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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Environmental Impact Statement

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Avoca Tank Project

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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:

name:	Mitchell Anthony Bland
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(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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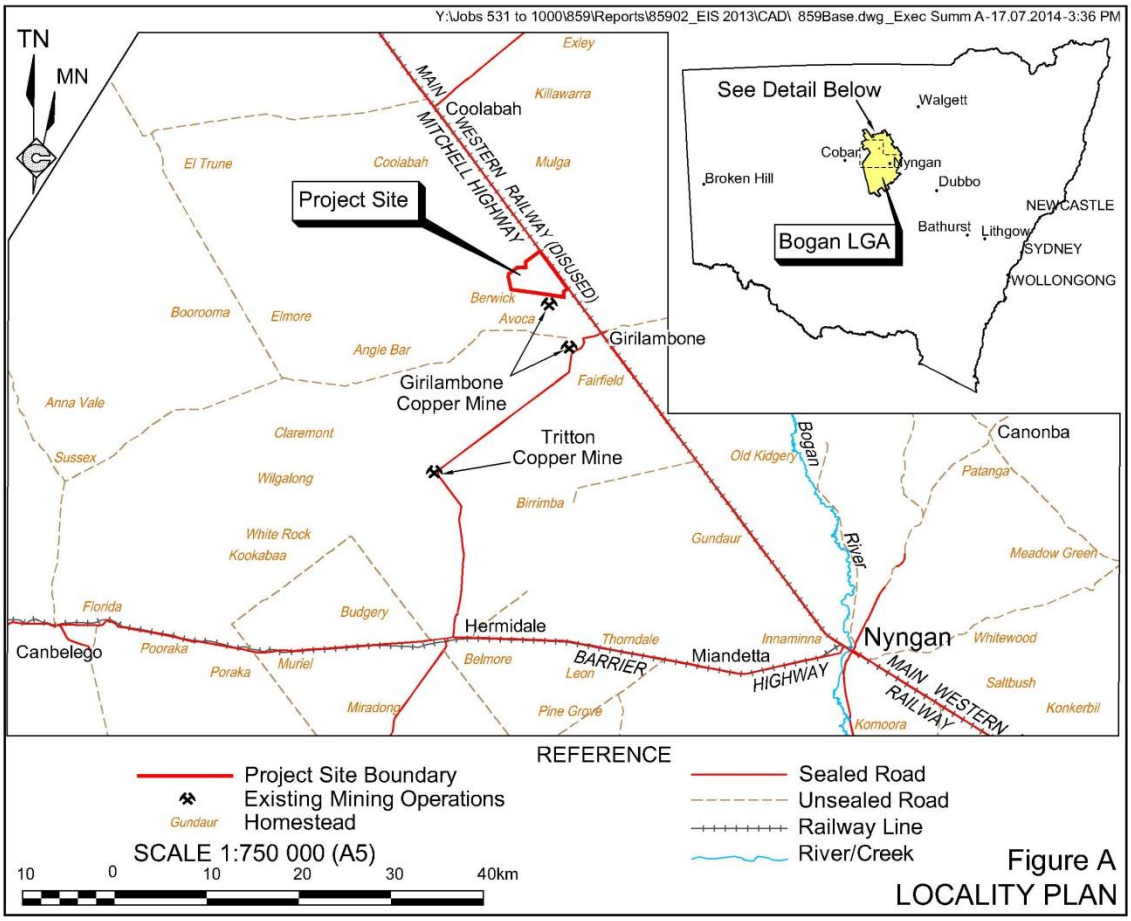
Executive Summary

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

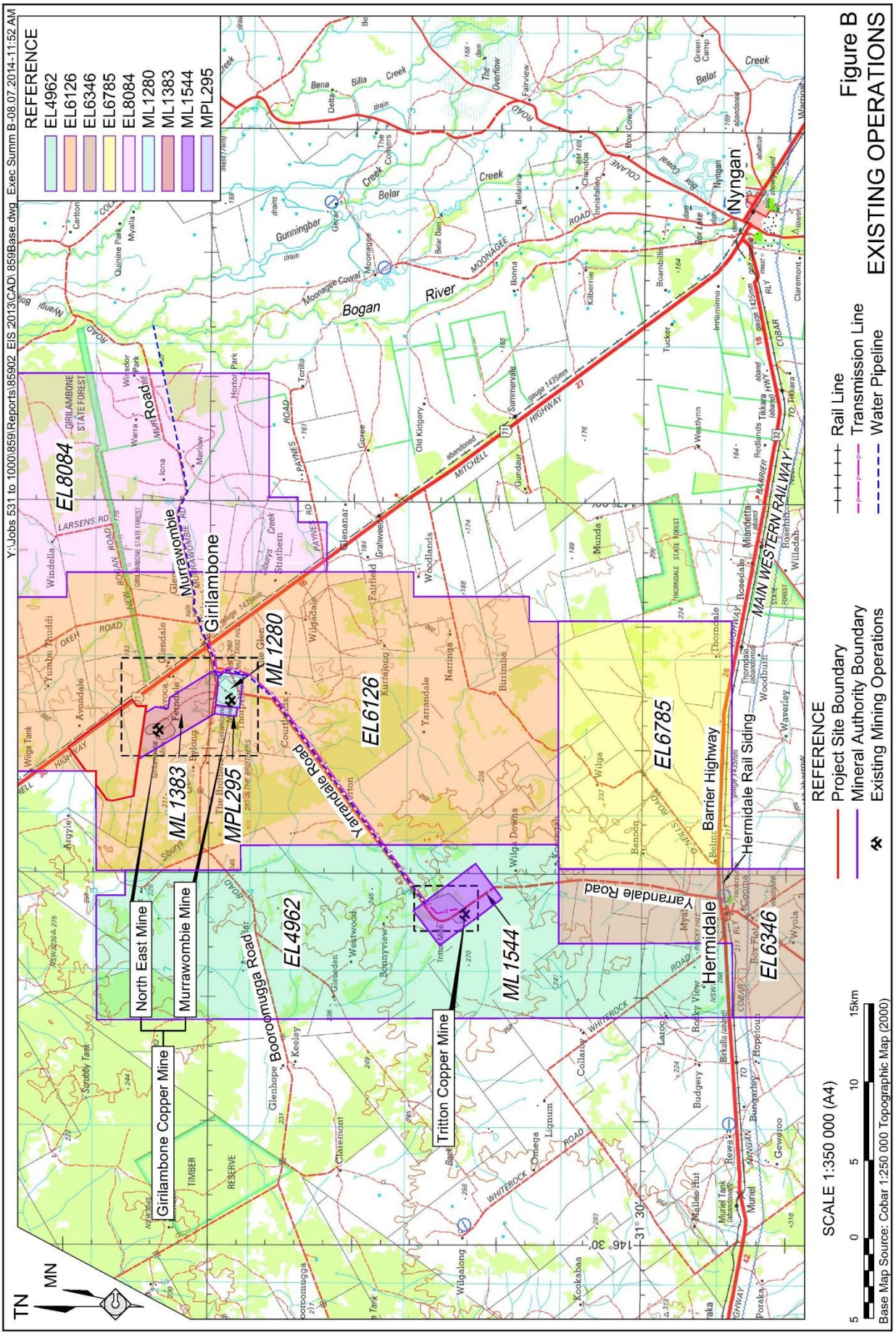
In addition to development consent, the Applicant anticipates the following approvals, licences and leases would be required.

- 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.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ML1383
ML1544
MPL295
EL8084
EL6126
EL6785
EL4962
EL6346
ML1280
ML1383
MPL295
ML1544
North East Mine
Murrawombie Mine
Girilambone Copper Mine
Tritton Copper Mine
Girilambone
Murrawombie
Nyngan
Hermidale
Hermidale Rail Siding
Barrier Highway
Yarrandale Road
Booroomugga Road
Bogan River
MAIN WESTERN RAIL WAY
MITCHELL HIGHWAY
OLSEN HIGHWAY
GIRILAMBONE STATE FOREST
THORNDALE STATE FOREST
TIMBER RESERVE
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.

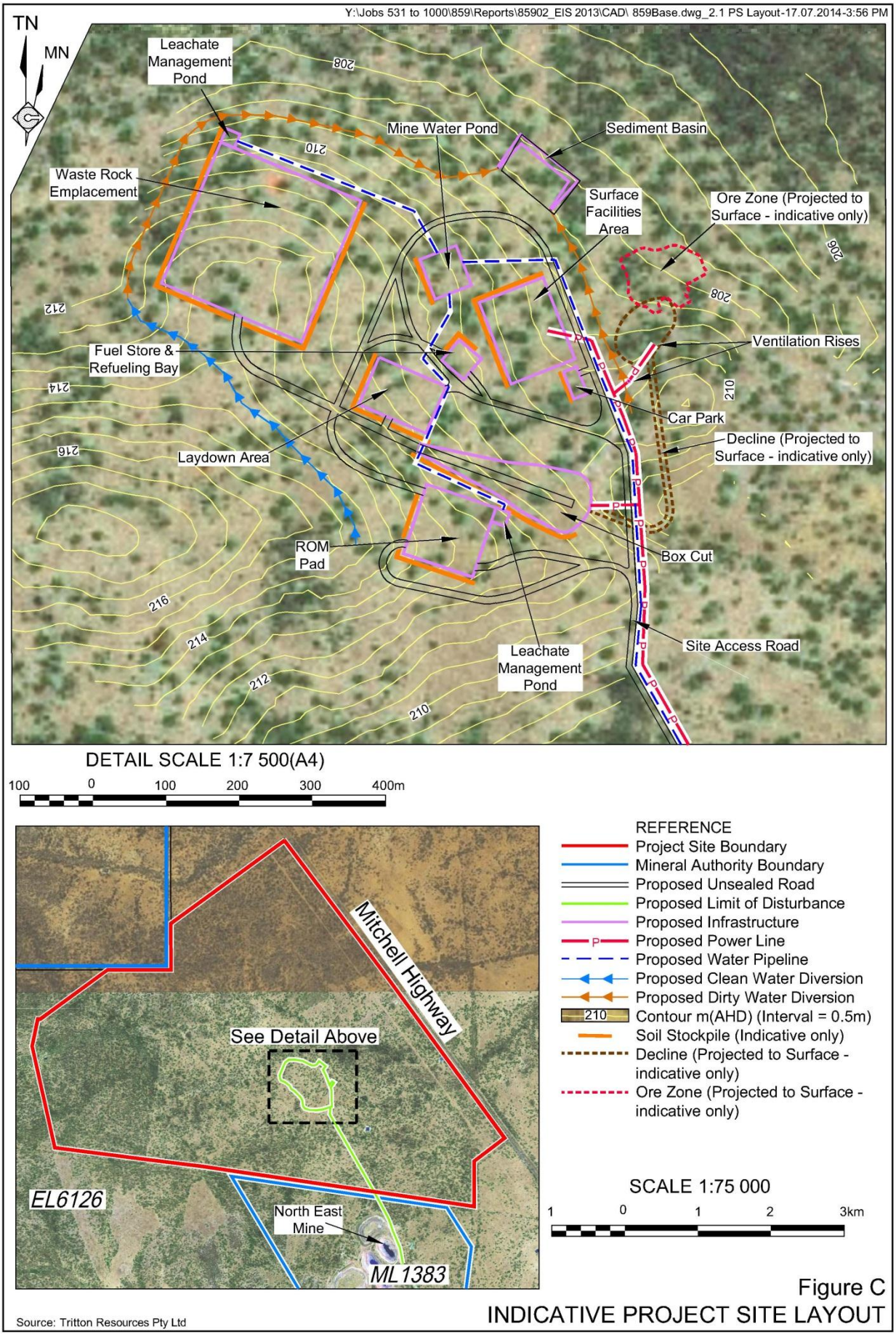


Figure C
INDICATIVE PROJECT SITE LAYOUT

- 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.

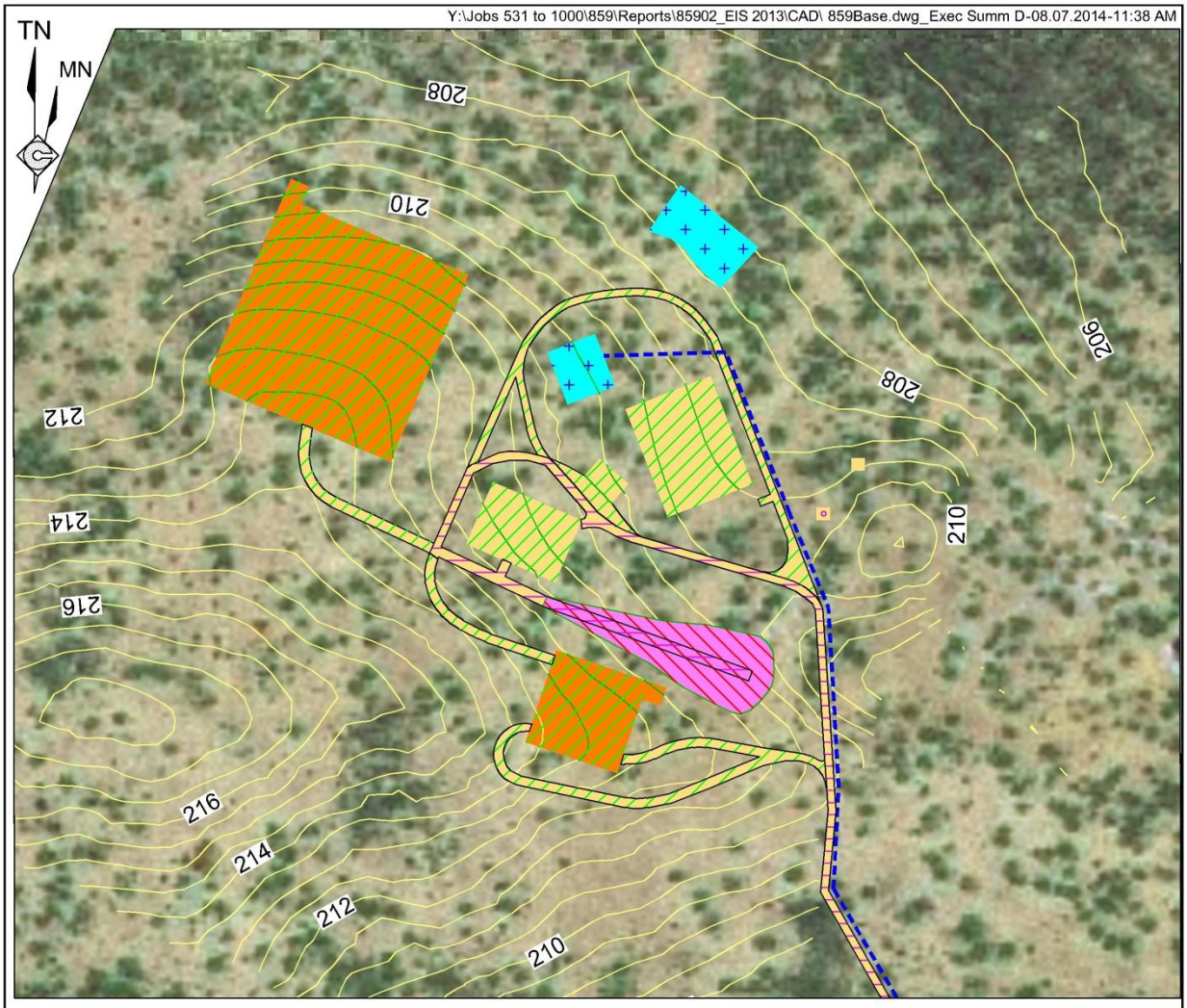
The remaining operations including site establishment, underground mining, ore transportation and maintenance operations would occur 24 hours per day, seven days per week.

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).

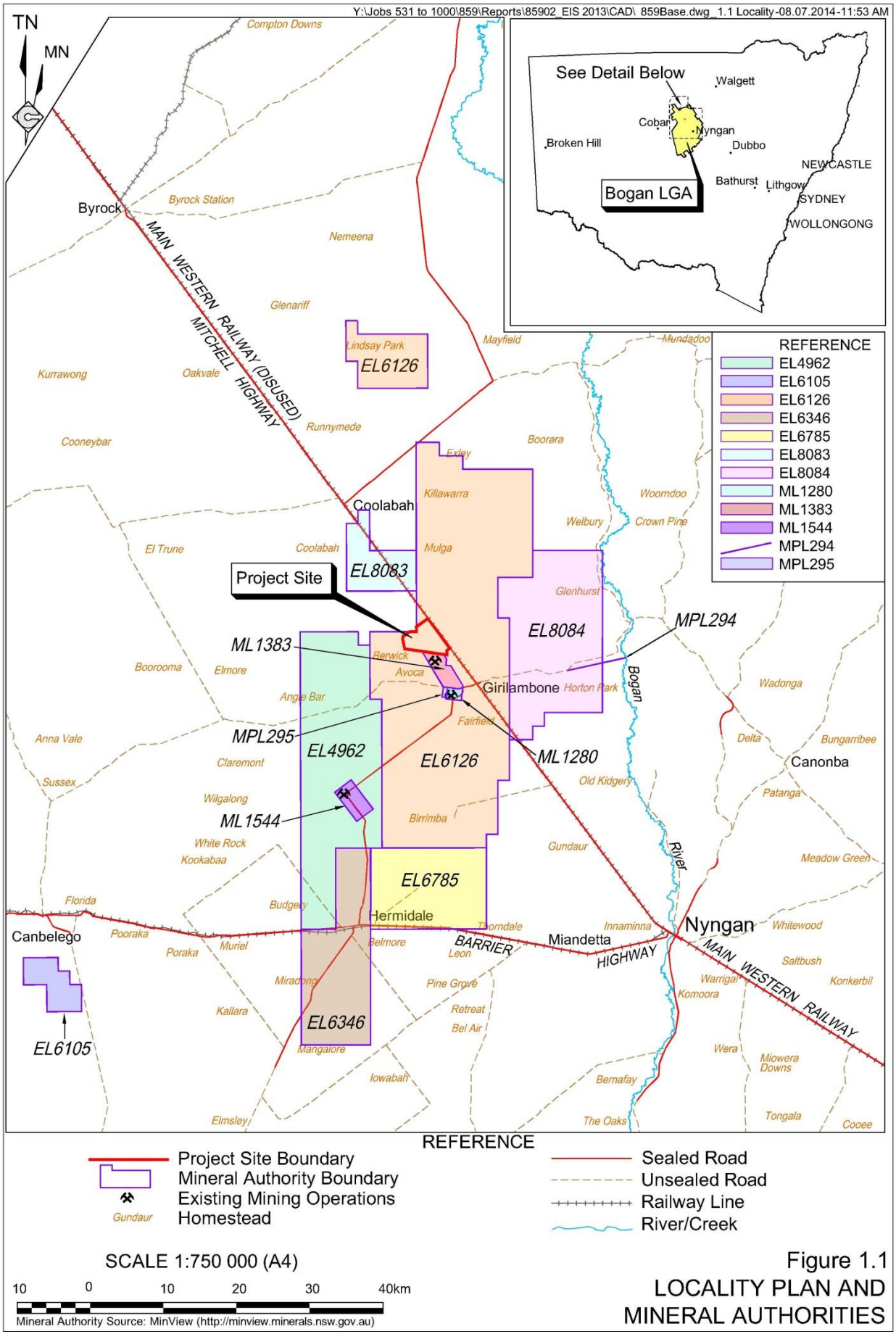


Figure 1.1
LOCALITY PLAN AND MINERAL AUTHORITIES

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.

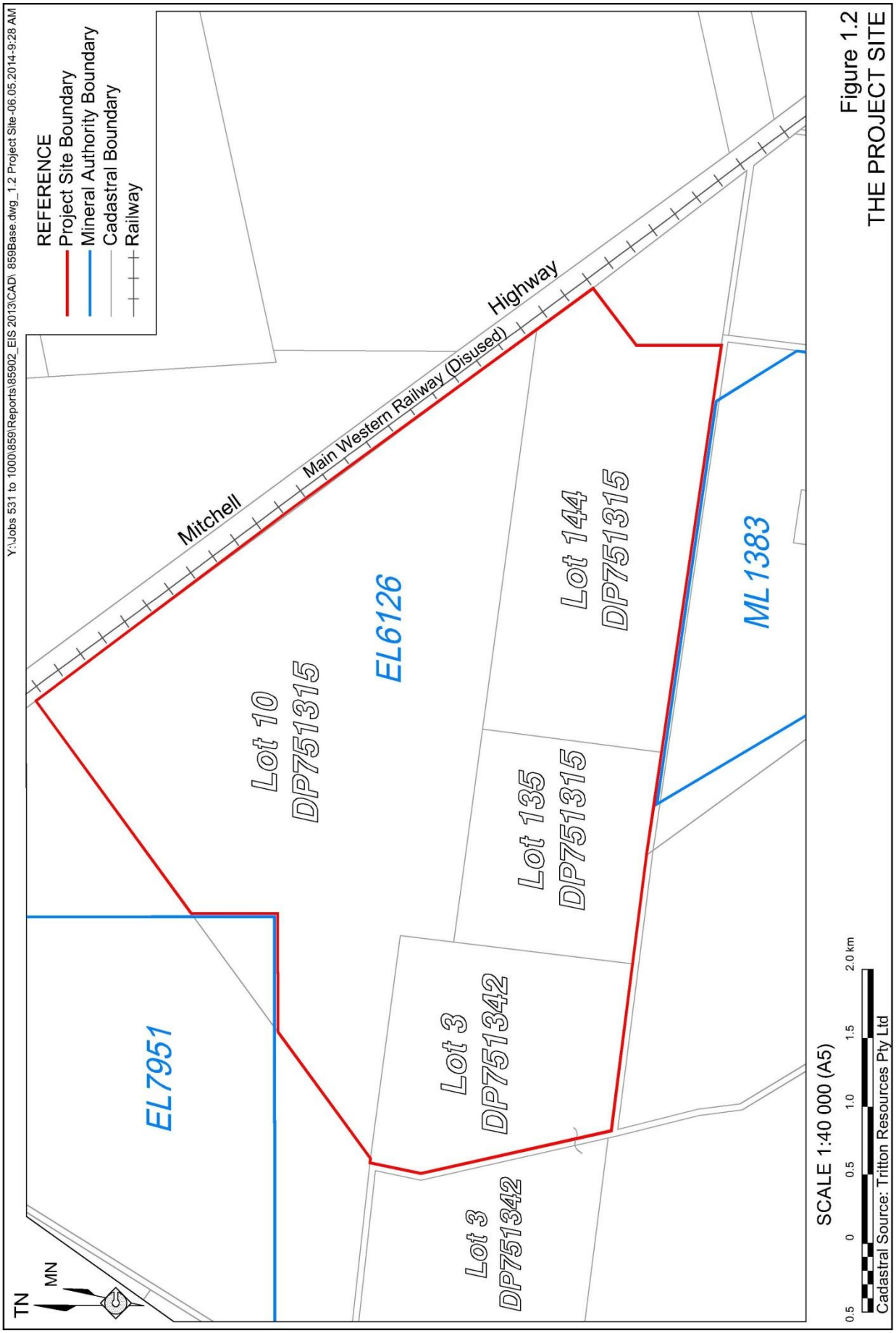
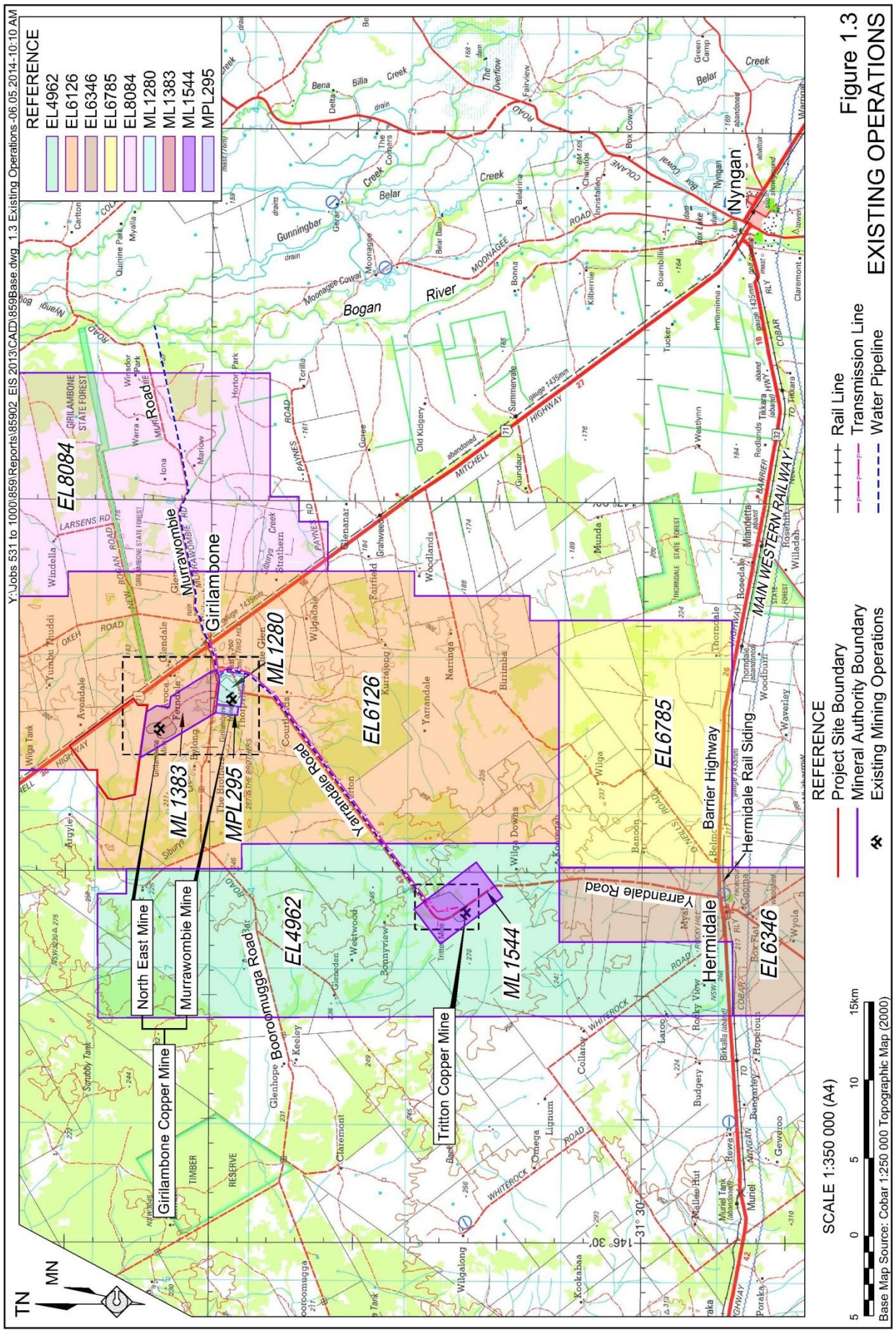


Figure 1.2
THE PROJECT SITE


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
EL6785
EL6346
ML1280
ML1383
ML1544
MPL295
Girilambone
Murrawombie
Hermidale
Nyngan
Bogan River
Yarrandale Road
Barrier Highway
Hermidale Rail Siding
MAIN WESTERN RAILWAY
North East Mine
Murrawombie Mine
Girilambone Copper Mine
Tritton Copper Mine
REFERENCE
Project Site Boundary
Mineral Authority Boundary
Existing Mining Operations
Rail Line
Transmission Line
Water Pipeline
SCALE 1:350 000 (A4)
Base Map Source: Cobar 1:250 000 Topographic Map (2000)
TN
MN
Figure 1.3
EXISTING OPERATIONS

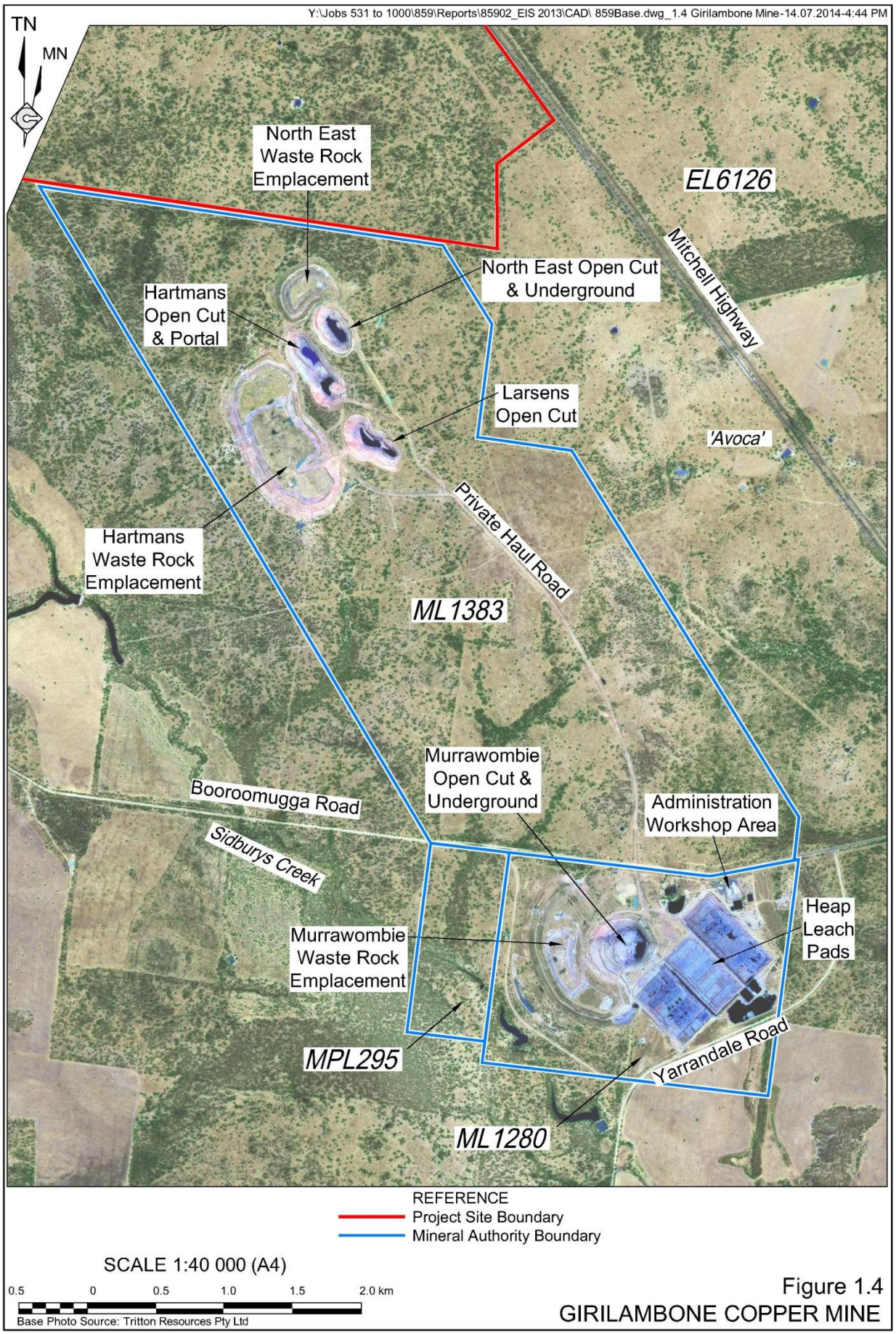


Figure 1.4
GIRILAMBONE COPPER MINE

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.

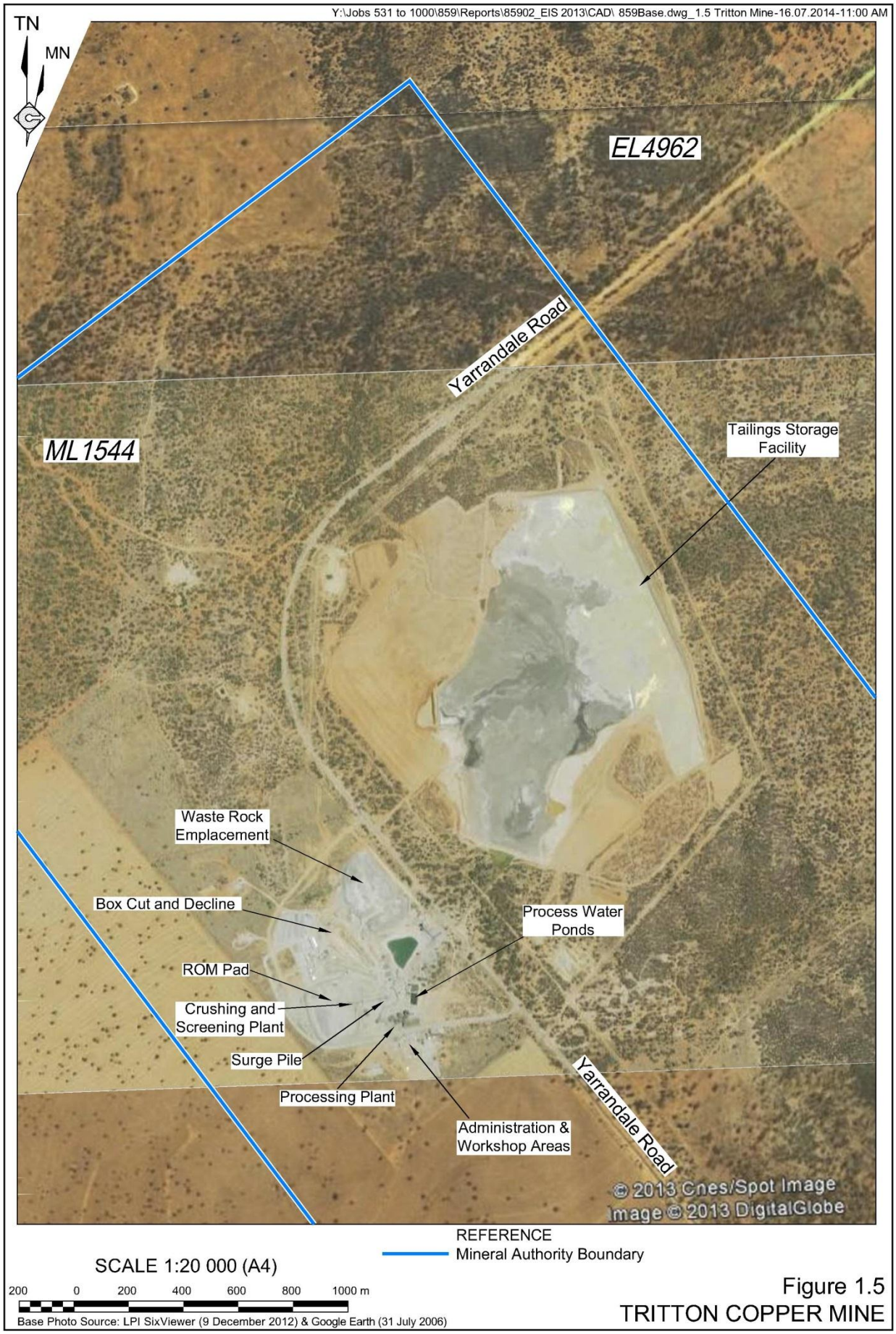


Figure 1.5
TRITTON COPPER MINE

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

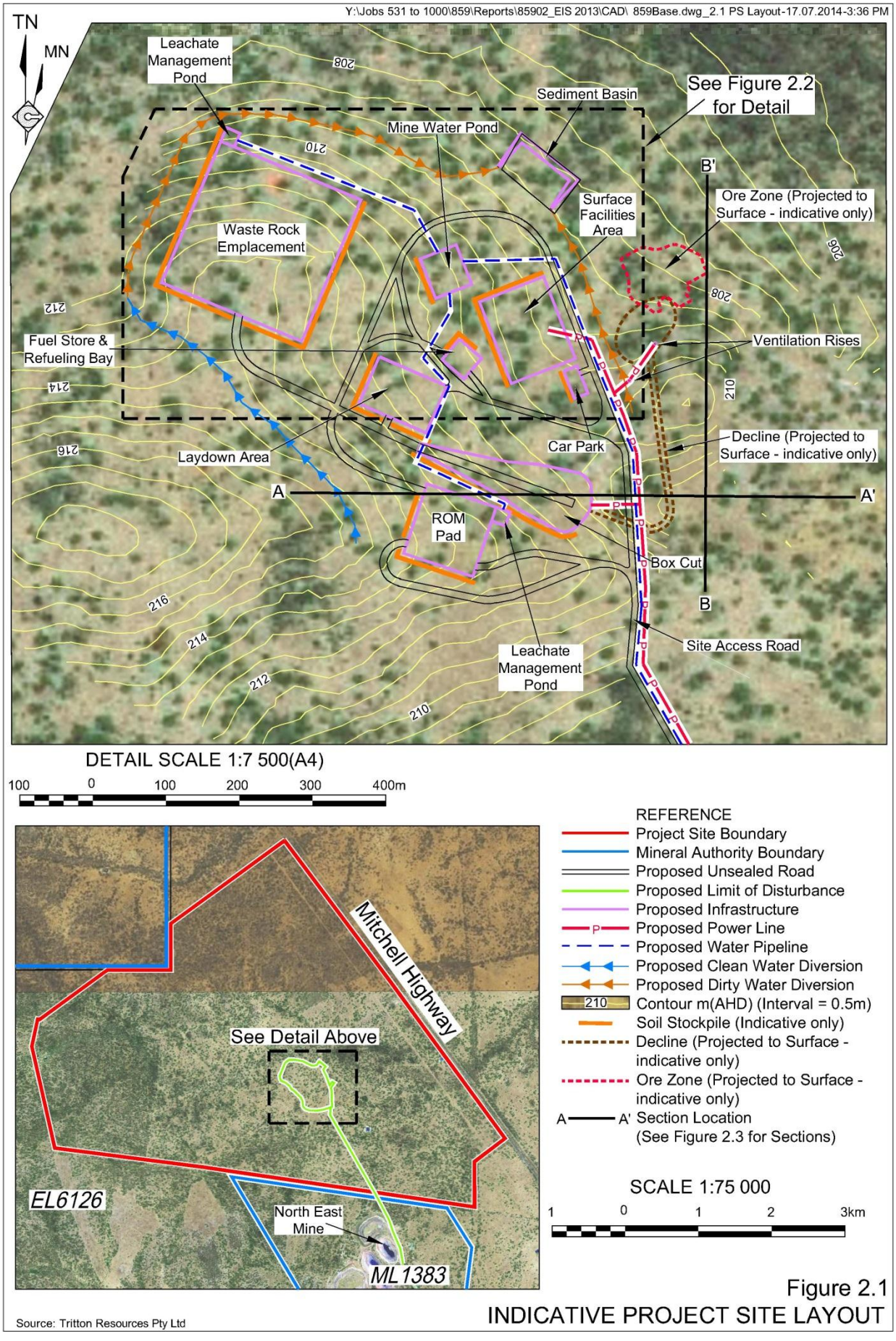
The Applicant's objectives in constructing and operating the Avoca Tank Project would be as follows.

- 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

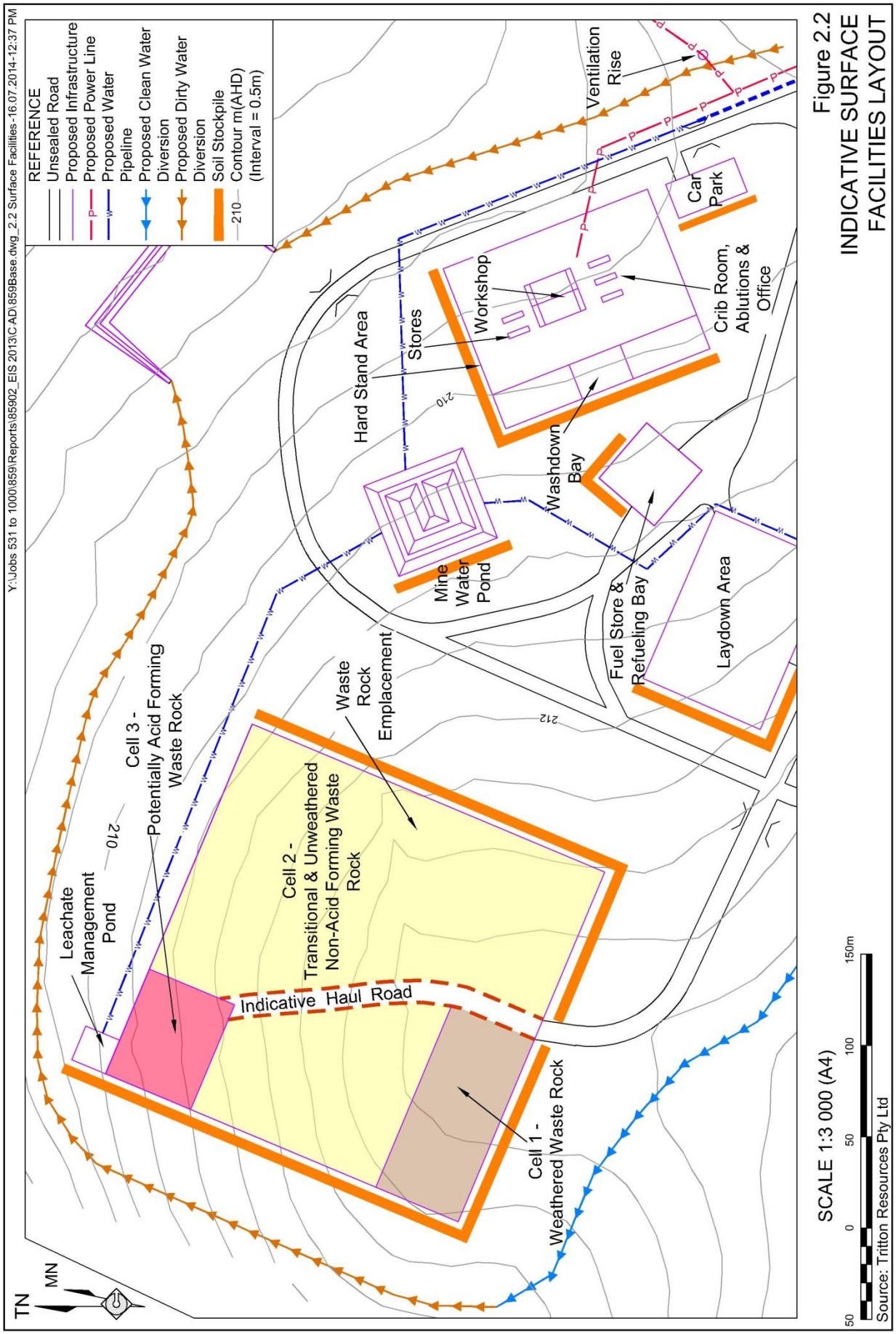


Figure 2.2
INDICATIVE SURFACE FACILITIES LAYOUT

- 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.

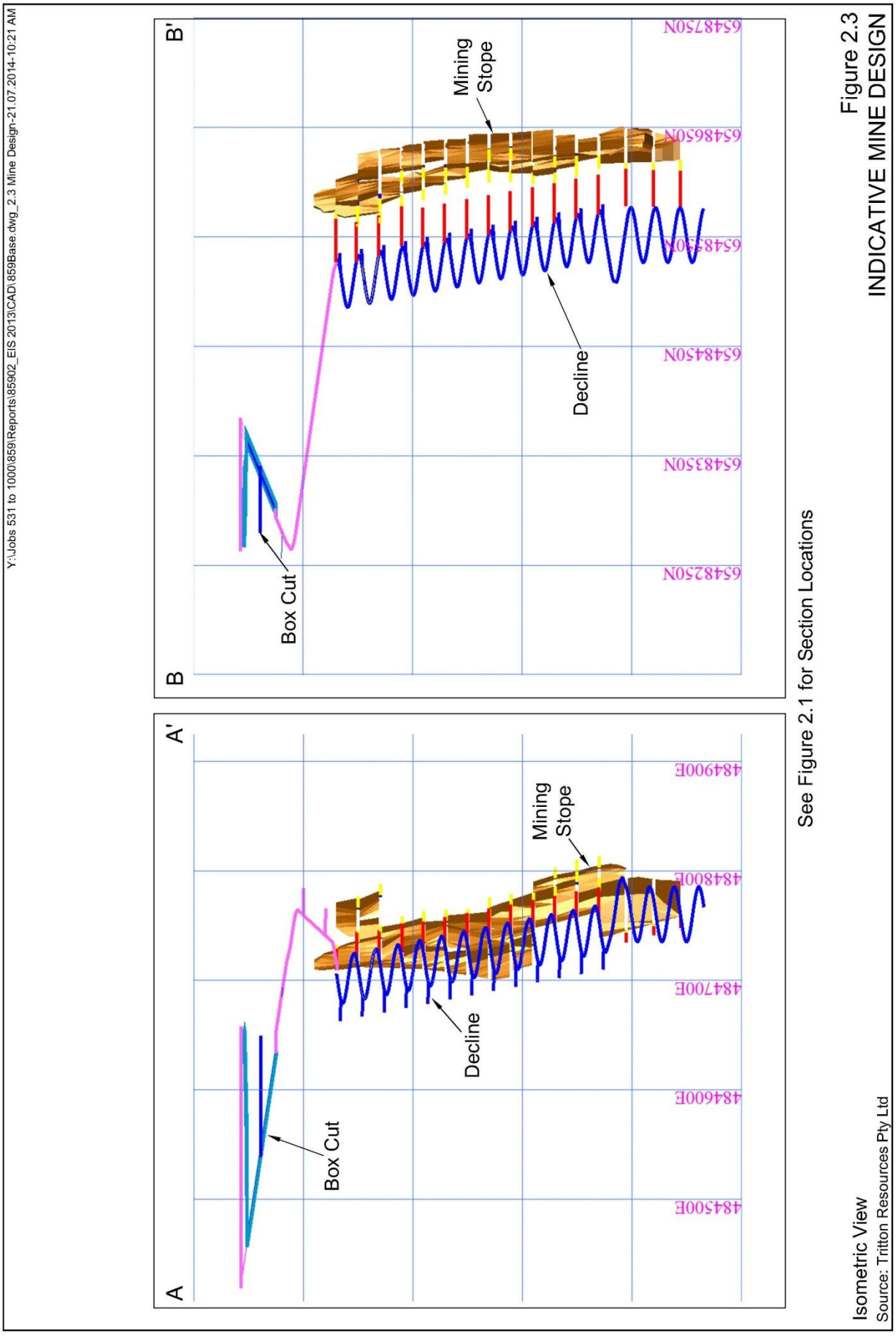


Figure 2.3
INDICATIVE MINE DESIGN

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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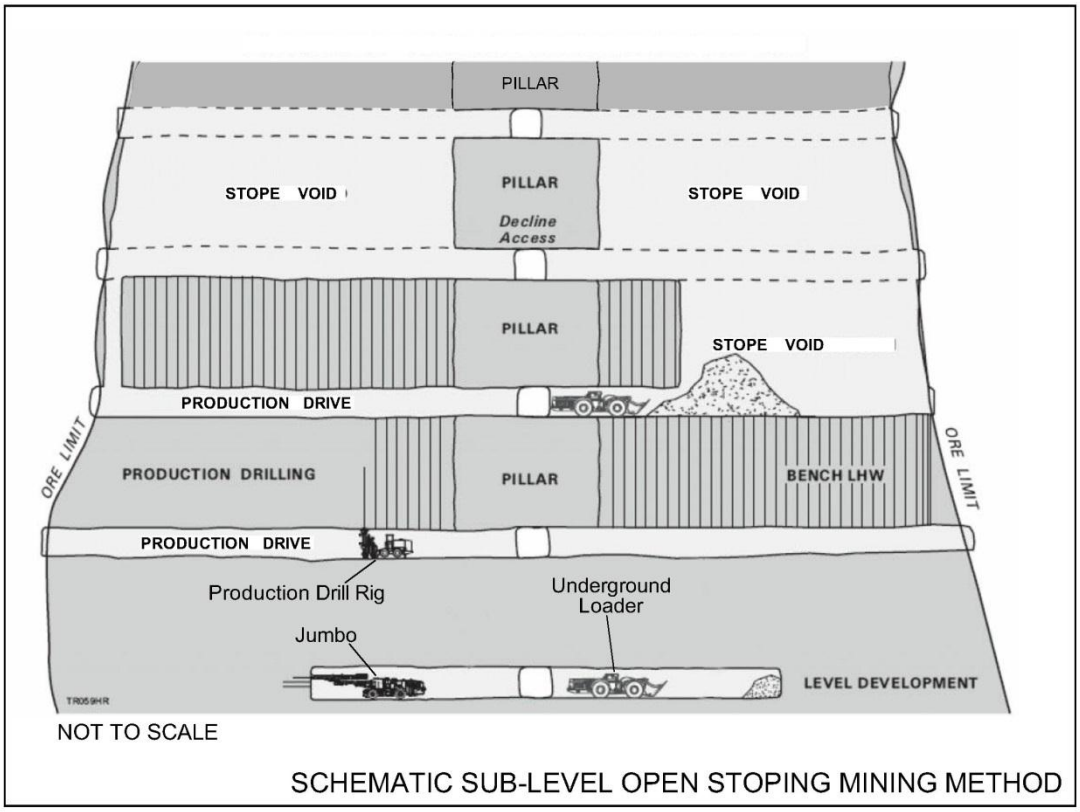

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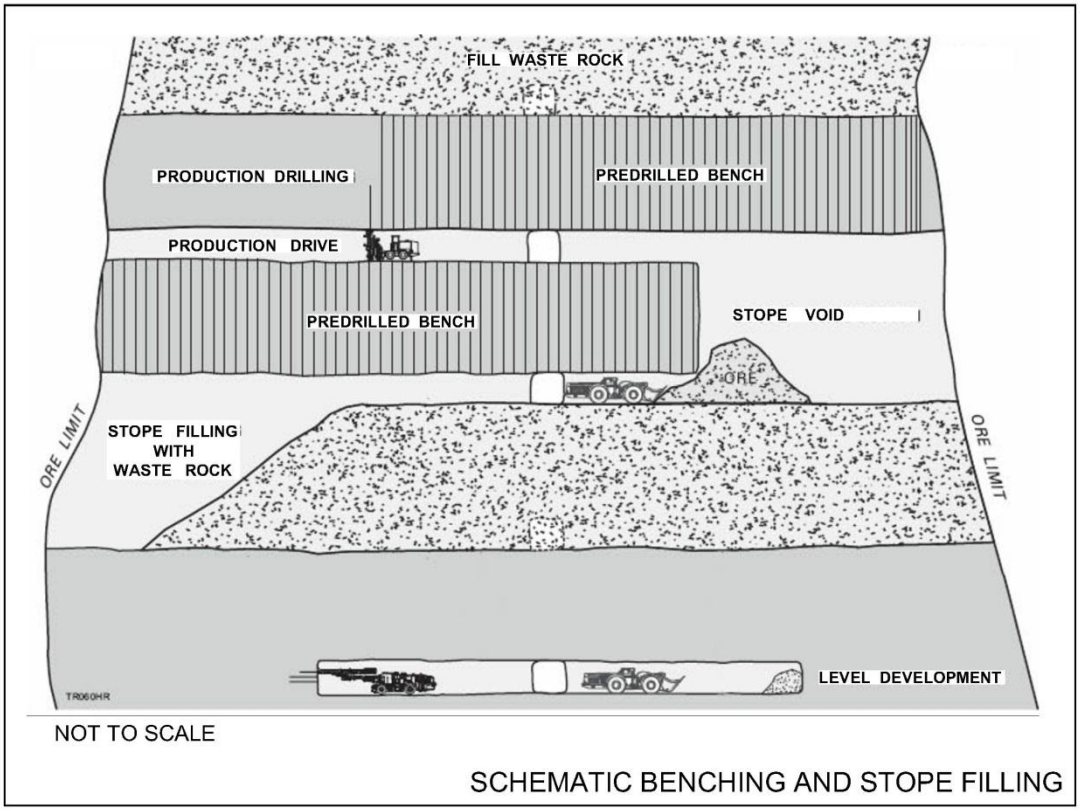
SCHEMATIC SUB-LEVEL OPEN STOPING MINING METHOD



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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

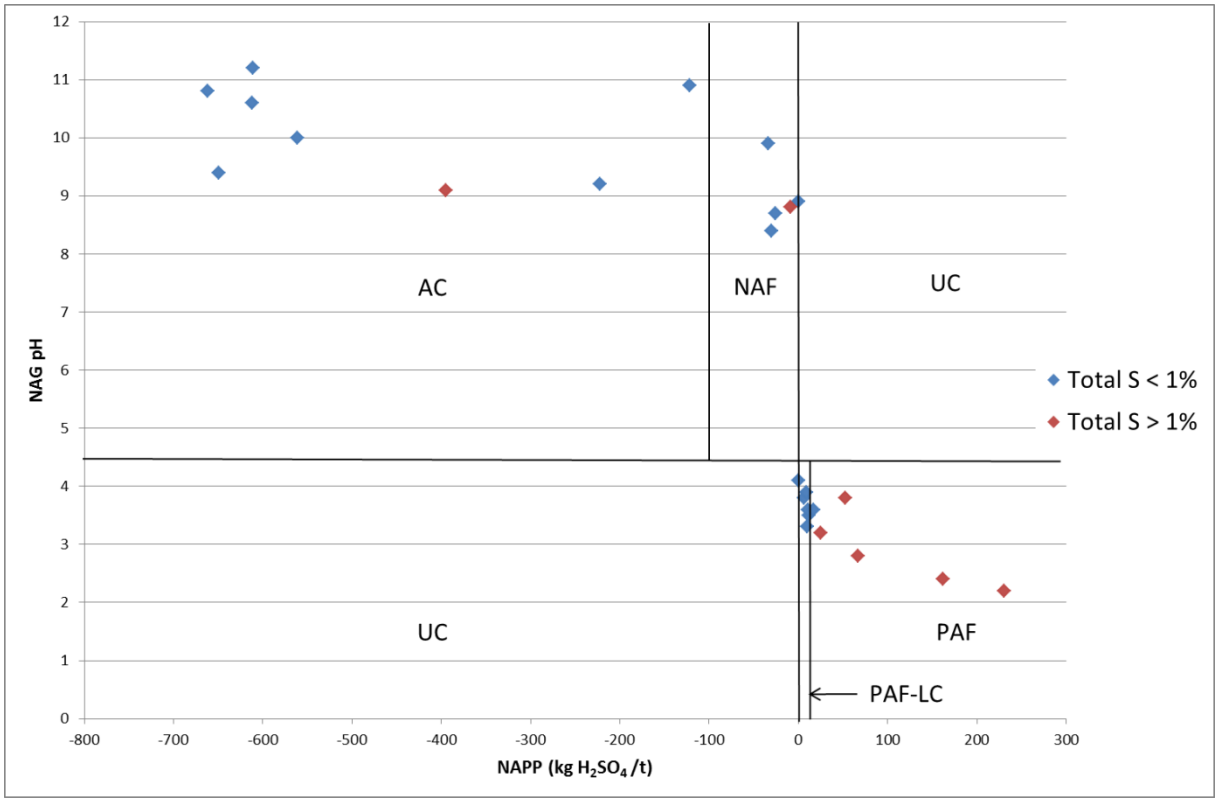


FIGURE 2.5
WASTE ROCK CHARACTERISATION RESULTS

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

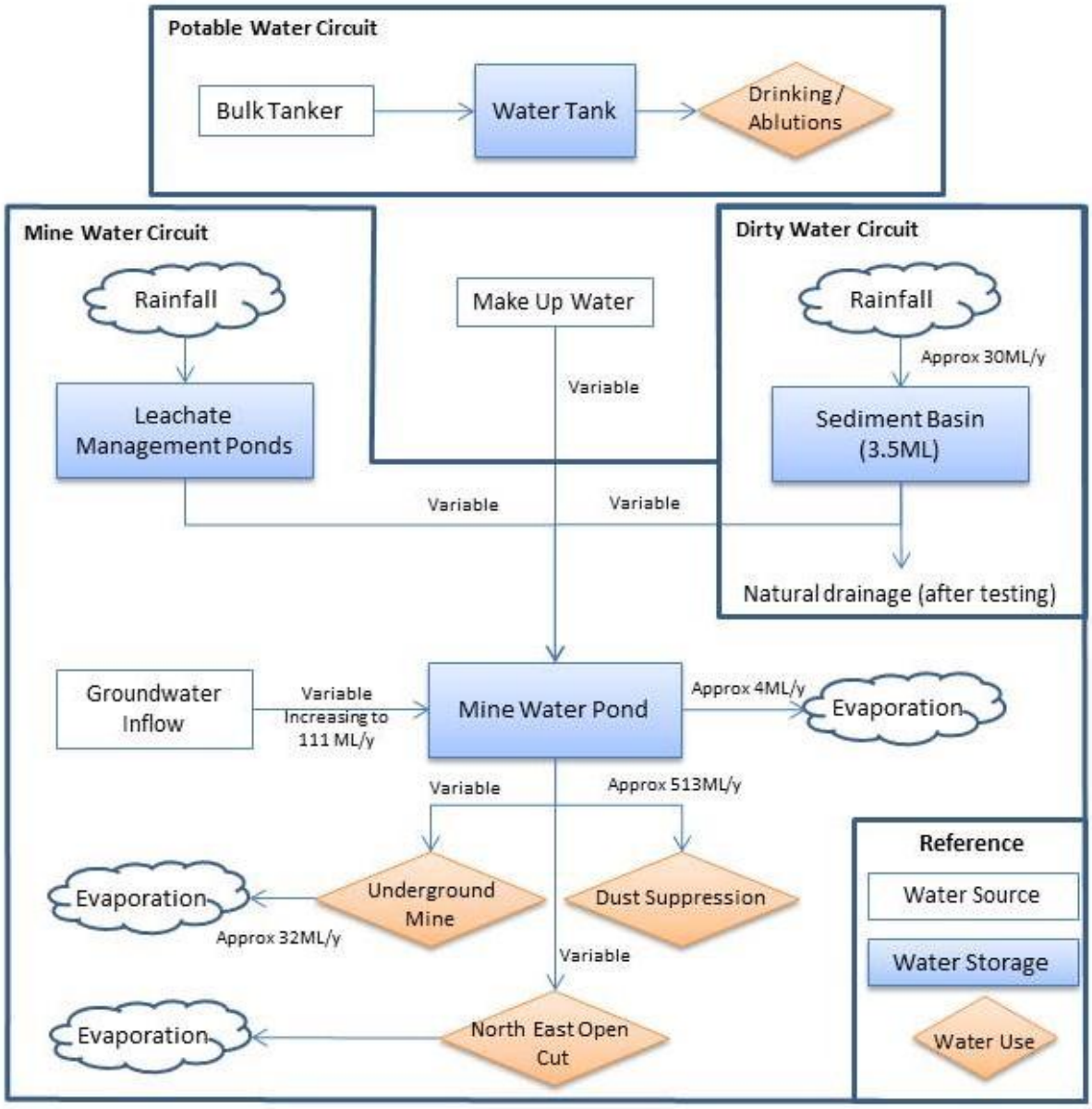


Figure 2.6
SCHEMATIC WATER BALANCE

  - 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.

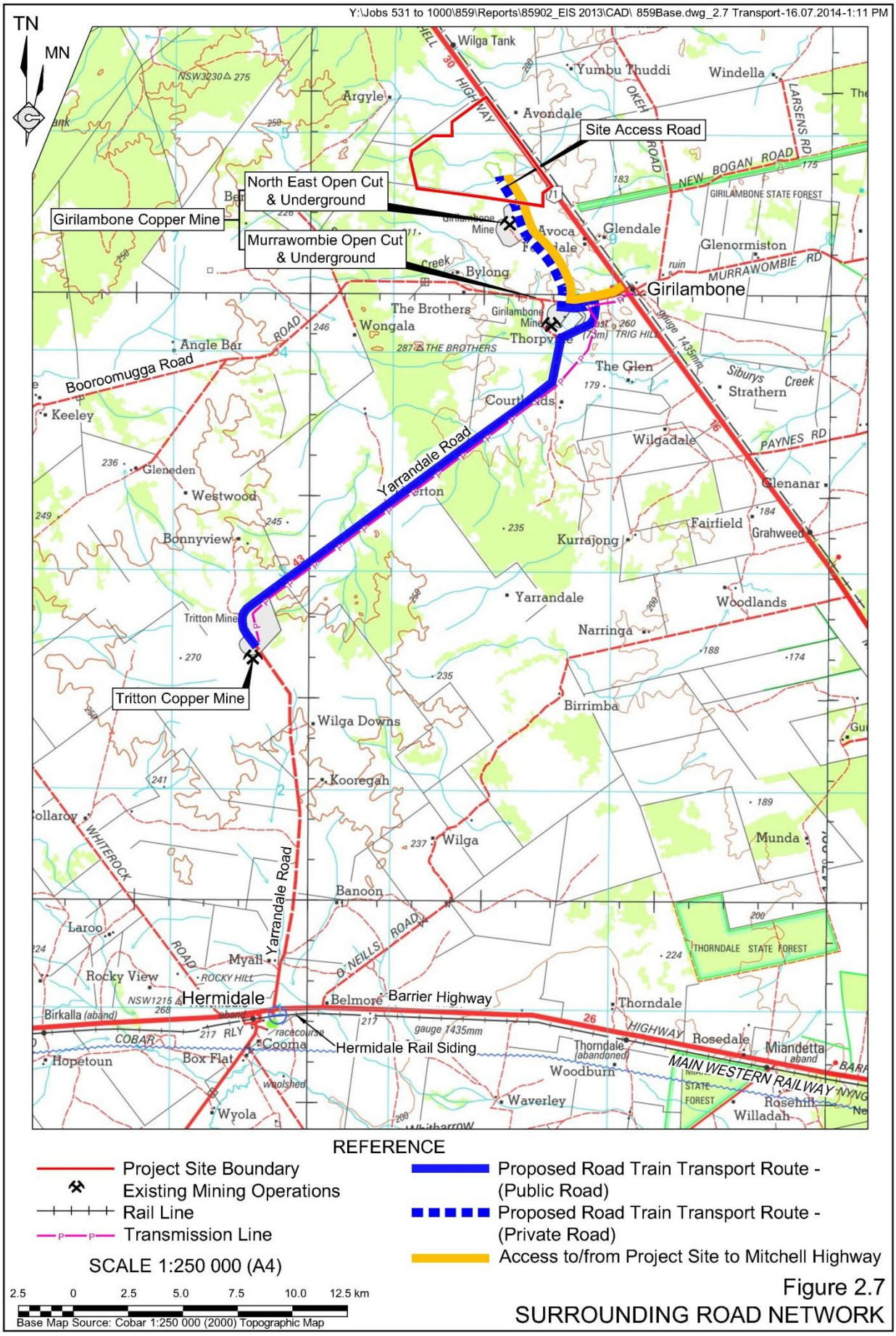


Figure 2.7
SURROUNDING ROAD NETWORK

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.

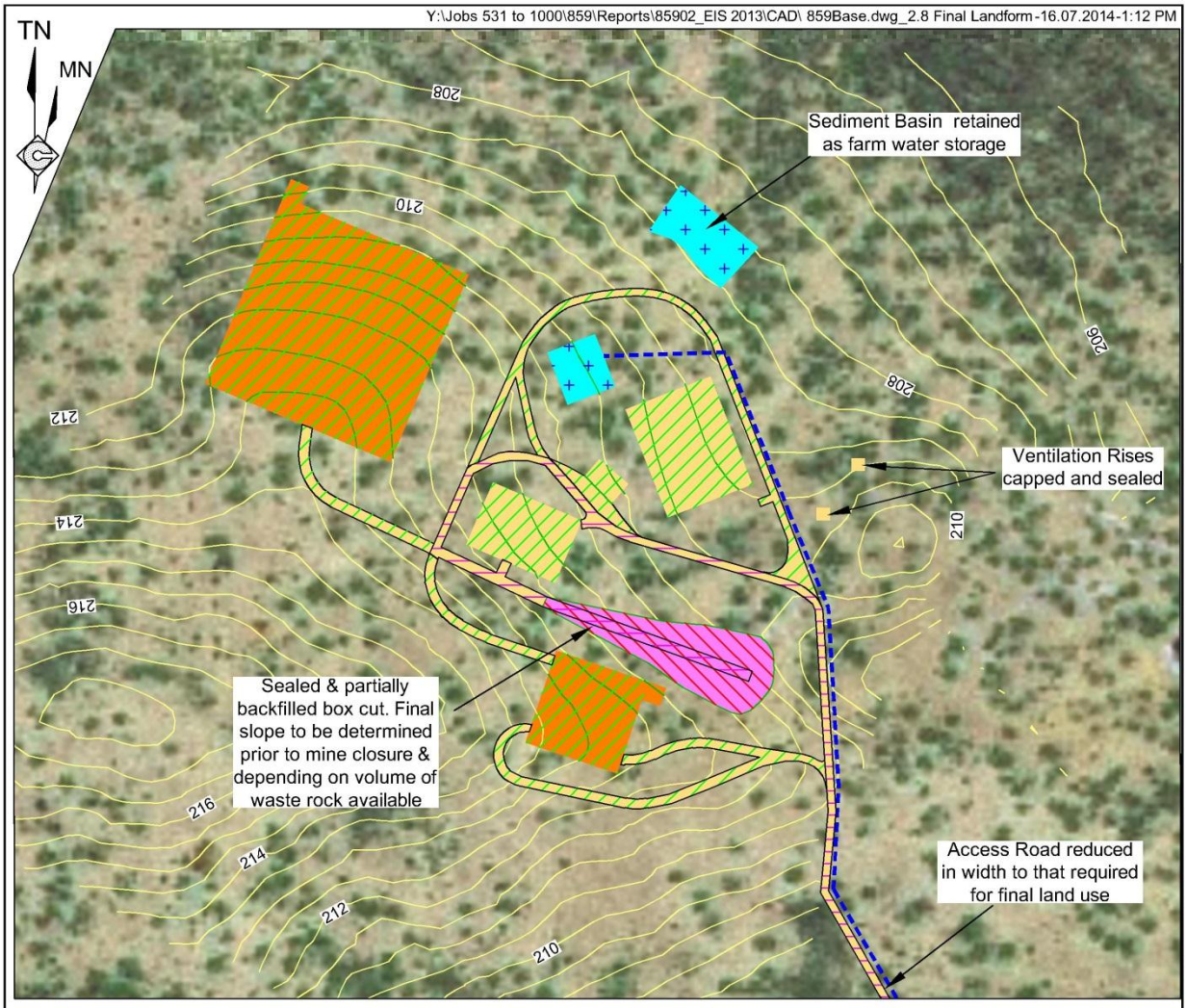
Primary Domains

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%.

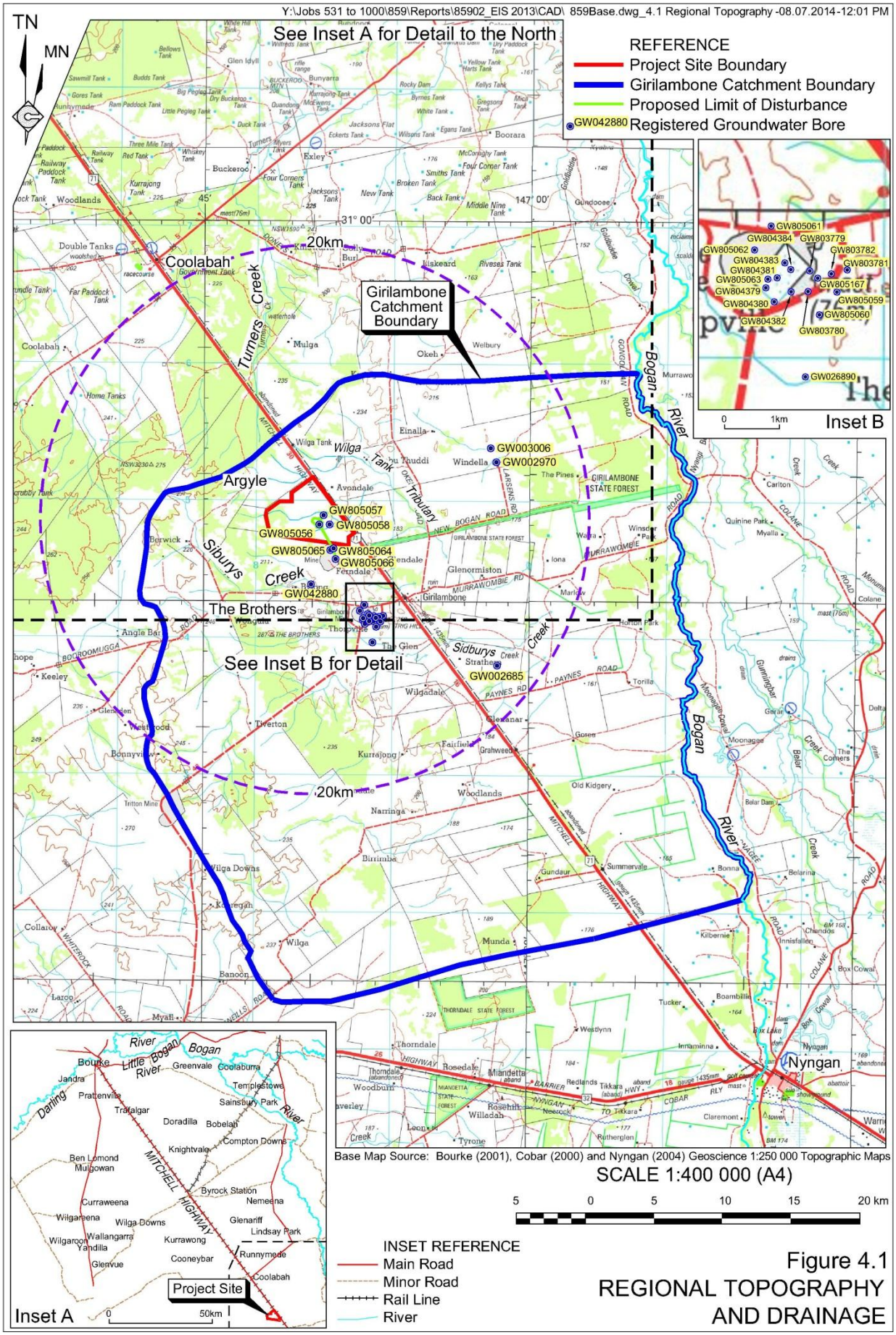


Figure 4.1
REGIONAL TOPOGRAPHY AND DRAINAGE

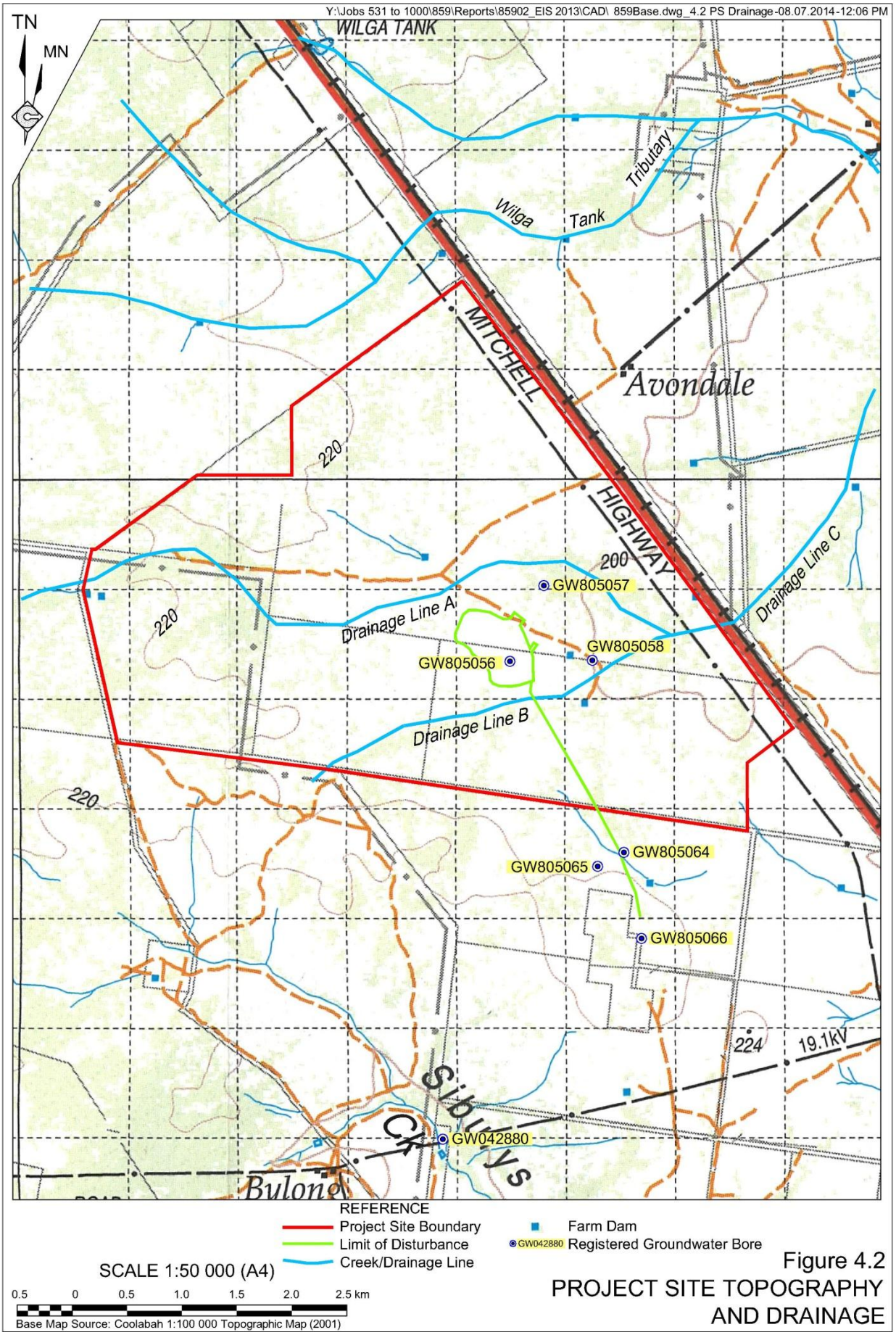


Figure 4.2
PROJECT SITE TOPOGRAPHY AND DRAINAGE

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.

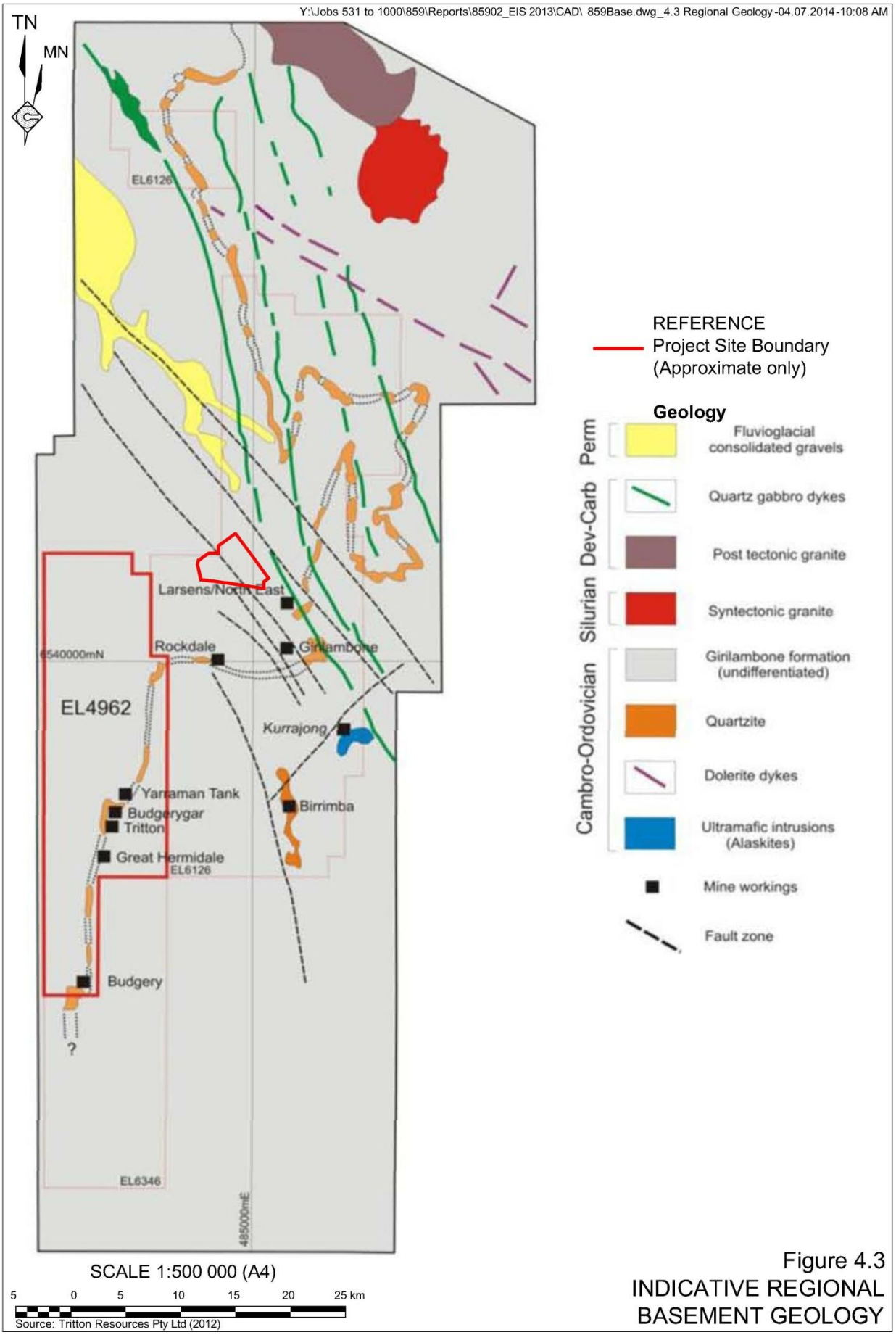


Figure 4.3
INDICATIVE REGIONAL BASEMENT GEOLOGY

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.

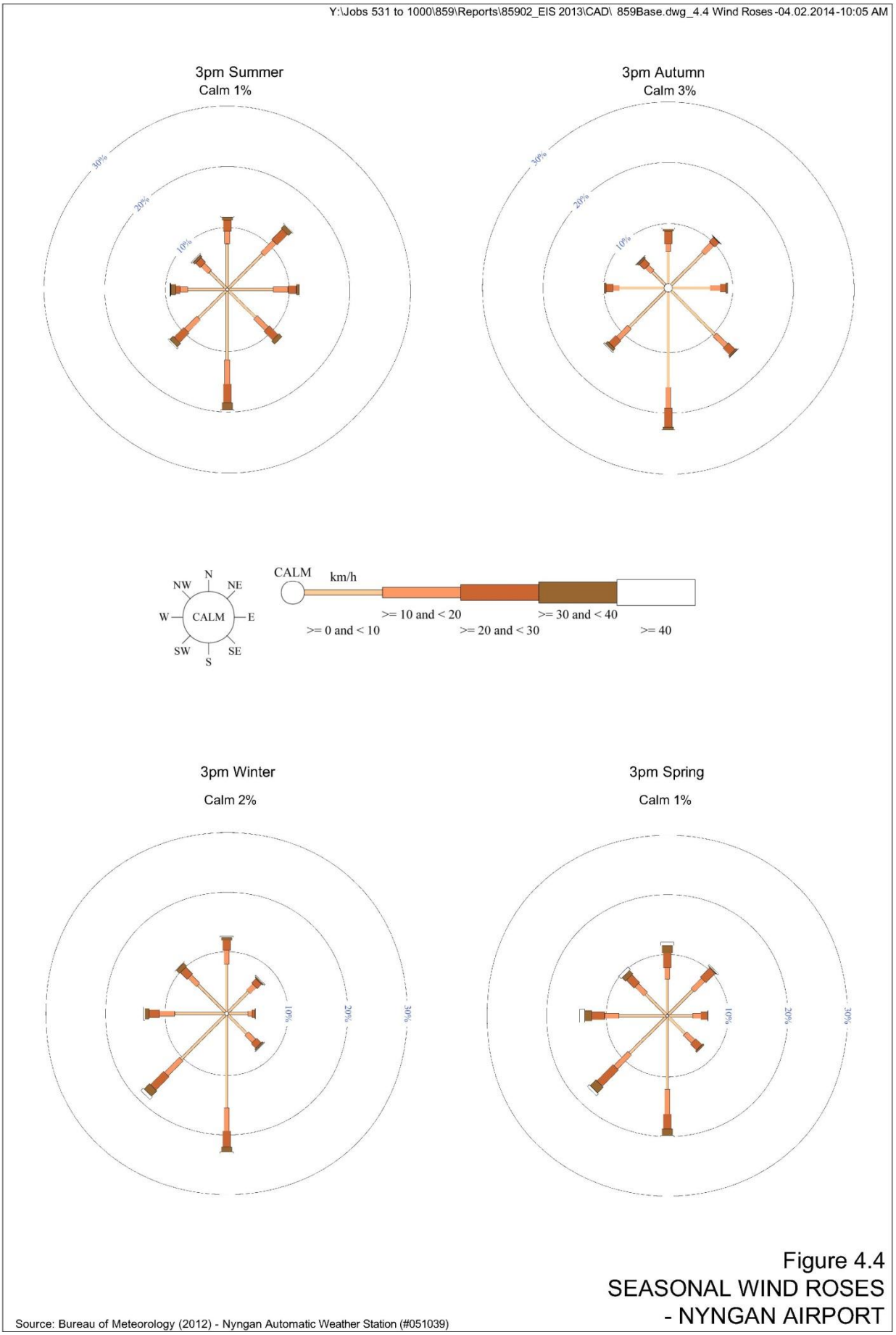


Figure 4.4
SEASONAL WIND ROSES
- NYNGAN AIRPORT

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.

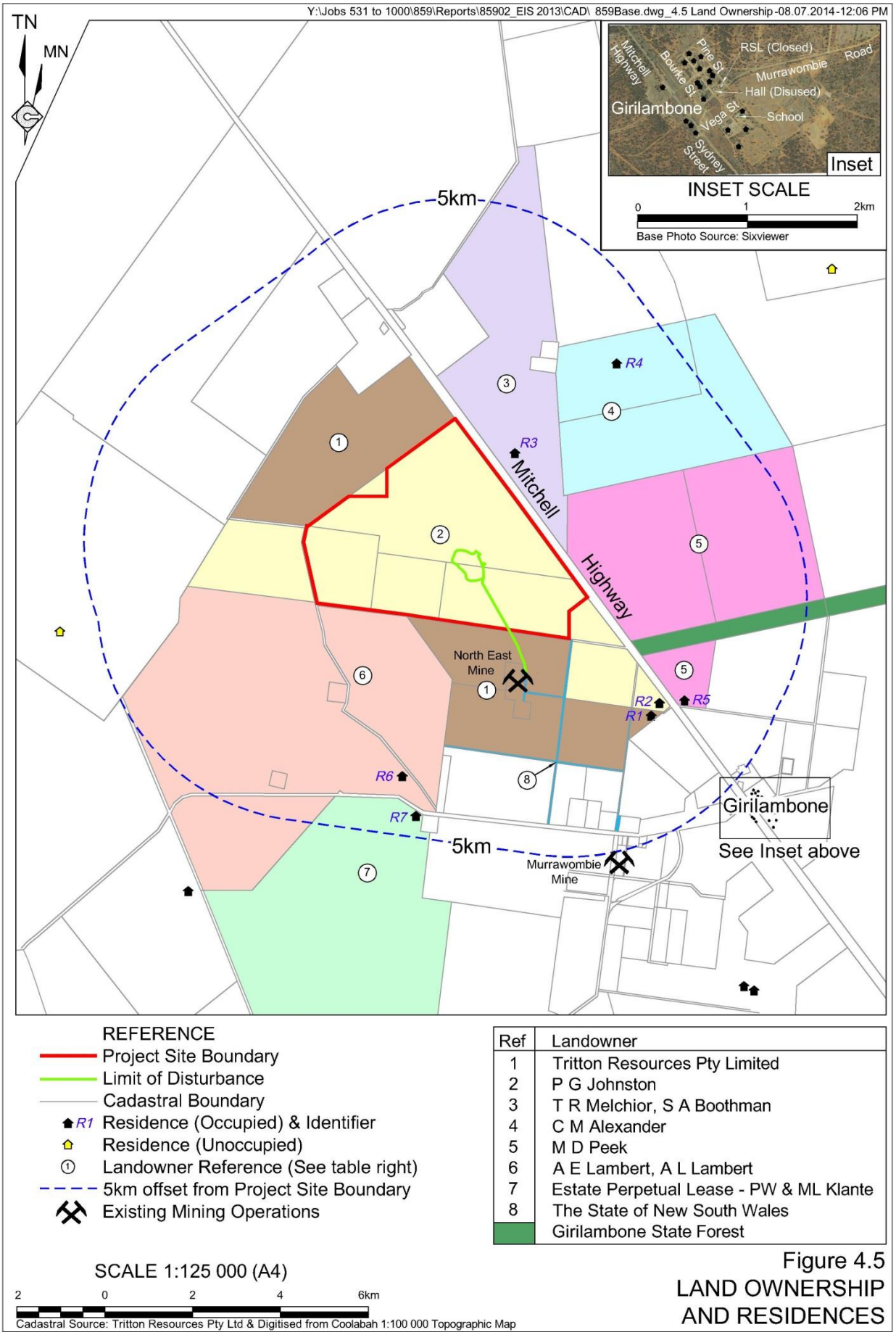
The closet residence to the proposed activities is Residence 3, located approximately 2.5km to the northeast of the hardstand area.

