Straits Tritton Copper

TRITTON RESOURCES PTY LTD

ABN 88 100 095 494

Environmental Impact Statement

for the

Avoca Tank Project



Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

July 2014

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Author's Certification

for the submission of an Environmental Impact Statement prepared in accordance with the *Environmental Planning and Assessment Act 1979* (Part 4 – Division 4.1 – Section 76A).

(a) EA prepared by:

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address:	62 Hill Street ORANGE NSW 2800

(b) Development application by:

applicant name:	Tritton Resources Pty Ltd
applicant address:	Yarrandale Road HERMIDALE NSW 2831

(c) Application Number: DGR 766

(d) Address/land details:

Lot	DP	Lot	DP
Part Lot 3	751342	144	751315
135	751315	Part Lot 10	751315
Source: Land and Property Information (LPI 2013).			

(e) Project Outline: The application seeks development consent for the construction and operation of an underground mine and associated infrastructure, including but not limited to a box cut, decline, ROM Pad, Waste Rock Emplacement, access road, workshop, offices, hardstand areas and related infrastructure. Approval is also sought for transportation of ore material to the Applicant's Tritton Copper Mine via an existing private haul road and Booroomugga and Yarrandale Roads using road trains.

(f) Assessment of Environmental Impact: The assessment of environmental impacts of this project includes the matters referred to in the Director-General's Requirements provided to the Applicant on 25 September 2014 under Section 78A of the *Environmental Planning and Assessment Act 1979*.

(g) Declaration: I, Mitchell Anthony Bland, 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 25 September 2014;
- the assessment contains all available information that is relevant to the environmental assessment of the project; and
- the information contained in this document is neither false nor misleading.

Signature: MBland

Name: Mitchell A. Bland Date: 23/7/14.

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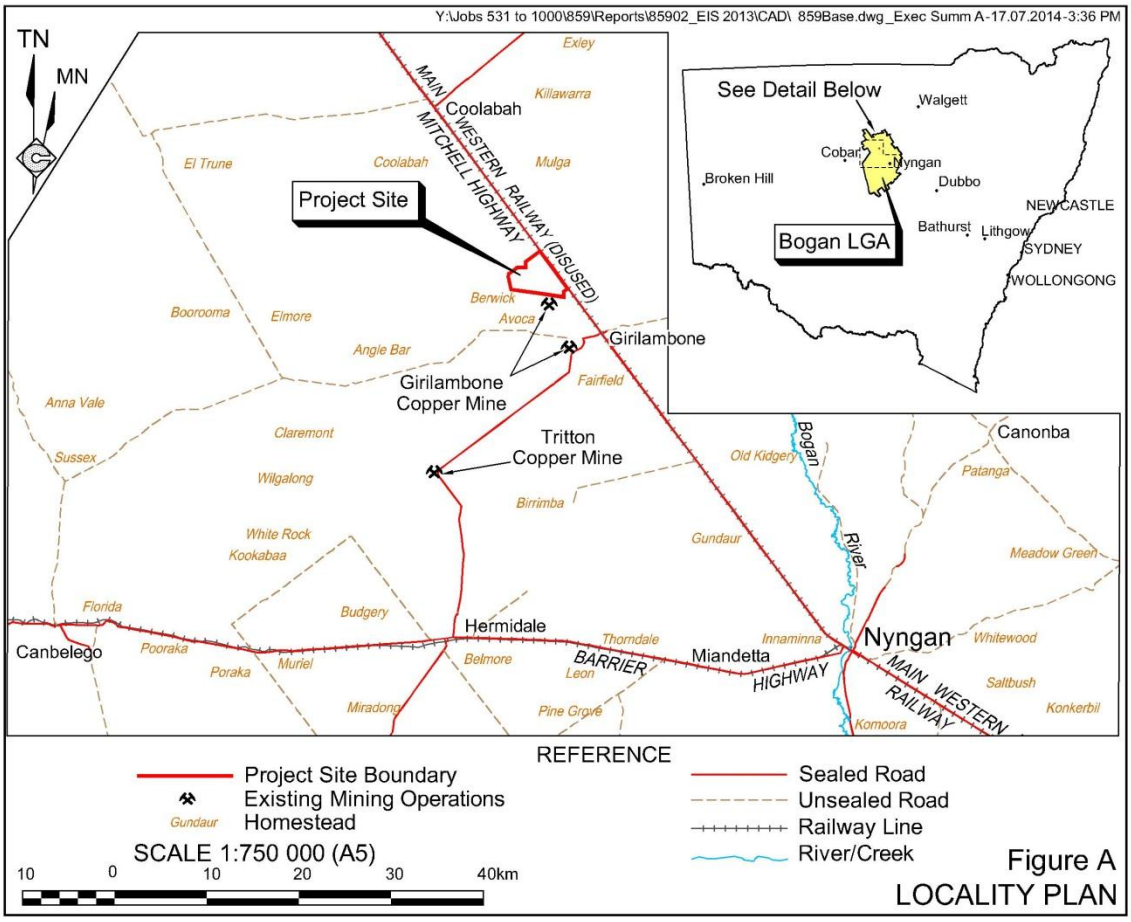
Executive Summary

INTRODUCTION

This *Environmental Impact Statement* has been prepared by R.W. Corkery and Co. Pty Limited, to accompany an application for development consent by Tritton Resources Pty. Ltd. (the Applicant), to develop and operate the Avoca Tank Project (the Proposal). The Proposal, which has a projected life of 7 years, would involve the development of a box cut and portal with an associated decline, permitting underground mining operations to occur in the identified mineralised zones. Associated surface infrastructure, including a run-of-mine Pad, waste rock emplacement, hardstand areas, water management structures and internal roads would also be constructed and maintained throughout the life of the Proposal.

The application area for the Proposal (the Project Site) is located approximately 2km north of the Applicant's existing Girilambone Copper Mine (North East Open Cut and Underground Mine), 24km northeast of the Applicant's Tritton Copper Mine, 7km northwest of the village of Girilambone, and approximately 55km northwest of the township Nyngan (**Figure A**). Access to the Project Site would be via the Mitchell Highway, Booramugga and Yarrandale Roads and the Applicant's private haul road from the North East Open Cut and Underground Mine to Booramugga Road.



The Project Site occurs on private land held by Mr P Johnstone. Mr Johnstone has consented to the application for development consent.

The Proposal is classified as;

- "Designated Development" under Clause 25 of Schedule 3 of the *Environmental Planning and Assessment Regulations 2000* as it would result in more than 4ha of disturbance; and
- "Regional Development" under Clause 5 of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011*.

The application is to be determined by the Joint Regional Planning Panel under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). An *Environmental Impact Statement* is required to accompany the application for development consent. Bogan Shire Council will exercise its functions in relation to receipt, notification and assessment of the application and associated fees.

This executive summary introduces the Applicant, provides relevant background information about the Proposal, presents an overview to the Proposal's design and operational safeguards, as well as a brief description of the local environment and predicted impacts on the surrounding physical, biological and socio-economic environment.

THE APPLICANT

The Applicant, Tritton Resources Pty Ltd, is a wholly owned subsidiary of Straits Resources Limited (Straits). The Applicant, through its associated companies, has operated the Tritton and Girilambone Copper Mines since 1992.

Straits is an established copper mining and exploration company listed on the Australian Securities Exchange and comprises an experienced Board and Management team focussed on operational excellence and strengthening the Company's corporate structure.

Straits flagship asset is the Tritton Copper Mine, located approximately 24km southwest of the Project Site and produces approximately 25 000t of copper concentrate and copper cement annually from a combination of the Applicant's regional mining operations.

PROPOSAL OBJECTIVES

The Applicant's objectives in constructing and operating the Proposal are as follows.

- To safely mine the identified copper-gold-silver reserves.
- To operate the Proposal in a manner that would minimise surface disturbance and impacts on surrounding residents and the local environment.
- To implement a level of management control and mitigation measures that ensures compliance with appropriate environmental criteria and reasonable community expectations.
- To develop and operate the Proposal in compliance with all relevant statutory requirements.
- To provide for the ongoing monitoring of local environmental parameters such as noise, water and air quality.
- To create a final landform that is suitable for a continuation of intermittent grazing.

- To achieve the above objectives in a cost-effective manner to ensure security of employment for the Applicant's workforce and the continued economic viability of the Applicant.

PLANNING CONTEXT

The Project Site is situated within land zoned Zone RU1 – Primary Production under the *Bogan Local Environment Plan 2011 (Bogan LEP). Underground mining is not identified as permissible within Zone RU1. However,* Clause 70(1)(b) of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries)* (Mining SEPP) identifies that mining is permissible, with consent, on any land where agriculture is permissible. As agriculture is permissible within Zone RU1, underground mining is also permissible, with consent.

The Proposal would be developed and operated in accordance with a number of State planning instruments and regional strategies, namely;

- *State Environmental Planning Policy (State and Regional Development) 2011;*
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries);*
- *State Environmental Planning Policy (Rural Lands) 2008; and*
- *Central Western Catchment Management Authority (CW-CMA) – Catchment Action Plan 2006 – 2016.*

The *Environmental Impact Statement* addresses each of the above documents together with the *Bogan LEP*.

APPROVALS REQUIRED

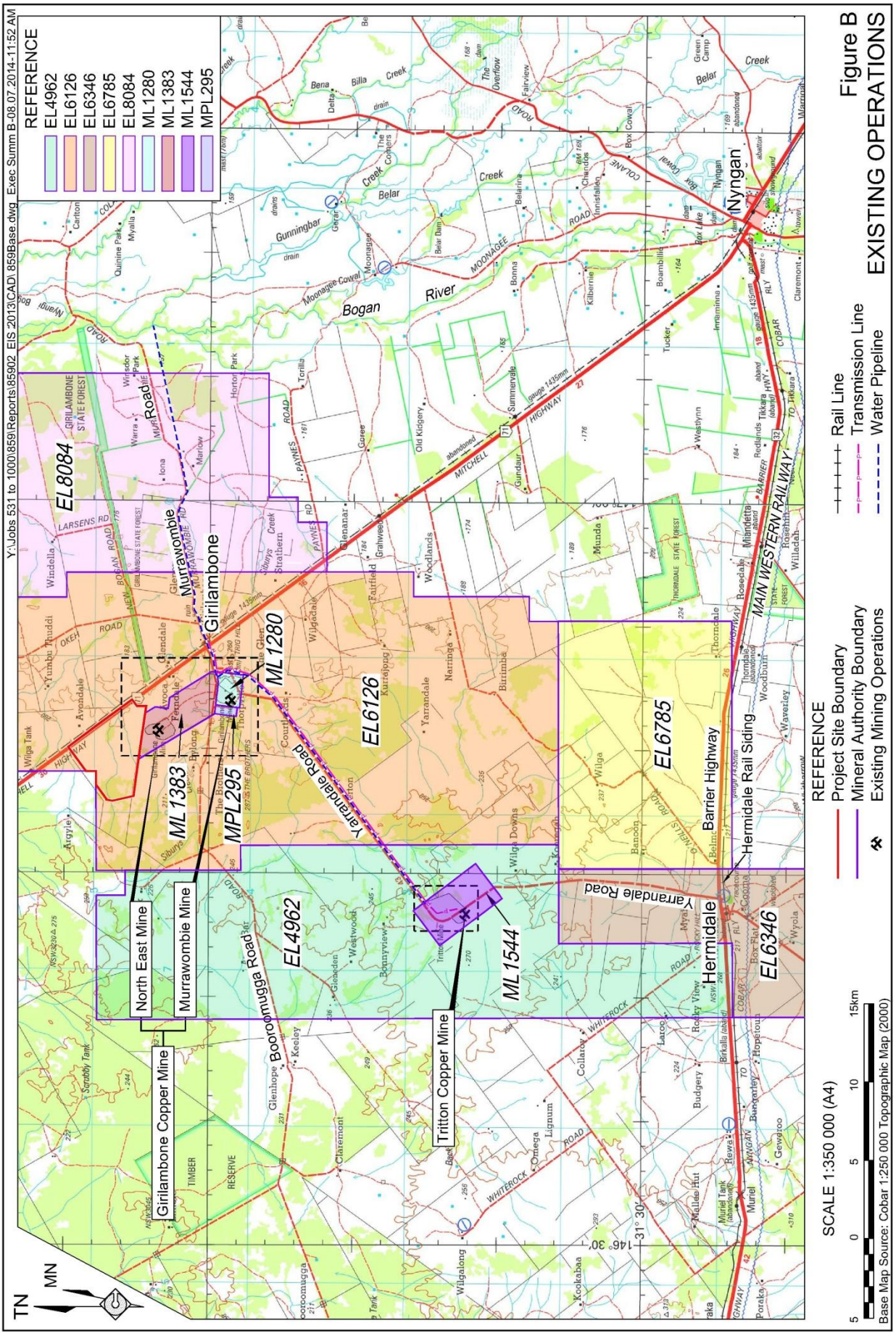
In addition to development consent, the Applicant anticipates the following approvals, licences and leases would be required.

- An Environment Protection Licence (EPL) issued by the Environment Protection Authority (EPA) under Section 47 of the *Protection of the Environment Operations Act 1997*.
- A Mining Lease issued by the Division of Resources and Energy (DRE) under the *Mining Act 1992* for the area nominated.
- A range of Approval's issued by the NSW Office of Water (NOW) under Sections 89, 90 and 91 of the *Water Management Act 2000* for water intersected by the proposed underground mine.

BACKGROUND

The copper deposits in the vicinity of the Project Site were first discovered in 1879, with mining commencing at the Girilambone Copper Deposit in 1881. In the early 1990's modern mining activities included the establishment of an open cut mining operation, the Murrawombie Mine, with ore processed using conventional heap leach methodology using sulphuric acid (**Figure B**).

The operator at that time, the Girilambone Copper Company (GCC), was the product of a Joint Venture between the Applicant (60%) and Nord Pacific Ltd (40%). GCC commenced open cut mining at the Murrawombie Open Cut in 1992. The operation was placed on care and maintenance in 2008.


Y:\Jobs 531 to 1000\859\Reports\85902 EIS 2013\CAD\ 859Base.dwg Exec Summ B-08.07.2014-11:52 AM
REFERENCE
EL4962
EL6126
EL6346
EL6785
EL8084
ML1280
ML1383
ML1544
MPL295
EL8084
EL6126
EL6785
EL4962
EL6346
ML1280
ML1383
MPL295
ML1544
Girilambone
Murrawombie
North East Mine
Murrawombie Mine
Girilambone Copper Mine
Tritton Copper Mine
Hermidale
Nyngan
Bogan River
Barrier Highway
Hermidale Rail Siding
Yarrandale Road
Booroomugga Road
MAIN WESTERN RAIL WAY
REFERENCE
Project Site Boundary
Mineral Authority Boundary
Existing Mining Operations
Rail Line
Transmission Line
Water Pipeline
SCALE 1:350 000 (A4)
5 0 5 10 15km
Base Map Source: Cobar 1:250 000 Topographic Map (2000)
TN MN
Figure B
EXISTING OPERATIONS

The North East Mine, comprising the Hartmans, Larsens and North East Open Cuts, is located approximately 2km to the south of the Project Site and 4km northwest of the Murrawombie Mine (**Figure B**). Mining of the three open cuts was completed by GCC prior to the Applicant assuming control of the company in 2005.

In addition, the Applicant also operates the Tritton Copper Mine located approximately 24km to the southwest of the Project Site (**Figure B**). Operations at the Tritton Copper Mine commenced in 2000 and are ongoing.

Following exploration operations within the Project Site, it was determined that the mineralisation and supporting resource calculations would permit an economically viable mining operation, resulting in the Proposal as described within this document.

PROPOSAL DESCRIPTION

Overview

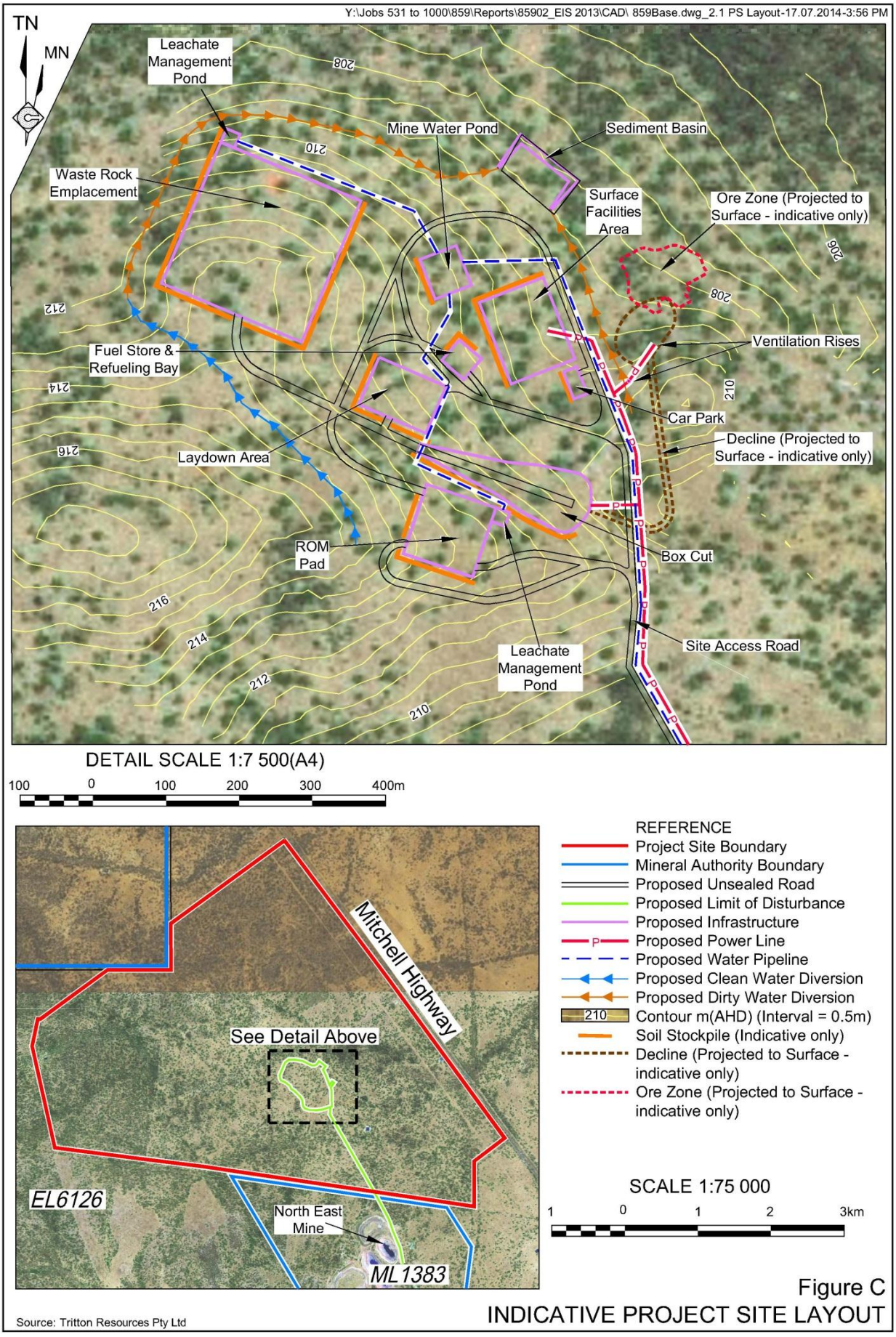
Figure C displays the principal components of the Avoca Tank Project which involves the following.

- Construction and use of a box cut, portal, decline, underground workings and two ventilation rises (one equipped as an emergency egress and the other with a ventilation fan at surface).
- Extraction of the economically recoverable copper-gold-silver resources to a depth of approximately 500m below surface using bench stoping and long hole open stope mining techniques.
- Transportation of ore material to the Tritton Copper Mine for processing using road registered road trains via a combination of a private haul road and Booramugga and Yarrandale Roads.
- Establishment of a surface waste rock emplacement for storage of waste rock extracted during construction of the box cut and initial sections of the decline and mine workings.
- Establishment of surface infrastructure, including a mine water pond, run-of-mine (ROM) Pad, laydown area, fuel store and refuelling bay and a hardstand area comprising a workshop, mobile plant parking area, wash down bay and transportable offices, crib room and ablution facilities.
- Extension of infrastructure from the North East Open Cut, including a site access road, water pipeline and electricity transmission line.
- Establishment of ancillary infrastructure.
- Construction and rehabilitation of a final landform that would be geotechnically stable and suitable for a final land use of intermittent grazing and nature conservation.

Site Establishment and Construction Phase

The Applicant would commence the following key site establishment and construction activities following receipt of development consent and other necessary approvals, licences and leases.

- Construction of the Site Access Road from the existing Girilambone Copper Mine and all other required internal roads.
- Construction of key site water management structures including clean and dirty water diversion channels, the Mine Water Pond, Sediment Basin and leachate management ponds.



Source: Tritton Resources Pty Ltd

Figure C
INDICATIVE PROJECT SITE LAYOUT

- Excavation of the box cut using bulldozers, blasting (as required) and load and haul techniques and placement of that material within the waste rock emplacement.
- Construction of the underground portal from the completed box cut, including the entrance to the decline and associated underground infrastructure, namely power, ventilation, water supply and safety equipment.
- Construction of the underground decline using conventional drill and blast techniques, with fragmented material transported to the surface.

Mining and Backfill Operations

Underground mining operations would utilise open stope mining techniques to extract the ore from the elongate vertical lenses. The ore and associated waste rock would be transported to the surface ROM Pad using conventional underground haul vehicles. Backfilling of underground voids with waste rock would be undertaken to provide for local mine stability and to allow the potential extraction of higher grade resources in localised areas. The Applicant estimates that approximately 25% of the stopes that would be created would be backfilled. The backfilling would utilise material from concurrent operations within the mine, or from material transported from the surface waste rock emplacement.

Transport and Processing Operations

Ore material placed on the ROM Pad would be loaded into two-trailer road trains (approximate 52t capacity) and transported to the Tritton Copper Mine for processing (see **Figure A**) via:

- the proposed Site Access Road;
- the existing private haul road between the North East Open Cut and Murrawombie operations; and
- Booramugga and Yarrandale Roads.

Processing would be undertaken at the existing Tritton Copper Mine processing plant under the existing Development Consent. Processed concentrate would then be transported to the Applicant's Hermidale siding for rail transport to local or international markets.

Hours of Operation

Vegetation clearing, topsoil stripping and rehabilitation operations would occur during daylight hours, seven days per week.

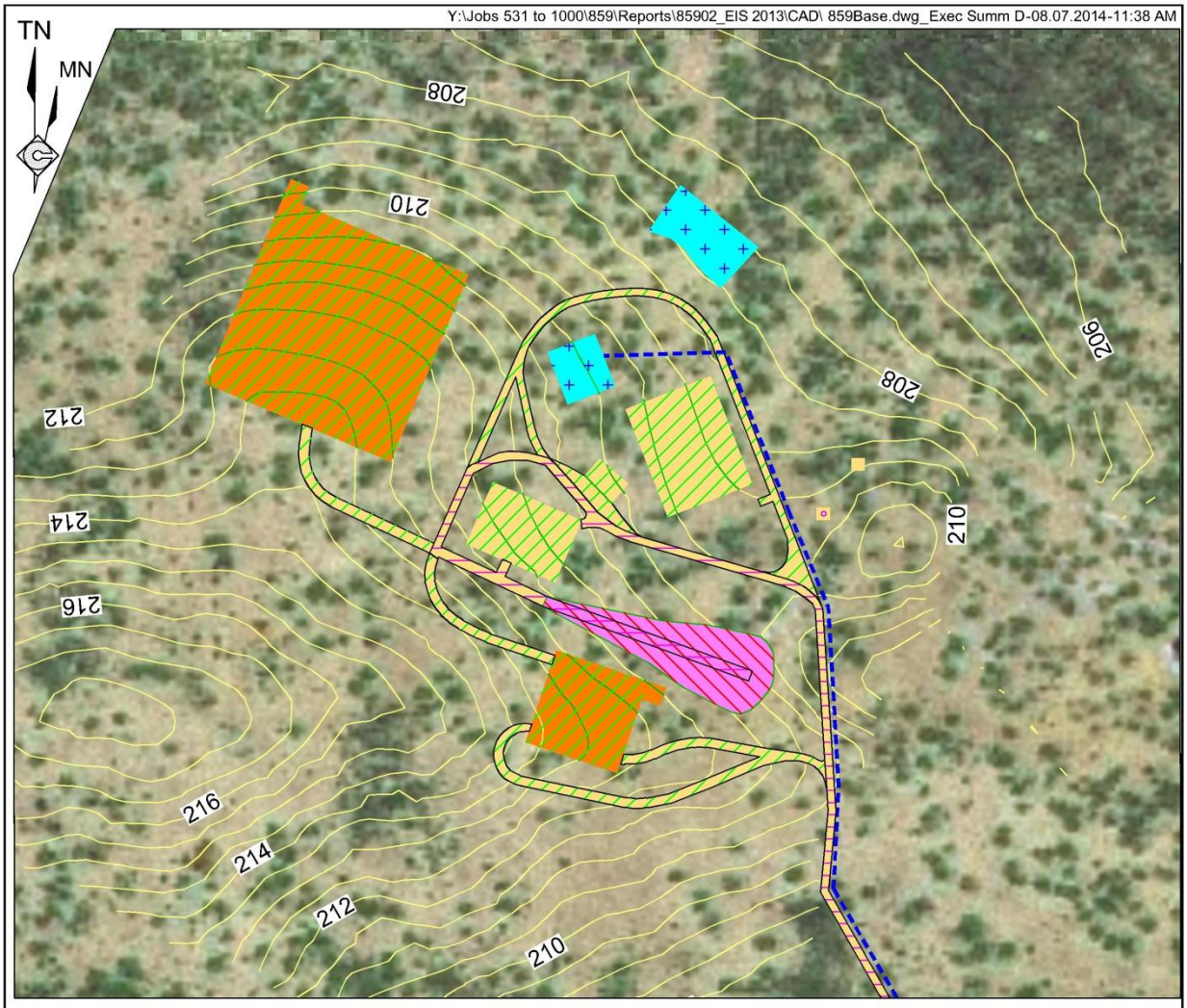
The remaining operations including site establishment, underground mining, ore transportation and maintenance operations would occur 24 hours per day, seven days per week.

Rehabilitation and Final Landform

Figure D presents the rehabilitation domains and indicative final landform for the Project Site, with all infrastructure, with the exception of water management structures (for ongoing rural use) and the Site Access Road removed.

ISSUE IDENTIFICATION AND PRIORITISATION

In order to undertake a comprehensive *assessment* of the Proposal, 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 their potential impacts)



REFERENCE
Unsealed Road
Pipeline
Clean Water Diversion
Water Storage
210 Existing Contour m(AHD) (Interval = 0.5m)
210 Final Contour m(AHD) (Interval = 0.5m)

Primary Domains
Domain 1 - Infrastructure Area
Domain 3 - Water Management Structures
Domain 4 - Waste Rock Emplacement and ROM Pad
Domain 8 - Underground Mining Area

Secondary Domains
Domain A - Infrastructure
Domain B - Water Storage
Domain G - Rural Land
Domain I - Final Void

SCALE 1:7 500(A4)
100 0 100 200 300 400m
Source: Tritton Resources Pty Ltd

Figure D
INDICATIVE REHABILITATION DOMAINS AND FINAL LAND USES

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 Impact Statement.*

Consultation

Consultation with the local community involved:

- individual discussions with the landowners / residents of properties within and surrounding the Project Site; and
- the establishment and subsequent quarterly meetings of the Community Consultative Committee.

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

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, with this priority used to provide an order of assessment and depth of coverage within the *Environmental Impact Statement.*

Based on the issues identified and the risk ratings allocated to the potential environmental impacts of these, the following order of priority of environmental issues has been determined.

1. Aboriginal Heritage.
2. Ecology.
3. Groundwater.
4. Noise.
5. Blasting and Vibration.
6. Historic Heritage.
7. Air Quality.
8. Surface Water.
9. Traffic and Transportation.
10. Visual Amenity.
11. Bush Fire.
12. Soil and Land Capability.
13. Agriculture.
14. Socio-Economic.

ENVIRONMENTAL FEATURES SAFEGUARDS AND IMPACTS

The components and features of the existing environment within and surrounding the Project Site have been studied in detail and the Proposal 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 in the following sections.

Aboriginal Heritage

The Proposal has the potential to impact on Aboriginal sites as a consequence of surface disturbing activities. Following consultation with registered Aboriginal community stakeholders, two field surveys to identify the type and distribution of Aboriginal sites was undertaken in April and October 2012.

Five Aboriginal heritage sites were identified within the Project Site. In addition, it was determined that a number of previously identified and registered Aboriginal heritage sites had been recorded in incorrect locations. One of these

erroneously registered sites was identified as occurring in close proximity to the Site Access Road. In order to avoid doubt, the Site Access Road was slightly realigned to avoid any potential interactions with the registered site, irrespective of whether artefacts occur within the site or not.

In order to ensure in situ protection of all identified Aboriginal sites, the Applicant would erect a fence with an appropriate buffer around each Aboriginal site and prohibit entry to non-authorised personnel to prevent any potential damage to the sites.

Ecology

The ecology assessment identified four vegetation communities and a total of 127 flora and 114 fauna species within the Project Site during surveys undertaken throughout 2012.

Of the flora species, namely the Cobar Greenhood Orchid, listed as vulnerable under both the *Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act), was recorded.

Each of the identified vegetation communities is a non-endangered community.

Eight fauna species listed as vulnerable under either the TSC Act or EPBC Act, or migratory under the EPBC Act, were identified during the field surveys.

The Proposal would result in the clearing of approximately 34ha of a non-endangered vegetation community, equating to approximately 2% of the Project Site vegetation. As a result of this, it was determined that a Biodiversity Offset is not required for the Proposal, due to the general principles of 'avoid and minimise' having been adopted in relation to the design of the Proposal. In addition, tests of significance were undertaken for all species listed under the TSC Act or EPBC Act either identified or having the potential to occur within the Project Site. Those assessments determined that there would be no significant impact on any of the identified species.

Groundwater

Groundwater in the vicinity of the Project Site is hosted by the Lachlan Fold Belt Murray-Darling Basin fractured rock groundwater source and is generally of poor quality, with electrical conductivities between 20 000µS/cm and 24 000µS/cm.

Within the Project Site, standing water levels in monitoring bores are between 30m and 40m below surface. The closest bore that intersects the fractured rock aquifer that is licenced for stock use is located approximately 15km to the east of the Project Site.

The Applicant determined the measured groundwater inflow to the Tritton Copper Mine over three years to be approximately 111ML/yr. Inflows to the North East and Murrawombie Mines were estimated to be 104ML/yr and 130ML/yr.

Anticipated groundwater inflows to the proposed mine were estimated semi-quantitatively using two equation-based methodologies, with inflows of between 392ML/yr and 567ML/yr predicted. Similarly, the extent of groundwater drawdown was estimated to be between 20.4km and 94.5km from the proposed mine.

It is noted, however, that these estimates are likely to significantly overestimate the actual impacts. As a result, the anticipated groundwater inflows to the proposed mine are expected to increase from nil initially to a rate similar to that observed at the Tritton Copper Mine, namely approximately 111Ml/yr at the end of the life of the Proposal. Similarly, the extent of

groundwater drawdown is expected to be limited to significantly less than the identified 20.4km

Noise

The sources of noise around the Project Site are typical of a rural environment with contributions from farming activities, insect noise, livestock, wind through vegetation and vehicles on local roads.

The criteria for noise generated by the Proposal are the default *Industrial Noise Policy* criteria as follows.

- Site establishment and mining operations – 35dB(A) ($L_{Aeq(15min)}$).
- Night-time sleep disturbance – 45dB(A) (L_{Amax}).
- Road traffic noise - 55dB(A) (daytime) and 50dB(A) (night-tine) ($L_{Aeq(1hr)}$).

Noise modelling undertaken as part of the noise impact assessment confirmed that all privately-owned residences would comply with the relevant criteria throughout all phases of the Proposal.

Blasting and Vibration

The criterion for blasting and vibration would be as follows.

- Air blast overpressure – 115dB(L).
- Ground vibration – 5mm/s Peak Particle Velocity (PPV).

A blasting assessment was undertaken using a highly conservative Maximum Instantaneous Charge of 1000kg. The results of the assessment confirmed compliance with the criteria at all surrounding privately-owned residences.

Historic Heritage

A non-Aboriginal heritage survey was undertaken concurrently with the Aboriginal heritage field survey. Three historic heritage sites were identified as occurring within the Project Site.

The sites would be left in situ with protection fencing provided, with no disturbances predicted to the sites from proposal-related activities.

Air Quality

Due to the nature of the proposed activities and the proposed management measures and based upon dust monitoring at the Applicant's existing mining operations, the potential impact on air quality at surrounding privately-owned residences would be negligible.

Surface Water

Surface water within the Project Site is typically only present immediately following substantial rainfall. Surface water flow is anticipated to be primarily sheet flow and is likely to have elevated suspended sediment loads.

Rainfall within undisturbed sections of the Project Site (clean water) would be diverted around the proposed areas of disturbance. Rainfall within disturbed sections of the Project Site would be captured (dirty water) within the water management system and utilised for mining or dust suppression purposes. Contaminated water, or water potentially laden with salt, chemicals or hydrocarbons, would be retained and used for mining-related purposes or pumped back to the North East Open Cut and would not be permitted to flow off site.

Make up water used for the Proposal (that is not sourced preferentially from the Site's water management system) would be

sourced from the Applicant's existing licenced water supply at the Girilambone Copper Mine. In light of the above, there would be no significant surface water-related impacts.

Traffic and Transportation

The Applicant proposes to construct a Site Access Road from its existing Girilambone Copper Mine, to permit access to the Applicants internal road network and ultimately the public Booramugga and Yarrandale Roads. Those roads would be utilised to transport ore from the Proposal's ROM Pad to the processing plant at the Tritton Copper Mine using road-registered two trailer road-trains.

The Proposal would result in approximately 50 road-train movements per day. These movements would essentially replace existing ore transportation movements associated with the Applicant's Girilambone Copper Mine. As a result, no adverse traffic and transportation impacts are anticipated.

Visual Amenity

The existing visual amenity surrounding the Project Site is typical of rural areas with views of native vegetation, cleared areas and intermittent agricultural and mining operations.

Activities within the Project Site would not be visible from surrounding residences and publically accessible vantage points.

Bush Fire

Taking into account the vegetation, slopes within the Project Site and the size of cleared areas around proposed infrastructure, a bush fire hazard assessment determined that the Proposal is classified as a medium category of bush fire attack, consistent with 'Category 1 bush fire prone land', as identified in the Bogan LEP.

Following the implementation of the proposed management measures, it was determined that the Proposal would not present a risk or be at risk from a significant bush fire-related attack.

Soil and Land Capability

The stripping, handling and storage of soils within the Project Site would be undertaken in a manner that would ensure that the soils are available for rehabilitation activities to permit the proposed future land use of the Project Site, namely continued intermittent agricultural use.

Agriculture

Cleared land within the Project Site has been previously used for intermittent sheep and cattle grazing. However, agricultural activities have not been undertaken within the Project Site since at least to 2004.

Taking into account the limited agricultural activities within and surrounding the Project Site, and the fact that the Proposal would result in limited disturbance, either directly or indirectly, the proposed activities are likely to have no or negligible adverse impacts on agricultural activities in the vicinity of the Project Site.

Socio-Economic

The Proposal would result in a range of socio-economic benefits to the community surrounding the Project Site. These benefits would include the following.

- Continued employment for approximately 318 persons, of which more than half would continue to reside

within the Bogan Local Government Area with a large proportion of the remainder residing in surrounding areas.

- Continued contribution to the local, Regional, State and National economies, including contributions of approximately $15.8M and $10M annually within the Bogan LGA through wages and salaries and purchase of goods and services respectively, with additional indirect contributions.
- Continued support for local community organisations and services.

Assessment of the potential socio-economic impacts demonstrates the beneficial impacts of the Project far outweigh any minor adverse impacts associated with the operations.

PROPOSAL EVALUATION AND JUSTIFICATION

The Avoca Tank 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.

An evaluation of the Proposal has been undertaken by firstly re-assessing the risks posed to the local environment by Proposal-related activities following the implementation of all operational controls, safeguards and/or mitigation measures, and secondly through consideration of the principles of ecologically sustainable development. This evaluation has found that, with the implementation of the proposed operational controls, safeguards and/or mitigation measures, the residual risk posed by each potential environmental impact has been reduced to either moderate or low, and therefore acceptable. Further, the design of the Proposal has addressed each of the sustainable development principles, and on balance, it is concluded that the Proposal achieves a sustainable outcome for the local and wider environment.

The Proposal 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 local surrounding towns, villages and regional centres, Bogan LGA, NSW and Australia, the market opportunities for copper exports and the principles of ecologically sustainable development.

CONCLUSION

The Proposal 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 Proposal provides for the development, mining and transportation of copper/gold/silver ore for processing at the Applicant's existing Tritton Copper Mine, which would continue to be significant in generating further employment opportunities and maintaining stimulus to the local economies. The post-mining landform would also provide for the re-establishment of intermittent agricultural activities.

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

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Section 1

Introduction

PREAMBLE

This section introduces the proposed Avoca Tank Project (the Proposal) and includes:

- *an outline and scope of the Environmental Impact Statement;*
- *details about the Applicant, Tritton Resources Pty Ltd;*
- *relevant background to the Proposal including a review of the history of mining and exploration and the environmental performance in the area surrounding the Project Site;*
- *the format of the Environmental Impact Statement; and*
- *identification of the personnel involved in the Proposal design, document preparation and specialist consultant investigations.*

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1.1 SCOPE

Tritton Resources Pty Ltd (the Applicant) proposes to develop and operate the Avoca Tank Project (the Proposal) to provide ore to the Company's existing and approved processing plant at the Tritton Copper Mine. The Proposal is located approximately 2km north of the Applicant's existing North East Mine and 24km northeast of its Tritton Copper Mine, 7km northwest of the village of Girilambone, and approximately 55km northwest of Nyngan (**Figure 1.1**).

The Proposal would comprise the following.

- A box cut and underground mining operation.
- A surface infrastructure area, including a run-of-mine (ROM) Pad, laydown area, workshop and offices.
- A surface waste rock emplacement.
- An extension of the existing haul road from the North East Mine.
- Ancillary surface infrastructure.

The Proposal would also include transportation of ore material from the ROM Pad to the Applicant's Tritton Copper Mine for processing via an existing private haul road and Booramugga and Yarrandale Roads.

All areas of proposed disturbance associated with the Proposal are contained within the "Project Site" which is described in more detail in Section 1.3.

The Proposal is not classified as 'State Significant Development' under the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP) because it:

- has a capital investment value of less than $30 million;
- would not extract coal or mineral sands; and
- would not be located within an environmentally sensitive area.

The Proposal is, however, classified as "Designated Development" under the Clause 25 of Schedule 3 of the *Environment Planning and Assessment Regulation 2000* because the area of disturbance would be more than 4ha. In addition, the Proposal may be classified as "Regional Development" under Clause 3 of Schedule 4A of the *Environmental Planning and Assessment Act 1979* because the capital cost of the Proposal would be $20 million. As a result, under Clause 21 of the State and Regional Development SEPP, the Proposal is to be assessed by a Joint Regional Planning Panel (JRPP).

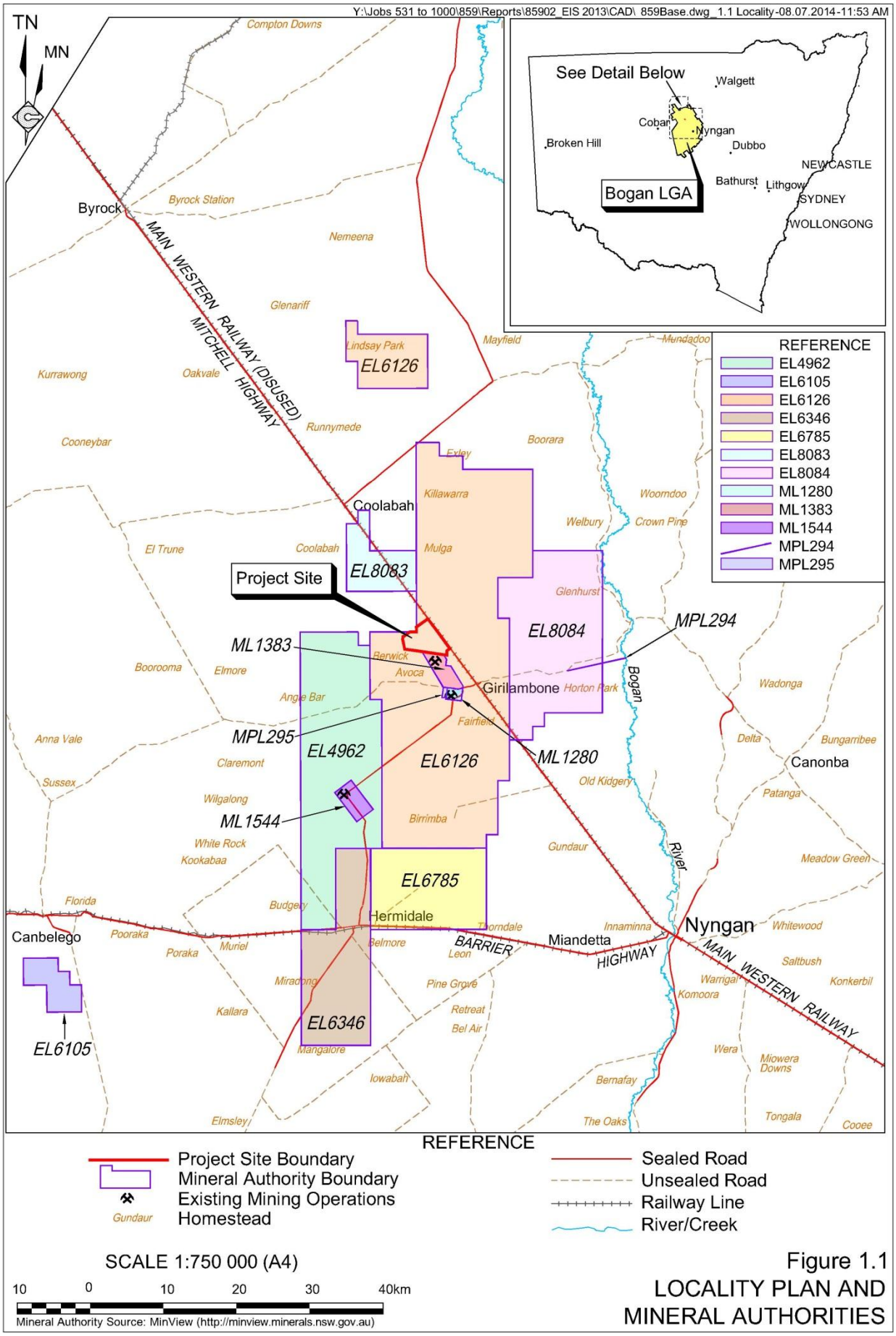


Figure 1.1
LOCALITY PLAN AND MINERAL AUTHORITIES

The Proposal, would also require the following additional approvals (see Section 2.1.3).

- A Mining Lease (ML) to be issued under the *Mining Act 1992*.
- A new or modified Environment Protection Licence issued under the *Protection of the Environment Operations Act 1997* (POEO Act).
- A range of approvals under the *Water Management Act 2000* (WM Act).

As a result, the Proposal may also be classified as "Integrated Development" under Section 91 of the EP&A Act.

This document outlines the Proposal, its resources and describes the existing environment on and surrounding the Project Site, and assesses the environmental impacts of the Proposal after a range of design and operation environmental safeguards are adopted.

The contents of this document reflect the following:

- The key assessment requirements identified within the Director-General's Requirements (DGRs) issued by the then NSW Department of Planning and Infrastructure and including reference to the key assessment requirements of the following government agencies:
  - Office of Environment and Heritage;
  - Roads and Maritime Services;
  - NSW Office of Water;
  - NSW Industry and Investment – Division of Resources and Energy;
  - Department of Primary Industries;
  - Environment Protection Authority; and
  - Bogan Shire Council.
- The requirements of Section 79(C) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).
- The requirements of Schedule 2 of the *Environmental Planning and Assessment Regulations 2000* (EP&A Reg).
- The experience of R.W. Corkery & Co. Pty Limited in the preparation of documentation for similar projects throughout NSW.

1.2 THE APPLICANT

The Applicant, Tritton Resources Pty Ltd, is a wholly owned subsidiary of Straits Resources Limited (Straits). The Applicant, through its associated companies, has operated the Tritton and Girilambone Copper Mines since 1992. A description of the existing, approved activities is provided in Section 1.4.3.

Straits is an established copper mining and exploration company listed on the Australian Securities Exchange. Straits flagship asset is the Tritton Copper Operations in NSW which produce approximately 25 000t of copper concentrate and copper cement annually. The operations incorporate multiple mines and a 1.5Mt per annum concentrator. Straits has an experienced Board and management team focussed on operational excellence and strengthening the Company's corporate structure.

1.3 PROJECT SITE

The Project Site covers an area of approximately 18.6ha and incorporates all areas of Proposal-related activities. **Table 1.1** and **Figure 1.2** present land titles within the Project Site, noting that all land titles within the Project Site are registered to Mr P.G. Johnston.

The applicant will formalise an arrangement to purchase land required for the Proposal from Mr Johnston should development consent be granted.

Table 1.1
Project Site Land Titles

Lot	DP	Lot	DP
Part Lot 3	751342	144	751315
135	751315	Part Lot 10	751315
Source: Land and Property Information (LPI 2013).			

1.4 BACKGROUND TO THE PROPOSAL

1.4.1 Existing Mineral Authorities

Table 1.2 presents the mineral authorities held by the Applicant and related companies in the vicinity of the Project Site. **Figure 1.1** presents the locations of the mineral authorities identified in **Table 1.2**.

1.4.2 Historic Mining Operations

The Girilambone copper deposits (see **Figures 1.3** and **1.4**), were first discovered in 1879 with mining commencing in 1881. Ownership has changed several times throughout the various stages of mining operations since that date.

Modern mining activities included the establishment of an open cut mining operation in the early 1990's. At that time, the copper ore was processed by conventional heap leach methodology using sulphuric acid as the leachate.

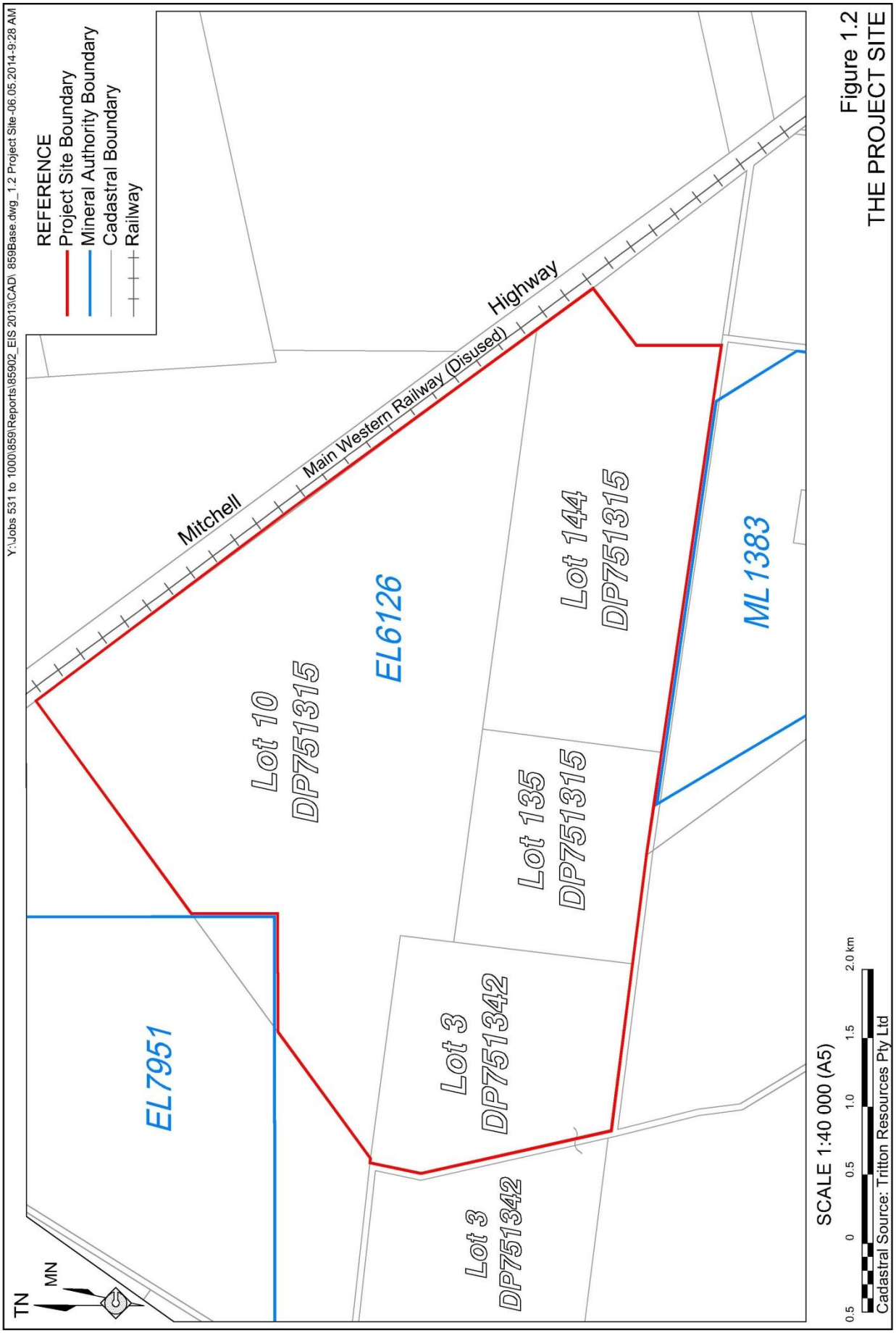
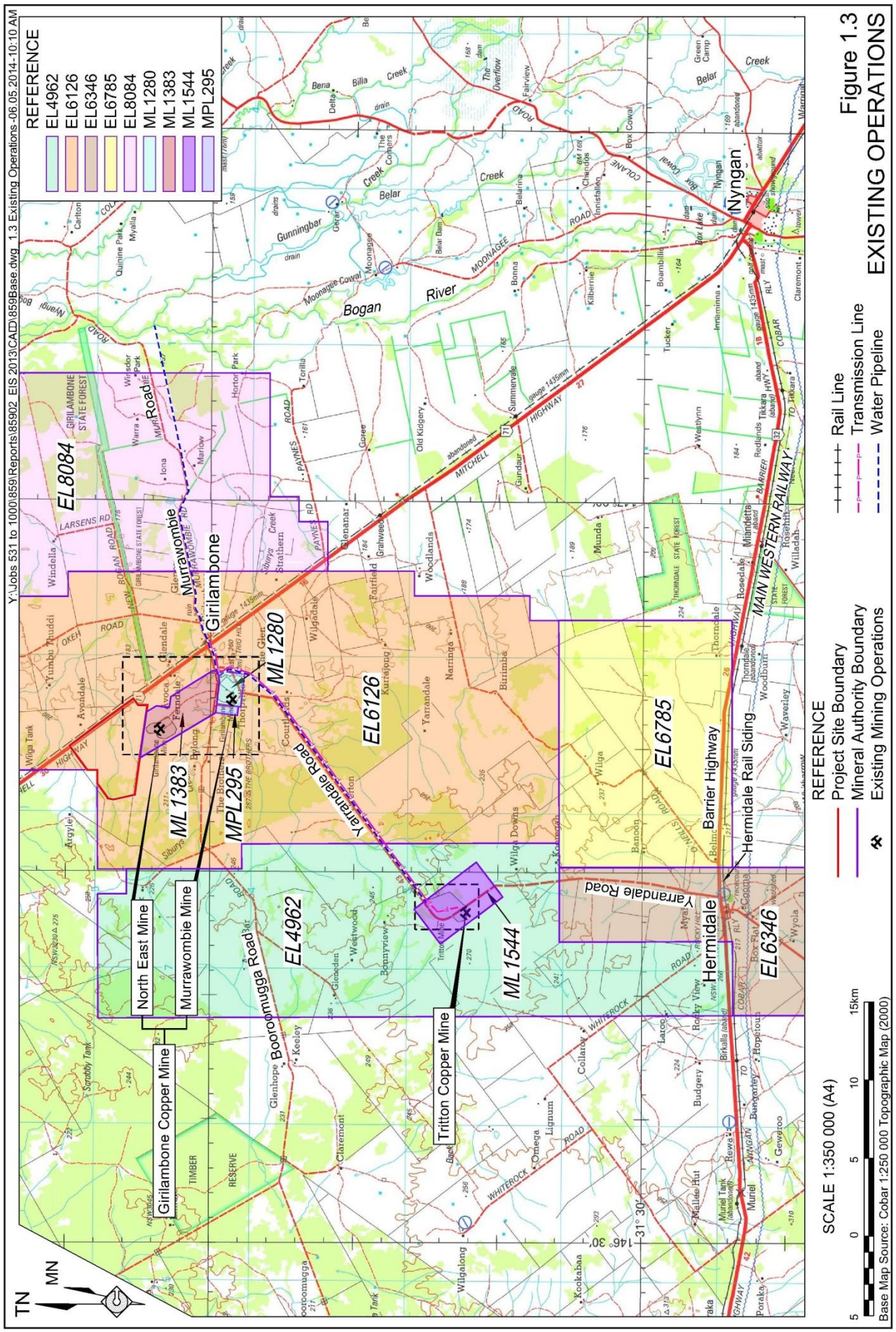


Figure 1.2
THE PROJECT SITE


Y:\Jobs 531 to 1000\859\Reports\85902 EIS 2013\CAD\859Base.dwg 1.3 Existing Operations -06.05.2014-10:10 AM
REFERENCE
EL4962
EL6126
EL6346
EL6785
EL8084
ML1280
ML1383
ML1544
MPL295
EL8084
EL4962
EL6126
EL6346
EL6785
ML1280
ML1383
ML1544
MPL295
Girilambone
Murrawombie
Yarrandale Road
Barrier Highway
Hermidale Rail Siding
Hermidale
Nyngan
Bogan River
North East Mine
Murrawombie Mine
Girilambone Copper Mine
Tritton Copper Mine
Booroomugga Road
MAIN WESTERN RAILWAY
REFERENCE
Project Site Boundary
Mineral Authority Boundary
Existing Mining Operations
Rail Line
Transmission Line
Water Pipeline
SCALE 1:350 000 (A4)
5 0 5 10 15km
Base Map Source: Cobar 1:250 000 Topographic Map (2000)
TN
MN
Figure 1.3
EXISTING OPERATIONS

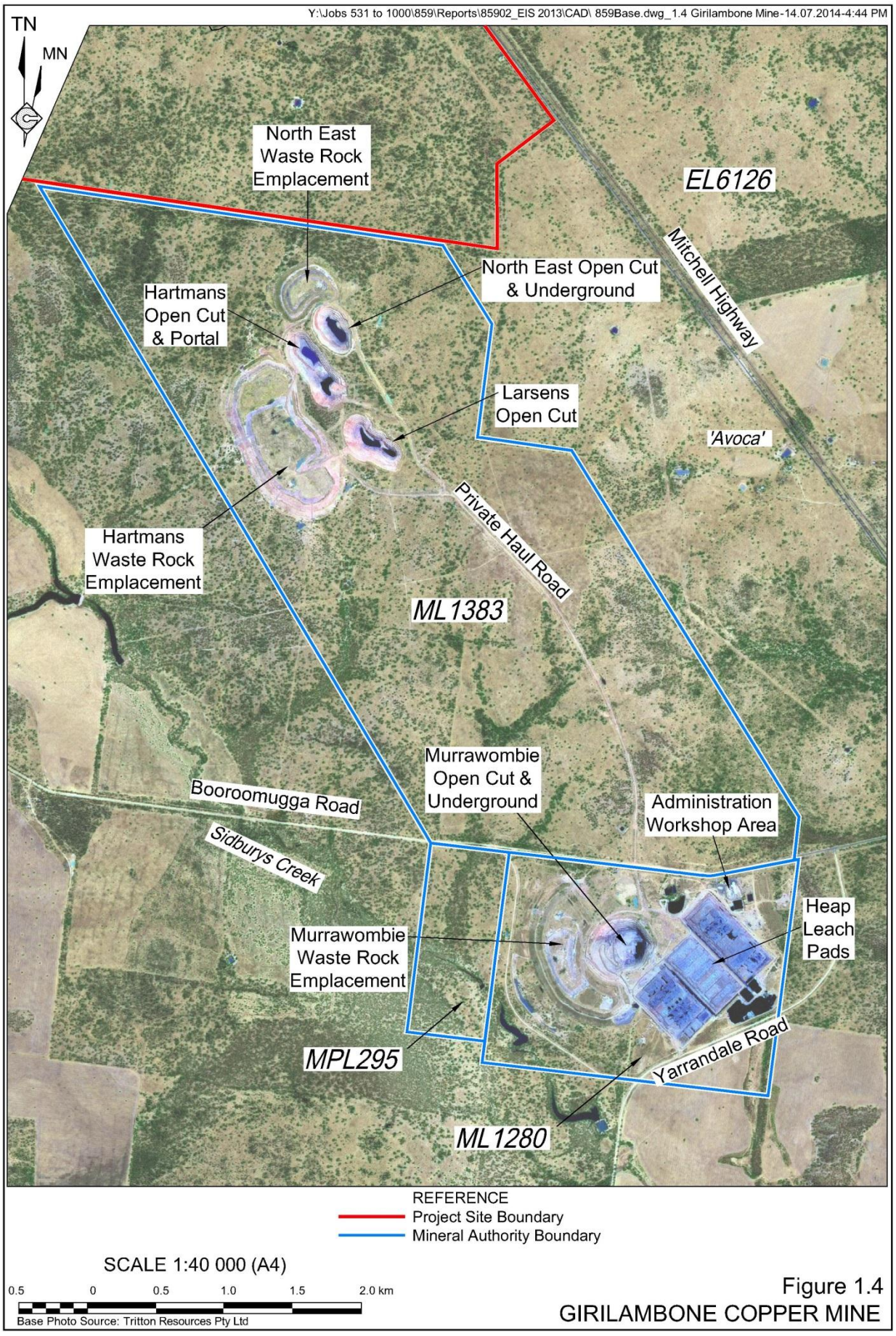


Figure 1.4
GIRILAMBONE COPPER MINE

Table 1.2
Existing Mineral Authorities

Mineral Authority (Mining Act 1992)	Holder / Applicant	Grant Date	Expiry Date
ML 1544	Tritton Resources Pty Ltd	22/12/2003	22/12/2024
ML 1383	Tritton Resources Pty Ltd	13/01/1996	12/01/2017
ML 1280[2]	Tritton Resources Pty Ltd	06/08/1992	05/04/2013[1, 2]
MPL 294	Tritton Resources Pty Ltd	06/08/1992	05/08/2013[1, 2]
MPL 295[2]	Tritton Resources Pty Ltd	06/08/1992	05/08/2013[1, 2]
EL 4962	Tritton Resources Pty Ltd	19/03/1996	25/04/2014[1, 2]
EL 6346	Tritton Resources Pty Ltd	23/11/2004	22/11/2014
EL 6105	Oxley Exploration Pty Ltd 51% / Tritton Resources Pty Ltd 49%	28/07/2003	27/06/2015
EL 6785	Tritton Resources Pty Ltd	22/05/2007	22/05/2015
EL 6126	Tritton Resources Pty Ltd	15/09/2003	14/09/2016
EL 8083	Tritton Resources Pty Ltd	10/05/2013	10/05/2015
EL 8084	Tritton Resources Pty Ltd	10/05/2013	10/05/2015
Note 1: Renewal Sought –pending determination.			
Note 2: Issued under the *Mining Act 1973* – All other authorities issued under the *Mining Act 1992.*			
Source: Minview (http://minview.minerals.nsw.gov.au) and Tritton Resources Pty Ltd.			

The Girilambone Copper Company (GCC) was the product of a Joint Venture between the Applicant (60%) and Nord Pacific Ltd (40%) in 1991. GCC commenced open cut mining at the Murrawombie Mine in 1992, and continued until 1997. Two levels of underground development were completed prior to the mine being placed on care and maintenance in 2008. Mine evaluation work is continuing as part of a consolidation of the Tritton projects within the Girilambone locality.

The North East Mine, comprising the Hartmans, Larsens and North East Open Cuts, is located approximately 2km to the south of the Project Site and 4km northwest of the Murrawombie Open Cut (see **Figures 1.3** and **1.4**). Mining of the three open cuts was completed by GCC (now a subsidiary of Straits) prior to the Applicant assuming control of the operations in 2005. Further decline development for the North East extension started in late 2007, and despite a short period of care and maintenance in 2008, continues to be developed.

The Murrawombie Open Cut and associated underground development, as well as the North East Mine, are collectively known for the purposes of this document as the Girilambone Copper Mine.

1.4.3 Current Mining Operations

1.4.3.1 Introduction

The Applicant currently operates the Girilambone and the Tritton Copper Mines (locations shown on **Figure 1.3**) utilising the same processing plant (located at the Tritton Copper Mine) to process ore from both operations.

The following subsections provide a summary of existing approved activities at each mine, including the respective mining and processing operations, current layouts and approvals.

