatened biota. The LMP would include the following.

- **Pest Animal Strategy**
  A pest animal strategy would be developed in conjunction with relevant government agencies and surrounding landholders to manage introduced fox, rabbit, hare and feral cat.
- **Weed Control Program**
  A weed control program would be developed to manage weed species within the Mine Site. The plan would provide for the prevention of future weed invasion and establishment within the Mine Site. Notably, the weed control plan would take into account the habitat value provided by some weed species, eg. African boxthorn, and delay control programs accordingly until alternative habitat can be established.
- **Grazing Strategy**
  Grazing as a land management tool has been used since European settlement. The strategy would ensure that continued grazing operations are consistent with ongoing operation and rehabilitation objectives of the Mine Site.
- **Conservation and Amelioration Strategy**
  Section 4.5.7.4 describes the proposed biodiversity offset strategy.

### 4.5.7.4 Offsetting of Impacts

In accordance with Step 4 of DEC and DPI (2005), the Proponent has proposed a Biodiversity Offset Strategy (TGP BOS) to offset the impact on biodiversity that cannot be avoided or mitigated. The objective of the TGP BOS is to ensure that the Project meets the "No Net Loss" benchmark nominated by DECCW (2010).

Section 2.14.8, **Figure 2.19** and **Table 2.12** describe the proposed implementation of the TGP BOS.

## 4.5.8 Assessment of Residual Impacts

### 4.5.8.1 Introduction

This sub-section assesses the residual impacts of the Project on biodiversity, and in particular threatened species, in accordance with Step 3 of DEC and DPI (2005). This step involves identifying not only the magnitude and duration of impacts, but also the significance of the impacts as related to the conservation importance of the habitat, individuals and populations likely to be affected.

In order to assess the significance of impacts, an evaluation of the TGP BOS against the OEH and DSEWPaC policies and principles described in Section 2.14.8.2 for assessing biodiversity offsets was completed.

### 4.5.8.2 Biodiversity Offset Strategy

#### 4.5.8.2.1 Introduction

The following sub-sections consider the TGP BOS against the following.

- OEH Interim Policy on Assessing and Offsetting Biodiversity Impacts of Part 3A Developments (DECCW, 2010) (Section 4.5.8.2.2).
- DSEWPaC Draft Policy Statement: Use of Environmental Offsets under the EPBC Act 1999 (DSEWPaC Draft Policy Statement“) (Section 4.5.8.2.3).
- The Principles for the use of Biodiversity Offsets in NSW presented as Appendix II of the Guidelines for Biodiversity Certification of Environmental Planning Instruments – Working Draft published by the then Department of Environment and Climate Change in April 2007 (DECCW Offset Principles) (Section 4.5.8.2.4).

#### 4.5.8.2.2 Evaluation against DECCW (2010)

In accordance with the recommendations of DECCW (2010), OzArk (2011a) completed a BioBanking Credit Report (in accordance with the BioBanking Assessment Methodology [BBAM]) for the disturbance proposed by the Project. **Table 4.37** provides the output generated by the BioBanking Credit Report for credit requirements (based on the type and condition of vegetation to be disturbed).

**Table 4.37** also provides the output generated by the BioBanking Credit Report for credits obtained from the proposed TGP BOS (based on the type and condition of vegetation to be conserved and enhanced).

Critically, for all but Community 5 (Benson 57), the TGP BOS provides for a surplus of ecosystem credits when compared to those required. Overall, a surplus of 870 ecosystem credits is provided by the TGP BOS and, given two of the communities for which surplus credits are provided are EECs (Benson 76 – 369 surplus credits and Benson 201 – 284 surplus credits), the TGP provides for conservation of “like for like <u>or better</u>” vegetation.

Considering the proposed TGP BOS against the BBAM generated offset requirements, the proposed offset meets the “No Net Loss” benchmark, only failing to meet the “maintain or Improve” benchmark given the unavoidable disturbance to EECs, i.e. red flag areas, and small deficit of credits provided for Community 5.

**Table 4.37**
**BioBanking Calculated Credit Requirements and Project Credits**

**BioBanking Calculated Credit Requirements for Impact Vegetation**

| Vegetation Community | Area Disturbed | Credits Required | Minimum Patch Size | Red Flag |
|---|---|---|---|---|
| Community 1: Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly on the eastern Cobar Peneplain Bioregion (Benson 76) | 3.6ha[1] | 113 | 5ha | Yes |
| Community 2: River Red Gum riverine woodlands and forests in Nandewar and Brigalow Belt South Bioregions (Benson 78) | 0 | 0 | - | Yes |
| Community 3: Fuzzy Box – Inland Grey Box on alluvial brown soils of the NSW South Western Slopes Bioregion and Southern BBS Bioregion (Benson 201) | 0.9ha | 30 | 5ha | Yes |
| Community 4: Poplar Box – Belah woodland on clay alluvial plains of north-central NSW (Benson 56) | 0 | 0 | - | No |
| Community 5: Belah / Black Oak Western Rosewood, Wilga Woodland of central NSW including Cobar Peneplain Bioregion (Benson 57) | 18.0ha | 453 | 25ha | No |

Note 1: The Biobanking Credit Report was completed when the calculated area of disturbance was 3.6ha (as opposed to 2.7ha). The report therefore overstates the minimum area requirements for Community 1.

**BioBanking Calculated Credits Generated by the Project Biodiversity Offset Strategy**

| Vegetation Community | Area Conserved (Condition) | Area Enhanced (Condition) | Credits Created | Patch Size | Net Improvement |
|---|---|---|---|---|---|
| **Community 1** | 21.1ha (Moderate to Good) | | 226 | 5-25ha | • Net surplus of 369 Credits.<br>• Patch size meets minimum area required. |
| | | 21.5 (Low Condition) | 256 | 5-25ha | |
| **Community 2** | 13.1ha (Moderate to Good) | | 137 | 5-25ha | • Net surplus of 286 Credits. |
| | | 13.5 (Low Condition) | 149 | 0-5ha | |
| **Community 3** | 5.1ha (Moderate to Good) | | 58 | 0-5ha | • Net surplus of 284 Credits.<br>• Patch size meets minimum area required. |
| | | 26.0ha (Low Condition) | 256 | 5-25ha | |
| **Community 4** | 4.9ha (Moderate to Good) | | 42 | 0-5ha | • Net surplus of 42 Credits. |
| **Community 5** | 17.2ha (Moderate to Good) | | 170 | 0-5ha | • Net deficit of 111 credits.<br>• Patch size meets minimum area required. |
| | | 17.2 (Low Condition) | 172 | 5-25ha | |

Note 1:
- Community 1: Inland Grey Box EEC.
- Community 2: River Red Gum riverine woodland forest.
- Community 3: Fuzzy Box EEC.
- Community 4: Poplar Box – Belah woodland on clay alluvial plains.
- Community 5: Belah / Black Oak Western Rosewood, Wilga Woodland community.

Source: Modified after OzArk (2011a) – Table 20

#### 4.5.8.2.3 Evaluation against DSEWPaC Draft Policy Statement

Three considerations are associated with the DSEWPaC Draft Policy Statement.

- Consideration 1 - Consistency with DSEWPaC definition.

  DSEWPaC defines environmental offsets as actions taken outside the development site. The TGP BOS incorporates conservation and enhancement of vegetation on land outside of the Mine Site. Furthermore the proposed conservation and enhancement on the Mine Site itself would be outside the areas of proposed disturbance.

  The DSEWPaC definition states that offsets cannot make proposals with unacceptable impacts acceptable, rather, the offsets provide compensation for those impacts which cannot be adequately reduced through avoidance and mitigation. As noted in Sections 4.5.7.2 and 4.5.7.3, impacts have been avoided and mitigated as far as practicable. The proposed TGP BOS is therefore considered to be consistent with the DSEWPaC definition.

- Consideration 2 - Types of environmental offsets.

  Actions that can be considered as environmental offsets are generally categorised into direct and indirect offsets. Direct offsets are aimed at on-ground maintenance and improvement of habitat or landscape values. Indirect offsets are the range of other actions that improve knowledge, understanding and management leading to improved conservation outcomes. OzArk (2011a) concludes that the proposed TGP BOS is largely consistent with the three DSEWPaC defined environmental aims for direct offsets, namely:

  – restoration or rehabilitation of existing degraded habitat, i.e. conservation of 61.4ha of remnant native vegetation; and

  – re-establishing habitat, i.e. enhancement and protection from competing land uses of 78.2ha of land adjoining the remnant vegetation to be conserved.

  Currently, the TGP BOS does not nominate a mechanism for long-term protection of existing habitat. However, on approval of the TGP BOS proposal, the Proponent would implement an „in perpetuity" conservation arrangement, either through establishing covenants on the land title or other form of formal conservation agreement over the land.

  OzArk (2011a) concludes that the proposed TGP BOS is largely consistent with the three DSEWPaC defined environmental aims for indirect offsets. Inconsistencies relate to the fact that the TGP BOS does not provide for contributions to relevant research or education programs, trust funds or banking schemes.

- Consideration 3 - Principle for the use of environmental offsets.

  The proposed conservation and amelioration strategy is consistent with seven of the eight Australian Governments requirements (OzArk, 2011a – *Table 24*). The only inconsistency relates to the fact that currently the TGP BOS does not nominate a mechanism for long-term protection of existing habitat. As noted above, on acceptance of the TGP BOS by the consent authority, the Proponent would implement an „in perpetuity" conservation arrangement.

#### 4.5.8.2.4 Evaluation against OEH Offset Principles

The following considers the adequacy of the proposed Biodiversity Offset Strategy against the 13 guiding "*Principles for the use of Biodiversity Offsets in NSW*" (DECC, 2007).

- <u>Principle 1: Impacts must be *avoided first* by using prevention and mitigation measures.</u>

  The Project was designed to avoid remnant native vegetation where possible, with the only areas where relocation was not possible related to the open cut footprints which are controlled by the location of the mineral resources (see Section 4.5.7.2). Notably, only 21.6ha (13.8%) of the 156.3ha of remnant native vegetation within the study area would be removed as a result of the Project.

  Section 4.5.7.3 nominates the measures that would be implemented to mitigate the residual impacts and would include, amongst other measures and controls, progressive rehabilitation and implementation of vegetation clearing protocols to reduce the potential impact on threatened fauna species.

- <u>Principle 2: All regulatory requirements must be met.</u>

  The Proponent would meet all regulatory requirements related to the construction, operation and rehabilitation of the Project.

- <u>Principle 3: Offsets must never reward ongoing poor performance.</u>

  The project design demonstrates the Proponent"s ability to avoid and mitigate, as far as practicable, adverse impacts on biota (see Sections 4.5.7.2 and 4.5.7.3). In addition, the existing, voluntary environmental rehabilitation at the Peak Hill Gold Mine demonstrate the Proponent"s willingness and capability to successfully complete rehabilitation of mine sites once mining operations have been completed. The rehabilitation has included the following.

  – Establishment of approximately 3 000 trees and shrubs (including yellow box, bimble box, inland grey box, mugga ironbark, river red gum, fuzzy box, tumble down gum, buloke, belah, myall, kurrajong and butterbush) within 90ha of alluvial areas adjacent to the Peak Hill Gold Mine.

  – Natural regeneration of western golden wattle, white cypress pine and myall woodlands through de-stocking within 40ha of formerly cropped areas that have now regenerated to native grassland.

  The Proponent notes that two species of macropod, namely the red-necked wallaby (*Macropus rufogriseus*) and Common Wallaroo (*Macropus robustus*), as well as the threatened grey-crowned babbler have moved into the rehabilitated area where they did not exist prior to 1996.

- <u>Principle 4: Offsets will complement other government programs.</u>

  The proposed TGP BOS would increase the biodiversity value of the Mine Site and adjoining land, protect and enhance existing EECs (meeting the DECCW

[2010] No Net Loss benchmark) and address key threatening processes, all of which are in line with government programs.

- Principle 5: Offsets must be underpinned by sound ecological principles.

  The calculation of ecosystem credit requirements (based on the type and condition of vegetation to be disturbed) and an assessment of the value (in terms of ecosystem credits) provided by the proposed TGP BOS has been completed in accordance with the BioBanking Assessment Methodology (BBAM). BBAM is recommended by OEH as the preferred method of identifying biodiversity offset requirements and assessing the suitability of proposed biodiversity offsets. Application of the BBAM indicates that the proposed TGP BOS would provide ecosystem credits in excess of that required, i.e. the proposed TGP BOS would provide for an improvement in biodiversity. More generally, the proposed TGP BOS considers sound ecological principles as follows.

  - On a regional scale, the proposed vegetation enhancement proposed as part of the TGP BOS would include species at all structural levels of the vegetation communities targeted for re-establishment, i.e. canopy species, shrub layer, understorey and groundcover. Importantly, the understorey and groundcover layers of the remnant patches of EECs and other native vegetation communities are currently almost non-existent due to historic grazing pressure and invasion of introduced species.
  - The proposed TGP BOS would also provide for an increase in the area of occupancy and ability to naturally recover of the remnant areas of the identified remnant EECs. The proposed TGP BOS provides for both the conservation of moderate to good condition vegetation, as well as the enhancement of adjoining vegetation in low condition. By protecting and increasing the size of remnant patches of native vegetation (including creation of linkages between remnant patches), the long-term viability and functionality of these communities and the biodiversity value of the final landform would be improved.
  - The proposed revegetation would specifically target species which provide habitat or resources for threatened fauna species, thereby encouraging an increase in biodiversity locally. Evidence of the success of the proposed conservation and amelioration strategy in relation to this aim is provided by the revegetation at the Peak Hill Gold Mine site which has resulted in the immigration of threatened species not previously recorded on the site, including the red-necked wallaby, common wallaroo and grey-crowned babbler.
  - Finally, the entire Mine Site and surrounding areas would be managed through a *Landscape Management Plan*, with specific end land uses identified and managed accordingly. This would ensure the long term viability of the rehabilitated, conserved and enhanced areas.

- Principle 6: Offsets should aim to result in a net improvement in biodiversity over time.

  The area of vegetation protection, enhancement and conservation of the three vegetation communities to be disturbed (approximately 139.6ha) is almost 6½ times the area that would be disturbed by mining and associated activities. Further, and as noted in Section 4.5.8.2.2, the ecosystem credits generated by the proposed conservation and enhancement of native vegetation (see **Table 4.37**) exceeds the nominated ecosystem credit requirements generated (see **Table 4.37**) for all but Community 5. In considering the deficit of ecosystem credits for Community 5, it is noted that the overall surplus of ecosystem credits generated by the TGP BOS (870 credits) is almost 8 times this deficit. Furthermore, this surplus includes 653 surplus credits for the Community 1 and 3 EECs and is considered "like for like or better" vegetation (in accordance with Principle 10 of DECCW, 2007).

Given that ecosystem credits exceeding requirements are generated by the TGP BOS (when considered against Principle 10 of DECCW, 2007), the Project is assessed as meeting the "No Net Loss" benchmark of DECCW (2010). The "maintain or improve" benchmark only not achieved due to the requirement for disturbance to red flag areas (EECs).

Considered more generally, the proposed Project Biodiversity Offset Strategy would have the following benefits leading to a net improvement in biodiversity over time.

- The proposed vegetation protection and enhancement would provide for increased patch sizes and linkages of fragmented remnant habitat, thereby improving the habitat value of the vegetation in the final landform.
- The proposed habitat enhancement program would provide for a re-establishment of a native understorey and ground cover within the EECs of the Mine Site and increased structural complexity at the through placement of logs, downed timber and other vegetation cleared.

- Principle 7: Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs.

  At this time there is no arrangement for the establishment of inclusion of land in the conservation estate, or covenanting arrangements over the Mine Site. However, once acceptance of the TGP BOS is obtained from the consent authority, the Proponent would implement an „in perpetuity" conservation arrangement.

- Principle 8: Offsets should be agreed prior to the impact occurring.

  Approval of the TGP BOS is expected as part of project approval for the Project[9]. As identified in the draft Statement of Commitments (Commitments 7.25 to 7.27), the Proponent would implement the native vegetation protection and enhancement measures of the TGP BOS and prepare a Biodiversity Offset Management Plan for monitoring and management of the offset areas within a nominated time frame.

- Principle 9: Offsets must be quantifiable – the impacts and benefits must be reliably estimated.

  **Figure 2.19** and **Table 2.12** quantify the total area of each vegetation community within the Mine Site and the areas of proposed disturbance. The condition of the vegetation to be disturbed has been classified and ecosystem credit requirements

[9] It is possible that approval may be in principle with exact form of the BOS to be confirmed and approved within a nominated timeframe in consultation with OEH and DoP.

identified (using the BBAM) (see **Table 4.37**). The condition of each vegetation community to be incorporated into the TGP BOS has been identified, and ecosystem credits assigned to these on the basis of current community condition and proposed management (see **Table 4.37**). As noted in Sections 4.5.8.2.2 and 4.5.8.2.3, the patch sizes and ecosystem credits provided by the proposed TGP BOS exceed the minimum patch size and credit requirements generated by the BBAM. It has therefore been determined that the proposed TGP BOS would meet the "No Net Loss" benchmark of DECCW (2010).

- <u>Principle 10: Offsets must be targeted – they must offset the impacts on a "like for like or better" basis.</u>

  The ecosystem credits generated by the TGP BOS exceed the minimum ecosystem credit requirements calculated using the BBAM (see **Table 4.37**) given a surplus of ecosystem credits for EECs is provided far exceeding the deficit for another non-EEC.

- <u>Principle 11: Offsets must be located appropriately.</u>

  The proposed TGP BOS occurs within and immediately surrounding the Mine Site and would include the same vegetation communities to those disturbed ("like for like or better" as required by Principle 10).

- <u>Principle 12: Offsets must be supplementary.</u>

  The proposed TGP BOS is supplementary to proposed rehabilitation works on the Mine Site and those already completed at the Peak Hill Gold Mine. Importantly, the proposed vegetation protection, enhancement and conservation are not already funded or have been funded or considered previously for funding.

- <u>Principle 13: Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.</u>

  The Proponent has committed to the proposed TGP BOS and envisages this would be included as a condition of any project approval granted. In addition, it is anticipated that the conditions to any project approval would include a requirement for the Proponent to undertake an independent compliance audit of the Project against the conditions of the Project approval.

#### 4.5.8.2.5 Assessment Summary

The proposed TGP BOS would result in the direct protection of 103.9ha of remnant native vegetation on the Mine Site and immediate surrounds, with enhancement activities increasing the area of native vegetation by a further 61.0ha. Species used in revegetation would replace a missing structural layer (the ground layer and understorey) and „like for like" canopy species would be used. Habitat values of trees to be removed would be incorporated into the restored areas for habitat complexity. The result would increase the area of occupancy of the EECs impacted, as well as assisting in natural recovery of the ecosystem and the animals and plants that depend on them. Cleared material (dead and down timber) removed from the electricity transmission line would be transported to this site to increase structural complexity and thus further aid in grassy woodland restoration.

On the basis of the proposed TGP BOS, OzArk (2011a) conclude that attainment of the DECCW (2010) nominated „no Net Loss‟ benchmark would be achieved. Furthermore, the TGP BOS would be consistent with:

- the majority of the DSEWPaC offset requirements (see Section 4.5.8.2.3); and
- the majority of the 13 nominated OEH Offset Principles.

Importantly, the primary reason for any inconsistency with the offset requirements and principles of DSEWPaC and OEH revolves around the fact that a mechanism for long-term conservation of the land contained within the proposed TGP BOS has yet to be nominated. The Proponent has committed to implementing some form of „in perpetuity‟ conservation arrangement on acceptance of the TGP BOS by the consent authority.

#### 4.5.8.3 Clearing of Native Vegetation

Clearing native vegetation to make way for the Project is the chief impact that would result from the Project, as it would lead to a reduction in available habitat for a number of threatened species which currently utilise the Mine Site.

**Magnitude of Impact**

Section 4.5.7.3.1 (and **Table 2.12**) summarised the approximate areas of each vegetation community on the Project Site to be cleared. Notably, less than 14% of vegetation on the Mine Site would be cleared. Clearing of EECs would equate to less than 7.5% and 3% of the two affected EECs (Inland Grey Box EEC and Fuzzy Box on Alluvials EEC).

**Duration of Impact**

The duration of the impacts is a consideration of the permanence and reversibility of impacts and considers both the resilience of the vegetation cleared and proposed mitigation measures proposed.

The affected communities are likely to be moderately to highly resilient as remnants of each remain in the local area, upon which genetic material would be drawn in the expansion of these communities within the final landform and conservation and amelioration areas. The resilience of each community would be increased given the proposed mitigation measures nominated in Section 4.5.7.3 which include management of weeds, feral pests and grazing, and general habitat enhancement activities.

Given the resilience of the vegetation communities affected, and the proposed revegetation and habitat enhancement included as part of the conservation and amelioration strategy, the impacts are considered to be reversible and are therefore temporary only.

**Significance of Impacts**

The significance of impacts consider both aspects related to the vegetation communities themselves, i.e. relative distribution, importance as habitat to threatened species, regional and local representation, as well as the mitigation and offset measures proposed.

The vegetation of the Project Site to be cleared is typical of the vegetation found elsewhere in the region. Notably, clearing of EECs would be restricted to a combined area of 3.6ha from two separate EECs which would be offset through conservation and enhancement within the Mine Site. Section 4.5.8.7 provides an evaluation of the TGP BOS using BBAM. Critically, the proposed TGP BOS would meet the "No Net Loss" benchmark, only failing to meet the

"Maintain or Improve" benchmark given the unavoidable disturbance to EECs, i.e. red flag areas, and small deficit of credits provided for Community 5.

While a number of trees with hollows would be cleared, a significant number would be retained and protected. Depletion of hollow-bearing trees, combined with fragmentation and clearing, may impact on populations of hollow-using fauna and reduce the number of species that an area can support. This depletion of hollow-bearing trees, and potential impact on native fauna, would be adequately offset through the establishment of the proposed TGP BOS.

#### 4.5.8.4 Loss of Hollow Bearing Trees

**Magnitude of Impact**

As noted in **Table 4.35**, 476 trees would be disturbed by the Project, of which 91 are either of high or moderate habitat value. It is noted that the location of these hollow-bearing trees is within the 21.6ha of Communities 1, 3 and (predominantly) 5 to be disturbed. Notably, significant numbers of trees with equivalent habitat values would be retained on the Mine Site and along the alignment of the water supply pipeline.

**Duration of Impact**

Effectively, once a tree is cleared, the tree hollow is gone and so the impact is permanent. In an attempt to mitigate this permanent impact, should hollows recognised as being currently or frequently used by threatened fauna be identified, the hollows would be relocated at the direction of a qualified ecologist or wildlife biologist.

Considering the proposed revegetation, the impact would ultimately be reversible, although only in the long-term.

**Significance of Impacts**

The impact of removing tree hollows is significant as it has the potential to influence the distribution of threatened species locally. However, given the retention of many more hollow-bearing trees within the Project Site and the proposed management of significant hollows, i.e. those identified as current or frequent habitat to threatened species, the relative significance of the impacts on the local distribution of native biota is assessed to be low.

#### 4.5.8.5 Management of Processing Residue

**Magnitude of Impact**

The implementation of the proposed operating controls and management measures nominated in Section 4.5.7.3 are likely to limit the magnitude of potential impacts to individual animals and the number of and individuals that may be impacted.

**Duration of Impact**

Given the proposed design of the residue storage facility would prevent the seepage of contaminated material to ground or surface water, the duration of potential impacts on local wildlife would be concurrent with the operation of the facility, namely the life of the Project.

### Significance of Impacts

Given that there is expected to be no significant seepage of contaminated material from the residue storage facility that could impact on local water supplies and native biota in the long-term and the proposed measures to prevent wildlife access to the facility, the operation of the residue storage facility would have no significant impact on local biodiversity.

## 4.5.8.6 Impacts on Threatened Species and Endangered Ecological Communities

### 4.5.8.6.1 Introduction

The following sub-sections consider the magnitude, extent and significance of Project-related impacts on those species considered to be potentially affected by the Project. The significance of the impacts has been assessed in accordance with the requirements of Section 5A of the *Environmental Planning and Assessment Act 1979* by OzArk (2011a) based on:

- the importance of individual species, populations and/or plants and/or subpopulations that are likely to be affected by the Project in maintaining the long-term viability of the species, population or ecological community; and
- the importance of habitat features that are likely to be affected by the Project in maintaining the long-term viability of the species, population or ecological community.

A summary of the assessment for each species completed by OzArk (2011a) is provided in the following sub-sections.

### 4.5.8.6.2 Grey-crowned Babbler

Within the Project Site, this species was recorded as three family groups along the water supply pipeline route, and possibly two family groups within the Mine Site. This species would potentially utilise all remnant native vegetation of the Mine Site and water supply pipeline route and derived grass communities.

OzArk (2011a) concludes that the Project would remove one tree with roosting sites and a breeding nest within core breeding habitat for this species. However, assuming the implementation of the proposed mitigation measures related to vegetation clearing (see Sections 4.5.7.3.2 and 4.5.7.3.3), no animals would be harmed by the Project. The Project could result in a reduction in the extent of a feeding resource within the Mine Site, however, it is not considered that it would cause a significant impact to the local population

### 4.5.8.6.3 Little Pied Bat

These bats are likely to feed on the Project Site and surrounding environs, however, are unlikely to roost within the Mine Site. This species would potentially utilise all remnant native vegetation within the Project Site.

OzArk (2011a) concludes that the Project would remove trees that have potential roosting habitat for this species, however, assuming the implementation of the proposed mitigation measures related to vegetation clearing (see Section 4.5.7.3) no animals would be harmed by the Project. The Project could result in a reduction in the extent of a feeding resource within the Mine Site, however, it is not considered that it would cause a significant impact to the local population.

#### 4.5.8.6.4 Superb Parrot

Up to 60 individuals of this species were identified within the Mine Site and this species would potentially utilise all remnant native vegetation within the Project Site and would feed in highly modified exotic grass dominated paddocks. Core breeding habitat does not occur within the Project Site.

OzArk (2011a) concludes that the Project is unlikely to directly remove breeding habitat, although it would reduce the extent of a feeding resource within the Project Site. The Project is unlikely to cause impact to a locally occurring population of this species such that it is placed at risk of local extinction.

The superb parrot is also listed as a threatened species under the EPBC Act and is therefore a matter of national environmental significance. OzArk (2011a) undertook an assessment of whether the Project would be likely to have a significant impact on this species in accordance with guidelines published by DSEWPaC and concluded that the Project would be unlikely to cause local extinction or impact to this species. As a result, a referral under the EPBC Act to the Commonwealth Minister for Sustainability, Environment Population & Communities is not required.

#### 4.5.8.6.5 Koala

This species was not observed, however, it may occur as dispersing or transient individuals along the alignment of the water supply pipeline which contains potential Koala habitat.

OzArk (2011a) concludes that the Project would remove trees that have potential for this species to feed upon, however, it is not considered that it would cause a significant impact to the local population such that it is placed at risk of local extinction.

#### 4.5.8.6.6 Inland Grey Box Endangered Ecological Community

This community was identified within both survey areas. The quality of the remnant stands of this community were better and more diverse in the TNWP Survey Area than the Mine Site Survey Area where there is no grassy or understorey layer. The community does not appear to be stressed within the Mine Site and TNWP remnants.

OzArk (2011a) concludes that while the Project would remove a small area of this EEC, this removal is unlikely to cause impact such that the EEC is placed at risk of local extinction as the proposed TGP BOS would provide for the direct conservation of this community at a ratio of greater than 12:1 ratio (increasing to 20:1 if the vegetation enhancement is included).

#### 4.5.8.6.7 Fuzzy Box Endangered Ecological Community

The Fuzzy Box on Alluvials of South West Slopes, Darling Riverine Plains and the Brigalow Belt South Endangered Ecological Community was identified within both survey areas. The quality of the remnant stands of this community were better and more diverse in the TNWP Survey Area than the Mine Site Survey Area where there is no grassy or understorey layer. The community does not appear to be stressed.

OzArk (2011a) concludes that while the Project would remove a small area of this EEC, this removal is unlikely to cause impact such that the EEC is placed at risk of local extinction as the proposed TGP BOS would provide for the direct conservation of this community at a ratio of greater than 30:1 ratio (increasing to almost 60:1 if the vegetation enhancement is included).

#### 4.5.8.6.8 Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River Endangered Ecological Community

A review of the NSW Scientific Committee determination shows that any natural waterway within the Project Site is part of this EEC. Most of the named creeks to be traversed by the water supply pipeline are assessed as having „moderate fish habitat" as they have potential to allow for the passage of fish when inundated but not possess populations of fish during „normal" periods.

OzArk (2011a) concludes that the Project would have some minor impact on portions of this EEC. However, assuming all works in or adjacent to these waterways are undertaken in accordance with the management measures nominated in Section 4.5.7.3, any impact on this EEC is unlikely to cause impact such that the EEC is placed at risk of local extinction.

#### 4.5.8.7 Other Impacts on Biodiversity

It is probable that some wildlife may be injured or killed by vehicles travelling on or to/from the Mine Site. Management of the workforce to require adherence to speed limits as a condition of employment would reduce the likelihood of this occurrence and ultimately ensure the significance of such impacts is low.

Noise, dust and lighting-related impacts associated with the Project are considered by OzArk (2011a) to be unlikely to have any significant impact on local biodiversity.

Through preparation and implementation of a *Landscape Management Plan*, the Project would be likely to reduce feral pest and weed numbers on the Mine Site and in the locality more generally.

## 4.6 ABORIGINAL HERITAGE

### 4.6.1 Introduction

The DGRs identify "***Heritage - both Aboriginal and non-Aboriginal***" as a key issue for assessment in the *Environmental Assessment*. Based on the risk assessment undertaken for the proposal (see Section 3.5), the specific Aboriginal heritage-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include the following.

- Removal or destruction of known Aboriginal sites and/or artefacts within the Project footprint (including Tomingley Narromine Water Pipeline route (high risk).
- Removal or destruction of currently unidentified Aboriginal sites and/or artefacts due to Project Site extraction and associated activities (high risk).

The heritage assessment for the Project was undertaken by Dr Jodie Benton of OzArk Environmental and Heritage Management Pty Ltd ("OzArk"), in consultation and conjunction with the registered stakeholders of the local Aboriginal community. The resulting report is presented as Part 5 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "OzArk (2011b)". This sub-section of the *Environmental Assessment* provides a summary of the Aboriginal heritage aspects of that report while Section 4.7 presents a summary of the non-Aboriginal heritage aspects of that report.

For the sake of clarity, unless specified, references in this section and in Section 4.7 to "heritage" refer to both Aboriginal and non-Aboriginal heritage.

### 4.6.2 Heritage Study Area

For the purposes of the current assessment, the heritage survey and assessment considered two separate study areas within the Project Site[10].

- The Mine Site Study Area: comprising all areas of proposed Project-related disturbance associated with the open cut mining operations and related activities.
- The Tomingley – Narromine Water Pipeline (TNWP) Study Area: a 5m wide and approximately 46km long corridor (predominantly located within existing road reserves) from the "Woodlands" property, Narromine to the Mine Site.

### 4.6.3 Assessment Methodology

The Aboriginal heritage assessment was undertaken in the following stages.

- Stage 1 – Background Research and Literature Review

  An understanding of the archaeological context of the Project Site was obtained through a review of historic records of the local area, previous archaeological studies and the Aboriginal Heritage Information Management System (AHIMS) register of Aboriginal sites. This information is summarised in Section 4.6.4.

- Stage 2 – Consultation and Community Involvement

  Local Aboriginal community stakeholders were identified in accordance with the *Interim Community Consultation Requirements* (ICCRs) (DEC, 2004). Each of the registered stakeholders was consulted in relation to survey and assessment methodology and on several occasions throughout the Project design and assessment process in relation to specific heritage matters. Section 4.6.5 provides further detail on the consultation undertaken as part of the heritage assessment.

- Stage 3 – Development of a Predictive Model for Site Location

  Based on the background research and experience of OzArk, the archaeological sensitivity of landforms within the two study areas were determined to predict the likely type and frequency of site types that may be identified. This allows for the development of a more targeted field survey methodology. Section 4.6.6 provides further detail on the predictive model for site location and distribution.

- Stage 4 – Field Survey

  Separate field surveys were undertaken on the following dates.

  – Mine Site Study Area: 5 to 7 August, 1 to 2 September 2009 and 30 November 2010.
  – TNWP Study Area: 1 and 2 July 2009.
  – Test excavation of a Potential Archaeological Deposit (PAD) identified during the field survey of the TNWP Study Area on 1 and 2 February 2011.

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[10] OzArk also surveyed the alignment of the Peak Hill – Tomingley Electricity Transmission Line Study Area. The results of this survey are included as part of a separate application under Part 5 of the EP&A Act for the construction and operation of this electricity transmission line.

Section 4.6.7 presents further detail on the site inspection methodology, coverage and results.

- Stage 5 – Development of Management Strategies for the Identified Aboriginal Sites

  Based on the relative cultural, scientific and public significance of the identified Aboriginal sites, management strategies have been recommended. These strategies have also been provided to the registered Aboriginal parties for consideration and comment. Section 4.6.8 presents further detail on the management strategies to be implemented for the identified Aboriginal sites.

- Stage 6 – Assessment of Impacts

  The results of the field survey were assessed, taking into account various factors including cultural and scientific significance of the identified sites. Section 4.6.9 provides further details in relation to the assessment of impacts, taking into account the management and mitigation measures identified in Section 4.6.8 and the consultation completed with the Aboriginal community discussed in Section 4.6.5.

### 4.6.4 Background Research and Literature Review

#### 4.6.4.1 Regional Archaeological Context

The Project Site is situated within the territory of people belonging to the *Wiradjuri* tribal and linguistic group. More specifically, the peoples who would have occupied the areas surrounding the Project Site prior to and immediately following European settlement would have been the Bogan River *Wiradjuri* people, whose range included Tomingley and was bounded to the east by the Herveys Range (Goobang).

Patterns of Aboriginal and early European settlement in the region (of Dubbo and surrounds) have been analysed as part of broad regional studies (Koettig, 1985; Balme, 1986). Based on these analyses, Koettig (1985) makes the following conclusions with regard to the Aboriginal occupation of the region.

- Evidence of Aboriginal occupation may be expected throughout all landscape units, with the most frequently occurring examples of occupation being open artefact scatters, scarred trees and grinding grooves.
- Aboriginal occupation of specific areas within the region would be determined by various factors, predominantly environmental and social. Although social factors cannot be explained through archaeological research, some of the environmental issues may be. These are as follows.
  - Proximity to water - the largest campsites were located close to permanent water.
  - Geological formation - Certain sites require specific conditions, e.g. grinding grooves occur where appropriate sandstone outcrops.
  - Availability of food resources - The widest range of potential foods was found along the main water courses due to the supply of permanent water.

Koettig (1985) suggested that larger and more constantly occupied sites are likely to occur along permanent watercourses, while less intense and sporadic occupation evidence is seen along ridge tops or temporary water sources e.g. creek headwaters.

### 4.6.4.2 Local Archaeological Record

Information on the presence of Aboriginal people in Tomingley and the immediate surrounds was compiled following historical research of:

- published references;
- unpublished manuscripts;
- archival records (including educational and police indexes and specific Aboriginal Board of Protection);
- information held by NSW Land and Property Information (NSW LPI); and
- oral history accounts[11].

The local historic information was compiled by Ms Belinda Burbidge, who is currently completing pHD studies at the University of Sydney on behalf of OzArk. A completed account is provided in *Section 4.2* of OzArk (2011b), with the following providing a summary of the findings of Ms Burbidge"s research.

The first historical reference to Aboriginal people appeared in the Peak Hill Express in 1905, reporting on the beginnings of Bulgandramine Mission, which operated between 1907 and 1941, located about 22km northwest of Peak Hill at the confluence of Gundong Creek with the Bogan River. The Peak Hill Express article suggests that Aboriginal people used Tomingley as a camp site and that Tomingley may have been originally intended as the site of such a mission. According to local Wiradjuri woman, Valda Keed, when Bulgandramine ran out of water people would walk back to Tomingley, to camp at more permanent water sources there. People would walk back along the Gundong Creek and sometimes camp along the way, and also along the Tantitha Road on the way to Wellington (pers. comm. Valda Keed: 27 September 2011, as referenced in OzArk, 2011b).

It is noted that a 1919/20 street map of Tomingley (see **Figure 4.30** on p. 4-152) includes an Aboriginal Reserve on the west hand side corner of the Narromine and Bulgandramine Roads. Neither land title information for this period, nor any other historical records (including from the Aborigines Protection Board, which was operational during this period), presently held and indexed with the NSW state archives, suggest that the identified site served this purpose. The evidence obtained from historical reports of the early 20th century, supported by the verbal history provided by Ms Valda Keed, suggest that while no formal Aboriginal reserve was maintained within Tomingley, various sites in and around Tomingley were regularly used by Aboriginal people as camp sites and sources or water and other resources.

Ms Burbidge"s research concludes that following the closure of the Bulgandramine Mission (circa 1941), the Aboriginal people from the mission did not return to Tomingley (which was in decline), rather taking up residence on the hill and along the flat at Peak Hill, as well as other neighbouring towns.

[11] Verbal history provided to OzArk and Alkane by traditional owners on 28 September 2011 at a community meeting convened by the Proponent for the purpose of discussing historic associations of the local people to the Tomingley area and management measures for a significant Aboriginal site identified on the Project Site.

#### 4.6.4.3 Regional Archaeological Record

OzArk (2011b) identifies that there have been numerous Aboriginal heritage studies in the vicinity of the Project Site, including but not necessarily limited to the following (presented in approximate chronological order).

- Assessment for a 66kV electricity easement from Parkes to Peak Hill (Moore, 1977).
- Studies associated with the development of the Northparkes Mine (Stone 1986, Nicholson 1990, Paton 2006), situated west of Peak Hill close to the headwaters of the Bogan River and in a generally similar environment to that of the Mine Site.
- Archaeological survey for a proposed water pipeline from the Northparkes Mine (Brayshaw, 1993).
- Assessment of the cultural heritage of a large part of the Hervey Ranges as part of the development of a Plan of Management for the Goobang National Park (English, 1998)
- Assessment of the proposed realignment of the Newell Highway north of Parkes (Appleton, 2003).
- A preliminary heritage assessment of the corridor options for the proposed Manildra–Parkes 132kV Electricity Transmission Line (ETL), located to the south and east of the Mine Site (OzArk, 2008).

A search of the Aboriginal Heritage Information Management System database (AHIMS) was undertaken over two areas as follows.

- A 10km x 30km area north of Tomingley covering the northern and central sections of the Water Pipeline Route.
- A 20km x 30km area centred on Tomingley and covering the Mine Site and southern section of the Water Pipeline Route (as well as a proposed electricity transmission line route that is the subject of a separate application under Part 5 of the EP&A Act).

A total of 46 registered sites were identified. However, OzArk (2011b) notes that one site has been recorded with incorrect coordinates and actually occurs outside the search area. **Table 4.38** provides a summary of the remaining 45 recorded sites, classified by site type. The search indicated that modified trees are the most common type of site identified within the search area, followed by open site and artefacts.

**Table 4.38**
**AHIMS-Registered Sites**

| Site Type | Number | % Frequency |
|---|---|---|
| Modified Tree | 26 | 58 |
| Open Site /Artefacts | 9 | 20 |
| Isolated find | 6 | 13 |
| Burial/Mod Tree | 3 | 7 |
| Quarry/Artefact | 1 | 2 |
| **Total** | **45** | **100** |

Source: OzArk (2011b) – Table 1

The locations of the recorded sites are identified on **Figure 4.25**.

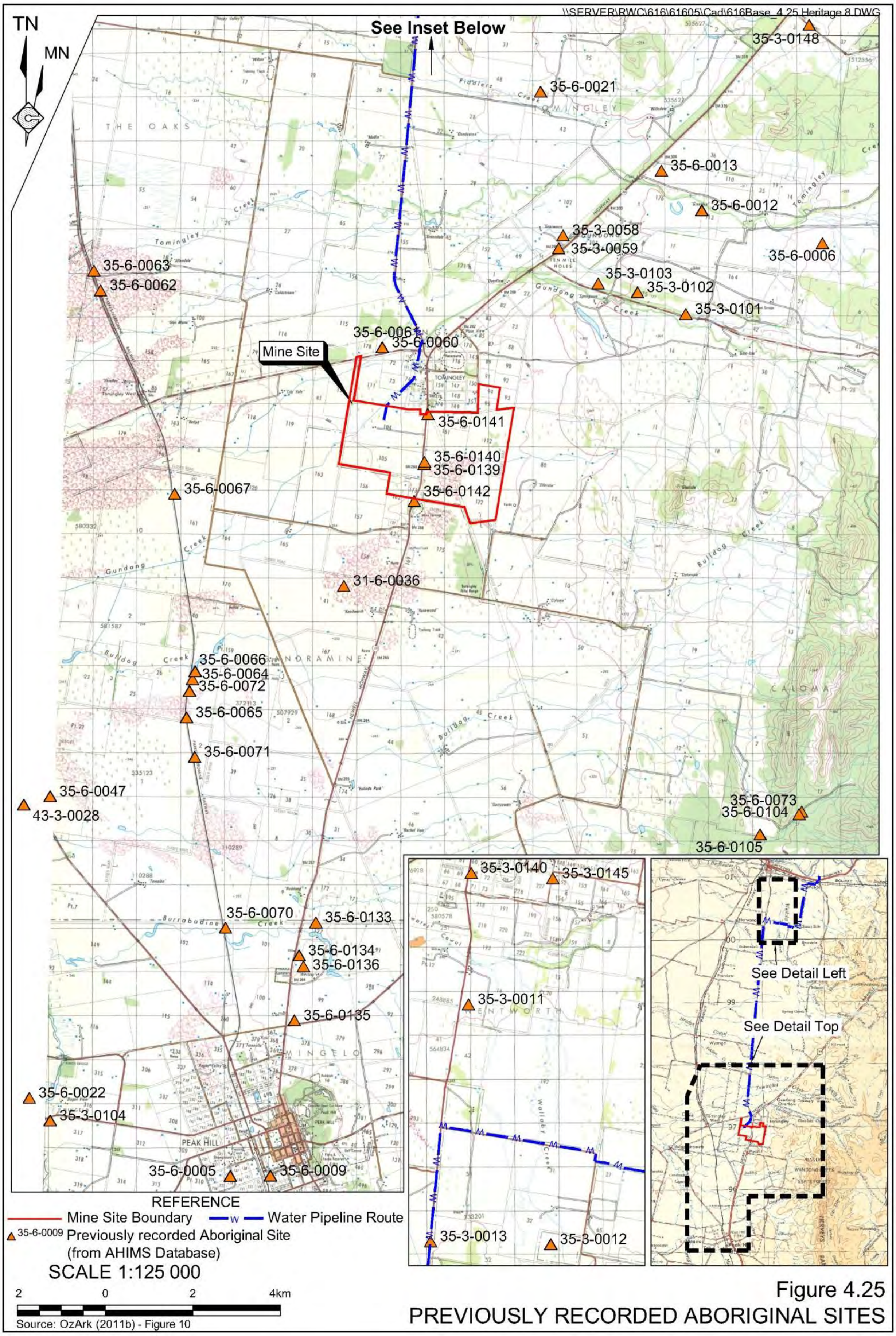


Figure 4.25
PREVIOUSLY RECORDED ABORIGINAL SITES

## 4.6.5 Consultation and Community Involvement

### 4.6.5.1 Consultation

#### 4.6.5.1.1 Mine Site, TNWP and Electricity Transmission Line Study Areas

In accordance with the requirements of the ICCRs, the proposed field survey and assessment of the three study areas[12] was advertised in the local print media on 22 April 2009. Letters were also sent to the Narromine and Peak Hill Local Aboriginal Land Councils, OEH (as the former DECCW), Narromine Shire and Parkes Shire Councils, the Register of Aboriginal Owners and additional groups identified as a consequence of the first round of advertising and agency contact.

Seven organisations or individuals formally registered interest in the Project following the advertisement, with a further two registering interest following attendance at a project information session held by the Proponent in Peak Hill. The registered groups and individuals are as follows.

- Narromine Local Aboriginal Land Council (Narromine LALC).
- Peak Hill Local Aboriginal Land Council (Peak Hill LALC).
- Little Burning Mountain Aboriginal Corp (LBMAC).
- Mooka Traditional Owner Corporation (MTOC).
- Wiradjuri Council of Elders (WCE).
- Trevor Robinson (individual).
- Peter Peckham (individual).
- The Bogan River Peak Hill Wiradjuri Aboriginal Corporation (BPHWAC).
- Bulgandramine Youth Development Aboriginal Corporation (BYDAC).

Letters describing the proposed heritage assessment methodology were sent to all stakeholders with a request for any specific cultural information (should any be available), as well as inviting comment / input on the methodology proposed. Feedback received was incorporated by OzArk into the assessment design prior to fieldwork being initiated.

A search of the National Native Title Tribunal website (last updated 31 December 2010) revealed that there are currently no native title claims over the any of the two study areas.

A draft copy of the Cultural Heritage Assessment (OzArk, 2011b) was provided to representatives of the Peak Hill Aboriginal Reference Group on 7 April 2011 for consideration of the proposed management of the identified Aboriginal sites (in accordance with Stage 4 of DECCW, 2010). At this time, the remaining registered Aboriginal stakeholders were notified as to the availability of the draft report for review and comment (as required by Stage 3 of the ICCR‟s which states):

> "*Once the draft report is completed, notice of its availability must be provided to all the registered stakeholders identified in Step 1, and the Local Aboriginal Land Council (even if not registered) for comment*" (p. 6 of DEC, 2004).

[12] Including the Peak Hill Tomingley Electricity Transmission Line Study Area.

The Proponent requested that any comments or requested modifications to the proposed management strategies be provided to the Proponent.

Consultation with the local Aboriginal community has been ongoing and continuous since the advertisement of the original invitation for registration of interest in the Project. The Proponent, either directly or through its archaeological consultant (OzArk), has involved the local Aboriginal community in the development of strategies to manage impacts on Aboriginal heritage and involve the community in the continued development of the Project. *Appendices 2* and *3* of OzArk (2011b) provide a detailed summary of the consultation undertaken.

Following concerns raised by DP&I (in September 2011) regarding the fulfilment of consultation requirements, the Proponent has undertaken the following additional consultation.

- The Proponent discussed the proposed management of a possible modified tree on the Mine Site with the local traditional owners to clarify their satisfaction with the proposed management of this site.
- A draft copy of the Cultural Heritage Management Plan (OzArk, 2011b) was provided to all registered Aboriginal stakeholders on 19 September 2011, inviting comment on the proposed management of identified Aboriginal sites. No feedback has been received from the registered Aboriginal stakeholders in response to this invitation.
- The registered Aboriginal stakeholders were invited to a community meeting (on 28 September 2011) convened by the Proponent to discuss the proposed management of the most sensitive Aboriginal sites.

Section 4.6.5.2 provides a summary of all Aboriginal community involvement in the Project and development of management strategies.

#### 4.6.5.1.2 "Woodlands" Test Excavation Site

Following the field survey of the TNWP (see Section 4.6.7.3), a potential archaeological deposit (PAD) was identified on the "Woodlands" property at the very northern end of the proposed water pipeline. OzArk (2011b) identified the need for a test excavation of this PAD and provided a test excavation methodology to the registered stakeholders relevant to the Narromine end of the project, being the Narromine LALC and Mr Paul Brydon (a local Traditional Owner as well as representative of Narromine LALC).

The consultation reflects the accepted boundaries of traditional owners in the area, based on a combined 37 years of experience of OzArk and Alkane (the Proponent) in working with the local Aboriginal community. Furthermore, those consulted reflected those stakeholders who participated in the field survey of the TNWP study area (see Section 4.6.7.1.3).

Follow-up communication regarding the specifics of the excavation programme followed in January 2011 (see *Appendix 3* of OzArk, 2011b).

A copy of the draft test excavation report was provided to Narromine LALC and Paul Brydon on 13 May 2011. No objections to the recommendations regarding construction of the TNWP through the site were received. On 28 October 2011, the test excavation report was sent to the remaining Aboriginal stakeholders. At the time of writing, no comments on the proposed management of the site have been received.

#### 4.6.5.2 Aboriginal Community Involvement

Several positions were made available for Aboriginal community representatives to participate in the field survey component of the Aboriginal heritage assessment (see Section 4.6.7). These were chosen from the pool of registered stakeholders based on factors including experience with and local knowledge of Aboriginal heritage places / sites and breadth of representation in relation to the local Aboriginal community. Notably, all registered stakeholders have been kept informed of the results, invited to attend meetings and to comment on management and mitigation measures proposed to manage the identified sites and Aboriginal heritage in general.

Following the completion of initial field survey (a supplementary field survey was completed in November 2010 over a small extension to the Mine Site), all registered stakeholders were invited to a meeting on 9 September 2009 to discuss the management of identified sites. Following some debate over the appropriate management of one of the more significant sites, namely TGP-ST7 (a carved tree located within the Wyoming One Open Cut - see Section 4.6.7.5), the registered stakeholders requested further discussion regarding the management of this site be deferred until after a separate community meeting was held.

On 17 September, 2009, a second meeting was held between the registered stakeholders and the Proponent. At that meeting, it was agreed that the following would be implemented.

- Develop a *Community Engagement Protocol* (CEP) with the local Aboriginal community for working cooperatively with the local Aboriginal community with the intent of mutual benefit from mining and exploration activity in the Peak Hill/Tomingley district. The CEP was signed by the Managing Director of Alkane and representatives of the following six registered organisations on 15 June 2010.
  - Peak Hill Local Aboriginal Land Council.
  - Little Burning Mountain Aboriginal Corporation.
  - Bogan River Peak Hill Wiradjuri Aboriginal Corporation.
  - Bulgandramine Youth Development Aboriginal Corporation.
  - Warramunga Community Advancement Co-operative Society Ltd.
  - Peak Hill Aboriginal Medical Service.

  This document essentially captures the Proponent‟s objectives, Aboriginal people‟s aspirations and principles for negotiations.
- Establish a Peak Hill Aboriginal Reference Group[13], i.e. a forum through which the Proponent can present proposed impacts on, and management of cultural heritage and the Aboriginal groups and individuals can respond. The six signatories to the CEP form the Peak Hill Aboriginal Reference Group.
- Develop a *Cultural Heritage Management Plan* in consultation with the Peak Hill Aboriginal Reference Group. The plan is to be consistent with OEH guidelines and policies and would be prepared by a professional archaeologist.
- Develop and implement an employee/contractor cultural heritage awareness training program.

[13] This is not an official organisation or group, rather a title considered as representative of the include organisations and individuals.

- Identify and assist with the establishment of an appropriate keeping place for items of cultural heritage significance in consultation with the Peak Hill Aboriginal Reference Group (and other Aboriginal stakeholders).
- Assist the local Aboriginal community through the provision or contribution towards education and training initiatives that would increase the potential of local Aboriginal people to gain employment. Assistance may also include supporting applications for third party funding for training programs.
- Ensure that the local Aboriginal community is provided with equal opportunity to gain Project-related employment. Consideration is to be given to Indigenous traineeships and apprenticeships.
- Ensure that the local Aboriginal community continue to be actively involved in environmental monitoring and Aboriginal heritage management within the Mine Site.
- Ensure that the local Aboriginal community is consulted in relation to the final land use within the Mine Site.

On 12 September 2011, the representative members of the Peak Hill Aboriginal Reference Group signed a letter to the DP&I confirming their satisfaction with the proposed approach to managing a sensitive site on the Mine Site.

On 28 September 2011, those attending a community meeting convened by the Proponent confirmed support of the proposed approach to Aboriginal cultural heritage of the Proponent and specifically the proposed management of further assessment of a modified tree on the Mine Site.

Notably, neither the Proponent nor OzArk have received any formal response from any of the registered Aboriginal stakeholders in relation to the draft Cultural Heritage Management Plan (although support for the approach to further assessment and management of Aboriginal sites was confirmed at the 28 September meeting).

### 4.6.6 Predictive Model

Predictive modelling aims to establish a theoretical model for site location and distribution within a given area. The predictive model considers proximity to permanent water, availability of resources for shelter and tool making and availability of food. Based on these factors, OzArk (2011b) makes the following predictions in relation to the nature of sites and their potential location within the three study areas.

- In the vicinity of second order creeks that would be traversed by the Tomingley Narromine Water Pipeline (such as Gundong Creek, Fiddlers Creek and Wallaby Creek), archaeological evidence may be sparse with the possible identification of camp sites and knapping events associated with sporadic focussed activities.
- On the flat plains over 200m from water, archaeological evidence is likely to be sporadic, if present at all.

Considering the regional archaeological record (see Section 4.6.4.2), OzArk (2011b) suggests that the most likely sites to be encountered within the two survey areas are as follows.

- Modified trees (scarred or carved).

- Open camp sites (within 150m of waterways).
- Isolated finds (likely to occur anywhere).

If present, OzArk (2011b) suggests that sites on the Mine Site Study Area have a low likelihood of remaining intact due to the considerable historic disturbance associated with agricultural activities and historic mining. Sites have a relatively higher potential to be present within the undisturbed portions of the TNWP Study Area, especially over parts of the road corridor that have not been previously cleared. Wherever the TNWP Study Area cross water courses, these locations have the highest potential for either open sites or modified trees to be present.

## 4.6.7 Field Survey Methodology and Results

### 4.6.7.1 Mine Site and TNWP Field Survey Methodology

#### 4.6.7.1.1 Overview

Separate field surveys were conducted for the two study areas. For field surveys, discussions were held on site regarding the findings of the field survey and the topics covered included cultural significance, management options and recommendations.

#### 4.6.7.1.2 Mine Site Study Area Survey

A field inspection and survey was undertaken from 5 to 7 August 2009 and on 1 and 2 September 2009 by two OzArk archaeologists and Anthony Wilson, John and Ken Robinson and Shani Hando representing Little Burning Mountain Aboriginal Corp. Representatives from Peak Hill LALC chose not to participate in the field work. Robert Clegg representing the Wiradjuri Council of Elders was invited to take part in the field assessment, but eventually declined the offer. Survey effort of 30 person days was expended in site identification and recording. Additional fieldwork over a small extension to the Mine Site (Lots 94 & 95, DP 755110) was undertaken on 30 November 2010 with Ken Robinson and Frances Robinson of LBMAC participating.

The study area was divided into paddocks (numbered according to survey sequence) and each was traversed using pedestrian transects. Field officers were spaced approximately 10m to 20m apart in the grassed areas with lower ground surface visibility and were spaced approximately 5m apart along tracks and areas of high ground surface visibility. Exposed creek banks and eroded dams were targeted specifically as these provide a guide to site distribution of other disturbed ground surfaces. All mature trees were assessed for the presence of scars or carved markings.

#### 4.6.7.1.3 TNWP Study Area Survey

A field inspection and survey was undertaken on 1 and 2 July 2009 by between two and three OzArk archaeologists and representatives of Peak Hill LALC (Mr Tom Peckham[14]) and Narromine LALC (Mr Paul Brydon).

The survey was undertaken on foot with the corridor traversed by four surveyors on day one and five surveyors on day two. The survey was undertaken from south to north from the Mine Site towards Narromine on the first day and then north to south from the "Woodlands" property towards the day one endpoint on the second day. The survey team split up unto two groups, each with an Aboriginal community representative, GPS and maps. The easement was traversed in sections with the surveyors between 5m and 10m apart.

[14] Tom Peckham works with both Peak Hill and Narromine LALC"s.

#### 4.6.7.1.4 Effective Survey Coverage

Ground surface visibility within the area surveyed varied from high (in areas of surface disturbance) to low (in areas of natural or dense vegetation) potentially affecting the ability to identify sites such as open sites, isolated finds, deposits associated with shelters and, to a lesser degree, grinding groove sites.

The following provides a summary the effective survey coverage within the two study areas.

**Mine Site Study Area**

Ground surface visibility was variable across due to differences in vegetation, recent land use and the timing of crop establishment. Vehicle access tracks, animal tracks, over-grazed areas and areas of sheet erosion allowed good visibility of up to 90%.

The western portion of the Mine Site Study Area, namely that area that has not been recently grazed, had an estimated ground surface visibility of less than 30%. Over the eastern portion of the Mine Site Study Area, where active grazing and cropping occurs, ground surface visibility was 30% to 70%.

**TNWP Study Area**

Ground surface visibility was variable as the proposed easement traversed a variety of landforms and land use areas.

Along previously cleared or disturbed parts of the road corridor, ground surface visibility was between 20% and 40% depending on the degree of soil erosion. In between the road table drains and clear zones, where ground and weed cover was often thick, visibility of 20% or less was encountered. However, interspersed amongst these low visibility areas are scatters of natural pebble material where visibility is often close to 100%. Overall, ground surface visibility was low to moderate (20% to 40%) given the mature vegetation in the landscape.

### 4.6.7.2 "Woodlands" Test Excavation Site Field Survey

A test archaeological excavation was carried out towards the northern end of the proposed TNWP over the site of an identified PAD (TNWP-OS1 with PAD) (see **Figure 4.28**). Five Aboriginal stakeholder representatives assisted in the test excavation which comprised six test excavation pits, each measuring 1m x 1m, at 30m intervals along the alignment of the TNWP through the PAD. The five Aboriginal stakeholder representatives included four representatives of Narromine LALC (Tom Peckham[15], Damian Cooney, Kristy Kelly and Dot Edwards) and Paul Brydon being a local Traditional Owner. Representation was considered appropriate given Mr Brydon and Mr Peckham represented the registered Aboriginal stakeholders during the field survey of the TNWP (see Section 4.6.7.1.3).

### 4.6.7.3 Survey Results

#### 4.6.7.3.1 Mine Site Study Area

Within the Mine Site Study Area, 19 Aboriginal sites were identified, including:

- 15 modified trees (11 scarred trees, 3 possible scarred trees and 1 carved tree);
- Two site complexes comprising a cluster of artefacts; and
- two isolated finds.

[15] Mr Peckham conducted the field survey of the TNWP representing Peak Hill LALC

**Figure 4.26** presents location of the identified sites and **Table 4.39** presents a brief description of each site. A detailed description of each site is presented in Section 6.1.4 of OzArk (2011b). Text in **bold** indicates whether the site occurs within or in the vicinity of an area of proposed disturbance.

**Table 4.39**
**Identified Aboriginal Sites within the Mine Site Study Area**

| Site Name | Site Type |
|---|---|
| TGP-OS1 | Open site with three artefacts visible including two quartz flakes and a silcrete flake. **This site occurs in the vicinity of the proposed Main Site Access Road.** |
| TGP-OS2 | Open site with over a large exposure between the property fence line and the existing track comprising at least 18 artefacts. **The Main Site Access Road would pass through and in the vicinity of this site.** |
| TGP-IF1 | Isolated find comprising a grinding implement. |
| TGP-IF2 | Isolated find comprising a possible anvil. **This site occurs adjacent to the Eastern Surface Water Diversion Structure.** |
| TGP-ST1 | Possible scarred tree comprising a White Box with two scars. The Aboriginal community believe that both of these scars are food procurement scars rather than the stripping of bark for a tool or implement. |
| TGP-ST2 | Scarred tree comprising a Grey Box with three scars, one with possible axe marks. |
| TGP-ST3 | Possible scarred tree comprising a rosewood with steel axe marks around the base of the tree indicating a possible attempt at ringbarking or an Aboriginal resource gathering site. |
| TGP-ST4 | Scarred tree comprising a Grey Box with one elongated scar. The size and shape suggest the removed bark may have been used as a canoe. |
| TGP-ST5 | Scarred tree comprising a Grey Box with two scars. |
| TGP-ST6 | Scarred tree comprising a Grey Box with one elongated scar. |
| TGP-ST7 | Carved tree comprising a Fuzzy Box with one elongated scar with carvings at the top and bottom of the scar in a diamond criss-cross pattern. The carving appears to have been done with a steel axe at the base, but possibly with a stone axe in the remnant surface part of the heartwood at the top of the scar. A second small scar is evident on the other side of the tree.<br>This tree is highly significant to the Aboriginal Community, who believe it may be associated with a burial, as is customary in the area. **This site occurs within the proposed footprint of the Wyoming One Open Cut.** |
| TGP-ST8 | Scarred tree comprising Grey Box with one small ovoid scar. **This site occurs in the vicinity of the amenity bund to the west of the Newell Highway.** |
| TGP-ST9 | Scarred tree comprising a dead Grey Box with one small ovoid scar. **This site occurs in the vicinity of the amenity bund to the west of the Newell Highway.** |
| TGP-ST10 | Possible scarred tree comprising a Grey Box with one small elongated scar. **This site occurs within the proposed footprint of Waste Rock Emplacement 3.** |
| TGP-ST11 | Scarred tree comprising Grey Box with one elongated scar. |
| TGP-ST12 | Scarred tree comprising a Grey Box with one elongated scar. |
| TGP-ST13 | Scarred tree comprising a Fuzzy Box with two scars. |
| TGP-ST14 | Scarred tree comprising a Bimble Box with one elongated scar. Steel axe marks were noted. |
| TGP- ST15 | Scarred tree comprising a Grey Box with two elongated scars. |
| Source: Modified after OzArk (2011b) – Table 3 and Section 6.1.4. | |

It has been negotiated with the registered Aboriginal stakeholders for further site assessment of TGP-ST7 to be undertaken to confirm the status of this site and identify as to whether any associated site, e.g. burial, is present. The proposed methodology and schedule of this additional site assessment is provided in Section 4.6.8.2.