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.



Ref	Landowner
1	Tritton Resources Pty Limited
2	P G Johnston
3	T R Melchior, S A Boothman
4	C M Alexander
5	M D Peek
6	A E Lambert, A L Lambert
7	Estate Perpetual Lease - PW & ML Klante
8	The State of New South Wales
	Girilambone State Forest

Figure 4.5
LAND OWNERSHIP AND RESIDENCES

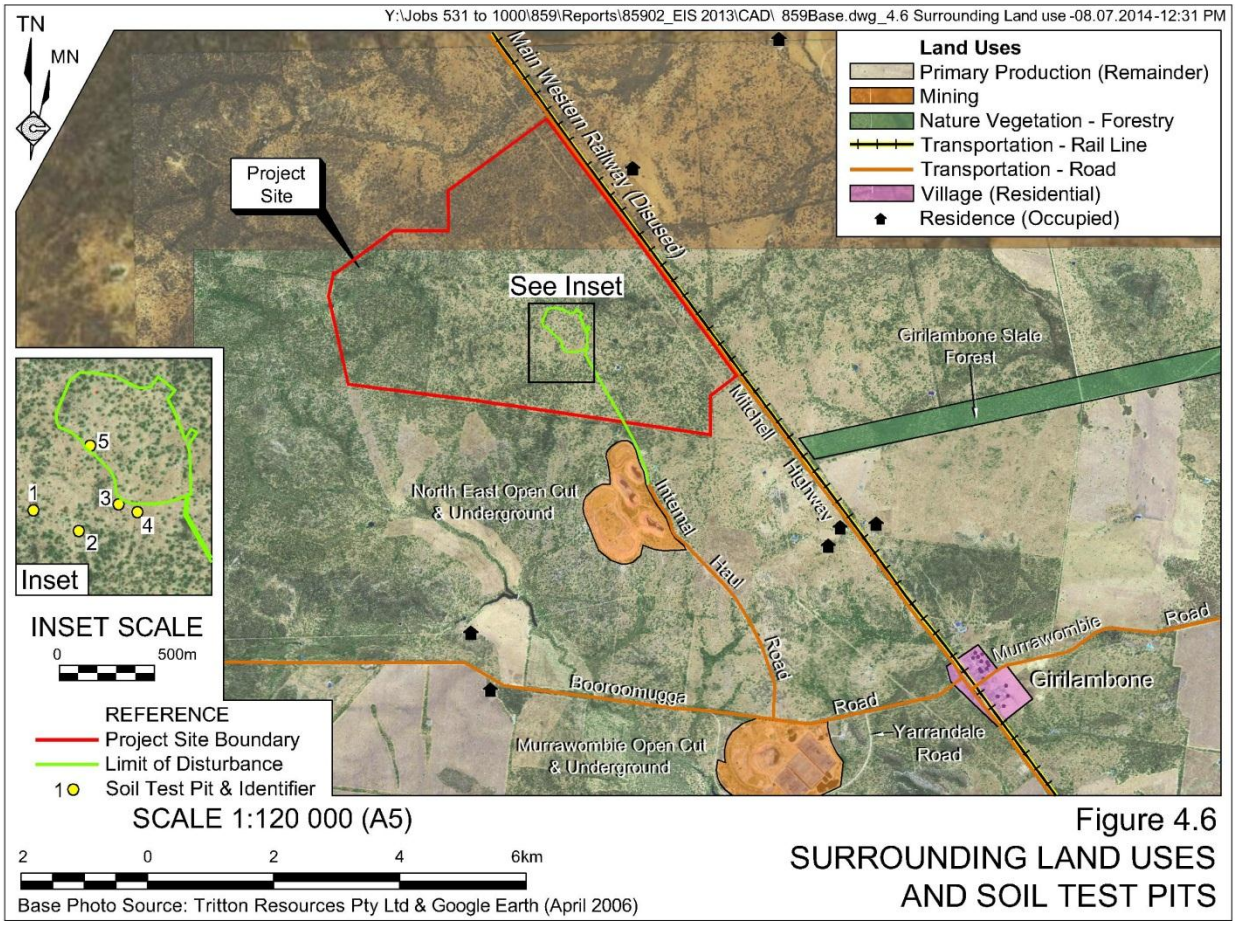


Figure 4.6
SURROUNDING LAND USES AND SOIL TEST PITS

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.		

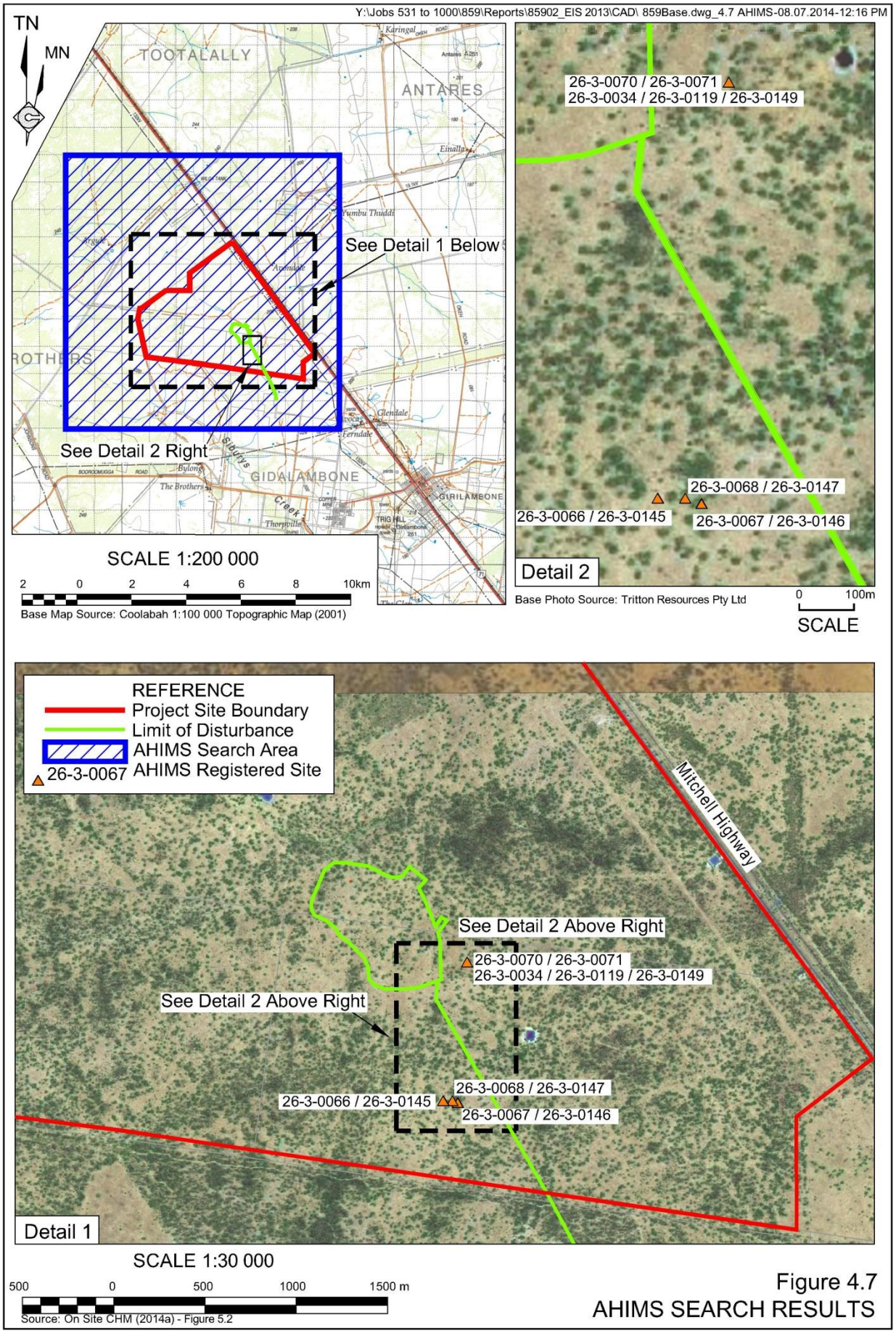


Figure 4.7
AHIMS SEARCH RESULTS

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.

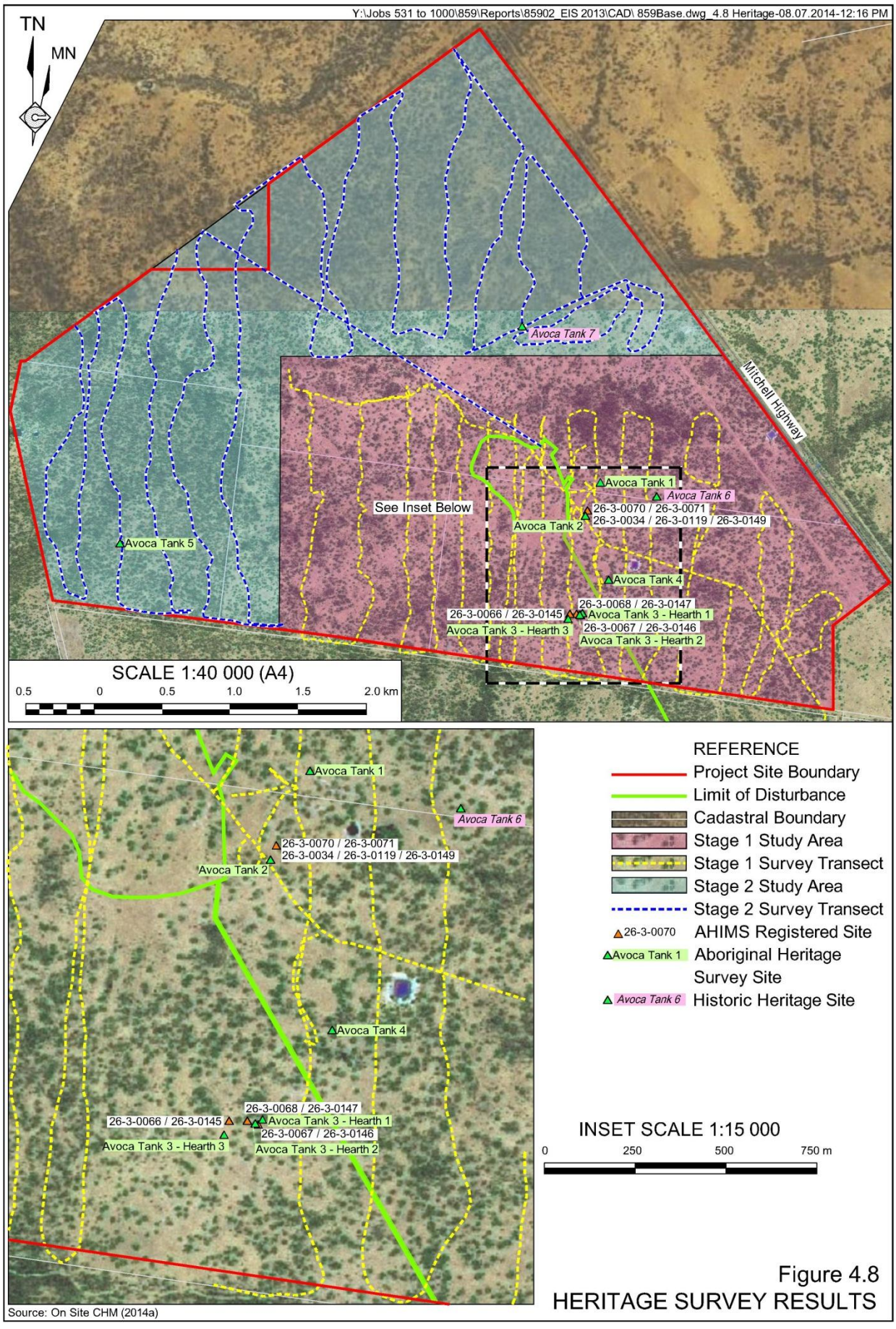
4.2.6 Survey Methodology

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**).

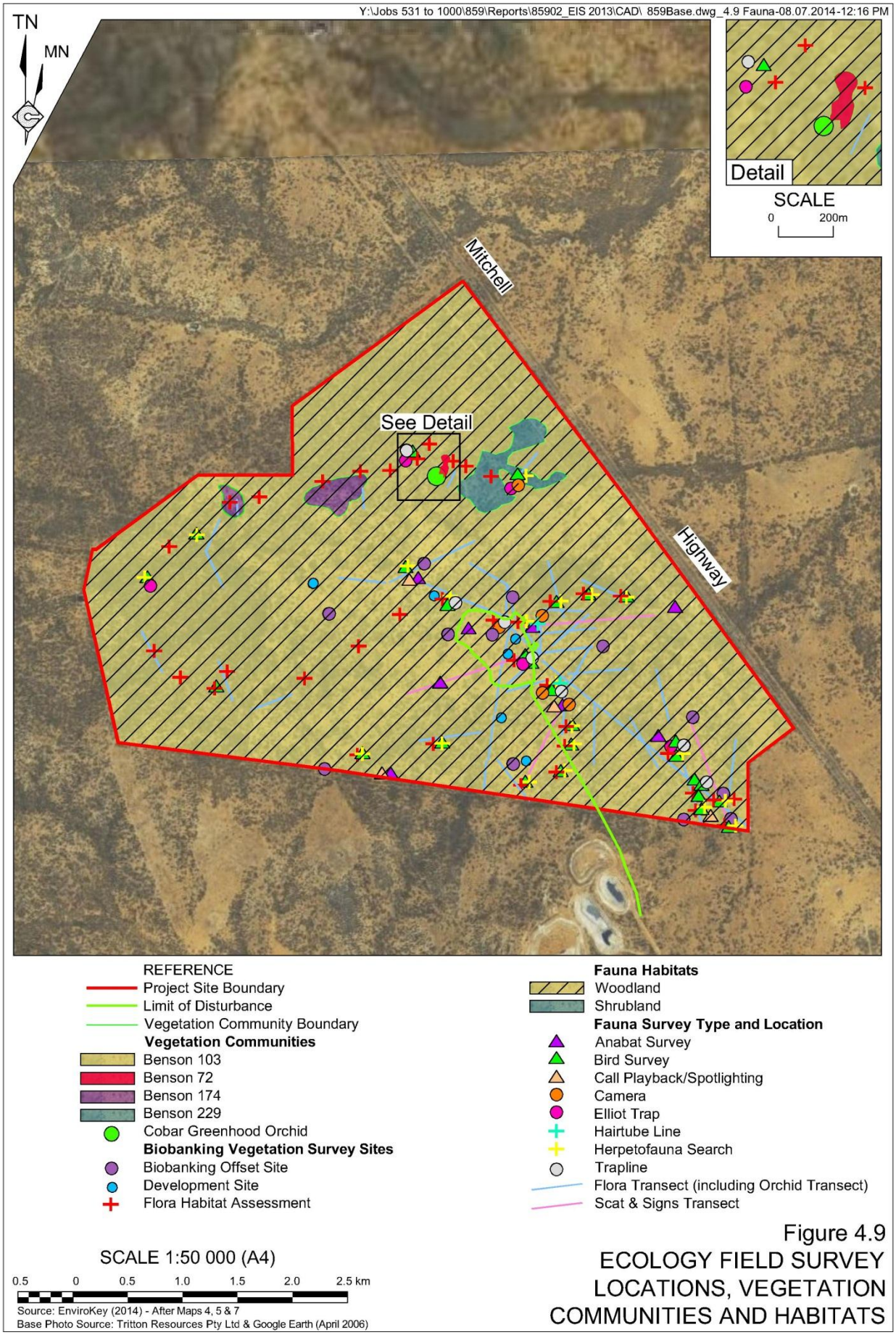


Figure 4.9
ECOLOGY FIELD SURVEY LOCATIONS, VEGETATION COMMUNITIES AND HABITATS

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.

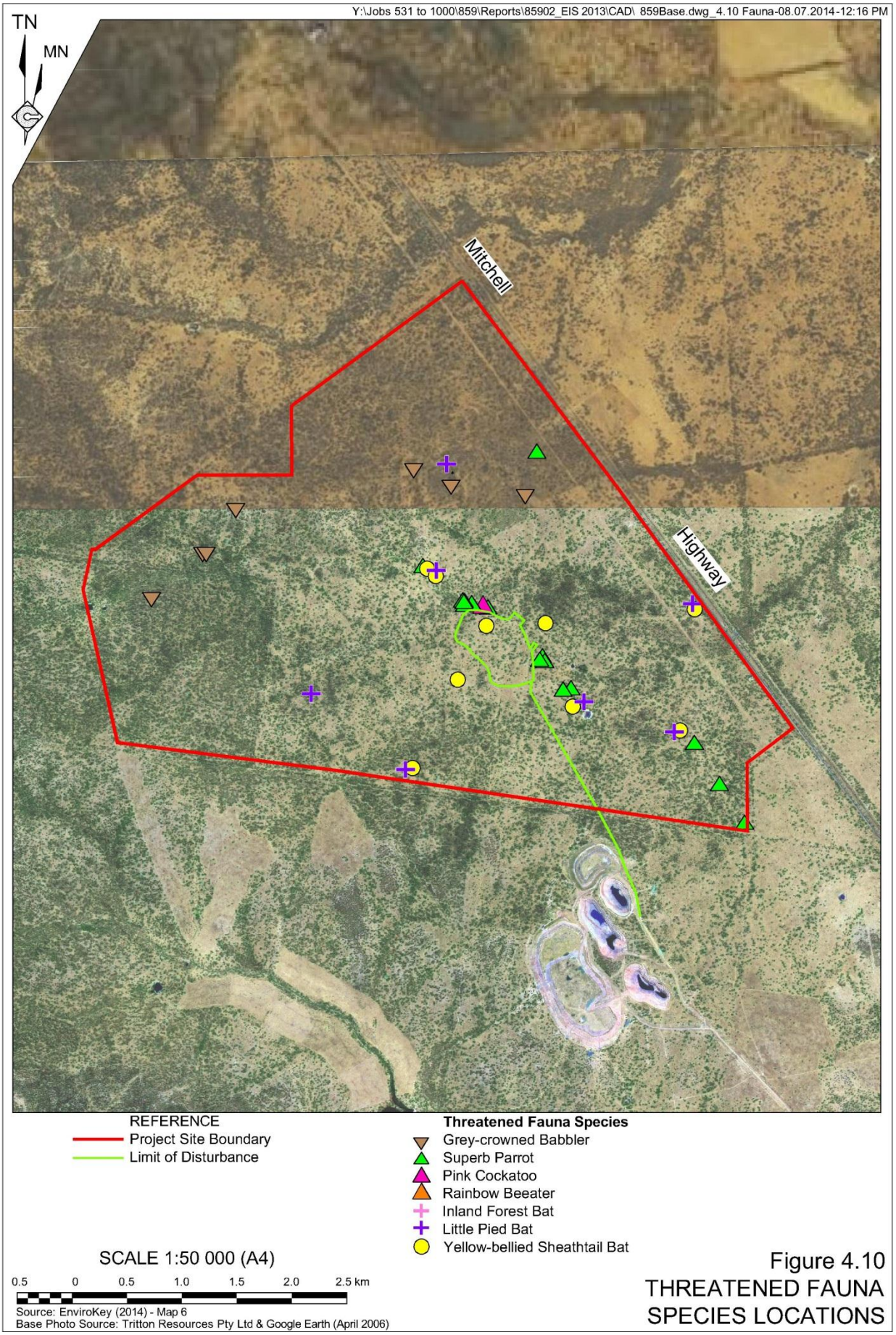


Figure 4.10
THREATENED FAUNA SPECIES LOCATIONS

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.

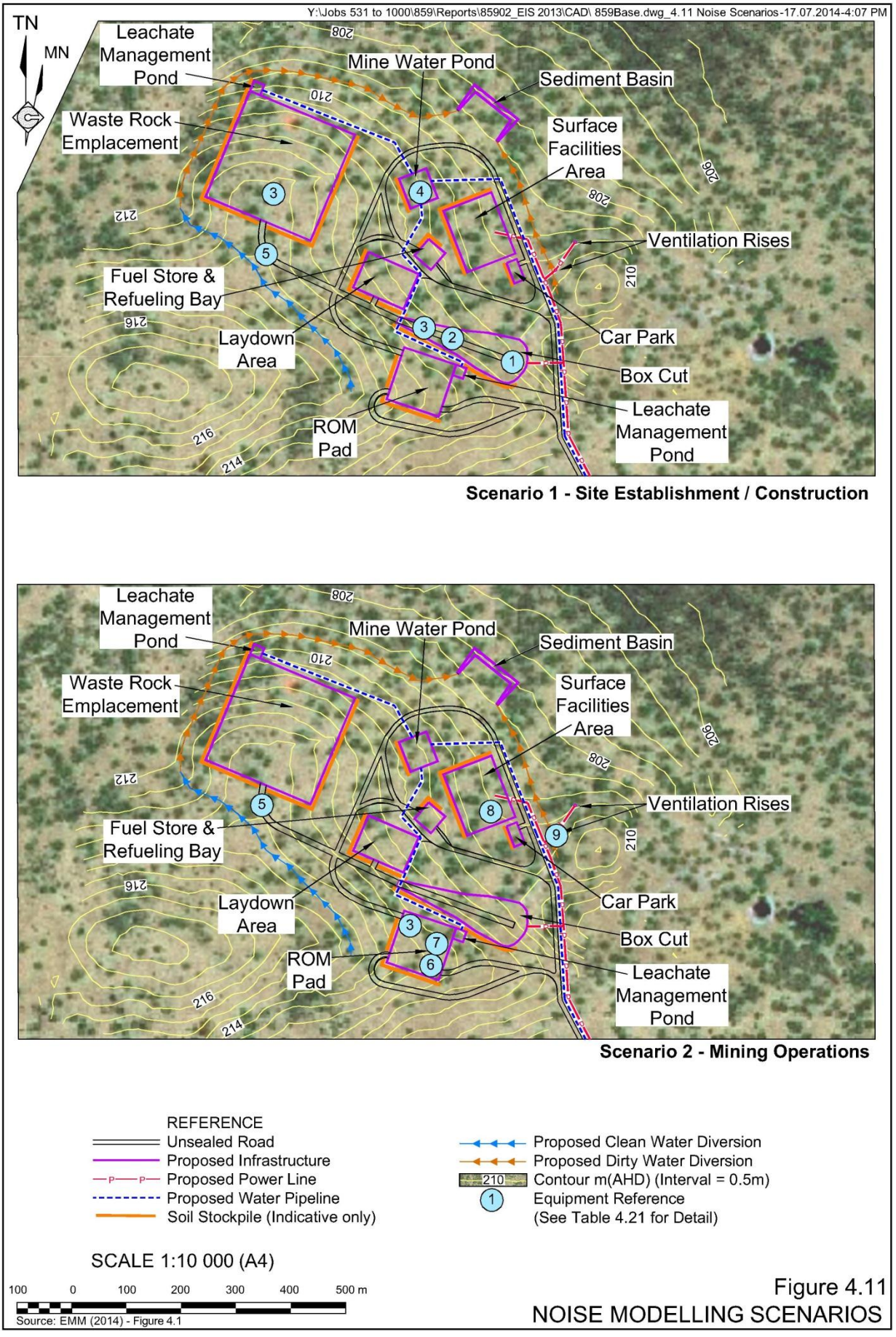


Figure 4.11
NOISE MODELLING SCENARIOS

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.

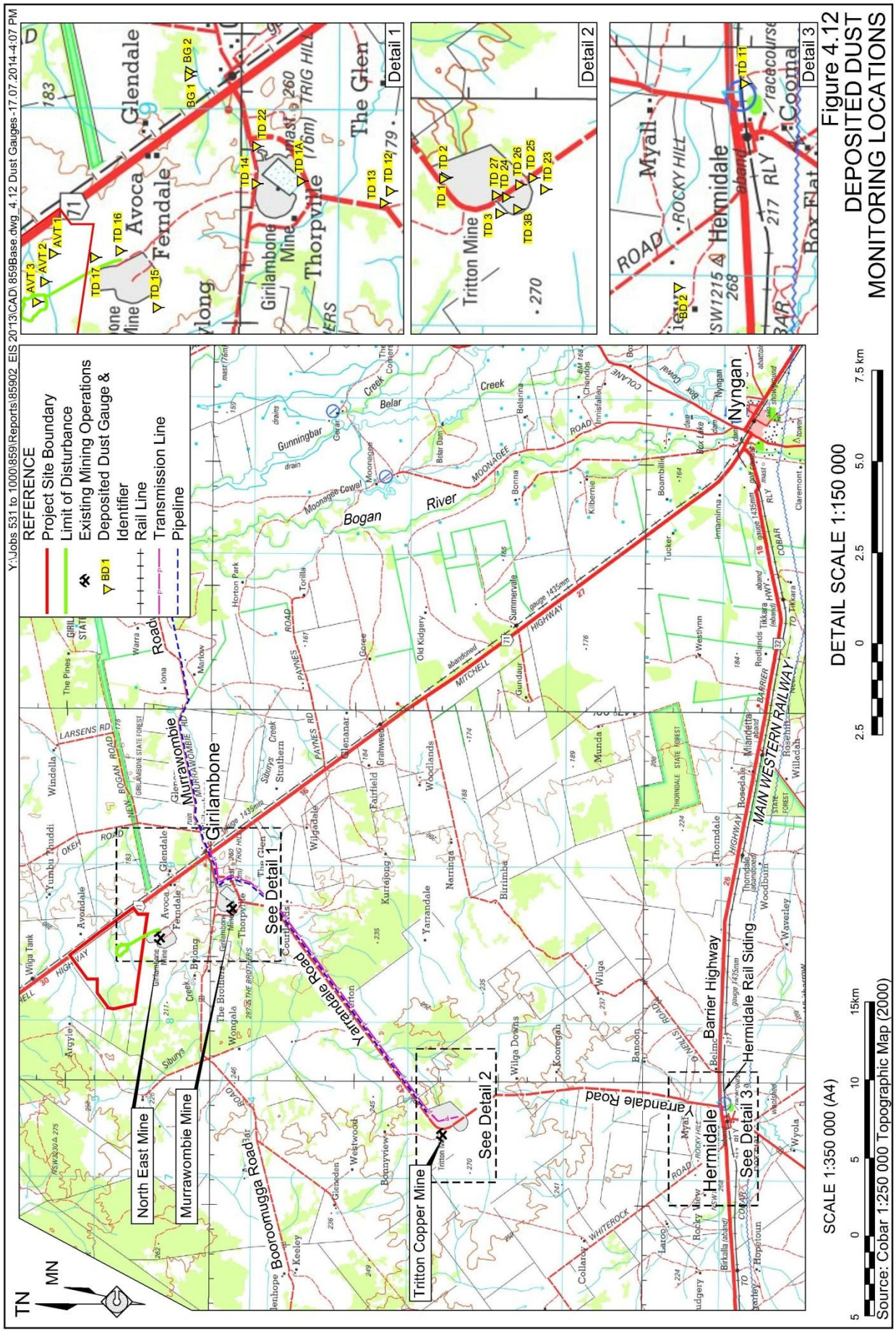


Figure 4.12
DEPOSITED DUST
MONITORING LOCATIONS

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.

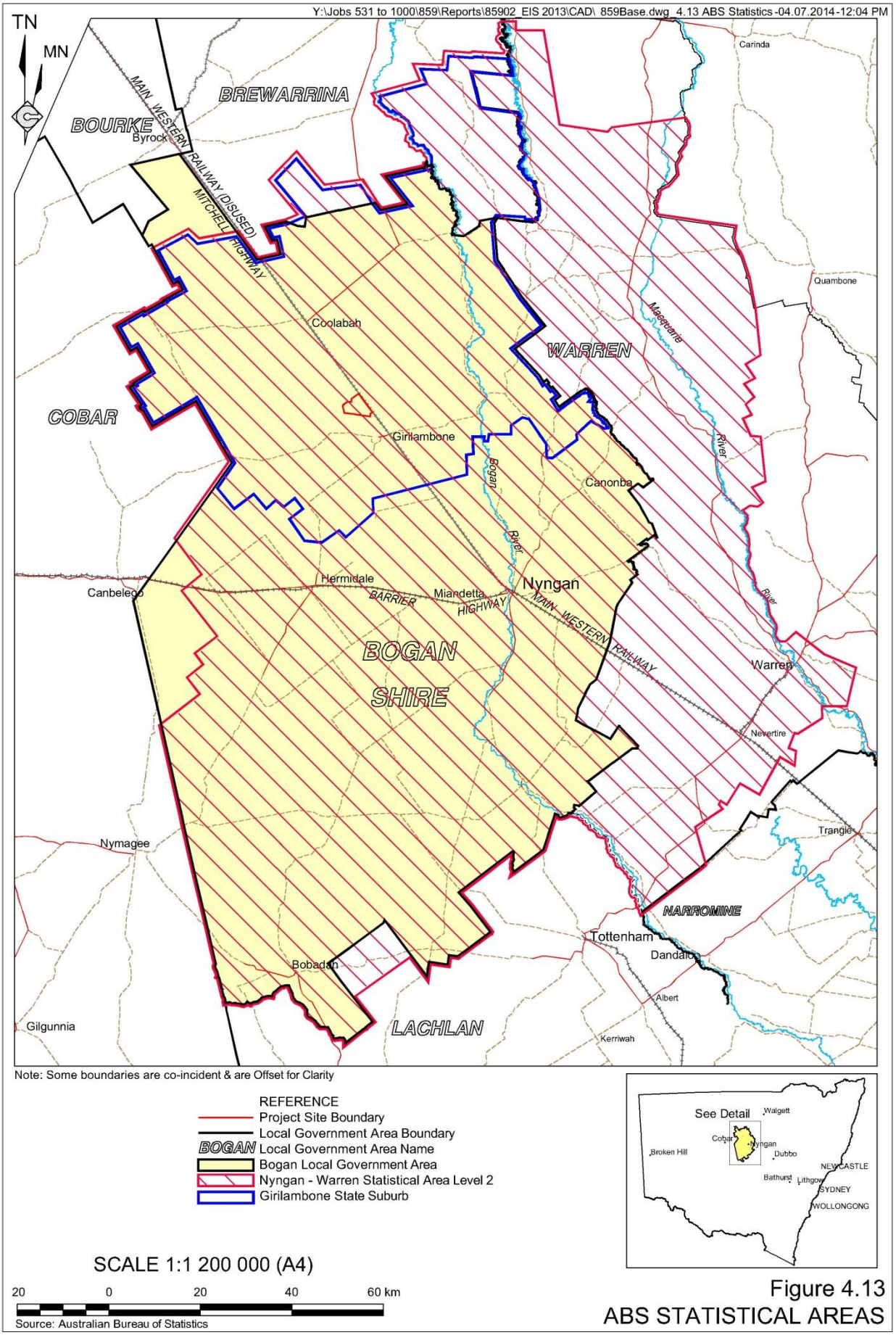


Figure 4.13
ABS STATISTICAL AREAS

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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Straits Tritton Copper

TRITTON RESOURCES PTY LTD

ABN 88 100 095 494

Environmental Impact Statement

for the

Avoca Tank Project

Appendices

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

July 2014

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Appendices

(Total No. of pages including blank pages = 824)

Appendix 1 Development Application Form

Appendix 2 Director-General's Requirements and Requirements of Consulted Government Agencies

Appendix 3 Coverage of Director-General's Requirements and Requirements of Consulted Government Agencies

Appendix 4 Statement of Commitments

Appendix 5 Aboriginal Cultural Heritage Assessment Report

Appendix 6 Ecology Assessment

Appendix 7 Groundwater Impact Assessment

Appendix 8 Noise and Blasting Assessment

Appendix 9 Historic Heritage Assessment Report

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Appendix 1

Development Application Form

(Total No. of pages including blank pages = 8)

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Bogan Shire Council
"Comfortable Country Living"

DEVELOPMENT APPLICATION

(Section 78A, *Environmental Planning & Assessment Act 1979*)

Bogan Shire Council
P.O. Box 221
Nyngan, NSW 2825
Ph: (02) 6835 9000
Fax: (02) 6835 9011

Office Use Only
DA No.: _____
Date Received: _____

The personal information that Council is collecting from you on this application form is personal information for the purposes of the Privacy and Personal Information Protection Act 1998 (PPIP Act). The supply of the information by you is not voluntary but is required by the Environmental Planning & Assessment Act, and in accordance with such Act and the Local Government Act, is required to be contained in a Public Register to which the public has right of access. This personal information may be supplied under certain circumstances to other public sector agencies e.g. Australian Bureau of Statistics, Australian Taxation Office, in accordance with the PPIP Act. Enquiries may be directed to Council's Public Officer concerning the PPIP Act or Council's Privacy Management Plan or your right of access to your personal information held by Council or its amendment.

Part 1 Site and Applicant Details

1. Location of the proposed development

Unit No _____ House No. _____ Property/Building Name: Avoca Tank
Street _____
Town/Village/Locality _____

2. Land title description
We need this to correctly identify the land

Lot(s): 10 (part), 135 and 144 / 3 (part) Section _____
Deposited Plan(s): 751315 / 751342
Other _____ Strata Plan _____

3. Your (the Applicant's) name
If you represent a company, please apply in the company's name. State your position under the "Title – Other".

Title ☐ Mr ☐ Mrs ☐ Ms ☐ Miss
☐ Dr ☐ Other: _____
Surname _____
Given names _____
Company: Tritton Resources Pty Ltd
Contact person: Tom Cooney

4. Your postal address

Suite 1, Level 2, HQ South Tower, 520 Wickham Street, FORTITUDE VALLEY QLD 4006

5. Your contact details

Phone (BH): (07) 3034 6200 Mobile: 0439 856 000
Fax: (07) 3034 6290 Email: tcooney@straits.com.au

Part 2 Development Details

6. Development Proposal
Indicate the **Type** of development proposed

☒ Use of land/building
☐ Erection of a building
☐ Subdivision of Land/building
☐ Change of building use
☐ Carrying out of work
☐ Demolition
☐ Advertisement/advertising sign

Part 2 Development Details (cont.)

7. Development Description

e.g. erection of dwelling, strata subdivision of a residential flat building, change of use of building from warehouse to retail store, etc

Construction and operation of an underground mine to extract up to approximately 681 000t of copper-gold-silver ore over 4 years for transportation and processing at the Tritton Copper Mine. The overall life of the Project is anticipated to be 7 years, including construction, mining and rehabilitation.

8. Proposed Use

State the intended use of the land/building, e.g. warehousing of whitegoods, motor vehicle repairs, etc.

Underground Mining

9. Staged development?

Are you applying for development consent in stages?

☒ **No**

☐ **Yes** → Attach information which describes the stages of your development.

10. What is the estimated cost of the development

Estimated Cost:

(Incl. GST – round up to nearest $1,000.00) $ 20,000,000.00.

11. Are you also seeking an approval under the Local Government Act 1993?

You can apply with this development application to seek an approval for any of the listed activities which require approval under Section 68 of the *Local Government Act, 1993*. Additional fees may be applicable.

NOTE: the plans, specifications & information required for Council to process and assess the relevant Activity (including that which is specified in the Regulations under the Local Government Act) must also be submitted with this application.

☒ **No** ☐ **Yes** – Tick the appropriate box(s) below ↓

(If you apply for any of the following activities please ensure the appropriate documentation required under the Local Government Act is also submitted – insufficient information WILL delay the processing of your development application)

- ☐ Install a manufactured home, moveable dwelling or associated structure on land
- ☐ Carry out water supply work
- ☐ Draw water from a council water supply or a standpipe or sell water so drawn
- ☐ Install, alter, disconnect or remove a meter connected to a service pipe
- ☐ Carry out sewerage work
- ☐ Carry out stormwater drainage work
- ☐ Connect a private drain or sewer with a public drain or sewer under the control of a council or with a drain or sewer which connects with such a public drain or sewer
- ☐ For fee or reward, transport waste over or under a public place
- ☐ Place waste in a public place
- ☐ Place a waste storage container in a public place
- ☐ Dispose of waste into a sewer of the council
- ☐ Install, construct or alter a waste treatment device or a human waste storage facility or a drain connected to any such device or facility
- ☐ Operate a system of sewage management (within the meaning of section 68A)
- ☐ Swing or hoist goods across or over any part of a public road by means of a lift, hoist or tackle projecting over the footway
- ☐ Expose or allow to be exposed (whether for sale or otherwise) any article in or on or so as to overhang any part of the road or outside a shop window or doorway abutting the road, or hang an article beneath an awning over the road
- ☐ Operate a public car park
- ☐ Operate a caravan park or camping ground
- ☐ Operate a manufactured home estate
- ☐ Install a domestic oil or solid fuel heating appliance, other than a portable appliance
- ☐ Install or operate amusement devices

12. Does the development require the Concurrence of State Agencies?

☒ **No** ☐ **Yes** – If yes, state applicable agencies below ↓

Part 2 Development Details (cont.)

13. Is this application for Integrated Development?

Nominate the additional approvals to be obtained from the administering approval bodies.

NOTE: an application for Integrated Development must include:

a) sufficient information to permit the approval body to assess the application;

b) an additional fee of $250 is applicable for each approval body - Council requires a separate cheque to be made out to these bodies;

c) additional copies of plans as determined by Council.

☐ **No** ☒ **Yes** – Tick the appropriate box(s) below

Fisheries Management Act 1994	☐	s.144	☐ s.201	☐ s.205	☐ s.219
Heritage Act 1977	☐	s.58			
Mine Subsidence Compensation Act 1961	☐	s.15			
Mining Act 1992	☒	ss. 63. 63			
National Parks and Wildlife Act 1974	☐	s.90			
Petroleum (Onshore) Act 1991	☐	s.9			

Protection of the Environment Operations Act 1997

☒ s.43(a), 47 & 55 - Environment protection licence to authorise scheduled development work

☐ s.43(b), 48 & 55 - Environment protection licence to authorise scheduled activities

☐ s.43(d), 55 & 122 - Licence to regulate water pollution from non-scheduled activities

Roads Act 1993	☐	s.138
Rural Fires Act 1997	☐	s.100B (see Item 19 for submission details)

Water Management Act 2000

☐ s.89 - Water use approval
☐ s.90 - Water management work approval
☒ s.91 - Activity approval

14. Part of your environmental consideration

Tick the applicable boxes, to indicate the likely affect of the proposed development.

Is the land, or part of it, Critical Habitat? ☐ Yes ☒ No

Is the development likely to significantly affect threatened species, populations or ecological communities, or their habitats? ☐ Yes ☒ No

Note: A more comprehensive environmental assessment must be submitted with this application, either if the form of a **Statement of Environmental Effects**, **Environmental Impact Statement**, and/or **Species Impact Statement**

15. Documents accompanying this application

Please list all documents accompanying this application:

Environmental Impact Statement for the Avoca Tank Project, prepared by R.W. Corkery and Co. Pty. Limited, dated July 2014

Part 3 Signatures

16. Are you the owner of the land?

☐ **Yes** ☒ **No** – If no, please ensure Q. 18 is completed.

17. Applicant's declaration

Before signing, make sure you have addressed and completed all applicable questions on this form.

I apply for approval to carry out the development described in this application, and I declare that to the best of my knowledge and belief, the information supplied is correct and complete. I also understand that:

- Personal information, provided on/with this application will be available to be accessed by the Public pursuant to the EP&A Act and the LG Act. The subject Acts permit members of the public to obtain extracts of the application and of certain accompanying documentation.
- I am not entitled to copyright and am taken to have indemnified all persons using the application and documents in accordance with the Act against any claim or action in respect of breach of copyright (cl 57, EP & A Reg. 2000).
- This application authorises Council officers to enter the property to perform inspections associated with its processing, determination and compliance.
- I am liable to pay for/rectify any damage caused to Council roads, drains etc arising from construction works associated with the proposed development.

Applicant's Signature _____

Applicant's Name _____

Capacity, if not Applicant _____

Part 3 Signatures (cont.)

18. Consent of all Land Owners to lodge this application

The owner(s) authorisation to lodge this application must be obtained if you are not the owner. This is a mandatory requirement of the Act.
Note: If the land is owned by a company, a company seal must be provided with at least one executive signature.

As owner of the above property, I/we consent to this application and grant permission for:-

(1) The Applicant to:
- submit amendments in relation to such application,
- make application for activity approvals associated with the development,
- make application for associated construction certificate(s),
- make application for review/modification of any subsequent approval; and

(2) Council officers to enter upon such property for the purposes of assessing this application and the performing of any associated and subsequent inspections.

Owner(s) Name: _____
(print)

Owner(s) Signature(s): _____

Date: _____

Part 4 Submission Checklist

19. The Development Application must be accompanied by the following documents: (Schedule1 EP&A Reg.)	**Yes**	**N/A**	**Office Use Only**
• **Site Plan of the land**, which must indicate the following:			
- Location, boundary dimensions, site area and north point of the land,	☒	☐	☐
- Existing vegetation and trees on the land,	☒	☐	☐
- The location and uses of existing buildings on the land,	☐	☒	☐
- Existing levels of the land in relation to buildings and roads,	☒	☐	☐
- The location and uses of buildings on sites adjoining the land.	☒	☐	☐
• **A Plan(s) of the development**, which must indicate the following:			
- The location of any proposed buildings or works (including extensions or additions to existing buildings or works) in relation to the land's boundaries and adjoining development,	☒	☐	☐
- Floor plans of any proposed buildings showing layout, partitioning, room sizes and intended uses of each part of the building,	☐	☒	☐
- Elevations and sections showing proposed external finishes & heights of proposed buildings,	☐	☒	☐
- Elevations and sections showing heights of any proposed temporary structures and the materials of which any such structures are proposed to be made (using the abbreviations set out in clause 7 of Schedule 1 of the Regulations),	☐	☒	☐
- Proposed finished levels of the land in relation to existing & proposed buildings & roads,	☒	☐	☐
- Proposed parking arrangements, entry and exit points for vehicles, & provisions for movement of vehicles within the site (including dimensions where appropriate),	☒	☐	☐
- Proposed landscaping and treatment of the land (indicating plant types and their height and maturity)	☒	☐	☐
- Proposed methods of draining the land.	☒	☐	☐
- For BASIX affected development, such other matters as any BASIX certificate for the development requires to be included on the sketch,	☐	☒	☐
- For BASIX optional development, if the development application is accompanied by a BASIX certificate or BASIX certificates, such other matters as any BASIX certificate for the development requires to be included on the sketch.	☐	☒	☐
• **In the case of development that involves the erection of a building**, an A4 plan of the building that indicates its height and external configuration, as erected, in relation to its site (as referred to in clause 56 of the Regulation),	☐	☐	☐
• **If the development involves building work to alter, expand or rebuild an existing building**, a scaled plan of the existing building.	☐	☒	☐
• **A Statement of Environmental Effects** (in the case of development other than designated development), which must indicate the following:			
- The environmental impacts of the development,	☐	☒	☐
- How the environmental impacts of the development have been identified,	☐	☒	☐
- The steps to be taken to protect the environment or lessen the expected harm to the environment,	☐	☒	☐
- Any matters required to be indicated by any guidelines issued by the Director-General of DoP	☐	☒	☐
• **An environmental impact statement** (in the case of designated development).	☒	☐	☐

Part 4	Submission Checklist (cont.)			
•	**A species impact statement** (in the case of land that is, or is part of, critical habitat or development that is likely to significantly affect threatened species, populations or ecological communities, or their habitats).	☐	☒	☐
•	**If the development involves a change of building use**:			
-	A list of the Category 1 fire safety provisions that currently apply to the existing building, and	☐	☒	☐
-	A list of the Category 1 fire safety provisions that are to apply to the building under its new use.	☐	☒	☐
•	**If the development involves any subdivision work**:			
-	Details of the existing and proposed subdivision pattern (including roads and allotments),	☐	☒	☐
-	Details of consultation with public authorities responsible for provision of utility services,	☐	☒	☐
-	Preliminary engineering drawings indicating proposed infrastructure including roads, water, sewerage, stormwater, power, telephone, gas,	☐	☒	☐
-	Existing and finished ground levels, existing buildings, trees, wells and water channels,	☐	☒	☐
-	Details of areas to be filled, including nominating any existing trees to be removed,	☐	☒	☐
-	Preliminary soil & water management details.	☐	☒	☐
•	**If the land is within a wilderness area and is the subject of a wilderness protection agreement or conservation agreement** within the meaning of the *Wilderness Act 1987*, a copy of the consent of the Minister for the Environment to the carrying out of the development,	☐	☒	☐
•	**Additional information required by Council**, where applicable:			
-	Measures proposed to protect any adjoining properties, roads and footpaths, and the public.	☒	☐	☐
-	Waste products generated by the development, there collection and manner of disposal.	☒	☐	☐
-	Soil & water management plan, including erosion & sedimentation control details.	☒	☐	☐
-	Type, vehicle size, frequency and delivery times of service and delivery vehicles to the site.	☒	☐	☐
•	**If the development is located on Bush Fire Prone Land**:			
-	A bush fire assessment detailing compliance/deviations from Planning for Bush Fire Protection,	☒	☐	☐
-	And if Integrated due to s100B, provide all details specified under clause 46 of the Rural Fires Regulation 2002, together with completion of the NSW RFS Referral Form.	☐	☒	☐
•	A development application for **any BASIX affected development** must also be accompanied by a BASIX certificate or BASIX certificates for the development, being a BASIX certificate or BASIX certificates that has or have been issued no earlier than 3 months before the date on which the application is made.	☐	☒	☐
•	If the proposed development involves the **alteration, enlargement or extension of a BASIX affected building** that contains more than one dwelling, a separate BASIX certificate is required for each dwelling concerned.	☐	☒	☐
•	**if the development involves the erection of a temporary structure**, the following documents:			
-	Documentation that specifies the live and dead loads the temporary structure is designed to meet,	☐	☒	☐
-	A list of any proposed fire safety measures to be provided in connection with the use of the temporary structure,	☐	☒	☐
-	In the case of a temporary structure proposed to be used as an entertainment venue—a statement as to how the performance requirements of Part B1 and NSW Part H102 of Volume One of the *Building Code of Australia* are to be complied with (if an alternative solution, to meet the performance requirements, is to be used),	☐	☒	☐
-	Documentation describing any accredited building product or system sought to be relied on for the purposes of section 79C (4) of the Act,	☐	☒	☐
-	Copies of any compliance certificates to be relied on,	☐	☒	☐
•	**in the case of a development involving the use of a building as an entertainment venue or a function centre, pub, registered club or restaurant**—a statement that specifies the maximum number of persons proposed to occupy, at any one time, that part of the building to which the use applies.	☐	☒	☐
•	A development application that relates to development in respect of which a **site compatibility certificate** is required by a State Environmental Planning Policy must be accompanied by such a certificate.	☐	☒	☐

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Appendix 2

Director-General's Requirements and Requirements of Consulted Government Agencies

(Total No. of pages including blank pages = 58)

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Development Assessment Systems & Approvals
Mining Projects
Contact: Nicholas Brbot
Phone: (02) 9228 2019
Fax: (02) 9228 6466
Email: nicholas.brbot@planning.nsw.gov.au

Mitchell Bland
R.W. Corkery & Co Pty Ltd
62 Hill Street
ORANGE NSW 2800

Dear Mr Bland

Avoca Tank Project (DGR 766)
Director-General's Requirements

I refer to your request for the Director-General's Requirements (DGRs) for the above development, which is designated local development under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). I have attached a copy of the DGRs for the Environmental Impact Statement (EIS) required for this development. These requirements have been prepared in consultation with relevant State agencies and are based on the information your company has provided to date. I have also attached the agencies' input into the formation of the DGRs, which you are also advised to consider closely during your preparation of the EIS. Detailed requirements for the EIS were not received from the Department of Water and Energy, consequently you are advised to liaise directly with them and obtain any further requirements.

In your request for DGRs, it was indicated that the proposal will require approval under the *Protection of the Environment Operations Act 1997, Water Management Act 2000* and *Roads Act 1993*. Accordingly, the proposal is classified as integrated development under section 91 of the EP&A Act. If further integrated approvals are identified, you must undertake your own consultation with the relevant public authorities, and address their requirements in the EIS.

When you lodge your DA for the proposal, you must provide:
- two hard copies and one electronic copy of the EIS to the Department;
- one hard and one electronic copy of the EIS to each identified integrated approval authority; and
- a cheque for $320 to each identified integrated approval authority, to offset costs involved in the review of the DA and EIS. Do not send a cheque to the Department of Planning and Infrastructure as it is not an integrated approval authority.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will require an additional approval under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of Sustainability, Environment, Water, Population and Communities in Canberra (6274 1111 or www.environment.gov.au).

Should the consent authority approve the proposal, then under section 22 of the *Mine Health and Safety Act 2004*, the owner or general manager of a mine or quarry must not undertake mining or quarrying operations without first nominating a person as the operator of the mine or quarry to the Chief Inspector of Mines. The Applicant should contact the local Mine Safety Operations Branch of the Division of Resources and Energy within the Department of Trade, Investment, Regional Infrastructure and Services in regard to this and other matters relating to compliance with the *Mine Health and Safety Act 2004*.

If you have any enquiries about these requirements, please contact Nicholas Brbot.

Yours sincerely

DKitto 25/9/13

David Kitto
Director
Mining & Industry Projects
as delegate for the Director-General

Director-General's Requirements

Section 78A(8) of the *Environmental Planning and Assessment Act 1979* and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

Designated Development

DGR Number	766
Proposal	Development of a box cut mine; underground mine and associated surface infrastructure to extract up to 400,000 tonnes of copper-gold ore per year to be transported to the Girilambone Mine for processing, for a period of up to 8 years.
Location	Mitchell Highway, Coolabah, approximatley 7km northwest of Girilambone.
Applicant	Tritton Resources Pty Limited
Date of Expiry	25 September 2015
General Requirements (refer Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*)	The Environmental Impact Statement (EIS) must include: • an executive summary; • a full/detailed description of the proposal, including: - identification of the resource; - description of the site; - a history of any previous quarrying operations on the site; - the proposed works (including rehabilitation works); - the duration and intensity of extraction operations; - any likely interactions between the proposed operations and existing/approved development and land use in the area; and - a detailed justification for the development; • a conclusion justifying the development on economic, social and environmental grounds, taking into consideration whether the proposal is consistent with the objects of the *Environmental Planning & Assessment Act 1979*; and • a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.
Key Issues	The EIS must also assess the potential impacts of the proposal during the establishment, operation and decommissioning of the proposal. The EIS must describe what measures would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the potential impacts on: • **Land Resources** – including a assessment of the potential impacts on: - soils and land capability, including an assessment of activities that would cause erosion and the measures proposed to minimise erosion and sedimentation; - landforms and topography, including cliffs, rock formations, steep slopes, etc; and - land use, including agricultural, forestry and conservation lands; • **Water Resources** – including: - 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 ground 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; • **Biodiversity** – including: - 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; • **Heritage** – including: - 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; and - a Historic heritage assessment (including archaeology) which must include a statement of heritage impact (including significance assessment) for any State significant or locally significant historic heritage items; • **Traffic and Transport** – 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 any safety issues which may exacerbated by the development; and - a description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network in the surrounding area over the life of the project; • **Noise and Vibration** - particularly any potential noise and vibration impacts on nearby private receptors due to construction, operation or road haulage; • **Air Quality** – particularly any potential dust impacts on nearby private receptors from construction, operation or road haulage; • **Rehabilitation** – including: - a detailed description of the proposed rehabilitation measures that would be undertaken during quarry closure; - a detailed rehabilitation strategy, including justification for the proposed final land form and consideration of the objectives of any relevant strategic land use plans or policies; and - the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy; • **Waste Management** – including importation of any waste material to the site; • **Hazards and Risks** – including any transport or storage of dangerous goods; • **Visual Amenity**; • **Agricultural Impacts;** • **Utilities and Services**; and • **Social and Economic Impacts.**
Environmental Planning Instruments	The EIS must assess the proposal against the relevant environmental planning instruments, including (but not limited to): • *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007;* • *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development;* • *State Environmental Planning Policy No. 44 – Koala Habitat Protection;* • *State Environmental Planning Policy No. 55 – Remediation of Land;* • *Bogan Local Environmental Plan 2011;* and • relevant development control plans and section 94 plans, strategies and management plans.

Guidelines	The EIS must take into account relevant State Government policies and guidelines, in particular the *Industrial Noise Policy* (EPA 2001), *Aquifer Interference Policy* (DPI 2012), *Soils and Construction: Managing Urban Stormwater* (Landcom 2004), *Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting* (ANZECC), *Using the ANZECC Guideline and Water Quality Objectives in NSW* (DEC), *Approved Methods for the Modelling and Assessment of Air Pollutants* (DEC), *Approved Methods for Sampling and Analysis of Air Pollutants* (DEC), *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (DECC 2004), *The Threatened Species Assessment Guideline – The Assessment of Significance* (DECC 2007), *Draft Guidelines for the Assessment of Aquatic Ecology in EIA* (DUAP 1998), *Guide to investigation, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011), *Code of Practice of the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010), *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010), *Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC 2005), *Guide to Traffic Generating Development* (RTA), *Road Design Guide* (RTA) or latest versions. During the preparation of the EIS you must consult the Department's EIS Guideline – Extractive Industries – Quarries. This guideline is available for purchase from the Department's Information Centre, 23-33 Bridge Street, Sydney or by calling 1300 305 695.
Consultation	During the preparation of the EIS, you must consult with Council and should consult with the relevant local, State and Commonwealth government authorities, service providers and community groups, and address any issues they may raise in the EIS. In particular, you should consult surrounding landowners and occupiers that are likely to be impacted by the proposal. Details of the consultations carried out and issues raised must be included in the EIS.

Bogan SHIRE COUNCIL Nyngan

"Comfortable Country Living"

22 October 2013

Mitchell Bland
R.W. Corkery & CO.Pty. Limited
62 Hill Street
ORANGE NSW 2800

Dear Mitchell

Avoca Tank Project

I refer to your request for Bogan Shire Council (BSC) to provide comment in relation to the preparation of the Environmental Impact Statement for the Tritton Resources Pty Ltd Avoca Tank Project. BSC recommends the following points be considered and incorporated prior to determination of the project.

Traffic Levels

Detail the expected increased level in traffic generation and changes in transportation routes.

Impact on Water Quality

Ensure the control and management of surface and ground waters are adequately addressed.

Waste Rock Emplacement Design

Ensure waste rock emplacements are of adequate design. Design should consider minimising visual impact whilst ensuring a stable structure.

Acid Mine Drainage

Illustrate management practices to predict, identify and manage potentially acid forming material that will prevent the formation of acid mine drainage.

Air Quality Management

Detail management activities to reduce and suppress dust generation.

Bushfire Management

Detail management activities to reduce the potential for bushfires and emergency procedures in the event of a bushfire.

Telephone: (02) 6835 9000
Facsimile: (02) 6835 9011
Email: admin@bogan.nsw.gov.au
www.bogan.nsw.gov.au
ABN: 68 886 242 083

Address all communications to:
The General Manager
PO Box 221
Nyngan NSW 2825

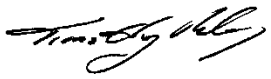
Council Chambers
81 Cobar Street
Nyngan
New South Wales
Australia

Rehabilitation

Provide sufficient detail of rehabilitation activity and expected timing with a management focus on progressive rehabilitation where practical.

Should you require any further information or wish to discuss this matter further please contact Timothy Riley on 68359000 between the hours of 8.30 am and 4.00 pm, Monday to Friday.

Yours sincerely,



Timothy Riley
Manager Development and
Environmental Services
Bogan Shire Council

Department of Primary Industries
Office of Water

Contact Tim Baker
Phone 02 6841 7403
Mobile 0428 162 097
Fax 02 6884 0096
Email Tim.Baker@water.nsw.gov.au

Chris Dickson
R W Corkery & Co
62 Hill St
ORANGE NSW 2800

Our ref ER22616
Your ref

Dear Mr Dickson

Subject: Avoca Tank Project – Tritton Resources – Request for Input into Director General's Requirements

I refer to your email dated 1st October 2013 requesting input into the Director Generals Requirements for the Avoca Tank Project. The NSW Office of Water has reviewed the Background Paper and provides the following advice to be addressed in preparation of the Environmental Impact Statement (EIS).

1. Key Issues

NSW Office of Water requires the EIS for the proposal to demonstrate the following:

1. Adequate and secure water supply for the proposal. Confirmation that water supplies for construction and operation are sourced from an appropriately authorised and reliable supply.
2. Identification of site water demands, water sources (surface and groundwater), water disposal methods and water storage structures in the form of a water balance. The water balance is to outline the proposed water management on the site and to also include details of any water reticulation infrastructure that supplies water to and within the site.
3. An impact assessment on adjacent licensed water users (surface and groundwater), riparian ecosystems and groundwater-dependent ecosystems. This is to meet the requirements of relevant state policy such as the NSW Aquifer Interference Policy, in addition to the objects and principles of the *Water Management Act 2000* which can be accessed at the following link: *http://www.water.nsw.gov.au/Water-management/Law-and-Policy/default.aspx*
4. An assessment of the potential to intercept groundwater and predicted maximum annual dewatering volumes, water quality and disposal/retention methods. This is to also include the modelled zone of influence for a number of stages both during mining operations and post mine life until equilibrium is achieved. This is to meet the requirements of the NSW Aquifer Interference Policy.
5. An impact assessment of the construction, operation and final landform of the proposed on-site waste rock emplacement, water management ponds and other potentially contaminating facilities. This is to include an assessment of the processing, management and disposal of potentially contaminating materials at the Tritton Copper Mine.
6. An assessment of any proposed modification to surface water management including modelling of redistribution of waters and an assessment of impact on neighbouring properties and the associated watercourse and floodplain.

209 Cobra St, Dubbo NSW 2830 | PO Box 717 Dubbo NSW 2830
t (02) 6841 7403 | f (02) 6884 0096 | www.water.nsw.gov.au

7. An impact assessment of any proposed works within or adjacent to watercourses and adequate provision of buffer requirements. This is to also include proposed pipelines and temporary or permanent vehicle crossings within the project application area. Ability to achieve the principles of the *Water Management Act 2000* and the requirements of the "*Guidelines for Controlled Activities on Waterfront Land*" will be required. The relevant guidelines can be accessed at the following link: http://www.water.nsw.gov.au/Water-Licensing/Approvals/Controlled-activities/default.aspx

8. Preparation of a surface water management plan and groundwater management plan to integrate the proposed water balance and management for the site and to identify adequate mitigating and monitoring requirements for both water quality and water volume.

9. Existing and proposed water licensing requirements in accordance with the Water Act 1912 and *Water Management Act 2000* (whichever is relevant). This is to demonstrate that existing licences (include licence numbers) and licensed uses are appropriate, and to identify where additional licences are proposed. The proponent will be required to ensure they hold adequate licensed entitlement commensurate with the anticipated volume of groundwater take prior to this take occurring. Groundwater take includes the volume of water intercepted by the proposed activities both via the underground mine and any extraction bores, in addition to any ongoing take induced by groundwater inflows and evaporative loss when the mine workings begin to fill. The maximum annual requirements need to be regularly reviewed through updates of modelling and reviews of metering data.

10. Adequate mitigating and monitoring requirements to address surface water and groundwater impacts.

A general list of environmental assessment requirements to be addressed in the EIS is provided in Attachment 1. The proposal is located within the Lachlan Fold Belt MDB Groundwater Source of the Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources and the Lower Bogan River Water Source of the Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Source. Any requirement for additional groundwater or surface water entitlement will need to be obtained through purchase and trade in accordance with these plans. These plans can be accessed at the following link: http://www.water.nsw.gov.au/Water-management/Water-sharing/default.aspx

Should you have any further queries in relation to this submission please do not hesitate to contact Tim Baker on (02) 6841 7403.

Yours sincerely

Mitchell Isaacs
Manager Strategic Stakeholder Liaison
3 October 2013

Department of Primary Industries
Office of Water

ATTACHMENT 1

NSW Office of Water Environmental Assessment Requirements
Avoca Tank Project

The NSW Office of Water provides the following advice for consideration:

Relevant Legislation

The assessment is required to take into account the requirements of the following legislation (administered by the Office), as applicable:

- *Water Management Act 2000 (WMA 2000)*.
- *Water Act 1912*.

In particular, proposals and management plans should be consistent with the Objects (s.3) and Water Management Principles (s.5) of the *WMA*.

Water Sharing Plans

Gazetted Water Sharing Plans (WSPs) prepared under the provisions of the *WMA* establish rules for access to, and the sharing of water between the environmental needs of the surface or groundwater source and water users. If the proposal is within a gazetted WSP area the assessment is required to demonstrate how the proposal is consistent with the relevant access and trading rules of the WSP. Refer to: http://www.water.nsw.gov.au/Water-Management/Water-sharing/default.aspx The following WSPs are relevant to the 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*

Relevant Policies

The assessment is required to take into account the following NSW Government policies, as applicable:

- *NSW Aquifer Interference Policy (2012)*
- *NSW Groundwater Policy Framework Document – General (August 1997)*
- *NSW Groundwater Quality Protection Policy (1998)*
- *NSW State Groundwater Dependent Ecosystem Policy (2002)*
- *NSW State Rivers and Estuaries Policy (1993)*
- *NSW Sand and Gravel Extraction Policy for Non-Tidal Rivers (1992)*
- *NSW Wetlands Policy (2010)*

These documents can be found at:
http://www.water.nsw.gov.au/Water-Management/Law-and-Policy/Key-policies/default.aspx

Guidelines

The assessment is required to take into account the following guidelines as applicable:

- *Australian Groundwater Modelling Guidelines (2012)*
- *MDBC Guidelines on Groundwater Flow Modelling (2000)*
- *Guidelines for the Assessment and Management of Groundwater Contamination (2007)*
- *Guidelines for Controlled Activities on Waterfront Land*:
  - Riparian corridors (and associated Vegetation Management Plans)
  - Watercourse crossings
  - Laying pipes and cables in watercourses
  - Outlet structures
  - In-stream works

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t (02) 6841 7403 | f (02) 6884 0096 | www.water.nsw.gov.au

These documents can be found at:
http://www.water.nsw.gov.au/Water-Licensing/Approvals/Controlled-activities/default.aspx
http://archive.nwc.gov.au/library/waterlines/82

Groundwater
The Office of Water is responsible for the management of groundwater resources so they can sustain environmental, social and economic uses for the people of New South Wales.

Groundwater Source
The assessment is required to identify groundwater issues and potential degradation to the groundwater source and provide the following:

- Details of the predicted highest groundwater table at the development site.
- Details of any works likely to intercept, connect with or result in pollutants infiltrating into the groundwater sources.
- Details of any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Describe the flow directions and rates and the physical and chemical characteristics of the groundwater source.
- Details of the predicted impacts of any final landform on the groundwater regime.
- Details of the existing groundwater users within the area (including the environment) and include details of any potential impacts on these users.
- Assessment of the quality of the groundwater for the local groundwater catchment.
- Details of how the proposed development will not potentially diminish the current quality of groundwater, both in the short and long term.
- Details on preventing groundwater pollution so that remediation is not required.
- Quantification of impacts on groundwater dependent ecosystems (GDEs).
- Details on protective measures to minimise any impacts on groundwater dependent ecosystems.
- Details of proposed methods of the disposal of waste water and approval from the relevant authority.
- Assessment of the potential for saline intrusion of the groundwater and measures to prevent such intrusion into the groundwater aquifer.
- Details of the results of any models or predictive tools used to predict groundwater drawdown, inflows to the site and impacts on affected water sources.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Details of any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- Description of the remedial measures or contingency plans proposed.

Licensing

- All proposed groundwater works, including bores for the purpose of investigation, extraction, dewatering, testing or monitoring must be identified in the proposal and an approval obtained from the Office of Water prior to their installation. Approved SSD and SSI projects may be excluded from the requirement for approvals due to Section 89J and 115ZG of the *Environmental Planning and Assessment Act 1979*.
- All predicted groundwater take must be accounted for through adequate licensing.

Groundwater Dependent Ecosystems (GDEs)
The assessment is required to identify any impacts on GDEs. GDEs are ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater.

GDEs represent a vital component of the natural environment. GDEs can vary dramatically in how they depend on groundwater from having occasional or no apparent dependence through to being entirely dependent. GDEs occur across both the surface and subsurface landscapes ranging in area from a few metres to many kilometres. Increasingly, it is being recognised that surface and groundwaters are often interlinked and aquatic ecosystems may have a dependence on both.

Ecosystems that can depend on groundwater and that may support threatened or endangered species, communities and populations, include:

- Terrestrial vegetation that show seasonal or episodic reliance on groundwater.
- River base flow systems which are aquatic and riparian ecosystems in or adjacent to streams/rivers dependent on the input of groundwater to base flows.
- Aquifer and cave ecosystems.
- Wetlands.
- Estuarine and near-shore marine discharge ecosystems.
- Fauna which directly depend on groundwater as a source of drinking water or that live within water which provide a source.

The *NSW Aquifer Interference Policy* and the *NSW Groundwater Dependent Ecosystem Policy* provides guidance on the protection and management of GDEs. It sets out management objectives and principles to:

- Ensure the most vulnerable and valuable ecosystems are protected.
- Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity.
- Ensure sufficient groundwater of suitable quality is available to ecosystems when needed.
- Ensure the *precautionary principle* is applied to protect GDEs, particularly the dynamics of flow and availability and the species reliant on these attributes.

A number of gazetted WSPs list and map priority GDEs and set out the management strategies and actions for sharing and protecting groundwater quality, quantity and dependent ecosystems. As indicated above, any GDEs that may be affected significantly need to be clearly identified and the impacts quantified to enable proper assessment.

Surface Water

The Office of Water is responsible for the management of rivers, estuaries, wetlands and adjacent riverine plains so they can sustain environmental, social and economic uses for the people in New South Wales.

<u>Watercourse/Riparian</u>

The assessment is required to consider the impact of the proposal on the watercourses and associated riparian vegetation within the site and provide the following:

- Identify the sources of surface water.
- Details of stream order (using the Strahler System).
- Details of any proposed surface water extraction, including quantity, purpose, location of existing pumps, dams, diversions, cuttings and levees.
- Details of available surface water licences that could be purchased to account for any proposed extractions.
- Detailed description of any proposed development or diversion works including all construction, clearing, draining, excavation and filling.
- An assessment of the impacts of the proposed methods of excavation, construction and material placement on the watercourse and associated vegetation.
- A detailed description of all potential water related environmental impacts of any proposed development in terms of riparian vegetation, sediment movement, water quality and hydrologic regime.
- A description of the design features and measures to be incorporated into any proposed development to guard against anything more than minimal long term actual and potential

environmental disturbances, particularly in respect of maintaining the natural hydrologic regime and sediment movement patterns and the identification of riparian buffers. (See note below)
- Details of the impact on water quality and remedial measures proposed to address more than minimal adverse effects.

Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. The protection or restoration of vegetated riparian areas is important to maintain or improve the geomorphic form and ecological functions of watercourses through a range of hydrologic conditions in normal seasons and also in extreme events. Refer to NSW Office of Water Guidelines for Controlled Activities (July 2012) - available via: http://www.water.nsw.gov.au/Water-Licensing/Approvals/Controlled-activities/default.aspx

Water Management Structures/Dams

The Office is responsible for the management and licensing of these structures under water legislation. If the proposal includes existing or proposed water management structures/dams, the assessment should provide information on the following:
- Date of construction (for existing structure/s).
- Details of the legal status/approval for existing structure/s.
- Details of any proposal to change the purpose of existing structure/s.
- Details if any remedial work is required to maintain the integrity of the existing structure/s.
- Clarification if the structure/s is on a watercourse.
- Details of the purpose, location and design specifications for the structure/s.
- Size and storage capacity of the structure/s.
- Calculation of the Maximum Harvestable Right Dam Capacity (MHRDC) for the site.
- Details if the structure/s is affected by flood flows.
- Details of any proposal for shared use, rights and entitlement of the structure/s.
- Details if the proposed development/subdivision has the potential to bisect the structure/s.

NSW Office of Water's Farm Dams Assessment Guide provides details on harvestable rights and the calculation of the MHRDC. Refer to: *http://www.water.nsw.gov.au/Water-Licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff/default.aspx*

Basic Landholder Rights

The *WMA* identifies Basic Landholder Rights (BLRs) for access to water whereby landholders over an aquifer or with river or lake frontage can access water for domestic (household) purposes or to water stock without the need for a water licence (although a works approval may still be required for a bore utilising BLR). Pipeline constructions and easements may therefore affect existing BLR users and therefore all potentially affected BLR users need to be identified and the impacts quantified.

Sustainable Water Supply

Competition for water in NSW is extremely high. In areas where a Water Sharing Plan (WSP) has commenced, a long term average extraction limit has been established which constrains overall growth in extractions in an area. In these areas there are limited types of new licenses that can be issued, for example for aboriginal cultural purposes or growth in town water supplies. Therefore in most instances new enterprises are required to enter the water market to purchase adequate water licences to meet their water demand requirements.

In areas where a WSP has not yet commenced, the NSW Government has established embargoes on applying for new licences. There are limited exemptions in some areas which need to be considered and applied for by a proponent. If an exemption does not apply, then again new enterprises need to enter the water market to purchase the required water licences. In some areas where a WSP has not yet commenced, there is still available water and the proponent may be able to apply for a new licence to account for the water taken from that water source.

The onus is on the proponent to assess which of the above is relevant and identify the potential sources of water of an appropriate reliability and quantity to meet their water supply requirements. The water supply requirements and potential water available should be identified in the EIS to enable NOW to assess the viability of the water supply required. Assurances should also be made that the proponent will enter the water market as required.

Therefore the assessment is required to address the issue of provision of a sustainable water supply for any project proposal. The assessment should include Water Management Plans detailing how a sustainable water supply can be sourced and implemented. Through the implementation of BASIX, Integrated Water Cycle Management and Water Sensitive Urban Design, any proposed development should also exhibit high water use efficiency.

End Attachment 1

859.

RECEIVED
0 SEP 2013
BY:.....

NSW EPA

Manager Mining and Industry Projects
NSW Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: Mr Nicholas Brbot

cc: Mr Mitchell Bland (R.W. Corkery & Co)

Notice Number	1515229
File Number	LIC07/2379-07
Date	04-Sep-2013

RE: "Avoca Tank Project - DGR ID No. 766"

I refer to your request for the Environment Protection Authority (EPA) requirements for the preparation of an Environmental Assessment (EA) in regard to the above proposal for which the EPA attended a Planning Focus Meeting (PFM) on 17 June 2013.

The EPA has considered the details of the proposal as provided by the applicant and outlined at the PFM and has identified the information it requires to assess the project in Attachment A. In summary, the EPA's key information requirements for the proposal include an adequate assessment of:

1. The impact of potential acid generation from waste rock, including proposed methods of encapsulation;
2. Water management including the potential impact of water pollution on local watercourses (including water demand and management requirements);
3. The impact on groundwater, including impact on groundwater dependant ecosystems and other water users;
4. Assessment of air quality impacts during both construction and operation; including mitigation strategies and management of dust.
5. Assessment of noise and vibration impacts during both construction and operation, including traffic noise. The assessment should address the impacts on nearby receptors and noise amenity in accordance with the NSW Industrial Noise Policy; and identify strategies to mitigate potential noise impacts.
6. Assessment of cumulative impacts during construction and operation.

Page 1

Based on the information supplied with the formal request for DGRs, the applicant will require an Environment Protection Licence to carry out Scheduled Development Works and Scheduled Activities at the premises. The applicant will need to make a separate application to the EPA to obtain this licence should the project be granted development consent.

The EPA notes all aspects of the project must be assessed in addressing the key information requirements.

For all components of the proposal, the actions that will be taken to avoid or mitigate environmental impacts, or compensatory measures to minimise unavoidable impacts must be fully detailed. In carrying out the assessment, the applicant should refer to the relevant guidelines in Attachments A and B and also any industry codes of practice or best environmental management practice guidelines.

To assist the EPA in assessing the EIS it is requested that the EIS follow the format of DIPNR's EIS guidelines (where in existence) and/or the specific EIS requirements as outlined in the attachments.

The EPA requests that 1 x hard copy and 1 x electronic copy of the EIS be provided to the EPA when the proponent lodges its application. These documents should be lodged at the Dubbo office of the Department, PO Box 2111, Dubbo NSW 2830. If you have any queries regarding this matter please contact Samantha Wynn at the Dubbo office by telephoning (02) 6883 5330.

Yours sincerely

Bradley Tanswell

Acting Head Pesticides, Operations & Planning Unit

North - Dubbo

(by Delegation)

Attachment A: EIS Requirements for Avoca Tank Project

Attachment B: General Guidance Material

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ATTACHMENT A: EIS REQUIREMENTS FOR AVOCA TANK PROJECT

How to use these requirements

The EPA requirements have been structured in accordance with the DIPNR EIS Guidelines, as follows. It is suggested that the EIS follow the same structure:

A. Executive summary

B. The proposal

C. The location

D. Identification and prioritisation of issues

E. The environmental issues

F. List of approvals and licences

G. Compilation of mitigation measures

H. Justification for the proposal

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A Executive summary

The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

B The proposal

1. Objectives of the proposal

- The objectives of the proposal should be clearly stated and refer to:
  a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced
  b) a life cycle approach to the production, use or disposal of products
  c) the anticipated level of performance in meeting required environmental standards and cleaner production principles
  d) the staging and timing of the proposal and any plans for future expansion
  e) the proposal's relationship to any other industry or facility.

2. Description of the proposal

General

- Outline the production process including:
  a) the environmental "mass balance" for the process – quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill etc)
  b) any life-cycle strategies for the products.
- Outline cleaner production actions, including:
  a) measures to minimise waste (typically through addressing source reduction)
  b) proposals for use or recycling of by-products
  c) proposed disposal methods for solid and liquid waste
  d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points
  e) water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge.
  f) soil contamination treatment and prevention systems.
- Outline construction works including:

a) actions to address any existing soil contamination

b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site)

c) construction timetable and staging; hours of construction; proposed construction methods

d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures.

Air

- Identify all sources of air emissions from the development.
  Note: emissions can be classed as either:
  - *point (eg emissions from stack or vent) or*
  - *fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).*
- Provide details of the project that are essential for predicting and assessing air impacts including:
  a) the quantities and physio-chemical parameters (eg concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or stored
  b) an outline of procedures for handling, transport, production and storage
  c) the management of solid, liquid and gaseous waste streams with potential for significant air impacts.

Noise and vibration

- Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.
- Specify the times of operation for all phases of the development and for all noise producing activities.
- For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks.

Water

- Provide details of the project that are essential for predicting and assessing impacts to waters:
  a) including the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on www.environment.nsw.gov.au/ieo, using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000)

b) the management of discharges with potential for water impacts

c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal.

- Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts eg effluent ponds) and showing potential areas of modification of contours, drainage etc.
- Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Waste and chemicals

- Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (NSW EPA, 1999).
- Provide details of liquid waste and non-liquid waste management at the facility, including:

  a) the transportation, assessment and handling of waste arriving at or generated at the site

  b) any stockpiling of wastes or recovered materials at the site

  c) any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site

  d) the method for disposing of all wastes or recovered materials at the facility

  e) the emissions arising from the handling, storage, processing and reprocessing of waste at the facility

  f) the proposed controls for managing the environmental impacts of these activities.

  Provide details of spoil disposal with particular attention to:

  a) the quantity of spoil material likely to be generated

  b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil

  c) the need to maximise reuse of spoil material in the construction industry

  d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material

  e) designation of transportation routes for transport of spoil.
- Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.
- Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.
- Reference should be made to the guidelines: *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (NSW EPA, 1999).

ESD

- Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving ESD, including:

an assessment of a range of options available for use of the resource, including the benefits of each option to future generations

f) proper valuation and pricing of environmental resources

g) identification of who will bear the environmental costs of the proposal.

3. Rehabilitation

- Outline considerations of site maintenance, and proposed plans for the final condition of the site (ensuring its suitability for future uses).

4. Consideration of alternatives and justification for the proposal

- Consider the environmental consequences of adopting alternatives, including alternative:
  a) sites and site layouts
  b) access modes and routes
  c) materials handling and production processes
  d) waste and water management
  e) impact mitigation measures
  f) energy sources
- Selection of the preferred option should be justified in terms of:
  a) ability to satisfy the objectives of the proposal
  b) relative environmental and other costs of each alternative
  c) acceptability of environmental impacts and contribution to identified environmental objectives
  d) acceptability of any environmental risks or uncertainties
  e) reliability of proposed environmental impact mitigation measures
  f) efficient use (including maximising re-use) of land, raw materials, energy and other resources.

C The location

1. General

- Provide an overview of the affected environment to place the proposal in its local and regional environmental context including:
  a) meteorological data (eg rainfall, temperature and evaporation, wind speed and direction)
  b) topography (landform element, slope type, gradient and length)
  c) surrounding land uses (potential synergies and conflicts)
  d) geomorphology (rates of landform change and current erosion and deposition processes)
  e) soil types and properties (including erodibility; engineering and structural properties; dispersibility; permeability; presence of acid sulfate soils and potential acid sulfate soils)
  f) ecological information (water system habitat, vegetation, fauna)
  g) availability of services and the accessibility of the site for passenger and freight transport.

2. Air

- Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.
- Describe surrounding buildings that may effect plume dispersion.
- Provide and analyse site representative data on following meteorological parameters:
  a) temperature and humidity
  b) rainfall, evaporation and cloud cover
  c) wind speed and direction
  d) atmospheric stability class
  e) mixing height (the height that emissions will be ultimately mixed in the atmosphere)
  f) katabatic air drainage
  g) air re-circulation.

3. Noise and vibration

- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.
- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

4. Water

- Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: www.environment.nsw.gov.au/ieo should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.

5. Soil Contamination Issues

- Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination, for example if the site was previously a landfill site or if irrigation of effluent has occurred.

D Identification and prioritisation of issues / scoping of impact assessment

- Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:
  a) relevant NSW government guidelines
  b) industry guidelines
  c) EISs for similar projects
  d) relevant research and reference material
  e) relevant preliminary studies or reports for the proposal
  f) consultation with stakeholders.
- Provide a summary of the outcomes of the process including:
  a) all issues identified including local, regional and global impacts (eg increased/ decreased greenhouse emissions)
  b) key issues which will require a full analysis (including comprehensive baseline assessment)
  c) issues not needing full analysis though they may be addressed in the mitigation strategy
  d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).

E The environmental issues

1. General

- The potential impacts identified in the scoping study need to be assessed to determine their significance, particularly in terms of achieving environmental outcomes, and minimising environmental pollution.
- Identify gaps in information and data relevant to significant impacts of the proposal and any actions proposed to fill those information gaps so as to enable development of appropriate management and mitigation measures. This is in accordance with ESD requirements.

Note: The level of detail should match the level of importance of the issue in decision making which is dependent on the environmental risk.

Describe baseline conditions

- Provide a description of existing environmental conditions for any potential impacts.

Assess impacts

- For any potential impacts relevant for the assessment of the proposal provide a detailed analysis of the impacts of the proposal on the environment including the cumulative impact of the proposal on the receiving environment especially where there are sensitive receivers.
- Describe the methodology used and assumptions made in undertaking this analysis (including any modelling or monitoring undertaken) and indicate the level of confidence in the predicted outcomes and the resilience of the environment to cope with the predicted impacts.
- The analysis should also make linkages between different areas of assessment where necessary to enable a full assessment of environmental impacts eg assessment of impacts on air quality will often need to draw on the analysis of traffic, health, social, soil and/or ecological systems impacts; etc.
- The assessment needs to consider impacts at all phases of the project cycle including: exploration (if relevant or significant), construction, routine operation, start-up operations, upset operations and decommissioning if relevant.
- The level of assessment should be commensurate with the risk to the environment.

Describe management and mitigation measures

- Describe any mitigation measures and management options proposed to prevent, control, abate or mitigate identified environmental impacts associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.
- Proponents are expected to implement a 'reasonable level of performance' to minimise environmental impacts. The proponent must indicate how the proposal meets reasonable levels of performance. For example, reference technology based criteria if available, or identify good practice for this type of activity or development. A 'reasonable level of performance' involves adopting and implementing

technology and management practices to achieve certain pollutant emissions levels in economically viable operations. Technology-based criteria evolve gradually over time as technologies and practices change.

- Use environmental impacts as key criteria in selecting between alternative sites, designs and technologies, and to avoid options having the highest environmental impacts.
- Outline any proposed approach (such as an Environmental Management Plan) that will demonstrate how commitments made in the EIS will be implemented. Areas that should be described include:

  a) operational procedures to manage environmental impacts

  b) monitoring procedures

  c) training programs

  d) community consultation

  e) complaint mechanisms including site contacts

  f) strategies to use monitoring information to improve performance

  g) strategies to achieve acceptable environmental impacts and to respond in event of exceedences.

7. Air

Describe baseline conditions

- Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.

Assess impacts

- Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.
- Assess the risk associated with potential discharges of fugitive and point source emissions for all stages of the proposal. Assessment of risk relates to environmental harm, risk to human heath and amenity.
- Justify the level of assessment undertaken on the basis of risk factors, including but not limited to:
  a. proposal location;
  b. characteristics of the receiving environment; and
  c. type and quantity of pollutants emitted.
- Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to:
  d. meteorology and climate;
  e. topography;
  f. surrounding land-use; receptors; and
  g. ambient air quality.

- Include a detailed description of the proposal. All processes that could result in air emissions (including blasting) must be identified and described. Sufficient detail to accurately communicate the characteristics and quantity of all emissions must be provided.
- Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.
- Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment.
- Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment. Air dispersion modelling must be conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005) http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf
- Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations (POEO) Act (1997)* and the *POEO (Clean Air) Regulation (2002)*.
- Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010.
- Detail emission control techniques/practices that will be employed by the proposal and demonstrate that these are best management practice, by applying the procedure outlined in *Coal Mine Particulate Matter Control Best Practice - Site-specific determination guideline* (November 2011). http://www.environment.nsw.gov.au/resources/air/20110813coalmineparticulate.pdf
- Estimate the resulting ground level concentrations of all pollutants. Where necessary (eg potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA.
- Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.
- Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.
- For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA / DECCW procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.
- Reference should be made to relevant guidelines e.g. *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2001)*; Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (EPA, 2001)*; Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005), *Coal Mine Particulate Matter Control Best Practice - Site-specific determination guideline* (November 2011), *Load Calculation Protocol for use by holders of NSW Environment Protection Licences when calculating Assessable Pollutant Loads* (EPA, 1999).

Describe management and mitigation measures

- Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.

8. Noise and vibration

Describe baseline conditions

- Determine the existing background (LA90) and ambient (LAeq) noise levels in accordance with the *NSW Industrial Noise Policy*.
- Determine the existing road traffic noise levels in accordance with the *NSW Environmental Criteria for Road Traffic Noise*, where road traffic noise impacts may occur.
- The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:

details of equipment used for the measurements

h) a brief description of where the equipment was positioned

i) a statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive locations(s)' and 'most affected locations(s)' described in Section 3.1.2 of the *NSW Industrial Noise Policy*

j) details of the exact location of the monitoring site and a description of land uses in surrounding areas

k) a description of the dominant and background noise sources at the site

l) day, evening and night assessment background levels for each day of the monitoring period

m) the final Rating Background Level (RBL) value

n) graphs of the measured noise levels for each day should be provided

o) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section B1.3 of the *NSW Industrial Noise Policy*

p) determination of LAeq noise levels from existing industry.

Assess impacts

- Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:

  a) determination of the intrusive criterion for each identified potentially affected receiver

  b) selection and justification of the appropriate amenity category for each identified potentially affected receiver

  c) determination of the amenity criterion for each receiver

  d) determination of the appropriate sleep disturbance limit.

- Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. Where LA1(1min) noise levels from the site are less than 15 dB above the background LA90 noise level, sleep disturbance impacts are unlikely. Where this is not the case,

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further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise*.

- Determine expected noise level and noise character (eg tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:
  a) site establishment
  b) construction
  c) operational phases
  d) transport including traffic noise generated by the proposal
  e) other services.

  Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).

- Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition.
- The noise impact assessment report should include:
  a) a plan showing the assumed location of each noise source for each prediction scenario
  b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site
  c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc
  d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated
  e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions
  f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate
  g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived
  h) an assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy*.
- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.
- The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.
- Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:

a) locations where the noise level exceeds the criteria and extent of exceedence
b) numbers of people (or areas) affected
c) times when criteria will be exceeded
d) likely impact on activities (speech, sleep, relaxation, listening, etc)
e) change on ambient conditions
f) the result of any community consultation or negotiated agreement.

- For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.
- Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment:

a) bench height, burden spacing, spacing burden ratio
b) blast hole diameter, inclination and spacing
c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.

Describe management and mitigation measures

- Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.
- For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:

a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage
b) control of traffic (eg: limiting times of access or speed limitations)
c) resurfacing of the road using a quiet surface
d) use of (additional) noise barriers or bunds
e) treatment of the façade to reduce internal noise levels buildings where the night-time criteria is a major concern
f) more stringent limits for noise emission from vehicles (i.e. using specially designed 'quite' trucks and/or trucks to use air bag suspension
g) driver education
h) appropriate truck routes
i) limit usage of exhaust breaks
j) use of premium muffles on trucks

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k) reducing speed limits for trucks

l) ongoing community liaison and monitoring of complaints

m) phasing in the increased road use.

4. Water

Describe baseline conditions

- Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).