1.4.3.2 Girilambone Copper Mine

Figure 1.4 presents an overview of the layout of the Girilambone Copper Mine, including the following infrastructure.

- Murrawombie Open Cut and Underground Portal.
- Murrawombie Waste Rock Emplacement.
- Heap Leach Pads.
- North East and Larsens Open Cuts.
- Hartmans Open Cut and Portal.
- North East and Hartmans Waste Rock Emplacements.
- Administration and workshop areas.

The Murrawombie Open Cut and Underground mine is currently in care and maintenance. However, these operations continue to be evaluated as part of the Applicant's ongoing review of its projects in the locality. Heap leach operations continue to extract residual copper from the Heap Leach Pads and include the installation of a new copper cementation plant in 2008. The administration and workshop areas continue to service both the Heap Leach Pad operations and the North East Mine.

Open cut mining has ceased within the Hartmans Open Cut which continues to be backfilled with extracted waste rock from the North East underground mine.

All ore currently extracted from open cut and underground operations, is treated at the Applicant's processing plant located at the Tritton Copper Mine. Ore material is transported from the Girilambone Copper Mine to the Tritton Copper Mine via a private haul road between the North East Open Cut and the Murrawombie Open Cut and then via the public Booramugga and Yarrandale Roads (**Figure 1.3**). This material is initially transported from the open cuts using off-road haul trucks and placed on a ROM Pad adjacent to each open cut. The material is then loaded into road-registered, side tipping road trains for transportation to the Tritton Copper Mine (see Section 1.4.3.3).

Table 1.3 outlines the existing development approvals for the Girilambone Copper Mine.

1.4.3.3 Tritton Copper Mine

Figure 1.5 presents an overview of the layout of the Tritton Copper Mine, including the following infrastructure.

- Box cut and decline.
- ROM Pad, crushing and screening plant and surge pile.
- Waste rock emplacement.

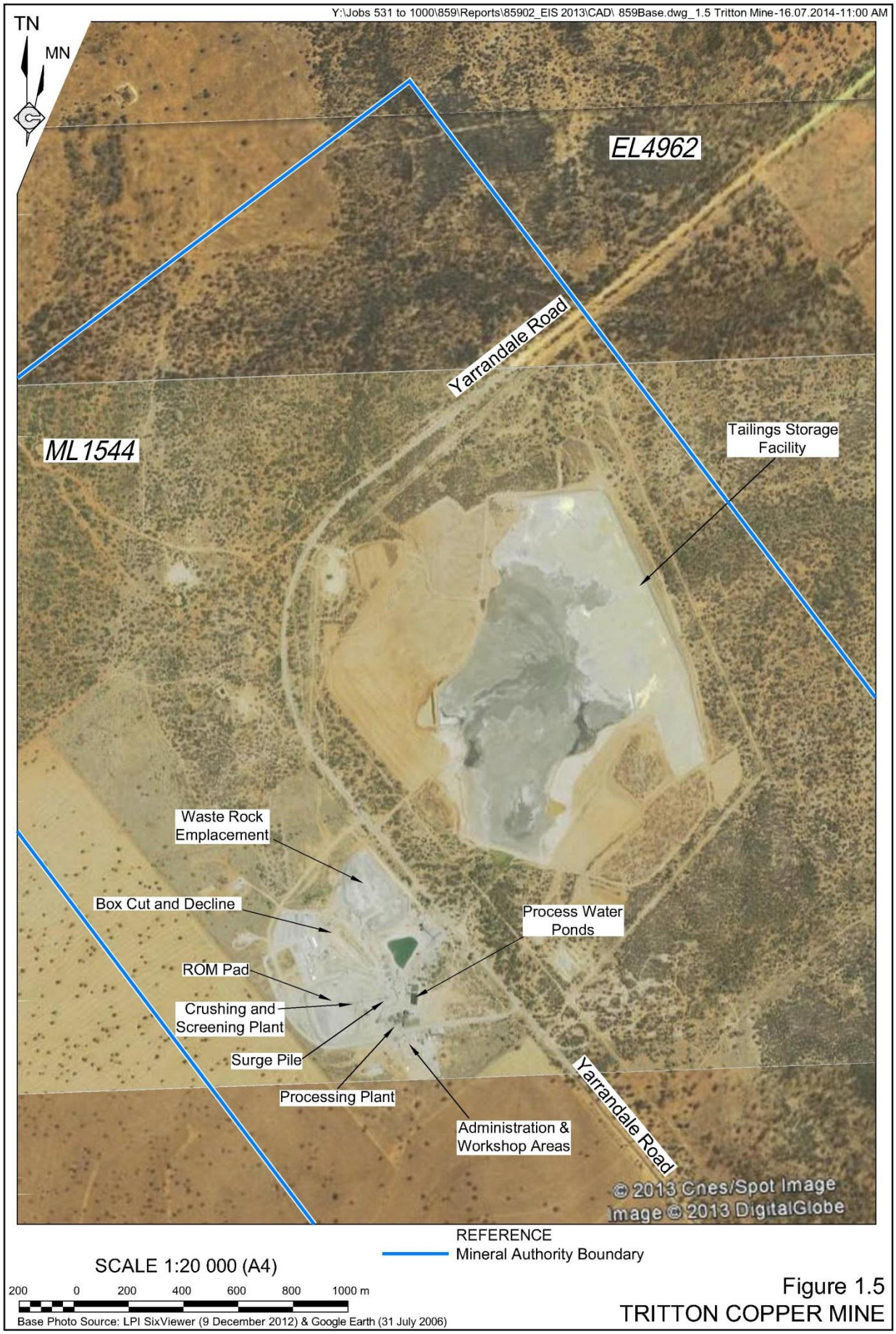


Figure 1.5
TRITTON COPPER MINE

Table 1.3
Girilambone Copper Mine Existing Development Approvals

Approval	No.	Grant Date	Expiry Date	Purpose of Approval
Murrawombie Mine				
Development Consent	1/91	25/10/1995	N/A	Original Development Approval for the Murrawombie Mine.
Development Consent	5/95	21/09/1995	N/A	Ancillary works associated with the original Murrawombie Development Approval.
Development Consent Modification	1/91	13/12/2007	N/A	Modification to commence underground mining at Murrawombie and to permit transportation of up to 1Mtpa of ore to the Tritton Copper Mine from the combined Girilambone operations.
Development Consent	2010/022	13/9/2010	13/9/2015	Subdivision of Booramugga Road which intersects the Murrawombie mining area.
Development Consent	2010/029	04/11/2010	04/11/2015	Construction of a Communication Tower at Murrawombie.
North East Mine				
Development Consent	6/95	25/10/1995	N/A	Original Development Approval for the North East Mine.
Development Consent Modification	42/2007M	26/07/2007	N/A	Modification to commence underground mining at North East and to permit transportation of up to 1Mtpa of ore to the Tritton Copper Mine from the combined Girilambone operations.
Development Consent	049/2007	13/09/2007	13/09/2012	Construction of the North East surface facilities.
Development Consent Modification	18/2010	2/7/2010	N/A	Construction of the North East ROM Pad.

Source: Tritton Resources Pty Ltd.

- Processing plant and process water ponds.
- Tailings Storage Facility.
- Administration and workshop areas.

Mining continues to be undertaken at the Tritton underground operations. The waste rock extracted is used to backfill underground workings, with any excess being placed at surface within the waste rock emplacement, adjacent to the box cut. Ore material is processed using an existing flotation plant, with tailings discharged to a Tailings Storage Facility.

Underground mining and processing operations are undertaken 24-hours per day, 7 days per week.

Concentrate produced by the processing plant at the Tritton Copper Mine is placed in sealed shipping containers. These containers are transported via Yarrandale Roads to the Hermidale rail siding. From the siding, they are transported by rail to Newcastle for export to China, India, Japan, Korea or the Philippines by ship.

Table 1.4 outlines the existing development approvals for the Tritton Copper Mine.

Table 1.4
Tritton Existing Development Approvals

Approval	No.	Grant Date	Expiry Date	Purpose of Approval
Development Consent (1)	41/98	01/09/1999	22/12/2024	Original Tritton Project Development Approval.
Development Consent (2)	30/2004	20/12/2004	29/12/2009	Construction of the Rail Loading Hardstand for the export of copper concentrate.
Development Consent Modification (3)	41/98	19/12/2007	22/12/2024	Upgrade of the Tritton Processing Plant to accept up to 1Mtpa of ore from the combined Girilambone operations.
Development Consent (4)	029/2007	25/05/2007	24/05/2012	Expansion of the administration facilities at Tritton.
Development Consent (5)	2010/006	25/05/2010	25/5/2015	Construction of a Paste fill Plant for the Tritton underground mine.
Development Consent (6)	2010/028	04/11/2010	4/11/2015	Construction of a Communication Tower at Tritton.

Source: Tritton Resources Pty Ltd.

1.4.4 Previous Exploration Operations

The Applicant has actively undertaken exploration activity within its Exploration Licences and Mining Leases (**Figure 1.1**). The following provides a summary of those exploration activities.

- Resource extensional drilling programs, testing depth and lateral extension of the Tritton, North East, Larsens, and Murrawombie resources.
- Diamond drilling to define copper resources adjacent to operations, including Double Tanks and Budgery mineral deposits.
- Reverse circulation and diamond drilling of geochemical soil anomalies, leading to new discoveries, including the Avoca Tank and Kurrajong projects.
- Successful grass roots exploration, including soil geochemistry and regional geophysical surveys across the tenement package.

In addition, the Applicant, in conjunction with the New South Wales Geological Survey and Geoscience Australia, has categorised the geological style of mineralisation within the Applicant's tenement package as a Volcanic Associated Massive Sulfide Deposit – Besshi style. This will allow better targeted exploration, for this style mineralisation in the future.

1.4.5 Mineral Resource Estimate

Section 4.1.3 presents an overview of the regional and Project Site geological setting, as well as the mineralisation associated with the Avoca Tank deposit. **Table 1.5** presents the estimated mineral resource associated with the deposit.

Table 1.5
Mineral Resource Estimate – 31 December 2013

Estimate	Classification	Cut Off Cu (%)	Tonnes (kt)	Cu (%)	Au (g/t)	Cu (kt)	Au (koz)
31 Dec 2013	Measured	0.6					
	Indicated	0.6	774	2.9	0.9	23.0	21
	Inferred	0.6	129	1.0	0.2	1.4	0.9
	Total	**0.6**	**903**	**2.6**	**0.8**	**24.4**	**21.9**
Source – Tritton Resources Pty Ltd.							

1.4.6 Ongoing Exploration Operations

The Applicant would continue to undertake exploration operations within the Project Site and surrounding mineral authorities. In summary, the following indicative exploration activities would continue to be undertaken.

- Geological mapping, surface geochemical sampling and geophysical investigations to identify further exploration targets within the Applicant's exploration licences.
- Diamond and reverse circulation drilling to further define existing mineralised zones and identify new zones.
- Detailed review of existing data to focus and develop the Applicant's geological understanding of the area within and surrounding the Project Site to assist in identifying further potential mineable resources.

1.4.7 Environmental Performance

1.4.7.1 Introduction

The Applicant is committed to undertaking all extraction, processing, transportation and associated activities in a responsible and pro-active manner which:

- enables the co-existence of the various land uses in the area;

- is environmentally and socially responsible; and
- minimises any real or perceived impacts on other members of the community.

Central to this approach would be the continuation of regular contact with neighbours and members of the local community and a willingness to openly discuss actual or perceived issues and to implement appropriate changes to operational procedures.

This commitment to environmental performance is demonstrated by the reviews of the existing operations which are reported through the *Annual Environmental Management Reports* in consultation with the relevant agencies to ensure continual improvement to the monitoring regime and performance of the operations. The following sections provide a summary of the environment monitoring performance for the existing operations, based upon *Annual Environmental Management Reports* prepared for the existing operations.

1.4.7.2 Air Quality

Dust gauge sample analysis for total insoluble solids and heavy metals indicate that both the yearly average and the seasonal averages are aligned to the background averages with some minor fluctuations which are more likely attributable to local agricultural activities than the Applicant's operations.

1.4.7.3 Noise

Modern mining operations have been ongoing at the Girilambone Copper Mine since 1992. During that time, it has been identified that mining operations do not trigger noise criteria at residences in the Girilambone locality, nor have there been any noise-related complaints. The Applicant continues to consult with the local community to ensure if any issues that may arise are dealt with promptly.

1.4.7.4 Biodiversity

No threatened species have been identified in the vicinity of the Girilambone or Tritton Copper Mines.

1.4.7.5 Surface Water

Monitoring of clean water storages in the vicinity of the Applicant's existing operations has returned results below the relevant Australian and New Zealand Environment and Conservation Council's *Guidelines for Fresh and Marine Water Quality* (ANZECC 2000) trigger values.

During the 2012 reporting year, approximately 290ML of the Applicant's 931ML surface water allocation from Burrendong Dam was used. This allocation is associated with Water Access Licences WAL009374, WAL009375 and WAL009940.

1.4.7.6 Groundwater

Groundwater sampling indicates that groundwater quality in the vicinity of the Applicant's operations naturally exceeds both the ANZECC (2000) stock watering and irrigation trigger values. These results are widely distributed, indicating that poor quality groundwater is a feature of the area surrounding the Applicant's operations.

In consultation with the Environment Protection Authority (EPA), an investigation was commenced in 2012 to clarify potential groundwater impacts in the vicinity of the Girilambone Copper Mine heap leach pads and pregnant liquor solution ponds. This investigation has been completed and identified actions are in progress.

1.5 FORMAT OF THE DOCUMENT

This *Environmental Impact Statement* includes five sections of text, references, 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 Proposal at a level of detail reflecting the environmental risk posed by each issue. The issues and their relevant importance to the assessment of the Proposal have been identified through consultation with government agencies, surrounding residents and the local community, and through specialist consultant assessments.

The format of the *Environmental Impact Statement* is as follows.

Section 1: introduces the Proposal, the Applicant, the Project Site and the mineral authorities held by the Applicant. Background information in relation to previous mining and mineral exploration operations within the Project Site and at surrounding operations is also provided. The section concludes with information on the structure of the document and management of investigations.

Section 2: describes the Applicant's objectives and proposed mining, waste and water management, hours of operation, infrastructure and services and rehabilitation activities. Section 2 also describes other feasible alternatives considered and rejected by the Applicant throughout the design phase of the Proposal.

Section 3: provides a description of the process used to identify and prioritise the key issues for assessment with reference to consultation undertaken and relevant statutory instruments. Section 3 also provides a general environmental risk analysis.

Section 4: describes the general environmental setting of the Project Site, with particular reference to aspects of the local environment likely to be critical to the assessment of the Proposal. The management and mitigation measures that have been incorporated into the Proposal design to protect the local environment, are also presented. This section also analyses the potential impact the Proposal would have on the physical, biological and social environment once the proposed safeguards and procedures are adopted.

Section 5: provides a conclusion to the document which justifies the Proposal in terms of biophysical, economic and social considerations, ecologically sustainable development and the requirements of Section 79C of the EP&A Act. Section 5 also records the consequences of not proceeding with the Proposal.

References: list the various source documents referred to for information and data used during the preparation of the *Environmental Impact Statement*.

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

Appendices: present the following additional information.

1. A copy of the application for development consent.
2. A copy of the Director-General's Requirements and matters identified for consideration in the correspondence submitted to NSW Department of Planning and Environment (DP&E), formerly known as NSW Department of Planning and Infrastructure (DP&I), by other State government agencies.
3. An itemised and tabulated summary of the Director-General's Requirements, and other raised issues, with reference to the section(s) within the *Environmental Impact Statement* or *Specialist Studies* where each is addressed.
4. A consolidated list of commitments made by the Applicant in relation to the Proposal.
5. Aboriginal Cultural Heritage Assessment Report prepared by OnSite Cultural Heritage Management Pty Ltd.
6. Ecology Assessment prepared by EnviroKey Pty Ltd.
7. Groundwater Impact Assessment prepared by Environmental Strategies Pty Ltd.
8. Noise and Blasting Assessment prepared by EMGA Mitchell McLennan Pty Ltd.
9. Historic Heritage Assessment Report prepared by OnSite Cultural Heritage Management Pty Ltd.

1.6 MANAGEMENT OF INVESTIGATIONS

This document has been prepared by Mr Mitchell Bland (B.Sc (Hons), MEconGeol, LLB (Hons)), Principal Environmental Consultant and Mr Chris Dickson (B.Sc. (Phys Geog.)), Environmental Consultant, both with R.W. Corkery & Co Pty. Limited (RWC). An internal peer review of all documentation has also been undertaken by Mr Alex Irwin, Senior Environmental Consultant (B.Sc.(Hons)) of RWC.

The following employees of the Applicant provided information in relation to the existing and proposed activities and reviewed and approved this document for release.

- Simon Fitzgerald – General Manager – Projects.
- Ian Sheppard – Chief Operating Officer.
- Tom Cooney – Projects Director.
- Greg Stephenson – Senior Environmental Advisor.
- Nathan Jones – Environmental Advisor.
- John Miller – General Manager – Tritton Mines.
- Chris Raymond – Exploration Superintendent.
- Derek Garment – HSET Manager – Tritton Mines.
- Emily Grimsley – Geologist – Tritton Mines.

A range of environmental investigations have been initiated to identify the environmental constraints. These studies have been undertaken by a team of specialist consultants managed by RWC including the following key individuals and companies.

- Heritage (Aboriginal and Historic) – OnSite Cultural Heritage Management Pty Ltd.

  Mr Gerard Niemoeller (BA (Hons)).

- Ecology – EnviroKey Pty Ltd.

  Mr Steve Sass (B.App.Sci (Env.Sci) (Hons)).

- Groundwater – Environmental Strategies.

  Mr Tim Chambers (M.Eng Sc, B.A Geology (Honours), B.Sc Comp. Sc.).

- Noise and Vibration – EMGA Mitchell McLennan.

  Mr Oliver Muller (BSc (REM & HGeog), MAAS).

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Section 2

Description of the Proposal

PREAMBLE

This section describes the Proposal including:

- *the objectives of the Proposal;*
- *an overview of the Proposal and the approvals required;*
- *the infrastructure that would be established;*
- *the site preparation that would be undertaken;*
- *the proposed mining, waste rock and ore management operations;*
- *ancillary activities that would be undertaken; and*
- *proposed rehabilitation.*

The Proposal is described in sufficient detail to provide an overall understanding of the nature and extent of the activities, how the various activities would be undertaken and to enable an assessment of the potential impacts on the surrounding environment. The level of detail provided is sufficient to enable a determination to be made as to the environmental impact of the Proposal. More detailed descriptions of the annual progression of mining, processing, waste management and rehabilitation will be presented in a Mining Operations Plan to be prepared and submitted following the determination of the application.

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

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2.1 INTRODUCTION

2.1.1 Objectives

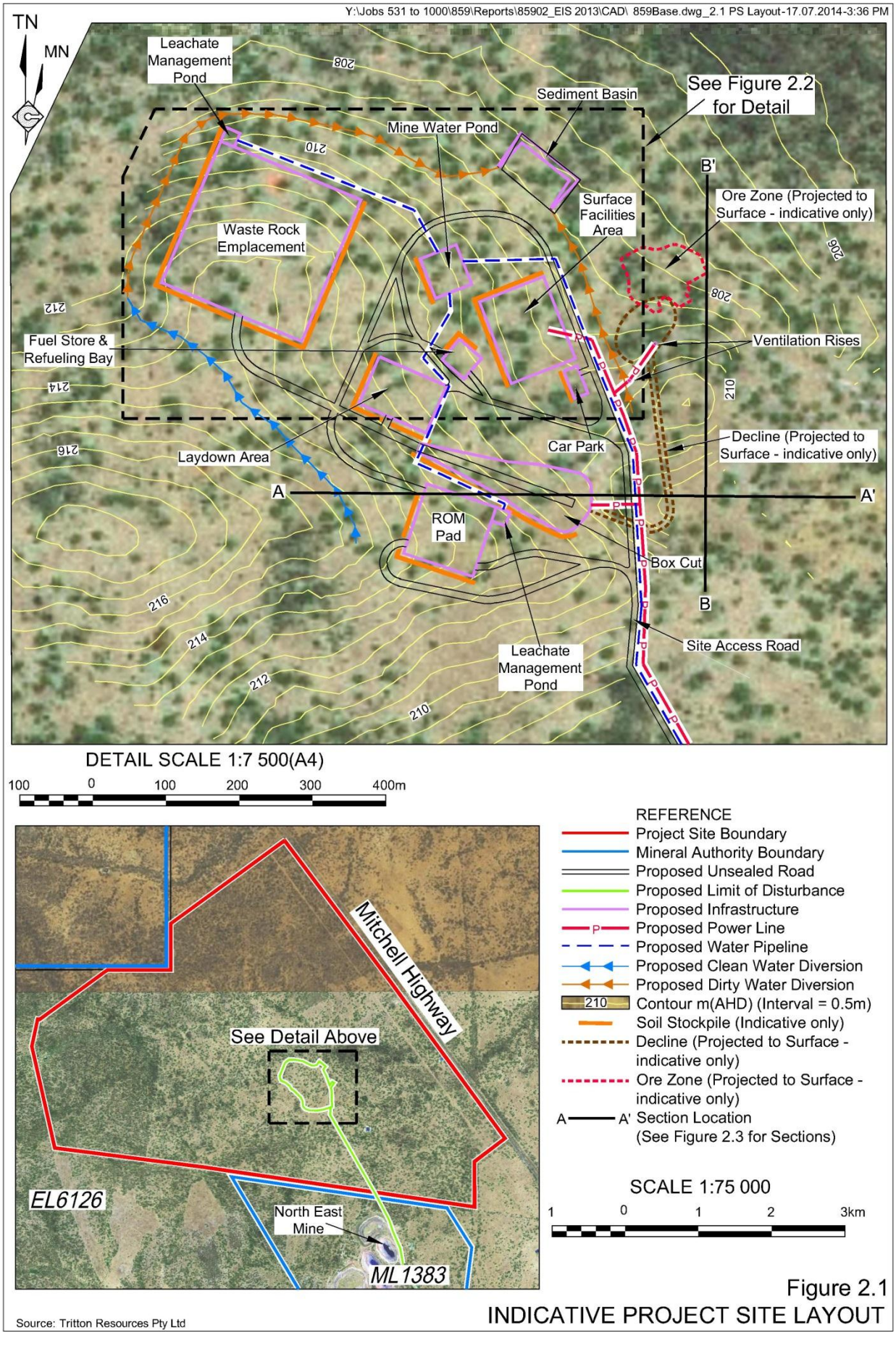
The Applicant's objectives in constructing and operating the Avoca Tank Project would be as follows.

- To safely mine the identified copper-gold-silver reserves.
- To operate the Proposal in a manner that would minimise surface disturbance and impacts on surrounding residents and the local environment.
- To implement a level of management control and mitigation measures that ensures compliance with appropriate environmental criteria and reasonable community expectations.
- To develop and operate the Proposal in compliance with all relevant statutory requirements.
- To provide for the ongoing monitoring of local environmental parameters such as noise, water and air quality.
- To create a final landform that is suitable for a continuation of intermittent grazing post-mining.
- To achieve the above objectives in a cost-effective manner to ensure security of employment for the Applicant's workforce and the continued economic viability of the Applicant.

2.1.2 Overview of the Proposal

The Proposal would include the following, with the locations of key features identified on **Figures 2.1** and **2.2**).

- Construction and use of a boxcut, portal, decline, underground workings and two rises (one equipped as an emergency egress and the other with a ventilation fan at surface).
- Extraction of the economically recoverable copper-gold-silver resources to a depth of approximately 500m below surface using bench stoping and long hole open stope mining techniques.
- Transportation of ore material to the Tritton Copper Mine for processing using road registered road trains via a combination of a private haul road and Booramugga and Yarrandale Roads.
- Establishment of a temporary surface waste rock emplacement for storage of waste rock extracted during construction of the boxcut and initial sections of the decline and mine workings.



Source: Tritton Resources Pty Ltd

Figure 2.1
INDICATIVE PROJECT SITE LAYOUT

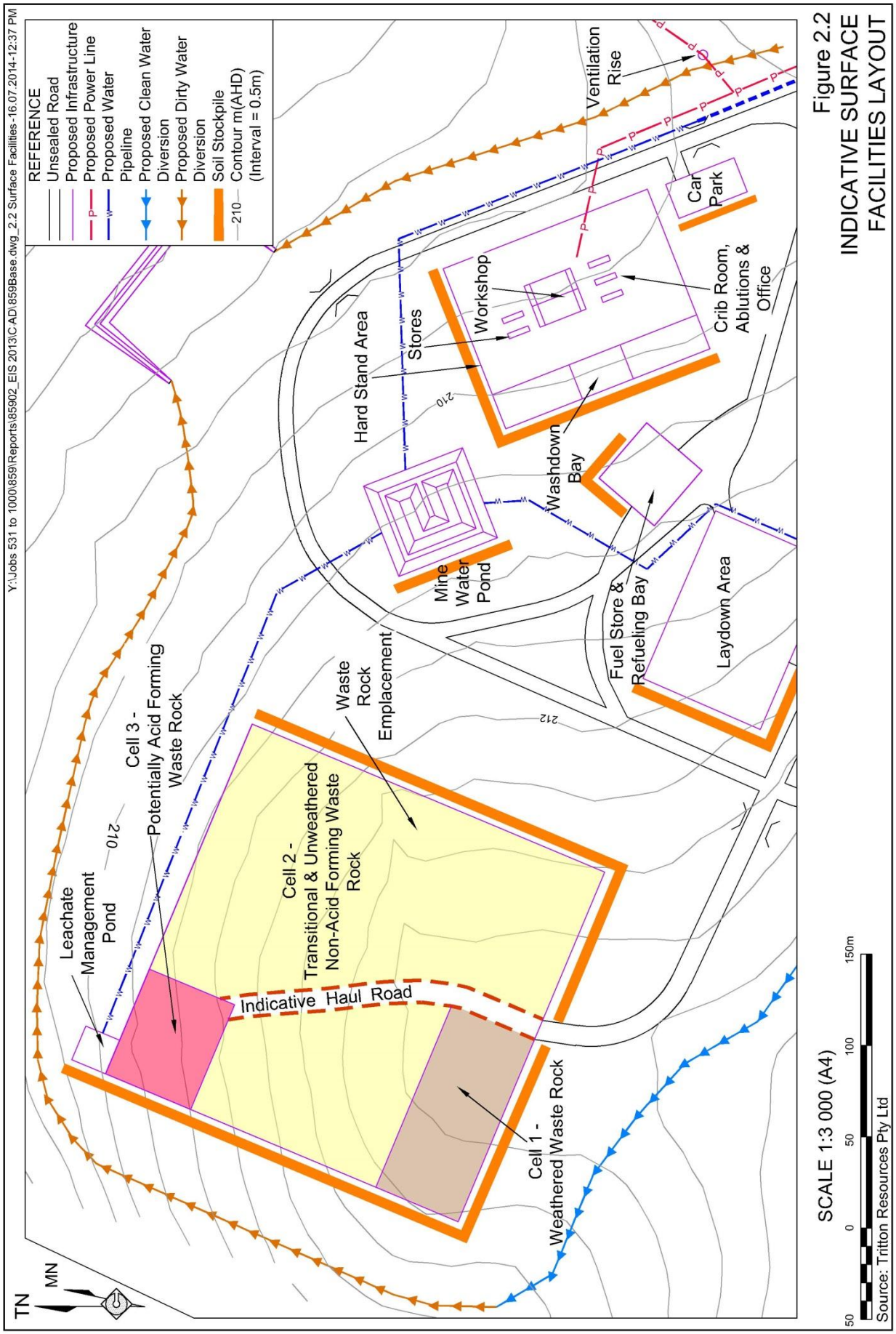


Figure 2.2
INDICATIVE SURFACE FACILITIES LAYOUT

- Establishment of surface infrastructure, including a mine water pond, ROM Pad, laydown area, fuel store and refuelling bay and a hardstand area comprising a workshop, mobile plant parking area, wash down bay and transportable offices, crib room and ablution facilities.
- Extension of infrastructure from the North East Open Cut, including a site access road, water pipeline and transmission line.
- Establishment of ancillary infrastructure.
- Construction and rehabilitation of a final landform that would be geotechnically stable and suitable for a final land use of intermittent agriculture and nature conservation.

Finally, throughout the life of the Proposal, the Applicant proposes to undertake additional exploration drilling to further define the mineralisation identified to date and to identify any additional resources, both within and in the vicinity of the Project Site. Extraction of additional mineralisation does not form a part of this application, and would be the subject of a subsequent application, if required.

2.1.3 Approvals Required

The Applicant anticipates that the following approvals will be required for the Avoca Tank Project.

- Development Consent – Joint Regional Planning Panel.

  Development consent in accordance with the provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) will be required for the Proposal. The Proposal may be classified as follows.

  – "Local or Regional Development" because the capital investment value is less than the $30 million threshold for State Significant Development and equal to the $20 million threshold identified in Clause 3 of Schedule 4A of the EP&A Act identified in Clause 5 of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011 (State and Regional Development SEPP).* In accordance with Clause 21 of the *(State and Regional Development SEPP),* the application is to be determined by the Joint Regional Planning Panel, with Bogan Shire Council to exercise its functions in relation to receipt, notification and assessment of the application and associated fees.

  – "Designated Development" because the Proposal would result in more than 4ha of disturbance as identified under Clause 25 of Schedule 3 of the *Environmental Planning and Assessment Regulations 2000*. As a result, an *Environmental Impact Statement* (EIS) will be required to accompany the application for development consent.

  – "Integrated development" under Section 91 of the EP&A Act because the following approvals will be required.

- Environment Protection Licence – Environment Protection Authority.

  An Environment Protection Licence or amendment to an existing Licence held by the Applicant issued by the Environment Protection Authority (EPA) under Section 47 of the *Protection of the Environment Operations Act 1997* will be required.

- Mining Lease – Department of Trade and Investment and Regional Infrastructure and Services – Mineral Resources Division.

  The Applicant currently holds Exploration Licence 6126 over the Project Site. A Mining Lease to be issued under the *Mining Act 1992* will be required.

- Aquifer Interference Approval – NSW Office of Water.

  An Aquifer Interference Approval will be required under Section 91 of the *Water Management Act 2000* for water intersected by the proposed underground mine. Water Supply Works and Water Use Approvals may also be required under Sections 89 and 90 of the *Water Management Act* 2000 for groundwater to be brought to surface and used for mining-related purposes.

Following receipt of development consent, the Applicant would also seek the necessary approvals from Bogan Shire Council for the construction of buildings, structures and appropriate waste water treatment systems for the Proposal.

Finally, it is noted that a separate application will be made under Section 75W of the EP&A Act to modify Development Consent 41/98 for the Tritton Copper Mine to permit importation of ore material from the Avoca Tank Project. Interaction between the development consent issued as a result of this application and Development Consent 41/98 would be as follows.

- The current Proposal would cover mining and transportation activities to the entrance of the Tritton Copper Mine.
- Development Consent 41/98 (as modified) would cover processing of all Avoca Tank ore material, tailings management and transportation of concentrate to the Applicant's customers.

2.2 SITE PREPARATION

2.2.1 Survey and Mark Out

Prior to the commencement of any ground-disturbing activities, the Applicant would survey all areas of proposed disturbance and physically mark out approved areas of disturbance using appropriately labelled survey pegs. Where appropriate, sensitive "no-go areas" such as sites of Aboriginal heritage significance would also be marked out and fenced using high visibility bunting or similar material. All site personnel would be made aware of the approved areas of disturbance and the significance of not disturbing areas outside the approved areas.

2.2.2 Vegetation Clearing

During vegetation clearing operations, larger vegetation would be removed using a bulldozer with its blade positioned just above the surface. This material would be stockpiled adjacent to the area of disturbance for later use during rehabilitation. No cleared vegetation material would be burnt or mulched.

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.

2.2.3 Soil Stripping

A description of the soils of the proposed areas of disturbance is provided in Section 4.13. In summary, the following soil stripping, stockpiling and management measures would be implemented.

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

- Strip topsoil from all areas of disturbance using a bulldozer, grader or scraper to a depth of approximately 20cm.
- Strip subsoil from the impact footprints of the box cut, ROM Pad, waste rock emplacement and mine water pond using a bulldozer or similar to a depth of approximately 50cm below the base of the topsoil. Subsoil stripping would not be undertaken elsewhere.
- Push stripped topsoil and subsoil material into separate windrow stockpiles adjacent to the proposed areas of disturbance. Indicative locations are identified on **Figures 2.1** and **2.2**.
- Ensure that the topsoil and subsoil stockpiles have a maximum height of 2m and 3m respectively and side slopes of 1:2 (V:H) or shallower.
- Ensure soil is not be stripped when either excessively dry or wet to preserve soil structure.
- Prevent the operation of machinery on soil stockpiles once formed and shaped to avoid compaction.
- Establish a cover of vegetation on all soil stockpiles to be retained for more than 3 months. Alternatively, spray on polymer covers may be used until vegetation can become established.

Table 2.1 presents the indicative soil inventory for the Proposal. The Applicant anticipates that a surplus of soil material would be available for rehabilitation within the Project Site and that remaining soil material would be used for rehabilitation of the Applicant's other sites where insufficient soil material remains for rehabilitation

Table 2.1
Indicative Soil Inventory

Area	Area to be disturbed (ha)	Topsoil		Subsoil[1]	
		Stripping Depth (cm)	Volume (m^3)	Stripping Depth (cm)[1]	Volume (m^3)
Box Cut	1.2	20	2 400	50	6 000
ROM Pad	1	20	2 000	50	5 000
Waste Rock Emplacement	4.4	20	8 800	50	22 000
Mine Water Pond	0.3	20	600	50	1 500
Hardstand	1.1	20	2 200	-	-
Laydown Area	0.7	20	1 400	-	-
Fuel store	0.2	20	400	-	-
Car Park	0.1	20	200	-	-
Site access and haul roads	4.1	20	8 200	-	-
Total	**13.1**		**26 200**		**34 500**

Note 1: Below base of topsoil.
Note 2: Site access Road total length = 4.1km. Average width = 10m. Area = 4.1ha.

2.3 MINING OPERATIONS

2.3.1 Layout of the Box cut

The box cut would be an elongated excavation that would permit access to the portal and decline via a haul road (**Figure 2.1**). The box cut would have the following indicative design parameters.

- Length – 240m.
- Maximum width – 85m.
- Maximum depth – 30m.
- Gradient of haul road – 1:7 (V:H).
- Slopes of walls – surface to 20m – 45º, 20m to base of boxcut – 60º.
- Vertical spacing of benches – 10m.

2.3.2 Construction of the Box Cut and Portal

2.3.2.1 Construction of the Box Cut

Once vegetation and soil material have been removed, (see Section 2.2.3), and surface water management structures have been constructed (see Section 2.6.2), the box cut would be excavated by conventional load and haul methods using an excavator or front-end loader and haul trucks. Where required, a bulldozer may be used to rip material that cannot be extracted using an excavator or front-end loader.

When the excavation has progressed to a point where material requires blasting, a hydraulic drill rig would be used to drill blast holes which would be loaded with either pre-packaged or bulk explosives, boosters and detonators. Fragmented material would be removed using load and haul techniques. Management of waste rock material removed during construction of the box cut is described in Section 2.4.

It is anticipated that the box cut would take approximately 10 to 14 weeks to complete.

2.3.2.2 Construction of the Portal and Underground Infrastructure

Once the box cut has been excavated to the required dimensions and material of suitable competency has been exposed in the base of the box cut, the surrounding walls would be stabilised using a combination of rock bolts, cable bolts and shotcrete. The portal, or entrance to the decline, would then be constructed using methods similar to those described in Section 2.3.4.2. Additional roof and wall support, would be installed in the near surface sections of the decline. This would include combinations of rock bolts, cable bolts, shotcrete or steel arch structures.

Following the establishment of the portal, infrastructure required for underground mining operations would be installed. This would indicatively include the following.

- Underground power, including a transformer to convert the voltage of the distributed electricity to that suitable for use underground.
- Temporary ventilation, including one or more vent fans located within the box cut.
- Mine water supply for underground mining operations.
- A tag board and associated surface safety equipment and infrastructure.

Development of the portal using a single heading would be required initially. However, once portal development reaches the initial extraction level, development on multiple headings may be undertaken.

2.3.3 Underground Development

2.3.3.1 Decline and Development Design

Figure 2.3 presents a view of the proposed decline and underground stoping operations. The decline would include the following indicative design parameters.

- Height – approximately 5.5m.
- Width – approximately 5.0m.
- Gradient – approximately 1:7 (V:H).
- Final design length – approximately 3 500m.
- Maximum depth of development – approximately 500m below the surface.

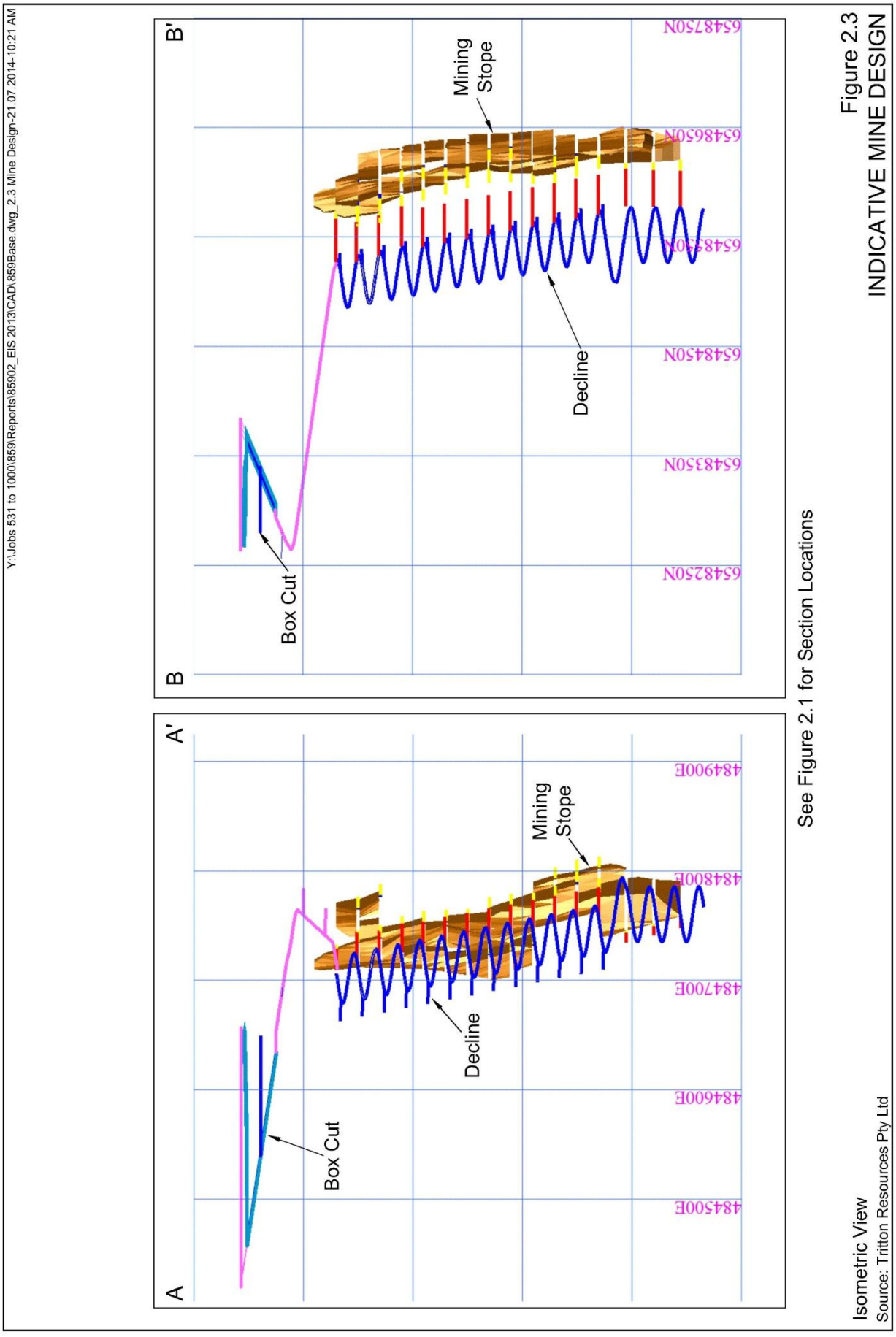


Figure 2.3
INDICATIVE MINE DESIGN

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

- Height – approximately 5.5m or 5.0m.
- Width – approximately 5.0m.

2.3.3.2 Drill and Blast Operations

The decline and development headings would be developed using conventional underground drill and blast techniques. A jumbo, or an underground drill rig, would drill a pattern of holes, the spacing and length of which would be determined by the blasting engineer or shot-firer. Once drilling has been completed, those holes would be loaded with bulk or pre-packaged explosives, boosters and detonators and the material would be fragmented *in situ* by blasting.

Drill and blast operations, including those for underground stoping operations, would be designed in a manner that would ensure compliance with the criteria identified in the Environment Protection Licence for the Proposal and described in Section 4.6.

2.3.3.3 Load and Haul Operations

Fragmented material would be extracted using an underground loader and transferred to underground haul trucks. Alternatively, the loader may transport material to a loading bay for later reclamation.

Once loaded into haul trucks, fragmented material would be transported to the waste rock emplacement area (**Figure 2.1**), or used for stope backfilling operations (see Section 2.3.4.3).

2.3.3.4 Ventilation and Emergency Egress

Initially, supply of fresh air to the workings would be provided using a ventilation fan located at the portal. Air would be pumped to the face of decline using air bags. Return air would flow back up the decline. As decline construction progresses, the ventilation infrastructure would be advanced to sub-surface levels to ensure adequate ventilation exists in all sections of the advancing decline.

When the decline has been advanced sufficiently, a ventilation rise would be installed to ensure the supply of fresh air to the underground workings (**Figure 2.1**). To facilitate construction of the rises, a horizontal drive would be established first, followed by the establishment of each rise using a long-hole raise mining technique for the return air raise and an up-hole raise boring technique for the emergency egress.

Long-hole raise mining involves drilling holes from one level to the level above, loading those holes with explosives and blasting the *in situ* rock. The return air rise would have a nominal cross sectional area of 5m x 5m.

Up-hole raise boring involves drilling a pilot hole from surface to intersect the ventilation drive. The hole is then reamed out to the required diameter from the bottom up using one or more larger diameter drill heads. The emergency egress would have a nominal diameter of 1.1m and would be equipped with a suitable ladderway to permit evacuation of personnel from the mine.

One fan with a nominal capacity of 200m^3/s would be installed on the surface. The fan would act as an exhaust fan for return air while the decline would act as the air intake into the underground mine. Other mine services such as power and water may also be installed within the rises.

2.3.4 Underground Stoping Operations

2.3.4.1 Mining Method

Ore would be extracted using conventional bench or sublevel open stoping mining techniques which are well suited to extract ore from elongate vertical lenses. **Figure 2.4** presents a schematic overview of the proposed mining method. In summary, these mining methods entail the following.

- Construction of production drives along the long the long axis of the ore body approximately every 20m vertically.
- Drilling of a series of fans of holes between the lower and upper drives.
- Loading of each fan of holes sequentially with bulk or pre-packaged explosives.
- Fragmenting the ore and allowing that material to fall into the stope from where it would be extracted and transported to the surface.
- Further fans of holes would be fired and ore extraction would progressively retreat back along the production drive.

Unmined material would left between the vertical stopes and vertical pillars and horizontal sills would provide support and prevent ground collapse. Geotechnical conditions may dictate the need to backfill stopes, and this would be done following completion of mining within each stope (see Section 2.3.4.3).

2.3.4.2 Stope Design

The Applicant would develop a range of stope designs to permit extraction of the ore. 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, as well as the geotechnical characteristics of the material to be mined. The mine design would be developed to ensure that there would be no surface subsidence within the Project Site.

2.3.4.3 Stope Backfilling Operations

Backfilling of underground stope voids with waste rock may be undertaken to provide for local mine stability and to allow extraction of higher grade resources in localised areas. The Applicant estimates that approximately 25% of the stopes that would be created would be backfilled.

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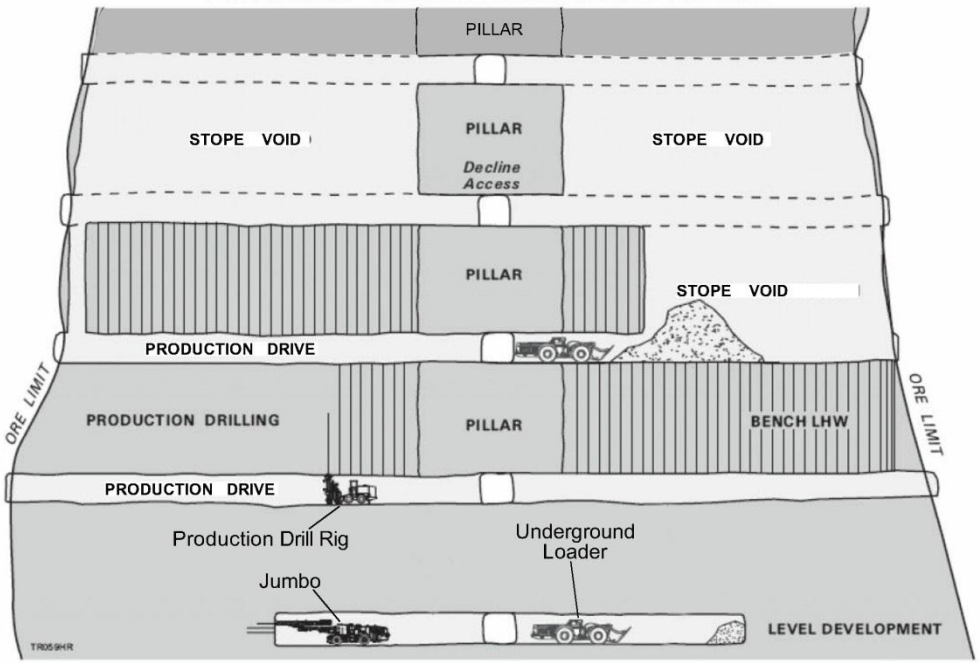

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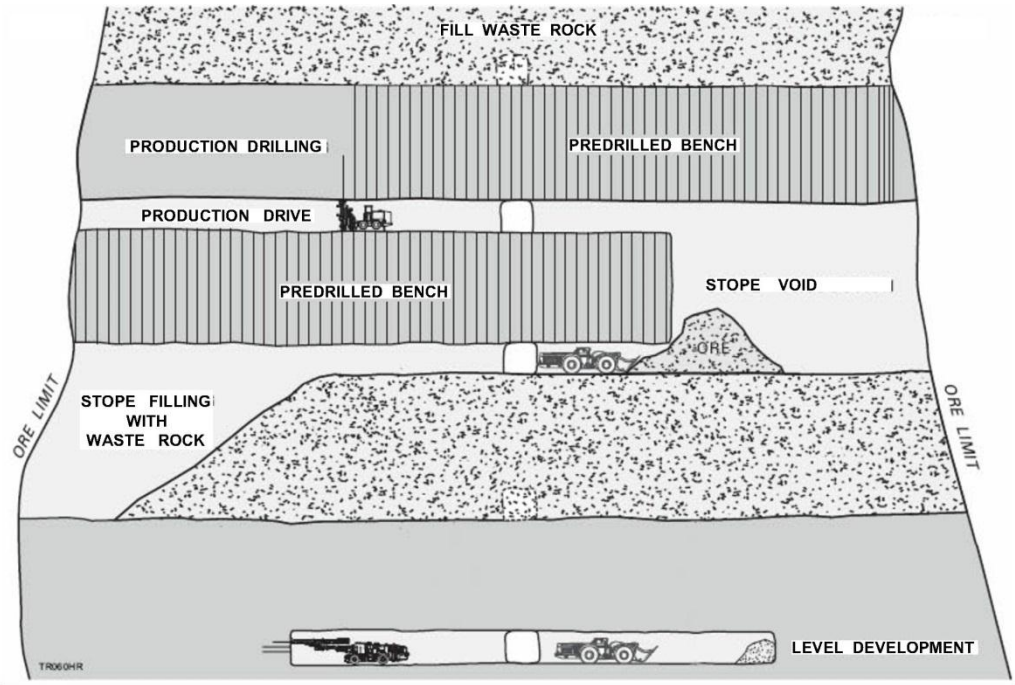
SCHEMATIC SUB-LEVEL OPEN STOPING MINING METHOD



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SCHEMATIC BENCHING AND STOPE FILLING

Figure 2.4
PROPOSED MINING METHODS

Source: Tritton Resources Pty Ltd

Figure 2.4 shows a typical schematic of stope back-filling with waste rock. The back-filling would use waste rock material sourced preferentially from concurrent underground development, with additional waste rock material transported from the waste rock emplacement on the surface, if required. Where waste rock is transported from the surface, preference would be given to removing potentially acid forming material from the surface for placement in the completed stopes (see Section 2.4.2).

The backfill material would be transported to a drive in the vicinity 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 an underground loader. During such operations, the loader may be operated remotely. Sections of some stopes may be cement stabilised.

The advantage of backfilling the stopes would be to reduce the quantity of waste rock transported to the surface, increase the geotechnical stability of the mined stopes and maximise the recovery of ore material, resulting in reduced environmental impacts and mining costs.

2.3.5 Mining Rate

Table 2.2 provides an indicative mining rate for the life of the Proposal, and shows ore extraction would occur over four years commencing late in Year 1. The indicative maximum mining rate would be approximately 375 000t per year. The mining rate would vary depending on the number of development headings and stopes available at any one time, It is expected the mining rate would increase progressively as the mine is developed and then decrease towards the end of the mine life as stopes are gradually completed.

Table 2.2
Indicative Mining Rate

Year	Ore (t)	Waste Rock (t)	Total (t)
1	8 000	194 000	202 000
2	156 000	150 000	306 200
3	313 000	60 000	373 000
4	204 000		204 000
Total	**681 000**	**404 000**	**1 095 000**
Source: Tritton Resources Pty Ltd.			

2.3.6 Mining Equipment

Table 2.3 presents the mobile mining equipment that would be required during the life of the Proposal. A number of light and heavy vehicles and ancillary equipment, such as lighting plants and service vehicles, would also be required.

Table 2.3
Proposed Mining Equipment

Indicative Equipment	Indicative Number Required	Hours of Operation
Box Cut Establishment		
Pneumatic drill and compressor.	1	7am to 10pm, 7 days per week
Excavator (Cat 336)	1	
Haul trucks (50 tonne)	2	
Site Establishment and Surface Operations		
Front-end loader (Cat 998)	1	7am to 10pm, 7 days per week
Bulldozer (Cat D10 or D8)	1	
Grader (Cat 14)	1	
Road train and haul trucks	up to 3	
Underground Mining Operations		
Jumbos drill rigs	1	24 hours per day; 7 days per week
Underground Load-Haul-Dump unit (bogger)	2	
Underground Haul trucks	2	
Tool Carrier	1	
Ventilation fan	1	
Power Generator (site establishment and initial mining operations)		
Diesel Generators 800 kVA (Cummins)	1	24 hours per day; 7 days per week
Source: Tritton Resources Pty Ltd		

2.4 WASTE ROCK MANAGEMENT

2.4.1 Introduction

During initial mining operations, material that contains insufficient metalliferous minerals to justify processing would be extracted and placed within the waste rock emplacement or, for non-acid generating material, used to establish surface infrastructure (**Figure 2.1**). Once mining operations have progressed sufficiently, waste rock material may be directly placed within completed stopes underground and may not be brought to the surface. In addition, waste rock material stockpiled within the waste rock emplacement may be transported back underground and placed within completed stopes.

This sub-section provides an overview of the characteristics of the waste rock material, the design of the waste rock emplacement and the procedures that would be implemented as part of waste rock management operations.

2.4.2 Waste Rock Characteristics

2.4.2.1 Introduction

The Applicant anticipates that approximately 404 000t of waste rock would be generated throughout the life of the Proposal. The geological setting and style of mineralisation within the Project Site is similar to that observed at both the Tritton and Girilambone Copper Mines. At each of those operations, a proportion of the waste rock generated has the potential to generate an acidic leachate. In light of this, the Applicant undertook a program to characterise the waste rock within the Project Site.

This subsection provides background information in relation to acid rock drainage generally and at the Tritton and Girilambone Copper Mines specifically, the methodology used to characterise waste rock within the Project Site and the results of that assessment.

2.4.2.2 Acid Rock Drainage

Rocks that contain elevated levels of some minerals, principally pyrite (FeS_2), once exposed to oxygen in the air and water may generate an acidic or low pH leachate as a result of the pyrite and similar minerals oxidising to release the contained sulphur. The free sulphur then combines with water to produce a leachate containing a dilute solution of sulphuric acid. The leachate, as a result of its low pH, may contain elevated concentrations of metals and, if discharged, could result in adverse environmental impacts by lowering the pH of receiving waters or increasing the concentration of dissolved metals beyond a level that is considered acceptable.

The Applicant prepared a *Waste Rock Characterisation and Management Plan* in June 2012 for the Tritton Copper Mine. That assessment identified that rocks with sulphur concentrations of less than approximately 1% are unlikely to be acid generating, while rocks with a sulphur contents greater that 1% may be acid generating.

The *Waste Rock Characterisation and Management Plan* identifies a range of management and mitigation measures for managing potentially acid forming waste rock. These have been used as the basis for the management measures identified in Section 2.4.4.

2.4.2.3 Waste Rock Characterisation Methodology

The Applicant analysed 25 samples of rock from drill holes in the vicinity of the Avoca Tank deposit. The samples were selected to be representative of all geological units likely to be extracted with a focus in particular on material that would be classified as waste rock. Ore material has been assumed, based on its mineralogy, to be acid forming. However, as this material would be removed from the Project Site shortly after it is brought to the surface and processed at the Tritton Copper Mine, management of this material is not anticipated to pose an environmental risk.

The 25 selected samples were subjected to acid base accounting analysis by ALS. Acid base accounting assesses the balance between a sample's ability to:

- produce acidic leachate through the oxidation of sulphides; and

- neutralise any acid produced through reaction with minerals, particularly carbonates, contained within the sample.

This methodology requires determination of the following.

- Maximum potential acidity – this is determined based on the total sulphur present within sulphide minerals.
- Acid neutralising capacity – this is the ability of a sample to neutralise any acidic leachate that may be produced.
- Net Acid Producing Potential (NAPP) – this is the balance between the maximum potential acidity and the acid neutralising capacity. This is typically expressed as the number of kilograms of sulphuric acid (H_2SO_4) that could be generated per tonne of sample.
- Static Net Acid Generation (NAG) – this is a direct measure of the sample's ability to produce acid through oxidation of sulphides. Samples are mixed with hydrogen peroxide to rapidly oxidise all sulphide minerals present. The pH of the resulting solution is then tested and the amount of acid produced is determined.

The acid formation potential of a sample is established by comparing the NAPP and the NAG results. **Table 2.4** presents the classification identified in the *Guidelines on Managing Acidic and Metalliferous Drainage* published by the Commonwealth Department of Industry, Tourism and Resources in February 2007.

Table 2.4
Acid Formation Potential Classification System

Acid Formation Potential	NAPP (kg H_2SO_4/t)	NAG (pH units)
Potentially Acid Forming	>10	<4.5
Potentially Acid Forming – Low Capacity	0 to 10	<4.5
Non-acid Forming	Negative	≥4.5
Acid Consuming	Less than -100	≥4.5
Uncertain	Positive	≥4.5
	Negative	<4.5

The identified classes of waste rock may be summarised as follows.

- Potentially acid forming (PAF) – these samples have the potential to produce an acidic leachate, with the NAPP result indicating how much acid could potentially be produced.
- Potentially acid forming – low capacity (PAF-LC) – these samples also have the potential to generate an acidic leachate. However, because of a limited concentration of sulphide minerals or elevated neutralising capacity, resulting in a NAPP result less than 10kg H_2S0_4/t, the amount of acid likely to be produced is limited.

- Non-acid forming (NAF) – these samples do not have the potential to produce an acidic leachate because the neutralising capacity of the sample exceeds the acid generating capacity.
- Acid consuming (AC) – these samples have the ability to neutralise acidic leachate because the neutralising capacity of the sample significantly exceeds the acid generating capacity.
- Uncertain (UC) – the ability of these samples to generate an acidic leachate is uncertain because the results of the NAPP and NAG tests are contradictory, indicating that the sample may produce an acidic leachate depending on the distribution of acid generating and neutralising minerals within the samples.

2.4.2.4 Waste Rock Characterisation Results

Table 2.5 and **Figure 2.5** present the results of the waste rock characterisation assessment. In summary, the results may be characterised as follows.

- Samples with sulphur concentrations less than 1% may typically be classified as:
  - acid consuming;
  - non-acid forming;
  - potentially acid forming – low capacity (or potentially acid forming with a NAPP capacity very close being classified as low capacity); or
  - uncertain.
- The majority of samples with a sulphur concentration of greater than 1% may be classified as potentially acid forming, with some samples demonstrating significant potential to generate acid.
- Potentially acid forming samples are associated with both the hanging wall and footwall of the ore body and may be encountered during construction of the decline and associated development drives.

These results are consistent with the results of previous characterisation test work for the Tritton Copper Mine completed during preparation of the *Waste Rock Characterisation and Management Plan.* As a result, in order to ensure consistency across each of its operations, the Applicant would ensure that waste rock within the Project Site is managed in accordance with the above plan.

Table 2.5
Waste Rock Characterisation Results

Sample No	NAPP	pH (OX)	Total Sulphur	Sample Location	Sample Classification
Units	**kg H2SO4/t**	**pH Unit**	**%**		
TRL 033696	-122	10.9	0.005	Footwall decline	AC
TRL 038758	-25.5	8.7	0.005	Between lenses	NAF
TRL 038473	-611	11.2	0.03	decline	AC
TRL 037865	-649	9.4	0.04	Hanging wall	AC
TRL 038457	-33.7	9.9	0.04	Footwall	NAF
TRL 039240	-662	10.8	0.04	Footwall decline	AC
TRL 037889	-612	10.6	0.05	Footwall	AC
TRL 038826	-30.1	8.4	0.12	Hanging wall	NAF
TRL 034993	0.25	4.1	0.32	Footwall	PAF-LC
TRL 033653	6.6	3.8	0.43	Footwall Decline	PAF-LC
TRL 038034	0.6	8.9	0.52	Hanging wall	UC
TRL 038908	8.7	3.9	0.65	Footwall	PAF-LC
TRL 038905	11.9	3.5	0.66	Footwall	PAF
TRL 038715	-222	9.2	0.69	Hanging wall	AC
TRL 038442	-561	10	0.79	Footwall	AC
TRL 034398	10.5	3.6	0.87	Footwall	PAF
TRL 034318	10	3.3	0.89	Hanging wall	PAF-LC
TRL 034320	17	3.6	0.95	Hanging wall	PAF
TRL 038827	-9	8.8	1.08	Hanging wall	NAF
TRL 037796	-395	9.1	1.57	Hanging wall	AC
TRL 038828	25.5	3.2	2.21	Hanging wall	PAF
TRL 034319	53	3.8	2.25	Hanging wall	PAF
TRL 038906	67.3	2.8	2.51	Footwall	PAF
TRL 038907	162	2.4	5.57	Footwall	PAF
TRL 033679	231	2.2	7.55	Footwall decline	PAF

Source: Tritton Resources Pty Ltd

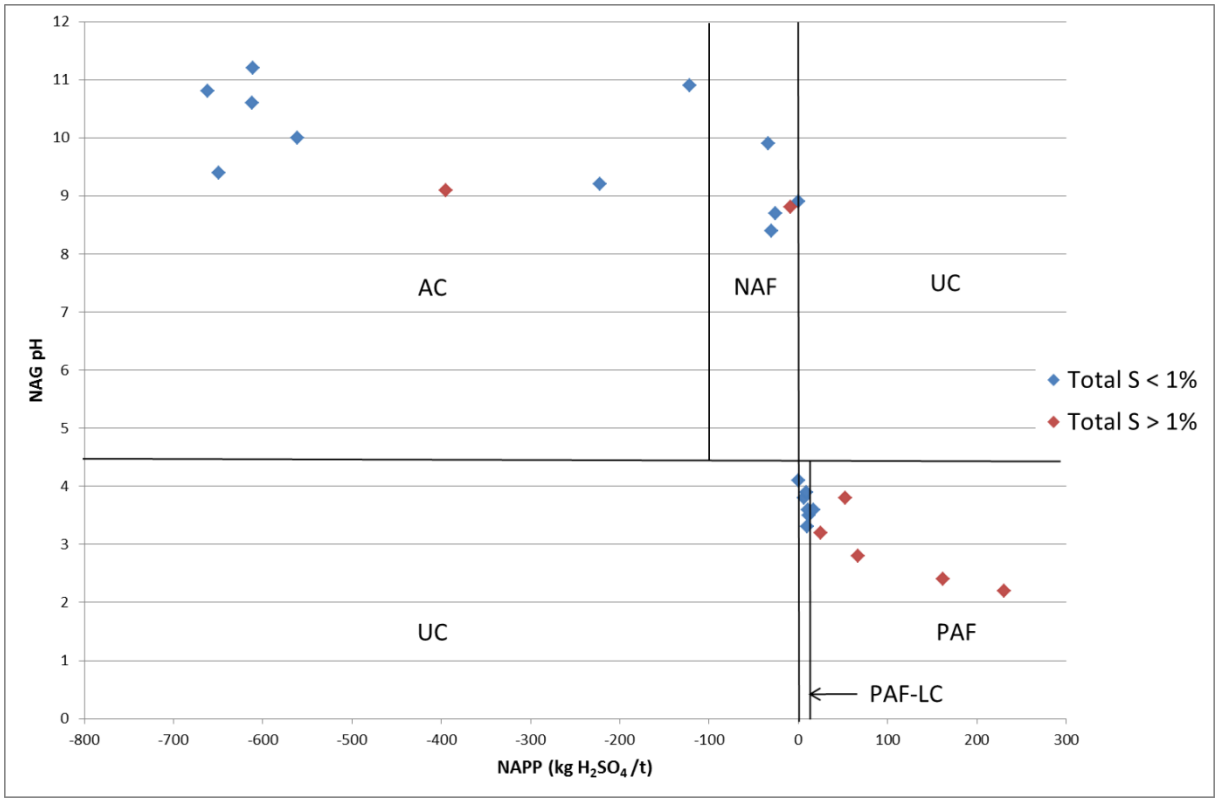


FIGURE 2.5
WASTE ROCK CHARACTERISATION RESULTS

2.4.3 Waste Rock Emplacement Layout

The location of the proposed waste rock emplacement is presented on **Figures 2.1, 2.2** and **Table 2.6** presents the design criteria for the emplacement.