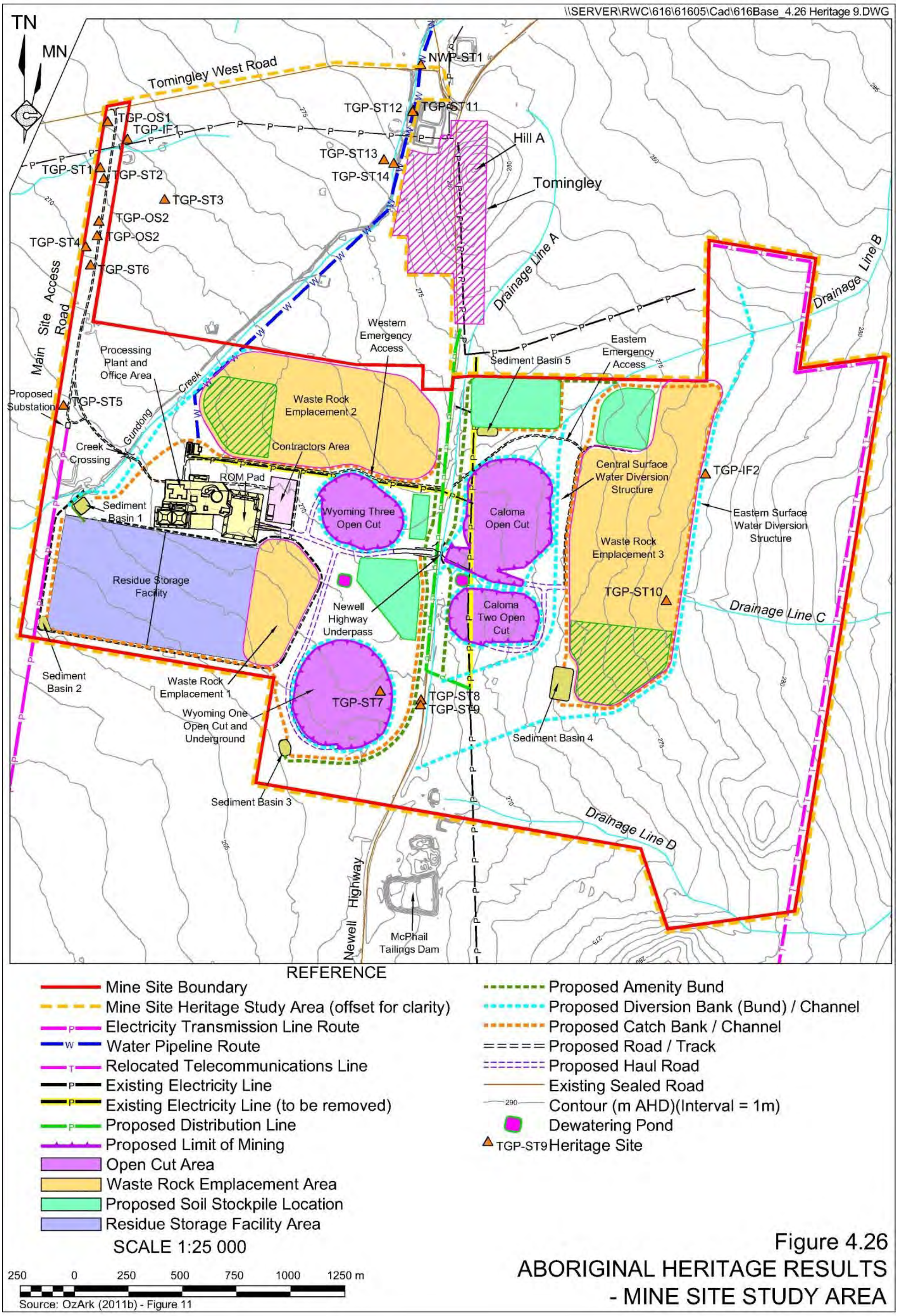


Figure 4.26
ABORIGINAL HERITAGE RESULTS
- MINE SITE STUDY AREA

#### 4.6.7.3.2 TNWP Study Area

Within the TNWP Study Area, 38 Aboriginal sites were identified (see **Figures 4.27** and **4.28**), including:

- 36 modified trees (29 scarred trees, 6 possible scarred trees and 1 scarred tree / ceremonial and dreaming site);
- one site complex with PAD; and
- one ceremonial and dreaming site.

**Table 4.40** presents a brief description of each site. A detailed description of each site is presented in *Section 6.1.6* of OzArk (2011b). Text in **bold** indicates whether the site occurs within or in the vicinity of an area of proposed disturbance.

#### 4.6.7.3.3 "Woodlands" Test Excavation Site (TNWP-OS1 with PAD)

A total of 121 artefacts were recovered from the six excavation test pits along the 200m transect through TNWP-OS1 with PAD. OzArk (2011b) noted the following in relation to the artefact sample recovered.

- Raw materials. The assemblage is dominated by quartz, with 86 out of a total 121 artefacts (71.1%) of this material. Of the remaining artefacts the majority were composed of chert or silcrete.
- Artefact types. Small, unmodified flakes, a by-product of stone tool manufacture, were the dominant artefact type recovered.

OzArk (2011b – in particular *Appendix 5*) provides further description and discussion on the artefacts recovered.

On the basis of the test excavation, OzArk (2011b) conclude that it is likely that further Aboriginal artefacts would be present along the alignment of the TNWP within TNWP-OS1 with PAD, most likely within the top 20cm of soil.

### 4.6.7.4 Significance Assessment

The significance of a site can be assessed in the following three ways.

- Cultural significance: the importance of a site to the relevant cultural group - in this case the Aboriginal community.
- Scientific significance: the importance of a site in view of current archaeological discourse based on a site's condition (integrity), content and representativeness.
- Public significance: the importance of a site to educate people about the past.

The cultural significance of the 57 Aboriginal sites located during the heritage assessment was addressed during the survey with the community representatives and in subsequent meetings (see Section 4.6.5). An assessment of the scientific and public significance of the identified Aboriginal sites was made by OzArk.

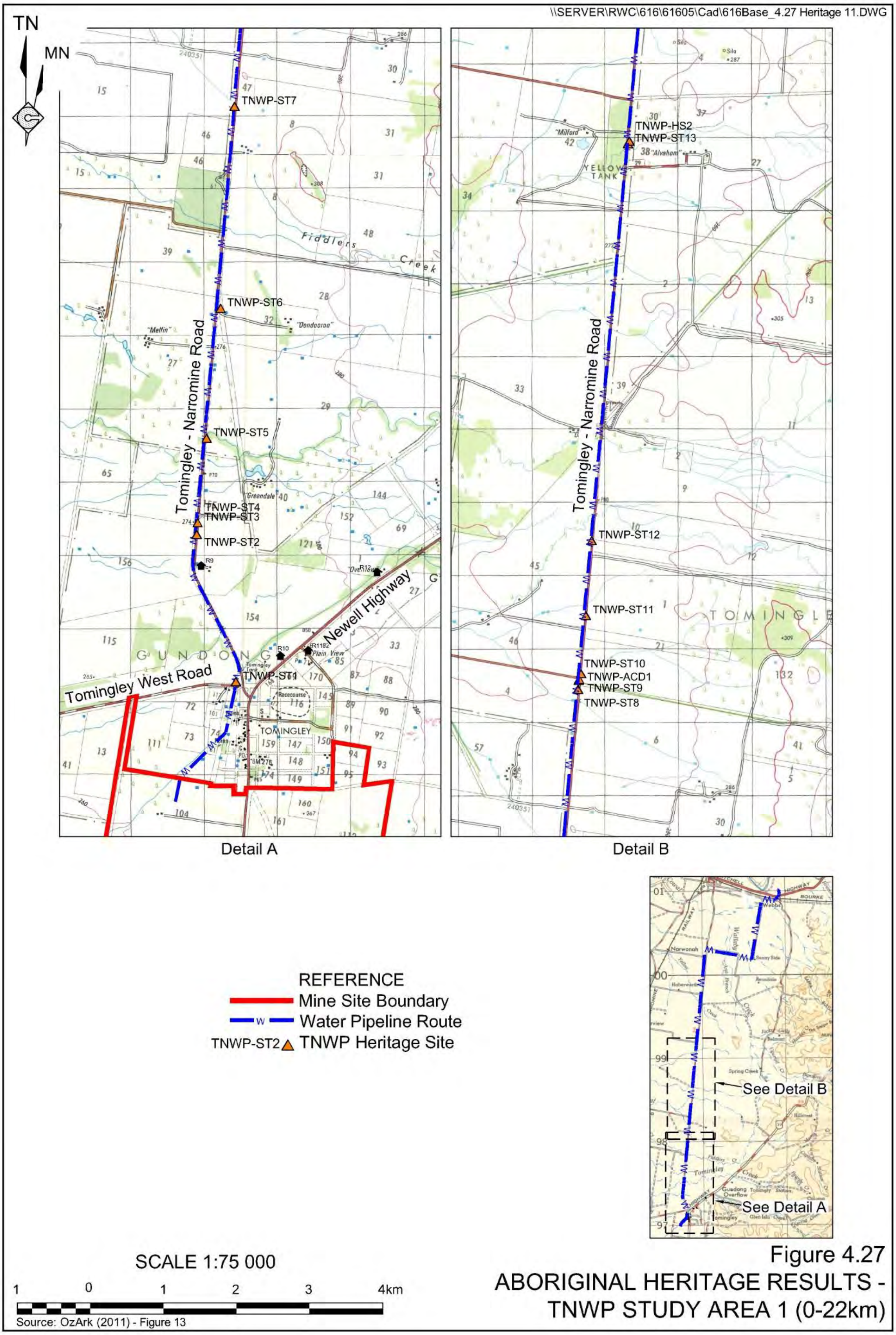


Figure 4.27
ABORIGINAL HERITAGE RESULTS - TNWP STUDY AREA 1 (0-22km)

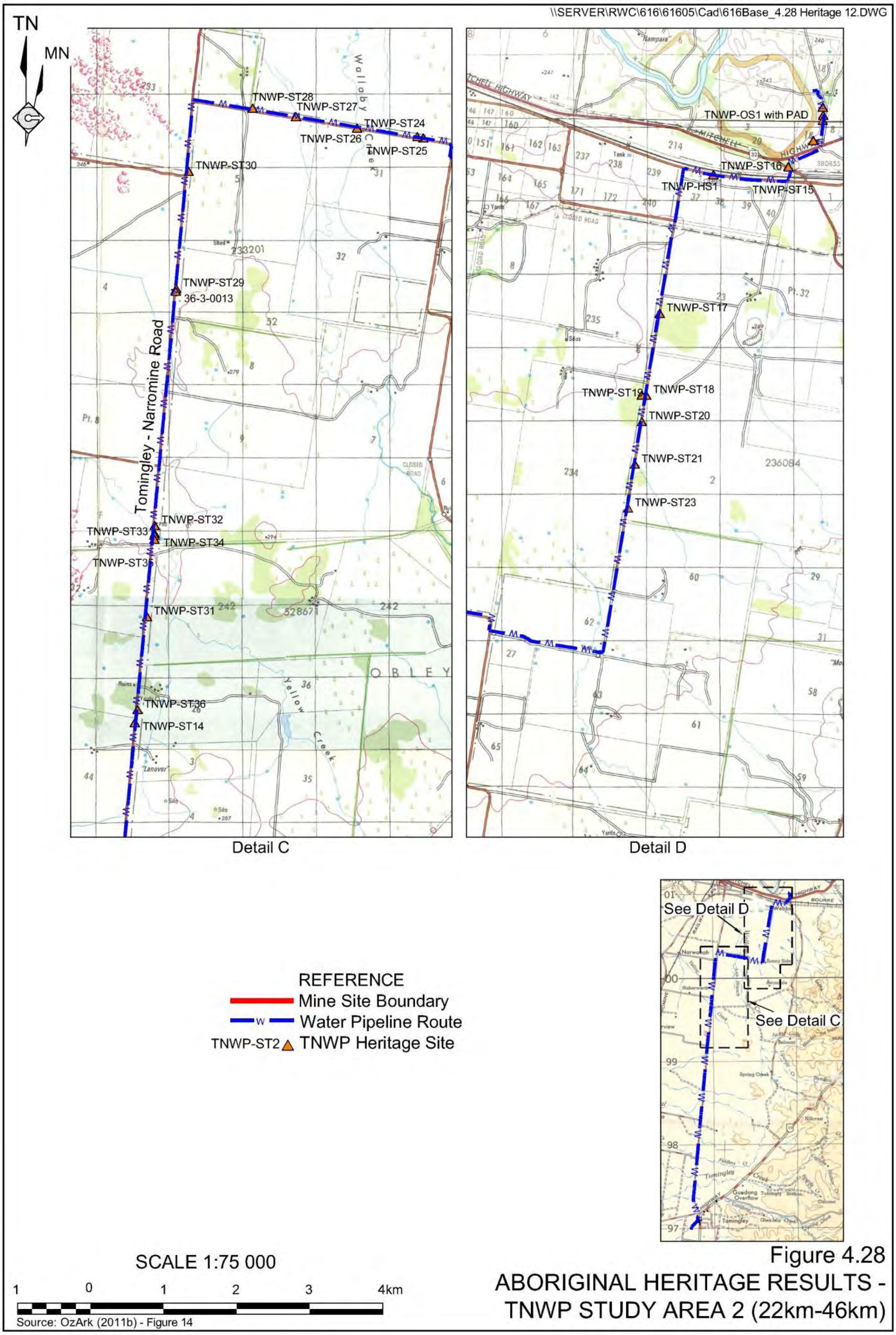


Figure 4.28
ABORIGINAL HERITAGE RESULTS - TNWP STUDY AREA 2 (22km-46km)

**Table 4.40**
**Identified Aboriginal Sites within the TNWP Study Area**

| Site Name | Site Type |
|---|---|
| TNWP-OS1 with PAD | Open site on a river terrace / aeolian dune landform 50 m south of the former Macquarie River channel with dozens of artefacts for at least 100m along the eroding edge of a terraced area. Due the nature of the elevated river bank landform, the high density and extent of artefacts, the presence of *in situ* artefacts and proximity to other sites, OzArk (1020b) state that there is high potential for sub-surface archaeological deposits to be present at this site. **The Water Supply Pipeline would pass through and in the vicinity of this site.** |
| TNWP-ST1 | Scarred tree comprising a Bimble Box with two elongated scars. |
| TNWP-ST2 | Scarred tree comprising a Bimble Box with one elongated scar. |
| TNWP-ST3 | Scarred tree comprising a Bimble Box with one elongated scar. |
| TNWP-ST4 | Scarred tree comprising a Bimble Box with one elongated scar. |
| TNWP-ST5 | Scarred tree comprising a River Red Gum with one elongated scar. |
| TNWP-ST6 | Possible scarred tree comprising a White Box with one irregular scar. |
| TNWP-ST7 | Scarred tree comprising a Grey Box with one ovate scar. |
| TNWP-ST8 | Scarred tree comprising a Bimble Box with one ovate scar. |
| TNWP-ST9 | Scarred tree / ceremonial comprising a Bimble Box with one scar and numerous bulbous burls. These burls led to the interpretation that the tree is a women"s birthing tree and the Aboriginal community wish to safeguard it. |
| TNWP-ACD1 | Ceremonial / dreaming site comprising a Bimble Box with numerous bulbous burls. These burls led to the interpretation that the tree is a women"s birthing tree and the Aboriginal community wish to safeguard it. The tree is interpreted to be at least 300 years old. |
| TNWP-ST10 | Scarred tree comprising a Bimble Box with in scar high in the tree. This scar has been interpreted by the Aboriginal representatives as a clan / boundary marker. |
| TNWP-ST11 | Scarred tree comprising a Grey Box with one ovoid scar. |
| TNWP-ST12 | Possible scarred tree comprising a Grey Box with one ovoid scar. |
| TNWP-ST13 | Scarred tree comprising a Bimble Box with one ovoid scar with horizontal axe markings in a single straight line. |
| TNWP-ST14 | Scarred tree comprising a Bimble Box with one elliptical scar. |
| TNWP-ST15 | Scarred tree comprising a Bimble Box with two scars. |
| TNWP-ST16 | Scarred tree comprising a Bimble Box with one elongated scar with axe marks noted on the heartwood. |
| TNWP-ST17 | Scarred tree comprising a Bimble Box with one elongated scar. |
| TNWP-ST18 | Scarred tree comprising a Red Gum with one ovoid scar. |
| TNWP-ST19 | Possible scarred tree comprising a Yellow Box with one elongated scar with axe marks. |
| TNWP-ST20 | Scarred tree comprising a Grey Box with one elongated scar with axe marks. |
| TNWP-ST21 | Scarred tree comprising a Grey Box with one ovoid scar with recent axe marks that post date post bark removal. |
| TNWP-ST22 | Scarred tree comprising a Grey Box with one ovoid scar. |
| TNWP-ST23 | Scarred tree comprising a Grey Box with two scars. |
| TNWP-ST24 | Scarred tree comprising a Grey Box with one elongated scar. |
| TNWP-ST25 | Possible scarred tree comprising a Grey Box with one elongated scar. |
| TNWP-ST26 | Scarred tree comprising a Grey Box with one elongated scar several metres up the tree. The scar is interpreted to be either a marker scar. |
| TNWP-ST27 | Scarred tree comprising a Grey Box with one elongated scar. |
| TNWP-ST28 | Scarred tree comprising a Bimble Box with one elongated scar. |
| TNWP-ST29 | Scarred tree comprising a Grey Box with one elongated scar. |
| TNWP-ST30 | Possible scarred tree comprising a Grey Box with one elongated scar. |
| TNWP-ST31 | Scarred tree comprising a Grey Box with one ovoid scar. |
| TNWP-ST32 | Possible scarred tree comprising a Grey Box with one ovoid scar. |
| TNWP-ST33 | Scarred tree comprising a Grey Box with one ovoid scar. |
| TNWP-ST34 | Scarred tree comprising a Grey Box with one ovoid scar. |
| TNWP-ST35 | Scarred tree comprising a Grey Box with one elongated scar. |
| TNWP-ST36 | Scarred tree comprising a Grey Box with one elongated scar. |

Source: Modified after OzArk (2011b) – Table 3 and Section 6.1.6

### Cultural Significance

Representatives of the local Aboriginal community indicated that all site types are culturally significant to the Aboriginal community as they provide physical evidence of Aboriginal occupation of the local area. Considered to be of particular cultural significance was the carved tree (TGP-ST7) of the Mine Site Study Area. The Aboriginal community believe this may indicate a burial site and as such has **extremely high cultural significance** to the local Aboriginal traditional owners.

### Scientific Significance

The scientific assessment of sites revolves around the known local context of the site type, i.e. are there many, some or no such features known locally? Isolated finds invariably hold little scientific significance. OzArk (2011b) determined scientific significance of the most common site types identified as follows.

- **Modified Trees**: While the overall high frequency of this site type combined with their overall low potential to increase our understanding of the area"s prehistory lower the significance of scarred trees in the area, the relationship of each physical site to oral history along with unusually high number of such sites increase their level of scientific significance. The combination of all these aspects interact to give these trees collectively **moderate scientific significance**.

  Carved trees are a rare site type. OzArk (2011) note that carved tree TGP-ST7 is not the most outstanding example of this type of site. However, it is an example of this rare site type. While without confirmation of a burial association, its scientific significance is difficult to determine, OzArk (2011b) assess it as having **high scientific significance** based on rarity and associated burial potential.

- **Open Artefact Sites:** Due to this site type being well represented regionally and containing non-exceptional material, these sites are assessed as having **low to moderate scientific significance**.

  Furthermore, the test excavation completed over TNWP-OS1 with PAD has identified this as a low artefact density, shallow deposit with a high likelihood of prior disturbance. OzArk (2011b) concludes that over the alignment of the proposed TNWP, TNWP-OS1 with PAD possesses **low scientific significance** and that further archaeological investigation is unwarranted.

### Public Significance

With the exception of TGP-ST7 (the carved tree) which is assessed as having **moderate public significance**, all sites are considered to have **low public significance** due to the fact that they are hard to locate and not on property that is accessible to the general public.

## 4.6.8 Management and Mitigation Measures

### 4.6.8.1 Introduction

The following sub-sections identify the management and mitigation measures that would be implemented to prevent, minimise or manage Project-related impacts to identified Aboriginal sites. In addition, general management and mitigation measures are identified to prevent

Project-related impacts to unidentified Aboriginal sites that may occur within the areas to be disturbed.

#### 4.6.8.2 Mine Site Study Area

The Project would result in direct impacts to two identified Aboriginal sites, namely Sites TGP-ST7 and TPG-ST10. In addition, four sites may potentially be impacted by the Project in the absence of appropriate management and mitigation measures. These sites include the following.

- Site TGP-OS1
- Site TGP-OS2
- Site TGP-ST8
- Site TGP-ST9

The following presents specific management and mitigation measures for each of the potentially impacted sites, together with measures that would be implemented to prevent Project-related impacts to the remaining identified Aboriginal sites.

**Site TGP-ST7**

The outer bark of the tree would be peeled off by a qualified arborist. The presence and/or condition of the scar beneath the removed bark would be assessed in order to make a more accurate determination of whether the marks on the tree relate to carving, or are a combination of ringbarking marks and natural erosions into the heartwood. Confirmation of the presence of a cultural carving on the tree would elevate the potential presence of burials in the vicinity of the tree. Conversely, assessment of the scarring as not being of cultural origin would remove the realistic possibility of burials being present. This additional site assessment is to be undertaken prior to determination of the application for project approval.

In the event that the scarring is deemed to not be of cultural origin, the following management would apply.

- A determination would be made with the registered Aboriginal representatives as to their consideration as to the tree representing a scarred tree.
- If considered a scarred tree, it would need to managed as discussed for the other scarred trees within the Mine Site that is to be impacted (TGP-ST10).
- If is not considered a scarred tree and carving has been discounted, then no further management will apply.

However, should the scarring be considered to display features representative of that resultant from traditional Aboriginal carving of trees, the Proponent has committed to completing further research as follows.

- The opinion of a suitably qualified Ground Penetrating Radar (GPR) technician or geomorphologist, with appropriate experience in remote sensing technology, would be sought to determine whether GPR would be likely to be effective in the identification of a potential burial in the vicinity of this site. As research indicates the carving on the tree will be facing towards the burial if it is present, it is considered that a 180º sweep of the GPR would provide adequate coverage.

- IF GPR is considered to provide effective identification and a potential burial site is identified, the following would be undertaken.
  - Undertake further community consultation to inform all stakeholders of this result.
  - Undertake formal archaeological excavation for human remains. Notification of the NSW Police would be required and a formal determination made of the age of the remains to ensure they do not date to the last 100 years.
  - If located, the remains would be managed in accordance with the wishes of the Aboriginal community. This is likely to require ceremony and reburial at a nominated location.
- It is considered likely that the use of GPR alone would not be affective in identifying a potential burial site, due to the presence of numerous below ground anomalies cause by exploration drill holes, backfilled sumps and other disturbance on the Mine Site. As a consequence, the following ground surface disturbing works would likely be undertaken in conjunction with the GPR to physically determine the presence or not of human remains.
  - Use a grader would to strip off layers of thin layers of soil within a 50m radius of TGP-ST7 to a depth where burial is determined to be unlikely.
  - Undertake the stripping operations in the presence of Aboriginal community representatives and/or an archaeologist who can inspect each pass of the grader for any evidence of human remains or other archaeological material. Sieves may be used to assess windrowed soil should there be concern that bone may be present within the removed deposits.
  - Once an area has been assessed in this manner, down to deposits deemed to be too deep to contain an Indigenous burial, then the area can be considered as clear of human remains.
- Once the issue of human remains and an inhumation has been resolved, the following would be undertaken to ensure the appropriate removal of the carved tree.
  - Hold a meeting involving the Proponent, the tree-removal contractor, Aboriginal community representatives and an archaeologist to confirm the tree-removal methods.
  - The likely methods may be to first use a cherry picker to assess the large hollow high up in the tree to ensure that no burial present.
  - Remove the tree using a chainsaw below the base of the carving and transport the removed section to an appropriate keeping place.

**Site TGP-ST10**

- Remove to an appropriate keeping place the scarred section of the tree in accordance with the procedures identified previously.

**Site TGP-OS1**

- Fence and mark the area of Site TGP-OS1 to prevent inadvertent disturbance of the site.

**Site TGP-OS2**

- Place geofabric directly on the ground within the disturbance footprint of the Main Site Access Road in the vicinity of Site TGP-OS2 prior to ground disturbing activities commencing. Cover this with or sand or gravel before constructing the base of the Main Site Access Road.
- Plant native vegetation by hand adjacent to the Main Site Access Road in the vicinity of Site TGP-OS2 to prevent vehicular access to other sections of the site.

**Sites TGP-ST8 and TGP-ST9**

- Fence around the drip lines of Sites TGP-ST8 and TGP-ST9 to prevent inadvertent disturbance of these sites.

**Remaining Identified Sites and Unidentified Sites**

- Ensure that all identified sites are identified on plans held by the Mine Planning and Environmental Officers and ensure that all ground disturbing activities do not disturb the identified sites.
- Construct, where required, appropriate fencing or other identifying markers around identified sites where those sites occur in the vicinity of areas of proposed disturbance or in areas where inadvertent disturbance may occur.
- Prepare, in consultation with the Aboriginal community, a *Cultural Heritage Management Plan* identifying procedures to protect or salvage all identified Aboriginal sites and prevent damage to all sites that may be identified during the life of the Project. This plan would be consistent with the commitments given in this document.

Finally, the Proponent would ensure that the commitments agreed between the Proponent and the local Aboriginal community and identified in Section 4.6.5.1 are implemented.

#### 4.6.8.3 TNWP Study Area

Construction of the Tomingley Narromine Water Pipeline would not disturb any of the identified scarred trees in the vicinity of the pipeline route. However, the pipeline would pass through TNWP-OS1 with PAD, which a test excavation has identified contains Aboriginal artefacts (OzArk, 2011b) of low scientific significance. The following measures would be implemented to manage the impact of the TNWP on TNWP-OS1 with PAD, the other identified sites identified along the TNWMP route as well as other sites that may be identified during construction of the TNWP.

- Mark all identified scarred trees with high visibility fencing at a suitable distance from the tree prior to construction of the pipeline commencing to prevent inadvertent disturbance of the trees.
- Ensure all disturbance remains within the nominated TNWP corridor and that the minimum area required for installation of the pipeline is disturbed.

- Any soil excavated for the water pipeline would be replaced in the area and not removed to some other location.
- During the construction of the TNWP through TNWP-OS1 with PAD, representatives of the Aboriginal community would be invited to be in attendance to monitor the excavation and to retrieve any further Aboriginal artefacts.
- Cars and machinery would, to the extent practicable, be confined to an existing dirt road when in the vicinity of TNWP-OS1 with PAD.
- Should in excess of 100 artefacts be identified within individual clusters, construction would cease and the OEH notified to obtain advice as to how to proceed.
- Should human skeletal material be noticed, all work would cease and the local police contacted. If the skeletal remains are deemed to be historical, OEH and the Narromine LALC would be contacted to determine how to proceed.
- Include the above management measures within a *Cultural Heritage Management Plan* for the Project.

Recognising that the corner of land between Tomingley West Rd, Gundong Creek and the Narromine Road has been identified as a possible camping spot (amongst others) for Aboriginal families in the late 1800‟s and early 1900‟s (see Section 4.6.4.2), as well as the fact that modified trees have been recorded in this area, the Proponent would implement the following management measures during pipeline construction over this land.

- Site monitors would be employed to inspect the areas to be disturbed for culturally sensitive material.
- Should material potentially relating to the use of this land as a camp site be uncovered, works would need to cease in that area while an analysis of the material and its significance was undertaken.

### 4.6.9 Assessment of Impacts

OzArk (2011b) states that assuming the implementation of the proposed mitigation and management measures, the Project would have no direct impact on 57 of the 60 sites identified during the Aboriginal heritage survey.

Furthermore, OzArk (2011b) states that, taking into consideration the fact the ground disturbing activities and salvage of artefacts in the vicinity of sites TGP-ST7, TPG-ST10 and TNWP-OS1 with PAD would be undertaken in accordance with the management measures and operational safeguards nominated in Section 4.6.8 and an Aboriginal Heritage Management Plan prepared in consultation with the Aboriginal community, the proposed disturbance of these sites would have an acceptable cumulative impact on the regional archaeological record and context. It is further noted that the residual impact on Aboriginal heritage following the adoption of the management measures and operational safeguards of Section 4.6.8 represents the minimum impact practically achievable for the Project.

# 4.7 NON-ABORIGINAL HERITAGE

## 4.7.1 Introduction

The DGRs identify "***Heritage - both Aboriginal and non-Aboriginal***" as a key issue for assessment in the *Environmental Assessment*. Based on the risk assessment undertaken for the proposal (see Section 3.5), the specific non-Aboriginal heritage-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include the following.

- Removal or destruction of sites of non-Aboriginal heritage significance due to Project activities (moderate risk).

The heritage assessment for the Project was undertaken by Dr Jodie Benton of OzArk Environmental and Heritage Management Pty Ltd ("OzArk"). The resulting report is presented as Part 5 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "OzArk (2011b)". This sub-section of the *Environmental Assessment* provides a summary of the non-Aboriginal heritage aspects of that report while Section 4.6 presents a summary of the Aboriginal heritage aspects of that report.

## 4.7.2 Background Research

### 4.7.2.1 Historical Record

European exploration of the Parkes district began in 1817 when John Oxley explored the Lachlan district and the watershed between the Bogan and Lachlan Rivers north of Trundle. In 1833, further investigation of the Bogan River was undertaken by Dixon, followed by Mitchell in 1835. Mitchell found that white squatters were already entering the area in the 1830"s, despite being outside the Limits of Settlement.

The name "Tomingley" first appears in the Government Gazette of 1848 naming a run of 22 400 acres claimed by J. Gilmore and covering the entirety of modern Tomingley. The earliest roads in the area followed waterways where possible. **Figure 4.29** presents a sketch map of the principal tracks in use during the early stages of settlement in the vicinity of the Mine Site. It is noted that a place called "Ten Mile Holes" on Gundong Creek provided the first place east of the Bogan River where water could reliably be found.

Gold was discovered in Tomingley in 1879. By 1883, two exploration shafts had been sunk, identifying reefs at depths of 65 feet (approximately 20m) and 25 feet (approximately 7.6m). These discoveries resulted in the establishment of a community to service the mining operations. In 1883, a 15 head stamper (crusher) was installed and, when water was available, excellent returns were reported. In 1884, Tomingley was proclaimed a village. In 1883, a series of leases were pegged which later became the McPhail Mine, located immediately to the south of the Mine Site. This mine supported the small village of McPhail. The McPhail Mine operated until approximately 1913 and produced approximately 70 000 ounces of gold during that time.

OzArk (2011b) notes that water from Ten Mile Holes on Gundong Creek played a vital role in providing water for the villages of Tomingley and McPhail and the associated mining operations. It is recorded that before European settlement, Gundong Creek had no channel west of the Ten Mile Holes. Apparently a channel to the southwest was first constructed to provide water to a series of market gardens.

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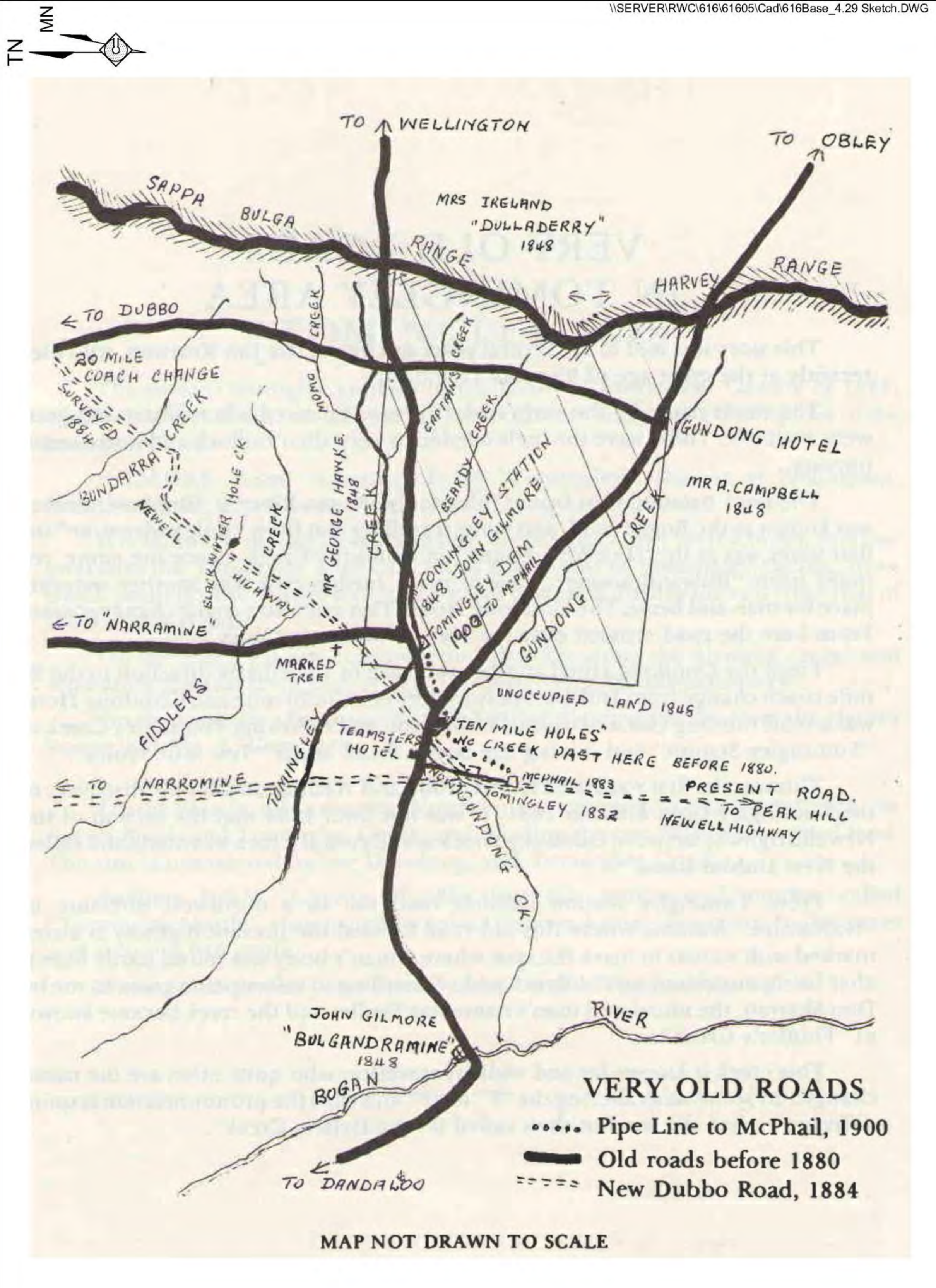


Figure 4.29
EARLY SKETCH MAP OF ROADS AND WATERWAYS AROUND TOMINGLEY

Source: OzArk (2011) - Figure 16

By 1920, the then Timbrebongie Shire Council employed men to cut a channel from the Ten Mile Holes to the Government Tank at Tomingley and away from the main road which was becoming a watercourse during high rainfall events. OzArk (2011b) and SEEC (2011) state that the current alignment of Gundong Creek reflects these diversions. **Figure 4.30** shows the extent of the village of Tomingley around 1919 or 1920.

### 4.7.2.2 Heritage Registers

OzArk (2011b) identifies the following non-Indigenous heritage sites listed by the following heritage databases and other information sources.

- Australian Heritage Database. There are six items listed on the Australian Heritage Database within the Narromine LGA with a further 17 items identified within the Parkes LGA. Within the Narromine LGA, five of the listed sites are within the town of Narromine, with the location of the sixth to be confirmed. Within the Parkes LGA, two of the listed sites occur in Peak Hill. One of these is the Peak Hill Cemetery while the second is an Indigenous Place. Neither would be impacted by the Project.
- NSW Heritage Office – State Heritage Register and Inventory. There are no items listed on the register within the Narromine LGA, although two items are listed within the Parkes LGA, both within the town of Parkes. There are 24 items listed on the inventory within the Narromine LGA, with none located in the vicinity of the Project Site. A further 13 items are listed on the inventory within the Parkes LGA. Of these, only three are located within Peak Hill, none of which would be impacted by the Project.
- *Narromine Shire Council Local Environment Plan 1997*. Schedule 1 of this plan identifies 11 items of heritage significance within the LGA. None of these items would be impacted by the Project.
- *Parkes Shire Council Local Environment Plan 1990*. Schedule 1 of this plan identified nine items of heritage significance within the LGA. None of these items would be impacted by the Project.
- New South Wales State Archives. This archival resource contains a range of online indexes relating government (crown) land, including registers of land purchases, mining leases and surveyor general crown plans. Other information held includes census material, some convict and court records, education, housing, and immigration records. Searches were performed on the properties where significant archaeological material was recorded.
- TROVE – National Library of Australia. This online searchable database provides electronically translated sources from the mid-19$^{th}$ century onwards. Sources available include pictures, journals, articles, digitised newspapers, maps, diaries and letters. OzArk (2011b) reviewed all 400 sources available on Tomingley.
- Land and Property Information. Records of land title information included on parish maps and crown plans held by the Land and Property Information division of the NSW Department of Finance and Services were searched for the properties of the Mine Site.

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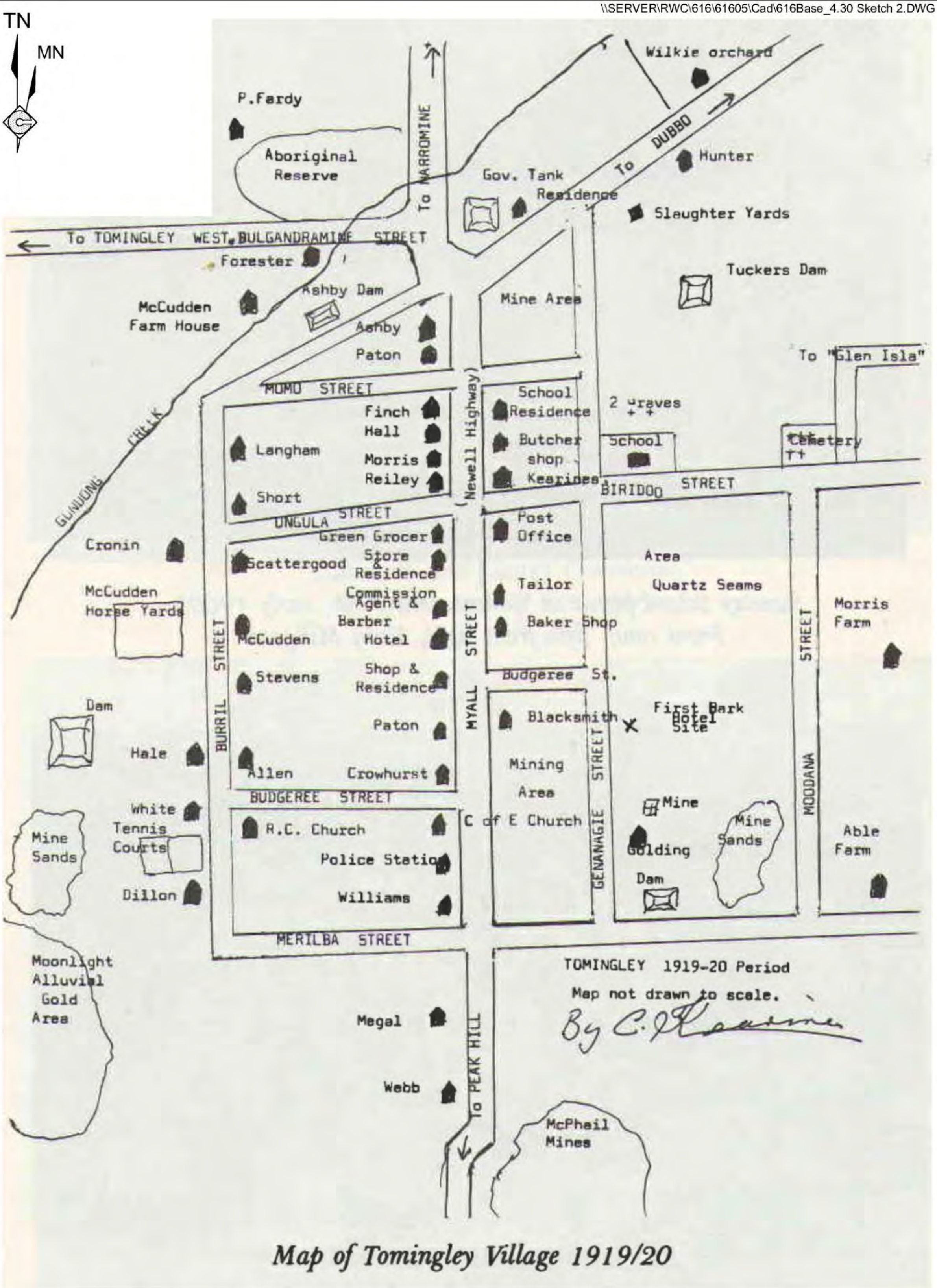


*Map of Tomingley Village 1919/20*

Figure 4.30
EARLY SKETCH MAP OF TOMINGLEY VILLAGE

Source: OzArk (2011) - Figure 17

#### 4.7.2.3 Local Community Consultation

OzArk (2011b) consulted Mrs Hutton of the Peak Hill Historical Society, who discussed McPhail Mines over the phone and then sent a brief summary, taken from the Narromine Mine Data Sheets.

Mr Bruce Maclean, owner of the Caloma property, was also consulted and provided information on the historic ownership and use of this property.

### 4.7.3 Field Survey Methodology and Results

#### 4.7.3.1 Survey Methodology

The non-Aboriginal heritage survey was undertaken concurrently with the Aboriginal heritage survey described in Section 4.6.7.

#### 4.7.3.2 Survey Results

A total of eight items of non-Aboriginal heritage significance were identified during the non-Aboriginal heritage survey, six within the Mine Site Study Area and two within the TNWP Study Area.

**Mine Site Study Area**

Within the Mine Site Study Area, six sites of non-Aboriginal heritage significance were identified, including:

- two historical building remains; and
- four items of moveable heritage.

**Figure 4.31** presents location of the identified sites and **Table 4.41** presents a brief description of each site. A detailed description of each site is presented in Section 11.2 of OzArk (2011b). Text in **bold** indicates whether the site occurs within or in the vicinity of an area of proposed disturbance.

**TNWP Study Area**

Within the TNWP Study Area, two sites of non-Aboriginal heritage significance were identified, both of which are blazed trees.

**Figures 4.32** and **4.33** presents location of the identified sites and **Table 4.42** presents a brief description of each site. A detailed description of each site is presented in Section 11.4 of OzArk (2011b). Neither of these sites would be disturbed during construction of the water pipeline.

It is noted that the alignment of the proposed TNWP would traverse an area identified on **Figure 4.30** as “Aboriginal Reserve”. However, as noted in Section 4.6.4.2, no formal Aboriginal Reserve appears to ever have been established at Tomingley. The site nominated on **Figure 4.30** more likely represents one of several camp sites used by the local Aborigines in the late 19$^{th}$ and early to 20$^{th}$ centuries. Section 4.6.8.3 provides the proposed management measures to be adopted during construction of the TNWP over this land.

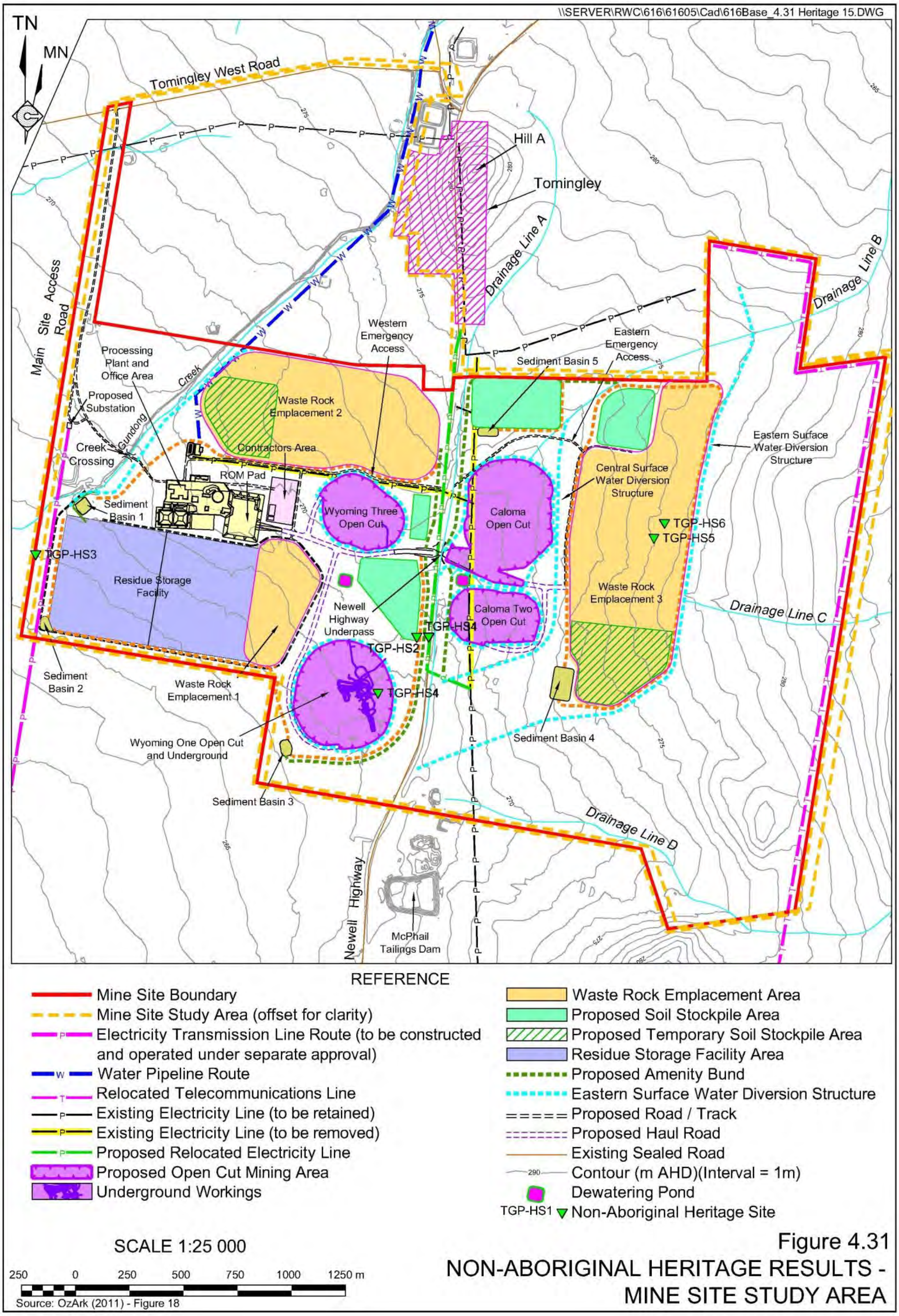


Figure 4.31
NON-ABORIGINAL HERITAGE RESULTS - MINE SITE STUDY AREA

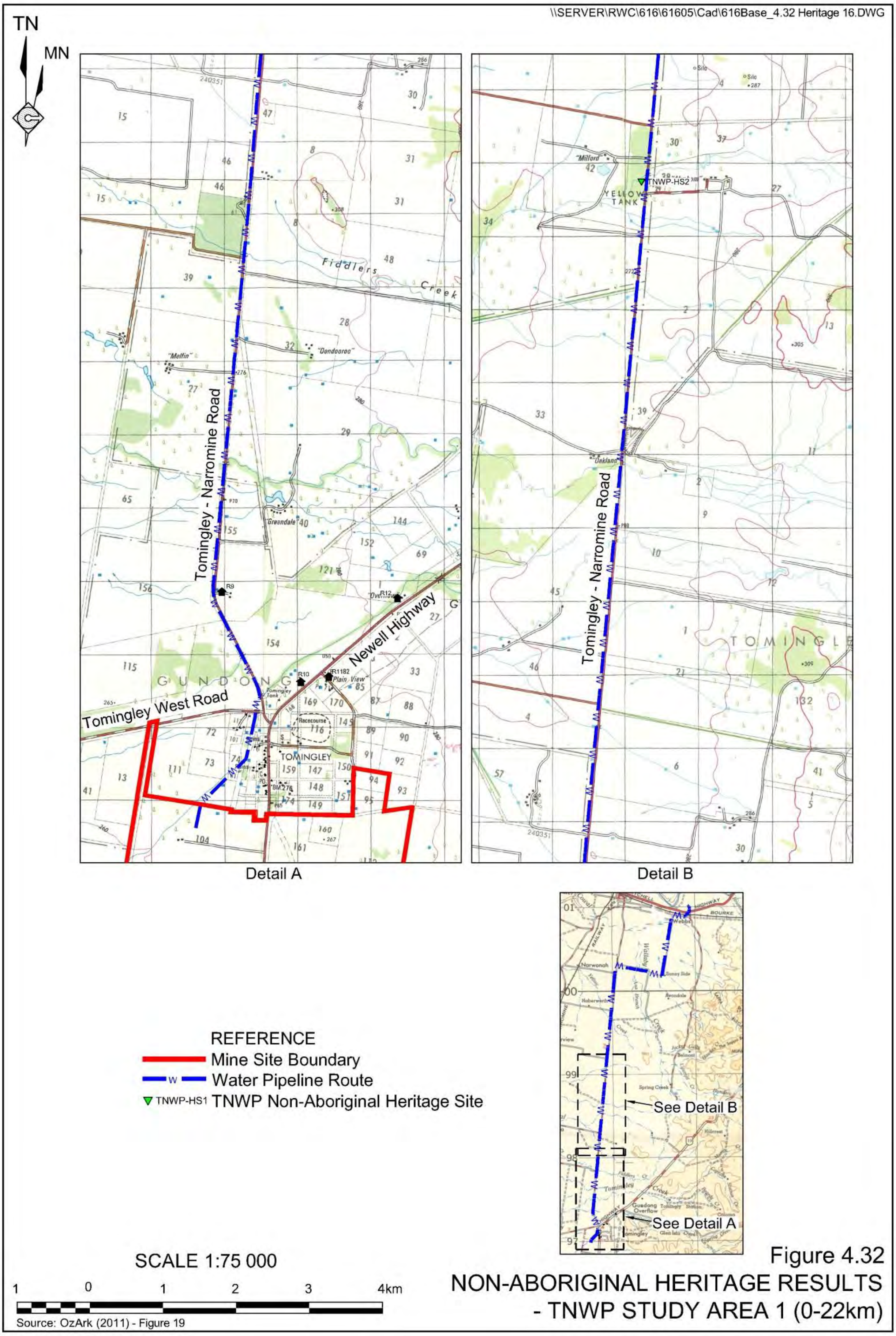


Figure 4.32
NON-ABORIGINAL HERITAGE RESULTS - TNWP STUDY AREA 1 (0-22km)

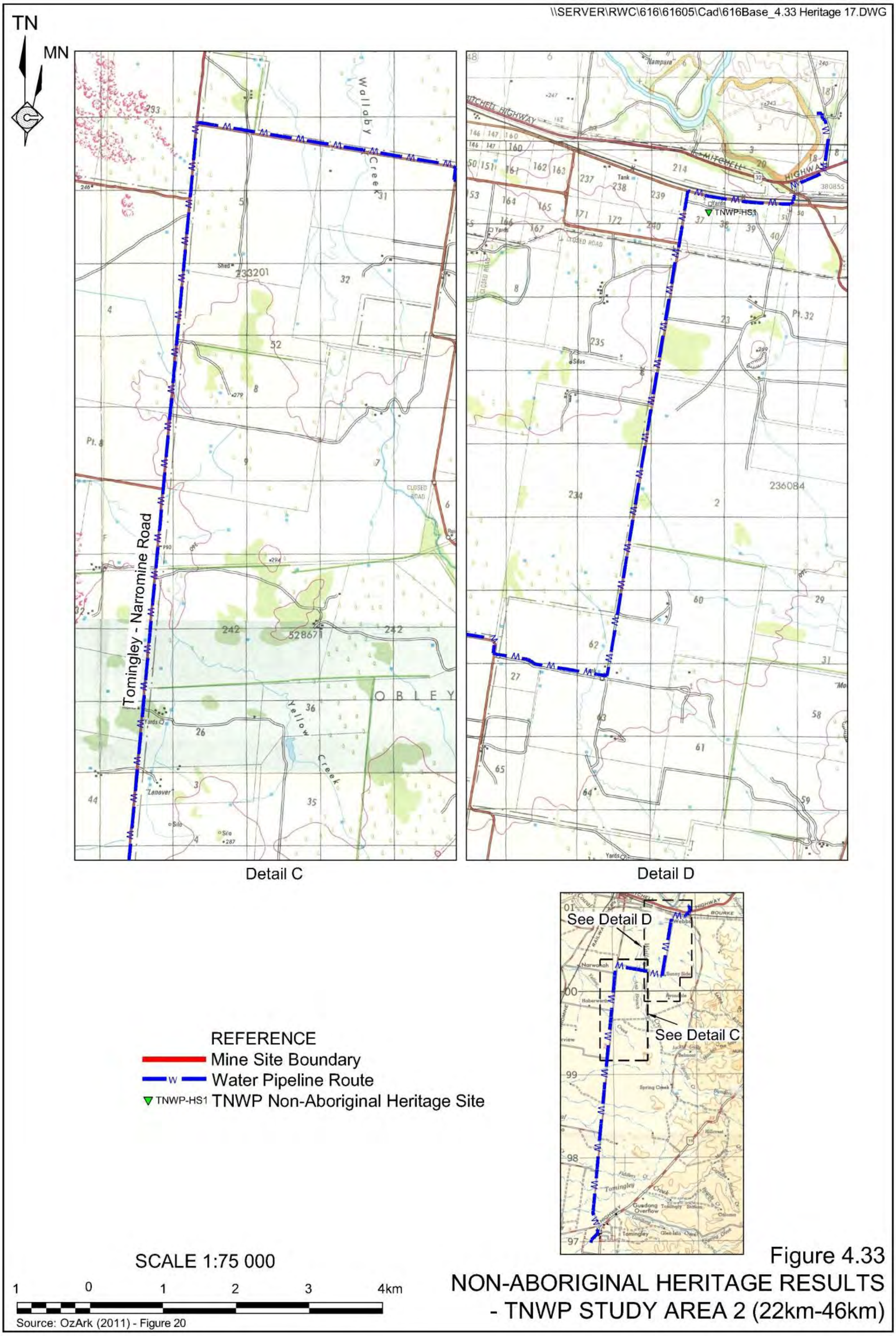


Figure 4.33
NON-ABORIGINAL HERITAGE RESULTS - TNWP STUDY AREA 2 (22km-46km)

**Table 4.41**
**Identified non-Aboriginal Sites within the Mine Site Study Area**

| Site Name | Site Type |
|---|---|
| TGP–HS1 | Building remnant comprising a small portion of foundation / floor remains of a rectangular structure with metal reinforcing rods with numerous scattered bricks and abundant pepper trees. Pepper trees are often remnants or indicators of prior European settlement as they were considered a good shade tree for homesteads. **This site is located in the vicinity of the southern-most soil stockpile on the Wyoming side of the Mine Site. It is noted that the coin has been collected by Alkane personnel for safe keeping and would be displayed in the office of the Tomingley Gold Project once constructed.** |
| TGP–HS2 | Building remnant comprising an *in situ* concrete slab surrounded by a scatter of historic rubbish, pieces of glass, bamboo and pepper trees. **This site is located in the vicinity of the southern-most soil stockpile on the Wyoming side of the Mine Site.** |
| TGP–HS3 | Moveable heritage comprising an abandoned, derelict Bedford truck from the 1940‟s with the words „Peak Perfection Cordials‟ on the passenger side of the truck. The badge on the car bonnet shows that the car was made in England. **This site is located to the west of the Residue Storage Facility.** |
| TGP–HS4 | Moveable heritage comprising a half penny coin circulated in 1886. Several bottles found nearby date to a considerable time after the minting of this coin **This site was located within the footprint of Wyoming One Open Cut, however, has been collected for safe-keeping.** |
| TGP–HS5 | Moveable heritage comprising several pieces of old farm machinery including a Mouldboard plough, seeder and part of a harvester. All items were horse drawn, have iron wheels and were abandoned around a tree and then pushed up around it by a bulldozer. **This site is located within the footprint of Waste Rock Emplacement 3.** |
| TGP–HS6 | Building remnant comprising a demolished building with associated farm machinery including a horse drawn wagon with axle wheel rims, hand-made sand stock bricks (probably date to 1850-1870) from a fire place / chimney, an old rusted single cast iron bed, broken pieces of a cast iron stove and small pieces of broken glass and pottery. **This site is located within the footprint of Waste Rock Emplacement 3.**<br>OzArk (2011b) consider it likely that this site is in situ, i.e. the remains represent the location of the dwelling (rather than this material having being dumped here). It is noted that Mr Bruce McLean of "Caloma" notes that his father referred to the structure as an old shed (as opposed to a homestead) suggesting it was not a residence on the property.<br>Of the recorded owners of the property on which the site is located, namely:<br>– C.T. Donnelly (earliest record of ownership [1912] to circa 1916 - 1926);<br>– J.H. Clarke (circa 1916 - 1926 to 1931);<br>– Bessie Mary Clarke (and Clarke family) (1931 to circa 1950‟s); and<br>– McLean family (circa 1950‟s to present);<br>no archival information is available, i.e. none appear to be of local or state significance. |
| Source: OzArk (2011b) – After Sections 11.1 and 11.2. | |

**Table 4.42**
**Identified non-Aboriginal Sites within the TNWP Study Area**

| Site Name | Site Type |
|---|---|
| TNWP – HS1 | Blazed tree comprising a white cypress pine. Two sets of numbers are apparent. The first number is difficult to interpret, possibly a number „3‟ and then the number „7‟, with the numbers 38 below. This tree occurs at the cadastral boundary and on the edge of Lot number 37 and 38. |
| TNWP – HS2 | Blazed tree comprising a Bimble Box. The glyphs can only just be deciphered as the scar has almost closed over. One letter „C‟ or „0‟ is apparent with the number 8 underneath and most likely refers to the property boundary. |
| Source: OzArk (2011b) – After Sections 11.1 and 11.2. | |

#### 4.7.3.3 Significance Assessment

The Heritage Council of NSW has established a set of criteria against which the significance of items of heritage value can be assessed. The following provides a summary of the significance assessment undertaken by OzArk (2011b) against each of the relevant criterion. A more detailed description of the significance assessment is provided in Section 12 of OzArk (2011b).

***Criterion (a)*** *– an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).*

- TGP-HS1, TGP-HS2 and HS4: These sites provide early evidence of the mining operations in the vicinity of Tomingley.
- TGP-HS5 and TGP-HS6: These sites attest to the agricultural and mining history of the area surrounding the Mine Site. It is noted, however, that a search of the various archival resources nominated in Section 4.7.2 has not identified any reference to these sites, or the properties on which they are located to suggest that they hold any great importance to the historic setting of the local area.
- TNWP-HS1 and TNWP-HS2: These trees provide physical evidence of the division of land into rural holdings over the past 150 years.

***Criterion (b)*** *– an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area).*

- TGP-HS1 and TGP-HS2: Donald McPhail started the McPhail Mine and the McPhail village was established to support that operation.
- TGP-HS5 and TGP-HS6: A search of the various registers and archives nominated in Section 4.7.2 identifies the historic owners of the land on which these sites are located, namely: C.T. Donnelly (circa 1912), Clarke family (circa 1912 to circa 1950‟s) and McLean family (circa 1950‟s to present). There are no archival records to suggest any of these owners hold specific importance in the cultural or natural history of NSW or the local area.

***Criterion (c)*** *– an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).*

- None of the sites recorded can be seen to relate specifically to this significance criterion.

***Criterion (d)*** *– an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;*

- None of the sites recorded provide evidence of particular connections on a social, cultural or spiritual level to parts of the Peak Hill and Tomingley community. Targeted research into possible association between sites TGP-HS5 and TGP-HS6 failed to identify significant association between the sites and particular community or cultural groups.

***Criterion (e)*** *– an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area)*

- TGP-HS1 and TGP-HS2: There is very little above ground evidence remaining and the evidence potentially within any sub-surface deposits is likely to be of limited local significance.
- TGP-HS5: The remnant agricultural machinery in itself does not contribute to our understanding of local cultural history. No information obtained from heritage register and archival searches suggests any use by or association to persons of local cultural significance.
- TGP-HS6: These sites may have intact foundations which may have potential local historical significance. However, as a search of the various registers and archives nominated in Section 4.7.2 does not provide any record of local significance or association to locally significant persons, the site does not contribute our understating of local cultural history.

***Criterion (f)*** *– an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area)*

- None of the sites recorded appear to have uncommon, rare or endangered aspects of the local area‟s history.

***Criterion (g)*** *– an item is important in demonstrating the principal characteristics of a class of NSW or the area's:*

- *cultural or natural places; or*
- *cultural or natural environments: or*
- None of the recorded sites demonstrate the principal characteristics of a class of NSW‟s or the local area‟s cultural or natural place.

In summary, OzArk (2011b) states the following.

- Sites TGP-HS1, TGP-HS2 and TGP-HS4 are of local significance as they present evidence of early mining in the locality.
- Sites TGP-HS3, TGP-HS5, TGP-HS6, TNWP-HS1 and TNWP-HS2 are of limited local significance.

### 4.7.4 Management and Mitigation Measures

The Proponent would implement the following management and mitigation measures prior to commencing construction operations within the Mine Site.

- Mark sites TNWP-HS1 and TNWP-HS2 with high visibility fencing at a suitable distance from the tree prior to construction of the pipeline commencing to prevent inadvertent disturbance of the trees.

- Protect and erect appropriate signage around sites TGP-HS1, TGP-HS2 and TGP-HS3 identifying the sites and preventing inadvertent damage to them.
- Document the site TGP-HS5, by photography, prior to removal of the artefacts. Discussions would be held with local historic society as to the potential use of these items in a display to document the history of the site.
- Undertake an assessment and archaeological investigation of site TGP-HS6 in accordance with the *Historical Archaeology Code of Practice*, published by the Heritage Office (of the then Department of Planning) (2006) and the Australia ICOMOS *Burra Charter* as „good heritage practice".

### 4.7.5 Assessment of Impacts

OzArk (2011b) state that, considering the management and mitigation measures that would be implemented, the Project would not result in significant impacts to the non-Aboriginal heritage recorded in the vicinity of the Project.

## 4.8 VISUAL AMENITY

### 4.8.1 Introduction

The DGRs identify "***Visual*** *– including landform and lighting impacts"* as a key issue for assessment in the *Environmental Assessment*. Based on the risk assessment undertaken for the Project (see Section 3.5), the specific visual amenity-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include the following.

- Changes in visual characteristics of the Mine Site resulting in:
  - changes to local visual amenity for the life of the Project (high risk);
  - an unsightly landform at the completion of the Project (high risk);
  - reduced night time amenity caused by lighting (moderate risk); and/or
  - distraction to traffic resulting in accidents/incidents (moderate risk).

The visual amenity assessment has been conducted by R.W. Corkery & Co. Pty Limited.

It is noted at the outset that the value placed upon visual amenity and the impacts upon surrounding visual amenity would vary from person to person and from location to location. As a result, a visual amenity assessment is, by its nature, somewhat subjective. As a result, during the visual amenity assessment emphasis has been placed on providing a description of the existing visual amenity surrounding the Project Site and the measures that would be undertaken by the Proponent to minimise potential visual amenity-related impacts on surrounding residents and others. In addition, indicative descriptions and impressions of the anticipated visual landscape following completion of mining-related operations have been provided.

### 4.8.2 Existing Visual Amenity

The existing visual amenity surrounding the Project Site is typical of rural areas in the central west of NSW, with the outlook from most rural residences and other vantage points including land used for agriculture, transportation or other infrastructure, as well as remnant native vegetation. Outlooks from residences within the village of Tomingley include views of surrounding buildings, established trees and smaller vegetation and the Newell Highway and other local roads.

The Mine Site is typically visible from the following locations.

- Residences in the southern and western sections of Tomingley.
- Rural residences to the west, north and east of the Mine Site, principally Residences R1, R2, R4 and R13 (see **Figure 4.9**).
- The Newell Highway and Tomingley West Road.

The alignment of the Tomingley Narromine Water Pipeline Route would be visible from rural residences and local roads in the vicinity of the proposed route.

The rural landscape surrounding the Project Site is typically flat and, with the exception of isolated paddock trees, planted windrows and remnant vegetation within road reserves (including unformed roads), largely cleared (**Figure 4.9**). In cleared areas, visual amenity changes with the seasons from red-brown fallowed paddocks to green growing crops and straw collared harvest residues (stubbles). Livestock, predominantly sheep, are a common feature in depending on availability of feed.