  Note: Methods of sampling and analysis need to conform with an accepted standard (e.g. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECCW 2004) *or be approved and analyses undertaken by accredited laboratories).*

- Provide site drainage details and surface runoff yield.
- State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: www.environment.nsw.gov.au/ieo. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.
- State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 *Guidelines for Fresh and Marine Water Quality* (http://www.deh.gov.au/water/quality/nwqms/volume1.html)(Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.
- State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries (www.hrc.nsw.gov.au) or the NSW Salinity Strategy (DLWC, 2000) (www.dlwc.nsw.gov.au/care/salinity/#Strategy).
- Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.
- Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:

a) lake or estuary flushing characteristics

b) specific human uses (e.g. exact location of drinking water offtake)

c) sensitive ecosystems or species conservation values

d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc

e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment

f) historic river flow data where available for the catchment.

Assess impacts

- No proposal should breach clause 120 of the *Protection of the Environment Operations Act* 1997 (i.e. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).
- Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.
- Include a rationale, along with relevant calculations, supporting the prediction of the discharges.
- Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).
- Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).
- Identify any potential impacts on quality or quantity of groundwater describing their source.
- Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.
- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.
- Containment of spills and leaks shall be in accordance with the technical guidelines section 'Bunding and Spill Management' of the *Authorised Officers Manual* (EPA, 1995) (http://www.environment.nsw.gov.au/mao/bundingspill.htm) and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.
- The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered:

  a) will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and

  b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.

- Consult with the EPA as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does

not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The EPA will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment.

Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.

- Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.
- Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact.
- Reference should be made to relevant guidelines e.g. *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004), and *Guidelines for Fresh and Marine Water Quality* ANZECC 2000).

Describe management and mitigation measures

- Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.
- Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.
- Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.
- Outline pollution control measures relating to storage of materials, possibility of accidental spills (eg preparation of contingency plans), appropriate disposal methods, and generation of leachate.
- Describe hydrological impact mitigation measures including:
  a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition)
  b) minimising runoff
  c) minimising reductions or modifications to flow regimes
  d) avoiding modifications to groundwater.
- Describe groundwater impact mitigation measures including:
  a) site selection
  b) retention of native vegetation and revegetation
  c) artificial recharge
  d) providing surface storages with impervious linings
  e) monitoring program.

- Describe geomorphological impact mitigation measures including:
  a) site selection
  b) erosion and sediment controls
  c) minimising instream works
  d) treating existing accelerated erosion and deposition
  e) monitoring program.
- Any proposed monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DECCW 2004).

5. Soils and contamination

Describe baseline conditions

- Provide any details (in addition to those provided in the location description - Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.

Assess impacts

- Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of:
  a) disturbing any existing contaminated soil
  b) contamination of soil by operation of the activity
  c) subsidence or instability
  d) soil erosion
  e) disturbing acid sulfate or potential acid sulfate soils.
- Reference should be made to relevant guidelines e.g. *Contaminated Sites – Guidelines for Consultants Reporting on Contaminated Sites* (EPA, 1997); *Contaminated Sites – Guidelines on Significant Risk of Harm and Duty to Report* (EPA, 1999).

Describe management and mitigation measures

- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:
  a) erosion and sediment control measures
  b) proposals for site remediation – see *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
  c) proposals for the management of these soils – see *Assessing and Managing Acid Sulfate Soils,* Environment Protection Authority, 1995 (note that this is the only methodology accepted by the EPA).

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6. Waste and chemicals

Describe baseline conditions

- Describe any existing waste or chemicals operations related to the proposal.

Assess impacts

- Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.
- Reference should be made to relevant guidelines e.g. *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (EPA, 1999).

Describe management and mitigation measures

- Outline measures to minimise the consumption of natural resources.
- Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.
- Outline measures to support any approved regional or industry waste plans.

7. Cumulative impacts

- Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.
- Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.
- Identify infrastructure requirements flowing from the proposal (eg water and sewerage services, transport infrastructure upgrades), and all infrastructure upgrades/modifications required at the existing mine infrastructure at Girilambone and Hermidale to cater for the Avoca Tank Project.
- Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (eg travel demand management strategies).
- Identify all existing mining operations that will be operated concurrently with the proposed project, time frames, and the likely cumulative impacts and mitigation measures to reduce impacts over the life of the project.

F. List of approvals and licences

- Identify all approvals and licences required under environment protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land, water).

G. Compilation of mitigation measures

- Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under EPA licences or approvals (eg outline of an environmental management plan).
- The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.

H. Justification for the Proposal

- Reasons should be included which justify undertaking the proposal in the manner proposed, having regard to the potential environmental impacts.

NSW EPA

Attachment B – General Guidance Material

Title	Web address
	Relevant Legislation
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Contaminated Land Management Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+140+1997+cd+0+N
Environmentally Hazardous Chemicals Act 1985	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
	Licensing
EPA Guide to Licensing	http://www.epa.nsw.gov.au/licensing/licenceguide.htm
	Air Issues
Air Quality	
Approved methods for modelling and assessment of air pollutants in NSW (2005)	http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf
POEO (Clean Air) Regulation 2002	http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+642+2002+cd+0+N
Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005)	http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf.
Coal Mine Particulate Matter Control Best Practice - Site-specific determination guideline (November 2011).	http://www.environment.nsw.gov.au/resources/air/20110813coalmineparticulate.pdf
Greenhouse Gas	
The Greenhouse Gas Protocol: Corporate Standard, World Council for Sustainable Business Development & World Resources Institute	http://www.ghgprotocol.org/standards/corporate-standard

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National Greenhouse Accounts (NGA) Factors, Australian Department of Climate Change (Latest release),	http://www.climatechange.gov.au/publications/greenhouse-acctg/national-greenhouse-factors.aspx
National Greenhouse and Energy Reporting System, Technical Guidelines (latest release)	http://www.climatechange.gov.au/en/government/initiatives/national-greenhouse-energy-reporting/tools-resources.aspx
National Carbon Accounting Toolbox	http://www.climatechange.gov.au/government/initiatives/ncat.aspx
Australian Greenhouse Emissions Information System (AGEIS)	http://ageis.climatechange.gov.au/

DECCW Estate

Land reserved or acquired under the NPW Act

List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
DECCW Revocation of Land Policy	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm

Noise and Vibration

Interim Construction Noise Guideline (DECC, 2009)	http://www.epa.nsw.gov.au/noise/constructnoise.htm
Assessing Vibration: a technical guideline (DEC, 2006)	http://www.epa.nsw.gov.au/noise/vibrationguide.htm
Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC, 1990)	http://www.epa.nsw.gov.au/noise/blasting.htm
Industrial Noise Policy Application Notes	http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm
Environmental Criteria for Road Traffic Noise (EPA, 1999)	http://www.epa.nsw.gov.au/noise/traffic.htm
Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (DECC, 2007)	http://www.epa.nsw.gov.au/noise/railinfranoise.htm
Environmental assessment requirements for rail traffic-generating developments	http://www.epa.nsw.gov.au/noise/railnoisegl.htm

Waste, Chemicals and Hazardous Materials and Radiation

Waste

Environmental Guidelines: Solid Waste Landfills (EPA, 1996)	http://www.epa.nsw.gov.au/resources/waste/envguidlns/solidlandfill.pdf
Draft Environmental Guidelines - Industrial Waste Landfilling (April 1998)	http://www.epa.nsw.gov.au/resources/waste/envguidlns/industrialfill.pdf
Waste Classification Guidelines (DECC,	http://www.epa.nsw.gov.au/resources/waste/091216classifywaste.pdf

2008)	
EPA Resource recovery exemption	http://www.epa.nsw.gov.au/waste/RRecoveryExemptions.htm
Radioactive Residues	
Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing	http://www.arpansa.gov.au/pubs/rps/rps9.pdf
Code of Practice for the Safe Transport of Radioactive Material	http://www.arpansa.gov.au/pubs/rps/rps2_2008.pdf
Contaminated Sites: Guidelines for the NSW Site Auditor Scheme	http://www.epa.nsw.gov.au/resources/clm/auditorglines06121.pdf

Water and Soils

Contaminated Sites Assessment and Remediation	
Managing land contamination: Planning Guidelines – SEPP 55 Remediation of Land	http://www.planning.nsw.gov.au/DevelopmentAssessments/RegisterofDevelopmentAssessmentGuidelines/tabid/207/language/en-US/Default.aspx
Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000)	http://www.epa.nsw.gov.au/resources/clm/20110650consultantsglines.pdf
Guidelines for the NSW Site Auditor Scheme - 2nd edition (DEC, 2006)	http://www.epa.nsw.gov.au/resources/clm/auditorglines06121.pdf
Sampling Design Guidelines (EPA, 1995)	Available by request from the EPA's Environment Line
National Environment Protection (Assessment of Site Contamination) Measure 1999 (or update)	http://www.ephc.gov.au/taxonomy/term/44
Flooding and Coastal Erosion	
Reforms to coastal erosion management	http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm
Floodplain development manual	http://www.dnr.nsw.gov.au/floodplains/manual.shtml
Coastline management manual	http://www.environment.nsw.gov.au/coasts/
Estuary management manual	http://www.environment.nsw.gov.au/coasts/InfoCoastEstFloodGrants.htm
Soils – general	
Soil and Landscape Issues in Environmental Impact Assessment (DLWC 2000)	http://www.dnr.nsw.gov.au/care/soil/soil_pubs/pdfs/tech_rep_34_new.pdf
Managing urban stormwater: soils and construction, vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; B Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008)	Vol 1 - Available for purchase at http://www.landcom.com.au/whats-new/publications-reports/the-blue-book.aspx Vol 2 - http://www.environment.nsw.gov.au/stormwater/publications.htm
Landslide risk management guidelines	http://www.australiangeomechanics.org/resources/downloads/
Site Investigations for Urban Salinity (DLWC, 2002)	http://www.environment.nsw.gov.au/resources/salinity/booklet3siteinvestigationsforurbansalinity.pdf

NSW GOVERNMENT Industry & Investment

Our Reference: V13/301
OUT13/26297

Mr Howard Reed
Manager Mining Projects
Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: Mr Nicholas Brbot

Dear Mr Reed

Proposed Avoca Tank Project (DGR ID No.766 - Bogan Shire)
Environmental Impact Statement Requirements

I refer to your email dated 21 August 2013 regarding the Tritton Resources Pty Ltd request for Director General's Requirements (DGRs) for the Avoca Tank Project. NSW Trade & Investment, Division of Resources and Energy (DRE) understand that the proposal is a designated development located in the Bogan Shire.

DRE has reviewed the *Background Paper for Avoca Tank Project June 2013* and along with information presented by the proponent at a Planning Focus Meeting held on 17 June 2013, provides the following comments which are directed at specific areas of DRE's responsibility for this proposal:

Mineral Resource Issues:

The following key issues need to be addressed in sufficient detail in the draft Environmental Impact Statement (EIS):

- A summary of the regional, local geology and mineralisation including information on the geological units within which the resource area is both appropriate and adequate for the EIS,
- A resource estimate (Note - if the reserve estimate becomes available then this should be included also),
- The mineralogy of the ore to be treated (Note comment below regarding total sulphide content),
- A summary of the project period providing sufficient detail for the EIS - i.e. eight years, comprising 2 years of site establishment activities, 4 years of mining and processing operations and 2 years of rehabilitation operations,

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Additional information that should be included in the EIS includes:

- The amount of ore, mineralised waste and unmineralised waste rock anticipated to be produced and/or treated annually and during the life of the project,
- The characteristics of the waste rock and tailings produced. The amount of material remaining in waste dumps and that to be used as backfill,
- Will there be any mineralised waste/low grade stockpiles remaining at the end of project life? - If so what is planned for this material and could it be recovered at a future time?
- Estimate of the sulphide content (%) for each lens/zone to be mined,
- A description of each lens to be mined (length, width, depth, any features different to the more general description),
- Plans and cross-sections showing the planned resource blocks, low grade material not to be mined and the extraction sequence data,
- A plan showing the surface projection of the ore zone(s) to be mined with planned layout of infrastructure and other features,
- Will the proposed project sterilise low grade material that could be mined in the future?

Mining operations for this proposal will require the grant of a mining lease and this is acknowledged in Item 2.2 of the Background Paper. Any mining lease granted will include the Mining Rehabilitation Environmental Management Process (MREMP).

Environmental Sustainability Issues:

1. Project Description

So that the project and its environmental interactions can be understood, the EIS must provide a comprehensive description of all aspects of the project. In terms of text, plans or charts, it must also clearly show the proposed extent and sequence of development.

2. Description of existing environment, identification of impacts and constraints

All areas affected by the mining proposal must be shown in the context of both the natural environment and the existing mine development. This should be in sufficient detail to enable an understanding of the scale of impacts and gauge the effectiveness of proposed control measures.

Impacts associated with the operational and post closure stages of the project must also be identified in detail and control strategies outlined. The identification and description of impacts must draw out those aspects of the site that may present barriers or limitations to effective rehabilitation and which may limit the post mine closure potential of the land.

The following are the key issues to be addressed in the EIS that are likely to have a bearing on rehabilitation and mine closure.

- Groundwater impacts associated with mining operations and any bore field proposed for water supply purposes. Long term recovery patterns of groundwater and any bearing these may have on subsequent land uses,
- Any surface water flow regimes and how these will be impacted by the project both during and after mining has ceased,
- The flora, fauna and ecological attributes of the disturbed area should be recorded and placed in a regional context,
- Characterise soils across the proposed area of surface disturbance and assesses their value and identify any limitations they present for rehabilitation. Land capability characteristics of the site also need to be described,
- Identify any Potential Acid Forming (PAF) material that may be found on site. The existing knowledge bank on waste rock geochemistry should be expanded with a comprehensive test program directed to ascertain the acid generation potential and leachate composition of the Avoca Tank Project waste streams.
- Investigations should consider Acid Mine Drainage (AMD) potential, the composition of waste rock leachates (whether acidic or not), as well as the potential for saline drainage. A comprehensive range of potential leachate ions/species must be considered. The resulting waste classification scheme should be subject to ongoing and, if necessary, longer term investigations on the AMD potential and leachate quality of waste rock. This should be provided for in the EIS Statement of Commitments,
- The geochemistry of waste materials must be characterised and the potential for adverse leachate seepages to occur, both during and after mining, must be assessed. The geochemical assessment should cover the full range of environmentally significant compounds that may be mobilised from soils, waste rock and tailings. Where there is a potential for acidic leachate from either tailings or waste rock to occur, management measures to prevent this occurring are to be presented. Contingency measures to deal with unexpected poor quality seepages (acid or saline) from the tailings and waste rock storages are also required.

3. Rehabilitation and Mine Closure

DRE's role focuses on ensuring that mined land in NSW is effectively rehabilitated and returned to beneficial post mining land uses. This is undertaken by requiring mine operators to have strategies in place to ensure the rehabilitation of all mined land, and strategies for an orderly transition from a mining land use to an agreed stable and beneficial post mining use. At the EIS stage, the strategies may be conceptual in nature. Each of the following aspects of rehabilitation planning should be addressed in the strategy:

- **Rehabilitation Objectives**: Describe the strategic rehabilitation objectives for the project and how these comply with relevant Government legislation or policies, research outcomes or industry leading practice. Describe the potential for integrating the rehabilitation strategy with any other offset (or conservation) strategies in the region,
- **Final Voids and Waste Rock Emplacements:** The EIS must include a detailed consideration of the final rehabilitation options for the open pit and waste rock dumps. Issues associated with final voids and waste rock landforms such as stability, acid rock drainage, ground and surface water and

aesthetics need to be addressed. The number, location and geometry of any final voids in the landscape must be fully justified. Final mine voids seldom, if ever, have a beneficial use and the permanent costs to the environment and future agricultural production should be acknowledged by the applicant and considered by the Department of Planning & Infrastructure before any approval,

- **Final Land Use**: Describe proposed final land uses for each disturbance domain (infrastructure areas, waste rock storages, subsidence zones, final void etc.) and provide a conceptual plan depicting these uses and final landforms,
- **Performance Standards and Completion Criteria**: For each disturbance domain, identify relevant performance measures (e.g. open woodland revegetation) and indicative completion criteria (e.g. Number of surviving trees trees/hectare after 5 years),
- **Monitoring and Research**: Outline the proposed rehabilitation methods and techniques and proposed monitoring and research programs,
- **Post-closure maintenance:** Describe any post-rehabilitation maintenance requirements for the project site and how these will be managed.

4. Other Considerations

Mining Operations Plan (MOP)

Subject to any planning approval prior to commencement, the proponent will be required to submit and have approved a Mining Operations Plan (MOP) or, if the pending *Mining Act 1992* amendments have commenced, a Rehabilitation and Environmental Management Plan (REMP).

Rehabilitation Security Bond

A review of the rehabilitation security bond will also be undertaken prior to project commencement. Parameters should be measured by licensing conditions and continual consultation with DRE.

Should you have any queries regarding this matter, please contact Steve Cozens, Senior Project Officer, Industry Coordination on telephone 8281 7335.

Yours sincerely

WILLIAM HUGHES
ACTING DIRECTOR
MINERALS OPERATIONS

12/9/13

cc: Mitchell Bland
orange@rwcorkery.com

Office of Environment & Heritage

Your reference:
Our reference: DOC 13/45452
Contact: Erica Baigent (02) 68835311
Date: 3 September 2013

Nicholas Brbot
Mining Projects
Department of Planning & Infrastructure
GPO Box 39
SYDNEY 2001

Dear Mr Brbot

RE Proposal - Avoca Tank Project DGR ID No. 766

Thank you for your email dated 21 August seeking the requirements of the Office of Environment and Heritage (OEH) for the preparation of an Environmental Impact Statement (EIS) for the above proposal.

The background information provided indicates that the proposed Avoca Tank proposal will involve underground mining operations and associated surface infrastructure.

OEH Role

OEH has responsibilities under the:

- *National Parks and Wildlife Act 1974* - namely the protection and care of Aboriginal objects and places, the protection and care of native flora and fauna and the protection and management of reserves; and the
- *Threatened Species Conservation Act 1995* which aims to conserve threatened species of flora and fauna, populations and ecological communities to promote their recovery and manage processes that threaten them.
- *Native Vegetation Conservation Act 2003* – ensuring compliance with the requirements of this legislation.

OEH understands from the correspondence that the proposed activity is a Part 4 application pursuant to the *Environmental Planning and Assessment Act 1979* (*EP&A Act*), and has not been classified as State Significant Development. As such OEH only has a statutory role in assessing such an activity if the consent authority determines that:

a) the activity is likely to significantly affect a threatened species, population, ecological community, or its habitat, as listed under the *Threatened Species Conservation (TSC) Act 1995*; and/or

b) An Aboriginal Heritage Impact Permit is required.

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The *Environmental Planning and Assessment Act 1979* (*EP&A Act*) and *Environmental Planning and Assessment Regulation 2000* require that the EIS should fully describe the proposal, the existing environment and impacts of the proposal. It is the responsibility of the proponent and consent authority to adequately consider the requirements under the *EP&A Act and Regulation.*

OEH can provide advice on the EIS where the EIS deals with natural and cultural heritage conservation issues. OEH may also comment on the legitimacy of the conclusions reached regarding the significance of impacts by the proposed development to these components of the environment.

This letter directs you primarily to our generic guidance material. However please note that it is up to the proponent (and later the consent/determining authority after appropriate consultation) to determine the detail and comprehensiveness of the surveys and level of assessment required to form legally defensible conclusions regarding the impact of the proposal. The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data.

OEH Requirements

In summary, the OEH's key information requirements for the proposal include an adequate assessment of:

1. **Impacts to Aboriginal cultural heritage objects;** and
2. **Impacts on flora, fauna, threatened species, populations, communities and their habitats.**

This assessment should include consideration of direct and indirect impacts as a result of both construction and operation of the project. Assessment of any cumulative impacts of this and other developments in the area will be essential.

Flora, Fauna and Threatened Species

A copy of our generic Environmental Assessment Guidelines are included in Attachments A and B. These guidelines address requirements under the *EP&A Act* and OEH's areas of responsibility relating to flora, fauna and threatened species, populations and ecological communities and their habitats.

OEH is committed to the protection, appropriate management, and where necessary, rehabilitation of native vegetation. For these reasons, OEH considers that careful planning should precede any development that involves further vegetation clearance or other significant impact within areas of remnant vegetation.

Negative impacts to native vegetation (eg clearing) should be avoided where possible. Where impacts cannot be avoided, the EIA should detail how a "maintain or improve" outcome for biodiversity will be achieved. BioBanking provides a voluntary mechanism through which this can be achieved. The BioBanking Assessment Methodology allows quantification of impacts and assessment of the value of offset areas and associated management regimes for those areas. The biobanking scheme provides an alternative path for proponents to the current threatened species assessment of significance process. Information about BioBanking is located on OEH's website at http://www.environment.nsw.gov.au/biobanking/ .

Cultural Heritage

The importance of protecting Aboriginal Cultural Heritage is reflected in the provisions under Part 6 of the *NP&W Act 1974*, as amended. That Act clearly establishes that Aboriginal objects and places are protected and may not be harmed, disturbed or desecrated without appropriate authorisation. Importantly, approvals under Parts 4 and 5 of the *EP&A Act 1979* do not absolve the proponent of their obligations under the *NP&W Act 1979.*

Under the *NP&W Act 1974*, it is the responsibility of each individual proposing to conduct ground disturbance works to ensure that they have conducted a due diligence assessment to avoid harming Aboriginal objects by the proposed activity. OEH has produced a generic due diligence process, which

is not mandatory to follow, however any alternative process followed must be able to demonstrate their process was reasonable and practicable in attempts to avoid harm to Aboriginal objects.

Consultation must also be in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010) as set by OEH if impact to cultural heritage is unavoidable.

Further advice regarding Aboriginal cultural heritage can be found on the OEH web-site at: http://www.environment.nsw.gov.au/licences/achregulation.htm. and within guidance documents listed in Attachment B.

Should you require further information please contact Erica Baigent, Conservation Planning Officer on (02) 68835311 or via erica.baigent@environment.nsw.gov.au .

Yours Sincerely,

SONYA ARDILL
Senior Team Leader Planning
North West Region

ATTACHMENT A

Office of Environment and Heritage

EIS Requirements for the Expansion of Westport Quarry DGR ID No. 756

1. Environmental impacts of the project

Impacts related to the following environmental issues need to be assessed, quantified and reported on:

- **Cumulative impact**
- **Aboriginal cultural heritage**
- **Biodiversity**
- **OEH Estate - Land reserved or acquired under the NPW Act**

The Environmental Impact Statement (EIS) should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at **Attachment B**.

2. Cumulative Impact

The cumulative impacts from all clearing activities and operations, associated edge effects and other indirect impacts on cultural heritage, biodiversity and OEH Estate need to be comprehensively assessed in accordance with the *Environmental Planning and Assessment Act 1979*.

This should include the cumulative impact of the proponent's existing and proposed development and associated infrastructure (such as access tracks etc) as well as the cumulative impact of other developments located in the vicinity. This assessment should include consideration of both construction and operational impacts.

3. Aboriginal cultural heritage

The EIS report should contain:

a. A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed development.

b. A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposed development, and the significance of these values for the Aboriginal people who have a cultural association with the land.

c. A description of how the requirements for consultation with Aboriginal people as specified in clause 80C of the *National Parks and Wildlife Regulation 2009* have been met.

d. The views of those Aboriginal people regarding the likely impact of the proposed development on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response.

e. A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified, and the need apply for a Aboriginal Heritage Impact Permit (AHIP).

f. A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.

g. A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.

h. A specific Statement of Commitment that the proponent will complete an Aboriginal Site Impact Recording Form and submit it to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through the proposed development.

In addressing these requirements, the proponent must refer to the following documents:

- ***Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*** (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/consultation.htm. This document further explains the consultation requirements that are set out in clause 80C of the National Parks and Wildlife Regulation 2009. The process set out in this document must be followed and documented in the Environmental Assessment Report.

- ***Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales*** (DECCW, 2010) http://www.environment.nsw.gov.au/licences/archinvestigations.htm. The process described in this Code should be followed and documented where the assessment of Aboriginal cultural heritage requires an archaeological investigation to be undertaken.

Notes:

i. An *Aboriginal Site Impact Recording Form* (http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm) must be completed and submitted to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through archaeological investigations required or permitted through these environmental assessment requirements.

ii. Under section 89A of the *National Parks and Wildlife Act* 1974, it is an offence for a person not to notify OEH of the location of any Aboriginal object the person becomes aware of, not already recorded on the Aboriginal Heritage Information Management System (AHIMS). An AHIMS Site Recording Form should be completed and submitted to the AHIMS Registrar (http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm), for each Aboriginal site found during investigations.

4. Biodiversity

Biodiversity impacts can be assessed using **either:**

- The BioBanking Assessment Methodology (scenario 1) **or**
- A detailed biodiversity assessment (scenario 2).

The requirements for each of these approaches are detailed below.

The BioBanking Assessment Methodology can be used either to obtain a BioBanking statement, or to assess impacts of a proposal and to determine required offsets without obtaining a statement. In the latter instances, if the required credits are not available for offsetting, appropriate alternative options may be developed in consultation with OEH officers.

Note:

i. The Shire may be listed in Schedule 1 of ***SEPP No. 44 - Koala Habitat Protection.*** If so, the requirements of the SEPP regarding Koala habitat protection should also be considered by the proponent.

SCENARIO 1 - Where a proposal is assessed using the BioBanking Assessment Methodology (BBAM)

1. Where a BioBanking Statement is being sought under Part 7A of the *Threatened Species Conservation* Act 1995 (TSC Act), the assessment must be undertaken by an accredited BioBanking assessor (as specified under Section 142B (1)(c) of the TSC Act 1995) and done in accordance with the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008). To qualify for a BioBanking Statement a proposal must meet the 'improve or maintain' standard.

1a. The Environmental Impact Statement (EIS) should include a specific Statement of Commitments that reflects all requirements of the BioBanking Statement including the number of credits required and any DG approved variations to impact on Red Flags.

2. Where the BioBanking Assessment Methodology is being used to assess impacts of a proposal and to determine required offsets, and a BioBanking Statement is not being obtained, the EIS should contain a detailed biodiversity assessment and all components of the assessment must be undertaken in accordance with the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008).

2a. The EIS should include a specific Statement of Commitments which:

- is informed by the outcomes of the proposed BioBanking assessment offset package;
- sets out the ecosystem and species credits required by the BioBanking Assessment Methodology and how these ecosystem and/or species credits will be secured and obtained;
- if the ecosystem or species credits cannot be obtained, provides appropriate alternative options to offset expected impacts, noting that an appropriate alternative option may be developed in consultation with OEH officers and in accordance with OEH policy;
- demonstrates how all options have been explored to avoid red flag areas; and
- includes all relevant 'BioBanking files (e.g. *.xml output files), data sheets, underlying assumptions (particularly in the selection of vegetation types from the vegetation types database), and documentation (including maps, aerial photographs, GIS shape files, other remote sensing imagery etc.) to ensure that the OEH can conduct an appropriate review of the assessment.

3. **Where appropriate**, likely impacts (both **direct** and **indirect**) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered. Please refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECCW, 2010).

4. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify and assess any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

SCENARIO 2 - Where a proposal is assessed outside the BioBanking Assessment Methodology

1. The EIS should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included in the following sections.

2. A field survey of the site should be conducted and documented in accordance with relevant guidelines, including:
   - the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians* (DECCW, 2009);
   - *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004); and
   - Threatened species survey and assessment guideline information on www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm.
   - Commonwealth survey requirements (birds, bats, reptiles, frogs, fish and mammals): http://www.environment.gov.au/epbc/publications/guidelines.html. These are relevant when species or communities listed under the *Environment Protection and Biodiversity Conservation Act* are present.

   It is preferable for proponents to use the Interim Vegetation Mapping Standard data form to collect the vegetation plot data for the project site, and any offset site associated with the project. This will provide data that is useful for vegetation mapping as well as in the BioBanking Assessment Methodology. This is available at http://www.environment.nsw.gov.au/research/VISplot.htm.

   If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with the OEH prior to undertaking the EIS, to determine whether the OEH considers that it is appropriate.

   Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have:
   - been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or
   - utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species,

   unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. If a previous survey is used, any additional species listed under the TSC Act since the previous survey took place, must be surveyed for.

   Determining the list of potential threatened species for the site must be done in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004).

The OEH Threatened Species website http://www.environment.nsw.gov.au/threatenedspecies/ and the *Atlas of NSW Wildlife* database must be the primary information sources for the list of threatened species present.

The BioBanking Threatened Species Database, the Vegetation Types databases (available via the OEH website at http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm and http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm, respectively) and other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums (http://www.ozcam.org/), previous or nearby surveys etc.) may also be used to compile the list.

Other reference literature may be available for the subject locality/region. The proponent should explore this possibility thoroughly.

3. The EIS should contain the following information as a minimum:

   a. Description and geo-referenced mapping of study area (**and associated spatial data files**), e.g. overlays on topographic maps, satellite images and /or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area. Separate spatial files (.shp format) to be provided to the OEH should include, at a minimum, shapefiles of the project site, impact footprint, vegetation mapping and classification for both the impact and any offset site(s);

   b. Description of survey methodologies used, including timing, location and weather conditions, and a comparison of survey effort (in tabular form) with that recommended in the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004). Where survey effort is not consistent with those guidelines justification must be provided;

   c. Detailed description of vegetation communities (including classification and methodology used to classify) and including all plot data. Plot data should be supplied to the OEH in electronic format (eg MS-Excel) and organised by vegetation community;

   d. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EIA;

   e. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status;

   f. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including **direct** and **indirect** and **construction** and **operation** impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor;

   g. Identification of the **avoidance**, **mitigation** and **management measures** that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed;

   h. Description of the residual impacts of the proposal. **If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected** (see the requirements for this at point 6 below); and

   i. Provision of specific Statement of Commitments relating to biodiversity.

4. An assessment of the significance of **direct** and **indirect** impacts of the proposal must be undertaken for threatened biodiversity **known or considered likely to occur** in the study area based on the presence of suitable habitat. The Assessment of Significance is a statutory mechanism which allows decision makers to assess whether a proposed development or activity is

likely to have a significant effect on threatened species, populations or ecological communities, or their habitats. This assessment must take into account:

a. the factors identified in s.5A of the EP&A Act[1]; and

b. the guidance provided by *The Threatened Species Assessment Guideline – The Assessment of Significance (DECCW, 2007)*. This guideline is available on the OEH website:
http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf

5. Where an offsets package is proposed by a proponent for impacts to biodiversity (and a BioBanking Statement has not been sought) this package should:
   a. Meet the OEH's *Principles for the use of biodiversity offsets in NSW*[2], which are available at: http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm
   b. Identify the conservation mechanisms to be used to ensure the long term protection and management of the offset sites; and
   c. Include an appropriate Management Plan (such as vegetation or habitat) that has been developed as a key amelioration measure to ensure any proposed compensatory offsets, retained habitat enhancement features within the development footprint and/or impact mitigation measures (including proposed rehabilitation and/or monitoring programs) are appropriately managed and funded.

6. **Where appropriate**, likely impacts (both **direct** and **indirect**) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered. Refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECC, 2010).

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[1] Following threatened species assessment via the Assessment of Significance, it may be necessary to prepare a **Species Impact Statement** (SIS). The proponent will need to prepare a SIS in the following circumstances:

- If (after having addressed Section 5A) the flora/fauna assessment concludes that there is likely to be a significant impact to threatened species, or
- The proposed development is likely to affect critical habitat declared under the TSC Act.

If a SIS is required, the proponent (not the consultant) must write to OEH for any formal requirements for the SIS that he might deem appropriate. The SIS must then be prepared in accordance with these requirements and provided to the OEH. In some instances the Minister for the Environment will also need to be consulted for approval.

Methods to reduce the impact on the protected and threatened species should be considered fully, and are considered an integral requirement within any SIS document.

Conducting an Assessment of Significance or an SIS according to the provisions of the *EP&A Act* and the *TSC Act* is a complex task and should be undertaken by suitably qualified person(s).

[2] **Please note** that the OEH's *Principles for the use of biodiversity offsets in NSW* ('the Principles') require offsets to be based on a **quantitative assessment** of the loss in biodiversity from the proposal and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable, and used for calculating both the impact and offset sites. Even where a proponent does not intend to use the BioBanking Assessment Methodology and Credit Calculator (Scenario 1), use of a **suitable alternative metric**, justified in the EA, is necessary to demonstrate that the proposal is consistent with the Principles or the Interim policy. Ultimately the proponent is expected to demonstrate quantitatively that the biodiversity losses associated with the project will be adequately compensated for by the improvement in vegetation condition and security expected from the offset site. This cannot be properly determined by a hectare comparison alone.

7. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

Attachment B – Guidance Material

Title	Web Address
Commonwealth Environment Protection & Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Threatened Species Conservation Act 1995	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+101+1995+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Aboriginal Cultural Heritage	
Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (2005)	Available from DoPI.
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/consultation.htm
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/archinvestigations.htm
Due Diligence Code for the Protection of Aboriginal Objects in NSW (DECCW 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/ddcop/10798ddcop.pdf
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm
Biodiversity	
BioBanking Assessment Methodology (DECC, 2008)	http://www.environment.nsw.gov.au/resources/biobanking/08385bbassessmethod.pdf
BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECCW, 2008)	http://www.environment.nsw.gov.au/biobanking/calculator.htm
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna –Amphibians (DECCW, 2009)	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Survey requirements (birds, bats, reptiles, frogs, fish and mammals) for species listed under the EPBC Act	http://www.environment.gov.au/epbc/publications/guidelines.html
DECCW Threatened Species website	http://www.environment.nsw.gov.au/threatenedspecies/

Atlas of NSW Wildlife	http://www.environment.nsw.gov.au/wildlifeatlas/about.htm
BioBanking Threatened Species Database	http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_species.aspx
Vegetation Types databases	http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org/
Threatened Species Assessment Guideline - The Assessment of Significance (DECCW, 2007)	http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm

Transport Roads & Maritime Services
NSW GOVERNMENT

WST13/00067/02

The Manager
Mining Projects
Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: Mr Nicholas Brbot

Dear Mr Brbot

DGR ID No.766: Avoca Tank Project;
Request for input into Director-General's Requirements (DGRs)

Thank you for your email on 21 August 2013 requesting input into DGRs for the Avoca Tank Project from Roads and Maritime Services (RMS).

RMS notes that extracted materials from the proposed mine will be transported by road to the Tritton Copper Mine for processing and then onto Hermidale for transportation by rail.

The Background Paper submitted for this project has been reviewed and RMS provides the following key issues which should be addressed in the Environmental Impact Statement:

- A traffic impact study prepared in accordance with the methodology set out in Section 2 of the RTA's Guide to Traffic Generating Developments and including:
    - Hours and days of construction and operation for each stage of the project and how proposed operations will interact with other road users;
    - Road transport volumes and types broken down into origin and destination, travel routes and peak hours for the construction, operation and decommissioning of the project. The study should provide details of projected transport operations including volumes of traffic and tonnage to be transported. Volumes should also include mine input related traffic generation (e.g. fuel deliveries, potable water deliveries, maintenance, services) and impacts of mine related traffic generation on public roads. The traffic study should address internal traffic movements and parking facilities;
    - An assessment of cumulative impacts during construction and operation of the project. In particular, the cumulative impacts of project traffic and traffic generated by the existing operations at the nearby Girilambone and Tritton Copper Mines;
    - Any over size and over mass vehicles and loads expected for the construction, operation and decommissioning of the project. The shortest and least trafficked route should be given

Roads and Maritime Services
[illegible] Darling Street, Dubbo NSW 2830
PO Box 334 Dubbo NSW 2830 DX 20256
www.rms.nsw.gov.au | 13 17 82

priority for the movement of construction materials and machinery to minimise the risk and impact to other motorists so far as is reasonably practicable;
  - Temporary and permanent staff numbers (including employees and contractors) and staff parking arrangements during construction, operation and decommissioning of the project. Modes and volumes of transportation of mining staff to and from the site, details of measures proposed to minimise staff commuter traffic on the local and classified road network and measures to improve commuter safety should also be included;
  - The impact of generated traffic and measures employed to ensure efficiency and safety on the public road network during construction, operation and decommissioning of the project;
  - Any mitigating measures required to address expected traffic generation.

- Proposed access treatments should be identified and be in accordance with Austroads Guide to Road Design 2010 and RMS Supplements including safe intersection sight distance;

RMS appreciates the opportunity to contribute to the DGRs and requests that a copy of the DGRs be forwarded to RMS at the same time they are sent to the applicant. Should you require further information please contact Andrew McIntyre on (02) 6861 1453.

Yours faithfully

5 SEP 2013

Tony Hendry
Road Safety & Traffic Manager
Western

NSW GOVERNMENT | Department of Primary Industries

V13/969#21
out13/34928

Mr Chris Dickson
Environmental Consultant
RW Corkery and Co Pty Ltd
PO Box 239
BROOKLYN NSW 2083

Dear Mr Dickson

Thank you for your email dated 25 October 2013 concerning any further issues regarding the Avoca Tank Project proposal.

As a result of reviewing the Tritton Resources Pty Ltd Background Paper for the Avoca Tank Project suppled, my Department have no further specific requests to the Director General Requirements dated 25 September 2013.

The nature of the proposal as a designed local development under Part 4 of the *Environmental Planning and Assessment Act 1979*, and its development as a box cut and underground mine in a semi-arid environment is noted. The agricultural use of the areas mainly for extensive grazing indicates its low intensity use in a semi-arid environment. The preliminary project documentation risk analysis (Table 3, page 26) proposes that the impact on agricultural land capability and productivity and soil resources and erosion will be low. Hence the assessment of land resources as outlined in the Director General Requirements is sufficient to assess the land and soil capability, and its use for agriculture. Also if any of the land is to be reinstated for agriculture, through rehabilitation that this also is shown in terms of areas and restoration techniques.

Please contact myself if you have any further queries.

Yours sincerely

Mary Kovac
Resource Management Officer
Central and Far West
DUBBO
20 November 2013

Cnr Hampden and Cobra Sts, Dubbo NSW 2830
Tel: 02 68811270 Fax: 02 68811295
www.industry.nsw.gov.au

Appendix 3

Coverage of Director-General's Requirements and Requirements of Consulted Government Agencies

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Table A2-1
Director-General's Requirements
(Department of Planning and Infrastructure – 25 September 2013

Paraphrased Requirement	Relevant EIS Section(s)
GENERAL	
The Environmental Impact Statement (EIS) must include:	
• an executive summary;	Executive Summary
• a full/detailed description of the proposal, including:	
– identification of the resource;	1.4.5
– description of the site;	1.3
– a history of any previous quarrying operations on the site;	1.4.2
– the proposed works (including rehabilitation works);	Section 2
– the duration and intensity of extraction operations;	2.10
– any likely interactions between the proposed operations and existing/approved development and land use in the area; and	1.4 Section 4
– a detailed justification for the development;	Section 5
• a conclusion justifying the development on economic, social and environmental grounds, taking into consideration whether the proposal is consistent with the objects of the Environmental Planning & Assessment Act 1979; and	5.3
• a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	p iii
KEY ISSUES	
The EIS must also assess the potential impacts of the proposal during the establishment, operation and decommissioning of the proposal. The EIS must describe what measures would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the potential impacts on:	
• **Land Resources** - including a assessment of the potential impacts on:	
– soils and land capability, including an assessment of activities that would cause erosion and the measures proposed to minimise erosion and sedimentation;	4.13
– landforms and topography, including cliffs, rock formations, steep slopes, etc; and	4.1.2
– land use, including agricultural, forestry and conservation lands;	4.13
• **Water Resources** - including:	
– identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*;	4.4.7
– an assessment of potential impacts on the quality and quantity of existing surface and ground water resources;	4.4.2, 4.9.2
– 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;	4.4.4, 4.9.3
– an annual site water balance for representative years of the proposed life of the project; and	2.6.3
– a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts;	4.4, 4.9

Table A2-1 (Cont'd)
Director-General's Requirements
(Department of Planning – 25 September 2013

Paraphrased Requirement	Relevant EIS Section(s)
KEY ISSUES (Cont'd)	
• **Biodiversity** - including:	
– accurate predictions of any vegetation clearing on site or for any road upgrades;	4.3.5
– 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;	4.3.5
– a detailed description of the measures to maintain or improve the consideration of a Biodiversity Offset Strategy;	4.3.7
• **Heritage** - including:	
– 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; and	4.2, 4.7
– a Historic heritage assessment (including archaeology) which must include a statement of heritage impact (including significance assessment) for any State significant or locally significant historic heritage items;	4.7
• **Traffic and Transport** - 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 any safety issues which may exacerbated by the development; and	4.10
– a description of the measures that would be implemented to maintain and/or improve the capacity. efficiency and safety of the road network in the surrounding area over the life of the project;	4.10.3
• **Noise and Vibration**	
– particularly any potential noise and vibration impacts on nearby private receptors due to construction, operation or road haulage;	4.5
• **Air Quality** - particularly any potential dust impacts on nearby private receptors from construction, operation or road haulage;	4.8
• **Rehabilitation** - including:	
– a detailed description of the proposed rehabilitation measures that would be undertaken during quarry closure;	2.13
– a detailed rehabilitation strategy, including justification for the proposed final land form and consideration of the objectives of any relevant strategic land use plans or policies; and	2.13
– the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy;	2.13.1
• **Waste Management** - including importation of any waste material to the site;	2.4, 2.8, 2.9
• **Hazards and Risks** - including any transport or storage of dangerous goods;	2.8.2.4, 4.12
• **Visual Amenity**;	4.11
• **Agricultural Impacts**;	4.14
• **Utilities and Services**; and	2.8
• **Social and Economic Impacts**.	4.15

Table A2-1 (Cont'd)
Director-General's Requirements
(Department of Planning – 25 September 2013

Paraphrased Requirement	Relevant EIS Section(s)
ENVIRONMENTAL PLANNING INSTRUMENTS	
The EIS must assess the proposal against the relevant environmental planning instruments, including (but not limited to):	
• *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*;	3.3.3.2
• *State Environmental Planning Policy No. 33 - Hazardous and Offensive Development*;	3.3.3.3
• *State Environmental Planning Policy No. 44 - Koala Habitat Protection*;	3.3.3.4
• *State Environmental Planning Policy No. 55 - Remediation of Land*;	3.3.3.5
• *Bogan Local Environmental Plan 2011*; and	3.3.5
• relevant development control plans and section 94 plans, strategies and management plans.	3.3.4
GUIDELINES	
The EIS must take into account relevant State Government policies and guidelines, in particular the:	
• *Industrial Noise Policy* (EPA 2001),	4.5
• *Aquifer Interference Policy* (DPI 2012),	4.4
• *Soils and Construction: Managing Urban Stormwater* (Landcom 2004),	4.9
• *Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting* (ANZECC),	4.4, 4.9
• *Using the ANZECC Guideline and Water Quality Objectives in NSW* (DEC),	4.4
• *Approved Methods for the Modelling and Assessment of Air Pollutants* (DEC),	4.8
• *Approved Methods for Sampling and Analysis of Air Pollutants* (DEC),	4.8.1
• *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DECC 2004),	4.3
• *The Threatened Species Assessment Guideline - The Assessment of Significance* (DECC 2007),	4.3
• *Draft Guidelines for the Assessment of Aquatic Ecology in EIA* (DUAP 1998),	NA
• *Guide to investigation, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011),	4.2
• *Code of Practice of the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010),	4.2
• *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010),	4.2
• *Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC 2005),	NA
• *Guide to Traffic Generating Development* (RTA),	4.10.1
• *Road Design Guide* (RTA) or latest versions.	4.10.1
During the preparation of the EIS you must consult the Department's EIS Guideline - Extractive Industries - Quarries. This guideline is available for purchase from the Department's Information Centre, 23-33 Bridge Street, Sydney or by calling 1300 305 695.	

Table A2-1 (Cont'd)
Director-General's Requirements
(Department of Planning – 25 September 2013

Paraphrased Requirement	Relevant EIS Section(s)
CONSULTATION	
During the preparation of the EIS, you must consult with Council and should consult with the relevant local, State and Commonwealth government authorities, service providers and community groups, and address any issues they may raise in the EIS. In particular, you should consult surrounding landowners and occupiers that are likely to be impacted by the proposal. Details of the consultations carried out and issues raised must be included in the EIS.	3.2.1, 3.2.2

Table A2-2
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
GENERAL		
Office of Environment and Heritage 03/09/2013	OEH's key information requirements for the proposal include an adequate assessment of: 1. Impacts to Aboriginal cultural heritage objects; and 2. Impacts on flora, fauna, threatened species, populations, communities and their habitats.	 4.2 4.3
Environment Protection Authority 04/09/2013	The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.	Executive Summary
	The Proposal **Objective of the Proposal** The objectives of the proposal should be clearly stated and refer to:	
	a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced.	Section 2
	b) a life cycle approach to the production, use or disposal of products.	2.3
	c) the anticipated level of performance in meeting required environmental standards and cleaner production principles.	1.4.7, Section 4, Appendix 4
	d) the staging and timing of the proposal and any plans for future expansion.	1.4.6, 2.3
	e) the proposal's relationship to any other industry or facility.	1.4.1
	Description of the Proposal • Outline the production process including:	
	a) the environmental "mass balance" for the process - quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill etc).	Section 4
	b) any life-cycle strategies for the products.	Section 2
	• Outline cleaner production actions, including:	
	a) measures to minimise waste (typically through addressing source reduction).	2.4, 2.9
	b) proposals for use or recycling of by-products.	2.4, 2.9
	c) proposed disposal methods for solid and liquid waste.	2.4, 2.9
	d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points.	4.8.5
	e) water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge.	4.4.5, 4.9.3
	f) soil contamination treatment and prevention systems.	4.13.4

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	GENERAL (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	• Outline construction works including:	
	a) actions to address any existing soil contamination.	NA
	b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site).	2.4
	c) construction timetable and staging; hours of construction; proposed construction methods.	2.10
	d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures.	4.5.5, 4.8.5, 4.9.4
	Consideration of Alternatives and Justification for the Proposal	
	• Consider the environmental consequences of adopting alternatives, including alternative:	
	a) sites and site layouts.	2.14.2
	b) access modes and routes.	2.14.3
	c) materials handling and production processes.	2.14.4
	d) waste and water management.	2.4, 2.6
	e) impact mitigation measures.	Appendix 4
	f) energy sources	NA
	• Selection of the preferred option should be justified in terms of:	
	a) ability to satisfy the objectives of the proposal.	2.1.1
	b) relative environmental and other costs of each alternative.	Section 4
	c) acceptability of environmental impacts-and contribution to identified environmental objectives.	Section 4
	d) acceptability of any environmental risks or uncertainties.	3.4
	e) reliability of proposed environmental impact mitigation measures.	Section 4
	f) efficient use (including maximising re-use) of land, raw materials, energy and other resources.	Section 2
	The Location **General**	
	• Provide an overview of the affected environment to place the proposal in its local and regional environmental context including:	
	a) meteorological data (e.g. rainfall, temperature and evaporation, wind speed and direction).	4.1.4
	b) topography (landform element, slope type, gradient and length).	4.1.2
	c) surrounding land uses (potential synergies and conflicts).	4.1.5
	d) geomorphology (rates of landform change and current erosion and deposition processes).	4.1.3
	e) soil types and properties (including erodibility; engineering and structural properties; dispersibility; permeability; presence of acid sulfate soils and potential acid sulfate soils).	4.13.2

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	GENERAL (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	f) ecological information (water system habitat, vegetation, fauna).	4.3.5
	g) availability of services and the accessibility of the site for passenger and freight transport.	4.10
	Identification and Prioritisation of Issues Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:	
	a) relevant NSW government guidelines.	Section 4
	b) industry guidelines.	Section 4
	c) EISs for similar projects.	NA
	d) relevant research and reference material.	Section 6
	e) relevant preliminary studies or reports for the proposal.	SCSC
	f) consultation with stakeholders.	3.2
	• Provide a summary of the outcomes of the process including:	
	a) all issues identified including local, regional and global impacts (eg increased / decreased greenhouse emissions).	4.8.1
	b) key issues which will require a full analysis (including comprehensive baseline assessment).	Section 4
	c) issues not needing full analysis though they may be addressed in the mitigation strategy.	Section 4
	d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).	3.5
	The Environmental Issues **General**	
	• The potential impacts identified in the scoping study need to be assessed to determine their significance, particularly in terms of achieving environmental outcomes, and minimising environmental pollution.	Section 4
	• Identify gaps in information and data relevant to significant impacts of the proposal and any actions proposed to fill those information gaps so as to enable development of appropriate management and mitigation measures. This is in accordance with ESD requirements.	5.3.2
	Describe Baseline Conditions	
	• Provide a description of existing environmental conditions for any potential impacts.	Section 4

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	GENERAL (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	**Assess Impacts**	
	• For any potential impacts relevant for the assessment of the proposal provide a detailed analysis of the impacts of the proposal on the environment including the cumulative impact of the proposal on the receiving environment especially where there are sensitive receivers.	Section 4
	• Describe the methodology used and assumptions made in undertaking this analysis (including any modelling or monitoring undertaken) and indicate the level of confidence in the predicted outcomes and the resilience of the environment to cope with the predicted impacts.	Section 4
	• The analysis should also make linkages between different areas of assessment where necessary to enable a full assessment of environmental impacts eg assessment of impacts on air quality will often need to draw on the analysis of traffic, health, social, soil and/or ecological systems impacts; etc.	Section 4
	• The assessment needs to consider impacts at all phases of the project cycle including: exploration (if relevant or significant), construction, routine operation, start-up operations, upset operations and decommissioning if relevant.	1.4.6, 2.2, 2.3, 2.10 2.13
	• The level of assessment should be commensurate with the risk to the environment.	3.5
	Describe Management and Mitigation Measures	
	• Describe any mitigation measures and management options proposed to prevent, control, abate or mitigate identified environmental impacts associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	Section 4, Appendix 4
	• Proponents are expected to implement a 'reasonable level of performance' to minimise environmental impacts. The proponent must indicate how the proposal meets reasonable levels of performance. For example, reference technology based criteria if available or identify good practice for this type of activity or development. A 'reasonable level of performance' involves adopting and implementing technology and management practices to achieve certain pollutant emissions levels in economically viable operations. Technology-based criteria evolve gradually over time as technologies and practices change.	Section 4
	• Use environmental impacts as key criteria in selecting between alternative sites, designs and technologies, and to avoid options having the highest environmental impacts.	Section 4

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
GENERAL (Cont'd)		
Environment Protection Authority 04/09/2013 (Cont'd)	• Outline any proposed approach (such as an Environmental Management Plan) that will demonstrate how commitments made in the EIS will be implemented. Areas that should be described include: a) operational procedures to manage environmental impacts. b) monitoring procedures. c) training programs. d) community consultation. e) complaint mechanisms including site contacts. f) strategies to use monitoring information to improve performance. g) strategies to achieve acceptable environmental impacts and to respond in event of exceedences (sic).	Various Section 4
	List of Approvals and Licences • Identify all approvals and licences required under environment protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land, water).	2.1.3
	Compilation of Mitigation Measures • Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under EPA licences or approvals (eg outline of an environmental management plan). • The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.	Appendix 4 NA
	Justification for the Proposal • Reasons should be included which justify undertaking the proposal in the manner proposed, having regard to the potential environmental impacts.	5.3.3
Bogan Shire Council 22/10/2013	Ensure waste rock emplacements are of adequate design. Design should consider minimising visual impact whilst ensuring a stable structure.	2.4, 4.11

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
ABORIGINAL CULTURAL HERITAGE		
Office of Environment and Heritage 03/09/2013	1. Impacts to Aboriginal cultural heritage objects The EIS report should contain:	
	a. A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed development.	4.2.3
	b. A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposed development, and the significance of these values for the Aboriginal people who have a cultural association with the land.	4.2.7
	c. A description of how the requirements for consultation with Aboriginal people as specified in clause 80C of the National Parks and Wildlife Regulation 2009 have been met.	4.2.1
	d. The views of those Aboriginal people regarding the likely impact of the proposed development on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response.	4.2.5
	e. A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified, and the need apply for a Aboriginal Heritage Impact Permit (AHIP).	4.2.8
	f. A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.	4.2.8
	g. A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.	4.2.8
	h. A specific Statement of Commitment that the proponent will complete an Aboriginal Site Impact Recording Form and submit it to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through the proposed development.	Appendix 4
	In addressing these requirements, the proponent must refer to the following documents:	
	• *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/consultation.htm. This document further explains the consultation requirements that are set out in clause BOC of the National Parks and Wildlife Regulation 2009. The process set out in this document must be followed and documented in the Environmental Assessment Report.	4.2.1
	• *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010) http://www.environment.nsw.gov.au/licences/archinvestigations.htm. The process described in this Code should be followed and documented where the assessment of Aboriginal cultural heritage requires an archaeological investigation to be undertaken.	4.2.1

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	BIODIVERSITY	
Office of Environment and Heritage 03/09/2013	Biodiversity impacts can be assessed using either: SCENARIO 1 - BioBanking Assessment Methodology (BBAM) SCENARIO 2 - Assessed outside the BioBanking Assessment Methodology	
	Note: i. The Shire may be listed in Schedule 1 of SEPP No. 44 - Koala Habitat Protection. If so, the requirements of the SEPP regarding Koala habitat protection should also be considered by the proponent.	3.3.3.4
	The EIS should contain the following information as a minimum:	
	a. Description and geo-referenced mapping of study area (and associated spatial data files), e.g. overlays on topographic maps, satellite images and / or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area. Separate spatial files (.shp format) to be provided to the OEH should include, at a minimum, shapefiles of the project site, impact footprint, vegetation mapping and classification for both the impact and any offset site(s);	4.3
	b. Description of survey methodologies used, including timing , location and weather conditions, and a comparison of survey effort (in tabular form) with that recommended in the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004). Where survey effort is not consistent with those guidelines justification must be provided;	4.3.4
	c. Detailed description of vegetation communities (including classification and methodology used to classify) and including all plot data. Plot data should be supplied to the OEH in electronic format (eg MS-Excel) and organised by vegetation community;	4.3.5
	d. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EIA;	1.6
	e. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status;	4.3.5
	f. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor;	4.3.6
	g. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed;	4.3.7

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
BIODIVERSITY (Cont'd)		
Office of Environment and Heritage 03/09/2013	h. Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected (see the requirements for this at point 6 below); and	4.3.7
	i. Provision of specific Statement of Commitments relating to biodiversity.	Appendix 4
	An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat.	4.3.7
	This assessment must take into account:	
	a. the factors identified in s.5A of the EP&A Act[1]; and	4.3.8.3
	b. the guidance provided *by The Threatened Species Assessment Guideline – The Assessment of Significance* (DECCW, 2007).	4.3.1
	Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974* should be considered.	NA
	With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	4.3.8
TRAFFIC		
Roads and Maritime Services 05/09/2013	The following key issues which should be addressed in the Environmental Impact Statement:	
	• A traffic impact study prepared in accordance with the methodology set out in Section 2 of the RTA's Guide to Traffic Generating Developments and including:	
	– Hours and days of construction and operation for each stage of the project and how proposed operations will interact with other road users;	2.7, 2.10.2

[1] Following threatened species assessment via the Assessment of Significance, it may be necessary to prepare a Species Impact Statement (SIS). The proponent will need to prepare a SIS in the following circumstances:

- If (after having addressed Section 5A) the flora/fauna assessment concludes that there is likely to be a Significant impact to threatened species, or
- The proposed development is likely to affect critical habitat declared under the TSC Act.

If a SIS is required, the proponent (not the consultant) must write to OEH for any formal requirements for the SIS that he might deem appropriate. The SIS must then be prepared in accordance with these requirements and provided to the OEH. In some instances the Minister for the Environment will also need to be consulted for approval.

Methods to reduce the impact on the protected and threatened species should be considered fully, and are considered an integral requirement within any SIS document.

Conducting an Assessment of Significance or an SIS according to the provisions of the EP&A Act and the TSC Act is a complex task and should be undertaken by suitably qualified person(s).

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
TRAFFIC (Cont'd)		
Roads and Maritime Services 05/09/2013 (Cont'd)	– Road transport volumes and types broken down into origin and destination, travel routes and peak hours for the construction, operation and decommissioning of the project. The study should provide details of projected transport operations including volumes of traffic and tonnage to be transported. Volumes should also include mine input related traffic generation (e.g. fuel deliveries, potable water deliveries, maintenance, services) and impacts of mine related traffic generation on public roads. The traffic study should address internal traffic movements and parking facilities;	2.7
	– An assessment of cumulative impacts during construction and operation of the project. In particular, the cumulative impacts of project traffic and traffic generated by the existing operations at the nearby Girilambone and Tritton Copper Mines;	2.5.2 2.7, 4.10.2
	– Any over size and over mass vehicles and loads expected for the construction, operation and decommissioning of the project. The shortest and least trafficked route should be given priority for the movement of construction materials and machinery to minimise the risk and impact to other motorists so far as is reasonably practicable;	2.7.1, 4.10.3
	– Temporary and permanent staff numbers (including employees and contractors) and staff parking arrangements during construction, operation and decommissioning of the project. Modes and volumes of transportation of mining staff to and from the site, details of measures proposed to minimise staff commuter traffic on the local and classified road network and measures to improve commuter safety should also be included;	2.11, 2.8.1, 4.10.3
	– The impact of generated traffic and measures employed to ensure efficiency and safety on the public road network during construction, operation and decommissioning of the project;	4.10.2, 4.10.3
	– Any mitigating measures required to address expected traffic generation.	4.10.2
	• Proposed access treatments should be identified and be in accordance with Austroads Guide to Road Design 2010 and RMS Supplements including safe intersection sight distance.	NA
Bogan Shire Council 22/10/2013	Detail the expected increased level in traffic generation and changes in transportation routes.	4.10.2
MINERAL RESOURCE		
Industry and Investment – Division of Resources and Energy 12/09/2013	The following key issues need to be addressed in sufficient detail in the draft Environmental Impact Statement (EIS):	
	• A summary of the regional, local geology and mineralisation including information on the geological units within which the resource area is both appropriate and adequate for the EIS.	4.1.3
	• A resource estimate.	1.4.5

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
MINERAL RESOURCE (Cont'd)		
Industry and Investment – Division of Resources and Energy 12/09/2013 (Cont'd)	• The mineralogy of the ore to be treated.	4.1.3
	• A summary of the project period providing sufficient detail for the EIS – i.e. eight years, comprising 2 years of site establishment activities, 4 years of mining and processing operations and 2 years of rehabilitation operations.	Section 2
	Additional information that should be included in the EIS includes:	
	• The amount of ore, mineralised waste and unmineralised waste rock anticipated to be produced and/or treated annually and during the life of the project.	2.3, 2.4, 2.10
	• The characteristics of the waste rock and tailings produced. The amount of material remaining in waste dumps and that to be used as backfill.	2.4.2, 2.4.3
	• Will there be any mineralised waste/low grade stockpiles remaining at the end of project life? – If so what is planned for this material and could it be recovered at a future time?	2.4.5
	• Estimate of the sulphide content (%) for each lens/zone to be mined.	2.4.2
	• A description of each lens to be mined (length, width, depth, any features different to the more general description).	2.3.4
	• Plans and cross-sections showing the planned resource blocks, low grade material not to be mined and the extraction sequence data.	Figure 2.3
	• A plan showing the surface projection of the ore zone(s) to be mined with planned layout of infrastructure and other features.	Figure 2.1
	• Will the proposed project sterilise low grade material that could be mined in the future?	1.4.6
ENVIRONMENTAL SUSTAINABILITY		
Industry and Investment – Division of Resources and Energy 12/09/2013	**Project Description** The EIS must provide a comprehensive description of all aspects of the project. In terms of text, plans or charts, it must also clearly show the proposed extent and sequence of development.	Section 2
	Description of existing environment, identification of impacts and constraints All areas affected by the mining proposal must be shown in the context of both the natural environment and the existing mine development. Impacts associated with the operational and post closure stages of the project must also be identified in detail and control strategies outlined. The following are the key issues to be addressed in the EIS that are likely to have a bearing on rehabilitation and mine closure.	
	• Groundwater impacts associated with mining operations and any bore field proposed for water supply purposes. Long term recovery patterns of groundwater and any bearing these may have on subsequent land uses.	4.4.6

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
ENVIRONMENTAL SUSTAINABILITY (Cont'd)		
Industry and Investment – Division of Resources and Energy 12/09/2013 (Cont'd)	• Any surface water flow regimes and how these will be impacted by the project both during and after mining has ceased.	4.9.4
	• The flora, fauna and ecological attributes of the disturbed area should be recorded and placed in a regional context.	4.3.2
	• Characterise soils across the proposed area of surface disturbance and assesses their value and identify any limitations they present for rehabilitation. Land capability characteristics of the site also need to be described.	4.13.3
	• Identify any Potential Acid Forming (PAF) material that may be found on site. The existing knowledge bank on waste rock geochemistry should be expanded with a comprehensive test program directed to ascertain the acid generation potential and leachate composition of the Avoca Tank Project waste streams.	2.4.2
	• Investigations should consider Acid Mine Drainage (AMD) potential, the composition of waste rock leachates (whether acidic or not), as well as the potential for saline drainage. A comprehensive range of potential leachate ions/species must be considered. The resulting waste classification scheme should be subject to ongoing and, if necessary, longer term investigations on the AMD potential and leachate quality of waste rock. This should be provided for in the EIS Statement of Commitments.	2.4.2
	• The geochemistry of waste materials must be characterised and the potential for adverse leachate seepages to occur, both during and after mining, must be assessed. The geochemical assessment should cover the full range of environmentally significant compounds that may be mobilised from soils, waste rock and tailings. Where there is a potential for acidic leachate from either tailings or waste rock to occur, management measures to prevent this occurring are to be presented. Contingency measures to deal with unexpected poor quality seepages (acid or saline) from the tailings and waste rock storages are also required.	2.4.2
	Rehabilitation and Mine Closure	
	• **Rehabilitation Objectives**: Describe the strategic rehabilitation objectives for the project and how these comply with relevant Government legislation or policies, research outcomes or industry leading practice. Describe the potential for integrating the rehabilitation strategy with any other offset (or conservation) strategies in the region.	2.13.3, 2.13.4

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
ENVIRONMENTAL SUSTAINABILITY (Cont'd)		
Industry and Investment – Division of Resources and Energy 12/09/2013 (Cont'd)	• **Final Voids and Waste Rock Emplacements**: The EIS must include a detailed consideration of the final rehabilitation options for the open pit and waste rock dumps. Issues associated with final voids and waste rock landforms such as stability, acid rock drainage, ground and surface water and aesthetics need to be addressed. The number, location and geometry of any final voids in the landscape must be fully justified. Final mine voids seldom, if ever, have a beneficial use and the permanent costs to the environment and future agricultural production should be acknowledged by the applicant and considered by the Department of Planning & Infrastructure before any approval.	2.3.4, 2.4.3
	• Final Land Use: Describe proposed final land uses for each disturbance domain (infrastructure areas, waste rock storages, subsidence zones, final void etc.) and provide a conceptual plan depicting these uses and final landforms.	2.13.6
	• Performance Standards and Completion Criteria: For each disturbance domain, identify relevant performance measures (e.g. open woodland revegetation) and indicative completion criteria (e.g. Number of surviving trees trees/hectare after 5 years).	2.13.4
	• Monitoring and Research: Outline the proposed rehabilitation methods and techniques and proposed monitoring and research programs.	2.13.8
	• Post-closure maintenance: Describe any post-rehabilitation maintenance requirements for the project site and how these will be managed.	2.13.8
	Other Considerations	
	Mining Operations Plan (MOP)	
	Subject to any planning approval prior to commencement, the proponent will be required to submit and have approved a Mining Operations Plan.	2.13.1
	Rehabilitation Security Bond	
	A review of the rehabilitation security bond will also be undertaken prior to project commencement.	4.13.1
Environment Protection Authority 04/09/2013	**The Proposal**	
	• Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving ESD, including:	5.3.2
	a) an assessment of a range of options available for use of the resource, including the benefits of each option to future generations	5.3.2
	b) Proper valuation and pricing of environmental resources,	5.3.2
	c) Identification of who will bear the environmental costs of the proposal.	5.3.2.5

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	AIR QUALITY	
Environment Protection Authority 04/09/2013	**The Proposal**	
	• Identify all sources of air emissions from the development. *Note: emissions can be classed* as *either:* – *point (eg emissions from stack or vent) or* – *fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).*	4.8.3
	• Provide details of the project that are essential for predicting and assessing air impacts including:	
	a) the quantities and physio-chemical parameters (eg concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or store.	2.5
	b) an outline of procedures for handling, transport, production and storage.	2.3, 2.4, 2.5, 2.7
	c) the management of solid, liquid and gaseous waste streams with potential for significant air impacts.	2.4, 2.6
	The Location Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.	4.1
	• Describe surrounding buildings that may effect plume dispersion.	4.1.5
	• Provide and analyse site representative data on following meteorological parameters: a) temperature and humidity.	4.1.4.2
	b) rainfall, evaporation and cloud cover.	4.1.4.4
	c) wind speed and direction.	4.1.4.5
	d) atmospheric stability class.	NA
	e) mixing height (the height that emissions will be ultimately mixed in the atmosphere).	NA
	f) katabatic air drainage.	NA
	g) air re-circulation.	NA
	The Environmental Issues **Describe Baseline Conditions** • Provide a description ·of existing air quality and meteorology, using existing information and site representative ambient monitoring data.	4.8.2

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	AIR QUALITY (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	**Assess Impacts** Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.	4.8.5
	• Assess the risk associated with potential discharges of fugitive and point source emissions for all stages of the proposal. Assessment of risk relates to environmental harm, risk to human heath and amenity.	
	• Justify the level of assessment undertaken on the basis of risk factors, including but not limited to:	3.5
	a. proposal location;	
	b. characteristics of the receiving environment; and	
	c. type and quantity of pollutants emitted.	
	• Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to:	
	d. meteorology and climate;	4.1.4
	e. topography;	4.1.2
	f. surrounding land-use; receptors; and	4.1.5
	g. ambient air quality.	4.8.2
	Include a detailed description of the proposal. All processes that could result in air emissions (including blasting) must be identified and described. Sufficient detail to accurately communicate the characteristics and quantity of all emissions must be provided.	
	• Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.	4.8.3
	• Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment.	4.8.6
	• Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment. Air dispersion modelling must be conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005) htlp:/lwww.environment.nsw.gov.aufresources/air/ammodellin905361.pdf	NA
	• Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations* (POEO) Act (1997) and the *POEO (Clean Air) Regulation* (2002).	4.8.4
	• Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010.	4.15.2.2

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	AIR QUALITY (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	• Detail emission control techniques/practices that will be employed by the proposal and demonstrate that these are best management practice, by applying the procedure outlined in *Coal Mine Particulate Matter Control Best Practice Site-specific determination guideline* (November 2011). http://www.erivironment.nsw.gov.au/resources/air/20110813coalmineparticulate.pdf	4.8.5
	• Estimate the resulting ground level concentrations of all pollutants. Where necessary (eg potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA.	4.8.6
	• Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.	4.8.4
	• Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.	4.8.1
	• For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA / DECCW procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.	NA
	• Reference should be made to relevant guidelines e.g. *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2001); *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (EPA, 2001); *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005), *Coal Mine Particulate Matter Control Best Practice – Site-specific determination guideline* (November 2011), *Load Calculation Protocol for use by holders of NSW Environment Protection Licences when calculating Assessable Pollutant Loads* (EPA, 1999).	4.8.1
	Describe Management and Mitigation Measures • Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.	4.8.6
Bogan Shire Council 22/10/2013	Detail management activities to reduce and suppress dust generation.	4.8.5

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	NOISE AND VIBRATION	
Environment Protection Authority 04/09/2013	**The Proposal**	
	• Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.	4.5.4
	• Specify the times of operation for all phases of the development and for all noise producing activities.	2.10.1
	• For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations - diagrams should be to a scale sufficient to delineate individual residential blocks.	NA
	The Location	
	• Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.	4.5.2
	• Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas,	4.1.5.2
	The Environmental Issues	
	Describe Baseline Conditions	4.5.2
	• Determine the existing background (LA90) and ambient (LAeq) noise levels in accordance with the *NSW Industrial Noise Policy*.	
	• Determine the existing road traffic noise levels in accordance with the NSW Environmental Criteria for Road Traffic Noise, where road traffic noise impacts may occur.	4.5.3.4
	• The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:	
	details of equipment used for the measurements	
	h) a brief description of where the equipment was positioned.	4.5.2.4
	i) a statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive locations(s)' and 'most affected locations(s)' described in Section 3.1.2 of the NSW Industrial Noise Policy.	4.5.2.4
	j) details of the exact location of the monitoring site and a description of land uses in surrounding areas.	4.5.2.4
	k) a description of the dominant and background noise sources at the site.	4.5.4
	l) day, evening and night assessment background levels for each day of the monitoring period.	4.5.6
	m) the final Rating Background Level-(RBL) value.	4.5.4

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	NOISE AND VIBRATION (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	n) graphs of the measured noise levels for each day should be provided.	Appendix 8
	o) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section B1.3 of the *NSW Industrial Noise Policy*.	Appendix 8
	p) determination of LAeq noise levels from existing industry.	4.5.2.4
	Assess impacts	
	• Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:	4.5.3
	a) determination of the intrusive criterion for each identified potentially affected receiver.	
	b) selection and justification of the appropriate amenity category for each identified potentially affected receiver.	4.5.3
	c) determination of the amenity criterion for each receiver.	4.5.3
	d) determination of the appropriate sleep disturbance limit.	4.5.3.3
	Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. Where LA1(1 min) noise levels from the site are less than 15dB above the background LA90 noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise*.	4.5.3.3
	• Determine expected noise level and noise character (eg tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:	
	a) site establishment.	4.5.4.1
	b) Construction.	4.5.4.1
	c) operational phases.	4.5.4.1
	d) transport including traffic noise generated by the proposal.	4.5.4.2
	e) other services.	NA
	Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).	
	• Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise. levels under calm conditions may also aid in quantifying the extent of impact where this is 'not the most adverse condition.	4.5.2

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
NOISE AND VIBRATION (Cont'd)		
Environment Protection Authority 04/09/2013 (Cont'd)	• The noise impact assessment report should include: a) a plan showing the assumed location of each noise source for each prediction scenario.	Figure 4.5
	b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site.	4.5.4
	c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc.	4.5.4 Appendix 8
	d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or Sound Plan computer models are adopted, the approach should be appropriately justified and validated.	Appendix 8
	e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions.	4.5.4
	f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate.	Appendix 8
	g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived.	NA
	h) an assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy*:	NA
	• Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.	NA
	• The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.	4.5.5
	• Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying: a) locations where the noise level exceeds the criteria and extent of exceedance (sic). b) numbers of people (or areas) affected. c) times when criteria will be exceeded. d) likely impact on activities (speech, sleep, relaxation, listening, etc). e) change on ambient conditions. f) the result of any community consultation or negotiated agreement.	NA

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	NOISE AND VIBRATION (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	• For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.	4.5.4.2
	• Where blasting is intended an assessment in accordance with the Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment: a) bench height, burden spacing, spacing burden ratio. b) blast hole diameter, inclination and spacing. c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.	2.3.2.1, 4.6.3
	Describe management and mitigation measures • Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.	4.5.5
	• For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:	
	a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage.	4.5.5
	b) control of traffic (eg: limiting times of access or speed limitations).	4.5.5
	c) resurfacing of the road using a quiet surface.	NA
	d) use of (additional) noise barriers or bunds.	NA
	e) treatment of the facade to reduce internal noise levels buildings where the night-time criteria is a major concern.	NA
	f) more stringent limits for noise emission from vehicles (Le. using specially designed 'quite' trucks and/or trucks to use air bag suspension.	NA
	g) driver education.	4.5.5
	h) appropriate truck routes.	4.5.5
	i) limit usage of exhaust breaks.	NA
	j) use of premium muffles on trucks.	NA

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
NOISE AND VIBRATION (Cont'd)		
Environment Protection Authority 04/09/2013 (Cont'd)	k) reducing speed limits for trucks.	NA
	l) ongoing community liaison and monitoring of complaints.	4.5.4
	m) phasing in the increased road use.	NA
WATER		
Environment Protection Authority 04/09/2013	**The Proposal** • Provide details of the project that are essential for predicting and assessing impacts to waters:	
	a) including the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, Including the risks they pose to Water Quality Objectives in the ambient waters (as defined on www.environment.nsw.gov.au/ieo.using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000).	4.4.2, 4.9.2
	b) the management of discharges with potential for water impacts.	2.6.2
	c) drainage works and associated infrastructure; land-forming	2.6
	d) and excavations; working capacity of structures; and water resource requirements of the proposal.	2.6
	• Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts eg effluent ponds) and showing potential areas of modification of contours, drainage etc.	Figure 2.1
	• Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.	2.6.3
	The Location • Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: www.environment.nsw.gov.au/ieo should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.	4.4.2, 4.9.2
	The Environmental Issues **Describe Baseline Conditions** Describe existing surface and groundwater quality - an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).	

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	*Note: Methods of sampling and analysis need to conform with an accepted standard (e.g. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECCW 2004) or be approved and analyses undertaken by accredited laboratories).*	
	• Provide site drainage details and surface runoff yield.	2.6.3
	• State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: www.environment.nsw.gov.au/ieo. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.	4.9.2.2, 2.6.2, 4.4.2.
	• State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 Guidelines for Fresh and Marine Water Quality (http://www.deh.gov.au/water/quality/nwqms/volume1.html)(Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.	4.9.2.2, 2.6.2, 4.4.2.
	• State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries (www.hrc.nsw.gov.au) or the NSW Salinity Strategy (DLWC, 2000) (www.dlwc.nsw.gov.au/care/salinity/#Strategy).	NA
	• Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.	NA

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	• Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:	4.4.2, 4.9.2
	a) lake or estuary flushing characteristics.	NA
	b) specific human uses (e.g. exact location of drinking water offtake).	NA
	c) sensitive ecosystems or species conservation values.	4.9.2
	d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc.	4.9.2
	e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment.	4.4.2.5
	f) historic river flow data where available for the catchment.	NA
	Assess impacts	
	• No proposal should breach clause 120 of the Protection of the *Environment Operations Act 1997* (Le. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).	4.4.6, 4.9.4
	• Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.	Section 4
	• Include a rationale, along with relevant calculations, supporting the prediction of the discharges.	2.6.3
	• Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).	4.4.5, 4.9.5
	• Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).	NA
	• Identify any potential impacts on quality or quantity of groundwater describing their source.	4.4.4, 4.9.4

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	• Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible, impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.	2.6.3
	• Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.	NA
	• Containment of spills and leaks shall be in accordance with the technical guidelines section 'Bunding and Spill Management' of the Authorised Officers Manual (EPA, 1995) (http://www.environment.nsw.gov.au/mao/bundingspill.htm) and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.	NA
	• The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered: a) will the proposal protect Water Quality and River, Flow Objectives where they are currently achieved in the ambient waters; and b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.	NA NA
	• Consult with the EPA as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The EPA will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment. *Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.*	NA
	• Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.	2.6.2
	• Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact.	2.6.2

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Environment Protection Authority 04/09/2013 (Cont'd)	• Reference should be made to relevant guidelines e.g. Managing Urban Storm water: Soils and Construction (Landcom, 2004), and Guidelines for Fresh and Marine Water Quality ANZECC 2000).	4.4.1
	Describe management and mitigation measures	
	• Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.	2.6.2
	• Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.	2.6.2
	• Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.	2.6.4
	• Outline pollution control measures relating to storage of materials, possibility of accidental spills (eg preparation of contingency plans), appropriate disposal methods, and generation of leachate.	2.8.2.4
	• Describe hydrological impact mitigation measures including:	
	a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition).	NA
	b) minimising runoff.	Section 2
	c) minimising reductions or modifications to flow regimes.	2.6.2
	d) avoiding modifications to groundwater.	4.4.6
	• Describe groundwater impact mitigation measures including:	
	a) site selection.	4.4.6
	b) retention of native vegetation and revegetation.	4.4.6
	c) artificial recharge.	NA
	d) providing surface storages with impervious linings.	2.6.1
	e) monitoring program.	4.4.8
	Describe geomorphological impact mitigation measures including:	
	a) site selection.	4.4.6
	b) erosion and sediment controls.	2.6.2
	c) minimising instream works.	Figure 2.1
	d) treating existing accelerated erosion and deposition.	2.6.2
	e) monitoring program.	4.9.5
	• Any proposed monitoring should be undertaken in accordance with the Approved Methods for the *Sampling and Analysis of Water Pollutants in NSW* (DECCW 2004).	Noted

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
WATER (Cont'd)		
Office of Water 03/10/2013	NSW Office of Water requires the EIS for the proposal to demonstrate the following:	
	1. Adequate and secure water supply for the proposal. Confirmation that water supplies for construction and operation are sourced from an appropriately authorised and reliable supply.	2.6.1, 2.6.3
	2. Identification of site water demands, water sources (surface and groundwater), water disposal methods and water storage structures in the form of a water balance. The water balance is to outline the proposed water management on the site and to also include details of any water reticulation infrastructure that supplies water to and within the site.	2.6.3
	3. An impact assessment on adjacent licensed water users (surface and groundwater), riparian ecosystems and groundwater-dependent ecosystems. This is to meet the requirements of relevant state policy such as the NSW Aquifer Interference Policy, in addition to the objects and principles of the *Water Management Act 2000* which can be accessed at the following link: http://www.water.nsw.gov.au/vVater-managementiLaw-andPolicy/default.aspx.	4.4.6
	4. An assessment of the potential to intercept groundwater and predicted maximum annual dewatering volumes, water quality and disposal/retention methods. This is to also include the modelled zone of influence for a number of stages both during mining operations and post mine life until equilibrium is achieved. This is to meet the requirements of the NSW Aquifer Interference Policy.	4.4.6.1
	5. An impact assessment of the construction, operation and final landform of the proposed onsite waste rock emplacement, water management ponds and other potentially contaminating facilities. This is to include an assessment of the processing, management and disposal of potentially contaminating materials at the Tritton Copper Mine.	2.6.2
	6. An assessment of any proposed modification to surface water management including modelling of redistribution of waters and an assessment of impact on neighbouring properties and the associated watercourse and floodplain.	4.9.4
	7. An impact assessment of any proposed works within or adjacent to watercourses and adequate provision of buffer requirements. This is to also include proposed pipelines and temporary or permanent vehicle crossings within the project application area. Ability to achieve the principles of the *Water Management Act 2000* and the requirements of the "Guidelines for Controlled Activities on Waterfront Land' will be required. The relevant guidelines can be accessed at the following link: http://www.water.nsw.gov.au/WaterLicensing/Approvals/Controlled-activities/default.aspx.	4.9.4

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Office of Water 03/10/2013 (Cont'd)	8. Preparation of a surface water management plan and groundwater management plan to integrate the proposed water balance and management for the site and to identify adequate mitigating and monitoring requirements for both water quality and water volume.	4.4.5 and 4.9.4
	9. Existing and proposed water licensing requirements in accordance with the *Water Act 1912* and *Water Management Act 2000* (whichever is relevant). This is to demonstrate that existing licences (include licence numbers) and licensed uses are appropriate, and to identify where additional licences are proposed. The proponent will be required to ensure they hold adequate licensed entitlement commensurate with the anticipated volume of groundwater take prior to this take occurring. Groundwater take includes the volume of water intercepted by the proposed activities both via the underground mine and any extraction bores, in addition to any ongoing take induced by groundwater inflows and evaporative loss when the mine workings begin to fill. The maximum annual requirements need to be regularly reviewed through updates of modelling and reviews of metering data.	4.4.7
	10. Adequate mitigating and monitoring requirements to address surface water and groundwater impacts.	2.6.2, 4.4.5, 4.9.3
	Groundwater Source The assessment is required to identify groundwater issues and potential degradation to the groundwater source and provide the following:	
	• Details of the predicted highest groundwater table at the development site.	4.4.2.3
	• Details of any works likely to intercept, connect with or result in pollutants infiltrating into the groundwater sources.	2.3.3
	• Details of any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.	4.4
	• Describe the flow directions and rates and the physical and chemical characteristics of the groundwater source.	4.4.2.1, 4.4.2.2
	• Details of the predicted impacts of any final landform on the groundwater regime.	2.13.7
	• Details of the existing groundwater users within the area (including the environment) and include details of any potential impacts on these users.	4.4.2.4
	• Assessment of the quality of the groundwater for the local groundwater catchment.	4.4.2.5
	• Details of how the proposed development will not potentially diminish the current quality of groundwater, both in the short and long term.	4.4.5
	• Details on preventing groundwater pollution so that remediation is not required.	4.4.5
	• Quantification of impacts on groundwater dependent ecosystems (GDEs).	4.4.2.6

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Office of Water 03/10/2013 (Cont'd)	• Details on protective measures to minimise any impacts on groundwater dependent ecosystems.	4.4.2.6
	• Details of proposed methods of the disposal of waste water and approval from the relevant authority.	2.6
	• Assessment of the potential for saline intrusion of the groundwater and measures to prevent such intrusion into the groundwater aquifer.	2.6, 4.4.4.5
	• Details of the results of any models or predictive tools used to predict groundwater drawdown, inflows to the site and impacts on affected water sources.	4.4.4
	Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:	
	• Details of any proposed monitoring programs, including water levels and quality data.	4.4.8
	• Reporting procedures for any monitoring program including mechanism for transfer of information.	4.4.8
	• Description of the remedial measures or contingency plans proposed.	4.4.5, 4.9.3
	Licensing	
	• All proposed groundwater works, including bores for the purpose of investigation, extraction, dewatering, testing or monitoring must be identified in the proposal and an approval obtained from the Office of Water prior to their installation. Approved SSD and SSI projects may be excluded from the requirement for approvals due to Section 89J and 115ZG of the *Environmental Planning and Assessment Act 1979*.	4.4.7
	• All predicted groundwater take must be accounted for through adequate licensing.	4.4.7
	Groundwater Dependent Ecosystems (GDEs) The assessment is required to identify any impacts on GDEs. GDEs are ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater. GDEs represent a vital component of the natural environment. GDEs can vary dramatically in how they depend on groundwater from having occasional or no apparent dependence through to being entirely dependent. GDEs occur across both the surface and subsurface landscapes ranging in area from a few metres to many kilometres. Increasingly, it is being recognised that surface and groundwaters are often interlinked and aquatic ecosystems may have a dependence on both.	