Table 2.6
Waste Rock Emplacement Design Criteria

Feature	Design
Area (ha)	4.4ha
Maximum Height (m above current ground level)	10m
Final Slope (V:H)	1:3 (V:H)
Approximate Final Design Volume (m^3)	250 000
Anticipated Volume Required (m^3)	150 000
Source: Tritton Resources Pty Ltd	

All waste rock material extracted from the box cut and the underground workings would be classified into one of three categories as follows prior to extraction.

- Class 1 – Weathered, non-acid forming waste rock suitable for use during rehabilitation operations as a subsoil growth medium.

- Class 2 – Transitional and unweathered, non-acid forming waste rock with sulphur concentrations of <1%.
- Class 3 – Potentially acid forming waste rock with sulphur concentrations of >1%. This class of waste rock would also include material where the acid generation potential is classified as "uncertain", if encountered.

The Applicant anticipates that the following volumes of each class of waste rock would be generated and bought to the surface during the life of the Proposal, with a proportion of this waste rock later reclaimed and hauled back underground as backfill.

- Class 1 – 12 000m^3 or 24 000t.
- Class 2 – 143 000m^3 or 286 000t.
- Class 3 – 5 000m^3 or 10 000t.

The waste rock emplacement would be constructed in three cells, one for each of the above classes of material. These cells would be established as follows (**Figure 2.2**).

- Cells 1 and 2 – would be used to store weathered, non-acid forming waste rock and transitional and unweathered, non-acid forming waste rock respectively. These cells would be constructed in the southern or eastern section of the waste rock emplacement.
- Cell 3 – would be used to temporarily store potentially acid forming waste rock. Any leachate collected within the pond would be transferred to the Mine Water Pond for use in the underground operations.

  This cell would be constructed in the northwestern section of the waste rock emplacement closest to the Leachate Management Pond. The cell footprint would be constructed in a manner that would ensure that potentially acidic leachate is not permitted to seep into the aquifer or flow to natural drainage. Rather, all leachate would be directed to the Leachate Management Pond.

2.4.4 Waste Rock Emplacement Procedure

Class 1 or weathered, non-acid forming waste rock extracted from the upper sections of the box cut would be placed solely within Cell 1 of the waste rock emplacement. This material would be retained for use during rehabilitation either within the Project Site or elsewhere at the Applicant's other mining operations where significant shortfalls of subsoil and suitable growth medium have been identified. This material would not be transported underground for use in stope filling operations.

Class 2 or transitional and unweathered, non-acid forming waste rock would be primarily placed within Cell 2 of the waste rock emplacement. Alternatively, this material may be used to construct site infrastructure, including the Site Access Road, hardstand or laydown areas, car park or ROM Pad. This material may require crushing using a portable crusher. Such crushing programs would be undertaken on a campaign basis and would typically be of a few days to weeks only.

Class 3 or potentially acid forming waste rock brought to the surface would be managed in one of two ways.

- Initially the waste rock would be placed solely within Cell 3. Once mining operations have progressed sufficiently, that material would preferentially be transported back underground and placed into completed stopes.
- Once completed stopes become available for backfilling operations, potentially acid forming waste rock would be placed directly into completed stopes and would not be brought to the surface at all. Once placed within completed stopes, the potential for further generation of acidic leachate would be limited as a result of the limited availability of oxygen for oxidation reactions.

Potentially acid forming waste rock placed on the surface would not be encapsulated while stored at the surface because it would be stockpiled for a limited period and clay material used for encapsulation would have adverse impacts during stope backfilling operations. These impacts may include blocking up of waste passes, uneven settling and placement of waste rock within the stopes.

In order to ensure that potential for adverse impacts associated with such storage is minimised to the greatest extent practicable, the following measures would be implemented in the event that acid generation is detected prior to transportation of all potentially acid generating material back underground.

- The frequency of monitoring of leachate within the leachate management pond would be increased.
- All leachate would be removed to the Mine Water Pond as it is generated, for use for mining-related purposes.
- A management plan would be developed to facilitate prompt transportation of acid-forming material back underground.

2.4.5 Waste Rock Balance

Table 2.7 presents the waste rock balance for the Proposal. In summary, during the life of the Proposal, an estimated 319 000t of waste rock would be transported to the surface, with 98 000t returned underground. The maximum anticipated volume of waste rock to be stored at surface would be approximately 292 000t in Year 2 with the waste rock stockpile expected to decrease in size in the final years of the Proposal.

As identified in Section 3.4.3, the Applicant would use waste rock in the following priority order during stope backfilling operations.

1. Class 3 or potentially acid forming material.
2. Class 2 or non-acid forming, transitional and unweathered waste rock.

Table 2.7
Indicative Waste Rock Balance

Year	Total Waste Rock Transported to Surface (t)	Waste Rock Transported Underground (t)	Waste Rock Balance on Surface (t)
1	195 000	0	195 000
2	124 000	27 000	292 000
3	-	36 000	256 000
4	-	35 000	221 000
Source: Tritton Resources Pty Ltd			

Class 1 of weathered waste rock would not be used for stope backfilling operations because of its physical properties and because this material would be used for rehabilitation of the Project Site and at the Applicant's other mining operations.

In light of the above, the Applicant notes that the following would remain at surface following completion of mining operations.

- 197 000t of Class 2 or non-acid forming, transitional and unweathered waste rock.
- 24 000t of Class 1 or weathered waste rock.

No potentially acid forming material would remain at surface at the end of the life of the Proposal.

Class 2 waste rock would have a range of beneficial uses, including:

- manufacture of roadbase or sheeting material for the Applicant's existing operations or for use by Bogan Shire Council or other organisations and individuals; and
- rehabilitation of the Applicant's existing or proposed mining operations, including partial backfilling of the proposed boxcut and capping of the Tailings Storage Facility at the Tritton Copper Mine.

Class 1 waste rock would be preserved for use as a growth medium or capping material for use during rehabilitation of the Applicant's mining operations.

As a result, the Applicant anticipates that the waste rock remaining at surface would be used for a beneficial purpose and that at the relinquishment of any Mining Lease, no waste rock would remain. Notwithstanding this, the description of rehabilitation activities within the Project Site presented in Section 2.13.6 takes into account the possibility that a small amount of waste rock may remain at the relinquishment of the Mining Lease.

Finally, the Applicant contends that use of the waste rock for rehabilitation of the other Applicant's mining operations would be ancillary to those approved operations and, as a result, no further approvals would be required. In addition, transportation of material from the Project Site would be an approved activity should development consent be granted. As a result, the Applicant contends that no further approvals would be required for transportation for use by other individuals or organisations such as Bogan Shire Council or the NSW Roads and Maritime Service.

2.5 ORE MANAGEMENT AND TRANSPORTATION

2.5.1 ROM Pad Design and Layout

The layout of the proposed ROM Pad is presented in **Figure 2.1**. The ROM Pad would be used to temporarily stockpile ore material prior to transportation to the Tritton Copper Mine for processing. The ROM Pad would be approximately 1.4ha in size and would be sheeted with non-acid generating waste rock to ensure all weather access. The ROM Pad has been designed to be sufficiently large to permit concurrent placement of ore material, operation of a transportable jaw crusher and ore loading operations, and to ensure separation of underground and surface equipment.

The perimeter of the ROM Pad would be bunded to ensure that surface water from undisturbed sections of the Project Site is not permitted to run onto the ROM Pad and similarly, surface water within the ROM Pad would be retained within the ROM Pad footprint for transfer to the Mine Water Pond for use within the underground mine.

The Applicant does not propose to line the ROM Pad because ore material would be stored on the pad for a short period only prior to being removed from the Project Site.

Ore material would be transported from the underground mine to the ROM Pad by underground haul trucks. This material would be stockpiled within the northern section of the ROM Pad. The Applicant anticipates that ore material would generally be stored within the ROM Pad for only a few days, extending on occasion to no more than a few weeks.

2.5.2 Load and Haul Operations

Transportation of ore material to the Tritton Copper Mine would be undertaken using the same fleet of vehicles currently used to transport ore from the Girilambone Copper Mine, namely road registered, two trailer road trains with an indicative capacity of 52t.

Empty road trains would arrive at the ROM Pad and would be loaded using a front-end loader or similar. All loads would be covered prior to the road trains leaving the ROM Pad. Loaded road trains would travel to the Tritton Copper Mine via:

- the proposed Site Access Road;
- the existing private haul road between the North East and Murrawombie operations; and
- Booramugga and Yarrandale Roads (see **Figure 2.7**).

Section 2.7.2.1 provides a description of the proposed and existing road infrastructure along the proposed transportation route.

The Applicant anticipates that ore material sourced from the proposed Avoca Tank Project would replace ore currently sourced from the Girilambone Copper Mine (North East and Larsens operations) as production there falls towards the end of the life of that operation. As a result, the Applicant anticipates that the currently approved rate and hours of transportation would continue as follows.

- Rate of transportation – not limited.
- Hours of transportation – 24 hours per day, 7 days per week.

Finally, the Applicant would require all drivers of trucks carrying ore from the Project Site to abide by the existing *Traffic Management Plan*.

2.6 WATER MANAGEMENT

2.6.1 Classes of Water

The Proposal includes five principal classes of water as follows.

- Potable and ablutions water – this water would be brought to site in bulk and stored within tanks for use within the ablutions facilities and for drinking purposes.
- Make up water – this water would be transported to site via a buried poly pipe installed adjacent to the Site Access Road (see **Figure 2.1**). The water would be sourced from the Applicant's current water supply at the North East Open Cut. That water is obtained under licence from a pumping station on the Bogan River located approximately 25km to the east of the Project Site. That water would be used for dust suppression and for make up water within the Mine Water Pond.
- Clean water – this water is run off from undisturbed sections of the Project Site. This water would, as far as practicable, be diverted away from disturbed areas and would be allowed to flow to natural drainage. Clean water diversions would be constructed in accordance with the recommendations of *Managing Urban Stormwater Volumes 1, 2C and 2E* and would be removed at the end of the life of the Proposal.
- Dirty water – this water is run off from disturbed sections of the Project Site. This water would be managed in accordance with the recommendations of *Managing Urban Stormwater– Volumes 1, 2C and 2E* (Landcom, 2004; DECC, 2008a and 2008b).
- Mine water – this water is water that would be removed from the underground mine and would comprise a mixture of water pumped underground from the Mine Water Pond and groundwater that may seep into the underground workings. This class of water may contain suspended sediment, salt chemicals or hydrocarbons or may have a reduced pH. It would not be permitted to flow to natural drainage. This water would be stored in the Mine Water Pond which would be lined to achieve a permeability of 1 x 10^{-9}m/s over 900mm or equivalent.

2.6.2 Erosion and Sediment Control

A *Erosion and Sediment Control Plan* would be prepared prior to the commencement of site establishment and construction operations. The plan would be prepared in accordance with the requirements of the following documents.

- *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004).
- *Managing Urban Stormwater: Soils and Construction – Volume 2C – unsealed roads* (DECC, 2008a).
- *Managing Urban Stormwater: Soils and Construction – Volume 2E – mines and quarries* (DECC, 2008b).

In summary, the plan would include the following components (**Figure 2.1**).

- Clean water diversions around areas of proposed disturbance.
- Dirty water containment structures that would divert all run off from disturbed areas within the Surface Facilities Area to a sediment basin. The sediment basin would be designed and operated in accordance with the ESCP, however, at this stage is proposed to be approximately at least 3.5ML capacity, sufficient for storage of run off from a 5-day 90th percentile rainfall event. Water within the sediment basin would be reused for operational purposes where possible or, following testing to demonstrate suitable water quality, discharged to natural drainage. The sediment basin volume, together with that of existing farm dams within the Project Site, would be less than the applicable Harvestable Right under Section 53 of the *Water Management Act 2000*.
- Mine water containment structures designed to separate potentially salt or hydrocarbon contaminated, or low pH water from dirty water for transfer to the Mine Water Pond. This water would be managed to ensure that it does not discharge. Mine water would be used in underground mining operations and for dust suppression.
- Road-side drainage and sediment control structures constructed in accordance with DECC (2008a).

2.6.3 Operational Site Water Balance

Table 2.8 and **Figure 2.6** presents the operational water balance for the Proposal. In summary, the Proposal includes the following water sources which would be used in the following preference order. **Table 2.8** presents two water balance scenarios, namely Scenario 1, prior to the interception of groundwater and Scenario 2, at the end of the life of the proposal when groundwater inflows are expected to be greatest.

- Mine water – including the following.
  - groundwater inflow to the underground mine – the volume of water flowing into the underground mine is expected to vary from nil at the commencement of mining operations to approximately 111ML/yr (see Section 4.4.6.1); and

Table 2.8
Indicative Operational Water Balance

Component	Estimation Methodology	Anticipated Annual Volume	
Water Sources		**Scenario 1[#1]**	**Scenario 2[#1]**
Dirty water	Volume = A x B x C ÷ 1 000 000 where A = Annual average rainfall (444mm) B = Area within dirty water catchment (approximately 160 000m^2) C = Runoff coefficient = 0.42[#2]	Up to 30ML	Up to 30ML
Groundwater inflow to workings	See Section 4.4.6.1	Nil	111ML
Makeup water	Variable based on demand	134ML	23ML
	Sub-total	**164ML**	**164ML**
Water uses or losses			
Dust suppression	Volume = A x B x C x D ÷ 1 000 000 Where A = Area requiring dust suppression (approximately 20 000m^2) B = average number of days per year with less than 1mm of rain (321 days)[#2] C = dust suppression requirements (2mm/m^2/hour)[#3] D = Average hours per day during which dust suppression is required (10 hours)	128ML	128ML
Evaporation – Mine Water Pond	Volume = A x B x C Where A = Area of pond surface (approximately 2 500m^2) B = Annual pan evaporation (2045mm) C = Pond Evaporation Correction Factor (0.5)	4ML	4ML
Evaporation – Underground ventilation and moisture contained in rock removed from the underground mine	Volume = 1L/s	32ML	32ML
	Sub-total	**164ML**	**164ML**

Note 1: Scenario 1 = prior to the interception of groundwater.
Scenario 2 = end of mine life when maximum groundwater inflows are anticipated.
Note 2: Source – Landcom (2004) - after Table F2.
Note 3: Source – Bureau of Meteorology – Nyngan Airport Automatic Weather Station.
Note 4: Source – National Pollution Inventory Handbook.

Source: Tritton Resources Pty Ltd

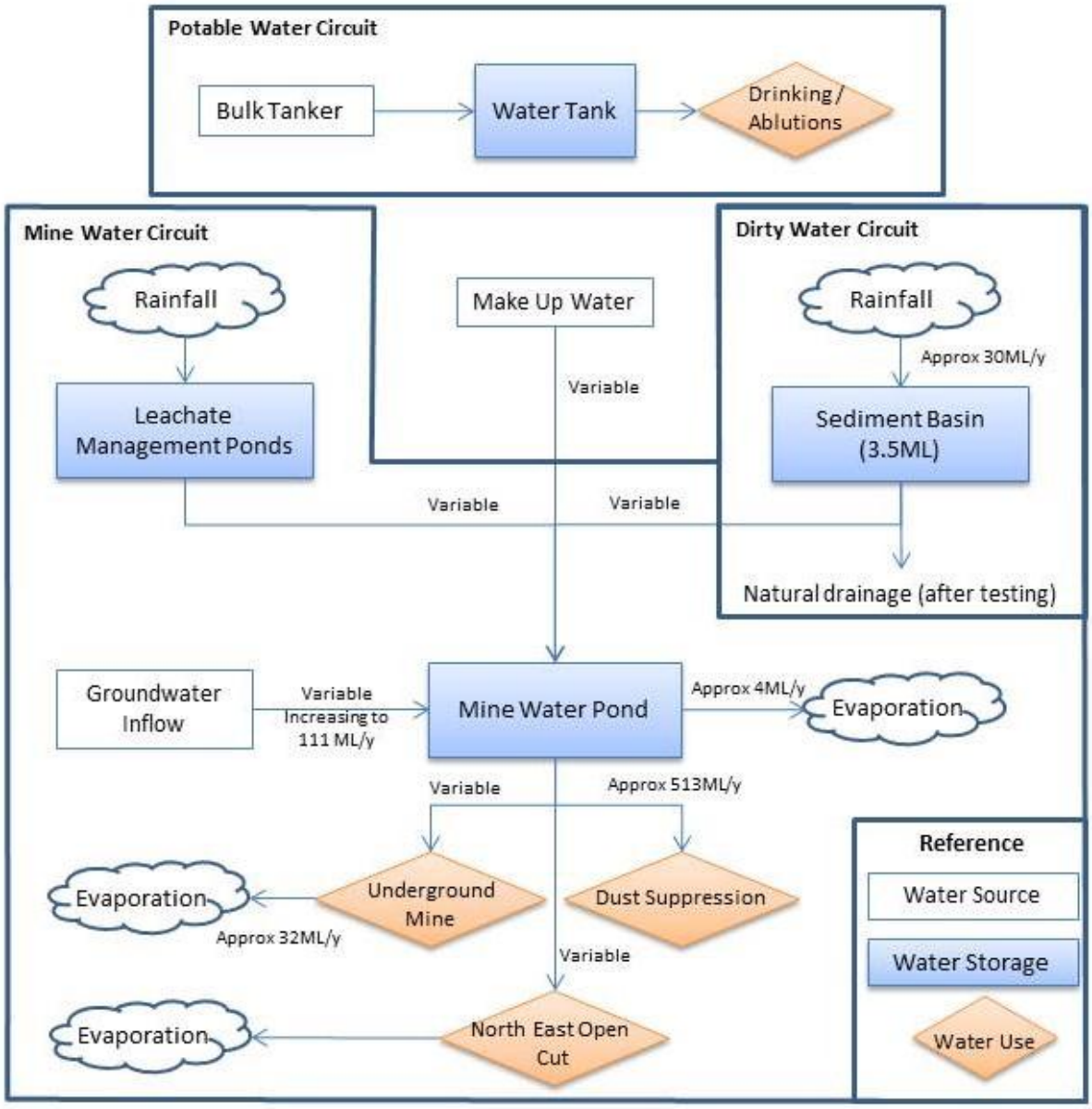


Figure 2.6
SCHEMATIC WATER BALANCE

  - surface water flows within the ROM Pad and waste rock emplacement - the volume of water from this source would vary but is unlikely to be substantial.

- Dirty water – the volume of available dirty water would depend on annual rainfall. In an average year, up to 30ML of water may be available.
- Make up water – any shortfall in water for operational purposes would be sourced from the Applicants licenced raw water dam at the Murrawombie Mine and transported to the Project Site via the proposed pipeline.

The Proposal also includes the following water uses or destinations.

- The proposed underground mine – water would be pumped from the Mine Water Pond to the underground mine for use in mining operations. The majority of that water would be returned to surface, however, a proportion would be lost to evaporation via the mine ventilation system. This has been conservatively estimated at approximately 1L/s or 32ML/yr.
- Dust suppression – dust suppression operations would conservatively be required over an active area of 2ha, with other areas protected, as required, through the use of chemical suppressants or other mechanisms. At an assumed application rate of 2mm/m^2/hour over 321 10-hour days, an estimated 128ML/yr would be required for dust suppression operations.
- North East Open Cut – in the event that more mine water was produced than could be used by the Proposal, the additional water would be transferred to the North East Open Cut. As the excess water would be largely groundwater and the North East Open Cut has partially filled with groundwater, transfer of that water would not result in adverse environmental impacts.

As a result, the Proposal would be able to adequately balance its water demands and supplies in such a manner that mine water would not be permitted to flow to natural drainage.

2.6.4 Water Management

An aerated wastewater treatment or pump out septic system would be installed in the vicinity of the ablutions facilities. This system would comply with the requirements of Bogan Shire Council and would be approved for use by Council prior to being commissioned.

2.7 TRANSPORTATION

2.7.1 Internal Project Site Transportation

A range of existing and proposed internal roads would be required to facilitate extraction of ore and waste rock and to permit movement of mobile plant within the Project Site. These would include the following (**Figure 2.1**).

- The Site Access Road which would permit access for light and heavy vehicles to the Surface Facilities Area.
- Internal access roads which would permit movement of mine-related vehicles within the Project Site.

All proposed roads would be unsealed and constructed in a manner that would permit all weather access to and within the Project Site. In addition, all proposed roads would be designed and constructed in accordance with the requirements of *Managing Urban Stormwater – Soils and Construction – Volume 2C Unsealed Roads* (DECC, 2008a).

The Site Access Road would be constructed to the same standard as the existing private haul road from the North East Mine to the Murrawombie Mine, namely a 12m wide road with a combined road base of approximately 400mm.

All internal roads would be sheeted with suitable material to minimise dust generation as a result of vehicle movements and would be watered with a water truck as required. Alternatively, suitable dust suppressant products would be mixed with water sprayed on the roads to minimise water required for dust suppression operations.

A lockable gate would be installed at the southern end of the Site Access Road and would be closed and locked to prevent vehicular access when the Project Site is non-operational.

Finally, the Project Site road network would be constructed and signposted in a manner that would ensure separation between mine and non-mine vehicles. Site access would be controlled and non-approved drivers and vehicles would be prevented from accessing the active sections of the Project Site without an appropriate clearance or escort.

2.7.2 External Transportation

2.7.2.1 External Road Network

Figure 2.7 presents the surrounding road network and the proposed road train transportation route. The proposed transportation route for ore material between the ROM Pad and the Tritton Copper Mine would be via:

- the Site Access Road;
- the existing private haul road between the North East and Murrawombie operations; and
- Booramugga and Yarrandale Roads.

All ore material from the Project Site would be transported to the Tritton Copper Mine via the above route. That traffic accessing the Project Site from Nyngan would do so via the Mitchell Highway and Booroomugga Road before entering the Site Access Road. The Applicant anticipates that the route would principally used for the transportation of personnel and deliveries of goods such as diesel and equipment, however, allowance has been made for occasional campaign based traffic of waste rock materials to supply road maintenance materials from Bogan Shire Council and other local customers.

The existing private haul road between the North East and Murrawombie operations is an unsealed road approximately 12m wide. Maintenance of the road is funded entirely by the Applicant. A lockable gate is installed at the southern end of the road. That gate is closed and locked when the North East Open Cut and Underground are non-operational.

Booramugga and Yarrandale Roads are sealed public roads. Both roads are in good condition and are managed by Bogan Shire Council.

The Mitchell Highway is a sealed public road. The road is in good condition and is a State Road managed by the Roads and Maritime Service.

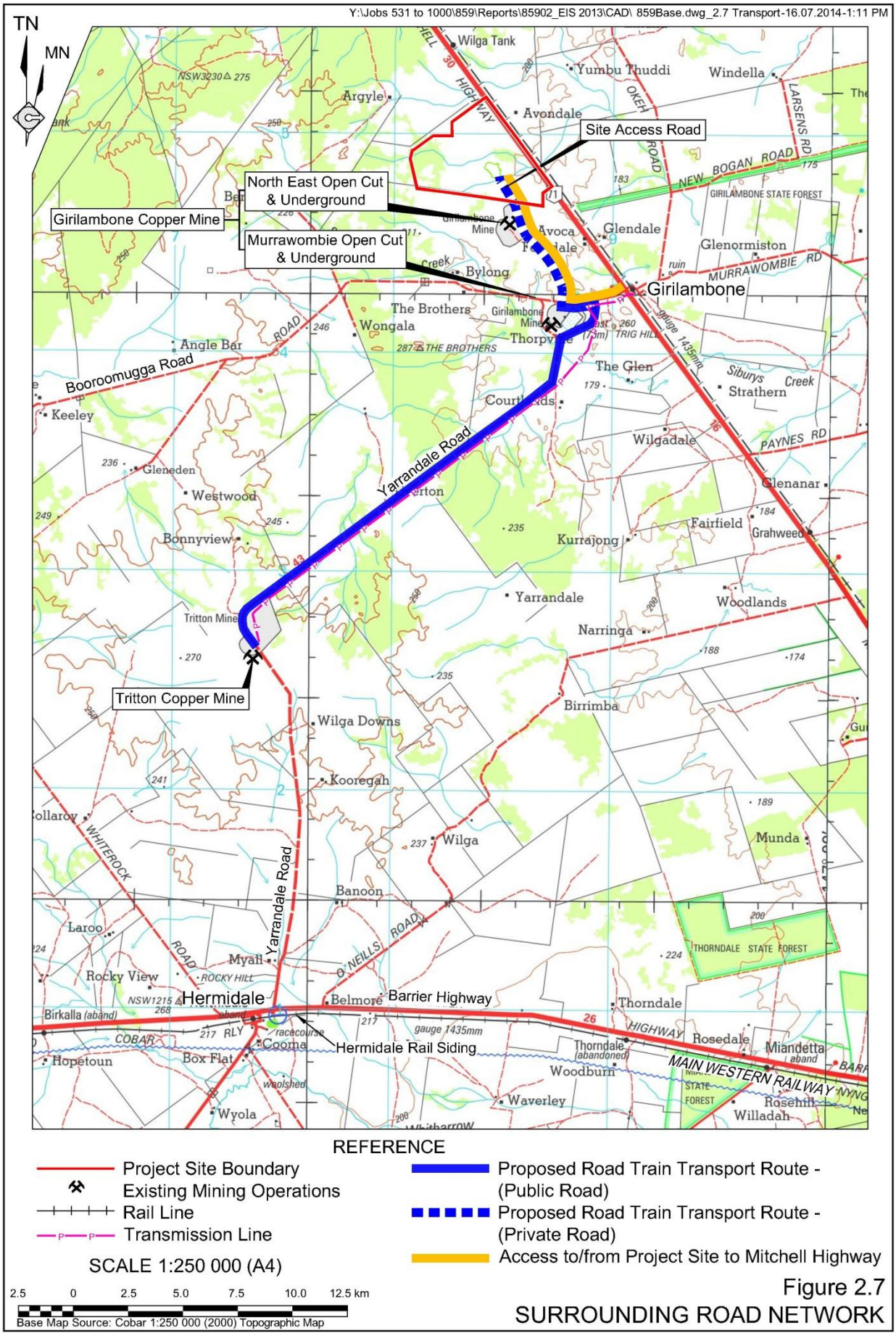


Figure 2.7
SURROUNDING ROAD NETWORK

2.7.2.2 Traffic Types and Levels

Traffic types associated with the Proposal would include the following.

- Light vehicles: including passenger vehicles and small buses.
- Heavy vehicles: including rigid trucks and semi-trailers delivering consumables, processing reagents and supplies, or transporting road maintenance materials to local projects.
- Oversize and long vehicles: including low loaders delivering mining equipment and two trailer road trains transporting ore material.

The Applicant anticipates that ore production within the Project Site would replace production from existing operations at the Girilambone Copper Mine. As a result, traffic levels of the public road network are not expected to change significantly as a result of the Proposal. Notwithstanding this, **Table 2.9** presents the anticipated Proposal-related traffic levels for each of the principal transportation routes identified in the previous subsection.

Table 2.9
Anticipated Maximum Daily Traffic Movements[1]

Route	Light Vehicles	Heavy Vehicles	Long and Oversize Vehicles
Proposal Construction			
Project Site – Tritton Copper Mine	12	2	nil
Project Site – Nyngan	24	4	nil
Proposal Operation			
Project Site – Tritton Copper Mine	6	2	50[2]
Project Site – Nyngan	12	2	nil
Note 1: Two vehicle movements = one return trip Note 2: Based on the maximum production rate of 316 000tpa, transportation operations on 270 days per year and 52t per load.			
Source: Tritton Resources Pty Ltd			

2.8 FACILITIES AND SERVICES

2.8.1 Facilities

The Applicant would establish the workshop and laydown area, which would comprise the following.(**Figure 2.1** and **2.4**).

- A workshop comprising shipping containers and an arched roof structure.
- One or more transportable stores buildings/shipping containers.
- A hardstand area sufficiently large to permit all mobile plant to be parked.
- A series of demountable buildings that would comprise the site office, crib (meals) room, ablution facilities, first aid room, security and meeting rooms.
- An unsealed car park area.
- A vehicle wash down bay.

All visitors would be required to stop and sign in at the site office prior to being permitted to access the active sections of the Project Site.

In addition a fuel bay and refuelling area incorporating bunded fuel and waste oil tank(s) and a concrete sealed refuelling area. The capacity of the bunded area would be 110% of the volume of the largest tank. All potentially contaminated surface water runoff within the refuelling area would be directed to an oil/water separator.

Finally, a laydown area would be constructed to permit storage of equipment awaiting use or removal from the Project Site.

2.8.2 Services

2.8.2.1 Introduction

The Applicant would establish the following services within the Project Site to support the proposed mining and processing operations. This sub-section describes each of these components.

- An electricity supply.
- Communications infrastructure.
- Hydrocarbon storage infrastructure.

2.8.2.2 Electricity Supply

A 11kV power line would be constructed from the Applicant's existing power supply at the North East Open Cut and Underground (**Figure 2.1** and **2.4**). The power line would be located adjacent to the Site Access Road and would provide power to the underground mine, workshop and other facilities within the Project Site.

A substation would be established in the vicinity of the ventilation rise to reduce the voltage of the supply to that suitable for use underground. This supply would be transferred to the underground workings initially via a temporary supply line to the portal and decline, and later by a supply line installed in the ventilation rise.

The voltage of the supply would be further reduced to 240V for supply to the workshop, offices, crib room and ablutions facilities.

Power for surface water pumps and other infrastructure may be provided by diesel or petrol generators.

2.8.2.3 Communications

The Project Site would be serviced by telephone and data lines. These services may be provided via a satellite or wireless link. In addition, communications within the remainder of the Project Site would be via a digital radio network.

2.8.2.4 Hydrocarbons

All diesel fuel for the mobile equipment would be stored in tanks with a total indicative capacity of approximately 110 000L within the fuel store area. The tanks would either be self-bunded or would be located within a covered, concrete-sealed bund that would be sized to meet the relevant containment requirements and Australian Standard AS 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids*, namely the bunded areas would have a capacity of 110% of the volume of the largest tank.

A sealed refuelling area would be located adjacent to the fuel store with all drainage directed to an oil/water separator. All haul trucks and other mobile equipment that would regularly access the surface would utilise the refuelling area while the jumbos, underground loaders, pumps and other less mobile equipment would be refuelled at there work locations using a mobile fuel tanker or tray-mounted fuel tanks.

Any bulk oils, greases and waste oils would be stored within the fuel store. In addition, bunded pallets would be maintained within the workshop areas for the storage of hydrocarbons or waste oils to be used or generated during servicing operations.

Appropriate hydrocarbon spill kits would be located in the vicinity of all hydrocarbon storage areas and the Applicant would ensure that all contractors and employees are appropriately trained in their use.

2.9 NON-PRODUCTION WASTE MANAGEMENT

Non-production waste would be managed in accordance with Clause 46K(1) of the *Protection of the Environment Operations (Waste) Regulation 2005* and the *NSW Waste Avoidance and Resource Recovery Strategy 2007* which was prepared with regard to the *Waste Avoidance and Resource Recovery Act 2001*. The underlying principle for all waste management would be to minimise waste generation, to recover, reuse and to recycle waste materials as much as possible, and to reduce environmental harm in accordance with the principles of ecologically sustainable development.

Table 2.10 provides a description of how non-production waste would be stored, managed and subsequently removed from the Project Site.

In addition, the Applicant would implement a purchasing policy that would take into account waste management and would, where practicable, purchase products that would result in the least waste generation. The Applicant would also ensure that all recyclable materials would, where practicable, be recycled on site or would be transported to an appropriate recycling facility.

2.10 PROPOSAL LIFE AND HOURS OF OPERATION

2.10.1 Hours of Operation

Table 2.11 presents the proposed hours of operation for each of the relevant components of the Proposal.

Table 2.10
Non-Production Waste Management

Waste Type	Storage	Removal Method
General solid waste (putrescible), including food scraps and inert materials	Covered bins located within the crib room, office 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 licensed waste contractor and transported to a licensed waste disposal facility.
Waste oils and greases	Placed within bunded area(s) within the workshop area.	Collected on a regular basis by a licensed waste contractor and transported to an appropriately licensed facility.
Batteries	Batteries would be placed within a covered and marked used battery storage area until removed from site.	Batteries would be collected as necessary by a licensed disposal 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 reused on site for construction of retaining walls, erosion protection, traffic control or would be removed from site for reuse elsewhere or recycling.
Scrap Steel /Metal	Stored in a specified areas within the workshop area or elsewhere such as the laydown area, as required.	Collected as necessary by a scrap metal recycler.
General Recyclables	Covered bins located within lunch rooms, offices, camp site and elsewhere as required. Where these bins are located outside a closed building they would be fitted with animal-proof lids.	Collected as necessary by a licensed recycling contractor and transported to an appropriate recycling facility.
Source: Tritton Resources Pty Ltd		

Table 2.11
Proposed Hours of Operation

Activity	Proposed Days of Operation	Proposed Hours of Operation
Vegetation clearing and topsoil stripping	7 days a week	Daylight hours
Site establishment operations, including box cut establishment	7 days a week	24 hours per day
Underground mining operations	7 days a week	24 hours per day
Transportation operations	7 days a week	24 hours per day
Maintenance operations	7 days a week	24 hours per day
Rehabilitation operations	7 days a week	Daylight hours
Source: Tritton Resources Pty Ltd.		

2.10.2 Proposal Life

The Applicant anticipates that site establishment, including establishment of the surface facilities area and the box cut and decline, would take up to 12 months to complete. Ore mining operations would commence in Year 2 of the Proposal and would require approximately 4 years to complete, with a further 2 years required for site decommissioning and rehabilitation. As a result, the proposed life of the Proposal would be 7 years.

The Applicant, however, notes that mining rates may vary from those identified in **Table 2.2** and that the actual Proposal Life may be longer than 7 years. In addition, throughout the life of the Proposal, the Applicant would continue to explore for possible extensions to the known mineralisation and for new areas of mineralisation within its mineral authorities. Further, ore reserves identified may extend the Proposal life, in which case separate applications for approval to extract that material would be made at that time.

2.11 EMPLOYMENT, CAPITAL COST AND ECONOMIC CONTRIBUTIONS

The Applicant notes that the proposed Avoca Tank Project would form a component of the Applicant's overall operations and that it would effectively replace existing operations the Girilambone Copper Mine. Section 4.15.4 presents an overview of the contribution made by the Tritton and Girilambone Copper Mines as a whole. Notwithstanding this, the following presents an overview of the employment, capital cost and economic contributions that the Avoca Tank Project would make to the local, regional, State and national economies.

- Approximately 55 full-time equivalent positions during the construction and operation of the Mine.
- The capital cost of the Project is anticipated to be approximately $20 million.
- The Proposal would contribute approximately $6.4 million per year to the local and regional economy through wages and a further $1.7 per year through purchases of local goods and services.
- The Proposal would contribute approximately $9.2 million per year to the State and national economy through purchases of goods and services within NSW and Australia.
- The Proposal would contribute approximately $4.0 million per year to the local, State and national governments through the payment of rates, taxes and royalties.

2.12 SAFETY/SECURITY MANAGEMENT

The Applicant would incorporate the Proposal into its existing *Health and Safety Management System*. The system identifies roles and responsibilities, procedures for investigation of near misses and safety incidents, and requirement for a regular and trigger-related review and audit of the system.

The Applicant would implement the following to maintain a level of safety and security appropriate for the proposed activities.

i) Use of locked gates to exclude access when site personnel are not working within the Project Site.

ii) Installation of and maintenance of safety signage around the Project Site and perimeter fencing, where necessary.

iii) A requirement that all visitors entering and departing the Project Site report their location to the Applicant through the use of a tag board and sign in/sign out process as appropriate.

2.13 SITE REHABILITATION AND DECOMMISSIONING

2.13.1 Introduction

Rehabilitation of all areas to be disturbed throughout the life of the Proposal would be an integral part of the Proposal. Rehabilitation activities would be planned and undertaken in accordance with a *Mining Operations Plan* (MOP) to be submitted to DRE and approved following the issue of development consent and prior to the commencement of on-site activities. The MOP would also address any rehabilitation-related requirements nominated in the development consent for the Proposal. Finally, it is noted that the MOP will be required to be accompanied by a rehabilitation cost estimate prepared in accordance with the relevant guidelines. That estimate would identify the likely costs associated with rehabilitation of the Proposal and a security to cover those costs would be required to be provided prior to the commencement of site establishment and construction operations.

In addition to the rehabilitation commitments in the *Environmental Impact Statement*, rehabilitation would be planned and undertaken with reference to the following documentation.

- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth Government, 2006).
- *Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth Government, 2006).
- *Strategic Framework for Mine Closure* (ANZMEC, 2000).

2.13.2 Rehabilitation Hierarchy

Figure 2.7 provides an indicative illustration as to the primary and secondary domains of the Project Site. The rehabilitation hierarchy for the Proposal follows the rehabilitation hierarchy identified in *ESG3: Mining Operations Plan (MOP) Guidelines* dated September 2013 and published by DRE. A summary of each phase of the rehabilitation hierarchy is as follows.

Decommissioning

Specific details of decommissioning completion criteria would be covered the MOP. In general, however, the decommissioning phase of the rehabilitation hierarchy would involve the cessation of usage of infrastructure, as well as its demolition or dismantling and removal of built structures 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 2.13.7.

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, including construction of final surface water controls, where required. Specific procedures relating to landform establishment that relate to completion criteria at this stage of the rehabilitation hierarchy are outlined in Section 2.13.7.

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. Specific procedures relating to growth media development are outlined in Section 2.13.7.

Ecosystem and Land Use Establishment

The ecosystem and land use establishment phase of the rehabilitation hierarchy involves the revegetation of the rehabilitated landform with native species commensurate with the targeted final land use. Specific procedures relating to ecosystem and land use establishment are outlined in Section 2.13.7.

Ecosystem and Land Use Sustainability

The ecosystem and land use sustainability phase of the rehabilitation hierarchy occurs once monitoring shows that there is adequate vegetation over the area. 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 2.12** have been met.

Table 2.12
Indicative Rehabilitation Completion Criteria, Performance Indicators and Monitoring Strategy

Page 1 of 2

Rehabilitation Phase	Indicative Completion Criteria	Performance Indicator	Monitoring Strategy
Decommissioning	All built infrastructure removed from site and disturbance areas ready for landform establishment operations.		Photographs. Visual inspection on completion.
Landform Establishment	All slopes stable and, with the exception of the Box Cut, suitable for soil placement.	All slopes (with the exception of the Box Cut) less than 1:3 (V:H).	Survey on completion.

Table 2.12 (Cont'd)
Indicative Rehabilitation Completion Criteria, Performance Indicators and Monitoring Strategy

Rehabilitation Phase	Indicative Completion Criteria	Performance Indicator	Monitoring Strategy
Landform Establishment (Cont'd)	The rehabilitated area does not represent an erosion hazard.	Surface water control structures installed and stabilised.	Photographs. Visual inspection on completion. Survey on completion.
Growth Media Development	Subsoil/topsoil placed on the shaped landform to the required depth.	Minimum 20cm of topsoil spread.	Test pits following spreading. Photographs.
	Soil ameliorants and fertiliser applied.	Soil testing complete and recommendations implemented.	Testing report(s) prior and following spreading. Contractor invoices.
	Soil scarified and ready for revegetation.	Surface even and slightly roughened to encourage water infiltration.	Photographs. Visual inspection on completion. Survey.
Ecosystem and Land Use Establishment	Appropriate species mix is selected.	Species mix is consistent with surrounding vegetation.	Ecology survey of surrounding vegetation – pre-closure.
	Seed spread and becoming established.	Appropriate strike rate taking into account species and climatic conditions.	Landscape Function Analysis survey – immediately post-revegetation.
		No significant 'bare' patches	
	Appropriate native plant species richness is present for the restored community.	Comparison to control site established in equivalent remnant vegetation.	Landscape Function Analysis survey – 6 monthly until established.
	Appropriate micro-habitat features established.		
Ecosystem and Land Use Sustainability	The area and its sustainability is consistent with the intended land use.	Establish areas of rehabilitation consistent with approval conditions.	Landscape Function Analysis survey – annual until relinquishment.
	Exotic weeds or vegetation are not competing or impacting on the intended land use.	Noxious weeds are no more prevalent within rehabilitation areas than analogue sites.	Weed and pest survey – 6 monthly until relinquishment.
	Feral pests are not impacting on the intended land use.	Feral pests are no more prevalent within rehabilitation areas than analogue sites.	

2.13.3 Rehabilitation Objectives

The Applicant's rehabilitation objectives are divided into the following three specific categories. The specific objectives associated with each category are as follows.

Decommissioning and Landform Establishment

- To stabilise all disturbed areas and minimise erosion and dust generation.
- To provide a geotechnically stable, safe and non-polluting landform which provides land suitable for the final land use of intermittent agriculture and which requires land management practices no greater surrounding undisturbed land.

Growth Media Development and Ecosystem Establishment

- To provide for soil management over the life of the Proposal which addresses the constraints related to stripping, storage and replacement on the final landform.
- To achieve a soil profile capable of sustaining the specified final land use.
- To provide for surface micro-habitats such as fallen timber, surface rocks or other features which would encourage colonisation by native flora and fauna.
- To establish vegetation with the species diversity commensurate to the ecological community disturbed.

Ecosystem Development (Final Land Use)

- To return all disturbed areas, with the exception of the box cut, to a final land use of intermittent agriculture.

2.13.4 Strategic Rehabilitation Management

2.13.4.1 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 as follows (**Figure 2.8**). Numbering of individual domains is consistent with Section 5 of *ESG3: Mining Operations Plan (MOP) Guidelines* dated September 2013 and published by DRE.

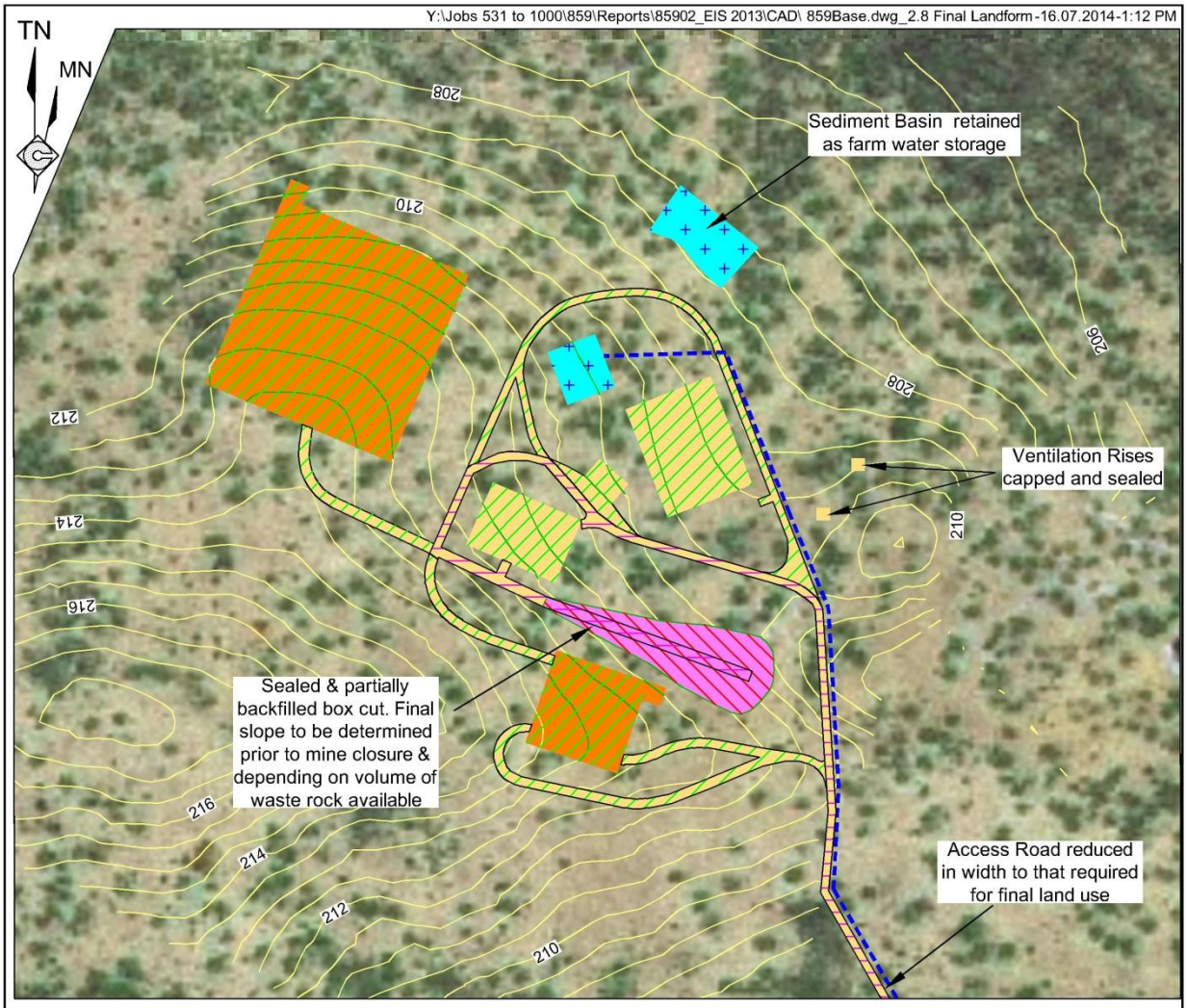
Primary Domains

Domain 1 – Infrastructure Area

This domain includes the hardstand and laydown areas, car park, fuel store and refuelling bay, water pipeline, power line and all roads.

Domain 3 – Water Management Structures

This domain includes the Mine Water Pond and sediment basin.



REFERENCE
Unsealed Road
Pipeline
Clean Water Diversion
Water Storage
210 Existing Contour m(AHD) (Interval = 0.5m)
210 Final Contour m(AHD) (Interval = 0.5m)

Primary Domains
Domain 1 - Infrastructure Area
Domain 3 - Water Management Structures
Domain 4 - Waste Rock Emplacement and ROM Pad
Domain 8 - Underground Mining Area

Secondary Domains
Domain A - Infrastructure
Domain B - Water Storage
Domain G - Rural Land
Domain I - Final Void

SCALE 1:7 500(A4)
100 0 100 200 300 400m
Source: Tritton Resources Pty Ltd

Figure 2.8
INDICATIVE REHABILITATION DOMAINS AND FINAL LANDFORM

Domain 4 – Waste Rock Emplacement and ROM Pad

This domain includes the waste rock emplacement and ROM Pad.

Domain 8 – Underground Mining Area

This domain includes the box cut, portal and ventilation rise and emergency egress.

Secondary Domains

Domain A – Infrastructure

This domain would include the Site Access Road which would be used for continued land management purposes.

Domain B – Water Management

This domain would include the Mine Water Pond and sediment basin which would be retained for ongoing agricultural use.

Domain G – Rural Land

All areas, with the exception of the boxcut and water management structures would be returned to a final land use of intermittent agriculture.

Domain I – Final Void

This domain would include the box cut and capped and sealed ventilation rises.

2.13.4.2 Rehabilitation Completion Criteria, Performance Indicators and Monitoring Strategy

Strategic rehabilitation completion criteria, associated performance indicators and monitoring strategy for the Proposal are summarised in **Table 2.12**. It is noted that **Table 2.12** provides a range of general criteria and that further detailed criteria would be provided in any MOP prepared following granting of development consent.

2.13.5 Final Landform

Figure 2.8 presents the final landform for the Proposal. In summary, the landform would comprise the following.

- A sealed portal and partially backfilled box cut, with the final slope to be determined depending on the volume of waste rock available. In addition, both rises would be capped and sealed. All mine openings would be sealed in accordance with the requirements of NSW Trade and Investment – Mine Safety at the time of mine closure.
- The Mine Water Pond and sediment basin would be retained as farm water storages.

- The remaining disturbed areas would be rehabilitates as follows.
  - Hardstand areas would be scraped and sheeting material placed within the box cut.
  - Compacted areas would be deep ripped.
  - Surface water control structures would be installed as required.
  - Soil would be spread.
  - Seed of species consistent with the Benson 103 – Poplar Box – Gum – barked Codibah – White Cypress Pine (Benson 103) Community would be spread.
  - Rehabilitated areas would be fenced until the newly established vegetation is able to withstand grazing by native and exotic animals.

The Site Access Road would be maintained for land management purposes. The width of the road would be reduced to a width suitable for that purpose, with the remainder of the road rehabilitated as described above.

2.13.6 Final Land Use

In proposing an end land use for the Project Site, the Applicant has considered:

- the current land use within the Project Site and surrounding properties (see Section 4.1.5.2);
- the infrastructure that would be developed within the Project Site; and
- the proximity of the Project Site to other industry.

End land uses considered included:

- the development of another industry;
- a return to an agricultural end land use; and
- the conservation of biodiversity.

In considering an end land use of another industry, the Applicant notes that the Proposal would result in construction of a number of items of infrastructure that may potentially be amenable to other industrial land uses. These include power and water supplies, and hardstand areas. However, limiting the potential for future industrial use of the Project Site is the distance from the Project Site to major population centres, including Nyngan.

In considering an end land use of agriculture, the Applicant notes that the Project Site and surrounding properties are currently used for intermittent agriculture, principally grazing, as climatic conditions permit.

In considering an end land use of nature conservation, the Applicant noted that sections of the Project Site, as well as large areas surrounding the Project Site, have been extensively disturbed by prior agricultural and other activities. There exists an opportunity for the Project Site to result in additional areas of land that would be used for the conservation of native habitat.

However, the Applicant also notes that land set aside for nature conservation is unlikely to generate sufficient income to pay for the required land management activities such as fencing and weed and pest control.

In light of the above, the Applicant proposes that the end land use would be intermittent agriculture.

2.13.7 Rehabilitation Methods and Procedures

2.13.7.1 Domain 1 – Surface Facilities Area and Infrastructure

Following completion of mining-related operations, and assuming that no further mining operations are proposed, the Applicant would remove infrastructure and services specifically established to service the mining operation that would no longer be required. This would include the following.

- All temporary buildings, including the office, crib room, ablutions and workshop.
- The waste water treatment facility.
- The fuel store and oil/water separator.

Other items of infrastructure would remain for ongoing land management purposes or for future mining operations. Indicatively, this would include the following.

- Buried water supply pipeline.
- Power line and power supply to the underground mine.
- Site Access Road, reduced in width to that require for ongoing light vehicle access.

Samples of soil below and surrounding areas potentially subject to hydrocarbon contamination would be taken and analysed. In the event that contamination is identified, contaminated material would be excavated and removed from the Project Site to a facility licensed to accept such material. Once excavation is complete, a second soil sample would be taken to confirm that all contaminated material has been removed.

All concrete footings and foundations of buildings or structures would be broken up and removed or covered. The materials used to form roads and hardstands would be removed and the areas ripped. All areas to be rehabilitated would be re-profiled to mimic the pre-mining landform.

Previously stockpiled topsoil would be spread over the ripped and profiled landform and covered with any previously cleared vegetation stockpiled within the Project Site. The following soil management procedures would be implemented.

- The final landform would have an even but roughened surface which would be ripped along the line of the contour to break any compacted and/or smooth surfaces. Ripping would also assist the keying of the soil into the underlying substrate, maximise aeration and infiltration and minimise erosion.

- Soil would be placed and spread on the shaped landform to the depths identified in **Table 2.12**. If required, soil would be ameliorated prior to revegetation to prevent surface crusting, increase moisture and organic content, and/or buffer surface temperatures to improve germination.
- Soil would not be respread when too moist, to avoid excessive compaction, or too dry to avoid excessive dust and wind erosion.
- The final landform would be spread with seed of a mix of species representative of the existing vegetation community, namely Benson 103.
- Finally, previously cleared and stockpiled vegetation would then be spread over the revegetated areas.

2.13.7.2 Domain 3 – Water Management Structures

The Mine Water Pond and sediment basin would be retained as farm water storages for future land management purposes. The combined capacity of the structures would be less than 3.5ML. This is significantly less than the harvestable right capacity of the Project Site of approximately 90ML.

Prior to decommissioning the Mine Water Pond for use as farm water storage, the Applicant would:

- return water within the pond back underground;
- remove the accumulated sediment and pond liner and dispose of the sediment as potentially acid generating material within the underground workings and the liner at an approved waste management facility; and
- construct a suitable inlet and spill way.

Alternatively, if the pond is not required as farm water storage, it would be decommissioned as described above and filled in. The footprint of the pond would be rehabilitated as described in Section 2.13.6.1.

Sediment and erosion control structures constructed for the mining operation that are not required for the final landform would be removed and rehabilitated as described previously.

2.13.7.3 Domain 4 – Waste Rock Emplacement and ROM Pad

As described in Section 2.4.3, the waste rock emplacement would comprise three separate placement areas as follows.

- Cell 1 – weathered, non-acid forming waste rock placement area. Material within this area would preferentially be retained on surface for use during rehabilitation operations within the Project Site and at the Applicant's other mining operations.

- Cell 2 – non-weathered, non-acid forming waste rock placement area. Material within this area may be transported back underground for used as backfill within completed stopes. Alternatively, material remaining at surface may be used during rehabilitation operations at the Applicant's other mining operations without further approval, or for non-mining related purposes, such as local road maintenance.
- Cell 3 – potentially acid forming waste rock placement area. Material within this area would be transported back underground and would be placed within completed stopes. As a result, at mine closure, this area would comprise a lined hardstand area with no accumulated waste rock remaining at the completion of mining operations.

In addition, the ROM Pad would comprise a hardstand area with all ore material removed.

Following the completion of mining operations, the Applicant would remove the accumulated sheeting material from the ROM Pad and Cell 3 of the waste rock emplacement area. Given the potential for this material to be contaminated with acid forming material, it would be transported back underground and placed either in a completed stope or in a location that would be below the regional water table.

Following removal of the sheeting material, these areas would be deep ripped, shaped to reflect the pre-mining topography and rehabilitated as described in Section 2.13.6.1.

Cells 1 and 2 would remain unrehabilitated until all material within them has been used for rehabilitation. In the event that any material remains, it would be:

- shaped to form a suitable final landform with slopes of 1:3 (V:H) or less;
- covered with weathered waste rock and soil; and
- revegetated as described in this section.

2.13.7.4 Domain 8 – Underground Mining Area

This domain includes the box cut, portal and rises.

The portal and rises would be capped and sealed in a manner that would permit reopening of the mine in accordance with the relevant guidelines applicable at the time of mine closure. Indicatively, this would require placement of a suitably engineered concrete cover over the rises and construction of a lockable barrier across the portal. Alternatively the portal may be blocked using placed waste rock.

The box cut would be bunded and fenced during the life of the Proposal. Following completion of mining operations, and confirmation of the volume of waste rock required for rehabilitation at the Applicant's other operation, remaining non-acid generating waste rock would be transported to the box cut which would be partially back filled.

2.13.8 Ecosystem Development and Monitoring

The Applicant's commitment to effective rehabilitation would involve an ongoing monitoring and maintenance program following completion of mining-related operations. Rehabilitated areas would be regularly inspected, particularly following rainfall events. During these inspections the following would be noted.

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover.
- Success of vegetation establishment.
- Natural regeneration of native species.
- Adequacy of drainage controls.
- General stability of the rehabilitated areas.

Representatives of relevant government agencies would inspect the progress of rehabilitation on the Project Site during annual AEMR meetings.

Rehabilitation remediation and enhancement activities would include but not be limited to the following.

- Where rehabilitation success fails to achieve performance nominated in the MOP, maintenance activities would be initiated. These contingency management activities would be documented in the MOP, however, are likely to 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 and exotic fauna, until the rehabilitated landform can withstand grazing pressure.
- Appropriate noxious weed and pest control or eradication methods and programs would be undertaken.

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 2.13.3.3 are achieved to the satisfaction of the relevant government agencies.

2.14 ALTERNATIVES CONSIDERED

2.14.1 Introduction

The Director-General's requirements for the Proposal require that this document include a description of the alternatives considered, including a detailed justification for the Proposal. This sub-section identifies the feasible alternatives considered and rejected during the design and planning phase of the Proposal. The alternative of not developing the Proposal is considered in Section 5.4.5 and an evaluation of the Proposal in terms of Ecologically Sustainable Development and biophysical, socio-economic and planning considerations is provided in Section 5.3.

2.14.2 Alternative Site Layout

The Applicant considered a range of site layouts for the Proposal. In summary, however, the layout of the Proposal is constrained by the following.

- The location of the mineralisation. While the mining operations would not result in surface subsidence, the location of the decline and box cut, and therefore the remaining surface infrastructure, is constrained by the location of the mineralisation.
- The exact location and orientation of the box cut is constrained by the depth to competent rock. The Applicant has placed the boxcut in an area where such material is as close as possible to the surface, minimising the depth to which the box cut must be established and therefore the volume of waste rock required to be removed to construct it.

Following establishment of the location of the box cut, the remaining infrastructure was placed as close as possible to the box cut to ensure that the minimum area of disturbance would be required. In addition, the size of each component of the layout was determined based on the minimum likely requirements.

2.14.3 Alternative Access Route

Potential exists to access the Project Site directly from the Mitchell Highway. This alternative would require the following.

- Construction of a Site Access Road from the Mitchell Highway to the Project Site, a distance of approximately 1.5km.

- Construction of suitable intersections between the highway and the Project Site Access Road and Booramugga Road. This is likely to be significantly more costly than simply extending the existing private haul road.
- Transportation of ore via the Project Site Access Road, Mitchell Highway, Booramugga Road and Yarrandale Road, a distance of approximately 35km. This compares with the proposed transportation route which would be approximately 31km. This alternative would also require laden ore trucks to turn right onto the Mitchell Highway and then right into Booroomugga Road, both movements that would require giving way to potentially fast moving traffic.

In light of the above this alternative was rejected.

2.14.4 On-Site Processing

The Applicant considered establishing a stand alone processing facility for the Avoca Tank ore. However, given the relatively small size of the ore body and therefore limited life of the Proposal, capital cost for a new plant and the amenability of the ore to treatment at the Applicant's existing processing facility at the Tritton Copper Mine, the option of on-site processing was rejected.

Section 3

Consultation, Issue Identification and Prioritisation

PREAMBLE

This section describes the consultation undertaken during the design and evaluation phase of the Proposal, as well as during the preparation of this Environmental Impact Statement.

This information, together with a review of relevant legislation, planning documents and environmental guidelines and a range of background environmental studies was used to develop a comprehensive list of all relevant environmental issues.

A review of the design of the Proposal and the components of the local environment was undertaken to identify risk sources and potential environmental impacts for each environmental issue. The assessed risk associated with each potential impact was used to determine the relative priority of each issue, which instructed the order of assessment and breadth of coverage within Section 4.

The risk rankings were initially applied following the adoption of standard control measures and then with all proposed control measures to establish the residual risk ranking.

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3.1 INTRODUCTION

In order to undertake a comprehensive assessment of the environmental impacts arising from the Proposal, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the local and broader community. To ensure this has occurred, a program of extensive community and government agency consultation and review of environmental planning documentation has been 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 Impact Statement*.

3.2 CONSULTATION

3.2.1 Community Consultation

The following information describes the consultation undertaken between the Applicant and the local, surrounding and significant regional communities, in regards to the overall operations and the proposed interactions between the community and the Proposal. Consultation with the Aboriginal community is described in Section 4.2.5.

3.2.1.1 Neighbouring Landowners

The Applicant has engaged in discussions with the owner of the land on which the Project Site is sited. The land owner is aware of the Applicant's plans for the Proposal and has indicated that he would prefer to discuss the Proposal further following receipt of development consent, assuming that it is granted.

3.2.1.2 Community Consultative Committee

The Applicant has established a Community Consultative Committee, including the following:

- an independent chairperson;
- five community representatives; and
- three Company representatives.

The committee has met on the following occasions.

- 22 February 2013.
- 21 May 2013.
- 20 August 2013.
- 26 November 2013.
- 18 February 2014.

On each occasion, the Proposal was discussed and the minutes record no feedback from the community representatives in relation to the Applicant's current or proposed activities.