Areas with remaining vegetation are typically linear, following existing or paper road easement, and include well established vegetation (**Figure 4.9**). As the land surrounding the Project Site is largely flat, these vegetation corridors limit the extent of views that may be obtained surrounding the Project Site.

In addition, the Newell Highway cuts the Mine Site and divides Tomingley into eastern and western sections. Views in the vicinity of the highway include heavy vehicles (semi-trailer, B-Double and other trucks) and light vehicles. A truck parking area is located immediately to the south of the Mine Site and trucks often park (often overnight) on the eastern side of the highway in Tomingley. It is noted that the Newell Highway is the major road transport route connecting Brisbane with Melbourne. Traffic counts conducted by the Proponent identified that highway is used by an average of 2 650 vehicles per day, of which approximately 33%, or 874 vehicles, are heavy vehicles (see Section 4.11.2).

The principal night-time activity in the vicinity of the Mine Site is transportation on the Newell Highway and other local roads. As a result, lighting-related impacts on the existing night-time visual amenity in areas away from the highway and other local roads is likely to be limited.

### 4.8.3 Management and Mitigation Measures

Managing the visual impact of mining, in particular open cut mining, offers a variety of challenges and requires a range of solutions. The Proponent proposes the following measures to manage the impact of its activities on the visual amenity surrounding the Mine Site.

- Construction of a vegetated amenity bund of between 3m and 4.5m in height:
  - adjacent to the eastern and western boundary of the Newell Highway;
  - to the north of the Caloma Open Cut;

  - to the south of the Wyoming One Open Cut; and
  - to the north of Waste Rock Emplacement 2 (**Figure 2.5**).

  The amenity bund would be constructed in a manner that would prevent direct views of the Mine Site by motorists using the Newell Highway. As one of the initial construction activities to be undertaken on the Mine Site, the establishment of vegetation cover on the bund is proposed during the initial phase of construction and mining.

- Construction and rehabilitation of the northern faces of Waste Rock Emplacements 2 and 3 to a height of 15m above the remainder of the waste rock emplacement. While predominantly a noise attenuation measure, the establishment, maintenance and revegetation of this 15m high „bund‟ would provide a visual screen from the village of Tomingley to the mining activities of the Mine Site.
- Progressive reshaping and rehabilitation of areas, including the waste rock emplacements, no longer required for mining related purposes.
- Implementation of the proposed biodiversity offset strategy, which would incorporate the protection of 83.7ha of remnant native vegetation and revegetation of a further 61ha of currently cleared land on and to the north of the Mine Site (between the Mine Site boundary and Tomingley), described in Section 2.14.8.
- Construction of the processing plant and other infrastructure within the Mine Site from non-reflective, neutral coloured material.
- Selection and placement of permanent and temporary lights that:
  - are not directed towards, and therefore do not impact on the vision of motorists using, the Newell Highway;
  - do not point towards surrounding residences; and
  - minimise the „loom‟ created by the lights.
- The Proponent would consider any reasonable request by a potentially affected resident for assistance to create a visual screen adjacent to their residence through planting of fast growing vegetation and/or landscaping, where such a screen would effectively reduce the visual impact of the Proponent‟s activities during the life of the Project.

The Proponent does not propose any visual amenity-specific measures in the vicinity of the Water Pipeline Route as the proposed pipeline would be buried.

## 4.8.4 Assessment of Impacts

### 4.8.4.1 Mine Site

The proposed final landform within the Mine Site is described in detail in Section 2.14.4. In summary, however, the final landform would comprise the following.

- four bunded and fenced open cuts.

- Three shaped and rehabilitated waste rock emplacements.
- One shaped and rehabilitated RSF (the final landform of the RSF would merge with that of waste rock emplacement 1 and the ROM pad).
- An underpass under the Newell Highway.
- A range of retained and revegetated amenity bunds and surface water control structures, e.g. contour banks, drainage channels and sediment basins.

The only components of the final landform that would be visible from outside the Mine Site would be the waste rock emplacements, RSF and the amenity bunds. It is noted that each of these structures would be revegetated using species representative of vegetation communities that occur within the Mine Site.

**Figure 4.34** presents indicative views of the Mine Site from Residences R3 (within Tomingley village to the north of the Mine Site), R4 (to the east of the Mine Site) and the Newell Highway (to the south of the Mine Site). **Figure 4.9** provides the location of each of the original photographs. Each photograph location includes two views, namely the existing view and an indicative impression of the final landform. It is noted that the views of the final landform presented in **Figure 4.34** are indicative only and are provided to give a general impression of the final landform at the end of the Project life.

From the views presented in **Figure 4.34**, it is apparent that the upper sections of each of the waste rock emplacements may be visible from residences and the Newell Highway to the south and east of the Mine Site. It is noted, however, that these would typically be distant views.

In addition, Waste Rock Emplacement 2 and, to a lesser extent, Waste Rock Emplacement 3 would be visible from residences in the southern section of Tomingley. It is noted that **Figure 4.34** presents a relatively uninterrupted view of the Mine Site where as each of the residences in the southern section of Tomingley would have views of the waste rock emplacement partially obscured by vegetation.

Finally, residences to the west of the Mine Site would initially experience views of the Main Site Access Road. However, following implementation of the proposed biodiversity offset strategy, those views would quickly be obscured as the vegetation became established.

In summary, the visual amenity in the vicinity of the Mine Site would be altered through the addition of three waste rock emplacements and the RSF. However, the impacts of that change to the existing visual amenity would be minimised as far as practicable through the construction of amenity bunds and early commencement of amelioration and rehabilitation. Furthermore, the Proponent would seek to address individual concerns in relation to impacts on visual amenity through discussions and negotiations with individual residents.

#### 4.8.4.2 Tomingley Narromine Water Pipeline Route

The water supply line would be buried and would have no impact on visual amenity (though improved access to water should facilitate a „greening‟ of the village gardens and lawns).

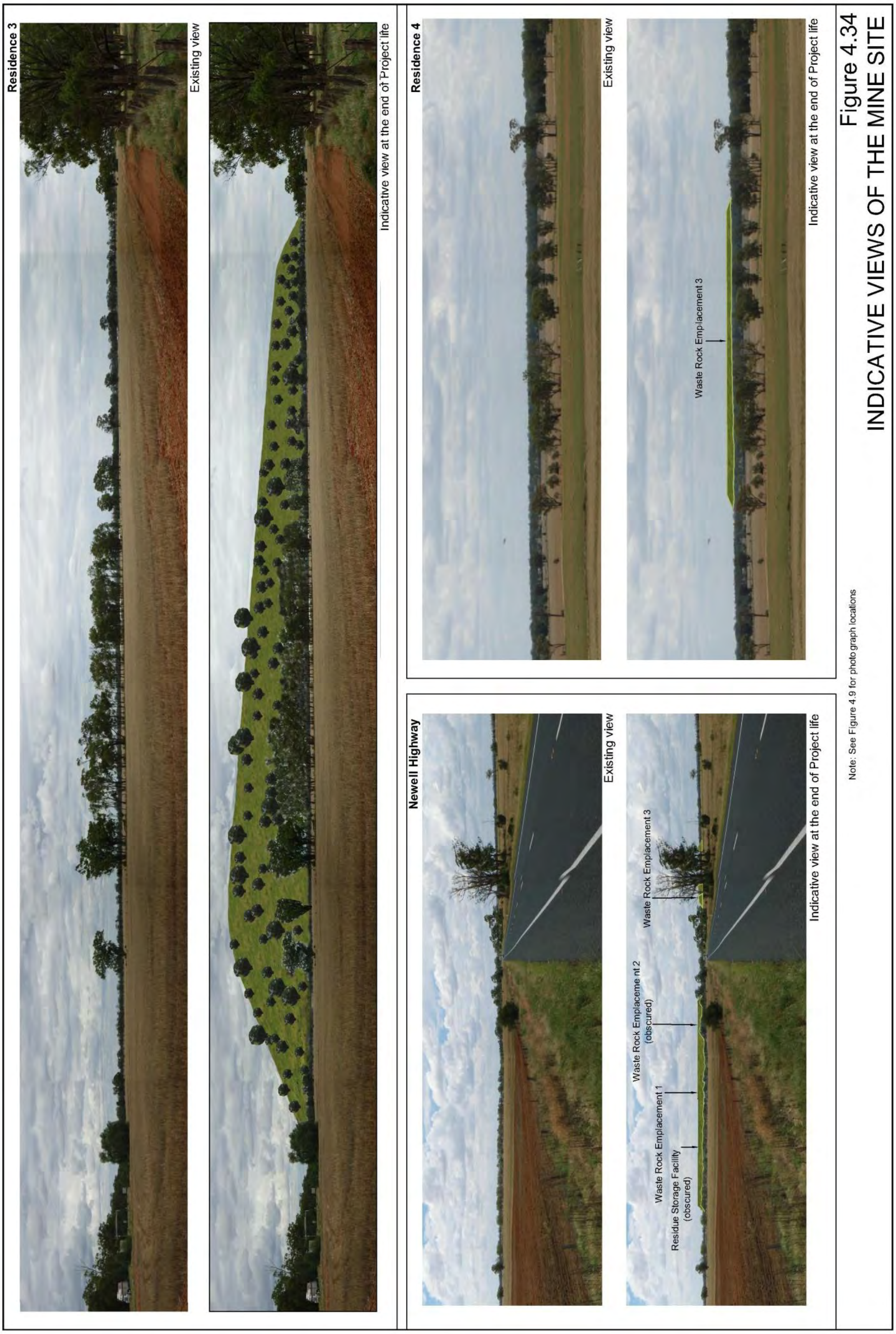


Figure 4.34
INDICATIVE VIEWS OF THE MINE SITE

# 4.9 AIR QUALITY

## 4.9.1 Introduction

The DGRs identify "Air Quality" as a key issue for assessment in the Environmental *Assessment*. Based on the risk assessment undertaken for the Project (see Section 3.5), the specific air quality-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include the following.

- Dust generation resulting from vehicle movements on unsealed roads, fixed plant, including crushing operations, blasting operations and wind action on disturbed areas, overburden emplacements and stockpiles resulting in:
  - nuisance/amenity impacts from dust deposited on window sills, cars, surfaces (high risk);
  - adverse health impacts (if $PM_{10}$ levels are excessive) (high risk);
  - stress of native vegetation, and indirect impacts on fauna habitat (low risk); and/or
  - reduced road safety (moderate risk).
- Increased contribution to greenhouse effect (moderate risk).

The DGRs require that the assessment of air quality refer to *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) and *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC, 2007).

The air quality assessment for the Project was undertaken by Ms Judith Cox of PAEHolmes. The resulting report is presented as Part 6 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "PAEHolmes (2011)." This sub-section of the *Environmental Assessment* provides a summary of that report.

It is noted that dust and greenhouse gas emissions associated with the proposed water pipeline, once construction operations are complete, would be negligible. As a result, the air quality assessment focuses principally on the air quality impacts associated with activities within the Mine Site.

## 4.9.2 Potential Sources of Air Contaminants

### 4.9.2.1 Particulate Matter (Dust)

Dust generation would be one of the principal air quality issues relevant to the Project. Depending upon the size and concentration of particles in the air and their composition, airborne dust has the potential to affect human health as well as contribute to the general degradation of the environment. The term ―*particulate matter"* refers to a category of airborne particles typically less than 50µm in aerodynamic diameter. The human respiratory system has a built-in defensive system that prevents particles greater than 10µm in diameter from reaching sensitive areas of the respiratory system. As a result particles with a diameter of less than 10µm (referred to a $PM_{10}$) and 2.5µm (referred to as $PM_{2.5}$), if in high enough concentration, may adversely affect human health.

As particles larger than 10µm can also contribute to environmental degradation, the air quality assessment also considers the total mass of particles suspended in the air, namely total suspended particulate matter (TSP). Particles that have an aerodynamic diameter sufficiently large so as not to be suspended in air (typically >35µm) are referred to as deposited dust and may result in environmental impacts, principally visual and amenity impacts.

The principal sources of dust emissions that would be generated by the Project would include:

- vegetation clearing and soil stripping;
- excavation of soil, waste rock and ore material and loading of that material into trucks;
- blasting;
- primary and secondary crushing of ore;
- road and hardstand area construction;
- delivery of road construction materials;
- wind erosion from disturbed areas; and
- general movement of vehicles on unsealed roads within the Mine Site.

#### 4.9.2.2 Greenhouse Gas Emissions

Greenhouse gases would be produced as a consequence of the Project, the primary source of which being through the combustion of fuel by hydrocarbon-powered equipment and vehicles. Greenhouse gas emissions would also be generated through on-site electricity consumption, use of explosives (for blasting) and the movement of the vehicles to and from the Mine Site. Although carbon dioxide ($CO_2$) would be the principal gas produced, greenhouse gases emitted as a result of the Project would also include carbon monoxide (CO), methane ($CH_4$), oxides of nitrogen ($NO_X$), $SO_2$ and non-methane volatile organic compounds (NMVOCs). For the purposes of the air quality assessment, all greenhouse gas levels are expressed in $CO_2$ equivalent units ($CO_2$-e).

### 4.9.3 Existing Environment

#### 4.9.3.1 Introduction

Air quality guidelines and goals refer to levels of “pollutants” in the air which include both existing and operational sources. In order to fully assess impacts against all the relevant air quality guidelines and goals, it is therefore necessary to compile information or estimates on existing dust deposition levels and the existing concentrations of airborne particulates.

An appreciation of the existing air quality in the vicinity of the Mine Site has been obtained from two principal sources, namely:

- dust deposition monitoring undertaken between December 2001 and July 2006 in the vicinity of the Mine Site; and
- dust deposition and total suspended particulates (TSP) monitoring undertaken in the vicinity of the Peak Hill Gold Mine (owned and formerly operated by the Proponent) located approximately 15km to the south of the Mine Site.

Deposited dust data from the years 1996 and 2001 to 2006 inclusive, and TSP data collected from 1996 to 2002 have been used by PAEHolmes (2011). It is noted that mining operations at the Peak Hill Gold Mine were undertaken between April 1996 and October 2002 and that processing operations continued until June 2005. This data would therefore have been influenced by the operation of the Peak Hill Gold Mine prior to its closure in 2005.

**Figure 4.35** presents the location of the air quality monitoring locations.

### 4.9.3.2 Deposited Dust

**Table 4.43** presents the results of the dust deposition monitoring program during the years 1996 and 2001 to 2006. This data indicates that the annual average dust deposition levels at all sites, with the exception of "Wyoming" during 2002, were less than 4g/m$^2$/month. The annual average dust deposition levels at all sampling locations was 2.0g/m$^2$/month.

**Table 4.43**
**Dust Deposition Monitoring Results (g/m$^2$/month)**

| Date | Monitoring Location[2] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | "Dunoon" | "Wyoming" | "Tomingley" | 41 Euchie St | "Little Oakleigh" | 59 Euchie St | "Cowabunga" | Warrigal Rd | 2 Caswell St | Frazer court hotel | "Towalba" | Average |
| **1996** | - | - | - | 2.6 | 2.1 | 3.3 | - | 2.9 | 3.1 | - | 3.4 | **2.9** |
| **1997 - 2000** | Data not available | | | | | | | | | | | |
| **2001** | - | - | - | 1.0 | 1.0 | 0.9 | 2.0 | 1.6 | 1.2 | 1.5 | - | **1.3** |
| **2002** | 2.1 | 4.1 | 1.7 | 1.7 | - | 1.9 | 0.9 | 1.7 | 1.5 | 1.6 | - | **1.9** |
| **2003** | 2.1 | 3.4 | 3.3 | - | - | - | - | - | - | - | - | **2.9** |
| **2004** | 1.6 | 2.6 | 1.8 | - | - | - | - | - | - | - | - | **2.0** |
| **2005** | 1.2 | 1.9[1] | 1.3 | - | - | - | - | - | - | - | - | **1.3** |
| **2006** | 0.9 | 1.7 | 1.6 | - | - | - | - | - | - | - | - | **1.4** |
| **Average** | **1.7** | **2.9[1]** | **2.0** | **1.8** | **1.5** | **2.0** | **1.5** | **2.1** | **1.9** | **1.5** | **3.4** | **2.0** |

Note 1: Contaminated samples excluded
Note 2: see **Figure 4.35**
Source: Modified after PAEHolmes (2011) – Table 5.1

It is noted that deposited dust levels at the "Dunoon", "Wyoming" and "Tomingley" properties in the vicinity of the Mine Site experienced higher deposited dust levels during 2002, 2003 and 2004 than in subsequent years. It is also noted that deposited dust levels in the vicinity of each of these monitoring locations are strongly influenced by climatic conditions, including rainfall and wind, and nearby activities, including agricultural operations. As a result, it is likely that background dust levels during the life of the Project would also be likely to vary.

### 4.9.3.3 Total Suspended Particulates

Measurements of TSP concentrations are available for the 59 Euchie Street monitoring location for the years 1996 to 2000, with data during the period 2001 to 2002 available for the Frazer Court monitoring location (see **Figure 4.35**).

**Table 4.44** presents annual average TSP concentrations from these monitoring locations for period 1996 to 2002.

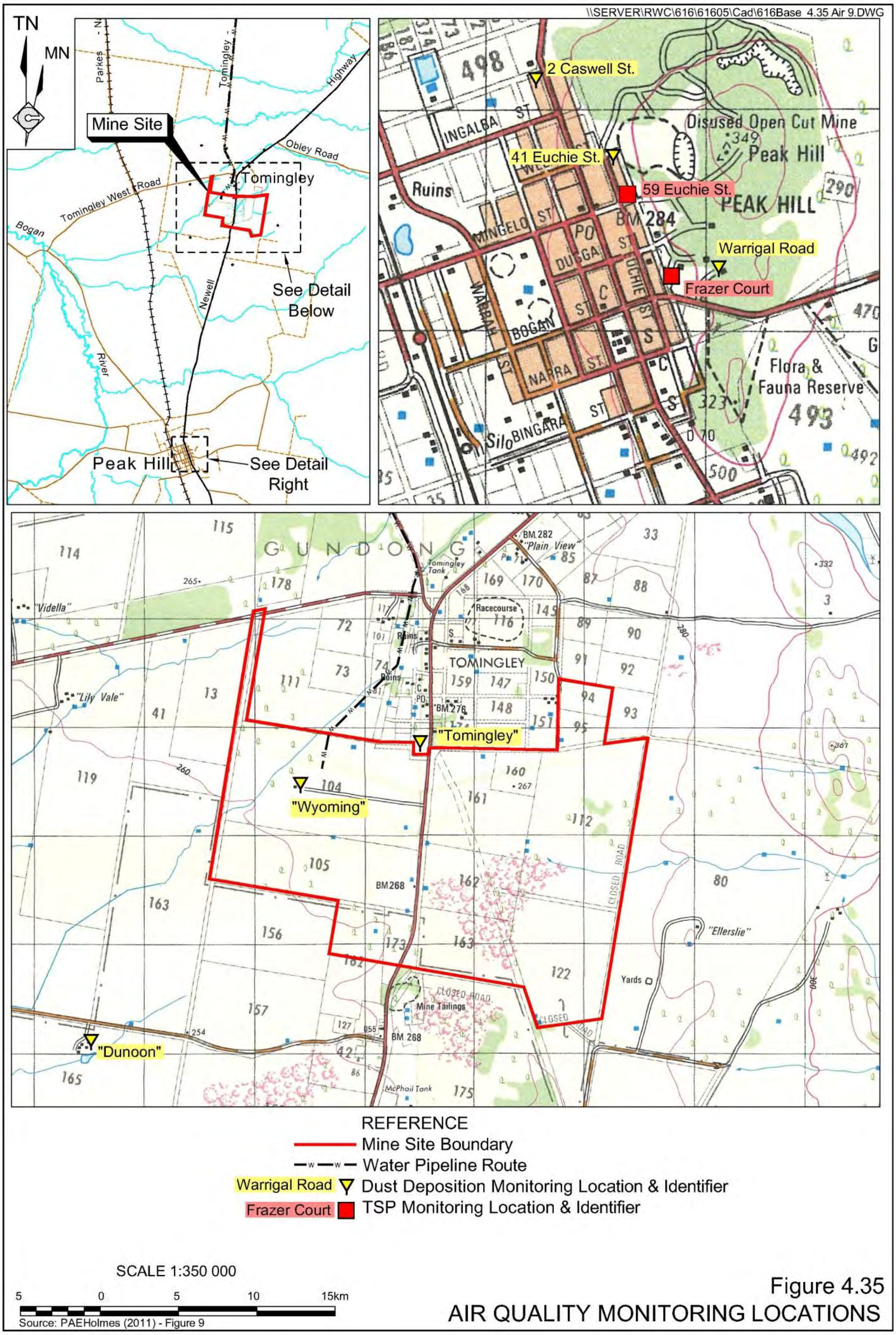


Figure 4.35
AIR QUALITY MONITORING LOCATIONS

**Table 4.44**
**TSP Monitoring Results (µg/m³)**

| | **Monitoring Location[1]** | |
|---|---|---|
| **Date** | **Euchie Street** | **Frazer Court** |
| **1996** | 58.7 | - |
| **1997** | 71.0 | - |
| **1998** | 47.2 | - |
| **1999** | 50.9 | - |
| **2000** | 43.7 | - |
| **2001** | - | 36.3 |
| **2002** | - | 58.0 |
| **Average** | **54.3** | **47.2** |
| Note 1: see **Figure 4.35** | | |
| Source: Modified after PAEHolmes (2011) – Table 5.2 | | |

The data indicate the following.

- The highest annual average TSP concentration of 71µg/m³ was measured in 1997.
- The mean annual average TSP concentration at both monitoring locations was 52µg/m³.
- The annual average TSP concentration in all years at both monitoring locations was less than the OEH annual average TSP concentration criteria of 90µg/m³.

### 4.9.3.4 $PM_{10}$

PAEHolmes (2011) states that the annual average concentration of $PM_{10}$ in areas where mining is a significant contributor to dust emissions is typically 40% of the annual average TSP concentration. As a result, based on the data presented in **Table 4.44,** the mean annual average $PM_{10}$ concentration at Peak Hill during the period 1996 to 2002 would have been likely to be 21µg/m³.

The most recent full year of data TSP data collection was recorded at Frazer Court in 2002 recording an annual average TSP concentration of 58µg/m³. Notably this is also the maximum value for this site across all years. Assuming that $PM_{10}$ constitutes 40% of the TSP, the worst-case background $PM_{10}$ value would be approximately 23µg/m³. PAEHolmes (2011) state that in the absence of a daily $PM_{10}$ record, this figure is the most appropriate figure to use as the background 24-hour $PM_{10}$ concentration.

### 4.9.3.5 Greenhouse Gases

Small concentrations of $NO_2$ and $SO_2$ would be emitted by vehicles travelling on local roads, however, these levels are considered to be minimal given the minor concentrations of $NO_2$ and $SO_2$ emitted by vehicles.

Existing background concentrations of carbon dioxide and methane are recognised to be negligible and typical of a rural area.

### 4.9.3.6 Summary of Background Data

From the monitoring data available, it has been assumed that the following background concentrations apply at the nearest residences.

- Annual average TSP: 51µg/m³.

- Annual average $PM_{10}$: 20µg/$m^3$.
- 24 hour maximum $PM_{10}$: daily varying[16].
- Annual average dust deposition of 2g/$m^2$/month.

These assumed background levels are conservative in that they include data from years when mining and processing activities were occurring at Peak Hill. It is anticipated that actual background levels would be lower than these levels.

## 4.9.4 Assessment Criteria

### 4.9.4.1 Particulate Matter and Dust Deposition

#### Goals Applicable to $PM_{10}$

Emissions of $PM_{10}$ particles are considered important pollutants in terms of impacts due to their ability to penetrate into the respiratory system. The OEH $PM_{10}$ assessment goals as expressed in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) are:

- a 24-hour maximum of 50µg/$m^3$; and
- an annual average of 30µg/$m^3$.

The 24-hour $PM_{10}$ reporting standard of 50µg/$m^3$ is numerically identical to the equivalent National Environment Protection Measure (NEPM) reporting standard except that the NEPM reporting standard allows for five exceedances per year.

#### Goal Applicable to Total Suspended Particulates

The annual goal for TSP concentrations as recommended by the National Health and Medical Research Council (NHMRC) is 90µg/$m^3$. This goal was developed before the more recent results of epidemiological studies suggested a relationship between health impacts and exposure to $PM_{10}$ concentrations. Typically, where the $PM_{10}$ goals are achieved, the TSP goals are also achieved.

#### Goals Applicable to Deposited Dust

In NSW, accepted practice regarding the deposited dust is that dust-related nuisance can be expected to impact within residential areas when annual average dust deposition levels exceed 4g/$m^2$/month.

In order to avoid dust nuisance, OEH (as the former Environment Protection Authority) developed assessment goals for dust fallout. **Table 4.45** presents the allowable increase in dust deposition relative to the ambient levels.

**Table 4.45**
**OEH Goals for Dust Deposition**

| Averaging Period | Maximum Increase in Deposited Dust Level | Maximum Total Deposited Dust Level |
|---|---|---|
| Annual | 2g/$m^2$/month | 4g/$m^2$/month |
| Source: *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) | | |

[16] As the background 24 hour $PM_{10}$ concentration would vary each day, PAEHolmes (2011) has adopted the approach that the predicted 24-hour average $PM_{10}$ concentration (background and increment attributable to the Project) should not exceed 50µg/$m^3$ at the nearest residences.

Based upon the maximum levels in **Table 4.45** and the background dust deposition established for the area ($2g/m^2$/month, see Section 4.9.3.2), a site-specific goal for all dust sources attributable to site activities would be $2g/m^2$/month.

#### 4.9.4.2 Greenhouse Gas Emissions

There are no specific guidelines are provided for maximum emissions of greenhouse gases. For the purposes of this assessment, Project-related emissions of greenhouse gases have been compared to NSW 2008 emissions.

### 4.9.5 Assessment Methodology

#### 4.9.5.1 Particulate Matter Emissions

**Numerical Modelling**

PAEHolmes (2011) has assessed the potential particulate matter-related impacts of the Project in accordance with the OEH *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005), using the US EPA ISCST3 computer model. The model incorporates mathematical algorithms to estimate dispersion of a plume of dust, taking into account the location of emission sources and volume of dust produced at each location, as well as the effects of wind and topography on the estimated dust plume. This model has been accepted by the OEH for assessing the dispersion of dust in the atmosphere.

The modelling has been based on the use of three particle-size categories, namely:

- $PM_{2.5}$ - 0µm to 2.5µm;
- $PM_{2.5\text{-}10}$ – 2.5µm to 10µm; and
- $PM_{10\text{-}30}$ - 10µm to 30µm.

The proportion of particle size categories has been derived from published measurements as follows (SPCC, 1986).

- $PM_{2.5}$ is 4.7% of the TSP.
- $PM_{2.5\text{-}10}$ is 34.4% of TSP.
- $PM_{10\text{-}30}$ is 60.9% of TSP.

The ISC model attempts to estimate the dispersion of a plume of dust using actual meteorological data, including wind speed and direction, each hour over the modelling period, and calculating the relevant dust concentration and deposition rate at specified locations. In the present case, the co-ordinates of all surrounding residences were entered into the model as point receptors (see **Figure 4.9**). The data for each residence was then averaged over each 24-hour period and for the entire year, with the maximum 24-hour values for $PM_{10}$ and deposited dust presented in the following sub-sections representing the highest concentration or amount deposited at that location in any 24-hour period during the year.

**Meteorological Data Inputs**

Section 4.2 of PAEHolmes (2011) presents a detailed overview of the meteorological data inputs used during the air quality assessment. In summary, a synthetic set of site-specific, meteorological data for the Mine Site was created using The Air Pollution Model (TAPM) developed by CSIRO. Local wind speed and wind direction from the Peak Hill Gold Mine Meteorological station operated by the Proponent for the 2003 calendar year were used in TAPM as an observation file.

### Particulate Matter Emission Sources

The air quality assessment was undertaken for three scenarios during the life of the Project, namely:

- Scenario 2 – end of Year 1;
- Scenario 3 – end of Year 2; and
- Scenario 4 – end of Year 4.

These scenarios are described in detail in Section 4.2.4.1 for the noise assessment and are presented in **Figures 4.13, 4.14** and **4.15**. It is noted that Scenario 1 was not assessed as this scenario reflects construction operations within the Mine Site.

It is noted that following completion of the air quality modelling, minor amendments were made to the site layout, including moving of Waste Rock Emplacement 1 to the south, minor adjustments to the open cut boundaries, inclusion of a fourth open cut (Caloma Two) and incorporation of an underground mining operation (Wyoming One). The minor amendments to the site layout, i.e. adjustment of waste rock emplacement and open cut boundaries, would result in the proposed sources of particulate matter emissions being further from sensitive receivers. In considering the additional open cut and underground mining operations, the following is noted.

- The development and operation of Caloma Two open cut would not involve the use of any additional equipment or change to operations such as the destination of waste rock and ore. As a result, mining from Caloma Two open cut does not represent a scenario that would generate additional emissions or operate significantly closer to surrounding receivers. On this basis, the three worst-case scenarios remain valid and PAEHolmes (2011) assessed there to be no need to re-run the model incorporating a fourth scenario.
- Underground mining involves less surface activity than open cut mining and therefore would generate fewer emissions. For this reason, the modelled worst-case scenarios remain valid and PAEHolmes (2011) assessed there to be no need to re-run the model incorporating a fourth scenario. Underground mining operations, and associated blasting, ore movement and processing have, however, been included in the greenhouse gas assessment for the Project (see Section 4.9.7.2).

As a result, and in light of the minor nature of the amendments, the air quality modelling was not re-run. This would result in the results of the assessment being conservative as the modelled emission sources are likely to be closer to surrounding residences in Tomingley than the actual emission sources.

### Particulate Matter Emission Inventories

The quantity of particulate matter generated by each activity has been established through reference to emission factors developed, both locally and by the US EPA. These emission factors applied are considered to be the most up-to-date methods for determining dust generation rates. **Table 4.46** presents the estimated dust emissions for three modelled scenarios and considered likely to provide the "worst-case" dust emissions for surrounding residences. These estimates assume the implementation of the measures presented in Section 4.9.6.

#### 4.9.5.2 Greenhouse Gas Emissions

The primary source of greenhouse gas emissions from the Project would be from the combustion of fuel by diesel powered equipment and vehicles within the Mine Site. Other sources of greenhouse gas emissions would include the following.

- Use of purchased electricity on the Mine Site.
- Use of explosives during blasting operations.
- Use of Liquefied Petroleum Gas (LPG) for heating purposes during processing operations.
- Use of fuel by vehicles travelling to and from the Mine Site.

In order to assess greenhouse gas emissions, the various greenhouse gas emitting activities were identified and through the use of established emission factors (AGO, 2005), annual $CO_2$-equivalent emissions were calculated.

PAEHolmes (2011) used the following formula to estimate the greenhouse gas emissions from fuel (diesel and LPG) usage:

$$GHG\ Emissions\ \ tCO_2 - e\ = \frac{Q \times EC \times EF}{1000}$$

Where:

| | | |
|---|---|---|
| Q | = | quantity of fuel in tonnes or thousands of litres |
| EC | = | energy content of the fuel in GJ/tonne or GJ/kL |
| EF | = | relevant emission factor in kg $CO_2$-e/GJ |

To calculate emissions from electricity usage, the following equation was used:

$$GHG\ Emissions\ \ tCO_2 - e\ = Q \times \frac{EF}{1000}$$

Where:

| | | |
|---|---|---|
| Q | = | electricity consumed in GJ |
| EF | = | relevant emission factor in kg $CO_2$-e/GJ |

To calculate emissions from explosives (ANFO) usage, the following equation was used:

$$GHG\ Emissions\ (tCO_2 - e) = Q \ x\ EF$$

Where:

Q = explosives used in tonnes

EF = relevant emission factor in tonnes of product

**Table 4.47** provides a summary of the emission factors used by PAEHolmes (2011) in applying these equations.

**Table 4.46**
**Dust Emissions Inventory for the Three Modelled Scenarios**

| ACTIVITY | TSP emission Scenario 2 in (kg/y) | TSP emission Scenario 3 in (kg/y) | TSP emission Scenario 4 in (kg/y) |
|---|---|---|---|
| **Overburden Management** | | | |
| Drilling | 68,424 | 66,050 | 15,138 |
| Blasting | 16,330 | 15,775 | 3,613 |
| Excavator loading overburden to haul truck | 5,193 | 3,977 | 1,088 |
| Hauling from Caloma open cut to WRE 3 | 90,270 | 69,137 | - |
| Hauling from Caloma 2 open cut to WRE 3 | - | - | 21,773 |
| Hauling from Wyoming 1 open cut to WRE 1 | 6,200 | 4,749 | 5,348 |
| Hauling from Wyoming 3 open cut to WRE 2 | 20,789 | 15,922 | - |
| Placing within WRE 3 | 2,337 | 1,790 | 326 |
| Placing within WRE 1 | 883 | 676 | 761 |
| Placing within at WRE 2 | 1,973 | 1,511 | - |
| Dozers operating on overburden | 36,640 | 36,640 | 36,640 |
| **Mining** | | | |
| Drilling | 1,277 | 928 | 2,114 |
| Blasting | 806 | 589 | 2,989 |
| Dozers ripping/pushing/clean-up | 109,963 | 109,963 | 109,963 |
| Loading ore to trucks | 132,623 | 106,550 | 118,303 |
| Hauling ore from Caloma open cut to ROM pad | 15,374 | 12,352 | - |
| Hauling ore from Caloma 2 open cut to ROM pad | - | - | 13,298 |
| Hauling ore from Wyoming 1 open cut to ROM pad | 8,184 | 6,575 | 30,060 |
| Hauling ore from Wyoming 3 open cut to ROM pad | 7,081 | 5,689 | - |
| Unloading ROM to ROM stockpiles | 442 | 355 | 394 |
| **Processing** | | | |
| Unloading ore from stockpiles to ROM bin | 442 | 355 | 394 |
| Primary crushing | 30,041 | 24,135 | 26,797 |
| Conveying to screen building | 46 | 46 | 46 |
| Unloading ore from conveyor to screen building | 442 | 355 | 394 |
| Screening | 1,878 | 1,508 | 1,675 |
| Conveying oversized material to crushing building | 46 | 46 | 46 |
| Unloading oversized ore from conveyor to crushing building | 126 | 101 | 112 |
| Secondary crushing | 85,616 | 68,784 | 76,371 |
| Conveying oversized material to screen building | 46 | 46 | 46 |
| Conveying undersized material to surge bin | 27 | 27 | 27 |
| Unloading undersized ore from conveyor to surge bin | 7 | 5 | 6 |
| Conveying undersized material from surge bin to ball mill | 44 | 44 | 44 |
| Unloading undersized ore from conveyor to ball mill | 22 | 18 | 20 |
| **Rehabilitation** | | | |
| Dozers operating on final landform | - | 3,861 | 3,861 |
| **Wind Erosion** | | | |
| Overburden stockpiles | 245,280 | 223,730 | 223,730 |
| Residue storage | 51,824 | 51,824 | 51,824 |
| Open cuts | 198,677 | 198,677 | 198,677 |
| ROM stockpiles | 1,402 | 1,402 | 1,402 |
| **Miscellaneous** | | | |
| Grading roads | 86,264 | 86,264 | 86,264 |
| **Total** | **1,227,019** | **1,120,458** | **1,033,545** |
| WRE = Waste Rock Emplacement | | | |
| Source: Modified after PAEHolmes (2011) – Table 8.1 | | | |

**Table 4.47**
**Summary of Emission Factors**

| Emission Source | Emission factor | | Scope | Source |
|---|---|---|---|---|
| Diesel - Non-transport activities | 69.5 | kg $CO_2$-e/GJ | 1 | Table 3 (DCC, 2009a) |
| | 5.3 | kg $CO_2$-e/GJ | 3 | Table 38 (DCC, 2009a) |
| LPG – processing | 59.9 | kg $CO_2$-e/GJ | 1 | Table 3 (DCC, 2009a) |
| Electricity | 0.89 | kg $CO_2$-e/kWh | 2 | Table 39 (DCC, 2009a) |
| | 0.18 | kg $CO_2$-e/kWh | 3 | Table 3 (DCC, 2009a) |
| Explosives ANFO | 0.17 | $CO_2$/tonne product | 1 | Table 4 (DCC, 2008a) |
| Source: Modified after PAEHolmes (2011) – Table 10.1 | | | | |

Greenhouse gas emitting sources are classified according to accepted greenhouse gas protocol as either Scope 1, 2 or 3 emissions as follows.

- **Scope 1 Emissions**: These are the direct emissions from sources within the boundary of the Mine Site such as the combustion of diesel and LPG equipment and vehicles.
- **Scope 2 Emissions**: These are the indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation.
- **Scope 3 Emissions**: These emissions are defined as all other indirect emissions that are a consequence of an organisation‟s activities but are not from sources owned, or controlled, by the organisation. In the case of the Project, this includes the consumption of fuel required for employee and visitor commute to the Mine Site.

### 4.9.6 Management and Mitigation Measures

The primary sources of particulate matter to be controlled are:

- windblown dust from exposed areas; and
- dust generated by mining activities, including vehicle movements, blasting and loading and unloading of material.

In general, the Proponent would implement best practice dust control measures whereas identified in the Environment Australia publication *Best Practice Environmental Management in Mining: Dust Control* (Environment Australia, 1998). Specifically, the Proponent would implement the following particulate matter management and mitigation measures.

- Disturb only the minimum area necessary for mining would be disturbed.
- Shape, topsoil and rehabilitate completed sections of the waste rock emplacements as soon as practicable.
- Use water carts as to minimise wind-blown and traffic-generated dust.
- Clearly mark all roads with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas.
- Rehabilitate all roads as soon as practicable once no longer required for mining-related purposes.
- Limit development of minor roads as far as practicable.

- Water all access tracks used by topsoil stripping equipment during their loading and unloading cycle.
- Ensure that all appropriate dust management measures are used during drilling operations, including dust aprons, dust extraction and water injection.
- Install dust suppression sprays in areas of regular traffic or high potential for dust emissions as required.
- Undertake blasting operation in appropriate weather conditions only.
- Ensure that adequate stemming is used during blasting operations.
- Ensure that all conveyor transfer points within the crushing and screening circuit of the processing operations are enclosed.
- Install and operate spray bars within the crushing and screening circuit of the processing operations to produce a fog of water to suppress dust. Points at which this control would be installed are as follows.
  - The ROM Bin back and side walls. A sensor would be installed to turn the system on when the loader is approaching to the ROM Bin.
  - The mouth of the Primary Crusher.
  - The conveyor between the primary crusher and secondary crusher (CV01).
  - The discharge point to the Head Chute in the Screening Tower (CV02).
  - The inlet to the Screening Tower.
  - The oversize outlet to the Screening Tower.
  - Loading points to the conveyors for the transfer of screened material to and from the screening Tower and Surge Bin (CV03, CV04, CV05 and CV06).
- The Emergency (Surge) Stockpile would be sprayed using the cannon on the water cart if dust generation is observed.

### 4.9.7 Assessment of Impacts

#### 4.9.7.1 Particulate Matter and Deposited Dust Impacts

**Table 4.48**, **Table 4.49** and **Table 4.50** summarise the predicted particulate matter and deposited dust concentrations at each of the residential receptors in the vicinity of the Mine Site for Scenarios 2, 3 and 4 respectively.

It is noted that the assessment of cumulative 24hr maximum $PM_{10}$ relies on the contemporaneous addition of the $70^{th}$ percentile observed 24-hour $PM_{10}$ concentration to the predicted daily varying 24-hour $PM_{10}$ concentration. PAEHolmes (2011) notes that this method is endorsed by the Victorian EPA. As no continuous records of 24-hour $PM_{10}$ concentrations are available for the Mine Site location, the $70^{th}$ percentile 24-hour $PM_{10}$ concentration ($25\mu g/m^3$) has been derived from the Peak Hill Gold Mine TSP monitoring dataset.

**Table 4.48**
**Anticipated Particulate Matter Impacts – Scenario 2**

| Receptor ID | Incremental (Project Alone) | | | | Total (Project + Background) | | | |
|---|---|---|---|---|---|---|---|---|
| | PM$_{10}$ (µg/m$^3$) | | TSP (µg/m$^3$) | Dust Deposition (g/m$^2$/month) | PM$_{10}$ (µg/m$^3$) | | TSP (µg/m$^3$) | Dust Deposition (g/m$^2$/month) |
| **Averaging period** | **24-hour** | **Annual** | **Annual** | **Annual** | **24-hour** | **Annual** | **Annual** | **Annual** |
| **Air quality goal** | ***50*** | ***N/A*** | ***N/A*** | ***2*** | ***50*** | ***30*** | ***90*** | ***4*** |
| R1 | 16 | 3 | 3 | 0.1 | 41 | 23 | 54 | 2.1 |
| R2 | 11 | 1 | 1 | 0.0 | 36 | 21 | 52 | 2.0 |
| R3 | 34 | 5 | 6 | 0.2 | **59** | 25 | 57 | 2.2 |
| R4 | 21 | 2 | 3 | 0.0 | 46 | 22 | 54 | 2.0 |
| R5 | 21 | 3 | 4 | 0.1 | 46 | 23 | 55 | 2.1 |
| R6 | 21 | 3 | 4 | 0.2 | 46 | 23 | 55 | 2.2 |
| R8 | 6 | 1 | 1 | 0.0 | 31 | 21 | 52 | 2.0 |
| R9 | 8 | 1 | 1 | 0.0 | 33 | 21 | 52 | 2.0 |
| R10 | 15 | 2 | 2 | 0.1 | 40 | 22 | 53 | 2.1 |
| R11 | 14 | 2 | 2 | 0.1 | 39 | 22 | 53 | 2.1 |
| R12 | 8 | 1 | 1 | 0.0 | 33 | 21 | 52 | 2.0 |
| R13 | 15 | 2 | 3 | 0.1 | 40 | 22 | 54 | 2.1 |
| R16 | 19 | 3 | 3 | 0.1 | 44 | 23 | 54 | 2.1 |
| R17 | 21 | 3 | 3 | 0.1 | 46 | 23 | 54 | 2.1 |
| R18 | 10 | 1 | 2 | 0.1 | 35 | 21 | 53 | 2.1 |
| R19 | 21 | 3 | 3 | 0.1 | 46 | 23 | 54 | 2.1 |
| R21 | 20 | 3 | 3 | 0.2 | 45 | 23 | 54 | 2.2 |
| R22 | 11 | 1 | 2 | 0.1 | 36 | 21 | 53 | 2.1 |
| R23 | 23 | 3 | 4 | 0.2 | 48 | 23 | 55 | 2.2 |
| R24 | 11 | 1 | 1 | 0.1 | 36 | 21 | 52 | 2.1 |
| R25 | 23 | 3 | 4 | 0.2 | 48 | 23 | 55 | 2.2 |
| R26 | 23 | 3 | 4 | 0.2 | 48 | 23 | 55 | 2.2 |
| R27 | 12 | 1 | 1 | 0.1 | 37 | 21 | 52 | 2.1 |
| R28 | 32 | 5 | 5 | 0.2 | **57** | 25 | 56 | 2.2 |
| R29 | 33 | 5 | 6 | 0.2 | **58** | 25 | 57 | 2.2 |
| R32 | 29 | 4 | 5 | 0.2 | **54** | 24 | 56 | 2.2 |
| R33 | 26 | 4 | 4 | 0.2 | **51** | 24 | 55 | 2.2 |
| R35 | 25 | 3 | 4 | 0.1 | 50 | 23 | 55 | 2.1 |
| R37 | 22 | 3 | 3 | 0.1 | 47 | 23 | 54 | 2.1 |
| R40 | 30 | 4 | 5 | 0.2 | **55** | 24 | 56 | 2.2 |

Source: Modified after PAEHolmes (2011) – Tables 8.2 and 8.5 — Shaded cells indicate an exceedance of the criterion

### Average Annual Emissions

All residences surrounding the Mine Site are expected to experience Project-related particulate matter concentrations and deposited dust levels that are less than the relevant annual assessment criteria during all modelled scenarios.

### 24 Hour Maximum Emissions

The incremental 24 hour maximum PM$_{10}$ emissions are less than 50µg/m$^3$ at all assessed receivers. However when added to the 70$^{th}$ percentile background 24 hour PM$_{10}$ concentration (25µg/m$^3$), PAEHolmes (2011) predicts some exceedances of the criteria at R3, R28, R29, R32, R33 and R40 in Scenarios 2 and 3 (see **Tables 4.48** and **4.49**), and R3 and R29 in Scenario 4 (see **Table 4.50**).

**Table 4.49**
**Anticipated Particulate Matter Impacts – Scenario 3**

| Receptor ID | Incremental (Project Alone) | | | | Total (Project + Background) | | | |
|---|---|---|---|---|---|---|---|---|
| | PM10 (µg/m³) | | TSP (µg/m³) | Dust Deposition (g/m²/month) | PM10 (µg/m³) | | TSP (µg/m³) | Dust Deposition (g/m²/month) |
| **Averaging period** | **24-hour** | **Annual** | **Annual** | **Annual** | **24-hour** | **Annual** | **Annual** | **Annual** |
| **Air quality goal** | ***50*** | ***N/A*** | ***N/A*** | ***2*** | ***50*** | ***30*** | ***90*** | ***4*** |
| R1 | 16 | 3 | 3 | 0.1 | 41 | 23 | 54 | 2.1 |
| R2 | 11 | 1 | 1 | 0.0 | 36 | 21 | 52 | 2.0 |
| R3 | 34 | 5 | 6 | 0.2 | **59** | 25 | 57 | 2.2 |
| R4 | 21 | 2 | 3 | 0.0 | 46 | 22 | 54 | 2.0 |
| R5 | 21 | 3 | 4 | 0.1 | 46 | 23 | 55 | 2.1 |
| R6 | 21 | 3 | 4 | 0.2 | 46 | 23 | 55 | 2.2 |
| R8 | 6 | 1 | 1 | 0.0 | 31 | 21 | 52 | 2.0 |
| R9 | 8 | 1 | 1 | 0.0 | 33 | 21 | 52 | 2.0 |
| R10 | 15 | 2 | 2 | 0.1 | 40 | 22 | 53 | 2.1 |
| R11 | 14 | 2 | 2 | 0.1 | 39 | 22 | 53 | 2.1 |
| R12 | 8 | 1 | 1 | 0.0 | 33 | 21 | 52 | 2.0 |
| R13 | 15 | 2 | 3 | 0.1 | 40 | 22 | 54 | 2.1 |
| R16 | 19 | 3 | 3 | 0.1 | 44 | 23 | 54 | 2.1 |
| R17 | 21 | 3 | 3 | 0.1 | 46 | 23 | 54 | 2.1 |
| R18 | 10 | 1 | 2 | 0.1 | 35 | 21 | 53 | 2.1 |
| R19 | 21 | 3 | 3 | 0.1 | 46 | 23 | 54 | 2.1 |
| R21 | 20 | 3 | 3 | 0.2 | 45 | 23 | 54 | 2.2 |
| R22 | 11 | 1 | 2 | 0.1 | 36 | 21 | 53 | 2.1 |
| R23 | 23 | 3 | 4 | 0.2 | 48 | 23 | 55 | 2.2 |
| R24 | 11 | 1 | 1 | 0.1 | 36 | 21 | 52 | 2.1 |
| R25 | 23 | 3 | 4 | 0.2 | 48 | 23 | 55 | 2.2 |
| R26 | 23 | 3 | 4 | 0.2 | 48 | 23 | 55 | 2.2 |
| R27 | 12 | 1 | 1 | 0.1 | 37 | 21 | 52 | 2.1 |
| R28 | 32 | 5 | 5 | 0.2 | **57** | 25 | 56 | 2.2 |
| R29 | 33 | 5 | 6 | 0.2 | **58** | 25 | 57 | 2.2 |
| R32 | 29 | 4 | 5 | 0.2 | **54** | 24 | 56 | 2.2 |
| R33 | 26 | 4 | 4 | 0.2 | **51** | 24 | 55 | 2.2 |
| R35 | 25 | 3 | 4 | 0.1 | 50 | 23 | 55 | 2.1 |
| R37 | 22 | 3 | 3 | 0.1 | 47 | 23 | 54 | 2.1 |
| R40 | 30 | 4 | 5 | 0.2 | **55** | 24 | 56 | 2.2 |

Source: Modified after PAEHolmes – Table 8.3 and 8.5 Shaded cells indicate an exceedance of the criterion

Given the predicted exceedances, PAEHolmes (2011) completed further analysis as to the probability of occurrence of these exceedances. By assessing the 365 day record of predicted $PM_{10}$ concentrations, PAEHolmes (2011) identified that for each residential receiver for which an exceedance of the cumulative 24 hour maximum $PM_{10}$ concentration was predicted, a concentration of greater than 25µg/m³ was only predicted on one day each year, i.e. 0.3% of the time.

Therefore, as there is a 30% probability of the background level being over 25µg/m³ and a 0.3% probability of the Project contribution being over 25µg/m³. The probability of these two events occurring simultaneously in any given year is approximately 0.09%. This translates to an average occurrence of about one day in three years. On this basis, PAEHolmes (2011) conclude that the Project is unlikely to result in an unacceptable increase in $PM_{10}$ concentrations locally.

**Table 4.50**
**Anticipated Particulate Matter Impacts – Scenario 4**

| Receptor ID | Incremental (Project Alone) | | | | Total (Project + Background) | | | |
|---|---|---|---|---|---|---|---|---|
| | $PM_{10}$ (µg/m$^3$) | | TSP (µg/m$^3$) | Dust Deposition (g/m$^2$/month) | $PM_{10}$ (µg/m$^3$) | | TSP (µg/m$^3$) | Dust Deposition (g/m$^2$/month) |
| **Averaging period** | **24-hour** | **Annual** | **Annual** | **Annual** | **24-hour** | **Annual** | **Annual** | **Annual** |
| **Air quality goal** | ***50*** | ***N/A*** | ***N/A*** | ***2*** | ***50*** | ***30*** | ***90*** | ***4*** |
| R1 | 15 | 2 | 2 | 0.1 | 40 | 22 | 53 | 2.1 |
| R2 | 10 | 1 | 1 | 0.0 | 35 | 21 | 52 | 2.0 |
| R3 | 26 | 3 | 4 | 0.2 | **51** | 23 | 55 | 2.2 |
| R4 | 16 | 2 | 2 | 0.0 | 41 | 22 | 53 | 2.0 |
| R5 | 18 | 3 | 4 | 0.1 | 43 | 23 | 55 | 2.1 |
| R6 | 21 | 3 | 4 | 0.3 | 46 | 23 | 55 | 2.3 |
| R8 | 6 | 1 | 1 | 0.0 | 31 | 21 | 52 | 2.0 |
| R9 | 7 | 1 | 1 | 0.0 | 32 | 21 | 52 | 2.0 |
| R10 | 12 | 1 | 2 | 0.1 | 37 | 21 | 53 | 2.1 |
| R11 | 11 | 1 | 1 | 0.0 | 36 | 21 | 52 | 2.0 |
| R12 | 7 | 1 | 1 | 0.0 | 32 | 21 | 52 | 2.0 |
| R13 | 14 | 2 | 2 | 0.1 | 39 | 22 | 53 | 2.1 |
| R16 | 17 | 2 | 2 | 0.1 | 42 | 22 | 53 | 2.1 |
| R17 | 19 | 2 | 3 | 0.1 | 44 | 22 | 54 | 2.1 |
| R18 | 10 | 1 | 1 | 0.1 | 35 | 21 | 52 | 2.1 |
| R19 | 18 | 2 | 3 | 0.1 | 43 | 22 | 54 | 2.1 |
| R21 | 18 | 2 | 3 | 0.1 | 43 | 22 | 54 | 2.1 |
| R22 | 10 | 1 | 1 | 0.1 | 35 | 21 | 52 | 2.1 |
| R23 | 20 | 3 | 3 | 0.1 | 45 | 23 | 54 | 2.1 |
| R24 | 11 | 1 | 1 | 0.1 | 36 | 21 | 52 | 2.1 |
| R25 | 20 | 2 | 3 | 0.1 | 45 | 22 | 54 | 2.1 |
| R26 | 19 | 2 | 3 | 0.1 | 44 | 22 | 54 | 2.1 |
| R27 | 11 | 1 | 1 | 0.1 | 36 | 21 | 52 | 2.1 |
| R28 | 25 | 3 | 4 | 0.1 | 50 | 23 | 55 | 2.1 |
| R29 | 26 | 3 | 4 | 0.1 | **51** | 23 | 55 | 2.1 |
| R32 | 23 | 3 | 3 | 0.1 | 48 | 23 | 54 | 2.1 |
| R33 | 22 | 3 | 3 | 0.1 | 47 | 23 | 54 | 2.1 |
| R35 | 20 | 3 | 3 | 0.1 | 45 | 23 | 54 | 2.1 |
| R37 | 18 | 2 | 3 | 0.1 | 43 | 22 | 54 | 2.1 |
| R40 | 24 | 3 | 3 | 0.1 | 49 | 23 | 54 | 2.1 |

Source: Modified after PAEHolmes – Table 8.4 and 8.5 Shaded cells indicate an exceedance of the criterion

### 4.9.7.2 Greenhouse Gas Emissions

The consumption levels of diesel fuel, LPG, electricity and explosives by scope are presented in **Table 4.51**.

Based on the fuel, LPG, electricity and explosives usage presented in **Table 4.51** and the emission calculation equations presented in Section 4.9.5.2, the annual $CO_2$-e emissions are summarised in **Table 4.52**.

The annual greenhouse emissions in NSW for 2008 were 156.4Mt (DCCEE, 2010). **Table 4.53** presents the $CO_2$-e emission percentage increase for each year of the Project"s operations above the NSW 2008 greenhouse emission estimate. These estimates include all scope emissions.

For the life of the Project, it has been estimated that approximately 0.38Mt of CO2-e would be released each year"s with less than 22% of these emissions Scope 1 emissions directly attributable to Mine Site operations. The maximum annual increase of emissions would be Years 1 to 3 which would represent an approximate annual contribution of 0.04% to baseline 2008 NSW emissions.

**Table 4.51**
**Summary of Scope 1 Diesel, LPG and Explosives Usage**

| Operational Year | Diesel Usage per Year (L) | LPG Usage per Year (L) | Explosives (ANFO) $CO_2$-e Emissions (t $CO_2$-E/Y) | Electricity Consumption per Year (Gwh) |
|---|---|---|---|---|
| Construction (4-5 months) | 446,206 | - | 48 | - |
| Year 1 | 5 569 152 | 418 080 | 501 | 34.5 |
| Year 2 | 5 579 844 | 418 080 | 479 | 34.5 |
| Year 3 | 5 668 976 | 418 080 | 330 | 34.5 |
| Year 4 | 5 438 036 | 418 080 | 218 | 34.5 |
| Year 5 | 4 058 756 | 418 080 | 14 | 34.5 |
| Year 6 | 1 354 689 | 418 080 | 47 | 34.5 |
| Year 7 | 340 000 | 418 080 | 69 | 34.5 |
| Year 8 | 340 000 | 418 080 | 41 | 34.5 |
| **Total** | **28 795 659** | **3 344 640** | **1 746** | **276** |
| Source: Alkane Resources Ltd | | | | |

**Table 4.52**
**Summary of Estimated $CO_2$-e Emissions**

| Year | Scope 1 (t $CO_2$-e) | | | Scope 2 (t $CO_2$-e) | Scope 3 (t $CO_2$-e) | | Total |
|---|---|---|---|---|---|---|---|
| | Diesel | LPG | Explosives (ANFO) | Electricity | Diesel | Electricity | |
| Construction (4-5 months) | 1 197 | - | 48 | - | 91 | - | 1 336 |
| Year 1 | 14 940 | 644 | 501 | 30,705 | 1 139 | 6 210 | 54 139 |
| Year 2 | 14 969 | 644 | 479 | 30,705 | 1 142 | 6 210 | 54 148 |
| Year 3 | 15 208 | 644 | 330 | 30,705 | 1 160 | 6 210 | 54 256 |
| Year 4 | 14 589 | 644 | 218 | 30,705 | 1 113 | 6 210 | 53 478 |
| Year 5 | 10 888 | 644 | 14 | 30,705 | 830 | 6 210 | 49 291 |
| Year 6 | 3 634 | 644 | 47 | 30,705 | 277 | 6 210 | 41 517 |
| Year 7 | 912 | 644 | 69 | 30,705 | 70 | 6 210 | 38 610 |
| Year 8 | 912 | 644 | 41 | 30,705 | 70 | 6 210 | 38 581 |
| **Total** | **77 250** | **5 149** | **1 746** | **245 640** | **5 891** | **49 680** | **385 356** |
| Source: Modified after PAEHolmes (2011) –Tables 10.3, 10.5, 10.7, 10.8, 10.9 and 10.10 | | | | | | | |

**Table 4.53**
**Summary of Estimated Percentage Increase $CO_2$-e Emissions**

| Year | % Increase from NSW 2008 emissions |
|---|---|
| Construction (4/5 months) | 0.001 |
| Year 1 | 0.035 |
| Year 2 | 0.035 |
| Year 3 | 0.035 |
| Year 4 | 0.034 |
| Year 5 | 0.032 |
| Year 6 | 0.027 |
| Year 7 | 0.025 |
| Year 8 | 0.025 |
| Source: PAEHolmes (2011) – Table 10.11 | |

### 4.9.8 Monitoring

The above assessment indicates that $PM_{10}$, TSP and deposited dust levels associated with the Project are likely to be acceptable. However, in order to demonstrate compliance with the Project air quality goals (refer Section 4.9.4) the Proponent would undertake an air quality monitoring program to demonstrate compliance with the nominated air quality goals. This would include monitoring of deposited dust levels at surrounding residences, subject to landowner agreement. The following residences would be targeted based on the results of air quality modelling (**Figure 4.9**).

- Residence R3.
- Residence R28.
- Residence R29.
- Residence R32.
- Residence R33.
- Residence R40.

In addition, the Proponent would monitor and report on Project-related greenhouse gas emissions as required under relevant State and Commonwealth regulations.

# 4.10 BLASTING AND VIBRATION

## 4.10.1 Introduction

The DGRs identify "**Noise and Blasting**" as a key issue for assessment in the *Environmental Assessment*. Based on the risk assessment undertaken for the Project (see Section 3.5), specific blasting-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) are as follows.

- Ground vibration and/or air overpressure from mine blasting resulting in:
  - Structural damage to buildings, structures and other infrastructure, e.g. telecommunication cables (extreme risk);
  - Subsidence of land in the village of Tomingley (as a consequence of collapse / subsidence of historic Tomingley Mine workings) (high risk);
  - Nuisance/amenity impacts on surrounding landowners / residents (moderate risk);
  - Loss of income to livestock producers (moderate risk); and/or
  - Disrupted communication services (low risk).
- Fugitive fly rock from blasting resulting in:
  - Personal injury (high risk); and/or
  - Disrupted traffic on the Newell Highway (high risk).

The noise and blasting assessment for the Project was undertaken by Mr Dick Godson of SLR Consulting Pty Ltd. The resulting report is presented as Part 1 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "SLR (2011)". This sub-section of the *Environmental Assessment* provides a summary of the blasting components of that report. Section 4.2 provides a summary of the noise components of that report.

## 4.10.2 Existing Environment

No mining operations are currently undertaken in the vicinity of the Mine Site. As a result, there is no current mining-related ground vibration or air blast in the area surrounding the Mine

Site. However, minor ground vibration may be associated with existing heavy vehicle movements on the Newell Highway. However, these are likely to be limited to areas immediately adjacent to the highway.

It is noted that the Proponent used drill and blast techniques within the Peak Hill Gold Mine for six and a half years between 1996 and 2005. During that time, 1 506 individual blasts operations were undertaken, with the closest blasting approximately 200m from the residential edge of Peak Hill. Each blast was monitored and the results are summarised below.

- Seven blasts (0.5% of all blasts) resulted in ground vibration levels of more than 5mm/sec.
- Thirty four blasts (2.2% of all blasts) resulted in airblast overpressure levels of more than 115dBL.

The Proponent notes that management of blasting impacts was made more difficult at Peak Hill because of the historic mine workings making prediction of blasting related impacts more difficult. By contrast, mine workings are not present within the Mine Site and the closest residence to the blasting operations would be approximately 700m.

## 4.10.3 Assessment Criteria

### 4.10.3.1 Introduction

Blasting impacts may be associated with blasting energy that is transmitted through the ground (ground vibration – measured as peak component particle velocity (mm/s)) or through the air (airblast overpressure – measured as dBLinear). This may result in structural damage to surrounding structures, including residential buildings and the proposed Newell Highway Underpass or nuisance/amenity impacts for residents. Blasting may also result in fragments of rock being ejected from the blasting envelope as fly rock. These fragments have the potential to pose a safety risk to motorists travelling on the Newell Highway.

A number of different criteria exist for assessing ground vibration and airblast-related impacts, depending on the structure to be assessed.

### 4.10.3.2 Residential Receivers

The OEH has adopted recommended airblast and ground vibration levels published by the Australian and New Zealand Environment and Conservation Council (ANZECC). These recommended levels, presented in **Table 4.54,** are based on prevention of human discomfort and have been adopted as the assessment criteria for the blasting assessment for residential receivers. It is noted that the criteria for prevention of cosmetic or structural damage to residential buildings are higher than the human comfort criteria. As a result, when the human comfort criteria are achieved then the cosmetic/structural damage criteria would also be achieved.

**Table 4.54**
**ANZECC Recommended Human Comfort Blasting Guidelines**

| | Acceptable[1] | Maximum |
|---|---|---|
| Airblast (dBLinear) | 115 | 120 |
| PCPV Vibration Level (mm/s)[2] | 5 | 10 |
| Note 1: The guidelines recommend that the Acceptable Criteria should be achieved by at least 95% of blasts in a 12 month period.<br>Note 2: PCPV – Peak Component Particle Velocity | | |
| Source: SLR (2011) – Section 6.3.3 | | |

#### 4.10.3.3 Newell Highway Underpass

An underpass under the Newell Highway would be constructed during the initial stages of the Project. The Proponent anticipates that once complete this structure would become an integral and permanent component of the Newell Highway. As a result, it would be necessary to ensure that blasting-related impacts do not result in ground vibration levels that would damage the underpass.

SLR (2011) states that the most recent relevant blast vibration damage criteria is included in British Standard 7385: Part 2-1993 "*Evaluation and Measurement for Vibration in Buildings Part 2"*. This is the Standard recommended in Australian Standard AS 2187: Part 2-2006 "*Explosives - Storage and Use - Part 2: Use of Explosives*" as the guideline values and assessment methods "are applicable to Australian conditions". **Table 4.55** presents the ground vibration criterion from British Standard 7385 relevant to the Newell Highway Underpass. This criterion has been adopted for this assessment.

**Table 4.55**
**British Standard 7385 Ground Vibration Criterion**

| Line | Type of Building | Peak Component Particle Velocity in Frequency Range of Predominant Pulse | |
|---|---|---|---|
| | | 4Hz to 15Hz | 15Hz and above |
| 1 | Reinforced or framed structures<br>Industrial and heavy commercial buildings | 50mm/s at 4Hz and above | |

Source: SLR (2011) – Modified after Table 18

### 4.10.4 Assessment Methodology

Anticipated ground vibrations and air blast overpressure levels were determined using the blasting formulae presented in Australian Standard 2187.2-1993 *Explosives—Storage, transport and use - Part 2: Use of explosives* and the Orica (ex ICI) Explosives Blasting Guide. This method of determining blast emissions is considered conservative.