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Office of Water 03/10/2013 (Cont'd)	Ecosystems that can depend on groundwater and that may support threatened or endangered species, communities and populations, include: • Terrestrial vegetation that show seasonal or episodic reliance on groundwater. • River base flow systems which are aquatic and riparian ecosystems in or adjacent to streams/rivers dependent on the input of groundwater to base flows. • Aquifer and cave ecosystems. • Wetlands. • Estuarine and near-shore marine discharge ecosystems. • Fauna which directly depend on groundwater as a source of drinking water or that live within water which provide a source. The *NSW Aquifer Interference Policy and* the *NSW Groundwater Dependent Ecosystem Policy* provides guidance on the protection and management of GDEs. It sets out management objectives and principles to: • Ensure the most vulnerable and valuable ecosystems are protected. • Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity. • Ensure sufficient groundwater of suitable quality is available to ecosystems when needed. • Ensure the *precautionary principle* is applied to protect GDEs, particularly the dynamics of flow and availability and the species reliant on these attributes. A number of gazetted WSPs list and map priority GDEs and set out the management strategies and actions for sharing and protecting groundwater quality, quantity and dependent ecosystems. As indicated above, any GDEs that may be affected significantly need to be clearly identified and the impacts quantified to enable proper assessment.	4.4.2.6 4.4.2.6 NA NA NA
	Surface Water The Office of Water is responsible for the management of rivers, estuaries, wetlands and adjacent riverine plains so they can sustain environmental, social and economic uses for the people in New South Wales.	Noted
	<u>Watercourse/Riparian</u> The assessment is required to consider the impact of the proposal on the watercourses and associated riparian vegetation within the site and provide the following: • Identify the sources of surface water. • Details of stream order (using the Strahler System).	4.9.2 4.9.2.1

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	WATER (Cont'd)	
Office of Water 03/10/2013 (Cont'd)	• Details of any proposed surface water extraction, including quantity, purpose, location of existing pumps, dams, diversions, cuttings and levees.	4.9.4
	• Details of available surface water licences that could be purchased to account for any proposed extractions.	NA
	• Detailed description of any proposed development or diversion works including all construction, clearing, draining, excavation and filling.	Section 2
	• An assessment of the impacts of the proposed methods of excavation, construction and material placement on the watercourse and associated vegetation.	NA
	• A detailed description of all potential water related environmental impacts of any proposed development in terms of riparian vegetation, sediment movement, water quality and hydrologic regime.	4.9.4
	• A description of the design features and measures to be incorporated into any proposed development to guard against anything more than minimal long term actual and potential environmental disturbances, particularly in respect of maintaining the natural hydrologic regime and sediment movement patterns and the identification of riparian buffers. (See note below).	4.9.4
	• Details of the impact on water quality and remedial measures proposed to address more than minimal adverse effects.	4.9.4
	Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. The protection or restoration of vegetated riparian areas is important to maintain or improve the geomorphic form and ecological functions of watercourses through a range of hydrologic conditions in normal seasons and also in extreme events. Refer to NSW Office of Water Guidelines for Controlled Activities (July 2012) available via: http://www.water.nsw.gov.auiWater-Licensing/Approvals/Controlled-activitles/default.aspx	
	Water Management Structures/Dams The Office is responsible for the management and licensing of these structures under water legislation. If the proposal includes existing or proposed water management structures/dams, the assessment should provide information on the following: • Date of construction (for existing structure/s). • Details of the legal status/approval for existing structure/s. • Details of any proposal to change the purpose of existing structure/s. • Details if any remedial work is required to maintain the integrity of the existing structure/s. • Clarification if the structure/s is on a watercourse.	N/A

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
WATER (Cont'd)		
Office of Water 03/10/2013 (Cont'd)	• Details of the purpose, location and design specifications for the structure/s. • Size and storage capacity of the structure/s. • Calculation of the Maximum Harvestable Right Dam Capacity (MHRDC) for the site. • Details if the structure/s is affected by flood flows. • Details of any proposal for shared use, rights and entitlement of the structure/s. • Details if the proposed development/subdivision has the potential to bisect the structure/s. NSW Office of Water's Farm Dams Assessment Guide provides details on harvestable rights and the calculation of the MHRDC. Refer to: http://www.water.nsw.gov.au/Water-Licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff/default.aspx.	2.13.7.2 NA 2.6.2, 2.13.7.2 NA
	Basic Landholder Rights The *WMA* identifies Basic Landholder Rights (BLRs) for access to water whereby landholders over an aquifer or with river or lake frontage can access water for domestic (household) purposes or to water stock without the need for a water licence (although a works approval may still be required for a bore utilising BLR). Pipeline constructions and easements may therefore affect existing BLR users and therefore all potentially affected BLR users need to be identified and the impacts quantified.	4.4.2.4, 4.4.6
	Sustainable Water Supply The assessment is required to address the issue of provision of a sustainable water supply for any project proposal. The assessment should include Water Management Plans detailing how a sustainable water supply can be sourced and implemented. Through the implementation of BASIX, Integrated Water Cycle Management and Water Sensitive Urban Design, any proposed development should also exhibit high water use efficiency.	2.6, 4.4.5, 4.9.4.
Bogan Shire Council 22/10/2013	Ensure the control and management of surface and ground waters are adequately addressed.	2.6, 4.4, 4.9
WASTE AND CHEMICALS		
Environment Protection Authority 04/09/2013	**The Proposal** • Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes (NSW EPA, 1999)*. • Provide details of liquid waste and non-liquid waste management at the facility, including: a) the transportation, assessment and handling of waste arriving at or generated at the site.	2.4, 2.9 2.4., 2.9

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
WASTE AND CHEMICALS (Cont'd)		
Environment Protection Authority 04/09/2013 (Cont'd)	b) any stockpiling of wastes or recovered materials at the site.	2.4.3, 2.4.4
	c) any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site.	2.4.4, 2.4.5, 2.9
	d) the method for disposing of all wastes or recovered materials at the facility.	2.4.3, 2.4.4
	e) the emissions arising from the handling, storage, processing and reprocessing of waste at the facility.	2.4.2.
	f) the proposed controls for managing the environmental impacts of these activities.	Section 4
	Provide details of spoil disposal with particular attention to:	
	a) the quantity of spoil material likely to be generated.	2.4.5
	b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil.	2.4.3, 2.4.4
	c) the need to maximise reuse of spoil material in the construction industry.	2.4
	d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material.	2.4.2
	e) designation of transportation routes for transport of spoil.	2.4.3
	• Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.	2.4, 2.9
	• Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.	2.8.2.4, 2.9
	The Environmental Issue **Describe Baseline Conditions** • Describe any existing waste or chemicals operations related to the proposal.	2.6.1, 2.8.4.1, 2.9
	Assess impacts • Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.	2.4
	Describe management and mitigation measures • Outline measures to minimise the consumption of natural resources.	2.9
	• Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.	2.9
	• Outline measures to support any approved regional or industry waste plans.	NA

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
	REHABILITATION	
Environment Protection Authority 04/09/2013	**The Proposal** • Outline considerations of site maintenance, and proposed plans for the final condition of the site (ensuring its suitability for future uses).	2.13
Bogan Shire Council 22/10/2013	Provide sufficient detail of rehabilitation activity and expected timing with a management focus on progressive rehabilitation where practical.	2.13
	SOIL	
Environment Protection Authority 04/09/2013	**Location** • Provide details of site history - if earthworks are proposed, this needs to be considered with regard to possible soil contamination, for example if the site was previously a landfill site or if irrigation of effluent has occurred.	1.3, 4.13
	The Environmental Issue **Describe Baseline Conditions** • Provide any details (in addition to those provided in the location description – Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.	4.13.2
	Assess impacts • Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of: a) disturbing any existing contaminated soil. b) contamination of soil by operation of the activity. c) subsidence or instability. d) soil erosion. e) disturbing acid sulfate or potential acid sulfate soils.	 NA 4.13.4 2.14.2 2.6.2, 4.13.4 NA
	Describe management and mitigation measures • Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including: a) erosion and sediment control measures. b) proposals for site remediation - see *Managing Land Contamination, Planning Guidelines SEPP 55 - Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998). c) proposals for the management of these soils - *see Assessing and Managing Acid Sulfate Soils*, Environment Protection Authority, 1995 (note that this is the only methodology accepted by the EPA).	 2.14.2 2.13, 3.3.3.5 NA

Table A2-2 (Cont'd)
Coverage of Environmental Issues

Government Agency	Paraphrased Requirement	Relevant EIS Section(s)
CUMULATIVE IMPACTS		
Environment Protection Authority 04/09/2013	**The Environmental Issues** • Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute. • Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region. • Identify infrastructure requirements flowing from the proposal (eg water and sewerage services, transport infrastructure upgrades), and all infrastructure upgrades/modifications required at the existing mine infrastructure at Girilambone and Hermidale to cater for the Avoca Tank Project. • Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts· (eg travel demand management strategies). • Identify all existing mining operations that will be operated concurrently with the proposed project, time frames, and the likely cumulative impacts and mitigation measures to reduce impacts over the life of the project.	1.4.3, Section 4 Section 4 Section 2 Section 4 1.4.3, Section 4
BUSHFIRE MANAGEMENT		
Bogan Shire Council 22/10/2013	Detail management activities to reduce the potential for bushfires and emergency procedures in the event of bushfire.	4.12
ACID ROCK DRAINAGE		
Bogan Shire Council 22/10/2013	Illustrate management practices to predict, identify and manage potentially acid forming material that will prevent the formation of acid mine drainage.	2.4, 2.4.2.1, 2.5.1,

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Appendix 4

Statement of Commitments

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PREAMBLE

This Statement of Commitments has been prepared to provide a compilation of the actions and initiatives the Applicant has committed to implement if the Proposal receives development consent. These commitments are designed to effectively manage, mitigate, guide and monitor the Proposal through the site establishment and construction, operational and rehabilitation phases.

The Environmental Impact Statement for the Proposal has identified a range of environmental, social and economic management outcomes and measures which would be required to avoid or reduce the potential adverse environmental and socio-economic impacts of the Proposal.

All parties involved in all phases of the Proposal would be required to undertake their work in accordance the conditions of the development consent that will incorporate a final set of commitments.

For each commitment, the desired outcomes are provided together with the intended actions and timing for implementation.

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Table A4-1
Statement of Commitments

<table>
<tr><th>Desired Outcome</th><th colspan="2">Action</th><th>Timing*</th></tr>
<tr><td colspan="4">1. Area of Activities</td></tr>
<tr><td>All approved components are constructed and activities are undertaken in the area(s) nominated on the approved plans and figures.</td><td>1.1</td><td>Identify and mark on the ground the boundaries of the approved areas of disturbance.</td><td>Prior to the commencement of site establishment and construction operations.</td></tr>
<tr><td colspan="4">2. Mining and Processing Activities</td></tr>
<tr><td>Mining and processing rates do not exceed assessed maximum rates.</td><td>2.1</td><td>Ensure run-of-mine ore production rates do not exceed 318 000t per year.</td><td>Continuous during operations.</td></tr>
<tr><td colspan="4">3. Operating Hours</td></tr>
<tr><td>Management of operating hours in accordance with approval conditions.</td><td colspan="2">3.1
<table>
<tr><th>Activity</th><th>Proposed Days of Operation</th><th>Proposed Hours of Operation</th></tr>
<tr><td>Vegetation clearing and topsoil stripping</td><td rowspan="6">7 days a week</td><td>Daylight hours</td></tr>
<tr><td>Site establishment operations, including box cut establishment</td><td rowspan="4">24 hours per day</td></tr>
<tr><td>Underground mining operations</td></tr>
<tr><td>Transportation operations</td></tr>
<tr><td>Maintenance operations</td></tr>
<tr><td>Rehabilitation operations</td><td>Daylight hours</td></tr>
</table></td><td>Continuous during operations.</td></tr>
<tr><td colspan="4">4. Aboriginal Heritage</td></tr>
<tr><td rowspan="3">Site activities are undertaken without impacting upon any Aboriginal heritage items.</td><td>4.1</td><td>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).</td><td rowspan="3">Prior to the commencement of site establishment and construction operations.</td></tr>
<tr><td>4.2</td><td>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.</td></tr>
<tr><td>4.3</td><td>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.</td></tr>
</table>

Table A4-1
Statement of Commitments

Desired Outcome	Action		Timing*
Aboriginal Heritage (Cont'd)			
Site activities are undertaken without impacting upon any Aboriginal heritage items (Cont'd).	4.4	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.	Prior to the commencement of site establishment and construction operations.
5. Ecology			
Avoid and minimise impacts on native vegetation and native animal habitats to the greatest extent practicable.	5.1	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.*	Prior to the commencement of site establishment and construction operations.
	5.2	Clearly mark-out the proposed disturbance footprint boundaries and identify vegetation to be cleared.	
	5.3	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.	
	5.4	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 saplings or remaining canopy trees wherever possible.	Ongoing
	5.5	Place felled canopy trees in adjacent vegetation areas outside of the proposed disturbance footprint to improve existing habitats.	During site establishment and construction operations.
	5.6	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.	Ongoing
	5.7	Install sediment and erosion control structures where appropriate.	During site establishment and construction operations.
	5.8	Stabilise exposed soils to prevent potential erosion.	

Table A4-1
Statement of Commitments

Desired Outcome	Action		Timing*
6. Groundwater			
Ensure that surface and groundwater is appropriately managed throughout the life of the Proposal.	6.1	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.	Prior to site establishment and construction operations and ongoing
Prevent contamination of groundwater as a result of Proposal activities.	6.2	Store all hydrocarbon and chemical products within a bunded area complying with the relevant Australian Standard.	Ongoing
	6.3	Refuel all equipment within designated, sealed areas of the Project Site, where practicable.	
	6.4	Undertake all maintenance works involving hydrocarbons, where practicable, within designated areas of the Project Site such as the workshop.	
	6.5	Direct all water from wash-down areas and workshops to oil/water separators and containment systems.	
	6.6	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.	
Determine groundwater inflows to the proposed mine.	6.7	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.	
Determine the extent of groundwater drawdown.	6.8	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.	

Table A4-1
Statement of Commitments

Desired Outcome	Action		Timing*
7. Noise			
Manage noise generated by the Proposal to levels that are compliant with conditional criteria.	7.1	Regularly service all on-site equipment to ensure sound power levels of each item remains at or below the default/or factory-set values.	Ongoing
	7.2	Install frequency modulated reversing alarms to all mobile equipment.	
	7.3	Ensure that all truck drivers are 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.	
	7.4	Maintain an open dialogue with the surrounding community and neighbours to ensure any concerns over noise or vibration are addressed.	
8. Blasting and Vibration			
Compliance with blasting criteria at all privately-owned receptors.	8.1	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.	During initial blasting operations until compliance established
9. Historic Heritage			
Site activities are undertaken without impacting upon any historic heritage items.	9.1	Ensure Avoca Tank 4 is fenced with a suitable buffer for the life of the Proposal.	During site establishment and construction operations and ongoing
	9.2	Ensure that mine site personnel are aware of the location of Avoca Tank 4 and provide the location of the site on mine plans.	
	9.3	Ensure all work crews would be informed that the fenced area are "no-go" areas for the duration of the works.	
	9.4	Ensure that mine site personnel do not disturb historic artefacts at Avoca Tank 6 and Avoca Tank 7.	
	9.5	Ensure that mine site personnel report any additional historic finds they may find and not remove or disturb historic artefacts.	
10. Air Quality			
Site activities are undertaken without exceeding relevant air quality criteria or adversely impacting on surrounding privately-owned receptors.	10.1	Limit, where practicable, excavation of material during periods of high winds.	Ongoing
	10.2	Limit disturbance to the minimum area necessary for mining and associated activities.	
	10.3	Operate the largest practical truck size to reduce the number of movements necessary to transport the ore and waste rock.	

Table A4-1
Statement of Commitments

Desired Outcome	Action	Timing*
Air Quality (Cont'd)		
Site activities are undertaken without exceeding relevant air quality criteria or adversely impacting on surrounding privately-owned receptors (Cont'd).	10.4 Adhere to all vehicle speed limits.	Ongoing
	10.5 Profile all surfaces to reduce velocity of overland winds.	
	10.6 Apply vegetative cover to non-operational exposed surfaces such as water management structures and soil stockpiles as soon as practical after disturbance.	
	10.7 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.	
	10.8 Apply water to all roads and trafficked areas using water trucks to minimise the generation of dust.	
	10.9 Water stockpiles to maintain moisture content and minimise the generation of dust.	
	10.10 Minimise drop heights when loading ore material for transportation to the Tritton Copper Mine.	
	10.11 Clearly define all haul roads edges with marker posts or equivalent to control their locations, especially when crossing large areas of non-descript disturbance.	
	10.12 Close, rip and revegetate all obsolete roads.	
	10.13 Reshape, topsoil and rehabilitate all completed areas as soon as practicable after the completion of mining operations.	
11. Surface Water		
Ensure that surface and groundwater is appropriately managed throughout the life of the Proposal.	11.1 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.	Prior to site establishment and construction operations and ongoing

Table A4-1
Statement of Commitments

Desired Outcome	Action		Timing*
Surface Water (Cont'd)			
Separate clean, dirty and mine water streams and ensure that each is managed in a manner that ensures impacts are minimised to the greatest extent practicable	11.2	Ensure that clean water is diverted away from areas of proposed disturbance and permitted to flow to natural drainage.	Ongoing
	11.3	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. .	
	11.4	Ensure that mine water, including saline groundwater, is retained and is not be permitted to flow to natural drainage.	
	11.5	Manage the flow of make up water to ensure that discharge of water from the Mine Water Pond does not occur.	
	11.6	Treat waste water would be using a suitable waste water treatment or pump out septic system.	
12. Traffic and Transportation			
Achieve safe and efficient road transport operations.	12.1	Water or treat internal roads with chemical suppressants, where appropriate, to minimise dust generation.	Ongoing
	12.2	Restrict vehicle speed on the Site Access Road to 80km/hr.	
	12.3	Ensure that all vehicles transporting ore are loaded using a front-end loader fitted with a bucket load indicator to avoid overloading.	
	12.4	Ensure that the trays of all heavy vehicles transporting ore are covered prior to leaving the ROM Pad.	
	12.5	Prepare, implement and enforce a Driver's Code of Conduct for all heavy vehicle drivers accessing the Project Site regularly.	
	12.6	Investigate any complaints in relation to transportation operations promptly.	
13. Visual Amenity			
Ensure that the visual amenity of surrounding residences is not adversely impacted.	13.1	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.	During site establishment and construction operations and ongoing
	13.2	Construct built structures from dull coloured, non-reflective materials.	

Table A4-1
Statement of Commitments

Desired Outcome	Action	Timing*
Visual Amenity (Cont'd)		
Ensure that the visual amenity of surrounding residences is not adversely impacted (Cont'd).	13.3 Undertake active dust suppression to reduce the potential for the creation of a 'dust cloud' over the Project Site.	During site establishment and construction operations and ongoing
	13.4 Include appropriate waste management to ensure that wind-blown rubbish does not spread from the Project Site.	
	13.5 Orientate night lighting towards the active areas of operation and towards the ground, minimising the light spill from the Project Site.	
	13.6 Ensure that lighting not required is turned off.	
	13.7 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.	
14. Bushfire Management		
Ensure that risks associated with bushfire are managed appropriately	14.1 Ensure that personnel are evacuated from the underground mine in the event of a bush fire encroaching upon or starting within the Project Site.	Ongoing
	14.2 Consider evacuation of all non-essential personnel from the Project Site if required.	
	14.3 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.	
	14.4 Undertake refuelling within the designated refuelling bay or within cleared areas, with all vehicles turned off during refuelling.	
	14.5 Enforce a no smoking policy in designated areas of the Project Site.	
	14.6 Maintain fire extinguishers within site vehicles and refuelling areas.	
	14.7 Ensure housekeeping activities are maintained to limit potential fuel loads within the active sections of the Project Site.	
	14.8 Ensure a water cart with fire fighting capabilities would be available to assist in extinguishing any fire ignited.	
	14.9 Ensure a cleared area of at least 15m is maintained around all buildings and other infrastructure within the Project Site.	

Table A4-1
Statement of Commitments

Desired Outcome	Action	Timing*
15. Soil and Land Capability		
Maintenance of soil value for rehabilitation and minimisation of soil loss through erosion.	15.1 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.	During soil stripping and stockpiling operations
	15.2 Strip topsoil from all areas of disturbance to a depth of approximately 20cm and store in stockpiles no more than 2m high.	
	15.3 Strip subsoil within the footprint of the Boxcut, 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.	
	15.4 Spread 100mm topsoil on the subsoil stockpile to facilitate revegetation.	
	15.5 Refrain from stripping or placing soils during wet conditions.	
	15.6 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.	
	15.7 Spread seed of a suitable non-persistent cover crop on all soil stockpiles.	
	15.8 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.	
	15.9 Fence and signpost all soil stockpiles and limit operation of machinery on the stockpiles to minimise compaction and further degradation of soil structure.	

Table A4-1
Statement of Commitments

Desired Outcome	Action	Timing*
Soil and Land Capability (Cont'd)		
Maintenance of soil value for rehabilitation and minimisation of soil loss through erosion (Cont'd).	15.10 Construct clean water diversions/dirty water retention banks to direct overland surface water flow away from the soil stockpiles and retain sediment laden water.	During soil stripping and stockpiling operations
	15.11 Maintain an inventory of all soil stripped, stockpiled and used during rehabilitation within the Project Site and elsewhere at the Applicant's operations.	Ongoing
16. Agricultural Resources		
Maintain the agricultural productivity of the Project Site and surrounding district	16.1 Ensure that appropriate weed and pest management programs are implemented in consultation with surrounding landholders and the Bogan Shire Council weeds officer.	Ongoing
	16.2 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.	
17. Socio-economic		
Minimise potential socio-economic impacts and maximise socio-economic benefits.	17.1 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.	Ongoing
	17.2 Support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance.	
	17.3 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*.	
	17.4 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.	

Table A4-1
Statement of Commitments

Desired Outcome	Action		Timing*
Socio-economic (Cont'd)			
Minimise potential socio-economic impacts and maximise socio-economic benefits (Cont'd).	17.5	Maintain a community complaints telephone line and ensure that the existence of the number is advertised widely.	Ongoing
	17.6	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.	
	17.7	Encourage the involvement of the local Aboriginal community in the workforce.	
	17.8	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.	
	17.9	Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the surrounding communities.	
	17.10	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.	
	17.11	Assist Bogan Shire Council to promote and encourage economic development that would continue beyond the life of the Proposal.	
	17.12	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.	
	17.13	Ensure that the land capability of those sections of the final landform to be used for grazing is similar to the current land capability.	

Appendix 5

Aboriginal Cultural Heritage Assessment Report

(Total No. of pages including blank pages = 234)

Note: A colour copy of this Appendix is available on the Project CD

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OnSite
Cultural Heritage Management

Aboriginal Cultural Heritage Assessment Report

Avoca Tank Project Environmental Impact Statement

Tritton Resources, Girilambone,
Bogan Shire NSW 2831

A report prepared for
RW Corkery & Co Pty Limited
Geological and Environmental Consultants
and Tritton Resources Pty Ltd

May 2014

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EXECUTIVE SUMMARY

R.W. Corkery and Co is preparing an Environmental Impact Statement (EIS) for Tritton Resources Pty Ltd (the Applicant) to undertake mining activity at an identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project (the Proposal). On Site Cultural Heritage Management Pty Ltd (On Site CHM) has been engaged by RW Corkery and Co Pty Limited and Tritton Resources to prepare an Aboriginal Cultural Heritage Assessment to inform the EIS about the management of Aboriginal heritage places values within the Avoca Tank Project Site.

The information presented in this Aboriginal Cultural Heritage Assessment has built upon the assessment (On Site CHM 2013) originally prepared for the exploration phase and Review of Environmental Factors (REF) that preceded the EIS. The survey and assessment processes and Aboriginal community consultation to inform the Proposal was undertaken in a two stage assessment process between March and August of 2012 and September 2012 and January 2013.

The results and recommendations of that assessment (On Site CHM 2013) were considered in the final design of the Proposal which has avoided all identified Aboriginal places and values. This report describes the Aboriginal heritage assessment processes undertaken by On Site CHM for the Avoca Tank Project and provides management strategies to ensure the conservation of identified Aboriginal places within the Avoca Tank Project Site during the development and operation of the Proposal.

The Avoca Tank Project Site is located approximately 4 kilometres northwest of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire NSW 2831. The Project Site covers an area of 1846 ha (18.46 km^2) and the Proposed Disturbance Footprint covering an area of 33.6 ha (0.336 km^2). Proposed extraction will occur underground meaning that the Proposed Disturbance Footprint will only cover a small percentage (1.8%) of the entire Project Site. The Avoca Tank Project Site occurs across Lots 135 and 144 (DP 751315) and part Lots 10 (DP 751315) and part Lot 3 (DP 751342). The Project Site is situated on the Coolabah 8235 1:100,000 map sheet.

Four objectives were defined for the Aboriginal Cultural Heritage Assessment in partnership with the local Aboriginal community:

1. Investigate and assess the nature and extent of Aboriginal heritage places and values within the Avoca Tank Project Site
2. Assess the cultural significance of these places and values
3. Assess the potential impacts on identified Aboriginal heritage places and values
4. Provide appropriate recommendations for the conservation and management of identified Aboriginal heritage places and values during the development and operation of the Proposal.

Extensive consultation has been conducted with the Aboriginal community in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (**Section 3.0**). The Avoca Tank project area falls within the boundaries of the Nyngan Local Aboriginal Land Council and according to Tindale (1974) falls within the boundaries of the Wongaibon Aboriginal people. The project area is also within land under the Ngemba/Ngiyampaa Native Title Claim. A copy of relevant claim details was provided by the National Native Title Tribunal and is included in **Appendix 1.**

On the basis of the review of the environmental context (**Section 4.0**) and previous archaeological studies (**Section 5.0**) predictions were made about the archaeological potential of the Avoca Tank project area:

1. Scarred trees are likely to be the most common site type within the Study Area with hearth sites (some potentially with artefacts) likely to be the next most common site type.
2. Stone artefact occurrences are predicted to be low given the paucity of potable water and suitable stone for the manufacture of stone tools.
3. The broad scale land clearing and previous land-use practices within the Study Area are likely to have impacted heavily on all of the site types discussed above.

On the basis of these predictions the archaeological potential and sensitivity of the Avoca Tank project area was considered to be low.

Representatives of the Nyngan Local Aboriginal Land Council (Sheila Couley) and Bogan Aboriginal Corporation (Lesly Ryan) participated in the archaeological survey of the Avoca Tank (Stage 1) assessment area between 26 and 30 April 2012. These representatives and Neville Merritt of the Ngemba/Ngiyampaa Native Title Claim group also participated in the archaeological survey of the Avoca Tank (Stage 2) assessment area between 29 October and 2 November 2012. During the fieldwork the significance and management of all Aboriginal objects and sites was discussed with representatives of the Nyngan Local Aboriginal Land Council, Bogan Aboriginal Corporation and the Ngemba/Ngiyampaa Native Title Claim group.

Assessment of the Avoca Tank Project Site has identified a total of five locations where Aboriginal objects and occupation evidence occurs (See **Table** Error! Reference source not found., Avoca Tank 1 to 5).

A review of the 11 previously recorded AHIMS sites within the Avoca Tank Project Site determined that there are duplicate recordings and these 11 sites actually represent 5 sites. Two of these sites were rerecorded as part of this survey. Duplicate site recordings 26-3-0034 / 26-3-0119/ 26-3-0149 have been rerecorded as Avoca Tank 1 and duplicate site recordings 26-3-0067 / 26-3-0146, 26-3-0068 / 26-3-0147, 26-3-0066 / 26-3-0145 have been recorded as Avoca Tank 3 comprising 3 hearth locales. Hearth nodules previously recorded at site 26-3-0070 / 26-3-0071 were unable to be relocated as part of this survey and it is likely that these features have since eroded away.

Table 1: Results of archaeological assessment of Avoca Tank Project Site. Grid references recorded by On Site CHM (GDA 94) and differ from AHIMS (See Section 5.1)

On Site CHM Site Name	Site Features	Easting	Northing	Corresponding AHIMS Sites
Avoca Tank 1	Stone artefact scatter	55 484966	6548490	26-3-0034 / 26-3-0119/ 26-3-0149 (open artefact scatter) 26-3-0070 / 26-3-0071 (hearth)
Avoca Tank 2	Isolated stone artefact	55 484857	6548245	-
Avoca Tank 3 (3 x hearths)	Hearth 1	55 484835	6547528	26-3-0067 / 26-3-0146
	Hearth 2	55 484815	6547517	26-3-0068 / 26-3-0147
	Hearth 3	55 484729	6547486	26-3-0066 / 26-3-0145
Avoca Tank 4	Historic Scar Tree & Aboriginal Stockman's Camp	55 485027	6547775	-
Avoca Tank 5	2 x isolated stone artefacts	55 481436	6548043	-

The results of this assessment reveal Aboriginal occupation evidence is sparsely distributed across the Avoca Tank Project Site and is indicative of low intensity use of the landscape by Aboriginal people characterised by a high level of mobility and relatively short term occupation or single use of these places.

The low intensity of Aboriginal occupation materials across the Project Site is likely due to the paucity of reliable sources of potable water, stone outcrops suitable for the manufacture of stone tools and to some extent the disturbance upon Aboriginal occupation materials by previous land use practices.

The cultural significance (encompassing Aboriginal and archaeological significance) of the identified Aboriginal places and the Project site has been assessed through Aboriginal consultation and archaeological analysis within a regional context as follows:

- Avoca Tank 1 (an open artefact scatter) is assessed as having a low to moderate level of cultural significance.
- Avoca Tank 2 (a single isolated stone artefact) is assessed as having a low level of cultural significance.
- Avoca Tank 3 (three 'hearths') is assessed as having a low level of cultural significance.
- Avoca Tank 4 (historic scar tree and Aboriginal stockman's camp) is assessed as having a moderate level of cultural significance. Avoca Tank 4 has been identified by Registered Aboriginal Parties as having a moderate to high level of Aboriginal significance and also attributed with historic and aesthetic values.

- Avoca Tank 5 (2 x isolated stone artefacts) is assessed as having a low level of cultural significance.
- The Registered Aboriginal Parties (RAPs) participating in the survey attributed the Study Area with a low level of Aboriginal significance.
- Given the paucity of Aboriginal sites and objects across the Project Site, the subject land has also been assessed as having a low archaeological potential and significance.

The Proposal has subsequently been developed to avoid all of the identified Aboriginal sites and objects within the Avoca Tank Project Site. None of the identified places (Avoca Tank 1 to 5 and associated AHIMS Sites) are proposed to be directly impacted upon or *harmed* during the development of this Proposal and AHIPs will therefore not be required.

The development of management strategies is therefore concerned with the prevention of *harm* through protection and conservation of these places during the development and operation of the Proposal.

On the basis that all of the identified places (Avoca Tank 1 to 5) and locations of previously recorded AHIMS Sites will be avoided and conserved during the development and operation of the Proposal, it is recommended that:

1. Avoca Tank sites (1 to 5) and locations of previously recorded AHIMS sites should continue to be designated as 'no go' areas in accordance with the Straits Community and Heritage Policy and Straits Procedures - Heritage Management Planning (Australia).

2. The existing fencing to demarcate these sites as 'no go' areas should be upgraded to steel pickets and wire sufficient to prevent unauthorised persons and animals prior to the development and operation of the Proposal. Fencing of these places does not require an Aboriginal Heritage Impact Permits (AHIPs).

3. The design and construction of Proposal components should consider the effect of water movement across the landscape and be sensitive to the possibility of creating indirect potential threats that may impact upon these places. This potential is perhaps most acute for the design of the haul road and location of drains. A buffer of at least 50 metres should be established and maintained between the 'no go' areas around identified places and proposed mine infrastructure.

4. Some specific conservation management planning is undertaken for Avoca Tank 4 to mitigate the potential increased risk of fire. The fencing of Avoca Tank 4 and shift in fire management across the Project Site may result in an increased fuel load and fire risk. Specific conservation management strategies may involve spraying / slashing of grass at appropriate intervals to suppress the fuel load or installation of a fire break outside fencing. The development of these management strategies should be informed by specialist advice.

5. The location of each place be accurately mapped as a polygon and incorporated into the relevant spatial management tool (GIS - Geographic Information System) during the development and operation of the Proposal. A buffer of at least 50 metres should be applied for these places.

6. Long term conservation management and monitoring strategies be developed and implemented for these places. These strategies should be developed as part of a specific Heritage Management Plan or incorporated into the relevant Environmental Management Plan as appropriate.

7. Information about the presence of these Aboriginal places, their values and management be incorporated into the induction materials and delivered to relevant personnel or contractors that may come into contact with these places.

8. Given the paucity of Aboriginal objects and sites across the Avoca Tank Study Area no further archaeological surveys of the Proposed Disturbance Footprint are considered warranted.

With regard to Recommendation 8, the previous assessment (On Site CHM 2013) prepared for Tritton Resources also recommended that no further archaeological surveys of the Avoca Tank Study Area were required should the project proceed to full scale mining.

Two of the Registered Aboriginal Parties (Nyngan LALC and Bogan Aboriginal Corporation) provided their support for this recommendation. Native Title Services Corporation, on behalf of the Ngemba/Ngiyampaa Native Title claim group considered that further more intensive surveys of the Proposed Disturbance Footprint should be undertaken. A response was provided by On Site CHM to NTS Corp (**Appendix 7**) who provided a further response also included at **Appendix 7**.

A copy of this assessment report has been distributed to the Registered Aboriginal Parties.

A summary of sites identified within the Avoca Tank Project Site, their significance and recommendations is provided below in **Table 10.1**.

Table 2: Summary table for identified sites within Avoca Tank project area, assessed significance, impacts and recommendations

Sites	Previously recorded AHIMS Sites	Site type and comments	Aboriginal Significance	Archaeological Significance	Impacts (harm) of Proposed Disturbance	Summary of mitigation strategy
Avoca Tank 1	26-3-0034 / 26-3-0119 / 26-3-0149	Open artefact scatter –Low density scatter (11 x stone artefacts) with high raw material diversity and moderate artefact type diversity.	Moderate	Low to moderate	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.
-	26-3-0070 / 26-3-0071	Hearth – unable to be relocated during this survey. Likely washed away and not extant	-	-	None	Location will be avoided. No further action warranted.
Avoca Tank 2	-	Isolated stone artefact	Low	Low	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.
Avoca Tank 3	26-3-0067 / 26-3-0146 26-3-0068 / 26-3-0147 26-3-0066 / 26-3-0145	3 x hearths – no other cultural material in association.	Low to moderate	Low	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.
Avoca Tank 4	-	Historic scar tree and Aboriginal stockman's camp.	Moderate to high	Moderate	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents. Undertake specific conservation management planning to mitigate the risk of fire.
Avoca Tank 5	-	2 x Isolated stone artefacts	Low	Low	None	Upgrade existing fencing (if appropriate). Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.

1.0 INTRODUCTION

R.W. Corkery and Co is preparing an Environmental Impact Statement (EIS) for Tritton Resources Pty Ltd (the Applicant) to undertake mining activity at an identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project (the Proposal). On Site Cultural Heritage Management Pty Ltd (On Site CHM) has been engaged by RW Corkery and Co Pty Limited and Tritton Resources to prepare an Aboriginal Cultural Heritage Assessment to inform the EIS about the management of Aboriginal heritage places values (including Aboriginal sites and objects) within the Avoca Tank Project Site.

The information presented in this Aboriginal Cultural Heritage Assessment has built upon the assessment (On Site CHM 2013) originally prepared for the exploration phase and Review of Environmental Factors (REF) that preceded this EIS. The baseline survey and assessment process undertaken for the exploration phase extended across the entire Avoca Tank Project Site including the Proposed Disturbance Footprint described in **Section 1.1** and displayed in **Figures 1.1** and **1.2.** The results and recommendations of that assessment (On Site CHM 2013) were considered in the final design of the Proposal which has avoided all identified Aboriginal places and values.

This report describes the Aboriginal heritage assessment processes undertaken by On Site CHM for the Avoca Tank Project and provides management strategies to ensure the conservation of identified Aboriginal places within the Avoca Tank Project Site during the development and operation of the Proposal.

1.1 OVER VIEW OF THE AVOCA TANK PROJECT

The Avoca Tank Project Site is located approximately 4 kilometres northwest of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire NSW 2831. The Avoca Tank Project Site covers an area of 1846 ha (18.46 km^2) and the Proposed Disturbance Footprint covering an area of 33.6 ha (0.336 km^2) (See **Figure 1.1**. and **1.2**). Proposed extraction will occur underground meaning that the Proposed Disturbance Footprint will only cover a small percentage (1.8%) of the entire Project Site.

The Avoca Tank Project Site occurs across Lots 135 and 144 (DP 751315) and part Lots 10 (DP 751315) and part Lot 3 (DP 751342). The Project Site is situated on the Coolabah 8235 1:100,000 map sheet.

The Proposal would include the following Key Components (**Figure 1.2**):

- 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 Yarrandale Road.
- 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.
- 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 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.

Figure 1.1: Avoca Tank Project Site. Project Site Boundary shown in red outline and Proposed Disturbance Footprint, including the proposed haul road are shown by the light blue line.

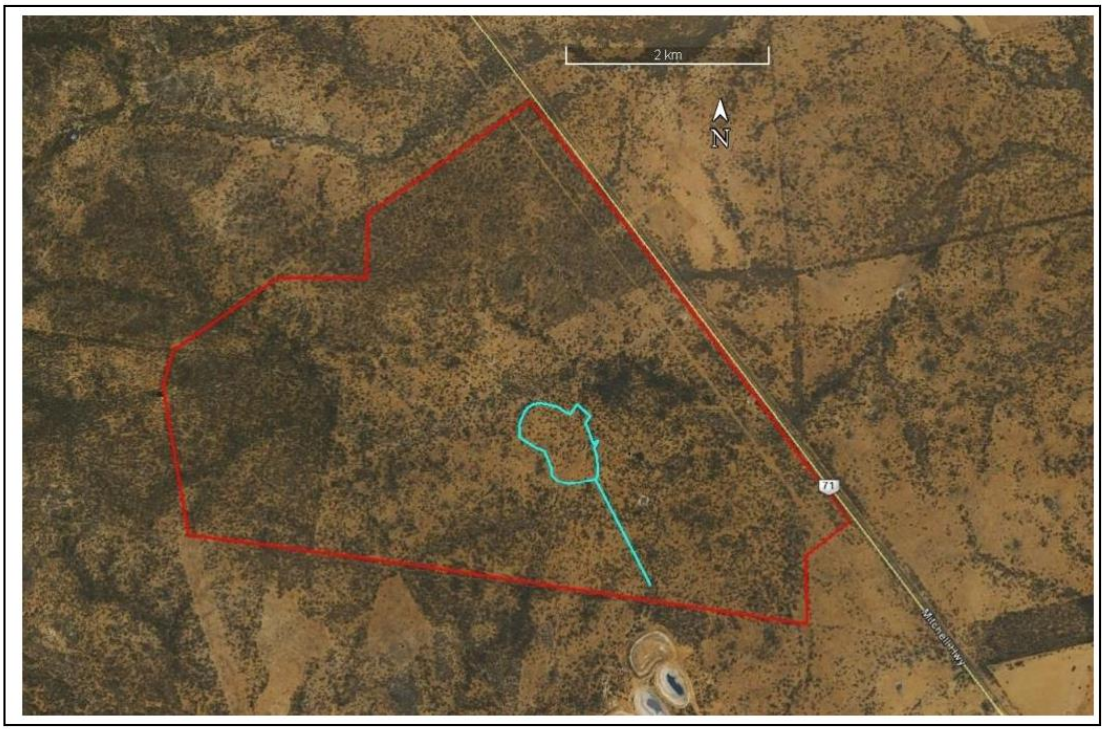
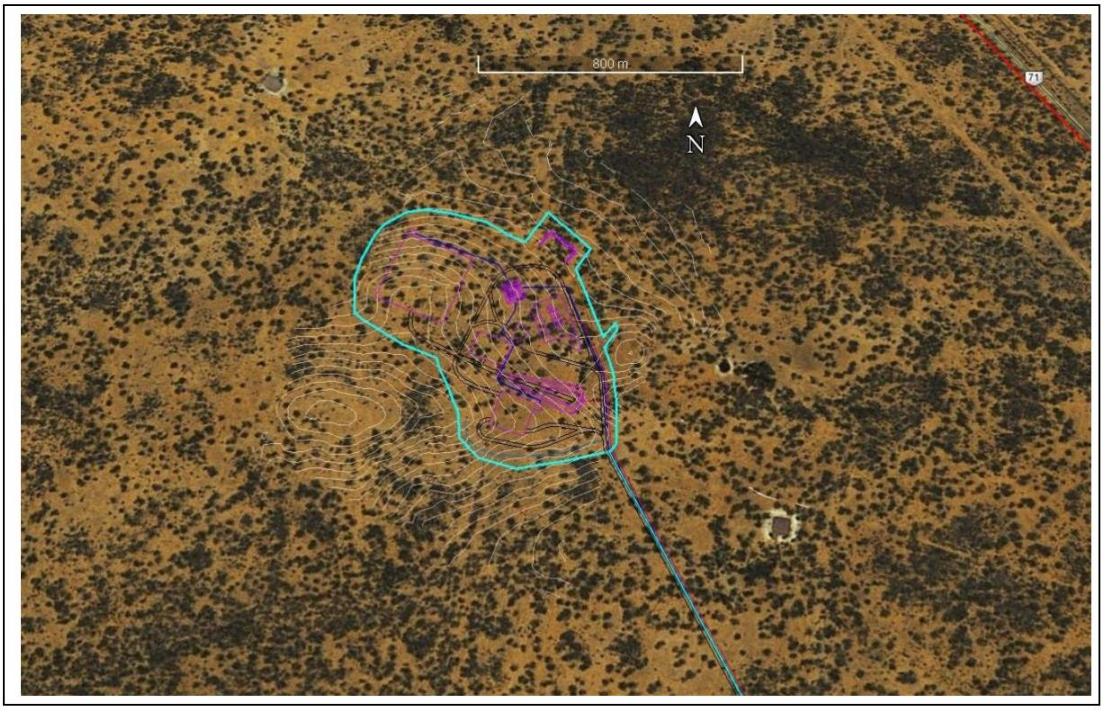


Figure 1.2: Proposed Disturbance Footprint and proposed haul road shown by the light blue line. Project components described in Section 1.1 shown within light blue line.



1.2 OBJECTIVES OF THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Four objectives were defined for this Aboriginal Cultural Heritage Assessment in partnership with the local Aboriginal community:

1. Investigate and assess the nature and extent of Aboriginal heritage places and values within the Avoca Tank Project Site
2. Assess the cultural significance of these places and values
3. Assess the potential impacts on identified Aboriginal heritage places and values
4. Provide appropriate recommendations for the conservation and management of identified Aboriginal heritage places and values during the development and operation of the Proposal.

1.3 BACKGROUND TO THIS ABORIGINAL CULTURAL HERITAGE ASSESSMENT

The Aboriginal Cultural Heritage Assessment processes documented in this report were conducted in two stages (Stage 1 and Stage 2) and included Aboriginal community consultation in accordance with *Aboriginal cultural heritage consultation requirements for proponents.*

Aboriginal community consultation, survey and assessment for the Stage 1 assessment area occurred between March and August of 2012 and Stage 2 was undertaken between September 2012 and January 2013.

The results of the Stage 1 and Stage 2 assessments were combined to produce a single assessment report (On Site CHM 2013) for the current Avoca Tank Project Site. These staged assessments were described within the Background Paper prepared for the Applicant by R.W Corkery & Co Pty Ltd (2013). The Aboriginal Cultural Heritage Assessment report (On Site CHM 2013) has been updated to inform the EIS.

Some of the assessment processes undertaken by On Site CHM for Stage 1 and 2 are still described and explained separately within some sections of this report to demonstrate compliance with the NPW Act and associated policy protecting Aboriginal sites and objects.

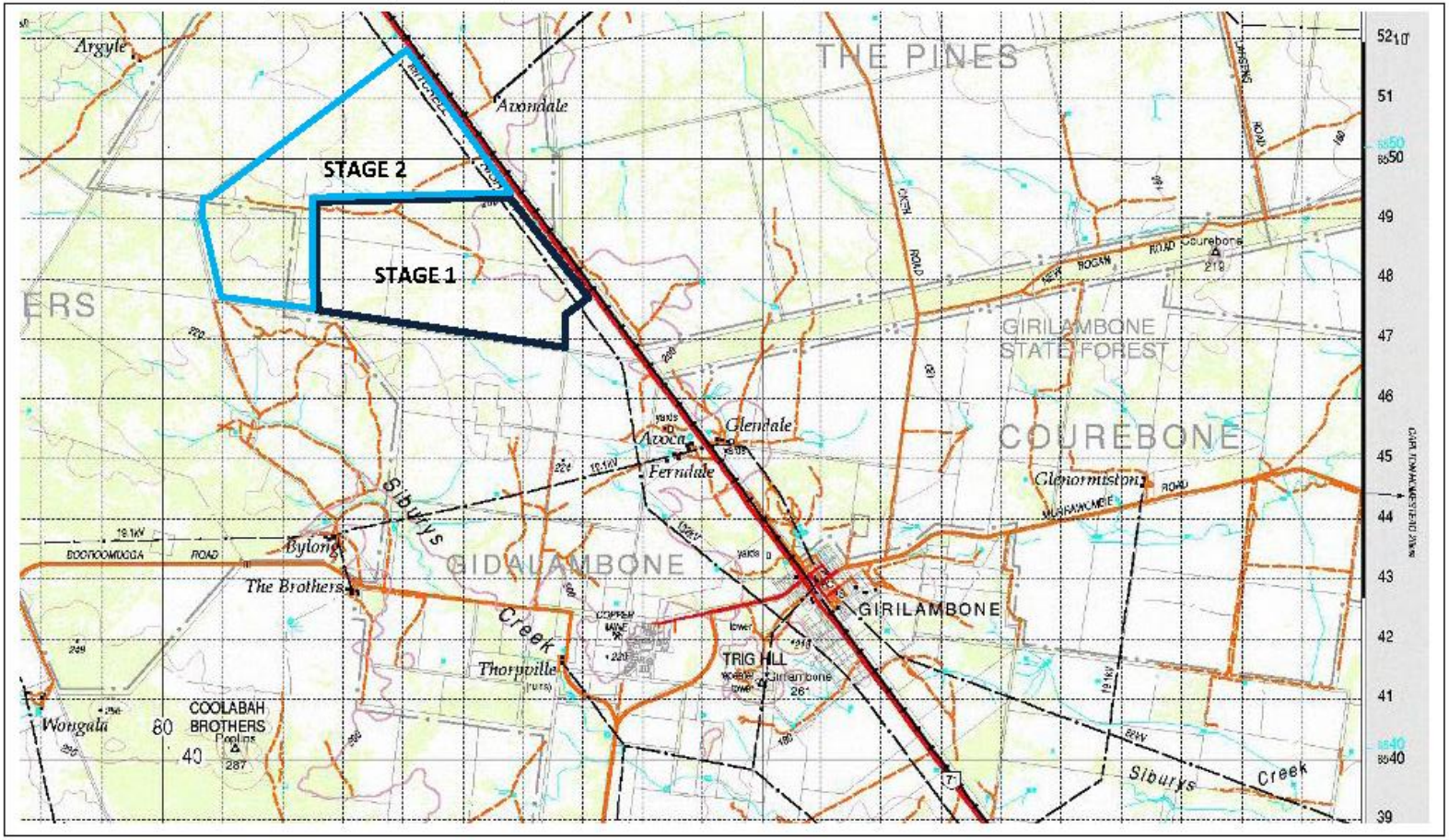
At the time of the surveys and assessments, the combined assessment areas of Stage 1 and 2 was 18.62km^2, slightly more than the current Project Site described in **Section 1.1** and shown in **Figure 1.1.** The Stage 1 Avoca Tank assessment area covered approximately 8.72km^2 across part of Lots 10, 135 and 144 (DP 751315) and the Stage 2 assessment area covered approximately 9.90 km^2 across part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315). The Avoca Tank assessment areas (Stages 1 and 2) are situated on the Coolabah 8235 1:100,000 map sheet and a map showing their location is shown in **Figure 1.3**.

1.4 PERSONNEL AND AUTHORSHIP

Gerard Niemoeller Principal Heritage Consultant of On Site CHM managed the project and led the research, fieldwork and preparation of this assessment report. Craig Reid, Assistant Archaeologist OSCHM assisted in the field work for Stage 1 and, Kate Duca Assistant Archaeologist On Site CHM assisted in the field work for Stage 2. David Tutchener, Archaeologist of On Site CHM undertook background research and prepared sections of this report.

Gerard Niemoeller conducted the Aboriginal consultation process in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010*. Paul Calvin of Straits Resources (Tritton) has also consulted with the Registered Aboriginal Parties about this Proposal and assessment.

Figure 1.3: Avoca Tank assessment area (18.62km^2) assessed by On Site CHM (Stages 1 and 2). Stage 1 assessment area (8.72km^2) across part of Lots 10, 135 and 144 (DP 751315) is shown in the dark blue polygon. The Stage 2 assessment area is shown in the light blue polygon (9.90 km^2), across part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet.



2.0 METHODOLOGY

2.1 ABORIGINAL CULTURAL HERITAGE

Aboriginal or Indigenous cultural heritage is a broad and complex concept and encompasses both tangible and intangible aspects relating to Aboriginal Culture, Country and People.

The language for defining and describing Aboriginal cultural heritage (places, sites / archaeological sites, items and objects) is also often complex. The terms and definitions applied for describing Aboriginal cultural heritage varies between Federal, State and Local Government legislation and policy. The language and description applied in studies will not only commonly vary in response to jurisdictions, legislation and policy, but also between disciplines and practitioners in response to range of factors.

To provide some consistency and clarity for the reader this study applies the terms 'Aboriginal heritage places and values' in accordance with the Australia ICOMOS Burra Charter (Marquis-Kyle, P & M. Walker 2004). The *Burra Charter* definition of 'place' includes locations that embody spiritual value (such as Dreaming places, sacred landscapes, and stone arrangements), social and historical value (such as massacre sites), as well as scientific value (such as archaeological sites or objects). In fact, one place may be all of these things or may embody all of these values at the same time. (Practice Note: The Burra Charter and Indigenous Cultural Heritage Management)

In this study and relevant to NSW, use of the term 'place' includes the Aboriginal places, objects, sites and items within the meaning of the *NSW National Parks and Wildlife Act* and associated policy and relevant NSW *Local Environment Plan*. Information about Aboriginal places and objects is registered on the Aboriginal Heritage Information Management System or AHIMS register which commonly refers to 'sites'. Use of the terms sites and objects specifically relate to interpretation of the *NSW National Parks and Wildlife Act* and associated policy.

The values of a place refer to their cultural significance. The Burra Charter defines cultural significance as meaning aesthetic, historic, scientific, social or spiritual for past present or future generations (Marquis-Kyle, P & M. Walker 2004:11).

2.2 STATUTORY AND POLICY FRAMEWORK

Primary protection of Aboriginal heritage places and values in NSW is established at the State level under the *NSW National Parks and Wildlife Act* and information about Aboriginal places and objects is registered on the AHIMS register.

Aboriginal heritage may however also be protected under Commonwealth, additional NSW State and Local Government legislation and included on various databases. Commonwealth

legislation protecting Aboriginal cultural may include *the Environment Protection and Biodiversity Conservation Act (EPBC Act)* and the *Aboriginal and Torres Strait Islander Heritage Protection Act (ATSIHPA).* The Australian Heritage Database contains information about places nominated, under assessment or included on the World, National or Commonwealth Heritage lists and the Register of the National Estate.

In NSW Aboriginal heritage may also be protected under the *NSW Heritage Act* or the *Local Environment Plan* respectively. The NSW State Heritage Inventory or database contains information about heritage places and items on statutory lists in NSW. Relevant registers (Australian heritage database, NSW Heritage database and local heritage inventory) were searched as part of the due diligence process and the results are discussed below.

The Avoca Tank Project Site and any place or feature within is not nominated, under assessment or listed, or subject to relevant processes for the identification and protection of Aboriginal cultural heritage values under EPBC Act, NSW Heritage Act or Local Environment Plan.

2.2.1 NSW National Parks and Wildlife Act

The Director General of the Office of Environment and Heritage (OEH) is responsible for protecting and conserving Aboriginal objects and declared Aboriginal places in NSW protected under the *NSW National Parks and Wildlife Act*.

Aboriginal objects are defined in NPW Act as any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Aboriginal places are defined in NPW Act as a place declared under s.84 of the NPW Act that, in the opinion of the Minister, is or was of special significance to Aboriginal culture. Such areas need not contain any Aboriginal objects but can only be gazetted with the approval of the Minister.

Part 6 of the *National Parks and Wildlife Act 1974* (NPW Act) provides specific protection for Aboriginal objects and declared Aboriginal places by establishing offences of harm. Harm is defined to mean destroying, defacing, damaging or moving an object from the land. There are a number of defences and exemptions to the offence of harming an Aboriginal object or place. One of the defences is that the harm was carried out under an Aboriginal Heritage Impact Permit (AHIP).

This assessment is being undertaken in accordance with relevant OEH policy and against the requirements of:

- *Aboriginal cultural heritage consultation requirements for proponents 2010*
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*
- *Guide to investigation, assessing and reporting on Aboriginal Cultural heritage in NSW*

2.3 STUDY METHODLOGY

This Aboriginal Cultural Heritage Assessment has included:

- Consultation with the Aboriginal Community to: identify Aboriginal traditional owners, elders and custodians who can speak about the assessment area; ascertain their views about the cultural significance of identified Aboriginal heritage places and values; identify whether there are particular research themes or questions of interest that could be incorporated into any research design or addressed through archaeological assessment.
- An AHIMS database search to identify previously recorded Aboriginal sites and objects within or within proximity to the Study Area.
- Review of AHIMS Site cards to provide archaeological context for the assessment of the Study Area.
- Review of other relevant heritage registers and databases (such as the Australian Heritage Database, NSW State Heritage Register and Inventory, Bogan Local Heritage Register).
- Review relevant cultural heritage and archaeological reports to provide a regional and local context for the assessment of the Study Area and Aboriginal places and values.
- A description of the environmental context of the Study Area as an explanation of the relevant resource structure and to aid the development of predictions.
- Development of predictions concerning the archaeological potential within the Study Area.
- Conduct a site assessment/archaeological survey in partnership with the Aboriginal community to record and document information about Aboriginal places relevant to determining and assessing the cultural heritage significance.
- Relocation of previously recorded Aboriginal places, sites and objects (if appropriate or possible).
- Preparation of this report documenting the results of the above processes, assessing the significance of identified places and formulation of management strategies.

3.0 ABORIGINAL COMMUNITY AND CONSULTATION

3.1 Aboriginal People in the Bogan Shire

The Avoca Tank study area falls within the boundaries of the Nyngan Local Aboriginal Land Council. According to Tindale (1974) the Girilambone and study area and falls within the boundaries of the Wongaibon Aboriginal people.

The study area is also within land under the Ngemba/Ngiyampaa Native Title Claim. A copy of relevant claim details was provided by the National Native Title Tribunal and is included in **Appendix 1.**

On Site Cultural Heritage Management and Straits Resources have consulted with NTS Corp in relation to the Native Title application for the Ngemba/Ngiyampaa People (Federal Court number: NSD415/12, NNTT number: NC12/1) throughout the assessment processes. Consultation against the *Aboriginal cultural heritage consultation requirements for proponents 2010* is documented in **Section 3.3**

3.2 Aboriginal history

This section will outline the Aboriginal occupation of the region by drawing on available historical, ethno-historical and anthropological records of the Ngiyampaa Wangaaypuwan (Wongaibon) Aboriginal people and their neighbours.

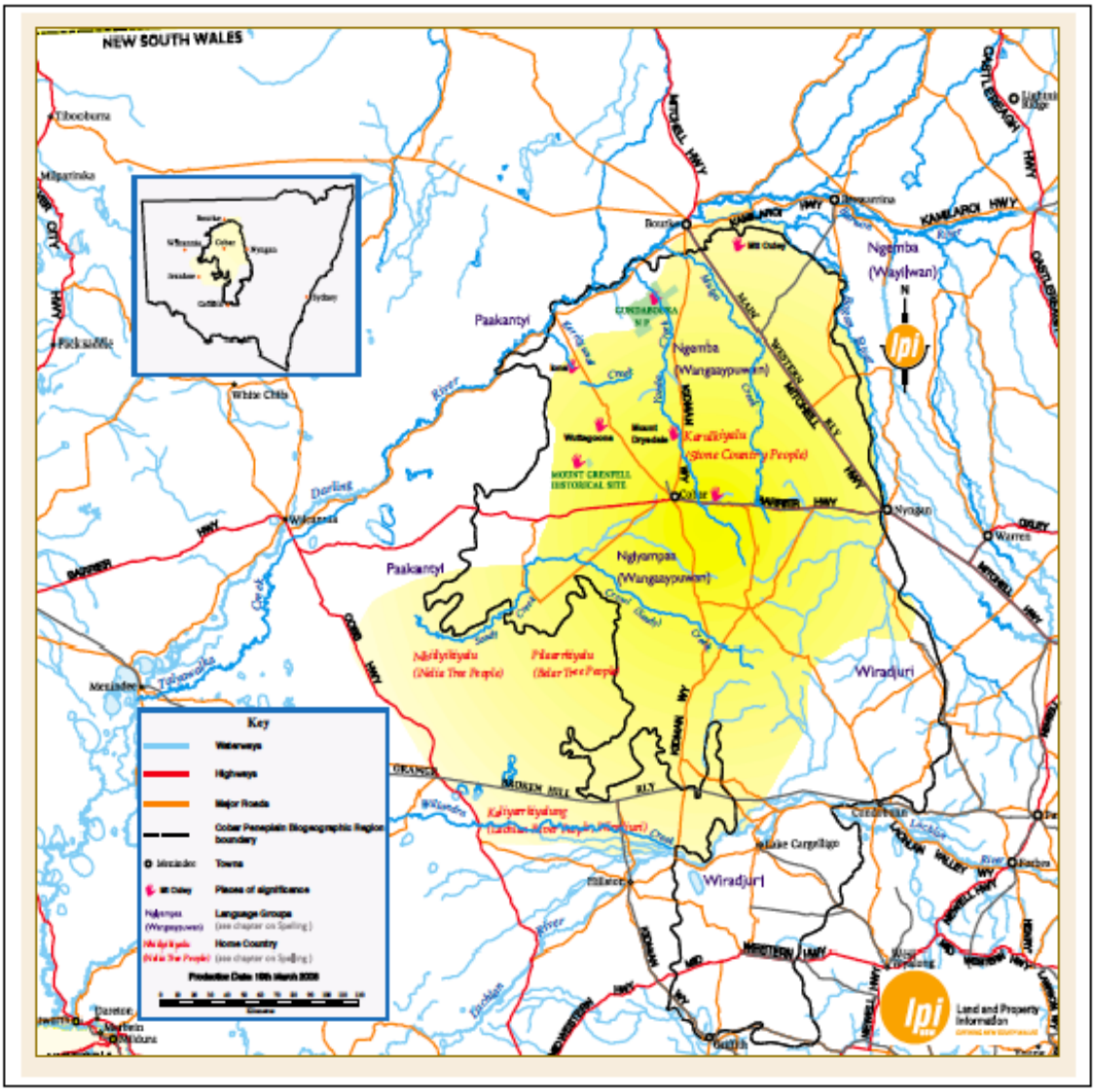
The Ngiyampaa Wangaaypuwan people are associated with the country roughly bounded in the north by the Darling-Barwon and Bogan Rivers, and in the south by the Lachlan River (Beckett et al, 2003) (See **Figure 3.3.1**). Ngiyampaa is a Pamu-Nyungan language of the Wiradhuric subgroup that once dominated the central highlands of the New South Wales. Ngiyampaa is also the word used to identify its speakers in this case, the Ngiyampaa Wangaaypuwan people. They distinguish themselves from other language groups in the area, these being the Ngemba, the Wiradjuri and the Paakantkji people.

Historical sources indicate that the European recording of the Ngiyampaa Wangaaypuwan and the consequent confusion in spelling causes some difficulty for the researcher. Other names for this group include Wongaibon, Wongai-bun, Wonghibone, Wonjhibon, Wonjibone, Wongi-bone, Wonghi, Wungai, Wuzai and Wozai (Tindale, 1974). Research (Donaldson, 1984) indicates that Wangaaypuwan is a way of speaking Ngiyampaa and differentiates them from other Ngiyampaa people in the area. Wangaaypuwan is comprised of the word 'Wangaay' and means the people who use 'Wangaay' for the word 'no' (Beckett et al, 2003). Ngiyampaa people also defined their identity by the type of country they occupied. For example the Ngiyampaa Wangaaypuwan people were stone country people whereas pilarr-kiyalu or Belar tree people lived near Willandra Creek. Donaldson (1997) has made a detailed comparison of

the Ngiyampaa place names and their anglicized equivalents. This study also includes further

details of the language and how it utilizes names to structure and communicate aspects of the Ngiyampaa Wangaaypuwan's knowledge about and relationships to the land (Donaldson, 1997).

Figure 3.1: Ngiyampaa Wangaaypuwan country (from Beckett, et al 2003:7)



Traditionally the Ngiyampaa Wangaaypuwan people were organized as a matriarchal society with men moving to live with the bride's family group after marriage. There were also strict laws regarding organized marriage and not marrying within your own 'meat', or family group. According to Fred Biggs who was interviewed by Jeremy Beckett the Ngiyampaa Wangaaypuwan people's religion centred on the sky world inhabited by a creator Baiami and his law was used in initiation and marriage ceremonies (Beckett, 1994). A particular aspect of the Baiami belief system was the role of the 'clever men' who were mortal men who were

able to perform extraordinary feats. Exploits included such things as travelling long distances and being able to project long strings from their testicles, from which they were able to project themselves into the sky world and make rain (Beckett, 1994).

It is recorded that The Bogan River Wiradjuri, the Ngiyampaa Wangaaypuwan's eastern neighbours suffered significant conflict with early white settlers in the region. The early contact history in this region from 1835 to the 1920's is characterized by conflict between indigenous people and white settlers regarding land use (Native Title Tribunal, 1998). The penalties for Indigenous people attacking stock, or indeed settlers, were in many cases extreme. In 1824, Aboriginal resistance to pastoralism west of the Great Dividing Range was met with a proclamation of martial law, the NSW colonial government's strongest military response to pastoralist complaints (Harrison, 2004). Even still by 1846–49, there were 1866 squatters' runs in New South Wales and from 1860 to 1890 the success of the colonies' wool industry accompanied intensified European land use (Roberts, 1970: 362).

The transportation of convict labour to NSW ended in during the 1840s, and the discovery of gold in the 1850s produced an employment gap in the pastoral industry that was met by Indigenous men and women (See Figure 2.**2**) (Harrison, 2004).

The work itself was often only seasonal and mostly poorly paid. Often after time pastoralists came to appreciate the in depth Indigenous knowledge of the land including water sources, which made it possible to transport stock over long distances. In later years, as more European workers became available, pastoralists reduced the cash component of Aboriginal workers' wages to virtually nothing, or entrapped it in the accounts book of the property store (Goodall, 1995).

Figure 2.2: W H Watts, 'Aboriginal workers, Willandra Station, Hillston area, New South Wales', c 1880. (Harrison, 2004: 33)

By the 1930s, in most parts of NSW nearly all of the Indigenous pastoral workers were either fringe dwellers or 'clients' of the Aborigines Protection Board (Harrison, 2004). This was due to number of factors including; The Soldier Settlement Scheme which was used as a way of settling returned soldiers in the country after both world wars, and the simple fact that family sized blocks of land needed less people to work them than the larger pastoral properties had done in earlier periods (Brock, 1995). With the introduction of various technologies by the 1950's the swathes of jobs were lost in both the agricultural and pastoral industries, for example mechanized harvesters, the widespread use of motorbikes instead of horses and road trains eliminated the need for droving almost completely.

3.3 Aboriginal Community Consultation

The Aboriginal Consultation for this assessment has been conducted in accordance with the consultation processes set out in the OEH policy *Aboriginal cultural heritage consultation requirements for proponents 2010.*

According to the *Aboriginal cultural heritage consultation requirements for proponents 2010* (Section 1.1, pg 1) the purpose of the document is to establish the requirements for consultation with the registered Aboriginal parties as part of the heritage assessment process to determine potential impacts of proposed activities on Aboriginal objects and places and to inform decision making for any application for an AHIP.

The aim is to facilitate positive Aboriginal cultural heritage outcomes by:

- Affording an opportunity for Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal objects(s) and/or place(s) in the area of the proposed project to be involved in consultation so that information about cultural significance can be provided to OEH to inform decisions regarding applications for an AHIP.

- Providing Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal objects (s) and/or place(s) in the area of the proposed project with the opportunity to participate in decision making regarding the management of their cultural heritage by providing proponents information regarding cultural significance and inputting into management options.

The requirements set out a 4 stage consultation process (see attached summary) designed to feed into the assessment process and establish a timeframe of 84 days to progress through the 4 stages. The timeframes are documented against the stages in the table below. **Please note this is a simplified outline of the requirements.** A full version of the requirements can be downloaded at the OEH website:
www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf

STAGE	MANDATORY TASKS FOR CONSULTATION STAGES	MIN REVIEW PERIOD
Stage 1:	***(Section 4.1.2) Notification of project proposal*** Proponents required to identify Aboriginal persons who may hold cultural knowledge relevant to determining the significance of any Aboriginal places and objects within the study area by corresponding with 7 organisations as stipulated in requirements.	14 days
	(Section 4.1.3) Registration of Interest Advertise in the local newspaper Write to identified Aboriginal organisations or individuals and provide opportunity to register their interest to be consulted about the project and AHIPs (Registered Aboriginal Parties)	14 days
Stage 2	***(Section 4.2) Presentation of information about the proposed project*** Provide information and methodology for the project to the Registered Aboriginal Parties	28 days
Stage 3	***(Section 4.3) Gathering information about cultural significance*** Gather and document information about cultural significance of places and objects through consultation (conducted concurrently with Stage 2)	
Stage 4	***(Section 4.4) Review of draft cultural heritage assessment report*** Incorporate information obtained in Stages 2 & 3 into draft Aboriginal heritage assessment report. Distribute draft Aboriginal heritage assessment report to Registered Aboriginal parties for review and incorporate any further input or comments.	28 days

Aboriginal consultation for Avoca Tank Study Areas (Stages 1 and 2) was conducted as part fo the assessment process. Aboriginal community consultation process Stages 1 – 4 (consistent with that discussed in **Section 3.2** above) was conducted for the Avoca Tank Stage 1 Study Area between March and August of 2012.

The Aboriginal community consultation process was conducted for the Avoca Tank Stage 2 Study Area between September 2012 and January of 2013. The record of consultation for the Avoca Tank assessments for Stages 1 and 2 and demonstration of compliance with the requirements is detailed below in **Sections 3.3.1** and **3.3.2**

3.3.1 Aboriginal Community Consultation: Avoca Tank Study Area – Stage 1

Stage 1 (Section 4.1.2)

In accordance with Stage 1 (Section 4.1.2) of the requirements On Site CHM wrote to the below organisations on 19 March 2012 to identify Aboriginal persons who may hold cultural knowledge relevant to determining the significance of the Avoca Tank Study Area and any Aboriginal values that may be located within. Closing date for replies was 3 April 2012.

a) Office of Environment and Heritage EPRG regional office, North West Dubbo.
b) Nyngan Local Aboriginal Land Council.
c) The Registrar, *Aboriginal Land Rights Act 1983* for a list of Aboriginal owners.
d) The National Native Title Tribunal for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements.

e) Native Title Services Corporation Limited (NTSCORP Limited).
f) Bogan Shire Council, Nyngan.
g) Central West Catchment Management Authority, Nyngan for contact details of any established Aboriginal reference group.

Four responses were received from organisations (a), (b), (d) and (f) by close of comments on 3 April. Joedie Davis of CMA replied on 5 April following the close of comments. The only additional Aboriginal party identified by the CMA (other than OEH) not identified in correspondence from organisations (a), (b), (d) and (f) was that of Raylene Weldon.

The Aboriginal persons and organisations identified as potentially holding cultural knowledge relevant to determining the significance of Aboriginal values within the Avoca Tank Study Area are shown below in **Table 2.1**.

Table 2.1: Aboriginal persons and organisations identified during stage 4.1.2 of the *Aboriginal cultural heritage consultation requirements for proponents 2010*

Aboriginal Organisation / Individual Name	Address	Contact Details
Bogan Aboriginal Corporation CEO Lesly Ryan	46 Nymagee St NYNGAN NSW 2825	boganac@netxp.com.au Ph: (02) 6832 1750 M: 0419418851
Nyngan Local Aboriginal Land Council / Vaneta Dutton CEO	PO Box 43 NYNGAN NSW 2825	nynganlalc@bigpond.com
Marra Wallan Pty Ltd Mr John Shipp CEO	PO BOX 6088 Dubbo NSW 2830	John@marrawallan.com.au john.shipp@bigpond.com
NTS Corp Ltd on behalf of Native Title application for the Ngemba/Ngiyampaa People (Federal Court number: NSD415/12, NNTT number: NC12/1) and Native Title applicants: Mrs Elaine Ohlsen Mr Peter Williams Mr Brett Smith Ms Danielle Flakeler-Carney Mr Neville Merritt Mr Edward Shipp Mr John Shipp Ms Grace Gordon Mr Jason Ford (identified by National Native Title Tribunal)	NTSCORP Ltd Unit 1a Suite 2.02, 44-70 Rosehill Street REDFERN NSW 2016	Phone: (02) 9310 3188 Fax: (02) 9310 4177 tlawrence@ntscorp.com.au nkim@ntscorp.com.au
Raylene Weldon Aboriginal Community member		raylene.weldan@det.edu.nsw.gov.au

Stage 1 (Section 4.1.3)

On Site CHM wrote to identified Aboriginal persons and organisations listed in Table 2**.1** on 4 April 2012 inviting them to register their interest by 19 April 2012 (**Appendix 1**).

In accordance with Section 4.1.3 of the consultation requirements a notice inviting registrations of interest and participation in the community consultation process also appeared in the Public Notices of the Nyngan Observer on Wednesday 4 April 2012. A copy of the advert is included below. Respondents were asked to register their interest by 19 April 2011 (**Appendix 1**).

Aboriginal Cultural Heritage Assessment

Tritton Resources Limited Pty proposes to undertake mineral exploration within part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The project area is approximately 4 kilometres northwest of the town of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire.

Pursuant to *Aboriginal cultural heritage consultation requirements for proponents* and *National Parks & Wildlife Act 1974*, Aboriginal people holding cultural knowledge relevant to determining the significance of the subject land or Aboriginal objects within are invited to register interest and participate in a community consultation process.

The purpose of this consultation is to assist the proponent undertake an Aboriginal cultural heritage assessment, prepare an Aboriginal Heritage Impact Permit application if required and assist the Director General of OEH consider and make a determination of the application. Please register your interest by 19 April 2012.

Gerard Niemoeller
On Site Cultural Heritage Management
PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
Ph: 0414441896

Below is a list of Aboriginal persons and organisations who registered their interest in response to the correspondence and advertisement in the paper to participate in the community consultation process (Registered Aboriginal Parties).

1. Bogan Aboriginal Corporation - Lesly Ryan, (via email)
2. Nyngan Local Aboriginal Land Council - Vaneta Dutton CEO (via email)
3. Marra Wallan Pty Ltd – John Shipp, CEO (via email)
4. Native Title Services for Ngemba/Ngiyampaa Claimants

Stage 2 (Section 4.2) and Stage 3 (section 4.3)

In accordance with Stage 2 (Section 4.2) and Stage 3 (section 4.3) of the *Aboriginal cultural heritage consultation requirements for proponents 2010* information about the proposed project, assessment methodology and request for information about the significance of this place was sent to the Registered Aboriginal parties on 24 April 2012 (**Appendix 1**). Respondents were asked to provide their input by 23 May 2012.

In accordance with Section 4.2.4(b) of the requirements and as part of the Aboriginal Cultural Heritage Assessment, the Registered Aboriginal parties (1, 2 and 3) were invited by Tritton Resources to participate in fieldwork between 26 - 30 April 2012.

Representatives of the Nyngan Local Aboriginal Land Council (Sheila Couley) and Bogan Aboriginal Corporation (Lesly Ryan) participated in an archaeological survey of the Avoca Tank Study Area area (Stager 1) between 26 and 30 April. Both Nyngan Local Aboriginal Land Council and Bogan Aboriginal Corporation are Registered Aboriginal Parties and participating in the formal consultation process. John Shipp of Marra Wallan was unable to participate in the fieldwork.

During the fieldwork the significance and management of all Aboriginal places were discussed with representatives of the Nyngan Local Aboriginal Land Council and Bogan Aboriginal Corporation (See **Section 9.0**).

It was also discussed that should the proposal shift from exploration to mining that AHIPs may be sought by Tritton Resources Pty Ltd to disturb the identified Aboriginal sites and objects.

The Registered Aboriginal Parties did not submit any written information or comments in response to documentation provided as part of Stage 2 or 3.

Stage 4 (Section 4.4)

A draft of the Stage 1 assessment report was sent to the registered Aboriginal parties on 26 July 2012. The Registered Aboriginal parties were provided 28 days to review the report and provide comment. The closing date for comments is 23 August 2012.

The Registered Aboriginal Parties did not submit any written information or comments about the draft assessment.

All correspondence documenting the consultation process for the Stage 1 Study Area is provided in **Appendix 1.**

3.3.2 Aboriginal Community Consultation: Avoca Tank Study Area – Stage 2

Stage 1 (Section 4.1.2)

In accordance with Stage 1 (Section 4.1.2) of the requirements On Site CHM wrote to the below organisations on 12 September 2012 to identify Aboriginal persons who may hold cultural knowledge relevant to determining the significance of the Avoca Tank Study Area and any Aboriginal values that may be located within. Closing date for replies was 27 September 2012.

a) Office of Environment and Heritage EPRG regional office, North West Dubbo
b) Nyngan Local Aboriginal Land Council
c) the Registrar, *Aboriginal Land Rights Act 1983* for a list of Aboriginal owners
d) the National Native Title Tribunal for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements
e) Native Title Services Corporation Limited (NTSCORP Limited)
f) Bogan Shire Council, Nyngan
g) Central West Catchment Management Authority, Nyngan for contact details of any established Aboriginal reference group

Five responses were received from organisations (a), (b), (c), (d) and (e) by close of comments on 27 September. The Aboriginal persons and organisations identified as potentially holding cultural knowledge relevant to determining the significance of Aboriginal values within the Avoca Tank Study Area are shown below in **Table 3.2**.

Table 3.2: Aboriginal persons and organisations identified during stage 4.1.2 of the *Aboriginal cultural heritage consultation requirements for proponents 2010*

Aboriginal Organisation / Individual Name	Address	Contact Details
Bogan Aboriginal Corporation CEO Lesly Ryan	46 Nymagee St PO Box 345 NYNGAN NSW 2825	boganac@netxp.com.au Ph: (02) 6832 1750 M: 0419418851
Nyngan Local Aboriginal Land Council / Vaneta Dutton CEO	PO Box 43 NYNGAN NSW 2825	nynganlalc@bigpond.com
Marra Wallan Pty Ltd Mr John Shipp CEO	79 Thompson Street / PO BOX 6088 Dubbo NSW 2830	John@marrawallan.com.au john.shipp@bigpond.com
NTS Corp Ltd on behalf of Native Title application for the Ngemba/Ngiyampaa People (Federal Court number: NSD415/12, NNTT number: NC12/1) and Native Title applicants: Mrs Elaine Ohlsen Mr Peter Williams Mr Brett Smith Ms Danielle Flakeler-Carney	NTSCORP Ltd Notifications Officer PO Box 2105 STRAWBERRY HILLS NSW 2012. Unit 1a Suite 2.02, 44-70 Rosehill Street REDFERN NSW 2016	Phone: (02) 9310 3188 Fax: (02) 9310 4177

Mr Neville Merritt Mr Edward Shipp Mr John Shipp Ms Grace Gordon Mr Jason Ford (identified by National Native Title Tribunal)		
Trevor Robinson	PO Box 73, Peak Hill NSW 2869	
Wiradjuri Interim Working party	PO Box 73, Peak Hill NSW 2869	

Stage 1 (Section 4.1.3)

On Site CHM wrote to identified Aboriginal persons and organisations listed in **Table 2.2** on 9 October 2012 inviting them to register their interest by 24 October 2012 (**Appendix 2**).

In accordance with Section 4.1.3 of the consultation requirements a notice inviting registrations of interest and participation in the community consultation process also appeared in the Public Notices of the Nyngan Observer on Wednesday 10 October 2012. Copy of the advert is included below (see below). Respondents were asked to register their interest by 24 October 2012 (**Appendix 2**).

Aboriginal Cultural Heritage Assessment

Tritton Resources Limited Pty proposes to undertake mineral exploration within part of Lots 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The Avoca Tank (Stage 2) project area is approximately 9 kilometres northwest of the town of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire.

Pursuant to *Aboriginal cultural heritage consultation requirements for proponents* and *National Parks & Wildlife Act 1974*, Aboriginal people holding cultural knowledge relevant to determining the significance of the subject land or Aboriginal objects within are invited to register interest and participate in a community consultation process.

The purpose of this consultation is to assist the proponent undertake an Aboriginal cultural heritage assessment, prepare an Aboriginal Heritage Impact Permit application if required and assist the Director General of OEH consider and make a determination of the application. Please register your interest by 24 October 2012.

Gerard Niemoeller
On Site Cultural Heritage Management
PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
Ph: 0414441896

Below is a list of Aboriginal persons and organisations who registered their interest in response to the correspondence and advertisement in the paper to participate in the community consultation process (Registered Aboriginal Parties).

1. Bogan Aboriginal Corporation - Lesly Ryan, CEO (via email).
2. Nyngan Local Aboriginal Land Council - Vaneta Dutton CEO (via email).
3. Native Title Services for Ngemba/Ngiyampaa Claimants – c/o Neville Kim.

Stage 2 (Section 4.2) and Stage 3 (section 4.3)

In accordance with Stage 2 (Section 4.2) and Stage 3 (section 4.3) of the *Aboriginal cultural heritage consultation requirements for proponents 2010* information about the proposed project, assessment methodology and request for information about the significance of this place was sent to the Registered Aboriginal parties on 26 October 2012 (**Appendix 2**). Respondents were asked to provide their input by 24 November 2012.

In accordance with Section 4.2.4(b) of the requirements and as part of the Aboriginal Cultural Heritage Assessment, the Registered Aboriginal parties (1, 2 and 3) were invited by Tritton Resources to participate in fieldwork survey from the 29th of October – 2nd of November 2012.

Representatives of the Nyngan Local Aboriginal Land Council (Sheila Couley) and Bogan Aboriginal Corporation (Lesly Ryan) participated in an archaeological survey of the Avoca Tank area between 29 October and 2 November 2012. Both Nyngan Local Aboriginal Land Council and Bogan Aboriginal Corporation are Registered Aboriginal Parties and participating in the formal consultation process. Neville Merritt of the Ngemba/Ngiyampaa Native Title claim group also participated in the fieldwork and survey on 1 – 2 November 2012. On November 1 Neville Merritt met with Sheila Couley (Nyngan Local Aboriginal Land Council) and Lesly Ryan (Bogan Aboriginal Corporation), Paul Calvin (Straits Resources) and Gerard Niemoeller and Kate Duca of On Site CHM. Paul Calvin and Gerard Niemoeller provided an overview of the survey and assessment process for the Avoca Tank project area. Results and identified places within the Avoca Tank Stage 1 study area were also discussed. The agenda and survey plan for following day was also discussed.

On Friday 2 November 2012, Neville Merritt was also shown the Avoca Tank Stage 1 study area surveyed in April 2012. We also visited sites Avoca Tank 1, 2 and 4. Management recommendations from the Stage 1 assessment were also discussed with Neville. Some lengthy discussion was had with the Aboriginal parties about the scar tree (Avoca Tanks 4) and the potential mine footprint. The mine footprint would largely be determined by the location and depth of the target ore deposit and whether the mine was proposed to be open cut or underground.

The Aboriginal parties agreed that if the tree needed to be moved it could and some preliminary strategies about any future potential removal and relocation were discussed. The

Aboriginal parties present expressed the opinion that the sensitive removal, conservation treatment, relocation and reinstatement at another location would be an acceptable outcome. The Registered Aboriginal parties would decide on an appropriate location for the relocation and reinstatement of the tree. On Site CHM explained that such a process would require an AHIP and a methodology for the removal, conservation and reinstatement would need to be developed as part of the AHIP application. A Care Agreement would also need to be developed as part of the AHIP application. Aboriginal parties present were satisfied with these discussions and generally in agreement with this management strategy if required.
The Registered Aboriginal Parties did not submit any written information or comments in response to documentation provided as part of Stage 2 or 3.

Stage 4 (Section 4.4)

A draft of this report was sent to the registered Aboriginal parties on 21st February 2013. The Registered Aboriginal parties were provided 28 days to review the report and provide comment. The closing date for comments was 22nd March 2013.

All of the registered parties supplied comment on the draft. Nyngan LALC and Bogan Aboriginal Corporation endorsed the assessment and resulting recommendations. A copy of these endorsement letters is included in **Appendix 2**.

Native Title Services Corporation, on behalf of the Ngemba/Ngiyampaa Native Title claim group, also provided comment on the assessment. A copy of the comments is also included at **Appendix 2** and a response to these comments is included in **Section 10.4**. NTS provided further response to these comments and these are also included at **Appendix 2**.

4.0 LANDSCAPE CONTEXT

According to the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010: 8), the purpose of reviewing the landscape context is to assist in the determination or prediction of:

- The potential of the landscape, over time, to have accumulated and preserved objects.
- The ways Aboriginal people have used the landscape in the past, with reference to the presence of resource areas, surfaces for art, other focal points for activities and settlement.
- The likely distribution of the material traces of Aboriginal land use based on the above.

Consideration of the landscape is essential to the definition and interpretation of Aboriginal land use across a landscape. The landscape will provide clues as to those areas of land that may have been more intensively used by Aboriginal people in the past, and also provide the context within which the material remains of past Aboriginal occupation may be preserved and detectable (DECCW 2010:8).

The landscape context should be appropriate in scale and detail relative to the study area and might include aspects relating to landscape history, description of landforms and geomorphic activity, soils, land use history and where relevant natural resources.

The archaeological record that we seek to understand is a reflection of Aboriginal land use and occupation. The archaeological potential of a given area will commonly be influenced by major factors such as access to potable water, stone resources suitable for the manufacture of stone tools, natural resources providing foodstuffs and other materials, shelter and suitable camping areas.

4.1 ENVIRONMENTAL CONTEXT OF THE AVOCA TANK STUDY AREA

Unless otherwise referenced the following environmental information is summarised from information supplied by Tritton from the Review of Environmental Factors for the Avoca Tank Project.

The Girilambone Region is classified as having a sub-arid climate with mean daily temperatures ranging between 19°C to 34°C in summer (January) and 4°C to 16°C in winter and with annual rainfall of approximately 445mm. The landscape around Girilambone consists of flat to gently undulating surfaces with extensive low lying ridges formed in response to the more resistant lithologies, such as quartzites and minor volcanic, formed throughout the region (Ackerman 2005:66). There are no major outcrops of these lithologies within the study area.

The desktop review indicates that there is very little topographic variation or relief within the Avoca Tank study areas (Stage 1 and Stage 2). Topographic maps show no rivers, creeks or permanent water holes and no potable water is readily available. Several dams are present but these are presumably from more recent times.

Most of the Stage 1 Study Area is dominated by a low rise extending east west. Broad and shallow drainage channels extend along the northern and southern margin of the rise. Several broad and shallow drainage channels also dissect the Stage 2 Study Area project and low rises in between. Drainage channels in the Stage 1 and 2 Study Areas are generally marked by dense white cypress regrowth. The drainage channels do not hold water or form formalised creeks at any point in the Study Areas and would only drain water during periods of heavy rains.

The Study Area appears to have been grazed heavily in the past. This is based on signs of disturbance including bare soil scalds, soil erosion, multi-stemmed Poplar Box trees (which have coppiced after ring barking or cutting off near the base) and patches of dense White Cypress pine regrowth. Minor areas occur as derived grassland, probably from more recent land clearing, while the entire Study Area was probably cleared at an earlier time based on the number of coppiced trees.

Geology

The Girilambone region is located within the western portion of the Lachlan Fold Belt. The district is underlain by the Girilambone Beds, a Cambro-Ordovician sequence of dominantly clastic rock types. Regionally, the Girilambone Beds consist of quartzofelspathic schist, phyllite, greywacke, slate, quartzite and minor altered basic volcanics and intrusives.

Within the vicinity of the Avoca Tank Project area, the Girilambone Beds include variably to well laminated psammopelites, pelites and greywackes lying stratigraphically above a thick sequence of mafic volcanics and intrusives. Strong magnetite minor sulphide alteration occurs on and above the contact zone and locally is well mineralised.

Landscapes

According to the landscape classification system described by Mitchell DECCW (2002) the Study Area falls within the Cobar Downs (Crd) landscape of the Cobar Peneplain Bioregion. The Cobar Downs landscape includes parts of seven land systems: *Cobar, Coolabah, Ironstone, Killala, Kopyje, Pirillie* and *Prattenville.*

According to Mitchell DECCW (2002:32) the Cobar Downs landscape is a landscape complex of slightly undulating rounded ridges and higher residuals of many Ordovician and Silurian sedimentary and metamorphic rocks, undulating rounded Devonian sandstone ridges or low plateau, rounded ridges with siliceous and ferruginous stones from Cretaceous or Tertiary conglomerates. Occasional overlying sand dune. Well defined dendritic drainage lines vary from broad to narrow, relief 10 to 20m. Scattered rock outcrop on ridges, stony surfaces

common on slopes. Shallow gravelly loamy soils, or ferruginous clay loam on ridges, grading to deeper acid and neutral red earths with hardpan down slope and calcareous red earths with areas of gilgai in drainage lines. Deep sands, sandy earths, and red earths on dunes.

Soils
Soils in the Girilambone area typically comprise sands, red-brown sandy gravels and colluvial soil. Around the minor rocky outcrops on the exploration site the soils are normally skeletal and on the hill flanks and plains, silty clays and sandy loams predominate.

Soils within the Study Area are classified within the Cobar land system and the Mineshaft land system. Soils of the Cobar land system comprise shallow gravelly loamy soils, grading to deeper acid and neutral red earths with hardpans downslope and in drainage lines. Soils of the Mineshaft land system comprise shallow stony, sandy and loamy soils that deepen slightly along drainage lines.

Soils within the Study Area are characterised by red earths. Very little topsoil remains, principally, as a result of poor farming practices, such as overgrazing. Gully erosion is evident on and surrounding the Avoca Tank Project area.

Vegetation Communities of the Study Area (Stages 1 and 2) can be characterized as woodland. The canopy trees are generally relatively young in age and most trees are coppiced confirming that broad scale clearing has occurred in the past. Vegetation of the study area is described as:

- **Canopy:** Dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and Gum Coolibah (*Eucalyptus intertexta*), with occasional Kurrajong (*Brachychiton populneus* subsp. *populneus*) with areas of dense White Cypress Pine regrowth.
- **Midstorey:** Dominated by Wilga (*Geijera parviflora*) and Emubush (*Eremophilia mitchellii*), with various Wattles (*Acacia* spp.) and Western Rosewood (*Alectryon oleifolius*). Poplar Box and Gum Coolibah saplings were quite common.
- **Groundcover layer**: Dominated by various native grasses, including Curly Windmill Grass (*Enteropogon acicularis*), Purple Lovegrass (*Eragrostis lacunaria*), Panic grass (*Panicum decompositum var. tenuius*), Knottybutt Grass (*Paspalidium constrictum*), Small Burrgrass (*Tragus australianus*), Five minute Grass (*Tripogon loliiformis*), plus various chenopods and herbs.

EnviroKey (2012) identified four vegetation communities within the study Avoca Tank Stage 1 and 2 Study Areas. A table showing identified vegetation communities is provided at Table 3.**1** and the spatial extent of vegetation communities described by EnviroKey is shown in Figure 4.1**4.1.**

Table 3.1: Native vegetation communities of the Study Area (Stages 1 and 2) (after EnviroKey 2012).