3.2.2 Government Agency Consultation

3.2.2.1 Introduction

Both formal and informal consultation was undertaken with a range of government agencies at State and local levels throughout the preparation of this document. The following subsections provide an overview of government agency consultation in formalised meetings and throughout the ongoing development of the Proposal.

3.2.2.2 Conceptual Project Development Plan Meeting

A Conceptual Project Development Plan Meeting was held with Division of Resources and Energy (DRE) (a division of the Department of Trade and Investment, Regional Infrastructure and Services) on 2 May 2013. At that meeting, the Applicant presented an overview of the exploration activities undertaken, the identified resources and the Proposal as it was then understood. As a result, DRE agreed to support the Proposal moving to the development application phase and advised the DP&E that formal government agency consultation could commence.

3.2.2.3 Planning Focus Meeting

A Background Paper was prepared and circulated to relevant government agencies in preparation for a Planning Focus Meeting which was held on site on 17 June 2013. During that meeting, an overview of the Proposal, as it was then understood, was presented and attendees from the following State and local government agencies inspected the Project Site and provided initial comments.

- Division of Resources and Energy (DRE).
- Environment Protection Authority (EPA).
- Roads and Maritime Services (RMS).
- Bogan Shire Council (Council).

The following government agencies were invited to attend the Planning Focus Meeting, but, for various reasons, were unable to participate in the on-site visit and meeting.

- Department of Planning and Infrastructure (DP&I) now Department of Planning and Environment (DP&E).
- NSW Office of Water (NOW).
- Office of Environment and Heritage (OEH).

Following the Project Site inspection, the attending government agencies present verbally outlined the issues from their perspectives that the *Environmental Impact Statement* should address. A number of these issues and others (including submissions by the government agencies who couldn't attend the Planning Focus Meeting) were subsequently provided to DP&E in writing to assist in the formulation of the Director-General's Requirements (DGRs)

for the Proposal. The DGRs and the included correspondence from OEH, RMS and DRE were provided to the Applicant on 25 September 2013. A full copy of the DGRs is reproduced in **Appendix 2** of this document. A range of other agencies provided their requirements directly to R.W. Corkery & Co Pty Limited (refer to Section 3.2.2.4) and a tabulated summary of these requirements, those raised in the DGRs, and the correspondence to DP&E or R.W. Corkery & Co Pty Limited provided by government agencies, and where each issue is addressed in the *Environmental Impact Statement* and accompanying documents, is presented in **Appendix 3**.

3.2.2.4 Individual Agency and Stakeholder Consultation

In addition to the agency consultation described previously, further individual consultation was undertaken with the following government agencies and service providers, as outlined within the consultation requirements described in the DGRs. Consultation with community groups is described in Section 3.2.1.

NSW Office of Water

The NSW Office of Water – Dubbo office, was contacted by phone on 1 October 2013 and briefed on the Proposal and the requirement to consult with NOW, as outlined within the DGRs. Further to the phone conversation, the *Background Paper* was provided to NOW to formulate the basis of NOW's response and to provide background information to the Proposal.

Formal correspondence was provided by NOW on 4 October 2013, submitting the issues that they would like to see addressed within the *Environmental Impact Statement, w*ith these issues summarised and incorporated into **Appendix 3.**

Department of Primary Industries

The NSW Department of Primary Industries (DPI) was formally consulted on 25 October 2013, requesting if the various divisions within the DPI had any specific issues relating to primary industries which should be addressed within the *Environmental Impact Statement*. A formal response was received on 20 November 2013 and the issues to be addressed have been summarised and included within **Appendix 3**.

Central West Catchment Management Authority

The Central West Catchment Management Authority (CW-CMA) was contacted on 25 October 2013, requesting if any specific issues were to be addressed within the *Environmental Impact Statement*. The CW-CMA provided a verbal response on 31 October 2013, requesting that the Catchment Action Plan 2006 – 2016 be addressed throughout the *Environmental Impact Statement*. No further issues were identified by CW-CMA.

3.2.2.5 Summary of Issues Identified

Table 3.1 presents an overview of the issues identified in written correspondence from the government agencies consulted.

Table 3.1
Key issues identified by Government Agencies

Issue	DP&E	NOW	OEH	DRE	EPA	RMS	DPI	CW-CMA	Council
Noise / Blasting / Vibration	✓				✓				
Air Quality / Greenhouse Gas	✓				✓				✓
Groundwater	✓	✓			✓			✓	✓
Surface Water / Erosion and Sediment Control	✓	✓			✓			✓	✓
Biodiversity	✓		✓					✓	
Aboriginal Heritage	✓		✓						
Traffic and Transportation	✓					✓			✓
Visual Amenity	✓								
Waste Management	✓								
Bush Fire Management	✓								✓
Hazardous Goods and Reagents	✓								
Non-Aboriginal Heritage	✓								
Soil Resources	✓								
Agricultural Impacts / Land Use	✓						✓		
Socio-Economic	✓								
Acid Rock Drainage	✓			✓	✓				✓
Rehabilitation and Final Land use	✓			✓					✓

3.3 RELEVENT LEGISLATION, PLANNING ISSUES, POLICIES AND GUIDELINES

3.3.1 Introduction

A range of Commonwealth and NSW Legislation, policies and guidelines apply to the Proposal. These documents were reviewed to identify any environmental aspects requiring consideration in the *Environmental Impact Statement*. In addition, the DGRs identified a number of guideline documents that would potentially be of assistance during the preparation of the *Environmental Impact Statement* (see **Appendix 2**). A brief summary of each relevant piece of legislation and planning instrument is provided in the following subsections. The application and relevance of planning instruments related to specific environmental issues have been addressed in Section 4 and / or the relevant specialist consultant assessments.

3.3.2 Legislation

3.3.2.1 Commonwealth Legislation

Native Title Act 1993

The *Native Title Act 1993* (NT Act) provides for the recognition and protection of native title rights and interests of Aboriginal and Torres Strait Islander peoples to land and waters according to their traditional laws and customs. It also establishes a mechanism to determine claims to native title. Native title rights and interests can only exist if they have not been extinguished by a prior valid grant of a right which is inconsistent with the continuation of native title rights and interests (such as the grant of freehold title).

A Native Title Claim was formally registered by the National Native Title Tribunal 12 April 2012 known as the Ngemba/Ngiyampaa People claim (Federal Court number: NSD415/12, NNTT number: NC12/1). In 2012, Straits sought legal advice as to whether previous land titles extinguished Native Title Rights. Advice received confirms that land areas relevant to the Avoca Tank Project, being Lot 10 and Lot 135, were both subject to the grant of Conditional Lease 1917/3, granted under the *Crown Lands Consolidation Act 1913*. As the conditional lease was granted prior to 1 January 1994, it will be either independently valid or validated by the *Native Title Act (NSW South Wales) 1994*. Native title will accordingly have been extinguished over Lot 10 and Lot 135 as a consequence of a 'previous exclusive possession act', being the grant of Conditional Lease 1917/3.

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) covers 'matters of national environmental significance'. Relevant matters of national environmental significance include:

- listed threatened species and ecological communities; and
- listed migratory species protected under international agreement.

'Actions' are defined under the EPBC Act to include projects and developments. Actions which would or would be likely to have significant impacts on matters of national environmental significance, or which might significantly impact on Commonwealth land, are 'controlled actions'. The Minister for the Environment determines whether a proposed action is a controlled action for the purpose of the EPBC Act. The carrying out of controlled actions are prohibited, unless approved by the Minister.

As the Ecology Assessment completed by EnviroKey Pty Ltd (and included as **Appendix 6** of the EIS), confirmed that the Proposal would not adversely impact on any matter of national environmental significance, it is not required to be referred under the EPBC Act.

National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) was introduced in 2007 with the objective of underpinning the introduction of an emissions trading scheme, informing government policy formulation and enabling Australia to meet its international reporting obligations.

The Applicant's mining activities currently trigger the thresholds for reporting under the NGER Act. If approved, the proposed activities would simply be included in the Applicant's corporate reporting requirements.

Energy Efficiency Opportunities Act 2006

The *Energy Efficiency Opportunities Act 2006* aims to improve the identification and evaluation of energy efficiency opportunities by large, energy using corporations, and to encourage the implementation of cost effective energy efficiency opportunities.

Large energy using corporations are required to undertake an assessment of energy efficiency opportunities and to report publicly on the outcomes of that assessment. Every 5 years, those corporations must submit assessment plans with deadlines for action on the assessed opportunities.

The Applicant is not currently registered for the Energy Efficiency Opportunities program.

3.3.2.2 NSW Legislation

The key NSW legislation relating to the approvals, leases and licences required for the Proposal and their implications for the Proposal are as follows.

Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the framework for the assessment and approval of development in NSW and is administered by the DP&E.

The EP&A Act aims to protect and conserve the environment through ecologically sustainable development. This is achieved through managing development to conserve resources, including agricultural land, natural areas, forests, minerals, water, and towns with the purpose of promoting social and economic welfare of the community and an enhanced environment.

Development consent is required under the EP&A Act for the purposes identified under the relevant Local Environment Plan (see Section 3.3.5). In order to obtain development consent, the development application needs to be accompanied by an *Environmental Impact Statement* as the Proposal is "designated development" in accordance with the provisions of Schedule 3(1) of the *Environmental Planning and Assessment Regulation 2000.*

The Proposal is also recognised classified under Section 91 of the EP&A Act as "integrated development" as other approvals, in addition to development consent, are required.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the framework for regulation and reduction of pollution and waste in NSW. The POEO Act is regulated by the Environment Protection Authority (EPA), which issues environment protection licences (EPLs) for wide-ranging scheduled activities, including mining for minerals, mineral processing and crushing, grinding or separating works.

The POEO Act also requires immediate reporting of pollution incidents which cause or threaten to cause material harm to the environment. All holders of EPLs are required to prepare, implement and regularly test *Pollution Incident Response Management Plans*.

As a result of discussions between the Applicant and the EPA on 17 June 2013, it was determined that a new EPL, or a modification to an existing EPL, would be required for the Proposal.

Water Management Act 2000

An objective of the *Water Management Act 2000* (WM Act) is the sustainable and integrated management of the State's water for the benefit of both present and future generations. The WM Act provides clear arrangements for controlling land-based activities that affect the quality and quantity of the State's water resources. It provides for four types of approval, namely:

- water use approval (Section 89) – which authorises the use of water at a particular location for a particular purpose, for up to 10 years;
- water management work approval (Section 90) – which authorises the construction and use of a specified water supply at a specified location;
- controlled activity approval (Section 91(2) – which authorises activities on or under waterfront land, i.e. within 40m of waterfront land; and
- aquifer interference activity approval (Section 91(3) – which authorises interference of an aquifer.

The Dictionary of the WM Act defines an aquifer interference activity as involving any of the following:

> "(a) the penetration of an aquifer,
> (b) the interference with water in an aquifer,
> (c) the obstruction of the flow of water in an aquifer,
> (d) the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations,
> (e) the disposal of water taken from an aquifer as referred to in paragraph (d)."

For controlled activities and aquifer interference activities, the WM Act requires that the activities avoid or minimise their impact on the water resource and land degradation, and where possible the land must be rehabilitated.

The Project Site is within the areas of the following water sharing plans for groundwater and surface water respectively. These plans set the framework for managing groundwater and surface water within and surrounding the Project Site.

- *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2012.*
- *Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012.*

The Applicant currently holds a Water Access Licences to use up to 913ML of surface water per annum from Burrendong Dam. That water is released from the dam and extracted from the Bogan River at pumping station located approximately 25km to the east of the Project Site.

An application will be made through NOW for Approval's under Sections 89, 90 and 91 of the WM Act to account for groundwater encountered within the groundwater system during extraction operations throughout the life of the Proposal.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) aims to manage and conserve nature, objects, places and features that have ecological and cultural value. The NP&W Act is administered and enforced by the OEH.

Aboriginal places and objects are protected under the NP&W Act. The Director-General has a database of information and records regarding Aboriginal objects whose existence and location have been reported, known as the Aboriginal Heritage Information Management System.

No Aboriginal places or objects would be disturbed by the Proposal.

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to conserve biodiversity and promote ecologically sustainable development by preventing extinction and promoting recovery of threatened species, populations, ecological communities and their habitats. This is done through eliminating and managing threats to the survival or evolutionary development of species, populations, ecological communities, such as the impacts of development.

This Act has been considered in the Ecology Assessment, a summary of which is described in Section 4.3.

Mining Act 1992

The *Mining Act 1992* aims to encourage and facilitate the discovery and development of mineral resources in NSW. The *Mining Act 1992* provides the framework for exploration, development, operation and closure of mines, and provides for the management of exploration licences and mining leases to allow access to mineral resources.

Granting of a Mining Lease can only occur following Development Consent being granted under the EP&A Act. The Applicant has made a mining lease application to the Minister for Resources and Energy in accordance with the *Mining Act 1992*.

Mine Health and Safety Act 2004 / Work Health and Safety (Mines) Act 2013

The *Mine Health and Safety Act 2002* (MHS Act) is to be utilised as the current, applicable safety Act, until such time that the *Work Health and Safety (Mines) Act 2013* (WHS Act), assented on 1 July 2013, is enacted, following the finalisation and gazettal of the *Work Health and Safety (Mines) Regulation*. The MHS Act (and by virtue the proposed WHS Act) puts into place special provisions to control particular risks that may arise from the exploration or mining of minerals to secure and promote health, safety and welfare of people that work in such operations.

The MHS Act aims to ensure that effective provisions for emergencies are developed and maintained in mining operations and at related places.

The Applicant would apply for and secure all relevant approvals, under the appropriate legislation, before work can commence.

Heritage Act 1977

The *Heritage Act 1977* aims to promote and protect the State's heritage, by preventing harm to buildings, relics or places that are on the State Heritage Register.

Under the Heritage Act, approval is required to carry out development on land on which an item listed on the State Heritage Register is located or that is subject to an interim heritage order. A conservation management plan may be entered into with respect to conserving an item listed on the State Heritage Register.

No listed places or objects would be disturbed by the Proposal.

Noxious Weeds Act 1993

The objective of the *Noxious Weeds Act 1993* (Noxious Weeds Act) is to reduce the negative impacts of weeds on the environment by establishing mechanisms to prevent, eliminate or restrict the spread of new or significant weeds.

The Noxious Weeds Act aims to effectively manage widespread weeds through weed control orders, requiring occupiers to control noxious weeds on land and to prohibit the entry of noxious weeds into the NSW. This is enforced by inspectors appointed under the Noxious Weeds Act, who are granted wide powers of entry and inspection in relation to the control of noxious weeds.

One noxious weed species, namely the Bathurst Burr, has been identified within the Project Site.

Rural Fires Act 1997

The aims of the *Rural Fires Act 1997* (Rural Fires Act) are to prevent, mitigate and suppress bush and other fires in rural fire districts, to coordinate fire fighting, to protect persons from injury and death, and to limit property damage arising from fires.

An approval is not required under Section 100B of the Rural Fires Act as the Proposal is not situated on land designated as 'bush fire prone land'.

3.3.3 State Planning Policies

3.3.3.1 State Environmental Planning Policy (State and Regional Development) 2011

The Proposal does not meet the requirements for State Significant Development as it does not meet the capital investment value threshold of $30 million identified in Clause 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP). However, it is classified as "Regional Development" under Clause 3 of Schedule 4A of the EP&A Act. Clause 21 of Part 4 of the State and Regional Development SEPP identifies that a Joint Regional Planning Panel (the Panel) would be the consent authority for the Proposal.

Under operating procedures established by Clause 21(2) of the State and Regional Development SEPP, Council is required to assist the Panel through the management of the application receipt, advertising and exhibition stages of the Proposal.

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

The *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 NSW of mining, petroleum production and extractive industries.

The Mining SEPP specifies matters requiring consideration in the assessment of any mining, petroleum production and extractive industry development. **Table 3.2** presents a summary of the matters that the Minister or his/her delegate needs to consider when assessing a new or modified Proposal (Part 3 – Clauses 12 to 17 of the SEPP) and a reference to the section(s) in this *Environmental Impact Statement* where each relevant element of the SEPP is addressed.

3.3.3.3 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 SEPP 33, the hazardous materials to be held or used within 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 January 2011* (DoP, 2011). 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 Applicant notes that the potentially hazardous goods that would be used or stored within the Project Site would include diesel and other hydrocarbons and explosives, which would be stored and used in accordance with a comprehensive *Hydrocarbon Management Plan*.

As the quantities of diesel and other hydrocarbons and explosives to be stored and used within the Project Site do not meet the thresholds identified in the SEPP, based upon *Applying SEPP 33* (DoP, 2011), a preliminary hazard analysis is not required for the Proposal.

3.3.3.4 State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection aims to encourage the proper conservation and management of Koala habitat. As the Bogan Local Government Area is not identified in Schedule 1 of the SEPP as an area in which potential habitat may exist this SEPP is not considered further.

Table 3.2
Application of the Mining SEPP

Relevant SEPP Clause	Description	EIS Section
12AA:Significance of resource	1) In determining an application for consent for development for the purposes of mining, the consent authority must consider the significance of the resource that is the subject of the application, having regard to: (a) the economic benefits, both to the State and the region in which the development is proposed to be carried out, of developing the resource, and	2.11 4.15.4
	(b) any advice by the Director-General of the Department of Trade and Investment, Regional Infrastructure and Services as to the relative significance of the resource in comparison with other mineral resources across the State.	-
	2) The following matters are (without limitation) taken to be relevant for the purposes of subclause (1) (a): (a) employment generation, (b) expenditure, including capital investment, (c) the payment of royalties to the State.	2.11 4.15.4
	3) The Director-General of the Department of Trade and Investment, Regional Infrastructure and Services is, in providing advice under subclause (1) (b), to have regard to such matters as that Director-General considers relevant, including (without limitation): (a) the size, quality and availability of the resource that is the subject of the application, and	1.4.5
	(b) the proximity and access of the land to which the application relates to existing or proposed infrastructure, and	2.7
	(c) the relationship of the resource to any existing mine, and	1.4.3
	(d) whether other industries or projects are dependent on the development of the resource.	4.15.3 4.15.4
	4) In determining whether to grant consent to the proposed development, the significance of the resource is to be the consent authority's principal consideration under this Part.	-
	5) Accordingly, the weight to be given by the consent authority to any other matter for consideration under this Part is to be proportionate to the importance of that other matter in comparison with the significance of the resource.	-
	6) To avoid doubt, the obligations of a consent authority under this clause extend to any application to modify a development consent.	NA
12AB: Non-discretionary development standards for mining	1) The object of this clause is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standard is not complied with).	-

Table 3.2 (Cont'd)
Application of the Mining SEPP

Relevant SEPP Clause	Description	EIS Section
12AB: Non-discretionary development standards for mining (Cont'd)	2) The matters set out in this clause are identified as non-discretionary development standards for the purposes of section 79C (2) and (3) of the Act in relation to the carrying out of development for the purposes of mining. Note. The development standards do not prevent a consent authority from imposing conditions to regulate project-related noise, air quality, blasting or ground vibration impacts that are not the subject of the development standards.	-
	3) Cumulative noise level The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings.	4.5.6
	4) Cumulative air quality level The development does not result in a cumulative annual average level greater than 30 µg/m3 of PM10 for private dwellings.	4.8.6
	5) Airblast overpressure Airblast overpressure caused by the development does not exceed: (a) 120 dB (Lin Peak) at any time, and (b) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.	4.6.4
	6) Ground vibration Ground vibration caused by the development does not exceed: (a) 10 mm/sec (peak particle velocity) at any time, and (b) 5 mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.	4.6.4
	7) Aquifer interference Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table. Note. The taking of water from all water sources must be authorised by way of licences or exemptions under the relevant water legislation.	4.6.4
	8) The Minister is to review a non-discretionary development standard under this clause if a government policy on which the standard is based is changed.	-
12: Compatibility with other land uses	Consideration is given to: - the existing uses and approved uses of land in the vicinity of the development;	1.4.3 4.1.5.2
	- the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and	4
	- any ways in which the development may be incompatible with any of those existing, approved or preferred land uses.	3.3

Table 3.2 (Cont'd)
Application of the Mining SEPP

Relevant SEPP Clause	Description	EIS Section
12: Compatibility with other land uses (Cont'd)	The respective public benefits of the development and the existing, approved or preferred land uses are evaluated and compared.	5
	Measures proposed to avoid or minimise any incompatibility are considered.	4
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.	1.4 5.4.3
	Measures taken by the Applicant to avoid or minimise any incompatibility are considered.	1.4
	The public benefits of the development and any existing or approved mining, petroleum production or extractive industry must be evaluated and compared.	5.4
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;	4.4 4.7
	- impacts on threatened species and biodiversity are avoided or minimised; and	4.3
	- greenhouse gas emissions are minimised and an assessment of the greenhouse gas emissions (including downstream emissions) of the development is provided.	4.8.1
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
16: Transportation	The following transport-related issues are considered. - The transport of some or all of the materials from the site by means other than public road.	2.7 2.14.3
	- Limitation of the number of truck movements that occur on roads within residential areas or roads near to schools.	2.7 4.10.3
	- The preparation of a code of conduct for the transportation of materials on public roads.	4.10.3
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;	2.13
	- the appropriate management of development generated waste;	2.4
	- remediation of any soil contaminated by the development; and	2.13.3
	- 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.	2.13.3

3.3.3.5 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. Given the history of the Project Site is one of agricultural grazing and mineral exploration, neither of which is likely to result in contamination of the land, the Applicant is satisfied that no contaminated land occurs on the Project Site. SEPP 55 is not considered further in the *Environmental Impact Statement*.

3.3.3.6 State Environmental Planning Policy (Rural Lands) 2008

The aims of this SEPP, as considered relevant to the Proposal, 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 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 Proposal is considered with respect to these aims.

- The land that would be affected by the Proposal has not been identified as State or regional significant agricultural land by Schedule 2 of the SEPP.
- The land in which the Proposal is situated is low productivity agricultural land (see Section 4.14).
- The Proposal 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, should this be required in the future.
- The protection of the land that is the subject of the Proposal would not provide any public benefit. In fact, the employment and local economic stimulus that would be generated by the Proposal would be of far greater public benefit than the current grazing.

This SEPP is not considered further in the *Environmental Impact Statement*.

3.3.4 Regional Planning Issues

3.3.4.1 Regional Environmental Plans

There are no regional planning instruments relevant to the Proposal.

3.3.4.2 Regional Strategies

The *Central Western Catchment Management Authority (CW-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 CW-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. **Table 3.3** provides the summary of these targets (as issued by the CW-CMA).

Table 3.3
CW- CMA Catchment Action Plan 2006 – 2016 Targets

Page 1 of 2

Themes	Catchment Targets	Programs	Management Targets
Land & Vegetation	CT1: Quality and quantity of vegetation managed to maintain and/or improve designated cover capable of preventing soil erosion (i.e. designated cover greater than or equal to 40%).	1. Sustainable Agriculture.	1. Sustainable agriculture management practice carries out by 50% of landholders by 2016.
		2. Landscape Management.	2. Maintain or rehabilitate one million hectares of native pasture vegetation communities by 2016.
		3. Pests.	3. No increase in the number of species, or extent of pest weeds or animals, above current levels and a reduction in the impact of pest species.
Rivers and Groundwater	CT2: The Surface Water System Health Index Rating and the Groundwater System Health Index Rating Improved at 60% of relevant monitoring sites and maintained at all other monitoring sites by 2016. CT3: Salinity in the Barwon-Darling at Wilcannia less than 800EC for 80% of the time as measured on a daily basis and less than 350EC for 50% of the time by the year 2016.	4. Aquatic Habitat.	4. Habitat improvement actions implemented on 20% of identified priority areas of stream floodplain, wetland and riparian areas by 2016.
		5. Water Quality and Salinity.	5. Water quality and salinity levels meeting ANZECC drinking water and recreational use criteria for greater than 95% of the time at key town use sites by 2016.
		6. Surface Water Management.	6. Flow sharing arrangements including water sharing plans implemented by DNR for all priority streams by 2010, with advice from the CW-CMA on water management issues which affect the catchment community.
		7. Groundwater Management.	7. Water pressure stabilised in key regions of the Great Artesian Basin, as defined by NSW Great Artesian Basin Advisory Committee, by 2016.

Table 3.3 (Cont'd)
Central Western CMA CAP 2006 – 2016 Targets

Themes	Catchment Targets	Programs	Management Targets
Biodiversity	CT4a: Ecological communities of high conservation value are adequately protected.	8. High Conservation Value Areas.	8. Ecological communities of high conservation value (including threatened species) are identified within tree years of Plan approval and adequately protected throughout the catchment by negotiation with landholders, within eight years of Plan approval.
		9. Conservation Land Use.	9. An ongoing program is established that allows landholders to incorporate lands managed for conservation as an alternative land use and part of a viable enterprise, within two years of Plan approval.
Community	CT4b: In each of the other ecological communities 12% of the area will be managed for conservation within 10 years of Plan approval and 25% within 25 years of Plan approval.	10. Cultural Heritage.	10. Establish an Indigenous Natural Resource and Cultural Reference Group, within two years of Plan approval to formally coordinate the input of Aboriginal communities into natural resource management planning activities in the Western Catchment.
			11. Develop and assist the implementation of a process for the documentation, evaluation and ownership of indigenous knowledge of sustainable land management and cultural values in the Western Catchment by 2009.
		11. Community Education.	12. There is a continual increase in land managers' awareness, knowledge and skills in NRM and adoption of practices which improve natural resource outcomes.
			13. Land managers and other natural resource managers are actively engaged in collaborative action to improve the management of natural resources through the development and implementation of regionally relevant NRM.
			14. There is a continual increase in the willingness of land managers, other stakeholders and the community to partner NRM organisations to deliver natural resource outcomes.
		12. Monitoring and Evaluation	Monitoring, evaluation and reporting strategy to be developed.

Source: Western CMA CAP 2006 – 2016, p. 140.

In early 2014, Catchment Management Authorities in NSW were incorporated into a new entity, namely Local Land Services (LLS) within the Department of Primary Industries. As a result, the Central Western Catchment Management Authority functions are to be exercised by the Central West Local Land Services. In January 2014, the *Central Western Transitional Catchment Action Plan*, drawn principally from the *CW-CMA Catchment Action Plan 2006 - 2016* was prepared for the Central West LLS region. The region covers 94,000km^2 and comprises the local government areas of Bogan, Coonamble, Dubbo, Forbes, Gilgandra, Lachlan, Narromine, Parkes, Warren, Warrumbungle, Weddin and Wellington. **Table 3.4** identifies relevant goals, strategies, actions and targets identified in the *Central Western Transitional Catchment Action Plan.*

3.3.5 Local Planning Issues

The Applicant notes that the Project Site is situated within land zoned as Zone RU1 - Primary Production under the *Bogan Local Environment Plan 2011* (Bogan LEP). The objectives of Zone RU1 – Primary Production under that plan are as follows.

- "To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones."

It is noted that underground mining is not identified as permissible with consent within this zone. However, Clause 70(1)(b) of the Mining SEPP identifies that mining is permissible, with consent, on any land where agriculture is permissible. As agriculture is permissible under Zone RU1 under the Bogan LEP, underground mining is also permissible, with consent.

It is also identified that the Project Site is situated in an area zoned as "Moderate Biodiversity Sensitivity" under the Bogan LEP. Clause 7.4 of the Bogan LEP identifies that the objective of the LEP in relation to such land is to maintain terrestrial biodiversity by:

- ''protecting native fauna and flora; and
- protecting the ecological processes necessary for their continued existence; and
- encouraging the conservation and recovery of native fauna and flora and their habitats."

In determining any application for development consent, the consent authority must consider whether or not the development:

- "is likely to have any adverse impact on the condition, ecological value and significance of the fauna and flora on the land;
- is likely to have any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna;
- has any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land; and
- is likely to have any adverse impact on the habitat elements providing connectivity on the land."

Table 3.4
Central Western Transitional CAP

Goal	Strategy	Actions	Targets
ENVIRONMENT G3 To improve and maintain the condition of the natural environment.	S7 To improve the extent, condition and connectivity of native vegetation	A7.1 Recreate and enhance connectivity for native species. A7.2 Maintain and increase extent and condition of native grasslands. A7.3 Manage hydrologic regime for semi-arid grassy woodland. A7.4 Increase and maintain area of native woody vegetation to above 30% threshold with at least 15% within the comprehensive, adequate and representative requirements of each bioregion. A7.5 Improve and/or maintain extent and condition of remnant and larger vegetation patches. A7.6 Reduce impacts of key threatening processes on threatened species through the implementation of recovery action plans. A7.7 Reduce the impact of Invasive Native Scrub (INS) on production and biodiversity. A7.8 Reinstate natural fire regimes for dry sclerophyll forest and semi-arid grassy/shrubby woodland. A7.9 Shrub thinning and increase surface roughness for semi arid shrubby woodland.	T7 By 2023, 8-16% of priority vegetation communities are being actively managed to achieve a good condition stable state, increase net extent and, where possible, increase connectivity.
	S8 To improve the stability, condition and connectivity of water assets	A8.1 Improve connectivity of water flow. A8.2 Encourage best management practice to manage threatening processes on water ways and aquatic ecosystems (invasive species, pollution, cold water pollution, barriers etc.). A8.3 Improve water use, reuse and recycling. A8.4 Priority GDEs and ground water sources identified and resilience analysis complete. A8.5 Rehabilitate / enhance riparian and floodplain habitat for recovery of priority reaches and conservation reaches (foster healthy populations of aquatic species, bed, bank, vegetation etc.).	T8 By 2023, 1-5% of priority river reaches and 10-35% of priority wetlands are actively managed to maintain a good condition stable state.
Source: *Central Western Transitional Catchment Action Plan* – After Table 1.			

A detailed Ecology Assessment has been prepared by EnviroKey (2014) and is presented in **Appendix 6**. A summary of that assessment is presented in Section 4.3.

3.3.6 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 Proposal required reference to other environment guideline documents. **Appendix 3** identifies each of the relevant guidelines and identifies the relevant section(s) of the *Environmental Impact Statement* and/or part of the *Specialist Consultant Studies Compendium* where they are considered and/or addressed.

3.4 ANALYSIS OF ENVIRONMENTAL RISK AND ISSUE PRIORITISATION

Risk is the chance of something happening that will have an impact upon the objectives of a task. In the present case, the relevant objective is the construction and operation of the Avoca Tank Project with minimal adverse impacts on the surrounding environment.

Risk is measured in terms of consequence (severity) and the likelihood (probability) of the event happening. In order to analyse the environmental risks associated with the Proposal, a structured analysis of risk involving the following individuals was undertaken by teleconference on 31 October 2013.

- Mr Simon Fitzgerald, former General Manager – Projects, Straits Resources Limited.
- Mr Greg Stephenson, former Senior Environmental Advisor, Tritton Mines.
- Mr Mitchell Bland, Principal Environmental Consultant with R.W. Corkery & Co. Pty Limited.

The group discussed and agreed upon:

- each of the likely risk sources;
- their potential consequences;
- the likely receptors / surrounding environment;
- potential environmental impacts; and
- how they could be mitigated or managed to reduce the level of impact(s).

The assessment of risk was firstly established based upon the adoption of the controls and mitigation measures that are standard throughout the mining industry. This level of risk was referred to as the risk with standard control measures. It was recognised that where it would be necessary to reduce the potential impacts beyond that achieved with standard control measures to a level considered both achievable and worthwhile, further controls or mitigation measures would need to be adopted. This level of impact after the adoption of the additional controls was referred to as residual risk. In some cases, it was accepted that the standard controls and

mitigation measures would be adequate to achieve an acceptable level of impact without the need for any additional controls or mitigation measures or that the risk was already as low as reasonably practical.

Each risk source was allocated a ranking based on the potential consequences and likelihood of occurrence and in accordance with Australian Standards HB 203:2006 and AS/NZS 4360:2004. The risk analysis considers the Proposal first with the adoption of standard control measures initially and then with all proposed control measures in order to evaluate the impact of the Proposal.

3.5 PRIORITISATION OF KEY ENVIRONMENTAL ISSUES

The prioritisation of the key environmental issues as a result of the risk analysis, and hence their general order of presentation in this document, has been established through reference to the following.

- The results of the issue consultation process recorded in Section 3.2.
- The results of the review of relevant legislation, planning issues, policies and guidelines presented in Section 3.3.
- The approach to the risk analysis outlined in Section 3.4 and documented further in Section 5.2.
- The experience of the document's author in assembling *Environmental Impact Statements*.

The key environmental issues are presented in Section 4 in the following order.

1. Aboriginal Heritage.
2. Ecology.
3. Groundwater.
4. Noise.
5. Blasting and Vibration.
6. Historic Heritage.
7. Air Quality.
8. Surface Water.
9. Traffic and Transportation.
10. Visual Amenity.
11. Bush Fire Management.
12. Soil and Land Capability.
13. Agricultural Resources.
14. Socio-Economic.

It is noted that the positioning of the agricultural and socio-economic assessments within the above order is not a direct consequence of the prioritisation assessment. Rather, from the assessment of the risk sources, potential consequences and nature of the existing environment, it was apparent that the majority of other environmental issues identified included actual or perceived social or socio-economic risks and, as such, it was appropriate that socio-economic issues be addressed following the discussion of the contributing issues.

Section 4

Assessment and Management of Key Environmental Issues

PREAMBLE

This section describes the specific environmental features of the Project Site and its surrounds that would or may be affected during the life of the Avoca Tank Project. The proposed design and/or operational management and mitigation measures are presented, followed by an assessment of the predicted level of impact the proposed activities may have after implementation of these measures. Where appropriate, proposed monitoring programs are also described.

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4.1 BACKGROUND ENVIRONMENTAL SETTING

4.1.1 Introduction

The descriptions of various environmental aspects of the Proposal throughout this section are reliant upon a range of background information common to many of the key environmental issues. In this subsection, background information is provided on the topography, meteorological data, land ownership and residences and land uses surrounding the Project Site.

4.1.2 Topography and Drainage

4.1.2.1 Regional Topography and Drainage

The Project Site is located within the Macquarie - Bogan Catchment, an area of approximately 92 000km, and is situated on a flat to gently sloping landform (**Figure 4.1**). The Bogan River rises approximately 19km northwest of Parkes before flowing in a north-northwesterly direction through Nyngan, approximately 55km to the southeast of the Project Site, and flows in a northerly direction, 25km to the west of the Project Site. The Bogan River merges with the Darling River, approximately 150km north of the Project Site.

There are several major weirs on the Bogan River, including the Muddal Weir, located west of Peak Hill; the Nyngan Weir, located on the northern outskirts of Nyngan, and Gongolgon Weir located approximately 100km north of the Project Site where the mean daily flow exceeds 700ML.

Topography surrounding the Project Site is gently east sloping, with maximum elevations to the west and south of the Project Site from 250m AHD near the 'Argyle' residence and 287m AHD at 'The Brothers' respectively (**Figure 4.1**). To the north and east of the Project Site, elevations generally range between 200m AHD and 175m AHD and drain towards an unnamed tributary (referred to here as the Wilga Tank Tributary) and Siburys Creek, located approximately 1km north and 3km to the south of the Project Site respectively. All drainage lines are ephemeral and typically indistinct.

In the vicinity of the Project Site, a catchment divide immediately to the northwest of the Project Site separates the north-flowing Turners Creek from the east flowing Wilga Tank Tributary and Siburys Creek. For the purposes of this document, the east-flowing catchment including the Wilga Tank Tributary and Siburys Creek is referred to as the "Girilambone Catchment".

4.1.2.2 Local and Project Site Topography and Drainage

The Project Site is situated on generally flat to gently east sloping land with a maximum elevation of approximately 220m AHD on the western boundary of the Project Site to a minimum elevation of approximately 195m AHD on the Project Site's eastern boundary (**Figure 4.2**). Average gradients within the Project Site are less than 1%.

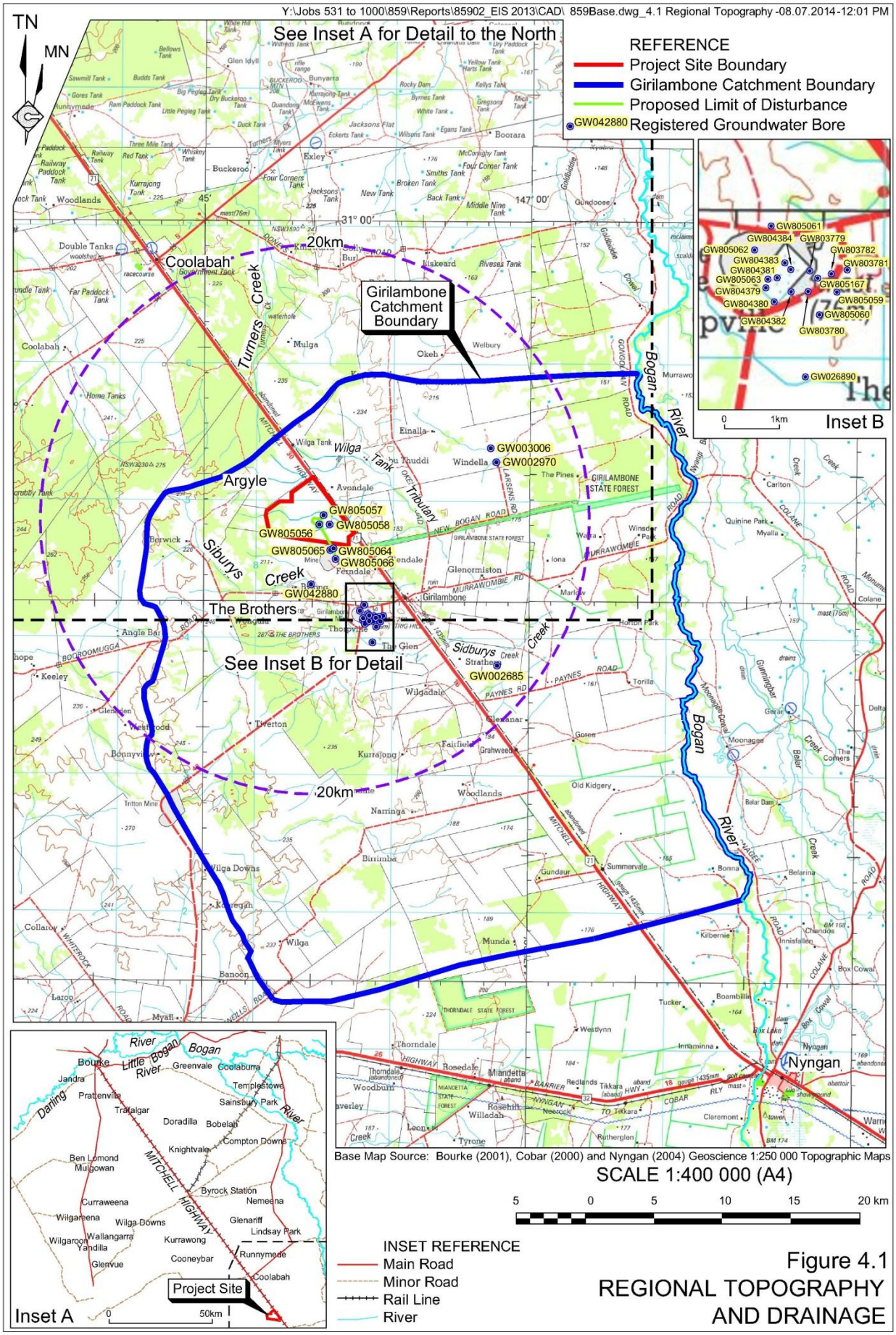


Figure 4.1
REGIONAL TOPOGRAPHY AND DRAINAGE

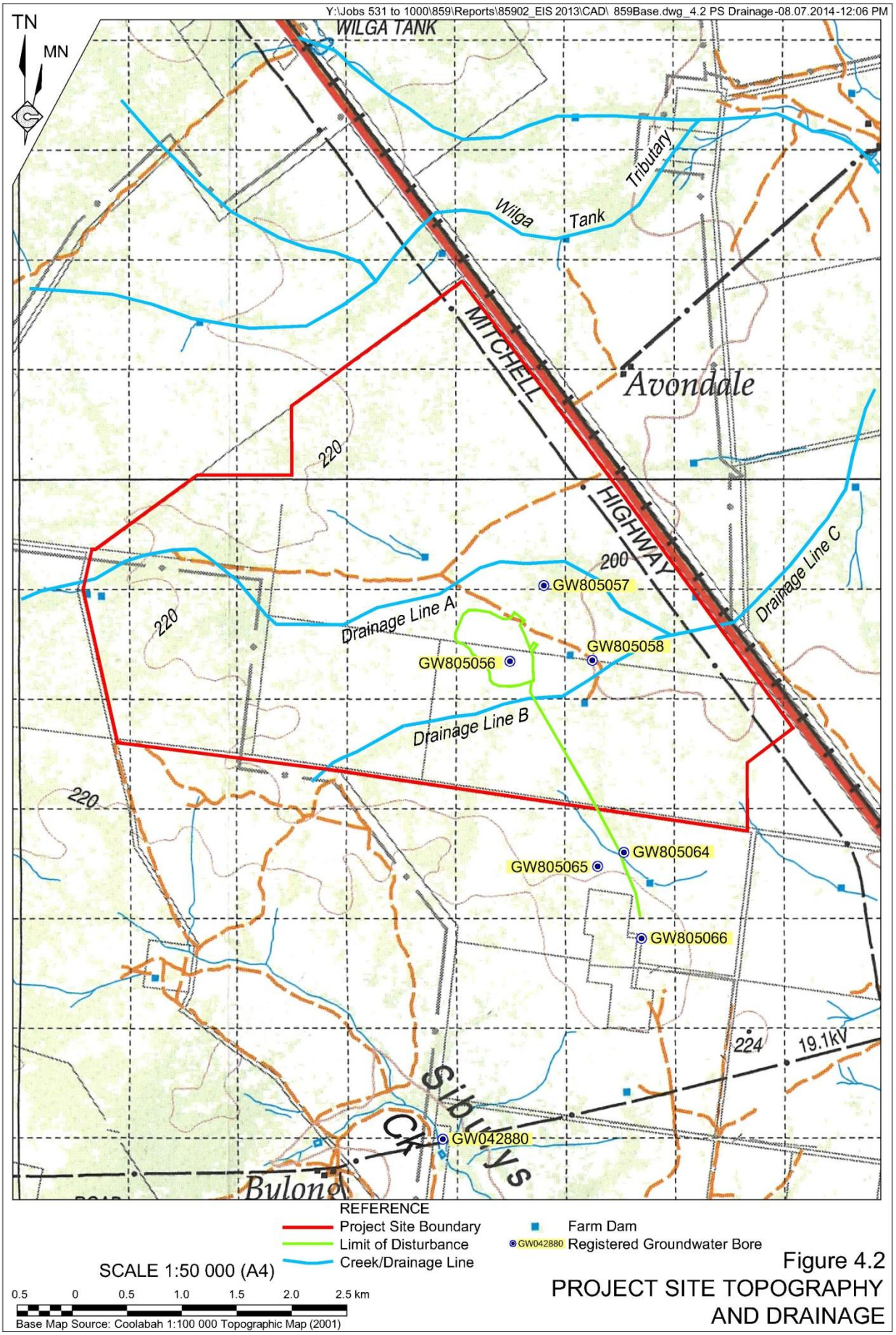


Figure 4.2
PROJECT SITE TOPOGRAPHY AND DRAINAGE

Drainage throughout the Project Site generally flows in an easterly direction. Surface water flows into two, ephemeral, indistinct and poorly defined and unnamed drainage lines, referred to for the purposes of this document as 'Drainage Line A' and 'Drainage Line B' (**Figure 4.2**). Drainage Lines A and B are first order streams prior to merging into a second order stream in the eastern section of the Project Site, approximately 0.5km from the Project Site's eastern boundary. The merged drainage line (referred to as Drainage Line C) flows to the northwest before merging with the Wilga Tank Tributary, approximately 5km east of the Project Site.

4.1.3 Geology

4.1.3.1 Regional Geology

The Project Site is located within the Girilambone Zone of the Lachlan Fold Belt. The Girilambone Zone includes widespread Girilambone Group metasediments and volumetrically minor mafic sequences (**Figure 4.3**). The Girilambone Group has recently been subdivided by the NSW Geological Survey into three north-south trending belts. The Western and Eastern zones are of similar Early Ordovician age while the faulted central portion has fossil ages of Middle to Late Ordovician. Metamorphic grades are generally greenschist facies with biotite facies recorded locally.

The Narrama Formation, a sub-unit of the Girilambone Group in the vicinity of the Tritton Copper Mine, consists of turbiditic psammites, psammopelites, pelites and quartzite with less abundant chert and mass flow breccias. Interspersed within the metasediment package are basaltic volcanics and intrusive dolerites, pyroxenites and gabbros as well as minor fault emplaced serpentinites. The volcanics occur as interbedded intermittent units that pinch and swell along strike. Many of the intrusives can also be found to be interbedded sill like with the stratigraphy. However, there are number of intrusives that appear to be vertically attenuated and cross cut stratigraphy. Minor granodioritic intrusives and dykes cut the older metasediment stratigraphy as do younger mafic dykes. Regionally, the stratigraphy is complicated by multiple deformations.

Much of the Girilambone Group is either covered by a thin veneer of alluvial sediments or is weakly dissected with sparse bedrock exposure. Where outcrop does occur, it is low lying and usually strongly weathered.

4.1.3.2 Local Geology

Mineralisation within the Project Site is hosted by the Early Ordovician Girilambone Group at the contact between an upper sequence of interlayered metasediments and a lower sequence of mafic volcanics and intrusives with minor associated metasediment enclaves. The sediments are predominantly pelites, psammopelites and greywackes, with a significant silica-magnetite-carbonate-chlorite-sulphide exhalative unit occurring above the mineralisation. This unit is referred to as the Quartz Magnetite Hematite horizon and is equivalent to a similar unit identified in the vicinity of the Tritton Copper Mine. A greywacke (immature sandstone) dominant package of sediments is a useful local marker above the mineralised contact and Quartz Magnetite Hematite altered sequence.

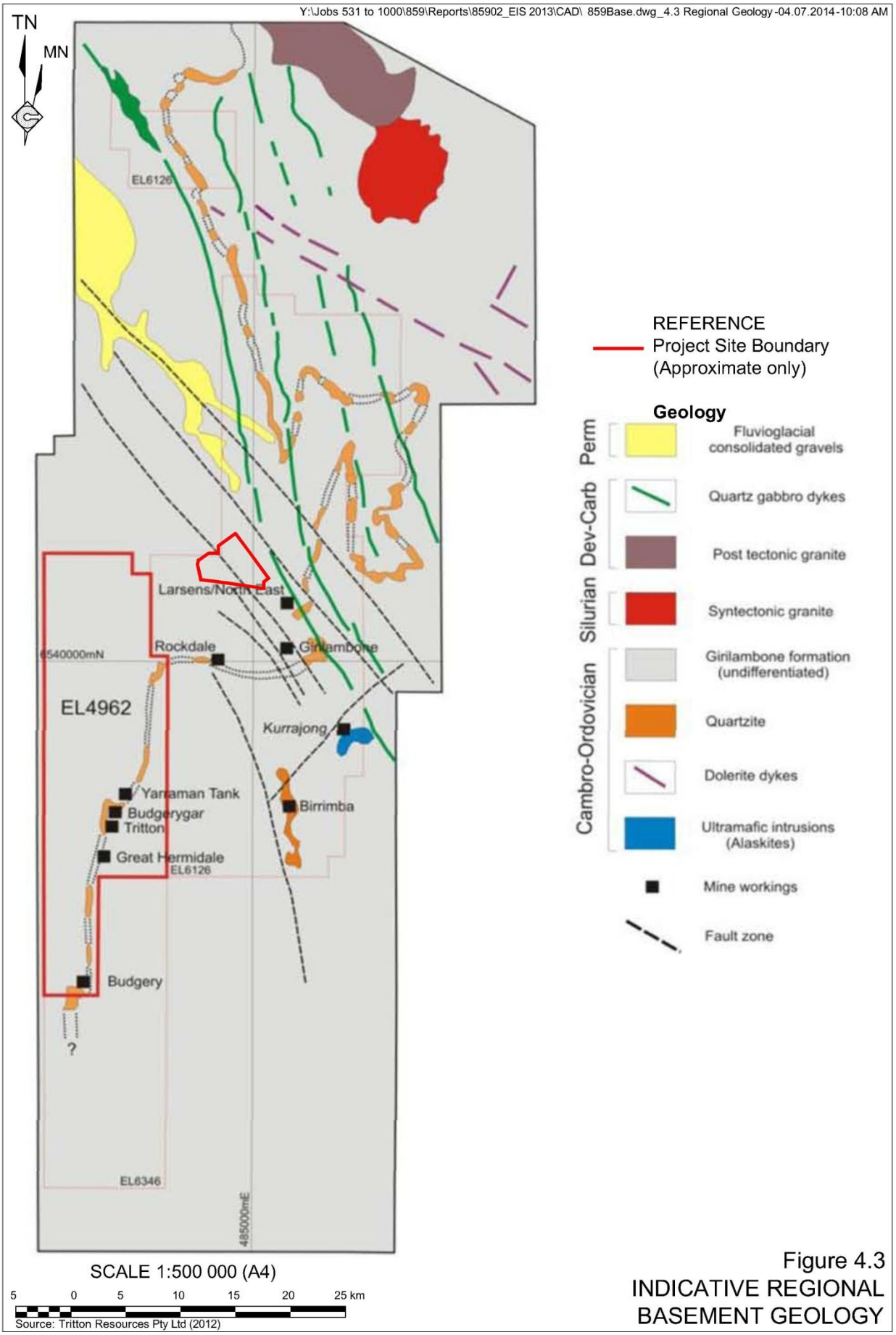


Figure 4.3
INDICATIVE REGIONAL BASEMENT GEOLOGY

The Quartz Magnetite Hematite equivalent horizon is located 20m to 40m above the three mineralised lenses within the Project Site and consists of a 1m to 3m thick, strong to locally intense manganese, barium and strontium rich horizon which appears to thicken toward the north. This suggests proximity to a penecontemporaneous structure and/or vent source for the exhalative fluids coincident with the northern edge of the mineralisation. Immediately below the silica-carbonate-(magnetite-chlorite-hematite) horizon is a more sparsely (locally moderate) developed banded silica-magnetite-sulphide-chlorite altered zone.

The mafic volcanics, predominantly doleritic intrusives and basaltic volcanics, are footwall to the mineralised system. The mafics are quite variable and chemistry suggest subtle chemical differences to the various bodies and some show narrow brecciated hydrothermal fluid path zones. Metasediment enclaves are observed throughout and weak mineralisation is often observed along the sediment/volcanic contacts which also often show local evidence of thermal contact alteration.

4.1.3.3 Mineralisation

Mineralisation at the Tritton group of mines is both structurally and lithologically controlled and would appear to be an analogue of the Besshi style of deposits in Japan. The polymetallic sulphides at Tritton, Budgery, Budgerigar, North East, Larsens and Murrawombie occur as moderate to large tabular sheets in association with strong silicification as well as footwall magnesian chlorite alteration and sulphide banding and stockworking.

The sulphide (dominantly pyrite with lesser chalcopyrite, sphalerite minor tennantite, arsenopyrite and galena and traces of gold) bodies were deposited synchronous with the host Ordovician sediments and minor basaltic sequences, as evidenced from sulphide breccia clasts and basaltic and mafic clasts within sedimentary breccias as well as petrographic descriptions which identify interlamination of fine grained sediments and fine grained sulphide. A laminar silica-hematite-magnetite pyrite unit often occurs at the top of the Tritton deposit indicative of an exhalite and minor quartz chlorite magnetite veining occurs within the main zone as well as within the foot wall as seen at Budgery and Tritton Deeps. Significant structural overprinting within dilation zones and structural traps (fold hinges) has upgraded zones within the sheets to form high grade pods of dominantly chalcopyrite and at the Tritton Copper Mine, minor bornite and tennantite mineralization.

Within the Project Site, the mineralisation is different in that it is strike limited due to geological conditions at the time of deposition (possible small graben structure or palaeo low bounded by mafic sequences), has multiple lenses and is of higher grade in copper, silver, zinc and gold to that of the remainder of the Girilambone Group of deposits.

Within the Project Site, mineralisation is dominated by massive pyrite-chalcopyrite-sphalerite, with minor but locally important magnetite-chalcopyrite and lesser banded pyrite-chalcopyrite and rare banded pyrite (containing high gold and silver). Three stacked lenses have been defined for the main portion of the resources with two additional lenses defined within the footwall sequence.

It is postulated that the higher grades within the Project Site are due to higher fluid temperatures and proximity to a vent source than elsewhere within surrounding mineralised zones. The alteration assemblages associated with the mineralisation also appear to be temperature elevated species including garnet-actinolite-biotite-magnetite-(chlorite).

Two additional mineralised systems occur deeper within the footwall mafic sequence and trend east-west or perpendicular to the main Avoca Tank mineralised lenses. The deeper of these appears to intersect the lower most mineralised horizon and is tentatively interpreted as a feeder zone which wanes in grade away from the main lenses. The mineralisation style is consistent with contorted banded pyrite-chalcopyrite-magnetite-chlorite with trace to locally weak sphalerite and galena.

4.1.4 Climate

4.1.4.1 Introduction

Climatic conditions have the potential to influence a range of Proposal-related impacts at surrounding residences and on the local environment. The climate in the vicinity of the Project Site may be classified under the Köppen climate classification as a "warm semi-arid climate", i.e. hot, dry summers and relatively cool dry winters, with the rainfall pattern having a summer maximum.

This subsection provides a brief overview of the climatic conditions surrounding the Project Site, focusing particularly on those aspects of the climate that are likely to influence the potential Proposal-related environmental impacts.

4.1.4.2 Data Sources

Meteorological data from the following Bureau of Meteorology (BOM) stations is presented in **Table 4.1**. Long term climate data was sourced from the following locations as they provided the largest and most complete datasets within the local area.

- Nyngan Airport Automated Weather Station (Station Number 51039), located approximately 45km southeast of the Project Site (temperature, humidity and wind).
- Girilambone (Wongala) Station (Station Number 151158), located approximately 13km to the southwest of the Project Site (rainfall).

Evaporation data was sourced from the Bureau of Meteorology's Average Pan Evaporation Map.

4.1.4.3 Temperature and Humidity

Table 4.1 indicates that January is the hottest month, with a mean maximum temperature of 39.2°C and a mean minimum temperature of 28.6°C. July is the coldest month with a mean maximum temperature of 19.3°C and a mean minimum temperature of 13.4°C. Late autumn, winter and early spring (April to September) is typically the most humid time of the year.

Table 4.1
Monthly Meteorological Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temperature (ºC) [1] (1920 to 2013)													
Mean Maximum	39.2	38.0	34.7	30.5	24.1	20.2	19.3	23.6	26.4	30.3	35.2	37.0	29.88
Mean Minimum	28.6	29.3	26.2	21.7	16.7	13.3	13.4	14.7	18.7	22.1	25.8	28.8	21.61
Relative Humidity (%)[1] (9am – 1910 / 3pm – 1915 to 2010)													
9:00am	48	53	56	61	72	80	79	70	59	51	47	46	60
3:00pm	31	36	37	40	49	55	52	44	38	34	30	29	39
Rainfall (mm) [2] (1991 to 2013)													
Mean rainfall	51.5	55.5	34.7	24.0	38.1	29.4	26.6	23.0	31.8	32.8	41.8	54.7	443.9
Highest daily rainfall	131.6	123.8	62.6	52.8	68.6	39.0	30.8	58.0	46.8	58.4	66.2	83.3	
Evaporation (mm) [3] (1975 – 2005)													
Average evaporation	300	250	200	125	80	50	60	80	125	175	300	300	2045

Source:

[1] – Bureau of Meteorology – Nyngan Airport Station (Station Number 051039).

[2] – Bureau of Meteorology – Girilambone (Wongala) Station (Station Number: 151158).

[3] – Bureau of Meteorology – Average Pan Evaporation Maps (http://www.bom.gov.au/jsp/ncc/climate_averages/evaporation/index.jsp).

4.1.4.4 Rainfall and Evaporation

Monthly average rainfall varies between 23.0mm and 55.5mm, with more rainfall in summer than winter. Rainfall variability is greatest in the warmer months of December to February. In general, monthly rainfall can be highly variable, with all months recording no rainfall in some years. Similarly, maximum daily rainfall can more than double average monthly rainfall, particularly in late summer and autumn, indicating that intense storms can occur.

Mean monthly evaporation varies throughout the year, from approximately 300mm in November, December and January to approximately 50mm in June. Mean monthly evaporation exceeds rainfall in all months and annual evaporation exceeds annual rainfall by a factor of four, indicating that the area is typically in water deficit.

4.1.4.5 Wind Conditions

Wind roses, indicating wind speed and direction, have been sourced from the BOM-operated Nyngan Airport Automated Weather Station (Station Number 051039) and are displayed on (**Figure 4.4**)**.** That data indicates that during the spring and summer, prevailing winds are from the northeast or south. During the autumn and winter, prevailing winds are from the south and west. Prevailing winds in the vicinity of the Project Site typically do not blow from the Project Site towards the Girilambone village.

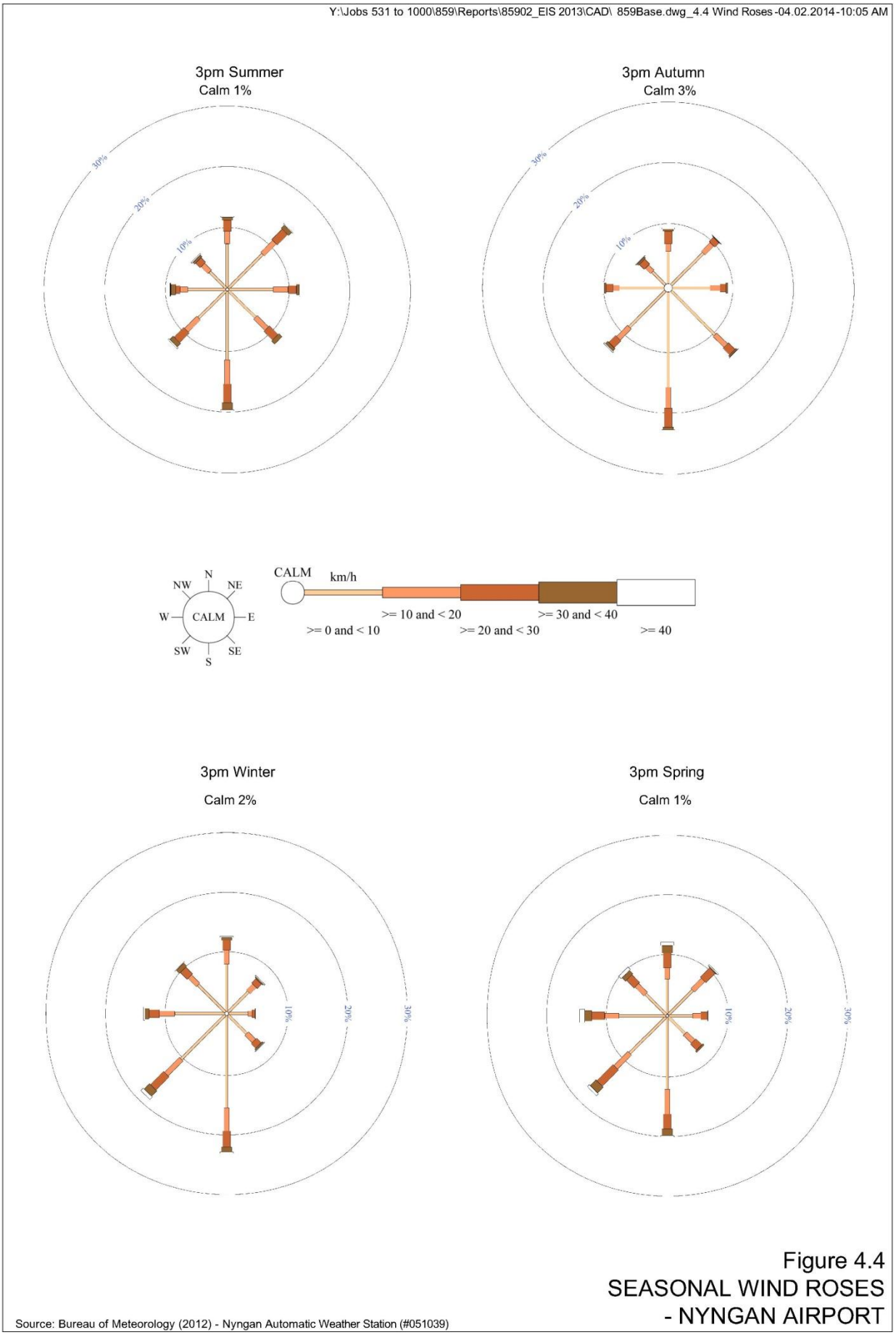


Figure 4.4
SEASONAL WIND ROSES
- NYNGAN AIRPORT

Source: Bureau of Meteorology (2012) - Nyngan Automatic Weather Station (#051039)

4.1.5 Land Ownership, Residences and Land Use

4.1.5.1 Land Ownership and Residences

Figure 4.5 presents land ownership in the vicinity of the Project Site. This data was sourced from an extensive search of the register of land titles administered by the Office of Land and Property Information.