The formulae are as follows:

PVS (5%) = 2,917 (R/Q ^0.5) ^-1.6

SPL (5%) = $172.4 - 24(\log_{10} R - 0.33 \log_{10} Q)$

Where,

PVS = Peak Vector Sum ground vibration level (mm/s).

PVS(5%) = Level of ground vibration above which 5% of the total population of data points would lie.

SPL = Peak airblast level (dBLinear).

SPL (5%) = Level of airblast above which 5% of the total population of data points would lie.

R = Distance between charge and receiver (m).

Q = Charge mass per delay (kg).

It is noted that blasts may be designed with a specified charge mass per delay (referred to as the maximum instantaneous charge (MIC)) to ensure that the relevant criteria are achieved at relevant receiver locations. It is also noted that blast emissions typically decrease with distance from the blast area. As a result, if the blast criteria are achieved at the closest sensitive receiver location then the criteria would be achieved at all other sensitive receiver locations.

### 4.10.5 Management and Mitigation Measures

Section 2.4.3.4 provides a description of the proposed blasting operations. In summary, each blast would be designed to:

- achieve the required degree of fragmentation;
- satisfy all environmental criteria;
- contain all fly rock within the nominated blast envelope; and
- ensure that there is no requirement to close the Newell Highway during blasting operations.

The Proponent would implement the following blasting mitigation measures and management procedures throughout the life of the Project.

- Design and implement each blast by a suitably qualified blasting engineer or experienced shot-firer.
- Design each blast to ensure the assessment criteria described in Section 4.10.3 are complied with at all residential receivers in the vicinity of the Mine Site and the Newell Highway Underpass and that there is no requirement to close the Newell Highway.
- Identify the blast envelope during design of each blast.
- Ensure, through appropriate orientation of blasting operations, that fragmented material is, as far as practicable, directed away from the Newell Highway. Fly rock is generally produced either at the blast hole collar or at the face of the blast and in order to minimise the potential for flyrock generation, the following would be implemented by the Proponent.
  - The burden on the front-row blast holes would be checked and the loading of explosives in the blast hole modified accordingly.
  - Optimum stemming length would be determined for each blast such that explosives are totally contained and separated from the collar of the blast hole.
  - Aggregate would be used as stemming material in order to fully contain the explosives within the blast hole. Where sub-optimal burden is identified, the blast holes would not be charged or the adjacent face would be buttressed.
- Inspect all blasts following initiation and record the presence of any fly rock outside the nominated blast envelope. Where required, amend the blast design procedures to better manage fly rock.
- Modify blast designs, mitigation measures and operating procedures, if required, on the basis of monitoring results.
- Initiate blasts between the hours of 9:00am and 5:00pm Monday to Saturday only. No blasts would be initiated outside these hours, except for safety or emergency reasons.
- Establish and maintain an environmental complaints line and register of complaints in accordance with the requirements of the Environment Protection Licence, once issued.
- Respond promptly to any issue of concern or complaint raised by the community or a government agency.

## 4.10.6 Assessment of Impacts

### 4.10.6.1 Residential Receivers

The closest residence to the proposed blasting operations is Residence R3 (see **Figure 4.9**). **Table 4.56** presents the anticipated blast emissions at Residence R3 based on the following.

- Maximum instantaneous charge identified in **Table 2.2**, namely 68kg.
- The minimum distance from the closet point of each open cut to Residence R3.

**Table 4.56**
**Anticipated Blast Emission Levels at Residence R3**

| Open-cut Blast Location | Offset Distance (m) | Ground Vibration (mm/s) | Airblast (dBLinear) |
|---|---|---|---|
| Wyoming Three | 871 | 0.8 | 113.3 |
| Caloma One | 715 | 1.1 | 115.3 |
| Wyoming One | 1 579 | 0.3 | 107.1 |

It is noted that the blasting criteria are predicted to be marginally exceeded (by 0.3dBLinear) at Residence R3 when blasting is being undertaken adjacent to the northwestern boundary of the Caloma One Open Cut. SLR (2011) notes, however, that based on the standard blasting formula used, a marginal reduction in the height of the explosive column from 5.5m to 5.2m would result in blasting emissions experienced at Residence R3 of less than 115dBLinear. It is also noted that the standard blasting formula are conservative and that a more accurate site-based formula would be developed once a number of blasts have been undertaken and monitoring results reviewed. As a result SLR (2011) states that with the adoption of the nominated blasting controls, the blasting criteria would be achieved at all residences surrounding the Mine Site.

### 4.10.6.2 Newell Highway Underpass

SLR (2011) states that based on the standard blasting formula for ground vibration and the blasting parameters presented in **Table 2.2** blasting operations at a distance of more than 105m from the near point of the Newell Highway Underpass would result ground vibration levels of less than the relevant criterion, namely 50mm/s.

As a result, SLR (2011) states that the blasting criterion may be achieved at the Newell Highway Underpass provided that monitoring at the underpass of ground vibration associated with any blast within 150m of the underpass is undertaken and blasting procedures are modified where required.

The Proponent has experience blasting near infrastructure at the Peak Hill Gold Mine where the Peak Hill town water supply reservoirs were within 100m of blasting operations. During monitoring of 1 506 blasts at the reservoirs, no exceedances of the relevant criteria were recorded and no damage to the structures was noted.

### 4.10.6.3 Operation of the Newell Highway

During blasting operations, in situ rock is fragmented using explosives. This results in an increase in volume of the in situ material, typically of around 25%. Typically the area that fragmented material would be distributed within is referred to as the blast envelope. Fly rock is material that is ejected beyond the planned or nominated blast envelope.

Typically, there are the two principal areas within the blast from which fly rock may be produced include the following.

- The blast hole collar. Blast holes are typically loaded with explosives with an amount of inert material or stemming filling the top of the hole. When the stemming length has not been optimised and the explosive column is too close to the upper surface of the rock mass, the explosive energy may be directed upwards rather than into the rock mass, ejecting material at velocities greater than planned.
- The face of the blast. Blast holes are typically set back a predetermined distance from a free face. This serves to contain the explosive energy within the rock mass. However, if this distance is too small, the explosive energy may be directed outwards, ejecting material at velocities greater than planned.

SLR (2011) refers to advice provided by Drilling Services Pty Ltd who confirm that given well managed blasting operations and the management and mitigation measures (such as those identified in Section 4.10.5), all fragmented material would be expected to be contained within the following blast envelope.

- 50m in front of the blast.
- 20m on either side of the blast.
- 10m behind the blast.

As a result, SLR (2011) states that there should be no adverse impacts on the operation of the Newell Highway as a result of blasting operations within the Mine Site.

### 4.10.7 Monitoring

Each blast would be monitored at relevant monitoring locations either within the Mine Site or, subject to landholder agreement, on private land.

## 4.11 TRAFFIC AND TRANSPORTATION

### 4.11.1 Introduction

The DGRs identify "**Traffic** – including a detailed description of the measures that would be implemented during construction and operation to minimise impacts on the Newell Highway and Tomingley West Road" as a key issue for assessment in the Environmental Assessment. Based on the risk assessment undertaken for the Project (see Section 3.5), the specific traffic-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment are as follows.

- Road construction activities, e.g. entrance to the Mine Site and Newell Highway Underpass resulting in:
  - Temporary inconvenience to commuters (if delayed for road works) (moderate risk); and/or
  - Change to existing floodways (moderate risk).

- Increased traffic levels due to movement of workforce and contractors resulting in:
  - increased traffic congestion and or traffic delays (low risk); and/or
  - elevated risk of accident/incident on local roads (high risk).
- Increased heavy vehicle movements or transportation of oversize of overweight loads resulting in road pavement deterioration (moderate risk).
- Transportation of dangerous or hazardous goods resulting in contamination as a result of a spill of dangerous or hazardous goods (moderate risk).

The traffic impact assessment for the Project was undertaken by Mr Frank Foley of FJF Group Pty Ltd. The resulting report is presented as Part 7 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "FJF (2011)". This sub-section of the *Environmental Assessment* provides a summary of that report.

## 4.11.2 Existing Environment

### 4.11.2.1 Introduction

The following sub-sections provide a description of current traffic levels and road conditions for the three principal access routes to the Mine Site, namely;

- Tomingley West Road;
- Tomingley – Narromine Road (Main Road 89); and
- Newell Highway (State Highway 17) (see **Figure 4.36**).

Both the Newell Highway and the Tomingley - Narromine Road are State roads. Tomingley West Road is a local road administered by Narromine Shire Council.

### 4.11.2.2 Road Network

The following provides a description of the operation and condition of each of the principal access roads, along with the intersections between these roads. The descriptions of condition are based on an inspection of the roads conducted by FJF Group in April 2009.

**Tomingley West Road**

The Tomingley West Road is a local two way, two lane undivided road with a sealed pavement of approximately 3.5m to 4m wide. There are currently no line or lane markings. Guide posts provide the only form of delineation of the side of the road. FJF (2011) reports that the pavement is in generally good condition with no visible signs of pavement failure.

The posted speed limit is 100km/hr, with the exception of that section of the road within approximately 260m of the Tomingley – Narromine Road where the posted speed limit is 60km/hr.

A notable feature of this road in the vicinity of the Mine Site is a four cell box culvert structure located approximately 100m from the intersection of the Tomingley West Road and the Tomingley – Narromine Road (see **Plate 4.1**). The culvert width is approximately 8.5m with guideposts installed on each corner of the culvert.

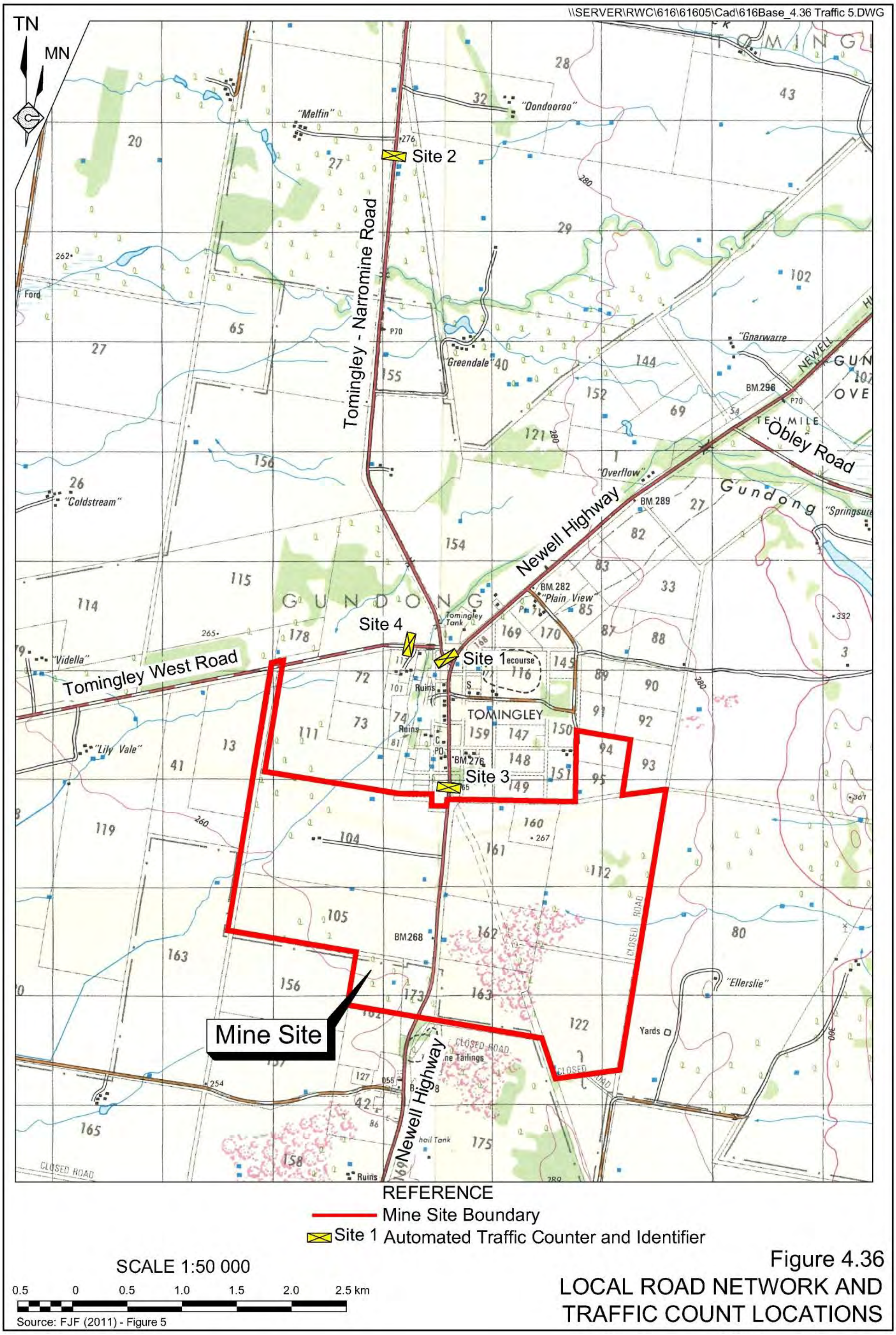


Figure 4.36
LOCAL ROAD NETWORK AND TRAFFIC COUNT LOCATIONS

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**Plate 4.1**: View to the east from Tomingley West Road featuring the culvert over Gundong Creek. (Source: FJF 2011 - Photo 2)

**Plate 4.2**: Upgraded intersection of the Tomingley West Road and Tomingley - Narromine Road (looking east from Tomingley West Road). (Source: FJF 2011 - Photo 8)

**Plate 4.3**: Upgraded intersection of the Tomingley West Road and Tomingley - Narromine Road (looking south from Tomingley - Narromine Road). (Source: FJF 2011 - Photo 7)

**Plate 4.4**: Intersection of Newell Highway and Narromine Road (looking southwest from the Newell Highway). (Source: FJF 2011 - Photo 5)

### Tomingley West Road – Tomingley - Narromine Road Intersection

Tomingley West Road intersects with Tomingley - Narromine Road as a "T" intersection. The width of sealed carriageway on Tomingley - Narromine Road is approximately 7m with a 1m to 2m gravel shoulder on either approach to the intersection (see **Plate 4.2**). The intersection meets the Auxiliary Right Turn (AUR) type intersection standard of the RTA Road design guide.

Safe Intersection Sight Distance (SISD) from the Tomingley West Road along Tomingley - Narromine Road was determined to be 200m to the north and 150m to the south respectively. The desirable SISD in accordance with the RTA Road design guide is 105m for this section of road under a 60km/hr speed limit.

### Tomingley - Narromine Road

Tomingley - Narromine Road is a 2 lane, 2 way main road with a granular pavement over a 6.5m wide sealed carriageway and 1m to 2m wide unsealed gravel shoulders (see **Plate 4.3**). FJF (2011) reports that the pavement is in fair condition with some signs of pavement failure.

It is noted that sections of this road in the vicinity of the intersection with the Tomingley West Road were upgraded following the site inspection by FJF Group.

The posted speed limit on the Tomingley - Narromine Road is 100km/hr with the exception of the section of road within approximately 460m from the intersection with the Newell Highway where the posted speed limit is 60km/hr.

### Newell Highway – Tomingley - Narromine Road Intersection

The intersection of the Newell Highway and Tomingley - Narromine Road is in the form of an auxiliary lane right turn treatment (AUR) with a left turn auxiliary lane (see **Plate 4.4**). FJF (2011) reports that the pavement is in good condition and the intersection features lighting.

Safe intersection sight distance from Tomingley - Narromine Road along the Newell Highway is approximately 160m to the left and 200m to the right. The desirable SISD in accordance with the RTA Road design guide is 105m for this section of road under a 60km/hr speed limit and 160m under an 80km/hr speed limit.

### Newell Highway (SH 17)

The Newell Highway is a 2 lane, 2 way undivided carriageway, and is classified as a Federal Highway. The sealed carriageway width is approximately 11m consisting of 2 x 3.5m wide lanes and 2 x 2m wide sealed shoulders.

The posted speed limit on the Newell Highway outside the village of Tomingley is 100km/hr. The posted speed limit is 50km/hr through the township of Tomingley and 60km/hr through the intersection of the Newell Highway and Tomingley - Narromine Road.

## 4.11.2.3 Traffic Volumes

Existing traffic volumes were established by examining and analysing the following.

- Historic traffic count data published by the RTA.
- Data collected from four traffic counters placed for a period of three weeks (29 April to 19 May 2009)) at the following locations (see **Figure 4.36**).
  - Site 1: Tomingley - Narromine Road (150m south of Tomingley West Road).

- Site 2: Tomingley - Narromine Road (4.66km north of Tomingley West Road).
- Site 3: Newell Highway (150m south of the Tomingley Shell Service Station).
- Site 4: Tomingley West Road (130m west of Tomingley - Narromine Road).

Based on the results of these traffic analyses, **Table 4.57** presents the existing (2009) and forecast (2020) traffic volumes. The 2020 traffic levels assume there would be no major non-Project related change to traffic generating industry surrounding the Mine Site and that traffic growth would remain between 2% and 2.3% for these roads.

**Table 4.57**
**Traffic Volumes (2009 & 2020)**

| Road | Current (2009) | | Future (2020)[2,3] | | Heavy Vehicles (%) | Growth |
|---|---|---|---|---|---|---|
| | Total Vehicle Volume | Peak Hour Vehicles[1] | Total Vehicle Volume | Peak Hour Vehicles[1] | | |
| Newell Highway (SH 17) | 2 650 | 300 | 3 375 | 380 | 33 | 2.3% |
| Tomingley - Narromine Road (MR 89) | 400 | 50 | 498 | 64 | 30 | 2% |
| Tomingley West Road | 60 | 12 | 74 | 17 | 33 | 2% |

Note 1: Peak hour vehicle totals are for both directions
Note 2: 2020 traffic volumes are forecast traffic volumes based on assumed growth.
Note 3: 2020 figures do not include Project-related traffic volumes.
Source: Modified after FJF (2011) – Table 6

#### 4.11.2.4 Intersection Performance

FJF (2011) used the SIDRA Intersection (version 3.2) program to determine the current performance of the two intersections servicing traffic travelling to and from the Mine Site, namely:

- the Tomingley West Road – Tomingley – Narromine Road intersection; and
- Newell Highway – Tomingley - Narromine Road Intersection.

The key indicators examined by the SIDRA program include level of service (LOS), delay and degree of saturation. The LOS definitions are presented in **Table 4.58**.

**Table 4.58**
**Level of Service Criteria**

| Level of Service | Average Delay Per Vehicle (s/veh) | Traffic Signals, Roundabout | Give Way and Stop Signs |
|---|---|---|---|
| A | Less than 14 | Good operation | Good operation |
| B | 15 to 28 | Good with acceptable delays and spare capacity | Acceptable delays & spare capacity |
| C | 29 to 42 | Satisfactory | Satisfactory but accident study required. |
| D | 43 to 56 | Operating near capacity | Near capacity and accident study required. |
| E | 57 to 70 | At capacity; at signals, incidents would cause excessive delays. Roundabouts would require other control mode. | At capacity, requires other control mode. |
| F | Over 70 | Over capacity | Over capacity |

Source: Modified after RTA Guide to Traffic Generating Developments

Both intersections were identified as having a LOS of A or B, an average delay of 1.8 seconds and a degree of saturation of <0.1. As a result, FJF (2011) states that there is no current congestion or operating issue associated with these intersections.

#### 4.11.2.5 Accident Statistics

FJF (2011) consulted the RTA in relation to accident statistics locally and it was determined that there is no indication of any existing trend in relation to the safety of local roads and/or intersections.

### 4.11.3 Changes to Traffic Levels Resultant from the Project

**Table 2.7** presents the predicted traffic generated by site construction and mine operations. Based on these predictions, and the assumed existing and forecast traffic levels presented in **Table 4.57**. **Table 4.59** provides the predicted increase in daily traffic as a result of the Project.[17]

**Table 4.59**
**Project Related Increase to Traffic**

| Road | Current Traffic | | Project Generated Traffic | | % Increase | | |
|---|---|---|---|---|---|---|---|
| | Light Vehicle | Heavy Vehicle | Light Vehicle | Heavy Vehicle | Light Vehicle | Heavy Vehicle | All Traffic |
| **Site Construction[1]** | | | | | | | |
| Newell Highway | 1775 | 875 | 120 | 14 | 6.8% | 1.6% | 5.1% |
| Tomingley - Narromine Road | 280 | 120 | 60 | 6 | 21.4% | 5.0% | 16.5% |
| Tomingley West Road | 40 | 20 | 180 | 20 | 450.0% | 100.0% | 333.3% |
| **Mine Operation[2]** | | | | | | | |
| Newell Highway | 2250 | 1125 | 102 | 6 | 4.5% | 0.5% | 3.2% |
| Tomingley - Narromine Road | 349 | 149 | 34 | 2 | 9.7% | 1.3% | 7.2% |
| Tomingley West Road | 49 | 25 | 136 | 8 | 377.6% | 32.0% | 294.6% |

Note 1: Assumes current traffic = 2009
Note 2: Assumes current traffic = 2020
Source: Modified after FJF (2011) – Table 10

Notably, the percentage increase in traffic on the Newell Highway is negligible. The percentage increase on Tomingley - Narromine Road and Tomingley West Road is more significant, however, the overall traffic volume would still remain minor.

Traffic conditions would also be changed during the construction of the Newell Highway underpass (see Section 2.2.4). Changes would include a diversion of the Newell Highway around the construction activities and reduction in speed limit to 80km/hr. There may also be additional traffic controls implemented during the construction of the diversion. Notably, the Proponent has consulted with the RTA with respect to the management of these works and the Newell Highway diversion and has executed a Works Authorisation Deed (see Section 2.1.3).

### 4.11.4 Impact Assessment and Mitigation Measures

#### 4.11.4.1 Tomingley West Road

The proposed traffic generated by the Project would increase the annual average daily traffic (AADT) of Tomingley West Road to between 218 vehicles per day and 260 vehicles per day. In accordance with the recommended minimum road standard recommended by the RTA (see

[17] While it is noted that the potential sources of commuting workers to site include Parkes, Peak Hill, Dubbo and Narromine, for the purpose of traffic analysis, FJF Group (2009) assumed that 66% would travel via the Newell Highway and Tomingley – Narromine Road, and the remaining traffic would travel to the Mine Site from the north via the Tomingley – Narromine Road.

*Table 3.2-4* of the *RTA Road Design Guide*), the Proponent would widen the section of road between the Main Site Access Road and Tomingley - Narromine Road to provide for two sealed lanes of at least 3m width. This would eliminate the need for traffic to move onto the unsealed shoulder to accommodate oncoming traffic.

The entry and exit of vehicles from the Mine Site could create a potential road safety hazard for oncoming traffic. However, this risk would be minimised as the Main Site Access Road intersection with Tomingley West Road would be designed and constructed in accordance with the *RTA Road Design Guide* for rural property access, to accommodate the turning path of a standard semi-trailer. The location of the Main Site Access Road intersection with Tomingley West Road would achieve the 160m SISD required for 60km/hr speed zone (in compliance with the RTA Road design guide).

The four cell box culvert, located approximately 100m from the intersection of the Tomingley West Road and Tomingley - Narromine Road, does not currently have guardrail protection. In addition, there are no lane markings on Tomingley West Road and the placement of guide posts is variable with some missing. In light of this, the Proponent would undertake the following.

- Provide for line marking of the road for a length of 1.6km with a broken central separation line;
- Install guide posts for improved delineation of the road.
- Install additional guide posts at the culvert and “narrow bridge” signage on approach to the culvert.

Finally, the Proponent would undertake a geotechnical investigation of pavement depths, materials and sub-grade conditions on Tomingley West Road. From this it would be determined if the existing pavement has the required strength to handle the increase in traffic volumes or if the pavement requires modification and/or strengthening. Should pavement strengthening be required, the Proponent would initiate discussions with the road authority, namely Narromine Shire Council to identify the most appropriate measures to manage this issue.

#### 4.11.4.2 Tomingley West Road – Tomingley - Narromine Road Intersection

A SIDRA analysis was undertaken by FJF (2011) for this intersection based on the forecast 2020 traffic volumes, together with the proposed Project-related traffic volumes. That assessment concluded that the performance of the intersection would remain acceptable, with the minimum level of service being an “A”. As a result, no additional mitigation is required.

#### 4.11.4.3 Tomingley - Narromine Road

FJF (2011) state that Tomingley - Narromine Road is in good condition and functions with a high level of service, spare capacity and minimal delays. No additional mitigation is considered necessary.

#### 4.11.4.4 Newell Highway – Tomingley - Narromine Road Intersection

A SIDRA analysis was undertaken by FJF (2011) for this intersection based on the forecast 2020 traffic volumes, together with the proposed Project-related traffic volumes. That assessment concluded that the performance of the intersection would remain acceptable, with the minimum level of service being a “B”. As a result, no additional mitigation is required.

#### 4.11.4.5 Newell Highway

This road is in good condition and functions with a high level of service, spare capacity and minimal delays (FJF, 2011).

#### 4.11.4.6 Traffic Volume and Road Safety

**Table 4.59** presents the predicted increases in traffic generated by the Project. Increases to traffic flow on the Newell Highway would be minimal (<6%) and would have no impact on traffic flows which are currently well below the capacity of this road. The proportional increase in traffic on Tomingley - Narromine Road and Tomingley West Road would be 16.5% and 333% respectively. However, the overall traffic volumes on these roads would be still minor, with the Proponent to upgrade Tomingley West Road to ensure pavement width and strength (if required) meet the require RTA or engineering standard.

The proposed increases in traffic generated by the Project would be unlikely to significantly increase the risk of a traffic accident on these roads.

#### 4.11.4.7 Restricted Access Vehicles

To mitigate the impact of Restricted Access Vehicles (RAVs) over mass and over weight deliveries to the Mine Site an individual *Traffic Control Plan* would be developed for each over mass and over weight delivery and would address:

- NSW RTA and NSW Police permit requirements;
- use of escort vehicles where necessary;
- any localised pavement strengthening or road widening requirements for the particular delivery;
- provision of traffic controllers where difficult or unsafe manoeuvres are required; and
- restriction on the times of delivery of over mass or over weight deliveries.

#### 4.11.4.8 Transport Management Plan

The Proponent would implement a comprehensive *Transport Management Plan* for construction and mine operation to ensure that impacts of the Project would be minimised. The *Transport Management Plan* would include the following.

- Safe driving practices/procedures for crossing the narrow culvert near the intersection of the Tomingley West Road and Tomingley - Narromine Road.
- Community information and awareness program of traffic activities. This may include press releases, specific newsletters and letter drops to neighbouring residents.
- Signposting of Tomingley - Narromine Road and Tomingley West Road with heavy vehicle and construction signage during the site construction stage.
- Restrictions on the timing of large equipment and material deliveries.
- Establishment of an inspection and maintenance program for the local road network to ensure conditions of roads are maintained.
- Implementation of a driver code of conduct with disciplinary action for non-compliance.

- Implementation of emergency, accident, incident, complaint or non-compliance response and reporting.
- Identification and enforcement of training requirements.
- An audit and review process for the plan.

# 4.12 SOILS AND LAND CAPABILITY

## 4.12.1 Introduction

The DGRs issued by the then Department of Planning (now DP&I) identify "**Soil** *and Water*" as a key issue for assessment in the *Environmental Assessment*. Based on the risk assessment undertaken for the Project (see Section 3.5), the specific soil-related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include the following.

- Reduction in soil quality through poor soil stripping, stockpiling or spreading practices resulting in:
  - Insufficient soil quantities for rehabilitation (low risk).
  - Reduced soil viability resulting in poor rehabilitation or inability to achieve nominated final land capability (high risk).
  - Increased erosion or erosion potential compared with original landform (moderate risk).

The soils assessment for the Project was undertaken by Dr Pat Hulme of Sustainable Soils Management Pty Ltd. The resulting report is presented as Part 8 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "SSM (2011)". This sub-section of the *Environmental Assessment* provides a summary of that report.

It is noted that a brief description of the soil units within the Mine Site is provided in Section 2.3.3.2. This sub-section provides a more detailed description, including a description of the assessment methodology.

## 4.12.2 Existing Environment

### 4.12.2.1 Regional Soil Environment

SSM (2011) note that the former NSW Department of Water and Energy have prepared, but not published, a soil map at 1:250 000 scale. That map identifies four soil units in the vicinity of the Mine Site as follows.

- The Haberworth Soil Unit: which is an alluvial unit that occurs in the western section of the Mine Site. This soil unit is derived from Obley Granite.
- The Strahorn Soil Unit: which is an alluvial unit that occurs in the eastern section of the Mine Site. This soil unit is derived from the Mumbidgle Formation.
- The Stony Hill Gilgai Soil Unit: that occurs in an area of poor drainage in the southeast of the Mine Site, to the south of the Caloma Open Cut.
- The Mugincoble Soil Unit: which is a thin soil unit in the vicinity of the village of Tomingley

*Section 1.5* of SSM (2011) provides additional information in relation to the regional soils surrounding the Mine Site.

#### 4.12.2.2 Assessment Methodology

**Figure 4.37** illustrates the study area of the SSM (2011) assessment of soils ("Soil Study Area") which incorporates the majority of the Mine Site as well as an area to the west of Tomingley village, south or Tomingley West Road and to the east and north of the Mine Site. A small area to the north of Waste Rock Emplacement 3 (Lots 94 and 95, DP755110) was added to the Mine Site after the completion of the soil survey and assessment. The soil units over this area of the Mine Site has been interpreted based on the mapped soil units to the south of this area and known landform and vegetation types over this area.

Initially, SSM (2011) undertook a preliminary soils assessment using two slightly different electromagnetic geophysical surveys, namely an EM31 survey and EM38 survey. These survey techniques use magnetic fields to induce electrical currents in the soil materials which in turn induce a secondary magnetic field which is detected by an instrument at the surface. The strength of the induced electrical current, and therefore the secondary magnetic field, would vary depending on the nature of the soil material in the vicinity of the transmitter. As a result, variation in the detected secondary magnetic field would reflect variation in the physical properties of the underlying soil material. The EM38 survey method detects variation in soil materials to a depth of approximately 1.5m, while the EM31 survey method detects variation in soil materials to a depth of approximately 6m.

Using the results of the preliminary survey, 19 soil test pits were excavated to a depth of approximately 1.5m deep to expose the soil profile (**Figure 4.37**). Soil types and depths were logged within each of the test pits and samples collected for laboratory analysis. Detailed descriptions of the classification of the observed soil types and laboratory analyses are presented in Section 2.2 of SSM (2011).

#### 4.12.2.3 Survey Area Soils

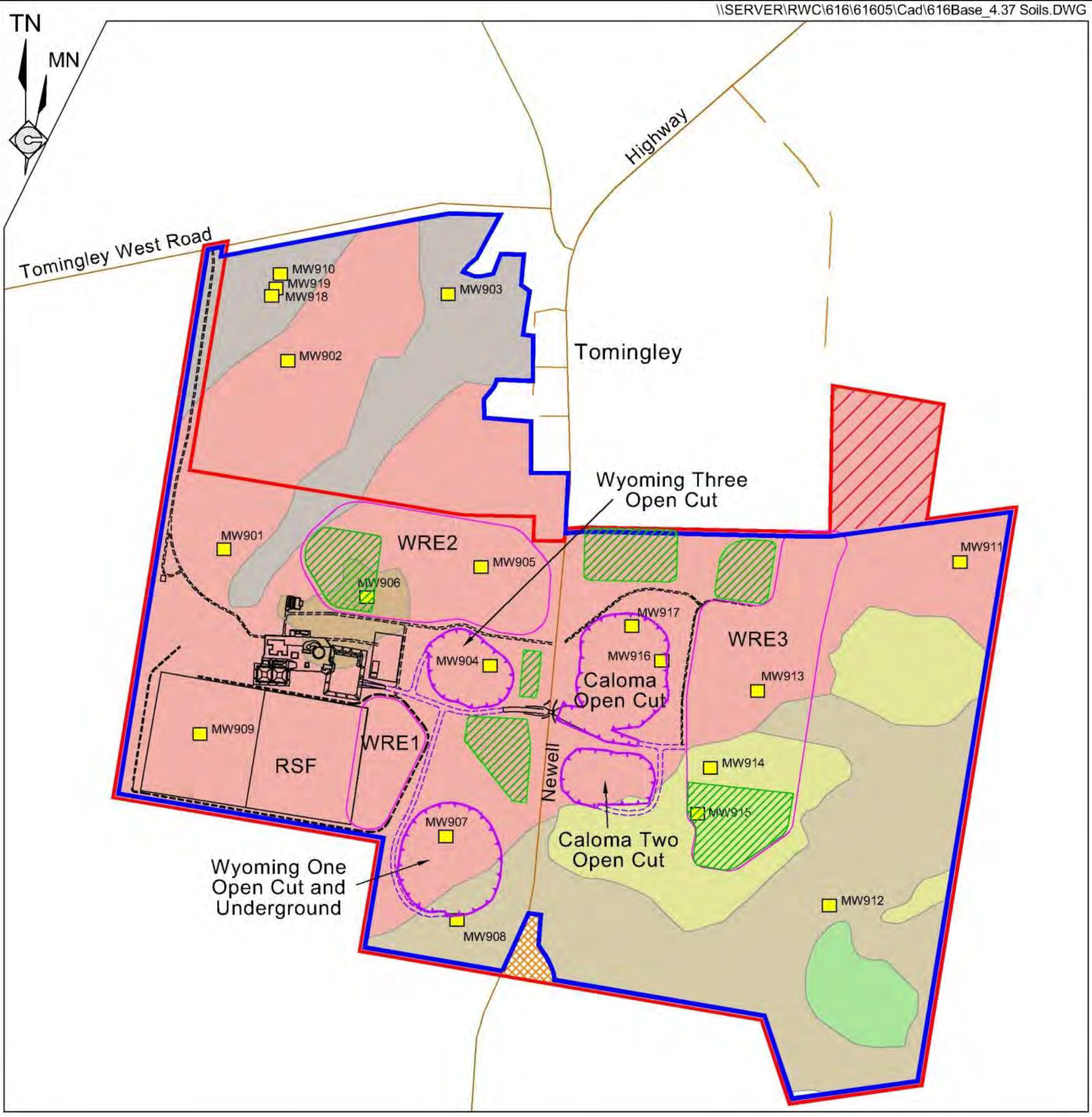
Based on the results of the preliminary survey, the observed soil profiles and the laboratory results, six soil units were identified within the Soil Study Area. The following sub-sections describe the identified soil units. **Figure 4.37** presents the location of each of the identified soil units.

**Red Dermosol**

The majority of the Soil Study Area is underlain by Red Dermosol, a soil unit that is characterised by a red, silty clay loam topsoil over a light clay subsoil. Mottling and manganese coatings on peds between 50cm and 100cm below surface indicates that the soil has experienced long term waterlogging.

Soil testing indicated that the soil has the following physical properties.

- Moderately acidic topsoil over alkaline subsoil.
- The soil is moderately fertile, with very low to moderate nitrogen and phosphorus levels, low sulphate sulphur and moderate levels of the micronutrients of manganese, iron and boron.
- The cation exchange capacity (capacity of the soil to store nutrients) increases from very low in the surface 50cm to adequate levels in the 50cm to 100cm layer.
- Salinity is desirably low for most samples.
- The dispersion index is higher than desirable.




REFERENCE

- Mine Site Boundary
- Soil Survey Area
- Proposed Limit of Mining
- Limit of Waste Rock Emplacement
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Existing Unsealed Road
- Proposed Soil Stockpile Area

**Soil Units**

- Red Dermosol
- Red Dermosol (inferred)
- Grey Dermosol
- Brown Dermosol
- Sodic Gilgaied Dermosol
- Sodic Dermosol
- Rudosol
- Disturbed Land (Newell Highway Rest Area)
- MW902 Soil Test Pit (and Identifier)

**Note:** Soil mapping does not extend onto Lots 94 & 95, DP 755110, as these lots were added to the Mine Site following the completion of the Soil Survey. Based on similarity of topography and vegetation, it is inferred that the soil on these lots is Red Demosol

SCALE 1:30 000

500 0 500 1000 1500 m

Source: Sustainable Soils Management (2011) - Figure 11

Figure 4.37
SOIL STUDY AREA
AND SOIL UNITS

### Grey Dermosol

Small sections of this soil unit were observed in the northwestern section of the Soil Study Area. With the exception of the Main Site Access Road and the very western edge of Waste Rock Emplacement 2, no Project-related ground disturbing activities would be undertaken within the area of this soil unit.

This soil type is characterised by a variety of sandy and silty material in layers up to 30cm thick, deposited as alluvial material adjacent to Gundong Creek. As this soil unit would not be significantly disturbed by the Project, SSM (2011) did not collect samples for laboratory analysis.

### Brown Dermosol

A small area of Brown Dermosol was observed within the disturbance footprint of the Processing Plant and Office Area and Waste Rock Emplacement 2. This soil unit is similar to the Red Dermosol, however, the electromagnetic survey indicated that this material had a very low conductivity.

Soil testing indicated that the soil has the following physical properties.

- The soil pH was typically neutral, however, slight increases in pH were observed with depth.
- The soil has low fertility, with very low nitrogen and phosphorus levels, low sulphate sulphur, and adequate levels of the tested micronutrients of manganese, iron and boron.
- The cation exchange capacity is low.
- Salinity is desirably low.
- The dispersion index is higher than desirable for all samples tested.

### Sodic Dermosol

The southeastern section of the Soil Study Area is underlain by Sodic Dermosol. The Sodic Dermosol soil unit is characterised by a silty clay loam topsoil over a light clay subsoil. This soil unit also showed evidence of long term waterlogging.

Soil testing indicated that the soil has the following physical properties.

- Topsoil is typically neutral with an alkaline subsoil.
- The soil has low fertility, with very low nitrogen and phosphorus levels, low sulphate sulphur and adequate levels of the tested micronutrients of manganese, iron and boron.
- The cation exchange capacity increases from very low in the surface 50cm, increasing to adequate in the 50cm to 150cm layer.
- Salinity is desirably low for all samples.
- The dispersion index is higher than desirable.

### Sodic Gilgaied Dermosol

Sodic Gilgaied Dermosol was observed within poorly drained sections of the Mine Site to the east of the Newell Highway. The Sodic Gilgaied Dermosol is characterised by a uniform soil profile that has been extensively gilgaied (a process where clay horizons alternatively shrink and swell in response to drying and wetting cycles to produce a surface with numerous mounds and depressions). The texture of this soil is generally uniform.

Soil testing indicated that the soil has the following physical properties.

- The soils are alkaline, increasing from moderately alkaline to strongly alkaline with depth.
- The soil has low nitrogen, phosphorus and sulphate sulphur and adequate levels of the tested micronutrients of manganese, iron and boron.
- The cation exchange capacity is adequate for all depths tested.
- The soil tested is sodic for all depths tested.
- Salinity is desirably low to 20cm below surface but undesirably high below this.
- The dispersion index was higher than desirable for all samples tested.

**Rudosol**

This soil type is typically a shallow soil with minimal profile development located in an area of elevated topography in the southeastern section of the Mine Site. SSM (2011) states that Rudosol has properties similar to Sodic Dermosol with some gravel in the surface layer and an elevated erosion risk associated with the steeper slopes in that section of the Mine Site.

The Project would not result in disturbance to this soil type.

#### 4.12.2.4 Land Capability

SSM (2011) states that land within the Soil Study Area has an agricultural land capability of Class 2 (land suitable for regular cultivation with minor strategic works) for all soil units, with the exception of Grey Dermosol. The land capability of the Grey Dermosol soil unit is Class 2 to 3 (land suitable for regular cultivation with minor to intensive soil conservation measures).

### 4.12.3 Management and Mitigation Measures

The Proponent would implement the following management and mitigation measures during the life of the Project. It is noted that a number of these measures have been identified in Section 2.3.3 and are repeated here for the sake of completeness.

- Strip soil material to the depths no more than those identified in **Table 4.60**.
- Ensure that soil materials are not stripped when in either an excessively dry or wet condition.
- Grade or push soil into windrows using graders or bulldozers for later collection by elevating scrapers or loading into trucks by front-end loaders to minimise compaction of soil materials, where practicable.
- Use soil materials immediately following stripping in areas undergoing progressive rehabilitation, where practicable. Where this is not practicable place soil transported by truck directly into storage or place soil transported by scrapers in thick “lifts” to minimise compaction.
- Minimise, as far as practicable, the operation of machinery on soil stockpiles to reduce compaction.

- Ensure that soil stockpiles have a maximum height of 5m (3m of subsoil and 2m of topsoil).
- Leave the surface of the soil stockpile with an even but roughened surface to assist in erosion control and seed germination and emergence.
- Establish an appropriate vegetative cover on all soil stockpiles to be retained for more than 3 months.
- Assess soil stockpiles prior to respreading for weed infestation and spray of otherwise treat as required.
- Consider and assess the requirements for soil additives such as gypsum prior to commencing respreading operations.
- Spread soil materials at least 200mm thick on the shaped landform during rehabilitation operations.

**Table 4.60**
**Maximum Soil Stripping Depths and Inventory**

| Soil Unit | Area to be disturbed (ha) | Topsoil | | Subsoil | |
|---|---|---|---|---|---|
| | | Proposed Maximum Stripping Depth (cm) | Maximum Available Volume ($m^3$) | Proposed Maximum Stripping Depth (cm)[1,2] | Maximum Available Volume ($m^3$)[3] |
| Red Dermosol | 142 | 30 | 426 000 | 20 to 70 | 639 000 |
| Grey Dermosol | 0.4 | 20 | 800 | - | - |
| Brown Dermosol | 16.0 | 50 | 80 000 | - | - |
| Sodic Dermosol | 20.0 | - | - | - | - |
| Sodic Gilgaied Dermosol | 2.7 | -- | - | - | - |
| **Total** | 181.1 | | 506 800 | | 639 000 |

Note 1: Below Base of Topsoil
Note 2: Maximum Stripping Depth Determined by Presence of Mottling
Note 3: Assumes average depth to mottling is 45cm
Source: Modified after SSM (2010) – Table 10

## 4.12.4 Assessment of Impacts

SSM (2011) state that Red, Brown and Grey Dermosol soils within the Soil Study Area are suitable for stripping and use during rehabilitation operations. Sodic and Sodic Gilgaied Dermosol and Rudosol soils are not suitable for stripping and use during rehabilitation operations.

SSM (2011) also state that assuming that best practice rehabilitation measures are implemented, including the soil management and mitigation measures identified in Section 4.12.3 (and Section 2.3.3), that the final land capability of the side slopes of the waste rock emplacements and RSF would, because of the anticipated slope of the final landform, be class 4 (land suitable for grazing but not for cultivation) or class 5 (land unsuitable for agriculture). The land capability of the upper surfaces of the rehabilitated waste rock emplacements and RSF, together with the remaining rehabilitated sections of the Mine Site, would be similar to the land capability of the existing landform, namely class 2 (land suitable for regular cultivation with minor strategic works) or class 3 (land suitable for regular cultivation with minor to intensive soil conservation measures).

# 4.13 HAZARDS

## 4.13.1 Introduction

The DGRs identify "***Hazards***", with specific reference made to the management of cyanide, as a key issue for assessment. The following sub-sections identify the various hazards associated with the Project and provide a summary of each hazard, proposed management and residual impacts associated with each.

## 4.13.2 Potential Hazards

Following a review of the proposed operations, the following hazards (that could potentially impact on the general public) were identified.

- Environmental, safety or health incident associated with cyanide transport, use or management.
- Bushfire.
- Traffic Incident.
- Storage and Use of Potentially Hazardous Materials, e.g. explosives.
- Land Contamination.

The following sub-sections consider each of these hazards, outlining the risk posed by each to the general public or surrounding environment,

## 4.13.3 Cyanide Management

### 4.13.3.1 Potential Hazards

#### 4.13.3.1.1 Environmental Hazards

The primary hazard associated with the transport, storage and use of sodium cyanide and management of the residual waste relates to the potential for this toxic compound to escape containment, contaminate land and water and result in vegetation or fauna mortality.

#### 4.13.3.1.2 Safety and Health Hazards

Hazards to human health and safety revolve around the fact that sodium cyanide is a toxic compound with exposure to this is liquid or gaseous form potentially resulting in detrimental health impacts and/or death.

### 4.13.3.2 Safeguards and Controls

A Preliminary Hazard Analysis (PHA) has been completed for the Project in relation to the transport, storage and use of sodium cyanide (see **Appendix 3**). The PHA provides the nominated operational safeguards and controls to be implemented by the Proponent.

The primary control over the management of cyanide containing residue is the design and construction of the RSF and Process Water Dam. Both would be lined with a compacted clay liner with a permeability of <1 x $10^{-9}$m/s or less and operated with sufficient freeboard to prevent overtopping. The RSF and Process Water Dam would be fenced to prevent access by terrestrial fauna with the volume of pooling water minimised at the decant by immediate return to the process water pond. This, combined with the maintenance of the five sediment basins on the Mine Site which would provide an alternative and more attractive water source (as the water would be fresher), would reduce the potential for birds and arboreal fauna to access the RSF.

Secondary controls would include the following.

- The Proponent would implement a shallow groundwater monitoring program to confirm that there is no leaching of contaminated water from with the RSF or Process Water Dam.
- The Proponent would undertake regular monitoring of the RSF and surrounds to confirm no fauna mortality or, if dead fauna encountered, allow for post-mortem to discover the cause of death (as described in Section 4.5.7.3.4).

#### 4.13.3.3 Assessment of Impact

As identified in the PHA (see **Appendix 3**), the risk associated with the transport, storage and use of sodium cyanide would be reduced to a tolerable level through the management actions and contingency plans to be implemented by the Proponent.

The potential impact of cyanide containing residue on local soil and water resources would be minimised by the proposed design controls to be implemented by the Proponent, i.e. preventing the leaching or overtopping of water from the RSF or Process Water Dam. As discussed in Section 4.5.8.5, the proposed primary and secondary controls to be implemented in regard to residue management would reduce the likelihood of any detrimental impacts on local flora and fauna.

### 4.13.4 Bushfire Hazard

#### 4.13.4.1 Introduction

Based on the risk assessment undertaken for the Project (see Section 3.5 and **Table 3.10**), specific **unmitigated** bushfire related impacts that may result as a consequence of the Project include the following.

- Initiation of fire on the Mine Site and spread to adjoining properties resulting in:
  - Injury or health impacts on project personnel (high risk);
  - Operational constraint posed by damaged equipment (moderate risk);
  - Destruction/damage of native vegetation and fauna habitat (moderate risk); and/or
  - Loss of livestock, crops and property on neighbouring land (moderate risk).

The Bushfire Assessment was prepared by R.W. Corkery & Co. Pty Ltd based, in part, on information provided in OzArk (2011a).

#### 4.13.4.2 Existing Bushfire Hazard

**Figure 4.38** provides the bushfire prone land status of the Mine Site and surrounds as taken from the Narromine Shire Council Bushfire Prone Land Map. The mapping indicates that the majority of the Mine Site is not bushfire prone, however, limited patches of bushfire prone land representing Bushfire Vegetation Category 1 (orange) and Bushfire Vegetation Category 2 (yellow) and appropriate buffer zone (100m for Category 1 and 30m for Category 2). On the basis of this mapping, the specifications and requirements of "*Planning for Bushfire Protection 2006*" (PBP) by the NSW Rural Fire Service (RFS, 2006) have been considered for the development (with specific attention provided to the consideration of an appropriate Asset Protection Zone (APZ) and construction requirements for the buildings and other structures on the Mine Site). Reference is also made to Clause 34 of the Narromine Local Environment Plan 1997 "*Land subject to bushfire hazards*".

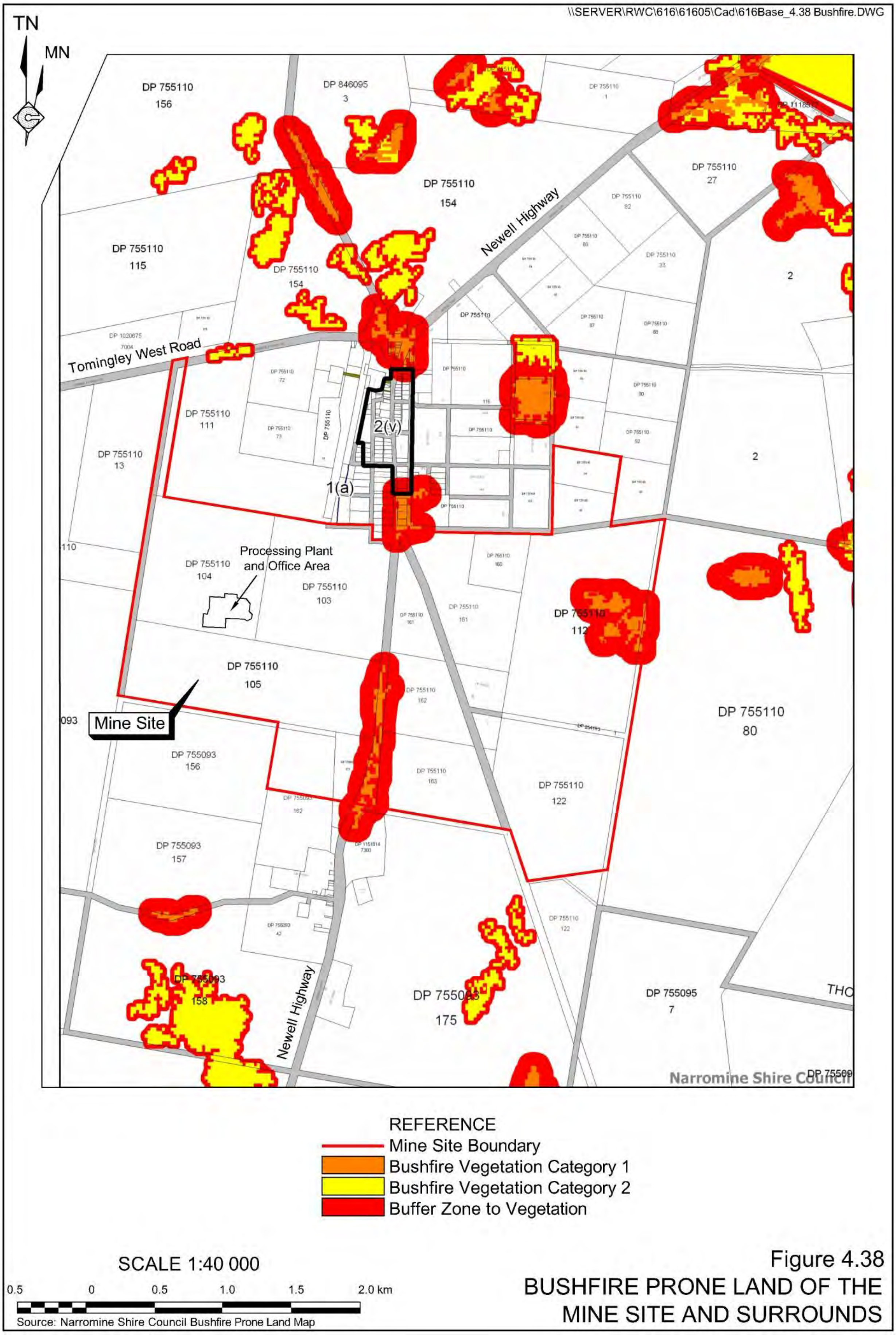



Figure 4.38
BUSHFIRE PRONE LAND OF THE MINE SITE AND SURROUNDS

### 4.13.4.3 Bushfire Management Objectives

#### 4.13.4.3.1 Planning for Bushfire Protection 2006

The objectives of RFS (2006), considered in this assessment of bushfire management of the Project, are to:

i) afford occupants of any building adequate protection from exposure to a bushfire;

ii) provide for a defendable space to be located around buildings;

iii) provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;

iv) ensure that safe operational access and egress for emergency service personnel and residents is available;

v) provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the asset protection zone (APZ); and

vi) ensure that utility services are adequate to meet the needs of fire fighters (and others assisting in bush fire fighting).

#### 4.13.4.3.2 Narromine Local Environment Plan

Clause 34 of the Narromine LEP 1997 requires that Council shall not grant consent to the subdivision of, or to the erection of a building on, land which is subject to bushfire hazards (by reason of the vegetation on the land or on any adjacent land) unless, in the opinion of the Council:

a) adequate provision is made for access for fire fighting vehicles, and

b) adequate safeguards are adopted in the form of fire breaks and reserves, and

c) adequate water supplies are available for fire fighting purposes.

It is noted that Council is not the consent authority in this instance, however, the Project is still considered against the requirements of Clause 34.

### 4.13.4.4 Safeguards and Controls

#### 4.13.4.4.1 Management of an Appropriate Asset Protection Zone

The method for determining an appropriate APZ for the Project Site buildings follows *Section A2.3* of RFS (2006).

- **Fire Danger Index**. *Table A2.3* of RFS (2006) nominates Narromine Shire LGA as occurring within the Lower Central West Plains (15) NSW Fire Area which has a Fire Danger Index (FDI) of 80.

- **Predominant Vegetation Class Formation**. As identified in Section 4.5.5, the Mine Site is predominantly cleared with remnant strips and patches of Inland Grey Box, Fuzzy Box / Grey box, and Belah / Black Oak woodland vegetation. This vegetation would be most accurately defined as Semi-arid Woodlands (Low Woodlands) (grassy sub formation) class in *Table A2.1* of RFS (2006) and would have a fuel load in the lower range for this formation, i.e. closer to 5t/ha than 18t/ha. The vegetation of the landholdings surrounding the Project Site is dominated by the same vegetation formation class as found on the Project Site.

- **Effective Slope Classification**. Within 100m of the Processing Plant and Office Area, the slopes are either upslope (assumed to be 0º) or less than 5º (Classes i and ii).

- **Minimum Specification for Asset Protection Zone**. Reference to *Table A2.5* of RFS (2006) nominates an APZ of 10m to both upslope (Class i) and downslope (Class ii) vegetation. Notably, all buildings would be well in excess of 10 from the cleared hardstand surface of the Processing Plant and Office Area.

#### 4.13.4.4.2 Site Bushfire Attack Assessment (Building Construction Requirements)

On the basis of the FDI, Vegetation Class and Effective Slope classifications provide in Section 4.13.4.4.1 (Steps 1 to 4 of the Site Bushfire Attack Site Assessment methodology provided by *Appendix 3* of RFS, 2006), *Table A3.4* of RFS (2006) was reviewed to identify whether any specific construction requirements would be necessary for the Mine Site infrastructure. An excerpt from *Table A3.4* of RFS (2006) is provided in **Box 4.1** illustrating the applicable bushfire attack category.

*Table A 3.4 DETERMINATION OF CATEGORY OF BUSH FIRE ATTACK FDI 80*

| Vegetation Formation (class) | Categories of Bush Fire Attack (AS 3959-1999) | | | | |
|---|---|---|---|---|---|
| | Flame Zone | Level 3 (Extreme) | Level 2 (High) | Level 1 (Medium) | No requirement |
| | Distance (m) of the site from the predominant vegetation class | | | | |
| | All upslopes and flat land (0 degrees) | | | | |
| Forests (wet and dry sclerophyll) | <17 | 17-<25 | 25-<35 | 35 - 100 | >100 |
| Woodlands | <9 | 9-<14 | 14-<20 | 20 - 100 | >100 |
| Tall heath | <13 | 13-<19 | 19-<27 | 27 - 100 | >100 |
| Short heath | <9 | 9-<13 | 13-<19 | 19 - 50 | >50 |
| Low woodland (semi-arid) | <7 | 7-<10 | 10-<15 | 15 - 50 | >50 |
| Arid shrublands | <8 | 8-<12 | 12-<18 | 18 - 50 | >50 |
| Forested wetlands | <13 | 13-<19 | 19-<28 | 28 - 50 | >100 |
| Freshwater wetlands | <9 | 9-<13 | 13-<19 | 19 - 50 | >50 |
| Rainforest | <7 | 7-<11 | 11-<16 | 16 - 50 | >50 |
| | Downslope > 0 to 5 degrees | | | | |
| Forests (wet and dry sclerophyll) | <22 | 22-<31 | 31-<42 | 42 - 100 | >100 |
| Woodlands | <12 | 12-<17 | 17-<25 | 25 - 100 | >100 |
| Tall heath | <15 | 15-<22 | 22-<31 | 31 - 100 | >100 |
| Short heath | <10 | 10-<15 | 15-<22 | 22 - 50 | >50 |
| Low woodland (semi-arid) | <8 | 8-<11 | 11-<17 | 17 - 50 | >50 |
| Arid shrublands | <9 | 9-<14 | 14-<21 | 21 - 50 | >50 |
| Forested wetlands | <17 | 17-<24 | 24-<34 | 34 - 100 | >100 |
| Freshwater wetlands | <10 | 10-<15 | 15-<22 | 22 - 50 | >50 |
| Rainforest | <9 | 9-<14 | 14-<20 | 20 - 50 | >50 |

Source: Modified after RFS (2006) - Table A3.4

**Box 4.1**

**BUSHFIRE ATTACK CATEGORY**

As illustrated by **Box 4.1**, on the basis that an APZ of in excess of 50m would be maintained, no specific construction requirements are necessary for Mine Site buildings or infrastructure.

#### 4.13.4.4.3 Local Bushfire Event

Specific bushfire management measures to manage a local bushfire event would be prepared should project approval be granted and would incorporate the following.

- An Asset Protection Zone (APZ) of at least 50m would be maintained around the buildings of the Processing Plant and Office Area. As defined by *Appendix 2* of RFS (2006) the APZ would provide for:
  - minimal separation for safe fire fighting (access to fire front);
  - reduced radiant heat;
  - reduced influence of convection driven winds;
  - reduced ember viability thereby limiting the impact of ember attack; and
  - dispersal of smoke which would otherwise severely impact on residents affected by reduced mobility or health issues.
- Fuel loads within the APZ would be monitored and reduced as required, i.e. no re-growth of shrub or tree vegetation would be allowed, grass growth would be monitored and cut back as necessary. Specialist advice would be sought, either from the NSW RFS or Council in relation to appropriate fuel load management within the APZ.
- The Main Site Access Road, and emergency access roads, would be regularly maintained to ensure safe access and egress from the Project Site in the event evacuation is called.
- Water infrastructure on the Mine Site, e.g. raw water pond and the water pipeline, are located within the Processing Plant and Office Area and would be accessible for management of ember attack on the buildings of the Processing Plant and Office Area.
- Training would be provided to site personnel in relation to specific fire fighting tasks and procedures.
- Emergency and Evacuation Management Procedures would be developed.
- In the event of a local bushfire event, all personnel would be required to assemble at the designated Emergency Assembly Area (likely to be within the car park of the Processing Plant and Office Area). A head count would be undertaken to confirm all site personnel and visitors are accounted. At this time, instructions as to specific procedures to be followed, i.e. site protection or evacuation, would be provided in accordance with the Emergency and Evacuation Management Procedures and advice provided by the NSW RFS.

The preparation and implementation of the above notwithstanding, the Applicant would ensure that all personnel recognise the authority of the NSW RFS and other emergency services, e.g. NSW Police, and adhere to any and all instructions provided by these authorities. Furthermore, access to all Project Site facilities and water storages would be provided to the RFS and any reasonable assistance offered.

#### 4.13.4.4.4 Management of Mine Site Operations

Activities on the Mine Site would have the potential to result in the outbreak of fire which could in turn result in the development of a bushfire. These activities, and the controls proposed to limit risk, are presented in **Table 4.61**.

**Table 4.61**
**Bushfire Hazard – Activities and Controls**

| Activity | Possible Ignition Source | Safeguards and/or Controls |
|---|---|---|
| Refuelling | • Spilt fuel ignited by spark | • Refuelling undertaken within designated fuel bays or within cleared area of the Project Site.<br>• Vehicles to be turned off during refuelling.<br>• No smoking policy to be enforced in designated areas of the Project Site.<br>• Fire extinguishers maintained within site vehicles and refuelling areas. |
| General Activities | • Cigarette<br>• Rubbish, e.g. glass, metal. | • No smoking policy to be enforced in designated areas of the Project Site.<br>• Focus on housekeeping to be maintained by mine management.<br>• Water cart available to assist in extinguishing any fire ignited.<br>• Site vehicles to carry a fire extinguisher. |

### 4.13.4.5 Assessment of Impact

#### 4.13.4.5.1 Local Bushfire Event

Management against the objectives of RFS (2006) and Clause 34 of Narromine LEP 1997 is as follows.

***Planning for Bushfire Protection 2006***

Does the proposed bushfire management provide the following.

(i) Afford occupants of any building adequate protection from exposure to a bushfire?

*A more than adequate APZ would be provided around the buildings of the Processing Plant and Office Area. Emergency and Evacuation Management Procedures would be implemented in the event of notification of a local bushfire event requiring all site personnel and visitors to assemble at the nominated Emergency Assembly Area prior to receipt of further instructions. Furthermore, best management practices in relation to vehicle maintenance, refuelling, hydrocarbon management and site housekeeping would reduce the risk of fire initiation on the Mine Site.*

(ii) Provide for a defendable space to be located around buildings?

*An APZ greater than recommended by RFS (2006) would be maintained around the buildings of the Processing Plant and Office Area.*

(iii) Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition?

*See management in response to (ii) above.*

(iv) Ensure that safe operational access and egress for emergency service personnel and residents is available?

*The Main Site Access Road would be regularly maintained and of suitable standard to allow for safe access and egress to and from the Processing Plant and Office Area. Secondary egress via the emergency access roads would also be maintained.*

(v) Provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the asset protection zone (APZ)?

*RFS (2006) recommends an APZ of 10m from buildings on the Project Site. Notably, all buildings would be at least 50m from the edge of the hardstand surface of the Processing Plant and Office Area. The fuel load of the APZ would therefore be minimal.*

*In the event of a local bushfire event, management measures and procedures as nominated in Section 4.13.4.4 would be implemented.*

(vi) Ensure that utility services are adequate to meet the needs of fire fighters (and others assisting in bush fire fighting)?

*Mobile phones on vehicles, and UHF radio communications would be available to fire fighters. Water would also be immediately available from the water storages (supplied by underground pipeline) within the Processing Plant and Office Area.*

**Narromine Local Environment Plan**

Does the proposal provide the following.

a.) Adequate provision is made for access for fire fighting vehicles?

*The Main Site Access Road would be regularly maintained and of suitable standard to allow for safe access and egress to and from the Processing Plant and Office Area. Secondary egress via the emergency access roads would also be maintained.*

b.) Adequate safeguards are adopted in the form of fire breaks and reserves?

*An APZ greater than recommended by RFS (2006) would be maintained around the buildings of the Processing Plant and Office Area. Furthermore, the mining activities to the south and east of the Processing Plant and Office Area would provide an additional fire break to bushfire approaching from these directions.*

c.) Adequate water supplies are available for fire fighting purposes?