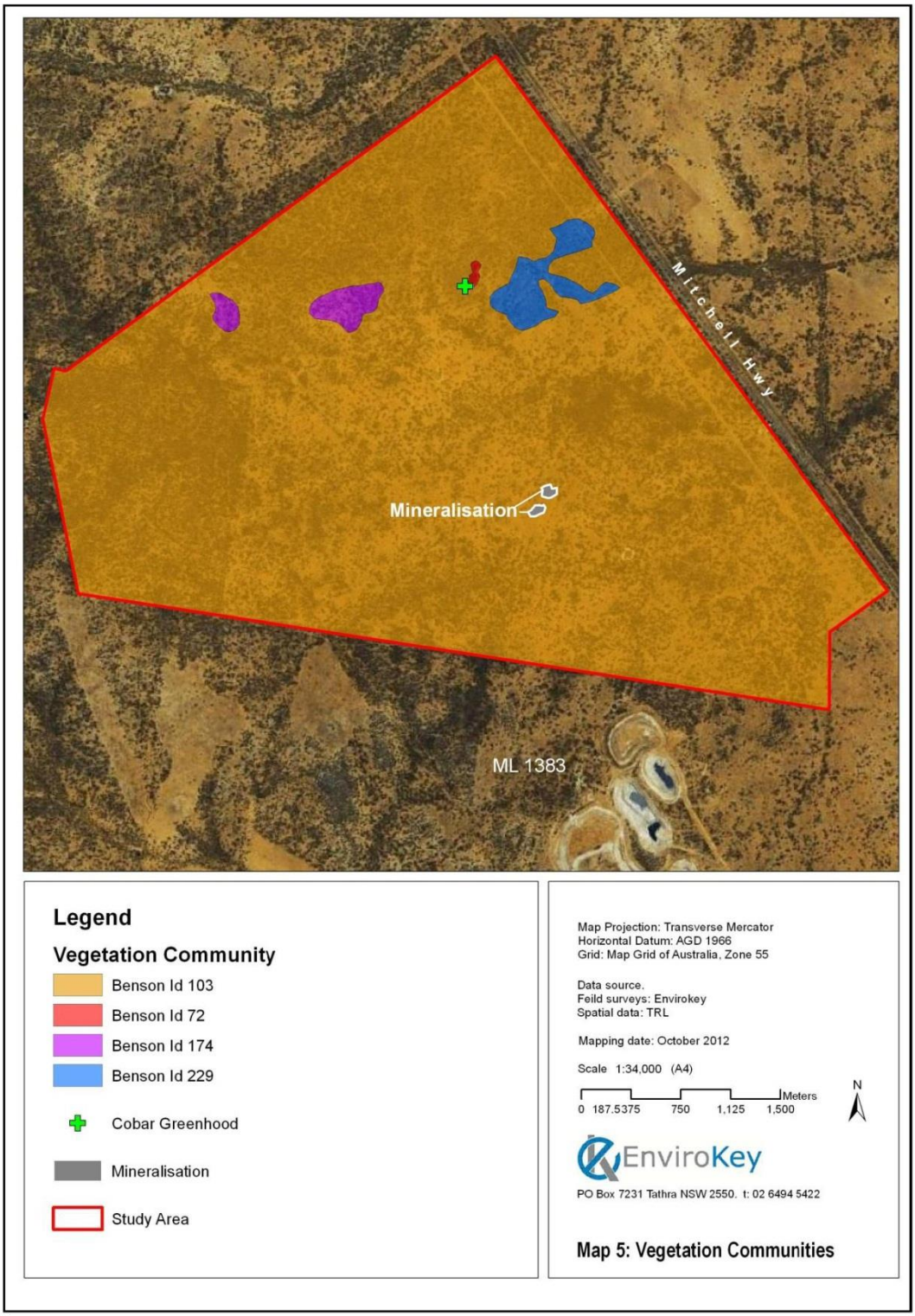
Vegetation Community Type	Extent within study area (ha)	Extent within study area (%)
Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion	1,749 ha	97.5 %
ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion	1.4 ha	0.08 %
ID 174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	17 ha	0.9 %
Benson ID 229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion	29 ha	1.6 %

The majority vegetation community (Benson ID 103) is described below. For additional vegetation descriptions please see EnviroKey (2012).

Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion

- This community comprised a woodland (occasionally an open woodland) and was generally dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and Gum Coolabah (*Eucalyptus intertexta*), with occasional Kurrajong (*Brachychiton populneus* subsp. *populneus*) and White Cypress Pine (*Callitris glaucophylla*) to 20m in height. In run-on areas, Gum Coolibah and White Cypress Pine dominated. Shrub cover ranged from sparse to dense, with the most dense cover occurring under canopy trees and/or in run-on areas. The most common shrub species were Wilga (*Geijera parviflora*), Budda (*Eremopholia mitchellii*), Western Golden Wattle (*Acacia decora*) and Ironwood (*Acacia excelsa*). Good rainfall in recent seasons supported a relatively high number and density of native groundcovers, including 20 grass species and various chenopods and herbs.
- Some variation in vegetation composition was evident within the study area, which generally is associated with subtle differences in topography. Run-on areas often had a relatively dense canopy/midstorey cover that was dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and/or White Cypress Pine (*Callitris glaucophylla*). Whereas, run-off areas generally had a sparser canopy/midstorey cover with Gum Coolabah (*Eucalyptus intertexta*) being a co-dominant with Poplar Box and only scattered White Cypress Pine. Historic disturbance factors probably played a role in this variation also (e.g. some run-on areas were covered with patches of very dense White Cyprus Pine regrowth). Despite this variation, vegetation composition and structure across the entire site aligned more closely to Benson ID 103 than any other vegetation communities described in that classification.

Figure 4.1: Native vegetation communities of the Study Area (reproduced from EnviroKey 2012).



4.2 EUROPEAN HISTORY AND LANDUSE

Early History

Charles Sturt first named the River Bogan in 1828, yet it was explorer and surveyor Major Mitchell who documented early European exploration of the Bogan region (Bogan Shire Council, 2012). Mitchell first surveyed the area in 1835 and many settlers came closely behind, but due to the resistance of the local indigenous groups many cattle runs were given up and later reclaimed by other graziers, making it difficult to record all the changes that occurred (Nyngan Historical Society, 1983). The European relationship with local indigenous groups on the lower Bogan River was strained by conflict and, as a result, and after multiple massacres and retaliations in the area the government cancelled a number of pastoral licenses in 1845 (About NSW, 2012). The area surrounding the Bogan River was difficult to settle in a number of ways as the early graziers of West Bogan County not only had difficulties attempting to subdue the local Indigenous groups, but they also suffered through anthrax outbreaks among their sheep and cattle herds, which devastated livestock numbers (Nyngan Historical Society, 1983). The Municipality of Nyngan was proclaimed on February 17, 1891 with Nyngan having a population of 1355, and in 1906 the Bogan Shire was incorporated.

History of the Avoca Tank Project Area

The subject land within the Avoca Tank Project area (Lots 10, 135 and 144 [DP 751315] or part of) are within the local government area of Bogan, Parish of Gidalambone within the county of Canbelego.

Investigation into the site history for the Avoca Tank project area is divided into two stages: Stage 1 (Lot 135 and subsequently 144 and 10) and Stage 2 investigations (Lot 3).

Stage 1 Study Area

An early Parish Map of Gidalambone indicates that the land units in the activity area of the Avoca Tank Project Stage 1 was marked as Lot 135 and was wholly owned by a Kenneth MacKinnon as early as 1910 and had a total area of 4087 acres (See **Appendix 3.1**). The Sydney Morning Herald on Tuesday 14 January 1919 notes that upon his death Kenneth McKinnon, grazier, bequeathed his property to his widow Catherine McKinnon and two sons Malcolm and Donald.

A later Parish Map in 1916 (See **Appendix 3.2**) indicates that the original Lot 135 was subdivided as early as 1907 into three parcels; Lot 10 (Acres 2563), Lot 135 (502 Acres) and Lot 144 (1022 Acres). Lot 144 was acquired by The Australian Bank of Commerce (See **Appendix 3.2**) and repurchased by at a later date by MacKinnon, Fuller and Lanson as illustrated by a 1937 parish map (See **Appendix 3.3**).
It would appear likely that the activity area under investigation was not only used for grazing purposes, but also for mining or at the very least mineral prospecting. The activity area, which

incorporates the Avoca Tank project area, is clearly marked as part of the Bogan Gold Fields on the map of West Bogan (See **Appendix 3.3**). It is also noted in a local history of the region (Heckendorf, K. 1980) that at Avoca, 3 miles NNW of Girilambone traces of gold were found.

It is also quite possible that the MacKinnon family (the name was most probably also spelt McKinnon) was related to the Alec McKinnon who held the licence for the Railway Hotel (also known as the Girilambone Hotel) from 1881 to 1921 (Heckendorf, K. 1980; 28).

Stage 2 Study Area

Is located to the south western corner of McKinnon's block, Lot 3 that comprises an area of 1575 acres is marked in 1910 as under the control of H. Thorpe, and may have utilized for mining purposes at some point (See **Appendix 3.1**). This block falls into a different parish division from the Stage 1 investigation and is included in the Parish of The Brothers. This is most likely the Henry Thorpe who also owned the block directly to the north of the activity area. A Parish map of the Brothers in 1911 (See **Appendix 3.4**) shows that this portion of the activity area was a Crown Lease under the name of J.H. Ferguson. Later maps of the Brothers Parish (See **Appendix 3.5** and **3.6**) indicated that Lot 3 was still listed under the name J.H. Ferguson in 1926 and 1957.

In 1900 the Girilambone Primary School photo (See Figure 4.2) a pupil named Mary Thorpe is listed as Mary Thorpe (McKinnon) of 'Glendale', most likely indicating a marriage later in life into the McKinnon family, perhaps coincidently there is a Tom McKinnon of 'Glendale' is also shown in the photo (Heckendorf, K. 1980; 48). 'Glendale' appears to be an agricultural property within Girilambone. It would also appear that both the Thorpe's and McKinnon's had a hand in the businesses of Girilambone in stores and hotels respectively (Heckendorf, K. 1980; 19).

It would appear that the Thorpe family had a substantial impact on the town of Girilambone as it is known that the 'Thorpe boys had a butchery and other retail based interests in the town' (Heckendorf, K. 1980; 17). It is also quite likely that William Henry Thorpe who was postmaster of Girilambone form 1921-24 was a descendant of Henry Thorpe (Heckendorf, K. 1980; 39).

4.3 LATER 20TH CENTURY LAND USE

The area of Bogan in the later 20th Century has been utilized mostly for agricultural purposes and mining. For instance during the 1980's the price of copper was pushed to record highs because of supply disruptions such as the Bougainville conflict. This stimulated the slackened local interest in copper exploration, and Nord Pacific Ltd commenced work aimed at bringing the old Girilambone copper mine back into production as an open cut mine (NSW DPI, 2007).

Figure 4.2: 1900 the Girilambone Primary School photo (Heckendorf, K. 1980; 48)

Girilambone School Pupils, 1900. Teacher, Mr Garland; Pupil Teacher, Miss Alice Funck. The photo and names by courtesy of Miss Annie Begg. Top Back Row: Katie Johnson (Murchison), Ada Payne (Robinson), Gertie Sinclair, Bill Gibson, Tom Begg and Joe Power at the end. The three boys at Katie Johnson's right-hand from L to R are Dave Gibson, Alex Milligan and Donald Murchison. In front of Katie Johnson myself Annie Begg, Ettie Sinclair and Laura Radburn (Robinson) and next to her is Lizzie Hansard (Murchison), Mary McDonald, Alice Eldridge and Mary Thorpe (McKinnon) of "Glendale". Next Row: Miss Alice Funck, pupil teacher; can't remember the boy's name in front of her; but the girl next to him is Gracie Lewis, next Dovie McDonald, Willie Rimmer, Emily Peacock, Nita Rimmer, Addie Hodder, Milly Gibson, Mary Sinclair, Jean Begg, but can't remember the next two girls. Next Row: Simple McDonald with black band on arm for her mother's death, next to her is Rose Power, Vera Egan, Gracie Davis, Ida Power (Mrs Vern Dicker) Maggie Gibson, Ruby Murchison (Williamson), Jim Robinson, Tom Murchison, Tom McKinnon of "Glendale", David Milligan, Walter Eldridge. Next Row: George Milligan, Harry Sinclair, Les Power, Bill Begg, Dave Garland (teacher's son), Bob Sinclair, Phil Carmichael, Harry Rimmer's brother and Jim Power.

The greater area of Nyngan has suffered from a number of major floods in the 1990's, in order to combat this a levee was built to protect against future flooding of the Bogan River (Bogan Shire Council, 2012).

4.4 SUMMARY CONCLUSIONS

The Avoca Tank Study Area (Stages 1 and 2) does not contain major sources of potable water likely to act as a foci point for Aboriginal occupation in the past. No major topographic relief, reflecting more resistant lithologies (such as quartzite and minor volcanic) is apparent in the Study Area. This is also likely to mean that stone outcrops suitable for the manufacture of stone tools may be scarce.

The integrity of the Study Area has been degraded due to previous land use and practices. Based on the number of coppiced trees the entire Study Area was probably cleared at an earlier time. Very little topsoil remains, principally, as a result of poor farming practices, such as overgrazing. Floods in the 1990's are also likely to have displaced, eroded or potentially obscured Aboriginal objects. These factors are likely to have had an effect on the visibility and integrity of any Aboriginal occupation material within the Study Area.

5.0 PREVIOUS ARCHAEOLOGICAL WORK

5.1 PREVIOUS STUDIES AND DISTRIBUTION OF SITES IN GIRILAMBONE AREA

A search of the Aboriginal Heritage Information Management System or AHIMS register was undertaken for a 10 EW x 10 NS kilometre area (100 km^2) surrounding the Avoca Tank Study Area. Table 4.**1** below shows the grid coordinates for the AHIMS register search. A total of 57 sites have been previously recorded within the 100 km^2 search area. Aboriginal sites identified by the AHIMS site register search are listed in Table 5.2 and shown in **Figure 5.1.** The results of the AHIMS site register search are provided in **Appendix 4**.

Table 4.1 - Minimum and maximum grid references employed for AHIMS register search

	Minimum	**Maximum**
Easting	55 478000	55 488000
Northing	6545000	6555000

Of the 57 previously recorded AHIMS sites a total of 11 sites have been previously recorded within the current Avoca Tank Study Area. Sites previously recorded within Study Area are listed in Table 5.3**3** and their distribution is shown in Figure 5.2**5.2**. The site cards for the 11 sites previously recorded within the Study Area are also provided in **Appendix 4**.

Table 5.2 – AHIMS Sites recorded in within 100km^2 search area. Grid references from AHIMS

SiteID	SiteName	Zone (AGD)	Easting	Northing	Site Features
26-3-0067	GM-HS-28_(Hearth);Girilambone Copper Mine;	55	484710	6547330	Earth Mound :Hearth : -
26-3-0068	GM-HS- 9_(Hearth);Girilambone Copper Mine;	55	484680	6547340	Earth Mound : -, Hearth : -
26-3-0070	GM-OS/HS- 1_(Hearth); Girilambone Copper Mine;	55	484760	6548100	Earth Mound : -, Hearth : -, Artefact : -
26-3-0071	GC-OS/HS-2_(Hearth); Girilambone Copper Mine;	55	484760	6548100	Earth Mound : -, Hearth : -, Artefact : -
26-3-0017	GC-ST-11; Girilambone Copper Mine;	55	485880	6545950	Modified Tree (Carved or Scarred) : -
26-3-0018	GC-ST-12;Girilambone Copper Mine;	55	485880	6545950	Modified Tree (Carved or Scarred) : -
26-3-0019	GC-ST-13;Girilambone Copper Mine;	55	485960	6546010	Modified Tree (Carved or Scarred) : -
26-3-0020	GC-ST-14;Girilambone Copper Mine;	55	485960	6546010	Modified Tree (Carved or Scarred) : -
26-3-0021	GC-ST-15;Girilambone Copper Mine;	55	485960	6546010	Modified Tree (Carved or Scarred) : -
26-3-0022	GC-ST-16;Girilambone Copper Mine;	55	485930	6545730	Modified Tree (Carved or Scarred) : -
26-3-0023	GC-ST-17;Girilambone Copper Mine;	55	486390	6545590	Modified Tree (Carved or Scarred) : -

SiteID	SiteName	Zone (AGD)	Easting	Northing	Site Features
26-3-0024	GC-ST-18;Girilambone Copper Mine;	55	486390	6545590	Modified Tree (Carved or Scarred) : -
26-3-0025	GC-ST-19;Girilambone Copper Mine;	55	486390	6545470	Modified Tree (Carved or Scarred) : -
26-3-0026	GC-ST-20;Girilambone Copper Mine;	55	486680	6545530	Modified Tree (Carved or Scarred) : -
26-3-0027	GC-CT/ST-20;Girilambone Copper Mine;	55	486650	6545500	Modified Tree (Carved or Scarred) : -
26-3-0028	GC-CT/ST-22;Girilambone Copper Mine;	55	486650	6545500	Modified Tree (Carved or Scarred) : -
26-3-0029	GC-ST-23;Girilambone Copper Mine;	55	487690	6545180	Modified Tree (Carved or Scarred) : -
26-3-0030	GC-ST-24;Girilambone Copper Mine;	55	487700	6545510	Modified Tree (Carved or Scarred) : -
26-3-0031	GC-ST-25;Girilambone Copper Mine;	55	485990	6545590	Modified Tree (Carved or Scarred) : -
26-3-0032	GC-ST-26;Girilambone Copper Mine;	55	485760	6546080	Modified Tree (Carved or Scarred) : -
26-3-0033	GC-ST-27;Girilambone Copper Mine;	55	484900	6545900	Modified Tree (Carved or Scarred) : -
26-3-0034	GC-OS-1;Girilambone Copper Mine;	55	484760	6548100	Artefact : -
26-3-0065	GM-HS-26_(Hearth);Girilambone Copper Mine;	55	486680	6545530	Earth Mound : -, Hearth : -
26-3-0066	GM-HS-27_(Hearth);Girilambone Copper Mine;	55	484630	6547340	Earth Mound : -, Hearth : -
26-3-0011	GC-ST-7;Girilambone Copper Mine;	55	485780	6544830	Modified Tree (Carved or Scarred) : -
26-3-0012	GC-ST-6;Girilambone Copper Mine;	55	485780	6544830	Modified Tree (Carved or Scarred) : -
26-3-0013	GC-ST-8;Girilambone Copper Mine;	55	486150	6545810	Modified Tree (Carved or Scarred) : -
26-3-0014	GC-ST-10;Girilambone Copper Mine;	55	485930	6546000	Modified Tree (Carved or Scarred) : -
26-3-0016	GC-ST-9;Girilambone Copper Mine;	55	485930	6546000	Modified Tree (Carved or Scarred) : -
26-3-0119	GC-OS-1	55	484760	6548100	Artefact : 1
26-3-0144	GC-HS-26	55	486680	6545530	Hearth : 1
26-3-0145	GC-HS-27	55	484630	6547340	Hearth : 1
26-3-0146	GC-HS-28	55	484710	6547330	Hearth : 1
26-3-0147	GC-HS-29	55	484680	6547340	Hearth : 1
26-3-0149	GC-OS-HS-1	55	484760	6548100	Hearth : 1
26-3-0155	GC-ST-6	55	485780	6544830	Modified Tree (Carved or Scarred) : 1
26-3-0156	GC-ST-7	55	485780	6544830	Modified Tree (Carved or Scarred) : 1
26-3-0157	GC-ST-8	55	486150	6545180	Modified Tree (Carved or Scarred) : 1
26-3-0158	GC-ST-9	55	485930	6546000	Modified Tree (Carved or Scarred) : 1
26-3-0159	GC-ST-10	55	485930	6546000	Modified Tree (Carved or Scarred) : 1
26-3-0160	GC-ST-11	55	485880	6545950	Modified Tree (Carved or Scarred) : 1
26-3-0161	GC-ST-12	55	485880	6545950	Modified Tree (Carved or

SiteID	SiteName	Zone (AGD)	Easting	Northing	Site Features
					Scarred) : 1
26-3-0162	GC-T-13	55	485960	6546010	Modified Tree (Carved or Scarred) : 1
26-3-0163	GC-ST-14	55	485960	6546010	Modified Tree (Carved or Scarred) : 1
26-3-0164	GC-ST-15	55	485960	6546010	Modified Tree (Carved or Scarred) : 1
26-3-0165	GC-ST-16	55	485930	6545730	Modified Tree (Carved or Scarred) : 1
26-3-0166	GC-ST-17	55	486390	6545590	Modified Tree (Carved or Scarred) : 1
26-3-0167	GC-ST-18	55	486390	6545590	Modified Tree (Carved or Scarred) : 1
26-3-0168	GC-ST-19	55	486390	6545470	Modified Tree (Carved or Scarred) : 1
26-3-0169	GC-ST-20	55	486680	6545530	Modified Tree (Carved or Scarred) : 1
26-3-0170	GC-CT/ST-21	55	486650	6545500	Modified Tree (Carved or Scarred) : 1
26-3-0171	GC-CT/ST-22	55	486650	6545500	Modified Tree (Carved or Scarred) : 1
26-3-0173	GC-ST-24	55	487700	6545510	Modified Tree (Carved or Scarred) : 1
26-3-0174	GC-ST-25	55	485990	6545590	Modified Tree (Carved or Scarred) : 1
26-3-0175	GC-ST-26	55	485760	6546080	Modified Tree (Carved or Scarred) : 1
26-3-0176	GC-ST-27	55	484900	6545900	Modified Tree (Carved or Scarred) : 1
26-3-0172	GC-ST-23	55	487690	6545180	Modified Tree (Carved or Scarred) : 1

Table 5.3: AHIMS Sites recorded in within the Avoca Tank Project Site. Grid references from AHIMS (Datum AGD)

AHIMS Site ID	Site Name	Easting	Northing	Site Features
26-3-0067	GM-HS-28JHearth Girilambone Copper Mine;	484710	6547330	Earth Mound, hearth
26-3-0068	GM-HS-29_(Hearth) ;Girilambone Copper Mine;	484680	6547340	Earth Mound, hearth
26-3-0070	GM-OS/HS-1JHearth);Girilambone Copper Mine;	484760	6548100	Earth Mound, hearth, artefact
26-3-0071	GC-OS/HS-2_(Hearth);Girilambone Copper Mine;	484760	6548100	Earth Mound, hearth, artefact
26-3-0034	GC-OS-1;Girilambone Copper Mine;	484760	6548100	Artefact : -
26-3-0066	GM-HS-27_(Hearth);Girilambone Copper Mine;	484630	6547340	Earth Mound, hearth
26-3-0119	GC-OS-1	484760	6548100	Artefact : 1
26-3-0145	GC-HS-27	484630	6547340	Hearth : 1
26-3-0146	GC-HS-28	484710	6547330	Hearth: 1

AHIMS Site ID	Site Name	Easting	Northing	Site Features
26-3-0147	GC-HS-29	484680	6547340	Hearth: 1
26-3-0149	GC-OS-HS-1	484760	6548100	Hearth : 1

Review of the AHIMS site cards and details reveals duplicate recordings of these sites and their features. This duplication is most evident in the site names and grid references but also in the descriptions and attached drawings. An examination of the site cards shows that the 11 sites are actually 5 sites with duplicate recordings. Table below shows these AHIMS sites re-organised accordingly. Site cards have been similarly organised and grouped in **Appendix 4**.

Table 5.4: AHIMS Sites recorded in within the Avoca Tank project area noting duplications. Grid references from AHIMS (Datum AGD)

AHIMS Site ID	Site Name	Easting	Northing	Site Features
26-3-0066 / 26-3-0145	GM-HS- 27_(Hearth); Girilambone Copper Mine;	484630	6547340	Earth Mound, hearth
26-3-0067 / 26-3-0146	GM-HS-28 Hearth Girilambone Copper Mine;	484710	6547330	Earth Mound, hearth
26-3-0068 / 26-3-0147	GM-HS-29_(Hearth); Girilambone Copper Mine;	484680	6547340	Earth Mound, hearth
26-3-0070 / 26-3-0071	GM-OS/HS-1 (Hearth); Girilambone Copper Mine;	484760	6548100	Earth Mound, hearth, artefact
26-3-0034 / 26-3-0119 26-3-0149	GC-OS-1; GC-OS-HS-1 Girilambone Copper Mine;	484760	6548100	Open Artefact scatter / Hearth

All but one of the 57 previously recorded sites were recorded by Central West Archaeological and Heritage Services. Annie Nicholson of National Heritage Studies also undertook two studies in the Girilambone Region in 1989 and 1990. Available reports are reviewed below. Tritton Resources supplied these reports, as none appear listed or available through the OEH AHIMS Database.

Figure 5.1: AHIMS Search boundary (orange) and plotted AHIMS Sites (red dots) from (Table 5.2) shown in relation to Avoca Tank Project. Project Site Boundary shown in red outline and Proposed Disturbance Footprint, including the haul road are shown by the light blue line. AHIMS Sites plotted with grid references from AHIMS. See also Figure 5.2.

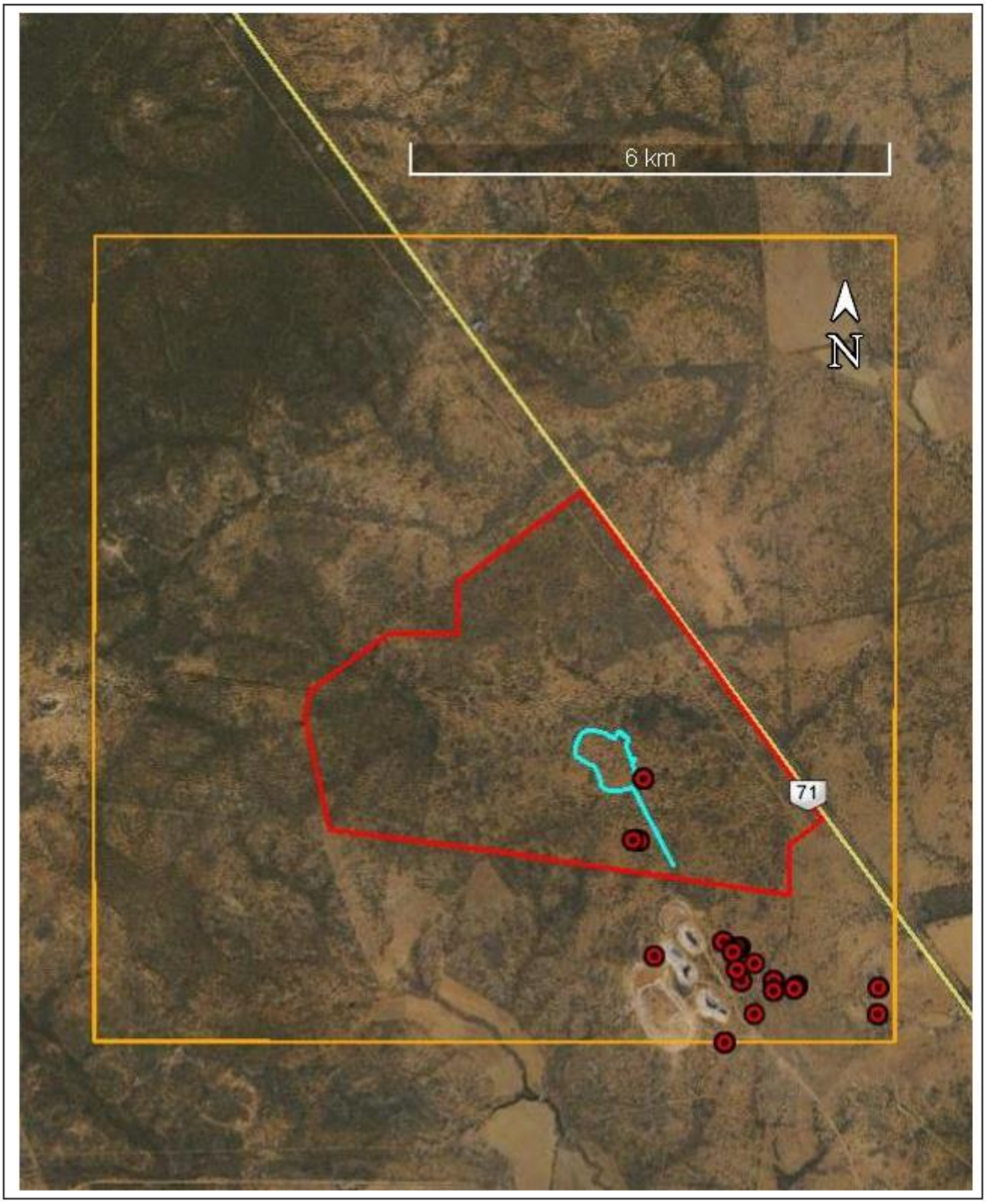
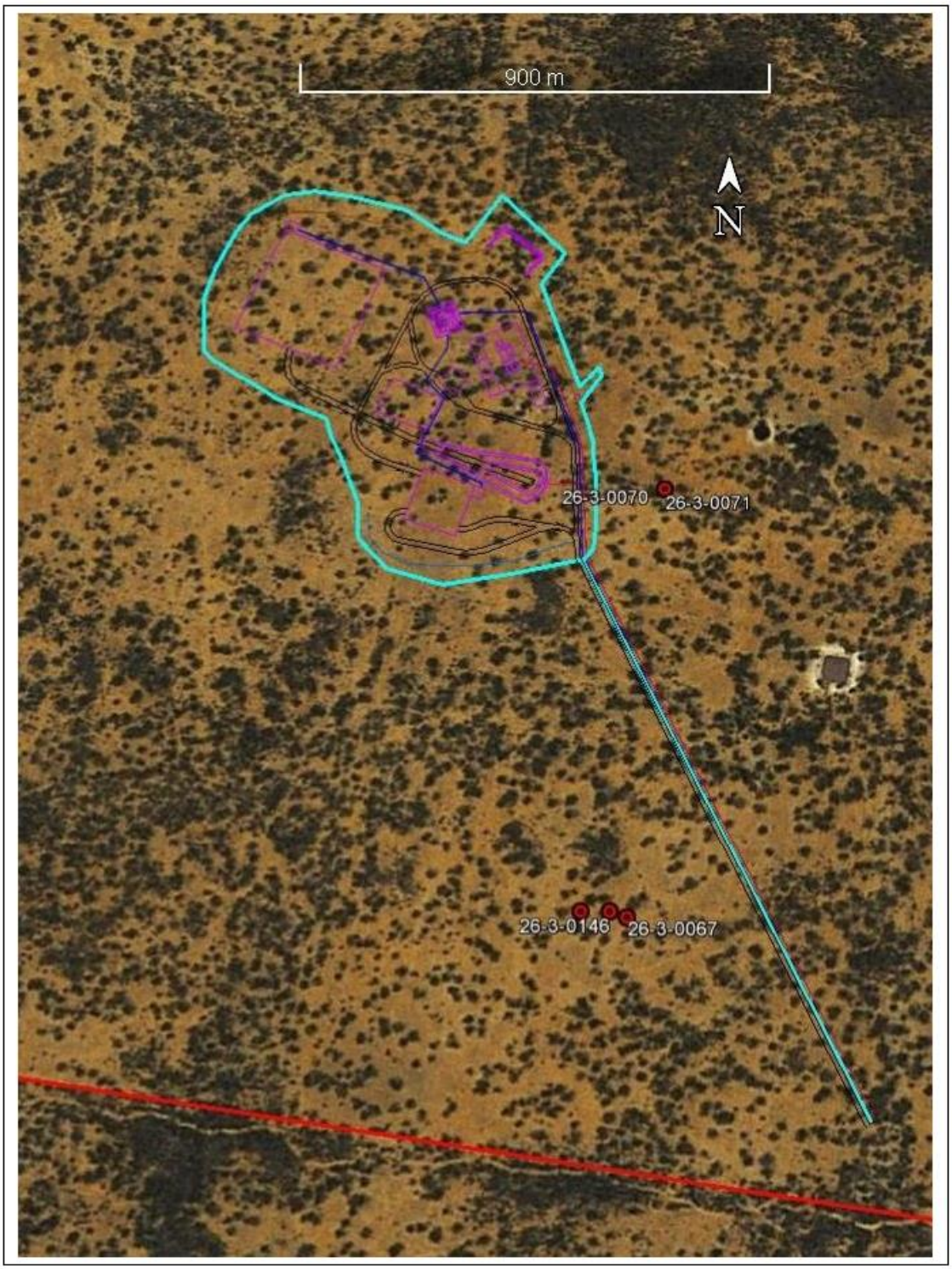


Figure 5.2: Distribution of previously recorded AHIMS Sites (red dots) within the Avoca Tank Project area and Proposed Disturbance Footprint. Southern Project Site Boundary shown in red at bottom of figure. Note the identical grid references and duplicate recordings of these sites as shown in Table 5.4. AHIMS Sites plotted with grid references from AHIMS



Nicholson (1989)

Nicholson (1989) conducted an An Environmental Baseline Report for the Environmental Impact Statement for proposed copper mining activities at the old Girilambone mine workings (the North-East Prospect and the Girilambone Prospect). The North-East prospect included a survey across Lot 138, an area of land adjoining the southern boundary of Lot 144 forming part of the current Avoca Tank study area. The survey was conducted with Lesly Ryan of Bogan Aboriginal Corporation who also participated in the current survey for the Avoca Tank project.

Nicholson (1989:2) in establishing a predictive model for the study area, discusses the range of site types present in the North-Central Rivers region and to the east of Nyngan. According to Nicholson (1989:2) these sites were represented in the following proportions;

Scarred trees	29% (20)
Carved trees	29% (20)
Open camp sites	19% (13)
Burial sites	9% (6)
Stone arrangements	7% (5)
Quarries	6% (4)
Contact sites	2% (1)

Nicholson (1989:3) also reviewed the work of Witter (cited in Nicholson 1989: 3, 1990:6) and Hughes, Hiscock and Donaldson (1984, cited in Nicholson 1989: 3). Witter found that large scatters of artefacts were found adjacent to water sources whilst on the plain away from major creek lines the artefact scatters were found to be much smaller.

Witter interpreted the large artefacts scatters as 'base camps' occupied by large groups of Aboriginal people between 5000 and 2000 years ago. The major water sources provided the focus for occupation during this period with people foraging out from these locations on a day-to-day basis (Nicholson 1989:3).

According to Witter (cited in Nicholson 1989: 3) sometime between 2000 and 200 years ago this settlement pattern changed, and people become more dispersed across the landscape. This settlement pattern change is reflected in the numerous small, widely dispersed artefact scatters characterising the region.

Hughes, Hiscock and Donaldson (1984; cited in Nicholson) conducted an archaeological survey south of Cobar and found that major campsites occurred throughout the region and were concentrated around major water sources (such as rivers, creeks, springs, rockholes and soaks). Other sites such as rock shelters with occupation deposit, rock art sites and axe grinding grooves occur but are restricted to the sandstone hill country and generally located near water.

Nicholson (1989:3) also reviews work conducted by Bonhomme (1983, cited in Nicholson 1989) near Cobar that identified the termite lump and/or sandstone hearth as the most common site type. This study produced the same pattern of base camps associated with small transient camps as discussed by Hughes et al (1984) and special activity areas previously identified by Witter (cited in Nicholson). A date of 4000 years B.P. for occupation in this area was obtained by dating material excavated from one of the hearths (Nicholson 1989:3-4).

Nicholson (1989:5) located one scarred tree and two isolated stone artefacts outside the Girilambone Prospect during the survey. The scarred tree recorded was a river red gum with a well defined oval scar on its trunk and measuring approximately 1.2 x 0.55m and 2.7m above the base of the trunk. One of the isolated stone artefacts recorded was a yellow chert flaked piece found on an eroded surface The second isolated stone artefact was a broken river pebble utilised as a grinding stone (6.5 x 3.5cm) and was smooth on one side.

Nicholson (1989:7) concluded that the absence of more extensive archaeological material in the study area is expected due to the lack of any major water sources and the results were consistent with models proposed for Aboriginal settlement in this region. These models posited that Aboriginal occupation focused on the major water sources with base camps (characterised by large artefact scatters) located adjacent to rivers, creeks, springs and soaks. Away from these areas evidence of occupation reduces to small low density scatters of artefacts representing short-term camps and/or special activity areas used during hunting and gathering trips (Nicholson, 1989:7).

Nicholson (1989:7) further concludes that the absence of archaeological remains in the North-East Prospect suggests that this; harsh, dry, flat land was probably not occupied by Aboriginal people in the past although it is likely to have been visited. The presence of a scarred tree and two isolated artefacts in the area around the Girilambone Prospect is indicative of this sort of activity.

Nicholson (1990)

A second survey was also conducted by Nicholson (1990) for associated mining infrastructure including a pumping station on the Bogan River, an electricity spurline and a 22 km pipeline corridor extending west to proposed settling ponds to the immediate east of the Girilambone Prospect (the current Girilambone Copper Mine).

A total of five sites were located, all were open surface scatters of stone artefacts. The sites were clustered in two locations. Two of the sites (Sites 1 and 2) were found in the vicinity of the Bogan River with the remaining three sites located in the area proposed for the series of settling ponds on the Girilambone Prospect (Sites 3, 4 and 5). Three of the sites contained less than 11 stone artefacts whilst the remaining two sites contained 42 and +50 stone artefacts and all but one site displayed 'extremely low' artefact densities. Flakes represented the majority of the recorded artefacts types for all assemblages (81%) and whilst quartz represented the dominant raw material type (82%). Other raw materials represented include

chert (10%), silcrete (3%), metamorphosed shale (2%), quartzite (2%) and volcanics (1 %) (Nicholson 1990:17). Sites 4 and 5 contained the highest raw material diversity with the remaining 3 sites being composed nearly entirely of quartz.

Two of the smaller sites (Sites 2 and 3) contained flakes only and cores represented 13% of the recorded artefact assemblages and were present on at three sites (Sites 1, 4 and 5). The cores were of a small size (<5cm) and taken to indicate that artefact manufacture had occurred at these locations (Nicholson 1990: 17-19). The presence of cortex on several cores allowed Nicholson to conclude that the cores were derived from river-rolled cobbles.

(Nicholson 1990: 17-19) concluded that sites 1 and 2 near the Bogan River were originally part of the same artefact scatter subject to disturbance in the space between which had subsequently revegetated to obscure connecting archaeological material. Sites 3, 4 and 5 were located adjacent to small ephemeral drainage lines. (Nicholson 1990:21) suggests that sites 3 – 5 (ie. small, low density scatters) represented a typical sample of the archaeological signature of the region.

(Nicholson 1990: 20) concluded that the pattern of artefact scatters located adjacent to watercourses is characteristic of semi-arid regions. The absence of sites away from watercourses was not unexpected and the pattern of site location recorded during the survey consistent with predictive models for site location in this region.

Kelton (1995)

Jim Kelton of Central West Archaeological and Heritage Services conducted an archaeological survey of an area of the proposed North Copper Mine, a portion of which was subject to previous archaeological investigation by Nicholson (1989). The original area surveyed by Kelton (1995) included a large part of the current Avoca Tank Stage 1 project area and adjoining land to the immediate south of the current Avoca Tank Stage 1 project area. The survey area was subsequently reduced to exclude the current Stage 1 area land.

Kelton (1995:6) also reports that he resurveyed at least part of the land surveyed by Nicholson (1989) as part of her investigation for the initial Girilambone Copper Mine Environmental Impact Assessment. Nicholson (1989) did not locate or record sites in this area.

Based on previous work in the region and his own observations Kelton predicts that open artefact scatters, scarred / carved trees, burial sites, hearth sites, ceremonial sites (such as 'bora grounds') are possible within the study area.

Kelton (1995:10) suggests criteria established by Pearson (cited in Kelton) for the location of camp sites/open artefact scatters in the NSW tablelands could also be applied to the region, with the most relative criteria being the following:

1. Accessibility to water. The need for ample supplies of drinking water, and a sufficiently large resource zone associated with that supply;
2. Level ground with good drainage;
3. Shelter from cold winter winds, with adequate summer cooling breezes; and,
4. Adequate fuel supplies.

Kelton (1995:12) in discussing hearth sites posits:

Termite nest material was often use by Aboriginal people in the region as an alternative heat retaining material in cooking fires, or else in conjunction with natural stone hearths which were used for the same purpose. A difficulty of interpretation arises where termite nest material occurs isolated from any other cultural material in what appears to be a hearth formation. The problem occurs in determining whether the hearth is in fact an Aboriginal hearth or else a natural occurrence resulting from a rotted and burnt tree.

This site type is common in the region and it is predicted that Aboriginal fire hearths of stone and termite nest material will occur across the study area, perhaps with the exception of on the higher quartzite hills and associated rocky slopes.

Kelton (1995) divided the survey area in two based on the different level of proposed mining activity (high and low impact) and surveyed these areas with differing levels of intensity/coverage. Kelton (1995:19) located 34 hearth sites, 27 scarred tree sites (including 2 possible carved trees), one open artefact scatter site, and 4 isolated artefact finds located during the field survey. A number of these sites recorded by Kelton (1995) are shown in Table 5.3and are of relevance to the current study area.

Kelton (1995:24) recorded a total of 32 hearth sites during the field survey, all of which were of termite nest material (with a further two sites recorded as part of a site complex, GC-OS-1). Kelton (1995:24-25) states that "a number of hearths have questionable Aboriginal origin due to the lack of supporting, associated cultural material, and the apparent questionable origin of the actual hearth material, with some material indicating the possibility that it has originated from natural sources rather than from collection and exploitation by past Aboriginal groups. However, when comparison was drawn between hearth sites of doubtful origin and hearth sites located in association with stone artefactual material, e.g. GC-OS-1, little difference could be established, thus raising the credibility of the majority of doubtful sites".

"On the other hand, some clumps of termite nest material were definitely observed to be the remains of rotted, burnt trees, with no cultural heritage value. These occurrences were not recorded" (Kelton 1995:24-25).

According to Kelton (1995:25) hearth sites were recorded across the study area with the only landform unit void of these sites being the rocky quartzite ridges and peaks. Kelton (1995:25) concludes that "based on the relatively large number of hearth sites located over the study area, it would appear that the drier areas away from perennial water sources may have been

more significant for resource exploitation to past Aboriginal groups in the region than has been proposed by those who have previously conducted archaeological studies in the region".

Kelton (1995:25) assessed the majority of hearth sites with a Low to Moderate significance due to their low scientific and educational value and the large number of this site type in the study area and adjacent areas. The two hearth sites associated with open artefact scatter site GC-OS-1 were attributed with moderate to high level of significance due to their relationship with the open artefacts scatter site complex.

Kelton (1995:26) states that 23 of the 27 recorded scarred tree sites displayed no axe marks. Two sites of the sites displaying axe marks GC-CT/ST- 21 and 22 were asserted be burial site markers by the Aboriginal representative present. The majority of scarred trees located during the field survey reflect the opportunistic removal of portions of bark and / or outer cambium, for use as implements or else shelters.

Kelton (1995:30) concluded that the site prediction model produced by Nicholson (1989,1990) was reasonably accurate with regard to the level of past Aboriginal 'settlement' or occupation site density in the locality, but not entirely reliable when applied to the level of occupation evidence identified during the 1995 survey by Kelton.

Kelton (1995:30) however could not explain the disparity between the site types and the numbers of sites located during that study (1995) when compared to the site types and numbers recorded in Nicholson's overlapping study area. Kelton (1995:31) posits that site types recorded during his study reflected a greater level of occupation than was expected throughout that study area.

Kelton (1995:31) argues that the results of his study tend to support Witter's (c1990) theory of change in Aboriginal settlement patterns throughout the region, depending on the potential of sites to yield reliable dates.

According to Kelton (1995:31) the evidence of occupation in the study area certainly pointed to the movement of small groups across the landscape, however, it could also be argued that this pattern of occupation would have been expected, given the nature of the local environment, irrespective of changes in settlement patterns.

"The high number of small hearth sites and scarred trees points to considerable, (and unexpected) possibly seasonal exploitation of the locality, even if only by small groups, and if only for short periods during the year. This higher than expected evidence of occupation within the study area should have been predicted, bearing in mind the relatively close proximity of the study area to the Bogan River and the associated rich riverine margin resource zone. The presence of 'soaks' some distance from the river would have meant adequate supplies of water were available to small groups of hunter gatherers whilst

travelling out from the resource rich riverine margins, and particularly following seasonal rain" (Kelton 1995:31).

According to Kelton (1995:31) the virtual absence of open artefact scatter sites was not unexpected, given that the study area was by no means abundant in resources and would not have supported large gatherings for any length of time. The location of a single extensive scatter of artefacts and hearth sites in the study area's northern section does not comply, totally, with previous models of occupation proposed for the area by researchers.

Central West Archaeological and Heritage Services (1998)

Central West Archaeological and Heritage Services also undertook an archaeological survey for the Tritton Copper project EIS (1998: 3-40-42) some 20 kms to the south west of the current study area. The predictive model developed by Central West predicted:

- Open campsites with stone artefacts and possible hearth sites might be expected around water occurrences such as the banks of ephemeral creeks and drainage lines.
- Scarred trees can be expected across all landform units.
- Isolated artefacts might occur across the entire survey area.
- Presence of previously recorded stone axe grinding groove site located 5km west of that survey area may indicate potential for similar occurrences.

The survey located a total of 47 scarred trees, two open artefact scatters one containing a single hearth and two isolated stone artefacts.

Both of the open artefact scatters were located along ephemeral creeks, one of which was described as extensive and of moderate to high significance. The other was extensively disturbed by Council works and considered of low significance.

Interestingly all of the scarred trees were considered to be of 'possible' Aboriginal origin and considered of low significance. Central West asserted that most of the tree sites identified were "bark shelter" type scars and that many were of European origin.

5.2 PREDICTIONS FOR THE STUDY AREA

Prior to undertaking any archaeological study it is useful to assess the archaeological potential of the Study Area. Predictions on the archaeological potential of a given area are made through synthesis of the environmental context, land use history and applying the findings of previous studies within the local area or region. This provides information about whether Aboriginal sites or objects are likely to occur in a given area, where these sites are likely to be located, their potential frequency, type, density and nature of Aboriginal sites or objects.

An analysis of the site details for the previously recorded AHIMS sites in **Table 5.3** shows that the most common site type recorded was that scarred trees (44, 77.2%) followed by hearths

(11, 19.3%) two of which were associated with artefacts, and 2 (3.5%) open stone artefact scatters.

It was previously discussed in **Section 4.0** that the Study Area is unlikely to contain substantial potable water. The relationship between Aboriginal occupation evidence and potable water is well understood and often most pronounced in semi arid to arid regions with low rainfall conditions. The Study Area does not contain any permanent water or defined ephemeral creek channels likely to support long to medium term Aboriginal occupation. Potential Aboriginal occupation evidence in the Study Area is therefore more likely to be sparsely distributed and discrete reflecting high mobility of small groups and short term task specific localities.

Review of the available information above in **Section 5.1** suggests that scarred trees are likely to be most common site type to occur in the region, although previous studies have treated this site type cautiously (Central West A&HS 1998). Hearths sites are likely to be the next most common site type. Stone artefacts scatters were found to be generally associated with water. The absence of potable water in the Study Area is likely to mean that open artefact scatters reflecting longer term encampments will be relatively few within the Study Area. The scarcity of stone outcrops suitable for the manufacture of stone artefacts is also likely to influence stone artefact occurrence in the Study Area.

It was also discussed in **Section 4.0** that the integrity of the Study Area has been degraded due to previous land use practices. Based on the number of coppiced trees the entire Study Area was probably cleared at an earlier time. Very little topsoil remains, principally, as a result of poor farming practices, such as overgrazing. These factors are also likely to have an effect on the integrity of any Aboriginal occupation material.

On the basis of the review of the environmental context and previous studies discussed above some predictions can be made about the archaeological potential of the Avoca Tank Study Area:

1. Scarred trees are likely to be the most common site type within the Study Area with hearth sites (some potentially with artefacts) likely to be the next most common site type.
2. Stone artefact occurrences are predicted to be low given the paucity of potable water and suitable stone for the manufacture of stone tools.
3. The broad scale land clearing and poor previous land-use practices within the Study Area are likely to have impacted heavily on all site types discussed above.

On the basis of these predictions the archaeological potential and sensitivity of the Avoca Tank Study Area is considered to be low.

6.0 SURVEY METHODOLOGY

Avoca Tank Stage 1

The archaeological survey strategy for the Stage 1 Study Area was designed with consideration of the immediate potential *harm* to Aboriginal objects was posed by the exploratory drilling program. Accordingly these potential impacts influenced the survey strategy. Tritton Resources supplied the location of all drill lines and holes to On Site CHM and the location of each and every proposed drill hole was inspected.

The drill lines formed the basis for the archaeological survey transects which were extended towards the boundaries of the Study Area to achieve greater coverage over the Study Area. The location of transects conducted across the Stage 1 Study Area are shown in **Figure 6.1.** The Proposed Disturbance Footprint and survey transects across this area are shown in **Figure 6.2** to understand the coverage of the survey further discussed in **Section 10.0**.

An intensive pedestrian archaeological survey of the Avoca Tank Study Area was conducted between 26 and 30 April 2012 by On Site Cultural Heritage Management archaeologists Gerard Niemoeller and Craig Reid.

Representatives of the Nyngan Local Aboriginal Land Council and Bogan Aboriginal Corporation participated in the entire archaeological survey and were present during the recording of all Aboriginal archaeological sites. Representatives were:

Sheila Couley – Chair, Nyngan Local Aboriginal Land Council
Lesly Ryan – CEO, Bogan Aboriginal Corporation
Deputy Chair, Nyngan Local Aboriginal Land Council

At least one but usually 2 to 3 representatives of Tritton/Straits participated and assisted in the survey every day over the 5 days. Tritton/Straits participants included:
Paul Calvin - Community and Heritage Manager
Phil Jones - Senior Project Geologist
Catherine Sullivan - Environmental Officer
Rodney Cooper - Environmental Advisor

The survey consisted of a series of transects north south along the proposed drill lines, spaced approximately 200 metres apart. Survey participants were spaced approximately 10 to 20 metres apart providing good survey coverage along each of the drill lines across the Avoca Tank project area. Each participant was therefore able to survey approximately 20 metres in width and allowing survey of approximately 100 metres in width per transect.

Transects were generally in straight lines along the drill lines but particular attention was also afforded to interesting features within the landscape such as prominent clearings or

exposures, gravel lags or concentrations, deflations or other areas of erosion and trees potentially bearing scars. This sometimes resulted in a meandering transect.

Avoca Tank Stage 2

At the time of the survey the proponent had advised that the Stage 2 area was being subject to archaeological survey to identify potential impacts on Aboriginal objects and identify constraints on the planning process for the mine footprint should the exploration program shift to full scale mining to be considered in the EIS.

For consistency and compatibility of results between the Stage 1 and 2 Study Areas a similar survey strategy was employed for the Stage 2 Study Area as was employed for the Stage 1 Study Area. The location of transects undertaken as part of Stage 2 is also shown in Figure 6.1. The Proposed Disturbance Footprint is also shown to understand the coverage of the survey strategy.

A pedestrian archaeological survey of the Avoca Tank Study Area (Stage 2) was conducted between 29 October and 2 November 2012 by On Site Cultural Heritage Management Principal Heritage Consultant / Archaeologist Gerard Niemoeller and Assistant Archaeologist Kate Duca.

Representatives of the Nyngan Local Aboriginal Land Council and Bogan Aboriginal Corporation participated in the entire archaeological survey and were present during the recording of all Aboriginal archaeological sites. Representatives were:

Sheila Couley – Chair, Nyngan Local Aboriginal Land Council
Lesly Ryan – CEO, Bogan Aboriginal Corporation
Deputy Chair, Nyngan Local Aboriginal Land Council

Neville Merritt of the Ngemba/Ngiyampaa Native Title claim group also participated in the fieldwork and survey on 1 – 2 November 2012.

At least one representative of Tritton/Straits participated and assisted in the survey every day over the 5 days. Tritton/Straits participants included:

Paul Calvin - Community and Heritage Manager
Rodney Cooper - Environmental Advisor

The survey consisted of a series of transects in a north south direction and spaced approximately 200 metres apart but at times, depending on the vegetation between 150 and 300 metres apart. Survey participants were spaced approximately 20 metres apart providing good survey coverage along each of the transects. Each participant was therefore able to

survey approximately 20 metres in width and allowing survey of approximately 100 metres in width per transect.

Transects were generally in a north south direction although particular attention was also afforded to interesting features within the landscape such as prominent clearings or exposures, gravel lags or concentrations, deflations or other areas of erosion and trees potentially bearing scars. This sometimes resulted in a meandering transect.

6.1 RELOCATION OF PREVIOUSLY RECORDED SITES

As discussed in **Section 5.1**, five AHIMS sites have been previously recorded within the Avoca Tank Study Area. An attempt to relocate all of these sites (via grid references) was undertaken as part of the Stage 1 survey. The AHIMS site cards do not however provide a datum for their recording beyond AGD. Given the age of the recording (1994) the grid references and localities were investigated using different datums (AGD 66, WGS 84, GDA 94) where required. Investigations to relocate these sites are discussed below in **Section 7.0**.

Figure 6.1: Pedestrian survey transects by On Site CHM. Stage 1 Study Area survey transects shown in yellow, Stage 2 shown in green. Red dots show previously recorded AHIMS Sites. Current Project Site Boundary shown in red and Proposed Disturbance Footprint shown in light blue. Orange line west of Mitchell Highway is power easement.

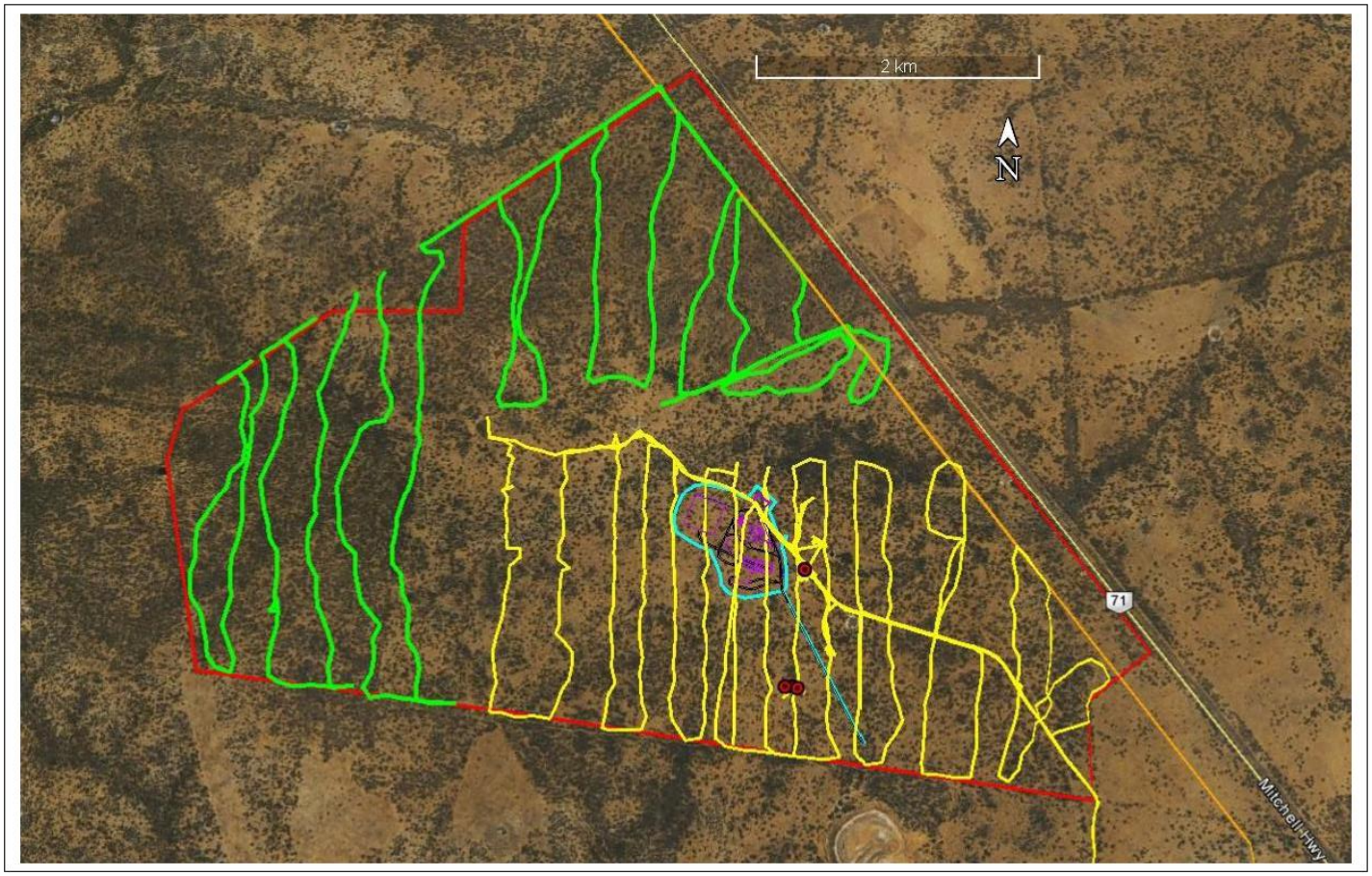


Figure 6.2: Stage 1 Study Area survey transects (yellow) in relation to the Proposed Disturbance Footprint (light blue). Red dots show previously recorded AHIMS Sites. Southern Project Site Boundary shown in red at bottom of figure.

7.0 RESULTS

7.1 GENERAL COMMENTS

The total length of all survey transects walked across the Avoca Tank project area Stages 1 and 2 (18.62km^2) was 63.5 kms. Based on the 100 metres wide survey transect it is estimated that 6.35km^2, or 34.1% of the 18.62 km^2 Avoca Tank Study Area was surveyed during the Stage 1 and 2 investigations.

A total of 4 transects conducted as part of the Stage 1 study traversed the Proposed Disturbance Footprint. Based on the 100 metres wide survey transect it is calculated that the Stage 1 transects covered approx 221,900m^2 (0.222km^2 or 66%) of the 0.336 km^2 Proposed Disturbance Footprint. Survey coverage of the Proposed Disturbance Footprint was shown in **Figure 6.2.**

Low quality milky quartz gravels were widespread across the project area but were generally too small to be part of any stone tool reduction sequence (median size 1-2cm). Gravel lags were still consistently inspected for evidence of artefact manufacture. A single outcrop of low quality milky quartz boulders (up to 60cm) was located during the survey. The outcrop was carefully inspected for any evidence of stone tool quarrying or manufacturing, of which there was none.

Five locations containing Aboriginal occupation evidence were located during the surveys (See Figure 7.1). Avoca Tank 1 to 4 were located within the Stage 1 area and one of these places Avoca Tank 3 consists of three 'hearths' within proximity and was recorded as one site. Avoca Tank 5 was located within the Stage 2 area. The location and summary details for these places are included in **Table 7.1** below.

AVOCA TANK STAGE 1

The total length of all survey transects walked along the drill lines was 35.9 kms. Based on the 100 metres wide survey transect discussed above it is estimated that 3.59km^2, or 41% of the 8.74 km^2 Avoca Tank project area was surveyed during this investigation.

The average percentage of ground surface visibility and exposures was recorded for every transect. The average visibility across the area is calculated to be 24.6% and average area of ground surface exposure is 14.6%. Details recorded for each pedestrian transect (Transects A-Q) as was shown in Figure 6.1 is included in **Appendix 5.**

AVOCA TANK STAGE 2

The total length of all survey transects walked as part of the Stage 2 survey 27.6 kms. Based on the 100 metres wide survey transect discussed above it is estimated that 2.76 km^2, or 28% of the 9.90 km^2 Avoca Tank project area (Stage 2) was surveyed during this investigation.

The average percentage of ground surface visibility and exposures was recorded for every transect. The average visibility across the Stage 2 area is calculated to be 26.6% and average area of ground surface exposure is 15.3%. Details recorded for each pedestrian transect (Transects 1-16) shown in **Figure 6.1** is included in **Appendix 5.**

Table 7.1: Summary details for Aboriginal sites recorded during this survey. Datum is GDA 94. Grid references recorded by On Site CHM.

Study Area	Site Name	Site Features	Easting	Northing
Stage 1	Avoca Tank 1	Stone artefact scatter	55 484966	6548490
Stage 1	Avoca Tank 2	Isolated stone artefact	55 484857	6548245
Stage 1	Avoca Tank 3 (3 x hearths)	Hearth 1	55 484835	6547528
Stage 1		Hearth 2	55 484815	6547517
Stage 1		Hearth 3	55 484729	6547486
Stage 1	Avoca Tank 4	Historic Scar Tree and Aboriginal Stockman's camp	55 485027	6547775
Stage 2	Avoca Tank 5	2 x isolated stone artefacts	55 481436	6548043

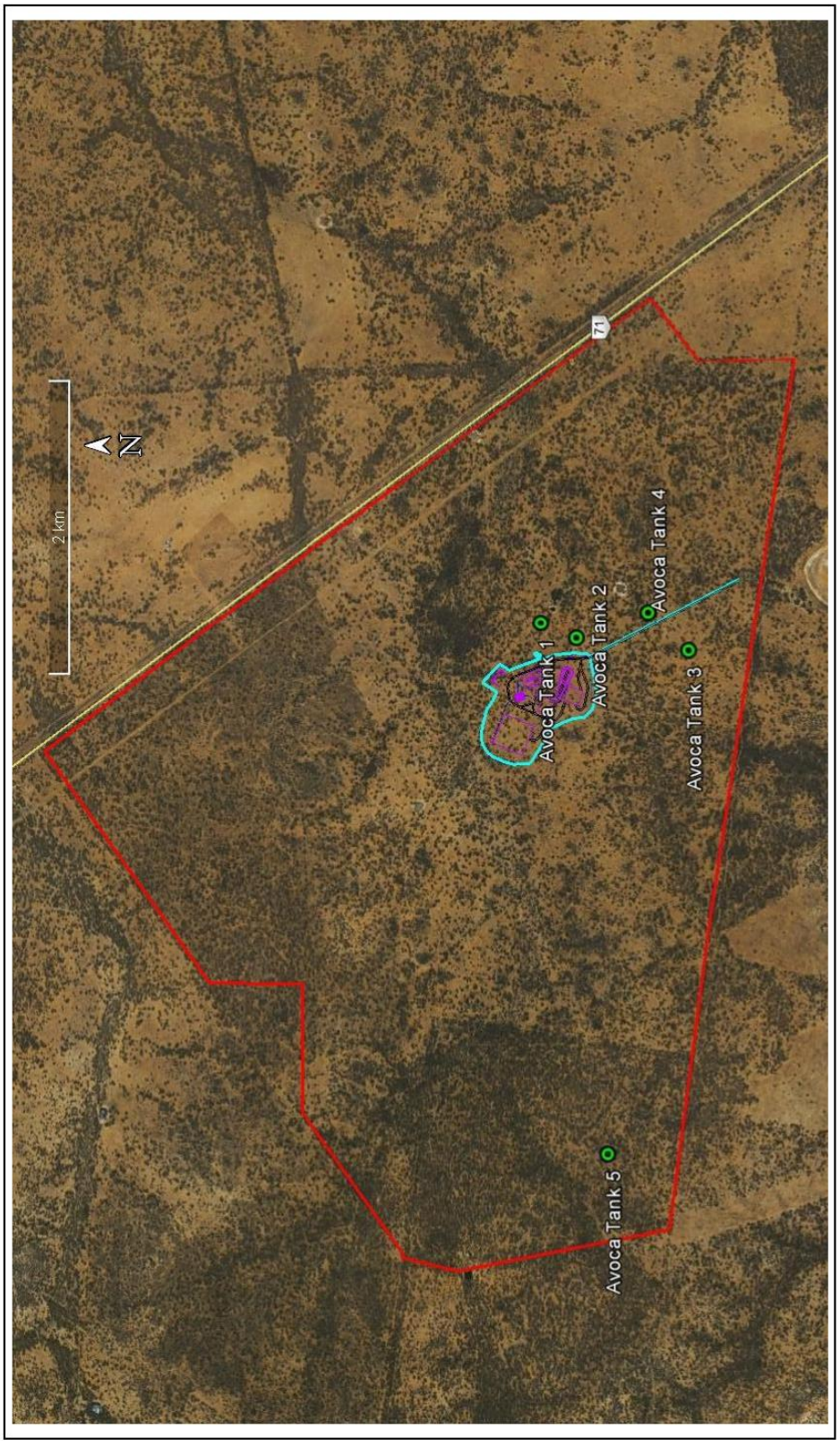


Figure 7.1 Sites Avoca Tank 1-5 (green dots) recorded across the Avoca Tank Project area.

7.2 SITE DESCRIPTIONS

7.2.1 *Avoca Tank 1*

Grid Reference: *55 484966 E, 6548490 N (GDA 94)*
Site Type: *Stone artefact scatter*

Site Description: Avoca Tank 1 is located on an open gently undulating grassy plain with tall open eucalypt woodland and some minor acacia. The site is located on a gentle slope with south east aspect. Artefacts are distributed along and either side of a disused eroded track.

The ground surface consists of fine grain silts with some minor quartz gravels. More dense quartz gravels are eroding out along track. A total of 11 artefacts were sparsely distributed along the eroded track and to either side. The majority of the artefacts are located at the eastern end of the scatter. It is likely that artefacts have been washed down the eroded track and gentle slope. The site is located approximately 50 metres north west of a dam. It is not clear whether this dam is a modified soak or entirely of more recent historical creation. Spoil around the edges of the dam indicates that the dam has been modified in recent times. Research of historical parish maps for this location did not show a dam.

Table 7.2**7.2** and **7.3** below show summary details for this site and recorded artefacts. Detailed attributes recording of these artefacts are provided in **Appendix 5.**

Table 7.2: Summary details for Avoca Tank 1

Approximate site size	2600 m^2	20m NS x 130 m EW	
Visibility (%)	Min: 0	Mean: 70	Max: 100
No. artefacts types represented	4		
No. raw materials represented	5		
Artefact densities (m^2)	Min: 0.1	Mean: 0.2	Max: 1
Artefact lengths (mm)	Min: 17	Mean: 34.8	Max: 80.8

Table 7.3: Artefact and raw material types recorded at Avoca Tank 1

	Basalt	Grannodiorite	Porphyritic	Quartz	Quartzite	Total	%
Flake	1			3	1	5	45.5
Retouched flake				1	3	4	36.3
Ground fragment		1				1	9.1
Hammerstone			1			1	9.1
Total	1	1	1	4	4	11	100
%	9.0	9.0	9.0	36.5	36.5	100	

Despite the low density of artefacts the site displays a relatively high diversity of stone artefact and raw material types. According to Phil Jones, Senior Geologist with Straits, three of these raw material types (porphyritic, grannodiorite, basalt) are not local and from outside the immediate region. The porphyritic and grannodiorite artefacts appeared to be manufactured from rounded worn cobbles indicating that these may have been sourced from a waterway. A high diversity of raw materials and low density of artefacts may indicate that Aboriginal occupants were highly mobile, visiting repeatedly but staying for short periods of time.

Site Integrity

The integrity of the site is considered low to moderate given the erosion that has occurred over the site. The erosion is also likely to have diminished the archaeological significance of this site.

Potential impact of proposal:

The western end of Avoca Tank 1 is approximately 150 metres from the eastern extent of the Proposed Disturbance Footprint and will therefore not be directly impacted by the Proposal. The site is within proximity to the Proposal and therefore has the potential to be accidentally disturbed through ancillary activities. Any disturbance or impact upon this site would require an Aboriginal Heritage Impact Permit (AHIP).

To protect this site during the development and operation of the Proposal it is recommended that the proponent:

- Cordon off the site to prevent accidental disturbance through entry by any vehicles or unauthorised persons.
- Inform Tritton personnel of the location and designate this area is a "no go zone".
- Develop appropriate management strategies to ensure the long term conservation of this site

Plate 7.1: Ground fragment of granno-diorite at Avoca Tank 1

7.2.2 *Avoca Tank 2*

***Grid Reference**: 55 484857 E, 6548245 N (GDA 94)*
***Site Type:** Isolated stone artefact*

Site Description: Avoca Tank 2 consists of a single silcrete stone artefact located on a large open grassy plain with open eucalypt woodland. The site is located approximately 40 metres south west of grid reference provided for (AHIMS Sites 26-3-0070, 26-3-0071, 26-3-0034, 26-3-0119, 26-3-0149). The artefact is located on the lower slope of a gentle rise to the west. Large exposures, with low quality quartz gravels and a low level of grass cover afforded good visibility across the immediate area (60%). There was also evidence of widespread sheet wash and gullying across the area. Detailed attributes recording of these artefacts are provided in **Appendix 5.**

Potential impact of proposal:

Avoca Tank 2 is approximately 120 metres east of the Proposed Disturbance Footprint and will therefore not be directly impacted by the Proposal. The site is within proximity to the Proposal and therefore has the potential to be accidentally disturbed through ancillary activities. Any disturbance or impact upon this site would require an Aboriginal Heritage Impact Permit (AHIP).

To protect this site during the development and operation of the Proposal it is recommended that the proponent:

- Cordon off the site to prevent accidental disturbance through entry by any vehicles or unauthorised persons.
- Inform Tritton personnel of the location and designate this area is a "no go zone".
- Develop appropriate management strategies to ensure the long term conservation of this site.

7.2.3 *Avoca Tank 3*

Site Type: *3 x Hearths*

General Site Description: 3 hearth features (within 80 metres) are located on large open grassy plain gently sloping to the north. The area is vegetated with sparse tall eucalypts with minor acacias around their drip line. The ground surface is comprised of thick grasses and large exposures with low quality gravels. The area has been subject to sheet wash. These places have been recorded due to their proximity to previously recorded 'hearth sites' by Kelton (1995) on the AHIMS Database as opposed to exhibiting any convincing evidence that they are in fact Aboriginal sites (See **Section 7.3** and **8.0**).

Hearth 1: (55 484835 E 6547528 N) *(GDA 94)*
Is situated on a hard exposure and consists of 4 loose compacted sediment nodules (all <10cm in size) over a 3m x 3m area. This feature is approximately 20 metres north east from the grid reference provided for AHIMS Site 26-3-0067/26-3-0146.

Hearth 2: (55 484815 E 6547517 N) *(GDA 94)*
Consists of small, hard nodules of sediments embedded in hard compacted silty matrix. The feature is approximately 1m x 1m and located in thick grass. Nodules appear to have minor charcoal content. This feature is approximately 9 metres WNW from the grid reference provided for AHIMS Site 26-3-0067/26-3-0146 and 22 metres ENE from the grid reference provided for 26-3-0068/26-3-0147.

Hearth 3: (55 484729 E 6547486 N) *(GDA 94)*
Is located on a large exposure (20m x 20m) with quartz gravels. The feature consists of small, hard nodules of sediments embedded in hard compacted silty matrix over an area of 2m x 2m. This feature is approximately 40 metres SSW from the grid reference provided for AHIMS Site 26-3-0066/26-3-0145

Despite an extensive search of the immediate surrounding area for each of these features no other cultural features or Aboriginal artefacts were located.

Potential impact of proposal:

Avoca Tank 3 is approximately 650 metres south of the Proposed Disturbance Footprint and 280 west of the proposed haul road and will therefore not be directly impacted by the Proposal. The site is within proximity to the Proposal and therefore has the potential to be accidentally disturbed through ancillary activities. Any disturbance or impact upon this site would require an Aboriginal Heritage Impact Permit (AHIP).

To protect this site during the development and operation of the Proposal it is recommended that the proponent:

- Cordon off the site to prevent accidental disturbance through entry by any vehicles or unauthorised persons.
- Inform Tritton personnel of the location and designate this area is a "no go zone".
- Develop appropriate management strategies to ensure the long term conservation of this site.

Plate 7.2: 'Hearth' 3 located near AHIMS Site localities 26-3-0066, 26-3-0145.

7.2.4 *Avoca Tank 4*

Grid Reference: *55 485027 E, 6547775 N (GDA 94)*
Site Type: *Historic scar tree, Aboriginal stockmen's camp and dam*

Site Description:
Site is located at a low point within a wide grassy plain and consists of two small waterholes at the end of an ephemeral drainage line. The western water hole is a natural soak and at a low point in landscape. The eastern waterhole appears to be either entirely man made or heavily modified soak evidence by the spoil heaps around the northern, eastern and southern boundary of the waterhole.

Some additional historic material also occurs in association with the waterhole. A small white earthenware ceramic jar base and three small blackened rocks which may have been used as part of a campfire (see Plates 5.5 and 5.6) were located between the waterholes and amongst a group of trees occur. Five burnt nodules across an area of 2 square metres, indicating a potential hearth, were located approximately 10 metres to the north east of the scar tree

An iron strip wedge was also located 1.5 metres north west from the base of the scar tree. The iron strip measured 250mm Long x 40mm wide and 15mm thick tapering to a thin edge at one end. The function or origin of this "wedge" is unclear but the general form, tapered edge and association with the scar tree suggest that it may have been used in the extraction of the bark from the tree. Another function for this wedge may be for the locking of cart wheels in place. The area was likely used as a water hole for working animals.

An historic flattened tin can was also found nearby.

The area does not show any intensive use or particular features that may indicate repeated use, accumulated Aboriginal objects excavation potential.

Scar Tree:
A large dead tree bearing a scar occurs on the north west margin of the eastern soak. The scar is 2.1 metres long and extends around 81% of the trunk. The bottom of the scar begins 40 cm from the ground and extends up the tree to approximately 2.5 metres above the ground. An epicormic or subsidiary stem extends from the base of the scar. Recorded attributes for the scar and tree are provided in Table 7.4 below.

Table 7.4: Scar Tree dimensions

Scar Length	210 cm
Scar circumference around tree at midpoint of scar	112 cm
Circumference of tree at midpoint of scar	138 cm
Scar Depth (min and maximum)	30mm, 60mm

The tree has been ring barked and displays several isolated and distinct axe marks above the ring barking and on remaining dead bark (xylem) running the length of the scar. These marks were made by a sharp, straight and even edge, characteristics more distinctive of a steel axe. No tool marks are visible on the scar and it is therefore difficult to discern whether this scar was produced using a stone or steel axe. It is also difficult to discern whether the removal of bark and the ring barking of the host tree are related.

The size and shape of the removed bark, a large rectangle, suggests use for a temporary shelter. The steel axe marks on the tree and presence of several historic artefacts suggest that the scar was probably produced in historic times. The absence of stone tools or other pre-contact Aboriginal occupation materials does not refute a historical date.

Aboriginal community members present suggested that the evidence represented the remains of an Aboriginal stockmen's camp. Aboriginal people were widely employed in the region during the 1900s to ring bark trees and clear land. Large dead ring barked trees were numerous across the survey area.

Site Integrity

The waterholes and surrounding area is heavily vegetated and grassed and does not appear subject to the erosion that covers much of the survey area. The scar tree is dead, continuing to degrading and in relatively poor condition.

Potential impact of proposal:

Avoca Tank 4 is approximately 480 metres south east of the Proposed Disturbance Footprint and will therefore not be directly impacted by the Proposal. The site is however approximately 60 metres east of the proposed haul road and therefore has the potential to be accidentally disturbed through ancillary activities. Any disturbance or impact upon this site would require an Aboriginal Heritage Impact Permit (AHIP).

To protect this site during the development and operation of the Proposal it is recommended that the proponent:

- Cordon off the site to prevent accidental disturbance through entry by any vehicles or unauthorised persons.
- Inform Tritton personnel of the location and designate this area is a "no go zone".
- Develop appropriate management strategies to ensure the long term conservation of this site.

Plate 7.3 (above):

Waterhole with scar tree at left of frame

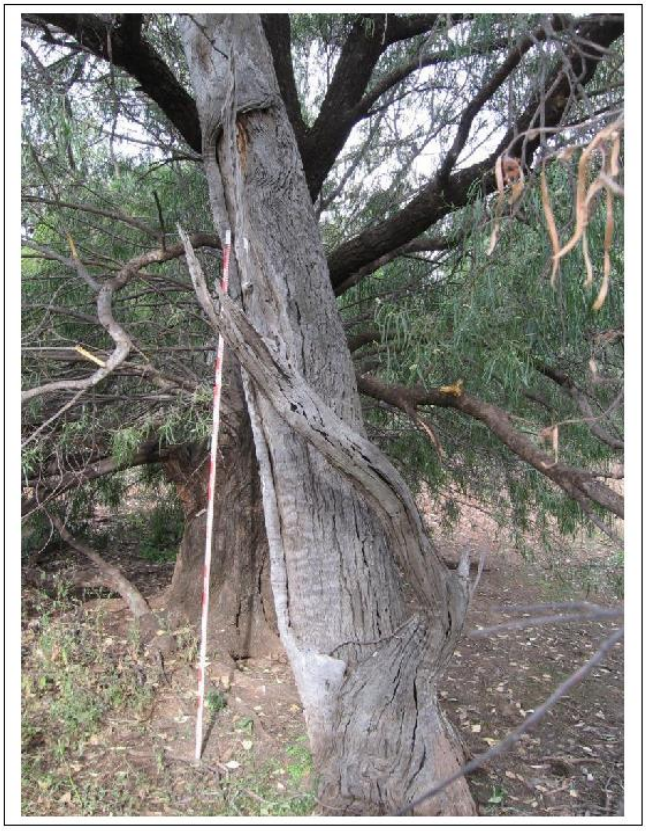


Plate 7.4: (right)

Scar tree located near waterhole

Plate 7.5: (above)
Tapered iron strip (wedge) located near scar tree

Plate 7.6: (right)
Ceramic jar

7.2.5 *Avoca Tank 5*

Grid Reference: *55 481436 E, 6548043 N (GDA 94)*
Site Type: *Isolated artefacts*

Site Description: Avoca Tank 5 consists of two quartz flakes, 20 metres apart and located on a gentle slope (<2°) with a south aspect. A low rise tending east west is situated to the to the north.

The area is characterised by mixed eucalypt woodland with sparse grasses and some young cypress. A low level of grass cover afforded good visibility across the immediate area (60%). The ground surface consists of compacted silts with low quality quartz gravels. Detailed attributes recording of these artefacts is provided in **Appendix 5.**

Potential impact of proposal:

Avoca Tank 5 is approximately 2700 metres west of the Proposed Disturbance Footprint and will therefore not be directly impacted by the Proposal. Given the considerable distance from the Proposed Disturbance Footprint there is also a low potential for this site to be accidentally disturbed through ancillary activities. Any disturbance or impact upon this site would require an Aboriginal Heritage Impact Permit (AHIP). The below recommendations are provided as a precaution.

To protect this site during the development and operation of the Proposal it is recommended that the proponent:

- Cordon off the site to prevent accidental disturbance through entry by any vehicles or unauthorised persons.
- Inform Tritton personnel of the location and designate this area is a "no go zone".
- Develop appropriate management strategies to ensure the long term conservation of this site

7.3 RELOCATION OF PREVIOUSLY RECORDED AHIMS SITES

As discussed in **Section 5.1** a review of the AHIMS site cards for the 11 previously recorded AHIMS sites within the Project Site Boundary determined that there are actually 5 sites with duplicate recordings. **Table 7.5** below shows these AHIMS sites re-organised accordingly.

An intensive inspection of (identical) grid references for AHIMS sites 26-3-0070/ 26-3-0071, 26-3-0034, 26-3-0119, 26-3-0149 was conducted using different datums (AGD 66, WGS 84 and GDA 94). A single stone artefact was located within 40 metres of the grid reference (AGD 66) and was recorded as Avoca Tank 2.

Table 7.5: Previously recorded AHIMS Sites within the Avoca Tank project area. Grid references from AHIMS. Extensive Search states AGD as Datum.

AHIMS Site ID	Site Name	Easting	Northing	Site Features
26-3-0066 / 26-3-0145	GM-HS- 27_(Hearth); Girilambone Copper Mine;	484630	6547340	Earth Mound, hearth
26-3-0067 / 26-3-0146	GM-HS-28 Hearth Girilambone Copper Mine;	484710	6547330	Earth Mound, hearth
26-3-0068 / 26-3-0147	GM-HS-29_(Hearth); Girilambone Copper Mine;	484680	6547340	Earth Mound, hearth
26-3-0070 / 26-3-0071	GM-OS/HS-1 (Hearth); Girilambone Copper Mine;	484760	6548100	Earth Mound, hearth, artefact
26-3-0034 / 26-3-0119 26-3-0149	GC-OS-1; GC-OS-HS-1 Girilambone Copper Mine;	484760	6548100	Open Artefact scatter / Hearth

A stone artefact scatter, Avoca Tank 1, consisting of 11 stone artefacts was also located 200 metres to the north, north east of the grid reference provided for these AHIMS Sites. All of the artefacts located at Avoca Tank 1 were recorded in detail (**Appendix 5)** with summary details included in the site description at 7.2.1.

Avoca Tank 1 is located approximately 50 metres north west of a dam and occurs on an eroding vehicle track. The AHIMS site cards also reports that the open artefact scatter (26-3-0034, 26-3-0119, 26-3-0149) is located on a track and 60 metres from a dam. The major difference between the current recording and AHIMS Site cards is the number of artefacts and size of the site reported. On Site CHM estimated the site area to be approximately 2600m^2 (20m NS x 130 m EW). The size of the site was defined by the spatial plotting of each artefact recorded on the site. The AHIMS site cards reports the site as 10,000m^2 (200 x 50 metres) and attached photos also show a much higher level of visibility, probably due to drought, than that recorded during this survey. It is quite possible that the floods of recent years and resulting erosion noted in 7.2.1 has displaced and dispersed much of the assemblage. On the basis of these similarities Avoca Tank 1 and 26-3-0034, 26-3-0119, 26-3-0149 is considered the same site. The spatial error margin (200 metres) is common for recordings prior to 2000 prior to more accurate GPS technology.

A comparison of the assemblages recorded at Avoca Tank 1 and AHIMS Sites 26-3-0034, 26-3-0119, 26-3-0149 shows some similarity in the raw materials (predominantly quartz and quartzite), although the current survey recorded more raw material diversity. It is highly probable that the porphyritic hammer stone recorded as part of this survey (artefact 7, **Appendix 5**) is the same as the artefact illustrated on site cards 26-3-0034, 26-3-0119, 26-3-0149 (see **Appendix 4**). On this basis it is asserted that Avoca Tank 1 and AHIMS Sites 26-3-0034, 26-3-0119, 26-3-0149 are the same site.

The AHIMS sites cards for 26-3-0070 / 26-3-0071 reported a hearth at this same location as poorly preserved and eroded in 1994. This hearth could not be re-located as part of this investigation. Given the substantial rains experienced since 1994 and widespread evidence of sheet wash, erosion and gullying noted across the survey area it is highly probable that this site has eroded away and is no longer extant.

The location of these previously recorded AHIMS sites and those recorded during this survey is shown below in **Figure 7.2**. The spatial difference shown between AHIMS Sites 26-3-0034, 26-3-0119, 26-3-0149 26-3-0070, 26-3-0071 and Avoca Tank 1 is likely to result from spatial error margins and subsequent improvement in GPS technology and spatial recording techniques.

Figure 7.2: Proposed Disturbance Footprint (light blue outline) in relation to location of previously recorded AHIMS Site AHIMS Sites 26-3-0034, 26-3-0119, 26-3-0149 26-3-0070, 26-3-0071 (Datum AGD 66) (red dot) and sites recorded by On Site CHM (Datum GDA 94) (green dots). Blue circle near Avoca Tank 1 marks outline of dam.

Each of the 'hearths' located at Avoca Tank 3 were also within close proximity to the grid references provided for the AHIMS sites recorded as hearths/earth mounds:

1: 26-3-0067, 26-3-0146
2: 26-3-0068, 26-3-0147
3: 26-3-0066, 26-3-0145

Although the location of the 'hearths' recorded at Avoca Tank 3 during this survey approximate the locations of previously recorded AHIMS hearth sites above the general site descriptions for two of the hearths recorded during this survey are appear different. The AHIMS Site cards for these sites seem to show loose scattered nodules of ant nest. 'Hearths' 2 and 3 at Avoca Tank 3 appear less scattered and are embedded in the ground more consistent with the remains of an ant nest. None the less an extensive search of the wider surrounding area failed to locate any further nodules more consistent with that described within the AHIMS Site cards. It may be that further erosion across the area has exposed more of the underlying baked sediments or it could be that these features are unrelated.

The location of these previously recorded AHIMS sites and hearths recorded during this survey is shown below in **Figure 7.3.**

Figure 7.3: Location of previously recorded AHIMS Sites (Datum AGD 66) (red dots) and hearths recorded at Avoca Tank 3 by On Site CHM (Datum GDA 94) (green dots). I6 is location of a drill hole.

In the absence of other supporting Aboriginal cultural material the author is somewhat sceptical about the definition of these nodules alone as a site within this particular environment. Numerous occurrences of ant nests at or within the base of large uprights or fallen dead rotting or hollow, un-burnt or semi-burnt trees were noted across the study area. The eventual burning out of these stumps and logs over some days would be likely to produce areas of baked sediments, hardened clumps or 'nodules'. With time and weather, the charcoal remnants of the tree would disappear and likely leave a similar manifestation to the 'nodules' recorded as sites. In the absence of any other cultural material it is unclear how these natural processes might be distinguished from cultural processes. This difficulty was previously noted by Kelton (1995) and is discussed further in **Section 8.**

7.4 SUMMARY OF RESULTS

The field survey of the Avoca Tank Project areas (Stages 1 and 2) covered 41% of the total land area and located Aboriginal occupation evidence at five localities (Avoca Tank 1 – 5).