Land within the Project Site is owned by Mr Peter Johnston. The Applicant has consulted with Mr Johnston who is aware of the Proposal and the proposed activities. Mr Johnston has provided landowner consent for the application for development consent.

The southern section of the Site Access Road is located on land owned by the Applicant.

The closet residence to the proposed activities is Residence 3, located approximately 2.5km to the northeast of the hardstand area.

4.1.5.2 Land Use

Figure 4.6 displays the range of land uses within and surrounding the Project Site. In summary, land uses are as follows.

- Mining - areas to the south and southeast of the Project Site include the Applicant's North East and Murrawombie Mines.
- Agriculture – land within and surrounding the Project Site has been or is currently being used for agricultural purposes, principally, intermittent sheep and cattle grazing. A range of agricultural properties include residences (**Figure 4.5**). To the Applicant's knowledge, no agricultural activities have been undertaken within the Project Site since approximately 2004.
- Nature conservation – substantial areas of native vegetation exist in the vicinity of the Project Site.
- Native vegetation forestry – The Girilambone State Forest occupies an area to the east of the Project Site.
- Transportation – a range of State and local roads exist in the vicinity of the Project Site, including Mitchell and Barrier Highways and Booramugga and Yarrandale Roads. The disused Main Western Railway is located to the east of the Mitchell Highway.
- Village residential – the village of Girilambone is located approximately 5km to the southeast of the Project Site.

The Applicant contends that the Proposal is consistent with the identified land uses and that the Project Site is suitable for the Proposal.

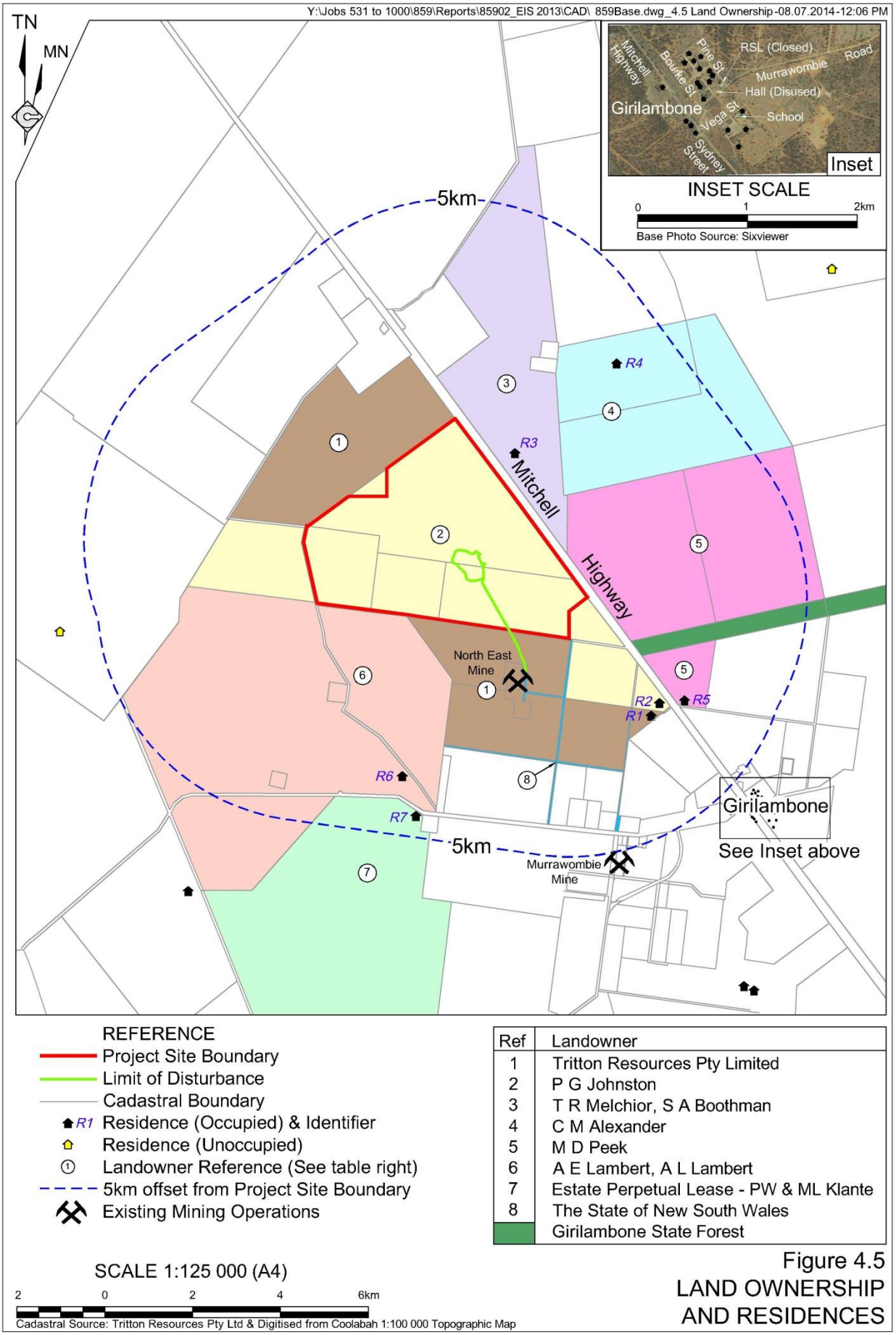


Figure 4.5
LAND OWNERSHIP AND RESIDENCES

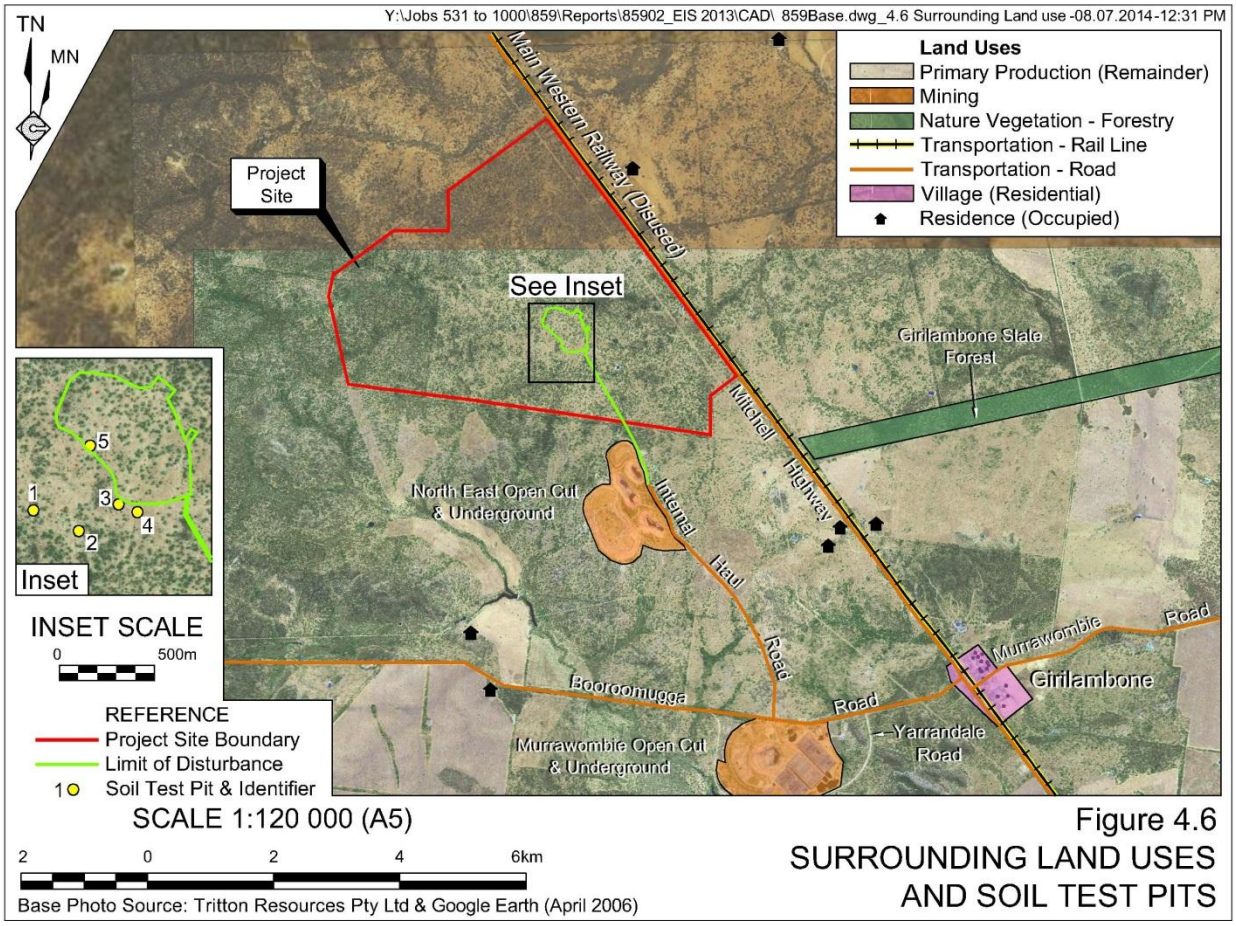


Figure 4.6
SURROUNDING LAND USES AND SOIL TEST PITS

4.2 ABORIGINAL HERITAGE

The Aboriginal heritage assessment of the Proposal was undertaken by OnSite Cultural Heritage Management (OnSite CHM). The assessment draws together studies undertaken by OnSite CHM and the results of previous Aboriginal heritage surveys undertaken across the Project Site. The full assessment is presented in ***Appendix 5*** *and is referenced throughout this section as OnSite CHM (2014a), with a summary of the assessment presented in the following subsections.*

4.2.1 Introduction

Based on the risk analysis undertaken for the Proposal (**Section 5.2** and **Table 5.3**), the potential impacts relating to heritage factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Unauthorised destruction of known sites (moderate risk).
- Unauthorised destruction of unknown sites within approval areas (moderate risk).

In addition, the DGRs identify "***Heritage***" as a key issue for assessment in the *Environmental Impact Statement*. The principal assessment matters from DP&E relating to heritage matters include:

> "an Aboriginal cultural heritage assessment (addressing both cultural and archaeological significance) which must demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, and developing and selecting mitigation options and measures."

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from OEH. The additional matters identified are generally consistent with the DGRs.

Furthermore, the Aboriginal heritage assessment for the Proposal was undertaken in accordance with the following guidelines.

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a).
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010b).
- *Code of Practice for Archaeological Investigation in NSW* (DECCW, 2010c).
- *Guide to Investigation, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011).

This subsection provides a summary of the Aboriginal consultation and subsequent field investigations undertaken over five days in April 2012 (referred to as the "Stage 1" investigations) and 3 days in October/November 2012 (referred to as "Stage 2" investigations).

The Stage 1 and Stage 2 investigations were undertaken as part of documentation supporting an application to conduct a proposed exploration drilling program. That application was subsequently approved by Division of Resources and Energy under Part 5 of the EP&A Act. The intention of the Stage 1 and Stage 2 investigations was to utilise information from those studies to support the current application for development consent. As a result, the Stage 1 and Stage 2 documentation has been amended and updated to include an Aboriginal Heritage Impact Assessment based upon the Proposal, as outlined in Section 2 of this document.

This subsection also describes the regional archaeological context; the results of previous surveys throughout the area surrounding the Project Site; a predictive model for Aboriginal heritage locations and the results of the 2012 surveys. Also presented are assessments of significance and the proposed management of the artefacts found through the investigation.

4.2.2 Ethnohistory

The Aboriginal inhabitants within the region surrounding the Project Site are the Ngiyampaa Wangaaypuwan (Wongaibon) people who generally resided in country roughly bounded in the north by the Darling-Barwon and Bogan Rivers, and in the south by the Lachlan River (Beckett et al, 2003). Ngiyampaa people also defined their identity by the type of country they occupied i.e. stone country.

Following European colonisation of the surrounding areas from 1835 onwards, conflicts arose between local indigenous people and white settlers regarding land use. Further inflaming the situation, Aboriginal resistance to pastoralism west of the Great Dividing Range was met with a proclamation of martial law, resulting in Aboriginal people being removed from the land with those remaining in the area generally destined to work on European pastoral farms as stockmen. By the 1930s, in most parts of NSW, nearly all of the Aboriginal population were either fringe dwellers or 'clients' of the Aborigines Protection Board.

4.2.3 Previous Surveys

4.2.3.1 Introduction

The results of previous surveys have been assembled from a search of the Aboriginal Heritage Information Management System (AHIMS) database and summarised in the following subsections. Also included are the summarised results of the previous surveys conducted within the Project Site.

4.2.3.2 Archaeological Record

The search of the AHIMS database within an area 10km x 10km (100km^2) centred on the Project Site was undertaken by OnSite CHM. The search identified 57 recorded sites. **Figure 4.7** displays the location of the AHIMS search area in the regional context and presents the location of those recorded sites within a 2km radius of the proposed area of disturbance. A full copy of the AHIMS site recording forms is presented in Appendix 4 of OnSite CHM (2014a).

Of the 57 identified AHIMS sites, 11 occur within or immediately surrounding the Project Site. A review of the AHIMS site cards revealed however duplicate recordings of these sites and their features. An examination of the site cards showed that the 11 AHIMS recorded sites are actually only five unique sites. As such, **Table 4.2** lists the 11 duplicated and 5 actual AHIMS sites, with these displayed on **Figure 4.7**.

Table 4.2
AHIMS Sites Recorded within the Project Site

AHIMS Ref. or ID	Site Name	Site Features
26-3-0066 / 26-3-0145	GM-HS/27_(Hearth)	Earth Mound, hearth
26-3-0067 /26-3-146	GM-HS-29_(Hearth)	Earth Mound, hearth
26-3-0068 / 26-3-0147	GM-OS/HS-1_(Hearth)	Earth Mound, hearth
26-3-0070 / 26-3-0071	GC-OS/HS-2_(Hearth)	Earth Mound, hearth , artefact
26-3-0034 / 26-3-0119 / 26-3-0149	GC-OS-1	Open Artefact scatter, hearth
Source: Modified after – OnSite CHM (2014a) - Table 5.4.		

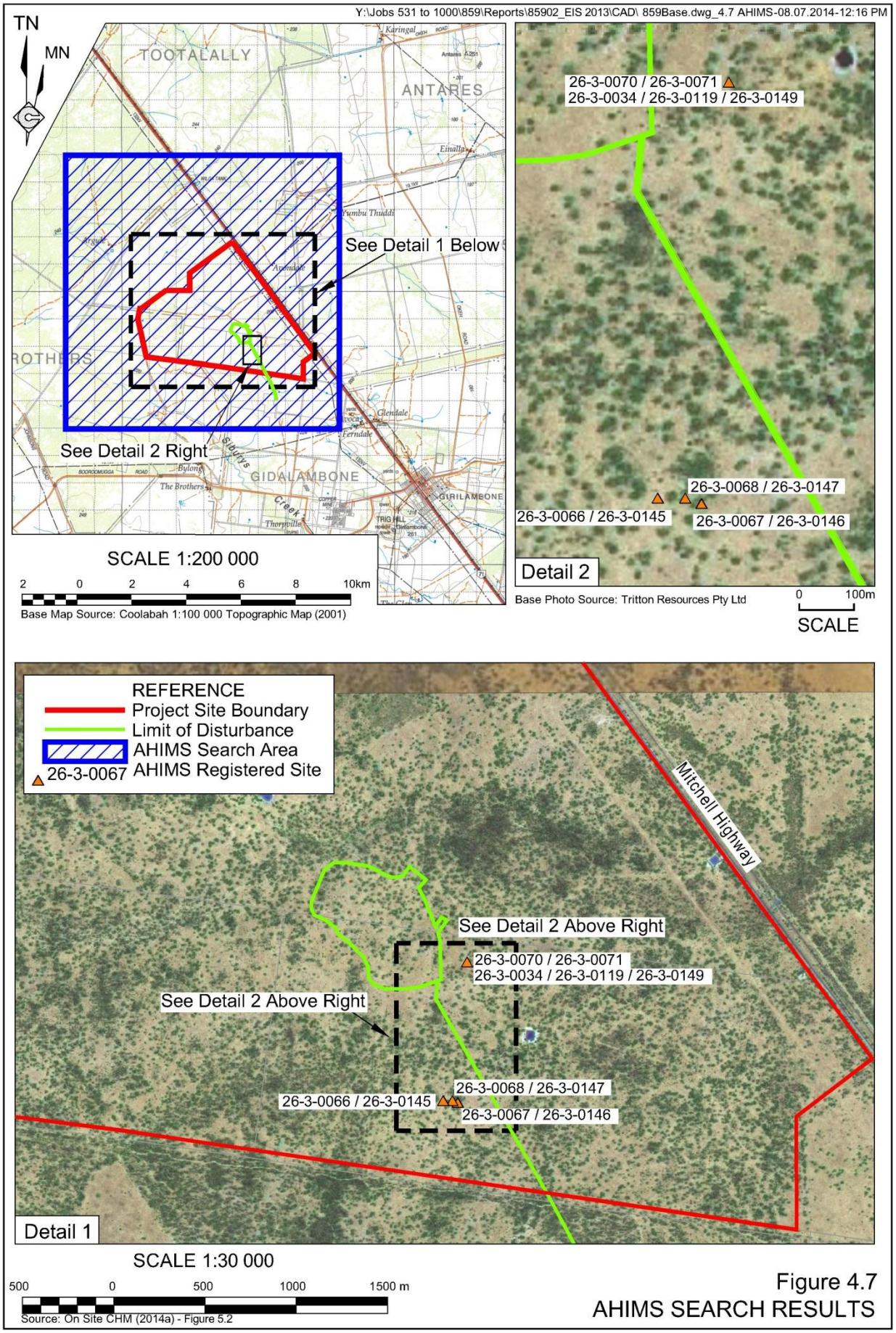


Figure 4.7
AHIMS SEARCH RESULTS

4.2.3.3 Previous Project Site Surveys

Three separate investigations have been previously undertaken within the Project Site, with Anne Nicholson of National Heritage Studies having undertaken investigations in 1989 and 1990 for an *Environmental Impact Statement* and mining infrastructure purposes respectively and Central West Archaeological and Heritage Services undertaking investigations in 1995 in preparation for mineral exploration operations.

Each of the previous surveys concluded that the Project Site was probably not occupied by Aboriginal people for long periods of time, but was likely to have been visited and used opportunistically.

4.2.4 Predictive Model

OnSite CHM developed a predictive model to establish the likely distribution of archaeological material against which the effectiveness and subsequent analysis of the survey results could be tested, compared and reasoned. The predictive model considered the existing archaeological record, resource availability, general knowledge of the habitation and land use patterns of the Aboriginal people of the region and factors affecting identification.

The predictive model identified that a general lack of reliable potable water sources is directly proportionate to the type and number of artefacts potentially occurring within the Project Site, with a review of the AHIMS sites determining that scarred trees are likely to be the most common site type, followed by hearths and open scatters. The scarcity of stone outcrops and the previous agriculture land uses practices, limit the likelihood of grinding stones or stone artefacts to occur within the Project Site.

On the basis of these predictions, the archaeological potential and sensitivity of the Project Site is considered to be low.

4.2.5 Consultation

4.2.5.1 Prior to Survey

In accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a), requests were sent to a range of organisations during both Stage 1 and Stage 2 consultation, requesting any Aboriginal persons having a cultural knowledge of the Project Site to register their interest in determining the significance of the Proposal and Aboriginal values located therein.

Further to the above, an advertisement was posted in the *Nyngan Observer* on 4 April 2012 as part of Stage 1 consultation, and again on 10 October 2012 as part of Stage 2 consultation, requesting respondents register their interest in the Proposal. As a result of the consultation program, the following organisations were identified as Registered Aboriginal Parties (RAPs) for the Proposal.

- Bogan Aboriginal Corporation.
- Nyngan Local Aboriginal Land Council (Nyngan LALC).

- Native Title Services for Ngemba/Ngiyampaa Claimants (referred as "Ngemba/Ngiyampaa Native Title claim group").
- Marra Wallan Pty Ltd.

A complete record of all correspondence is located within Appendices 1, 2 and 7 of OnSite CHM (2014a).

4.2.5.2 During the Survey

The following RAP representatives participated in the entire Stage 2 investigations with OnSite CHM and the Applicant in April 2012, and were present during the recording of all Aboriginal heritage sites.

- Ms Sheila Couley (Nyngan LALC).
- Mrs Lesley Ryan (Bogan Aboriginal Corporation).

The following RAP representatives participated in the entire Stage 1 investigations with OnSite CHM and the Applicant in October / November 2012, and were present during the recording of all Aboriginal heritage sites.

- Ms Sheila Couley (Nyngan LALC).
- Mrs Lesley Ryan (Bogan Aboriginal Corporation).

Mr Neville Merritt, of the Ngemba/Ngiyampaa Native Title claim group, also participated in the Stage 2 fieldwork and survey investigations on 1 and 2 November 2012. Mr Merritt who was also shown the Stage 1 investigation area site Avoca Tank 1, 2 and 4.

4.2.5.3 Following the Survey

A draft of the Stage 1 assessment report was sent to the RAPs on 26 July 2012, requesting their review and comments on the report within 28 days in accordance with DECCW (2010a), with no feedback provided by any RAPs.

A draft of The Stage 2 Assessment Report, incorporating the results of the Stage 1 assessment, was sent to the RAPs on 21 February 2013. The RAPs were provided 28 days to review the report and provide comment with the closing date being 22 March 2013.

All of the RAPs supplied comment on the draft Stage 2 Assessment Report, with Nyngan LALC and Bogan Aboriginal Corporation endorsing the assessment and resulting recommendations.

Native Title Services Corporation (NTS Corp), on behalf of the Ngemba/Ngiyampaa Native Title claim group, also provided comment on the assessment, noting clarification or opposition to issues such as survey descriptions, management (fencing) requirements and monitoring. As a result of this, OnSite CHM responded to NTS Corp, clarifying the survey description and management issues to the satisfaction of NTS Corp. However, NTS Corp remained adamant that further surveys were required following the final proposed location of all Proposal-related infrastructure, something which OnSite CHM disagreed with, outlining that due to the low

density of Aboriginal occupation evidence, further surveys were not required. Further information in relation to the post survey correspondence between OnSite CHM and MTS Group is provided in Appendix 7 of OnSite CHM (2014a).

A copy of all post survey correspondence with the RAPs is provided in Appendix 7 of OnSite CHM (2014a).

4.2.5.4 Adequacy of Consultation

The Applicant contends that the consultation undertaken as part of the Stage 1 and Stage 2 assessments meets the requirements of DECCW (2010a) because the impact to known Aboriginal sites would be as per the impacts assumed in those assessments, namely, all sites would be avoided.

It is anticipated that each of the RAPs will be provided an opportunity to review and make comment on this report during the exhibition stage of the application. Should any comments and/or suggestions be received from the RAPs following the exhibition, a detailed response would be provided at the Response to Submissions stage.

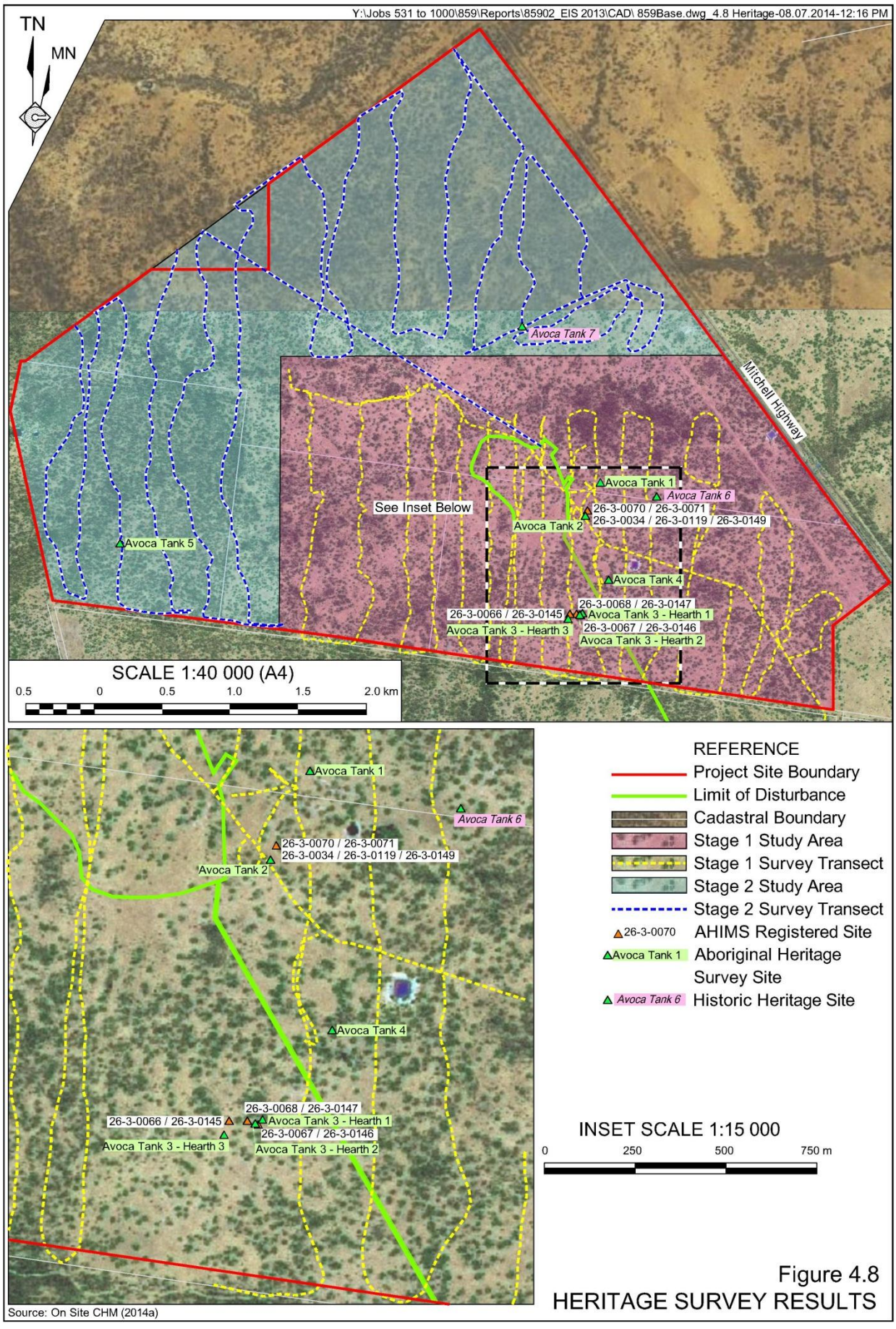
4.2.6 Survey Methodology

Throughout the Stage 1 and Stage 2 surveys undertaken in April and October / November 2012, the same survey methodology was applied, for consistency and comparability of results. Each survey consisted of a series of pedestrian transects in a north south direction, spaced approximately 200m apart depending on vegetation and proximity to water features (**Figure 4.8**). Surveyors paid close attention to trees of a suitable age to have cultural scars and areas that could potentially contain items such as hearths. Survey participants were spaced approximately 20m abreast within each transect, combining to allow an approximately survey reach of 100m per transect, ultimately providing good survey coverage. It was calculated that 41% of the total land within the Project Site was covered.

OnSite CHM (2014a) state that it was determined that the surveys undertaken satisfied the survey effectiveness requirements as prescribed in *National Parks and Wildlife Amendment (Archaeological Investigations) Regulation 2010*.

4.2.7 Survey Results

The combined Stage 1 and Stage 2 surveys resulted in a total of five Aboriginal sites being identified within the Project Site. These were given the designations of Avoca Tank 1 to Avoca Tank 5. **Table 4.3** presents a description of each of the identified sites while **Figure 4.8** presents the location of each. It should be noted that two historic heritage (non-Aboriginal) sites were also located during the field surveys and were given the designations of Avoca Tank 6 and Avoca Tank 7. These are discussed in detail in Section 4.7.



Source: On Site CHM (2014a)

Figure 4.8
HERITAGE SURVEY RESULTS

Table 4.3
Identified Aboriginal Heritage Items within the Project Site

Reference ID	Site Type	Site Context / Comments	Corresponding AHIMS Site ID
Stage 1 Survey Results			
Avoca Tank 1	Stone artefact scatter.	11 artefacts scatter located on an open gently undulating grassy plain with tall open eucalypt woodland 50m away from a dam. The geological type of artefacts indicates they were not manufactured locally.	26-3-0034 / 26-3-0119/ 26-3-0149 26-3-0070 / 26-3-0071
Avoca Tank 2	Isolated stone artefact.	Single silcrete artefact located on large open grassy plain with open woodland.	-
Avoca Tank 3	Hearths (x3).	3 separate hearths located within 80m of each other on large open grassy plain. Hearth 1 – consists of 4 sediment nodules over 3m x 3m area. Hearth 2 – consists of numerous small nodules with minor charcoal content over 1m x 1m area. Hearth 3 – consists of numerous small nodules over 2m x 2m area.	26-3-0067 / 26-3-0146 26-3-0068 / 26-3-0147 26-3-0066 / 26-3-0145
Avoca Tank 4	Historic Scar Tree and Aboriginal Stockman's camp.	Situated in a low point within a grassy plain with two small waterholes nearby (1 natural, 1 likely man-made). Scar on tree next to likely man-made waterhole extends 2.1m and around 80% of the tree. Displays markings similar to that of a steel axe. Contains European material including a jar base and flattened tin. Aboriginal community members suggest the evidence presents an Aboriginal stockman's camp associated with historical activities.	-
Stage 2 Survey Results			
Avoca Tank 5	Isolated stone artefacts (x2).	2 isolated quartz flakes in sparse grasses and mixed woodland.	Not Applicable

Source: OnSite CHM (2014a) – Section 7.

Following a review of the type and location of the sites identified by OnSite CHM (2014a), it was recognised that several sites listed under the AHIMS register displayed similar site descriptions within similar areas to sites Avoca Tank 1 and Avoca Tank 3. The review identified that a number of the 11 previously recorded AHIMS sites were duplicate AHIMS site recordings based upon differing datum's originally used to record the sites (AGD 66, WGS 84 and GDA 94), with the review ultimately determining that the 11 AHIMS sites recordings actually represented two Aboriginal Heritage sites only namely, Avoca Tank 1 and Avoca Tank 3 (**Table 4.3**).

Avoca Tank 2, Avoca Tank 4 and Avoca Tank 5 are newly identified sites and have not previously been listed on the AHIMS register.

It should be noted that the hearth previously recorded at Site GC-OS/HS-2_(Hearth) (AHIMS site 26-3-0070 / 26-3-0071) was unable to be relocated during the field surveys and is likely to have been eroded away. OnSite CHM (2014a) state that no further action is warranted regarding this site.

4.2.8 Potential Impacts on Aboriginal Heritage Sites

It is proposed that all identified heritage sites would be avoided throughout the construction and operational phases of the Proposal, with the proposed mitigation measures identified in Section 4.2.9, ensuring all sites are adequately protected.

4.2.9 Mitigation Measures

The Applicant would minimise the potential for harm to occur to the identified sites by avoiding all sites. To limit the potential for unintended disturbance, the Applicant would implement the following avoidance measures.

- Ensure each identified site is permanently fenced and signposted as a 'no go' area in accordance with the Applicant's policy *Community and Heritage Policy and Straits Procedures – Heritage Management Planning (Australia).*
- Inclusion of bush fire fuel load management within the Proposal's *Environmental Management Strategy* for the Avoca Tank 4 fenced area to reduce the potential for bush fires to affect the scarred tree.
- Provide for a buffer of 50m between the identified sites and proposed mine infrastructure, ensuring that all mine site personnel are aware of the location of each site and show the location of the sites on accessible plans.
- Ensure that work crews in the vicinity of the identified sites are informed by way of an induction as to the location of each site and its legislative protection under the *National Parks Wildlife Act 1974*. All work crews would be informed that the fenced area remains a "no-go" area for the duration of the works.

4.2.10 Assessment of Impacts

4.2.10.1 Assessment of Significance

Cultural Significance

The Aboriginal or cultural significance of Aboriginal relics and sites can only be assessed by the Aboriginal community, and in particular, the Elders. Throughout the consultation, field work and report review by the RAPs, it was generally agreed that the Project Site contained a low level of Aboriginal significance.

Research and Educational Potential

Archaeological research and educational potential refers to the degree to which a site can contribute data to answer specific research questions and be utilised for education purposes. It was determined that all of the sites had a low to moderate research potential due to the size, type and number of artefacts identified, as well as the impacts of previous land use practices, resulting in the degradation of potential for these sites to provide in situ research potential.

Aesthetic Value

Although the environmental context of each site could be considered to have aesthetic values, those values are no greater than the surrounding areas without Aboriginal objects. Therefore, with the exception of the scar tree and environmental context of Avoca Tank 4 none of the recorded sites display any particularly prominent aesthetic values.

Uniqueness and/or Rarity

Uniqueness and/or rarity refer to the frequency of a particular site type, or an activity at a site and the similarities between site types in the Project Site and the wider regional context. Excluding Avoca Tank 4, the remaining sites were identified as having a low to moderate level of archaeological research potential due to the common nature of the identified sites within the local context.

The assessment of impacts of Avoca Tank 4 is discussed in detail in Section 4.7.7

Assessment of Site Impacts

The conclusions from the comprehensive background and field investigations of the identified Aboriginal heritage items is that the Proposal would not impact directly on any of the identified sites recorded within the Project Site.

4.2.11 Conclusion

Based upon the avoidance of all identified sites occurring within the Project Site and the implementation of the outlined mitigation measures, it has been determined that there would be a negligible impact upon the local or regional Aboriginal heritage as a result of the Proposal.

4.3 ECOLOGY

*The ecology assessment for the Proposal was undertaken by EnviroKey Pty Ltd. The full assessment is presented as **Appendix 6** and is referred to hereafter as EnviroKey (2014). This subsection presents an overview of that assessment and should be read in conjunction with the full assessment.*

4.3.1 Introduction

Based on the risk analysis undertaken for the Proposal (**Section 5.2** and **Table 5.3**), the potential impacts relating to ecology factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Loss of terrestrial ecology habitat, local vegetation and biodiversity (low risk).
- Injuries to native wildlife and fauna during clearing / earthworks (pre-strip) (low risk).
- Adverse impacts on groundwater dependent ecosystems (low risk).
- Indirect impacts to fauna communities due to light / noise / blasting etc. (low risk).

In addition, the DGRs identify "***Biodiversity***" as a key issue for assessment in the *Environmental Impact Statement*. The principal assessment matters from DP&E relating to biodiversity matters include the following.

- "Accurate predictions of any vegetation clearing on site or for any road upgrades.
- A detailed assessment of the potential impacts of the development on any threatened species or populations or their habitats, endangered ecological communities and groundwater dependent ecosystems.
- A detailed description of the measures to maintain or improve the consideration of a Biodiversity Offset Strategy."

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from OEH. The additional matters identified are generally consistent with the DGRs.

Furthermore, the Ecology assessment for the Proposal was undertaken in accordance with the following guidelines.

- *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities – Working Draft* (DECC, 2004)
- *The Threatened Species Assessment Guideline – The Assessment of Significance* (DECC, 2007).

This subsection provides information on the predicted and observed regional and local flora, fauna and vegetation communities, including threatened flora and fauna species within the Project Site. This subsection concludes with an assessment of the anticipated significance of Proposal-related impacts.

4.3.2 Regional and Local Setting

4.3.2.1 Regional Setting

The Project Site is situated within the area managed by the NSW Central West Catchment Management Authority (CW-CMA) which comprises the Castlereagh, Bogan and Macquarie River valleys. Six separate bioregions exist within the CW-CMA area with the Project Site occurring within Cobar Peneplain Bioregion and the Canbelego Downs subregion.

It is noted that an appropriate 400m length of the Site Access Road between the southern boundary of the Project Site and the disturbed area adjacent to the North East Waste Rock Emplacement was not surveyed. However, given the uniform nature of vegetation and habitat within the surveyed area, the Applicant contends that this does not adversely impact on the assessment undertaken.

The Cobar Peneplain Bioregion has experienced significant vegetation losses since European Settlement, with 33% of the woody native vegetation cleared. The Bioregion does however, support dense shrubby woodlands with the widespread vegetation communities consisting of Poplar Box (*Eucalyptus populnea*), White Cypress Pine (*Callitrus glaucophylla*) and Gum Coolabah (*Eucalyptus intertexta*) communities, as well as extensive mulga areas where skeletal soils are present. Mallee woodland communities also form part of the regional vegetation and are considered to be of high conservation significance within the Bioregion. More than 90% of the original extent of mallee communities within the Cobar Peneplain Bioregion have been cleared or significantly altered.

The Bioregion's diverse landscape and vegetation also supports a wide variety of fauna species with 36 vulnerable and 7 endangered fauna species occurring in the Cobar Peneplain Bioregion, with an additional 64 birds, 12 mammals, 23 reptiles and 8 frogs considered as being of conservation concern.

4.3.2.2 Local Setting

With the exception of the Bogan River, located approximately 25km to the east of the Project Site, all water courses are ephemeral and are likely to flow only after substantial rain. Notwithstanding this, these water courses are likely to provide locally important habitat for a variety of species. Five dams exist within the Project Site and are located in local depressions. These dams are generally dependant on rainfall and are regularly dry.

The native vegetation of the surrounding area is dominated by Poplar Box Woodland, with varying intergrades of Gum Coolabah, Cypress Pine and occasional Mulga. The status of vegetation surrounding the Project Site is considered similar to the current status of regional vegetation in that varying degrees of clearing for broad-scale agricultural activities such as cropping and grazing has previously occurred. The local vegetation has also endured modification through feral animals such as goats, rabbits and pigs.

4.3.3 Background Research

4.3.3.1 Previous Ecological Studies

Whilst no previous ecological studies have been undertaken within the Project Site, EnviroKey have previously undertaken ecological studies on similar land associated with the Girilambone Copper Mine operations, principally:

- an assessment for the North East Mine entitled '*Flora and Fauna Impact Assessment: Proposed ROM Pad Extension, TRL North East Site (ML 1383) Girilambone, NSW'* (EnviroKey, 2011a);
- a draft flora and flora study of the Murrawombie and North East Mine entitled '*Flora and Fauna Study: Murrawombie and North East Mine, Girilambone, N.S.W (ML1280, ML1383 & MPL295)'* (EnviroKey, 2011b); and
- a final flora and flora study of the Murrawombie and North East Mine entitled *Flora and Fauna Study: Murrawombie and North East Mine, Girilambone, N.S.W (ML1280, ML1383 & MPL295)'* (EnviroKey, 2011c).

4.3.3.2 Database Searches

EnviroKey (2014) undertook a search on 3 February 2014 within a 50km radius of the Project Site for threatened flora and fauna species listed under the schedules of the *Threatened Species Conservation Act 1995* (TSC Act), within the Canbelego Downs subregion, on the Office of Environment and Heritage's (OEH) 'Threatened Species online database' and the OEH 'BioNET' database. EnviroKey also undertook a search on the Commonwealth Department of the Environment Protected Matters Database on 6 February 2014, using a 50km radius surrounding the Project Site for species or communities listed within the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Table 4.4 presents the results of the various 50km radius database searches, identifying 22 species of birds, 4 species of mammals/marsupials, 4 species of bats and 4 flora species listed within the schedules of TSC Act. The results also identified 3 endangered ecological communities, 5 flora species and 16 fauna species (9 of which are also migratory species) listed within the schedules of the EPBC Act.

A search of the Noxious Weeds List from the NSW Department of Primary Industries (DPI) website in February 2014 for the Bogan LGA area revealed 88 noxious weeds with the potential to occur within the Project Site.

4.3.3.3 Predicted Species, Communities and Populations

Based on an analysis of habitat within the Project Site and online database searches (see **Table 4.4**), as well as, the results of EnviroKey (2011a and 2011b), the threatened species listed in **Table 4.5** have the potential to occur within the Project Site, with each species listed in **Table 4.5** subjected to a Significance Assessment (provided in full in Section 10 of EnviroKey (2014). It should be noted that no endangered ecological communities were identified as having the potential to be impacted as a result of the Proposal.

Table 4.4
Listed Species with Potential to Occur

TSC Act Fauna Species	
Birds	
Barking Owl	Red-tailed Black Cockatoo
Blue-billed Duck	Spotted Harrier
Brolga	Superb Parrot
Brown Treecreeper	Turquoise Parrot
Diamond Firetail	Varied Sittella
Glossy Black Cockatoo	White-fronted Chat
Grey Falcon	**Bats**
Grey-crowned Babbler (eastern subspecies)	Greater Long-eared Bat
Hooded Robin	Little Pied Bat
Little Eagle	Yellow-bellied Sheathtail bat
Magpie Goose	*Nyctophylus (?corbeni)*
Pink Cockatoo	**Mammals / Marsupials**
Malleefowl	Kultarr
Masked Owl	Stripe-faced Dunnart
Painted Honeyeater	White-footed Tree-rat
Pied Honeyeater	Yellow-footed Antechinus
TSC Act Flora Species	
Coolabah Bertya (*Bertya opponens)*	Cobar Greenhood Orchid (*Pterostylis cobarensis)*
Pine Donkey Orchid *(Diuris tricolor)*	Illawarra Ziera (*Ziera granulate)*
EPBC Act Fauna Species	
Australian Painted Snipe[1]	Latham's Snipe[1]
Cattle Egret[1]	Malleefowl[1]
Fork-tailed Swift[1]	Painted Snipe[1]
Great Egret[1]	Rainbow Bee-eater[1]
Superb Parrot	White-bellied Sea-Eagle[1]
White-throated Needletail[1]	Silver Perch[1]
Brush-tailed Rock Wallaby	Spotted-tail Quoll
South-eastern Long-eared Bat	Murray Cod
EPBC Act Flora Species	
A speargrass (*Austrostipa metatoris*)	Coolabah Bertya (*Bertya opponens)*
Cobar Greenhood Orchid (*Pterostylis cobarensis)*	Pine Donkey Orchid *(Diuris tricolor)*
Slender Darling-pea *(Swainsona murrayana)*	
EPBC Act Threatened Ecological Communities	
Myall Woodland in the Darling Riverine Plains; Brigalow Belt South; Cobar Peneplain; Murray-Darling Depression; Riverina and NSW South Western Slopes bioregions	*Woodland in the Riverina; NSW South Western Slopes; Cobar Peneplain; Nandewar and Brigalow Belt South Bioregions*
Artesian Springs Ecological Community	
[1] Indicates Migratory species	
Source: EnviroKey (2014) – Map 2 and 3 and modified from Table 9.	

Table 4.5
Threatened Species with Potential to Occur within the Project Site

Species	TSC Act	EPBC Act	Species	TSC Act	EPBC Act
Australian Bustard#	X		Pied Honeyeater	X	
Diamond Firetail	X		Pink Cockatoo#	X	
Grey-crowned Babbler	X		Spotted Harrier	X	
Grey Falcon	X		Superb Parrot*	X	X
Hooded Robin	X		Turquoise Parrot	X	
Little Eagle	X		Varied Sittella	X	
Mallefowl*	X	X	Kultarr	X	
Masked Owl	X		South-eastern Long-eared Bat*#		X
Painted Honeyeater	X		Little Pied Bat	X	
Inland Forest Bat#	X		Yellow-bellied Sheathtail Bat	X	
Cobar Greenhood Orchid	X	X			

* Indicates that the species is also listed as Vulnerable under the EPBC Act.

# Indicates that whilst the species was not identified in **Table 4.4**, EnviroKey's experience within the region has determined that the species may potentially occur within the Project Site.

Source: EnviroKey (2014) – Modified from Table 9.

4.3.4 Field Survey Methodology

4.3.4.1 Introduction

Field surveys were completed by EnviroKey between 13 and 20 March 2012 and between 3 and 7 October 2012. This subsection provides an overview of the flora and fauna survey methodologies employed by EnviroKey (2014).

4.3.4.2 Flora Survey Methodology

Flora field surveys were carried out in conjunction with the fauna field surveys (see Section 4.3.4.3) and totalled 13 days.

The March 2012 survey consisted of desk-top air photo interpretation and on-ground validation of communities to ensure consistency with those detailed in recent classifications, with the November 2012 survey targeting threatened flora species predicted to occur within the Project Site, as well as surveying the remaining areas not previously completed within the first survey. Field surveys were conducted according to the Random Meander Method (transects) described by Cropper (1993). Transects were approximately 500m in length and were traversed abreast by two observers at 500m distance, before returning parallel to the original transect, effectively equating to 2km per transect. The distance covered by the 33 transects equates to 66km of field searches, representing all vegetation communities and habitat types within the Project Site (**Figure 4.9**).

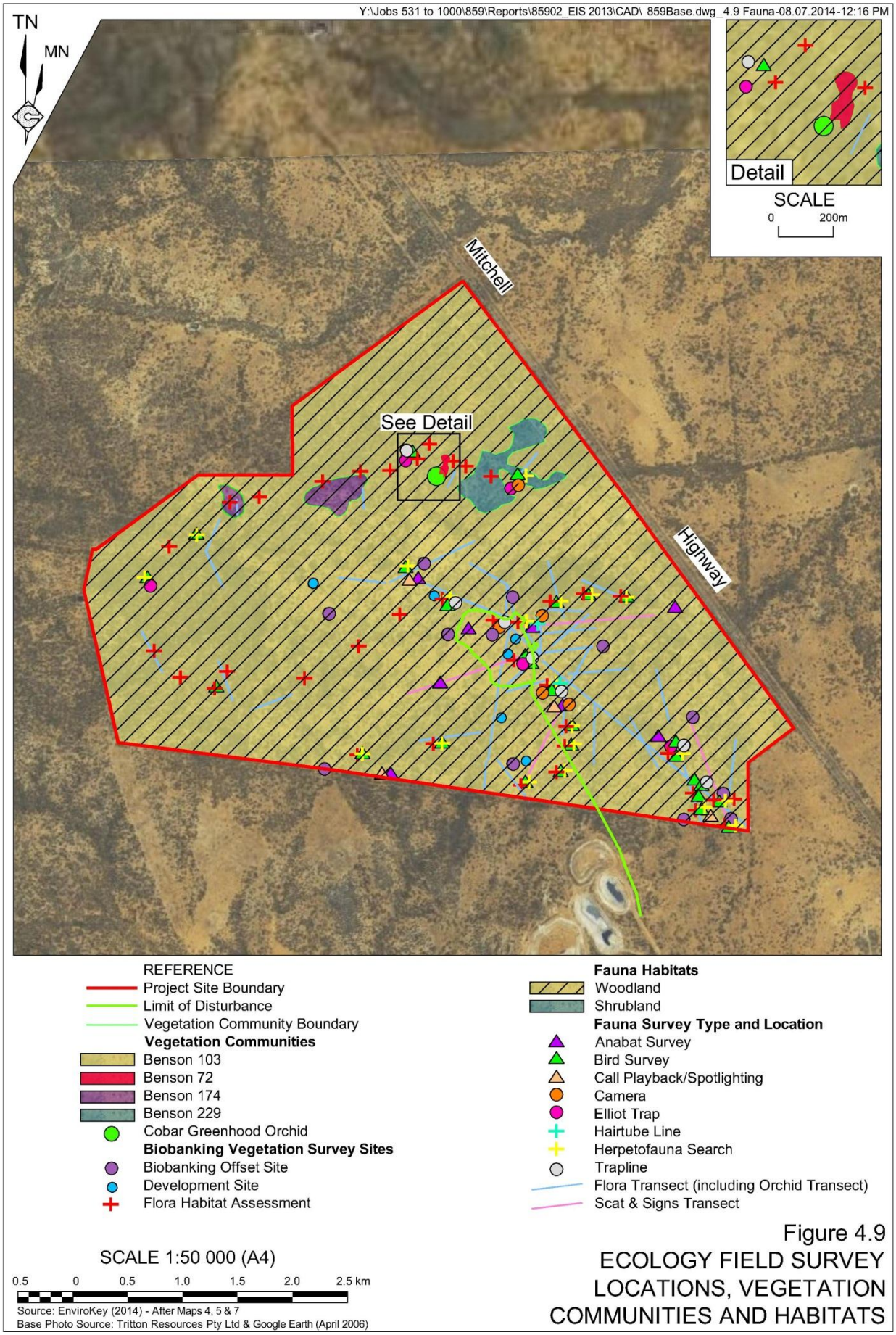


Figure 4.9
ECOLOGY FIELD SURVEY LOCATIONS, VEGETATION COMMUNITIES AND HABITATS

Field data collected was consistent with the methodology outlined within the Biobanking Assessment Methodology and Credit Calculator Operation Manual (DECC 2008) with **Figure 4.9** displaying the flora habitat survey locations.

Classification of the observed vegetation communities and species mix within those communities was referenced using *Plants of Western NSW* (Cunningham *et al*. 2011) and the online version of the *Flora of NSW (*PlantNET *2012).* Nomenclature has been aligned to that used by Benson (2006 and 2008) and Benson *et al*. (2006) for vegetation communities and the *Plants of Western NSW* and the online version of the *Flora of NSW* for individual species.

4.3.4.3 Fauna Survey Methodology

Fauna field surveys undertaken at the locations displayed on **Figure 4.9**. A number of standard techniques were employed during the fauna surveys. These are described in detail in EnviroKey (2014) and are summarised briefly in **Table 4.6**.

4.3.5 Project Site Flora and Fauna

4.3.5.1 Introduction

EnviroKey (2014) presents a detailed list of all species, vegetation communities and habitats recorded within the Project Site. This subsection presents an overview of that information.

4.3.5.2 Vegetation Communities Identified

EnviroKey (2014), in accordance with the *BioMetric* classification system and consistent with Benson (2006), identified four main vegetation communities within the Project Site. Each of these communities is described as follows and displayed on **Figure 4.9**.

- Benson 103 – Poplar Box – Gum-barked Coolibah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion. Some variation in vegetation composition is evident and is associated with subtle differences in topography. However, this community generally aligned to Benson 103 more than any other vegetation community or sub-community. This vegetation community dominates the Ecology Survey Area with approximately 97% total coverage.
- Benson 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion. This vegetation community occurs in one small cluster within Benson 103.
- Benson 174 – Mallee – Smooth-barked Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion. This vegetation community occurs in two separate clusters within Benson 103.
- Benson 229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion. This vegetation community occurs in one large patch within the Project Site.

Table 4.6
Fauna Survey Methods

Survey Type	Total Survey Effort
Diurnal Birds	44 locations for 20 minutes each. **Total survey effort**: 880 minutes.
Trap Lines	Survey 1: Six locations over 216 trap nights/288 trap days. Survey 2: Five locations over 80 trap nights/100 trap days. **Total survey effort**: 296 trap nights/388 trap days.
Echolocation Call Recording	Survey 1: Eight locations over four nights. Five locations were surveyed for one hour on one night. Two sites were surveyed for one hour on four nights. Mobile monitoring between two sites over four nights. **Total** 13 recording hours plus mobile monitoring. Survey 1: Three sites for one hour each. **Total** 3 hours. **Total survey effort**: 16 recording hours.
Hair Tubes	**Survey 1**: Two sites (25 tubes each site) over 7 consecutive nights. **Total survey effort**: 350 trap nights.
Elliot trapping	Survey 1: Three sites (25 traps each site) over a total of 450 trap nights. Survey 2: Four sites (25 traps each) over a total of 400 trap nights. **Total survey effort**: 850 trap nights.
Motion Activated Infrared Cameras	Survey 1: Five sites over 7 nights/9 days resulting in 35 camera nights/45 camera days. Survey 2: Four sites over 4 nights/5days resulting in 16 camera nights/20camera days. **Total survey effort**: 51 camera nights/65 camera days.
Call Playback	Survey 1: Five sites in total. Three sites were surveyed each night for 4 nights (12 surveys). Two sites on one occasion (2 surveys). Each survey was completed in 1hr. Total survey effort was 14 hours over four nights. Survey 2: Three sites for one hour on each occasion. Total effort 3 person hours over three nights. **Total survey effort**: 17 hours.
Spotlighting	Survey 1: Five sites in total. Three sites were surveyed each night for 4 nights (12 surveys). Two sites on one occasion (2 surveys). Each survey was completed in 1person hour. Total survey effort was 14 person hours over four nights. Survey 2: Three sites in total for a total of 1 person hour at each site. Total of 3 person hours over three nights. **Total survey effort**: 17 person hours.
Herpetofauna Search	29 sites in total for 30 minutes each. **Total survey effort:** 870 person minutes.
Track and Scat Search	Transect searches. **Total survey effort:** approximately 70kms in total.
Habitat Assessment	41 sites using a 50m x 20m quadrat.

Source: EnviroKey (2014) – Table 3.

EnviroKey (2014) stated that, based upon soil erosion, soil scalds, evidence of ringbarked / cut Poplar Box trees, patches of dense White Cypress Pine regrowth, as well as the presence of derived grassland associated with more recent clearing, the Project Site has been historically heavily grazed. Despite this, the vegetation within the Project Site is considered to be in moderate to good condition in accordance with DECC (2008).

4.3.5.3 Flora Species Identified

EnviroKey (2014) identified a total of 127 flora species within the Project Site, comprising 114 native species and 13 exotic species. A full list of identified flora species is provided in EnviroKey (2014) – Appendix 3.

One population of the Cobar Greenhood Orchid (*Pterostylis cobarensis*), listed as vulnerable under both the TSC Act and EPBC Act, was recorded within the Benson 72 vegetation community, with its location displayed on **Figure 4.9**.

A total of 13 introduced weed species were identified within the Project Site with one noxious weed occurring (as listed under the NSW DPI Noxious Weeds list for the Bogan LGA) identified, namely Bathurst Burr (*Xanthium spinosum).*

4.3.5.4 Fauna Species Identified

Overview

A total of 114 fauna species (106 native and 8 introduced) were recorded by EnviroKey (2014) comprising:

- 25 reptile species (none threatened);
- 9 frog species (none threatened);
- 17 mammal species (including 8 species of microchiropteran bat, 3 being threatened and 1 being a species of concern in western NSW); and
- 63 bird species signalling moderate to high bird diversity with the Project Site, including:
  - 6 vulnerable TSC Act - only threatened species;
  - 1 EPBC Act - only migratory species; and
  - 2 species listed as vulnerable under both the TSC Act and EPBC Act.

An earlier survey conducted on land adjoining the Project Site in October 2011 (EnviroKey, 2011b) recorded a total of 99 fauna species. The combined 2011 and 2012 surveys identified:

- 25 reptile species;
- 10 frog species;
- 22 mammal species (including 9 species of microchiropteran bat); and
- 87 bird species.

A consolidated list of identified fauna species is provided in EnviroKey (2014) – Appendix 4.

The location and summary of all fauna species listed under the TSC Act or EPBC Act recorded within the Project Site by EnviroKey during the 2012 field surveys are displayed on **Figure 4.10** and listed in **Table 4.7**.

NSW or nationally listed critical habitats and/or critically endangered populations were not recorded within the Project Site.

Table 4.7
Recorded Threatened Fauna Species

Scientific Name	Common Name	Status
Cacatua leadbeateri	Pink Cockatoo	Vulnerable (TSC Act)
Pomatostomus temporalis temporalis	Grey-crowned Babbler	Vulnerable (TSC Act)
Polytelis swainsonii	Superb Parrot	Vulnerable (TSC Act) Vulnerable (EPBC Act)
Vespadelus balstoni	Inland Forest Bat	Vulnerable (TSC Act)
Chalinolobus picatus	Little Pied Bat	Vulnerable (TSC Act)
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	Vulnerable (TSC Act)
*Nyctophilus corbeni**	South Eastern Long-eared Bat	Vulnerable (TSC Act) Vulnerable (EPBC Act)
Merops ornatus	Rainbow Bee-eater	Migratory (EPBC Act)
* Indicates identification under the precautionary principle.		
Source: EnviroKey (2014) – Appendix 2.		

Avifauna

Of the total 63 bird species identified by EnviroKey (2014), three threatened species (listed in **Table 4.7)**, were identified as being vulnerable under the TSC Act and/or the EPBC Act, as well as one species listed as a migratory species (Rainbow Bee-eater (*Meropsornatus*). The assemblage of birds is considered typical of semi-arid woodlands in western NSW but was noted that bird diversity was considerably lower than that recorded during the EnviroKey (2011b) study on adjoining land, largely as a result of the notable absence of many waterbirds due to the drier than average conditions prior to the 2012 survey.

Mammals (Excluding Microchiropteran Bats)

Eight of the total 13 species of mammals (excluding microchiropteran bats) were identified as introduced species. The Yellow-footed Antechinus (identified in EnviroKey 2011c), despite not being listed as a threatened species under the TSC Act, is regarded as a species of conservation concern in western NSW with the overall past disturbance practices and feral introduced species, providing an explanation as to the notable absence of many mammal species.

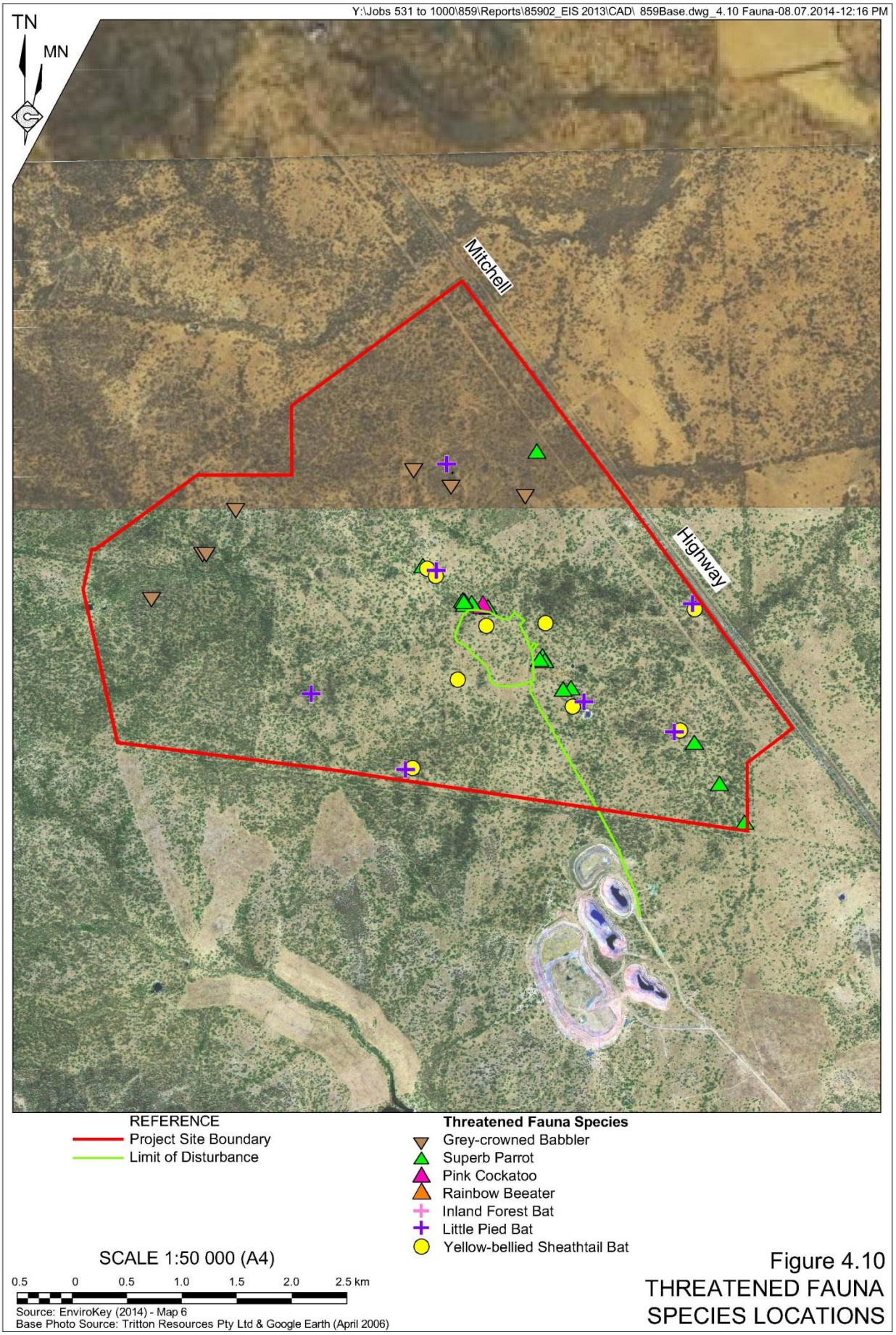


Figure 4.10
THREATENED FAUNA SPECIES LOCATIONS

Microchiropteran Bats

Eight species of microchiropteran bat were recorded using Anabat recordings, three of which (Little Pied Bat (*Chalinolobus picatus*), Inland Forest Bat (*Vespadelus balstoni*) and Yellow-bellied Sheathtail (*Saccolaimus flaviventris*)) are listed under the TSC Act. A fourth threatened species, South-eastern Long-eared Bat (*Nyctophilus corbeni*) (*f*ormerly *N. timoriensis)*, was also potentially identified within the Project Site, as recordings could not be distinguished from the wider genus. This species was subsequently defined as occurring under the precautionary principle. One additional species of microchiropteran bat (Chocolate Wattled Bat (C*halinolobus morio*)) was recorded on the adjoining land in 2011 but was not identified as occurring during the 2012 field surveys.

Reptiles

Reptile species richness is considered high with 25 species recorded by EnviroKey (2014) within the Project Site. However, no threatened reptile species were recorded and none are known or expected to occur in the local setting due to the absence of suitable habitat (i.e. spinifex grasslands).