*Water would be immediately available from the water storages (supplied by underground pipeline) within the Processing Plant and Office Area. Furthermore, a water cart would be available for fire fighting purposes as required.*

#### 4.13.4.5.2 Management Mine Site Operations

Mining, processing and ancillary activities undertaken on the Mine Site would increase the number and type of ignition sources in the local area. However, the proposed controls and safeguards (see **Table 4.61**), in conjunction with general clearing activities associated with the Project would ensure that the potential for fire initiation and spread on the Mine Site is minimised.

## 4.13.5 Traffic Incident

### 4.13.5.1 Potential Incident(s)

Mine traffic (road registered semi-trailers and light vehicles) would occasionally enter and exit the Mine Site from the Newell Highway, the main transport route between Melbourne and Brisbane, and could potentially result in an accident involving an over size or other Project related vehicle and a vehicle driven by a member of the public.

The construction of the Newell Highway underpass would also require temporary diversion of traffic from the existing Newell Highway and could potentially lead to an accident as a result of general public unfamiliarity with the modified conditions.

### 4.13.5.2 Safeguards and Hazard Reduction Strategies

While the risk associated with an incident between a Project-related vehicle (over size truck, road registered heavy vehicle or light vehicle) and a vehicle driven by a member of the public is considered low based on the limited volume of Project-related traffic to use the emergency access roads onto the Newell Highway, the following hazard reduction measures or strategies would be implemented.

- Give way signs would be erected at the exit of the emergency access roads to the Newell Highway.
- The emergency access roads would utilise existing access points onto the Newell Highway which have large sight distances in either direction.
- All truck drivers would be advised of the potential conflict between Project-related traffic and the general public.
- Appropriate traffic management controls would be implemented during the construction of the Newell Highway underpass. The Proponent would implement a comprehensive *Transport Management Plan* for construction and mine operation.
- The Newell Highway diversion would be constructed and maintained to a suitable standard (as discussed in Section 2.2.4.3).

### 4.13.5.3 Assessment of Impacts

Given the low risk associated with this particular hazard and the proposed hazard reduction measures and strategies, it is unlikely that a traffic incident involving a mine vehicle and vehicle of the public would occur.

### 4.13.6 Storage and Use of Potentially Hazardous Materials

**Appendix 3** provides a risk screening for the use and storage of potentially hazardous materials on the Mine Site and a PHA for the transport, storage and use of sodium cyanide and LPG on the Mine Site.

The risk screening and PHA determined that none of the dangerous goods to be used on the Mine Site are deemed hazardous.

### 4.13.7 Land Contamination

#### 4.13.7.1 Potential Incident(s)

Based on the risk assessment undertaken for the Project (see Section 3.5 and **Table 3.10**), specific **unmitigated** land contamination related incidents that may result as a consequence of the Project include the following.

- Extraction exposing previously contaminated materials resulting in:
  - Transfer of contaminated material (moderate risk); and/or
  - Surface water contamination (moderate risk).

The only potential source of land contamination on the Mine Site would be diesel fuel and other hydrocarbon products used by previous agricultural producers. It is noted that the operation of the Project may also have the potential to contaminate land through inappropriate management of saline water, hydrocarbons, sodium cyanide, other reagents and residues.

#### 4.13.7.2 Safeguards and Hazard Reduction Strategies

The following hazard reduction practices would be adopted to ensure water flowing from areas on the Project Site with the potential to generate hydrocarbon-contaminated water, e.g. washdown areas, workshops, hydrocarbon storage and refuelling areas, is not contaminated by hydrocarbons.

- Water taken from the open cuts would be stored within the nominated dewatering ponds which would be lined with compacted clay and have a permeability of 1 x $10^{-9}$m/s or less.
- The RSF and Process Water Dam would similarly be lined with compacted clay and have a permeability of 1 x $10^{-9}$m/s or less. Appropriate freeboard would be maintained in these structures to prevent overtopping (see also Section 4.3.3.2.5).
- Monitoring of groundwater using shallow piezometers (or lysimeters) would be undertaken to confirm no leaching of contaminated water from these structures.
- All water from wash-down areas and workshops would be directed to oil/water separators and containment systems.
- All hydrocarbon and reagent storage tanks would either be self-bunded or bunded with an impermeable surface and a capacity to contain a minimum 110% of the largest storage tank capacity.

- All hydrocarbon products and reagents would be securely stored.
- With the exception of less mobile mining equipment, e.g. excavators which would be refuelled within the open cuts, designated areas would be allocated for refuelling and minor maintenance work. The use of these areas would be enforced by mine management.

In the event of a major hydrocarbon spill, a 3-phase remedial action plan would be adopted as follows.

- **Phase 1** – Recover as much as possible at the source by pumping free hydrocarbon from the surface and excavating hydrocarbon-contaminated materials. Contaminated materials would be stockpiled on site under cover and on an impermeable surface, e.g. a high-density polyethylene sheet. This material would later be bio-remediated on site and/or transported to an approved waste depot.
- **Phase 2 – Source Control:** Begin hydraulic control of the source to prevent spreading of contamination. Subject to the relative position of the open cut excavation and the source of contamination, this could involve digging one or more holes close to the centre of the spill area, and pumping from those holes to create a cone of depression with a hydraulic gradient towards the holes. Such actions would prevent movement of contamination away from the area of the spill.
- **Phase 3 – Recovery:** If necessary, install boreholes to remove and treat contaminated groundwater.

#### 4.13.7.3 Assessment of Impacts

The proposed hazard reduction measures and strategies would ensure that the risk of land contamination is very low. The potential impact associated with land contamination is therefore low.

## 4.14 SOCIO ECONOMIC SETTING

### 4.14.1 Introduction

The DGRs identify "***Socio-economic***" as a key issue for assessment in the *Environmental Assessment*. Based on the risk assessment undertaken for the Project (see Section 3.5), the specific socio-economic-related impacts that may result as a consequence of the Project (<u>without the implementation of the safeguards, controls and mitigation measures presented in this section</u>) and therefore require assessment include the following.

- Alteration of social activities or employment due to employment generation and capital expenditure resulting in:
  - Increased economic activity and related social impacts attributable to reduced unemployment (positive impact);
  - Loss of local farm workers and tradespeople to work on the mine (moderate risk); and
  - Increased resilience in local community through diversification and capacity building (positive impact).

- Perceived or real impacts on local amenity of neighbouring properties resulting in:
  - Reduced quality of life (actual or perceived) (high risk); and/or
  - Immigration of some workers and families wanting to live closer to the Project (moderate risk rating).

The socio-economic assessment has been conducted by R.W. Corkery & Co. Pty Limited in consultation with the Proponent.

A detailed description of the Project-related employment and economic contributions are presented in Sections 2.12 and a description of the community surrounding the Project is provided in Section 4.1.6. This sub-section provides a description of the measures that the Proponent would implement to maximise the positive socio-economic benefits and minimise adverse socio-economic impacts, if any, associated with the Project and provides an assessment of the anticipated socio-economic impacts associated with the Project.

## 4.14.2 Management and Mitigation Measures

In addition to the mitigation measures and management procedures described previously throughout Section 4, the Proponent would implement the following management and mitigation measures to ensure that Project-related benefits for the community surrounding the Project are maximised and adverse impacts are minimised. Where possible these measures have been categorised to reflect the particular aspect that would be addressed by each.

**Social and Community**

- Engage the community surrounding the Project in regular dialogue in relation to the proposed and ongoing operation of the Project and maintain an "open door" policy for any member of the community who wishes to discuss any aspect of the Project. The Proponent already has a demonstrated record of community engagement, both at the former Peak Hill Gold Mine (which operated between April 1996 and October 2002, with processing operations continuing until June 2005) and through the regular meeting and consultation conducted for the current Project (see Section 3.2.1).
- Proactively and regularly consult with those residents most likely to be adversely impacted by the Project.
- Continue to support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance throughout the life of the Project.
- Implement a comprehensive and targeted environmental monitoring program, provide the local community with access to the results of monitoring and use these results, in consultation with the local community, to improve environmental performance at the Mine Site. It is again noted that the Proponent has a proven record of managing mining operations in close proximity to local communities (at the Peak Hill Gold Mine) without unacceptable impacts on this community.

Management of environmental issues at the Peak Hill Gold Mine was focussed around issues related to blasting and dust emissions. Over the life of the Peak Hill Gold Mine, 127 complaints were received with approximately 90% of these related to these two issues. Notably, through consultation with the community and modifications to operations to improve performance, the number of complaints received reduced significantly over the life of the mine. Between 1996 and 1998, 88 complaints were received, however, demonstrating improved performance and this reduced to 39 between 1999 and 2002.

The Proponent intends on using the lessons learnt, both in terms of environmental management of issues such as blasting and dust as well as community engagement, to minimise adverse impacts (both actual and perceived) on the local community.

- Form and maintain a Community Consultative Committee (CCC), including representative members of the community and Narromine Council. The CCC would be an important forum for reviewing and discussing environmental monitoring and performance, and discussing possible improvements that could be made to operations to improve environmental (and social) performance).
- Regularly brief the CCC on activities within the Mine Site and seek feedback in relation to Project-related impacts whether real or perceived. In addition, seek advice in relation the most appropriate manner in which to provide assistance to the community in an effective, fair and equitable manner.
- Advertise and maintain a community complaints telephone line.

**Employment and Training**

- Give preference when engaging new employees, where practicable, to candidates who live within the Narromine, Dubbo or Parkes Local Government Areas over candidates with equivalent experience and qualifications based elsewhere and ensure that the mining and other contractors do so as well.
- Encourage the involvement of the local Aboriginal community in the workforce. Notably, the Proponent has, and continues to work with the „Peak Hill Wiradjuri Reference Group", a forum through which Alkane can present proposed impacts on, and management of cultural heritage and the Aboriginal groups and individuals can respond. In addition, the Proponent has formalised a Community Engagement Protocol which has been signed by six registered Aboriginal organisations. As noted in Section 4.6.5.2, this document essentially captures the mining company"s objectives, Aboriginal people"s aspirations and principles for negotiations.
- Encourage and support participation of locally based employees and contractors in appropriate training or education programs that would provide skills and qualifications that may be of use following completion of the Project.

#### Economic Contribution and Development

- Give preference, where practicable, to suppliers of equipment, services or consumables located within the Narromine, Dubbo or Parkes Local Government Areas.
- Assist community members and others, as appropriate, to establish complimentary businesses in the vicinity of the Project where those businesses would provide a benefit to the community through increased economic activity or development. This may include working with other parties to identify and develop appropriate final land uses for the Mine Site following completion of the Project.
- Assist surrounding Councils, namely the Narromine, Dubbo and Parkes Councils, to promote and encourage economic development that would continue beyond the life of the Project in the area surrounding the Mine Site.

#### Infrastructure and Services

- Make available excess water from the water supply bores and pipeline to Narromine Shire Council for supply to the residents of Tomingley.
- Ensure that infrastructure and services installed for the Project, including the water supply bores and pipeline, electricity transmission line, appropriate buildings and hardstand areas, remain available for alternative uses following completion of the Project (provided that such uses are consistent with the final land uses identified in this document or any subsequent approval).
- Encourage and support, in consultation with the local community, the provision of services to the community. These may include health, education, transportation and other services.

#### Agricultural Lands

- Manage Mine Site drainage as described and discussed in Section 4.3.3 so as to minimise any changes to downstream water quantity and quality, and upstream flooding regime.
- Continue to appropriately manage weeds, pests and bushfire risks on land held by the Proponent in consultation with surrounding land owners.
- Ensure that land held by the Proponent that is not required for Project-related purposes, including those areas to be included within the proposed biodiversity offset strategy (see Section 2.14.8), are appropriately managed.
- Ensure that the land capability of those sections of the final landform to be used for agricultural purposes is similar to the current land capability. Any agricultural land that forms part of the final landform would be more heavily treed than it is at present due to proposed biodiversity and screen plantings.

## 4.14.3 Assessment of Impacts

### 4.14.3.1 Land Use

Clause 12 of the Mining SEPP (see Section 3.3.2.2) requires that consideration be given to:

- the existing uses and approved uses of land in the vicinity of the development;
- the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and
- any ways in which the development may be incompatible with any of those existing, approved or preferred land uses.

**Existing and Approved Local Land Use**

Section 4.1.5.2 provides a summary of the existing and approved land uses (both current and historic) in the vicinity of the Mine Site. Agriculture dominates the local setting, however, it is noted that mining has played a significant role in the development (and continued economic activity) of the local area, e.g. historic Tomingley gold field and McPhail Mine and more recently the Peak Hill Gold Mine.

**Potential Impact on and Compatibility with Local land Use**

Section 2.14.5 provides a review of possible final uses of the Mine Site at the completion of mining, however, the preferred land use of the local setting is likely to continue to be dominated by agriculture.

Impacts of the Project on this preferred local land use are likely to be limited to the removal of up to 775ha of land from agriculture for the life of the Project (although it is likely that sections of the Mine Site not required for mining or ancillary activities would continue to be used by local land holders for grazing). Parts of the final landform are to be returned to agricultural production at the completion of the Project, however, it is acknowledged that areas such as the final open cut voids, waste rock emplacement and RSF batters and areas to be included within the proposed biodiversity offset strategy would either not be available for agriculture or provide a lower land capability in the final landform.

The Project is unlikely, however, to impact adversely on the continued use of lands surrounding the Mine Site for agriculture. As discussed in Sections 4.3.5, the Project would have minimal impact on local surface water resources. Furthermore, with the implementation of the proposed operational safeguards, in particular those related to reagent and processing residue management, the Project is unlikely to impact adversely on local soil resources. It has also been assessed that the impacts of the Project on local noise and air quality are not likely to impact on local livestock or crops. In fact, the retention of water management infrastructure such as the pipeline and dams on the Mine Site may in fact assist local agricultural operations by providing for additional water availability locally.

On the basis that impacts associated with the Project would be largely limited to the Mine Site (and immediate surrounds), and that these impacts are unlikely to impact adversely on ongoing agricultural operations, it is assessed that the Project would be compatible with the approved or preferred land uses of the local setting. In addition, the potential for the Mine Site to be used for a land use other than agriculture at the completion of the Project, e.g. nature conservation, tourism or other light industry which could utilise the available power and water infrastructure, could in fact compliment ongoing agriculture in the local area by diversifying employment generating activities and therefore boosting economic and social development.

#### 4.14.3.2 Socio-Economic Setting

The Project would result in a range of socio-economic benefits to the community surrounding the Project. These benefits would include the following.

- Direct employment (full-time equivalent) for approximately 100 people during construction and between 85 and 90 people during operation of the Project.
- Injection of approximately $28.6 million per year into the local and regional economy, with an additional approximately $20.4 million into the State and Federal economies. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities.
- Ongoing support for training and education of employees and others in the vicinity of the Mine Site, including the Aboriginal community.
- Support to establish complimentary businesses in the vicinity of the Project, with the resulting benefits of increased economic activity and opportunities.
- Provision of infrastructure, including the water supply bores and pipeline, the electricity transmission line, buildings and hardstand areas, that may be suitable for industrial or other use following completion of mining operations, provided for long term economic development of the Tomingley area.
- Support for the provision of services, including health, education, transportation and other services, to the community.
- Continued support for local sporting and other organisations.

It is acknowledged that the Project would also have some limited adverse impacts, principally associated with noise emissions from the Mine Site. However, the Proponent notes that it would monitor noise emissions from the Mine Site and modify operations to ensure that compliance with the nominated noise criteria is achieved. Further, consultation with potentially affected land owners would continue to be undertaken over the life of the Project and, if appropriate, agreements would be negotiated with surrounding land owners to allow increases in allowable noise levels.

#### 4.14.3.3 Conclusion

The Proponent contends that any adverse socio-economic or environmental impacts, both actual and perceived, would be more than adequately countered by the positive effect that the Project would have on the community and economy in the vicinity of the Mine Site and the wider area. Furthermore, the Project and proposed final land use post-mining would be compatible with the existing, approved and preferred land uses of the local setting.

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# Section 5

# Draft Statement of Commitments

## PREAMBLE

*The draft Statement of Commitments presented in this section has been prepared in accordance with the requirements of Part 3A of the Environmental Planning and Assessment Act 1979, and presents a compilation of the actions and the initiatives the Proponent commits to implement if the proposed Tomingley Gold Project is approved. These commitments are designed to effectively manage, mitigate, guide and monitor the Project through its various phases.*

*The Environmental Assessment has identified a range of environmental, social and management outcomes and measures, all required to avoid or reduce the environmental and social impacts of the project. The draft Statement of Commitments reflects these desired outcomes, action and timing of commitments that would be undertaken to achieve the outcomes.*

*All parties involved in the design, establishment and operational phases of the project will be required to undertake their components of work in accordance with these commitments.*

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**Table 5.1**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **1. ENVIRONMENTAL MANAGEMENT** | | | |
| Compliance with all conditional requirements in all approvals, licences and leases. | 1.1 | Comply with all commitments recorded in **Table 5.1** (this table). | Continuous and as required |
| | 1.2 | Comply with all conditional requirements included in the:<br>• Project Approval;<br>• Environment Protection Licence;<br>• Mining Lease(s); and<br>• any other approvals. | Ongoing |
| **2. AREA OF ACTIVITIES** | | | |
| All approved activities are undertaken generally in the location(s) nominated on the figures shown in Sections 2 and 4. | 2.1 | Mark, and where appropriate, survey the boundaries of the areas of proposed disturbance on the Mine Site. | Prior to the commencement of the relevant activity |
| | 2.2 | Mark, and where appropriate, survey the alignment of the Tomingley Narromine Water Pipeline. | Prior to the commencement of the relevant activity |
| | 2.3 | Mark, and where appropriate fence, boundaries relevant to the biodiversity offset strategy. | Within 6 months of approval of the biodiversity offset strategy |
| | 2.4 | Construct perimeter security fence as early as possible during construction operations to limit the potential for inadvertent or unauthorised access to the operational sections of the Mine Site. | Within 3 months of commencement. |
| **3. OPERATING HOURS** | | | |
| All operations are undertaken within the approved operating hours. | 3.1 | Undertake all activities, where practicable, in accordance with the following operating hours. | Continuous and as required |

| Activity | Proposed Hours of Operation |
|---|---|
| Vegetation clearing and topsoil stripping | 7 days per week<br>(6:00am to 6:00pm) |
| Construction operations<br>Open cut mining operations<br>Underground mining operations | 7 days per week<br>(24 hours) |
| Blasting operations | Monday to Saturday<br>(9:00am to 5:00pm[1]) |
| Maintenance operations<br>Processing operations | 7 days per week<br>(24 hours) |
| Rehabilitation operations | 7 days per week<br>(7:00am to 10.00pm) |

Note 1: Unless required for misfire re-blast, emergency or safety reasons.

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **4. NOISE** | | | |
| Noise generated by operational activities does not exceed intrusiveness criteria nor significantly impacts on neighbouring landowners and/or residents. | 4.1 | Operate mining equipment in accordance with **Figures 4.11** to **4.15**, or equivalent arrangement that provides for the same whole of mine sound pressure level, i.e. provides for compliant noise emissions from the Mine Site. | Ongoing |
| | 4.2 | Provide for the enclosure, cladding or other mitigation of the crushing, screening and processing plant to reduce sound power levels and ensure compliant noise emissions from the Mine Site. | Prior to commencement of crushing operations |
| | 4.3 | Install frequency modulated reversing alarms on mobile equipment. | Ongoing |
| | 4.4 | Undertake land preparation operations, including vegetation clearing and soil stripping, during the daytime only. | Ongoing |
| | 4.5 | Construct, Waste Rock Emplacements 2 and 3 from the northern margin of the emplacement towards the south to create a 15m high acoustic and visual amenity bund. | Ongoing |
| | 4.6 | Ensure that noisy equipment is operated in exposed locations (such as on top of the acoustic bunds) or in close proximity to residences (during the daytime only and preferentially when the wind is blowing from the northwest, north or northeast). | Ongoing |
| | 4.7 | Preferentially operate noisy equipment during the evening and night, including bulldozers, excavators and haul trucks, in the southern section of the Mine Site, as close as possible to the acoustic bunds on Waste Rock Emplacements 2 and 3 and in the deepest sections of the open cuts where there would be an the most effective topographic barrier between the sources of mining-related noise and nearby residences. | Ongoing |
| | 4.8 | Progressively stand down the mining fleet during the onset of a temperature inversion, or as required in response to real-time noise monitoring (see Commitments 4.8 to 4.11). | Ongoing |
| Noise generated by the Project is monitored and procedures developed and implemented to respond to ensure compliance is maintained. | 4.9 | Install a real-time noise monitor and appropriate communication equipment at an appropriate location within the southern section of the Tomingley village. | Prior to the commencement of activities on the Mine Site |
| | 4.10 | Establish, in consultation with a suitably qualified and experienced noise consultant and the community, appropriate noise trigger levels at the real-time noise monitoring location that would ensure that the relevant noise criteria are not exceeded at residences surrounding the Mine Site. | |
| | 4.11 | Establish a procedure whereby appropriate personnel are notified when noise levels recorded by the real-time monitor reach the identified trigger levels. | |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **4. NOISE (CONT'D)** | | | |
| Noise generated by the Project is monitored and procedures developed and implemented to respond to ensure compliance is maintained. (cont'd) | 4.12 | Establish a procedure whereby the noisiest equipment is progressively relocated or shut down to prevent further increase in the noise level received at the monitoring station (see also Commitments 4.5 to 4.7). | Prior to the commencement of activities on the Mine Site |
| Noise management plan prepared and implemented. | 4.13 | Prepare a *Noise Management Plan* that is consistent with the procedures to be developed in accordance with Commitments 4.1 to 4.12 and any negotiated agreements with residents. | Within 3 months of receiving project approval |
| | 4.14 | Ensure that a 24-hour complaints telephone line is maintained and that the surrounding community is made aware of the number. If noise-related complaints are received. | Prior to the commencement of activities on the Mine Site |
| | 4.15 | Ensure that prompt action is taken to identify the nature of any complaint received and verify the relevant noise levels using the real-time noise monitoring equipment. | Within 24 hours of receipt of complaint |
| **5. SURFACE WATER** | | | |
| Complete additional studies of potential flood-related impacts to the north of the eastern section of the Mine Site. | 5.1 | Undertake a detailed survey prior to construction of amenity bunding north of the Caloma Open Cut and adjust surface water management structure design to ensure no significant changes to current flooding patterns | Prior to the construction of the amenity bund north of Caloma Open Cut |
| Appropriately document Erosion and Sediment Control management measures. | 5.2 | Prepare a detailed *Erosion and Sediment Control Plan*, including a description of surface water management structures and procedures to ensure that the criteria identified in the Environment Protection Licence or project approval, assuming that they are granted, are achieved. | Prior to commencement of mining operations. |
| Construct and maintain access to the Mine Site | 5.3 | Construct a culvert and causeway crossing over Gundong Creek to accept flows generated by rainfall events up to a 1 in 10-year ARI event before overtopping. | During site establishment phase (prior to mining) |
| | 5.4 | Maintain an alternative emergency access during flood events via the emergency site access road to the Newell Highway | Ongoing |
| Separate clean water from dirty water (General) | 5.5 | Construct temporary diversion banks on the upslope boundary of all areas to be stripped of groundcover and soil. | Prior to clearing and stripping operations |
| | 5.6 | Construct catch banks and/or install a sediment fence on the downslope boundary of an area to be stripped of groundcover and soil. | Prior to clearing and stripping operations |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**

Page 4 of 22

| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **5. SURFACE WATER (CONT'D)** | | | |
| Separate clean water from dirty water (General) (cont'd) | 5.7 | Direct sediment-laden runoff into sediment basins for treatment prior to discharge (if required). | Ongoing |
| | 5.8 | Construct all water management infrastructure in accordance with Volume 2E of the guideline document "*Soils and Construction: Managing Urban Stormwater*" (DECC, 2008b). | Construction of water management infrastructure |
| Design and construct surface water management structures to prevent the discharge of polluted (elevated suspended solids) water from the Mine Site and minimise impacts on environmental flows | 5.9 | Construct the Western, Central and Eastern Surface Water Diversion Structures with the design specifications provided in Section 4.3.3.2.3 (unless modified by approved *Erosion and Sediment Control Plan*). | During site establishment phase (prior to commencement of mining) |
| | 5.10 | Construct Catch Banks 1 to 5 with the design specifications provided in Section 4.3.3.2.3 (unless modified by approved Erosion and Sediment Control Plan). | |
| | 5.11 | Construct Sediment Basins 1 to 5 with the design specifications provided in Section 4.3.3.2.4 (unless modified by approved *Erosion and Sediment Control Plan*). | |
| | 5.12 | Construct drop-down structure and energy dissipaters as described in Section 4.3.3.2.6 (unless modified by approved *Erosion and Sediment Control Plan*). | Ongoing |
| | 5.13 | Construct a table drain along the eastern side of the Newell Highway with the design specifications provided in Section 4.3.3.2.8 (unless modified by approved *Erosion and Sediment Control Plan*). | During site establishment phase (prior to commencement of mining) |
| | 5.14 | Install a Relocatable Waste Water Treatment Plant (RWWTP) to provide secondary treatment of sewage within the Mine Site. | |
| | 5.15 | Ensure that all fuel and reagent storage, delivery and handling areas are appropriately sealed and bunded and that overflow pipes are installed in a manner that would minimise the potential for pollution in the event of overfilling. | Ongoing |
| Design and construct surface water management structures to prevent the discharge of contaminated (hydrocarbon, cyanide, trace metals etc.) water from the Mine Site | 5.16 | Construct the RSF in accordance with design specifications and have QA/QC assessment completed. | During site establishment phase (prior to commencement of mining) |
| | 5.17 | Line the RSF and Raw Water Dam with compacted clay to achieve a permeability of 1 x $10^{-9}$m/s or less. | |
| | 5.18 | Provide for design specific freeboard within the RSF and Raw Water Dam to prevent overtopping. | |
| | 5.19 | Securely store all hydrocarbon and chemical products. | Ongoing |
| | 5.20 | Ensure all hydrocarbon and chemical storage tanks are either self-bunded tanks or bunded with an impermeable surface and a capacity to contain a minimum 110% of the largest storage tank capacity. | Ongoing |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | Timing |
|---|---|---|
| **5. SURFACE WATER (CONT'D)** | | |
| Design and construct surface water management structures to prevent the discharge of contaminated (hydrocarbon, cyanide, trace metals etc.) water from the Mine Site (cont'd) | 5.21 Refuel all equipment within designated areas of the Mine Site, where practicable. | Ongoing |
| | 5.22 Undertake all maintenance works involving hydrocarbons, where practicable, within designated areas of the Mine Site such as the maintenance workshop. | Ongoing |
| | 5.23 Direct all water from wash-down areas and workshops to oil/water separators and containment systems. | Ongoing |
| Design and construct surface water management structures to prevent the discharge of saline water from the Mine Site | 5.24 Line the Dewatering Dams with compacted clay to achieve a permeability of $1 \times 10^{-9}$m/s or less. | During site establishment phase (prior to commencement of mining) |
| Only capture surface water on the Mine Site up to the 'Maximum Harvestable Right' of Proponent owned or controlled properties | 5.25 Fill in or isolate from natural flows dams which would result in the capture (when combined with the Mine Site sediment basins) of greater than 51.0ML. | During site establishment phase (prior to commencement of mining) |
| Implementation of a comprehensive and ongoing surface water monitoring program. | 5.26 Monitor surface water quality for pH, electrical conductivity, total suspended solid concentration, Oil & Grease levels, within: | |
| | • licensed discharge points; | Quarterly and during surface overflow events from licensed discharge points |
| | • receiving waters (Gundong Creek); and | Quarterly and within 12 hours after an overflow event to the receiving waters |
| | • Clean, Dirty and Dewatering Dams. | Quarterly from Clean, Dirty and Dewatering Dams |
| **6. GROUNDWATER** | | |
| Effective management of water dewatered from the open cuts | 6.1 Remove water accumulating in the open cuts, transfer to Dewatering Dams and use preferentially for dust suppression activities. | Ongoing |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **6. GROUNDWATER (CONT'D)** | | | |
| Minimisation of groundwater contamination | 6.2 | Design and construct the RSF as described in Section 2.7.2 and in accordance with the requirements of the relevant government agencies. Key design parameters would be as follows.<br>• Area - two cells with a combined area of 42ha.<br>• Crest elevation – 280.5m AHD.<br>• Crest width – 6m.<br>• Slope of outer face – 1:3 (V:H).<br>• Slope of inner face – 1:1.5(V:H).<br>• Key trench – up to 2m deep, base 3m wide, side slopes = 2:1 (V:H).<br>• Maximum elevation of residue – 280.0m AHD. | During site establishment phase |
| | 6.3 | Construct the floor and walls of the residue storage facility of clay material that would be compacted to achieve a permeability of less than $1x10^{-9}$m/day. | During site establishment phase |
| | 6.4 | Construct a drainage channel at the base of the inside wall of the RSF and directly beneath the residue inflow spigots to capture the drainage that occurs at the time of residue placement. | During site establishment phase |
| | 6.5 | Construct central decant towers fitted with submersible pumps in the centre of each residue cell. | During site establishment phase |
| | 6.6 | Place residue uniformly around the perimeter of the RSF via several slurry spigots. | Ongoing |
| | 6.7 | Ensure immediate return of water from the RSF decant to the Raw Water Dam. | Ongoing |
| | 6.8 | Install piezometers around the perimeter of the RSF and monitor these regularly to assess the integrity of the facility (see Section 4.4.8). | During site establishment phase |
| Ensure the availability of groundwater to surrounding users is maintained. | 6.9 | In the event that routine monitoring indicates that mining activities could be resulting in reduced groundwater availability to surrounding landholders, commission a hydrogeologist to review the data, and provide independent advice as to the cause of the trigger. | In the event that routine monitoring indicates that a groundwater availability is reduced |
| | 6.10 | If a reduction in groundwater availability is determined to be as a consequence of operations associated with the Project, negotiate with the affected landowner(s) with the intent of formulating an agreement. | In the event that monitoring identifies a reduction in groundwater availability is consequence of the Project |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **7. BIODIVERSITY** | | | |
| Avoid impacts on native flora and fauna. | 7.1 | Align the Main Site Access Road using an existing farm track to avoid as many mature trees as practicable within a corridor containing remnant stands of Inland Grey Box – Poplar Box – White Cypress Pine. | During site establishment phase (prior to commencement of mining) |
| | 7.2 | Locate the Mine Site activities and infrastructure so as to avoid the majority of remnant native vegetation. Restrict disturbance of remnant native vegetation to (approximately):<br>• 2.7ha (of 36.9ha) of Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams;<br>• 0.9ha (of 30.9ha) of Fuzzy Box – inland Grey Box on alluvial brown loam soils; and<br>• 18.0ha (of 70.3ha) of Belah / Black Oak Western Rosewood Wilga woodland. | Ongoing |
| | 7.3 | Locate the Mine Site activities and infrastructure so as to avoid disturbance to all but approximately 476 paddock trees. | During site establishment phase (prior to commencement of mining) |
| Minimise impacts on native flora and fauna. | 7.4 | Modify the alignment of the water pipeline as necessary to avoid disturbance to a stand of vegetation which is categorised as a remnant of the Inland Grey Box Woodland EEC. | During site establishment phase (prior to commencement of mining) |
| | 7.5 | Clearly mark areas of ground disturbance prior to commencement of activities and disturbance restricted to these areas. | |
| | 7.6 | Establish clearing procedures or protocols to identify (and avoid) disturbance to nests or roosting sites of threatened fauna, e.g. grey-crowned babbler. If impact is unavoidable, engage a suitably qualified and experienced ecologist would be engaged to remove the animal(s) and/or nest/roosting habitat nests prior to clearing. | During site establishment phase (prior to commencement of mining) |
| | 7.7 | Schedule the clearing of trees with moderate or high habitat value between April to September to reduce risk of impact to tree dependant microbats and birds, in particular the Grey-crowned babbler. | Ongoing |
| | 7.8 | Protect the ten known habitat trees on the western side of the Newell Highway and four habitat trees on the eastern side of the Newell Highway by installing high visibility fencing around these trees to provide a 25m buffer exclusion area. | Ongoing |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **7. BIODIVERSITY (CONT'D)** | | | |
| | 7.9 | Undertake all clearing of trees in accordance with a *Vegetation Clearing Protocol* (VCP) which requires that the clearing supervisor:<br>• check all trees for the presence of nesting or roosting fauna before felling or pushing then start tree removal immediately after visual inspection; and the operator; then<br>• gradually nudge a hollow that requires removal, at intermittent intervals so that any animal occupying a habitat tree has the chance of vacating the area after the initial disturbance period. | Ongoing |
| | 7.10 | (If Grey-crowned babblers identified) delay clearing until nests are vacated. If roosting babblers persist, a suitably qualified and experienced ecologist would be engaged to remove the animal(s) and/or nest/roosting habitat prior to clearing | Ongoing |
| Mitigate unavoidable impacts on native flora and fauna. | 7.11 | Clear sufficient vegetation for the subsequent 12 months of mining operation only. | Ongoing |
| | 7.12 | Directly transfer stripped soil materials onto rehabilitation areas where practicable. | Ongoing |
| Mitigate unavoidable impacts on native flora and fauna. | 7.13 | Undertake a program of weed control prior to soil stripping activities and following re-vegetation to ensure native plants are not overgrown during their early periods of growth. | Ongoing |
| | 7.14 | Salvage tree trunks, major limbs and, if practicable, minor branches for use in rehabilitation of the Mine Site or amelioration areas | Ongoing |
| | 7.15 | Erect signs to notify of the location and significance of vegetation stockpiles. | Ongoing |
| | 7.16 | Implement an erosion and sediment control plan for all areas of disturbance likely to generate sediment or be subject to erosion. | Ongoing |
| | 7.17 | Revegetate the Mine Site as described in Section 2.14 and in accordance with a MOP or REMP to be prepared prior to the commencement of activities on the Mine Site. | Ongoing |
| Avoid, minimise or mitigate impacts on native flora and fauna associated with residue management. | 7.18 | Ensure that WAD cyanide concentration reporting to the RSF is less than 50mg/L. | Ongoing |
| | 7.19 | Manage the RSF without a central decant pond. | Ongoing |
| | 7.20 | Construct fencing using a combination of a large (tall >1.8m) chain mesh fence (to exclude large mammals) with a fine mesh skirt at its base (to exclude small mammals and reptiles). | Ongoing |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **7. BIODIVERSITY (CONT'D)** | | | |
| Avoid, minimise or mitigate impacts on native flora and fauna associated with residue management. (cont'd) | 7.21 | Cover any standing water at the decant tower with floating plastic balls (to deter birds and arboreal mammals from landing on the water surface). | Ongoing |
| | 7.22 | Maintain alternative water sources in the vicinity of the Mine Site, including establishment of aquatic and edge species to attract bird species to these areas and away from any standing water within the RSF. | Ongoing |
| | 7.23 | Monitor the concentration of WAD cyanide within the RSF, the presence or otherwise of standing water on the surface of the facility and wildlife mortality, if any. | Ongoing |
| | 7.24 | Monitor fauna usage and/or mortality on or in the vicinity of the residue storage facility (in accordance with the recommendations of OzArk (2011a), and Section 4.5.7.3.4). | Ongoing |
| | 7.25 | Report to DECCW, investigate and implement additional measures in the event of unacceptable wildlife mortality. | As required |
| Offset residual impacts on native flora and fauna. | 7.26 | Develop a biodiversity offset strategy, in consultation with DECCW, in accordance with the general strategy presented in Section 2.14.8 and **Figure 2.19**. The biodiversity offset strategy should provide for the following.<br>• Protection and conservation of existing remnants of Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams, Fuzzy Box – inland Grey Box on alluvial brown loam soils; and River Red Gum riverine woodland forest. An indicative illustration of remnants to be protected and conserved is provided by **Figure 2.19**.<br>• enhancement, through protection, ameliorative revegetation and conservation of land adjacent to remnant native vegetation. An indicative illustration of remnant vegetation to be protected, conserved and enhanced is provided by **Figure 2.19**. | Within 12 months of receipt of project approval |
| | 7.27 | Establish legally binding arrangement over lands included in the biodiversity offset strategy to for conservation of the land in perpetuity. | Within 18 months of receipt of project approval |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **7. BIODIVERSITY (CONT'D)** | | | |
| Offset residual impacts on native flora and fauna. (cont'd) | 7.28 | Prepare a *Biodiversity Offset Management Plan*. That plan would:<br>• specify biodiversity-related actions to be undertaken during the life of the Project and for several years after the site has been decommissioned;<br>• describe management of the proposed biodiversity area; and<br>• describe the proposed revegetation and amelioration program, including identification of areas to be revegetated/ameliorated and the species to be used. | Within 18 months of receipt of project approval |
| | 7.29 | Develop a pest animal strategy in conjunction with relevant government agencies and surrounding landholders to manage introduced fox, rabbit, hare and feral cat. | Within 12 months of commencement of mining operations |
| | 7.30 | Develop a weed control program to manage weed species within the Mine Site. | Within 12 months of commencement of mining operations |
| Rehabilitate disturbed areas to create a final landform that maintains or improves biodiversity values of the Project Site. | 7.31 | Create a final landform more diverse and complex then the pre-mining landform, i.e. approximating the conceptual final landform provided by **Figure 2.18**. | Ongoing |
| | 7.32 | Revegetate the final landform as nominated by **Figure 2.18** (or MOP or REMP). | Ongoing |
| **8. ABORIGINAL HERITAGE** | | | |
| Impact on Site TGP – ST7 is minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. | 8.1 | Engage a suitably qualified arborist to peel back the bark of Site TGP-ST7 in order confirm the presence and (if present) assess the condition of the scar beneath the removed bark such that a more accurate determination of the origin or tree carving, i.e. cultural or not. | Prior to commencement of the Project |
| | 8.2 | In the event that the scarring is deemed to not be of cultural origin, the following management would apply.<br>• A determination would be made with the registered Aboriginal representatives as to whether the tree is an example of a scarred tree.<br>• If considered a scarred tree, it would need to managed in accordance with Commitment 8.6.<br>• If not considered a scarred tree, then no further management will apply. | Prior to commencement of the Project |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **8. ABORIGINAL HERITAGE (CONT'D)** | | | |
| Impact on Site TGP – ST7 is minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. (cont'd) | | Should the scarring be considered to display features representative of that resultant from traditional Aboriginal carving of trees, the Proponent would manage the site in accordance with Commitment 8.6. | |
| | 8.3 | Seek the opinion of a suitably qualified Ground Penetrating Radar (GPR) technician or geomorphologist, with appropriate experience in remote sensing technology, to determine whether GPR would be likely to be effective in the identification of a potential burial in the vicinity of this site. As research indicates the carving on the tree will be facing towards the burial if it is present, it is considered that a 180º sweep of the GPR would provide adequate coverage. | Prior to any disturbance in associated with Wyoming One Open Cut |
| | 8.4 | Undertake the following if a potential burial site is identified.<br>• Undertake further community consultation.<br>• Undertake formal archaeological excavation for human remains.<br>• If located, the remains would be managed in accordance with the wishes of the Aboriginal community | Prior to disturbance of Site TGP-ST7 and any disturbance in associated with Wyoming One Open Cut |
| | 8.5 | Undertake the following is a potential burial site is not identified using GPR.<br>• Use a grader to strip off thin layers of soil within a 50m radius of TGP-ST7 to a depth where burial is determined to be unlikely.<br>• Undertake the stripping operations in the presence of Aboriginal community representatives and/or an archaeologist.<br>• Inspect each pass of the grader for any evidence of human remains or other archaeological material. | Prior to disturbance of Site TGP-ST7 and any disturbance in associated with Wyoming One Open Cut |
| | 8.6 | On resolution of the issue of human remains, the following would be undertaken to ensure the appropriate removal of the carved tree.<br>• Hold a meeting involving the Proponent, the tree-removing contractor, Aboriginal community representatives and an archaeologist to confirm the tree-removal methods.<br>• Assess the large hollow high up in the tree to ensure that no burial present.<br>• Remove the tree using a chainsaw below the base of the carving and transport to an appropriate keeping place.<br>• Remove to an appropriate keeping place the scarred section of the tree in accordance with the procedures identified previously. | Prior to disturbance of Site TGP-ST7 |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **8. ABORIGINAL HERITAGE (CONT'D)** | | | |
| Impact on Site TGP – ST7 is minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. (cont'd) | | Should human remains be confirmed, all work should cease and the local police contacted. If the skeletal remains are deemed to be historical, OEH and the Narromine LALC should be contacted to determine how to best proceed. | |
| Impact on Site TGP – ST10 is minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. | 8.7 | Remove the scarred section of the tree and transfer to an appropriate keeping place in accordance with the wishes of the registered Aboriginal stakeholders. The exact location and procedure for scar removal and transfer will be included in a Cultural Heritage Management Plan, however, will likely involve the following.<br>• Hold a meeting involving the Proponent, the tree-removing contractor, Aboriginal community representatives and an archaeologist to confirm the tree-removal methods.<br>• Remove the tree using a chainsaw below the base of the carving and transport the removed section to an appropriate keeping place.<br>• Transfer the scarred section to the nominated keeping place. | Prior to disturbance of Site TGP-ST10 |
| Impact on Site TNWP – OS1 with PAD is minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. | 8.8 | Invite representatives of the Aboriginal community to be in attendance to monitor the excavation and to retrieve any Aboriginal artefacts. | During construction |
| | 8.9 | Confine cars and machinery, to the extent practicable, to an existing dirt road when in the vicinity of TNWP-OS1 with PAD. | During construction |
| | 8.10 | Cease construction, notify OEH and obtain advice as to how to proceed should in excess of 100 artefacts be identified. | As necessary |
| | 8.11 | Cease all work and notify local police should human skeletal material be noticed. If the skeletal remains are deemed to be historical, OEH and the Narromine LALC would be contacted to determine how to proceed. | As required |
| Impact on Site TGP – OS2 is minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. | 8.12 | Place geofabric directly on the ground within the disturbance footprint of the Main Site Access Road in the vicinity of Site TGP-OS2 prior to ground disturbing activities commencing. Cover this with or sand or gravel before constructing the base of the Main Site Access Road. | Prior to commencement of mining operations |
| | 8.13 | Plant by hand native vegetation adjacent to the Main Site Access Road in the vicinity of Site TGP-OS2 to prevent vehicular access to other sections of the site. | Prior to commencement of mining operations |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**

Page 13 of 22

| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **8. ABORIGINAL HERITAGE (CONT'D)** | | | |
| Impact on Site TGP – OS1 is minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. | 8.14 | Fence and mark the area of Site TGP-OS1 to prevent inadvertent disturbance of the site. | Prior to commencement of mining operations |
| Impact on Sites TGP – ST8 & ST9 are minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. | 8.15 | Fence around the drip lines of Sites TGP-ST8 and TGP-ST9 to prevent inadvertent disturbance of these sites. | Prior to commencement of mining operations |
| Impact on remaining sites of the Mine Site avoided. | 8.16 | Ensure that all identified sites are identified on plans held by the Mine Planning and Environmental Officers. | Prior to commencement of mining operations |
| | 8.17 | Ensure that all ground disturbing activities do not disturb the identified sites. | Ongoing |
| | 8.18 | Construct, where required, appropriate fencing or other identifying markers around identified sites where those sites occur in the vicinity of areas of proposed disturbance or in areas where inadvertent disturbance may occur. | Prior to commencement of mining operations |
| | 8.19 | Prepare, in consultation with the Aboriginal community, a Cultural Heritage Management Plan identifying procedures to protect or salvage all identified Aboriginal sites and prevent damage to all sites that may be identified during the life of the Project. | Within 6 months of receiving project approval |
| Impact on sites identified along the alignment of the TNWP are minimised and undertaken in accordance with the requirements of the registered Aboriginal stakeholders. | 8.20 | Mark all identified scarred trees with high visibility fencing at a suitable distance from the tree prior to construction of the pipeline commencing to prevent inadvertent disturbance of the trees | Prior to construction of the pipeline commencing |
| | 8.21 | Ensure all disturbance remains within the nominated TNWP corridor and that the minimum area required for installation of the pipeline is disturbed. | During construction |
| | 8.22 | Any soil excavated for the water pipeline would be replaced in the area and not removed to some other location. | During construction |
| Maintain Aboriginal heritage values on site. | 8.23 | In the event the disturbance footprint changes, ensure that appropriate consultation and field survey is undertaken to confirm no sites or objects of Aboriginal heritage significance are impacted. | If the disturbance footprint changes |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **8. ABORIGINAL HERITAGE (CONT'D)** | | | |
| Maintain Aboriginal heritage values on site. (cont'd) | 8.24 | Ensure work in an area is suspended should any Aboriginal sites be uncovered. The OEH Western Regional Archaeologist (Dubbo Office) and local Aboriginal community will be contacted to discuss how to proceed. | If a previously unidentified object or Aboriginal site is uncovered |
| **9. NON ABORIGINAL HERITAGE** | | | |
| Site activities are undertaken to minimise impacts on non-Aboriginal heritage items. | 9.1 | Identify all identified sites on mine plans and ensure that activities in the vicinity of those sites are appropriately managed. | Prior to the commencement of site establishment operations. |
| | 9.1 | Protect and erect appropriate signage around sites TGP-HS1, TGP-HS2 and TGP-HS3. | |
| | 9.2 | Mark sites TNWP-HS1 and TNWP-HS2 with high visibility fencing at a suitable distance from the tree. | Prior to construction of the pipeline |
| | 9.3 | Document the site TGP-HS5, by photography, prior to removal of the artefacts. Discussions would be held with local historic society as to the potential use of these items in a display to document the history of the site. | Prior to disturbance to site TGP-HS5 |
| | 9.4 | Undertake an assessment and archaeological investigation of site TGP-HS6 in accordance with the Historical Archaeology Code of Practice, published by the Heritage Office (of the then Department of Planning) (2006) and the Australia ICOMOS Burra Charter as 'good heritage practice'. | Prior to disturbance to site TGP-HS6 |
| **10. VISUAL AMENITY** | | | |
| Limit the visibility of operational areas from nearby residences and the Newell Highway. | 10.1 | Construct vegetated amenity bunds as nominated on **Figure 2.5** and **2.6** as follows.<br>• Adjacent to the eastern and western boundary of the Newell Highway.<br>• To the north of the Caloma Open Cut.<br>• To the south of the Wyoming One Open Cut.<br>• to the north of Waste Rock Emplacement 2, | Within the initial 12 months of operations |
| | 10.2 | Construct and rehabilitate the northern faces of Waste Rock Emplacements 2 and 3 to an initial height of 15m above the remainder of the waste rock emplacement. | Continuous for the life of the Project |
| | 10.3 | Progressively reshape and rehabilitate areas, including waste rock emplacements, no longer required for mining related purposes. | |
| | 10.4 | Undertake remnant vegetation protection and enhancement as described in Section 2.14.8, including ameliorative tree plantings to the south of Tomingley (**Figure 2.19**). | |
| | 10.5 | Construct the processing plant and other infrastructure within the Mine Site from non-reflective, neutral coloured material. | During the site establishment phase |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **10. VISUAL AMENITY (CONT'D)** | | | |
| Limit the visibility of operational areas from nearby residences and the Newell Highway. (cont'd) | 10.6 | Place and operate lighting on the Mine Site that:<br>• are not directed towards, and therefore do not impact on the vision of motorists using, the Newell Highway;<br>• do not point towards surrounding residences; and<br>• minimise the 'loom' created by the lights. | Continuous for the life of the Project |
| | 10.7 | Provide for additional visual screening in response to reasonable and feasible request from surrounding land holders. | As required |
| | 10.8 | Maintain the Mine Site in a clean and tidy condition at all times. | Continuous for the life of the Project |
| | 10.9 | Implement commitments related to air emissions management. | |
| **11. AIR QUALITY** | | | |
| Minimise impacts to air quality relating to the Project. | 11.1 | Disturb only the minimum area necessary for mining. | Ongoing |
| | 11.2 | Shape, topsoil and rehabilitate completed sections of the waste rock emplacements as soon as practicable. | Ongoing |
| | 11.3 | Operate water carts to minimise wind-blown and traffic-generated dust. | Continuous for the life of the Project |
| | 11.4 | Clearly mark all roads with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas. | Ongoing |
| | 11.5 | Rehabilitate all roads as soon as practicable once no longer required for mining-related purposes. | Continuous for the life of the Project |
| | 11.6 | Limit development of minor roads as far as practicable. | Ongoing |
| | 11.7 | Ensure that all appropriate dust management measures are used during drilling operations, including dust aprons, dust extraction and water injection. | Continuous for the life of the Project |
| | 11.8 | Undertake blasting operation in appropriate weather conditions only. | Ongoing |
| | 11.9 | Ensure that adequate stemming is used during blasting operations. | Ongoing |
| | 11.10 | Ensure that all conveyor transfer points within the crushing and screening circuit of the processing operations are enclosed. | Ongoing |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **11. AIR QUALITY (CONT'D)** | | | |
| Minimise impacts to air quality relating to the Project. (cont'd) | 11.11 | Install and operate spray bars within the crushing and screening circuit of the processing operations to produce a fog of water to suppress dust. Points at which this control will be installed are as follows.<br>• The ROM Bin back and side walls.<br>• The mouth of the Primary Crusher.<br>• The conveyor between the primary crusher and secondary crusher (CV01).<br>• The discharge point to the Head Chute in the Screening Tower (CV02).<br>• The inlet to the Screening Tower.<br>• The oversize outlet to the Screening Tower.<br>• Loading points to the conveyors for the transfer of screened material to and from the screening Tower and Surge Bin (CV03, CV04, CV05 and CV06). | Ongoing |
| Monitor and manage dust emissions. | 11.12 | Prepare an *Air Quality Monitoring Program* for the Project. | Within 12 months of project approval |
| **12. BLASTING AND VIBRATION** | | | |
| Minimise impacts from blasting on surrounding receptors and infrastructure. | 12.1 | Ensure that all blasts are designed by a suitably qualified and experienced blasting engineer or shot-firer and that each blast has an MIC of no greater than 68kg (unless more precise predictions of blast emissions are completed indicating compliance with air overpressure and ground vibration criteria at using larger MIC). | Continuous for the life of the Project |
| | 12.2 | Ensure appropriate stemming and burden is provided for each blast hole to minimise the potential for fly rock. | Ongoing |
| | 12.3 | Use aggregate for all stemming operations. | Ongoing |
| | 12.4 | Ensure that fragmented material is directed away from the Newell Highway. | Ongoing |
| | 12.5 | Identify the blast envelope during design of each blast. | Ongoing |
| | 12.6 | Inspect all blasts following initiation and any note the presence of fly rock outside the blast envelope. Where required, amend the blast design procedures to manage fly rock. | Ongoing |
| | 12.7 | Initiate blasts between the hours of 9:00am and 5:00pm Monday to Saturday only. | Ongoing |
| | 12.8 | Establish and maintain an environmental complaints line and register of complaints in accordance with the requirements of the Environment Protection Licence, once issued. | Ongoing |
| | 12.9 | Respond promptly to any issue of concern or complaint raised by the community or a government agency. | Ongoing |
| | 12.10 | Erect signage to advise local traffic of blasting operations. | Prior to first blast |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**

Page 17 of 22

| Desired Outcome | Action | Timing |
|---|---|---|
| **13. TRAFFIC AND TRANSPORTATION** | | |
| Achieve safe and efficient transport operations. | 13.1 Develop and enforce a Code of Conduct for all drivers for all heavy vehicles that travel to and from the Mine Site regularly. The Code of Conduct would stipulate safe driving practices must be maintained at all times. | During site establishment operations |
| | 13.2 Investigate immediately any complaints received and substantiated incidents acted on decisively, which could include the banning the offending driver(s) from the Mine Site. | Continuous during the life of the Project |
| | 13.3 Widen the section of Tomingley West Road between the Main Site Access Road and Tomingley - Narromine Road to provide for two sealed lanes of at least 3m width. | Prior to commencement of mining |
| | 13.4 Construct the Main Site Access Road intersection with Tomingley West Road in accordance with the *RTA Road Design Guide* for rural property access. | During site establishment phase (prior to commencement of mining) |
| | 13.5 Undertake the following road upgrades on Tomingley West Road.<br>• Provide for line marking of the road for a length of 1.6km with a broken central separation line.<br>• Install guide posts for improved delineation of the road.<br>• Install additional guide posts at the culvert and "narrow bridge" signage on approach to the culvert. | Prior to commencement of mining |
| | 13.6 Undertake a geotechnical investigation of pavement depths, materials and sub-grade conditions on Tomingley West Road. | Prior to commencement of mining |
| | 13.7 Prepare an individual *Traffic Control Plan* for each over mass and over weight delivery. | As required |
| | 13.8 Prepare and implement a comprehensive *Transport Management Plan* for construction and mine operation. | Prior to commencement of construction |
| Construct and Operate the Newell Highway underpass without adverse impact on regional traffic conditions. | 13.9 Design and construct the Newell Highway underpass to meet the requirements of the Austroads "*Guide to Road Design*" and to the specifications presented in Section 2.4.2.2. | Prior to commencing construction of the Newell Highway underpass |
| | 13.10 Construct a temporary diversion of the Newell Highway in accordance with RTA requirements and to the specifications presented in Section 2.4.2.3. | During site establishment phase (prior to commencement of mining) |
| | 13.11 Reconstruct the Newell Highway over the underpass as described in Section 2.4.2.2 and to the required standard of the RTA. | |
| | 13.12 Prepare, in consultation with the Roads and Traffic Authority, a *Construction Road Traffic Management Plan*. | Prior to commencing construction of the Newell Highway diversion |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **14. SOILS AND LAND CAPABILITY** | | | |
| Maintenance of soil value for rehabilitation and minimisation of soil loss through erosion. | 14.1 | Strip soil material to the depths no more than those identified in **Table 4.60**. | Ongoing |
| | 14.2 | Ensure that soil materials are not stripped when in either an excessively dry or wet condition. | Ongoing |
| | 14.3 | Grade or push soil into windrows using graders or bulldozers for later collection by elevating scrapers or loading into trucks by front-end loaders to minimise compaction of soil materials, where practicable. | Ongoing |
| | 14.4 | Use soil materials immediately following stripping in areas undergoing progressive rehabilitation, where practicable. Where this is not practicable place soil transported by truck directly into storage or place soil transported by scrapers in thick "lifts" to minimise compaction. | Ongoing |
| | 14.5 | Minimise, as far as practicable, the operation of machinery on soil stockpiles to reduce compaction. | Ongoing |
| | 14.6 | Ensure that soil stockpiles have a maximum height of 5m (3m of subsoil and 2m of topsoil). | Ongoing |
| | 14.7 | Leave the surface of the soil stockpile with an even but roughened surface to assist in erosion control and seed germination and emergence. | Ongoing |
| | 14.8 | Establish an appropriate vegetative cover on all soil stockpiles to be retained for more than 3 months. | Ongoing |
| | 14.9 | Assess soil stockpiles prior to respreading for weed infestation and spray of otherwise treat as required. | Six monthly |
| | 14.10 | Consider and assess the requirements for soil additives such as gypsum prior to commencing respreading operations. | Ongoing |
| | 14.11 | Spread soil materials at least 200mm thick on the shaped landform during rehabilitation operations. | During rehabilitation operations |
| Create a final landform that is safe, stable and is amenable to a combination of agricultural and native flora/fauna conservation activities. | 14.12 | Maintain a soil inventory:<br>• to ensure appropriate volumes of different soil units are stripped consistently with the soil requirements of the final landform.<br>• to identify the age of various soil stockpiles on the Mine Site and therefore assist in minimising the length of time soils remained stockpiled.<br>• to assist the Proponent in using the most appropriate soils for the different elements of the final landform. | Ongoing |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **14. SOILS AND LAND CAPABILITY (CONT'D)** | | | |
| Create a final landform that is safe, stable and is amenable to a combination of agricultural and native flora/fauna conservation activities. (cont'd) | 14.13 | Ensure that the land capability of those sections of the final landform to be used for agricultural purposes is similar to the current land capability. Any agricultural land that forms part of the final landform will be more heavily treed than it is at present due to proposed biodiversity and screen plantings. | Rehabilitation phase |
| **15. WASTE** | | | |
| Manage waste appropriately on the Mine Site. | 15.1 | Maintain a register of the types and quantities of wastes produced on the Project Site. | Ongoing |
| | 15.2 | Design and maintain storage areas to contain spillages. | Ongoing |
| | 15.3 | Segregate and retain recyclable and non-recyclable waste in designated storage areas prior to removal from the Project Site. | Ongoing |
| | 15.4 | Keep the Project Site in a clean and tidy condition. | Ongoing |
| | 15.5 | Ensure waste is regularly removed from the Project Site by a licensed contractor. | Ongoing |
| **16. SOCIO ECONOMIC SETTING** | | | |
| Maximise the positive impacts and minimise any actual or perceived adverse impacts on the social fabric or facilities available to the community surrounding the Mine Site. | 16.1 | Engage the community surrounding the Project in regular dialogue in relation to the proposed and ongoing operation of the Project and maintain an "open door" policy for any member of the community who wishes to discuss any aspect of the Project. | Ongoing |
| | 16.2 | Proactively and regularly consult with those residents most likely to be adversely impacted by the Project. | Ongoing |
| | 16.3 | Continue to support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance throughout the life of the Project. | Ongoing |
| | 16.4 | Advertise and maintain a community complaints telephone line. | Continuous for the life of the Project |
| | 16.5 | Make available excess water from the water supply bores and pipeline to Narromine Shire Council for supply to the residents of Tomingley. | As feasible |
| | 16.6 | Ensure that infrastructure and services installed for the Project, including the water supply bores and pipeline, electricity transmission line, appropriate buildings and hardstand areas, remain available for alternative uses following completion of the Project, provided that such uses are consistent with the final land uses identified in this document or any subsequent approval. | Post-mining |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**

Page 20 of 22

| Desired Outcome | Action | Timing |
|---|---|---|
| **17. CONSULTATION** | | |
| Maintain ongoing consultation with the local community and Council. | 17.1 Form and maintain a Community Consultative Committee (CCC), including representative members of the community and Narromine Shire Council. | Within 6 months of receipt of project approval |
| | 17.2 Regularly brief the CCC on activities within the Mine Site and seek feedback in relation to Project-related impacts whether real or perceived. | Quarterly |
| Respond to environmental complaints. | 17.3 Establish and maintain an environmental complaints line and register of complaints in accordance with the requirements of the Environment Protection Licence, once issued. | Within 6 months of receipt of project approval |
| | 17.4 Respond promptly to any issue of concern or complaint raised by the community or a government agency. | Ongoing |
| **18. ENVIRONMENTAL MONITORING** | | |
| Implement a comprehensive and ongoing surface water monitoring program. | 18.1 Monitor surface water quality at Sampling Points 1 and 2 for:<br>• Dissolved oxygen (% saturation);<br>• pH or Acidity;<br>• Total Suspended Solids or Turbidity (NTU);<br>• Total phosphorus (mg/L);<br>• Total nitrogen (mg/L); and<br>• Electrical conductivity (mS/cm). | After rainfall events which result in local flow within Gundong Creek |
| | 18.2 Monitor surface water quality within Sediment Basin 2 for:<br>• Dissolved oxygen (% saturation);<br>• pH or Acidity;<br>• Total Suspended Solids or Turbidity (NTU);<br>• Total phosphorus (mg/L);<br>• Total nitrogen (mg/L);<br>• Electrical conductivity (mS/cm);<br>• WAD Cyanide (mg/L); and<br>• Total Cyanide (mg/L). | Quarterly once the residue storage facility is in use |
| | 18.3 Monitor the quality of the residue discharge for:<br>• pH or Acidity;<br>• WAD Cyanide (mg/L); and<br>• Total Cyanide (mg/L). | Daily |
| Implement a comprehensive and ongoing groundwater monitoring program. | 18.4 Monitor standing water levels within groundwater bores WYMB01, WYMB03 and WYMB06. | Quarterly |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **18. ENVIRONMENTAL MONITORING (CONT'D)** | | | |
| Implement a comprehensive and ongoing groundwater monitoring program. (cont'd) | 18.5 | Install and monitor shallow piezometers around the RSF and monitor for:<br>• pH or Acidity;<br>• Electrical conductivity (mS/cm);<br>• WAD Cyanide (mg/L); and<br>• Total Cyanide (mg/L). | Prior to commencement of residue discharge and then quarterly |
| Implementation of an appropriate noise monitoring program to ensure continuing compliance with DECCW guideline levels. | 18.6 | Prepare and implement a *Noise Management Plan* which would include the following.<br>• Real-time noise monitoring procedures and trigger levels.<br>• Weather station monitoring procedures and adverse weather trigger levels.<br>• Routine and complaint-driven attended noise monitoring procedures.<br>• Reporting procedures, including reporting to relevant government agencies and the surrounding community. | Within 3 months of project approval |
| | 18.7 | Monitor ground vibration and air overpressure at the residences closets to the Mine Site. | Every blast. |
| Implementation of an appropriate air quality monitoring program to ensure continuing compliance with DECCW guideline levels. | 18.8 | Establish dust deposition gauges at residences surrounding the Mine Site. Residences to be chosen from include:<br>• Residence R3.<br>• Residence R28.<br>• Residence R29.<br>• Residence R32.<br>• Residence R33.<br>• Residence R40. | Ongoing |
| **19. ENVIRONMENTAL MANAGEMENT SYSTEM** | | | |
| A systematic set of documents are in place to guide the planning and implementation of all environmental management strategies. | 19.1 | Incorporate the environmental procedures in an on-site management system. | Prior to relevant activity |

**Table 5.1 (Cont'd)**
**Draft Statement of Commitments for the Tomingley Gold Project**



| Desired Outcome | Action | | Timing |
|---|---|---|---|
| **19. ENVIRONMENTAL MANAGEMENT SYSTEM (Cont'd)** | | | |
| | 19.2 | Prepare or update the following management and monitoring plans;<br>• *Mining Operations Plan*<br>• *Cultural Heritage Management Plan*<br>• *Erosion & Sediment Control Plan*<br>• *Noise Management Program*<br>• *Air Quality Monitoring Program*<br>• *Biodiversity Offset Management Plan* | Various and as nominated by project approval |
| | 19.3 | Incorporate relevant environmental data / information in *Annual Environmental Management Reports*. | Annually |

# Section 6

# Project Evaluation and Conclusions

## PREAMBLE

*This section of the Environmental Assessment concludes the document with:*

- *an assessment of the alternatives considered and rejected during the planning stages of the Project;*
- *an evaluation of the Project, including an assessment of the residual environmental risk after the management and mitigation measures identified in Sections 4 and 5 are taken into account; and*
- *an assessment of the Project against the principles of Ecologically Sustainable Development.*

*The Section concludes with a justification of the Project.*

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# 6.1 ALTERNATIVES CONSIDERED

## 6.1.1 Introduction

The Director-General's Requirements require that the *Environmental Assessment* include a detailed description of the "*alternatives considered, including a detailed justification of the proposed mine plan.*"

The considerations of feasible alternatives to the proposed activities are discussed in this sub-section. These relate principally to:

- alternative hours of operation (Section 6.1.2);
- alternative locations of surface infrastructure (Section 6.1.3);
- alternative eastern surface water diversion structure (Section 6.1.4);
- alternative Newell Highway crossing (Section 6.1.5); and
- alternative management of waste rock (Section 6.1.6).