At least two of these sites have been determined to be the same locations for several previously recorded AHIMS Sites. Table 7.6 shows a comparison of for previously recorded sites and those recorded during this study.

Table 7.6: Comparison of previously recorded AHIMS sites and sites recorded during this study. Grid references recorded by On Site CHM (Datum GDA 94).

On Site CHM Site Name	Site Features	Easting	Northing	Corresponding AHIMS Sites
Avoca Tank 1	Stone artefact scatter	55 484966	6548490	26-3-0034 / 26-3-0119/ 26-3-0149 (open artefact scatter) 26-3-0070 / 26-3-0071 (hearth)
Avoca Tank 2	Isolated stone artefact	55 484857	6548245	-
Avoca Tank 3 (3 x hearths)	Hearth 1	55 484835	6547528	26-3-0067 / 26-3-0146
	Hearth 2	55 484815	6547517	26-3-0068 / 26-3-0147
	Hearth 3	55 484729	6547486	26-3-0066 / 26-3-0145
Avoca Tank 4	Historic Scar Tree & Aboriginal Stockman's Camp	55 485027	6547775	-
Avoca Tank 5	2 x isolated stone artefacts	55 481436	6548043	-

The hearth nodules recorded at site 26-3-0070 / 26-3-0071 were unable to be relocated as part of this survey. The AHIMS site card reported this site to be eroded and in poor condition in 1994 and it is likely that these features have since been further displaced.

8.0 DISCUSSION

A number of predictions were outlined in **Section 5.2** concerning the nature, extent and types of Aboriginal objects that may occur within the Study Area.

These predictions were:

1. Scarred trees are likely to be the most common site type within the Study Area with hearth sites (some potentially with artefacts) likely to be the next most common site type.
2. Stone artefact occurrences are predicted to be low given the paucity of potable water and suitable stone for the manufacture of stone tools.
3. The broad scale land clearing and poor previous land-use practices within the Study Area are likely to have impacted heavily on all of the site types discussed above.

All of the site types predicted to occur within the Study Area were recorded during this survey. The scar tree recorded during this survey is, upon analysis, most likely to have been created during historic times (1900s).

A total of 14 stone artefacts were recorded at three locations (Avoca Tank 1, 2 and 5) representing a low density of artefacts across the Study Area. This was predicted to result from the paucity of potable water and suitable stone for the manufacture of stone tools. The results of this study are considered to confirm these predictions. It is also relevant to note the one artefact scatter is situated in the immediate vicinity of water. It is further interesting to note that no stone artefacts were located at the water source of Avoca Tank 4. This may indicate that the dam/waterhole was heavily modified in historical times from a seasonal soak, which may not have been particularly reliable.

It was also discussed in **Section 5.2** that potential Aboriginal occupation evidence in the Study Area was likely to be sparsely distributed and discrete reflecting high mobility and short term task specific localities. This is perhaps best reflected by the low number of artefacts yet relatively high diversity of stone artefact types and raw materials at Avoca Tank 1 (see 7.2.1). The presence of several exotic stone raw materials is a likely signature of this high mobility suggesting repeated but short term use of this locality. The absence of pre-contact Aboriginal occupation evidence at the Avoca Tank 4 waterhole may also indicate this.

Certainly the Aboriginal community representatives were of the view that occupation of the Study Area would have been infrequent and for very short periods of time. Aboriginal history from the informants suggests that people largely travelled along watercourses (rivers and creeks) rather than across the country between. It may be that the quite diverse assemblage at Avoca Tank 1 reflects such transit across country. Anecdotal evidence (Phil Jones, Tritton Senior geologist) suggests that none of the raw materials, except quartz, at Avoca Tank 1 occur within the Study Area. Certainly the authors own observations support this view where the only exposures of rock were quartz and some minor shales in several isolated areas. The

presence of two cobbles with smooth rolled surfaces suggests procurement from a distant water source.

It may also be plausible that the creation of this dam or modification of an existing soak to create a more reliable water source may have also encouraged Aboriginal people to congregate at this location of potable water in post contact times.

It was also predicted that the broad scale land clearing and poor previous land-use practices were likely to have impacted on all site types within the Study Area. It is not clear from the results of this study whether these practices have impacted or not. Recent flooding and resulting erosion in the area appears to have impacted upon Aboriginal occupation evidence and degraded artefact numbers at Avoca Tank 1 (AHIMS Sites 26-3-0034, 26-3-0119, 26-3-0149) and displaced the loose hearth nodules previously recorded at AHIMS sites 26-3-0070, 26-3-0071.

It was also predicted that the archaeological potential and sensitivity of the Study Area was considered to be low. This archaeological survey has determined that Aboriginal occupation evidence is sparsely distributed across the Avoca Tank Project area and found to only occur at five discrete locations. Despite a relatively intensive archaeological survey program, this study has only located three additional sites (Avoca Tank 2, 4 and 5) besides those previously recorded during the survey program by Kelton (1995).

8.1 PREVIOUS STUDIES AND SITE DEFINITION IN THE REGION

The general archaeological model posited in the region is that Aboriginal occupation, and therefore Aboriginal archaeological materials, are strongly associated with sources of potable water. (Nicholson 1989, 1990, Hughes, Hiscock and Donaldson 1984, Witter; cited in Nicholson). According to this model, occupation material will generally decrease in both frequency and density with distance away from water sources.

This decrease is likely to reflect one or all of the following factors: high level of mobility, movement of smaller groups or resource procurement in response to seasonal variation. All of these factors have been discussed in some form in the studies undertaken by practitioners in the Girilambone region.

Kelton's (1995) study results are generally consistent with this model although also indicate that occupation materials may be far more densely distributed across the landscape than previous and current studies have found. Indeed Kelton (1995:30) admits he could not explain the disparity between the site types and the numbers located during that study (1995) when compared to the site types and numbers recorded in Nicholson's overlapping study area.

One explanation for this disparity may concern the definition of sites and subsequent over representation of certain site types within the region. The most represented sites in the

region are scar trees and hearths. Discussion about the identification of scar trees is beyond the scope of the current study but the identification of hearths is discussed below in light of some observations from the current investigation.

Kelton (1995:12) in discussing hearth sites suggests:

"Termite nest material was often use by Aboriginal people in the region as an alternative heat retaining material in cooking fires, or else in conjunction with natural stone hearths which were used for the same purpose. A difficulty of interpretation arises where termite nest material occurs isolated from any other cultural material in what appears to be a hearth formation. The problem occurs in determining whether the hearth is in fact an Aboriginal hearth or else a natural occurrence resulting from a rotted and burnt tree".

Unfortunately Kelton (1995:12) does not discuss this methodological issue any further or provide any criteria to distinguishing between cultural and natural formation of these features in the absence of other supporting other cultural evidence.

Kelton (1995:24) recorded a total of 32 hearth sites during the field survey, all of which were of termite nest material (with a further two sites recorded as part of a site complex, GC-OS-1). Kelton (1995:24-25) states that "a number of hearths have questionable Aboriginal origin due to the lack of supporting, associated cultural material, and the apparent questionable origin of the actual hearth material, with some material indicating the possibility that it has originated from natural sources rather than from collection and exploitation by past Aboriginal groups. However, when comparison was drawn between hearth sites of doubtful origin and hearth sites located in association with stone artefactual material, e.g. GC-OS-1, little difference could be established, thus raising the credibility of the majority of doubtful sites".

"On the other hand, some clumps of termite nest material were definitely observed to be the remains of rotted, burnt trees, with no cultural heritage value. These occurrences were not recorded" (Kelton 1995:24-25).

Examination of the raw data presented for hearth sites in Appendix 4 of Kelton's (1995) report shows that the association between hearth sites and other Aboriginal cultural material evidence only occurs at 5 (14 %) (includes duplication of site recordings) of the 34 hearth occurrences.

Based on the line of reasoning employed by Kelton, the inverse could also apply: when comparison was drawn between hearth sites of doubtful origin and hearth sites located in association with stone artefactual material, e.g. GC-OS-1, little difference could be established, thus lowering the credibility of hearth sites located in association with stone artefactual material. It is just as plausible that occurrences of 'hearths nodules' associated with other cultural evidence are unrelated and may also result from the natural occurrences.

It is also seems that much of Kelton's assertions are based on the works of Bonhomme (1983). According to Bonhomme (1983, cited in Nicholson 1989). Open camp sites including stone artefact scatters and Aboriginal hearths were found to be the most common site type in the study area south of Cobar. Aboriginal hearths in this region consist of either lumps of termite mound and/or sandstone, clay lumps or simply accumulations of charcoal.

Several differences are apparent between Bonhomme's study area and results and that of the current Avoca Tank study area. Many of these hearth sites were located on the margins of a dry lake and across adjacent lunettes and many were closely associated with other occupation material. The occurrence of 'hearths' in a sand lunette largely absent of trees and termite mounds that may have created naturally burnt nodules is likely to be considerably more convincing than the current environment. Such occurrences in lunettes are also common in the Lake Mungo region and commonly occur with other faunal remains and artefacts.

It is evident that the identification of hearth sites should be treated somewhat cautiously given these methodological issues. It is certainly not contended here that all of the hearth sites recorded by Kelton (1995) are of natural origin but it is suggested that environmental context and association with other cultural evidence should play a critical and key role in determining whether such a feature may be of cultural or natural origin.

Certainly a reinterpretation of Kelton's 1995 findings applying such caution and indicators such as cultural association would both explain the disparity (5 hearth sites instead of 34) and present an archaeological model more consistent with the picture emerging from interpreting other more definable and reliable features of the archaeological record for Aboriginal occupation.

9.0 CULTURAL SIGNIFICANCE ASSESSMENT

The Burra Charter (the Australia ICOMOS Charter for Places of Cultural Significance) defines cultural significance as meaning aesthetic, historic, scientific, social or spiritual for past present or future generations (Marquis-Kyle, P & M. Walker 2004:11).

Cultural significance is embodied in; the place itself, it's fabric, setting, use, associations, meanings, records, related places and related objects. Places may have a range of values for different individuals or groups.

The cultural significance of the Study Area is assessed below. In the context Aboriginal cultural heritage and occupation evidence (or archaeology) and development assessment, the criteria most commonly applied to assess cultural significance are those of Aboriginal significance (encompassing social and spiritual) and archaeological (scientific significance). Where relevant aesthetic and historic values are also discussed. Educational values or potential is another category often applied to the assessment of significance. The level of educational values will comply range between different individual or groups (eg Aboriginal people and archaeologists). Management strategies to conserve identified values are discussed in **Section 10**.

9.1 ABORIGINAL SIGNIFICANCE (SOCIAL AND SPRITIUAL)

For Aboriginal people places of cultural significance are tangible expressions of identity and experience. The Study Area contains Aboriginal objects which represent a tangible link to Aboriginal identify and experience. To some degree then all Aboriginal objects and places are likely to be of significance to Aboriginal people. The degree of significance will vary according to a number of culturally determined factors.

Avoca Tank Study Area

In general terms the Registered Aboriginal Parties (RAPs) participating in the survey attributed the Study Area with a low level of Aboriginal significance. Nyngan LALC and Bogan AC representatives were generally satisfied that the survey was thorough and sufficient and did not see the need for further survey should the proposal shift from exploration to mining.

All of the sites recorded during this survey were individually discussed with the Registered Aboriginal Parties participating in the survey (**Section 3.3**). Management strategies and options were also discussed for each site and were developed based on RAP views about the significance of each site. These discussions and their interpretation provided a basis to understand the Aboriginal significance of the identified sites discussed below and the development of management strategies discussed in **Section 10**.

Avoca Tank 1: (stone artefact scatter)
Registered Aboriginal Party participants attributed this place with a moderate level of significance. They did not express concern about Tritton applying for an AHIP to disturb the area if required but did think that the artefacts should be collected should an AHIP be granted. Participants considered many of the artefacts of interest and wanted them kept locally by the Nyngan LALC.

Avoca Tank 2: (isolated stone artefact)
Registered Aboriginal Party participants attributed this place with a low level of significance. They did not express concern about Tritton applying for an AHIP to disturb the artefact and did not wish to collect the single flake if required.

Avoca Tank 3: (hearths)
Registered Aboriginal Party participants were familiar with hearth type sites as represented at Avoca Tank 3 and did not view these hearths as particularly significant due to the absence of other occupation material. Participants attributed this place with a low to moderate level of significance and did not express concern about Tritton applying for an AHIP to disturb this place if required.

Avoca Tank 4: (historic scar tree, Aboriginal stockmen's camp and dam)
Registered Aboriginal Party participants attributed this place with moderate to high level of significance. They discussed this place for some time, showed interest and offered historical information about Aboriginal people being employed as stockmen as interpretation of the features. Participants attributed the place with both ***historical*** and ***aesthetic*** values and expressed a desire to retain this place. This place is also likely to have educational and interpretive values to the local Aboriginal community.

Avoca Tank 5: (2 x isolated stone artefacts)
Registered Aboriginal Party participants attributed this place with a low level of significance. They did not express concern about Tritton applying for an AHIP to disturb these artefacts if required and did not wish to collect them.

9.2 ARCHAEOLOGICAL SIGNIFICANCE

The archaeological significance of a site or artefacts may be assessed according to two criteria, representativeness/rarity and research potential. These two criteria are interrelated.

- **Representativeness / Rarity** refers to the frequency of a particular site type, or particular attributes of a site, the similarities between site types in the study area and the wider regional context. Rare or unique site types are accorded higher archaeological significance than site types that are more common. The representativeness refers to the capacity of a site to demonstrate particular attributes within a site class. A site with high representative values will commonly be an outstanding example of its type. Sites with high

representativeness and rarity values will also commonly have high educational or interpretive values.

- **Archaeological research potentia**l refers to the degree to which a site can contribute data to answer specific research questions. The degree of a site's research potential is related to factors such as size, structure and content reflecting the range and frequency of activities exhibited at the site, regional frequency and the level of site integrity and preservation.

The attributing of archaeological significance is primarily based on the discussion of previously recorded site types within the region.

Avoca Tank 1: (stone artefact scatter)
Stone artefact scatters are a moderately common site type but are generally confined to water. It is not clear whether the dam nearby may be a soak modified in recent historical times. It was discussed in Section 7 that Avoca Tank 1 was previously recorded in 1994 as AHIMS sites 26-3-0034, 26-3-0119, 26-3-0149. Recent flooding and resulting erosion has evidently degraded artefact numbers previously recorded. Avoca Tank 1 is assessed as having a **moderate level of rarity value** and **low level of representative value.**

A high diversity of artefact types and raw materials at a given site generally indicates a higher level of archaeological research potential. This is based on the potential of the assemblage to answer a range of questions about stone artefact manufacture and technologies or their use. The stone artefact assemblage has however been degraded and is relatively small. Partial artefact values have also been recorded as part of this study. Avoca Tank 1 is therefore assessed as having a **low to moderate level of archaeological research potential.** The archaeological values would be largely salvaged should collection of these artefacts occur under an AHIP and Care Agreement.

Avoca Tank 2: (isolated stone artefact)
Isolated stone artefacts cannot be considered particularly unusual or rare in regional terms and the capacity of a single stone artefact to answer specific research questions limited. Artefact attributes (scientific values) have also been recorded as part of this study. Avoca Tank 2 is therefore assessed as having a **low level of rarity and representative value** and a **low level of archaeological research potential.**

Avoca Tank 3: (hearths)
It was previously discussed in Section 5 that this type of hearth site is relatively common and well represented in the region. Avoca Tank 3 is therefore assessed as having a **low level of rarity and representative value.**

The absence of other occupation material in association limits the archaeological research potential of Avoca Tank 3 beyond those already recorded as part of this survey. As noted

previously the author, in the absence of other occupation material in association, is sceptical about the definition of this site type. Avoca Tank 3 is therefore assessed as having a **low level of archaeological research potential.**

Avoca Tank 4: (historic scar tree, Aboriginal stockmen's camp and dam)
Scar trees generally have a high level of rarity value and their numbers are in steady decline due to their vulnerability to destructive natural and biological elements (storms, lightning, fire, rot and insect attack etc). However according to the literature scar trees are also well represented in the wider and local region.

Examination of the data presented by Kelton (1995; Appendix 3) shows that 8 (29.6%) of the 27 scar trees recorded were considered to result from extraction of bark for 'shelters' similar to that at Avoca Tank 4. Similarly the survey by Central West Archaeological and Heritage Services (1998) for the Tritton Copper project EIS (1998: 3-40-42) some 20 kms to the south west of the current study area identified a total of 47 scarred trees all of which were considered to be of 'possible' Aboriginal origin and considered of low significance. Central West asserted that most of the tree sites identified were "bark shelter" type scars and that many were of European origin. Some time has elapsed since the undertaking of these studies and natural processes are likely to have decreased their numbers further. It is also suggested that their numbers may be overrepresented in previous studies.

The assertion that this place represents an Aboriginal stockman's camp remains an interpretation and cannot be substantiated or refuted through this study. Nonetheless it remains a very plausible explanation for the presence of the different features and in the author's opinion the most likely. It is unclear how common Aboriginal stockmen camps may be in the wider area or what typical features of such camps may be. However given the widespread employment of Aboriginal men as stockmen such camps are, or at least were, likely to be relatively common.

The top of this tree and scar is substantially deteriorated and is not considered to be a good representative example of its type. Avoca Tank 4 (scar tree) is therefore considered to have a **moderate to high level of rarity** and **moderate level of representative value.**

The scar tree has a limited potential to answer questions about the removal and use of bark given the degraded state of the tree and absence of tool marks. The tree therefore has a **low to moderate level of archaeological research potential.**

Avoca Tank 5: (2 x isolated stone artefacts)
Isolated stone artefacts cannot be considered particularly unusual or rare in regional terms and the capacity of 2 single stone artefacts to answer specific research questions is limited. Artefact attributes (scientific values) have also been recorded as part of this study. Avoca Tank 5 is therefore assessed as having a **low level of rarity and representative value** and a **low level of archaeological research potential.**

Given the paucity of Aboriginal sites and objects across the Project Site, the subject land is generally assessed as having a low archaeological potential and significance.

9.3 AESTHETIC SIGNIFICANCE

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.

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. Further such values do not directly relate to understanding the identified Aboriginal objects or sites or their management under the NPW Act.

It could be argued that the Aboriginal stone artefacts identified at Avoca Tank 1, 2 and 5 have some aesthetic values to Aboriginal people. These values are considered secondary to the primary value, of social significance, attributed to artefacts by Aboriginal people.

9.4 HISTORICAL SIGNIFICANCE

The Registered Aboriginal Parties participating in the survey attributed Avoca Tank 4 with some historical significance based on the interpretation that the features are all related and represent the activities of Aboriginal stockmen employed in the early 1900s.

This interpretation cannot be substantiated or refuted but remains a very plausible explanation for this place. This historical association remains significant for Aboriginal people at the local level.

9.5 ATTRIBUTING SIGNIFICANCE

Identified sites were attributed with a separate value between (1 to 5 / low to high See Table 9.1) for their Aboriginal significance (based on interpretations of the consultation) and archaeological significance (representative / rarity values and archaeological research potential). Values attributed for archaeological significance were based on the discussion above.

These scores were then totalled (0 to 5 values x 4 significance indicators = cumulative values) to provide a numeric value reflecting the level of cultural significance for each place (See Table 9.2).

These values were ranked against the following index of cumulative values to determine the overall cultural significance of each place. Aboriginal significance was also included in this matrix. The cultural significance for each site is summarised in **Table 9.3**.

Table 9.1: Significance indicators and cumulative values index

Value	Significance	Cumulative values	Attributed significance
1	Low	4-7	Low
2	Low to moderate	8-11	Low to moderate
3	Moderate	12 – 14	Moderate
4	Moderate to high	15 - 17	Moderate to high
5	High	18 – 20	High

Table 9.2: Significance values assigned for identified sites

Sites	Aboriginal significance	Rarity values	Representative values	Archaeological research values	Cumulative Value total	Attributed significance
Avoca Tank 1	3	3	1	2	9	Low to moderate
Avoca Tank 2	1	1	1	1	4	Low
Avoca Tank 3	2	1	1	1	5	Low
Avoca Tank 4	4	4	3	2	13	Moderate
Avoca Tank 5	1	1	1	1	4	Low

Table 9.3: Summary of cultural significance for identified sites

Sites	Attributed significance	Comments
Avoca Tank 1	Low to moderate	Small, low density artefact scatter with moderate diversity of stone artefact type and raw material diversity reflecting. Moderately significant to RAPs.
Avoca Tank 2	Low	Single isolated stone artefact. Common in region and of low significance to RAPs.
Avoca Tank 3	Low	3 x hearth sites with no other cultural material in association. Common site type in region. Low to moderate significance to RAPs.
Avoca Tank 4	Moderate	Scar tree has moderate to high rarity value and significance to RAPs. Aboriginal Stockmen's camp has historical and aesthetic value to RAPs
Avoca Tank 5	Low	2 x isolated stone artefact. Common in region and of low significance to RAPs.

10.0 CONCLUSIONS, MANAGEMENT AND RECOMMENDATIONS

10.1 CONCLUSIONS

1. The survey and assessment process for the Avoca Tank Project has identified a total of five locations where Aboriginal sites and objects occurs. (Avoca Tank 1 to 5).
2. A review of the 11 previously recorded AHIMS sites within the Project Site Boundary has determined that there are duplicate recordings. These 11 sites actually represent 5 sites. Two of these sites have been rerecorded as part of this survey. Duplicate site recordings 26-3-0034 / 26-3-0119/ 26-3-0149 have been identified and rerecorded as Avoca Tank 1 and duplicate site recordings 26-3-0067 / 26-3-0146, 26-3-0068 / 26-3-0147, 26-3-0066 / 26-3-0145 have been recorded as Avoca Tank 3 comprising 3 hearth locales. Hearth nodules recorded at site 26-3-0070 / 26-3-0071 were unable to be relocated as part of this survey and it is likely that these features have since eroded away. Problems relating to the definition of the 'hearth' site type have also been discussed within this assessment.
3. The results of this assessment reveal Aboriginal occupation evidence is sparsely distributed across the Study Area and is indicative of low intensity use of the landscape by Aboriginal people in the past. This use was characterised by a high level of mobility and relatively short term occupation or single use of these places.
4. The low intensity of Aboriginal occupation evidence across the Study Area is likely due to the paucity of reliable sources of potable water, stone outcrops suitable for the manufacture of stone tools and to some extent the disturbance upon Aboriginal occupation evidence through previous land use practices.
5. The cultural significance (encompassing Aboriginal and archaeological significance) of the study area and these places has been assessed through Aboriginal consultation and archaeological analysis within a regional context. The Registered Aboriginal Parties (RAPs) participating in the survey attributed the Study Area with a low level of Aboriginal significance. Given the paucity of Aboriginal sites and objects across the Project Site, the subject land has also been assessed as having a low archaeological potential and significance. Avoca Tank 1 (an open artefact scatter), is assessed as having a low to moderate level of cultural significance. Avoca Tank 2 (a single isolated stone artefact), is assessed as having a low level of cultural significance. Avoca Tank 3 (three 'hearths') is assessed as having a low level of cultural significance. Avoca Tank 4 (historic scar tree and Aboriginal stockman's camp) is assessed as having a moderate level of cultural significance. Avoca Tank 4 has been assessed by Registered Aboriginal Parties as having a moderate to high level of Aboriginal significance and also attributed with historic and aesthetic values. Avoca Tank 5 (2 x isolated stone artefacts), is assessed as having a low level of cultural significance.

10.2 COMMENTS FROM THE REGISTERED ABORIGINAL PARTIES

A draft of the previous assessment report (On Site CHM 2013) was sent to the Registered Aboriginal Parties on 21st February 2013. The Registered Aboriginal Parties were provided 28 days to review the report and provide comment. The closing date for comments was 22nd March 2013.

All of the Registered Aboriginal Parties supplied comment on that draft. Nyngan LALC and Bogan Aboriginal Corporation endorsed the assessment and the recommendations. A copy of those endorsement letters is included in **Appendix 7**.

Native Title Services Corporation, on behalf of the Ngemba/Ngiyampaa Native Title claim group, also provided comment on the assessment (**Appendix 7**). A response was provided to NTS Corp who provided further response also included at **Appendix 7**.

The recommendations of that report included strategies to mitigate potential impacts and disturbance of identified Aboriginal sites and objects if AHIPS were sought by the proponent. Given the Proposal will now avoid all identified Aboriginal sites and objects, the focus of the recommendations in this report have been revised from mitigating impact to managing the conservation of places during the development and operation of the Proposal. A copy of the original recommendations (On Site CHM 2013) has been provided at **Appendix 7** to provide context to the comments of the Registered Aboriginal Parties.

Plate 10.1 (below): (from left) Aboriginal Representatives Lesly Ryan (Bogan Aboriginal Corporation), Sheila Couley (Nyngan Local Aboriginal Land Council), Kate Duca (OnSite CHM), Neville Merritt (Ngemba/Ngiyampaa Native Title claim group) discuss site protection with Paul Calvin (Tritton / Straits Resources) (On Site CHM 2013).

10.3 MANAGEMENT OPTIONS

This assessment has identified five Aboriginal heritage places (Avoca Tank 1 to 5) within the Avoca Tank Project Site containing Aboriginal objects legally protected under the *National Parks and Wildlife Act (*NPW Act). Part 6 of the NPW Act provides specific protection for Aboriginal objects by establishing offences of *harm*. *Harm* is defined to mean destroying, defacing, damaging or moving an object from the land. There are a number of defences and exemptions to the offence of harming an Aboriginal object. One of these defences is that the *harm* was carried out under an Aboriginal Heritage Impact Permit (AHIP).

The Proposal has subsequently been developed to avoid all of the identified Aboriginal sites and objects within the Avoca Tank Project Site. None of the identified places (Avoca Tank 1 to 5 and associated AHIMS Sites) are proposed to be directly impacted upon or *harmed* during the development of this Proposal and AHIPs will therefore not be required.

The development of management strategies is therefore concerned with the prevention of *harm* through protection and conservation of these places during the development and operation of the Proposal. The main risks of *harm* to these places through accidental or indirect impacts are discussed below.

During the exploratory drilling program Tritton Resources implemented a series of management strategies to afford protection to these places. These strategies were implemented in accordance with the Straits Community and Heritage Policy and Straits Procedures - Heritage Management Planning (Australia). A copy of the recommendations from the internal memo and photographic evidence (see **Plate 10.1**) of implemented protection measures are provided in **Appendix 6**.

One of the protection measures implemented by Tritton included cordoning off and classifying these places as "no go zone areas" (**Appendix 6**). The continuity of the implemented 'no go' areas and avoidance strategy will ensure that many potential accidental risks for the conservation of these places will be mitigated (Avoca Tank 1 to 5).

Stone artefacts are, by their nature durable objects. The most common direct human induced *harm* to stone artefacts and scatters (Avoca Tank 1, 2, 3 and 5) is generally through vehicle movement and associated disturbance or casual collection. The adequate exclusion of these places and designation as 'no go' will generally mitigate these potential harms. NTS comments **(Appendix 7)** on the previous assessment requested the upgrade of this fencing from a temporary to more permanent nature and this has been considered within the below recommendations (**Section 10.4**).

Common indirect and inadvertent harm to stone artefacts and scatters may also occur through undertaking of earthworks and construction of infrastructure within their proximity. The modification of areas near stone artefacts scatters may alter the natural movement of

water and thereby increase the erosive effect of water movement on a stone artefact scatter. Considering this effect within the design and ensuring adequate buffers will also mitigate this effect (Avoca Tank 1, 2, 3 and 5).

In addition to the potential disturbances and mitigative strategies discussed above, the development of conservation management strategies for Avoca Tank 4 and the scar tree should also consider the threat of fire. The landscape of the Study Area is likely to have been previously burnt on occasions. The cessation of burning (due to the proposed operational mine), near the scarred tree may result in an increased fuel load developing and posing a fire threat to the scar tree. Similarly, the exclusion of the scar tree through fencing will also exclude animal grazing and trampling which may also result in an increased fuel load and threat by fire. Ongoing management should consider and mitigate these potential risks.

10.4 RECOMMENDATIONS

On the basis that all of the identified places (Avoca Tank 1 to 5) and locations of previously recorded AHIMS Sites will be avoided and conserved during the development and operation of the Proposal, it is recommended that:

1. Avoca Tank sites (1 to 5) and locations of previously recorded AHIMS sites should continue to be designated as 'no go' areas in accordance with the Straits Community and Heritage Policy and Straits Procedures - Heritage Management Planning (Australia).

2. The existing fencing to demarcate these sites as 'no go' areas should be upgraded to steel pickets and wire sufficient to prevent unauthorised persons and animals prior to the development and operation of the Proposal. Fencing of these places does not require an Aboriginal Heritage Impact Permits (AHIPs).

3. The design and construction of Proposal components should consider the effect of water movement across the landscape and be sensitive to the possibility of creating indirect potential threats that may impact upon these places. This potential is perhaps most acute for the design of the haul road and location of drains. A buffer of at least 50 metres should be established and maintained between the 'no go' areas around identified places and proposed mine infrastructure.

4. Some specific conservation management planning is undertaken for Avoca Tank 4 to mitigate the potential increased risk of fire. The fencing of Avoca Tank 4 and shift in fire management across the Project Site may result in an increased fuel load and fire risk. Specific conservation management strategies may involve spraying / slashing of grass at appropriate intervals to suppress the fuel load or installation of a fire break outside fencing. The development of these management strategies should be informed by specialist advice.

5. The location of each place be accurately mapped as a polygon and incorporated into the relevant spatial management tool (GIS - Geographic Information System) during the development and operation of the Proposal. A buffer of at least 50 metres should be applied for these places.

6. Long term conservation management and monitoring strategies be developed and implemented for these places. These strategies should be developed as part of a specific Heritage Management Plan or incorporated into the relevant Environmental Management Plan as appropriate.

7. Information about the presence of these Aboriginal places, their values and management be incorporated into the induction materials and delivered to relevant personnel or contractors that may come into contact with these places.

8. Given the paucity of Aboriginal objects and sites across the Avoca Tank Study Area no further archaeological surveys of the Proposed Disturbance Footprint are considered warranted.

With regard to Recommendation 8, the previous assessment (On Site CHM 2013) prepared for Tritton Resources also recommended that no further archaeological surveys of the Avoca Tank Study Area were required should the project proceed to full scale mining.

The survey strategy employed by On Site CHM achieved coverage across 34% of the entire Avoca Tank Study Area and above 60% survey coverage of the Proposed Disturbance Footprint (See **Section 7.1.** and **Figure 6.2**). This level of coverage is considered sufficient to understand the potential for further Aboriginal objects and occupation evidence to occur across this landscape. This assessment has determined that Aboriginal objects and occupation evidence is sparsely distributed across the Avoca Tank Study Area.

Further archaeological surveys were not recommended due to the low density of Aboriginal objects and occupation evidence and low potential for further such evidence to occur. Subsequent and more intensive surveys are generally only considered warranted when a baseline survey identifies a moderate to high potential for further Aboriginal occupation evidence to occur. This is not the case within the Avoca Tank Project Site.

Two of the Registered Aboriginal Parties (Nyngan LALC and Bogan Aboriginal Corporation) provided their support for this recommendation. Native Title Services Corporation, on behalf of the Ngemba/Ngiyampaa Native Title claim group considered that further more intensive surveys of the Proposed Disturbance Footprint should be undertaken. A response was provided by On Site CHM to NTS Corp (**Appendix 7**) who provided a further response also included at **Appendix 7**.

A copy of this assessment report has also been distributed to the Registered Aboriginal Parties.

A summary of sites identified within the Avoca Tank Project Site, their significance, impacts of the proposed disturbance and recommendations is provided below in **Table 10.1**.

Table 10.1: Summary table for identified sites within Avoca Tank project area, assessed significance, impacts and recommendations

Sites	Previously recorded AHIMS Sites	Site type and comments	Aboriginal Significance	Archaeological Significance	Impacts (harm) of Proposed Disturbance	Summary of mitigation strategy
Avoca Tank 1	26-3-0034 / 26-3-0119 / 26-3-0149	Open artefact scatter –Low density scatter (11 x stone artefacts) with high raw material diversity and moderate artefact type diversity.	Moderate	Low to moderate	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.
-	26-3-0070 / 26-3-0071	Hearth – unable to be relocated during this survey. Likely washed away and not extant	-	-	None	Location will be avoided. No further action warranted.
Avoca Tank 2	-	Isolated stone artefact	Low	Low	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.
Avoca Tank 3	26-3-0067 / 26-3-0146 26-3-0068 / 26-3-0147 26-3-0066 / 26-3-0145	3 x hearths – no other cultural material in association.	Low to moderate	Low	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.
Avoca Tank 4	-	Historic scar tree and Aboriginal stockman's camp.	Moderate to high	Moderate	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents. Undertake specific conservation management planning to mitigate the risk of fire.
Avoca Tank 5	-	2 x Isolated stone artefacts	Low	Low	None	Upgrade existing fencing (if appropriate). Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents.

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APPENDIX 1

PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
ABN: 43 329 728 630
Ph: 0414441896
www.onsitechm.com.au

Our Ref: A015

19 March 2012

Establishing a Register of Interest for an Aboriginal Cultural Heritage Assessment and Aboriginal Heritage Impact Permit application – Girilambone Avoca Tank Project NSW 2831

I am writing to you in accordance with Section 4.1.2 of the ***Aboriginal cultural heritage consultation requirements for proponents*** and specifically to initiate Stage 1 of the Aboriginal consultation process.

Tritton Resources Limited Pty is in the early stage of exploration of a newly identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project. The Avoca Tank Project area covers approximately 8.7km^2 across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The project area is approximately 4 kilometres north west along the Mitchell Highway of the town of Girilambone NSW 2831. A map showing the location of the subject area is attached.

On Site Cultural Heritage Management has been engaged to conduct an Aboriginal Cultural Heritage Assessment of the subject land. The assessment may result in an application for an Aboriginal Heritage Impact Permit (AHIP) pursuant to the *NSW National Parks and Wildlife Act*.

In accordance with Stage 1 of the *Aboriginal cultural heritage consultation requirements for proponents*, I am writing to you to identify Aboriginal persons who may hold cultural knowledge relevant to determining the significance of Aboriginal objects that may be located within the project area.

Could you please conduct relevant database or register searches and provide the names of Aboriginal people you consider may be affected by this proposal. The names of Aboriginal persons you provide will be invited to register an interest in the project and participate in the consultation process.

Your assistance in this process would be much appreciated and ensure that the proponent and OEH consider the views of Aboriginal people affected by this proposal.

Could you please forward the names of those Aboriginal persons you consider may be affected by this proposal to me by 3 April 2012.

Please note that this correspondence has been sent to the following organisations in accordance with Section 4.1.2 of the consultation requirements:

a) Office of Environment and Heritage EPRG regional office, North West Dubbo
b) Nyngan Local Aboriginal Land Council
c) the Registrar, *Aboriginal Land Rights Act 1983* for a list of Aboriginal owners
d) the National Native Title Tribunal for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements
e) Native Title Services Corporation Limited (NTSCORP Limited)
f) Bogan Shire Council, Nyngan
g) Central West Catchment Management Authority, Nyngan for contact details of any established Aboriginal reference group

Please contact me should you require any further information or wish to discuss this proposal.

Regards

Gerard Niemoeller
Principal Heritage Consultant

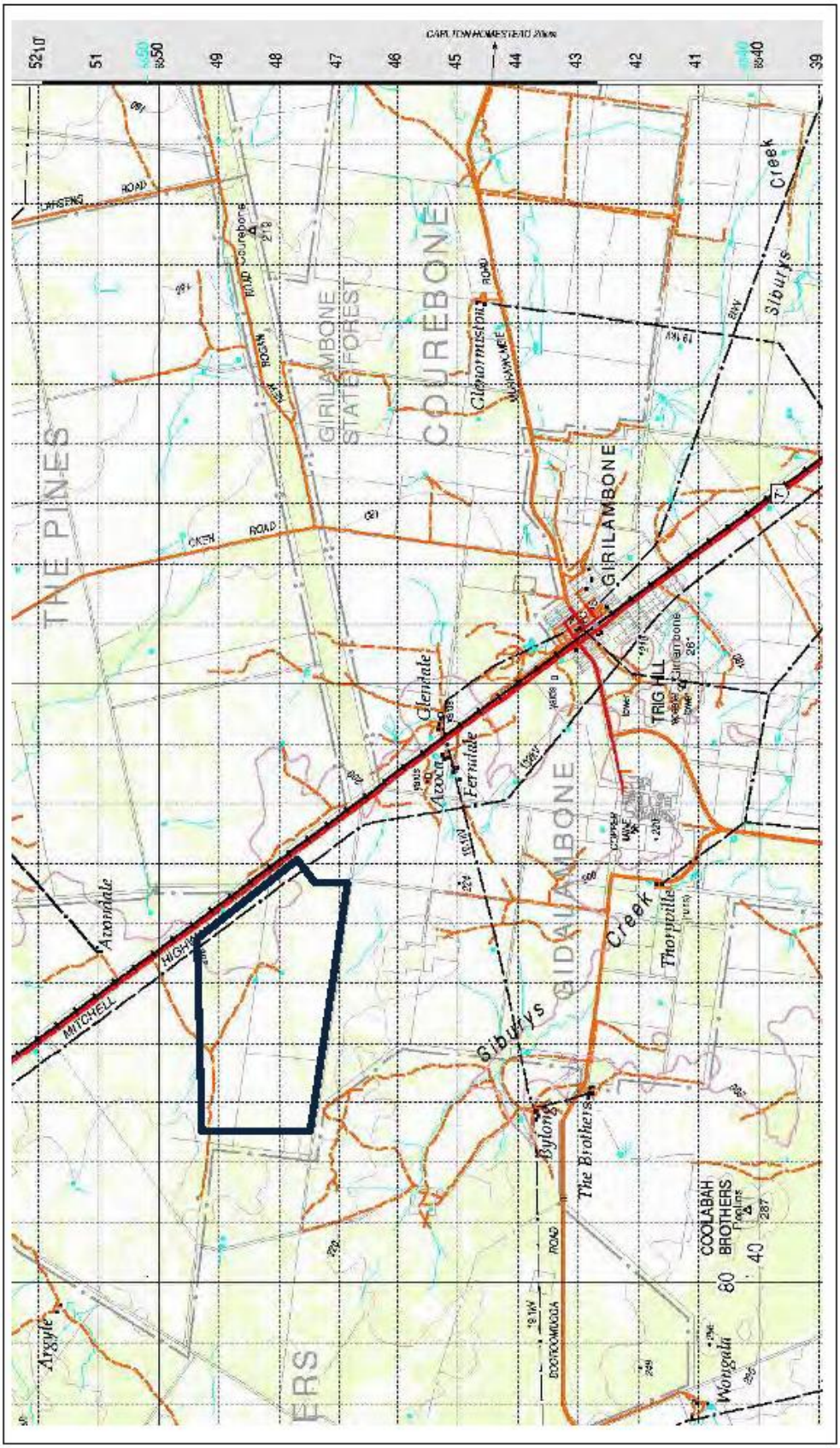

Figure 1: Avoca Tank project area (8.7km^2) shown in thick blue lines across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet

NSW GOVERNMENT Office of Environment & Heritage

Your reference	Proposed Girilambone Avoca Tank Project, Girilambone NSW
Our reference	DOC12/11482
Contact	Paul Houston 68835361

Onsite Cultural Heritage Management
PO Box 574
NAROOMA NSW 2546
Att: Gerard Niemoeller

20th March 2012

Dear Gerard,

WRITTEN NOTIFICATION AS REQUIRED UNDER OFFICE OF ENVIRONMENT AND HERITAGE (OEH) ABORIGINAL CULTURAL HERITAGE REQUIREMENT FOR PROPONENTS 2010 – Proposed Girilambone Avoca Tank Project, Girilambone NSW

I refer to your letter dated 19th March 2012 to the Office of Environment and Heritage (OEH) regarding the above matter.

A list of known Aboriginal parties that OEH feels is likely to have an interest in this development is attached as Attachment 1 (overleaf). Please note this list is not necessarily an exhaustive list of all interested Aboriginal parties and receipt of this list does not remove the requirement of a proponent/consultant to advertise in local print media and contact other bodies seeking interested Aboriginal parties, in accordance with the requirements.

If you wish to discuss any of the above matters further please contact me, at your earliest convenience, on (02) 6883 5361.

Yours sincerely

Paul Houston
Aboriginal Heritage Planning Officer
OEH

The Department of Environment Climate Change and Water is now known as The Office of Environment and Heritage.

PO Box 2111, Dubbo NSW 2830
48-52 Wingewarra St Dubbo NSW
Tel: (02) 6883 5330 Fax: (02) 6884 9382
www.environment.nsw.gov.au

ATTACHMENT 1

OEH'S LIST OF ABORIGINAL STAKEHOLDER GROUPS WITHIN THE BOGAN LGA - THAT MAY HAVE AN INTEREST IN THE PROJECT; PROVIDED AS PER THE "OEH ABORIGINAL CULTURAL HERITAGE REQUIREMENT FOR PROPONENTS 2010".

Organisation/Affiliation	Name/Title	Address
Bogan Aboriginal Corporation		PO Box 345 NYNGAN NSW 2825
John Shipp		79 Thompson Street Dubbo
NYNGAN LALC	Chairperson	PO Box 43 NYNGAN NSW 2825

The Department of Environment Climate Change and Water is now known as The Office of Environment and Heritage.

PO Box 2111, Dubbo NSW 2830
48-52 Wingewarra St Dubbo NSW
Tel: (02) 6883 5330 Fax: (02) 6884 9382
www.environment.nsw.gov.au

NYNGAN LOCAL ABORIGINAL LAND COUNCIL

PO Box 43
NYNGAN NSW 2825
EMAIL: nynganlalc@bigpond.com

ABN: 67 669 167 656
PH: (02) 6832 2639
FAX: (02) 6832 2878

28th March 2012

On Site
Cultural Heritage Management
Attention: Gerard Niemoeller
PO BOX 574
NAROOMA NSW 2546

Dear Gerard

Re: Girilambone Avoca Tank Project 2831

Nyngan Local Aboriginal Land Council would like to register an interest in the Girilambone Avoca Tanks Project.

Another Aboriginal Organisation in the Nyngan Community is Bogan Aboriginal Corporation. There contact details are:
Bogan Aboriginal Corporation
CEO: Lesly Ryan
46 Nymagee St
Nyngan NSW 2825
Ph: 02 68 321 750
M: 0419 418 851
E: boganac@netxp.com.au

Looking forward to working with you in the future.Thankyou

Yours faithfully

Veneta Dutton
CEO
Nyngan LALC

NYNGAN LOCAL
ABORIGINAL
LAND COUNCIL

National Native Title Tribunal

South-East & Central Registry
Sydney Office
Level 25, 25 Bligh Street
Sydney NSW 2000
GPO Box 9973
Sydney NSW 2000
Telephone (02) 9227 4000
Facsimile (02) 9227 4030

26 March 2012

Gerard Niemoeller
Principal Heritage Consultant
Onsite Cultural Heritage Management
PO Box 574
Narooma NSW 2546

Our Reference: 4815/12nt
Your Reference: A015

Dear Mr Niemoeller

Native Title Search Results of Girilambone within Bogan Shire Council Local Government Area

Thank you for your search request of 19 March 2012 in relation to the above area.

Search Results
The results provided are based on the information you supplied and are derived from a search of the following Tribunal databases:

Register Type	NNTT Reference Numbers
Schedule of Applications (unregistered claimant applications)	NC12/1
Register of Native Title Claims	Nil.
National Native Title Register	Nil.
Register of Indigenous Land Use Agreements	Nil.
Notified Indigenous Land Use Agreements	Nil.

I have included an application summary, map attachment and a NNTT Registers fact sheet to help you understand the search result.

Please note that there may be a delay between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. As a result, some native title determination applications recently filed in the Federal Court may not appear on the Tribunal's databases.

Resolution of native title issues over land and waters.

Freecall 1800 640 501
www.nntt.gov.au

The search results are based on analysis against external boundaries of applications only. Native title applications commonly contain exclusions clauses which remove areas from within the external boundary. To determine whether the areas described are in fact subject to claim, you need to refer to "Area covered by claim" section of the relevant Register Extract or Application Summary and any maps attached.

Search results are the existence of native title
Please note that the enclosed information from the Register of Native Title Claims and/or the Schedule of Applications is **not** confirmation of the existence of native title in this area. This cannot be confirmed until the Federal Court makes a determination that native title does or does not exist in relation to the area. Such determinations are registered on the National Native Title Register.

Tribunal accepts no liability for reliance placed on enclosed information
The enclosed information has been provided in good faith. Use of this information is at your sole risk. The National Native Title Tribunal makes no representative, either express or implied, as to the accuracy or suitability of the information enclosed for any particular purpose and accepts no liability for use of the information or reliance placed on it.

If you have any further queries, please contact me on 1800 640 501.

Yours sincerely

Nakari Thorpe
Senior Case Management Assistant

Telephone (02) 9227 4004
Facsimile (02) 9227 4030
Email Nakari.thorpe@nntt.gov.au

Encl

NATIONAL NATIVE TITLE TRIBUNAL

Claimant Application Summary

Application numbers	Federal Court number: NSD415/12 NNTT number: NC12/1
Application name	Ngemba/Ngiyampaa People
Name of body where application filed	Federal Court of Australia
Date application filed	14/03/2012
Current stage(s)	Currently Identified for Registration Testing, Pre Notification
Registration information	*Please refer to the Register of Native Title Claims/National Native Title Register (as appropriate) for registered details of this application.* **Registration test status:** Currently identified for Reg. Test
Applicants	Mrs Elaine Ohlsen, Mr Peter Williams, Mr Brett Smith, Ms Danielle Flakeler-Carney, Mr Neville Merritt, Mr Edward Shipp, Mr John Shipp, Ms Grace Gordon, Mr Jason Ford
Address for service	NTSCORP Ltd Unit 1a Suite 2.02, 44-70 Rosehill Street REDFERN NSW 2016 Phone: (02) 9310 3188 Fax: (02) 9310 4177
Persons claiming to hold native title	The Ngemba/Ngiyampaa People are the native title claim group on whose behalf the Applicant makes this application. The native title claim group comprises all the descendents of the following apical ancestors: Caroline Hilt (who was born on the Barwon River around 1847); Thomas Sullivan (who was born in Brewarrina about 1860); Nellie Colless (who was born in Brewarrina around 1868); Billy Coleman (who was born in Cobar in 1840); Mary Ann Allen (who was born in 1844); Moses Biggs (who was born in 1837); Polly Parkes (who was born in 1846); Anne Brandy (who was born in Colane in 1874); Caroline Brandy (who was born on Duck Creek in 1869); Wadna Boe (who was born in 1848); Richard King (who was born in 1827); Jimmy Keewong (who was born in 1849); Kitty Narrangie; Tom Dennis (who was born in Brewarrina in 1864); Winnie Pierce (who was born in Brewarrina in 1878); Jack Dennis (who was born on the Barwon River in around 1855); Kate Baker (who was born in Boorooma in 1874); Francis "Tracker" Williams (who was born in Gundabooka in 1883); William Johnson (who was born in Big Willandra in 1876); Henry Parkes (who was born in 1863); Topsy Harris also known as Topsy Scotty (who was born in Marfield in 1866); Jack Redtank; Thomas Williams also known as Thomas Broughton (who was born in Roto); Maggie Redtank (who was born in Keewong in 1868);

	Ada Arnott (who was born in Nyngan in 1865); Moses Divine; Jack Smith (who was born in Mossgiel in 1869); Ellen Sprowl also known as Ellen McHughes (who was born in Brewarrina in 1867); Fanny Hippi also known as Fanny Williams; Millie Wells also known as Millie Shearer (who was born in Brewarrina in 1874); Pluto Williams (who was born in Trida/Mossgiel in 1873); Steve Shaw (who was born in Coronga Peak in 1855); Fanny Brown also known as Tiltagara Fanny (who was born in Hillston in 1862); David Brown (who was born on the Macquarie River in 1850);„ Janey Brown (who was born on the Macquarie River in 1853); Betsy Gwen (who was born in Haddon Rigg near Warren in 1849); Louise Hinton (who was born on the Macquarie River in 1843); Cissy Lee (who was born in 1852); Boorooma Murphy (who was born in Boorooma in 1832); Harry Murphy (who was born in Brewarrina around 1871); Thomas Nixon (who was born in Buttabone in 1843); Colaine Lumpy (who was born in 1864); Charlotte Wilson; Tilly Riley (who was born in 1863); Geordie Murray (who was born in 1851 in Ivanhoe).
Native title rights and interests claimed	1. Where exclusive native title can be recognised (such as areas where there has been no prior extinguishment of native title or where s.238 and/or ss.47, 47A, 47B apply), the Ngemba/Ngiyampaa People as defined in Schedule A of this application, claim the right to possession, occupation, use and enjoyment of the lands and waters of the application area to the exclusion of all others subject to the valid laws of the Commonwealth and the State of New South Wales. 2. Where exclusive native title cannot be recognised, the Ngemba/Ngiyampaa People as defined in Schedule A of this application, claim the following non-exclusive rights and interests including the right to conduct activities necessary to give effect to them: (a) the right to access the application area; (b) the right to use and enjoy the application area; (c) the right to move about the application area; (d) the right to camp on the application area; (e) the right to erect shelters and other structures on the application area; (f) the right to live being to enter and remain on the application area; (g) the right to hold meetings on the application area; (h) the right to hunt on the application area; (i) the right to fish in the application area; (j) the right to have access to and use the natural water resources of the application area; (k) the right to gather and use the natural resources of the application area (including food, medicinal plants, timber, tubers, charcoal, wax, stone, ochre and resin as well as materials for fabricating tools, hunting implements, making artwork and musical instruments); (l) the right to share and exchange resources derived from the land and waters within the application area; (m) the right to participate in cultural and spiritual activities on the application area; (n) the right to maintain and protect places of importance under traditional laws, customs and practices in the application area; (o) the right to conduct ceremonies on the application area; (p) the right to transmit traditional knowledge to members of the native title claim group including knowledge of particular sites on the application area; (q) the right to speak for and make non-exclusive decisions about the application area in accordance with traditional laws and customs; (r) the right to speak authoritatively about the application area among other Aboriginal People in accordance with traditional laws and customs; and (s) the right to control access to or use of the lands and waters within the application area by other Aboriginal People in accordance with traditional laws and customs. 3. The native title rights and interests referred to in paragraph 2 do not confer possession, occupation, use or enjoyment of the lands and waters of the application area to the exclusion of all others. 4. The native title rights and interests are subject to and exercisable in accordance with: (a) the laws of the State of New South Wales and the Commonwealth of Australia including the common law; (b) the rights (past or present) conferred upon persons pursuant to the laws of the Commonwealth and the laws of the State of New South Wales; and

	(c) the traditional laws and customs of the Ngemba/Ngiyampaa People for personal, domestic and communal purposes (including social, cultural, religious, spiritual and ceremonial purposes).

Area	**Jurisdiction:** New South Wales **Location:** The application covers an area of 95,125sq km over northern-central NSW. It covers Brewarrina to the north, Gilgandra to the east, Hillston to the south and Ivanhoe to the west. **Local government region(s):** Bogan Shire Council, Bourke Shire Council, Brewarrina Shire Council, Carrathool Shire Council, Central Darling Shire Council, Cobar Shire Council, Coonamble Shire Council, Gilgandra Shire Council, Lachlan Shire Council, Walgett Shire Council, Warren Shire Council **Representative A/TSI body(s):** NTSCORP Limited **Approximate size:** 95,125sq km (Note: There may be areas within the external boundary of the application that are not claimed.) **Land/water and/or sea:** Land/Water **Area covered by the claim (as detailed in the application):** (A) Area covered by application The area covered by the application ("the Application Area") comprises all of the land and waters within the external boundaries described in Attachment B and depicted in the map at Attachment C. The Application Area description and map have been prepared with the assistance of the Geo-Spatial Unit of the National Native Title Tribunal. The area covered by this application does not include the areas described at point B below. (B) Areas within the external boundaries not covered by the application 1. The area covered by the application excludes any land and waters covered by past or present freehold title or by previous valid exclusive possession acts as defined by section 23B of the Native Title Act (1993) (Cth). 2. The area covered by the application excludes any land and waters which are: a) a Scheduled interest; b) a freehold estate; c) a commercial lease that is neither an agricultural lease nor a pastoral lease; d) an exclusive agricultural lease or exclusive pastoral lease; e) a resdential lease; f) a community purpose lease; g) a lease dissected from a mining lease and referred to in s.23B(2)(c)(vii) of the Native Title Act 1993 (Cth); h) any lease (other than a mining lease) that confers a right of exclusive possession over particular land or waters. 3. Subject to paragraphs 5 and 6, the area covered by the application excludes any land or waters covered by the valid construction or establishment of any public work, where the construction or establishment of the public work commenced on or before 23 December 1996. 4. Subject to paragraphs 5 and 6, exclusive possession is not claimed over areas which are subject to valid previous non-exclusive possession acts done by the Commonwealth, State or territory. 5. Subject to paragraph 7 below, where the act specified in paragraphs 2, 3 and 4 falls within the provisions of: a) s.23B(9) - Exclusion of acts benefiting Aboriginal Peoples or Torres Strait Islanders; b) s.23B(9A) - Establishment of a national park or state park; c) s.23B(9B) - Acts where legislation provides for non-extinguishment; d) s.23B(9C) - Exclusion of Crown to Crown grants; and e) s.23B(10) - Exclusion by regulation the area covered by the act is not excluded from the application. 6. Where an act specified in paragraphs 2, 3 and 4 affects or affected land or waters referred to in: a) s.47 - Pastoral leases etc covered by claimant application; b) s.47A - Reserves covered by claimant application;

	c) s.47B - Vacant Crown land covered by claimant application the area covered by the act is not excluded from the application. 7. The area covered by the application excludes land or waters where native title rights and interests claimed have been otherwise extinguished. 8. The area covered by the application excludes the land and waters covered by the Barkandji People's native title determination application NSD6084/1998 (Barkandji Traditional Owners #8 v Attorney General of NSW) (NC97/32).

Attachments	1. A map showing the boundaries of the area covered by the application , Attachment C of the Application, 1 page - A3, Attached 14/03/2012. 2. Description of the area covered by the application, Attachment B of the Application, 4 pages - A4 , Attached 14/03/2012.

NNTT contact details	**Case manager:**	Nicole Maher
	Address:	National Native Title Tribunal Level 25 25 Bligh Street SYDNEY NSW 2000 GPO Box 9973 SYDNEY NSW 2001
	Phone:	(02) 9227 4000 Freecall 1800 640 501
	Fax:	(02) 9227 4030
	Web page:	www.nntt.gov.au

Searching the NNTT Registers in New South Wales

Search service
On request the National Native Title Tribunal will search its public registers for you. A search may assist you in finding out whether any native title applications (claims), determinations or agreements exist over a particular area of land or water.

In New South Wales native title cannot exist on privately owned land including family homes or farms.

What information can a search provide?
A search can confirm whether any applications, agreements or determinations are registered in a local government area. Relevant information, including register extracts and application summaries, will be provided.

In NSW because we cannot search the registers in relation to individual parcels of land we search by local government area.

Most native title applications do not identify each parcel of land claimed. They have an external boundary and then identify the areas not claimed within the boundary by reference to types of land tenure e.g., freehold, agricultural leasehold, public works.

What if the search shows no current applications?
If there is no application covering the local government area this only indicates that at the time of the search either the Federal Court had not received any claims in relation to the local government area or the Tribunal had not yet been notified of any new native title claims.

It does not mean that native title does not exist in the area.

Native title may exist over an area of land or waters whether or not a claim for native title has been made.

Where the information is found
The information you are seeking is held in three registers and on an applications database.

National Native Title Register
The National Native Title Register contains determinations of native title by the High Court, Federal Court and other courts.

Register of Native Title Claims
The Register of Native Title Claims contains applications for native title that have passed a registration test.

Registered claims attract rights, including the right to negotiate about some types of proposed developments.

Register of Indigenous Land Use Agreements
The Register of Indigenous Land Use Agreements contains agreements made with people who hold or assert native title in an area.

The register identifies development activities that have been agreed by the parties.

Application summaries
An application summary contains a description of the location, content and status of a native title claim.

This information may be different to the information on the Register of Native Title Claims, e.g., because an amendment has not yet been tested.

How do you request a search?

A search request form is available on the Tribunal's web site at:
http://www.nntt.gov.au/registers/search.html
Mail, fax or email your request to the Tribunal's Sydney registry, identifying the local government area/s you want searched.

Email: SydneySearch@nntt.gov.au
Fax: (02) 9227 4030
Address: GPO Box 9973, Sydney NSW 2001
Phone: (02) 9227 4000

Application Summary Attachment:
NSD415/2012 (NC12/1),
External boundary description
Attachment B of the Application
Page 1 of 4, A4, 14/03/2012

External boundary description

The application area covers all the land and waters within the external boundary described as:

Commencing at the southernmost point of the application at the intersection of the centrelines of the Roto Road reserve and the Lachlan River at Hillston and extending generally north westerly along the centreline of that road reserve to Mossgiel Trunk Road; then generally westerly along the centreline of that road reserve to the Cobb Highway; then generally north westerly along the centreline of that road reserve to the Ivanhoe – Menindee Road; then generally westerly along the centreline of that road reserve to the eastern boundary of native title determination application NSD6084/98 Barkandji Traditional Owners 8 (NC97/32) at Longitude 144.206842° East; then continuing along the boundaries of that native title determination application, also described as:

From the centreline of the Ivanhoe – Menindee Road reserve at Longitude 144.206842° East; and extending northerly to the western boundary of Lot 4594 on DP767758 at Latitude 32.301343° South; then generally northerly along the western boundaries of that lot to the easternmost corner of Lot 776 on DP762100; then north westerly along the boundaries of that lot to the easternmost corner of Lot 775 on DP762082; then continuing north westerly and south westerly along the boundaries of that lot to the southernmost corner of Lot 774 on DP762102; then south westerly, north westerly, north easterly and south easterly along the boundaries of that lot to the southernmost corner of Lot 1979 on DP763987; then generally north easterly and north westerly along the boundaries of that lot to the westernmost corner of Lot 4595 on DP767759; then generally north easterly along the north western boundaries of that lot and Lot 1130 on DP762534 to the easternmost corner of Lot 939 on DP762071; then north westerly along the boundary of that lot to the southern boundary of the Barrier Highway road reserve; then north easterly and generally easterly along the southern boundaries of that road reserve to Longitude 144.803043° East; then generally north easterly through Longitude 144.804560° East, Latitude 31.576881° South to a point on the western boundary of Lot 1282 on DP762978 at Latitude 31.429323° South; then north westerly to the westernmost corner of that lot; then generally north easterly along the north western

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Application Summary Attachment:
NSD415/2012 (NC12/1),
External boundary description
Attachment B of the Application
Page 2 of 4, A4, 14/03/2012

boundaries of that lot, Lot 1283 on DP762979 and Lot 4176 on DP766743 to the easternmost corner of Lot 5412 on DP768323, being the point at where it leaves the boundary of native title determination application NSD6084/98 Barkandji Traditional Owners 8 (NC97/32).

Then continuing generally north easterly along the north western boundaries of Lot 4176 on DP766743, Lot 4177 on DP766744, Lot 4857 on DP769170 and onwards across Louth Road to the western boundary of Lot 2 on DP803696; then generally northerly along the south western boundary of that lot, south western and north western boundaries of Lot 964 on DP762132, south western boundary of Lot 3610 on DP765962, south western and north western boundaries of Lot 3609 on DP765961, western boundary of Lot 933 on DP762220, south western and north western boundaries of Lot 625 on DP761643 to it northernmost corner; then continuing north easterly across Gunderbooka Kings Cross Road to the western boundary of Lot 1394 on DP763061; then generally northerly along the western and northern boundaries of that lot to the western most corner of Gundabooka National Park; then generally north easterly along the northern boundaries of that national park to the northernmost boundary of Lot 3147 on DP765352; then north easterly along the boundary of that lot to the western boundary of Lot 2250 on DP764515; then north westerly and easterly along the boundaries of that lot and onwards to the centreline of the Kidman Way road reserve; then generally northerly along the centreline of that road reserve to the prolongation westerly of the southern boundary of Lot 4678 on DP767842; then easterly to and along the southern boundary of that lot and Lot 263 on DP760955; then generally northerly along the eastern boundaries of that lot to the eastern boundary of an unnamed road reserve located between Lot 4291 on DP767038 and Lot 61 on DP751841; then northerly to centreline of that unnamed road reserve; then generally north easterly along the centreline of that road reserve to the western boundary of the Mitchell Highway; then continuing north easterly across that highway to the westernmost corner of Lot 52 on DP751841; then generally north easterly along the western boundary of that lot, eastern boundary of Lot 4133 on DP766638, western boundaries of Lot 40 on DP751867, Lot 42 on DP751867, Lot 6830 on DP43320 and Lot 6829 on DP43320 to the Kamilaroi Highway; then continuing north easterly across that highway to the centreline of an unnamed road reserve located parallel to the western boundary of Lot 39 on DP751867; then generally northerly along that road reserve to the prolongation southerly of the easternmost boundary of Lot 59 on DP751867, then generally northerly to and along the eastern boundary of that lot and the eastern

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Application Summary Attachment:
NSD415/2012 (NC12/1),
External boundary description
Attachment B of the Application
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boundary of Lot 4357 on DP767194 to the Darling River and onwards to its centreline; then generally northerly, generally easterly and generally south easterly along the centreline of that river, the Barwon River, the Macquarie River and the Castlereagh River to the centreline of the Newell Highway at Gilgandra; then north westerly along the centreline of that highway road reserve to the Oxley Highway; then north easterly and generally westerly along the centreline of that highway road reserve to Nancarrows Road; then generally southerly along the centreline of that road reserve to Boothaguy Creek; then generally westerly along the centreline of that creek to again the Oxley Highway; then generally south westerly along the centreline of that highway road reserve to the Gunningbar Creek; then generally north westerly along the centreline of that creek to the Albert Priest Channel; then generally westerly along the centreline of that channel to an unnamed road reserve which bisects Lot 2 on DP232612; then generally south westerly along the centreline of that road reserve to the Mitchell Highway at Mullengudgery; then generally north westerly along the centreline of that highway road reserve to the Bogan River at Nyngan; then generally southerly along the centreline of that river to Bulbodney Creek; then generally southerly along the centreline of that creek to Tigers Creek; then generally south westerly along the centreline of that creek to Yarra Yarra Creek; then generally south westerly along the centreline of that creek to Longitude 146.921830° East, then westerly to an unnamed watercourse at approximately Longitude 146.911275° East, Latitude 32.558960° South; then generally westerly along the centreline of that watercourse to Fiveways Road; then westerly approximately 500 metres to an unnamed watercourse at Latitude 32.557767° South; then generally south westerly along the centreline of that unnamed watercourse to Tinda Creek; then generally southerly along the centreline of that creek to Morumbil Swamp; then generally south westerly along the centreline of that swamp, Crowie Creek, Booberoi Creek and the Lachlan River back to the commencement point.

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Application Summary Attachment:
NSD415/2012 (NC12/1),
External boundary description
Attachment B of the Application
Page 4 of 4, A4, 14/03/2012

Data Reference and source

- Application boundary data compiled by National Native Title Tribunal based on data provided by NTSCORP.
- Native title determination application NSD6084/98 Barkandji Traditional Owners 8 (NC97/32) as accepted for registration on 2 November 2006.
- Cadastre data sourced from Public Sector Mapping Agency (November 2010).
- Roads based on casement data sourced from LPM Authority, NSW.
- Rivers / Creeks based on casement data, 1:100,000 topographic data which is © Commonwealth of Australia and is supplied by Geoimage Pty Ltd under licence from Geoscience Australia and information supplied by NTSCORP (based on 2007 LPI topographic data).

Reference datum

Geographical coordinates have been provided by the NNTT Geospatial Services and are referenced to the Geocentric Datum of Australia 1994 (GDA94), in decimal degrees and are based on the spatial reference data acquired from the various custodians at the time.

Use of Coordinates

Where coordinates are used within the description to represent cadastral or topographical boundaries or the intersection with such, they are intended as a guide only. As an outcome to the custodians of cadastral and topographic data continuously recalculating the geographic position of their data based on improved survey and data maintenance procedures, it is not possible to accurately define such a position other than by detailed ground survey.

Prepared by Geospatial Services, National Native Title Tribunal (19 August 2011)

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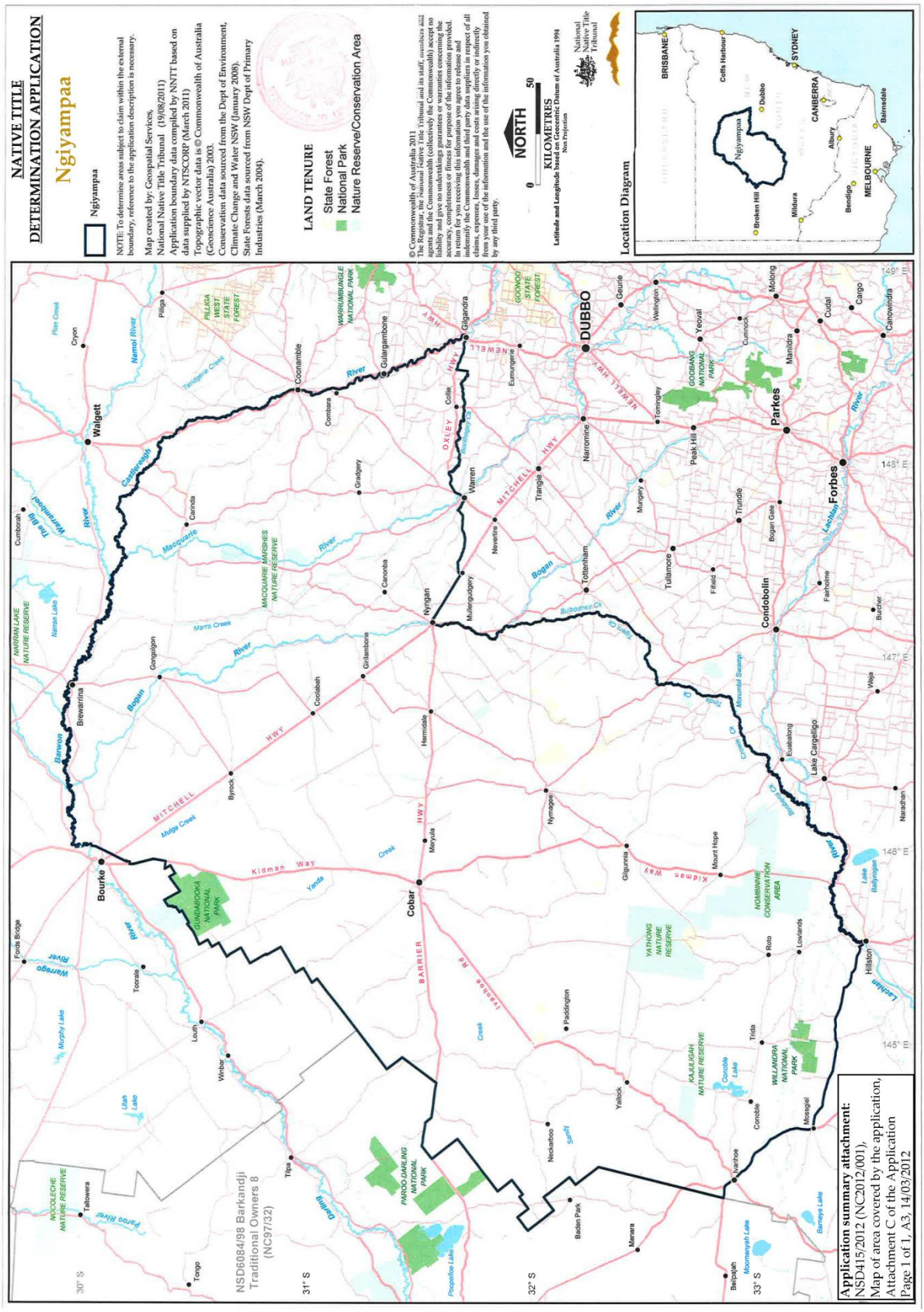
Attachment C – Map of the Area covered by the application


NATIVE TITLE
DETERMINATION APPLICATION
Ngiyampaa
Ngiyampaa
NOTE: To determine areas subject to claim within the external boundary, reference to the application description is necessary.
Map created by: Geospatial Services, National Native Title Tribunal (19/08/2011)
Application boundary data compiled by NNTT based on data supplied by NTSCORP (March 2011)
Topographic vector data is © Commonwealth of Australia (Geoscience Australia) 2003.
Conservation data sourced from the Dept of Environment, Climate Change and Water NSW (January 2008).
State Forests data sourced from NSW Dept of Primary Industries (March 2004).
LAND TENURE
State Forest
National Park
Nature Reserve/Conservation Area
© Commonwealth of Australia 2011
The Registrar, the National Native Title Tribunal and its staff, members and agents and the Commonwealth (collectively the Commonwealth) accept no liability and disclaim all responsibility for any omissions and for the accuracy, completeness or fitness for purpose of the information provided. In return for you receiving this information you agree to release and indemnify the Commonwealth and third party data suppliers in respect of all claims, expenses, losses, damages and costs arising directly or indirectly from your use of the information and the use of the information you obtained by any third party.
NORTH
0
50
KILOMETRES
Latitude and Longitude based on Geocentric Datum of Australia 1994
Non Projection
National Native Title Tribunal
Location Diagram
BRISBANE
Coffs Harbour
SYDNEY
Dubbo
Ngiyampaa
CANBERRA
Broken Hill
Albury
Mildura
Bendigo
MELBOURNE
Bairnsdale
DUBBO
Parkes
Forbes
Condobolin
Bourke
Cobar
Walgett
Coonamble
Gilgandra
Warren
Nyngan
Brewarrina
Narromine
Peak Hill
Trundle
Tullamore
Tottenham
Hillston
Lake Cargelligo
Euabalong
Mount Hope
Nymagee
Canbelego
Byrock
Hermidale
Cobar
Meryula
Gilgunnia
Roto
Lowlands
Paddington
Yallock
Tralee
Nevertire
Trangie
Mudgee
Gulgong
Dunedoo
Coolah
Gulargambone
Coonabarabran
Baradine
Pilliga
Gwabegar
Tooraweenah
Binnaway
Gilgandra
Collie
Eumungerie
Wellington
Geurie
Yeoval
Tomingley
Molong
Cumnock
Manildra
Cudal
Cargo
Canowindra
Forbes
Lachlan River
Bogan Gate
Fifield
Farholme
Butcher
Weja
Nanadhan
Lake Brewster
Lake Ballapoon
Lake Cowal
Lake Bumbaldry
Lake Cargelligo
Lake Bathurst
Lake Forbes
Lake Bumbaldry
Lake Cowal
Lake Ballapoon
Lake Brewster
Lake Bathurst
Lake Forbes
Lake Cargelligo

OFFICE OF THE REGISTRAR
ABORIGINAL LAND RIGHTS ACT 1983 (NSW)

11-13 Mansfield Street
Glebe NSW 2037
PO Box 112, Glebe NSW 2037
P. 02 9562 6327 F. 02 9562 6350

Gerard Niemoeller
On Site Cultural Heritage Management
PO Box 574
NAROOMA NSW 2546

Dear Gerard

Re: Request - Search for Registered Aboriginal Owners

I refer to your letter dated 19th March 2012 regarding an Aboriginal Stakeholders within Girilambone area, NSW.

I have searched the Register of Aboriginal Owners and the project area described does not have Registered Aboriginal Owners pursuant to Division 3 of the *Aboriginal Land Rights Act* 1983 (NSW).

I suggest you contact the Nyngan Local Aboriginal Land Council. They may also be able to assist you in identifying other Aboriginal stakeholders for this project.

Yours sincerely

Tabatha Dantoine
Administration Officer
Office of the Registrar, *Aboriginal Land Rights Act* (1983)

23 March 2012

PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
ABN: 43 329 728 630
Ph: 0414441896
www.onsitechm.com.au

Our Ref: A015

4 April 2012

Registering Interest for an Aboriginal Cultural Heritage Assessment and Aboriginal Heritage Impact Permit application – Girilambone Avoca Tank Project, Bogan Shire Council NSW 2831

I am writing to you in accordance with Section 4.1.3 of the ***Aboriginal cultural heritage consultation requirements for proponents.***

Tritton Resources Limited Pty is in the early stages of exploration of a newly identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project. The Avoca Tank Project area covers approximately 8.7km^2 across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The project area is approximately 4 kilometres northwest of the town of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire. A map showing the location of the subject area is attached.

On Site Cultural Heritage Management has been engaged to conduct an Aboriginal Cultural Heritage Assessment of the subject land. The assessment may result in an application for an Aboriginal Heritage Impact Permit (AHIP) pursuant to the *NSW National Parks and Wildlife Act*.

Purpose of this letter

The preparation of an AHIP requires the proponent to establish a ***Register of Interest*** for the project and undertake community consultation as outlined in the Office of Environment and Heritage (formerly DECCW) ***Aboriginal cultural heritage consultation requirements for proponents***. These requirements set out and establish a 4 stage consultation process.

Your details were provided to me in response to correspondence to those organisations listed in Section 4.1.2 of the consultation requirements. I am now writing to you in accordance with Section 4.1.3 of those requirements. A list of organisations and individuals corresponded with as part of this process is also attached for your information.

More specifically the proponent has engaged the services of ***On Site Cultural Heritage Management*** to:

- undertake the community consultation process as per the *Aboriginal cultural heritage consultation requirements for proponents*
- undertake an Aboriginal Cultural Heritage Assessment of the Avoca Tank Project and
- prepare Aboriginal Heritage Impact Permit applications (if required)

The purpose of establishing the Register of Interest is to formally identify and undertake community consultation with Aboriginal people who hold cultural knowledge relevant to determining the significance of the Avoca Tank project area or Aboriginal objects within the subject land (Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet and within the Bogan Shire).

The purpose of Aboriginal community consultation is to assist the proponent in the preparation of an application for an Aboriginal Heritage Impact Permit (AHIP) and to assist the Director General of the Office of Environment and Heritage in his or her consideration and determination of that application.

Should you decide to register your interest you will be provided with further information consisting of a proposed methodology for the project (in accordance with Stage 2 of the consultation requirements) and a list of questions to assist in understanding whether cultural values occur within the project area (to assist with Stage 3).

I am also required to inform you that should you decide to register your interest your details will be forwarded to Office of Environment and Heritage, Dubbo and the Nyngan Local Aboriginal Land Council unless you specify that you do not want your details released.

If you hold cultural knowledge relevant to determining the cultural significance of the Aboriginal objects located within the Avoca Tank project area or Aboriginal objects within the subject land (Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet and within the Bogan Shire) then I invite you to register your interest for this project. You can register your interest by writing a letter, email or telephoning me by 19 April 2012. My contact details are provided above. If you are registering your organisation then please provide the name and details of a nominated contact person.

Please note that any registrations of interest received after 19 April 2012 will not be included on the register. A notice inviting registrations of interest and participation in the community consultation process also appeared in the Public Notices of the Nyngan Observer on Wednesday 4 April 2012.

Please contact me should you require any further information or wish to discuss this proposal.

Regards

Gerard Niemoeller
Principal Heritage Consultant

List of Aboriginal organisations / individuals identified during Stage 4.1.2 of *Aboriginal cultural heritage consultation requirements for proponents* and invited to register to interest as part of this assessment

Aboriginal Organisation / Individual Name	Address	Contact Details
Bogan Aboriginal Corporation CEO Lesly Ryan	46 Nymagee St NYNGAN NSW 2825	boganac@netxp.com.au Ph: (02) 6832 1750 M: 0419418851
Nyngan Local Aboriginal Land Council / Vaneta Dutton CEO	PO Box 43 NYNGAN NSW 2825	nynganlalc@bigpond.com
Mr John Shipp	79 Thompson Street DUBBO NSW 2830	
NTS Corp Ltd on behalf of Native Title application for the Ngemba/Ngiyampaa People (Federal Court number: NSD415/12, NNTT number: NC12/1) and Native Title applicants: Mrs Elaine Ohlsen Mr Peter Williams Mr Brett Smith Ms Danielle Flakeler-Carney Mr Neville Merritt Mr Edward Shipp Mr John Shipp Ms Grace Gordon Mr Jason Ford (identified by National Native Title Tribunal)	NTSCORP Ltd Unit 1a Suite 2.02, 44-70 Rosehill Street REDFERN NSW 2016	Phone: (02) 9310 3188 Fax: (02) 9310 4177 tlawrence@ntscorp.com.au

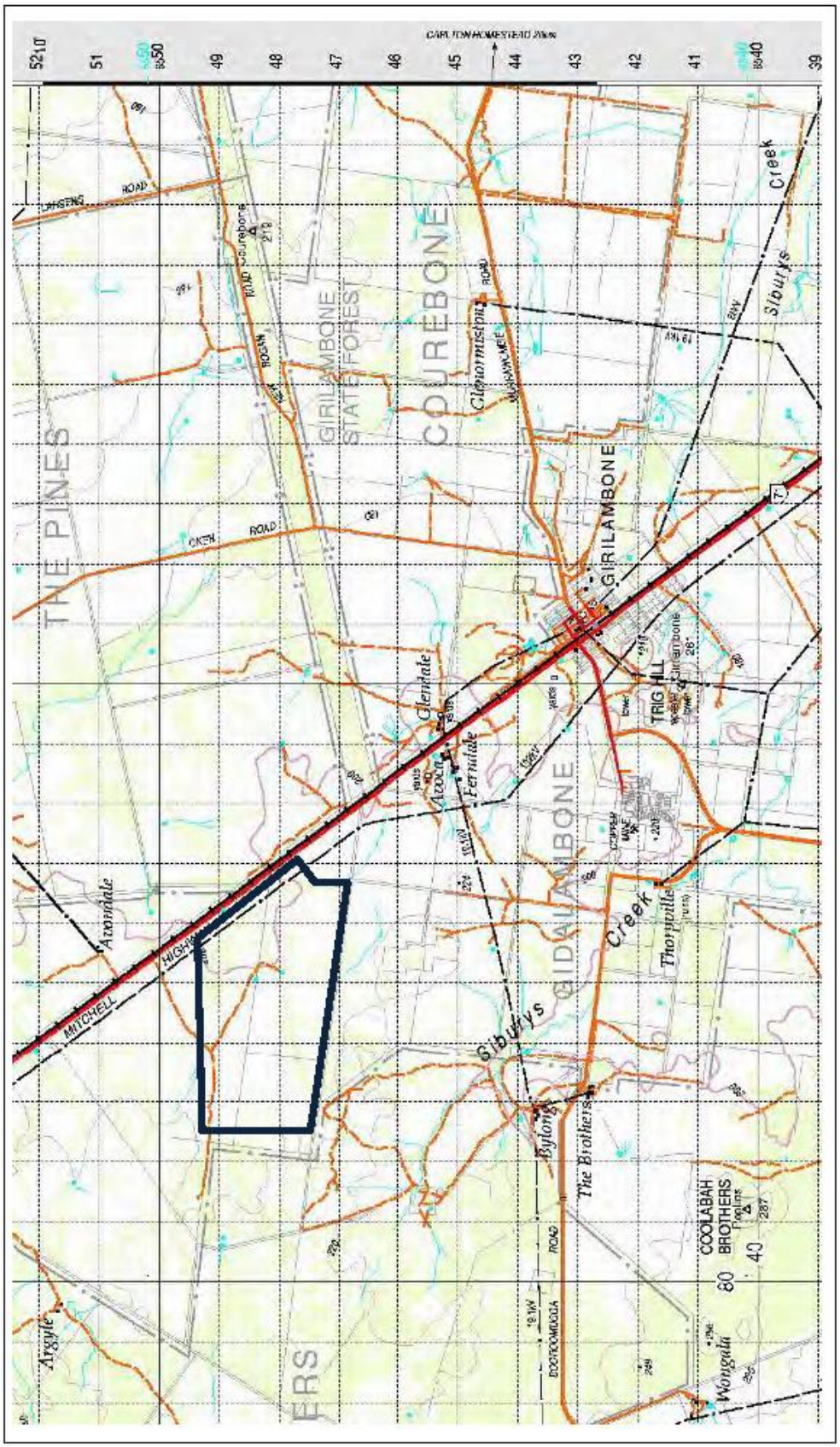


Figure 1: Avoca Tank project area (8.7km^2) shown in thick blue lines across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet

Aboriginal Cultural Heritage Assessment

Tritton Resources Limited Pty proposes to undertake mineral exploration within part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The project area is approximately 4 kilometres northwest of the town of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire.

Pursuant to Aboriginal cultural heritage consultation requirements for proponents and National Parks & Wildlife Act 1974, Aboriginal people holding cultural knowledge relevant to determining the significance of the subject land or Aboriginal objects within are invited to register interest and participate in a community consultation process.

The purpose of this consultation is to assist the proponent undertake an Aboriginal cultural heritage assessment, prepare an Aboriginal Heritage Impact Permit application if required and assist the Director General of OEH consider and make a determination of the application. Please register your interest by 19 April 2012.

Gerard Niemoeller
On Site Cultural Heritage Management
PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
Ph: 0414 441 896

OnSite Cultural Heritage Management
Pty Ltd

PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
Ph: 0414441896
www.onsitechm.com.au
ABN: 48 089 066 744

Our Ref: A015

24 April 2012

ABORIGINAL CULTURAL HERITAGE ASSESSMENT - Methodology and Significance

Avoca Tank Project (Tritton Resources) Girilambone, Bogan Shire NSW 2831

REGISTERED ABORIGINAL PARTIES: Bogan Aboriginal Corporation - Lesly Ryan, CEO
Nyngan Local Aboriginal Land Council - Vaneta Dutton CEO
Marra Wallan Pty Ltd – John Shipp, CEO
Native Title Services for Ngemba/Ngiyampaa Claimants

1.0 INTRODUCTION

This document is provided to the 'Registered Aboriginal Parties' in accordance with the Stage 2 and Stage 3 (sections 4.2 and 4.3) of the ***Aboriginal cultural heritage consultation requirements for proponents 2010*** and to present information about the proposed project currently subject to an Aboriginal Cultural Heritage Assessment. The purpose of the community consultation outlined in these requirements is to:

- consult with Aboriginal people who hold cultural knowledge relevant to determining the significance of the subject place and Aboriginal objects that may be within.
- assist the proponent prepare an Aboriginal Heritage Impact Assessment and Permit application (if required)
- assist the Director General of the Office of Environment and Heritage consider and make a determination of that application.

This document is provided to those persons and organisations who registered their interest in response to correspondence of 4 April 2012 and in accordance with Stage 1 (Section 4.1.3). The names of those persons and organisations who registered their interest are listed above. Contact details of all the Aboriginal parties who registered their interest is also attached to this document.

1.1 The Project

Tritton Resources Limited Pty is in the early stages of exploration of a newly identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project. The Avoca Tank Project area covers approximately 8.7km^2 across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The project area is approximately 4 kilometres northwest of the town of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire. A map showing the location of the subject area is attached.

On Site Cultural Heritage Management has been engaged by Tritton Resources to undertake the community consultation process as per the *Aboriginal cultural heritage consultation requirements for proponents* and conduct an Aboriginal Cultural Heritage Assessment of the subject land. The assessment may result in an application for an Aboriginal Heritage Impact Permit (AHIP) pursuant to the *NSW National Parks and Wildlife Act*.

2.0 CONSULTING WITH ABORIGINAL PEOPLE ABOUT THE SIGNIFICANCE OF THE PROJECT AREA

Stage 3 (Section 4.3) of the ***Aboriginal cultural heritage consultation requirements for proponents 2010*** requires the proponent to seek information about the cultural significance of the project area land and the Aboriginal objects or places that may be within. This purpose of this stage is also to facilitate a process whereby the registered Aboriginal parties can:

a) contribute to culturally appropriate information gathering and the research methodology
b) provide information that will enable the cultural significance of Aboriginal objects and/or places on the proposed project area to be determined
c) have input into the development of any cultural heritage management options.

A list of questions about the proposed project and assessment is provided below. These questions are only suggestions and you may provide any additional information you feel is necessary to inform the proponent and OEH about the Aboriginal cultural significance or values of the project area.