Frogs

Frog diversity is considered highly diverse with nine species detected during the EnviroKey (2014) field surveys. Many species were recorded within the vicinity of existing farm dams, however, numerous tadpoles and metamorphs were observed in and around small ephemeral pools.

No threatened frog species were recorded as occurring within the Project Site.

4.3.5.5 Habitats Recorded

EnviroKey (2014) identified two fauna habitats within the Project Site, namely 'Woodland' and 'Shrubland', accounting for 98.4% and 1.6% of the Project Site respectively (see **Figure 4.9**). Habitat conditions are considered moderate to good across the landscape, as reflected by the diversity of microhabitats and the condition of native vegetation (where previous land clearing practices have been a considerable influence).

4.3.6 Potential Direct and Indirect Biodiversity Impacts

4.3.6.1 Introduction

The following potential direct impacts could occur as the result of the Proposal.

- Clearing of and loss of native vegetation including threatened flora habitat.
- Loss of fauna habitats (hollow-bearing trees).
- Injury and mortality of protected and threatened fauna.
- Loss of connectivity through fragmentation and the degradation of wildlife and habitat corridors.
- Exacerbate key threatening processes.

The following potential indirect impacts could occur as the result of the Proposal.

- Invasion and spread of weeds and pest fauna species.
- Edge effects from noise, vibration and light.
- Introduction or increased exposure to key threatening processes that many affect terrestrial and aquatic species, populations, ecological communities and their habitat (including threatened biota).
- Regional cumulative impacts affecting the long-term viability and survival of common and threatened species, populations and ecological communities and their habitats.

Each of these direct or indirect impacts are discussed in detail in the following subsections.

4.3.6.2 Direct Biodiversity Impacts

Clearing of Native Vegetation and Loss of Threatened Species Habitat and Communities

Clearing of native vegetation is a key threatening process listed under the TSC Act and the EPBC Act. The Proposal would result in the clearing of approximately 34ha, equating to approximately 2% of the Project Site.

Only the 'Benson 103 – Poplar Box – Gum-barked Coolibah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion vegetation community' would be impacted.

All identified threatened fauna species are highly mobile species (with the exception of Grey-crowned Babbler) that forage over large areas and are unlikely to be confined to the boundaries of the Project Site. It was noted that although the Grey-crowned Babbler was identified as occurring within the Project Site (**Figure 4.10**), the location of the proposed disturbance footprint would be well clear of any of the occupied home ranges of the Grey-crowned Babbler that occur within the northwest and western sections of the Project Site.

Of the 34ha proposed for clearing, no threatened ecological communities as listed by the TSC Act or EPBC Act would be impacted as none occur within the Project Site.

The loss of fauna habitats, in particular hollow-bearing trees, has the potential to occur as the results of the Proposal. However, due to the previous land uses and associated land clearing for agricultural purposes, hollow-bearing trees are generally restricted to 'stags' given that the majority of canopy trees have either been removed completely or ring-barked.

Based upon EnviroKey's previous surveys at surrounding locations, a conservative assumption of 1.13 hollow-bearing trees per hectare with 2.14 hollows per hollow-bearing tree has been adopted. With a disturbance of 34ha, approximately 41 hollow-bearing trees containing approximately 73 hollows may occur within the Proposed Disturbance Footprint. When put into context and based upon the stated calculations, the Project Site may contain up to 4 461 hollows, with the Proposal accounting for the removal of approximately 2% of hollows potentially present within the Project Site.

Injury and Mortality

Injury and mortality of fauna has the potential to occur, primarily related to the interactions of mine vehicles during clearing and transport operations.

Habitat Connectivity and Fragmentation

It is highly unlikely that the Proposal would impact habitat connectivity and fragmentation due to the small size of the proposed disturbance footprint and the similar habitats that exist within and surrounding the Project Site.

Exacerbate Key Threatening Processes

Key threatening processes are listed under the TSC Act and EPBC Act that have the potential to either:

- adversely affect threatened species, populations or ecological communities; or
- cause common species, populations or ecological communities to become threatened.

The listed key threatening processes identified and summarised in **Table 4.8** have been identified as being relevant to the Proposal.

Table 4.8
Key Threatening Processes

Key Threatening Process	Listed Act	Type of Threat	Potential Impacts
Clearing of native vegetation	TSC Act EPBC Act	Habitat loss/change	The proposal would result in the clearing of approximately 34ha of native vegetation.
Infection of native plants by *Phytophthora cinnamon*	TSC Act EPBC Act	Pathogen	Infected root material can be dispersed by earth moving equipment and other vehicles.
Loss of hollow-bearing trees	TSC Act EPBC Act	Habitat loss	It is likely that up to 38 hollow-bearing trees will be removed.
Source: Modified from EnviroKey (2014) - Table 8.			

4.3.6.3 Potential Indirect Impacts on Flora and Fauna

Noxious Weeds and Feral Fauna Species

The potential exists for the dispersal and propagation of the 13 identified weed species (including one noxious weed species – see Section 4.3.5.3) to occur on land surrounding the Project Site that are relatively weed-free or consist of native vegetation as the result of Proposal soil and vehicle-related interactions.

The Proposal may also provide for feral fauna species to extend their reach into the natural environment as the constructed roads and cleared areas have been noted as providing a means for feral animals to travel further into native vegetated areas.

Noise, Vibration and Light

The potential for noise, vibration and light to affect existing fauna exists, however given that the larger, open cut mining operations occurring nearby have had no notable effect on threatened species (EnviroKey; 2010, 2011a; 2011b; 2011c) it is anticipated that these issues would not impact upon existing fauna species or communities. Furthermore, it was also identified in EnviroKey (2012) that lighting associated with similar mining operations provided opportunities for foraging for microchiropteran bats as the lights attract moths and other flying insects.

Cumulative Impacts

There is a potential cumulative impact on biodiversity given the proximity of the existing Girilambone Copper Mine. However, it is recognised that both operations have relatively small footprints in the regional landscape and EnviroKey (2014) determined that it is unlikely that the Proposal would contribute to a cumulative impact to the local biodiversity at any scale.

4.3.7 Management and Mitigation Measures

4.3.7.1 Introduction

The Applicant has designed the Proposal to minimise impacts on threatened species by firstly avoiding and then mitigating potential biodiversity impacts. The following subsections present the design features, operational controls and management measures proposed to avoid and mitigate impacts on local biodiversity.

It should be noted that a Biodiversity Offset Strategy is not required for the Proposal because the general principles of 'avoid and minimise' have been adopted. This is evidenced by the following.

- Minimisation of the area of disturbance.
- Avoidance of areas of key habitat for the Cobar Greenhead Orchid.
- Implementation of a range of management plans (see Section 4.3.7.3).
- Retention of those sections of the Project Site that would not be disturbed by the Proposal (approximately 1 812ha) for the existing land use, namely intermittent agriculture.

4.3.7.2 Avoidance of Impacts

The layout of the surface infrastructure has been designed with the intent to minimise disturbance and concentrate activities in areas previously disturbed by agricultural activities, minimise the clearing of remnant native vegetation and utilise existing access tracks where possible to ensure that no 'significant effect' would occur upon any threatened or migratory biota or their habitats.

4.3.7.3 Mitigation of Impacts

The Applicant would implement the following to mitigate disturbance of natural vegetation and threatened species habitat.

- Draft and implement the following plans to manage potential biodiversity impacts.
  - *Pest Animal Management Plan.*
  - *Weed Management Plan.*
  - *Fauna Management Plan.*
  - *Threatened Species Monitoring Plan.*
- Clearly mark-out the proposed disturbance footprint boundaries and identify vegetation to be cleared.
- Implement a hollow-bearing tree pre-clearance survey where a qualified professional inspects all hollows and immediate surrounds for any species prior to clearing activities. If any fauna is identified, these would be relocated to areas outside of the proposed disturbance footprint prior to clearing.
- Ensure machinery required for the Proposal remains existing on vehicular access tracks or within the proposed disturbance footprint, where practicable. Where this is not possible, machinery would be manoeuvred to avoid sapling or remaining canopy trees wherever possible.
- Place felled canopy trees in adjacent vegetation areas outside of the proposed disturbance footprint to improve existing habitats.
- Eradicate any identified noxious weed and other weed material encountered, ensuring that the weed is destroyed and/or removed using appropriate methods to ensure weeds do not spread into the remainder of the Project Site.
- Install sediment and erosion control structures where appropriate.
- Stabilise exposed soils to prevent potential erosion.

4.3.8 Assessment of Impacts

4.3.8.1 Introduction

This subsection presents an assessment of the anticipated Proposal-related impacts on listed flora and fauna species and communities within the Project Site. The residual impacts are presented assuming the adoption of the various measures outlined in Section 4.3.7.

4.3.8.2 Vegetation Communities

Of the four identified vegetation communities, 34ha out of the total 1 836ha of the 'Benson 103 – Poplar Box – Gum-barked Coolibah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion vegetation community' within the Project Site would be impacted upon by the Proposal. This equates to less than 2% of the Benson 103 vegetation community within the Project Site. EnviroKey (2014) concluded that the Proposal would not have a significant impact upon this vegetation community.

4.3.8.3 TSC Act Impact Assessment

Significance Assessments were undertaken by EnviroKey (2014) for the 22 fauna species identified in **Table 4.5** and listed under the TSC Act that were either known to, or have the potential to occur within the Project Site, concluding that, following the implementation of the measures outlined in Section 4.3.7, the Proposal is unlikely to have a significant effect on all identified threatened species.

4.3.8.4 EPBC Act Assessment

Significance assessments were undertaken by EnviroKey (2014) for the three threatened species identified in **Table 4.5** as listed under the EPBC Act that were either known to, or have the potential to occur within the Project Site, concluding that, following the implementation of the measures outlined in Section 4.3.7.the Proposal is '*unlikely*' to have a '*significant effect*' on the three threatened species.

Furthermore, although one migratory species that was recorded during the field survey (Rainbow Bee-eater), with a further four species identified as potentially occurring within the Project Site, the overall Project Site was considered to not comprise habitat to support these species. As such, the impacts from the Proposal are '*unlikely*' to impact the identified migratory species.

4.3.8.5 Matters of National Environmental Significance

No additional matters of National Environmental Significance were identified as being related to the Proposal.

4.3.9 Conclusion

EnviroKey (2014) has undertaken an assessment of significance of impact in accordance with *Draft Guidelines for Threatened Species Assessment* (DECCW and DPI July 2005) and the 7-part test of Section 5A of the EP&A Act. It is concluded from the assessment of significance of impact and the proposed management measures that the Proposal is unlikely to have a significant impact upon the identified species.

4.4 GROUNDWATER

The Groundwater Impact Assessment for the Proposal was undertaken by Environmental Strategies (ES). The full assessment is presented as ***Appendix 7*** *and is referred to hereafter as ES (2014). This subsection presents an overview of that assessment and should be read in conjunction with the full assessment.*

4.4.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to groundwater and their risk rankings after the adoption of standard mitigation measures are as follows.

- Reduction in groundwater discharge to surrounding creeks/rivers, adverse impacts on groundwater dependent ecosystems or surrounding groundwater users (low risk).
- Reduction in groundwater discharge to surrounding creeks/rivers, adverse impacts on groundwater dependent ecosystems or surrounding groundwater users (low risk).
- Discharge of poor quality groundwater to surrounding aquifers (low risk).

In addition, the DGRs identify "***Water Resources***", including groundwater, as a key issue, which includes groundwater, for assessment in the *Environmental Impact Statement*. The principal assessment matters from DP&E relating to noise matters includes the:

- identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*;
- an assessment of potential impacts on the quality and quantity of existing surface and groundwater resources;
- description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo;
- an annual site water balance for representative years of the proposed life of the Proposal; and
- a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from NOW, EPA and DRE. The additional matters identified are generally consistent with the DGRs, with the addition of the following.

- The impact of groundwater, including impact on groundwater dependant ecosystems and other water users (EPA).

- Groundwater impacts associated with mining operations … and long term recovery patters of groundwater and any bearing these may have on subsequent land uses in rehabilitation and mine closure phases (DRE).

Furthermore, the groundwater assessment for the Proposal was undertaken in accordance with the following guidelines.

- *Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting (*ANZECC & ARMCANZ, 2000).
- *Using the ANZECC Guideline and Water Quality Objectives in NSW* (DEC, 2000).
- *Aquifer Interference Policy* (DPI, 2012).

4.4.2 Hydrogeological Setting

4.4.2.1 Regional Hydrogeology

The Project Site is within the NSW Murray-Darling Basin (MDB) fractured rock groundwater source, in particular the Lachlan Fold Belt MDB groundwater source. This consists of a fractured rock aquifer with a low to moderate level of connection between surface water and groundwater.

Regional groundwater displays typically low yields and high salinity, with electrical conductivity (EC) levels generally between 20 000 and 25 000µs/cm (Green *et al*, 2011).

4.4.2.2 Local Hydrogeology

Groundwater within the immediate vicinity of Project Site is situated within rocks of the Girilambone Group with typically low primary permeability. Secondary permeability is controlled by fractures, faults and foliation within the strata. From observations at the nearby Girilambone Copper Mine and Tritton Copper Mine, secondary permeability is likely to be controlled by the dominant north-northeast trending foliation and faults, as well as bedding, which dip to the east-southeast.

Recharge of the regional groundwater system is thought to be primarily via rainfall infiltration; however, a component may come from infiltration through the base of drainage lines and rivers during periods of flow (*Green et al*, 2011).

As the result of a groundwater assessment of the Girilambone Copper Mine operations undertaken by OTEK Australia Pty Ltd (OTEK) in 2012 (OTEK, 2012), it was determined the standing water levels range between 8m to 127m below surface in bores located closest to the Project Site. It was also determined that from the bore construction notes, water bearing zones ranged from 41m to 59m below surface level and displayed a fracture permeability zone thickness of 6m. Surrounding groundwater users are described in further detail in Section 4.4.2.4.

4.4.2.3 Project Site Hydrogeology

Three groundwater monitoring bores exist within the Project Site (**Figure 4.2.** and **Table 4.9**).

Table 4.9
Groundwater Monitoring Bores

Local Bore ID	Works Request No.	Licence Number	Standing Water Level (SWL) below ground level (m)	Water Bearing Zone (m)	Total Depth (m)
AT001	GW805056	80BL620335	39.97	29-65	66.00
AT002	GW805057	80BL620336	35.95	47-53	54.00
AT003	GW805058	80BL620335	31.04	41-47	48.00
Source: ES (2014) - Table 5.1.					

4.4.2.4 Surrounding Groundwater Users

A review of the NSW Natural Resource Atlas identified 22 registered groundwater bores within a 20km radius of the Project Site (**Figure 4.1**). **Table 4.10** provides the standing water level, water bearing zone and total depth of each identified bore.

The nearest groundwater water supply bore (GW026890) that is registered for stock purposes is located approximately 8.5km southeast of the Project Site. Based on the drilling logs, this bore is screened within an unconsolidated formation and not within the fractured rock formation which the Proposal would intercept. The nearest water supply bore (GW002970), which is registered for stock purposes and within fractured rock aquifer is located approximately 15km to the east of the Project Site.

4.4.2.5 Groundwater Quality

Groundwater quality from the monitoring bores within the Project Site, collected monthly between November 2012 and March 2013, is summarised in **Table 4.11.**

These results are consistent with the Girilambone Copper Mine's groundwater monitoring results for March 2013, which may be summarised as follows.

- Salinity (measured as TDS) – approximately 13 000 mg/L.
- Electrical Conductivity – approximately 21 000µS/cm.

4.4.2.6 Groundwater Dependent Ecosystems

ES (2014) undertook a search of the Groundwater Dependent Ecosystems Atlas (Australian Government, Bureau of Meteorology, http://www.bom.gov.au/jsp/weave/gde.html), confirming that no groundwater dependant ecosystems exist within 150km of the Project Site. As a result, groundwater dependant ecosystems are not discussed any further in this document.

Table 4.10
Surrounding Groundwater Bores

Works Request No.	Licence Number	Depth to Water – Standing Water Level (SWL) (m)	Water Bearing Zone (m)	Total Depth (m)
GW805065	80BL620254	82.00	80 – 86	87.00
GW805066	80BL620254	127.00	125 – 131	132.00
GW042880	80BL106391	18.00	22 – 62	62.00
GW805061	80BL620307	24.00	30-36	37.00
GW805062	80BL620254	127.00	125 – 131	132.00
GW805064	80BL620254	64.10	75-81	82.00
GW803782	80BL245097	8.00	28-29	40.00
GW804384	80BL245970	N.R	31-39	43.00
GW803779	80BL245099	11.00	26-28	40.00
GW805063	80BL620255	26.77	125-131	132.00
GW804381	80BL245970	N.R	34-47	52.00
GW804379	80BL245970	N.R	47-52	61.00
GW804382	80BL245970	N.R	34-47	52.00
GW803780	80BL245100	10.60	31-32	40.00
GW803781	80BL245098	39.00	39-40	40.00
GW805059	80BL620337	11.78	15-21	22.00
GW804383	80BL245970	N.R	25-33	40.00
GW804380	80BL245970	N.R	55-57	61.00
GW805167	80WA716017	7.94	N.R	17.56
GW026890	80WA709380	N.R	22.30-22.90 & 26.10-27.50	27.40
GW805060	80BL620338	9.32	12-18	19.00
GW003006	N.R	N.R	N.R	86.00
GW002970	N.R	N.R	21.30	61.30
GW002685	N.R	N.R	26.2 – 32.0	86.90
GW805056*	80BL620335	39.97	29-65	66.00
GW805057*	80BL620336	35.95	47-53	54.00
GW805058*	80BL620335	31.04	41-47	48.00

Note 1: N.R indicates no result.
Note 2: * Indicates Project Site bores.
Source: ES(2014) – Table 5-1 & Table 5.2.

Table 4.11
Project Site Groundwater Quality

Works Request No.	Bore ID	Average pH	Average EC (μS/cm)	Total Dissolved Solids (TDS) (mg/L)
GW805056	AT001	7.7	20 560	12 920
GW805057	AT002	7.6	23 660	14 680
GW805058	AT003	7.8	21 480	13 340

Source: ES (2014) - Table 6.1.

4.4.3 Groundwater Use and Supply

Groundwater within the adjacent and surrounding areas is typically used for monitoring or stock purposes. Due to the low yields and high salinity values, the groundwater is of marginal use for stock watering, based upon the ANZECC & ARMCANZ (2000) guidelines that state water with TDS levels over 10 000mg/L is generally unsuitable for stock use.

4.4.4 Assessment Methodology

4.4.4.1 Introduction

ES (2014) undertook an assessment of groundwater-related impacts associated with the Proposal using two alternative methodologies as follows.

- A qualitative assessment based on a review of groundwater inflows to the Applicant's other mining operations at the Girilambone and Tritton Copper Mines.
- A quantitative assessment based on the following.
  - Theis Equation – 1935.
  - Cooper-Jacob Equation – 1946.
  - Thiem Equation – 1906.

This subsection provides a description of the conceptual model that was developed by ES (2014) to describe the hydrogeological setting of the proposed mine, as well as an overview of each of the above assessment methodologies.

4.4.4.2 Conceptual Model

As noted in Section 4.4.2.1, the proposed mine is located within the Lachlan Fold Belt MDB groundwater source. The aquifer that would be intersected by the proposed mine may be described as follows.

- Fractured rock aquifer with limited primary permeability and porosity. Groundwater is typically hosted in localised fractures, potentially with limited interconnectivity.
- ES (2014) note that monitoring bores within the Project Site have been installed to approximately 66m below surface. As the proposed mine would extend to approximately 500m below surface, ES (2014) have conservatively assumed that the observed fracture density in the monitoring bores extends to the base of the mine. In reality, fracture density and permeability is likely to decrease with depth. ES (2014) have assumed cumulative water bearing fracture zone thickness of 1m every 100m vertically, totalling a saturated thickness of 5m.

- Limited interconnection between surface water and groundwater. As a result, rainfall and evaporation have not been considered.
- Limited groundwater would be removed with the ore and waste rock. As a result, the modelling has assumed the all groundwater inflows would report to the mine sump and would be required to be pumped from the mine.

4.4.4.3 Qualitative Assessment

ES (2014) note that each of the Applicant's mining operations are in similar hydrogeological settings, namely fractured rock aquifers with variable levels of interconnectivity between fractures. As a result, measured groundwater inflows to the existing mines are likely to be a reasonable approximation for the likely inflows that would be expected at the proposed mine. The Applicant has measured the volume of water pumped into and out of the Tritton Copper Mine since May 2010, with the difference between these volumes presumed to be attributable to groundwater inflow to the mine. During the period May 2010 to May 2014, the average annual groundwater inflow was 111ML per year, with monthly inflows varying between nil and 16ML. This variation is likely to be a reflection of the fact that groundwater in flows are likely to be greatest when a fracture zone is first intersected, with flow rates decreasing once the fracture zone has been dewatered.

Flow rates have been estimated for each of the Girilambone Copper Mine operations. **Table 4.12** presents the Applicant's estimated annual groundwater inflow for each of the existing mining operations.

Table 4.12
Estimated Groundwater Inflow

Mining Operation	Measured Annual Inflow	
Larsons Open Cut/Underground	17ML	104ML
North East Open Cut	87ML	
Hartmans Open Cut	-	
Murrawombie Open Cut	130ML	
Tritton Underground Mine	111ML	
Source: ES (2014) – After Table 13.		

4.4.4.4 Quantitative Assessment

Limitations Associated with Quantitative Assessments

The quantitative assessment undertaken by ES (2014) relies on the equations identified in Section 4.4.4.1. These equations attempt to approximate the real-world hydrogeological setting of the proposed mine and then impose a simulated "well" on that aquifer to estimate likely groundwater impacts. As a result, a number of assumptions and approximations are required. **Table 4.13** summarises the key assumptions and approximations that relate to the Proposal and the assessment undertaken by ES (2014) and provides commentary in relation to how each may vary from the actual hydrogeological setting. It is noted that these assumption tend to overstate the extent and connectivity of the aquifer and, as a result, the quantitative assessments are likely to be moderately to highly conservative.

Table 4.13
Groundwater Assumptions and Approximations

Parameter	Assumption/Approximation	Comment
Saturated aquifer thickness	1m/100 vertical metres for a total of 5m over proposed 500m vertical extent of workings.	
Aquifer extent	Infinite	Limited connectivity between fractures likely to limit aquifer extent.
Aquifer parameters	Homogenous	Fracture density would vary within the aquifer.
	Isotropic	Fractures likely to have a preferred orientation, therefore aquifer would be anisotropic.
	Uniform thickness	Aquifer thickness is likely to vary.
Existing piezometric surface	Horizontal	The piezometric surface is likely to broadly reflect the existing surface topography.
Rate of dewatering	Constant	Dewatering rate is likely to vary as new water-filled fractures are intersected and then become dewatered (see Section 4.4.4.5).
Source: ES (2014) – After Section 14.3.2.		

Table 4.14 presents the assumed rate of underground development based on the mine schedule prepared by the Applicant at the time the groundwater assessment was undertaken. The Applicant subsequently revised the mining schedule, reducing the life of the mining operations from 63 months or 5.25 years to 48 months or 4 years. The Applicant contends that this would not significantly impact on the groundwater assessment as the mine plan, including depth of extraction, would not change.

Table 4.14
Modelled Rate of Underground Development

Month[1]	Depth of Underground Development (m below surface)
6	100
15	200
27	300
42	400
63	500
Note 1: Following commencement of decline development.	
Source: ES (2014) – After Table 11.1.	

Aquifer Parameters

Table 4.15 presents the aquifer parameters used by ES (2014) during the quantitative groundwater assessment.

Table 4.15
Aquifer Parameters

Parameter	Value 1[1]	Value 2[1]
Hydraulic Conductivity (m/day)	0.483	0.781
Specific Storage	4.563×10^{-6}	1.565×10^{-6}
Transmissivity (m^2/day)	2.415	3.905
Storativity	2.2815×10^{-5}	7.825×10^{-6}
Note 1: Based on pump test results at the Girilambone Copper Mine for close (Value 1) and distant (Value 2) monitoring bores.		
Source: ES (2014) – After Tables 13.1 and 13.2.		

Theis Equation

The Theis Equation is as follows. This equation was used to estimate the volume of groundwater that would flow into the proposed mine and the extent of the cone of drawdown.

$$s = \frac{Q}{4\pi T} W(u)$$

$$u = \frac{r^2 S}{4Tt}$$

Where:

Q= m^3/day
s= drawdown (m)
T= transmissivity (m^2/day)
W= Theis well function
r= radius (m)
S= storativity (dimensionless)
t= time (days)

Cooper-Jacob Equation

The Cooper-Jacob Equation is based on the Theis Equation and is as follows. This equation was also used to estimate the volume of groundwater that would flow into the proposed mine and the extent of the cone of drawdown.

$$s = \frac{2.3Q}{4\pi T} log \frac{2.25Tt}{r^2 S}$$

Where:

Q= m^3/day
s= drawdown (m)
T= transmissivity (m^2/day)
r= radius (m)
S= storativity (dimensionless)
t= time (days)

Thiem Equation

The Theim Equation is as follows. This equation was used to estimate the extent of the cone of groundwater drawdown based on the volumes of groundwater that would flow into the proposed mine determined by the Theis and Cooper-Jacob Equations.

$$Q = \frac{2\pi T(s_1 - s_2)}{2.3Log(r_2/r_1)}$$

Where:

Q= m^3/day
s= drawdown (m)
T= transmissivity (m^2/day)
r= radius (m)
S= storativity (dimensionless)
t= time (days)

4.4.5 Management and Mitigation Measures

The Applicant would implement the following to mitigate the potential for adverse groundwater-related impacts.

- Prepare and implement a *Water Management Plan* prior to the commencement of site establishment and construction operations. The plan would describe management of the following.
  - Sediment and erosion control.
  - Hydrocarbons and chemicals.
  - Water balance, including separation of clean, dirty and mine water and monitoring of water flows within the Project Site.
  - Surface water and groundwater monitoring.
- Store all hydrocarbon and chemical products within a bunded area complying with the relevant Australian Standard.
- Refuel all equipment within designated, sealed areas of the Project Site, where practicable.
- Undertake all maintenance works involving hydrocarbons, where practicable, within designated areas of the Project Site such as the 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 or bunded with an impermeable surface and a capacity to contain a minimum 110% of the largest storage tank capacity.

- Ensure that volumes of water pumped into and out of the proposed mine are monitored and recorded to enable net groundwater inflows to be determined.
- Ensure that standing water levels in surrounding monitoring bores and groundwater inflow rates to the proposed mine are monitored monthly and should the actual groundwater inflows or reduction in standing water levels be greater than that assessed, ensure that the advice of a suitable qualified hydrogeologist is sought.

4.4.6 Assessment of Impacts

4.4.6.1 Groundwater Inflows

Table 4.16 presents the groundwater inflow results derived from the qualitative and quantitative groundwater assessments using the methodologies identified in Section 4.4.4.

Table 4.16
Qualitative and Quantitative Groundwater Inflow Results

Month	Qualitative Assessment	Quantitative Assessment							
		Theis Equation				Cooper-Jacob Equation			
		Scenario 1		Scenario 2		Scenario 1		Scenario 2	
	ML/y	ML/d	ML/y	ML/d	ML/y	ML/d	ML/y	ML/d	ML/y
6	104 to 130	0.18	66	0.26	95	0.18	66	0.26	95
15		0.43	157	0.61	223	0.43	157	0.61	223
27		0.65	237	0.94	343	0.65	237	0.94	343
42		0.87	318	1.26	460	0.87	318	1.26	460
63		1.07	392	1.55	567	1.07	392	1.55	567
Source: ES (2014) – After Tables 14.4 and 14.6 and Section 14.2.									

In summary, the quantitative analysis suggests that groundwater inflows would gradually increase from between 0.18ML/d and 0.26ML/d to between 1.07ML/d and 1.55ML/d. This equates to a maximum annual groundwater inflow of between 392ML/y and 566ML/y. However, ES (2014) note that for the reasons identified in Section 4.4.4.4, the quantitative assessment is likely to significantly overestimate the actual groundwater inflows to the proposed mine. As a result, ES (2014) propose that the measured inflows from the Applicant's existing mining operations should be used as a likely approximation of actual inflows to the proposed mine, namely, that the likely maximum inflow to the proposed mine are likely to be 111ML/y.

4.4.6.2 Groundwater Drawdown

Table 4.17 presents the extent of groundwater drawdown at the end of the proposed life of the mine. These results are derived from the quantitative groundwater assessments using the methodologies identified in Section 4.4.4. For the purposes of this summary, the limit of groundwater drawdown is the distance from the centre of the proposed mine to the point where the modelled drawdown is less than 1m.

Table 4.17
Quantitative Groundwater Drawdown Results

Scenario	Groundwater Inflow		Modelled Drawdown (km)		
			Theis Equation	Cooper-Jacob Equation	Thiem equation
	ML/d	ML/y			
Scenario 1	1.07	392	35.0 to 44.5	20.4 to 21.1	21.1
Scenario 2	1.55	567	67.6 to 94.5	42.9 to 45.8	45.7
Source: ES (2014) – After Tables 13-5, 13-7 and 13-8.					

In summary, the predicted drawdown is expected to be between 20.4km and 44.5km from the centre of the proposed mine for Scenario 1 and between 42.9km and 4.5km for Scenario 2. The (ES(2014), however, note that this is likely to be a very significant overestimate of the actual extent of groundwater drawdown because it is highly unlikely that there would be fracture connectivity over the sort of distances identified by the modelling. Rather, it is likely that fracture connectivity and therefore the extent of drawdown would be limited to a much smaller distance. Furthermore, the Applicant's existing operations do not show the degree of drawdown suggested by the quantitative modelling. As a result, ES (2014) suggest that the maximum groundwater drawdown would be approximately 20.4km.

4.4.6.3 Groundwater Quality

ES (2014) and the Applicant note the following in relation to existing groundwater quality and matters with the potential to adversely impact on groundwater quality.

- Groundwater within and surrounding the Project Site is of poor quality, with limited beneficial uses.
- Hydrocarbons and other chemicals would be stored and used in accordance with the commitments in Section 4.4.5 and relevant industry and other standards.
- The contaminated water circuit would be managed as described in Section 2.6.
- During mining operations dewatering of the proposed mine would ensure that the groundwater gradient would be towards the mine.

In light of the above, ES (2014) and the Applicant contend that the Proposal would not adversely impact on groundwater quality during or following the life of the Proposal.

4.4.6.4 Groundwater Users

ES (2014) note that there are limited groundwater users in the vicinity of the Project Site (see Section 4.4.2.4) and that the groundwater has limited beneficial uses. As a result, the Proposal is unlikely to adversely impact on groundwater users surrounding the Project Site.

4.4.6.5 Groundwater Dependent Ecosystems

ES (2014) note that the closest high priority groundwater dependent ecosystem or groundwater outflow zone is more than 150km from the Project Site. As a result, the Proposal is unlikely to adversely impact on any groundwater dependent ecosystems.

4.4.7 Licensing Requirements

ES (2014) recommend the Applicant obtain an aquifer interference approval under the *Water Management Act 2000* to permit construction of the proposed mine and extraction of up to 111ML per year. The Applicant notes that it holds a range of licences and approvals permitting extraction of groundwater from its current operations. A proportion of the allocations associated with those licences and approvals may be reallocated to the Proposal. Alternatively, the Applicant would ensure that an adequate allocation would be purchased prior to intersection of groundwater within the proposed decline

4.4.8 Groundwater Monitoring

The Applicant would continue monitoring the existing monitoring bores monthly, with the results reported in the *Annual Environmental Management Reports* for the Proposal.

4.5 NOISE

The Noise Impact Assessment for the Proposal was undertaken by EMGA Mitchell McLennan (EMM). The full assessment is presented as ***Appendix 8*** *and is referred to hereafter as EMM (2014). This subsection presents an overview of that assessment and should be read in conjunction with the full assessment.*

4.5.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to noise factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Amenity impacts on residential and other sensitive residences (including infrasound) (low risk).
- Health impacts on residential and other sensitive residences (including infrasound) (low risk).
- Amenity impacts on residential and other sensitive residences (low risk).

In addition, the DGRs identify "***Noise***" as a key issue for assessment in the *Environmental Impact Statement*. The principal assessment matters from DP&E relating to noise matters includes the:

> "assessment of the potential impacts of the proposal during the establishment, operation and decommissioning of the proposal, particularly any potential noise and vibration impacts on nearby private receptors due to construction, operation and road haulage"

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from EPA. The additional matters identified are generally consistent with the DGRs.

The DGRs require that the noise assessment refer to the following guideline documents.

- The *NSW Industrial Noise Policy* (EPA, 2000).
- The *NSW Road Noise Policy* (EPA, 2011).
- The *Interim Construction Noise Guideline* (DECC, 2009).

4.5.2 Existing Noise Climate

4.5.2.1 Introduction

The existing meteorological and acoustic environment surrounding the Project Site has been reviewed in order to determine the atmospheric conditions under which noise modelling is required, as well as to establish noise criteria at representative receivers surrounding the Project Site and adjacent to the transport routes. The following subsections provide a summary of the existing noise sources and meteorological and acoustic conditions.

4.5.2.2 Existing Noise Sources and Identified Residences

The Project Site is situated in a rural area and is sparsely populated. As such, the existing acoustic environment of the Project Site is characterised by rural noise sources such as agricultural machinery, stock, birds, traffic on local roads, particularly the Mitchell Highway, wind generated noises.

Figure 4.5 identifies the privately-owned residences surrounding the Project Site that may potentially be impacted by Proposal-related noise. It should be noted that due to the distance between the Project Site and the village of Girilambone, it is anticipated that noise impacts at Residences R1, R2 and R5 would be greater than impacts within the village and as such, residences within the village have not been assessed.

Table 4.18 presents the co-ordinates of relevant residences and distance to the closest disturbance within the Project Site from these residences.

Table 4.18
Identified Noise Residences

Residence	Easting	Northing	Distance to closest Disturbance (km)
R1	488604	6545101	5.0
R2	488804	6545250	5.0
R3	485502	6550984	2.4
R4	487827	6553240	5.3
R6	489237	6545308	5.5
R7	482857	6543708	5.6
Source: EMM (2014) - Table 2.1.			

4.5.2.3 Meteorological Conditions

Due to the lack of available local meteorological information, a following range of worst-case meteorological parameters were assumed, consistent with those prescribed within the guideline documents identified within parenthesis below.

- Wind – Worst-case wind conditions were adopted for each residence at 3m/s wind speed from the direction of the noise source (*NSW Industrial Noise Policy*)
- Temperature Inversions – The *NSW Industrial Noise Policy* requires that for areas classed as arid/semi-arid (i.e. areas with <500mm average rainfall), that a 'G' Class Stability should be used.
- Drainage Flow Winds – Considered applicable for Residences R1 to R5 but not for R6 and R7 due to intervening topography.

4.5.2.4 Background Noise Levels

In the absence of background noise data and the generally rural nature of the Project Site, the default background noise level as identified within the *NSW Industrial Noise Policy* of 30dB(A) was adopted for all residences surrounding the Project Site for all noise assessment periods.

4.5.3 Environmental Noise Criteria

4.5.3.1 Introduction

The following subsections summarise the noise criteria that were used to assess the potential noise vibration impacts of the Proposal on the surrounding environment.

4.5.3.2 Operational Noise Criteria

The Industrial Noise Policy specifies two noise criteria:

- an *intrusiveness criterion* which limits L_{Aeq} noise levels from the industrial source to a value of 'background plus 5dB(A); and
- an *amenity criterion* which aims to protect against excessive noise levels where an area is becoming increasingly developed.

Table 4.19 applies the intrusiveness and amenity noise criteria to the Proposal, with the Project Specific Noise Level also included as this would be formed and implemented as the result of the lowest noise level from the intrusive or amenity criteria.

Table 4.19
Industrial Noise Policy Criteria

Intrusive Criteria			
Residence	**Time Period**	**Rating Background Level (RBL), dB(A)**	**Criteria dB(A)($L_{Aeq(15min)}$)**
All Residences	Day	30	35
	Evening	30	35
	Night	30	35
Amenity Criteria			
Residence	**Time Period**	**Recommended Noise Level dB(A) Acceptable**	**Recommended Noise Level dB(A) Maximum**
All Residences	Day	50	55$L_{Aeq(period)}$
	Evening	45	50$L_{Aeq(period)}$
	Night	40	45$L_{Aeq(period)}$
Project Specific Noise Level			
Residence	**Time Period**	**Recommended Noise Level dB(A) Acceptable**	**Criteria dB(A)($L_{Aeq(15min)}$)**
All Residences	Day	30	35
	Evening	30	35
	Night	30	35
Source: EMM (2014) - Tables 3.1 to 3.4.			

4.5.3.3 Sleep Disturbance Criteria

The EPA recommends an $L_{A(1\text{-minute})}$ sleep disturbance criterion at the facade of a residence should be the Rating Background Level plus 15dB(A) during the night-time period (10:00pm to 7:00am). Therefore, based upon the Rating Background Level of 30dB(A), EMM (2014) has adopted a sleep disturbance criterion of 45dB(A) L_{max} for all residences.

4.5.3.4 Road Traffic Noise Criteria

The road traffic and noise assessment was conducted in accordance with the *NSW Road Noise Policy* with the Mitchell and Barrier Highway's being defined as "freeway/arterial/sub-arterial" with Booramugga and Yarrandale Roads being defined as a "local road" type. **Table 4.20** presents the relevant road noise criteria for each identified road type.

Table 4.20
Road Traffic Noise Assessment Criteria for Residential Land Uses

Type of Development	Noise Level Criterion	
	Day	Night
Arterial or sub-arterial roads	$L_{Aeq,15hr}$ 60dB(A)	$L_{Aeq,9hr}$ 55dB(A)
Local Roads	$L_{Aeq,1hr}$ 55dB(A)	$L_{Aeq,1hr}$ 50dB(A)
Source: Modified after EMM (2014) - Table 3.6.		

4.5.4 Assessment Methodology

4.5.4.1 Site Establishment and Noise and Operational Noise

Assessment of site establishment/construction and operational noise was conducted using *Brüel and Kjær Predictor Version 8.14* noise prediction software that calculates total noise levels at residences from the concurrent operation of multiple noise sources. Noise modelling was based on three-dimensional digitised ground contours of the surrounding land and over the two operational scenarios, namely a site establishment and construction phase and an operational phase, for the Proposal. The model for each scenario was developed by placing the various noise sources (of known sound power levels) in typical/worst case locations as shown diagrammatically on **Figure 4.11.** It should be noted that the ventilation fan was identified as potentially being a 'low frequency' noise component and a 5dB penalty was applied in accordance with the requirements outlined within the *NSW Industrial Noise Policy*.

Table 4.21 provides the identified noise sources used in the modelling, as well as providing the associated sound power levels for each piece of equipment.

4.5.4.2 Traffic-related Noise

The traffic noise assessment was undertaken by adopting the closest identified residence on the identified road and assessing the Proposal-related noise impacts at that residence, noting that if the results complied with the relevant criteria, the remaining residences along the transport route would also comply during both the site establishment/construction and operational phases. The assessment was undertaken using the Calculation of Road Traffic Noise (UK Department of Transport) method and was based upon a maximum of 80 road train (heavy vehicle) movements and 60 employee (light vehicle) movements per day on any road. Section 5.5 of EMM (2014) provides detailed information regarding road traffic scenarios.

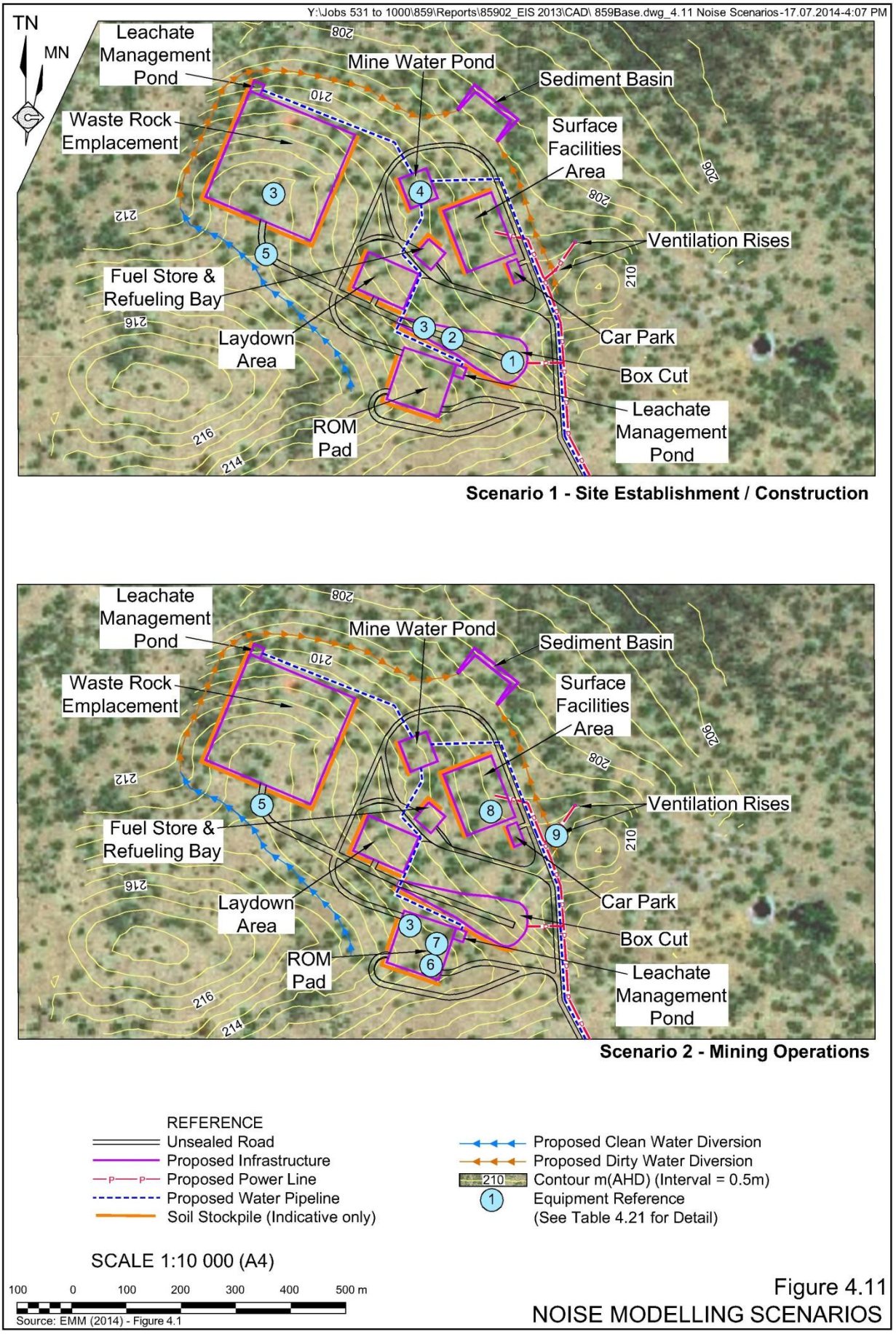


Figure 4.11
NOISE MODELLING SCENARIOS

Table 4.21
Equipment for Noise Modelling

Equipment Description	Noise Modelling Reference	Units		Lw, $L_{eq(15\text{-}min)}$, dB(A)
		Site Establishment/ Construction	Mining Operations	
Blast drill rig	1	1	0	115
Excavator	2	1	0	107
Haul truck - 50 t	3	2	1	111
Bulldozer	4	1	0	111
Grader - Cat 14H	5	1	1	104
Road train	6	0	1	102
Front-end loader (FEL) - Cat 998	7	0	1	108
Generator - 800KVa	8	0	1	113
Ventilation fan - 500 kW/1.5 kPa	9	0	1	104
Note 1: See Figure 4.11 for equipment locations.				
Note 2: Table 2.3 notes that two haul trucks would be utilised during mining operations. However, only one would typically operate on the surface at any one time.				
Source: Modified from EMM (2014) – Tables 4.1 and 4.2.				

The closest distance of a residence being to the centre line of a road utilised for the Proposal is as follows.

- Booramugga and Yarrandale Roads (Operational Phase) – 700m.
- Mitchell Highway (Girilambone Village) (Operational Phase) – 15m.
- Mitchell Highway (Site Establishment and Operational Phase) – 15m.
- Barrier Highway (Site Establishment and Operational Phase) – 15m.

Existing road traffic noise data for Booramugga and Yarrandale Roads were obtained from the "*Road Train Noise Assessment*" prepared by Bridges Acoustics in October 2013 (Bridges, 2013) for Tritton's Girilambone Mine. The road traffic noise assessment also took into account the proposed modification to Girilambone Copper Mine transport operations (increase from 3.3 movements per hour to 14 movements per hour currently before Bogan Shire Council. As such, two Girilambone Copper Mine cumulative transport scenarios were undertaken to calculate noise generated from future truck movements as follows.

1. The existing road traffic noise level (including Girilambone Copper Mine's current transport operations) combined with road traffic noise level associated with the Proposal.
2. Potential future ambient road traffic noise level (assuming a modification of the approval for Girilambone Copper Mine's current transport operations) combined with road traffic noise level associated with the Proposal.

4.5.5 Management and Mitigation Measures

The Applicant would implement the following noise management and mitigation measures throughout the life of the Proposal.

- Strictly comply with the proposed hours of operation identified in **Table 2.11**.
- Regularly service all on-site equipment to ensure sound power levels of each item remains at or below the default/or factory-set values.
- Install frequency modulated reversing alarms to all mobile equipment.
- Ensure that all truck drivers would be required to comply with the Applicant's Drivers Code of Conduct outlining procedures for reducing noise impacts during transportation within the Project Site and off site.
- Maintain an open dialogue with the surrounding community and neighbours to ensure any concerns over noise or vibration are addressed.

4.5.6 Assessment of Impacts

4.5.6.1 Site Establishment and Construction Noise

The predicted noise levels assessed within the site establishment and construction phase under worst-case meteorological scenario conditions identified that all residences would comply with the relevant criteria.

4.5.6.2 Operational Noise

The predicted noise levels assessed with the operational phase under worst-case meteorological scenario conditions identified that all residences would comply with the Project Specific Noise Level operational noise criteria of 35dB(A). Furthermore, EMM (2014) determined that cumulative noise emissions associated with the Proposal and the Girilambone Copper Mine would be insignificant.

4.5.6.3 Sleep Disturbance

Maximum noise levels at all residences were modelled under the same worst-case meteorological conditions as for the operational scenario, identifying that L_{max} noise levels associated with road train loading operations satisfied the sleep disturbance criteria at all residences.

4.5.6.4 Road Traffic Noise

The predicted noise levels, under both cumulative transport scenarios between the Proposal and the Girilambone Copper Mine identified that the predicted road traffic noise levels satisfy the *NSW Road Noise Policy* criteria at all residences on Booramugga and Yarrandale Roads and along the Mitchell and Barrier Highways.

4.6 BLASTING AND VIBRATION

The Blasting and Vibration Assessment was included as part of the Noise Impact Assessment for the Proposal and was undertaken by EMGA Mitchell McLennan (EMM). The full assessment is presented as ***Appendix 8*** *and is referred to hereafter as EMM (2014). This subsection presents an overview of that assessment and should be read in conjunction with the full assessment.*

4.6.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to noise factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Amenity impacts on residential and other sensitive residences (low risk).
- Flyrock ejected outside blast envelope resulting in damage to nearby residences / surrounding property / infrastructure / stock (low risk).
- Flyrock ejected outside blast envelope resulting in injury or death (low risk).
- Flyrock and airblast impacting upon airborne aircraft and aerial operations (low risk).

Whilst blasting is not specifically outlined within the DGRs as requiring particular assessment, it was identified within the risk assessment that blasting poses a low risk and as such, blasting studies were undertaken as a component of the noise and vibration assessment and have been addressed separately within this section of the *Environmental Impact Statement*.

4.6.2 Blasting Criteria

The EPA adopts blasting assessment criteria based on the human comfort criteria identified in the document *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990* published by the Australian and New Zealand Environment and Conservation Council (ANZECC, 1990). These criteria have been adopted for blasting for the Proposal and are as follows.

- The recommended maximum overpressure level for blasting is 115dB(L).
- The level of 115dB(L) may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 120dB(L) at any time.
- The recommended maximum vibration velocity for blasting is 5mm/s Peak Particle Velocity (PPV).
- The PPV level of 5mm/s may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 10mm/s at any time.

4.6.3 Assessment Methodology

As specific details relating to the Maximum Instantaneous Charge that would be required to construct the box cut and portal to access the underground mining operations were not available at the time of completion of EMM (2014), the blasting assessment assumed a very conservative Maximum Instantaneous Charge of 1000kg. The closest residence (Residence R3 at 2 400m away from the proposed box cut and portal location) was used during the assessment, with more distant residences likely to receive lower vibration and air blast impacts than those modelled. It is recognised that the actual Maximum Instantaneous Charge would be significantly less than the modelled Maximum Instantaneous Charge of 1000kg. However, if compliance is met at 1000kg, it is assumed any blasts less than 1000kg would be well below all blasting criteria.

Blast overpressure and vibration results were calculated using the method given in the Australian Standard *AS2187-2: Explosives – Storage and use Part 2: Use of explosives*, (2006) and ICI Explosives Blasting Guide, as applicable to blasting in hard rock.

4.6.4 Assessment of Impacts

The blast overpressure and vibration calculations identified that the use of a Maximum Instantaneous Charge of 1 000kg or less would result in compliance with the ANZECC blasting criteria at the nearest Residence R3 as displayed in **Table 4.22**.

Table 4.22
Blast Calculations at 1 000kg Maximum Instantaneous Charge

Distance to Residence R3 (m)	Maximum Instantaneous Charge (kg)	Derived overpressure (dB(L)peak)	Derived vibration PPV (mm/s)
2 400	1 000	107	5
Criteria		**115**	**5**
Source: Modified from EMM (2014) - Table 5.4			

It has also been assessed that due to the distance between privately-owned residences and the proposed box-cut, no issue would occur with regards to flyrock or blast fumes. Should blast fumes be visible at surrounding residences, the Applicant would undertake a review of the blast in question and discuss with the blasting contractor to identify the issue and ensure that it is not repeated should further blasts be required.

4.6.5 Monitoring

The Applicant would ensure that initial blasts are monitored to determine compliance with the criteria identified in Section 4.6.2 at distances less than 2.4km from the box cut. Once compliance has been demonstrated, monitoring would be discontinued.

4.7 HISTORIC HERITAGE

The historic heritage assessment of the Proposal was undertaken by OnSite Cultural Heritage Management Pty Ltd (OnSite CHM). The full assessment is presented in ***Appendix 9*** *and is referenced throughout this section as OnSite CHM (2014b), with a summary of the assessment presented in the following subsections.*

4.7.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to historic heritage and their risk rankings after the adoption of standard mitigation measures are as follows.

- Impact to known European heritage sites within the Project Site (low risk).

In addition, the DGRs identify "***Historic Heritage***" as a key issue for assessment in the *Environmental Impact Statement*. The principal assessment matter from DP&E relating to historic heritage matters include a historic heritage assessment which must include a statement of heritage impact for any state significant or locally significant historic heritage items.

4.7.2 Historical Record

The area surrounding the Project Site was first explored in 1828 by Charles Sturt who named the Bogan River, with Major Mitchell further exploring and surveying the area in 1835. The municipality of Bogan was proclaimed on 17 February 1891, with Nyngan having a population of 1 355 in that year. The wider Bogan Shire was incorporated in 1906.

The earliest retrievable records indicate that land within the southern section of the Project Site was owned by Mr Kenneth MacKinnon in 1910, with a total of 4 087 acres. The land was utilised not only for grazing but also for mining or at least mineral prospecting (OnSite CHM, 2014b).

Land within the northern section of the Project Site comprised part of a wider 1 575 acres that in 1910 was under the control of Mr Henry Thorpe, with the land also used for both grazing and mining purposes.

Throughout the 20th Century until present, the area surrounding the Project Site was utilised intermittently for agricultural purposes, with the continuation of localised mining operations associated with historic copper deposits and from the 1980s onwards, commencement of modern mining operations.

4.7.3 Background Research

A search of the following historic-heritage databases was undertaken on 26 May 2014.

- The Commonwealth Department of Environment website for items on the Australian Heritage Database including the National Heritage List, Commonwealth Heritage List and Register of the National Estate.

- Office of Environment and Heritage Database – for items listed under the:
  - State Heritage Register as administered by the Heritage Council of NSW and under the statutory protection of the *NSW Heritage Act 1977*; and
  - State Heritage Inventory – this includes items listed by local government and State agencies.
- *Bogan Shire Local Environmental Plan 2011*.

The results of the database searches identified that no of Federal, State or locally identified historic heritage places or items are registered within the Project Site.

4.7.4 Survey Methodology

Further to the background database searches, a field survey was conducted by OnSite CHM in association with the Aboriginal heritage surveys. The methodology for both surveys is fully described previously in Section 4.2.6.

4.7.5 Survey Results

OnSite CHM (2014b) identified three historic heritage sites, namely Avoca Tank 4, Avoca Tank 6 and Avoca Tank 7 (**Figure 4.8**). Details of each site are included in **Table 4.23** and locations shown on **Figure 4.8**.

Table 4.23
Historic Heritage Sites

Site Name	Site Features	Easting	Northing
Avoca Tank 4	Historic Scar Tree and Aboriginal Stockman's camp	55 485027	6547775
Avoca Tank 6	Historic glass fragment	55 485381	6548386
Avoca Tank 7	Historic glass bottle (1939)	55 484392	6549640
Source: OnSite CHM (2014b) – Table 5.1.			

Avoca Tank 4 was also recorded as a site of the same name as part of the Aboriginal heritage assessment. Avoca Tank 4 comprises the following historical heritage components:

- A likely man-made or modified natural waterhole.
- An earthenware ceramic jar and flattened tin can.
- Three blackened rocks, likely used as part of a campfire.
- An iron strip wedge, which may have been for bark extraction or for locking of cart wheels in place.
- A scar tree with sharp, straight and even edged axe marks, indicating the use of a steel axe.

The Aboriginal community members participating in the survey were of the opinion that the Avoca Tank 4 site represented the remains of an Aboriginal stockmen's camp. During the early years of European settlement and pastoral activity, Aboriginal people remaining in the area were widely employed as stockmen which included practices of clearing lands and ring barking trees.

Both Avoca Tank 6 and Avoca Tank 7 represent isolated finds likely reflecting a low level of pastoral activity.

4.7.6 Mitigation Measures

The Applicant would implement the management and mitigation measures identified in Section 4.2.9, as well as the following additional measures.

- Ensure Avoca Tank 4 is fenced with a suitable buffer for the life of the Proposal.
- Ensure that mine site personnel are aware of the location of Avoca Tank 4 and provide the location of the site on mine plans.
- Ensure all work crews would be informed that the fenced area are "no-go" areas for the duration of the works.
- Ensure that mine site personnel do not disturb historic artefacts at Avoca Tank 6 and Avoca Tank 7.
- Ensure that mine site personnel report any additional historic finds they may find and not remove or disturb historic artefacts.

Avoca Tank 6 and Avoca Tank 7 are of considerable distance from the Proposed Limit of Disturbance and would not be impacted by the Proposal.

4.7.7 Assessment of Impacts

Avoca Tank 4 is deemed to have a moderate to high level of cultural significance (Aboriginal and archaeological significance). The scar tree has rarity value due to their steady state of decline within the natural environment and vulnerability to destructive natural and biological elements. Whilst the explanation for the site as an Aboriginal stockman's camp remains anecdotal, it is a plausible explanation for the presence of the different features and as such, is relatively rare in the immediate area. Avoca Tank 4 is therefore considered significant at the local level with both Avoca Tank 6 and 7 assessed to be of low significance.

Based upon the avoidance of all historic heritage sites, including the implementation of the outlined mitigation measures for Avoca Tank 4, it has been determined that there would be a negligible impact upon the local or regional historic heritage as a result of the Proposal.

4.8 AIR QUALITY

The air quality assessment for the Proposal was prepared by RW Corkery & Co Pty Limited based on experience with similar mining projects in western NSW.

4.8.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to air quality factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Amenity impacts on residents and other sensitive residences (low risk).
- Health and / or amenity impacts on residential and other sensitive residences (low risk).
- Increased dust load on crops on surrounding agricultural land (low risk).

In addition, the DGRs identify **"Air Quality"** as a key issue for assessment in the *Environmental Impact Statement* with the principal assessment matter from DP&E being that

> "The EIS must describe what measures would be implemented to avoid, minimise, mitigate, offset, manager and/or monitor the potential impacts on Air Quality, particularly any potential dust impacts on nearby private receptors from construction, operation and road haulage."

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from EPA. The additional matters identified are generally consistent with the DGRs.

The DGRs require that the air quality assessment refer to the following guideline document.

- *Approved Methods for Sampling and Analysis of Air Pollutants* (DEC, 2007)

The following subsections consider the existing environment, the sources of dust emissions, proposed management measures and impact assessment. In light of the rural and isolated location of the Project Site, and the fact that the only seven residences are located within 5km of the Project Site, it is not considered necessary to undertake air quality modelling to complete an assessment of the likely impact of the Proposal. Rather a qualitative air quality assessment, focussing on the potential impacts of principal pollutants, has been prepared.

It is noted that emissions to the air associated with construction and operation of the water pipeline and power transmission line would be limited and short-term in nature. As a result, air quality emissions associated are not included in this assessment.

In addition, it is also noted that the proposed activities and their associated greenhouse gas emissions would be limited in nature and would largely replace activities that are currently being undertaken at the Applicant's Girilambone Copper Mine. In light of this, assessment of greenhouse gas emissions has not been undertaken

4.8.2 Existing Environment

4.8.2.1 Introduction

Air quality surrounding the Project Site is typical of an outback/rural environment where influences are determined principally by the season, the extent and nature of surrounding agricultural activities and mining activities undertaken at the adjacent Girilambone Copper Mine.

4.8.2.2 Existing Sources of Air Pollutants

The closest operations with the potential to generate particulate emissions are associated with the Girilambone Copper Mine, located immediately south of the Project Site. The Girilambone Copper Mine (see Section 1.4.3.2) currently extracts material from a combination of open cuts and underground operations. Waste rock is currently placed in-pit or underground and ore material is either placed on the Murrawombie Heap Leach pads or transported to the Tritton Copper Mine for processing.

As a result, potential sources of particulate emissions from the Girilambone Copper Mine include:

- dust emissions associated with the unloading and loading of waste rock and ore material;
- wind-generated dust from exposed areas (i.e. open cuts , waste rock emplacements and haul roads); and
- dust entrainment due to vehicle movements on internal roads; and

Furthermore, the local area is subject to agricultural activities which may also result in particulate emissions associated with:

- the movement of farm vehicles or livestock over unsealed access roads, farm tracks and areas devoid of vegetation;
- cropping activities, particularly ploughing, sowing and harvesting;
- the movement of vehicles on the unsealed local road network; and
- wind-blown dust from cleared or heavily grazed areas.

4.8.2.3 Background Deposited Dust Levels

The Applicant collects deposited dust data from a range of locations within the Project Site and in the vicinity of the Tritton and Girilambone Copper Mines and Hermidale. The locations of the monitoring points are presented on **Figure 4.12** and an overview of the results of the monitoring program from December 2011 to August 2013 is presented in **Table 4.24**. The results may be summarised as follows.

- Average deposited dust results at locations that are remote from the Applicant's existing mining operations vary between 0.4g/m^2/month and 2.7g/m^2/month. This is in line with background deposited dust results within rural communities throughout western NSW.
- Average deposited dust levels in close proximity to the Applicant's Girilambone and Tritton Copper Mines vary between 0.5g/m^2/month and 5.9g/m^2/month, with two locations recording average deposited dust levels of 8.1g/m^2/month (Site TD23) and 25.9g/m^2/month (TD3B). These monitoring locations are in close proximity to the Tritton Copper Mine's Waste Rock Emplacement and the elevated deposited dust values are likely to be related to waste rock placement and wind generated dust from the exposed surface of the emplacement.

4.8.3 Potential Sources of Dust Emissions

Potential sources of dust emissions associated with the Proposal include the following.

- Construction of the various surface infrastructure components.
- Surface-based materials handling activities across the Project Site including front-end loader operation in the vicinity of the ROM Pad.
- Haulage of material from the Box Cut to the ROM Pad or waste rock emplacement and the movements of vehicles on the unsealed site access road.
- Placement of material onto the ROM Pad and waste rock emplacement.
- Wind erosion associated with exposed surfaces throughout the Project Site.
- Maintenance of unsealed roads.

Stockpiles associated with the stripping of topsoil would be stabilised shortly after construction and would therefore not be a significant contributing source to air quality emissions.

4.8.4 Air Quality Guidelines

In NSW, accepted practice is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4g/m^2/month or the existing dust deposition levels as a result of a Proposal would increase by more than 2g/m^2/month.