The alternative of not developing the Project is considered in Section 6.3.5.

## 6.1.2 Alternative Hours of Operation

The Proponent proposes to operate the Project 24-hours per day, seven days per week. Alternative hours of operation considered included operating during the day and evening (7:00am to 10:00pm) or day (7:00am to 6:00pm) only. This would have the advantage of reduced night-time (and evening under day-time only operations) noise emissions and reduced noise-related impacts on surrounding residents. However, this alternative was rejected for the following reasons.

- Reduced hours of operations would increase the life of the Project and extend the period over which the capital costs of the Project would be required to be repaid.
- Increased contract mining costs would be incurred because contractor equipment would be unused for a portion of each day.
- Increased operational difficulties would be experienced through daily shutdown and restart of the processing plant.

Each of these would have a severe impact on the viability of the Project to a point where, combined, the Project would not be viable or would be a much higher risk investment.

## 6.1.3 Alternative Surface Infrastructure Locations

The Proponent considered a number of alternative locations for each of the principal items of infrastructure, namely the waste rock emplacements, processing plant at the residue storage facility. For simplicity of reference, these items are collectively referred to as surface infrastructure in this sub-section. It is noted that the locations of the proposed open cuts are constrained by the location of the associated mineralisation and the geotechnical properties of the rock mass. **Figure 6.1** presents a number of domains within and surrounding the Mine Site and the following identifies constraints that would prevent construction of site infrastructure within those domains.

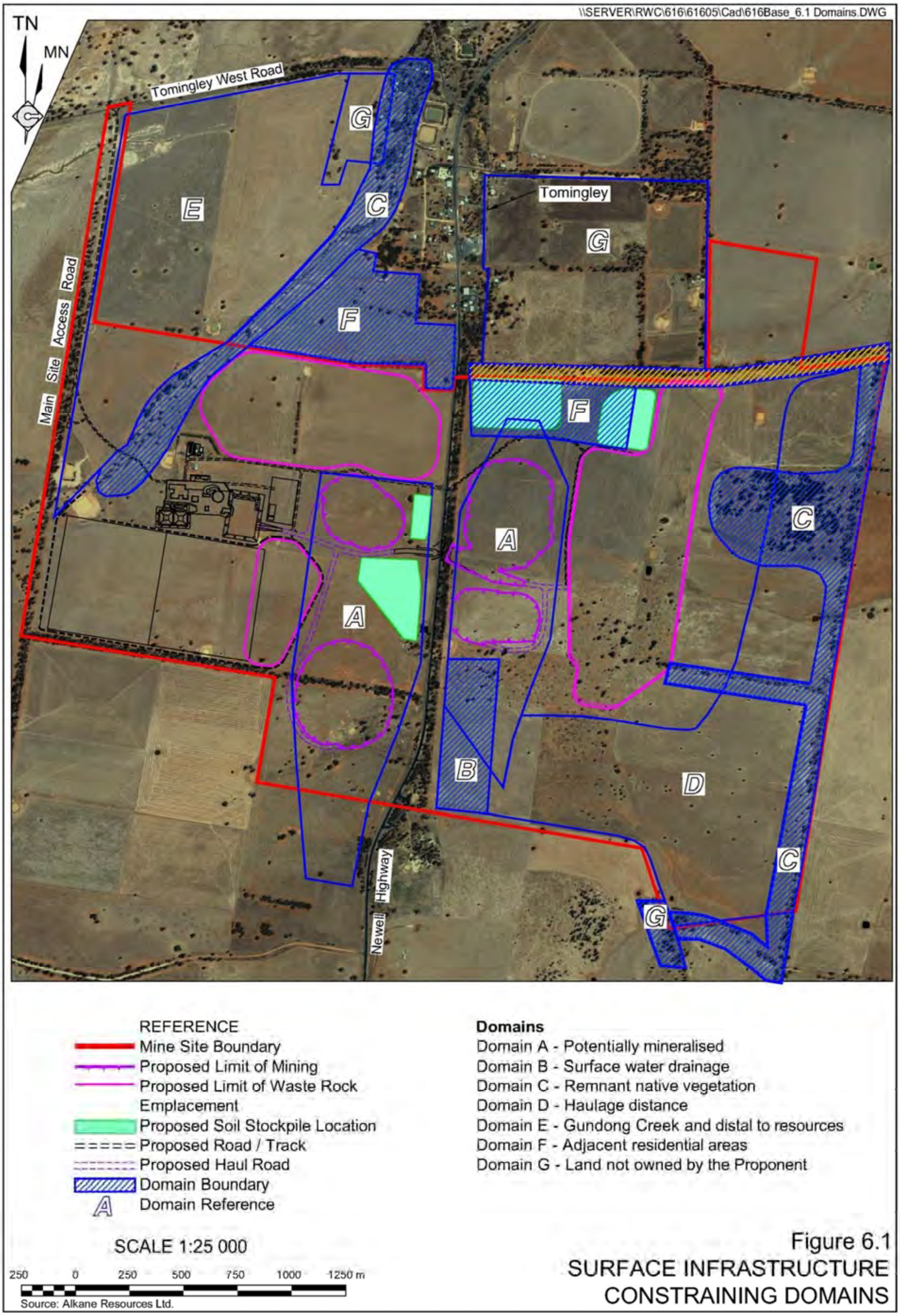



Figure 6.1
SURFACE INFRASTRUCTURE CONSTRAINING DOMAINS

- Domain A – Potentially mineralised

  Exploration drilling has indicated that the potential for additional mineralisation exists within Domain A. As a result, placing surface infrastructure within this domain may potentially prevent recovery of those resources in the future.

- Domain B – Surface water drainage

  Placement of surface infrastructure within this domain would severely impact on the ability of surface waters to flow to Culverts 1 and 2, potentially permanently altering the flow regimes to the east of the Newell Highway and causing adverse environmental impacts.

- Domain C – Remnant native vegetation

  Placement of surface infrastructure in this domain would disturb up to an additional 50ha of native vegetation.

- Domain D – Excessively long haulage distance

  Placement of surface infrastructure, in particular waste rock emplacements within this domain would require an excessively long haulage of material, with resulting cost and greenhouse gas implications.

- Domain E – Western side of Gundong Creek and distal to resources

  Placement of surface infrastructure within this domain would require haul trucks and or cyanide-containing process residue to cross Gundong Creek with the resulting environmental impacts associated with construction of an appropriate crossing, impacts to the flood regime and risk of spills or unintended discharges to Gundong Creek.

- Domain F – Adjacent residential areas

  Placement of surface infrastructure within this domain would result in unacceptable environmental and amenity impacts for the residents of Tomingley.

- Domain G – Land not owned by the Proponent

  Placement of surface infrastructure within this domain would require purchase of additional land.

Finally, the Proponent has located the processing plant to the south of Waste Rock Emplacement 2 and the north of the RSF to maximise the mitigation of noise emissions and minimise amenity impacts associated with operation of the plant for surrounding residents.

### 6.1.4 Alternative Eastern Surface Water Diversion Structure Alignment

The Proponent considered an alternative alignment for the Eastern Surface Water Diversion Structure. This alternative alignment would have resulted in a larger catchment draining to the structure and more water being diverted to the east of Waste Rock Emplacement 3, reducing the potential for a sudden in-rush of water into the Caloma Open Cut. The alternative alignment would have also required construction of structure that would have been more than 6m deep compared with the proposed maximum 3.4m deep structure. The alternative structure would have been a maximum of 30m wide, while the proposed structure would be a maximum of 17.5m wide. As a result, the alternative structure would have disturbed significantly more area than the proposed structure and would have posed a significant, long-term erosion risk.

### 6.1.5 Alternative Newell Highway Crossing

The Proponent considered two other alternative crossings over the Newell Highway. These included an overpass over the highway and a level crossing where haul trucks would cross the highway at an intersection that would have been controlled by lights or similar.

The highway overpass would have resulted in an overpass being constructed to permit haul trucks to travel over the highway. This would have negated to the requirement for the amount of road works that will be required to complete the proposed underpass and potentially less disruption to highway traffic during construction. However, this alternative would require haul trucks travelling from the Caloma Open Cut to the processing plant to climb above the level of the highway before being able to cross it, resulting an additional haulage times and associated greenhouse gas emissions. In addition, while crossing the highway, the haul trucks would be in an elevated position, potentially resulting in increased noise emissions for surrounding residents and distraction for motorists using the highway.

A level crossing intersection of the Newell Highway offers the simplest and most cost-efficient transport arrangement. However, the risk of potential conflict / accident between the mining fleet and general public was considered too great to proceed with this alternative.

The Newell Highway is an extremely busy transport corridor and any disruption to traffic would lengthen the travel time between Melbourne and Brisbane.

### 6.1.6 Placement of Waste Rock within Completed Open Cuts

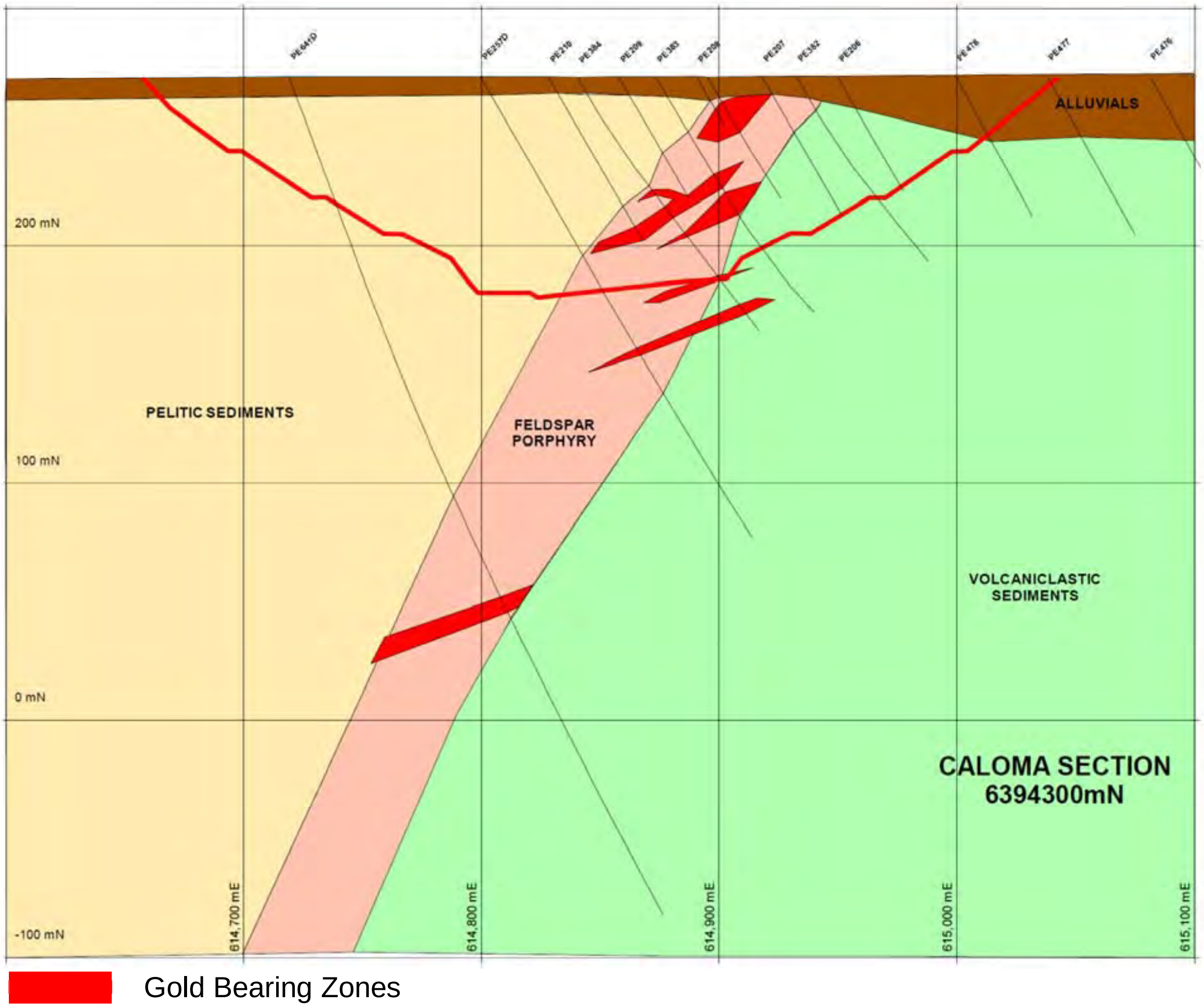
Given the proposed sequential development of the four open cuts, the possibility of back-filling the Caloma and Wyoming Three Open Cuts with waste rock from the Caloma Two and Wyoming One Open Cuts was considered. However, similar to the Wyoming One ore body, the gold containing ore of Caloma and Wyoming Three continues below the base of the open cut (see **Figure 6.2**). The potential to mine this deeper resource by underground methods (as proposed for Wyoming One) remains. Backfilling these open cuts would effectively sterilise this resource and therefore waste rock is to be managed by placement within the out-of-pit waste rock emplacements.

The Proponent has committed to continually reviewing waste rock management and should the underground mining of the Caloma or Wyoming Three ore bodies be confirmed as unviable, the backfilling alternative may be reconsidered.

## 6.2 EVALUATION OF THE PROJECT

### 6.2.1 Residual Environmental Risk and Impacts

An assessment of the unmitigated environmental risks associated with the Project has previously been presented in **Table 3.10**. Following consideration of the proposed management and mitigation measures described in Section 4, together with the commitments provided in Section 5, an assessment of the mitigated risks associated with the Project was completed for each potential environmental impact based on the likelihood of occurrence and potential environmental consequence. **Tables 6.1** reproduces **Table 3.8** and presents the risk matrix used during the mitigated risk analysis. **Table 6.2** reproduces the results of the analysis of (unmitigated) risk together with the residual (mitigated) risks associated with the Project. It is noted that in some cases no residual risk rating has been allocated as the assessment recorded in Section 4 has determined that the impact would not occur.




Source: Alkane Resources Ltd

**Figure 6.2**
**CALOMA GOLD RESOURCE**

**Table 6.1**
**Risk Rating Matrix**

| **Likelihood** | **Consequences** | | | | |
|---|---|---|---|---|---|
| | **Insignificant 1** | **Minor 2** | **Moderate 3** | **Major 4** | **Catastrophic 5** |
| A (Almost Certain) | H | H | E | E | E |
| B (Likely) | M | H | H | E | E |
| C (Possible) | L | M | H | E | E |
| D (Unlikely) | L | L | M | H | E |
| E (Rare) | L | L | M | H | H |
| Note: Rating modified after HB 203:2006 (Standards Australia, 2006) - Table 4(C) | | | | | |

**Table 6.2**
**Analysis of Mitigated Risk**

Page 1 of 6

| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Unmitigated Risk Ranking | Consequence of Occurrence if Mitigated | Likelihood of Occurrence if Mitigated | Residual Risk Rating |
|---|---|---|---|---|---|
| **Groundwater** | | | | | |
| Pollution of groundwater due to leaching of contaminants from the RSF | Reduced groundwater quality leading to reduction in beneficial uses of the water and therefore availability to existing groundwater users | H | 3 | E | M |
| Pollution of groundwater due to hydrocarbon spills | Contamination requiring minor recovery works. | M | 2 | D | L |
| | Contamination requiring major recovery works. | H | 3 | E | M |
| Reduction of groundwater levels due to mining intercepting aquifers | Reduction in the volume of water contained within the affected groundwater aquifer (drawdown of water table). | H | 1 | C | L |
| | Reduced yields of local groundwater bores. | M | 1 | C | L |
| | Reduced viability of groundwater dependent ecosystems. | L | 2 | E | L |
| Reduction in groundwater bore yields | Reduced yields in the groundwater bores of the Gundong Creek Alluvium. | M | 2 | E | L |
| | Reduced yields in the groundwater bores of the fractured rock aquifers. | M | 1 | C | L |
| Reduction in contribution to surface water flows. | Reduced surface flows to Gundong and other creek catchments of the Bogan River. | L | 1 | D | L |
| | Reduced viability of groundwater dependent ecosystems. | M | 2 | E | L |
| **Surface Water / Flooding / Erosion and Sedimentation** | | | | | |
| Reduction in environmental flows as a result of on-site capture of water. | Reduced availability of water to downstream users. | M | 1 | D | L |
| | Reduced environmental flows. | L | 2 | E | L |
| | Stress to, and possible reduction in viability of native vegetation. | L | 2 | E | L |
| | Degradation of aquatic habitats. | M | 2 | E | L |
| Discharge of dirty, saline or contaminated water. | Pollution of downstream waters. | H | 2 | D | L |
| | Stress to, and possible mortality of flora and/or fauna. | H | 2 | E | L |
| | Reduced soil quality and associated reduction in viability of productive post-mining land use. | M | 2 | D | L |
| Discharge of contaminated water containing cyanide from the RSF. | Pollution of downstream waters. | H | 2 | E | L |
| | Stress to, and possible mortality of flora and/or fauna. | H | 2 | E | L |
| | Reduced soil quality and associated reduction in viability of productive post-mining land use. | M | 2 | E | L |

**Table 6.2 (Cont'd)**
**Analysis of Mitigated Risk**



| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Unmitigated Risk Ranking | Consequence of Occurrence if Mitigated | Likelihood of Occurrence if Mitigated | Residual Risk Rating |
|---|---|---|---|---|---|
| Surface Water / Flooding / Erosion and Sedimentation (cont'd) | | | | | |
| Changes to hydrology of creeks and drainage lines. | Reduced environmental flows within the Bogan River catchment. | M | 1 | D | L |
| | Increased erosion potential resultant from changed alignment of flow. | H | 2 | D | L |
| | Reduction in the quality of aquatic habitat. | M | 2 | E | L |
| Changes to the flood regimes of Gundong Creek. | Increased erosion potential within Gundong Creek catchment. | M | 2 | E | L |
| | Changes to vegetation community structure and habitat value. | L | 2 | D | L |
| | Reduced viability of land uses on affected properties as a result of changes to flooding regime. | M | 2 | E | L |
| Erosive actions of water in undisturbed sections of the Mine Site | Excessive soil erosion. | M | 2 | D | L |
| | Sedimentation of surrounding drainage lines and land. | M | 2 | D | L |
| Erosive actions of water on disturbed sections of the Mine Site, including waste rock emplacement batters, prior to rehabilitation. | Excessive soil erosion. | M | 2 | D | L |
| | Sedimentation of surrounding drainage lines and land. | M | 2 | D | L |
| | Reduced success of Mine Site rehabilitation. | H | 3 | E | M |
| Biodiversity (Flora and Fauna) | | | | | |
| Direct impacts on native flora and fauna - clearing of vegetation. | Loss of, or alteration to, existing habitats. | E | 1 | A | H[1] |
| | Removal or mortality of individual species. | E | 1 | B | M |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | H | 3 | E | M |
| | Possible local extinction of threatened species, populations and endangered ecological communities. | H | 3 | E | H[1] |
| Direct impacts on native flora and fauna - road kill. | Mortality of individual species. | M | 2 | D | L |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | M | 3 | E | M |
| Direct impacts on native fauna - pooling of contaminated water on the RSF. | Mortality of individual species. | H | 2 | D | L |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | M | 3 | E | M |
| Indirect impacts on flora, fauna and fauna habitat, e.g. noise, dust etc. | Alteration to existing habitats. | M | 2 | E | L |
| | Local or regional reduction in distribution of threatened species, populations and endangered ecological communities. | M | 3 | E | M |

[1] A high risk ranking is retained as a consequence of either a certain likelihood or extreme consequence (regardless of whether the corresponding likelihood or consequence is rare or insignificant).

**Table 6.2 (Cont'd)**
**Analysis of Mitigated Risk**

Page 3 of 6

| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Unmitigated Risk Ranking | Consequence of Occurrence if Mitigated | Likelihood of Occurrence if Mitigated | Residual Risk Rating |
|---|---|---|---|---|---|
| Aboriginal Heritage | | | | | |
| Removal or destruction of known Aboriginal sites and/or artefacts within the Project footprint (including Tomingley Narromine Water Pipeline route) | Removal, damage or destruction of Aboriginal artefacts. | H | 3 | B | H |
| Removal or destruction of currently unidentified Aboriginal sites and/or artefacts due to Project Site extraction and associated activities. | Damage or destruction of Aboriginal artefacts. | H | 3 | E | M |
| European Heritage | | | | | |
| Removal or destruction of sites of heritage significance due to Project activities. | Damage or destruction of items of heritage significance. | M | 2 | C | M |
| Noise | | | | | |
| Increased noise levels resulting from operation of mobile equipment, crushing and screening equipment and product transportation. | Increased noise levels associated with Project activities (≤5dBA above noise criteria) causing annoyance, distractions, i.e. amenity impacts. | H | 2 | D | L |
| | Increased noise levels associated with Project activities (>5dBA above noise criteria) causing more significant amenity impacts. | H | 3 | D | M |
| | Sleep disturbance as a result of maximum noise levels. | H | 3 | D | M |
| | Increased noise levels associated with the Project leading to impacts on local fauna assemblage. | M | 2 | E | L |
| Ground vibration from mine blasting.<br><br>Airblast Overpressure from mine blasting (air vibration) | Structural damage to buildings, structures and other infrastructure, e.g. telecommunication cables. | E | 3 | E | M |
| | Subsidence of land in the village of Tomingley (as a consequence of collapse / subsidence of historic Tomingley Mine workings). | H | 3 | E | M |
| | Nuisance/amenity impacts on surrounding landowners / residents. | M | 2 | E | L |
| | Loss of income to livestock producers. | M | 2 | E | L |
| | Disrupted communication services. | L | 2 | E | L |
| Fugitive fly rock from blasting. | Personal injury. | H | 4 | E | H[1] |
| | Disrupted traffic on the Newell Highway. | H | 3 | E | M |

**Table 6.2 (Cont'd)**
**Analysis of Mitigated Risk**

Page 4 of 6

| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Unmitigated Risk Ranking | Consequence of Occurrence if Mitigated | Likelihood of Occurrence if Mitigated | Residual Risk Rating |
|---|---|---|---|---|---|
| **Air Quality – Dust, Odour and Greenhouse Gas** | | | | | |
| Dust generation resulting from: - vehicle movements on unsealed roads; - fixed plant, including crushing operations; - blasting operations; and - wind action on disturbed areas, overburden emplacements and stockpiles. | Nuisance/amenity impacts from dust deposited on window sills, cars, surfaces etc. | H | 2 | D | L |
| | Adverse health impacts (if $PM_{10}$ levels are excessive). | H | 3 | E | L |
| | Stress of native vegetation, and indirect impacts on fauna habitat. | L | 2 | E | L |
| | Reduced road safety. | M | 3 | E | M |
| Greenhouse gas emissions. | Increased contribution to greenhouse effect. | M | 1 | C | L |
| **Traffic and Transport** | | | | | |
| Road construction activities, e.g. entrance to the Mine Site and Newell Highway Underpass. | See "*air pollution*", "*flora and fauna protection*" and "*noise*" and "*Aboriginal heritage*" above. | | | | |
| | Temporary inconvenience to commuters (if delayed for road works). | M | 2 | D | L |
| | Change to existing floodways | M | 2 | E | L |
| Increased traffic levels due to movement of workforce and contractors. | Increased traffic congestion and or traffic delays. | L | 2 | E | L |
| | Elevated risk of accident/incident on local roads. | H | 4 | E | H[1] |
| Increased heavy vehicle movements. | Road pavement deterioration. | M | 2 | D | L |
| Transportation of oversize of overweight loads. | Road pavement deterioration. | M | 2 | D | L |
| Transportation of dangerous or hazardous goods. | Water or land contamination as a result of a spill of dangerous or hazardous goods. | M | 3 | E | M |
| **Visual Amenity** | | | | | |
| Changes in visual characteristics of the Mine Site. | Changes to local visual amenity for the life of the Project. | H | 1 | A | H[1] |
| | Unsightly landform at the completion of the Project. | H | 2 | D | L |
| | Reduced night time amenity caused by lighting. | M | 2 | D | L |
| | Distraction to traffic resulting in accidents/incidents. | M | 2 | E | L |

**Table 6.2 (Cont'd)**
**Analysis of Mitigated Risk**

Page 5 of 6

| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Unmitigated Risk Ranking | Consequence of Occurrence if Mitigated | Likelihood of Occurrence if Mitigated | Residual Risk Rating |
|---|---|---|---|---|---|
| **Soil Resources** | | | | | |
| Reduction in soil quality through poor soil stripping, stockpiling or spreading practices. | Insufficient soil quantities for rehabilitation. | L | 2 | E | L |
| | Reduced soil quality resulting in poor rehabilitation or inability to achieve nominated final land capability. | H | 2 | D | L |
| | Increased erosion hazard compared with original landform. | M | 2 | D | L |
| Increased erosion or erosion potential of soils. | See "erosion and sedimentation" above. | | | | |
| **Land Use** | | | | | |
| Temporary and permanent changes to the landform of the Project Site. | Altered final landform not compatible with activities/lifestyle of adjoining land owners. | H | 3 | E | M |
| | Reduced productivity of land for agricultural production as post-mining land use. | H | 2 | D | L |
| | Increased local biodiversity. | Positive Impact | | | |
| Unstable or eroding final landform. | Increased sedimentation of drainage from the Mine Site. | H | 2 | E | L |
| | Reduced stability of the final landform. | M | 2 | E | L |
| **Waste Management** | | | | | |
| Production of contaminating or polluting materials, eg. waste oils, saline water, tailings, general rubbish. | Hydrocarbon or other pollutant contamination of surface water. | H | 2 | D | L |
| | Hydrocarbon or other pollutant contamination of groundwater. | M | 2 | E | L |
| | Contamination of local water and/or soil resources by leaking or spilt residue. | M | 3 | E | M |
| | Reduced amenity of Project Site due to poor rubbish, litter management. | M | 1 | D | L |
| Acid Mine Drainage from mineralised waste rock | Reduced viability of remnant or rehabilitated vegetation. | M | 2 | E | L |
| | Stress to, or mortality of local flora and fauna. | M | 2 | E | L |
| | Reduced productivity of land. | M | 2 | E | L |
| **Land Contamination** | | | | | |
| Extraction exposing previously contaminated materials. | Transfer of contaminated material. | M | 2 | E | L |
| | Surface water contamination. | M | 2 | E | L |

**Table 6.2 (Cont'd)**
**Analysis of Mitigated Risk**

Page 6 of 6

| Risk Source | Potential Environmental Impact (Type/Level/Scale provided if applicable) | Unmitigated Risk Ranking | Consequence of Occurrence if Mitigated | Likelihood of Occurrence if Mitigated | Residual Risk Rating |
|---|---|---|---|---|---|
| **Bushfire** | | | | | |
| Initiation of fire on the Mine Site and spread to adjoining properties. | Injury or health impacts on project personnel. | H | 3 | E | M |
| | Operational constraint posed by damaged equipment. | M | 2 | E | L |
| | Destruction/damage of native vegetation and fauna habitat. | M | 2 | E | L |
| | Loss of livestock, crops and property on neighbouring land | M | 2 | E | L |
| **Socio-Economic Impacts** | | | | | |
| Alteration of social activities or employment due to employment generation and capital expenditure. | Increased economic activity and related social impacts attributable to reduced unemployment | Positive Impact | | | |
| | Loss of local farm workers and tradespeople to work on the mine. | M | 1 | D | L |
| | Increased resilience in local community through diversification and capacity building. | Positive Impact | | | |
| Perceived or real impacts on local amenity of neighbouring properties. | Reduced quality of life (actual or perceived). | H | 2 | D | L |
| | Immigration of some workers and families wanting to live closer to the Project. | M | 2 | D | L |

Consequence of Occurrence: 1 = Insignificant; 2 = Minor; 3 = Moderate; 4 = Major; 5 = Catastrophic
Likelihood of Occurrence: A = Almost Certain; B = Likely; C = Possible; D = Unlikely; E = Rare
Risk Rating: E = Extreme; H = High; M = Moderate; L = Low

Through the implementation of the proposed management and mitigation measures identified in Section 4 and summarized in the Statement of Commitments in Section 5, the residual (mitigated) risk rating for the majority of potential environmental impacts has been reduced. Several residual risk ratings, however, remain "high." The following provides further consideration of those potential impacts

- Loss of, or alteration to, existing habitats.

  *The Project would result in the removal of approximately 2.7ha of Inland Grey Box Poplar Box White Cypress Pine community and 0.9ha of Fuzzy Box Inland Grey Box community, both of which may be classified as Endangered Ecological Communities in NSW. In addition, 18ha of Belah / Black Oak Western Rosewood Wilga Woodland community, which could provide habitat for threatened native fauna would be disturbed. The remaining disturbance on the Mine Site would be restricted to cleared and farmed land or planted vegetation. These impacts have been avoided as far as practical, however, as the areas of EEC to be disturbed occur within the footprints of the Wyoming One Open Cut further reduction in impact was not feasible. However, as described in Section 2.14.8 and assessed in Section 4.5.8, the Proponent has proposed the implementation and management* *of a biodiversity offset strategy to protect and enhance the remaining remnants of these communities on the Mine Site and surrounds. Therefore, while the residual risk rating remains 'high', by virtue of the fact that loss of, or alteration to, existing habitats is a certain outcome (albeit a very minor area and temporarily), OzArk (2011b) conclude that the Project would not have a significant effect on threatened species or populations or endangered ecological communities listed under State or Commonwealth legislation.*

- Possible local extinction of threatened species, populations and endangered ecological communities.

  *Although considered extremely unlikely, it is conceivable that the Project may result in the local loss of a threatened species or (even less likely) an EEC. Again, reference is made to the proposed biodiversity offset strategy described in Section 2.14.8 and assessed in Section 4.5.8. Considering the proposed biodiversity offset strategy and other operational safeguards and mitigation measures, OzArk (2011b) conclude that the Project is unlikely to have such an impact on threatened species or populations or endangered ecological communities listed under State or Commonwealth legislation as to lead to local extinction.*

- Removal, damage or destruction of Aboriginal artefacts.

  *Three Aboriginal sites (Sites TGP-ST7, TPG-ST10 and TNWP-OS1 with PAD) are located such that avoiding impact is not possible. Acknowledging this, the Proponent has engaged with the registered Aboriginal stakeholders for the Project, in particular the Traditional Owners of the Peak Hill / Tomingley area, to ensure that management of these sites is undertaken in a culturally sensitive manner (see Section 4.6.5). Section 4.6.8 documents the proposed management of these sites (as well as the remaining sites of the Mine Site and TNWP that would be avoided), which have been presented to the registered Aboriginal stakeholders both at community meetings as well as in the form of a draft Cultural Heritage Management Plan. At community meetings held to discuss management of the two sites, those present verbally assented to the management measures proposed. No feedback has been received following distribution of the CHMP disagreeing with, or requesting changes to the proposed management of these sites.*

  *It is noted that additional survey work is to be undertaken on Site TGP-ST7 to clarify the origin of modifications to the tree, i.e. whether these represent cultural carvings or not and if so whether an associated burial or other significant site occurs in the vicinity. The registered Aboriginal stakeholders have provided support for initial bark removal to assess the origin of the tree modifications, however, have indicated that further ground disturbance should be undertaken only when there is certainty over the requirement for disturbance, i.e. following determination of the project.*

  *On the basis of the support provided by the registered Aboriginal stakeholders for the proposed approach to Aboriginal site management, the high residual risk* *rating is considered acceptable as risk has been reduced to the lowest rating possible (given the removal of any Aboriginal site is considered by the Aboriginal community to be at least of moderate consequence).*

- Fugitive fly rock from blasting resulting in personal injury.

  *Given the potential severity of impact should personal injury occur as a result of fly rock from the Mine Site, the residual risk rating for this impact is high. It is noted that given the proposed management of blasting to be implemented by the Proponent, the likelihood of such an occurrence would be reduced as far as practically possible. Confidence in the application of the nominated blasting controls can be obtained from the history of good practice displayed by the Proponent at the Peak Hill Gold Mine.*

- Elevated risk of a major or severe accident/incident on local roads

  *As indicated in Section 4.11.4, the Project would not result in increased traffic levels on roads surrounding the Mine Site that would be in excess of the capacity of those roads. In addition, the Proponent has committed to implementing a number of measures, including widening and upgrading of Tomingley West Road, that would promote the safe use of surrounding roads. However, as the Proponent does not control motorists who use those roads, the potential for accidents cannot be eliminated. As a result, the risk rating associated with accident or incident on the roads surrounding the mine Site remains high.*

- Permanent disturbance to landform.

  *Section 2.14.4 describes the final landform. The Project would result in permanent changes to the landform within the Mine Site. However, the Proponent contends that the changes would be reasonable and that progressive and final rehabilitation operations would ensure that the proposed final landform would be safe, stable, self-sustaining and non-polluting. In addition, the visual amenity assessment presented in Section 4.8.4 concluded that the visual impact of the final landform would not be significant. Finally, as permanent disturbance to the landform is certain, should the Project receive Project approval, the "high" risk rating is a reflection that the likelihood of occurrence is "A = Almost certain" and a "high" risk rating is the lowest rating available.*

The risks associated with the majority of potential environmental impacts are considered moderate or less and therefore, while these may result in impacts deemed unacceptable to some stakeholders, the development and operation of the Project, with the implementation of appropriate management and mitigation measures, are generally considered acceptable.

### 6.2.2 Ecologically Sustainable Development

#### 6.2.2.1 Introduction

Sustainable practices by industry, all levels of government and the community are recognised to be important for the future prosperity and well-being of the world. The principles of Ecologically Sustainable Development (ESD) that have been recognised for over a decade were based upon meeting the needs of the current generation while conserving our ecosystems for the benefit of future generations. In order to achieve sustainable development, recognition needs to be placed upon the integration of both short-term and long-term environmental, economic, social and equitable objectives.

Throughout the design of the project, the Proponent has endeavoured to address each of the sustainable development principles. The following sub-sections draw together the features of the project that reflect the four principles of sustainable development, namely:

- the precautionary principle;
- the principle of social equity;
- the principle of the conservation of biodiversity and ecological integrity; and
- the principle for the improved valuation and pricing of environmental resources.

#### 6.2.2.2 The Precautionary Principle

In order to satisfy this principle of ESD, emphasis must be placed on anticipation and prevention of environmental damage, rather than reacting to it. During the planning phase for the Project and throughout the preparation of the *Environmental Assessment*, the Proponent engaged specialist consultants to examine the existing environment, predict possible impacts and recommend controls, safeguards and/or mitigation measures in order to ensure that the level of impact satisfies statutory requirements or reasonable community expectations.

Throughout the development of the Project, the Proponent and its consultants have adopted an anticipatory approach to impacts, particularly that of irreversible ecological damage, by undertaking an analysis of the risks posed by proposed activities, an appropriate level of research and baseline investigations and environmental evaluation. The controls, safeguards and/or mitigation measures have therefore been planned with a comprehensive knowledge of the existing environment and the potential risk of environmental degradation posed by Project-related activities.

The implementation of the environmental safeguards, controls and mitigation measures has been formalised by the Proponent as the draft Statement of Commitments presented as Section 5.

Examples of matters relating to the precautionary principle that were considered during the various stages of the project are listed below.

**Project Objectives**

The principal objectives of the Project are the design and operation of a gold mine in a manner that minimises surface disturbance and impact on the environment and surrounding residents, as well as ensuring compliance with environmental criteria, reasonable community expectations and all relevant statutory requirements through appropriate design, management and mitigation measures.

**Project Design Components**

A number of design features were incorporated during the initial design stage in recognition of the precautionary principle. In addition, subsequent modifications were made in response to issues identified during the specialist consultant investigations undertaken as part of the environmental assessment phase. These design features and modifications included the following.

- All Project infrastructure is to be constructed on the eastern side of Gundong Creek to limit the requirement for construction of large creek crossings and flood control structures on both sides of the creek. As a result, surface waters would not be restricted into a narrow area between items of infrastructure and the existing flood regime of widespread distribution of floodwater across the land adjacent to the creek can continue (see also Section 6.1.3).
- The location of all items of infrastructure was chosen to minimise the amount of vegetation that would be disturbed during the life of the Project (see also Section 6.1.3).
- Both Waste Rock Emplacements 2 and 3 have been designed to provide an amenity barrier between the residents of Tomingley and mining, processing and waste rock and residue management activities on both the eastern and western sides of the Mine Site. This would have the effect of ensuring that unintended impacts associated with the Project are minimised to the greatest extent possible.
- Sediment Basins 1 to 5 were designed to ensure that all surface water within disturbed sections of the Mine Site would be captured and either used for mining-related purposes or sediment permitted to settle before being discharged.
- The design of the Eastern Surface Water Diversion Structure has been amended to reduce the size of the structure and minimise the potential for long-term erosion or sedimentation issues (see also Section 6.1.4).
- The final landform has been designed to provide for areas of native vegetation, agriculture and, potentially, light industry or other activities. The Mine Site final landform also provides for the protection and extension of remnant areas of native vegetation (including EECs). The proposed approach to final landform creation and land use allows for the greatest flexibility in the use of the Mine Site following completion of the Project.

**Management and Operational Safeguards**

The framework for ongoing environmental management, operational performance and rehabilitation of the Mine Site would be provided through the project approval and be managed in accordance with the Mining, Rehabilitation and Environmental Management Process, both of which would involve the input from relevant State and local government agencies. The *Mining Operations Plan* (or *Rehabilitation and Environmental Management Plan*) would contain a range of site specific environmental procedures to achieve consistency with specified outcomes and to control identified risks. This document would be updated periodically. In addition, the *Annual Environmental Management Report* would document the progress of the Project and provide an opportunity to review the effectiveness of the environmental management strategies adopted. Finally, the following management and operational safeguards would be implemented in accordance with the precepts of the precautionary principle.

- All on-site procedures would be regularly reviewed, particularly in light of monitoring results.
- Surface water, groundwater, noise, deposited dust and $PM_{10}$ levels would be monitored at locations potentially most affected by the Project in order to ensure the continued compliance with the goals outlined in this document. Importantly,

the Proponent has committed to real time monitoring of noise at the southern-most residence in Tomingley (with land owner consent).

- The northern sections of Waste Rock Emplacements 2 and 3 would be constructed to a height of approximately 15m above the remainder of the waste rock emplacement to provide a noise barrier between the active sections of the Mine Site and Tomingley.
- Mobile equipment operation would be restricted during the evening and night time, especially under inversion conditions to minimise the potential for noise-related impacts to residents in Tomingley. Section 4.2.5 (and **Figures 4.11** to **4.15**) provides an illustration of operating scenario's which reduce noise emissions from the Mine Site as low as reasonably and feasibly possible. It is important to note that actual modifications to mining operations may differ from that presented in **Figures 4.11** to **4.15** while still resulting in the same noise levels (as measured by real time noise monitoring) as predicted at residences surrounding the Mine Site.
- Surface water management structures identified within Section 4.3.3 would be constructed and maintained to ensure that potentially sediment-laden water does not flow from the Mine Site.
- Water within the sediment basins would preferentially be used for mining-related purposes, minimising the water that would be required to be drawn from the water supply pipeline.
- A biodiversity offset strategy would be implemented which would provide for the protection and extension of remnant native vegetation (including EECs) on the Mine Site. The areas of to be protected and enhanced would be fenced (unless impractical to do so) and access limited to minimise the potential for inadvertent disturbance.
- Wherever practicable, areas not required for mining-related activities would remain vegetated to assist in minimising erosion and reducing the suspended sediment load in surface water flowing through the Mine Site.
- Soil material would be stripped, stockpiled and re-spread on the basis of the quality of the soil (as indicated by the soil mapping unit), and planned final land use of different areas of the final landform.

### Rehabilitation and Subsequent Land Use

Long term adverse impacts on the environment would be avoided through:

- creation of a safe, stable, vegetated, non-polluting final landform;
- progressive rehabilitation, including shaping of the final landform, spreading of soil and reseeding or replanting with endemic, locally sourced species as described in Section 2.14.6; and

- a final land use of agriculture, nature conservation and other land uses, possibly including light industry, to be determined in conjunction with the surrounding community and the relevant government agencies.

### Conclusion

The precautionary principle has been considered during all stages of the design and assessment of the Project. The approach adopted, ie. risk analysis, initial assessment, consultation, specialist investigations and safeguard design, provides a high degree of certainty that the project would not result in any major unforeseen impacts.

### 6.2.2.3 Social Equity

Social equity embraces value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to the community. Social equity includes both inter-generational (between generations) and intra-generational (within generations) equity considerations.

Equity within generations requires that the economic and social benefits of the development be distributed appropriately among all members of the community. Equity between generations requires that the non-material well-being or "quality of life" of existing and future residents of the local community would be maintained throughout and beyond the life of the Project.

Both elements of social equity are addressed through the design of the Project itself, the implementation of operational safeguards to mitigate any short-term or long-term environmental impacts, and the proposed rehabilitation of the areas directly disturbed. Examples of matters relating to social equity that are relevant to the various stages of the proposed development are listed below.

### Identification of Project Objectives

As noted above, the principal objective of the Project is the design and operation of a gold mine in a manner that minimises surface disturbance and impact on the environment and surrounding residents. The Project would also be developed with the objective of maximising the social and economic benefits to local communities (Tomingley and Peak Hill) and wider region (Narromine, Parkes and Dubbo LGAs) through:

- provision of employment, including a commitment to employee training (whilst not adversely affecting the ability of other employers within the region to maintain suitably qualified staff);
- support to community organisations, groups and events and, as appropriate, assist in and contribute to the planning and development of community based projects;
- assist the local Aboriginal community through the provision or contribution towards education and training initiatives that will increase the potential of local Aboriginal people to gain employment; and
- development of a purchasing policy specifying the local purchase of project-related consumables such as fuel, oil, cleaning products etc where practicable.

The Project has also been designed with the objective to ensure the continued viability of surrounding land uses throughout and beyond the life of the Project.

### Design of Project Components

The Project has been designed to maintain inter-generational equity, i.e. in recognition that the mining and processing of the gold resource is a short term land use, and to ensure components of the existing biological, social and economic environment available to existing generations would also be available to future generations.

- The final landform and land use of the Mine Site has been designed conceptually to provide for both the protection and enhancement of native vegetation / fauna habitat, and the continued commercial use of the affected properties (either for agriculture or possibly light industry which could utilise the Project-established infrastructure).
- A biodiversity offset strategy would be established to compensate for any disturbance to native vegetation and fauna habitat, to safeguard the populations of threatened flora and fauna species and EECs, and ultimately provide a higher level of protection and management to these threatened species.
- Surface water management on the Mine Site has been designed to have minimal impact on environmental flows and maintain or improve the water quality available to downstream users.
- The availability of groundwater to surrounding landholders, although not predicted to be significantly affected by the Project, would be monitored throughout the life of the Project and compensatory measures taken in the event reductions in the availability (yield) are identified.
- The establishment of water transfer infrastructure from Narromine to Tomingley would be available following the completion of mining and could provide added security of water availability to the residents of Tomingley

### Integration of Safeguards and Procedures

The Proponent recognises that all members of the local community should benefit appropriately from the Project, either directly or indirectly. In order to ensure a realistic distribution of benefits, the Proponent would continue to consult with the local community and maintain a pro-active approach to issues of interest. This dialogue would also include a system to record, manage and respond to any complaints relating to the operation.

Several issues, some Project-related and others of a more general nature, have possible inter-generational effects. The following describes these issues and the approach to be taken by the Proponent to ensure potential for adverse inter-generation impacts are minimised.

- Residue Management. The RSF has been designed to ensure it remains structurally sound, retains all residue, i.e. no leachate, and can be rehabilitated to provide for future nature conservation, agricultural or other light industrial land use. Ongoing monitoring would be undertaken to confirm no leakage of leachate into local groundwater or surface water drainage, with this monitoring undertaken for the life of the Project and for as long as required by the responsible government agency. These measures will ensure that the proposed residue management does not adversely impact on the environment and land users of future generations.
- Weed Management. The spread of weeds is recognised as an issue that could potentially impact on surrounding land owners over the life of the Project and beyond. While this issue is a more general one for the local area, the Proponent

recognises that poor land management on the Mine Site could exacerbate the problem. Conversely, the proposed implementation of appropriate weed control on Proponent owned land would assist in overall weed management of the local area. The Proponent proposes to implement appropriate weed management programs. Any such works would be undertaken in consultation with the local Weeds Officer of Narromine Shire Council or DTIRIS.

- Land Use. The proposed rehabilitation objectives and measures described in Section 2.14.2 have been designed to ensure that the Mine Site lands are available for future use for agricultural or nature conservation purposes and do not restrict the ongoing agricultural activities on surrounding lands.
- Cultural Heritage. A *Cultural Heritage Management Plan* is being developed in conjunction with the Aboriginal community to provide for the protection and, where unavoidable, salvage of those Aboriginal sites that would or could otherwise be disturbed by the Project. The Proponent has already assisted in the establishment of the Peak Hill Aboriginal Reference Group and developed a *Community Engagement Protocol* with the local Aboriginal community which aims to provide for mutual benefit from mining and exploration activity in the Peak Hill/Tomingley district.

### Rehabilitation and Subsequent Land Use

The final landform would be constructed and rehabilitated in a manner that would generally retain land for native vegetation management with some land retained for agricultural or possibly light industrial activities. The land retained for agricultural or light industrial purposes would provide a basis for continuing economic activity in the local community. The areas rehabilitated for native vegetation protection and enhancement may provide areas for recreational activities for the local community.

### Conclusion

The principle of social equity has been addressed through the consideration of how the Project could benefit the local and regional communities, the design of particular elements of the Project and the integration of operational safeguards and management measures that would maximise community involvement in reviews of operations, as well as ensure that gains made in the short-term do not result in adverse impacts on the environment or the local community post-completion of the Project. Notably, the Project would contribute significantly to the economic activity of the local and regional community through the generation of employment, increased demand for local goods and services, direct community contributions and flow-on effects. These benefits of the Project, which are considered in more detail in Section 6.3.3, would be distributed throughout the local community. The Project has also been designed such that elements of the existing environment available to this generation, including water and local biodiversity would continue to be available to future generations. The Proponent would adopt a pro-active approach in identifying and addressing any concerns identified by the local community.

#### 6.2.2.4 Conservation of Biological Diversity and Ecological Integrity

The protection of biodiversity and maintenance of ecological processes and systems are central goals of sustainability. It is important that developments do not threaten the integrity of the ecological system as a whole or the conservation of threatened species in the short- or long-term. Details of how the Project has been designed to achieve compliance with these principles are set out below.

**Identification of Project Objectives**

The Proponent has nominated specific objectives with respect to the rehabilitation of the Mine Site and development of final landform / land use (see Section 2.14.2). Importantly, these rehabilitation objectives provide for the establishment of:

- a low maintenance, geotechnically stable and safe, non-polluting landform which blends with surrounding landforms and provides land suitable for the final land use of nature conservation, agriculture, tourism or light industry; and
- native vegetation with the species diversity commensurate to each relevant ecological community.

**Design of Project Components**

The Proponent is committed to undertake all activities in an environmentally responsible manner, and recognises the need to ensure that changes to natural components of the environment do not significantly adversely affect biological diversity or ecological integrity.

The Proponent, on advice from the specialist consultancies commissioned to assist with the design and to assess the impact of the Project, has provided for the conservation of biological diversity and ecological integrity through the following design elements. As far as practical, the Proponent has followed Step 4 of the guideline document "*Draft Guidelines for Threatened Species Assessment*" (DEC/DPI, 2005), ie. "*avoid, mitigate and then offset*".

**Impact Avoidance**

- Impacts on threatened flora and fauna have been further avoided through the strategic location of surface disturbance away from remnant native vegetation and use of previously cleared land for the construction of surface infrastructure.
- Areas of the waste rock emplacement footprints have been nominated as temporary soil stockpiles (rather than using additional areas of the Mine Site).

**Impact Mitigation**

- Water management structures have been designed and would be constructed to ensure that only water of appropriate quality leaves the Mine Site and minimise changes to surface flows to the southwest (into Gundong Creek and the Bogan River).
- Soil would be stripped and managed in stockpiles for eventual respreading over the final landform.
- The construction of internal roads and access routes would minimise disturbance to native vegetation.
- Progressive rehabilitation of the Project Site would provide for the re-establishment of native and pasture vegetation. The area to be rehabilitated back

to nature conservation would be greater that what is currently available for nature conservation within the Project Site, as the majority of the land has been previously been cleared of trees for agricultural purposes.

- Effective weed control would be undertaken to reduce the spread of weeds over the Project Site and surrounding land.

### Impact Offsetting

- The limited areas of disturbance to native vegetation and fauna habitats associated with the Project would be compensated by the establishment of a biodiversity offset strategy. The strategy would provide for the protection and enhancement of remnant native vegetation on and surrounding the Mine Site.

### Integration of Safeguards and Procedures

The following safeguards and procedures would be integrated into the Project with the objective of maintaining biological diversity and ecological integrity.

- Clearing of vegetation would be undertaken on a campaign basis to ensure that clearing is undertaken during periods when local fauna is unlikely to be nesting, roosting or over-wintering within the trees and shrubs to be cleared.
- Given the potential occurrence of threatened native fauna on the Mine Site and within trees to be cleared, a Pre-start Clearing Inspection of the proposed disturbance area would be completed prior to each clearing campaign to identify if any threatened fauna species are present in trees nominated for clearing. In the event a threatened fauna species is present, clearing would be suspended until it moves away from the subject area or is relocated by a suitably qualified person.
- Remnant native vegetation enhancement would involve seeding and tree planting activities as deemed appropriate to improve the coverage and species diversity of each remnant to be conserved.
- Rehabilitation of the Mine Site would include the establishment of endemic vegetation, including grassland species.
- Weed eradication programs would be implemented, as required.

### Rehabilitation and Subsequent Land Use

The final landform has been designed to provide for future use of the Project Site lands for nature conservation, agricultural activity and/or some other light industry to be determined in consultation with the local community and local government.

### Conclusion

The Project addresses the principle of conservation of biological diversity and ecological integrity through the minimisation of disturbance to areas of native vegetation, and conservation of greater areas of native vegetation than are disturbed. Should threatened species be identified within those areas of the Mine Site to be disturbed, these would be relocated or managed appropriately in consultation with OEH or a suitably qualified professional. Weed eradication programs would continue to be implemented as appropriate and would further assist in addressing the conservation of biological diversity and ecological integrity principle of sustainable development.

#### 6.2.2.5 Improved Valuation and Pricing of Environmental Resources

The issues that form the basis of this principle relate to the acceptance that:

- the polluter pays;
- when all resources are appropriately valued, cost-effective environmental stewardship is adopted; and
- the adoption of user-pays principle based upon the full life cycle of the costs.

A reflection of these issues on the Project is set out below.

**Identification of Project Objectives**

The Proponent's principal objective (see Sections 6.2.2.2 to 6.2.2.4) demonstrates that an appropriate value has been placed on elements of the existing environment.

**Design of Project Components and Integration of Safeguards and Procedures**

The extent of research, planning and design of environmental safeguards, mitigation measures and offset strategies to prevent irreversible damage to environmental resources, other than the gold to be mined, is evidence of the value placed by the Proponent on these resources.

**Rehabilitation and Subsequent Land Use**

The design of the final landform to integrate ongoing agricultural activities, light industry and nature conservation with the re-establishment and conservation of native vegetation illustrates the value placed by the Proponent on both the commercial and ecological elements of the Project Site.

**Conclusion**

The value placed by the Proponent on environmental resources is evident in the identification of Project objectives, extent of site-specific research, planning and environmental safeguards and measures to be implemented to prevent irreversible damage to the environment on and surrounding the Project Site. It is planned that the income received from the sale of the gold would be sufficient to enable the Proponent to achieve an acceptable profit level whilst undertaking all environmentally-related tasks and meeting all commitments in all approvals, licences and permits and those made to the local community.

#### 6.2.2.6 Conclusion

The approach taken in planning the Project has been multi-disciplinary, involved consultation with community representative groups, potentially affected local residents and various government agencies and emphasis on the application of safeguards to minimise potential environmental, social and economic impacts. The design of the Project has addressed each of the sustainable development principles, and on balance, it is concluded that the proposed Tomingley Gold Project achieves a sustainable outcome for the local and wider environment.

# 6.3 JUSTIFICATION OF THE PROJECT

## 6.3.1 Introduction

In assessing whether the development and operation of the Project is justified, consideration has been given both to the predicted residual impacts on the local and wider environment and the potential benefits the Project would have for the Proponent, surrounding land owners and residents, the Tomingley and Peak Hill communities (including Aboriginal community), the local LGAs of Narromine, Parkes and (to a lesser extent) Dubbo, NSW and Australia. When considering the predicted residual impacts, a review of the proposed controls, safeguards and mitigation measures prepared by the Proponent was also undertaken to determine the emphasis placed on impact minimisation and the incorporation of the principles of ESD.

This section also considers the consequences of the Project not proceeding.

## 6.3.2 Biophysical Considerations

### 6.3.2.1 Introduction

**Table 6.2** presents the range of mitigated residual impacts on the biophysical environment predicted should the Project proceed based on the assessments summarised in Section 4. The residual impacts considered being of greatest significance and the proposed management of these are summarised in the following sub-sections.

### 6.3.2.2 Noise

Noise modelling completed as part of the noise assessment for the Project (SLR, 2011), predicts the Project would generate noise levels greater than those currently experienced in the vicinity of the Mine Site. Initial noise modelling indicated that without the implementation of noise mitigation measures, the increase in noise levels received at residences surrounding the Mine Site would exceed the nominated intrusiveness criteria, i.e. background noise + 5dB(A). The construction of the 15m high outer wall of Waste Rock Emplacements 2 and 3 and operation of mobile equipment behind this assisted in reducing the noise levels received, in particular within the village of Tomingley, however, did not result in the predicted noise levels being reduced such that compliance with the intrusiveness criteria during the night time was achieved.

Acknowledging that operation of the processing plant must continue 24 hours a day, additional noise mitigation measures were considered and applied.

- It was determined that the cost associated with reducing the individual sound power level (SPL) of the mobile equipment to be operated on the Mine Site could not be sustained. That is, the costs of retro-fitting an existing mobile fleet with noise attenuating features, or purchasing new mobile equipment with such noise attenuation in-built cannot be supported by Project economics.
- Attenuation of noise generated by the crushing circuit, through the enclosing of the secondary crusher and screen tower to achieve a reduction in the emitted SPL of at least 8dB, was applied.
- Further restrictions on the number and location of the various mobile equipment were modelled.

This modelling demonstrates that with limited exception, the noise levels predicted to be received at residences surrounding the Mine Site would comply with the intrusiveness criteria during the day time and evening periods. Elevated noise levels up to 4dB above the intrusiveness criteria are predicted (during the day time) at only three residences during the initial 3 month construction period. These exceedances are predicted largely as a result of the operation of scrapers and therefore would only occur during the short soil stripping campaigns on the Mine Site.

Exceedances of the intrusiveness criteria during the night time have been reduced, both in the size of the exceedance and frequency of occurrence, as far as reasonably and feasibly possible through the application of the noise mitigation measures described in Section 4.2.5. Critically, the scale of exceedance has been reduced to no more than 2dB, a difference unlikely to be noticeable to most people, at all but one residence (R3). Furthermore, the period of time when exceedances are likely is generally restricted to a period of no more than 12 to 15 months (when operations are equivalent to those simulated by Scenarios 2 and 3).

To ensure noise levels do not exceed the modelled predictions, the Proponent proposes to implement real-time noise monitoring at the potentially most affected location (at the southern end of Tomingley village). This monitoring would enable mine management to have an accurate real-time record of the noise levels being received at this residence. This would ensure that restrictions or modifications to operations could be made as and when noise levels approach or reach the intrusiveness criteria or the levels predicted by noise modelling.

The Proponent has committed to implementing further noise mitigation controls at residence R3, and/or any other residence at which the measured noise levels exceed intrusiveness criteria by more than 2dB, on request of the resident, e.g. air conditioning, window treatment (such as double glazing).

#### 6.3.2.3 Surface Water Resources

The conclusion of the surface water assessment (SEEC, 2011) is that there would be limited residual impacts to surface water as a result of the Project. In fact, as a result of the proposed surface water management structures such as catch banks and sediment basins, the quality of water (total suspended solids, total nitrogen, total Phosphorous) discharged from the Mine Site during and following the completion of the Project would be improved on current water quality. This notwithstanding, the Proponent would implement appropriate mitigation measures if it was determined that impacts to surface water resources have occurred as a result of the Project.

#### 6.3.2.4 Groundwater Resources

The groundwater impact assessment (Impax, 2011) determined that while the mining operations could drawdown the water table surrounding the Mine Site, there would be minimal impact on groundwater quality or access to groundwater by surrounding users as a result of the Project. The Proponent would, however, implement appropriate mitigation measures if it is determined that impacts to groundwater resources have occurred as a result of the Project, e.g. through leaching of contaminated groundwater from the RSF or reduced yields within bores surrounding the Mine Site.

#### 6.3.2.5 Biodiversity

Based on the conclusions of the biodiversity assessment for the Project (OzArk, 2011a), the following residual impacts relating to biodiversity would result.

The Project would result in the removal of approximately 21.6ha of remnant native woodland vegetation. Of this 2.7ha is considered to meet the classification of the NSW listed Inland Grey

Box Woodland EEC and 0.9ha meets the classification of the NSW listed Fuzzy Box on Alluvials EEC. However, this minor impact is assessed as being appropriately offset by the proposed establishment and management of a biodiversity offset strategy which provides for:

- the conservation of 21.1ha (in moderate to good condition) and enhancement of a further 21.5ha (in low condition) of the Inland Grey Box Woodland EEC (Benson 76);
- the conservation of 5.1ha (in moderate to good condition) and enhancement of a further 26.0ha (in low condition) of the Fuzzy Box on Alluvials EEC (Benson 201);
- the conservation of 17.2ha (in moderate to good condition) and 17.2ha (in low condition) of Belah/Black Oak Western Rosewood, Wilga Woodland (Benson 57); and
- the conservation of 13.1ha (in moderate to good condition) and enhancement of a further 13.5ha (in low condition) of River Red Gum riverine woodland forest (Benson 78).

When considered using the BioBanking Assessment Methodology (DECC, 2008d), the TGP BOS provides for a surplus of ecosystem credits when compared to those required for all but Community 5 (Benson 57). Overall, a surplus of 870 ecosystem credits is provided by the TGP BOS and, given two of the communities for which surplus credits are provided are EEC's (Benson 76 – 369 surplus credits and Benson 201 – 284 surplus credits), the TGP provides for conservation of "like for like <u>or better</u>" vegetation (see Section 4.5.8.2.2).

The proposed biodiversity offset strategy satisfies each of DECCW's nominated principles for biodiversity offsets (DECC, 2008c) (see Section 4.5.8.2.4).

In addition, the Proponent proposes to rehabilitate various areas of disturbance on the Mine Site using native vegetation (see **Figure 2.18**).

On the basis of the above, it is assessed that the Project would result in 'no net loss' of biodiversity locally and would potentially lead to an improvement through the widening and connection of protected wildlife / habitat corridors.

#### 6.3.2.6 Cultural Heritage

In total, 57 sites of Aboriginal heritage sites were identified within the Project Site (19 on the Mine Site and 38 along the Tomingley Narromine Water Pipeline route). Of the 57 sites, impact to three sites (TGP-ST7, TPG-ST10 and TNWP-OS1 with PAD) would be unavoidable and a further four sites (TGP-OS1, TGP-OS2, TGP-ST8 and TGP-ST9) may potentially be impacted by the Project in the absence of appropriate management and mitigation measures.

Specific management measures for each site have been proposed and presented to the registered Aboriginal community stakeholders. No objection to the proposed methodology for further site assessment and management has been received from the registered Aboriginal stakeholders. Furthermore, support has been provided for the proposed management by the Traditional Owners of the Peak Hill / Tomingley area. The Proponent will continue to engage with the Aboriginal community to ensure that Aboriginal cultural heritage continues to be managed appropriately and sensitively.

#### 6.3.2.7 Air Quality

The air quality assessment for the Project (PAEHolmes, 2011), predicted that the probability of an exceedance of the maximum 24-hour $PM_{10}$ concentrations is 0.09% at up to six residences, i.e. one day every 3 to 4 years. The air quality modelling completed by PAEHolmes (2011) predicted compliance with all other annual emission criteria. Contribution to greenhouse gas emissions, even accounting for Scope 3 emissions, would represent a maximum annual contribution of 0.04% to baseline 2008 NSW emissions.

Monitoring of emissions to air would be undertaken to ensure that the conservative predictions summarised above are correct. Should concentrations be noted to be approaching trigger criteria, relevant and contributing project operations would be identified and activity appropriately reduced until such time as the monitoring information provided confidence that concentrations had been reduced.

### 6.3.3 Socio-economic Considerations

While the impacts summarised in Section 6.3.2 have been assessed to comply with nominated criteria or to meet accepted environmental standards, the cumulative effect of these minor impacts may have some adverse effect on the amenity of the local setting.

Importantly, the Project would provide several economic benefits to the local and regional socio-economic setting, including the following.

- Direct full-time employment for approximately 100 full-time equivalent positions during the site establishment and up to 90 full-time equivalent positions during the operational phase of the Project.
- Employees would preferably be sourced from the region (Parkes, Narromine and Dubbo LGAs) and even if drawn from further afield, would be encouraged to reside locally.

Increased employment opportunities associated with the Project would have additional flow-on benefits including:

- the provision of new employment would provide an impetus to other local businesses;
- contribution of $28.6 million per year to the local and regional economy through wages and purchases of local goods and services; and
- support of local community services and projects.

The Project would provide for the continued diversification of development / industry in the region which would lead to increased training and employment opportunities for the residents of the region.

The socio-economic benefits of the Project would also flow through to the economies of NSW and Australia. It is anticipated that the Project would contribute approximately $20.4 million per year to the State and national economy through purchases of goods and services within NSW and Australia.

It is acknowledged that while impacts on the biophysical environment have been assessed as complying with nominated criteria or meeting accepted environmental standards, the cumulative effect of these minor impacts may have some adverse effect on the socio-economic setting. This is often expressed as a reduction in the amenity of the local area.

An objective assessment of this impact on local amenity is difficult as what one person may consider as acceptable, may not be to another person (and vice versa). However, where all biophysical impacts are assessed as complying with nominated criteria or standards, it is considered unlikely for impacts on local amenity to be unacceptable to a reasonable person.

It is further noted that the Proponent remains accountable for managing the Project in a manner that complies with the nominated environmental criteria and meets reasonable community expectations. A comprehensive monitoring program would be established to demonstrate compliance with environmental criteria, and liaison with both official and unofficial community representation would continue to address community concerns as they arise.

### 6.3.4 Planning Considerations

#### 6.3.4.1 Introduction

This subsection reviews the compliance of the Project with local and State planning instruments. It is noted that whilst the relevance of these instruments may change in the future, the following represents the application of these in their current form to the Project as described in Section 2.

#### 6.3.4.2 Permissibility

As noted in Section 3.3.4.1, mining is permissible within the Mine Site by virtue of its location within Zone 1(a) (General Rural) of the Narromine LEP 1997 which identifies mining as being permissible with consent.