1. **Are there any objects or places of cultural value in the project area or in the immediate proximity? If so how will the proposed development affect those values?**

2. **Do you have any cultural concerns or perspectives about this project or assessment?**

3. **Do you think there is the potential for burials to occur at the site? If so why?**

4. **Are there any particular research questions you would like to see answered through the archaeological assessment process?**

5. **Have you got any views about the management of the lands within the Avoca Tank Project Area that may not be impacted?**

6. **Is any of the information you have provided culturally sensitive and is it OK to print your views in a report?**

3.0 METHODOLOGY FOR THIS ABORIGINAL CULTURAL HERITAGE ASSESSMENT

The methodology for the current assessment is proposed to include:

- Consultation with the Aboriginal Community to: identify Aboriginal traditional owners, elders and custodians who can speak about this place *(Stage 1 - completed)*; ascertain their views about the cultural significance of the Aboriginal objects; identify whether there are particular research themes or questions of interest that could be incorporated into any research design or addressed through archaeological assessment *(Stage 2 and 3 – this document)*

- An AHIMS database search to identify previously recorded sites within or within proximity to the study area. *An AHIMS database search has identified that there are 4 previously recorded Aboriginal sites within the identified area. All of these places are recorded as being earth mounds and or hearths.*

- Review of AHIMS Site cards to provide a archaeological context for the assessment of the study area

- Review of other relevant heritage registers (such as the Register of the National Estate, NSW State Heritage Register, Bogan Local Heritage Register). *A search of these databases has not identified any historic places or objects within the Avoca Tank Project Area.*

- Review relevant cultural heritage and archaeological reports to provide a regional and local context for the assessment of this Aboriginal place and associated objects

- Conduct a site assessment to record and document information about the site and Aboriginal objects relevant to determining and assessing the cultural heritage significance. *An attempt to relocate AHIMS sites discussed above will be made as part of the survey.*

- Preparation of a report documenting the results of the above processes, assessment of the places significance and the formulation of appropriate heritage management strategies

- Preparation of an Aboriginal Heritage Impact Permit application (if required)

This assessment is being conducted in accordance with relevant DECCW policy and regulations and specifically:

- *Aboriginal cultural heritage consultation requirements for proponents 2010*
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*

- *Supporting Information Requirements for AHIP Applications*

This assessment has also considered relevant OEH internal policy and specifically:

- *Operational Policy: Protecting Aboriginal Cultural Heritage*
- *Guide to Determining and Issuing Aboriginal Heritage Impact Permits*

4.0 WHERE TO FROM HERE?

Registered Aboriginal parties have 28 days to review this document and provide information about the assessment methodology and significance of the project area. Your views and any written submissions you make and will be incorporated into the assessment and report and provided to OEH.

If you would like to review this document and provide further comment please do so by Wednesday 23 May 2012.

Registered Aboriginal parties will also have a further 28 days to review the final Aboriginal Cultural Heritage Assessment report.

Please contact On Site Cultural Heritage Management should you require any further information or wish to discuss this proposal.

List of Aboriginal organisations / individuals identified during Stage 4.1.2 of *Aboriginal cultural heritage consultation requirements for proponents* and invited to register to interest as part of this assessment

Aboriginal Organisation / Individual Name	Address	Contact Details
Bogan Aboriginal Corporation CEO Lesly Ryan	46 Nymagee St NYNGAN NSW 2825	boganac@netxp.com.au Ph: (02) 6832 1750 M: 0419418851
Nyngan Local Aboriginal Land Council / Vaneta Dutton CEO	PO Box 43 NYNGAN NSW 2825	nynganlalc@bigpond.com
Marra Wallan Pty Ltd Mr John Shipp CEO	PO BOX 6088 Dubbo NSW 2830	John@marrawallan.com.au john.shipp@bigpond.com
NTS Corp Ltd on behalf of Native Title application for the Ngemba/Ngiyampaa People (Federal Court number: NSD415/12, NNTT number: NC12/1) and Native Title applicants: Mrs Elaine Ohlsen Mr Peter Williams Mr Brett Smith Ms Danielle Flakeler-Carney Mr Neville Merritt Mr Edward Shipp Mr John Shipp Ms Grace Gordon Mr Jason Ford (identified by National Native Title Tribunal)	NTSCORP Ltd Unit 1a Suite 2.02, 44-70 Rosehill Street REDFERN NSW 2016	Phone: (02) 9310 3188 Fax: (02) 9310 4177 tlawrence@ntscorp.com.au

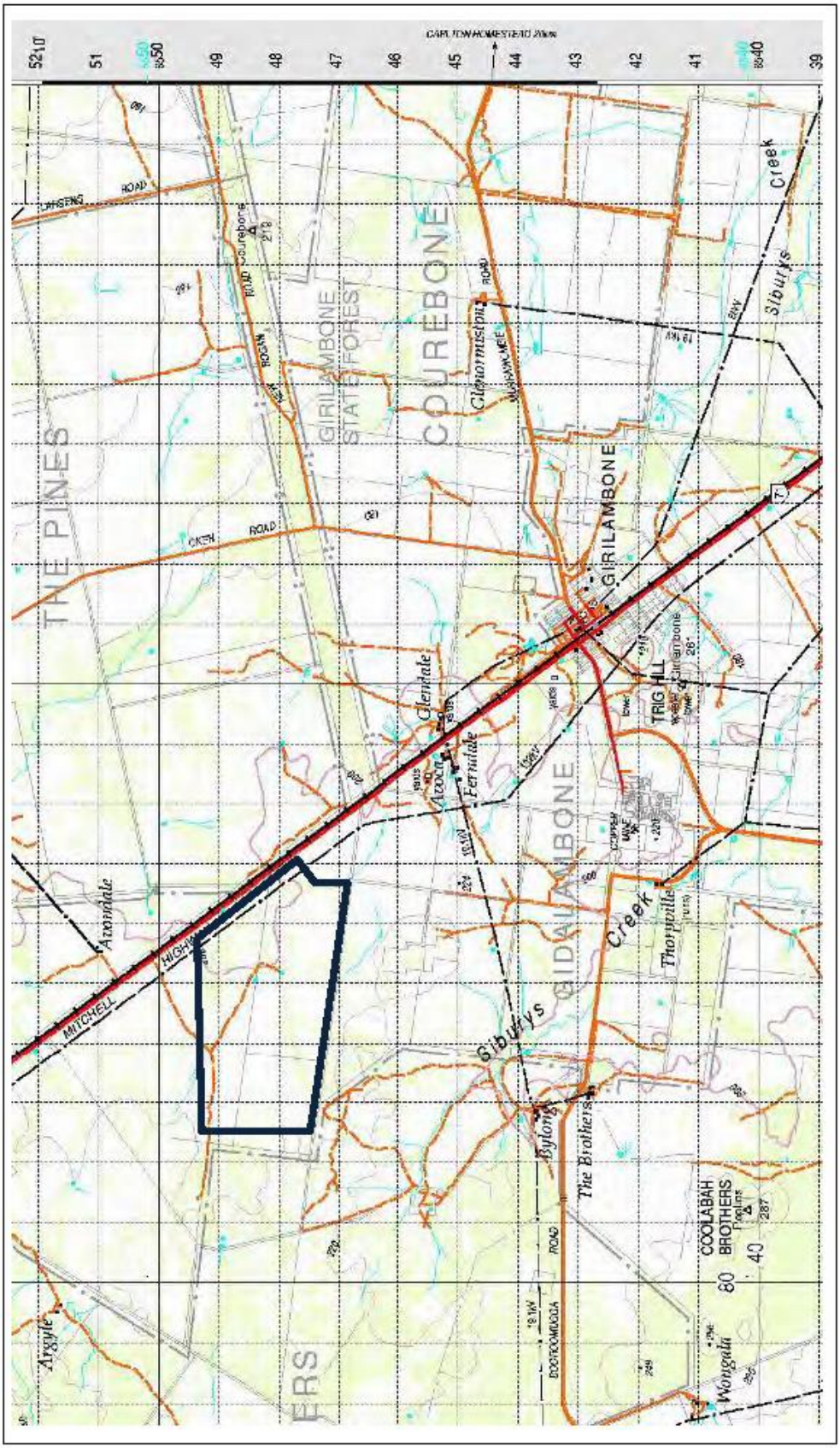


Figure 1: Avoca Tank project area (8.7km^2) shown in thick blue lines across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet

OnSite Cultural Heritage Management

APPENDIX 2

OnSite Cultural Heritage Management *Pty Ltd*

PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
ABN: 48 089 066 744
Ph: 0414441896
www.onsitechm.com.au

Our Ref: A018

12 September 2012

Establishing a Register of Interest for an Aboriginal Cultural Heritage Assessment and Aboriginal Heritage Impact Permit application – Avoca Tank Project (Stage 2) Girilambone NSW 2831

I am writing to you in accordance with Section 4.1.2 of the ***Aboriginal cultural heritage consultation requirements for proponents*** and specifically to initiate Stage 1 of the Aboriginal consultation process.

Tritton Resources Limited Pty is in the early stage of exploring a newly identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project. The Avoca Tank Project land is divided into two stages and situated across 18.62km^2. The land is located approximately 4 kilometres north west of Girilambone NSW 2831 along the Mitchell Highway.

The Avoca Tank **Stage 1** project land covers approximately 8.7km^2 across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The Stage 1 land was the subject of a previous Aboriginal Cultural Heritage Assessment by On Site Cultural Heritage Management between April and August (2012).

On Site Cultural Heritage Management has now been contracted to conduct an Aboriginal Cultural Heritage Assessment of the adjoining Avoca Tank **Stage 2** project land. The assessment may result in an application for an Aboriginal Heritage Impact Permit (AHIP) pursuant to the *NSW National Parks and Wildlife Act*. A map showing the location of the Avoca Tank project area (Stages 1 and 2) is attached.

In accordance with Section 4.1.2, Stage 1 of the *Aboriginal cultural heritage consultation requirements for proponents*, I am writing to you to identify Aboriginal persons who may hold cultural knowledge relevant to determining the significance of Aboriginal objects that may be located within the project area.

Could you please conduct relevant database or register searches and provide the names of Aboriginal people you consider may be affected by this proposal. The names of Aboriginal persons you provide will be invited to register an interest in the project and participate in the consultation process.

Your assistance in this process would be much appreciated and ensure that the proponent and OEH consider the views of Aboriginal people affected by this proposal.

Could you please forward the names of those Aboriginal persons you consider may be affected by this proposal to me by Thursday 27 September 2012.

Please note that this correspondence has been sent to the following organisations in accordance with Section 4.1.2 of the consultation requirements:

a) Office of Environment and Heritage EPRG regional office, North West Dubbo
b) Nyngan Local Aboriginal Land Council
c) the Registrar, *Aboriginal Land Rights Act 1983* for a list of Aboriginal owners
d) the National Native Title Tribunal for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements
e) Native Title Services Corporation Limited (NTSCORP Limited)
f) Bogan Shire Council, Nyngan
g) Central West Catchment Management Authority, Nyngan for contact details of any established Aboriginal reference group

Please contact me should you require any further information or wish to discuss this proposal.

Regards

Gerard Niemoeller
Principal Heritage Consultant

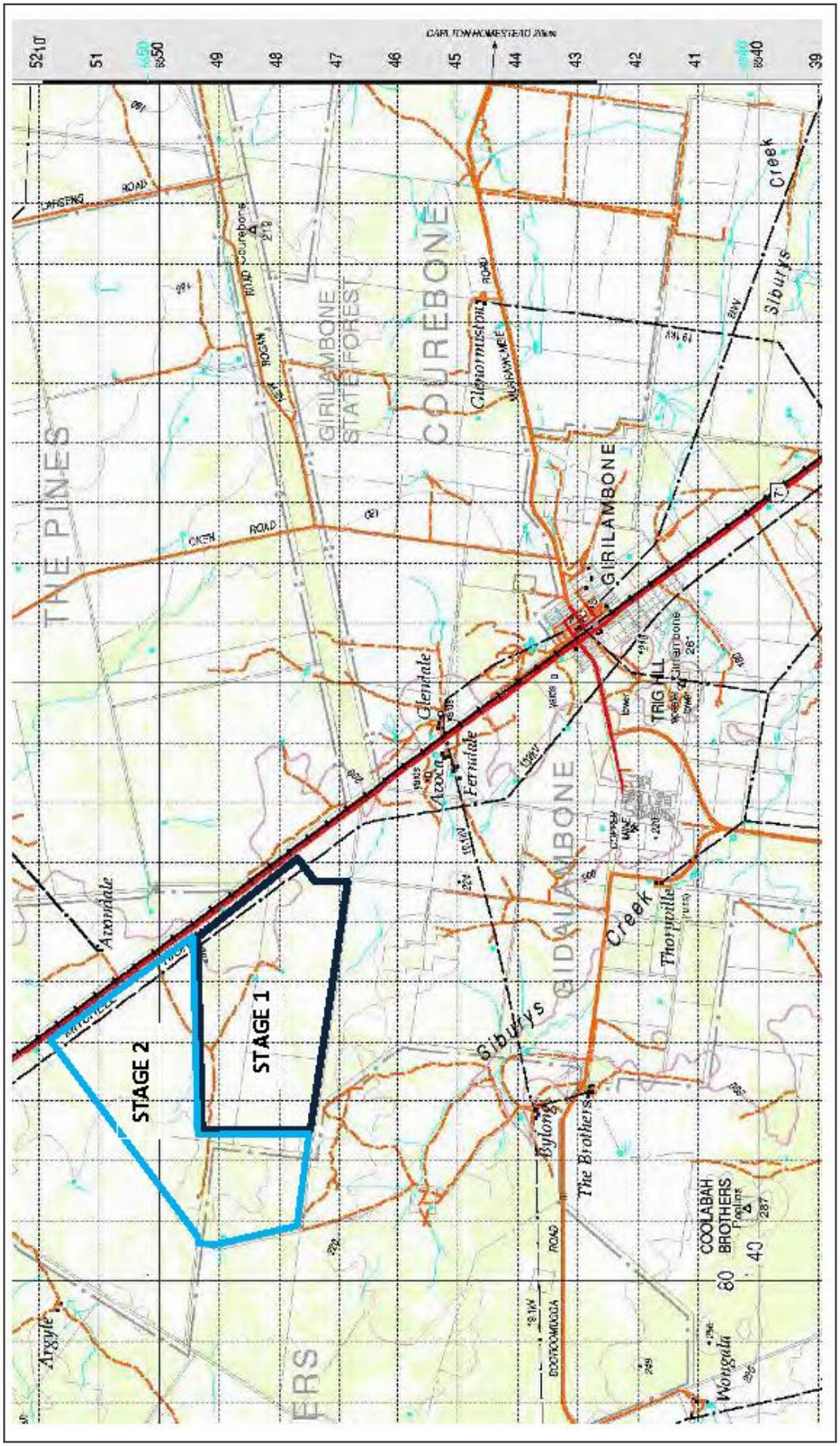


Figure 1: Avoca Tank project area (Stage 2) shown in light blue polygon (9.90 km^2), part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The adjoining Stage 1 area (8.72km^2) across part of Lots 10, 135 and 144 (DP 751315) is shown in the dark blue polygon and was the subject of a previous Aboriginal Cultural Heritage Assessment by On Site CHM (2012).

NSW GOVERNMENT Office of Environment & Heritage

Your reference	Proposed Girilambone Avoca Tank Project Stage 2 , Girilambone NSW
Our reference	DOC12/38580
Contact	Paul Houston 68835361

Onsite Cultural Heritage Management
PO Box 574
NAROOMA NSW 2546
Att: Gerard Niemoeller

13th September 2012

Dear Gerard,

WRITTEN NOTIFICATION AS REQUIRED UNDER OFFICE OF ENVIRONMENT AND HERITAGE (OEH) ABORIGINAL CULTURAL HERITAGE REQUIREMENT FOR PROPONENTS 2010 – Proposed Girilambone Avoca Tank Project Stage 2, Girilambone NSW

I refer to your letter dated 12th September 2012 to the Office of Environment and Heritage (OEH) regarding the above matter.

A list of known Aboriginal parties that OEH feels is likely to have an interest in this development is attached as Attachment 1 (overleaf). Please note this list is not necessarily an exhaustive list of all interested Aboriginal parties and receipt of this list does not remove the requirement of a proponent/consultant to advertise in local print media and contact other bodies seeking interested Aboriginal parties, in accordance with the requirements.

If you wish to discuss any of the above matters further please contact me, at your earliest convenience, on (02) 6883 5361.

Yours sincerely

Paul Houston
Aboriginal Heritage Planning Officer
OEH

The Department of Environment Climate Change and Water is now known as
The Office of Environment and Heritage.

PO Box 2111, Dubbo NSW 2830
48-52 Wingewarra St Dubbo NSW
Tel: (02) 6883 5330 Fax: (02) 6884 9382
www.environment.nsw.gov.au

ATTACHMENT 1

OEH'S LIST OF ABORIGINAL STAKEHOLDER GROUPS WITHIN THE BOGAN LGA - THAT MAY HAVE AN INTEREST IN THE PROJECT; PROVIDED AS PER THE "OEH ABORIGINAL CULTURAL HERITAGE REQUIREMENT FOR PROPONENTS 2010".

Organisation/Affiliation	Name/Title	Address
Bogan Aboriginal Corporation		PO Box 345 NYNGAN NSW 2825
John Shipp		79 Thompson Street Dubbo
NYNGAN LALC	Chairperson	PO Box 43 NYNGAN NSW 2825
Trevor Robinson		Po Box 73, Peak Hill NSW 2869
Wiradjuri Interim Working Party		Po Box 73, Peak Hill NSW 2869

The Department of Environment Climate Change and Water is now known as
The Office of Environment and Heritage.

PO Box 2111, Dubbo NSW 2830
48-52 Wingewarra St Dubbo NSW
Tel: (02) 6883 5330 Fax: (02) 6884 9382
www.environment.nsw.gov.au

From: Nyngan LALC
To: gerard@onsitechm.com.au
Subject: Site work for Avoca tanks
Date: Wednesday, 19 September 2012 1:13:21 PM

Hi Gerard

As previous Sheila Couley Nyngan LALC & Lesly Ryan Bogan Aboriginal Corporation would be the people to contact for site work
Kind Regards

Veneta Dutton
Chief Executive Officer

NYNGAN Local Aboriginal Land Council
PO BOX 43
102 Pangee Street.
Nyngan, NSW, 2825

p: 02 68 322 639
f: 02 68 322878
PO BOX 43 Nyngan NSW
nynganlalc@bigpond.com

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National Native Title Tribunal

Sydney Office, Operations East
Level 16, Law Courts Building,
Queens Square
Sydney NSW 2000
GPO Box 9973
Sydney NSW 2000
Telephone (02) 9227 4000
Facsimile (02) 9227 4030

13 September 2012

Gerard Niemoeller
Principal Heritage Consultant
Onsite Cultural Heritage Management
PO Box 574
Narooma NSW 2546

Our Reference: 5118/12jd
Your Reference: A018

Dear Mr Niemoeller

Native Title Search Results of town of Girilambone

Thank you for your search request of 12 September 2012 in relation to the above area.

Search Results
The results provided are based on the information you supplied and are derived from a search of the following Tribunal databases:

Register Type	NNTT Reference Numbers
Schedule of Applications (unregistered claimant applications)	Nil.
Register of Native Title Claims	NC12/1
National Native Title Register	Nil.
Register of Indigenous Land Use Agreements	Nil.
Notified Indigenous Land Use Agreements	Nil.

I have included a register extract, map attachment and a NNTT Registers fact sheet to help you understand the search result.

Please note that there may be a delay between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. As a result, some native title determination applications recently filed in the Federal Court may not appear on the Tribunal's databases.

The search results are based on analysis against external boundaries of applications only. Native title applications commonly contain exclusions clauses which remove areas from within the

external boundary. To determine whether the areas described are in fact subject to claim, you need to refer to "Area covered by claim" section of the relevant Register Extract or Application Summary and any maps attached.

Search results and the existence of native title
Please note that the enclosed information from the Register of Native Title Claims and/or the Schedule of Applications is **not** confirmation of the existence of native title in this area. This cannot be confirmed until the Federal Court makes a determination that native title does or does not exist in relation to the area. Such determinations are registered on the National Native Title Register.

Tribunal accepts no liability for reliance placed on enclosed information
The enclosed information has been provided in good faith. Use of this information is at your sole risk. The National Native Title Tribunal makes no representative, either express or implied, as to the accuracy or suitability of the information enclosed for any particular purpose and accepts no liability for use of the information or reliance placed on it.

If you have any further queries, please contact me on 1800 640 501.

Yours sincerely

Jessica Di Blasio | EXECUTIVE ASSISTANT/CLIENT SERVICES OFFICER
National Native Title Tribunal | Sydney office, Operations East
Level 16, Law Courts Building, Queens Square, Sydney, New South Wales 2000
Telephone (02) 9227 4000 | Facsimile (02) 9227 4030 | Email jessica.diblasio@nntt.gov.au
Freecall 1800 640 501 | www.nntt.gov.au

Facilitating timely and effective outcomes.

NATIONAL NATIVE
TITLE TRIBUNAL

Application Information and Extract from the Register of Native Title Claims

Application Information

Application numbers:	Federal Court number: NNTT number:	NSD415/12 NC12/1
Application name:	Ngemba, Ngiyampaa, Wangaaypuwan and Wayilwan native title determination application	
Registration history:	Registered from 12/04/2012.	

Register Extract (pursuant to s.186 of the *Native Title Act 1993*)

Application filed with: Federal Court of Australia

Date application filed: 14/03/2012

Date claim entered on Register: 12/04/2012

Applicants: Mrs Elaine Ohlsen, Mr Peter Williams, Mr Brett Smith, Ms Danielle Flakeler-Carney, Mr Neville Merritt, Mr Edward Shipp, Mr John Shipp, Ms Grace Gordon, Mr Jason Ford

Address for service:
NTSCORP Ltd
Unit 1a Suite 2.02, 44-70 Roschill Street
REDFERN NSW 2016
Phone: (02) 9310 3188
Fax: (02) 9310 4177

Additional Information:

Not Applicable

Area covered by the claim:

(A) Area covered by application
The area covered by the application ("the Application Area") comprises all of the land and waters within the external boundaries described in Attachment B and depicted in the map at Attachment C.

The Application Area description and map have been prepared with the assistance of the Geo-Spatial Unit of the National Native Title Tribunal. The area covered by this application does not include the areas described at point B below.

(B) Areas within the external boundaries not covered by the application
1. The area covered by the application excludes any land and waters covered by past or present freehold title or by previous valid exclusive possession acts as defined by section 23B of the Native Title Act (1993) (Cth).

2. The area covered by the application excludes any land and waters which are:
a) a Scheduled interest;
b) a freehold estate;
c) a commercial lease that is neither an agricultural lease nor a pastoral lease;
d) an exclusive agricultural lease or exclusive pastoral lease;
e) a residential lease;
f) a community purpose lease;
g) a lease dissected from a mining lease and referred to in s.23B(2)(c)(vii) of the Native Title Act 1993 (Cth);
h) any lease (other than a mining lease) that confers a right of exclusive possession over particular land or waters.

3. Subject to paragraphs 5 and 6, the area covered by the application excludes any land or waters covered by the valid construction or establishment of any public work, where the construction or establishment of the public work commenced on or before 23 December 1996.

4. Subject to paragraphs 5 and 6, exclusive possession is not claimed over areas which are subject to valid previous non-exclusive possession acts done by the Commonwealth, State or territory.

5. Subject to paragraph 7 below, where the act specified in paragraphs 2, 3 and 4 falls within the provisions of:
a) s.23B(9) - Exclusion of acts benefiting Aboriginal Peoples or Torres Strait Islanders;
b) s.23B(9A) - Establishment of a national park or state park;
c) s.23B(9B) - Acts where legislation provides for non-extinguishment;
d) s.23B(9C) - Exclusion of Crown to Crown grants; and
e) s.23B(10) - Exclusion by regulation
the area covered by the act is not excluded from the application.

6. Where an act specified in paragraphs 2, 3 and 4 affects or affected land or waters referred to in:
a) s.47 - Pastoral leases etc covered by claimant application;
b) s.47A - Reserves covered by claimant application;
c) s.47B - Vacant Crown land covered by claimant application
the area covered by the act is not excluded from the application.

7. The area covered by the application excludes land or waters where native title rights and interests claimed have been otherwise extinguished.

8. The area covered by the application excludes the land and waters covered by the Barkandji People's native title determination application NSD6084/1998 (Barkandji Traditional Owners #8 v Attorney General of NSW) (NC97/32).

Persons claiming to hold native title:

The Ngemba/Ngiyampaa People are the native title claim group on whose behalf the Applicant makes this application. The native title claim group comprises all the descendents of the following apical ancestors:

Caroline Hilt (who was born on the Barwon River around 1847);
Thomas Sullivan (who was born in Brewarrina about 1860);
Nellie Colless (who was born in Brewarrina around 1868);
Billy Coleman (who was born in Cobar in 1840);

Mary Ann Allen (who was born in 1844);
Moses Biggs (who was born in 1837);
Polly Parkes (who was born in 1846);
Anne Brandy (who was born in Colane in 1874);
Caroline Brandy (who was born on Duck Creek in 1869);
Wadna Boe (who was born in 1848);
Richard King (who was born in 1827);
Jimmy Keewong (who was born in 1849);
Kitty Narrangie;
Tom Dennis (who was born in Brewarrina in 1864);
Winnie Pierce (who was born in Brewarrina in 1878);
Jack Dennis (who was born on the Barwon River in around 1855);
Kate Baker (who was born in Boorooma in 1874);
Francis "Tracker" Williams (who was born in Gundabooka in 1883);
William Johnson (who was born in Big Willandra in 1876);
Henry Parkes (who was born in 1863);
Topsy Harris also known as Topsy Scotty (who was born in Marfield in 1866);
Jack Redtank;
Thomas Williams also known as Thomas Broughton (who was born in Roto);
Maggie Redtank (who was born in Keewong in 1868);
Ada Arnott (who was born in Nyngan in 1865);
Moses Divine;
Jack Smith (who was born in Mossgiel in 1869);
Ellen Sprowl also known as Ellen McHughes (who was born in Brewarrina in 1867);
Fanny Hippi also known as Fanny Williams;
Millie Wells also known as Millie Shearer (who was born in Brewarrina in 1874);
Pluto Williams (who was born in Trida/Mossgiel in 1873);
Steve Shaw (who was born in Coronga Peak in 1855);
Fanny Brown also known as Tiltagara Fanny (who was born in Hillston in 1862);
David Brown (who was born on the Macquarie River in 1850);,
Janey Brown (who was born on the Macquarie River in 1853);
Betsy Gwen (who was born in Haddon Rigg near Warren in 1849);
Louise Hinton (who was born on the Macquarie River in 1843);
Cissy Lee (who was born in 1852);
Boorooma Murphy (who was born in Boorooma in 1832);
Harry Murphy (who was born in Brewarrina around 1871);
Thomas Nixon (who was born in Buttabone in 1843);
Colaine Lumpy (who was born in 1864);
Charlotte Wilson;
Tilly Riley (who was born in 1863);
Geordie Murray (who was born in 1851 in Ivanhoe).

Registered native title rights and interests:

The following Native Title Rights & Interests were entered on the Register on 12/04/2012:
1. Where exclusive native title can be recognised (such as areas where there has been no prior extinguishment of native title or where s.238 and/or ss.47, 47A, 47B apply), the Ngemba/Ngiyampaa People as defined in Schedule A of this application, claim the right to possession, occupation, use and enjoyment of the lands and waters of the application area to the exclusion of all others subject to the valid laws of the Commonwealth and the State of New South Wales.

2. Where exclusive native title cannot be recognised, the Ngemba/Ngiyampaa People as defined in Schedule A of this application, claim the following non-exclusive rights and interests including the right to conduct activities necessary to give effect to them:
(a) the right to access the application area;
(b) the right to use and enjoy the application area;
(c) the right to move about the application area;
(d) the right to camp on the application area;

(e) the right to erect shelters and other structures on the application area;
(f) the right to live being to enter and remain on the application area;
(g) the right to hold meetings on the application area;
(h) the right to hunt on the application area;
(i) the right to fish in the application area;
(j) the right to have access to and use the natural water resources of the application area;
(k) the right to gather and use the natural resources of the application area (including food, medicinal plants, timber, tubers, charcoal, wax, stone, ochre and resin as well as materials for fabricating tools, hunting implements, making artwork and musical instruments);
(l) the right to share and exchange resources derived from the land and waters within the application area;
(m) the right to participate in cultural and spiritual activities on the application area;
(n) the right to maintain and protect places of importance under traditional laws, customs and practices in the application area;
(o) the right to conduct ceremonies on the application area;
(p) the right to transmit traditional knowledge to members of the native title claim group including knowledge of particular sites on the application area;
(q) the right to speak for and make non-exclusive decisions about the application area in accordance with traditional laws and customs;
(r) the right to speak authoritatively about the application area among other Aboriginal People in accordance with traditional laws and customs; and
(s) the right to control access to or use of the lands and waters within the application area by other Aboriginal People in accordance with traditional laws and customs.

3. The native title rights and interests referred to in paragraph 2 do not confer possession, occupation, use or enjoyment of the lands and waters of the application area to the exclusion of all others.

4. The native title rights and interests are subject to and exercisable in accordance with:
(a) the laws of the State of New South Wales and the Commonwealth of Australia including the common law;
(b) the rights (past or present) conferred upon persons pursuant to the laws of the Commonwealth and the laws of the State of New South Wales; and
(c) the traditional laws and customs of the Ngemba/Ngiyampaa People for personal, domestic and communal purposes (including social, cultural, religious, spiritual and ceremonial purposes).

Register attachments:

1. A map showing the boundaries of the area covered by the application , Attachment C of the Application, 1 page - A3, Attached 14/03/2012.
2. Description of the area covered by the application, Attachment B of the Application, 4 pages - A4 , Attached 14/03/2012.

Note: The Register may, in accordance with s.188 of the Native Title Act 1993, contain confidential information that will not appear on the Extract.

Searching the NNTT Registers in New South Wales

Search service
On request the National Native Title Tribunal will search its public registers for you. A search may assist you in finding out whether any native title applications (claims), determinations or agreements exist over a particular area of land or water.

In New South Wales native title cannot exist on privately owned land including family homes or farms.

What information can a search provide?
A search can confirm whether any applications, agreements or determinations are registered in a local government area. Relevant information, including register extracts and application summaries, will be provided.

In NSW because we cannot search the registers in relation to individual parcels of land we search by local government area.

Most native title applications do not identify each parcel of land claimed. They have an external boundary and then identify the areas not claimed within the boundary by reference to types of land tenure e.g., freehold, agricultural leasehold, public works.

What if the search shows no current applications?
If there is no application covering the local government area this only indicates that at the time of the search either the Federal Court had not received any claims in relation to the local government area or the Tribunal had not yet been notified of any new native title claims.

It does not mean that native title does not exist in the area.

Native title may exist over an area of land or waters whether or not a claim for native title has been made.

Where the information is found
The information you are seeking is held in three registers and on an applications database.

National Native Title Register
The National Native Title Register contains determinations of native title by the High Court, Federal Court and other courts.

Register of Native Title Claims
The Register of Native Title Claims contains applications for native title that have passed a registration test.

Registered claims attract rights, including the right to negotiate about some types of proposed developments.

Register of Indigenous Land Use Agreements
The Register of Indigenous Land Use Agreements contains agreements made with people who hold or assert native title in an area.

The register identifies development activities that have been agreed by the parties.

Application summaries
An application summary contains a description of the location, content and status of a native title claim.

This information may be different to the information on the Register of Native Title Claims, e.g., because an amendment has not yet been tested.

How do you request a search?

A search request form is available on the Tribunal's web site at:
http://www.nntt.gov.au/registers/search.html
Mail, fax or email your request to the Tribunal's Sydney registry, identifying the local government area/s you want searched.

Email: NSWEnquiries@nntt.gov.au
Fax: (02) 9227 4030
Address: GPO Box 9973, Sydney NSW 2001
Phone: (02) 9227 4000

Application Summary Attachment:
NSD415/2012 (NC12/1),
External boundary description
Attachment B of the Application
Page 1 of 4, A4, 14/03/2012

External boundary description

The application area covers all the land and waters within the external boundary described as:

Commencing at the southernmost point of the application at the intersection of the centrelines of the Roto Road reserve and the Lachlan River at Hillston and extending generally north westerly along the centreline of that road reserve to Mossgiel Trunk Road; then generally westerly along the centreline of that road reserve to the Cobb Highway; then generally north westerly along the centreline of that road reserve to the Ivanhoe – Menindee Road; then generally westerly along the centreline of that road reserve to the eastern boundary of native title determination application NSD6084/98 Barkandji Traditional Owners 8 (NC97/32) at Longitude 144.206842° East; then continuing along the boundaries of that native title determination application, also described as:

From the centreline of the Ivanhoe – Menindee Road reserve at Longitude 144.206842° East; and extending northerly to the western boundary of Lot 4594 on DP767758 at Latitude 32.301343° South; then generally northerly along the western boundaries of that lot to the easternmost corner of Lot 776 on DP762100; then north westerly along the boundaries of that lot to the easternmost corner of Lot 775 on DP762082; then continuing north westerly and south westerly along the boundaries of that lot to the southernmost corner of Lot 774 on DP762102; then south westerly, north westerly, north easterly and south easterly along the boundaries of that lot to the southernmost corner of Lot 1979 on DP763987; then generally north easterly and north westerly along the boundaries of that lot to the westernmost corner of Lot 4595 on DP767759; then generally north easterly along the north western boundaries of that lot and Lot 1130 on DP762534 to the easternmost corner of Lot 939 on DP762071; then north westerly along the boundary of that lot to the southern boundary of the Barrier Highway road reserve; then north easterly and generally easterly along the southern boundaries of that road reserve to Longitude 144.803043° East; then generally north easterly through Longitude 144.804560° East, Latitude 31.576881° South to a point on the western boundary of Lot 1282 on DP762978 at Latitude 31.429323° South; then north westerly to the westernmost corner of that lot; then generally north easterly along the north western

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Application Summary Attachment:
NSD415/2012 (NC12/1),
External boundary description
Attachment B of the Application
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boundaries of that lot, Lot 1283 on DP762979 and Lot 4176 on DP766743 to the easternmost corner of Lot 5412 on DP768323, being the point at where it leaves the boundary of native title determination application NSD6084/98 Barkandji Traditional Owners 8 (NC97/32).

Then continuing generally north easterly along the north western boundaries of Lot 4176 on DP766743, Lot 4177 on DP766744, Lot 4857 on DP769170 and onwards across Louth Road to the western boundary of Lot 2 on DP803696; then generally northerly along the south western boundary of that lot, south western and north western boundaries of Lot 964 on DP762132, south western boundary of Lot 3610 on DP765962, south western and north western boundaries of Lot 3609 on DP765961, western boundary of Lot 933 on DP762220, south western and north western boundaries of Lot 625 on DP761643 to it northernmost corner; then continuing north easterly across Gunderbooka Kings Cross Road to the western boundary of Lot 1394 on DP763061; then generally northerly along the western and northern boundaries of that lot to the western most corner of Gundabooka National Park; then generally north easterly along the northern boundaries of that national park to the northernmost boundary of Lot 3147 on DP765352; then north easterly along the boundary of that lot to the western boundary of Lot 2250 on DP764515; then north westerly and easterly along the boundaries of that lot and onwards to the centreline of the Kidman Way road reserve; then generally northerly along the centreline of that road reserve to the prolongation westerly of the southern boundary of Lot 4678 on DP767842; then easterly to and along the southern boundary of that lot and Lot 263 on DP760955; then generally northerly along the eastern boundaries of that lot to the eastern boundary of an unnamed road reserve located between Lot 4291 on DP767038 and Lot 61 on DP751841; then northerly to centreline of that unnamed road reserve; then generally north easterly along the centreline of that road reserve to the western boundary of the Mitchell Highway; then continuing north easterly across that highway to the westernmost corner of Lot 52 on DP751841; then generally north easterly along the western boundary of that lot, eastern boundary of Lot 4133 on DP766638, western boundaries of Lot 40 on DP751867, Lot 42 on DP751867, Lot 6830 on DP43320 and Lot 6829 on DP43320 to the Kamilaroi Highway; then continuing north easterly across that highway to the centreline of an unnamed road reserve located parallel to the western boundary of Lot 39 on DP751867; then generally northerly along that road reserve to the prolongation southerly of the easternmost boundary of Lot 59 on DP751867, then generally northerly to and along the eastern boundary of that lot and the eastern

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Application Summary Attachment:
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External boundary description
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boundary of Lot 4357 on DP767194 to the Darling River and onwards to its centreline; then generally northerly, generally easterly and generally south easterly along the centreline of that river, the Barwon River, the Macquarie River and the Castlereagh River to the centreline of the Newell Highway at Gilgandra; then north westerly along the centreline of that highway road reserve to the Oxley Highway; then north easterly and generally westerly along the centreline of that highway road reserve to Nancarrows Road; then generally southerly along the centreline of that road reserve to Boothaguy Creek; then generally westerly along the centreline of that creek to again the Oxley Highway; then generally south westerly along the centreline of that highway road reserve to the Gunningbar Creek; then generally north westerly along the centreline of that creek to the Albert Priest Channel; then generally westerly along the centreline of that channel to an unnamed road reserve which bisects Lot 2 on DP232612; then generally south westerly along the centreline of that road reserve to the Mitchell Highway at Mullengudgery; then generally north westerly along the centreline of that highway road reserve to the Bogan River at Nyngan; then generally southerly along the centreline of that river to Bulbodney Creek; then generally southerly along the centreline of that creek to Tigers Creek; then generally south westerly along the centreline of that creek to Yarra Yarra Creek; then generally south westerly along the centreline of that creek to Longitude 146.921830° East, then westerly to an unnamed watercourse at approximately Longitude 146.911275° East, Latitude 32.558960° South; then generally westerly along the centreline of that watercourse to Fiveways Road; then westerly approximately 500 metres to an unnamed watercourse at Latitude 32.557767° South; then generally south westerly along the centreline of that unnamed watercourse to Tinda Creek; then generally southerly along the centreline of that creek to Morumbil Swamp; then generally south westerly along the centreline of that swamp, Crowie Creek, Booberoi Creek and the Lachlan River back to the commencement point.

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Application Summary Attachment:
NSD415/2012 (NC12/1),
External boundary description
Attachment B of the Application
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Data Reference and source

- Application boundary data compiled by National Native Title Tribunal based on data provided by NTSCORP.
- Native title determination application NSD6084/98 Barkandji Traditional Owners 8 (NC97/32) as accepted for registration on 2 November 2006.
- Cadastre data sourced from Public Sector Mapping Agency (November 2010).
- Roads based on casement data sourced from LPM Authority, NSW.
- Rivers / Creeks based on casement data, 1:100,000 topographic data which is © Commonwealth of Australia and is supplied by Geoimage Pty Ltd under licence from Geoscience Australia and information supplied by NTSCORP (based on 2007 LPI topographic data).

Reference datum

Geographical coordinates have been provided by the NNTT Geospatial Services and are referenced to the Geocentric Datum of Australia 1994 (GDA94), in decimal degrees and are based on the spatial reference data acquired from the various custodians at the time.

Use of Coordinates

Where coordinates are used within the description to represent cadastral or topographical boundaries or the intersection with such, they are intended as a guide only. As an outcome to the custodians of cadastral and topographic data continuously recalculating the geographic position of their data based on improved survey and data maintenance procedures, it is not possible to accurately define such a position other than by detailed ground survey.

Prepared by Geospatial Services, National Native Title Tribunal (19 August 2011)

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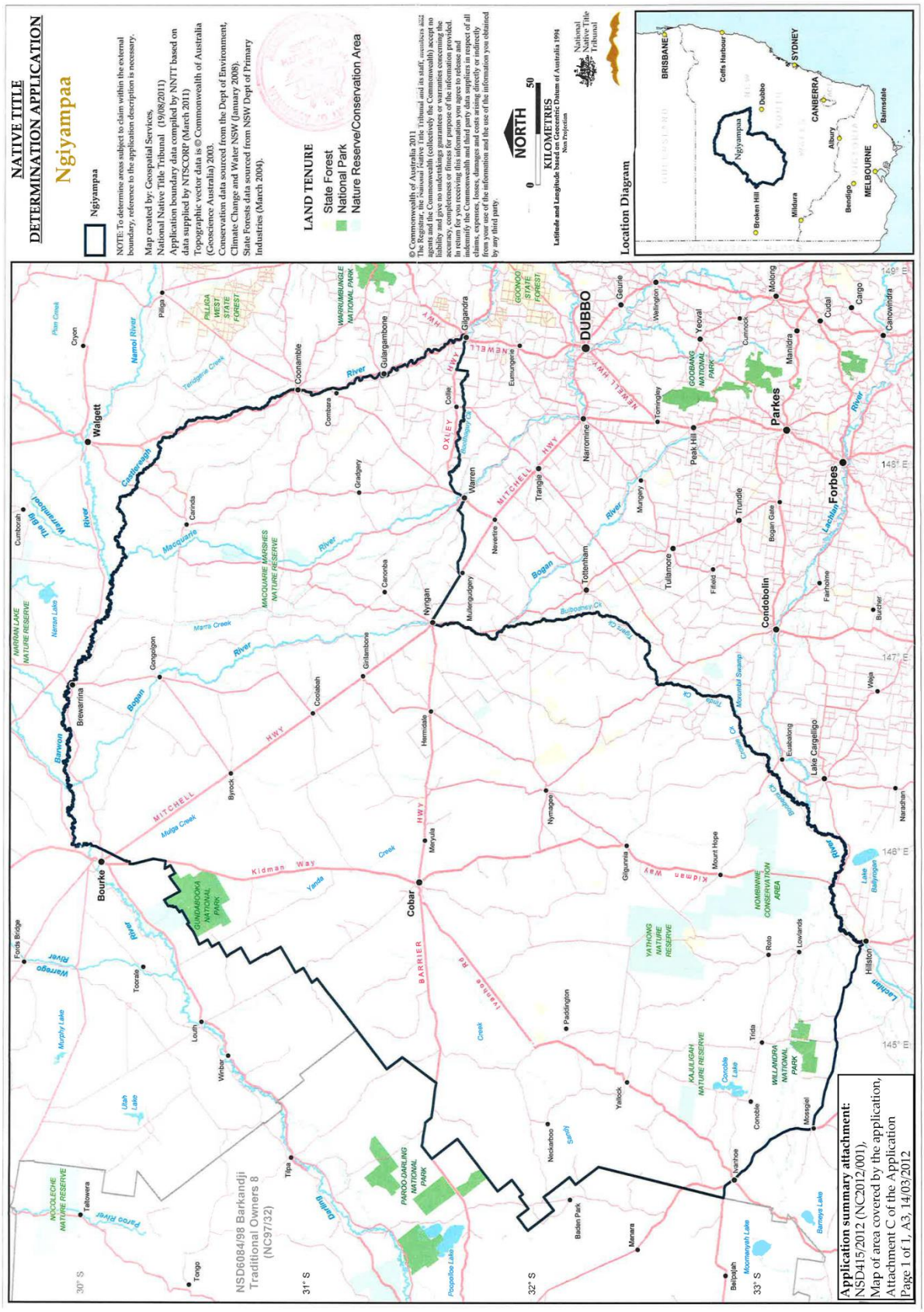
Attachment C – Map of the Area covered by the application



OnSite Cultural Heritage Management

OFFICE OF THE REGISTRAR
ABORIGINAL LAND RIGHTS ACT 1983 (NSW)

11-13 Mansfield Street
Glebe NSW 2037
PO Box 112, Glebe NSW 2037
P. 02 9562 6327 F. 02 9562 6350

Gerard Niemoeller
On Site Cultural Heritage Management
PO Box 574
NAROOMA NSW 2546

Dear Gerard

Re: Request - Search for Registered Aboriginal Owners

I refer to your letter dated 12 September 2012 regarding Aboriginal Stakeholders within Girilambone area, NSW.

I have searched the Register of Aboriginal Owners and the project area described does not have Registered Aboriginal Owners pursuant to Division 3 of the *Aboriginal Land Rights Act* 1983 (NSW).

I suggest you contact the Nyngan Local Aboriginal Land Council. They may also be able to assist you in identifying other Aboriginal stakeholders for this project.

Yours sincerely

Shannon Williams
Project Officer
Office of the Registrar, *Aboriginal Land Rights Act* (1983)

18 September 2012

ntscorp

18 September 2012 ref: oeh 18-9-12/1cor

Mr G. Niemoeller
OnSite Cultural Heritage Management Pty Ltd
PO Box 574
NAROOMA NSW 2546

Dear Mr.Niemoeller

ACHA / AHIP : Avoca Tank Project (Stage 2) - Girilambone

I refer to your letter/notice dated 12/9/2012 received 17/9/2012.

Please refrain from forwarding notices of the subject nature via email – it is requested that you please send via Australia Post to: **Notifications Officer – PO Box 2105 STRAWBERRY HILLS NSW 2012.**

I acknowledge that section 4.1.2 of the Office of Environment & Heritage's Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 require you to contact Ntscorp in order to compile a list of Aboriginal people who may have an interest in the proposed project area and hold knowledge relevant to determining the cultural significance of Aboriginal objects and/or places. However, NTSCORP's privacy guidelines restrict us from providing proponents with contact details of traditional owners who may have such an interest or hold such knowledge.

In response to your notification, NTSCORP will forward your correspondence to any individuals, groups and organisations whom NTSCORP is aware assert traditional interests within or hold cultural knowledge about the relevant area. Recipients of our correspondence will be invited to register their interest in the project directly with you as soon as possible.

Please be aware that NTSCORP cannot make a guarantee or undertaking that the recipients of our correspondence represent the entirety of traditional owners for the relevant area. In order to undertake the said process, a time frame of 21 days is required. The subject notice will be processed as soon as possible.

You might wish to note that my attempts to contact you via email on each of gniemoeller@skymesh.com.au and gerard@onsitechm.com.au were returned as "undeliverable".

Yours faithfully

Peter Schultz
Senior Land Tenure & Notifications Officer

+61 2 9310 3188
+61 2 9310 4177
71 098 971 209
www.ntscorp.com.au

T:\Future Acts\Correspondence\Templates\Updated notifications as at June 2012\OEH s4.1.2 mail out

OnSite Cultural Heritage Management

OnSite Cultural Heritage Management Pty Ltd

PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
ABN: 43 329 728 630
Ph: 0414441896
www.onsitechm.com.au

Our Ref: A018

9 October 2012

Registering Interest for an Aboriginal Cultural Heritage Assessment and Aboriginal Heritage Impact Permit application – Girilambone Avoca Tank Project (Stage 2), Bogan Shire Council NSW 2831

I am writing to you in accordance with Section 4.1.3 of the ***Aboriginal cultural heritage consultation requirements for proponents.***

Tritton Resources Limited Pty is in the early stage of exploring a newly identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project. The Avoca Tank Project land is divided into two stages and situated across 18.62km^2. The land is located approximately 4 kilometres north west of Girilambone NSW 2831 along the Mitchell Highway.

The Avoca Tank **Stage 1** project land covers approximately 8.7km^2 across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The Stage 1 land was the subject of a previous Aboriginal Cultural Heritage Assessment by On Site Cultural Heritage Management between April and August (2012).

On Site Cultural Heritage Management has now been contracted to conduct an Aboriginal Cultural Heritage Assessment of the adjoining Avoca Tank **Stage 2** project land across 9.90 km^2, part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet). The assessment may result in an application for an Aboriginal Heritage Impact Permit (AHIP) pursuant to the *NSW National Parks and Wildlife Act*. A map showing the location of the Avoca Tank project area (Stages 1 and 2) is attached.

Purpose of this letter

The preparation of an AHIP requires the proponent to establish a ***Register of Interest*** for the project and undertake community consultation as outlined in the Office of Environment and Heritage ***Aboriginal cultural heritage consultation requirements for proponents***. These requirements set out and establish a 4 stage consultation process.

Your details were provided to me in response to correspondence to those organisations listed in Section 4.1.2 of the *Aboriginal cultural heritage consultation requirements for proponents*. I am now writing to you in accordance with Section 4.1.3 of those requirements. A list of organisations and individuals corresponded with as part of this process is also attached for your information.

More specifically the proponent has engaged the services of ***On Site Cultural Heritage Management*** to:

- undertake the community consultation process as per the *Aboriginal cultural heritage consultation requirements for proponents*
- undertake an Aboriginal Cultural Heritage Assessment of the Avoca Tank Project (Stage 2) and
- prepare Aboriginal Heritage Impact Permit application (if required)

The purpose of establishing the Register of Interest is to formally identify and undertake community consultation with Aboriginal people who hold cultural knowledge relevant to determining the significance of the Avoca Tank project area (Stage 2) or Aboriginal objects within the subject land (9.90 km^2 across part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet and within the Bogan Shire).

The purpose of Aboriginal community consultation is to assist the proponent in the preparation of an application for an Aboriginal Heritage Impact Permit (AHIP) and to assist the Director General of the Office of Environment and Heritage in his or her consideration and determination of that application.

Should you decide to register your interest you will be provided with further information consisting of a proposed methodology for the project (in accordance with Stage 2 of the consultation requirements) and a list of questions to assist OEH in understanding the cultural value of the project area (to assist with Stage 3).

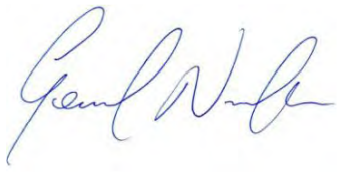
I am also required to inform you that should you decide to register your interest your details will be forwarded to Office of Environment and Heritage, Dubbo and the Nyngan Local Aboriginal Land Council unless you specify that you do not want your details released.

If you hold cultural knowledge relevant to determining the cultural significance of the Aboriginal objects located within the Avoca Tank project area or Aboriginal objects within the subject land (9.90 km^2, part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet and within the Bogan Shire then I invite you to register your interest for this project. You can register your interest by writing a letter, email or telephoning me by 24 October 2012. My contact details are provided above. If you are registering your organisation then please provide the name and details of a nominated contact person.

Please note that any registrations of interest received after 24 October 2012 will not be included on the register. A notice inviting registrations of interest and participation in the community consultation process also appeared in the Public Notices of the Nyngan Observer on Wednesday 10 October 2012.

Please contact me should you require any further information or wish to discuss this proposal.

Regards



Gerard Niemoeller
Principal Heritage Consultant

List of Aboriginal organisations / individuals identified during Stage 4.1.2 of *Aboriginal cultural heritage consultation requirements for proponents* and invited to register interest as part of this assessment

Aboriginal Organisation / Individual Name	Address	Contact Details
Bogan Aboriginal Corporation CEO Lesly Ryan	46 Nymagee St PO Box 345 NYNGAN NSW 2825	boganac@netxp.com.au Ph: (02) 6832 1750 M: 0419418851
Nyngan Local Aboriginal Land Council / Vaneta Dutton CEO	PO Box 43 NYNGAN NSW 2825	nynganlalc@bigpond.com
Marra Wallan Pty Ltd Mr John Shipp CEO	79 Thompson Street / PO BOX 6088 Dubbo NSW 2830	John@marrawallan.com.au john.shipp@bigpond.com
NTS Corp Ltd on behalf of Native Title application for the Ngemba/Ngiyampaa People (Federal Court number: NSD415/12, NNTT number: NC12/1) and Native Title applicants: Mrs Elaine Ohlsen Mr Peter Williams Mr Brett Smith Ms Danielle Flakeler-Carney Mr Neville Merritt Mr Edward Shipp Mr John Shipp Ms Grace Gordon Mr Jason Ford (identified by National Native Title Tribunal)	NTSCORP Ltd Notifications Officer PO Box 2105 STRAWBERRY HILLS NSW 2012. Unit 1a Suite 2.02, 44-70 Rosehill Street REDFERN NSW 2016	Phone: (02) 9310 3188 Fax: (02) 9310 4177
Trevor Robinson	PO Box 73, Peak Hill NSW 2869	
Wiradjuri Interim Working party	PO Box 73, Peak Hill NSW 2869	

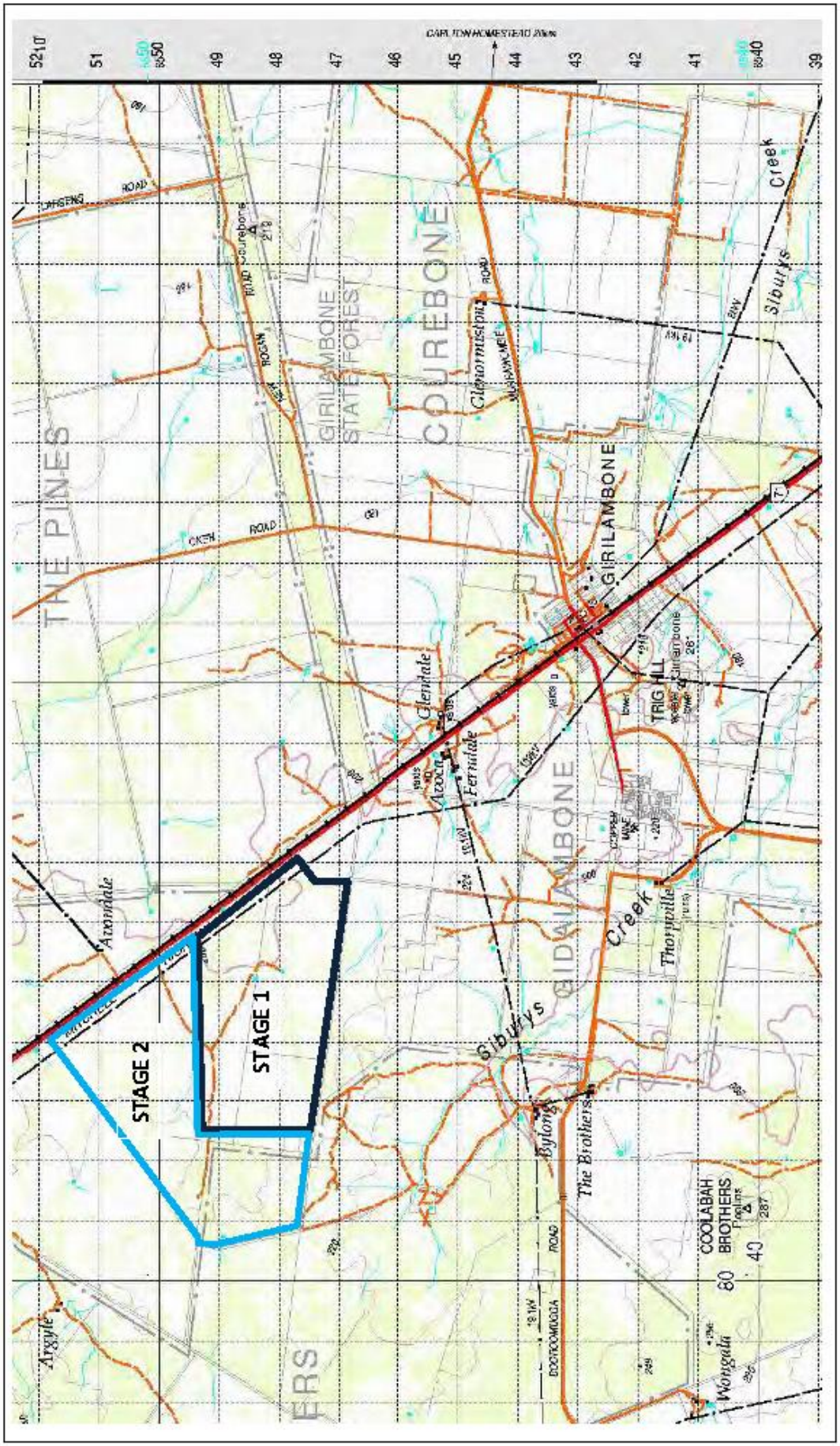


Figure 1: Avoca Tank project area (Stage 2) shown in light blue polygon (9.90 km^2), part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The adjoining Stage 1 area (8.72km^2) across part of Lots 10, 135 and 144 (DP 751315) is shown in the dark blue polygon and was the subject of a previous Aboriginal Cultural Heritage Assessment by On Site CHM (2012).

OnSite Cultural Heritage Management
Pty Ltd

PO Box 574 NAROOMA NSW 2546
gerard@onsitechm.com.au
Ph: 0414441896
www.onsitechm.com.au
ABN: 48 089 066 744

26 October 2012

Our Ref: A018

ABORIGINAL CULTURAL HERITAGE ASSESSMENT - Methodology and Significance

Avoca Tank Project – Stage 2 (Tritton Resources) Girilambone, Bogan Shire NSW 2831

TO THE REGISTERED ABORIGINAL PARTIES:

Bogan Aboriginal Corporation - Lesly Ryan, CEO
Nyngan Local Aboriginal Land Council - Vaneta Dutton CEO
Native Title Services for Ngemba/Ngiyampaa Claimants – c/o Neville Kim

1.0 INTRODUCTION

This document is provided to the 'Registered Aboriginal Parties' in accordance with Stage 2 and Stage 3 (Sections 4.2 and 4.3) of the ***Aboriginal cultural heritage consultation requirements for proponents 2010*** *(Requirements).*

The Registered Aboriginal Parties are those persons and organisations who registered their interest as part of Stage 1 (Section 4.1.3) of the Requirements and in response to:

- Correspondence of 9 October 2012 or
- The notice inviting registrations of interest and participation in the community consultation process that appeared in the Public Notices of the Nyngan Observer on Wednesday 10 October 2012.

The names of the Registered Aboriginal Parties are listed above at the top of this correspondence their contact details are included at the end of this document. Information about the project is provided below in Section 2.0.

According to Section 1.1 (pg 1), the purpose of the *Aboriginal cultural heritage consultation requirements for proponents* document is to establish the requirements for consultation with the Registered Aboriginal Parties as part of the heritage assessment process, to determine potential impacts of proposed activities on Aboriginal objects and places and to inform decision making for any application for an AHIP.

The aim is to facilitate positive Aboriginal cultural heritage outcomes by (Section 1.1, pg 1):

- affording an opportunity for Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal objects(s) and/or place(s) in the area of the proposed project to be involved in consultation so that information about cultural significance can be provided to OEH to inform decisions regarding applications for an AHIP

- providing Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal objects (s) and/or place(s) in the area of the proposed project with the opportunity to participate in decision making regarding the management of their cultural heritage by providing proponents information regarding cultural significance and inputting into management options.

2.0 THE PROJECT – AVOCA TANK (STAGE 2)

Tritton Resources Limited Pty is in the early stage of exploring a newly identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project. The Avoca Tank Project land is divided into two stages and situated across 18.62km^2. The land is located approximately 4 kilometres north west of Girilambone NSW 2831 along the Mitchell Highway.

The Avoca Tank **Stage 1** project land covers approximately 8.7km^2 across part of Lots 10, 135 and 144 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The Stage 1 land was the subject of a previous Aboriginal Cultural Heritage Assessment by On Site Cultural Heritage Management between April and August (2012).

On Site Cultural Heritage Management has been engaged to conduct an Aboriginal Cultural Heritage Assessment of the adjoining Avoca Tank **Stage 2** project land across 9.90 km^2, part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet). As part of the assessment process On Site CHM is also conducting community consultation as per the process in the *Aboriginal cultural heritage consultation requirements for proponents.*

The exploration proposed to be undertaken by Tritton Resources involves an exploratory drilling program across the area of 200+ drill holes. The majority of this program is intended to be air core drilling which is performed and launched from the back of a small specially modified 4WD truck requiring little to no clearing of drill pads.

Some further exploratory drilling using truck mounted rigs and requiring clearing of drill pads may also be undertaken in some localised areas within exploration area. The results of the exploratory drilling program will influence whether any future proposed mining will be proposed and the overall footprint of the project and mine layout (above ground open cut mining or underground mining).

The assessment may result in an application for an Aboriginal Heritage Impact Permit (AHIP) pursuant to the *NSW National Parks and Wildlife Act*. A map showing the location of the Avoca Tank project area (Stages 1 and 2) is attached.

3.0 METHODOLOGY FOR THIS ABORIGINAL CULTURAL HERITAGE ASSESSMENT

The aim of Stage 2 (Section 4.2) of the requirements is to provide registered Aboriginal parties with information about the scope of the proposed project and the proposed cultural heritage assessment process. Information about the project is provided above in Section 2.0

The methodology for the current assessment is proposed to include:

- Consultation with the Aboriginal Community to: identify Aboriginal traditional owners, elders and custodians who can speak about this place *(Registered Aboriginal Parties)*; ascertain their views about the cultural significance of the Aboriginal objects; identify whether there are particular research themes or questions of interest that could be incorporated into any research design or addressed through archaeological assessment *(Stage 2 and 3 of the requirements – this document)*

- An AHIMS database search to identify previously recorded sites within or within proximity to the study area. *An AHIMS database search has identified that there are no previously recorded Aboriginal sites within the identified area.*

- Review of other relevant heritage registers (such as the Register of the National Estate, NSW State Heritage Register, Bogan Local Heritage Register). *A search of these databases has not identified any historic places or objects within the project Area.*

- Review relevant cultural heritage and archaeological reports to provide a regional and local context for the assessment of this Aboriginal place and associated objects

- Conduct a site assessment (survey) to identify, record and document information about Aboriginal objects relevant to determining and assessing the cultural heritage significance.

- Preparation of a report documenting the results of the above processes, assessment of the places significance and the formulation of appropriate heritage management strategies

- Preparation of an Aboriginal Heritage Impact Permit application (if required)

This assessment is being conducted in accordance with relevant DECCW policy and regulations and specifically:

- *Aboriginal cultural heritage consultation requirements for proponents 2010*
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*
- *Guide to investigation, assessing and reporting on Aboriginal Cultural heritage in NSW*
- *Applying for an Aboriginal Heritage Impact Permit: Guide for applicants*

4.0 CONSULTING WITH ABORIGINAL PEOPLE ABOUT THE SIGNIFICANCE OF THE PROJECT AREA

Stage 3 (Section 4.3) of the ***Aboriginal cultural heritage consultation requirements for proponents 2010*** requires the proponent to seek information about the cultural significance of the project area land and the Aboriginal objects or places that may be within. The purpose of this stage is also to facilitate a process whereby the registered Aboriginal parties can:

a) contribute to culturally appropriate information gathering and the research methodology
b) provide information that will enable the cultural significance of Aboriginal objects and/or places on the proposed project area to be determined
c) have input into the development of any cultural heritage management options.

A list of questions about the proposed project and assessment is provided below. These questions are only suggestions and you may provide any additional information you feel is necessary to inform the proponent and OEH about the Aboriginal cultural significance or values of the project area.

1. **Are there any objects or places of cultural value in the project area or in the immediate proximity? If so how do you think the proposed development might affect those values?**

2. **Do you have any cultural concerns or perspectives about this assessment or project?**

3. **Do you think there is the potential for burials to occur at the site? If so why?**

4. **Are there any particular research questions you would like to see answered through the archaeological assessment process?**

5. **Have you got any views about the management of the lands within the Avoca Tank Project Area that may not be impacted?**

6. **Is any of the information you have provided culturally sensitive and is it OK to print your views in a report?**

5.0 PRELIMINARY ASSESSMENT

An AHIMS site search has been conducted for the Stage 2 area and reveals that there are no previously recorded Aboriginal objects or sites within the project area. An examination of topographic maps and aerial photography shows that the Stage 2 land is relatively flat, undifferentiated and there are no obvious features (such as sources of water, hills) that may have acted as foci points for Aboriginal occupation in the past.

Based on previous studies in the region the most likely Aboriginal sites types present in the project area will be stone artefacts, hearths/earth mounds and scarred trees. Given the potential absence (on maps) of potable water in the project and wider area these occurrences are predicted to be infrequent and isolated.

6.0 WHERE TO FROM HERE?

Registered Aboriginal parties have 28 days to review this document and provide information about the assessment methodology and significance of the project area. Your views and any written submissions you make will be incorporated into the assessment and report and provided to OEH.

If you would like to review this document and provide further comment please do so by Saturday 24 November 2012.

Registered Aboriginal parties will also have a further 28 days to review the final Aboriginal Cultural Heritage Assessment report.

Please contact Gerard Niemoeller of On Site Cultural Heritage Management on 0414441896 should you require any further information or wish to discuss this proposal.

List of Aboriginal organisations / individuals who registered their interest during Stage 4.1.3 of *Aboriginal cultural heritage consultation requirements for proponents* and as part of this assessment

Aboriginal Organisation / Individual Name	Address	Contact Details
Bogan Aboriginal Corporation CEO Lesly Ryan	46 Nymagee St PO Box 345 NYNGAN NSW 2825	boganac@netxp.com.au Ph: (02) 6832 1750 M: 0419418851
Nyngan Local Aboriginal Land Council / Vaneta Dutton CEO	PO Box 43 NYNGAN NSW 2825	nynganlalc@bigpond.com
NTS Corp Ltd on behalf of Native Title application for the Ngemba/Ngiyampaa People (Federal Court number: NSD415/12, NNTT number: NC12/1) and Native Title applicants: Mrs Elaine Ohlsen Mr Peter Williams Mr Brett Smith Ms Danielle Flakeler-Carney Mr Neville Merritt Mr Edward Shipp Mr John Shipp Ms Grace Gordon Mr Jason Ford (identified by National Native Title Tribunal)	NTSCORP Ltd Notifications Officer PO Box 2105 STRAWBERRY HILLS NSW 2012. Unit 1a Suite 2.02, 44-70 Rosehill Street REDFERN NSW 2016	Phone: (02) 9310 3188 Fax: (02) 9310 4177

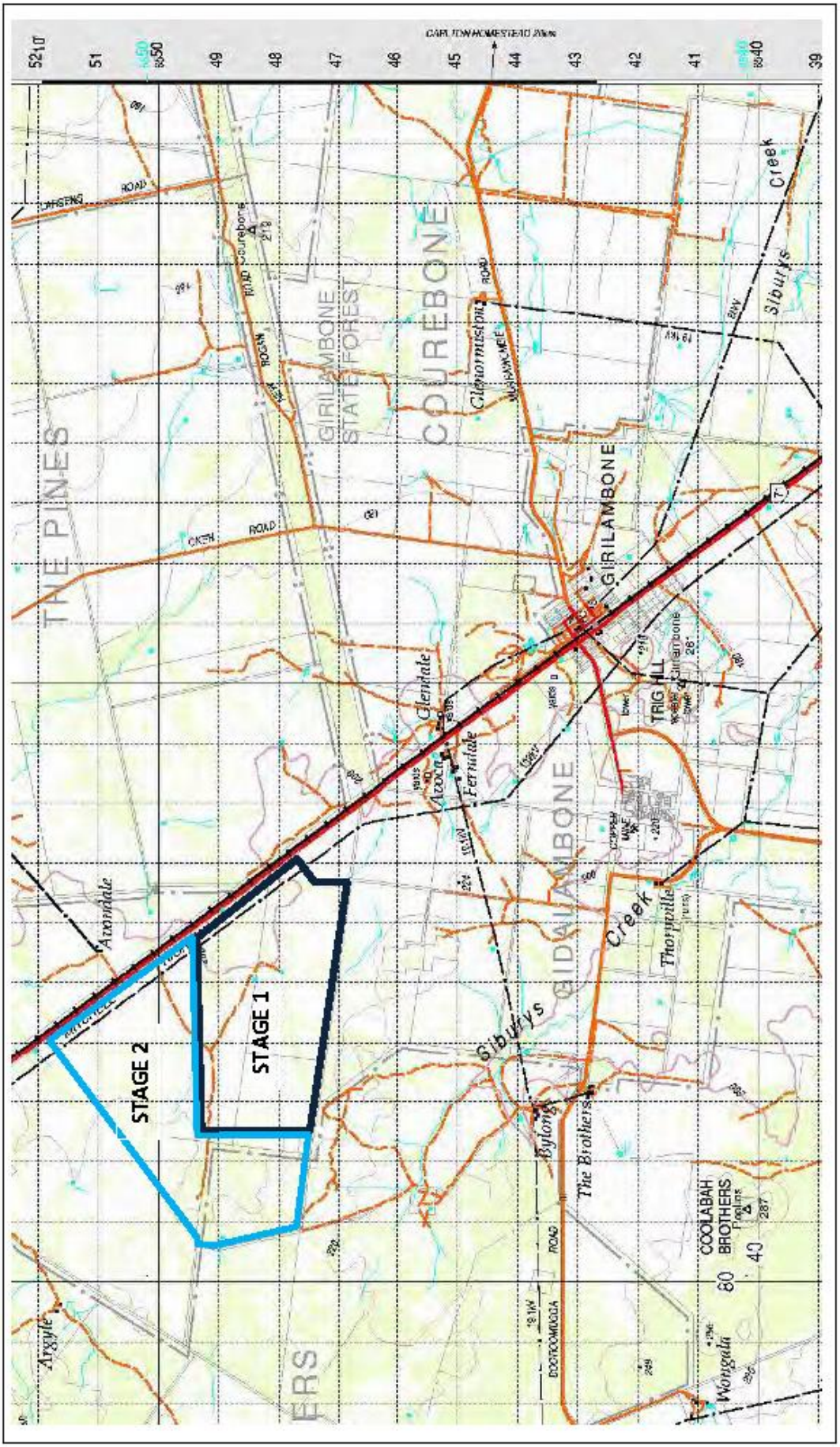
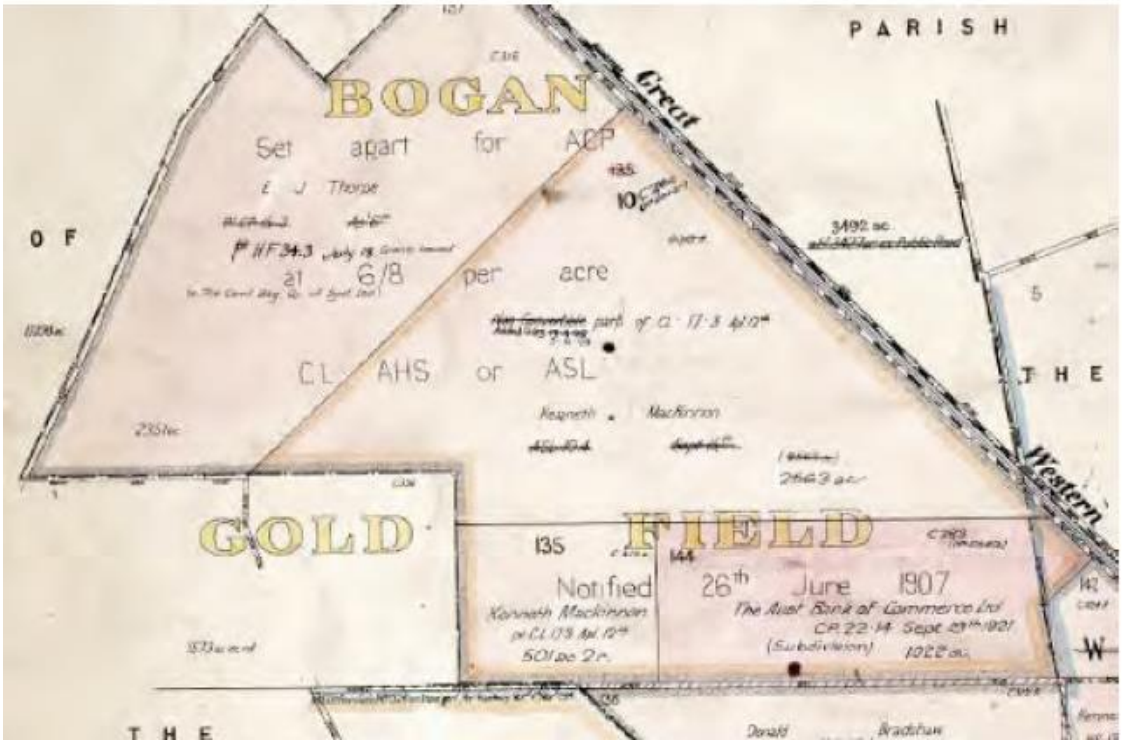


Figure 1: Avoca Tank project area (Stage 2) shown in light blue polygon (9.90 km^2), part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet. The adjoining Stage 1 area (8.72km^2) across part of Lots 10, 135 and 144 (DP 751315) is shown in the dark blue polygon and was the subject of a previous Aboriginal Cultural Heritage Assessment by On Site CHM (2012).

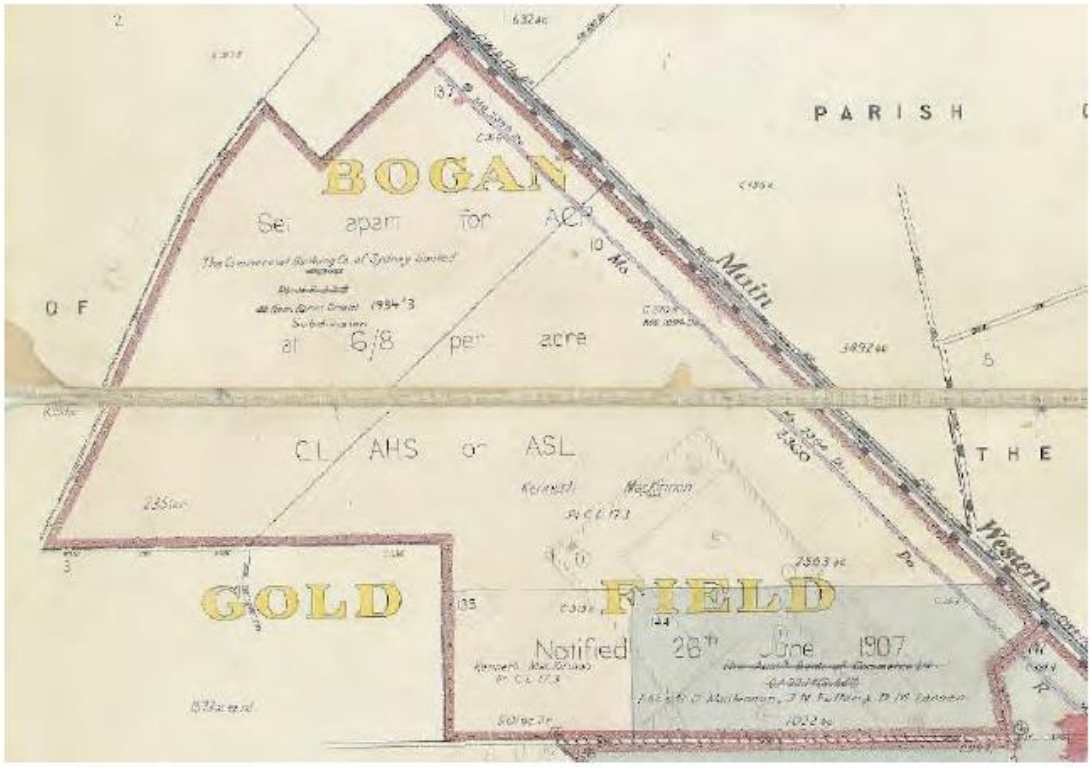
APPENDIX 3

Appendix 3.1: Parish of Gidalambone 1910 Map

Appendix 3.2: Parish of Gidalambone 1916 Map



Appendix 3.3: Parish of Gidalambone 1937 Map



Appendix 3.4: Parish Map of The Brothers 1911

Appendix 3.5: Parish Map of The Brothers 1926

Appendix 3.6: Parish Map of The Brothers 1957

APPENDIX 4

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS Web Services (AWS)
Search Result

Your Ref Number : A018
Client Service ID : 81416

Onsite Cultural Heritage Management - Narooma
PO Box 574
Narooma New South Wales 2546
Attention: Gerard Niemoeller
Email: gerard@onsitechm.com.au

Date: 26 September 2012

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 55, Eastings : 478000 - 488000, Northings : 6545000 - 6555000 with a Buffer of 0 meters, conducted by Gerard Niemoeller on 26 September 2012

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

57	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

PO BOX 1967 Hurstville NSW 2220
43 Bridge Street HURSTVILLE NSW 2220
Tel: (02)9585 6345 (02)9585 6741 Fax: (02)9585 6094

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : A018
Client Service ID : 81416

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
26-3-0067	GM-HS-28_(Hearth);Girilambone Copper Mine;	AGD	55	484710	6547330	Open site	Valid	Earth Mound : -, Hearth : -	Mound (Oven)	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0068	GM-HS-29_(Hearth);Girilambone Copper Mine;	AGD	55	484680	6547340	Open site	Valid	Earth Mound : -, Hearth : -	Mound (Oven)	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0070	GM-OS/HS-1_(Hearth);Girilambone Copper Mine;	AGD	55	484760	6548100	Open site	Valid	Earth Mound : -, Hearth : -, Artefact : -	Mound (Oven),Open Camp Site	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0071	GC-OS/HS-2_(Hearth);Girilambone Copper Mine;	AGD	55	484760	6548100	Open site	Valid	Earth Mound : -, Hearth : -, Artefact : -	Mound (Oven),Open Camp Site	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0017	GC-ST-11;Girilambone Copper Mine;	AGD	55	485880	6545950	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0018	GC-ST-12;Girilambone Copper Mine;	AGD	55	485880	6545950	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0019	GC-ST-13;Girilambone Copper Mine;	AGD	55	485960	6546010	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0020	GC-ST-14;Girilambone Copper Mine;	AGD	55	485960	6546010	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0021	GC-ST-15;Girilambone Copper Mine;	AGD	55	485960	6546010	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0022	GC-ST-16;Girilambone Copper Mine;	AGD	55	485930	6545730	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		

Report generated by AHIMS Web Service on 26/09/2012 for Gerard Niemoeller for the following area at Datum :GDA, Zone : 55, Eastings : 478000 - 488000, Northings : 6545000 - 6555000 with a Buffer of 0 meters.Additional Info : Used to provide context for archaeological study. Number of Aboriginal sites and Aboriginal objects found is 57

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OnSite Cultural Heritage Management

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : A018
Client Service ID : 81416

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
26-3-0023	GC-ST-17;Girilambone Copper Mine;	AGD	55	486390	6545590	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0024	GC-ST-18;Girilambone Copper Mine;	AGD	55	486390	6545590	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0025	GC-ST-19;Girilambone Copper Mine;	AGD	55	486390	6545470	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0026	GC-ST-20;Girilambone Copper Mine;	AGD	55	486680	6545530	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0027	GC-CT/ST-20;Girilambone Copper Mine;	AGD	55	486650	6545500	Open site	Valid	Modified Tree (Carved or Scarred) : -	Carved Tree,Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0028	GC-CT/ST-22;Girilambone Copper Mine;	AGD	55	486650	6545500	Open site	Valid	Modified Tree (Carved or Scarred) : -	Carved Tree,Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0029	GC-ST-23;Girilambone Copper Mine;	AGD	55	487690	6545180	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0030	GC-ST-24;Girilambone Copper Mine;	AGD	55	487700	6545510	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0031	GC-ST-25;Girilambone Copper Mine;	AGD	55	485990	6545590	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		

Report generated by AHIMS Web Service on 26/09/2012 for Gerard Niemoeller for the following area at Datum :GDA, Zone : 55, Eastings : 478000 - 488000, Northings : 6545000 - 6555000 with a Buffer of 0 meters.Additional Info : Used to provide context for archaeological study. Number of Aboriginal sites and Aboriginal objects found is 57

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : A018
Client Service ID : 81416

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
26-3-0032	GC-ST-26;Girilambone Copper Mine;	AGD	55	485760	6546080	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0033	GC-ST-27;Girilambone Copper Mine;	AGD	55	484900	6545900	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0034	GC-OS-1;Girilambone Copper Mine;	AGD	55	484760	6548100	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0065	GM-HS-26_(Hearth);Girilambone Copper Mine;	AGD	55	486680	6545530	Open site	Valid	Earth Mound : -, Hearth : -	Mound (Oven)	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0066	GM-HS-27_(Hearth);Girilambone Copper Mine;	AGD	55	484630	6547340	Open site	Valid	Earth Mound : -, Hearth : -	Mound (Oven)	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0011	GC-ST-7;Girilambone Copper Mine;	AGD	55	485780	6544830	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0012	GC-ST-6;Girilambone Copper Mine;	AGD	55	485780	6544830	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0013	GC-ST-8;Girilambone Copper Mine;	AGD	55	486150	6545810	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0014	GC-ST-10;Girilambone Copper Mine;	AGD	55	485930	6546000	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0016	GC-ST-9;Girilambone Copper Mine;	AGD	55	485930	6546000	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0119	GC-OS-1	AGD	55	484760	6548100	Open site	Valid	Artefact : 1		

Report generated by AHIMS Web Service on 26/09/2012 for Gerard Niemoeller for the following area at Datum :GDA, Zone : 55, Eastings : 478000 - 488000, Northings : 6545000 - 6555000 with a Buffer of 0 meters.Additional Info : Used to provide context for archaeological study. Number of Aboriginal sites and Aboriginal objects found is 57

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OnSite Cultural Heritage Management

Office of Environment & Heritage
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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : A018
Client Service ID : 81416

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0144	GC-HS-26	AGD	55	486680	6545530	Open site	Valid	Hearth : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0145	GC-HS-27	AGD	55	484630	6547340	Open site	Valid	Hearth : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0146	GC-HS-28	AGD	55	484710	6547330	Open site	Valid	Hearth : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0147	GC-HS-29	AGD	55	484680	6547340	Open site	Valid	Hearth : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0149	GC-OS-HS-1	AGD	55	484760	6548100	Open site	Valid	Hearth : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0155	GC-ST-6	AGD	55	485780	6544830	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0156	GC-ST-7	AGD	55	485780	6544830	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0157	GC-ST-8	AGD	55	486150	6545180	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0158	GC-ST-9	AGD	55	485930	6546000	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0159	GC-ST-10	AGD	55	485930	6546000	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0160	GC-ST-11	AGD	55	485880	6545950	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : A018
Client Service ID : 81416

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
26-3-0161	GC-ST-12	AGD	55	485880	6545950	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0162	GC-T-13	AGD	55	485960	6546010	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0163	GC-ST-14	AGD	55	485960	6546010	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0164	GC-ST-15	AGD	55	485960	6546010	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0165	GC-ST-16	AGD	55	485930	6545730	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0166	GC-ST-17	AGD	55	486390	6545590	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Cathy Kelman					**Permits**		
26-3-0167	GC-ST-18	AGD	55	486390	6545590	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0168	GC-ST-19	AGD	55	486390	6545470	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		
26-3-0169	GC-ST-20	AGD	55	486680	6545530	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Central West Archaeological and Heritage Services Pty Ltd					**Permits**		

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OnSite Cultural Heritage Management

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : A018
Client Service ID : 81416

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
26-3-0170	GC-CT/ST-21	AGD	55	486650	6545500	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0171	GC-CT/ST-22	AGD	55	486650	6545500	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0173	GC-ST-24	AGD	55	487700	6545510	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0174	GC-ST-25	AGD	55	485990	6545590	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0175	GC-ST-26	AGD	55	485760	6546080	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0176	GC-ST-27	AGD	55	484900	6545900	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
26-3-0172	GC-ST-23	AGD	55	487690	6545180	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		

Report generated by AHIMS Web Service on 26/09/2012 for Gerard Niemoeller for the following area at Datum :GDA, Zone : 55, Eastings : 478000 - 488000, Northings : 6545000 - 6555000 with a Buffer of 0 meters.Additional Info : Used to provide context for archaeological study. Number of Aboriginal sites and Aboriginal objects found is 57

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[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

26-3-0070

NPWS Code

1:250,000 map sheet: ____

AMG Grid reference (Full reference - please include leading digits)
250K 484760 mE 25K
250K 6548100 mN 5/6 25K

Scale of map used for grid reference (Please use largest scale available.) [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, 100K map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-70
Site types: open Campsite.
Accessioned by: ____ Date: ____
Data entered by: BK Date: 5 APR 95

Owner/Manager: Girilambone Copper Co.
Address: P.O. Box 12 Girilambone

Site name: GC-05½HS-1 Locality/property name: Girilambone Copper Mine
NPWS District: Cobar Region: Coonabarabran

Reason for investigation: Arch. Survey - EIS

Portion no:
Parish: Girilambone

Photos taken? ~~Yes~~ No
How many attached? +

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)
From Booroomugga Rd, site is located aprox 5.5km along main access track & N. East prospect, aprox 50m. from a dam & soak.

Other sites in locality? Yes
Are sites in NPWS Register? Yes
Site Types include: Open Artefact Scatter

Have artefacts been removed from site? No. When?
By whom? Deposited where?

Is site important to local Aborigines? Yes
Give contact(s) name(s) + address(es) Buddy Weldon, Nyngan LALC

Contacted for this recording? Yes
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report). NPWS Report Catalogue #
Arch. Survey of Girilambone Copper Mine, N. East Prospect

Checklist: surface visibility, damage/disturbance/ threat to site
Condition of site: ~~Fair~~ Disturbed - Eroded

Recommendations for management & protection (attach separate sheet if necessary):
As Rec Report

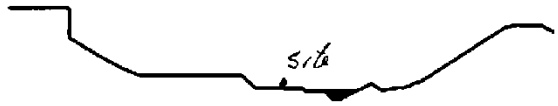
Site recorded by: J. Kelton
Address/institution: Comsa
Date: 16/12/1994

OnSite Cultural Heritage Management

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach / hill slope / ridge top, etc: Slope b. site aspect: East c. slope: ∠10°

d. mark on diagram provided *or* on your own sketch the position of the site: e. Describe briefly:



f. Local rock type: Quartzite / Shale g. Land use/effect: Grazing / Mining

2. Distance from drinking water: 20 km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4. Vegetation: Euc. Dry Sclerophyll

5. Edible plants noted: —

6. Faunal resources (include shellfish): — —

7. Other exploitable resources (river pebbles, ochre, etc):

Site type: Hearth Site (Termite Nest)

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.
DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.
ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.
BURIALS: number & condition of bone, position, age, sex, associated artefacts.
TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.
QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.
OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do NOT dig, disturb, damage site or contents.

~~Hearth situated Shelf~~

PART OF Open Woodland Scatter Site

EC-OS-1

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444

Standard Site Recording Form Revised 5/88

26-3-0071

NPWS Code

1:250,000 map sheet:

AMG Grid reference (Full reference - please include leading digits)

250K 25K: 484760 mE

250K 5/8 25K: 6548100 mN

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, 100K map name: Coolabah 8235

HEAD OFFICE USE ONLY:

NPWS Site no: 26-3-71

Site types: Open Camp Site.