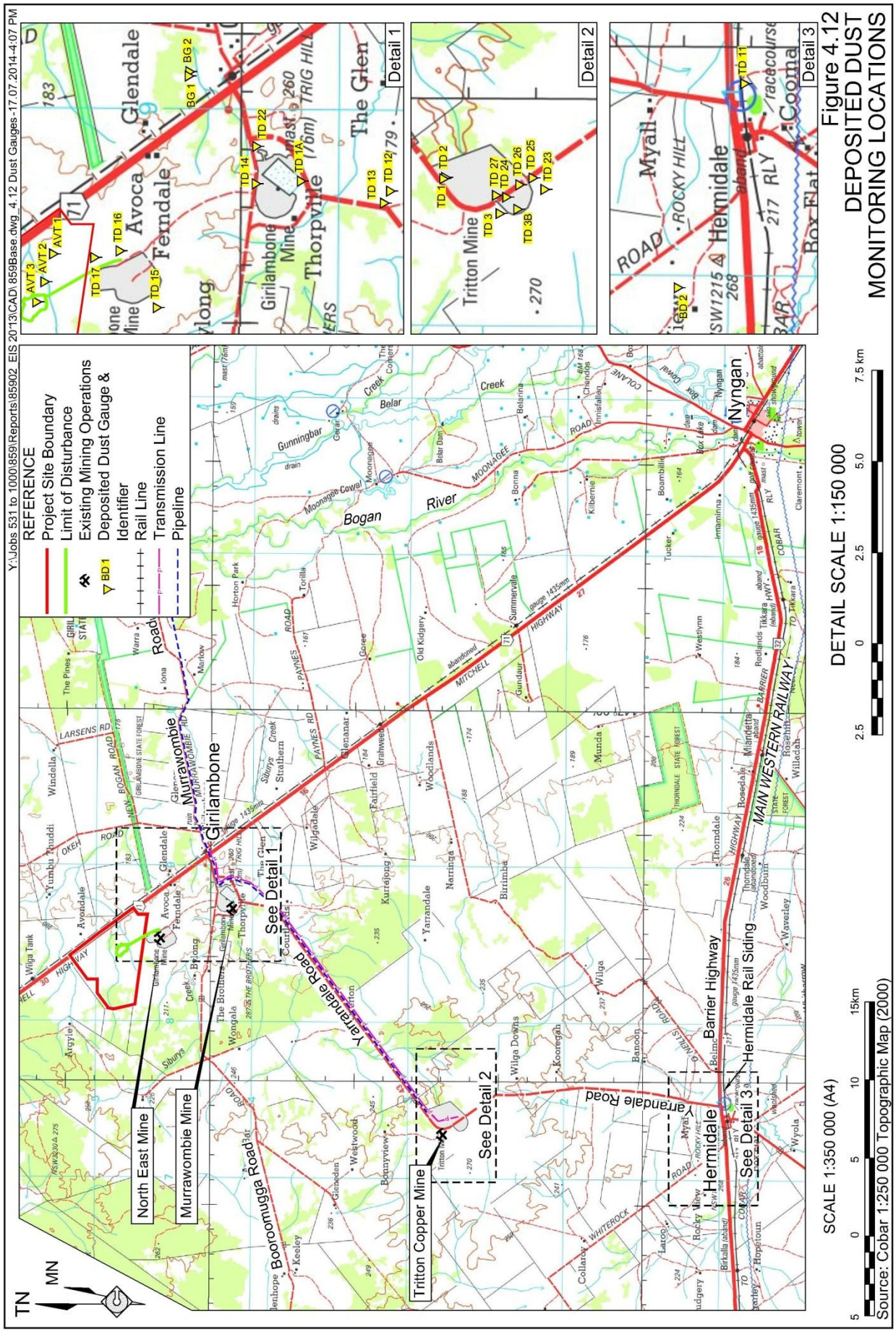


Figure 4.12
DEPOSITED DUST
MONITORING LOCATIONS

Table 4.24
Deposited Dust Monitoring Results – 2012 and 2013

Location		Insoluble Solids (g/m^2/month)			
Site	**Identifier**	**No. Samples**	**Average**	**Min**	**Max**
Background Monitoring Results					
Avoca Tank	AVT1	12	0.8	0.1	1.6
Avoca Tank	AVT2	12	0.9	0.2	2.4
Avoca Tank	AVT3	12	0.4	0.1	0.6
Budgery	TD8A	20	1.8	0.4	5.1
Yarrandale Rd	TD12	19	2.0	0.1	11.3
Yarrandale Rd	TD13	20	0.9	0.1	2
Girilambone	BG1	19	0.7	0.1	1.5
Girilambone	BG2	18	2.7	0.2	15.5
Girilambone Copper Mine					
Murrawombie	TD1A	20	3.3	0.5	13.6
Murrawombie	TD14	20	2.5	0.7	6.5
North East	TD15	17	0.5	0.1	1.2
North East	TD16	20	0.7	0.2	1.5
North East	TD17	20	0.6	0.1	1.6
Murrawombie	TD22	19	0.6	0.2	1.2
Tritton Copper Mine					
Yarrandale Rd	TD1	20	1.1	0.2	4
Yarrandale Rd	TD2	20	1.3	0.2	3.8
Tritton	TD3	19	2.3	0.4	10.6
Tritton	TD3B	19	25.9	1.1	85
Tritton	TD23	18	8.1	1.1	50.3
Tritton	TD24	20	4.7	0.8	27.9
Tritton	TD25	20	5.4	0.4	21.5
Tritton	TD26	20	5.9	1.6	21.3
Tritton	TD27	20	2.1	0.1	10.4
Source: Tritton Resources Pty Ltd.					

4.8.5 Management and Mitigation Measures

The Applicant would implement the following management and mitigation measures throughout the life of the Proposal.

- Limit, where practicable, excavation of material during periods of high winds.
- Limit disturbance to the minimum area necessary for mining and associated activities.
- Operate the largest practical truck size to reduce the number of movements necessary to transport the ore and waste rock.

- Adhere to all vehicle speed limits.
- Profile all surfaces to reduce velocity of overland winds.
- Apply vegetative cover to non-operational exposed surfaces such as water management structures and soil stockpiles as soon as practical after disturbance.
- Maintain ore handling areas / stockpiles in a moist condition by using water carts to water down areas likely to generate wind-blown and traffic-generated dust.
- Apply water to all roads and trafficked areas using water trucks to minimise the generation of dust.
- Water stockpiles to maintain moisture content and minimise the generation of dust.
- Minimise drop heights when loading ore material for transportation to the Tritton Copper Mine.
- Clearly define all haul roads edges with marker posts or equivalent to control their locations, especially when crossing large areas of non-descript disturbance.
- Close, rip and revegetate all obsolete roads.
- Reshape, topsoil and rehabilitate all completed areas as soon as practicable after the completion of mining operations.

4.8.6 Assessment of Impacts

Based on the proposed best practice management measures and operational controls, the distance to surrounding residences, the results of the Applicant's existing dust monitoring program and the experience of R.W. Corkery & Co. Pty Limited, the Proposal would be highly unlikely to result in dust levels that would exceed the air quality guidelines at residences surrounding the Project Site.

4.8.7 Air Quality Monitoring

Monitoring of deposited dust levels would continue to be undertaken at locations AVT1, AVT2 and AVT3 throughout the life of the Proposal. All deposited dust monitoring results would be reported within *Annual Environmental Management Reports* that would be prepared as a condition of the Mining Lease.

4.9 SURFACE WATER

The surface water assessment of the Proposal was undertaken by RW Corkery & Co Pty Limited based on experience with similar mining projects in western NSW

4.9.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to surface water factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Discharge of sediment-laden water impacting upon riverine ecology and downstream users (low risk).
- Pollution of surface water and shallow groundwater (low risk).
- Impact on surface or groundwater biota within surface water and shallow groundwater environments (low risk).
- Diversion and retention banks erosion / instability leading to increased sediment loads (low risk).

In addition, the DGRs identify "**Water Resources**" as a key issue for assessment in the *Environmental Impact Statement*. The principal assessment matter from DP&E relating to surface water includes:

- "identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000;
- an assessment of potential impacts on the quality and quantity of existing surface … water resources;
- a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo;
- an annual site water balance for representative years of the proposed life of the project; and
- a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts."

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from NSW Office of Water and EPA. The additional matters identified are generally consistent with the DGRs.

Furthermore, the DGRs require that the surface water assessment refer to the *Soils and Construction: Managing Urban Stormwater* (Landcom, 2004) guidelines in addition to the water quality guidelines outlined in Section 4.4.

4.9.2 Existing Environment

4.9.2.1 Drainage

Regional, local and Project Site drainage is described in Section 4.1.2. In summary, the Project Site is located within the Macquarie - Bogan Catchment, with the Bogan River located approximately 25km to the east of the Project Site (**Figure 4.1**). Within the Project Site, two ephemeral, poorly defined, unnamed drainage lines, referred to as Drainage Line A and

Drainage Line B have been identified (**Figure 4.2)**. Drainage Line A and B are first order streams prior to merging into a second order stream, approximately 0.5km from the Project Site's eastern boundary. The merged drainage line flows to the northwest before merging with the Wilga Tank Tributary.

4.9.2.2 Surface Water Quality

Surface water within the Project Site is typically only present immediately following substantial rainfall. Surface water flow is anticipated to be primarily sheet flow and is likely to have elevated suspended sediment concentrations.

4.9.2.3 Surface Water Users

The Applicant obtains makeup water from the Bogan River in the vicinity of its confluence with Gunningbar Creek (**Figure 4.1**). That water obtained under the following Water Access Licences issued under the *Water Management Act 2000.*

- WAL009374 – 705ML/year – high security.
- WAL009375 – 210ML/year – general security.
- WAL009940 – 16ML/year – supplementary water.

That water is pumped initially to storage facilities at the Girilambone Copper Mine via a pipeline within or parallel to the Murrawombie Road. From the Girilambone Copper Mine it is pumped to the Tritton Copper Mine and North East Open Cut. The village of Girilambone and residents along the route of the pipeline also access water via the pipeline.

In addition, other water users surrounding the Project Site capture water via overland flows and store it in on-farm storages. That water is used, when available, for watering stock.

4.9.3 Management and Mitigation Measures

Section 2.6 presents the surface water management and mitigation measures that would be implemented throughout the life of the Proposal.

4.9.4 Assessment of Impacts

The Applicant contends that the Proposal would have a negligible impact on the surface water environment within and surrounding the Project Site for the following reasons. Section references in parenthesis identify relevant sectors of this document where each of the following is discussed in more detail.

- Prepare and implement a *Water Management Plan* prior to the commencement of site establishment and construction operations. The plan would describe management of the following.
  - Sediment and erosion control.

  - Hydrocarbons and chemicals.
  - Water balance, including separation of clean, dirty and mine water and monitoring of water flows within the Project Site.
  - Surface water and groundwater monitoring.

- Ensure that clean water is diverted away from areas of proposed disturbance and permitted to flow to natural drainage.
- Ensure that dirty water is retained until the suspended sediment concentration is less than 50mg/L prior to discharge. Alternatively use that water for mining related purposes. .
- Ensure that contaminated water, including saline groundwater, is retained and is not be permitted to flow to natural drainage.
- Manage the flow of make up water to ensure that discharge of water from the Mine Water Pond does not occur.
- Treat waste water would be using a suitable waste water treatment or pump out septic system.

4.9.5 Monitoring

The Applicant would ensure that the concentration of dirty water within the sediment basin is less then 50mg/L prior to discharge to natural drainage lines.

4.10 TRAFFIC AND TRANSPORTATION

The traffic and transportation assessment of the Proposal was undertaken by RW Corkery & Co Pty Limited based upon similar mining projects and associated traffic and transportation assessments.

4.10.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential traffic and transportation-related impacts and their risk rankings after the adoption of standard mitigation measures are as follows.

- Increased traffic levels due to movement of workforce and contractors resulting in:
  - increased traffic congestion (low risk);
  - elevated risk of accident/incident on local roads (low risk); and/or
  - road pavement deterioration (low risk).

- Increased heavy vehicle movements for product transportation resulting in:
  - increased traffic congestion (low risk);
  - elevated risk of accident/incident on local roads (high risk); and/or
  - road pavement deterioration (moderate risk).

In addition, the DGRs identify "***Traffic and Transport***" as a key issue for assessment in the *Environmental Impact Statement* with the assessment matters from DP&E including:

- "An assessment of potential traffic impacts on the capacity, efficiency and safety of the road network, in particular the assessment must include a Road Safety Audit to review the condition of the proposed routes and identify and safety issues which may be exacerbated by the development.
- A description of the measures that would be implemented to maintain and/or improve the capacity, efficient and safety of the road network in the surrounding area of the life of the Project."

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from Roads and Maritime Services (RMS) and Bogan Shire Council. The additional matters identified are generally consistent with the DGRs.

4.10.2 Existing Road Traffic Environment

Section 2.7.2 provides a description of the road network surrounding the Project Site. In summary, ore material and would be transported from the Project Site to the Tritton Copper Mine via the following route (**Figure 4.12**). This route would also be used by light and heavy vehicle traffic travelling between the Tritton Copper Mine and the Project Site.

- The proposed Site Access Road.
- The existing private haul road between the North East and Murrawombie operations.
- Booramugga and Yarrandale Roads.

Booramugga and Yarrandale Roads are both local public roads, with the vast majority of traffic on these roads related to the Applicant's operations. The roads are in good condition and are administered by Bogan Shire Council.

Traffic travelling between Nyngan and the Project Site would do so via the Mitchell Highway and Booramugga Road (**Figure 4.12**).

The Applicant has been advised that traffic count data on Booramugga and Yarrandale Roads is not available. However, the Applicant undertook a road traffic noise assessment to support an application to permit 24-hour transportation of ore material between the Girilambone and Tritton Copper Mines via Yarrandale Road (Bridges, 2013). That noise assessment included a count of road train traffic during ore transportation operations between 7.43am and 3.30pm on 15 October 2013. During that 7 hour, 48 minute period, 26 road train passbys were recorded. Conservatively assuming that this rate of transportation is sustained for a full 24 hour period, the existing road train transport is approximately 80 movements per day.

As noted in Section 1.4.3, approval exists for transportation of up to 1Mtpa from the combined Girilambone Copper Mine operations to the Tritton Copper Mine. At an indicative capacity of 52t per two trailer road train and transportation operations on approximately 270 days per year, the approved daily heavy vehicle movements is approximately 140 per day (70 loads).

In addition, to ore transportation operations, the Applicant estimates that there are an average of approximately four non-ore related heavy vehicle and 12 light vehicle movements per day between the Girilambone and Tritton Copper Mines. The Applicant also estimates that traffic levels associated with local residents and non-mining activities is limited and is conservatively estimated at between 20 and 40 movements per day.

Finally, the Applicant anticipates that the Proposal would replace traffic that would otherwise travel between the Girilambone and Tritton Copper Mines. As a result, **Table 4.25** presents the anticipated traffic levels on Booramugga and Yarrandale Roads associated with all of the Applicant's operations, both approved and proposed.

Table 4.25
Anticipated Maximum Daily Traffic Movements[1]

Route	Applicant-related Movements			Non-Applicant Related Movements
	Light Vehicles	Heavy Vehicles	Long and Oversize Vehicles	
Proposal Construction				
Project Site – Tritton Copper Mine	12	2	nil	20 to 40
Project Site – Nyngan	24	4	nil	
Proposal Operation				
Project Site – Tritton Copper Mine	6	2	50[2]	20 to 40
Project Site – Nyngan	12	2	nil	
Note 1: Two vehicle movements = one return trip.				
Note 2: Based on the maximum production rate of 316 000tpa, transportation operations on 270 days per year and 52t per load.				
Source: Tritton Resources Pty Ltd.				

As a result, existing and proposed traffic levels on Booramugga and Yarrandale Road is expected to be between 78 and 98 movements per day. This is significantly below the 500 movements per day recognised as a level appropriate to local rural roads.

In light of this the Applicant has not undertaken a Road Safety Analysis or formal intersection or road performance analysis.

4.10.3 Management and Mitigation Measures

The Proponent would implement the following management and mitigation measures throughout the life of the Proposal.

- Water or treat internal roads with chemical suppressants, where appropriate, to minimise dust generation.
- Restrict vehicle speed on the Site Access Road to 80km/hr or such lower speeds as may be appropriate.
- Ensure that all vehicles transporting ore are are not loaded beyond their legal capacity.
- Ensure that the trays of all heavy vehicles transporting ore are covered prior to leaving the ROM Pad.
- Prepare, implement and enforce a Driver's Code of Conduct for all heavy vehicle drivers accessing the Project Site regularly.
- Investigate any complaints in relation to transportation operations promptly.

4.10.4 Assessment of Impacts

In light of the above, the Applicant contends that the Proposal would not adversely impact on the public road network surrounding the Project Site.

4.11 VISUAL AMENITY

The visual amenity assessment of the Proposal was undertaken by RW Corkery & Co Pty Limited based upon similar mining projects in Western NSW.

4.11.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential visibility-related impacts and their risk rankings after the adoption of standard mitigation measures are as follows.

- Amenity impact through change in content and composition of views from residences and public vantage points (low risk).
- Visual intrusion or reduction in scenic quality at residential and other sensitive receptors (moderate risk).
- Local amenity impact of visibility of industrial traffic on residential and other sensitive receptors (low risk).

In addition, the DGRs identify "***Visual Amenity***" as a key issue for assessment in the *Environmental Impact Statement* with the principal assessment matter from DP&E being that:

> "The EIS must describe what measures would be implemented to avoid, minimise, mitigate, offset, manager and/or monitor the potential impacts on visual amenity."

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from Bogan Shire Council. The additional matters identified are generally consistent with the DGRs.

It is noted at the outset that the value placed upon visual amenity and the impacts upon surrounding visual amenity varies from person to person and from location to location. As a result, a visual amenity assessment is, by its nature, highly subjective. As a result, 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 Applicant to minimise potential visual amenity-related impacts on surrounding residents and publically accessible vantage points.

4.11.2 Existing Visual Amenity

The existing visual amenity surrounding the Project Site is typical of rural areas in western NSW, with the outlook from most rural residences and other vantage points predominantly that of scrubby woodland vegetation within land cleared and developed for agriculture.

To the south of the Project Site, views of the Applicant's mining operations at the Tritton and Girilambone Copper Mines are available from Booramugga and Yarrandale Roads.

The Project Site is effectively screened in all directions by natural woodland vegetation. The closest residence (Residence R3) and publically accessible vantage point (on the Mitchell Highway on the eastern boundary of the Project Site), are approximately 2.4km and 1.5km respectively from the closest area of proposed disturbance.

The Project Site is located in a landscape with very few artificial light sources. These include:

- the Applicant's operations at the Girilambone Copper Mine;
- vehicles, including the Applicant's vehicles moving on local roads; and
- lights from rural residences and agricultural operations.

4.11.3 Management and Mitigation Measures

The Applicant would implement the following management and mitigation measures throughout the life of the Proposal. It is noted that many of these controls serve a dual function in the management of other environmental parameters, such as air quality management and rehabilitation.

- Design surface infrastructure to ensure that the height of any stockpiles (ROM Pad and waste rock emplacement) or buildings (workshop, office and crib room) are constructed to the lowest manageable height to reduce the potential for components to be visible on the horizon from surrounding locations.

- Construct built structures from dull coloured, non-reflective materials.
- Undertake active dust suppression to reduce the potential for the creation of a 'dust cloud' over the Project Site.
- Include appropriate waste management to ensure that wind-blown rubbish does not spread from the Project Site.
- Orientate night lighting towards the active areas of operation and towards the ground, minimising the light spill from the Project Site.
- Ensure that lighting not required is turned off.
- Decommission and remove surface infrastructure following the completion of extraction operations, ultimately returning the Project Site to a post-mining comparable landform through rehabilitation and revegetation activities.

4.11.4 Assessment of Impacts

Based on the relative isolation of the Project Site (both from surrounding residential locations and public vantage points such as roads), and the proposed visual amenity related controls, it is assessed that the proposed activities would not impact significantly on local visual amenity.

The proposed final landform would also provide for a landscape amenable for future agricultural uses and should therefore eventually blend with the surrounding undisturbed lands.

4.12 BUSH FIRE MANAGEMENT

The bush fire management assessment of the Proposal was undertaken by RW Corkery & Co Pty Limited and draws information from EnviroKey (2014).

4.12.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to bush fire and their risk rankings after the adoption of standard mitigation measures are as follows.

- Fire initiated off site threatening Site operations, impacting on-site stock and infrastructure (moderate risk).
- Fire initiated on site threatening Site operations or spreading off site and impacting on stock and infrastructure (moderate risk).

In addition, Bogan Shire Council identified that the *Environmental Impact Statement* should "*Detail management activities to reduce the potential for bushfires and emergency procedures in the event of a bushfire."*

This subsection identifies the dominant vegetation type within the Project Site and surrounding landholdings in order to determine the potential bush fire hazard associated with the Proposal.

In identifying the bush fire hazard, the document *Planning for Bushfire Protection* produced by the NSW Rural Fire Service in consultation with the then Planning NSW (now Department of Planning and Environment) in 2006 (RFS, 2006), forms the basis of the identification of bush fire hazard.

4.12.2 Existing Bush Fire Hazard Environment

4.12.2.1 Vegetation

As identified in Section 4.3.5.2, the vegetation within and surrounding the Project Site is dominated by Poplar Box Woodland with varying intergrades of Gum Coolabah, Cypress Pine and occasional Mulga, generally defined by EnviroKey (2013) as 'Poplar Box – Gum-barked Coolibah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Benson 103)'.

RFS (2006) classifies vegetation into 12 'formations', based upon designations defined within Keith (2004), and a variety of 'sub-formations' to provide an indication of flammability and therefore bush fire hazard. The vegetation within the Project Site has been classified as Formation 11 – Semi-arid woodlands (Low Woodlands) – Shrubby sub-formation', which has been paraphrased from RFS (2006) as woodland with widely spaced tree canopies <15m high and an understorey of drought resistant shrubs and variable grass cover. This sub-formation is prevalent in the western plains region with rainfall between 250mm/year to 500mm/year. A maximum fuel load of 8t/ha is assigned to this vegetation type.

The vegetation of the landholdings surrounding the Project Site is dominated by the same vegetation community as found on the Project Site.

4.12.2.2 Slope Classification

The Project Site typically displays very low slopes (<5 ^{o}).

4.12.2.3 Distance to Activities

In calculating the distance from the vegetation to the activities, it has been assumed that during a bush fire event, people would withdraw from vegetated areas to either open areas (i.e. the hardstand, waste rock emplacement or ROM Pad) or the relative safety of the buildings.

Buildings are generally located within the centre of the area of disturbance (or surrounded by hardstand areas that would act as a fire break) with an average setback distance at least 30m to vegetated areas.

4.12.2.4 Hazard Assessment

The bush fire hazard assessment takes into account not only the vegetation and associated bush fire hazard within the Project Site, but the vegetation immediately surrounding the Project Site, the local area generally and the Fire Danger Index (FDI), determined by location and included within RFS (2006). **Table 4.26** presents the parameters for the assessment, which were then compared to RFS (2006) to determine bush fire hazard (referred to as bush fire attack category in RFS (2006)).

Table 4.26
Bush fire Hazard Assessment

Assessment	Vegetation Classification	Slope	Distance to Vegetation	FDI	Category of Bush fire Attack
Formation 11	Semi-arid woodlands (Low Woodlands) – Shrubby sub formation	$<5^{o}$	>15m	80	Level 1 (Moderate)
Source: Based RFS (2001) – Appendix 3.3.					

A moderate category of bush fire attack describes a site or asset where specific construction requirements for buildings are required (outlined in Section 4.12.3)

The result of the bush fire hazard assessment generally reflects the land within the Project Site and surrounds being defined as 'Category 1 bush fire prone land', as identified in the Bogan LEP.

4.12.3 Management and Mitigation Measures

The Applicant would implement the following management and mitigation measures throughout the life of the Proposal to manage risks associated with bush fire that may impact on the Project Site.

- Ensure that personnel are evacuated from the underground mine in the event of a bush fire encroaching upon or starting within the Project Site.
- Consider evacuation of all non-essential personnel from the Project Site if required.
- Liaise with Rural Fire Service or other emergency service personnel, in the event of a bush fire and provide all assistance required, including equipment and personnel, and follow all instructions in relation to fire management.

In addition, the following management and mitigation measures would be implemented throughout the life of the Proposal to prevent a bush fire starting as a result of Proposal-related activities.

- Undertake refuelling within the designated refuelling bay or within cleared areas, with all vehicles turned off during refuelling.
- Enforce a no smoking policy in designated areas of the Project Site.
- Maintain fire extinguishers within site vehicles and refuelling areas.

- Ensure housekeeping activities are maintained to limit potential fuel loads within the active sections of the Project Site.
- Ensure a water cart with fire fighting capabilities would be available to assist in extinguishing any fire ignited.
- Ensure a cleared area of at least 15m is maintained around all buildings and other infrastructure within the Project Site.

4.12.4 Assessment of Impact

In light of the relatively low bush fire risk within the Project Site and proposed management and mitigation measures, the Applicant contends that the Proposal would not result in a significant adverse bush fire-related risk.

4.13 SOIL AND LAND CAPABILITY

The soil and land capability assessment of the Proposal was undertaken by RW Corkery & Co Pty Limited. The assessment draws on the results of a program of soil test pitting and analysis under taken by Mr Greg Stephenson of Tritton Resources Pty Ltd.

4.13.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to soil and land capability factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Inadequate soil available for rehabilitation purposes leading to less successful rehabilitation and increased rehabilitation costs and maintenance (low risk).
- Degradation of soil in stockpiles leading to less successful rehabilitation and increased rehabilitation costs and maintenance to the Mine Area (moderate risk).
- Erosion of soil stockpiles leading to increased sediment loads in creeks (low risk).

In addition, the DGRs identify "***Land Resources*** *– including … soils and land capability*" as a key issue for assessment in the *Environmental Impact Statement*.

Additional matters for consideration in preparing the *Environmental Impact Statement* were also provided in the correspondence attached to the DGRs from the EPA and DRE. The additional matters identified are generally consistent with the Director-General's Requirements, with the addition of matters related to soil contamination and acid sulphate soils from the EPA.

4.13.2 Existing Environment

4.13.2.1 Regional Soil Landscapes

The soil resources of the Project Site is typical of that of the more elevated sections of the Boorindal Plains sub-region of the Cobar Peneplain, with red earths and red texture contrast soils with stony lag gravels on slopes.

The soils of the Girilambone – Hermidale area have been described by Walker (1991) as varying in depth and characteristics with their position in the landscape. Walker (1991) identifies two soil landscape units in the vicinity of the Project Site, as follows.

- Cobar Land System – comprising soils that are shallow gravely loamy soils, grading to deeper acid and neutral red earths with hardpans down slope and in drainage lines.
- Mineshaft Land System – comprising soils that are shallow stony, sandy and loamy soils and which deepen slightly along drainage lines.

Straits Resources (2009) identifies that the soils surrounding the Murrawombie Open Cut comprise sands and red brown sandy gravels and colluvial soil with a large number of quartzitic and schistose outcrops with skeletal soils. Silt clays and sandy loams predominate on the hill flanks and plains. Soils surrounding the North East Open Cut are described as red earths with very little topsoil present. Gully erosion is evident surrounding the North East Open Cut.

4.13.2.2 Project Site Soils

A program of test pitting within the Project Site was undertaken by Mr Greg Stephenson of Tritton Resources Pty Ltd. That program comprised the following.

- Hand excavation of five soils pits to a depth of approximately 50cm. The location of each of the test pits is shown on **Figure 4.6**.
- Visual logging of each of the test pits.
- Collection of representative samples for analysis by the Soil Conservation Service.

Table 4.27 presents a brief description the soil profiles within each test pit. In summary, the soils of the Project Site may be described as red earths with variable gravel and increasing clay with depth.

Table 4.27
Soil Test Pit Results

	Description
Soil Profile 1	Red coloured, sandy loam with abundant gravel from the surface to 35cm. Below this, the soil becomes more clay rich, with less gravel. Roots of trees/shrubs were observed to a depth 32cm.
Soil Profile 2	Red coloured, sandy loam with abundant gravel from the surface to 39cm. Below this, the soil becomes more clay rich, with occasional gravel. Roots of trees/shrubs were observed to a depth 27cm.
Soil Profile 3	Red coloured, sandy loam with abundant limited gravel to a depth of 25cm. Below this, gravel is abundant to a depth of 34cm where the soil becomes more clay rich, with rare gravel. Roots of trees/shrubs were observed to a depth 25cm.
Soil Profile 4	Red coloured loam with rare gravel, except at the surface where gravel is common. Below a depth of 25cm, the soil becomes more clay rich. No roots were observed.
Soil Profile 5	Red coloured loam with abundant gravel from the surface to 23cm. Below this, the soil becomes more clay rich, with abundant gravel. Roots of trees/shrubs were observed to a depth 40cm.
Source: Tritton Resources Pty Ltd.	

Table 4.28 presents the results of the soil analyses undertaken by the Soil Conservation Service. The results may be summarised as follows.

- Electrical conductivity/salinity – Electrical conductivity of soils within the Project Site is typically less than 40µs/cm, with Soil Profile 2 returning salinities of 50µs/cm and 70µs/cm, indicating that the Project Site soils are typically non-saline.
- pH – Optimal pH for plant growth is between 6.0 and 6.5. Near surface soils within the Project Site typically returned pH values between 6.3 and 7.2, with soils in Soil Profile 1 returning results less than 6.0. Subsoils tended to be slightly more alkaline that their associated topsoils. This indicates that soil pH within the Project Site is highly variable.
- Emerson aggregate test – Near surface soils within the Project Site are typically classified as Class 3(2) or Class 3(3). By contrast, deeper soils are typically classified as Class 2(2) or 3(3). As a result, the near surface soils may be classified as unlikely to be sodic or having a slight to moderate dispersibility. By contrast, the deeper soils may be classified as being likely to be sodic or having a high to moderate dispersibility.

4.13.3 Project Site Land Capability

Soils within the Project Site are identified as Class 6 land, or land with very severe limitations in accordance with OEH (2012). This corresponds with the current land use for the Project Site, which includes infrequent grazing agriculture.

Table 4.28
Soil Analysis Results

Horizon	Depth (cm)	EC (µS/cm)	pH	CEC	Exchangeable Cations (me/100g)					P (mg/kg)	EAT	Texture
					Na^+	K^+	Ca^{2+}	Mg^{2+}	Al^{3+}			
Soil Profile 1												
A1	8	10	5.4	6.2	0.3	0.7	2.2	1.4	0.5	4	3(2)	Fine sandy loam
A2	27	<10	5.8	6.2	0.4	0.5	2.2	1.8	0.4	2	3(2)	Fine sandy clay loam
B	>35	10	6.4	9.8	0.8	0.6	3.9	4.1	<0.3	1	2(2)	Clay loam
Soil Profile 2												
A	39	50	7.0	8.3	0.4	0.4	5.0	2.5	0.4	2	3(2)	Sandy clay loam
B	>39	70	7.4	11.9	0.5	0.5	6.8	3.9	0.4	1	3(3)	Clay loam
Soil Profile 3												
A1	25	10	6.3	7.5	0.3	0.7	4.0	1.8	0.4	2	3(2)	Fine sandy loam
A2	9	10	7.2	9.3	0.4	0.5	5.3	2.4	<0.3	1	2(1)	Fine sandy clay loam
B	>34	20	7.6	12.4	0.7	0.5	5.7	4.3	<0.3	<1	2(2)	Clay loam
Soil Profile 4												
A	25	10	6.7	13.2	0.4	0.8	6.8	3.5	<0.3	1	3(3)	Loam
B	>25	30	7.6	20.3	1.0	0.7	12.2	7.4	-	<1	2(1)	Clay loam
Soil Profile 5												
A	23	20	6.6	9.3	0.2	1.0	4.7	2.0	<0.3	3	3(2)	Loam
B	>23	40	7.1	10.0	0.5	0.7	4.4	2.2	<0.3	2	2(2)	Clay loam

Note 1: EC = Electrical conductivity; CEC = Cation Exchange Capability; EAT = Emerson Aggregate Test.

Note 2: EAT Classes.

- Class 2(2) Highly likely to be sodic.
- Class 2(1), 3(4), and 3(3) May be sodic.
- Class 3(2) Unlikely to be sodic.

4.13.4 Management and Mitigation Measures

The Applicant would implement the following management and mitigation measures throughout the life of the Proposal.

- Minimise handling of all soils, so that they retain their structural integrity, by:
  - locating soil stockpiles adjacent to or as close as possible to disturbance areas;
  - stripping soil using a bulldozer or scrapper and directly placing that material into stockpiles; and
  - clearly marking areas for stripping and stockpiling.
- Strip topsoil from all areas of disturbance to a depth of approximately 20cm and store in stockpiles no more than 2m high.

- Strip subsoil within the footprint of the Box cut, Mine Water Pond, ROM Pad and waste rock emplacement to a depth of 50cm below the base of the topsoil and store in stockpiles no more than 3m high. Subsoil would not be removed from other areas of disturbance because those areas would not be subject to further excavation or compaction of the subsoil.
- Spread 100mm topsoil on the subsoil stockpile to facilitate revegetation.
- Refrain from stripping or placing soils during wet conditions.
- Ensure that the formed soil stockpile surfaces have a surface that is as 'rough' as possible, in a micro-scale, to assist in surface water runoff control and seed retention and germination.
- Spread seed of a suitable non-persistent cover crop on all soil stockpiles.
- Ensure that soil stockpiles are constructed with side slopes of 1:3 (V:H) or less and that the surface of all stockpiles achieves an effective 70% cover within 10 days of formation. This may be achieved through the use of mulches, spray on polymer-based products or hessian that would allow a vegetative cover to become established.
- Fence and signpost all soil stockpiles and limit operation of machinery on the stockpiles to minimise compaction and further degradation of soil structure.
- Construct clean water diversions/dirty water retention banks to direct overland surface water flow away from the soil stockpiles and retain sediment laden water.
- Maintain an inventory of all soil stripped, stockpiled and used during rehabilitation within the Project Site and elsewhere at the Applicant's operations.

4.13.5 Assessment of Impacts

Adherence to the recommended soil stripping, handling, stockpiling procedures and other management practices together with appropriate rehabilitation practices would result in a generally minimal impact to soils and land capability within the Project Site. Land capability of the final landform, with the exception of the Box cut, the Mine Water Pond, and the sediment basin would be the same as the existing land capability, namely Class 6 land. The Box cut would remain as a void and the Mine Water Pond and sediment basin would remain as water storages for the final land use.

4.14 AGRICULTURAL RESOURCE ASSESSMENT

The agricultural resource assessment of the Proposal was undertaken by RW Corkery & Co Pty Limited with the assistance of the Applicant.

4.14.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to agricultural resource factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Inability of local business to compete with mining wages leading to reduced staff availability for local agricultural businesses (low impact).
- Mining operations leading to negative impacts on agriculture within the LGA (positive impact).

In addition, the DGRs identify "***agricultural impacts***" as a key issue for assessment in the *Environmental Impact Statement*. In its correspondence attached with the DGRs the Department of Primary Industries referred to agricultural resources as a matter to be addressed in the *Environmental Impact Statement* suggesting that an assessment consistent with that identified in the DGRs would be sufficient.

The development of mineral resources needs to be balanced with the continued use and preservation of productive agricultural resources. The term 'agricultural resources' is used here to describe the land upon which agriculture is dependant, the water that is used to sustain it and the industry and secondary businesses that develop to directly supply and support agriculture. As the Proposal is classified as 'Regional Development' the following assessment of the potential impact of the Proposal to agricultural resources has been based upon the DPI factsheet *Agricultural Issues for Extractive Industry Development*.

A range of matters identified in that fact sheet are addressed in previous subsections. These include:

- the location and description of the proposed development, including areas of temporary and permanent disturbance and hours of operation (Section 2); and
- an assessment of dust (Section 4.8), noise (Section 4.5), blasting (Section 4.6), visual amenity (Section 4.11), waste (Section 2.9), ecology (Section 4.3), bush fire hazards (Section 4.12) and emergency response measures such as spill kits (Section 2.8).

In addition, general information in relation to management of and impacts upon groundwater, surface water, transport and rehabilitation is provided in Sections 4.4, 4.9, 4.10 and 2.13 respectively.

The following subsections include assessments of potential agricultural-specific impacts in the vicinity of the Project Site.

4.14.2 Existing Agricultural Environment

4.14.2.1 Agricultural Resources and Enterprises

Regional Agricultural Resources and Enterprises

A community profile from the 2011 ABS Census (see Section 4.15.3) indicates that for those people working in the Bogan LGA, agriculture is the largest employer (34.9% of the working population) followed by mining (14.9% of the working population). Of those working in the agriculture industry 79% recorded their occupation as either owner or manager, indicating that most agricultural operations are single person operations.

Australian Bureau of Statistics (ABS) information relating to land used for agriculture and gross production values is not available at a Local Government Area level. However, the data is available for "Nyngan-Warren Statistical Area (SA) 2" (**Figure 4.13**). **Table 4.29** presents an overview of land used for agriculture and gross production values for the Nyngan-Warren SA2 for the 12 months to June 2011. These figures are compared to the same statistics for NSW as a whole.

The area of holdings within the Nyngan-Warren SA2 is 2.77% of the total area of holdings within NSW. However, the SLA2 includes 4.07% of NSW broad-acre cropping area, with cropping within the SA2 contributing $169 million to the NSW economy during 2010/2011 financial year. Other significant agricultural commodities were livestock for slaughter ($37 million) and wool ($26 million).

Table 4.29
Regional Agricultural Production – Nyngan-Warren 2010-11

Component	Nyngan-Warren SA2		NSW
	Value	% of NSW	
Cropping (ha)			
Area of Holding	1 614 343	2.77%	58 326 346
Broadacre crops – cereal	222 137	4.07%	5 452 675
Vegetables for human consumption	Nil	0.00%	15 909
Fruit and nuts – Orchard trees and nut trees	34	0.07%	47 483
Fruit and nuts – Other fruit	2	0.01%	48 324
Broadacre crops – non-cereal	62 677	3.26%	1 923 621
Livestock/Grazing (number of head)			
Dairy cattle	14	0.01%	325 821
Meat cattle	74 307	0.40%	5 383 931
Sheep	715 773	0.89%	26 824 697
Pigs	73	0.01%	486 178
Gross Value of Agricultural Production ($ million)			
Agricultural production – Total gross	232	1.98%	11 714
Crops	169	2.39%	7 079
Livestock slaughtered and other disposals	37	1.20%	3 084
Wool	26	3.05%	853

Source: ABS Catalogues 7121.0 and 7503.0 2012.

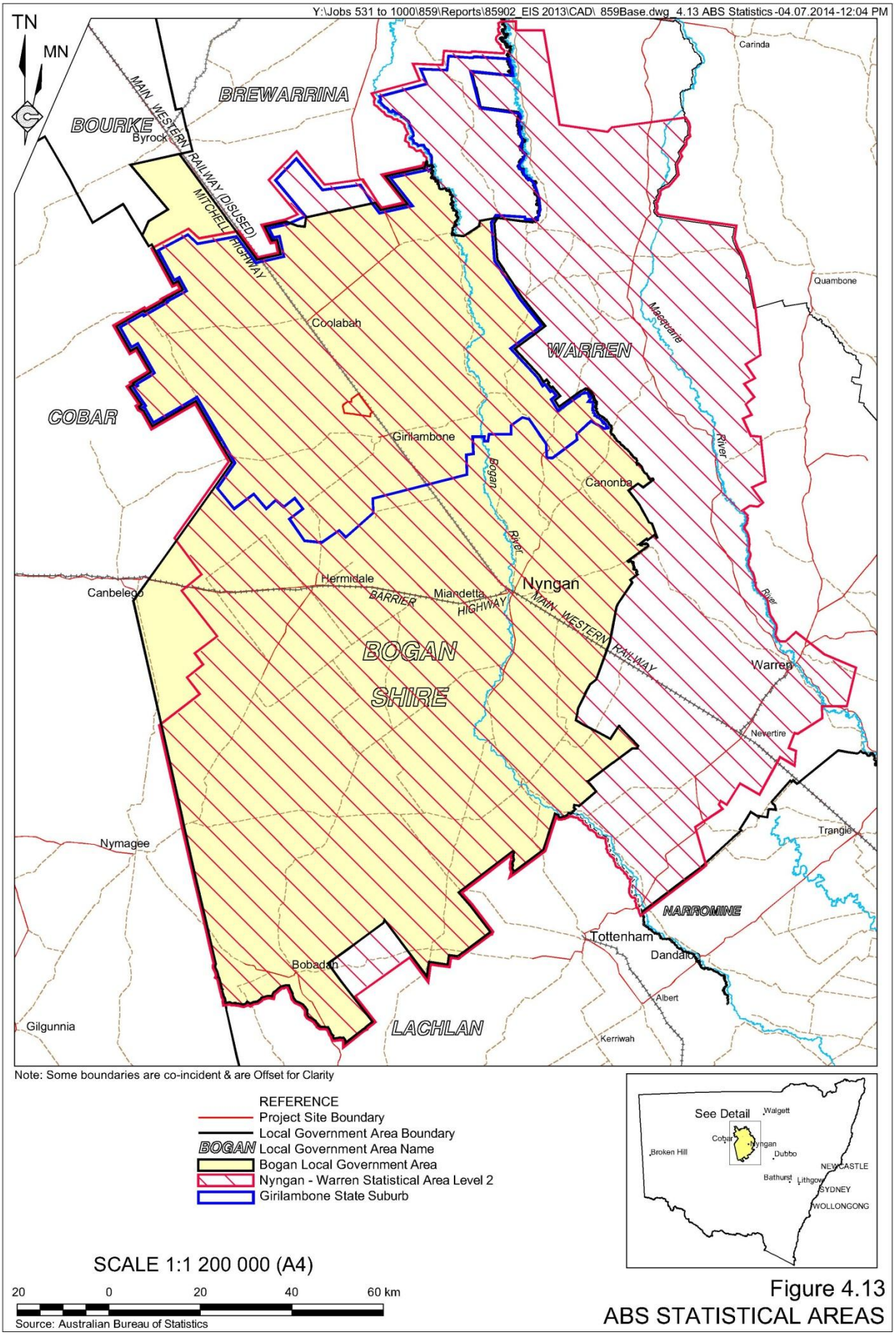


Figure 4.13
ABS STATISTICAL AREAS

In addition to primary production the agriculture industry in the Nyngan-Warren SA2 includes a variety of support services that include but are not limited to the following.

- Wholesale and retail supply stores.
- Stock and station agents such as Elders and Landmark.
- Farm maintenance businesses such as fence and yard building contractors, tradesmen, mechanical repairs and veterinary businesses.
- Abattoir services such as KJ Halal Meat.
- Various business advice agencies, such a legal or accounting firms.

There is no cattle saleyard in the Bogan LGA, with stock typically sold through the saleyard in Dubbo, one of the busiest saleyards in NSW. In addition the presence of offices for the Livestock Health and Pest Authority and Rural Financial Counselling Service in Nyngan indicate the historic and significant role that agriculture has played in the Bogan LGA.

Local Agricultural Resources and Enterprises

Cleared land within and surrounding the Project Site has been or is currently being used for agricultural purposes, principally, sheep and cattle grazing. However, to the Applicant's knowledge, no agricultural activities have been undertaken within the Project Site since at least 2004.

The land capability assessment for the Project Site (Section 4.13.3) identified the land as Class 6 land, or land with very severe limitations. This has limited the potential for agricultural use of the Project Site to the infrequent grazing.

4.14.2.2 Water Resources

As indicated in Section 4.1.2, all drainage lines within and surrounding the Project Site, with the exception of the Bogan River located approximately 25km to the east of the Project Site, are ephemeral and only flow following substantial rainfall. As a result, surface water resources are limited to farm dams which are likely to dry up frequently during extended periods without rain.

In addition, as indicated in Section 4.4.2.5 groundwater water in the vicinity of the Project Site is highly saline and are generally of limited use for agriculture. The closest bore licenced for groundwater production in the vicinity of the Project Site is located approximated 8.5km to the southeast of the Project Site.

As a result, water resources in the vicinity of the Project Site are limited in availability and quality and severely limit agricultural activities.

4.14.2.3 Road Transport Infrastructure

Agricultural enterprises in the vicinity of the Project Site are generally well serviced by State roads as described in Section 4.10.2. In summary, the Mitchell Highway provides access to markets to the south and east of the Project Site, including the Dubbo Sale Yards, while the Barrier Highway provides access to the west.

Local sealed and unsealed road provide access from the State road network to individual properties

4.14.2.4 Management and Mitigation Measures

The Applicant would ensure that the following management and mitigation measures would be implemented throughout the life of the Proposal.

- Ensure that appropriate weed and pest management programs are implemented in consultation with surrounding landholders and the Bogan Shire Council weeds officer.
- Ensure that appropriate bush fire management measures as identified in Section 4.12 are implemented to prevent initiation of a fire within the Project Site or management of any fire that may impact on the Project Site.

4.14.3 Impact Assessment

Taking into account the limited agricultural activities within and surrounding the Project Site and the fact that the Proposal would result in limited disturbance, either directly or indirectly, the proposed activities are likely to have no or negligible adverse impacts on Agricultural activities in the vicinity of the Project Site. Indeed as noted in Section 4.15, the Applicant's ongoing operations provide opportunity for off-farm income for local residents, supporting those agricultural enterprises that would otherwise be non-viable.

4.15 SOCIO-ECONOMIC

The socio-economic assessment for the Proposal was undertaken by R.W. Corkery & Co. Pty Limited in consultation with the Applicant.

4.15.1 Introduction

Based on the risk analysis undertaken for the Proposal (Section 5.2 and **Table 5.3**), the potential impacts relating to socio-economic factors and their risk rankings after the adoption of standard mitigation measures are as follows.

- Inability of local business to compete with mining wages leading to reduced staff availability for local agricultural businesses (low risk).

- Perception of negative health impacts on the community at surrounding residences (low risk).
- Increased pressure on local infrastructure (low risk)

In addition, the DGRs identify "**Socio-economic**" as a key issue for assessment in the *Environmental Impact Statement*.

4.15.2 Policy Context

4.15.2.1 Introduction

The following strategies and plans have been identified as applying to the region in which the Project Site is located and, as such, the objectives and aims of each has been summarised in the following subsections.

- *Orana Regional Action Plan (2012).*
- *Bogan Shire Community Strategic Plan – 2026 (2013).*
- *Bogan Shire Delivery Program 2013 – 2017 (2013).*

4.15.2.2 Orana Regional Action Plan

The *Orana Regional Action Plan* (Orana RAP) was compiled as part of the overarching planning document *NSW 2021 – A Plan to Make NSW Number One* (NSW 2021) prepared by the Department of Premier and Cabinet. The Principal objective of NSW 2021 is to 'rebuild the economy, return quality services, renovate infrastructure and protect our local environment and community'. To achieve that, the Orana RAP identifies, amongst other things, the following actions.

- Stimulate mineral and petroleum investment (Priority 1).
- Leverage opportunity for Orana from the growth within the mining sector (Priority 1).
- Build a strong and skilled local workforce (Priority 1).
- Develop the NSW Freight and Port Strategy (Priority 4).
- Provide funding to local councils to improve local infrastructure (Priority 4).

4.15.2.3 Bogan Shire Community Strategic Plan – 2026

The *Bogan Shire Community Strategic Plan – 2026* was compiled by Council and adopted in March 2013 to 'identify the community's main priorities and aspirations for the future and to plan strategies for achieving these goals'. These goals include the following.

- Goal 1 – Build the community by creating a connected and cohesive community with opportunities for all residents, workers and visitors.

- Goal 2 – Connect the community through a transport network which enables efficient movements of people and freight.
- Goal 3 – Manage the environment to support the current and long-term liveability of the Shire.
- Goal 4 – Enhance the health and safety of the community through provision of effective essential services and ensuring equitable access.
- Goal 5 – Develop the economy by stimulating and maintaining economic growth to build a strong economic and support the development of local businesses.
- Goal 6 – Maintain a responsible local government which is open and transparent in delivering responsive services to the community.

A range of strategies exist within the above listed goals that relate to the Proposal. In particular, strategies within Goal 5 (Economy) with the most applicable, socio-economic-related strategies outlined below.

- Strategy 5.1.1 – Work in conjunction with the mines to obtain mutual benefit from an abundance of natural mining resources which provide our shire with opportunities for local economic growth and employment.
- Strategy 5.1.5 – Support and strengthen local businesses networks to encourage the sharing of information and resources to build the capacity of local business and industry.
- Strategy 5.1.4 – Investigate opportunities to support the township of Nyngan and the villages of Girilambone, Coolabah and Hermidale.

4.15.2.4 Bogan Shire Delivery Program (2013 – 2017)

The Bogan Shire Delivery Program was developed and implemented by Council in June 2013 to translate the strategies within the *Bogan Shire Community Strategic Plan* into actions during the 2013 – 2017 period (Council office terms).

Strategies 5.1.1, 5.1.2 and 5.1.3 are identified in the Delivery Program to occur as 'ongoing' throughout the 2013 – 2017 period with either the General Manager or the Manager of Development and Environmental Services being the Council contact leader.

4.15.3 Community Profile

4.15.3.1 Surrounding Communities

The Project Site is located within the Central West of NSW approximately:

- 7km northwest of the village of Girilambone;
- 40km north-northeast of the village of Hermidale; and
- 55km northwest of the township of Nyngan.

The Project Site is located within the Bogan Local Government Area (LGA), fully encompassed by the Orana Region of NSW.

Communities surrounding the Project Site include the following.

- Immediate neighbours and local residents surrounding the Project Site, particularly to the east of the Project Site in the township of Girilambone (see Section 4.1.5).
- Residents of the surrounding rural properties and village of Hermidale.
- Residents of the town of Nyngan and other areas within the Bogan LGA

Each of these communities would be impacted to a greater or lesser degree depending on their proximity to the Project Site and the size, resilience and cohesiveness of the relevant community and its economy. For the purpose of this assessment, particular focus is placed on those communities most likely to be impacted by the Proposal, including residents of Girilambone and Hermidale, as well as the regional town of Nyngan, and the Bogan LGA.

The village of Girilambone was established in 1884 to service the construction of the Main Western Railway that connects the rural townships of Nyngan and Bourke. The village has steadily declined since the late 1800's to a population today of less than 200. The village hosts a service station, public school and a general store.

The village of Hermidale, located on the Barrier Highway, was established in 1892. Hermidale hosts a single service station, hotel and a general store/post office. Hermidale also hosts a rail siding and loading facility that is used by the Applicant to load the concentrate from the Tritton and Girilambone Copper Mines.

Nyngan is a regional township of approximately 2 000 people located approximately 660km northwest of Sydney in the geographical centre of New South Wales. The township was originally settled in 1835 by an exploration party but the local village of Canonba, located 28km north of Nyngan, was the region's main village up until 1880. It was at this time that the Dubbo-Bourke branch of the Main Western Railway was built through Nyngan and that resulted in the township growing around the railway. Nyngan has continued to serve as an important regional centre but has declined in population over the 20th and 21st centuries due to outward migration.

The Bogan LGA is located within the Orana Region of New South Wales and is surrounded by the Warren LGA to the east, Lachlan LGA to the south, Cobar LGA to the west and the Bourke and Brewarrina LGA's to the north. Nyngan is the largest populated town within the Bogan LGA, with the population of the LGA recorded in 2011 as 2 900. The LGA is generally supported by agricultural production, grazing of sheep and cattle and cropping, primarily wheat, as well as mining activities.

4.15.3.2 Community Statistics

The following demographic data was sourced primarily from the Australian Bureau of Statistics (ABS) 2011 census data, with limited supporting data from the 2006 census (where available). All data has been gathered from the community profile tables and quick data sets from the ABS website (http://www.abs.gov.au/). Information is provided for the "Girilambone State Suburb" (Girilambone SS) and the Bogan LGA (**Figure 4.13**) as well as utilising NSW data for comparison purposes.

Population and Age Characteristics

Table 4.30 presents the population data from both the 2006 and 2011 census, excluding the Girilambone SS as statistics from 2006 was not available. In summary, the population of Girilambone SS and Bogan LGA in 2011 were 220 and 2900 respectively. Population growth within the Bogan LGA between 2006 and 2011 was significantly lower than the NSW average, with only a 0.6% population gain, including a population decline of 1.2% of males, compared with 5.3% gain for NSW as a whole

Table 4.30
2006 and 2011 Census Population Statistics

	Girilambone SS		Bogan LGA			NSW		
	2006	**2011**	**2006**	**2011**	**%**	**2006**	**2011**	**%**
Total	NA	220	2 882	2 900	0.6	6 549 177	6 917 658	5.3
Males	NA	106	1 496	1 478	-1.2	3 228 451	3 408 878	5.3
Females	NA	114	1 386	1 422	2.5	3 320 726	3 508 780	5.4
Note: NA = not available.								
Source: ABS 2011 and 2006 Census.								

Table 4.31 presents the 2011 Census population data broken down by age. In summary, the Girilambone SS age statistics are generally comparable to the Bogan LGA statistics across the majority of age brackets. In comparison to the whole of NSW, the Bogan LGA had a higher proportion of people aged between 5 and 14 and 65 and 74 years and a lower proportion of people between 25 and 34 years old. This potentially reflects limited economic and employment opportunities for those in the early stages of there working life.

Employment

Table 4.32 presents employment statistics from the 2011 Census. These indicate that more persons are involved in full-time employment in the Girilambone SS and Bogan LGA when compared to NSW total labour force as a whole. The total labour force participation rates indicate that more persons within the Girilambone SS (69.2%) hold full-time and part-time employment in comparison to the Bogan LGA and NSW with participation rates of 59.6% and 59.7% respectively.

Table 4.31
2011 Census Age Statistics

	Girilambone SS		Bogan LGA		NSW	
	No.	**%**	**No.**	**%**	**No.**	**%**
Children						
0-4	16	7.2	229	7.8	458 735	6.6
5-14	34	15.4	452	15.5	873 776	12.6
Studying or Working						
15-19	7	3.1	169	5.8	443 416	6.4
20-24	12	5.4	159	5.4	449 687	6.5
25-34	28	12.7	283	9.7	941 496	13.6
35-44	38	17.2	414	14.2	971 629	14.1
45-54	35	15.9	374	12.8	950 451	13.7
Approaching Retirement or Retired						
55-64	28	12.7	298	10.2	810 290	11.7
65-74	14	6.3	318	10.9	541 687	7.8
75-84	6	2.6	154	5.3	336 756	4.9
85+	3	1.3	49	1.6	139 735	2.0
Total	**220**		**2 900**		**6 917 658**	

Source: ABS 2011 Census.

Table 4.32
2011 Census Employment Statistics

	Girilambone SS	Bogan LGA	NSW
	2011	**2011**	**2011**
Employed			
Full-time[1]	76 (72.5%)	860 (68.9%)	2 007 925 (63.1%)
Part-time	16 (15.2%)	294 (23.5%)	939 464 (29.9%)
Employed, away from work	7 (6.6%)	55 (4.4%)	120 121 (3.8%)
Employed, hours not stated	6 (5.7%)	38 (3.0%)	70 821 (2.2%)
Total	**105**	**1 247**	**3 138 331**
Unemployed, Looking for			
Full-time work	0 (0%)	47 (2.1%)	116 697 (1.7%)
Part-time work	12 (7.1%)	29 (1.3%)	79 829 (1.2%)
Total	**12**	**76**	**196 526**
Labour Force Participation			
Total labour force	117	1 323	3 334 857
Not in labour force	49	722	1 933 275
Labour force status not stated	3	172	317 017
Total Persons	**169**	**2 217**	**5 585 149**
Labour force participation	**69.2%**	**59.6%**	**59.7%**

Source: ABS 2011 Census.

Industry of Employment

Table 4.33 presents employment by industry statistics from the 2011 Census. The most significant industry of employment in the Girilambone and Bogan LGA is agriculture, forestry and fishing, with 60% and 34.9% respectively, compared to the State average of 2.2%. Importantly, mining comprised 14.9% of employment within the Bogan LGA, with the majority of this attributable to the existing Tritton and Girilambone Copper Mines owned and operated by the Applicant.

Table 4.33
2011 Census Industry of Employment Statistics

	Girilambone SS		Bogan LGA		NSW	
	2011	% of Labour Force	2011	% of Labour Force	2011	% of Labour Force
Agriculture, forestry & fishing	33	60.0%	245	34.9%	69 576	2.2%
Mining	0	0.0%	105	14.9%	31 186	1.0%
Manufacturing	0	0.0%	24	3.4%	264 865	8.4%
Electricity, gas, water & waste services	0	0.0%	15	2.1%	34 203	1.1%
Construction	3	5.5%	49	7.0%	230 057	7.3%
Wholesale trade	6	10.9%	10	1.4%	138 890	4.4%
Retail trade	0	0.0%	45	6.4%	324 727	10.4%
Accommodation & food services	0	0.0%	14	2.0%	210 380	6.7%
Transport, postal & warehousing	4	7.3%	43	6.1%	155 027	4.9%
Information media & telecommunications	0	0.0%	0	0%	72 488	2.3%
Financial & insurance services	0	0.0%	0	0%	158 422	5.1%
Rental, hiring & real estate services	4	7.3%	4	0.6%	51 554	1.6%
Professional, scientific & technical services	0	0.0%	10	1.4%	247 295	7.9%
Administrative & support services	0	0.0%	7	1.0%	102 354	3.3%
Public administration & safety	0	0.0%	49	7.0%	192 634	6.1%
Education & training	0	0.0%	20	2.8%	248 951	7.9%
Health care & social assistance	0	0.0%	16	2.3%	364 321	11.6%
Arts & recreation services	0	0.0%	8	1.1%	46 330	1.5%
Other services	5	9.1%	17	2.4%	117 615	3.8%
Inadequately described/Not stated	0	0.0%	22	3.1%	77 455	2.5%
Total	**55**		**703**		**3 138 330**	

Source: ABS 2011 Census.

Income

Table 4.34 presents income statistics from the 2011 Census. The data indicates that the median individual income and median household income in Girilambone SS is less than for the Bogan LGA and which is in turn less than for NSW as a whole.

Table 4.34
2011 Census Income Statistics

	Girilambone SS	Bogan LGA	NSW
Median individual income ($/weekly)	$422	$478	$561
Median family income ($/weekly)	$1 300	$1 182	$1 477
Median household income ($/weekly)	$866	$902	$1 237
Source: ABS 2011 Census.			

Housing Cost

Table 4.35 presents housing cost statistics from the 2011 Census. The data indicates that the Girilambone SS median housing loan monthly repayment was 10% and 51% lower than Bogan LGA and NSW respectively, with median weekly rents displaying similar trends with Girilambone SS approximately 32% and 68% lower than Bogan LGA and NSW respectively.

Table 4.35
2011 Census Cost of Housing and Household Size Statistics

	Girilambone SS	Bogan LGA	NSW
Median housing loan repayment ($/monthly)	$975	$1 083	$1 993
Median rent ($/weekly)	$95	$140	$300
Average number of persons per bedroom	1.2	1.1	1.1
Average household size	2.5	2.5	2.6
Source: ABS 2011 Census			

Education

Table 4.36 presents post-school education statistics from the 2011 Census. The data indicates that fewer people hold bachelor degrees, graduate diplomas and postgraduate degrees (university level education) in the Girilambone SS and Bogan LGA than for NSW as a whole. By contrast, people with certificate levels and advanced diplomas (TAFE level education) were more common in the Girilambone SS and Bogan LGA when compared to NSW. This may reflect the general lack of accessible universities for residents of in the Bogan LGA and limited professional opportunities for those with such qualification. By contrast, the higher proportion of TAFE-based qualification identifies that the Nyngan-based TAFE is critical infrastructure for the local population.

4.15.3.3 Community Facilities and Social Infrastructure

While Census data provides a range of information in relation to population statistics, a range of other factors are indicative of the level of social cohesiveness and resilience of communities. This subsection provides an overview of the facilities and social infrastructure that exist within the communities surrounding the Project Site.

Table 4.36
2011 Census Post School Level of Education

	Girilambone SS	Bogan Shire LGA	NSW
Postgraduate Degree Level	0 (0%)	15 (1.5%)	238 851 (7.5%)
Graduate Diploma and Graduate Certificate Level	0 (0%)	14 (1.4%)	82 617 (2.6%)
Bachelor Degree Level	9 (15%)	146 (15%)	787 336 (24.6%)
Advanced Diploma and Diploma Level	12 (20%)	95 (9.8%)	462 059 (14.4%)
Certificate Level	29 (48.3%)	387 (39.9%)	986 704 (30.9%)
Level of education inadequately described	0	16 (1.7%)	100 290 (3.1%)
Level of education not stated	10 (16.7%)	298 (30.7%)	539 067 (16.9%)
Total	**60**	**971**	**3 196 924**

Source: ABS 2011 Census

Education

Early Childhood

A range of childcare services and support groups for younger children exist within the Bogan LGA and include, but are not limited to the following:

- A preschool centre in Nyngan offering a variety of early childhood services, including daycare and pre-schooling, catering for children between the ages of 3 and 5.
- The Bogan Bush Mobile is a mobile playgroup that caters to children up to 6 years throughout the Bogan LGA, travelling to villages including Girilambone and Hermidale on a fortnightly basis.

Schools

Table 4.37 presents the number of public primary and secondary schools within the Bogan LGA, along with enrolment numbers.

Consultation with Regional Asset Planners for the Department of Education and Training for Western NSW identified that the Department takes a "whole of region" approach to managing capacity, with demountable classrooms available to all public schools where demand requires additional classroom space.