#### 6.3.4.3 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The SEPP specifies matters requiring consideration in the assessment of any mining, petroleum production and extractive industry development, as defined in NSW legislation. **Table 3.1** presents a summary of each element requiring consideration and a reference to the section in the *Environmental Assessment* where this is addressed.

#### 6.3.4.4 State Environmental Planning Policy (Infrastructure) 2007

In accordance with Clause 101 of the Infrastructure SEPP, the Mine Site:

- provides vehicular access other than the classified road, i.e. Main Site Access Road;
- provides for the safe construction and operation of the Newell Highway underpass;
- provides for visual screening of Mine Site activities; and
- would not be sensitive to adverse impacts from the classified road.

#### 6.3.4.5 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33)

The transport, storage and use of sodium cyanide and LPG required a *Preliminary Hazard Analysis* (PHA) under the SEPP 33 (in accordance with DoP, 2008) to be conducted (**Appendix 3**). The PHA confirms that with the implementation of various safeguards and controls, the risks associated with sodium cyanide and LPG would be reduced to a Tolerable level and hence the Project does not represent a hazardous industry. SEPP 33 is not required to be considered further.

#### 6.3.4.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)

The Ecological Assessment completed by OzArk (2011a) has confirmed that one of the species listed in Schedule 2 of SEPP 44 is found within the Project Site. The proportion of these feed tree species within the canopy would vary across the Project Site (due to the 46km linear distance covered by the water pipeline route), however, in accordance with the precautionary principle, the woodland vegetation of the Project Site could be regarded as "potential Koala habitat". However, fauna surveys failed to identify any signs of Koala habitation of the area and therefore the Project Site is not considered core Koala habitat. No Koala Management Plan is therefore required, however, the Proponent has committed to undertaking Pre Clearance Inspections to ensure that no Koalas are present within these areas prior to clearing.

### 6.3.5 Consequences of not Proceeding with the Project

The consequences of not proceeding with the Project include the following.

- The recoverable gold resource would not be mined. Such an outcome would be contrary to the objective of I&I NSW and the Proponent to maximise resource utilisation.
- The opportunity to create up to 100 construction and 90 operational full-time jobs would be foregone.
- The contribution of $28.6 million per year to the local and regional economy through wages and purchases of local goods and services would be foregone.
- The opportunity to re-establish an industry historically associated with the region would be foregone, along with the training opportunities proposed by the Proponent. This loss of training opportunities would also reduce the ability of the local communities to retain younger people who generally are lost from regional communities to pursue opportunities elsewhere.
- Approximately $20.4 million per year in rates, taxes and royalties would be foregone to the local, State and national governments annually.
- The minor impacts on the local biophysical environment would not eventuate.

It is considered that the benefits of proceeding with the Project therefore far outweigh the minor impacts on the environment that would result.

## 6.4 CONCLUSION

The proposed Tomingley Gold Project has been designed, as far as practicable, to address the issues of concern to the community and all levels of government. The Project provides for the recovery of valuable gold resources which contribute significantly to the economies of NSW and Australia. The subsequent landform would be constructed to sustain agricultural operations, light industry and nature conservation.

This document and the range of specialist consultant studies undertaken have identified that the Project should proceed because it would:

- satisfy sustainable development principles;
- operate with risks to the local environment minimised to the greatest extent practicable through Project design and implementation of a range of environmental controls and safeguards;
- have a minimal and manageable adverse impact on the biophysical environment;
- have a substantial positive impact on the local and wider regional and NSW socio-economic environment;
- contribute to the continued economic activity of the Narromine, Parkes and Dubbo LGAs; and
- provide a site suitable for future agricultural activities and possibly light industry incorporating areas for long term nature conservation.

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# Section 7

# Glossary of Terms, Acronyms and Symbols

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# GLOSSARY OF ACRONYMS

**AADT** Annual Average Daily Traffic.

**AEMR** Annual Environmental Management Review.

**AGO** Australian Greenhouse Office.

**AHD** Australian height datum (in metres).

**AHIMS** Australian Heritage Information Management System.

**ANZECC** Australian and New Zealand Environment and Conservation Council.

**ARI** Annual Recurrence Interval

**AS** Australian Standard.

**dB(A)** decibels, A-weighted scale.

**DECC** (Former) Department of Environment and Climate Change (NSW).

**DECCW** (Former) Department of Environment Climate Change and Water (NSW).

**DSEWPaC** Department of Sustainability, Environment, Water, Heritage, Populations and Communities (Commonwealth).

**DoH** Department of Housing (NSW).

**DoP** (Former) Department of Planning (NSW).

**DP** Deposited Plan.

**DPI** Department of Primary Industries

**DPI-MR** (Former) Department of Primary Industries - Mineral Resources. (See I&I NSW).

**DP&I** Department of Planning and Infrastructure (NSW)

**DTIRIS** Department of Trade and Investment, Regional Infrastructure and Services

**DWE** (Former) Department of Water & Energy.

**EC** Electrical Conductivity.

**ECRTN** Environmental Criteria for Road Traffic Noise.

**EEC** Endangered Ecological Community

**EL** Exploration Licence.

**EPBC Act** *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).*

**EP&A Act** *Environmental Planning and Assessment Act 1979 (NSW).*

**ESD** Ecologically Sustainable Development.

**I&I NSW** (Former) Industry & Investment NSW.

**INP** Industrial Noise Policy.

**LALC** Local Aboriginal Land Council.

**LEP** Local Environmental Plan.

**LGA** Local Government Area.

**LPMA** (Former) Land & Property Management Authority (NSW).

**MIC** Maximum Instantaneous Charge

**ML** Mining Lease

**MLA** Mining Lease Application.

**MOP** Mining Operations Plan

**MR** Main Road

**NATA** National Association of Testing Authorities.

**NEPC** National Environment Protection Council.

**NEPM** National Environment Protection Measure.

**NHMRC** National Health and Medical Research Council.

**NOW** NSW Office of Water.

**NPW Act** *National Parks and Wildlife Act 1974 (NSW).*

**NPWS** (Former) National Parks and Wildlife Service (NSW).

**NVC Act** *Native Vegetation Conservation Act 1997 (NSW).*

**OEH** Office of Environment and Heritage (NSW)

**PHA** Preliminary Hazard Analysis

**PSA** Particle Size Analysis

**POEO Act** *Protection of the Environment Operations Act 1997 (NSW).*

**RH** Relative Humidity.

**ROM Pad** Run of Mine Pad

**RTA** Roads and Traffic Authority.

**RBL** Rating Background Level

**SEPP** State Environmental Planning Policy.

**SH** State Highway.

**SR** Shire Road

**TDS** Total Dissolved Solids.

**TSC Act** *Threatened Species Conservation Act 1995 (NSW).*

**TSP** Total Suspended Particulate

**TSS** Total Suspended Solids

**WM Act** *Water Management Act 2000*.

# GLOSSARY OF SYMBOLS AND UNITS

| | |
|---|---|
| **$^{o}$** | degrees. |
| **$^{o}$C** | degrees Celsius. |
| % | percentage. |
| **$M** | million dollars. |
| < | less than. |
| ≤ | less than or equal to. |
| > | greater than. |
| ≥ | greater than or equal to. |
| **bcm** | bank cubic metre – a volume of 1m$^3$ in the ground prior to disturbance. |
| **cm** | centimetre (= 10mm). |
| **dB** | decibel, unit used to express sound intensity. |
| **dB(A)** | the unit of measurement of sound pressure level heard by the human ear, expressed in "A" scale. |
| **g** | gram (= 0.001 kilogram). |
| **g/m$^2$/month** | grams per square metre per month – unit for deposited dust. |
| **ha** | hectare (100m x 100m). |
| **kg** | kilogram (= 1 000 grams). |
| **kL** | kilolitre (= 1 000 litres). |
| **km** | kilometre (= 1 000 metres). |
| **km$^2$** | square kilometre (= 1 million m$^2$). |
| **km/hr** | kilometres per hour. |
| **kV** | kilovolts. |
| **kW** | kilowatts. |
| **L** | litre. |
| **lcm** | loose cubic metre – a volume of 1m$^3$ after excavation. |
| **L/s** | litres per second. |
| **$L_{A10}$** | sound level exceeded 10% of the sampling time. |
| **$L_{A90}$** | sound level exceeded 90% of the sampling time. |
| **$L_{Aeq}$** | the $L_{Aeq}$ is the "equal energy" average noise levels, and is used in some instances for the assessment of traffic noise effects or the risk of hearing impairment due to noise exposures. |
| **$L_{Aeq(1\ hour)}$** | the "equal energy" average noise level over 60 minutes – used for assessing impacts of noise from motor vehicles on public roads. |
| **$L_{Amax}$** | the absolute maximum noise level measured in a given time interval. |
| **m** | metre. |
| **m AHD** | metres Australian Height Datum. |
| **M** | million. |
| **m$^2$** | square metre. |
| **m$^3$** | cubic metre. |
| **m/s** | metres per second. |
| **Mbcm** | million bank cubic metres. |
| **mg** | milligram (weight unit = 0.001 gram). |
| **mg/L** | milligrams per litre (parts per million). |
| **ML** | megalitre. |
| **mm** | millimetre (= 0.001 metres). |
| **mm/s** | millimetres per second |
| **Mt** | million tonnes (metric tonne = 1 000kg). |
| **Mtpa** | million tonnes per annum. |

**NTU** Nephelometric turbidity units.

**$PM_{10}$** particulate matter <10μm in diameter.

**SWL** standing water level.

**t** tonne (= 1 000kg).

**tpa** tonnes per annum.

**V:H** vertical to horizontal ratio

**μS/cm** microsiemens per centimetre – unit of electrical conductivity

**μm** micrometres (= 0.001mm)

**μg/m$^3$** micrograms (1 x $10^{-6}$ grams) per cubic metre

# GLOSSARY OF TERMS

**A horizon** – part of soil profile immediately below the topsoil.

**activated carbon –** a form of carbon that has been processed to make it extremely porous and thus to have a very large surface area available for adsorption or chemical reactions

**adverse weather conditions (in respect of dust)** – conditions, such as high wind, that assist the movement of dust from the mine towards receptors.

**adverse weather conditions (in respect of noise)** – conditions, such as temperature inversions or gentle winds (<3m/s) from the mine towards receptors.

**aerial photograph** – a photograph of the landscape taken from a plane (typically covering several kilometres across) used for the surveying and interpretation of vegetation type, geology, land use, etc.

**aerial survey** – survey of a landscape from an aeroplane, typically involving aerial photography, to determine specific characteristics (e.g. mineral potential or land use).

**airblast overpressure** – a shock wave from a blast transmitted through the air, normally measured in dB(Linear).

**air pollutant** – a substance in ambient atmosphere, resulting from the activity of man or from natural processes, causing adverse effects to man and the environment (also called "air contaminant").

**air pollution emissions inventory** – all information, collection and processing system containing data on emissions of, and sources of, air pollution from both man-made and natural causes.

**air quality criteria** – quantitative relationship between a pollutant's dose, concentration, deposition rate or any other air quality-related factors, and the related effects on receptors, e.g. humans, animals, plants, or materials. Air quality criteria serve as the scientific basis for formulating ambient air quality standards or objectives.

**alkaline** – having a pH greater than 7.0.

**alluvial** – pertaining to material, such as sand or silt, deposited by running water (e.g. a creek or river).

**ambient level** – existing level of a phenomenon without the influence of the project.

**amenity** – the desirability of an area.

**amphibian** – animals (such as frogs) adapted to live both on land and in water.

**anecdotal evidence** – informal, oral or written evidence of an event.

**aquifer** – rock or sediment capable of holding and transmitting groundwater; a layer of water-bearing material which is permeable and can transmit significant quantities of water.

**aquitard** – a layer of water-bearing material which is relatively impermeable and cannot transmit significant quantities of water.

**arboreal** – pertaining to tree habitats.

**archaeology** – the scientific study of human history, particularly the relics and cultural remains of the distant past.

**artefact** – anything made by human workmanship, particularly by previous cultures (such as chipped and modified stones used as tools).

**atmospheric stability** – a measure of turbulence which determines the rate at which the effluent is dispersed as it is transported by the wind.

**attenuation** – reduction in sound pressure levels between two locations.

**average annual daily traffic (AADT)** – unit of assessment of traffic flow along a road.

**average annual rainfall** – the average amount of rain to fall at a specific location over the period of 1 year (measured in millimetres).

**B horizon** – subsoil material located below the A horizon material and above the parent rock.

**background dust level** – dust level in the absence of mining and processing activities.

**background noise level** – the level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (eg sound from a particular noise source; or sound generated for test purposes).

**bank cubic metre –** a volume of $1m^3$ in the ground prior to disturbance.

**baseline monitoring** – monitoring performed prior to site development.

**batter** – an engineered slope of soil or rock fill on either side upslope or downslope of a road, embankment or mine waste storage.

**bench** – a horizontal step in the face of a quarry or mine which could be up to 1m to 5m wide (if terminal).

**biodiversity offset strategy** – a method of providing for disturbance attributable to the project through additional or compensatory measures.

**blasting** – the operation of breaking rock by means of explosives.

**bore** – a well, usually of less than 20cm diameter, sunk into the ground and from which water is pumped.

**bulldozer** – an item of tracked mobile earth moving equipment fitted with a front blade and with rear rippers used for pushing and ripping soil and rock.

**bund** – embankment of clay or weathered rock emplaced for visual or acoustic screening or to control surface water flow.

**carved tree** – tree carved to signify an important site, e.g. ceremonial or burial site.

**catch bank** – an earth bank constructed to divert water away from disturbed areas.

**catchment area** – the area determined by topographic features within which rainfall will contribute to runoff at a particular point.

**cation** – an ion having a positive charge and characteristically moving toward a negative electrode.

**Carbon in Leach (CIL) Process** – the process by which gold is removed from carbonaceous material. Cyanide solution is added to crushed ore to dissolve the gold. Activated carbon is then added onto which the gold is adsorbed. The gold bearing carbon is then heated and passed through a series of electrowinning cells, where the gold plates onto the stainless steel cathodes.

**channel** (natural) – river or irrigation channel, includes bed and bank.

**channel** (surface water control structure) – extraction used to intercept and redirect runoff.

**clay** – a size term denoting particles, regardless of mineral composition, with diameter less than 0.004 mm.

**community** – a combination of plants that are dependent on their environment and influence one another and modify their own environment. They form together, with their common habitat and other associated organisms, an ecosystem, which is also related to neighbouring ecosystems and to the macroclimate of the region.

**concentration** – the amount of a substance, expressed as mass or volume, in a unit volume of air.

**conductivity** – the measurement of the ability of a substance (either a measure of solid, liquid or gas) to transmit electricity; a measure of the salt content.

**conservation** – the management of resources in a way that will benefit both present and future generations.

**contour bank** – an earth bank constructed across a slope parallel to contours.

**cross-section** – a two-dimensional representation of an area presented as if the area had been cut along its length.

**crusher** – that part of a processing plant where the coal is mechanically crushed into smaller pieces.

**crushing** – the mechanical process of reducing rock size usually by pressure or impact.

**culvert** – large pipe or channel carrying water underneath a structure (eg. a road).

**cumulative** – increasing by successive additions.

**cyanide** – a chemical compound that contains the cyano group (C≡N). Cyanide is used to dissolve gold and silver from ore.

**cyclone** – a classifier that makes use of centrifugal forces that greatly accelerate the rate at which particles separate. The centrifugal force is generated by injecting the feed slurry under pressure.

**day time (noise)** – that period of the day between 7:00am and 6:00pm.

**decibel** – unit expressing difference in power between acoustic signals.

**density** – 1. The mass of a substance (e.g. sediment) divided by its volume; water has a density of exactly 1 kilogram per litre;
2. The coverage of vegetation (e.g. trees) per unit of distance (along a linear transect) or unit of area (in an area transect).

**dispersibility** – a characteristic of soils relating to their structural breakdown in water into individual particles.

**Dore** – gold bars smelted at the mine Site which commonly contain 95% gold. Dore may contain small concentrations of silver, copper and traces of other metals.

**drainage line** – a passage along which water concentrates and flows towards a stream, drainage plain or swamp intermittently during or following rain.

**drawdown** – the difference between the water level observed during pumping and the non-pumping water level (static water level or static head).

**drilling** – the action of boring holes (usually less than 30 centimetres in diameter and up to several kilometres deep) into the ground, typically to establish a water bore or to investigate the geology found at depth.

**dust** – particles of mostly mineral origin generated by erosion of surfaces and the mining and handling of materials.

**dust concentration** – the amount of a substance, expressed as mass or volume, in a unit volume of air.

**electrical conductivity (EC)** – the ability of a substance (either solid, liquid or gas) to transmit electricity, often used as a measure of salinity.

**ecology** – the relationship between living things and their environment.

**ecologically sustainable development (ESD)** – using, conserving and enhancing the community's resources so that ecological processes on which life depends are maintained and the total quality of life, now and in the future can be increased.

**ecosystem** – the totality of biological processes and interactions within a specified physical environment.

**emission** – a discharge of a substance (e.g. dust) into the environment.

**environment** – a general term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms (including human beings) exists.

**environmental constraint** – limitation on a project by components of the existing environment.

**environmental policy** – statement by an organisation of its intentions and principles, in relation to the overall environmental performance, which provides a framework for action and for the setting of its environmental objectives and targets.

**ephemeral** – not permanent, e.g. a stream that flows only seasonally or after rainfall or a lake that periodically dries out.

**erodibility** – the tendency of soil, earth or rock to erode.

**erosion** – the wearing away of the land surface (whether natural or artificial) by the action of water, wind and ice.

**erosion potential** – the susceptibility of a parcel of land to the prevailing agents of erosion. It is dependent on a combination of climate, landform, soil, land use and land management factors.

**evaporation** – the loss of water as vapour from the surface of a liquid that has a temperature lower than its boiling point.

**evening (noise)** – that period of the day between 6:00pm and 10:00pm.

**excavate** – to dig into natural material or fill using an excavator or other machinery.

**excavator** – item of earth moving equipment fitted with a bucket on an articulated boom and used for digging material from a face in front of, or below the machine.

**existing air quality** – the quality of the ambient air near ground level, expressed as concentrations or deposition rates or air pollutants – also expressed as ambient air quality.

**exotic** – introduced or foreign, not native.

**fauna** – a general term for animals (birds, reptiles, marsupials, fish etc.) particularly in a defined area or over a defined time period.

**front-end loader** – machine used to lift and place soil, earth, rocks, etc. on a construction site.

**fugitive emission** – emission not entering the atmosphere from a stationary vent (stack). Examples of fugitive dust sources include vehicular traffic on unpaved roads, handling of raw materials, wind erosion of dusty surfaces, etc.

**geotechnical** – technical or engineering aspects relating to soil, rock and other materials.

**grader** – an item of earthmoving equipment, rubber tyred and fitted with a centrally mounted blade and rippers used to shape and trim the ground surface.

**gradient** – rate of change of a given variable (such as temperature or elevation) with distance.

**grassland** – an extensive area of largely treeless land covered mainly by natural grasses.

**greenhouse** – the heating of the earth's surface because outgoing long-wavelength radiation from the earth is absorbed and re-emitted by the carbon dioxide and water vapour in the lower atmosphere and eventually returns to the surface.

**ground vibration** – oscillatory motion of the ground caused by the passage of seismic waves originating from a blast.

**groundcover** – vegetation that grows close to the ground (such as grasses and herbs) providing protection from erosion.

**groundwater** – all waters occurring below the land surface; the upper surface of the soils saturated by groundwater in any particular area is called the water table.

**groundwater depression** – localised lowering of the regional water table.

**habitat** – the place where an organism normally lives; habitats can be described by their floristic and physical characteristics.

**haul road** – road used in a mine for haulage of material mined and for general site access.

**haul truck** – a truck specifically designed for off-road hauling of material mined.

**head (hydraulic head)** – energy contained in a water mass, produced by elevation, pressure or velocity.

**heritage** – the things of value which are inherited.

**heritage significance** – of aesthetic, historic, scientific, cultural, social, archaeological, natural or aesthetic value for past, present or future generations.

**hydraulic gradient** – the direction of flow of groundwaters.

**hydrogeology (geohydrology)** – the study of groundwater and the related geologic aspects of surface waters.

**impact** – the effect of human induced action on the environment.

**in situ** – a term used to distinguish material (e.g. rocks, minerals, fossils, etc.) found in its original position of formation, deposition, or growth, as opposed to transported material.

**infiltration** – the process of surface water soaking into the soil.

**in-flow** – flow directed into a particular feature, such as a lake or a mine pit.

**infrastructure** – the supporting installations and services that supply the needs of a project eg. road or rail.

**inter-generational equity** – the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

**intermittent** – flows periodically, irregularly.

**invertebrate** – commonly, animals without a backbone (jellyfish, worms, molluscs, etc.).

**ion** – an atom or compound that has gained or lost an electron, so that it is no longer electrically neutral but carries a positive or negative charge.

**landform** – a specific feature of a landscape (such as a hill) or the general shape of the land.

**loam** – loose soil composed of clay and sand, especially a kind containing organic matter and of great fertility.

**Local Environmental Plan (LEP)** – a plan developed by a council to control development in part or all of their shire or municipality.

**long-term** – a period of time often associated with annual air quality standards. Long-term models usually address pollutant concentrations over several seasons to one year.

**mammal** – animal of the class mammalia, distinguished by the presence of hair and mammary glands.

**maximum instantaneous charge (MIC)** – the maximum amount of explosives detonated during each delay during a blast.

**migratory** – passing, usually predictably (based on aquatic species), from one region or climate to another, for purposes of feeding, breeding, or other biological purposes.

**mine site** – that area of the Project Site where mining, processing and related activities would be undertaken.

**mitigation measure** – measure employed to reduce (mitigate) an impact (such as the construction of a perimeter bund to reduce sound emissions).

**mobile equipment** – wheeled or tracked self propelled equipment such as trucks and front-end loaders.

**monitoring** – systematic sampling and, if appropriate, sample analysis to record changes over time caused by impacts such as mining; the regular measurement of components of the environment to understand a feature of the environment and/or establish that environmental standards are being met.

**native** – said of an organism or group of organisms that is restricted to a particular region or environment. A local inhabitant of a place.

**natural** – existing in, or formed by, nature (generally excludes anything obviously modified by human beings).

**neutral** – neither acidic nor basic (e.g. a pH equal to 7.0).

**night time (noise)** – that period of the day between 10:00pm and 7:00am.

**noxious** – introduced species considered to be harmful to native species or to the habitat of native species.

**nutrient** – generally refers to nitrogen and phosphorus, which are essential for biological growth.

**particle size distribution** – the relative proportions of particles (e.g. in a sediment) that fall within specific size categories.

**particulate matter** – small solid or liquid particles suspended in or falling through the atmosphere - sometimes expressed by the term particulates.

**peak particle velocity (ppv)** – a measure of ground vibration reported in millimetres per second (mm/sec).

**perennial** – refers to stream which has flow throughout the year or plant that lives for more than two growing seasons.

**permeability** – a material property relating to the ability of the material to transmit water.

**pH** – a measure of the degree of acidity or alkalinity of a solution; expressed numerically (logarithmically) on a scale of 1 to 14, on which 1 is most acid, 7 is neutral acid, and 14 is most basic (alkaline).

**piezometer** – a core drilled specifically for the monitoring of groundwater levels and water quality.

**pollution** – the alteration of air, soil, or water as a result of human activities such that it is less suitable for any purpose for which it could be used in its natural state.

**population** – a group of organisms all of the same species occupying a particular area.

**potable** – water suitable for human consumption.

**precautionary principle** – where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation; a principle of ESD which states that decisions about any proposed development should be guided by careful management to avoid serious and irreversible damage to the environment.

**progressive rehabilitation** – rehabilitation of mine or disturbed areas as soon as practicable after they are released during the life of the mine or after the final landform is achieved.

**Project approval** – approval for a project granted by the Minister for Planning Part 3A of the *Environmental Planning & Assessment Act.*

**Project Site** – the area of land which corresponds with the area of application for development consent and the Mining Lease Application area.

**quadrat** – a square survey area.

**quantify** – to determine the quantity or amount of a component in a substance.

**recharge** – the addition of water to an aquifer, directly from the surface, indirectly from the unsaturated zone, or by discharge from overlying or underlying aquifer systems.

**rehabilitation** – the preparation of a final landform after mining and its stabilisation with grasses, trees and shrubs. In mining, rehabilitation means restoring mined land so that it can be used for the same or some other purpose after mining has finished.

**relative humidity** – the ratio of actual moisture in the air to the amount the air could hold if saturated, at a given temperature.

**remnant native vegetation** – native vegetation remaining after widespread clearing has taken place.

**reptile** – cold-blooded vertebrates, including lizards, snakes, turtles, and crocodiles.

**reserves** – in the mining context refers to those parts of a resource where sufficient information is available to undertake mine planning.

**resources** – an estimate of potentially usable magnetite and limestone in a defined area based on preliminary information.

**revegetation** – replacement of vegetation, principally grasses and legumes on areas disturbed by mining activities.

**riparian** – pertaining to a river or stream bank.

**runoff** – that portion of the rainfall falling on a catchment area that flows from the catchment past a specified point.

**saline** – water with high salt concentration.

**salinity** – the dissolved content of water expressed in terms of milligrams per litre.

**scarred tree** – tree with cuts in its bark or wood made by Aborigines.

**screening** – a process which separates crushed rock into various size fractions – this usually involves a mechanical vibration of the rock over a series of decks fitted with steel mesh, steel plate or polyurethane or rubber mats with fixed sized apertures.

**sediment** – material such as mud and sand that has been moved and deposited by water, ice or wind.

**sediment basin** – a small excavation designed to trap the coarse material washed from disturbed areas.

**sequence (geological)** – layers of (predominantly) sedimentary rocks sourced from a common geological environment or period.

**silt** – a classic sediment, most of the particles of which are between 0.063mm and 0.004mm in diameter.

**solubility** – the ability of a substance (such as copper) to dissolve in a solvent (such as water); solubility depends on such factors as temperature and pH.

**species** – a taxonomic grouping of organisms that are able to interbreed with each other but not with members of other species.

**species diversity** – a measure of the number of different species in a given area.

**stable** – used with respect to the atmospheric boundary layer, when the vertical temperature gradient is greater than the adiabatic lapse rate. Vertical air motions are suppressed. The turbulence intensity is low resulting in poor dispersion conditions.

**stakeholder** – person, group or organisation or company with an interest in an activity or outcome.

**stockpile** – a pile used to store material for future use.

**storage capacity** – the maximum volume of liquid able to be retained in a container (e.g. a reservoir or lake).

**stormwater** – surface water runoff immediately after rainfall.

**stratigraphy** – the succession and age of strata of rock and unconsolidated material. Also concerns the form, distribution and lithologic composition of the strata.

**stripping** – removal of vegetation and topsoil.

**structure (soil)** – the physical texture of the soil arising from the interrelationship between the grain size, composition, and organic nature of a soil.

**subsoil** – the layer of soil lying below the topsoil; usually contains less organic matter and is less fertile.

**surface water** – all water flowing over, or contained on, a landscape (e.g. runoff, streams, lakes etc).

**suspended solids** – analytical term applicable to water samples referring to material recoverable from the sample by filtration.

**sustainable development** – development that meets the needs of the present without compromising the ability of future generations to meet their needs (World Commission on Environment and Development 1990).

**temperature inversion** – a weather term for a surface defining the boundary between two layers of air or different temperatures; generally used in meteorology with respect to an increase of temperature with height in contrast with the usual decrease of temperature with height in the troposphere. An inversion layer is distinguished by its large stability, which limits the turbulence and therefore the dispersion of pollutants.

**terrestrial** – of or relating to the land, as distinct from air or water.

**texture (of soil)** – variations in composition, grain size distribution, and structure.

**topography** – the physical relief and contour of a region.

**topsoil** – the surface or upper layer of soil, usually containing more organic material, viable life forms, seeds and nutrients than the subsoil beneath it.

**total suspended particulates (TSP)** – the mass of all particulate matter suspended in a solution.

**total suspended solids** – a common measure used to determine suspended solids concentrations in a waterbody and expressed in terms of mass per unit of volume (e.g. milligrams per litre).

**tributary** – a stream or river that flows into a larger river or lake.

**waste rock** – in the mining context refers to non-economic material to be removed to allow access to the resource.

**weed** – any plant (in particular an herbaceous one) that survives in an area where it is harmful or troublesome to the desired land use.

**wildlife corridor** – a strip of vegetation that has a design purpose of allowing animals to pass from one area to another and acting as an undisturbed area for wildlife preservation.

**wind direction** – the direction from which the wind, averaged over a certain period of time, is blowing.

**wind erosion** – wearing away of exposed soil, earth, or rock surfaces by the abrasive action of wind-blown particles (e.g. grains of sand).

**wind rose** – diagrammatic representation of wind direction, strength, and frequency of occurrence over a specified period.

**woodland** – plant communities dominated by trees whose crowns shade less than 30% of the ground.

**yield** – (of a water bore) 1) the capacity of the bore to produce water. 2) the amount of water actually withdrawn.

# Section 8

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# Appendices



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# Appendix 1

# Application for Project Approval

(No. of pages including blank pages = 8)

Note: Since submission of the application for project approval, Capital Investment Value (CIV) for the Tomingley Gold Project has been reviewed (with reference to Department of Planning Circular PS 10-008 "*New Definition of Capital Investment Value*", dated 10 May 2008). The CIV for the Project has now been calculated as $65.6M

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# Major project application

NSW GOVERNMENT
**Department of Planning**

Date duly made: 5 / 8 / 09

Project application no. 09_0155

## 1. Before you lodge

This form is required to apply for the approval of the Minister to carry out a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* (the Act) applies.

Before lodging this application, it is recommended that you first consult with the Department of Planning (the Department) concerning your project.

A Planning Focus Meeting may need to be held for this project involving the Department, relevant agencies, council or other groups identified by the Department. If a Planning Focus Meeting is held, the Department will issue the Director-General's requirements for the Environmental Assessment following the meeting.

**Disclosure statement**

Persons lodging applications are required to declare reportable political donations (including donations of or more than $1,000) made in the previous two years.

For more details, including a disclosure form, go to **www.planning.nsw.gov.au/donations**.

**Lodgement**

All applications must be lodged with the Director-General of the Department of Planning, by courier or mail. An electronic copy should also be emailed to the assessment contact officer assigned to the project.

NSW Department of Planning
Ground floor, 23–33 Bridge Street, Sydney NSW 2000
GPO Box 39 Sydney NSW 2001
Phone 1300 305 695.

## 2. Details of the proponent

Company/organisation/agency: Alkane Resources Ltd

ABN: 35000689216

☐ Mr ☐ Ms ☐ Mrs ☐ Dr ☐ Other

First name:

Family name:

Position:

STREET ADDRESS

Unit/street no.: 129

Street name: Edward Street

Suburb or town: Perth

State: WA

Postcode: 6000

POSTAL ADDRESS (or mark 'as above'): PO Box 8178

Suburb or town: Perth Business Centre

State: WA

Postcode: 6849

Daytime telephone: 08 9328 9411

Fax: 08 9227 6011

Mobile:

Email: ichalmers@alkane.com.au

## 3. Identify the land you propose to develop

STREET ADDRESS (where relevant)

Unit/street no.

Street or property name

Suburb, town or locality

Postcode

Local government area(s)

State electorate(s)

REAL PROPERTY DESCRIPTION

Note: The real property description is found on a map of the land or on the title documents for the land. If you are unsure of the real property description, you should contact the Department of Lands.

Please ensure that you place a slash (/) to distinguish between the lot, section, DP and strata numbers. If the project applies to more than one piece of land, please use a comma to distinguish between each real property description.

OR detailed description of land attached. ☒

MAP: A map of the site and locality should also be submitted with this application.

## 4. Major project description and other requirements

Provide a brief title for your project.

Tomingley Gold Project

Approval is sought for construction and operation of the following.

- Three open cuts.
- Three waste rock emplacements.
- A processing plant and residue storage facility.
- An approximately 46km water pipeline from a licensed bore located approximately 7km to the east of Narromine to the Mine Site located immediately south of the village of Tomingley in central NSW.
- An approximately 19km 66kV power transmission line from Peak Hill to the Mine Site.
- Associated infrastructure, including amenity bunds, site access and haul roads, an underpass under the Newell Highway, offices and other facilities and a substation and transformers.

In addition, relocation of sections of an existing 22kV power distribution line and telecommunications cables would also be required.

Finally, approval is sought for construction and rehabilitation of a final landform suitable for a final land use of nature conservation, agriculture, tourism or light industry.

PROJECT APPROVAL

If you are applying for approval of a project, include in the project title, all significant components for which approval is being sought. If the application relates to part only of a project, the project title should reflect this.

Is the application for approval of a project? ☒ Yes ☐ No

Is the application related to part only of a project? ☐ Yes ☒ No

CONCEPT PLAN APPROVAL

If you are applying for approval of a concept plan, include in the project title, all components for which approval 'in concept' is being sought. If the application also relates to approval of a project, a description of this should also be included in the project title.

Is the application for approval of a Concept Plan? ☐ Yes ☒ No

Is a project application being made concurrently for all or part of the project? ☐ Yes ☒ No

**You are also required to provide a Project Description and address any matters required by the Director-General in accordance with section 75E or section 75M of the Act. Failure to do so may lead to your application being rejected.**

Is a Project Description attached? ☒ Yes ☐ No

Does the Project Description include any additional matters required by the Director-General under section 75E or section 75M of the Act? ☐ Yes ☒ No

Note: An electronic copy of the project description is also required as all applications must be provided on the Department's website. You should contact the Department on the correct electronic format.

ESTIMATED CAPITAL INVESTMENT VALUE

Please indicate the estimated capital investment value (CIV) of the project. The CIV includes all costs necessary to establish and operate the project, including the design and construction of buildings, structures, associated infrastructure and fixed or mobile plant and equipment (but excluding GST and land costs).

$50 million

EQUIVALENT FULL-TIME JOBS

Please indicate the number of jobs created by the project. This should be expressed as a proportion of full time jobs over a full year.

| | |
|---|---|
| Construction jobs (full-time equivalent) | approximately 90 |
| Operational jobs (full-time equivalent) | approximately 60 |

## 5. Approvals from State agencies

Does the project require any of the following: (tick all that are appropriate)

- ☐ an aquaculture permit under section 144 of the *Fisheries Management Act 1994*
- ☐ an approval under section 15 of the *Mine Subsidence Compensation Act 1961*
- ☒ a mining lease under the *Mining Act 1992*
- ☐ a production lease under the *Petroleum (Onshore) Act 1991*
- ☒ an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act)
- ☒ a consent under section 138 of the *Roads Act 1993*
- ☒ a licence under the *Pipelines Act 1967*

## 6. Landowner's consent or notification

As the owner(s) of the above property, I/we consent to this application being made on our behalf by the proponent:

| Land | Land |
|---|---|
| Signature | Signature |
| Name | Name |
| Date | Date |

Note: Under clause 8F of the *Environmental Planning and Assessment Regulation 2000* (the Regulation), certain applications for approval under Part 3A of the Act do not require the consent of the landowner, however, the proponent is required to give notice of the application:

- in the case of linear infrastructure projects, by notice in a newspaper circulating in the locality prior to the commencement of the public consultation period,
- in the case of mining or petroleum production projects, by notice in a newspaper circulating in the locality within 14 days of this application being made,
- in the case of critical infrastructure projects, to the owner of the land within 14 days of this application being made, and
- in other cases, to the owner of the land at any time before the application is made.

## 7. Political donation disclosure statement

Persons lodging applications are required to declare reportable political donations (including donations of or more than $1,000) made in the previous two years. Disclosure statements are to be submitted with your application or request.

Have you attached a disclosure statement to this application?

☐ Yes

☒ No

Note: For more details about political donation disclosure requirements, including a disclosure form, go to **www.planning.nsw.gov.au/donations**.

## 8. Proponent's signature

As the proponent(s) of the project and in signing below, I/we hereby:

- provide a description of the project and address all matters required by the Director-General pursuant to section 75E and/or section 75M of the Act, and
- apply, subject to satisfying clause 8D of the Environmental Planning and Assessment Regulation, for the Director-General's environmental assessment requirements pursuant to Part 3A of the Act, and
- declare that all information contained within this application is accurate at the time of signing.

| Signature | In what capacity are you signing if you are not the proponent |
|---|---|
| Name | |

D. Ian Chalmers

Name, if you are not the proponent

Date
23 July 2009

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# Appendix 2

# Director-General's Requirements and Coverage of Key Assessment Requirements in the *Environmental Assessment*

- Correspondence from the Director-General Department of Planning – 9 September 2009
- Table A2-1: Coverage of Director-General's Requirements in the *Environmental Assessment*
- Table A2-2: Policies, Guidelines & Plans Referenced by DGRs
- Table A2-3: Coverage of Requirements nominated by other Government Agencies in the *Environmental Assessment*

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NSW GOVERNMENT
**Department of Planning**

**Major Development Assessment**
Contact Kane Winwood
Phone: (02) 9228 6298
Fax: (02) 9228 6466
Email: kane.winwood@planning.nsw.gov.au

Mr Ian Chalmers
Managing Director
Alkane Resources Limited
PO Box 8178
PERTH BUSINESS CENTRE WA 6849

Dear Mr Chalmers

**Tomingley Gold Project (09_0155)**
**Director-General's Requirements**

I refer to your application for the above Project.

I have attached a copy of the Director-General's requirements for the project. These requirements have been prepared in consultation with the relevant agencies and are based on the information your company has provided to date. I have also attached a copy of the agencies' comments for your information.

Please note that the Director-General may alter these requirements at any time.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of the Environment, Water, Heritage and the Arts in Canberra (6274 1111 or http://www.environment.gov.au) to determine if the project will require an approval under the EPBC Act. The Commonwealth Government has accredited the NSW environmental assessment process, so if it is determined that an approval is required under the EPBC Act, please contact the Department immediately as supplementary Director-General's requirements may need to be issued.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit your Environmental Assessment for the project to determine the:

- applicable fee (see Division 1A, Part 15 of the *Environmental Planning and Assessment Regulation 2000)*; and
- number (hard-copy and CD-ROM) of copies of the Environmental Assessment that will be required for exhibition purposes.

Once it receives the Environmental Assessment, the Department will review in consultation with the relevant agencies to determine if it adequately addresses the Director-General's requirements, and may require you to revise it prior to public exhibition.

The Department is required to make all the relevant information associated with the project publicly available on its website. Consequently, I would appreciate it if you would ensure that all the documents you subsequently submit to the Department are in a suitable format for the web, and arrange for an electronic version of the Environmental Assessment to be hosted on a suitable website during the exhibition period.

If you have any enquiries about these requirements, please contact Kane Winwood.

Yours sincerely

Chris Wilson
**Executive Director**
**Major Projects Assessment**
as delegate of the Director-General

# Director-General's Requirements

**Section 75F of the *Environmental Planning and Assessment Act 1979***

| | |
|---|---|
| **Application Number** | 09_0155 |
| **Project** | The Tomingley Gold Project, which includes:<br>• constructing, operating and rehabilitating an open cut gold mine and associated infrastructure;<br>• extracting and processing up to 1 million tonnes of gold ore per year for up to 9 years; and<br>• transporting the processed ore from the site via road. |
| **Location** | Approximately 53 kilometres southwest of Dubbo |
| **Proponent** | Alkane Resources Limited |
| **Date of Issue** | 9 September 2009 |
| **General Requirements** | The Environmental Assessment must include<br>• an executive summary;<br>• a detailed description of the project including:<br>– the need for the project;<br>– a detailed resource and land use assessment;<br>– alternatives considered, including a detailed justification for the proposed mine plan;<br>– likely staging of the project; and<br>– plans of any proposed building works;<br>• a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment;<br>• a detailed assessment of the key issues specified below and any other significant issues identified in the risk assessment (see above), which includes:<br>– a description of the existing environment and its values, using sufficient baseline data;<br>– an assessment of the potential impacts of all stages of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below);<br>– a description of the measures that would be implemented to avoid, minimise and, if necessary, offset the potential impacts of the project, and ensure that the project is in the public interest and meets the net benefit test<br>– detailed contingency plans for managing any potentially significant risks to the environment;<br>• a statement of commitments;<br>• a conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning and Assessment Act 1979*, including the principles of ecological sustainable development; and<br>• a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading. |
| **Key Issues** | • **Noise and Blasting** – including construction, operational and road traffic noise;<br>• **Soil and Water** – including:<br>– a detailed site water balance;<br>– a detailed groundwater model;<br>– potential water quality impacts on the environment and other land users, including a geochemical assessment of the potential leachate impacts; and |

Department of Planning, 23-33 Bridge Street (GPO Box 39), Sydney, NSW 2001
Website www.planning.nsw.gov.au

4

| | |
|---|---|
| | – a description of final void water management;<br>• **Hazards** – including a detailed description of the measures and safeguards that would be implemented to minimise the risks associated with transporting, handling and using cyanide.<br>• **Biodiversity** – including:<br>– accurate estimates of any vegetation disturbance associated with the project<br>– impacts on threatened species, populations or ecological communities; critical habitats; and native vegetation generally;<br>– a detailed description of the measures that would be implemented to maintain or improve the biodiversity values region in the medium to long term;<br>• **Visual** – including landform and lighting impacts;<br>• **Heritage** – both Aboriginal and non-Aboriginal;<br>• **Air Quality;**<br>• **Traffic** – including a detailed description of the measures that would be implemented during construction and operation to minimise impacts on the Newell Highway and Tomingley West Road;<br>• **Waste** – including:<br>– accurate estimates of the quantity and nature of the potential waste streams of the project;<br>– a detailed description of the measures that would be implemented to minimise, reuse, recycle and dispose of any waste produced on site, including tailings and waste rock;<br>• **Energy** – calculate the scope 1, 2 and 3 emissions of the mining operations and describe what measures would be implemented to ensure these operations are energy efficient;<br>• **Rehabilitation**– including a detailed strategy that describes:<br>– how the site would be progressively rehabilitated and integrated into the landscape; and<br>– what measures would be put in place for the long term protection and management of the site following cessation of mining, taking into consideration any relevant strategic land use planning or resource management plans or policies; and<br>• **Socio-economic**. |
| **References** | The environmental assessment of the project must take into account relevant State Government guidelines, policies and plans. While not exhaustive, the following attachment contains a list of some guidelines, policies and plans that may be relevant to the environmental assessment of this project on the existing and proposed development in the vicinity of the site. |
| **Consultation** | During the preparation of the Environmental Assessment, you should undertake an appropriate level of consultation with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners.<br><br>In particular you must consult with the:<br>• Commonwealth Department of Environment, Water, Heritage and the Arts;<br>• Department of Environment, Climate Change and Water;<br>• Department of Industry and Investment;<br>• Department of Transport and Infrastructure;<br>• NSW Heritage Office;<br>• Department of Services, Technology & Administration;<br>• De[art,emt pf Transport and Infrastructure; and<br>• Parkes and Narromine Shire Councils.<br><br>Both the consultation process, and the issues raised during this consultation process, must be described in the environmental assessment. |
| **Deemed Refusal Period** | 90 days |

**Table A2-1**
**Coverage of Director-General's Requirements in the *Environmental Assessment***

Page 1 of 3

| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | **GENERAL** | |
| DoP (09/09/09) | The Environmental Assessment must include | |
| | • an executive summary; | ES-1 |
| | • a detailed description of the project including: | |
| | – the need for the project; | 6.3 |
| | – a detailed resource and land use assessment; | 1.3.3, 2.14.5 |
| | – alternatives considered, including a detailed justification for the proposed mine plan; | 6.1 |
| | – likely staging of the project; and | 2.4.5 |
| | – plans of any proposed building works; | 2.2 |
| | • a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment; | 3.5 |
| | • a detailed assessment of the key issues specified below and any other significant issues identified in the risk assessment (see above), which includes:<br>– a description of the existing environment and its values, using sufficient baseline data;<br>– an assessment of the potential impacts of all stages of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below);<br>– a description of the measures that would be implemented to avoid, minimise and, if necessary, offset the potential impacts of the project, and ensure that the project is in the public interest and meets the net benefit test<br>– detailed contingency plans for managing any potentially significant risks to the environment; | Throughout Section 4 |
| | • a statement of commitments; | Section 5 |
| | • a conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning and Assessment Act 1979*, including the principles of ecological sustainable development; and | 6.2 & 6.3 |
| | • a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading. | iii |
| | **KEY ISSUES** | |
| DoP (09/09/09) | • **Noise and Blasting** – including construction, operational and road traffic noise; | 4.2 |
| | • **Soil and Water** – including: | 4.3, 4.4, 4.12 |
| | – a detailed site water balance; | 4.3.5.5 |
| | – a detailed groundwater model; | 4.4.5.2, 4.4.6 |
| | – potential water quality impacts on the environment and other land users, including a geochemical assessment of the potential leachate impacts; and | 4.4.7.2 |
| | – a description of final void water management; | 4.4.7.3 |

**Table A2-1 (Cont'd)**
**Coverage of Director-General's Requirements in the *Environmental Assessment***

Page 2 of 3

| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | • **Hazards** – including a detailed description of the measures and safeguards that would be implemented to minimise the risks associated with transporting, handling and using cyanide. | 4.13 |
| | • **Biodiversity** – including:<br>– accurate estimates of any vegetation disturbance associated with the project<br>– impacts on threatened species, populations or ecological communities; critical habitats; and native vegetation generally;<br>– a detailed description of the measures that would be implemented to maintain or improve the biodiversity values region in the medium to long term; | <br>2.14.8.1, 4.5.7.3<br>4.5.8.3 to 4.5.8.7<br>2.14.8, 4.5.7 |
| | • **Visual** – including landform and lighting impacts; | 4.8 |
| | • **Heritage** – both Aboriginal and non-Aboriginal; | 4.6 & 4.7 |
| | • **Air Quality**; | 4.9 |
| | • **Traffic** – including a detailed description of the measures that would be implemented during construction and operation to minimise impacts on the Newell Highway and Tomingley West Road; | 4.11 |
| | • **Waste** – including:<br>– accurate estimates of the quantity and nature of the potential waste streams of the project;<br>– a detailed description of the measures that would be implemented to minimise, reuse, recycle and dispose of any waste produced on site, including tailings and waste rock; | <br>2.8<br>2.8 |
| | • **Energy** – calculate the scope 1, 2 and 3 emissions of the mining operations and describe what measures would be implemented to ensure these operations are energy efficient; | 4.9.7.2 |
| | • **Rehabilitation** – including a detailed strategy that describes:<br>– how the site would be progressively rehabilitated and integrated into the landscape; and<br>– what measures would be put in place for the long term protection and management of the site following cessation of mining, taking into consideration any relevant strategic land use planning or resource management plans or policies; and | 2.14<br>2.14.6<br>2.14.5, 2.14.7 & 2.14.8 |
| | • **Socio-economic**. | 2.12, 4.14 & 6.3.3 |
| **REFERENCES** | | |
| DoP (09/09/09) | The environmental assessment of the project must take into account relevant State Government guidelines, policies and plans. | Throughout |
| **CONSULTATION** | | |
| DoP (09/09/09) | Consultation during the preparation of the Environmental Assessment, you should undertake an appropriate level of consultation with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners. | 3.2 |

**Table A2-1 (Cont'd)**
**Coverage of Director-General's Requirements in the *Environmental Assessment***

Page 3 of 3

| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | In particular you must consult with the:<br>• Commonwealth Department of Environment, Water, Heritage and the Arts;<br>• Department of Environment, Climate Change and Water;<br>• Department of Industry and Investment;<br>• Department of Transport and Infrastructure;<br>• NSW Heritage Office;<br>• Department of Services, Technology & Administration;<br>• Department of Transport and Infrastructure; and<br>• Parkes and Narromine Shire Councils. | 3.2.2 |
| | Both the consultation process, and the issues raised during this consultation process, must be described in the environmental assessment. | 3.2 |

**Table A2-2**
**Policies, Guidelines & Plans Referenced by DGRs**

Page 1 of 2

| Parameter | Guideline |
|---|---|
| **Risk** | |
| | AS/NZS 4360:2004 Risk Management (Standards Australia) |
| | HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia) |
| | Risk Management Handbook for the Mining Industry (DPI) |
| | Risk Management Policy Framework for Dam Safety (Dam Safety Committee) |
| **Noise & Blasting** | |
| | NSW Industrial Noise Policy (DECC) |
| | Environmental Criteria for Road Traffic Noise (NSW EPA) May 1999 |
| | Environmental Noise Management Manual (RTA) Dec 2001 |
| | Interim Construction Noise Guideline (DECC) |
| | Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC) Sep 1990 |
| | Assessing Vibration: a technical guideline (DEC) Feb 2006 |
| **Soil and Water** | |
| *Soil* | Rural Land Capability Mapping (DLWC) |
| | Agricultural Land Classification (DPI) |
| | Draft Guidelines for the Assessment & Management of Groundwater Contamination (DECC) |
| *Surface Water* | National Water Quality Management Strategy: Water quality management - an outline of the policies (ANZECC/ARMCANZ) |
| | National Water Quality Management Strategy: Policies and principles - a reference document (ANZECC/ARMCANZ) |
| | National Water Quality Management Strategy: Implementation guidelines (ANZECC/ARMCANZ) |
| | National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ) |
| | National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ) |
| | Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC) |
| | State Water Management Outcomes Plan |
| | NSW Government Water Quality and River Flow Environmental Objectives (DECC) |
| | Managing Urban Stormwater: Soils & Construction (Landcom) |
| | Managing Urban Stormwater: Treatment Techniques (DECC) |
| | Managing Urban Stormwater: Source Control (DECC) |
| *Groundwater* | National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC) |
| | NSW State Groundwater Policy Framework Document (DLWC) |
| | NSW State Groundwater Quality Protection Policy (DLWC) |
| | NSW State Groundwater Quantity Management Policy (DLWC) Draft |
| **Hazards** | |
| | State Environmental Planning Policy No. 33 – Hazardous and Offensive Development |
| | Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DUAP) |
| | Multi-Level Risk Assessment |
| | Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis |

**Table A2-2 (Cont'd)**
**Policies, Guidelines & Plans Referenced by DGRs**

Page 2 of 2

| Parameter | Guideline |
|---|---|
| **Biodiversity** | |
| | Draft Guidelines for Threatened Species Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* (DEC) |
| | NSW Groundwater Dependent Ecosystem Policy (DLWC) |
| | Policy & Guidelines - Aquatic Habitat Management and Fish Conservation (NSW Fisheries) |
| | Policy & Guidelines - Fish Friendly Waterway Crossings (NSW Fisheries) |
| **Heritage** | |
| *Aboriginal* | Ask First; A Guide to Respecting Indigenous Heritage Places and Values (AHC) 2002 |
| | Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC) |
| *Non- Aboriginal* | The Australia ICOMOS Burra Charter for Places of Cultural Significance 1999 |
| | The Australian Natural Heritage Charter (For the Conservation of Places of Natural Heritage Significance) 2nd ed. 2002 |
| | Statements of Heritage Impact (NSW Heritage Office) |
| | NSW Heritage Manual: Assessing Heritage Significance (NSW Heritage Office) 2001 |
| | NSW Heritage Manual: Conservation Management Documents 1996 |
| | NSW Heritage Manual: Heritage Terms and Abbreviations 1996 |
| | Historical Archaeology Code of Practice (NSW Heritage Council DoP) 2006 |
| **Air Quality** | |
| | Protection of the Environment Operations (Clean Air) Regulation 2002 |
| | Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC) |
| | Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC) |
| **Traffic & Transport** | |
| | Guide to Traffic Generating Development (RTA) |
| | Road Design Guide (RTA) |
| **Waste** | |
| | NSW Waste Avoidance and Resource Recovery Strategy 2007 (DECC) |
| | NSW Waste Avoidance and Resource Recovery Strategy Performance Report 2006 (DECC) |
| | Waste Classification Guidelines: Part 1 Classification of Waste (DECC) 2008 |
| **Greenhouse Gas** | |
| | AGO Factors and Methods Workbook (AGO) |
| | Guidelines for Energy Savings Action Plans (DEUS, 2005) |
| **Rehabilitation** | |
| | Strategic Framework for Mine Closure (ANZMEC & Minerals Council of Australia) |
| | Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia) |
| | Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia) |

**Table A2-3**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***

Page 1 of 24

| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | **GENERAL** | |
| RTA (28/08/09) | • The construction of the mine can be expected to generate additional traffic accessing the existing Highway rest area. The RTA may have requirements for an intersection upgrade to cater for additional traffic movements; this will be at full cost to the developer. | 2.2.4, 2.2.5, 2.9.3.2 & 4.11.4 |
| | • The developer will be required to submit a construction traffic management plan to address management of construction traffic accessing the site prior to the underpass being complete | Noted |
| | • Road Safety Audits are to be conducted at the design and pre-opening stages in accordance with Austroads (2009) Guide to Road Safety Part 6; Road Safety Audit. The developer is responsible for mitigating deficiencies noted within the audit report. This is relevant for works impacting on the Newell Highway | Noted |
| I&I NSW (02/09/09) | **Mineral Resources Issues** | |
| | • Mining operations for this proposal will require the grant of a mining lease. Any mining lease granted will include the Mining Rehabilitation Environmental Management Process (MREMP). | Noted |
| | • Alkane will be required to prepare and comply with the MREMP which includes the preparation of a Mining Operations Plan (MOP) and an Annual Environments Management Report (AEMR). | Noted |
| | **Mineral Resource/Geology** | |
| | The EA must provide an overview of the regional and local geology in addition to the geology of the deposit (stratigraphy, structure etc) and out line in the size of the mineral resource to be mine and how this has been determined. The EA will also need to demonstrate that sufficient investigative drilling has been undertaken within areas of proposed infrastructure development to minimise possible sterilisation of valuable mineral resources. | 4.1.4 & 1.3 |
| | **Mine Planning** | |
| | A description of the mining sequence and layout is required. Processing techniques including the use of cyanide, destruction method and discharge levels will also need to be documented. | 2.4 |
| | **Landform Design/Management** | |
| | • Visual Amenity – A description of the visual impact and mitigation measures should be given. Consideration should be given to the aesthetics to Tomingley village, the surrounding rural area and the Newell Highway which dissects the site. | 4.8.4 |
| | • Open Cuts – A description of the open cut pit geotechnical stability (especially Caloma due to its close proximity to the highway). | 2.4.2 & 2.4.3 |
| | • Residue Storage Facilities – A description of residue storage facility design, including final cover design, should be given. The company should also demonstrate that permeability rates for the floor of the facility meet with current standards. A description of the characterization of residue also needs to be provided. | 2.7 |
| | As this facility is located near a creek line a description of the flood mitigation measures are to be provided. | 4.3.5.3 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| I&I NSW (02/09/09) | • Waste Rock Emplacements – A description of the final landform design should be given including final surface water management. Waste rock characterization should detail the types of waste produced and the management and handling proposed to ensure long term stability of any potential leachates. | 2.5 |
| | • Rehabilitation and Revegetation – Progressive rehabilitation methods are to be described including the management of topsoil and subsoil. A description of sediment and erosion control will also need to be provided.<br>Vegetation types and species are required to be documented. A description of potential species selection to be used in the regeneration of the area for future land use should also be given. | 2.14 |
| | **Closure** | |
| | • Stakeholder Liaison – A commitment to effectively liaise with relevant stakeholders and the community regarding mine closure and concepts are to be documented. | 3.2 |
| | • Final Land Use – Conceptual final landforms are to be documented, including final surface water drainage design. Final land use options are to be consistent with relevant planning, environmental, rural and community values. | 2.14.4, 2.14.5 & 4.14.3.1 |
| | **Monitoring** | |
| | • Monitoring should include the provision of baseline data before mining commences, continuing to the end of mine life to ensure that the mining area is not contributing to any long term environmental degradation. | Throughout Section 4 |
| | • Parameters should be measured by licensing conditions and consultation with Industry and Investment NSW. | |
| DECCW (28/08/09) | In summary, the Departments' key information requirements for the proposal are: | |
| | 1. The impact on threatened flora and fauna species, and endangered ecological communities and their habitats. | 4.5.8.6 |
| | 2. The impact on vegetation communities (in addition to threatened species) and provision of an offset strategy that will be implemented to ensure a maintain or improve outcome for biodiversity. | 4.5.8.3 |
| | 3. The impact on noise and vibration amenity. | 4.2.6 |
| | 4. The impact of potential acid generation from waste rock, including proposed methods of encapsulation. | 2.5 |
| | 5. The impact on surface water and groundwater quality and quantity (including water demand and management requirements). | 4.3.5 & 4.4.7 |
| | 6. The impact on Aboriginal Cultural Heritage. | 4.6.9 |
| | 7. The impact on air quality (including odour). | 4.9.7 |
| | 8. The management of cyanide onsite and in transport. | 2.6.3.3, 2.6.4 & 2.7 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| DECCW (28/08/09) | **Objectives of the Proposal** | |
| | The objectives of the proposal should be clearly stated and refer to: | |
| | a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced | Section 2 |
| | b) a life cycle approach to the production, use or disposal of products | Section 2 |
| | c) the anticipated level of performance in meeting required environmental standards and cleaner production principles | Section 4 |
| | d) the staging and timing of the proposal and any plans for future expansion | 2.4.5 |
| | e) the proposal's relationship to any other industry or facility. | Section 2 |
| | **Description of the Proposal** | |
| | Outline the production process including: | |
| | a) the environmental "mass balance" for the process – quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill, etc) | Section 2 |
| | b) any life-cycle strategies for the products. | Section 2 |
| | Outline cleaner production actions, including: | |
| | a) measures to minimise waste (typically through addressing source reduction) | 2.8 |
| | b) proposals for use or recycling of by-products | 2.8 |
| | c) proposed disposal methods for solid and liquid waste | 2.5, 2.6.3.3 & 2.8 |
| | d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points | 4.9 |
| | e) water management system including all potential sources of water pollution, proposals for re-use, treatment, etc., emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge | 4.3 & 4.4 |
| | f) soil contamination treatment and prevention systems. | 4.13.7.2 |
| | Outline construction works including: | |
| | a) actions to address any existing soil contamination | N/A |
| | b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site) | 2.3 |
| | c) construction timetable and staging; hours of construction; proposed construction methods | 2.2, 2.4.5 & 2.11 |
| | d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures. | Throughout Section 4 |
| Parkes Shire Council (14/08/09) | • Ensure adequacy of social infrastructure and housing for Tomingley and Peak Hill. This may need some detailed analysis of where the work force may come from. | 4.14.2 |
| | • The EA should include detail on any consultation with the CSIRO in respect of how the construction and operation of the mine may impact on the Parkes Radio Telescope. | N/A |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | • Some more detail on the specific route the power line from Peak Hill may take and how this may impact on Parkes Shire Roads. | N/A |
| | **CONSIDERATION OF ALTERNATIVES AND JUSTIFICATION OF THE PROPOSAL** | |
| DECCW 28/08/09 | Consider the environmental consequences of adopting alternatives, including alternative: | |
| | a) sites and site layouts | 6.1.3 |
| | b) access modes and routes | 2.9.3.4 |
| | c) materials handling and production processes | N/A |
| | d) waste and water management | 6.1.6 |
| | e) impact mitigation measures | Throughout Section 4 |
| | f) energy sources | N/A |
| | Selection of the preferred option should be justified in terms of:<br>a) ability to satisfy the objectives of the proposal<br>b) relative environmental and other costs of each alternative<br>c) acceptability of environmental impacts and contribution to identified environmental objectives<br>d) acceptability of any environmental risks or uncertainties<br>e) reliability of proposed environmental impact mitigation measures<br>f) efficient use (including maximising re-use) of land, raw materials, energy and other resources. | Section 6.1 |
| | **EXISTING ENVIRONMENT** | |
| DECCW 28/08/09 | Provide an overview of the affected environment to place the proposal in its local and regional environmental context including: | |
| | a) meteorological data (e.g rainfall, temperature and evaporation, wind speed and direction) | 4.1.3 |
| | b) topography (landform element, slope type, gradient and length) | 4.1.2 |
| | c) surrounding land uses (potential synergies and conflicts) | 4.1.5 |
| | d) geomorphology (rates of landform change and current erosion and deposition processes) | 4.3.2 |
| | e) soil types and properties (including erodibility; engineering and structural properties; dispersibility; permeability; presence of acid sulfate soils and potential acid sulfate soils) | 4.12.2.3 |
| | f) ecological information (water system habitat, vegetation, fauna) | 4.5.2, 4.5.3 & 4.5.5 |
| | g) availability of services and the accessibility of the site for passenger and freight transport. | N/A |
| | **IDENTIFICATION AND PRIORITISATION OF ISSUES** | |
| DECCW 28/08/09 | Provide an overview of the methodology used to identify and prioritise issues. | Section 3 |
| | Provide a summary of the outcomes of the process including: | |
| | a) all issues identified including local, regional and global impacts (eg increased/ decreased greenhouse emissions) | 3.4 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | b) key issues which will require a full analysis (including comprehensive baseline assessment) | 3.5 |
| | c) issues not needing full analysis though they may be addressed in the mitigation strategy | 3.5.2 |
| | d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment). | 3.5.2 |
| | **CUMULATIVE IMPACTS** | |
| DECCW 28/08/09 | Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute. | Throughout Section 4 |
| | Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region. | 4.9, 4.2, 4.3 & 4.4 |
| | Identify infrastructure requirements flowing from the proposal (e.g. water and sewerage services, transport infrastructure upgrades). | 2.10.3 |
| | Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (eg. travel demand management strategies). | 4.14 |
| | **ABORIGINAL HERITAGE** | |
| DECCW 28/08/09 | **Aboriginal Cultural Heritage Assessment** | |
| | **a) <u>Aboriginal Community Group/s Consultation</u>**<br>Applicants should contact (as early as possible) local Aboriginal community groups, including: Local Aboriginal Land Councils, any known Tribal Elders Corporations and Native Title Claimants to ensure that proper consultation processes are carried out. Local Aboriginal community groups will require time to consider a proposal and to discuss any issues with its members, and sufficient time must be allowed for this to occur.<br>The purpose of Aboriginal participation in the assessment process is:<br>• To notify the local Aboriginal people in sufficient detail and in a timely manner about activities or developments which may impact on Aboriginal heritage, so that their concerns and possible options for action can be identified on a fully informed basis;<br>• To ensure that Aboriginal people who hold cultural knowledge, including native title holders or applications, are able to contribute to the assessment process in ways that are culturally acceptable to them;<br>• To identify locations and cultural values of Aboriginal sites and places of significance to the Aboriginal community that may be affected by the proposal so that potential impacts can be avoided wherever possible; and<br>• To identify whether there are culturally acceptable mitigative measures when impacts are considered to be unavoidable by the applicant.<br>It is essential that applicants provide the DEC with documentation from the Aboriginal community groups regarding their views and recommendations for actions. | 3.2.1.5 & 4.6.5 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | **b) Aboriginal Cultural Heritage Assessment Report**<br>The report should contain:<br>1. Information on the nature, timing and location of consultation, including the identification of individuals and/or groups consulted and copies of any correspondence from those individuals and/or groups;<br>2. A statement of the Aboriginal community group/s understanding of the values of the known Aboriginal site/s and/or Aboriginal place located on the development site. This may include social, spiritual, historic, and archaeological values.<br>3. A statement of the Aboriginal community groups response to the development and their recommendations (if any) for mitigation of impacts and/or conservation of known Aboriginal sites and/or Aboriginal place/s.<br><br>The results of this assessment must be integrated with the technical (archaeological) assessment and provide the basis for the final assessment of Aboriginal heritage values and recommendations for management options. The DEC will also require a clear demonstration .in the development application of how the proponent proposes to address any issues which have been raised as part of the Aboriginal cultural assessment, and whether. This is acceptable to the Aboriginal community. | 4.6 and Part 5 of the SCSC |
| | **Archaeological Assessment** | |
| | a) Locational Context<br>• description of location of study.<br>• legislative context.<br>• cadastral context (eg: Lot, DP)<br>• identification of any associated Aboriginal cultural heritage studies undertaken in the study area | 4.6.4 |
| | b) Description of Development Impact<br>• type of development.<br>• extent of direct impacts.<br>• extent of potential indirect impacts (eg: run-off, increased visitation)<br>• flexibility of project design<br>• staging and how this might affect present or future management decisions | Section 2, 4.6.8, 4.6.9 and Part 5 of the SCSC |
| | c) Assessment Context<br>• the brief for the work being undertaken for this particular project<br>• objectives of the assessment | 4.6 and Part 5 of the SCSC |
| | d) Archaeological Context<br>• targeted review of known archaeology of region and previous work in the study area to identity range of expected archaeological evidence relative to the project and landscape.<br>• type/s of Aboriginal sites.<br>• **synthesis** and **evaluation** of this information to identify archaeological issues. This will provide the basis for defining the archaeological assessment and management context relevant to this study, and the development of appropriate management options, with protection/conservation being the primary consideration. It should be noted that a summary of previous work is not adequate. | 4.6.4, 4.6.7 & 4.6.8 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***

Page 7 of 24

| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | e) Landscape Context<br>• description of landscape classification and land units being used for the study (at the different levels of landscape, landscape unit, landform, topographic unit)<br>• identification of any paleo-features<br>• assessment of how the landscape context and previous land surface change is relevant to the study<br>• assessment of how the landscape relates to models of site location and archaeology (as per synthesis above), and development of a framework for assessing the sites and landscapes within the study area<br>• identification of areas of archaeological sensitivity.<br><br>The landscape analysis may need to include a geomorphic study to ensure that significant features are identified and considered in the overall assessment (e.9.: paleofeatures with the potential to include older sites). | 4.6.4, 4.6.6, 4.6.7.6 and Part 5 of the SCSC |
| | f) Condition of Landsurface<br>• identify previous land surface impacts across the study area, with the view to assessing whether sites may be buried such as campsites, burials, and the integrity of the land surface in those locations.<br>• description of ground surface conditions and supporting tabulated data (for surveys).<br>• assessment of how the land surface conditions have revealed, concealed, destroyed, impacted on or preserved archaeological evidence and how this relates to archaeological potential, the condition of Aboriginal sites and the geomorphology in these contexts | 4.6.6 and Part 5 of the SCSC |
| | g) Methodology for Investigation<br>• description of input from the Aboriginal community to the method proposed for undertaking the study<br>• the proposed field methodology, such as type of sampling strategies and survey coverage (this should be targeted to the objectives of the study)<br>• description of the scope and method of recording and analysis by which the objectives of the study will be achieved<br>• the method whereby a clear and supportable significance assessment will be undertaken a supportable rationale for any proposed test excavations<br>• the program of work<br>• rationale for any variation in the methods adopted o test excavation methodology, if relevant | 4.6.3, 4.6.4 and Part 5 of the SCSC |
| | h) Survey Coverage Data<br>• description of survey coverage and the effectiveness of that coverage for detecting potentially buried Aboriginal sites (this needs to be fully described and evaluated within the context of the objectives and the study plan. Specific methods are detailed in the DEC Standards & Guidelines Kit) | 4.6.7 and Part 5 of the SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***

Page 8 of 24

| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | i) Analysis and Reporting<br>• detailed Aboriginal site description/s including tabulated data summarising site content and any analysis, as per the DEC Guidelines<br>• comprehensive evaluation of the study results (for potentially buried archaeological deposits this includes incorporating the information on archaeological potential and the reliability of survey coverage)<br>results of test excavations, if relevant | 4.6.7, 4.6.8, 4.6.9 and Part 5 of the SCSC |
| | j) Archaeological Significance Assessment<br>• the significance criteria and attributes used for the assessment need to be fully supported by the information presented on the archaeological and landscape context of the site/s (e.g.: representativeness, items and landscape elements considered to be rare, information potential, social/historical values). The criteria for assessment need to be measurable. | 4.6.7.6 and Part 5 of the SCSC |
| | k) Conclusions of the Study<br>• evaluation of potential impacts on known Aboriginal sites and areas of<br>• archaeological sensitivity and potential (if relevant)<br>• establish clear relationship between significance assessment and impacts<br>• consideration of cumulative impact of development on comparable sites and landscapes at both a local and regional level consideration of various management options, **specifically identification of conservation options**, including on-site conservation and compensatory areas (for larger scale projects) . description of mitigation works required for specific sites to be impact on | 4.6.9 and Part 5 of the SCSC |
| | l) Management Options<br>• recommendations for conservation and other management options based on the results of the archaeological report and discussions with the land owner / manager and the Aboriginal community group/s<br>• incorporation of management options from Aboriginal community group/s where these relate to the management options being proposed for sites or places | 4.6.8 and Part 5 of the SCSC |
| | The following maps are required as a minimum (more detailed specifications are set out in the DEC Guidelines). Mapping should be at the same scale throughout the report.<br>• location of study area (1:25,000 map series where available, more detailed maps are useful additions)<br>• development layout if known, flexible components of design if applicable<br>• locations of previous survey undertaken and sites recorded (referred to in text) | Part 5 of the SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | • survey coverage data showing location and extent of different methods used<br>• land units and topographic information used<br>• land surface history highlighting the location and boundaries of the disturbed and intact deposits<br>• Aboriginal site locations<br>• A comprehensive glossary of terms used should also be provided. | |
| | **AIR QUALITY** | |
| DECCW<br>28/08/09 | Identify all sources of air emissions from the development.<br>*Note: emissions can be classed as either:*<br>• *point (eg emissions from stack or vent) or*<br>• *fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).* | *Appendix 3* of Part 6 of the SCSC |
| | Provide details of the project that are essential for predicting and assessing air impacts including:<br>a) the quantities and physio-chemical parameters (eg concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or stored<br>b) an outline of procedures for handling, transport, production and storage<br>c) the management of solid, liquid and gaseous waste streams with potential for significant air impacts. | Part 6 of the SCSC (*Appendix 3*)<br>Section 2 & 4.9.6<br>2.5, 2.6.3.3, 2.7 & 2.8 |
| | Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.<br>Describe surrounding buildings that may effect plume dispersion.<br>Provide and analyse site representative data on following meteorological parameters:<br>a) temperature and humidity<br>b) rainfall, evaporation and cloud cover<br>c) wind speed and direction<br>d) atmospheric stability class<br>e) mixing height (the height that emissions will be ultimately mixed in the atmosphere)<br>f) katabatic air drainage<br>g) air re-circulation. | Part 6 of the SCSC |
| | Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data. | 4.9.3 |
| | Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point. | 4.9.2 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | Estimate the resulting ground level concentrations of all pollutants. Where necessary (eg potentially, significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the DECCW. | 4.9.7 |
| | Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals. | 4.9.7.1 |
| | Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations. | 4.9.7.2 |
| | For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA/DECCW procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate. | N/A |
| | Outline specifications of pollution control equipment (including manufacturers performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes. | 4.9.6 |
| **ECOLOGICALLY SUSTAINABLE DEVELOPMENT** | | |
| DECCW<br>28/08/09 | Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving ESD, including:<br>a) an assessment of a range of options available for use of the resource, including the benefits of each option to future generations<br>b) proper valuation and pricing of environmental resources<br>c) identification of who will bear the environmental costs of the proposal. | 6.2.2 |
| **ECOLOGY** | | |
| I&I NSW<br>(02/09/09) | **Aquatic Ecological Assessment** | |
| | The aquatic ecological environmental assessment should include the following information.<br>• A recent aerial photograph (preferably colour) of the waterway crossings (or reproduction of such a photograph) should be provided.<br>• Area which may be affected either directly or indirectly by the development of the corridor of the proposed pipeline to the north of Tomingley and the proposed power transmission line to the south of Tomingley should be identified and shown on an appropriately scaled map (and aerial photographs).<br>• Description of aquatic and riparian vegetation should be presented and mapped.<br>• The extent of aquatic habitat removal or modification which may result from the proposed development.<br>• Details of the location of all waterway crossings along the water pipeline and the power transmission line, including any access tracks with details of various phases of construction. | 4.5.8.6.8 and Part 4 of the SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | • Details of the methodology (for example directional drilling, trenching, boring) at each waterway crossing. | 2.2.2.2 and Part 4 of the SCSC |
| | • Aspects of the management of the proposal, both during construction and after completion, which relate to impact minimisation, such as Environment Management Plans. A vegetation rehabilitation plan is to include the rehabilitation of the riparian zone damaged during waterway construction activities. | 4.5.7 |
| | **Key Issues** | |
| | • Directional Drilling for Sensitive Waterways – The Department's Aquatic Habitat Protection Unit (AHPU) is to be consulted with regards to the crossing methodology and site specific mitigation measures for each watercourse, particularly methods of dredging, trenching or directional drilling to be used in each waterway, and the proposed mitigation measures to protect riparian and aquatic habitat. The Department supports the use of directional drilling under waterways. While directional drilling generally achieves good outcomes, it is highlighted that appropriate contingency actions be detailed addressing potential problems that could be experienced during the process. Recovery operations for a damaged drill for instance may require dredging and reclamation activities. | Part 4 of the SCSC |
| | • Waterway Crossings – The AHPU also needs to be consulted with regards to the crossing methodology for the proposed Main Access Road across Gundong Creek. A classification scheme such as that used by the Department which classifies waterways into Class 1-4 habitats is available in the document *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* available on the website at http://www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/toolkit#Policies-&-guidelines. The Department has some concerns regarding the potential construction of temporary waterway crossings for heavy machinery during the pipeline construction and the powerline construction and maintenance. Badly designed and constructed waterways crossings can have significant impacts on fish populations. The design and construction of roads and tracks across all waterways should be undertaken in accordance with the document outlined above. | Part 4 of the SCSC |
| | • Threatened Species, populations and ecological communities – *Fisheries Management Act 1994* – The proposal should include a threatened aquatic species assessment (as per part 7A *Fisheries Management Act 1994*) to address whether there are likely to be any significant impacts on listed threatened species, populations or ecological communities listed under the *Fisheries Management Act 1994*.<br>• Riparian Buffer Zones – The Department's policy advocates the use of terrestrial buffer zones as per the *Policy and Guidelines Aquatic Habitat Management and Fish Conservation 1999* available on the Department's website at | Part 4 of the SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | http://www.fisheries.nsw.gov.au/pub/aquahab.htm. The guidelines state that "Terrestrial areas adjoining freshwater, estuarine or coastal habitats be carefully managed in order to minimise land use impacts on these aquatic habitats. As a precautionary approach, buffer zones at least 50 metres wide should be established and maintained where possible, with their natural features and vegetation preserved" particularly along Gundong Creek. | Part 4 of the SCSC |
| **NOISE AND BLASTING** | | |
| DECCW<br>28/08/09 | Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials. | 4.2.4 (including **Figures 4.11** to **4.15**) |
| | Specify the times of operation for all phases of the development and for all noise producing activities | |
| | For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations — diagrams should be to a scale sufficient to delineate individual residential blocks. | N/A |
| | Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality. | 4.2.2 & **Figure 4.9** |
| | Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas. | 4.1.5 |
| | Determine the existing background ($L_{A90}$) and ambient ($L_{Aeq}$) noise levels in accordance with the *NSW Industrial Noise Policy*. | 4.2.2 |
| | Determine the existing road traffic noise levels in accordance with the *NSW Environmental Criteria for Road Traffic Noise*, where road traffic noise impacts may occur. | 4.2.2 |
| | The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:<br>a) details of equipment used for the measurements<br>b) a brief description of where the equipment was positioned<br>c) a statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive locations(s)' and 'most affected locations(s)' described in Section 3.1.2 of the *NSW Industrial Noise Policy*<br>d) details of the exact location of the monitoring site and a description of land uses in surrounding areas<br>e) a description of the dominant and background noise sources at the site<br>f) day, evening and night assessment background levels for each day of the monitoring period<br>g) the final Rating Background Level (RBL) value | 4.2.2 and Part 1 of SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | h) graphs of the measured noise levels for each day should be provided<br>i) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section B1.3 of the *NSW Industrial Noise Policy*<br>j) determination of $L_{Aeq}$ noise levels from existing industry. | 4.2.2 and Part 1 of SCSC |
| | Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:<br>a) determination of the intrusive criterion for each identified potentially affected receiver<br>b) selection and justification of the appropriate amenity category for each identified potentially affected receiver<br>c) determination of the amenity criterion for each receiver<br>d) determination of the appropriate sleep disturbance limit. | 4.2.3 |
| | Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible effects on sleep. Where $L_{A1(1min)}$ noise levels from the site are less than 15 dB above the background $L_{A90}$ noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise*. | 4.2.3 & 4.2.6 |
| | Determine expected noise level and noise character (eg tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:<br>a) site establishment<br>b) construction<br>c) operational phases<br>d) transport including traffic noise generated by the proposal<br>e) other services.<br>*Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).* | 4.2.6 |
| | Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition. | 4.2.6 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | The noise impact assessment report should include:<br>a) a plan showing the assumed location of each noise source for each prediction scenario<br>b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site<br>c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc<br>d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated<br>e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions<br>f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate<br>g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived<br>h) an assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy*. | <br>**Figures 4.11** to **4.15**<br>**Table 4.17** & **Figures 4.11** to **4.15**<br>4.2.5<br>4.2.4 and Part 1 of SCSC<br>Part 1 of SCSC<br>4.2.6 and Part 1 of SCSC<br>4.2.4 (including **Figures 4.11** to **4.15**)<br>Part 1 of SCSC |
| | Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures. | 4.2.1.2.6 |
| | The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation. | 4.2.5 |
| | Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:<br>a) locations where the noise level exceeds the criteria and extent of exceedance<br>b) numbers of people (or areas) affected<br>c) times when criteria will be exceeded<br>d) likely impact on activities (speech, sleep, relaxation, listening, etc)<br>e) change on ambient conditions<br>f) the result of any community consultation or negotiated agreement. | 4.2.5, **Table 4.17** & **Figures 4.11** to **4.15** |
| | For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS. | 4.2.6.2 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment:<br>a) bench height, burden spacing, spacing burden ratio<br>b) blast hole diameter, inclination and spacing<br>c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency<br>Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc. | 2.4.3.4 |
| | For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:<br>a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage<br>b) control of traffic (eg: limiting times of access or speed limitations)<br>c) resurfacing of the road using a quiet surface<br>d) use of (additional) noise barriers or bunds<br>e) treatment of the facade to reduce internal noise levels buildings where the night-time criteria is a major concern<br>f) more stringent limits for noise emission from vehicles (ie. using specially designed 'quite' trucks and/or trucks to use air bag suspension<br>g) driver education<br>h) appropriate truck routes<br>i) limit usage of exhaust breaks<br>j) use of premium muffles on trucks<br>k) reducing speed limits for trucks<br>l) ongoing community liaison and monitoring of complaints m) phasing in the increased road use. | 4.2.5 |
| | **REHABILITATION** | |
| DECCW<br>28/08/09 | Outline considerations of site maintenance, and proposed plans for the final condition of the site (ensuring its suitability for future uses). | 2.14.4 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| **SOIL CONTAMINATION ISSUES** | | |
| DECCW 28/08/09 | Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination, for example if the site was previously a landfill site or if irrigation of effluent has occurred. | 4.1.5.2 |
| | Provide any details (in addition to those provided in the location description – Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination. | 4.12.2 |
| | Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of: | |
| | a) disturbing any existing contaminated soil | N/A |
| | b) contamination of soil by operation of the activity | 4.13.7 |
| | c) subsidence or instability | N/A |
| | d) soil erosion | 4.3.3.2 & 4.12.3 |
| | e) disturbing acid sulfate or potential acid sulfate soils. | 2.5.2 |
| | Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including: | |
| | a) erosion and sediment control measures | 4.3.3.2 |
| | b) proposals for site remediation – see *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) | 3.3.2.7 |
| | c) proposals for the management of these soils – see *Assessing and Managing Acid Sulfate Soils*, Environment Protection Authority, 1995 (note that this is the only methodology accepted by the DECCW). | N/A (2.5.2) |
| **TRAFFIC** | | |
| RTA 28/08/09 | • Existing traffic volumes of the Newell Highway (HW17) including traffic type break up, peak volumes, peak times and future growth rates. | 4.11.2.3 |
| | • A Traffic Impact Study detailing expected vehicle types, volumes and movements during both construction and operation. The study is to be broken down into peak and general times. | 4.11 and Part 7 of SCSC |
| | • Intersection treatments and mitigation measures to cater for predicted traffic impacts. This is to include any required temporary or staged treatments and other measures. Treatments are to be provided for any proposed new junctions as well as any other temporary junctions or existing intersection upgrades. The intersections are to cater for all heavy and over dimensional vehicles that will be accessing the development. Intersection design will be assessed on RTA Road Design Guide requirements. This traffic study should also address internal traffic movement and parking facilities. | Part 7 of SCSC |
| | • A formal agreement in the form of a Works Authorisation Deed or deed of agreement will be required between the developer and the RTA. Other ancillary works including an underbore of the Mitchell Highway for a water pipeline and two crossings of the Newell Highway for 66kV electrical transmission lie would also be covered by this Deed. | Noted |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | • A Road Occupancy Licence is required prior to any works commencing within 3m of the travel lanes of the Newell Highway. This can be obtained by contacting Mr Paul Maloney on 02 6861 1686. Submission of a traffic control plan is required as part of this licence. | Noted |
| | **Newell Highway Underpass** | |
| | • The proponent will be required to construct a sidetrack of the Newell Highway to cater for two-way traffic during construction of the proposed underpass. Sidetrack requirements are to be designed to 90km/h standard with an 80km/h speed zone throughout in accordance with the RTA Road Design Guide. The sidetrack is to be a minimum 9m width seal and verge with edge line marking. The pavement is to be minimum 400mm pavement thickness; the pavement design is to e approved by the RTA. The sidetrack is also to be designed to cater for oversized loads up to 8m wide that travel the Highway. This sidetrack should be included in the Part 3A assessment by Department of Planning | 2.2.4 |
| | • Typical cross section width of the Newell Highway at the underpass is to cater for 2x3.5m travel lanes, 1.2m central median, 2m sealed shoulders, with allowance for approved safety barriers (to AS 5100 where appropriate)and verges behind the barriers in accordance with the RTA Road Design Guide. | **Figures 2.3** & **2.4** |
| | • The pavement design for the Newell Highway is to be to the satisfaction of the RTA. | Noted |
| | • The applicant is to demonstrate proposed method for drainage of the underpass structure and associated works to ensure that the Highway will not be compromised. | 2.2.4 |
| | • The applicant will be responsible for maintenance and subsequent removal of the proposed underpass structure at the completion of the mine operation and will be required to lodge a security deposit/bond adjusted annually for CPI increase as part of the Deed to ensure this. | 2.2.4 & 2.14.6.2 |
| | **Culvert Augmentation Works** | |
| | • Any required upgrade of existing Highway drainage structures is to be at full cost to the developer. | Noted |
| | • A sidetrack of the Newell Highway will be required to conduct culvert augmentation works. The sidetrack pavement width and depth is as per the above requirements for the underpass sidetrack. | 2.2.4 |
| | • Hydrological analysis for the impact on existing Highway drainage structures is to be provided to the RTA for assessment. | 4.3.3.2.7 |
| | **WASTE AND CHEMICALS** | |
| DECCW 28/08/09 | Provide details of the quantity, quality and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes (NSW EPA, 1999)*. | 2.6.4 |
| | Provide details of liquid waste and non-liquid waste management at the facility, including:<br>a) the transportation, assessment and handling of waste arriving at or generated at the site | Appendix 3 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | b) any stockpiling of wastes or recovered materials at the site<br>c) the method for disposing of all wastes or recovered materials at the facility<br>d) the emissions arising from the handling, storage, processing and reprocessing of waste at that: facility<br>e) the proposed controls for managing the environmental impacts of these activities. | 2.5.4, 2.6.3.3, 2.7.2.5 & 2.8 |
| | Provide details of spoil disposal with particular attention to:<br>a) the quantity of spoil material likely to be generated<br>b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil<br>c) the need to maximise reuse of spoil material in the construction industry<br>d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material<br>e) designation of transportation routes for transport of spoil. | 2.6.3.3 & 2.7 |
| | Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes. | 2.6.4 and **Appendix 3** |
| | Provide details of the type, quantity and quality of any chemical substances to be used or stored or describe arrangements for their safe use and storage | 2.6.4 |
| | Reference should be made to the guidelines: *Waste Classification Guidelines Part 1: Classifying Waste (NSW EPA, 2008)*. | Noted |
| | Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/o, chemicals. | **Appendix 3** |
| | Assess potential impacts to fauna and the environment in general due to the storage, use and disposal of cyanide. | 4.5.8 |
| | Outline measures to minimise the consumption of natural resources. | Throughout Section 4 |
| | Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste. | |
| | Outline measures to mitigate or reduce potential for impact to fauna or other aspects of the environment due to the storage, use and disposal of cyanide. | 4.5.7.3.3 |
| | Outline measures to support any approved regional or industry waste plans. | N/A |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | **WATER** | |
| DECCW<br>28/08/09 | Provide details of the project that are essential for predicting and assessing impacts to waters:<br>a) including the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on www.environment.nsw.gov.au/ieo, using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000)<br>b) the management of discharges with potential for water impacts<br>c) drainage works and associated infrastructure; land forming and excavations; working capacity of structures; and water resource requirements of the proposal. | <br>4.3.2 & 4.4.2<br><br>4.3.5.4<br>4.3.3 |
| | Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts eg effluent ponds) and showing potential areas of modification of contours, drainage etc. | **Figure 2.1** & 4.3.3 |
| | Outline how total water cycle considerations are to be addresses showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options. | 4.3.5.5 |
| | Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: www.environment.nsw.gov.au/ieo should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area. | 4.3.2, 4.3.5.8 and Part 2 of SCSC |
| | Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (eg. a wet weather sampling program is needed if runoff events may cause impacts). | 4.3.2 & 4.4.2 |
| | Provide site drainage details and surface runoff yield. | 4.3.3, **Figure 2.5** and 4.3.5 |
| | State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: www.environment.nsw.gov.au/ieo. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice. | 4.3.5.8 and Part 2 of SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | State the indicators and associated trigger values or criteria for the identified environmental valuer This information should be sourced from the ANZECC 2000 *Guidelines for Fresh and Marine Water Quality* (http://www.deh.gov.au/water/quality/nwqms/volume1.html) (Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater. | 4.3.5.4 and Part 2 of SCSC |
| | State any locally specific objectives, criteria or targets, which have been endorsed by the government, eg. the Healthy Rivers Commission Inquiries (www.hrc.nsw.gov.au) or the NSW Salinity Strategy (DLWC, 2000) (www.dlwc.nsw.gov.au/care/salinity/#Strategy). | 4.3.5.8 and Part 2 of SCSC |
| | Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (eg. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the DECCW on the approach and study design must be obtained. | N/A |
| | Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (ie. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:<br>a) lake or estuary flushing characteristics<br>b) specific human uses (eg. exact location of drinking water offtake)<br>c) sensitive ecosystems or species conservation values<br>d) a description of the condition of the local catchment eg. erosion levels, soils, vegetation cover, etc<br>e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment<br>f) historic river flow data where available for the catchment. | 4.3.5.8 and Part 2 of SCSC |
| | No proposal should breach clause 120 of the *Protection of the Environment Operations Act 1997* (ie. pollution of waters is prohibited unless undertaken in accordance with relevant regulations). | Noted |
| | Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented. | 4.3.5.8 and Part 2 of SCSC |
| | Include a rationale, along with relevant calculations, supporting the prediction of the discharges. | 4.3.5.8 and Part 2 of SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater). | 4.3.5.8 and Part 2 of SCSC |
| | Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow). | 4.3.5.2 and Part 2 of SCSC |
| | Identify any potential impacts on quality or quantity of groundwater describing their source. | 4.4.7.2 |
| | Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation. | 4.3.5 and Part 2 of SCSC |
| | Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils. | N/A (2.5.2) |
| | Containment of spills and leaks shall be in accordance with the technical guidelines section 'Bunding and Spill Management' of the Authorised Officers Manual (EPA, 1995) (http://www.environment.nsw.gov.au/mao/bundingspill.htm) and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge. | 4.13.7 |
| | The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered:<br>a) will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and<br>b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters. | 4.3.5.8 and Part 2 of SCSC |
| | Consult with the DECCW as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The DECCW will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment.<br>*Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.* | Noted |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | Any proposed monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DECCW 2004). | 4.3.6 |
| DECCW – Office of Water | 1. Adequate and secure water supply for the proposal. | 4.3.5.5 |
| | 2. Identification of site water demands, water sources (surface and groundwater), water disposal methods and water storage structures in the form of a water balance. This is to also include details of any water reticulation infrastructure that supplies water to the site. | 2.10.3.5 & 4.3.5.5 |
| | 3. Proposed water management on the site based on the site water balance. This is to also include a surface water management plan to identify the existing and proposed surface water management structures and flow paths. | **Figure 2.5** and 4.3.3 |
| | 4. An assessment of any proposed modification to surface water management including modelling of redistribution of waters and an assessment of impact on neighbouring properties and the associated watercourse and floodplain. | 4.3.3 & 4.3.4 |
| | 5. Proposed water licensing requirements in accordance with the *Water Act 1912, Water Management Act 2000* and NSW Inland Groundwater Water Shortage Zones Order No. 1 & 2, 2008 (19 December 2008). This is to demonstrate that existing licences (include licence numbers) and licensed uses are appropriate, and to identify where additional licences are proposed. | 2.1.3 and Part 3 of SCSC |
| | 6. An assessment of impact on adjacent licensed water users, basic landholder rights, and groundwater-dependent ecosystems. | 4.4.7.1 |
| | 7. Requirement to intercept groundwater and predicted dewatering volumes, water quality and disposal/retention methods. | 4.4.6, 4.4.7.1 and Part 3 SCSC |
| | 8. An impact assessment of the construction, operation and final landform of the proposed on-site waste rock emplacements, residue storage facilities and other potentially contaminating facilities to meet the requirements of the NSW State Groundwater Policy framework document. | 4.3.6 |
| | 9. Proposal to construct watercourse crossings and carry out works within 40m of a watercourse in accordance with former DWE Controlled Activity Approval Guidelines. | |
| | 10. Adequate mitigating and monitoring requirements to address surface and groundwater impacts. | 4.3.6 and 4.4.8 |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | **Key issue: Water supply and water balance** | |
| | • The EA must include assessment of water supply and/or water interception and extraction against any Water Sharing Plan and water licences affecting the site or potential water supply to the proposal. A full description of water supply to all stages of the proposal must be included, which includes: | |
| | – water source(s) which may be used to supply water to the proposal, existing licences, additional water requirements, and a checklist against any regulatory water sharing or other ministerial plans or other instruments applying to that water source | 2.10.3.5 & 4.3.5.5 |
| | – explanation of any embargoes or full commitment declarations for the proposal, and any identified means to source water supply for the proposal | Part 3 of SCSC |
| | – examination of reliability of water supply to the proposal, including alternatives to site rainfall runoff harvesting in the event of drought | 4.3.5.5 |
| | – demonstration of prioritisation and effective reuse of saline or other contaminated water within the proposal | 4.3.5.5 and Part 2 SCSC |
| | – explanation of water circuitary and means to segregate contaminated, sediment-laden and clean water volumes within the proposal and proposal site. This would require development of surface water management plan. | 4.3.3 |
| | **Key Issue: Groundwater Resource Protection** | |
| | • Groundwater — the EA must include demonstration that the project is consistent with the principles of the NSW State Groundwater Policy Framework Document, the NSW State Groundwater Quality Protection Policy, the NSW State Groundwater Dependent Ecosystems Policy and the Draft NSW State Groundwater Quantity Management Policy. This must include, for the pre-, during, and post- development phases of the project the following: | |
| | – identification of surrounding water users and any groundwater dependent ecosystems; | 4.4.2 |
| | – detailed explanation of potential groundwater volume, piezometric level, water table heights and the direction of flow and quality, any identified connected water sources impacted by extraction | 4.4.2.6 |
| | – detailed explanation of groundwater drawdown or other impacts upon connected groundwaters. | 4.4.6, 4.4.7 and Part 3 SCSC |
| | – explanation of the site water balance, including any changes to water balance inputs from rainfall runoff, additional supplies, dewatering requirements and/or groundwater seepage; | 4.3.5.5 |
| | – detailed description of any proposed water supply system utilising groundwater as a source, and identification of licensing requirements; | Part 3 SCSC |
| | – detailed analysis of the impacts of dewatering if required for the project, identifying the magnitude and duration of pumping, the areal extent of water level drawdown, the likely quality of extracted groundwater, alterations to site water balance, and the monitoring and reporting protocols to be adopted to meet licensing requirements; | 4.4.6, 4.4.7 and Part 3 SCSC |

**Table A2-3 (Cont'd)**
**Coverage of Requirements nominated by Other Government Agencies in the *Environmental Assessment***



| Government Agency | Paraphrased Requirement | Relevant Section(s) |
|---|---|---|
| | – measures to prevent contamination of the groundwater. | 4.4.4 |
| | – identification of potential and likely groundwater-dependent ecosystems, and any impact upon these ecosystems which may result from the proposal; this must include<br>o Terrestrial vegetation with seasonal or episodic reliance on groundwater, and<br>o Aquatic and riparian ecosystems in, or adjacent to, streams or rivers dependent upon the input of groundwater to minimum base flows | 4.4.7.4 |
| | **Key Issue: Landform or Void Rehabilitation** | |
| | • **Rehabilitation, Final Landform** – the EA must include: | |
| | – justification of the proposed final landform with regard to its impact on local and regional groundwater systems and surface water systems; | 2.14.4 |
| | – a detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape; | 2.14.6 |
| | – detailed modelling of potential groundwater volume, flow and quality impacts of the presence of an inundated final void on identified receptors specifically considering those environmental systems that are likely to be groundwater dependent; | 4.4.6.3 |
| | – a detailed description of the measures to be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation; and | MOP |
| | – the measures that would be established for the long-term protection of local and regional aquifer and surface water systems and for the ongoing management of the site following the cessation of the project. | 2.14.7 |

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# Appendix 3

# SEPP 33 Risk Screening and Preliminary Hazard Analysis

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# A3.1 INTRODUCTION

Consideration has been made as to whether the Project should be considered a hazardous or potentially hazardous industry under *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33). In accordance with the risk screening method provided by the Department of Planning document *Applying SEPP 33 – Consultation Draft* (DoP, 2008b), the following presents the details of the determination as to the classification of the Project under SEPP 33.

Industries or projects determined by the risk screening to be hazardous or potentially hazardous would require the preparation of a Preliminary Hazard Analysis (PHA) in accordance with Clause 12 of SEPP 33. No further assessment under SEPP 33 is required for projects not considered potentially hazardous.

# A3.2 RISK SCREENING

## A3.2.1 Hazardous Materials within the Project Site

Hazardous materials are defined within DoP (2008b) as substances falling within the classification of the *Australian Code for the Transportation of Dangerous Goods by Road and Rail* (Dangerous Goods Code) (Department of Infrastructure, Transport, Regional Development and Local Government, 2009). Based on this definition, the hazardous materials to be stored with the Mine Site, their quantities and storage location are summarised in **Table A3.1**.

**Table A3.1**
**Hazardous Materials Storage with the Mine Site**

| Material | Class | Description | Storage Quantity | Storage Location | Distance to Site boundary | Threshold Limit | Threshold Triggered |
|---|---|---|---|---|---|---|---|
| Diesel Fuel | C1 | Combustible liquids: flashpoint above 61°C but not exceeding 150°C | 100 000L | Bunded fuel bay in the vicinity of the workshop | >500m | 10m | No |
| Lubricating oils and greases | C2 | Combustible liquids flashpoint above 150°C | <2 500L | Bunded fuel bay and workshop areas | >500m | nil | No |
| Liquified Petroleum Gas (LPG) | 2.1 | Flammable Gas: Gases which ignite on contact with an ignition source | 6 x 7 500L tanks (45 000L) (~22.7t) | Bunded location adjacent to the Processing Plant within the Processing Plant and Office Area (see **Figure 2.16**) | 600m | 10t or 16m$^3$ | **Yes** |
| Sodium Cyanide (Solid) | 6.1 PGI | Solid briquettes delivered in sealed iso-container | 22t | Bunded location adjacent to the Processing Plant within the Processing Plant and Office Area (see **Figure 2.16)** | NA | 2.5t | **Yes** |
| Sodium Cyanide (solution) | 6.1 PGIII | Solution mixed on site | 5 000L | | NA | 2.5t | **Yes** |
| Hydrochloric Acid | 8 PGII | Concentrated liquid | 24 000L (23.6t) | | NA | 50t | No |
| Caustic Soda (Sodium Hydroxide) (Solution) | 8 PGIII | Concentrated liquid | 24 000L (36t) | | NA | 50t | No |
| Ammonium Nitrate | 5.1 | Oxidizing substances and organic peroxides | 20t | Magazine | >50m | 25t | No |

### A3.2.2 Transportation of Hazardous Materials

Transport information for the hazardous materials to and from the Mine Site is presented in **Table A3.2**.

**Table A3.2**
**Hazardous Material Transportation**

| Material | Class | Average No. of Loads | Threshold Limit | Approximate Load Size | Threshold Triggered |
|---|---|---|---|---|---|
| | | Loads per Year | | | |
| Diesel Fuel | C1 | 225 | 1000 | 25kL | No |
| Lubricating oils and greases | C2 | 50 | 750 | 100kg | No |
| Liquified Petroleum Gas (LPG) | 2.1 | 20 | 500 | 40t | **Yes** |
| Sodium Cyanide (solid) | 6.1 PGI | 15 | nil | 22t | **Yes** |
| Hydrochloric Acid | 8 PGII | 12 | 500 | 10t | No |
| Caustic Soda (Sodium Hydroxide) (solution) | 8 PGII | 12 | 500 | 4t | No |
| Ammonium Nitrate | 5.1 | 100 | 500 | 15t | No |

### A3.2.3 Risk Screening Results

Based on the risk screening results presented in **Tables A3.1** and **A3.2** a Preliminary Hazard Analysis (PHA) is required for the transport, storage and use of sodium cyanide for the Project.

## A3.3 PRELIMINARY HAZARD ANALYSIS

### A3.3.1 Introduction

This PHA has been conducted as part of the *Environmental Assessment* to evaluate the hazards associated with the use, storage and transport of two dangerous goods (sodium cyanide and lead concentrate).

- Sodium cyanide is a Class 6.1 reagent used in the recovery of silver from crushed and ground ore and would be stored on the Mine Site in quantities exceeding the threshold nominated by DoP (2008) as triggering the preparation of a PHA (2.5t). Transport of a Class 6.1 dangerous good in any quantity is also identified by DoP (2008b) as triggering a PHA.

- LPG is a Class 2.1 flammable gas which would be used for heating reagents during processing operations and would be stored on the Mine Site in quantities exceeding the threshold nominated by DoP (2008) as triggering the preparation of a PHA (10t). The bulk mass of LPG transported to the Mine Site in road registered trucks (40t) would also exceed the threshold for classification as a potentially hazardous industry (DoP, 2008b) requiring the preparation of a PHA.

Preparation of this PHA addresses the requirements of *State Environmental Planning Policy (SEPP) No. 33 (Hazardous and Offensive Development)* and has been documented in general accordance with *Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 6* (DUAP, 1992a).

The PHA has been completed in accordance with the general principles of risk evaluation and assessment outlined in the NSW Department of Urban Affairs and Planning (DUAP) *Multi-Level Risk Assessment* (DUAP, 1999).

Assessed risks are compared to the qualitative risk assessment criteria developed in accordance with Australian Standard/New Zealand Standard (AS/NZS) 4360:2004 *Risk Management* (AS/NZS 4360:2004). Further, this PHA considers the qualitative criteria provided in *Risk Criteria for Land Use Planning: Hazardous Industry Planning Advisory Paper No. 4* (DUAP, 1992b).

### A3.3.2 Objectives and Scope

The objective of this PHA is to identify the risks posed by the Project-related use, storage and transport of sodium cyanide and LPG to people, property and the environment and assess the identified risks using applicable qualitative criteria. This assessment considers off-site risks to people, property and the environment (in the presence of controls) arising from atypical and abnormal hazardous events and conditions, i.e. equipment failure, operator error and external events. The assessment does not consider risks to the employees, property or business of the Proponent.

This analysis should be read in conjunction with Section 2 of the *Environmental Assessment*.

### A3.3.3 Study Methodology

The NSW Department of Planning (DoP) *Multi Level Risk Assessment* (DUAP, 1999) approach was used for this study. The approach considered the development in context of its location and its technical and safety management control. The *Multi Level Risk Assessment Guidelines* are intended to assist industry, consultants and the consent authorities to carry out and evaluate risk assessments at an appropriate level for the facility being studied.

The Multi Level Risk Assessment approach is summarised in **Figure A3.1**. There are three levels of assessment, depending on the outcome of the preliminary screening. These are:

- Level 1 – Qualitative Analysis, primarily based on the hazard identification techniques and qualitative risk assessment of consequences, frequency and risk;
- Level 2 – Partially Quantitative Analysis, using hazard identification and the focused quantification of key potential offsite risks; and
- Level 3 – Quantitative Risk Analysis (QRA), based on the full detailed quantification of risks, consistent with Hazardous Industry Planning Advisory paper No.6 – Guidelines for Hazard Analysis.

The initial Level 1 qualitative analysis methodology employed during the preparation of the PHA was as follows:

i) Identification of the hazards associated with the use, storage and transport of sodium cyanide.

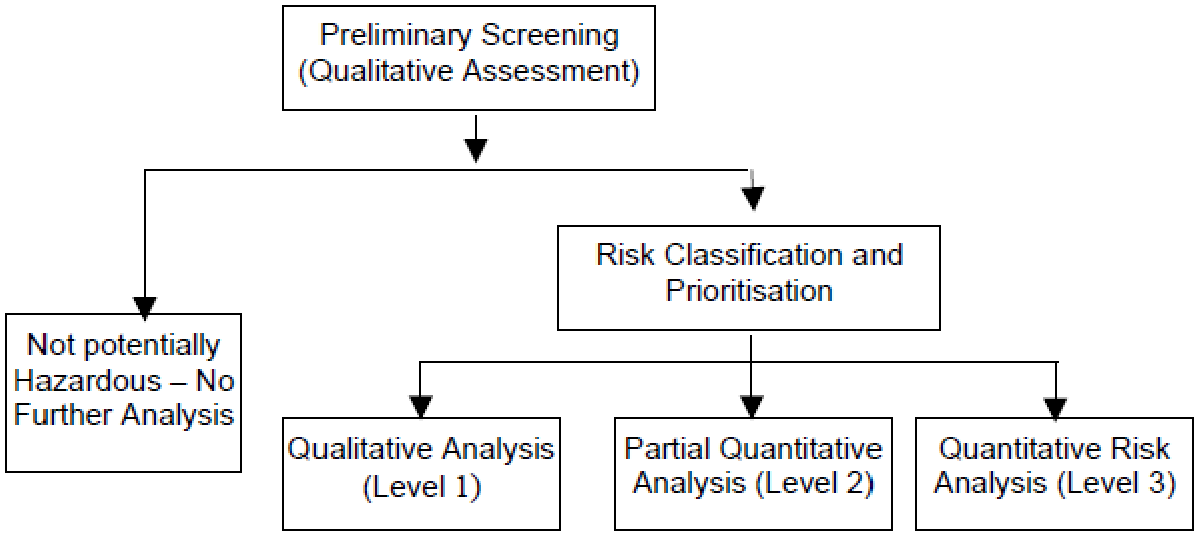



**Figure A3.1**
**MULTI LEVEL RISK ASSESSMENT PROCESS**

ii) Examination of the maximum reasonable consequence of identified events, namely the worst-case consequence that could reasonably be expected, given the scenario and based upon previous experience.

iii) Qualitative estimation of the likelihood of events.

iv) Proposal of risk treatment measures.

v) Qualitative assessment of risks to the environment, members of the public and their property arising from atypical and abnormal events and compare these to applicable qualitative criteria.

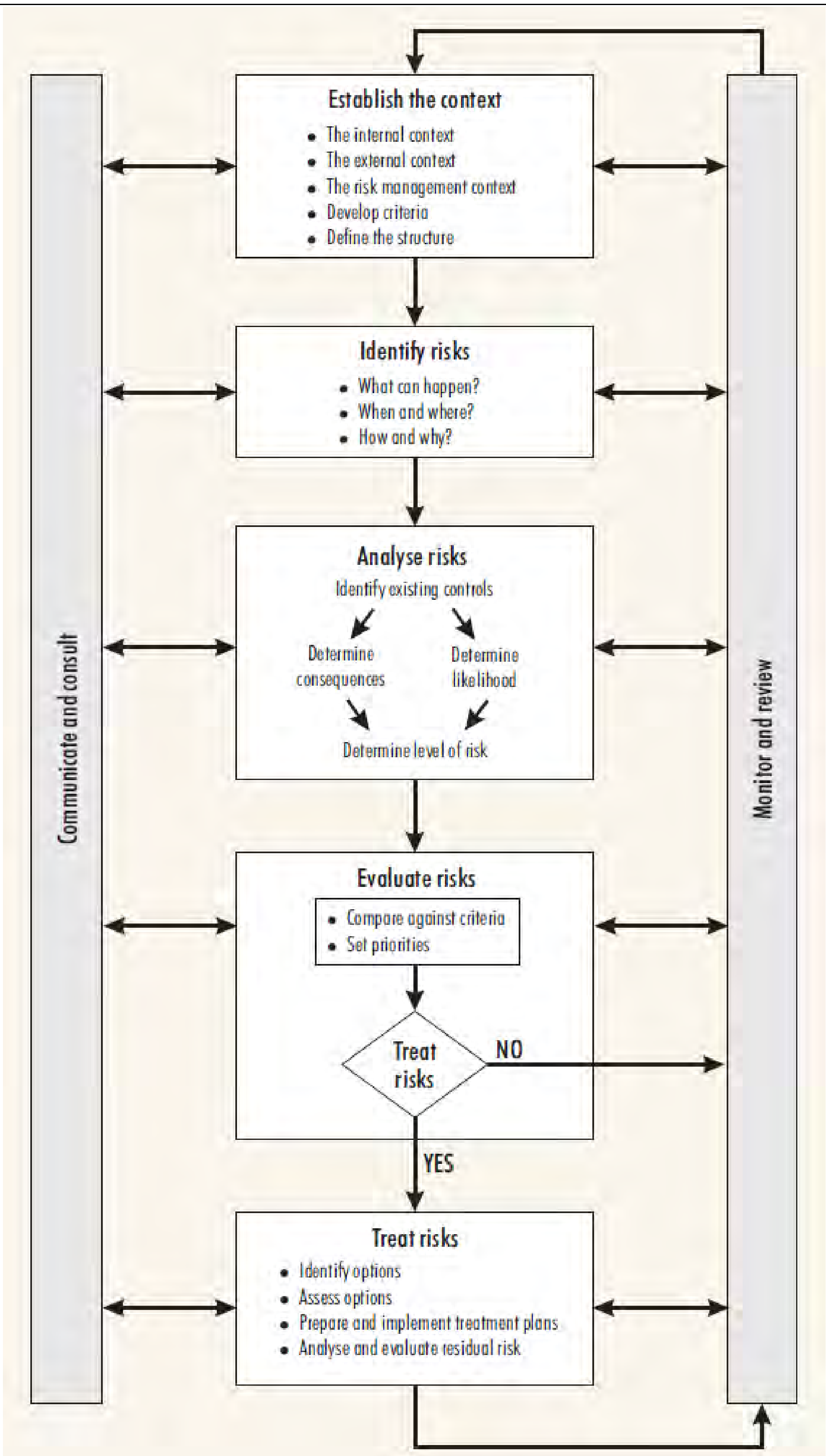
vi) Recommendation of further risk treatment measures if considered warranted.

vii) Qualitative determination of the residual risk assuming the implementation of the risk treatment measures.

### A3.3.4 Risk Management Process

The PHA has been undertaken in general accordance with the risk management process described in AS/NZS 4360:2004. The risk management process is shown schematically in **Figure A3.2** and includes the following components.

- Establish the risk assessment context – Section A3.3.4.
- Identify risks – Section A3.3.5.
- Analyse, evaluate and treat risks – Section A3.3.6 and Tables A3.6a and A3.6b.




Source: AS/NZS 4360:2004

**Figure A3.2**
**RISK MANAGEMENT PROCESS**

### A3.3.5 Qualitative Measures of Consequence, Likelihood and Risk Ranking Table

To undertake a qualitative risk assessment it is useful to define (in a descriptive sense) the various levels of consequence of a particular event, and the likelihood (or probability) of such an event occurring. Risk assessment criteria were developed in accordance with AS/NZS 4360:2004 which allowed the workshop team to develop risk criteria during the establish the context phase.

In accordance with AS/NZS 4360:2004, **Tables A3.3**, **A3.4** and **A3.5** were reviewed by the PHA workshop team. The tables were considered to be consistent with the specific objectives and context of the PHA.

**Table A3.3**
**Qualitative Likelihood Rating**

| Level | Descriptor | Description |
|---|---|---|
| A | Almost Certain | Is expected to occur in most circumstances. |
| B | Likely | Will probably occur in most circumstances. |
| C | Possible | Could occur. |
| D | Unlikely | Could occur but not expected. |
| E | Rare | Conceivable, but only in exceptional circumstances. |
| Source: HB 203:2006 (Standards Australia, 2006) - Table 4(A) | | |

**Table A3.4**
**Qualitative Consequence Rating**

| Level | Descriptor | People | Environment | Asset / Production |
|---|---|---|---|---|
| 5 | Catastrophic | Multiple fatality | Extreme environmental harm, e.g. widespread catastrophic impact | More than $5 million (M) loss or production delay |
| 4 | Major | Permanent total disabilities, single fatality | Major environmental harm, e.g. widespread substantial impact | $1M to $5M loss or production delay |
| 3 | Moderate | Major injury or health effects, e.g. major lost workday case/permanent disability | Serious environmental harm, e.g. widespread and significant impact | $500 thousand (k) to $1M loss or production delay |
| 2 | Minor | Minor injury or health effects, e.g. restricted work or minor lost workday case | Material environmental harm, e.g. localised and significant impact | $50k to $500k loss or production delay |
| 1 | Insignificant | Slight injury or health effects, e.g. first aid/minor medical treatment level | Minimal environmental harm, e.g. interference or likely interference to an environmental value | Less than $50k loss or production delay |
| Source: Modified after HB 203:2006 (Standards Australia, 2006) - Table 4(B) | | | | |

**Table A3.5**
**Risk Rating Matrix**

| Likelihood | Consequences | | | | |
|---|---|---|---|---|---|
| | **Insignificant 1** | **Minor 2** | **Moderate 3** | **Major 4** | **Catastrophic 5** |
| A (Almost Certain) | A | A | I | I | I |
| B (Likely) | T | A | A | I | I |
| C (Possible) | T | T | A | A | I |
| D (Unlikely) | T | T | T | A | A |
| E (Rare) | T | T | T | T | A |
| Note: Rating modified after HB 203:2006 (Standards Australia, 2006) - Table 4(C) | | | | | |

The risk rankings are defined as follows.

Tolerable (T): The risk associated is acceptably low.

As low As Reasonably Practicable (A): The risk has been reduced to as low a level as possible and all feasible controls and mitigation strategies are implemented.

Intolerable (I): The risk cannot be reduced to an acceptable level with residual impacts likely to have significant impact on the local environment or stakeholders.

Risk acceptance criteria for the Project require risks to be reduced to a Tolerable (T) level.

## A3.3.6 Hazard Identification

### A3.3.6.1 Overview

The risk screening process undertaken in accordance with SEPP 33 identified one potentially hazardous material to be used, stored and transported to and from the Project Site, namely sodium cyanide.

The hazard (or risk) identification summary table (**Table A3.6**) provides a summary of the potential off-site risks and hazards identified for the Project and a qualitative assessment of the risks posed. **Tables A3.6** also consider the component areas of the Project where the potentially hazardous materials would be used, stored or transported, the types of incidents attributable to these potentially hazardous materials and the risk treatment or management measures that would be adopted.

### A3.3.6.2 Component Areas

For the purposes of hazard identification and assessment, the following component areas were identified for the use, storage and transport of sodium cyanide and LPG.

- Transportation to the Mine Site.
- Storage facilities within the Mine Site.
- Combustion and energy generation (LPG only).
- Ore treatment and processing (sodium cyanide only).
- Residue and process water management (sodium cyanide only).

### A3.3.6.3 Incident Classes

The following generic classes of incident were identified.

- Accident.
- Leaks/spills.
- Fire.
- Theft / sabotage.

These incident classes were applied to the component areas to identify scenarios for which control/mitigation measures were developed.

### A3.3.6.4 Project Risk Treatment Measures

**Sodium Cyanide**

Indicative sodium cyanide management measures are identified in Section 2.6.4. These management measures would be documented in detailed *Reagent Management Plan* that would be prepared prior to receipt of the first delivery of sodium cyanide. The Proponent anticipates that this plan would be required to be prepared in consultation with or approved by the following government agencies.

- Department of Planning.
- Department of Environment, Climate Change and Water.
- NSW Office of Water.
- Roads and Traffic Authority.
- Industry and Investment NSW.
- WorkCover NSW.
- Parkes Shire Council.
- Narromine Shire Council.

In addition, general hazard control measures would be documented in the following management plans to be developed for the Project.

- *Contractor Management Plan.*
- *Emergency Management Plan.*
- *Bushfire Management Plan.*

Finally, the following overarching control measures would be adopted for the Project.

- **Design and Engineering of Structures –** Civil engineering structures would be constructed in accordance with applicable codes, guidelines and Australian Standards.
- **Maintenance –** Ongoing and timely maintenance of all mobile and fixed plant and equipment in accordance with the manufacturer's recommended maintenance schedule, and consistent with the maintenance schemes required by relevant standards. Only vehicles permitted to carry dangerous goods would be used for transport of hazardous materials.
- **Supply and Transport Contractor –** Only licenced and approved cyanide supply and transport companies would be used to supply and transport cyanide to the Mine Site. Transportation operations would only be undertaken once all required approvals, licences, risk assessments and management procedures have been obtained.
- **Storage, Handling and Usage Procedures –** Storage, handling and usage procedures for potentially hazardous materials would be developed in accordance with Australian Standards, relevant legislation and Material Safety Data Sheets. These procedures would be site specific in relation to personal protective equipment, emergency management equipment and first aid treatment.
- **Staff Training –** Operators and drivers would inducted, trained and (where appropriate) licensed for their job descriptions. Only those personnel licensed to undertake skilled and potentially hazardous work would be permitted to do so.
- **General Contractor Management** – All contractors employed by the Proponent would be required to operate in accordance with the relevant Australian Standards, NSW Legislation and Project Contractor Management Plan.

### LPG

The storage facilities for LPG would be stored in accordance with the required Australian Standard. Similarly, the tankers transporting the LPG to the Mine Site would be appropriately registered.

Mine Site personnel responsible for the delivery of the LPG from the tanker to the Mine Site storage tanks would receive appropriate training for this task.

General hazard control measures would be documented in the following management plans to be developed for the Project.

- *Contractor Management Plan.*
- *Emergency Management Plan.*
- *Bushfire Management Plan.*

Finally, the overarching control measures to be adopted for the management of sodium cyanide would also apply to the management of LPG on the Mine Site.

### A3.3.7 Risk Management and Evaluation

**Tables A3.6** and **A3.7** present a qualitative assessment of risks associated with the use, storage and transport of sodium cyanide and LPG respectively. Hazard treatment measures are identified, where required, to produce a 'tolerable' level of risk in accordance with the risk acceptance criteria described in Section A3.3.4. These measures are consistent with those identified in Section 2. Reference is also made to the control measures identified in Section A3.3.5.4.

**Table A3.6**
**Hazard Assessment – Sodium Cyanide**

Page 1 of 4

| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| Off-site transport to the Project Site | Accident | Traffic accident resulting in spillage and possible pollution. | • All transport requirements for sodium cyanide would be complied with, indicatively including the following.<br>- All transportation operations in accordance with the **"International Cyanide Management Code For The Manufacture, Transport and Use of Cyanide In The Production of Gold" (Cyanide Code).**<br>- Dangerous goods licenced drivers to be used.<br>- All drivers would be subject to competency tests.<br>- All vehicles would be appropriately licenced. for dangerous goods.<br>- Internal audits by supplier.<br>- Only audited transport route(s) to be followed by driver.<br>- MSDS and Chemalert information retained by driver and Proponent.<br>- Effective communication between driver, supplier and the Proponent.<br>• Approved *Reagent Management Plan* prepared, implemented and personnel trained in its use.<br>• *Emergency Management Plan* for dealing with cyanide spill developed and implemented. The plan would indicatively involve the following.<br>– Advise emergency services of the spill.<br>– Isolate the spill area (if possible to do so safely).<br>– Evacuate (or assist in evacuation) all persons within appropriate distance of the spill. | E | 4 | T |
| | Spill | Operator error/poor maintenance leading to leak or spill. | • As above | D | 3 | T |
| | Fire | Accident resulting in fire and the generation of HCN gas. | • As above | E | 4 | T |

**Table A3.6 (cont'd)**
**Hazard Assessment – Sodium Cyanide**

Page 2 of 4

| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| Storage facilities within the Mine Site | Accident/ Fire/ Explosion | Damage to cyanide storage facility as a result of accident, fire or explosion within the plant | • Non-flammable storage containers and bunding.<br>• Plant designed to minimise potential risks associated with fire and explosion.<br>• Isolate incompatible substances.<br>• Develop and implement safe work procedures.<br>• Install appropriate fire protection and management systems. | E | 4 | T |
| | Spill | Inadequate maintenance and/or design resulting in spillage. | • Bunding constructed of impermeable material.<br>• Bunding constructed to relevant construction standard.<br>• MSDS and Chemalert information retained by the Proponent.<br>• Environmental inspections and reporting completed regularly.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT.<br>• Approved *Reagent Management Plan* prepared, implemented and personnel trained in its use. | D | 3 | T |
| | | | • *Emergency Management Plan* for dealing with spill developed and implemented. The plan will involve the following.<br>– Advise emergency services of the spill.<br>– Isolate the spill area (if possible to do so safely).<br>– Evacuate (or assist in evacuation) all persons within 1.3km of the spill. | E | 3 | T |
| | Theft / Sabotage | Theft and malicious act/sabotage. | • Access to the Mine Site restricted by lockable gate.<br>• Storage facility to be fenced and locked with restricted access.<br>• Regular monitoring by personnel.<br>• Signage identifying risks associated with sodium cyanide. | E | 4 | T |

**Table A3.6 (cont'd)**
**Hazard Assessment – Sodium Cyanide**



| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| Ore treatment and processing | Accident | Accident within the processing plant area resulting in spillage of ore slurry or solution containing sodium cyanide. | • Restricted vehicle access to the processing plant area enforced.<br>• Leach circuit contained within separate bunded area with a capacity of at least 110% of the largest container or tank likely to contain cyanide.<br>• MSDS and Chemalert information retained by the Proponent.<br>• Regular maintenance inspections and reporting of all storage, transfer and containment facilities.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT.<br>• Approved *Reagent Management Plan* prepared, implemented and personnel trained in its use.<br>• *Emergency Management Plan* for dealing with spill developed and implemented. | C | 2 | T |
| | Spill | Operator error or poor maintenance leading to leak or spill. | • Restricted vehicle access to the processing plant area enforced.<br>• Processing plant contained within bunded area capable of retaining any spill.<br>• MSDS and Chemalert information retained by The Proponent.<br>• Plant personnel provided with appropriate training.<br>• Regular inspections of the plant completed and any maintenance requirements reported and enacted.<br>• Approved *Reagent Management Plan* prepared, implemented and personnel trained in its use.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT.<br>• *Emergency Management Plan* for dealing with spill developed and implemented. | D | 3 | T |

**Table A3.6 (cont'd)**
**Hazard Assessment – Sodium Cyanide**



| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| Residue and process water management | Spill | Leak from or rupture of tailings pipeline. | • Inspections and reporting completed regularly.<br>• Pumping ceased immediately on identification of leak.<br>• Pumping only to recommence following repair of leak.<br>• All tailings material excavated and manually placed within the RSF.<br>• *Emergency Management Plan* for dealing with spill developed and implemented. | D | 2 | T |
| | | Leak from RSF. | • RSF constructed in accordance with NSW Dams Safety Committee requirements.<br>• Regular inspections of RSF walls for structural integrity.<br>• Specific operating procedures implement for the construction of each lift.<br>• RSF lined with impermeable clay or artificial liner.<br>• Monitoring of shallow piezometers to detect seepage or leakage from the RSF.<br>• Contingency strategy to be developed and implemented in the event seepage or leakage identified by monitoring. | C | 2 | T |
| | | Overflow or leak from Process Water Dam. | • Dam designed with suitable freeboard to retain rainfall from design storm event and diversion structures to prevent inflow of surface waters.<br>• Dam constructed with impermeable liner.<br>• Inspections and reporting completed regularly.<br>• If leak detected, flow to be isolated and contained. Water within the process water dam to be pumped to either raw water dam or RSF and the dam repaired.<br>• Contaminated material to be excavated and manually placed within the RSF. | D | 3 | T |

**Table A3.7 (cont'd)**
**Hazard Assessment – LPG**



| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| Transport to the Mine Site | Accident | Traffic accident resulting in spillage and possible pollution. | • All transport requirements for LPG would be complied with, indicatively including the following.<br>- Dangerous goods licenced drivers to be used.<br>- All vehicles would be appropriately licenced and registered for the transport of LPG.<br>- Access to the Mine Site would be via Newell Highway and Tomingley West Road only.<br>- MSDS and Chemalert information retained by driver and Proponent.<br>- Effective communication between driver, supplier and the Proponent would be maintained.<br>• *Emergency Management Plan* for dealing with LPG leak or spill developed and implemented. The plan would indicatively involve the following.<br>– Advise emergency services of the spill.<br>– Isolate the spill area (if possible to do so safely).<br>– Evacuate (or assist in evacuation) all persons within appropriate distance of the spill. | D | 3 | T |
| | Spill | Operator error/poor maintenance leading to leak or spill. | • As above.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT. | D | 2 | T |
| | Fire | Accident resulting in fire. | • Smoking and any other flame generating activities would be prohibited within the truck cab or in the vicinity of the tanker.<br>• *Emergency Management Plan* for dealing with LPG leak or spill developed and implemented. The plan would indicatively involve the following.<br>– Advise emergency services of the fire (or potential for fire).<br>– Isolate the area (if possible to do so safely).<br>– Evacuate (or assist in evacuation) all persons within appropriate distance of the fire. | E | 4 | T |

**Table A3.7 (cont'd)**
**Hazard Assessment – LPG**



| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| Transport to the Mine Site (cont'd) | Fire (cont'd) | Accident resulting in fire (cont'd) | • *Bushfire Management Plan* for dealing with fire developed and implemented. The plan would indicatively involve the following.<br>– Training for Mine Site personnel.<br>– Advise emergency services of the fire.<br>– Isolate the area (if possible to do so safely).<br>– Nominate muster areas and evacuation procedures. | | | |
| Storage facilities within the Mine Site | Accident/ Fire/ Explosion | Damage to storage tanks as a result of accident, fire or explosion within the plant | • Non-flammable storage containers and bunding.<br>• Plant designed to minimise potential risks associated with fire and explosion.<br>• Isolate incompatible substances.<br>• Develop and implement safe work procedures.<br>• Provide appropriate training for Mine Site personnel.<br>• Install appropriate fire protection and management systems. | E | 4 | T |
| | Spill | Inadequate maintenance and/or design resulting in spillage | • Bunding constructed of impermeable material.<br>• Bunding constructed to relevant construction standard.<br>• MSDS and Chemalert information retained by the Proponent.<br>• Develop safe working procedure for LPG transfer from tanker to Mine Site storage tanks.<br>• Environmental inspections and reporting completed regularly.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT.<br>• Approved *Emergency Management Plan* prepared, implemented and personnel trained in its use. | D | 3 | T |
| | | | • *Emergency Management Plan* for dealing with spill developed and implemented. The plan will involve the following.<br>– Advise emergency services of the spill.<br>– Isolate the spill area (if possible to do so safely).<br>– Evacuate (or assist in evacuation) all persons. | E | 3 | T |

**Table A3.7 (cont'd)**
**Hazard Assessment – LPG**



| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| Storage facilities within the Mine Site (cont'd) | Theft / Sabotage | Theft and malicious act/sabotage. | • Access to the Mine Site restricted by lockable gate.<br>• Storage facility to be fenced and locked with restricted access.<br>• Regular monitoring by personnel.<br>• Signage identifying risks associated with LPG. | E | 4 | T |
| LPG combustion and energy generation | Accident | Accident within the processing plant area resulting in spillage or leak of LPG | • Restricted vehicle access to the processing plant area enforced.<br>• Combustion undertaken within bunded area capable of retaining any spill.<br>• MSDS and Chemalert information retained by the Proponent.<br>• Regular maintenance inspections and reporting of all storage, transfer and containment facilities.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT.<br>• *Emergency Management Plan* for dealing with spill developed and implemented. | D | 2 | T |
| | Spill | Operator error or poor maintenance leading to leak or spill. | • Restricted vehicle access to the processing plant area enforced.<br>• Processing plant contained within bunded area capable of retaining any spill.<br>• MSDS and Chemalert information retained by The Proponent.<br>• Plant personnel provided with appropriate training.<br>• Regular inspections of the plant completed and any maintenance requirements reported and enacted.<br>• Approved Reagent Management Plan prepared, implemented and personnel trained in its use.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT.<br>• Emergency Management Plan for dealing with spill developed and implemented. | D | 3 | T |

**Table A3.7 (cont'd)**
**Hazard Assessment – LPG**

Page 4 of 4

| Project Component | Incident Type | Scenario | Proposed Control / Treatment | Likelihood | Consequence | Risk |
|---|---|---|---|---|---|---|
| LPG combustion and energy generation (cont'd) | Fire | Failure / damage to processing plant resultant in spillage or leakage of LPG which ignites | • Restricted vehicle access to the processing plant area enforced.<br>• Ignition sources excluded from immediate areas surrounding the processing plant.<br>• Regular maintenance inspections and reporting of all storage, transfer and containment facilities.<br>• Operational personnel to have completed relevant training in emergency response and/or HAZMAT.<br>• *Emergency Management Plan* for dealing with spill developed and implemented.<br>• *Bushfire Management Plan* for dealing with fire developed and implemented. | E | 4 | T |