Table 4.37
Schools within the Bogan LGA

School	Years Available	Enrolment numbers (Pupils)*
Nyngan High School	Years 7 – 12	180
Nyngan Public School	Kindergarten – Year 6	142
Marra Creek Public School	Kindergarten – Year 6	10
St Joseph's (private)	Kindergarten – Year 6	148
Hermidale Public School	Kindergarten – Year 6	14
Girilambone Public School	Kindergarten – Year 6	16
Pre-school	3 – 5 years old	Unknown
Pre-school (mobile)	0 – 6 years old	Unknown
* 2012 information.		
Source: Department of Education and Training.		

Higher Education

Nyngan College, a TAFE Western branch of TAFE NSW, is the only tertiary or adult education facility within the Bogan LGA and focuses on programs for the local community in agricultural, business and computing. Courses at Nyngan College include the following.

- Aboriginal programs.
- Agriculture, Horticulture and Animal Care.
- Arts, media and entertainment.
- Building, construction and architecture.
- Business, finance and property services.
- Environment and Conservation.
- Hairdressing and Beauty.
- Health and community services.
- Vocational Access.
- Information and communications technology.
- Language.
- Manufacturing and Engineering.
- Mining.
- Sport and recreation.
- Textiles, clothing, footwear and furnishings.
- Tourism, Travel and Hospitality.
- Transport: Automotive.

Health

A local public hospital, namely the Nyngan Multi-Purpose Service, caters for accidents and emergency services, admissions, aged care and outpatient services. The service also contains an ambulance service for transportation to surrounding hospitals for additional treatment, such as childbirth, mental health conditions and surgery.

Two general practice surgeries also exist in Nyngan, along with a dental surgery and pharmacy.

Recreational and Cultural Facilities

There is a large variety of recreational and cultural facilities available in the Bogan LGA, with most centred on the town of Nyngan. Cultural and tourism facilities include:

- the Nyngan Museum, Mid State Shearing Shed, Nyngan Agricultural Show grounds and annual show;
- Cobb and Co. Heritage Trail Tour and historical buildings throughout the township;
- Macquarie Marshes; and
- Bogan River (for water sports, fishing and other water activities).

Sporting and recreational infrastructure in Nyngan include:

- various sporting fields that accommodate a variety of sporting clubs (rugby league, soccer, netball, cricket and Little Athletics);
- a golf club;
- a lawn bowling club;
- a jockey club;
- a pony club;
- a tennis club;
- a boxing club;
- water ski club; and
- the Nyngan and District War memorial Swimming Pool and associated swimming club.

Recreational facilities in Hermidale include sports and gun clubs.

Other Community Facilities and Groups

A number of community facilities and social organisations exist in Nyngan, including:

- the Bogan Shire Library;
- craft groups;
- water sports clubs;
- scouts and girl guides clubs;
- a Men's Shed;
- Nyngan Garden Club;
- the Country Women's Association (CWA);
- Lions Club International; and
- Rotary International.

CWA branch and a community library are both available in the village of Hermidale.

4.15.3.4 Economic Profile

Currently, Girilambone only has one operating business, being the 'Hog and Billy Hotel'. This business provides meals and alcohol to residents and visitors to Girilambone. The village previously supported a general store, a Returned Serviceman's League Club (RSL) and a bowling club.

The village of Hermidale has a local pub ('Big Red Tavern'), the Hermidale Hotel and a local post office/general store. Fuel is also available for purchase from the Big Red Tavern for locals and travellers along the Barrier Highway.

The township of Nyngan, and by virtue the wider Bogan LGA, includes numerous industries and related businesses, including the following.

- Automotive Sales.
- Accountants.
- Gift Shops.
- Real Estates.
- Trades (Electricians, plumbers, engineers).
- Restaurants, Cafes and Take-aways.
- Hair and Beauty services.
- Rural supply services.
- Caravan Park.
- Bed and Breakfasts.
- Hardware.
- Clothing.
- News Agency and Post Office.
- Banking.
- Computing services.
- Fuel stores.
- Insurance services.
- Tourism services, including the Mid State Shearing Shed.
- Motels.
- Pubs.

4.15.4 Social and Economic Contributions

4.15.4.1 Introduction

The Applicant anticipates that the proposed Avoca Tank mining operations would replace existing mining operations at the Girilambone Copper Mine. As a result, the Proposal would effectively extend the Applicant's current mining operations at or close to their present levels for the life of the Proposal.

This subsection provides an overview of the Applicant's current social and economic contribution to the surrounding communities, including an overview of the employment contributions, direct and indirect economic contributions and financial and other contributions to community and other organisations within the Bogan LGA.

4.15.4.2 Employment Contributions

The Applicant, as of 4 November 2013, had a combined workforce at the Tritton and Girilambone Copper Mines of 318 people. **Table 4.38** presents an overview of the residential locations for each those directly employed by the Applicant. In summary, more than half of the Applicant's employees live within the Bogan LGA, with a further 39% living in surrounding regions or elsewhere within NSW. It is noted that when compared with the 1 247 persons identified in the 2011 Census employment statistics as being employed within the Bogan LGA (**Table 4.38**), the Applicant's operations provides approximately 13% of all jobs in the Bogan LGA. In addition, the Applicant's operations are likely to contribute to a significant number of additional jobs through indirect employment through suppliers of goods and services directly to the Applicant or to its employees.

Table 4.38
Direct Employment Contributions – 2012/2013

Location	Employment Numbers		Annual Employment Costs ($M)
	Number of employees	% of total workforce	
Bogan LGA			
Girilambone	13	4%	1.1
Hermidale	5	2%	0.5
Nyngan	143	45%	14.1
Subtotal	**161**	**51%**	**15.8**
Elsewhere in NSW			
Orana Region	65	20%	7.0
Other Regions of NSW	59	19%	6.3
Subtotal	**124**	**39%**	**13.3**
Interstate			
Interstate	33	10%	4.5
TOTAL	**318**	**100%**	**33.6**
Source: Tritton Resources Pty Ltd.			

In addition, the Applicant provides a range of training opportunities for it's employees, including employment of approximately 10 apprentices and support for a range of other training opportunities.

4.15.4.3 Direct Economic Contribution

Table 4.38 presents an overview of the wages and salaries paid by the Applicant during the 2012/2013 financial year. It is noted that after tax wages and salaries are largely spent within the local community where the employee lives and works, generating further economic activity and employment through the provision of goods and services, effectively multiplying the impact of the contribution. In summary, the Applicant contributed, through wages and salaries. Approximately $15.8M to the economy of the Bogan Local Government Area, with a further $7.0M contributed to the wider Orana Region.

In addition, the Applicant's records indicated that a further $630 000 was paid to a range of local contractors for labour hire-related services.

Table 4.39 presents the amounts paid to suppliers of good and non-labour hire services during the 2012/2013 financial year. In summary, The Applicant contributed approximately $10M to businesses within the Bogan Local Government Area during the 2012/2013 financial year, with a further $20.1M and $60.2M contributed to the Orana and wider NSW economies during that time.

Finally, during the 2012/2013 financial year, the Applicant contributed approximately $15M to local, State and Commonwealth government through payment of various taxes, rates and royalties. In addition, additional government revenue was generated through payment of local rates and income tax by the Applicant's employees and those of its suppliers and payment of GST on goods and services purchased.

Table 4.39
Direct Supplier Contributions – 2012/2013

Location	Annual Supplier Costs ($M)
Bogan LGA	
Girilambone	1.0
Hermidale	3.4
Nyngan	6.6
Subtotal	**10.0**
Elsewhere in NSW	
Orana Region	20.1
Other Regions of NSW	60.2
Subtotal	**80.3**
Interstate/International	
Interstate	35.3
International	0.1
TOTAL	**35.4**

Source: Tritton Resources Pty Ltd.

4.15.5 Management and Mitigation Measures

In addition to the mitigation measures and management procedures relating to other environmental aspects identified in Section 4 previously, the Applicant would implement the following management and mitigation measures to ensure that benefits for the community surrounding the Project Site arising from the Proposal are maximised and adverse impacts are minimised.

- Continue to engage in regular dialogue with surrounding neighbours in relation to the Applicant's activities and maintain an "open door" policy for interested parties to discuss aspects of those activities that may be perceived as problematic.

- Support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance.
- Form and maintain a Community Consultative Committee (CCC) in accordance with the guidelines established in the document *Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects - June 2007*.
- Regularly brief the CCC and wider community on the Applicant's activities and seek feedback in relation to any actual or perceived adverse impacts. Seek advice on how to provide assistance to resolve issues raised by any member of the community in an effective, fair and equitable manner.
- Maintain a community complaints telephone line and ensure that the existence of the number is advertised widely.
- Give preference when engaging new employees, where practicable, to candidates from the surrounding communities over candidates with equivalent experience and qualifications from elsewhere and ensure that the mining and other contractors do so as well.
- Encourage the involvement of the local Aboriginal community in the workforce.
- Encourage and support participation of locally-based employees and contractors in training or education programs to impart the appropriate skillsets and qualifications in them for continued development and economic growth within the surrounding communities following completion of the Proposal.
- Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the surrounding communities.
- Assist community members and others, as appropriate, to establish complementary businesses, where those businesses would provide a benefit to the community through increased economic development.
- Assist Bogan Shire Council to promote and encourage economic development that would continue beyond the life of the Proposal.
- 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.
- Ensure that the land capability of those sections of the final landform to be used for grazing is similar to the current land capability.

4.15.6 Impact Assessment

The Proposal would result in a range of socio-economic benefits to the community surrounding the Project Site. These benefits would include the following.

- Continued employment for approximately 318 persons, of which approximately 50% would continue to reside within the Bogan LGA.

- Continued contribution to the local, Regional, State and National economies, including contributions of approximately $15.8M and $10M annually within the Bogan LGA through wages and salaries and purchase of goods and services respectively, with additional indirect contributions.
- Continued support for local Community Organisations and Services.

Assessment of the potential socio-economic impacts demonstrates the beneficial impacts of the Proposal far outweigh any minor adverse impacts associated with the operations.

Section 5

Evaluation and Justification of the Proposal

PREAMBLE

This section concludes the environmental assessment of the Avoca Tank Project with an evaluation of risk sources and potential environmental impacts for each of the principal environmental issues.

The risk analysis of the potential environmental impacts takes into account the standard mitigation measures adopted throughout the mining industry, as well as the additional measures to be implemented as part of the Proposal so as to assign each environmental impact an overall residual risk ranking based upon likelihood and consequence of occurrence.

The Proposal is then evaluated based on the residual risk posed and in consideration of ecologically sustainable development.

A justification for the Proposal is then provided based on its residual impacts, the likely social and economic benefits that would be generated and the consequences locally, regionally and nationally, of the Proposal not proceeding.

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5.1 INTRODUCTION

This section concludes the *Environmental Impact Statement*. The development and operation of the Avoca Tank Project is evaluated and justified through consideration of its potential impacts on the environment and potential benefits to the local and wider community.

The evaluation of the Proposal is undertaken by firstly assessing the identified environmental risks posed to the local environment by the proposed activities and then considering the implementation of the commitments for controls, safeguards or mitigation measures outlined in Section 4. The Proposal has also been evaluated against the principles of Ecologically Sustainable Development (ESD) in order to provide further guidance as to the acceptability of the Proposal, as presented in the *Environmental Impact Statement*.

Section 5.4, which presents the justification of the Proposal, revisits the predicted residual impacts on the biophysical environment, considers the socio-economic benefits which would be provided and assesses the consequences of not proceeding with the Proposal.

5.2 ANALYSIS OF ENVIRONMENTAL RISK

As identified in Section 3.4, risk is the chance of something happening that will have an impact upon the objectives of a task. In the present case, the relevant objective is the construction and operation of the Avoca Tank Project with minimal adverse impacts on the surrounding environment or local community.

In order to analyse the environmental risks associated with the Proposal, a structured analysis of risk involving the following individuals was undertaken by teleconference on 31 October 2013.

- Mr Simon Fitzgerald, General Manager - Proposals with Straits Resources Limited.
- Mr Greg Stephenson, Senior Environmental Advisor, Tritton Mines.
- Mr Mitchell Bland, Principal Environmental Consultant with R.W. Corkery & Co. Pty Limited.

The outcomes of the risk analysis incorporated the adoption of standard, industry-wide controls and mitigation measures, together with the implementation of specific control measures for the Proposal, so as to produce a residual risk ranking that accurately summarises the risks of the individual risk sources throughout the life of the Proposal.

Risk is measured in terms of consequence (severity) and the likelihood (probability) of the event happening. The allocation of a consequence rating was based on the definitions contained in **Table 5.1**. Similarly, the likelihood or probability of an impact occurring was allocated based on the definitions contained in **Table 5.2**. Finally, the overall risk is then determined by considering the relative consequence and likelihood of an event occurring as defined by **Table 5.3**. To ensure consistency, the definitions contained in **Tables 5.1** to **5.3** are consistent with those used by the Applicant for its internal risk assessment processes.

Table 5.1
Qualitative Consequence Rating

Insignificant	Minor	Moderate	Major	Critical
Health and Safety				
• First aid treatment or injury only; • Low level soreness or small amount of pain.	• Medical Treatment Injury; • Restricted Work Injury; • Presented to hospital (no overnight stay).	• Single Lost Time Injury; • Short term hospitalisation (< 7 days); • Reversible impairment to human health.	• Multiple Lost Time Injuries; • Extended hospital treatment (> 7 days); • Permanent disability < 30%; • Serious long-term health issue.	• Permanent disability > 30%; • One or more fatalities.
Environment				
• No or very low environmental impact; • Impact confined to a small area.	• Low environmental Impact; • Rapid clean-up by internal staff or contractors; • Impact contained to area already impacted by operations.	• Moderate environmental impact; • Clean-up by internal staff or contractors; • Impact confined within lease boundary.	• Major environmental impact; • Considerable clean-up effort required by internal staff and external contractors; • Impact may extend across lease boundary.	• Severe environmental impact; • Likely species destruction and long recovery period; • Extensive clean-up using external resources; • Impact on a regional scale.
Community/External Relations				
• Isolated complaint received; • No media coverage; • No damage to reputation or relationships with stakeholders.	• Multiple or sporadic complaints received; • No media coverage • Short-term damage with relationship with one or more stakeholders but no damage to reputation.	• Repeated or serious rate of complaints; • Local media interest and coverage; • Reversible damage with stakeholders and to reputation.	• Ongoing complaints from local groups, NGO's or regulators; • Regional/national media interests; • Protests by external stakeholders; • Local or regional damage to reputation.	• High level concern from community, regulators, stakeholders and /or stakeholders; • Adverse national or international media coverage; • International damage to reputation.
Legal				
• Questionable or minor non-conformance with operating condition; • No fine or prosecution; • Unlikely to attract regularity interest; • Easy to resolve.	• Non-compliance with operating conditions; • Could attach low level administrative response from regulator; • No court appearance required.	• Breach of local or national law with potential prosecution by regulator; • Continuing occurrence of minor breach.	• Major breach of local or national law; • Prosecution or penalties by regulator likely; • Short term treat to operations continuing • Civil action initiated.	• Significant breach of national or international law with potential jail sentence; • Operations suspended or cease (short term or long term); • Licenses withdrawn or revoked; • Class action initiated.
Operational / Cost				
• Minor impact, easily corrected with no loss of production; • <$5,000	• Minor damage to equipment or infrastructure with minimal loss of production (< 1 day); • $5,000 - $50,000	• Damage to equipment or infrastructure causes production to cease < 1 week; • $50,000 - $100,000	• Damage to equipment or infrastructure causes production to cease < 1 month; • $100,000 - $500,000	• Damage to equipment or infrastructure causes production to cease > 1 month; • > $500,000

Source: Tritton Resources Pty Ltd.

Table 5.2
Qualitative Likelihood Rating

Rating	Description in terms of full operating life of the site	Description in terms of frequency
Almost Certain	Consequences expected to occur in most circumstances	Daily or continuous
Likely	Consequences will probably occur in most circumstances	Weekly or monthly
Possible	Consequences could occur at some time	Annually
Unlikely	Consequence will probably NOT occur in most circumstances	Within the life of the operation
Rare	Consequence may occur in exceptional circumstances	>100 years

Source: Tritton Resources Pty Ltd.

Table 5.3
Risk Rating Matrix

Likelihood	**Consequences / Severity**				
	Insignificant	**Minor**	**Moderate**	**Major**	**Critical**
Almost Certain	HIGH 15	HIGH 10	EXTREME 6	EXTREME 3	EXTREME 1
Likely	MODERATE 19	HIGH 14	HIGH 9	EXTREME 5	EXTREME 2
Possible	LOW 22	MODERATE 18	HIGH 13	EXTREME 8	EXTREME 4
Unlikely	LOW 24	LOW 21	MODERATE 17	HIGH 12	EXTREME 7
Rare	LOW 25	LOW 23	MODERATE 20	HIGH 16	HIGH 11

Source: Tritton Resources Pty Ltd.

The four levels of risk identified in **Table 5.3** are managed by the Applicant as follows.

- Low – can be managed by routine procedures and is unlikely to require specific application of resources.
- Moderate – can be managed to minimise the potential for environmental harm by the implementation of specific monitoring programs and response procedures. Responsibility for the implementation of monitoring and management activities must be specified.

- High – requires the development of specific management or action plans identifying specific monitoring, trigger levels for contingency management and specification as to the roles and responsibilities of personnel to implement contingency management. Senior executive management attention is required to ensure appropriate resources are available to manage this risk.
- Extreme – presents a risk which may not be able to be satisfactorily managed by the development and implementation of management plans. Board attention is needed to identify alternative methods of operation to reduce the risk to a level where it can be satisfactorily managed.

Table 5.4 presents the identified risk source, the potential consequences, the initial risk rankings assuming standard controls, the location of the proposed management and control measures within Section 4 of this *Environmental Impact Statement* and the residual risk rankings as a result of implementing the additional management, mitigation and control measures. The standard and residual risk rankings have been determined from **Table 5.3** and colour-coded appropriately to highlight the overall reduction in environmental risk associated with the Proposal.

It should be noted that in some cases it was accepted that the standard controls and mitigation measures would be adequate to achieve an acceptable level of risk without the need for any additional controls or measures or that the risk was as low as reasonably practicable (ALARP). In other cases, the residual risk ranking does not change from the predetermined risk ranking with standard controls when the adoption of additional management and control measures has been implemented, and is similarly deemed to be ALARP.

5.3 EVALUATION AND JUSTIFICATION OF THE PROPOSAL

5.3.1 Introduction

Schedule 2(7) of the *Environmental Planning and Assessment Regulation, (2000)* requires the *Environmental Impact Statement* to evaluate and justify the Proposal, having regard to the principles of Ecologically Sustainable Development (ESD) and the biophysical, economic and social impacts of the Proposal. This subsection provides an assessment of these matters to a level that would allow the determining authority to satisfy itself that each matter has been adequately addressed.

Table 5.4
Analysis of Standard and Residual Environmental Risk

Risk Source	Consequence / Hazard	Risk with Standard Control Measures	Proposed Control Measures Section Ref.	Residual Risk with Proposed Control Measures
ENVIRONMENTAL ISSUE – ABORIGINAL HERITAGE				
Unauthorised destruction of known sites.	Loss of heritage values.	M(20)	4.2.9	M(20) ALARP
Unauthorised destruction of unknown sites within approval areas.	Loss of heritage values.	M(20)	4.2.9	M(20) ALARP
ENVIRONMENTAL ISSUE – ECOLOGY				
Planned clearing of vegetation communities.	Loss of terrestrial ecology habitat, local vegetation and biodiversity.	L(22)	4.3.7	L(22)
Planned clearing of vegetation.	Injuries to native wildlife and fauna during clearing / earthworks (pre-strip).	L(23)	4.3.7	L(23)
Changes to groundwater and surface water systems.	Adverse impacts on groundwater dependent ecosystems.	L(23)	4.3.7	L(23)
Mining operations.	Indirect impacts to fauna communities due to light / noise / blasting etc.	L(25)	4.3.7	L(25)
ENVIRONMENTAL ISSUE – GROUNDWATER				
Interception of groundwater from alluvial aquifers in mine workings	Reduction in groundwater discharge to surrounding creeks/rivers, adverse impacts on groundwater dependent ecosystems or surrounding groundwater users.	L(25)	4.4.6	L(25)
Interception of groundwater from fractured rock aquifers in mine workings	Reduction in groundwater discharge to surrounding creeks/rivers, adverse impacts on groundwater dependent ecosystems or surrounding groundwater users.	L(22)	4.4.6	L(22)
Modified groundwater quality / quantity	Discharge of poor quality groundwater to surrounding aquifers.	L(21)	4.4.6	L(21)
ENVIRONMENTAL ISSUE – NOISE				
Noise emissions from mining operations (including site establishment and construction).	Amenity impacts on residential and other sensitive receptors (including infrasound).	L(21)	4.5.5	L(21)
	Health impacts on residential and other sensitive receptors (including infrasound).	L(23)	4.5.5	L(23)
Off-site traffic noise.	Amenity impacts on residential and other sensitive receptors.	L(22)	4.5.5	L(22)

Table 5.4 (Cont'd)
Analysis of Standard and Residual Environmental Risk

Risk Source	Consequence / Hazard	Risk with Standard Control Measures	Proposed Control Measures Section Ref.	Residual Risk with Proposed Control Measures
ENVIRONMENTAL ISSUE – BLASTING				
Ground Vibration and airblast from blasting activities.	Amenity impacts on residential and other sensitive receptors.	L(25)	4.6.4	L(25)
Flyrock from blasting (property)	Flyrock ejected outside blast envelope resulting in damage to nearby residences / surrounding property / infrastructure / stock.	L(25)	4.6.4	L(25)
Flyrock from blasting (injury)	Flyrock ejected outside blast envelope resulting in injury or death.	L(25)	4.6.4	L(25)
Flyrock and airblast from blasting.	Flyrock and airblast impacting upon airborne aircraft and aerial operations.	L(25)	4.6.4	L(25)
ENVIRONMENTAL ISSUE – NON-INDIGENOUS HERITAGE				
Site establishment and construction operations.	Impact to known European heritage sites within the Project Site.	L(25)	4.7.6	L(25)
ENVIRONMENTAL ISSUE – AIR QUALITY				
Generation of blasting fume.	Amenity impacts on residents and other sensitive receptors.	L(25)	4.6.4	L(25)
Emissions of PM_{10}/$PM_{2.5}$/TSP/Deposited dust from construction activities.	Health and / or amenity impacts on residential and other sensitive receptors.	L(25)	4.8.5	L(25)
Emissions of PM_{10}/$PM_{2.5}$/TSP/Dust from mining operations.	Health and / or amenity impacts on residential and other sensitive receptors.	L(24)	4.8.5	L(24)
Emissions of PM_{10}/$PM_{2.5}$/TSP/ Deposited dust transportation operations	Health and / or amenity impacts on residential and other sensitive receptors.	L(25)	4.8.5	L(25)
Deposited dust impacting agricultural productivity.	Increased dust load on crops on surrounding agricultural land.	L(25)		L(25)
ENVIRONMENTAL ISSUE – SURFACE WATER				
Runoff from rainfall event causes water release.	Discharge of sediment-laden water impacting upon riverine ecology and downstream users.	L(24)	4.9.3	L(24)
Discharge/seepage of stored saline water into surface water/shallow groundwater system.	Pollution of surface water and shallow groundwater.	L(23)	4.9.3	L(23)
Retention of excess poor quality water.	Inability to discharge to surface water and groundwater systems without chemical or additional treatment.	NA		NA

Table 5.4 (Cont'd)
Analysis of Standard and Residual Environmental Risk

Risk Source	Consequence / Hazard	Risk with Standard Control Measures	Proposed Control Measures Section Ref.	Residual Risk with Proposed Control Measures
ENVIRONMENTAL ISSUE – SURFACE WATER (Cont'd)				
Chemical contamination of surface water from mining activities.	Impact on surface or groundwater biota within surface water and shallow groundwater environments.	L(21)	4.9.3	L(23)
Erosion/failure of sediment and erosion controls.	Diversion and retention banks erosion / instability leading to increased sediment loads.	L(24)	2.6.2	L(24)
ENVIRONMENTAL ISSUE – TRAFFIC				
Increased traffic on surrounding roads (workforce)	Elevated risk of accident / incident on local roads.	H(12)	4.10.3	H(12) ALARP
	Increased traffic congestion.	L(25)	4.10.3	L(25)
	Road pavement deterioration.	L(25)	4.10.3	L(25)
Increased heavy vehicle traffic on surrounding roads (operational)	Increased traffic congestion.	L(25)	4.10.3	L(25)
	Elevated risk of accident / incident on local roads.	H(12)	4.10.3	H(12) ALARP
	Road pavement deterioration.		4.10.3	
Existing road design unsuited to planned use / traffic levels.	Conflicts with other users leading to damage to existing infrastructure resulting in community complaints and impact on the local road network.	NA	NA	NA
ENVIRONMENTAL ISSUE – VISIBILITY				
Establishment of surface infrastructure	Amenity impact through change in content and composition of views from residences and public vantage points.	L(24)	4.11.3	L(24)
Lighting or lighting glow	Visual intrusion or reduction in scenic quality at residential and other sensitive receptors.	M(18)	4.11.3	L(23)
Transportation operations	Local amenity impact of visibility of industrial traffic on residential and other sensitive receptors.	L(25)	4.11.3	L(25)

Table 5.4 (Cont'd)
Analysis of Standard and Residual Environmental Risk

Risk Source	Consequence / Hazard	Risk with Standard Control Measures	Proposed Control Measures Section Ref.	Residual Risk with Proposed Control Measures
ENVIRONMENTAL ISSUE – BUSH FIRE				
Fire initiated offsite.	Fire initiated off site threatening Site operations, impacting on-site stock and infrastructure.	M(17)	4.12.3	M(17)
Fire initiated onsite.	Fire initiated on site threatening Site operations or spreading off site and impacting on stock and infrastructure.	M(20)	4.12.3	M(20)
ENVIRONMENTAL ISSUE – SOILS				
Inappropriate soil management.	Inadequate soil available for rehabilitation purposes leading to less successful rehabilitation and increased rehabilitation costs and maintenance.	L(25)	4.13.4	L(25)
Inappropriate soil management.	Degradation of soil in stockpiles leading to less successful rehabilitation and increased rehabilitation costs and maintenance to the Mine Area.	M(18)	4.13.4	L(21)
Inappropriate soil management.	Erosion of soil stockpiles leading to increased sediment loads in creeks.	L(24)	4.13.4	L(25)
ENVIRONMENTAL ISSUE – SOCIO-ECONOMIC/AGRICULTURAL				
Mining operations.	Impacts on land values and housing market within the LGA.	Positive impact	4.15.5	Positive impact
Proposal operations	Impacts of land values and housing markets within the LGA.	Positive impact	4.15.5	Positive impact
Mining operations.	Perception of negative health impacts on the community at surrounding residences.	L(25)	4.15.5	L(25)
Mining operations.	Equity imbalance in wages / access to resources between miners and other sectors within the surrounding community.	Positive impact	4.15.5	Positive impact
Mining operations.	Community division between support and opposition for the Proposal within the community.	NA	NA	NA
Mining operations.	Inability of local business to compete with mining wages leading to antagonism towards the Proposal from local businesses.	L(25)	4.15.5	L(25)

Table 5.4 (Cont'd)
Analysis of Standard and Residual Environmental Risk

Risk Source	Consequence / Hazard	Risk with Standard Control Measures	Proposed Control Measures Section Ref.	Residual Risk with Proposed Control Measures
ENVIRONMENTAL ISSUE – SOCIO-ECONOMIC/AGRICULTURAL (Cont'd)				
Population increase associated with employment growth.	Stress on the local services leading to community disharmony and poor relationships with the Applicant.	Positive impact	4.15.5	Positive impact
Mining operations.	Mining operations lead to negative impacts on agriculture within the LGA.	Positive impact	4.15.5	Positive impact
Mining Operations	Loss of High Quality Agricultural Land.	NA	4.14.3	NA
Proposal Operations	Increased pressure on local infrastructure.	L(25)	4.15.5	L(25)

Low | Moderate | High | Extreme

ALARP = As Low as Reasonably Practicable

5.3.2 Ecologically Sustainable Development

5.3.2.1 Introduction

Throughout the design of the Proposal, the Applicant has endeavoured to address each of the following Ecologically Sustainable Development (ESD) principles, where applicable.

- The precautionary principle.
- The principle of social equity.
- The principle of the conservation of biodiversity and ecological integrity.
- The principle for the improved valuation and pricing of environmental resources.

5.3.2.2 The Precautionary Principle

The precautionary principle states that "*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*" (IGAE, 1992).

The environmental safeguards discussed in Section 4 have been provided with a comprehensive knowledge of the existing environment derived from experience of R.W. Corkery & Co Pty Limited with similar mining projects, the various studies undertaken by recognised specialist consultants and invaluable input provided by the Applicant gained from similar nearby mining operations to provide an appreciation of the potential impacts that may result from the Proposal.

R.W. Corkery and Co Pty Limited has been involved in similar mining projects throughout the western region of NSW for over 33 years and has been involved in providing environmental advice and documentation to the Applicant since 1992. Throughout this time, R.W. Corkery and Co Pty Limited has gained a detailed understanding of the physical and social environment surrounding the Project Site, resulting in the ability to provide a comprehensive assessment of the potential environmental impacts.

Assisting in the compilation of this document, the following specialist consultants, recognised for being leaders in their respective fields, each undertook detailed impact assessments to provide the Applicant with the most appropriate management and mitigation measures to minimise any potential harm with the surrounding environment as a result of the Proposal.

- Mr Gerard Niemoeller (BA(Hons)) of On Site Cultural Heritage Management Pty Ltd, for the assessment of Aboriginal and Historic Heritage.
- Mr Steve Sass (B.App.Sci (Env.Sci) (Hons)) of EnviroKey Pty Ltd, for the assessment of Ecology.
- Mr Tim Chambers (M.Eng Sc, B.A Geology (Honours), B.Sc Comp. Sc.) of Environmental Strategies, for the assessment of groundwater.
- Mr Oliver Muller (BSc (REM & HGeog), MAAS) and Mr. Teanuanua Villierme of EMGA Mitchell McLennan, for the assessment of noise and blasting.

Further to the above, the Applicant has been undertaking mining and processing operations within the immediate and local area since 1991 (as described fully in Section 1.4.3) and has continued to gain an appreciation of the local environmental setting. The information gathered and understood from the Applicant's extensive experience and knowledge throughout this time, and the fact that the Proposal is effectively an extension of existing mining operations (albeit in a separate orebody), has provided invaluable information in the collation of information and the designation of appropriate mitigation and management measures based upon its experiences.

Following a full evaluation of the potential environmental impacts of the Proposal based upon the consolidated knowledge of the Applicant, R.W. Corkery and Co Pty Limited and the specialist consultant team, there are no activities or features for which there is a level of uncertainty in achieving an acceptable level of environmental performance.

5.3.2.3 Social Equity

The objective of this principle is 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*" (IGAE, 1992). Essentially, 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.

Inter-generational equity was considered in the design of the Proposal as the nature of the proposed operations would result in the prolonging of an industry that would continue to provide ongoing training to local employees and contractors who could potentially use these skills to benefit the local or regional economy.

Intra-generational equity was considered in the Proposal as the ongoing operations would continue to provide the 51% of current employees who reside within the Bogan Local Government Area, further opportunity to provide employment in close proximity to their residences, adding to the regions overall economy.

It is concluded that due to the isolated nature of the Project Site, the nature and proposed post-mining land uses, namely intermittent low intensity agricultural operations, as well as the proposed management measures as outlined in Section 4, that the objectives of this principle would be maintained as a result of the Proposal and not adversely impact current or future generations.

5.3.2.4 Conservation of Biological Diversity and Ecological Integrity

The protection of biodiversity and maintenance of ecological processes and systems is a central goal 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.

Disturbance to native vegetation within the Project Site would be limited and would only remove vegetation from the most common vegetation community being the 'Benson 103 – Poplar Box – Gum-barked Coolibah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion vegetation community'.

As assessment of the Proposal on the biological diversity and ecological integrity of the local area identified that no endangered ecological communities or species listed under either the TSC Act or EPBC Act would be affected, concluding that the Proposal is unlikely to have a significant impact on biological diversity or ecological integrity.

5.3.2.5 Improved Valuation, Pricing and Incentive Mechanisms

This principle involves consideration of the Proposal and the surrounding environmental resources (e.g. air, water, land and living things) which may be affected and the financial resources required by the Applicant to minimise or manage these impacts on surrounding environmental resources.

The Applicant's principal objective of the Proposal is the design and operation of an underground mining operation in a manner that minimises surface disturbance and any impact on the environment and surrounding residents. The Applicant has financially committed to this and other such measures by providing adequate financial resources (from the sale of processed products) to reinstate any disturbed habitat through appropriate rehabilitation procedures, as well as providing for the installation and ongoing management of fences to reduce the chance for any interaction with the identified Aboriginal and historic heritage sites.

It is planned that the income received from the sale of the processed ore would be sufficient to enable the Applicant 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.

5.3.2.6 Conclusion

The approach taken in planning the Proposal 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 Proposal has addressed each of the Ecologically Sustainable Development principles and is concluded that the proposed Avoca Tank Project achieves a sustainable outcome for the local and wider environment.

5.3.3 JUSTIFICATION OF THE PROPOSAL

5.3.3.1 Introduction

In assessing whether the development and operation of the Avoca Tank Project is justified, consideration has been given to both biophysical and socio-economic factors, including the predicted residual impacts on the environment and the potential benefits of the Proposal. This subsection also considers the planning considerations involved in the design of the Proposal, the alternatives considered as part of the final design and the consequences of the Proposal not proceeding. The overall justification recognises weightings placed upon both the negative and positive residual impacts identified within this document.

5.3.3.2 Biophysical Considerations

The Proposal has been designed in a manner that would:

- maximise the recovery of copper-gold-silver resources from the Avoca Tank deposit;
- minimise the total disturbance footprint by maximising the volume of waste rock to be used as backfill within the completed underground stopes;
- avoid all identified sites of cultural heritage value to the Aboriginal community;
- minimise the requirement to clear native vegetation, ensuring no threatened or vulnerable species are significantly impacted upon;
- minimise the potential for pollution to the groundwater aquifers, including the discharge of contaminants from the Project Site such as sediment-laden water or hydrocarbons;
- utilise the nearby and existing infrastructure to process the ore in such a way that negates the requirement for an on-site processing plant and minimises impacts on the surrounding environment; and
- rehabilitate the disturbed areas of the Project Site to create a landform that maximises its value for future land users.

Inevitably, despite the proposed operational controls and safeguards to be implemented by the Applicant, there remains the potential for some residual impacts on the biophysical environment to occur. The assessed biophysical impacts that the Proposal would have on the local environment are set out below.

- Five sites of Aboriginal heritage significance were identified within the Project Site. The Applicant has committed to avoid each of the identified sites and would implement measures to avoid inadvertent disturbance. As a result, there would be no significant adverse impacts on Aboriginal heritage as a result of the Proposal.
- The development of the Proposal would involve the clearing of approximately 34ha of a total of 1 798ha within the Project Site. The vegetation community to be disturbed, namely the Benson 103 – Poplar Box – Gum-barked Coolibah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion vegetation community, is a commonly occurring native vegetation community. The assessment of significance determined that this disturbance would not significantly affect the life cycle of any threatened species, population or community within the Project Site.
- Groundwater within the Project Site is of poor quality, with very limited potential for beneficial use or value to the environment through support of groundwater dependent ecosystems or discharge to surface water. The closest registered groundwater user is located approximately 15km to the east of the Project Site. In addition, all groundwater that would flow into the proposed mine would be used for mining-related purposes. As a result, neither groundwater dependent

ecosystems nor surrounding groundwater users are expected to be adversely impacted by the Proposal.

- Operational noise and vibration generated by the Proposal would, assuming the implementation of the nominated safeguards and controls, not exceed the relevant criteria at any privately-owned residence.
- A surface water management system has been designed to ensure segregation of clean, dirty (sediment laden) and contaminated (salt, hydrocarbon or chemical-laden) water. Accumulated dirty water would be used for mining-related purposes or would be discharged following testing to ensure that the water meets the quality criteria identified in the Environment Protection Licence to be issued for the Proposal. Contaminated water would also be used for mining-related purposes and would not be discharged to natural drainage. As a result, the Proposal would not result in a significant impact on surface water within the Project Site.
- The proposed traffic from the Project Site to the Tritton Copper Mine would primarily displace existing and approved traffic from the Applicant's North East and Murrawombie Copper Mines. As a result, the Proposal would not result in additional adverse traffic-related impacts.
- Activities within the Project Site would not be visible from publically accessible vantage points.
- Bushfire, soil and land capability and agricultural impacts associated with the Proposal would be negligible.

5.3.3.3 Socio-economic Considerations

The impacts of the Proposal on the socio-economic environment would be largely positive, with the proposed activities largely replacing current activities that will soon cease. As a result, the Proposal would result in the continued employment of existing employees of which over half (51%) live within the Bogan LGA and a further 39% of whom live in surrounding areas of NSW.

Through the payment of wages, purchase of consumables and local goods and services and commissioning of local contractors, the Proposal would contribute approximately $25.8 million and $93.6 million per year to the Bogan LGA and NSW economies, with a further $15 million in taxes royalties and rates.

Less tangible, but also an important benefit of the Proposal would be the continuation of the mining industry locally. Mining has traditionally, and continues to be an important driver to the economy of the Bogan LGA and the addition of a new mine would strengthen the industry locally.

The nature of land use surrounding the Project Site, as well as proposed future land use, has been considered as part of this assessment. Importantly, the Proposal would not adversely impact on any current or future land use on, or surrounding the Project Site.

Overall, the Proposal has been designed to ensure all potential adverse impacts are, to the maximum extent practicable, controlled which, in turn, would result in limited negative social impacts.

5.3.3.4 Planning Considerations

This subsection reviews the compliance of the Proposal with relevant State planning instruments, regional strategies, the Bogan LEP 2010 and Section 79C of the *Environmental Planning and Assessment Act 1979*.

State Environmental Planning Policy (State and Regional Development) 2011

The Proposal is classified as "Regional Development" under this SEPP. As a result, Bogan Shire Council is required to accept and assess the application for development consent, with the Joint Regional Planning Panel to be the determining authority.

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

The State Environmental Planning Policy (Mining SEPP) specifies matters requiring consideration in the assessment of any mining, petroleum production and extractive industry development, as defined in NSW legislation. **Table 3.2** presents a summary of each element requiring consideration and a reference to the section in the *Environmental Impact Statement* where each is addressed.

Central Western Catchment Management Authority – Catchment Action Plan 2006 – 2016

The *Central Western Catchment Management Authority (CW-CMA) – Catchment Action Plan 2006 – 2016* (CW-CMA Catchment Action Pland 2006 – 2016) requires addressing for any development within the CW-CMA area. The Applicant contends that the Proposal adequately addressed each of the matters identified in that document.

Central Western Transitional Catchment Action Plan

The *Central Western Transitional Catchment Action Plan identifies* goals, strategies, actions and targets for the Central Western Local Land Services Area. The Applicant contends that the Proposal adequately addresses each of the matters addressed in that document.

Bogan Local Environment Plan 2011

The *Bogan Local Environmental Plan*, and specifically the land zoning identified in that document, has been addressed in Section 3.3.5 of this document. It is noted that although underground mining is not identified as permissible with consent within the Project Site, Clause 70(1)(b) of the Mining SEPP identifies that mining is permissible, with consent, on any land where agriculture is permissible. As agriculture is permissible under Zone RU1 of the Bogan LEP, underground mining is also permissible, with consent.

Furthermore, as the Project Site occurs on land identified being with the "Moderate Biodiversity Sensitivity" zone, Section 4.3 of this document details that the management measures to protect native fauna and flora, protect ecological processes and encourage the conservation and recovery of native flora fauna and their habitats. That section concludes that

the Proposal would not have a significant effect upon biological diversity within and surrounding the Project Site.

5.3.3.5 Section 79C Considerations

Section 79C of the *Environmental Planning and Assessment Act 1979* requires the consent authority, when determining a non-State Significant Development, development application, to take into consideration the following matters:

a) the provision of:

i. any environment planning instrument;

The relevant environmental planning instruments being:

- *State Environmental Planning Policy (State and Regional Development) 2011;*
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007;*
- *State Environmental Planning Policy 33 – Hazardous and Offensive Developments;*
- *State Environmental Planning Policy No. 44 – Koala Habitat Protection*
- *State Environmental Planning Policy 55 – Remediation of Land; and*
- *Bogan Local Environmental Plan 2011 is considered in detail in Section 3.3.*

Each of these instruments are addressed in full in Section 3.3 of this document.

ii. any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved; and

The Applicant is not aware of any proposed instruments that are relevant to the Proposal.

iii. any development control plan and any planning agreement that has been entered into under Section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F; and

No Development Control Plan has been identified as being relevant to the Proposal.

iii. a) any planning agreement that has been entered into under Section 93F, or any draft planning agreement that a developer has offered to enter into under Section 93F; and

No planning agreement has been entered into or is required for the Proposal.

iv. the regulations (to the extent that they prescribe matters for the purposes of this paragraph); and

Schedule 3(1) of the *Environmental Planning and Assessment Regulation 2000* is considered in determining that the Proposal is considered as "Designated Development" and is discussed in Section 3.3.2.

v. any coastal zone management plan (within the meaning of the Coastal Protection Act 1979); and

No coastal zone management plans are relevant to the Proposal.

b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality; and

The likely impacts of the Proposal, including environmental impacts on both the natural and built environments and social and economic impacts are assessed in Section 4 of this document.

c) the suitability of the site for the development; and

The suitability of the Project Site for the Proposal, including a description of surrounding lands and their use, is discussed in Section 4.1.

d) any submissions made in accordance with this Act or the regulations; and

The Applicant anticipates that submissions related to the Proposal will be provided following completion of the public exhibition and that it will be provided with an opportunity to respond to those submissions at that time.

e) the public interest

Information relating to community and socioeconomic setting of the Proposal and the Proposal-related contributions to the local, regional and national economies is presented in Sections 2.11 and 4.15. throughout this document. Overall, the Applicant contends that the Proposal would satisfy public interest.

5.3.3.6 Consequences of not Proceeding with the Proposal

The consequences of not proceeding with the Proposal include the following.

i. The mineral resources recoverable by underground mining methods would not be mined by the Applicant. Such an outcome would be contrary to the State's and the Applicant's objective to maximise resource utilisation.

ii. The opportunity to secure the existing 318 full-time positions would be foregone.

iii. The continued $25.8 million and $93.6 million per year expenditure on wages, consumables, services and goods within the Bogan and NSW economies, with an additional $15 million per year in royalties and other taxes, would be foregone.

iv. The additional minor impacts on the local biophysical environment would not eventuate.

It is considered that the benefits of proceeding with the Proposal therefore far outweigh the impacts on the environment that would result. The nominated consequences of not proceeding with the Proposal also weigh heavily in favour of proceeding with the Proposal.

5.4 CONCLUSION

The proposed Avoca Tank Project has, to the extent feasible, been designed to address the issues of concern identified by the relevant levels of government and legislation.

- The Proposal provides for the production and transportation of copper-gold-silver ore whilst minimising the residual impacts on the biophysical environment.
- Through the creation of local employment within and contribution of a considerable expenditure with the regional economy, the socio-economic impacts of the Proposal are considered to be almost entirely positive.
- The post-mining landform would integrate the re-establishment of vegetation conducive to the use of ongoing native conservation with the potential to be utilised for historical agricultural purposes.

Section 6

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Section 7

Glossary of Terms, Acronyms and Symbols

PREAMBLE

This section provides an overview of the technical terms, acronyms and symbols used throughout this document that may be unfamiliar to those who are not familiar with the more technical aspects of this assessment.

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GLOSSARY OF TERMS

A horizon – the top layer of the soil profile containing decomposed organic materials. Commonly referred to as 'topsoil'.

acid – substance with a pH less than 7.0; the lower the pH, the higher the corrosive ability of the substance.

acoustics – the science of sound and vibration.

agricultural resources – the land on which agriculture is dependent and the associated water resources (quality and quantity) that are linked to that land.

airblast overpressure – a shock wave from the blast transmitted through the air, normally measured in dB(Linear).

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.

amenity – the desirability of an area.

amphibians – animals (such as frogs) adapted to live both on land and in water.

Applicant – person, organisation or company proposing to carry out an activity / seeking development consent.

aquifer – rock or sediment in a formation, group of formations, or part of a formation which is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

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).

B horizon – material located below the A horizon material and above the parent rock. Commonly referred to as 'subsoil'

backfill – material used to fill a created void.

background level – the concentration (deposition) level of a pollutant which must be added to the concentration (deposition) level of the modelled sources in order to obtain a total.

background dust level – dust level in the absence of mining and processing activities.

background noise level – noise level in the absence of mining and processing activity.

bank cubic metre (bcm) – a volume of $1m^3$ in the ground prior to disturbance.

baseline data – a body of information collected over time to define specific characteristics of an area (e.g. species occurrence or noise levels) prior to the commencement of an activity (e.g. a mining operation). Baseline data allows any impacts arising from the activity to be identified by comparison with previously existing conditions.

baseline monitoring – monitoring performed prior to the commencement of site activities.

batter – an engineered slope of soil or rock fill on either side upslope or downslope of a road, embankment or mine waste storage.

bedrock – unweathered rock lying below the soil and weathering profile.

biodiversity – the full range of living things and the ecosystem in which they live.

blasting – the operation of breaking rock by means of explosives.

bore – a hole, usually of less than 20 cm diameter, sunk into the ground and from which water is pumped.

brackish – a term for water that contains noticeable proportion of salt but far less than salt water.

buffer – a physical barrier / structure or width of land that encloses, partially encloses, or defines a particular environment. A buffer serves to minimise the impacts of non-desirable external influences on the adjoining environment.

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.

catchment – drainage area of a reservoir, river, creek, etc.

catchment area – the area determined by topographic features within which rainfall will contribute to runoff at a particular point.

conductivity – the measurement of the ability of a substance (either a measure of solid, liquid or gas) to transmit electricity; used to determine the amount of salt in a soil sample.

confluence – junction of streams.

conservation – the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations, while maintaining its potential to meet the needs as aspirations of future generations.

contractor – specialist brought in to perform a specific task, such as the construction of mine infrastructure or the excavation (mining) of the open cut.

cross-section – a two-dimensional representation of an area presented as if the area had been cut along its length.

cumulative – increasing by successive additions.

Development Application - an application a local council or other Authority for approval of an activity deemed to require an approval prior to commencement.

drainage line – a longitudinal depression in the landscape often without a bed or bank that intermittently carries runoff.

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) into the ground, typically to establish a water bore to investigate the geology found at depth or to allow explosives to be placed for blasting.

dust – particles of mostly mineral origin generated by erosion of surfaces, the mining and handling of materials, farming etc.

dust deposition – dust particles that settle out from the air – measured in grams per square metre per unit month (g/m^2/month).

dust deposition gauge – instrument set up to record the rate of deposition of dust.

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 – a functional unit of energy transfer and nutrient cycling in a given place. Includes all the relationships within the biotic community and between the biotic components of the system.

Elliot trap – a baited cage used in faunal surveys to capture small animals.

emission – a discharge of a substance (e.g. dust) into the environment.

emissions inventory – an information, collection and processing system containing data on emissions of, and sources of, air pollution from both man-made and natural causes.

Environmental Impact Statement (EIS) – a formal description of a project and an assessment of its likely impact on the physical, social and economic environment. It includes an evaluation of alternatives and an overall justification of the project. The EIS is used as a vehicle to facilitate public comment and as the basis for analysing the project with respect to granting approval under relevant legislation.

environmental officer – person at a mine who reviews environmental compliance and coordinates monitoring.

ephemeral – intermittent water flow, not permanent, e.g. a stream that flows only seasonally or after rainfall or a lake that periodically dries out.

erosion – the wearing away of the land surface (whether natural or artificial) by the action of water, wind and ice.

evaporation – the loss of water as vapour from the surface of a liquid that has a temperature lower than its boiling point.

evening period – the period from 6:00pm to 10:00pm (when relating to noise).

excavator – item of earthmoving equipment fitted with a bucket on an articulated boom and used for digging material from a face in front of, or below the machine.

exploration program – a program set up by a company to explore for mineral deposits (typically involving aerial survey, ground survey, drilling and geophysical assessment).

fault – a fracture in rock along which there has been observable displacement.

fauna – a general term for animals (birds, reptiles, marsupials, fish etc.) particularly in a defined area or over a defined time period.

feral – domesticated animals that have become wild.

flora – a general term for plant, particularly those found in a defined area or characteristic of a defined time period.

flyrock – rock that is propelled into the air by the force of an explosion beyond the defined blast envelope. Usually originates from pre-broken material on the surface or upper open blast face.

front-end loader – machine used to lift and place soil, earth, rocks, etc. on a construction or mine site.

fugitive emissions – emissions 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.

geochemical – chemical aspects of the composition on the earth's crust.

geological reserves – the measured total quantity of in-situ resource in a deposit, prior to consideration of mining parameters.

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, particularly unsealed roads

gradient – rate of change of a given variable (such as temperature or elevation) with distance.

ground vibration – oscillatory motion of the ground caused by the passage of seismic waves originating from a blast (or other force).

groundwater – the water contained in interconnected pores located below the water table in an unconfined aquifer or located in a confined aquifer.

groundwater dependent ecosystems – ecosystems that use groundwater as part of survival, and can potentially include wetlands, vegetation, springs, base flows, cave ecosystems, river pools and hanging swamps.

haul road – road used in a mine for haulage of ore and waste rock and for general site access.

haul truck – a truck specifically designed for hauling and tipping soil or rock within the mine or similar situation.

heavy metals – normally trace metals which occur in ore deposits which, depending on their concentration may be environmentally hazardous e.g. copper, lead and zinc.

hydraulic conductivity (k) – the rate of flow of water in an aquifer through a cross section of unit area under a unit hydraulic gradient, at the prevailing temperature. Usually expressed in units of metres per second or metres per day.

hydraulic gradient – the direction of flow of groundwater.

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.

indigenous – belonging to, or found naturally in, a particular environment.

inflow – flow directed into a particular feature, such as an open cut.

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.

inversion – 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.

light vehicle – a vehicle that has a gross vehicle mass of 4.5 tonnes or less.

Local Environmental Plan (LEP) – a plan developed by a council to control development in part or all of their local government area.

maximum instantaneous charge (MIC) – the maximum amount of explosives detonated during each delay during a blast.

mine water – all water used in mining and processing.

mitigation measures – measures employed to reduce (mitigate) an impact (such as the construction of a noise barrier to reduce sound emissions).

mobile equipment – wheeled or tracked self-propelled equipment such as trucks, front-end loaders, and bulldozers.

monitoring – the regular measurement of components of the environment to establish environmental standards are being met.

net acid-generation (NAG) testing – experimental determination of the potential of a material (e.g. waste rock) to generate acid upon exposure to air and water.

net acid-producing potential (NAPP) – potential of a material (e.g. waste rock) to generate acid upon exposure to air and water.

neutral – neither acidic nor basic (e.g. a pH equal to 7.0).

night-time period – the period from 10:00pm to 7:00am Monday to Saturday and 10:00pm to 8:00am on Sundays and Public Holidays (when relating to noise).

noxious – introduced species considered to be harmful to native species or to the habitat of native species.

ore – material (usually rock) with a sufficient concentration of a valuable metal or mineral to justify mining and processing the material to extract the metal or mineral.

peak airblast – the maximum level of the airborne shockwave resulting from the detonation of explosives.

peak particle velocity (ppv) – a measure of ground vibration reported in millimetres per second (mm/sec).

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 bore drilled specifically for the monitoring of groundwater levels and/or water quality.

piezometric surface – water table surface.

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.

porosity – the percentage of a solid material that consists of voids and areas of space, or the ratio, expressed as a percentage of the volume of the pores or interfaces of a substance to the total volume of the mass. A measure of its ability to hold liquid.

potable – water suitable for human consumption.

precautionary principle – the principle that, if a threat of serious or irreversible environmental damage exists, lack of full scientific certainty that the damage will occur should not be used as a reason to postpone measures to prevent that environmental damage.

Project Site – the area of land which corresponds with the area of application for development consent and containing the Mining Lease Application area.

Rating Background Level – the overall single-figure background noise level representing each assessment period (day / evening / night) over the whole monitoring period.

rehabilitation – the preparation of a final landform after mining and related activities and its stabilisation with grasses, trees and shrubs.

resource – an estimate of potentially usable mineral solution in a defined area based on preliminary information.

revegetation – replacement of vegetation, principally grasses and legumes on areas disturbed by mining activities.

runoff – that portion of the rainfall falling on a catchment area that flows from the catchment past a specified point.

run-of-mine (ROM) – mined ore as loaded directly from the mining face and delivered to a particular area (generally a ROM pad).

salinity – the total content of dissolved solids in groundwater, commonly expressed as parts of dissolved solids per million parts of solution, or milligrams of dissolved solids per litre of solution (mg/L);

sampling period – range of time over which samples are taken.

sedimentation – process or rate of depositing of sediment.

sequence (geological) – layers of (predominantly) sedimentary rocks sourced from a common geological environment or period.

sight distance – the distance along the road visible to the driver. It is measured along the normal travelled path of a roadway from the driver's location (such as at an intersection) to a specified height above the roadway when the view is unobstructed by traffic.

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.

stakeholder – person, group or organisation or company with an interest in an activity or outcome.

stockpile – a pile used to store material (such as ROM ore or soil) for future use.

storage capacity – the maximum volume of liquid able to be retained in a dam.

stormwater – surface water runoff immediately after rainfall.

stratigraphy – the succession and age of strata of rock and unconsolidated material.

stream order – defined by the Strahler steam order used to define stream size based upon a hierarchy of tributaries.

stygofauna – aquatic invertebrates living within the groundwater systems. This includes 'obligate stygofauna' that represent endemic species that relate to particular regions or ecosystems only.

sub-catchment – a smaller area within a catchment drained by one or more.

subsoil – the layer of soil lying below the topsoil; usually contains less organic matter and is less fertile but is essential for retention of moisture for plant growth. Also referred to as the 'B Horizon'.

surface waters – all water flowing over, or contained on, a landscape (e.g. runoff, streams, etc.).

survey transect – a path along which one records and counts occurrences of the phenomenon of study (e.g. plants).

suspended solids – analytical term applicable to water samples referring to material recoverable from the sample by filtration.

temperature inversion – an increase in air temperature with height (see inversion).

terrestrial – of or relating to the land, as distinct from air or water.

threatened species – a species specified in Part 1 or 4 of Schedule 1, Part 1 of Schedule 1A or Part 1 of Schedule 2 of the TSC Act 1995 or listed in the categories as defined in Section 179 of the EPBC Act 1999.

topography – the physical relief and contour of a region.

topsoil – the surface layer soil profile containing the main percentage of organic material. Also referred to as the 'A Horizon'.

total suspended particulates (TSP) – the mass of all particulate matter suspended in air.

total suspended solids – a common measure used to determine concentrations of fine materials present in water.

transmissivity – the rate at which groundwater is transmitted at a specific hydraulic gradient through a rock mass of a specified width.

vehicle movement – a one-way trip.

vibration – oscillating movement.

visual amenity – attractiveness to the eye.

watercourse – stream or river invariably with running water.

wind direction – the direction from which the wind, averaged over a certain period of time, is blowing.

wind rose – diagrammatic representation of wind direction, strength, and frequency of occurrence over a specified period.

waste rock – non-economic material to be removed from the mine to allow access to the resource.

waste emplacement – structure to hold rock, formed by the placement of rock in a random and/or structured manner.

water quality criteria – generally refers to numeric levels specified for key water quality variables, such as electrical conductivity or pH, which can be measured to determine the suitability of water for human consumption, supporting aquatic life, etc.

yield – (of a water bore) - the amount of water actually withdrawn.

Glossary of Acronyms, Symbols and Units

° – degrees

°C – degrees Celsius

µS/cm – microsiemens per centimetre; a measure of electrical conductivity

% – percentage

$M – million dollars

100 year flood limit – predicted extent of a 1 in 100 year flood occurrence

< – less than

> – greater than

AADT – Average Annual Daily Traffic

ABS – Australian Bureau of Statistics

AC – Acid Consuming

AHD – Australian Height Datum; in metres (similar to metres above mean sea level)

AHIMS – Aboriginal Heritage Information Management System

ANZECC – Australian and New Zealand Environment and Conservation Council

ARMCANZ - Agriculture and Resource Management Council of Australia and New Zealand

AS – Australian Standard

Ag – silver

Au – gold

bcm – bank cubic metre – a volume of $1m^3$ in the ground prior to disturbance

BOM – Bureau of Meteorology

cm – centimetre (unit of length) = 0.01 metre

CMA – Catchment Management Authority

CW-CMA – NSW Central West Catchment Management Authority

CWA – Country Women's Association

D% – dispersion percentage

dB – decibel. The unit used to express sound intensity

dB(A) – decibels, A-weighted scale. The unit used for most measurements of environmental noise. The scale is based upon typical responses of the human ear to sounds of different frequencies.

DECC – Department of Environment and Climate Change

DECCW – Department of Environment, Climate Change and Water (NSW). Now OEH

DGRs – Director-General's Requirements

DP – Deposited Plan

DP&E – NSW Department of Planning and Environment

DP&I – Department of Planning and Infrastructure (NSW)

DPI – Department of Primary Industries (NSW)

DRE – Division of Resources and Energy

EC - electrical conductivity

EIS – Environmental Impact Statement

EPA – Environment Protection Authority (NSW)

EP&A Act – Environmental Planning and Assessment Act 1979 (NSW)

EP&A Regulation – Environmental Assessment and Planning Regulation 2000

EPBC Act – Environment Protection and Biodiversity Conservation Act 1999

EPL – Environment Protection Licence

ES – Environmental Strategies

ESD – Ecologically Sustainable Development

EL – Exploration Licence

FDI – Fire Danger Index

FEL – front-end loader

g – gram (= 0.001 kilogram)

GCC – Girilambone Copper Company

g/m^2/month – grams per square metre per month unit for deposited dust

GHG – greenhouse gas

ha – hectare (100 m x 100 m)

JRPP – Joint Regional Planning Panel

kg – kilogram (weight measure)

kL – kilolitre (thousand litre)

km – kilometre (= 1 000 metres)

km^2 – square kilometres

km/hr – kilometres per hour

lcm – loose cubic metres

L – litre

L/day – litres per day

L/s – litres per second

L_{Aeq} – the L_{Aeq} is the energy average of the varying noise over the sample period and is equivalent to the level of a certain noise which contains the same energy as the varying environment. It is a common measure of environmental and traffic noise.

$L_{Aeq\ 1\ hour}$ – the "equal energy" average noise level over 60 minutes – used for assessing impacts of motor vehicles.

L_{Amax} – the absolute maximum noise level measured in a given time interval.

L_{AN} – the A-weighted sound pressure level exceeded by N% of a given measured period.

LALC – Local Aboriginal Land Council

LEP – Local Environmental Plan

LGA – Local Government Area

m – metre

M – million

m AHD – metres Australian Height Datum

m BGL – metres below ground level

m^2 – square metre

m^3 – cubic metre

MDB – Murray-Darling Basin

mg – milligram (weight unit)

mg/L – milligrams per litre (parts per million)

MIC – Maximum Instantaneous Charge

ML – Mining Lease

ML – Megalitre (1 million litres) – typically of water

ML/a – megalitres per annum

ML/day – megalitres per day

ML/year – megalitres per year

mm – millimetre (= 0.001 metres)

MOP – Mining Operations Plan

m/s – metres per second

Mt – million tonnes (metric tonne = 1 000 kg)

Mtpa – million tonnes per annum

NAF – non-acid forming

NAPP – net acid-producing potential

NATA – National Association of Testing Authorities

NGER Act – National Greenhouse and Energy Reporting Act 2007

NNTT – National Native Title Tribunal

NOW – NSW Office of Water

NP&W Act – National Parks and Wildlife Act 1974 (NSW)

NRM – Natural Resource Management

NTS Corp – Native Title Services Corporation

Nyngan LALC – Nyngan Local Aboriginal Land Council

OEH – Office of Environment and Heritage

On Site CHM – On Site Cultural Heritage Management

OTEK – OTEK Australia Pty Ltd

PAF – potentially acid forming

PAF-LC – Potentially acid forming – low capacity

pH – measurement indicating whether water or soil is acid or alkaline

POEO Act – Protection of the Environment Operations Act 1997

PPV – Peak Particle Velocity

RAP – Regional Action Plan

RAPs – Registered Aboriginal Parties

RFS – Rural Fire Service

ROM – Run-of-Mine

RMS – Roads and Maritime Services

RSL – Returned Serviceman's League

RTA – Roads and Traffic Authority (NSW) – now RMS

SA – Statistical Area

SEPP – State Environmental Planning Policy

SR – Shire Road

SS – State Suburb

SWL – standing water level

t – tonnes

TDS – total dissolved solids – expressed in mg/l

tpa – tonnes per annum

TSC Act – Threatened Species Conservation Act 1995 (NSW)

TSP – Total Suspended Particulate

UC – uncertain

V – volt

V:H – vertical to horizontal ratio

WAL – Water Access Licence

Western CMA – Western Catchment Management Authority

WM Act – Water Management Act 2000

WSP – Water Sharing Plan

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