Accessioned by: _____ Date: _____

Data entered by: BK Date: 5 APR 95

Owner/Manager:

Address:

Site name: GC-OS-1/HS-2

Locality/property name:

NPWS District: Cober

Region: Cowra/Lachlan

Reason for investigation: Arch. Survey

Portion no:

Parish: Gidgiambone

Photos taken? No

How many attached?

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

As for OS-1

Other sites in locality? Yes

Are sites in NPWS Register? Yes

Site Types include: Open Artefact Scatter

Have artefacts been removed from site? No

By whom?

When?

Deposited where?

Is site important to local Aborigines? Yes

Give contact(s) name(s) + address(es) Buddy Welcker, Nyngan LALC

Contacted for this recording? Yes

(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report). Arch. Survey of Girilambone Copper Mine, N. East Prospect

NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site: Eroded.

Recommendations for management & protection (attach separate sheet if necessary).

As Per Report

Site recorded by: J. Kelton

Address/institution: COWRA

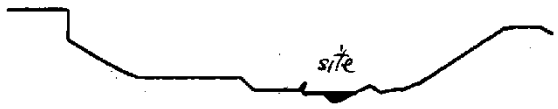
Date: 16/12/1994

OnSite Cultural Heritage Management

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: Lower Slope b. site aspect: East c. slope: <5°

d. mark on diagram provided *or* on your own sketch the position of the site: e. Describe briefly:



f. Local rock type: Quartzite/Slate g. Land use/effect: Grazing/Mining

2. Distance from drinking water: 20km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4. Vegetation: Euc. dry sclerophyll

5. Edible plants noted: —

6. Faunal resources (include shellfish): —

7. Other exploitable resources (river pebbles, ochre, etc): —

Site type: Hearth Site (Termite Nest)

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.
DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.
ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.
BURIALS: number & condition of bone, position, age, sex, associated artefacts.
TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.
QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.
OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do NOT dig,disturb,damage site or contents.

Termite Nest Hearth Site
Associated with Open Artefact Scatter Site
LL-OS-1

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

[√] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet:

AMG Grid reference (Full reference - please include leading digits): 250K 48 47 60 mE (25K); 250K 61 54 81 00 mN (5/6 25K)

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [√] 100K [ ] 250K

1:25K, 50K, 100K map name: Coolabah 8235

Site name: GC-OS-1

Locality/property name: Girilambone Copper Mine

NPWS District: Cobar

Region: Coonabarabran

Reason for investigation: Arch Survey

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-34
Site types: Open Campsite
Accessioned by: _____ Date: _____
Data entered by: BJS Date: 5 APR 95
Owner/Manager: Girilambone Copper Mine
Address: P.O. Box 12 Girilambone

26-3-0034

Portion no:
Parish: Gidilambone

Photos taken? Yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)
Site 5.4km from Boorenugga Rd. in N.East Prospect

See Report for location.

Other sites in locality? Yes
Are sites in NPWS Register? Yes
Site Types include: Open Artefact Scatter

Have artefacts been removed from site? No
By whom?
When?
Deposited where?

Is site important to local Aborigines? Yes
Give contact(s) name(s) + address(es) Buddy Weldon, Nyngan LALC

Contacted for this recording? Yes
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): Arch. Survey of Girilambone Copper Mine N/East extension

NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site:
- Exposed, low integrity
- Visible on exposed track.

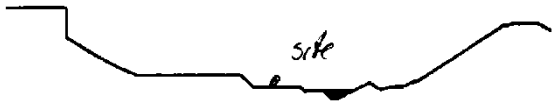
Recommendations for management & protection (attach separate sheet if necessary):
As Per Report

Site recorded by: I. Kelton
Address/institution: CowRA
Date: 16/12/1994

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: lower Slope b. site aspect: east c. slope: < 15°

d. mark on diagram provided *or* on your own sketch the position of the site: e. Describe briefly:



f. Local rock type: Quartzite/Slate g. Land use/effect: Grazing / Mining

2. Distance from drinking water: 2.5km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4. Vegetation: Euc. – Dry Sclerophyll

5. Edible plants noted: –

6. Faunal resources (include shellfish): –

7. Other exploitable resources (river pebbles, ochre, etc):

Site type: Open Artefact Scatter

DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do NOT dig, disturb, damage site or contents.

As Per Attached Sheets

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.

DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.

ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.

BURIALS: number & condition of bone, position, age, sex, associated artefacts.

TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.

QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.

OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

OS-1

Site : located 50 m south of soak
along grid line No's

Dimensions 200 m x 50 m.

4 heath sites average .75m dia

> 20 quartz flakes

(5) Pieces
N
Flakes

1.	40 x 23 x 14	11. 13 x 6 x 3
2.	24 x 26 x 10	12. 20 x 9 x 7
3.	28 x 15 x 8	13. 18 x 12 x 2
4.	27 x 8 x 10	14. 10 x 7 x 3
5.	18 x 10 x 8	15. 12 x 8 x 4
6.	22 x 13 x 6	16. 7 x 9 x 5
7.	20 x 12 x 3	17. 8 x 7 x 3
8.	17 x 17 x 5	18. 11 x 8 x 6
9.	12 x 7 x 4	19. 10 x 8 x 5
10.	11 x 8 x 5	20. 7 x 5 x 3

Flakes

non specific

Soak

Dam

60m

50m

OS1 (IF5)

0

20m 20m

Amorphous stone frags

Sandstone/quartzite x 10

1.	70 x 28 x 10
2	55 x 30 x 28
3	60 x 25 x 30
4	32 x 40 x 38
5	40 x 27 x 16
6	12 x 11 x 10
7	23 x 18 x 18/19
8	32 x 14 x 10
9	40 x 28 x 26
~~10~~	~~20 x 14 x 12~~

OS-1

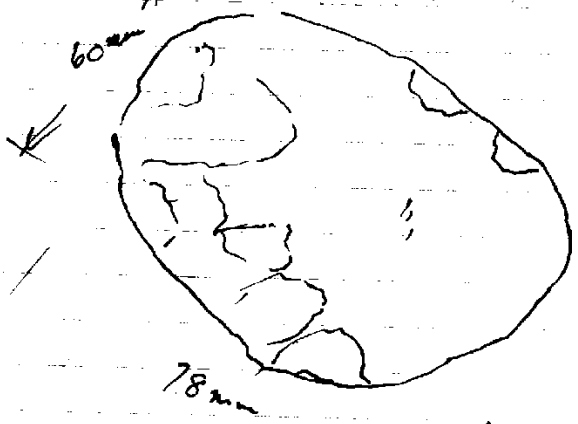
Mangement - Buffer Zone !!

~~IF. 5~~

16-12

- ~~20~~ artefacts est. 250 — 250 metres along

(1) Hand grindstone / Volcanic / Pebble / Bifacial
- silica gloss on f
- abrasion on edges
- negative scars — possibly from use as a hammer stone



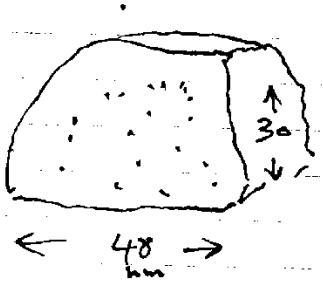
flat side

78 X 60 X 40

(2) Broke - quartzite pebble

48 X 30 X 30

(3) 28 X 15 X 7 yellow chert flake.



[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

26-3-0119

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits): 250K 48 47 60 mE (25K) 250K 65 48 100 mN (5/6, 25K)

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, 100K map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-0119
Site types:
Accessioned by: _____ Date: _____
Data entered by: _____ Date: _____

Owner/Manager: Girilambone Copper Mine
Address: P.O. Box 12 Girilambone

Site name: GC-OS-1
Locality/property name: Girilambone Copper Mine
NPWS District: Cobar
Region: Coonabarabran

Reason for investigation: Arch Survey

Portion no:
Parish: Girilambone

Photos taken? Yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)
Site 5.4km from Boorenaugga Rd. in N.East Prospect
See Report for location.

Other sites in locality? Yes
Are sites in NPWS Register? Yes
Site Types include: Open Artefact Scatter

Have artefacts been removed from site? No
By whom? When?
Deposited where?

Is site important to local Aborigines? Yes
Give contact(s) name(s) + address(es): Buddy Weldon, Nyngan LALC

Contacted for this recording? Yes
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): Arch. Survey of Girilambone Copper Mine N/East extension
NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site
Condition of site: · Exposed, low integrity
· Visible on exposed track.

Recommendations for management & protection (attach separate sheet if necessary):
As Per Report

Site recorded by: I Ketton
Address/institution: CoWRA
Date: 16/12/1994

[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

One Site: 26-3-0149

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits)
250K 484760 mE (25K) 250K 6548100 mN (5/6 25K)

Scale of map used for grid reference (Please use largest scale available) [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, 100K map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: [redacted] GC-OS-HS-1 (26-3-0149)
Site types:
Accessioned by: _____ Date: _____
Data entered by: _____ Date: _____

Owner/Manager: Girilambone Copper Co.
Address: P.O. Box 12 Girilambone

Site name: GC-OS-HS-1 Locality/property name: Girilambone Copper Mine
NPWS District: Cobar Region: Coonabarabran

Reason for investigation: Arch. Survey - EIS

Portion no:
Parish: Girilambone

Photos taken? ~~Yes~~ No
How many attached? +

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)
From Boorooma Rd, site is located aprox 5.5km along main access track in N. East prospect, aprox 50m. from a dam & soak.

Other sites in locality? Yes
Are sites in NPWS Register? Yes
Site Types include: Open Artefact Scatter

Have artefacts been removed from site? No. When?
By whom? Deposited where?

Is site important to local Aborigines? Yes
Give contact(s) name(s) + address(es) Buddy Weldon, Nyngan LALC

Contacted for this recording? Yes
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report). Arch. Survey of Girilambone Copper Mine, N. East Prospect
NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site
Condition of site: ~~Poor~~ Disturbed - Eroded

Recommendations for management & protection (attach separate sheet if necessary):
As Per Report

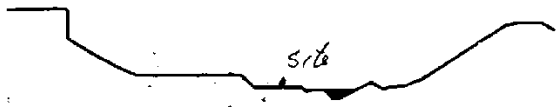
Site recorded by: J. Kelton
Address/institution: Cowra
Date: 16/12/1994

OnSite Cultural Heritage Management

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: Slope b. site aspect: East c. slope: ∠10°

d mark on diagram provided *or* on your own sketch the position of the site: e. Describe briefly:



f. Local rock type: Quartzite/Shale g. Land use/effect: Grazing / Mining

2. Distance from drinking water: 20 km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4. Vegetation: Euc. Dry Sclerophyll

5. Edible plants noted: —

6. Faunal resources (include shellfish): —

7. Other exploitable resources (river pebbles, ochre, etc):

Site type: Hearth Site (Termite Nest)

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.
DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.
ART area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.
BURIALS: number & condition of bone, position, age, sex, associated artefacts.
TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.
QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.
OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do **NOT** dig, disturb, damage site or contents.

~~As per attached Sheet~~

PART OF OPEN CAMPING

Scatter

EC-05-1

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

[√] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits): 250K 48 47 60 mE (25K); 250K 65 48 100 mN (5/6 | 25K)

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [√] 100K [ ] 250K

1:25K, 50K, 100K map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: _____
Site types:
Accessioned by: _____ Date: _____
Data entered by: _____ Date: _____
Owner/Manager:
Address:

Site name: GC-OS-1/HS-2 Locality/property name:

NPWS District: Cobar Region: Coonabarabran

Reason for investigation: Arch. Survey

Portion no:
Parish: Girilambone

Photos taken? No
How many attached?

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.): As for OS-1

Other sites in locality? Yes Site Types include: Open Artefact Scatter
Are sites in NPWS Register? Yes

Have artefacts been removed from site? No When?
By whom? Deposited where?

Is site important to local Aborigines? Yes
Give contact(s) name(s) + address(es): Buddy Weldon, Nyngan LALC

Contacted for this recording? Yes
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): Arch. Survey of Girilambone Copper Mine, N. East Prospect
NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site: Eroded.

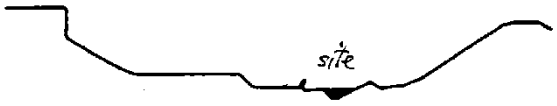
Recommendations for management & protection (attach separate sheet if necessary):
As Per Report

Site recorded by: J. Kelton
Address/institution: CoWRA
Date: 16/12/1994

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: Lower Slope b. site aspect: East c. slope: <5°

d. mark on diagram provided *or* on your own sketch the position of the site: e. Describe briefly:



f. Local rock type: Quartzite/Slate g. Land use/effect: Grazing/Mining

2. Distance from drinking water: 20km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4. Vegetation: Euc. dry sclerophyll

5. Edible plants noted: —

6. Faunal resources (include shellfish): —

7. Other exploitable resources (river pebbles, ochre, etc):

Site type: Hearth Site (Termite Nest)

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.
DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.
ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.
BURIALS: number & condition of bone, position, age, sex, associated artefacts.
TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.
QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.
OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do NOT dig,disturb,damage site or contents.

Termite Nest Hearth Site
Associated with Open Artefact Scatter Site
WL-OS-1

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

OS-1

- located 50 m south of soak
- along gps mining grid line No's

Dimensions 280 m x 50 m.

4 hearth sites average .75m diam

>20 quartz flakes

(5) F/piece

N

Flakes

1. 40 x 23 x 14
2. 38 x 26 x 10
3. 28 x 15 x 8
4. 27 x 8 x 10
5. 18 x 10 x 8
6. 22 x 13 x 6
7. 20 x 12 x 3
8. 14 x 7 x 5
9. 12 x 7 x 4
10. 11 x 8 x 5

11. 13 x 6 x 3
12. 20 x 9 x 7
13. 18 x 12 x 2
14. 10 x 7 x 3
15. 12 x 8 x 4
16. 9 x 9 x 5
17. 8 x 7 x 3
18. 11 x 8 x 6
19. 10 x 8 x 5
20. 7 x 5 x 3

} Flakes

} non specific

Soak

Dam

60m

50m

OS/1 (IF5)

0

20m 20m

Amorphous stone frags

Sandstone/greywacke x 10

1. 70 x 28 x 10
2. 55 x 30 x 28
3. 60 x 35 x 30
4. 52 x 40 x 38
5. 40 x 27 x 16
6. 12 x 11 x 10
7. 23 x 18 x 18/14
8. 32 x 14 x 10
9. 40 x 28 x 26
10. ~~20 x 8 x 12~~

OS-1 Mangenese - Buffer zone ; !

~~IF~~. 5 16-12

- ~~20~~ artefacts est. 150 250 metres along

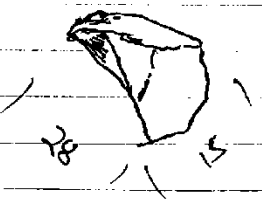
(1) Hand grindstone / Volcanic / Pebble / Bifacial
- silica gloss on f
- abrasion on edges
- negative scars — possibly from use as a hammer stone

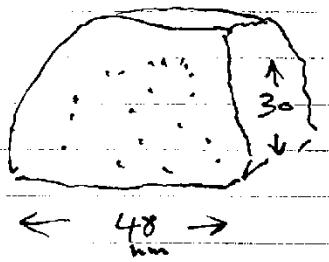
flat side

78 X 60 X 40

(2) Broke - quartzite pebble 48 X 30 X 30

(3) 28 X 15 X 7 yellow chert flake.





[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444

Standard Site Recording Form Revised 5/88

26-3-0067

NPWS Code

1:250,000 map sheet:

AMG Grid reference (Full reference - please include leading digits): 250K 484710 mE (25K); 250K 6547330 mN (5/6 25K)

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, (100K) map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-67
Site types: Open Camp Site
Accessioned by: _____ Date: _____
Data entered by: JK Date: 5APR95

Owner/Manager: Girilambone Copper Co. P.O. Box 12 Girilambone.

Site name: GC-45-28

Locality/property name: Girilambone Copper mine. NORTH EAST prospect.

NPWS District: Cobar

Region: Coonabarabran

Reason for investigation: ARCH Survey.

Portion no:
Parish: Girilambone

Photos taken? yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.) Site located aprx 50.4km north of Booroomugga Rd on west side of main access track. Located with GPS - No Landmarks

Other sites in locality? yes
Are sites in NPWS Register? yes

Site Types include: Open Scatter

Have artefacts been removed from site? No
By whom?

When?
Deposited where?

Is site important to local Aborigines? Yes.
Give contact(s) name(s) + address(es): Buddy Weldon. Nyngan. LALC.

Contacted for this recording? yes.
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): An archaeological Survey of Girilambone Copper Mine. North East Prospect Proposed Extension

NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site: . Poor
. Eroded Scattered

Recommendations for management & protection (attach separate sheet if necessary):

As per Report.

Site recorded by: J. KELTON

Address/institution: 92 Darling St Cowra. 2794

Date: 16/12/94

OnSite Cultural Heritage Management

HS-28 16/12/94

- Ant Nest
- Poor
- Eroded / Scattered
- Ridge Line = background.

26-3-67

28

29

N

1.50 m

0.95m

101°
42 paces to
HS-29

[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

26-3-0146

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits): 250K 484710 mE 25K; 250K 6547330 mN 5/6 25K

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K (100K) map name: Coolabah 8235

Site name: GG-HS-28

Locality/property name: Girilambone Copper mine. NORTH EAST prospect.

NPWS District: Cobar

Region: Coonabarabran

Reason for investigation: ARCH Survey.

Portion no:

Parish: Girilambone

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-0146
Site types:
Accessioned by: _____ Date: _____
Data entered by: _____ Date: _____

Owner/Manager: Girilambone Copper Co.
Address: P.O. Box 12 Girilambone.

Photos taken? yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.): Site located aprox 50 km north of Booroomugga Rd on west side of main access track.
Located with GPS - No Land marks

Other sites in locality? yes
Are sites in NPWS Register? yes

Site Types include: open Scatter

Have artefacts been removed from site? No
By whom?

When?
Deposited where?

Is site important to local Aborigines? yes.
Give contact(s) name(s) + address(es): Buddy Weldon. Nyngan. LALC.

Contacted for this recording? yes.
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): an archaeological Survey of Girilambone Copper Mine. North East Prospect Proposed Extension

NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site: Poor. Eroded Scattered

Recommendations for management & protection (attach separate sheet if necessary): As per Report.

Site recorded by: J. KELTON

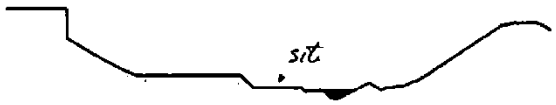
Address/institution: 92 Darling St Cowra. 2794

Date: 16/12/94

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: Ridge Top b. site aspect: 360 c. slope: 15°

d. mark on diagram provided *or* on your own sketch the position of the site:



e. Describe briefly: Single hearth

f. Local rock type: Quartzite / Shale g. Land use/effect: Grazing / Mining

2. Distance from drinking water: 20 km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4. Vegetation: Euc. dry sclerophyll

5. Edible plants noted: Yes

6. Faunal resources (include shellfish): —

7. Other exploitable resources (river pebbles, ochre, etc): —

Site type: Hearth Site (Termite Nest)

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.
DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.
ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.
BURIALS: number & condition of bone, position, age, sex, associated artefacts.
TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.
QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.
OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

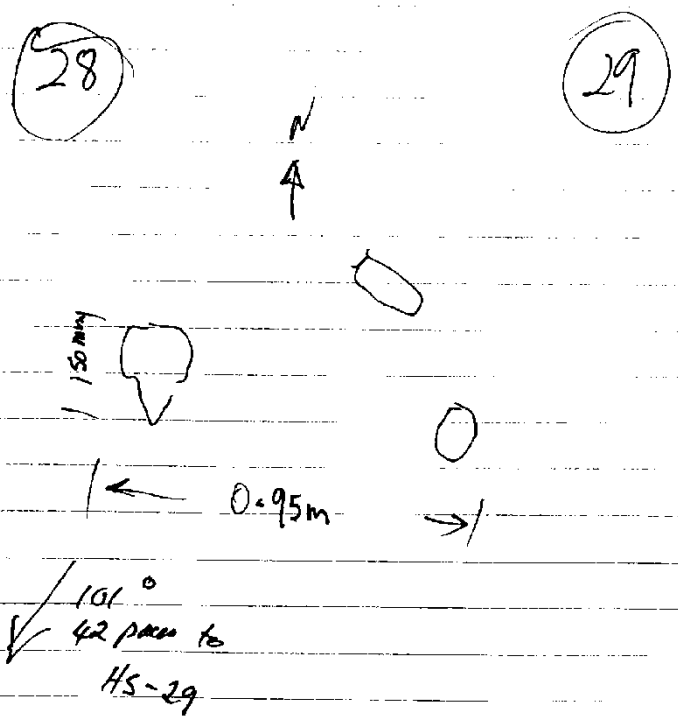
DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do NOT dig, disturb, damage site or contents.

(As Per Attached Sheet)

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

HS-28 16/12/94

- Ant Nest
- Poor
- Eroded / Scalded
- Ridge line - bare ground.



[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

26-3-0068

NPWS Code

1:250,000 map sheet:

AMG Grid reference (Full reference - please include leading digits): 250K 484680 mE (25K) 250K 6547340 mN (5/6, 25K)

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K (100K) map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-68
Site types: Open Camp Site
Accessioned by: _____ Date: _____
Data entered by: BK Date: 5APR95

Owner/Manager: Girilambone Copper Co.
Address: P.O. Box 12 Girilambone.

Site name: GC-HS-29.
Locality/property name: Girilambone Copper mine. North East prospect.
NPWS District: Cobar
Region: Coonabarabran.

Reason for investigation: ARCH Survey. - EIS

Portion no:
Parish: Gidalambone

Photos taken? yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.): Site located aprox 5.3 km north of Booroomugga Rd on Western Side of main track. - No Land marks - Located with GPS

Other sites in locality? yes
Are sites in NPWS Register? yes
Site Types include: open Scatter

Have artefacts been removed from site? No
By whom?
When?
Deposited where?

Is site important to local Aborigines? yes.
Give contact(s) name(s) + address(es): Buddy Weldon. Nyngan. LALC.
Contacted for this recording?
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): An Archaeological Survey of Girilambone Copper Mine. North East prospect proposed Extension
NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site
Condition of site: · Poor · Eroded

Recommendations for management & protection (attach separate sheet if necessary): AS per Report

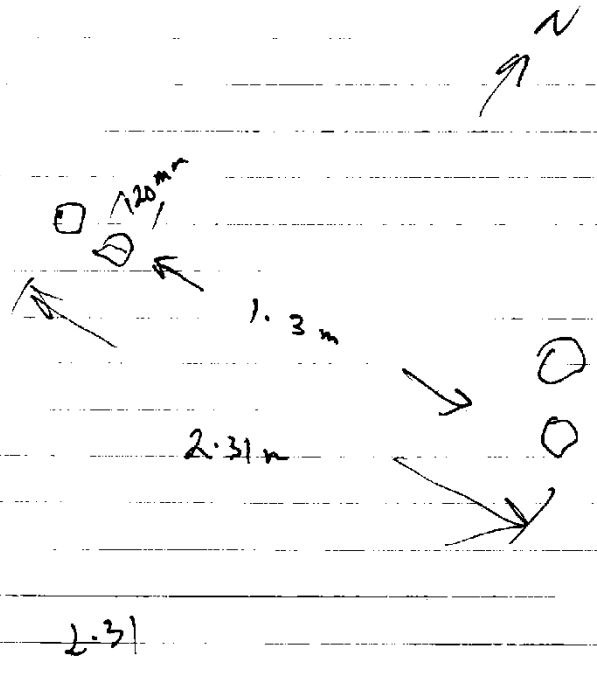
Site recorded by: S. KELTON
Address/institution: 92 Darling St Cowra 2794
Date: 16/12/94

OnSite Cultural Heritage Management

26-3-68

HS-29 16/12/

- Ant Nest
- Poor
- Eroded



[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

26-3-0147

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits): 250K 48468 mE 25K; 250K 65473 40 mN 25K (5/6)

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, (100K) map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-0147
Site types:
Accessioned by: _____ Date: _____
Data entered by: _____ Date: _____

Owner/Manager: Girilambone Copper Co.
Address: P.O. Box 12 Girilambone.

Site name: GC-HS-29.
Locality/property name: Girilambone Copper mine. North East Prospect.
NPWS District: Cobar
Region: Coonabarabran

Reason for investigation: ARCH SURVEY. - EIS

Portion no:
Parish: Gidalambone

Photos taken? yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.): Site located aprox 5.3 km north of Booroomugga Rd on Western Side of main track. - No Landmarks - Located with GPS

Other sites in locality? yes
Are sites in NPWS Register? yes
Site Types include: open Scatter

Have artefacts been removed from site? No
By whom?
When?
Deposited where?

Is site important to local Aborigines? yes
Give contact(s) name(s) + address(es): Buddy Weldon. Nyngan. LALC.
Contacted for this recording?
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): An Archaeological Survey of Girilambone Copper Mine. North East prospect proposed Extension
NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site
Condition of site: Poor, Eroded

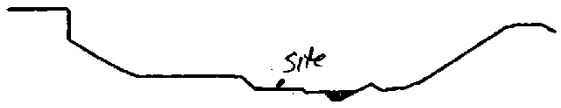
Recommendations for management & protection (attach separate sheet if necessary): RS per Report

Site recorded by: J. KELTON
Address/institution: 92 DARLING ST COWRA 2794
Date: 16/12/94

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: Ridge b. site aspect: 360° c. slope: <10°

d. mark on diagram provided *or* on your own sketch the position of the site: e. Describe briefly:



f. Local rock type: Quartzite/Shale g. Land use/effect: Grazing/Mining

2. Distance from drinking water: 20 km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4 Vegetation: Euc. dry sclerophyll.

5. Edible plants noted: Yes - Kurrajong - Wild Orange

6. Faunal resources (include shellfish): –

7. Other exploitable resources (river pebbles, ochre, etc): –

Site type: Hearth Site (Termite Nest)

DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do NOT dig, disturb, damage site or contents.

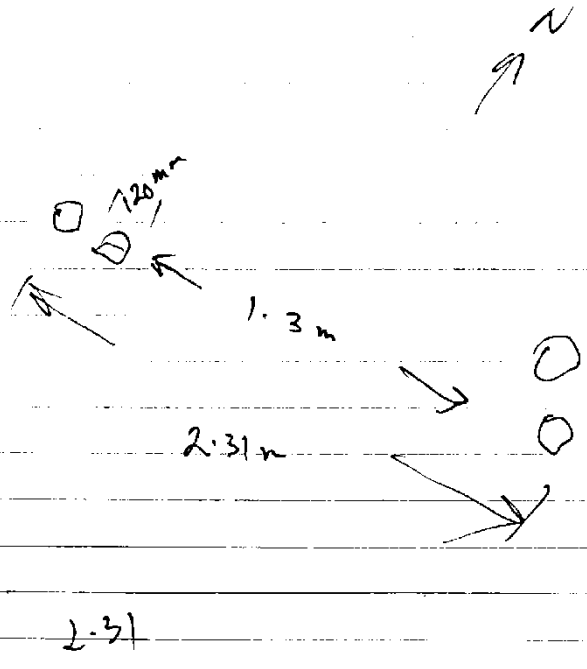
As Per Attached Sheet

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.
DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.
ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving: no. of figures, sizes, patination.
BURIALS: number & condition of bone, position, age, sex, associated artefacts.
TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.
QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.
OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, ma mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

HS-29 16/12/

- Ant Nest
- Poor
- Eroded



[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

26-3-0066

NPWS Code

1:250,000 map sheet:

AMG Grid reference (Full reference - please include leading digits): 250K 484630 mE 25K; 250K 6547340 mN 5/6 25K

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, (100K) map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-66
Site types: Open Camp Site
Accessioned by: _____ Date: _____
Data entered by: SB Date: 5APR95

Owner/Manager: Girilambone Copper Co.
Address: P.O. Box 12 Girilambone.

Site name: GC-HS-27
Locality/property name: Girilambone Copper mine NORTH EAST Prospect.
NPWS District: COBAR
Region: Coonabarabran

Reason for investigation: ARCH SURVEY - EIS

Portion no:
Parish: Girilambone

Photos taken? yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.): Site located aprox 5.4 km north of Booroomugga Rd to west of main central access track - Located with GPS - No Landmarks

Other sites in locality? yes
Are sites in NPWS Register? yes
Site Types include: open Scatter

Have artefacts been removed from site? NO
By whom?
When?
Deposited where?

Is site important to local Aborigines? yes
Give contact(s) name(s) + address(es): Buddy Weldon Nyngan. LALC.

Contacted for this recording? yes
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): An Archaeological Survey of Girilambone Copper mine. NORTH EAST Prospect Proposed Extensions.
NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site
Condition of site: - Poor.
- Eroded / Scattered

Recommendations for management & protection (attach separate sheet if necessary):
As per Report.

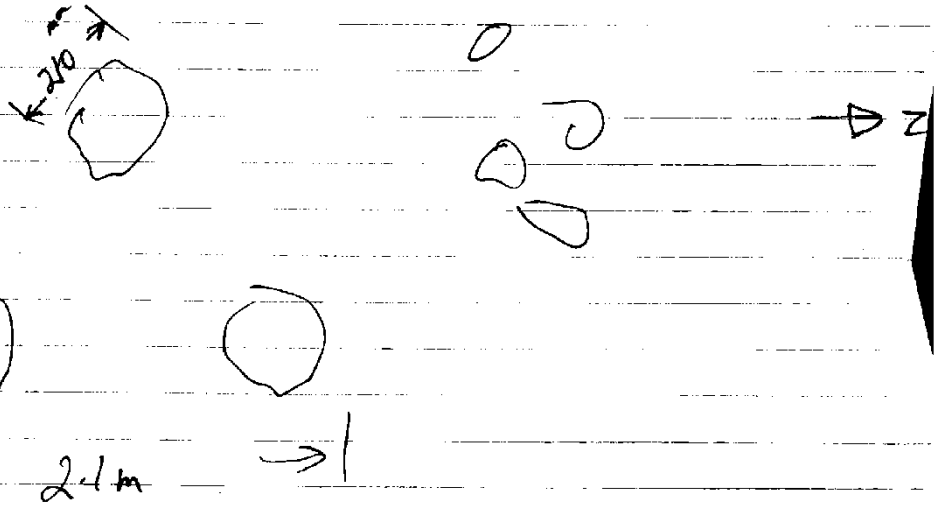
Site recorded by: J. KELTON
Address/institution: 92 DARLING ST. COWRA 2794
Date: 16/12/94

OnSite Cultural Heritage Management

HS-[redacted]-27 16/12/

- Ant Nest
- Poor Cond.
- Eroded / Scattered
- Western side of gentle slope

26-3-66



[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444
Standard Site Recording Form Revised 5/88

26-3-0145

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits): 250K 484630 mE 25K; 250K 6547340 mN 5/6 25K

Scale of map used for grid reference (Please use largest scale available): [ ] 25K, 50K (preferred) [✓] 100K [ ] 250K

1:25K, 50K, (100K) map name: Coolabah 8235

HEAD OFFICE USE ONLY:
NPWS Site no: 26-3-0145
Site types:
Accessioned by: _____ Date: _____
Data entered by: _____ Date: _____

Owner/Manager: Girilambone Copper Co.
Address: P.O. Box 12 Girilambone.

Site name: GC-HS-27
Locality/property name: Girilambone Copper mine NORTH EAST Prospect
NPWS District: COBAR
Region: Coonabarabran

Reason for investigation:
ARCH SURVEY - EIS

Portion no:
Parish: Girilambone

Photos taken? yes
How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)
Site located aprox 5.4 km north of Booroomugga Rd to west of main central access track - Located with GPS - No Landmarks

Other sites in locality? yes
Are sites in NPWS Register? yes
Site Types include: open Scatter

Have artefacts been removed from site? No
By whom?
When?
Deposited where?

Is site important to local Aborigines? yes
Give contact(s) name(s) + address(es): Buddy Weldon Nyngan. LALC.

Contacted for this recording? yes
(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report): An Archaeological Survey of Girilambone Copper mine. NORTH EAST Prospect Proposed Extensions.
NPWS Report Catalogue #

Checklist: surface visibility, damage/disturbance/ threat to site
Condition of site: - Poor.
- Eroded / Scattered

Recommendations for management & protection (attach separate sheet if necessary):
As per Report.

Site recorded by: D. KELTON
Address/institution: 92 DARLING ST. COWRA 2794
Date: 16/12/94

OnSite Cultural Heritage Management

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: Slope b. site aspect: West c. slope: <10°

d. mark on diagram provided *or* on your own sketch the position of the site:

e. Describe briefly: Single Hearth

f. Local rock type: Quartzite / Shale g. Land use/effect: Grazing / Mining

2. Distance from drinking water: 20 km Source: Bogan River

3. Resource Zone associated with site (estuarine, riverine, forest etc): Open Woodland

4. Vegetation: Euc. dry sclerophyll

5. Edible plants noted: Yes

6. Faunal resources (include shellfish):

7. Other exploitable resources (river pebbles, ochre, etc):

Site type: Hearth Site (Termite Nest)

CHECKLIST TO HELP: length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.

DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.

ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.

BURIALS: number & condition of bone, position, age, sex, associated artefacts.

TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.

QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.

OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

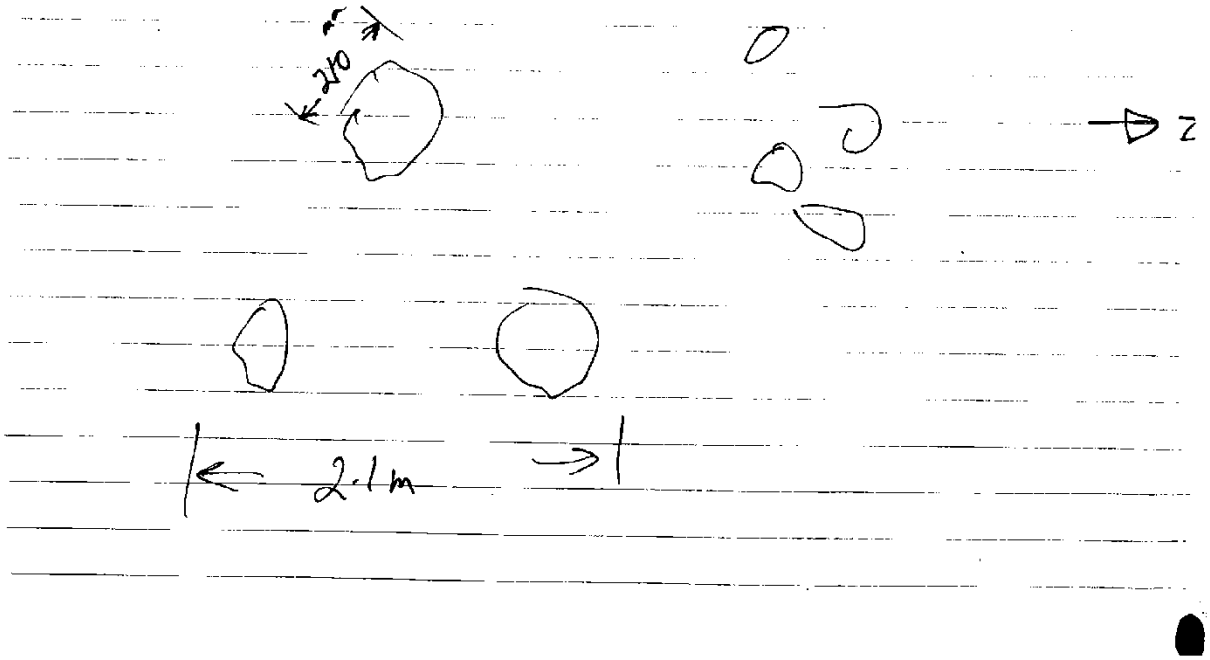
DESCRIPTION OF SITE & CONTENTS.
Note state of preservation of site & contents. Do **NOT** dig,disturb,damage site or contents.

As Per Attached Sheet

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

HS-[redacted]-27 16/12/

- Art Nest
- Poor Cond.
- Eroded / Scattered
- Western side of gentle slope



OnSite Cultural Heritage Management

APPENDIX 5

Details of Transects for Avoca Tank project area (Stage 1)

Transect	Slope^0	Average visibility %	Exposures %	Exposure types	Sites or objects	Length (m)
A	0 - 2	30	10	gravel lags, anthills, sheetwash deflations	no	1750
B	0 - 2	30	10	gravel lags, anthills, sheetwash deflations	no	1700
C	0 - 2	20	10	gravel lags, anthills, sheetwash deflations	no	1950
D	0 - 2	30	10	gravel lags, anthills, sheetwash deflations	no	1800
E	0 - 2	30	15	gravel lags, anthills, sheetwash deflations	no	1850
F	0 - 2	20	15	gravel lags, anthills, sheetwash deflations	no	1850
G	0 - 2	20	10	gravel lags, anthills, sheetwash deflations	no	1850
H	0 - 2	30	20	gravel lags, anthills, sheetwash deflations	no	1900
I	0 - 2	20	15	gravel lags, anthills, sheetwash deflations	yes	1900
J	0 - 2	15	10	gravel lags, anthills, sheetwash deflations	yes	1950
K	0 - 2	10	10	gravel lags, anthills, sheetwash deflations	no	2000
L	0 - 2	30	25	gravel lags, anthills, sheetwash deflations	no	2000
M	0 - 2	30	20	gravel lags, anthills, sheetwash deflations	no	2200
N	0 - 2	30	20	gravel lags, anthills, sheetwash deflations	no	2000
O	0 - 2	25	15	gravel lags, anthills, sheetwash deflations	no	1500
P	0 - 2	25	15	gravel lags, anthills, sheetwash deflations	no	800
Q	0 - 2	20	15	gravel lags, anthills, sheetwash deflations	no	500

Details of Transects for Avoca Tank project area (Stage 2)

Transect	Slope^0	Average visibility %	Exposures %	Exposure types	Sites or objects	Length (m)
1	0 - 2	30	10	gravel lags, anthills, sheetwash deflations	no	700
2	0 - 2	35	20	gravel lags, anthills, sheetwash deflations	no	900
3	0 - 2	30	10	gravel lags, anthills, sheetwash deflations	no	1100
4	0 - 2	25	15	gravel lags, anthills, sheetwash deflations	no	2000
5	0 - 2	20	10	gravel lags, anthills, sheetwash deflations	no	1000
6	0 - 2	25	15	gravel lags, anthills, sheetwash deflations	no	1200
7	0 - 2	30	15	gravel lags, anthills, sheetwash deflations	no	1500
8	0 - 2	30	20	gravel lags, anthills, sheetwash deflations	no	2100
9	0 - 2	25	15	gravel lags, anthills, sheetwash deflations	no	1400
10	0 - 2	20	15	gravel lags, anthills, sheetwash deflations	no	1500
11	0 - 2	15	10	gravel lags, anthills, sheetwash deflations	no	2900
12	0 - 2	20	15	gravel lags, anthills, sheetwash deflations	no	3200
13	0 - 2	20	20	gravel lags, anthills, sheetwash deflations	no	2400
14	0 - 2	35	25	gravel lags, anthills, sheetwash deflations	yes	2200
15	0 - 2	35	15	gravel lags, anthills, sheetwash deflations	no	1800
16	0 - 2	30	15	gravel lags, anthills, sheetwash deflations	no	1700

Stone artefact attributes recorded at Avoca Tank 1, 2 and 5

Site	Artefact No	Raw Material	Artefact Type	Platform surface	Termination	Length (mm)	Width (mm)	Thickness (mm)	Comments
Avoca Tank 1	1	quartzite	retouched flake	flake scar	feather	33.8	20.8	12.1	cortex on dorsal
Avoca Tank 1	2	quartzite	flake	crushed	feather	22.5	21.6	7.8	
Avoca Tank 1	3	grannodiorite	ground fragment			52.9	36.8	23.2	
Avoca Tank 1	4	quartz	retouched flake	flake scar		24.2	30.8	8.6	distal retouch
Avoca Tank 1	5	quartzite	retouched flake	cortex		38.8	28.0	19.4	proximal flake
Avoca Tank 1	6	quartz	flake	flake scar	feather	21.8	26.6	2.6	overhang removal
Avoca Tank 1	7	porphyritic	hammerstone			80.8	71.1	36.1	cortex
Avoca Tank 1	8	basalt	flake	indeterminate		17.0	11.6	1.8	proximal flake
Avoca Tank 1	9	quartz	flake	flake scar	feather	23.8	28.1	6.6	
Avoca Tank 1	10	quartz	flake	indeterminate	step	36.3	21.1	9.5	
Avoca Tank 1	11	quartzite	retouched flake	flake scar		31.2	32.5	12.2	overhang removal & distal retouched
Avoca Tank 2	1	silcrete	flake	flake scar	feather	24.0	10.9	8.8	
Avoca Tank 5	1	quartz	flake	flake scar	feather	24.5	19.1	7.2	
Avoca Tank 5	2	quartz	flake	indeterminate	feather	18.8	19.4	4.2	

APPENDIX 6

ABORIGINAL CULTURAL HERITAGE ASSESSMENT - Avoca Tank Project

STRAITS RECOMMENDATIONS:

1. That all areas identified as sites are cordoned off and are classified as "**no go zone areas**" until an AHIP has been granted (see **Plates 1** & **2**)

2. That all Straits employees and contractors working in this area are made aware that certain areas have been identified as no go zones and they are reminded of the financial consequences they can face

3. That the areas are monitored on a regular basis until an AHIP has been approved

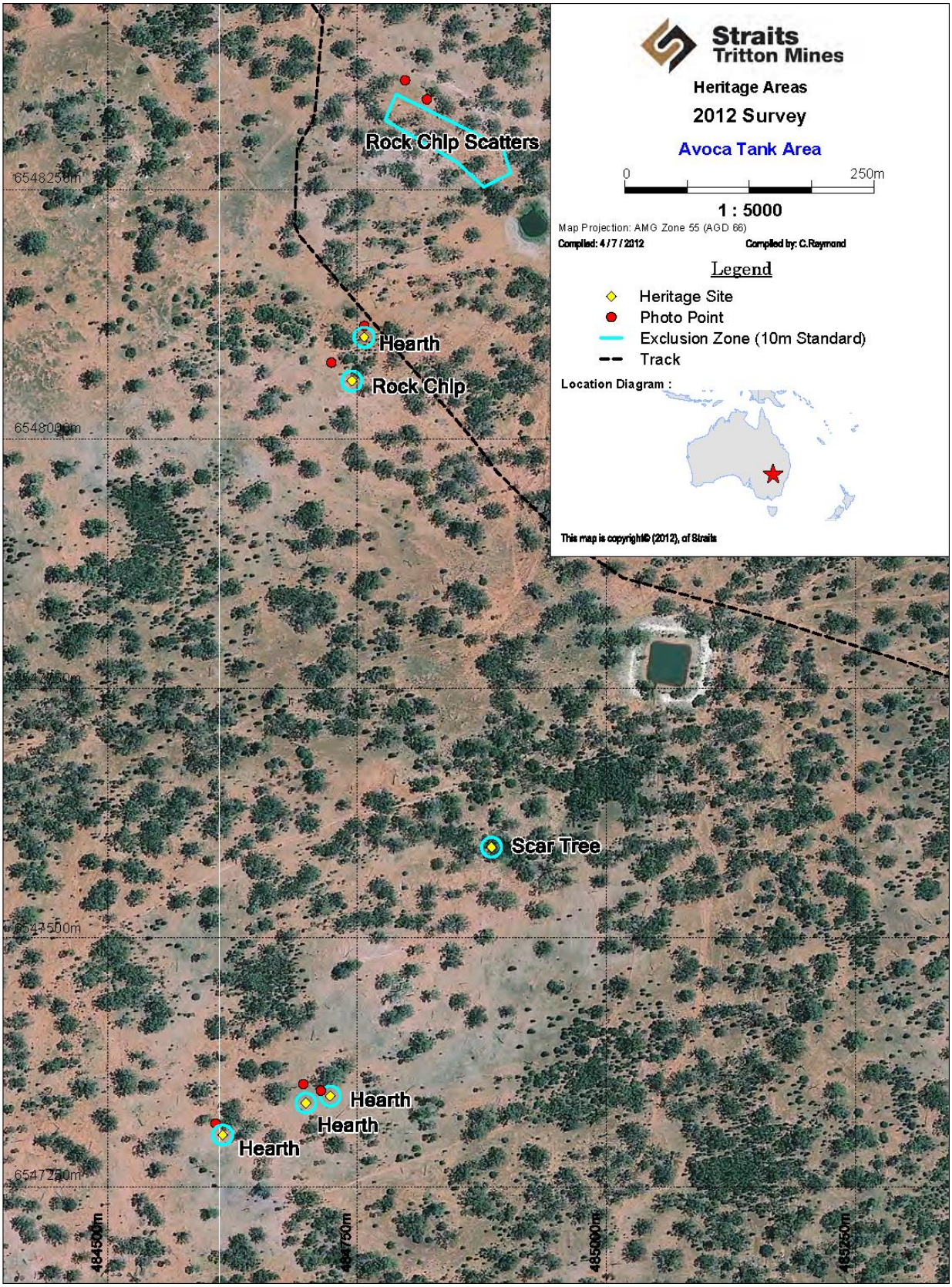
4. That Straits Community and Heritage Manager work closely with staff to ensure these messages are relayed and to work closely with Nyngan Local Aboriginal Land Council or Bogan Aboriginal Corporation to apply for custodianship of Aboriginal objects

5. That photographic monitoring points outside the **no go zone area** of each site is established for the purpose of auditing the sites until an AHIP has been granted

Paul W Calvin
Community and Heritage Manager

Plate 1 (above): (from left) Aboriginal Representatives Lesly Ryan (Bogan Aboriginal Corporation), Sheila Couley (Nyngan Local Aboriginal Land Council), Kate Duca (OnSite CHM), Neville Merritt (Ngemba/Ngiyampaa Native Title claim group) discuss site protection with Paul Calvin (Straits Resources).

Plate 2 (below): Site protection and Compliance information for Tritton personnel


Straits
Tritton Mines
Heritage Areas
2012 Survey
Avoca Tank Area
0
250m
1 : 5000
Map Projection: AMG Zone 55 (AGD 66)
Compiled: 4 / 7 / 2012
Compiled by: C.Raymond
Legend
Heritage Site
Photo Point
Exclusion Zone (10m Standard)
Track
Location Diagram :
This map is copyright© (2012), of Straits
Rock Chip Scatters
Hearth
Rock Chip
Scar Tree
Hearth
Hearth
Hearth
6548250m
6548000m
6547750m
6547500m
6547250m
484500m
484750m
485000m
485250m

APPENDIX 7

10.0 CONCLUSIONS, MANAGEMENT AND RECOMMENDATIONS

10.1 CONCLUSIONS

1. The survey and assessment process across the Avoca Tank project area (Stages 1 and 2) has identified a total of five locations where Aboriginal objects and occupation evidence occurs. (Avoca Tank 1 to 5).
2. A review of the 11 previously recorded AHIMS sites within the Avoca Tank project area (Stage 1) has determined that there are duplicate recordings and these 11 sites actually represent 5 sites. Two of these sites have been rerecorded as part of this survey. Duplicate site recordings 26-3-0034 / 26-3-0119/ 26-3-0149 have been rerecorded as Avoca Tank 1 and duplicate site recordings 26-3-0067 / 26-3-0146, 26-3-0068 / 26-3-0147, 26-3-0066 / 26-3-0145 have been recorded as Avoca Tank 3 comprising 3 hearth locales. Hearth nodules recorded at site 26-3-0070 / 26-3-0071 were unable to be relocated as part of this survey and it is likely that these features have since eroded away.
3. The results of this assessment reveal Aboriginal occupation evidence is sparsely distributed across the Avoca Tank project area and indicative of low intensity use of the landscape by Aboriginal people characterised by a high level of mobility and relatively short term occupation or single use of these places.
4. The low intensity of Aboriginal occupation materials across the area is likely due to the paucity of reliable sources of potable water, stone outcrops suitable for the manufacture of stone tools and to some extent the disturbance upon Aboriginal occupation materials by previous land use practices.
5. Aboriginal consultation and archaeological analysis of these places within a regional context has assessed the cultural significance of these places (encompassing Aboriginal and archaeological significance). Avoca Tank 1 (an open artefact scatter), is considered to have a low to moderate level of cultural significance. Avoca Tank 2 (a single isolated stone artefact), is considered to have a low level of cultural significance. Avoca Tank 3 (three 'hearths') is considered to have a low level of cultural significance. Avoca Tank 4 (historic scar tree and Aboriginal stockman's camp) is considered to have a moderate level of cultural significance. Avoca Tank 4 has been identified by Registered Aboriginal Parties as having a moderate to high level of Aboriginal significance and also attributed with historic and aesthetic values. Avoca Tank 5 (2 x isolated stone artefacts), is considered to have a low level of cultural significance.

10.2 MANAGEMENT OPTIONS

The Aboriginal objects identified within the Avoca Tank study area are legally protected under the *National Parks and Wildlife Act 1974 (*NPW Act). Part 6 of the NPW Act provides specific protection for Aboriginal objects and declared Aboriginal places by establishing offences of harm. Harm is defined to mean destroying, defacing, damaging or moving an object from the land.

There are a number of defences and exemptions to the offence of harming an Aboriginal object or place. One of the defences is that the harm was carried out under an Aboriginal Heritage Impact Permit (AHIP).

The Burra Charter advocates a cautious approach to the management of a place, cultural significance and values: do as much as necessary but as little as possible (Article 3). Within the context of development and associated assessment processes under the *Environmental Assessment and Planning Act,* the formulation of management strategies is also influenced by the level of cultural significance, the proposal and potential impacts on identified values.

A number of strategies are generally applied to the management of Aboriginal objects and their values. These strategies are conservation, mitigated impact and unmitigated impact. Conservation and mitigated impact may be interrelated. For instance places and objects might be conserved in situ, or through mitigated impact places, objects and their values might be conserved through strategies such as documentation, salvage, appropriate curation, display and interpretation. Development of management strategies should ultimately derive from a clear understanding of the cultural significance of a given place and the range of values held by different groups or individuals.

10.3 RECOMMENDATIONS

This assessment has identified five places (Avoca Tank 1 to 5) within the Avoca Tank project area (Stages 1 and 2) containing Aboriginal objects protected under the *National Parks and Wildlife Act*. Tritton has advised that all of these sites will be avoided as part of any exploratory drilling program. Recommendations for avoiding each of the identified sites during the drilling program were provided with the site descriptions (**Section 7.2**).

Straits (Tritton) Resources has implemented a series of management strategies to afford protection of these sites during the exploratory drilling program and from related activities. These strategies have been implemented in accordance with the Straits Community and Heritage Policy and Straits Procedures - Heritage Management Planning (Australia). Recommendations from the internal memo and photographic evidence (see **Plate 10.1**) of implemented site protection measures are provided in **Appendix 6**.

Should the exploration program within the Avoca Tank project area proceed to mining that may potentially impact on the identified sites then mitigative strategies will need to be developed and applied.

Should impacts upon identified sites (Avoca Tank 1 to 5) be unavoidable the proponent will need to apply for relevant AHIPs.

Plate 10.1 (below): (from left) Aboriginal Representatives Lesly Ryan (Bogan Aboriginal Corporation), Sheila Couley (Nyngan Local Aboriginal Land Council), Kate Duca (OnSite CHM), Neville Merritt (Ngemba/Ngiyampaa Native Title claim group) discuss site protection with Paul Calvin (Tritton / Straits Resources).

It was discussed above that management strategies should be developed with a clear understanding of the place, its values and cultural significance. On this basis and the potential impacts of proposed mining activities it is recommended that:

1. Wherever possible Tritton seek to conserve identified places in situ and develop and implement appropriate management strategies during exploration activities or construction, development and operation of an active mine.

Should impact on these places be unavoidable during the construction, development or operation of a mine it is recommended that the proponent apply for Aboriginal Heritage Impact Permits (AHIPs):

2. The stone artefacts at Avoca Tank 1 (AHIMS Sites 26-3-0034 / 26-3-0119 / 26-3-0149) should be subject to cultural collection under a care agreement with Nyngan LALC.
3. The hearth previously recorded at AHIMS sites 26-3-0070 / 26-3-0071 was unable to be relocated during this survey and is likely to have been eroded away. No further action is warranted regarding this place.
4. Avoca Tank 2, consisting of one isolated stone artefact is considered to have a low level of cultural significance and no further action is warranted regarding this site.

5. Avoca Tank 3, consisting of 3 hearths, is considered to have a low level of cultural significance and no further action is warranted regarding this site.
6. Avoca Tank 4, consisting of the historic scar tree, Aboriginal stockmen's camp and its setting has a moderate to high level of Aboriginal significance and should be conserved and managed accordingly. If this place is able to be avoided and conserved then a site specific and appropriate management plan/policy should be prepared to protect the cultural heritage values and their significance.
   If conservation is not possible then Tritton should develop a methodology in consultation with the Registered Aboriginal Parties about the potential salvage, relocation and conservation of the scar tree. Preliminary discussion with the Aboriginal community representatives present during the Stage 1 and 2 survey indicated that the salvage and relocation of the tree to another location would be acceptable if this place could not be avoided. More comprehensive recording and documentation of this place should also be undertaken as part of any AHIP process.

7. Avoca Tank 5, consisting of 2 isolated stone artefacts is considered to have a low level of cultural significance and no further action is warranted regarding this site.
8. Should the project proceed to full scale mining operations, no further archaeological surveys of the Avoca Tank project area is required.

On the basis of the legal requirements of the *National Parks and Wildlife Act* it is recommended that:

9. Where impact on identified places cannot be avoided, Tritton should apply for an Aboriginal Heritage Impact Permit (s90).
10. OEH provide consent to salvage and destroy these localities and include as conditions recommendations 2 to 7 above.

A summary of sites identified within the Avoca Tank project area (Stage1), their significance and recommendations is provided below in Table 10.1.

Comments on this assessment from the Registered Aboriginal Parties are discussed below in **Section 10.4.**

Table 10.1: Summary table for identified sites within Avoca Tank project area, their significance and recommendations

Sites	Previously recorded AHIMS Sites	Site type and comments	Aboriginal Significance	Archaeological Significance	Summary of mitigation strategy
Avoca Tank 1	26-3-0034 / 26-3-0119 / 26-3-0149	Open artefact scatter –Low density scatter (11 x stone artefacts) with high raw material diversity and moderate artefact type diversity.	Moderate	Low to moderate	Apply for an AHIP if required and salvage artefacts under care agreement with Nyngan LALC
-	26-3-0070 / 26-3-0071	Hearth – unable to be relocated during this survey. Probably not extant	-	-	Apply for an AHIP if required for recorded location of site
Avoca Tank 2	-	Isolated stone artefact	Low	Low	Apply for an AHIP if required. No further action warranted.
Avoca Tank 3	26-3-0067 / 26-3-0146 26-3-0068 / 26-3-0147 26-3-0066 / 26-3-0145	3 x hearths – no other cultural material in association.	Low to moderate	Low	Apply for an AHIP if required. No further action warranted.
Avoca Tank 4	-	Historic scar tree and Aboriginal stockman's camp.	Moderate to high	Moderate	Conserve tree, camp and environmental context. If impact is unavoidable then apply for an AHIP to salvage and relocate tree.
Avoca Tank 5	-	2 x Isolated stone artefacts	Low	Low	Apply for an AHIP if required. No further action warranted.

10.4 COMMENTS ON THIS ASSESSMENT FROM REGISTERED ABORIGINAL PARTIES

A draft of this report was sent to the registered Aboriginal parties on 21st February 2013. The Registered Aboriginal parties were provided 28 days to review the report and provide comment. The closing date for comments was 22nd March 2013.

All of the registered parties supplied comment on the draft. Nyngan LALC and Bogan Aboriginal Corporation endorsed the assessment and resulting recommendations. A copy of these endorsement letters is included in **Appendix 7**.

Native Title Services Corporation, on behalf of the Ngemba/Ngiyampaa Native Title claim group, also provided comment on the assessment (**Appendix 7**). NTS comments on the assessment have been tabulated and a response provided below in **Table 10.2.** The table of comments was sent to NTS Corp who provided a further response also included at **Appendix 7**.

Table 10.2: Response to NTS Corp Comments on Avoca Tank Project Draft ACHAR

NTSCORP COMMENTS	RESPONSE TO NTSCORP COMMENTS
Coverage of Surveys Undertaken	
At section 6.0, the Draft ACHAR states that, for the Stage 1 area, *'[t]he surey consisted of* a *series of transects north south along the proposed drill lines'*. No such statement in regards to drill-hole locations is made in respect of the Stage 2 survey area coverage. No comments are made in respect of the location of access roads and other infrastructure in relation to either survey location. This makes it unclear whether the surveys undertaken to inform the Draft ACHAR cover all areas which will be impacted by the Project, including all proposed drill holes, access roads and other infrastructure sites. Accordingly, NTSCORP submits that Tritton should ensure that, whether as part of a further assessment process or as part of the management processes adopted for the Project, all areas where infrastructure will be located, including access roads, be subject to further assessment surveys which includes representatives from the Claim Group.	At this stage of the project the proposed footprint and layout of the mine has not been finalised. The final layout will be informed by a number of factors including constraints identified as part of environmental and heritage studies and the location of the ore body as determined by drilling. The intention to plan the mine layout and avoid heritage places wherever possible is demonstrated within **Recommendation 1**. The survey strategy for the Stage 1 area was developed on the basis of the proposed drill holes locations and to achieve coverage across the entire project area. A similar survey strategy was developed and adopted for the Stage 2 area with the same aim; to achieve coverage across the entire project area. ***Section 6.0 - Avoca Tank Stage 2 (pg 50)*** *At the time of the survey the proponent had advised that the Stage 2 area was being subject to archaeological survey to identify potential impacts on Aboriginal objects and identify constraints on the planning process for the mine footprint should the exploration program shift to full scale mining and to be considered in the EIS.* *For consistency and compatibility of results between the Stage 1 and 2 project areas a similar survey strategy was employed for the Stage 2 project area as was employed for the Stage 1 project area. The location of transects undertaken as part of Stage 2 is shown in* ***Figure 6.1.*** The survey strategy employed by OSCHM achieved coverage across 34% (6.35km^2) of the entire Avoca Tank (Stages 1 and 2). This level of coverage is considered sufficient to understand the potential for Aboriginal occupation evidence to occur across the landscape level. This archaeological survey has

	determined that Aboriginal occupation evidence is sparsely distributed across the Avoca Tank project area and despite the 63.5 kilometres of transects surveyed found to only occur at five discrete locations. Further archaeological surveys were not recommended due to this low density of Aboriginal occupation evidence and low potential for further evidence to occur. Subsequent and more intensive surveys are generally only warranted when a baseline survey identifies a moderate to high potential for further Aboriginal occupation evidence to occur. This is not the case within the Avoca Tank project area. It is also worth noting that Tritton Resources invited representatives from the Claim group to participate in both surveys. Neville Merritt participated in the Stage 2 survey and was also shown a number of sites identified during the Stage 1 survey (including Avoca Tank 1, 2 and 4 and AHIMS site 26-3-0070/26-3-0071). A range of potential management strategies were discussed with Neville (see page 27 – 28). The other Registered Aboriginal Parties (Nyngan LALC and Bogan Aboriginal Corporation) have also since provided their support for the recommendations in the report, including Recommendation 8 that no further archaeological surveys are required.
Comments and Suggestions on Management Measures	
Fencing of Identified Places and Objects The Claim Group have expressed concerns over the plastic fencing currently used at the Projects site to demarcate and protect identified objects and places. Cordoning off and designating identified sites as 'no go zones' is discussed at sections 7.2.1 to 7.2.5 of the Draft ACHAR. The Claim Group request that fencing off of identified objects and places be specifically adopted as	The plastic fencing currently installed around the identified sites is temporary. The fencing at sites that will be conserved and managed during the development and operational phase of any proposed mine will be upgraded as part of the boundary fencing program. The fencing at these sites will be upgraded to steel pickets and wire sufficient to prevent trespassers and animals. Straits have also implemented protection measures in accordance with the Straits Community and Heritage Policy and Straits Procedures - Heritage Management Planning (Australia). Recommendations from the internal memo and implemented site protection measures were discussed at Section 10.3 (pg

one of the management measures in addition to those detailed at section 10.3 of the Draft ACHAR. The Claim Group requests that steel pickets and wire be used instead of plastic fencing to ensure durability and sufficient protection. The Claim Group also request that such fencing be sufficiently high to prevent animals and trespassers from entering the 'no go zones'.	83) and provided at **Appendix 6.** A recommendation (consistent with those discussed at sections 7.2.1 to 7.2.5) relating to the fencing of these sites (with steel pickets and wire) and designation as 'no go zones' will also be included within **Section 10.3, Recommendation 2** of the final report.
Ongoing Monitoring NTSCORP suggests that ongoing monitoring, including representatives from the Claim Group, be included as a management measure in addition to those detailed at section 10.3 of the Draft ACHAR. Such monitoring should be required for all activities which involve surface disturbance, and would be able to incorporate the additional assessment surveys as suggested above. The monitoring process should include mechanisms which enable Tritton and the cultural heritage monitors onsite to jointly develop protection and mitigation measures in respect of additional objects and sites which are identified as exploration proceeds.	The below comments refer to the practice of monitoring earthworks for Aboriginal objects in a subsurface context (usually stone artefacts). These comments do not refer to the practice of cultural monitoring of identified cultural heritage places to be conserved during the construction, development and operation of an active mine. Cultural monitoring of identified and retained Aboriginal heritage places by the Aboriginal Community should be considered by Tritton as appropriate and part of the development and implementation of management strategies referred to in **Recommendation 1**. The archaeological survey determined that Aboriginal occupation evidence is sparsely distributed across the Avoca Tank project area, which is considered to have a low archaeological potential to contain further Aboriginal occupation evidence. Just as further survey is not considered warranted from an archaeological perspective, nor is monitoring of general earthworks. From an archaeological perspective monitoring might generally only be warranted when a survey identifies a moderate to high potential for Aboriginal occupation evidence to occur in a subsurface context. This is not the case within the Avoca Tank project area. Further, where areas of potential subsurface deposit are identified, current OEH policy practice favours the undertaking of test excavations over monitoring. A number of reasons are accepted for the preference of test excavation strategy to identify Aboriginal occupation evidence to occur in a subsurface context:

	1. The undertaking of test excavations is generally conducted during the planning and approvals phase of a project. The identification of Aboriginal cultural heritage values during this phase provides more flexibility for the project planning to develop and implement appropriate heritage conservation strategies in response to the nature and significance of those values. 2. The undertaking of test excavations is usually implemented under the framework of an AHIP or process in the Code of Practice for Archaeological Investigations. This framework provides certainty to the Aboriginal communities that Aboriginal heritage values will be identified and appropriately considered. In contrast monitoring is considered a 'high risk' approach: 3. Monitoring of project earthworks usually occurs after the project planning phase and at the commencement of activities that have the potential to *harm* Aboriginal objects (within the meaning of the NPW Act). This timing also means that the flexibility and opportunity to respond appropriately and achieve a good heritage conservation outcome to protect identified Aboriginal heritage values *in- situ* is greatly reduced. 4. In the absence of an AHIP, the identification of Aboriginal objects in a subsurface context during earthworks also requires 'a stop work approach' and necessity to apply for an AHIP supported by the necessary assessment and consultation processes. This may also lead to long and costly delays for the project and proponent and will generally not produce good heritage conservation outcomes. Regardless, the paucity of Aboriginal occupation evidence across the project area and low potential for Aboriginal objects to occur within a subsurface context does not warrant the implementation of either

	management strategy (test excavation or monitoring). Besides the paucity of Aboriginal occupation evidence to warrant monitoring, another factor relates to the low integrity of the landscape across the Avoca Tank project area. The landscape is considered degraded and eroded. These conditions are not conducive to the preservation of subsurface archaeological deposits containing Aboriginal objects. At least part of this degradation has been caused by erosion caused relating to previous land use practices. These erosive agents are considered to have impacted greatly upon the landscape. Previous land use practices, erosion and the resulting integrity of the subject land and effects on Aboriginal objects are discussed throughout the report but especially in **Sections 4.1** and **4.4**.
Relocation of Objects & Further Consultation Processes The potential relocation of identified objects as exploration proceeds to mining is discussed at section 9.1 and included as one of the ten management principles at section 10.3 of the Draft ACHAR. NTSCORP suggests that the Claim Group be specifically consulted with and included in any salvage and storage programmes developed in relation to this relocation. At several places in the Draft ACHAR, including as one of the management mechanisms listed at section 10.3, it is suggested that Aboriginal Heritage Impact Permits (AHIPs) may be required if impact in identified places or objects cannot be avoided. NTSCORP submits that the consultation processes which will be adopted in any AHIP processes, including both cultural heritage significance assessments and development of management mechanisms, be delineated in the Draft	The relocation and salvage of any Aboriginal objects would require the development of an appropriate salvage methodology in consultation with the Registered Aboriginal Parties. Salvage methodologies have not been developed because, as yet, it is not understood whether the final footprint and layout may impact on identified Aboriginal cultural heritage values. Any salvage methodology would be circulated to the Registered Aboriginal Parties for their review and comment prior to the Aboriginal Heritage Impact Permit (AHIP) application. "The National Parks and Wildlife Act 1974 (NPW Act) allows the transfer of Aboriginal objects to an Aboriginal person or Aboriginal organisation for safekeeping. The person or organisation must enter into a care agreement with OEH." If required, a care agreement would also be developed as part of any salvage methodology and AHIP application. Consultation about the relocation, future storage and conservation practices for Aboriginal objects is required to be undertaken with the Registered Aboriginal Parties. Some discussion with the Registered Aboriginal Parties (including Neville Merritt as representative for

ACHAR and include specific consultation and collaboration with the Claim Group.	the Claim group) about salvage methodologies and care agreement for the scar tree at Avoca Tank 4 was provided at **Section 3.3.2** (pgs 27-28) The Claim group is one of three Registered Aboriginal parties and will be consulted during the development of any proposed salvage methodologies and care agreements required to be developed for the project.
Further Surveys Required if Project Proceeds to Mining	
NTSCORP do not support point 8 of the proposed management measures at section 10.3 of the Draft ACHAR. If the Project proceeds to mining, it is appropriate that further cultural heritage surveys be undertaken at a greater level of intensity and coverage sufficient to reflect the increased impacts of production as compared to exploration. This is particularly pertinent given that no member of the Claim Group was involved in Stage 1 of the survey process, as noted in section 3.3.1.	The archaeological survey determined that Aboriginal occupation evidence is sparsely distributed across the Avoca Tank project area. Further archaeological surveys were not recommended due to the low density of Aboriginal occupation evidence and low potential for further evidence to occur. Subsequent and more intensive surveys are generally only warranted when a baseline survey identifies a moderate to high potential for further Aboriginal occupation evidence to occur. This is not the case within the Avoca Tank project area. It is also worth noting that Tritton Resources invited representatives from the Claim group to participate in both the Stage 1 and 2 surveys. Neville Merritt participated in the Stage 2 survey and was also shown a number of sites identified during the Stage 1 survey (including Avoca Tank 1, 2 and 4 and AHIMS site 26-3-0070/26-3-0071). A range of potential management strategies were discussed with Neville (see page 27 – 28). The other Registered Aboriginal Parties (Nyngan LALC and Bogan Aboriginal Corporation) who participated in the surveys have provided support for the recommendations in the report, including **Recommendation 8** that no further archaeological surveys are required. Their views about the Aboriginal occupation and significance of the Avoca Tank study area are provided in **Sections 8.0** and **9.1**.

NYNGAN LOCAL ABORIGINAL LAND COUNCIL
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8th April 2013

Mr Gerard Niemoeller
Principle Heritage Consultant
On Site Cultural Management Pty Ltd
PO BOX 574
Narooma NSW 2546

Dear Gerard,

RE: Site Assessment done on "Avoca" and "Avoca Tanks".

On behalf of the Aboriginal Site Assessment done on the above properties in which we accompanied Mr Gerard Niemoeller.
Nyngan Local Aboriginal Land Council (LALC) had input and discussions on the artefacts located at both of the above properties.

We would like to endorse the recommendations that are stated in your final report.
If need for removal of any artefacts an Aboriginal Heritage Impact Permit application would be applied for to ensure the objects can be relocate and protect of the artefacts. If they need be removed it will also any prevent loss or harm to them and could be stored in a local cultural keeping place.

For further information please contact the Nyngan LALC.

Yours Faithfully

Veneta Dutton
CEO
Nyngan
Local Aboriginal Land Council (LALC)

be informed, be involved. be inspired.

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5th April 2013

Mr Gerard Niemoeller
Principal Heritage Consultant
On Site Cultural Management Pty Ltd
PO Box 574
NAROOMA NSW 2546

Hi Gerard

In regards to the Site assessment done on "Avoca" and "Avoca Tanks".
On behalf of the Aboriginal Site assessment done on the properties in which I accompanied Gerard and had input and discussion on the artefacts located on the above properties.

I would like to endorse the recommendations that are stated in your final report.
If need for the removal of any artefacts an Aboriginal Heritage Impact Permit application would be applied for to relocate the objects if the need be.

For further information please contact me.

Yours faithfully

Lesly Ryan
CEO/Sites officer
Bogan Aboriginal Corporation

Bogan Aboriginal Corporation

9 April 2013

Gerard Niemoeller
Principal Heritage Consultant
On Site Cultural Heritage Management Pty Ltd
PO Box 574
NAROOMA NSW 2546

By Email: gerard@onsitechm.com.au

WITHOUT PREJUDICE

Dear Gerard,

Comments on Avoca Tank Project Draft ACHAR

As per your correspondence of 25 February 2013, NTSCORP Ltd (**NTSCORP**), on behalf of the Ngemba, Ngiyampaa, Wayilwan, Wangaypuwaan People native title claim group (**Claim Group**), makes the following comments on the draft Aboriginal Cultural Heritage Assessment Report (**Draft ACHAR**) prepared in respect of the Avoca Tank Project (**Project**) proposed by Tritton Resources Limited Pty (**Tritton**).

Coverage of Surveys Undertaken

At section 6.0, the Draft ACHAR states that, for the Stage 1 area, '*[t]he survey consisted of a series of transects north south along the proposed drill lines*'. No such statement in regards to drill-hole locations is made in respect of the Stage 2 survey area coverage. No comments are made in respect of the location of access roads and other infrastructure in relation to either survey location.

This makes it unclear whether the surveys undertaken to inform the Draft ACHAR cover all areas which will be impacted by the Project, including all proposed drill-holes, access roads and other infrastructure sites. Accordingly, NTSCORP submits that Tritton should ensure that, whether as part of a further assessment process or as part of the management processes adopted for the Project, all areas where infrastructure will be located, including access roads, be subject to further assessment surveys which includes representatives from the Claim Group.

Comments and Suggestions on Management Measures

Fencing of Identified Places and Objects

The Claim Group have expressed concerns over the plastic fencing currently used at the Projects site to demarcate and protect identified objects and places.

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Cordoning off and designating identified sites as 'no go zones' is discussed at sections 7.2.1 to 7.2.5 of the Draft ACHAR. The Claim Group request that fencing off of identified objects and places be specifically adopted as one of the management measures in addition to those detailed at section 10.3 of the Draft ACHAR. The Claim Group requests that steel pickets and wire be used instead of plastic fencing to ensure durability and sufficient protection. The Claim Group also request that such fencing be sufficiently high to prevent animals and trespassers from entering the 'no go zones'.

Ongoing Monitoring

NTSCORP suggests that ongoing monitoring, including representatives from the Claim Group, be included as a management measure in addition to those detailed at section 10.3 of the Draft ACHAR. Such monitoring should be required for all activities which involve surface disturbance, and would be able to incorporate the additional assessment surveys as suggested above. The monitoring process should include mechanisms which enable Tritton and the cultural heritage monitors onsite to jointly develop protection and mitigation measures in respect of additional objects and sites which are identified as exploration proceeds.

Relocation of Objects & Further Consultation Processes

The potential relocation of identified objects as exploration proceeds to mining is discussed at section 9.1 and included as one of the ten management principles at section 10.3 of the Draft ACHAR. NTSCORP suggests that the Claim Group be specifically consulted with and included in any salvage and storage programmes developed in relation to this relocation.

At several places in the Draft ACHAR, including as one of the management mechanisms listed at section 10.3, it is suggested that Aboriginal Heritage Impact Permits (**AHIPs**) may be required if impact in identified places or objects cannot be avoided. NTSCORP submits that the consultation processes which will be adopted in any AHIP processes, including both cultural heritage significance assessments and development of management mechanisms, be delineated in the Draft ACHAR and include specific consultation and collaboration with the Claim Group.

Further Surveys Required if Project Proceeds to Mining

NTSCORP do not support point 8 of the proposed management measures at section 10.3 of the Draft ACHAR. If the Project proceeds to mining, it is appropriate that further cultural heritage surveys be undertaken at a greater level of intensity and coverage sufficient to reflect the increased impacts of production as compared to exploration. This is particularly pertinent given that no member of the Claim Group was involved in Stage 1 of the survey process, as noted in section 3.3.1.

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We thank you for your consideration of these comments. Please contact the undersigned on (02) 9310 3188 or at rmackay@ntscorp.com.au if you would like to discuss these comments further.

Yours Faithfully,

Ross Mackay
Strategic Project Officer
NTSCORP Limited

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24 May 2013

Gerard Niemoeller
Principal Heritage Consultant
On Site Cultural Heritage Management Pty Ltd
PO Box 574
NAROOMA NSW 2546

By Email: gerard@onsitechm.com.au

Dear Gerard,

Comments on Avoca Tank Project Draft ACHAR Response

As requested, NTSCORP Limited (**NTSCORP**), on behalf of the Ngemba, Ngiyampaa, Wayilwan, Wangaypuwaan People native title claim group (**Claim Group**), makes the following comments on the *Response to NTS Comments on Avoca Tank Project Draft ACHAR* (**Response**).

Coverage of Surveys Undertaken

Thank you for clarifying the methodology behind the scope of the surveys undertaken.

Whilst NTSCORP are happy to concede that no further surveys need be undertaken for the purposes of the Aboriginal Cultural Heritage Assessment Report (**ACHAR**) itself, NTSCORP maintains that all areas which will be impacted by the Project, including all proposed drill-holes, access roads other infrastructure sites and eventual mine footprint must be subject to a survey prior to construction taking place. This is particularly important as there are no monitoring processes proposed. Accordingly, whether as part of a further assessment process or as part of the management processes adopted, it must be assured that all infrastructure areas which have not been subject to previous surveys informing the ACHAR, will be subject to further assessment surveys. These further assessments will include representatives from the Claim Group.

Comments and Suggestions on Management Measures

Fencing of Identified Places and Objects

Thank you for clarifying fencing and management procedures in respect of identified places and objects of cultural heritage significance. The measures detailed in this respect of your response address the concerns of the claim group in this regard.

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Ongoing Monitoring

NTSCORP continue to maintain its position that, regardless of the cultural heritage potential analysis undertaken, ongoing monitoring, including representatives from the Claim Group, be included as a management measure in addition to those detailed at section 10.3 of the Draft ACHAR for all surface disturbance activities. Although the Response indicates an informed opinion that there is 'low potential for Aboriginal objects to occur', monitoring is required to assure the Claim Group that any unidentified sites and objects will not be impacted as exploration proceeds and a mine footprint is determined.

Relocation of Objects & Further Consultation Processes

It is NTSCORP's preferred position that salvage and relocation methodologies be delineated in the Draft ACHAR, however accepts and does not oppose that, in this instance, such methodologies will be developed as exploration proceeds.

NTSCORP acknowledges the comments in the Response that the Claim Group will be included in consultation for any salvage methodologies, care agreements and AHIP processes required as exploration proceeds. NTSCORP requests that, as these consultation processes are required, the proponent meets with representatives of the Claim Group in a closed session to discuss, develop and/or confirm proposed salvage and relocation methodologies.

Further Surveys Required if Project Proceeds to Mining

NTSCORP maintain their position not to support point 8 of the proposed management measures at section 10.3 of the Draft ACHAR. If the Project proceeds to mining, it is appropriate that further cultural heritage surveys involving representatives of the Claim Group be undertaken at a greater level of intensity to include both ethnographic and archaeological surveys and coverage sufficient to reflect the increased impacts of production as compared to exploration.

We thank you for this opportunity to provide further comments in response. Please contact the undersigned on (02) 9310 3188 or at rmackay@ntscorp.com.au if you would like to discuss these comments further.

Yours faithfully,

OBO

Ross Mackay
Strategic Project Officer
NTSCORP Limited

cc: Paul Calvin, Community & Heritage Manager, Straits Resources

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Appendix 6

Ecology Assessment

(Total No. of pages including blank pages = 192)

Note: A colour copy of this Appendix is available on the Project CD

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Ecology Assessment

Proposed Avoca Tank Project, Girilambone, NSW.

A report prepared for R.W. Corkery& Co. Pty. Ltd and Tritton Resources Pty. Ltd.

APRIL 2014

Report No. EcIA 0556

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Ecology Assessment

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April 2014

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Citation

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EnviroKey		Project Title:	Avoca Tank Project	
Project Identifier :		EcIA.0556		
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Final	15/04/2014	JW, SS	-	Steve Sass

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COMPLIANCE WITH DIRECTOR-GENERALS REQUIREMENTS

Table 1
Compliance with Director-Generals Requirements

Director-Generals Requirements relating to biodiversity	**Relevant section of this report**
Accurate predictions of any vegetation clearing on site or for any road upgrades.	Chapter 7
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.	Chapter 7
A detailed description of the measures to maintain or improve the consideration of a Biodiversity Offset Strategy.	Section 8.5
Assess the proposal against the *State Environmental Planning Policy No. 44 - Koala Habitat Protection*.	Section 2.4
The report must take into account the following state government guidelines: • *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DECC 2004). • *The Threatened Species Assessment Guideline - The Assessment of Significance.* • *Draft Guidelines for the Assessment of Aquatic Ecology in EIA.*	Chapter 5 & 10
OEH's key information requirements for the proposal include an adequate assessment of impacts on flora, fauna, threatened species, populations, communities and their habitats.	Chapter 7 & 10
Description and geo-referenced mapping of Study Area (and associated spatial data files), e.g. overlays on topographic maps, satellite images and / or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and Study Area. Separate spatial files (.shp format) to be provided to the OEH should include, at a minimum, shapefiles of the project site, impact footprint, vegetation mapping and classification for both the impact and any offset site(s).	Chapter 4, 5 & 6
Description of survey methodologies used, including timing , location and weather conditions, and a comparison of survey effort (in tabular form) with that recommended in the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004). Where survey effort is not consistent with those guidelines justification must be provided.	Chapter 6
Detailed description of vegetation communities (including classification and methodology used to classify) and including all plot data. Plot data should be supplied to the OEH in electronic format (eg MS-Excel) and organised by vegetation community.	Chapter 5 & Appendix 7
Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EIA.	Appendix 1
Identification of national and state listed threatened biota known or likely to occur in the Study Area and their conservation status.	Chapter 9

Director-Generals Requirements relating to biodiversity	**Relevant section of this report**
Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.	Chapter 7
Identification of the avoidance, mitigation and management measures that would be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements would be guaranteed.	Chapter 8
Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected.	Chapter 7
An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the Study Area based on the presence of suitable habitat.	Chapter 10
Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974* should be considered.	Not applicable
With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 10.3 & 10.4

EXECUTIVE SUMMARY

EnviroKey Pty. Ltd (EnviroKey) were engaged by R.W Corkery & Co Pty. Ltd (RWC) on behalf of Tritton Resources Pty. Ltd (the "Applicant") to prepare an Ecology Assessment for the proposed Avoca Tank Project ("the Proposal") located approximately 7 kilometres north-west of Girilambone, NSW (see **Map 1**).

The purpose of the Ecology Assessment is to determine the potential impacts to threatened species, populations and communities and their habitats as a result of a proposed activity. The Ecology Assessment would be utilised to support an Environmental Impact Statement (EIS) for the Proposal which extends over an area of approximately 1,846 hectares (defined as the 'Project Site Boundary and the 'Study Area').

The Study Area comprises four Biometric vegetation communities. These being 'ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion', 'ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion', 'ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion' and 'ID229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion'. Field surveys revealed a total of 127 flora species comprising 114 native species and 13 exotic species. One threatened flora species was recorded during the extensive field survey. A single Cobar Greenhood Orchid (*Pterostylis cobarensis*) was recorded within the Biometric Vegetation Community Benson ID 72. This species is listed as 'vulnerable' under the NSW *Threatened Species Conservation Act 1995* (TSC Act).No threatened ecological communities were recorded within the Study Area.

For fauna, two general fauna habitats are present; woodland and shrubland. A total of 114 fauna species were recorded comprising:

- 63 species of bird
- 25 species of reptile
- 9 species of frog
- 17 species of mammal (including nine species of microchiropteran bat).

A total of eight threatened or migratory fauna species (seven definite, one by precautionary principle) were identified within the Study Area. These were the:

- Pink Cockatoo (*Cacatua leadbeateri*), Vulnerable TSC Act
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Vulnerable TSC Act
- Superb Parrot (*Polytelis swainsonii*), Vulnerable TSC Act, Vulnerable EPBC Act
- Inland Forest Bat (*Vespadelus balstoni*), Vulnerable TSC Act
- Little Pied Bat (*Chalinolobus picatus*), Vulnerable TSC Act
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), Vulnerable TSC Act
- Eastern Long-eared Bat (*Nyctophilus corbeni),* Vulnerable TSC Act, Vulnerable EPBC Act
- Rainbow Bee-eater (*Merops ornatus*), Migratory EPBC Act

With consideration of the nature and extent of the proposed activity, the following amelioration measures are proposed:

- General land management amelioration measures (eg, pest animal control).
- Amelioration measures to be undertaken prior to commencement of the Proposal (eg, pre-clearance surveys, threatened species monitoring).
- Amelioration measures to be undertaken during the Proposal (eg, clearly marking areas to be cleared and areas to be retained).
- Amelioration measures to be undertaken after the proposed activity has been completed (eg, rehabilitation, monitoring).

This Ecology Assessment has adequately considered the ecology of the Study Area by:

- conducting a field assessment that is consistent with OEH guidelines.
- adopting the precautionary principle in the assessment of impact.
- designing appropriate ameliorations measures to mitigate potential impacts to an acceptable level.

This report has determined that the Proposal is unlikely to have a significant effect of any listed threatened species, communities, populations and their habitats in accordance with s5A of the NSW *Environmental Planning & Assessment Act 1979* provided amelioration measures as detailed within Chapter 8 are adopted, implemented and maintained. Therefore, a species impact statement is not required.

This report has also determined that the Proposal is unlikely to have a significant effect of any EPBC Act listed threatened and migratory biota and their habitats. Therefore, a referral to the Commonwealth Environment Minister is not warranted.

1 INTRODUCTION

EnviroKey Pty. Ltd (EnviroKey) were engaged by R.W Corkery & Co Pty. Ltd (RWC) on behalf of Tritton Resources Pty. Ltd (the "Applicant") to prepare an Ecology Assessment for the proposed Avoca Tank Project (ATP) located approximately 7 kilometres north-west of Girilambone, New South Wales (see **Map 1**).

The purpose of the Ecology Assessment is to determine the potential impacts to threatened species, populations and communities and their habitats as a result of a proposed activity in accordance with the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Ecology Assessment would be utilised to support an Environmental Impact Statement (EIS) for the Proposal which extends over an area of approximately 1,846 hectares (defined as the 'Project Site Boundary' and the 'Study Area').

1.1 STUDY AREA

The Study Area is located within the Bogan Local Government Area (LGA), and the Canbelego Downs sub-region of the Central West Catchment Management Authority. The location of the Study Area is identified on **Map 1** and is generally defined by Applicant-owned cadastral boundaries.

1.2 SCOPE AND OBJECTIVES

The scope and objectives of this Ecology Assessment is to:

- Identify the Study Area by describing:
  - Topography and Landform
  - Geology and Soils
  - Land Use
  - Previous Ecological Surveys
- Describe the field survey methodologies used;
- Identify species and communities of conservation significance which are present or have the potential to be present, including threatened flora, fauna, their habitats and threatened ecological communities;
- Provide maps and photographs detailing vegetation communities, habitat extent and condition, the location of any significant flora and fauna species present;
- Undertake an evaluation of the potential for terrestrial threatened and migratory biota or populations listed within the schedules of the EPBC Act and the TSC Act to occur within the Study Area based on local records and the presence/quality of habitat;

- Assess the significance of the potential impacts of the proposed activity on species, populations, communities and their habitats that occur, or have the potential to occur within the Study Area pursuant to s5A of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act), the TSC Act and the EPBC Act;
- Explicitly conclude whether the proposed activity would require a Species Impact Statement (SIS) or whether referral to the Commonwealth Environment Minister is required;
- Provide a series of amelioration measures designed to reduce risks and minimise the impacts of the proposed activity.

1.3 PROJECT DESCRIPTION

The Proposal would include the following:

- 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 Yarrandale Road.
- 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.
- 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 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.

1.4 DEFINITIONS AND ACRONYMS

The following definitions and acronyms are used within this report.

CMA – Catchment Management Authority.

EP&A Act – NSW *Environmental Planning and Assessment Act 1979.*

EPBC Act – Commonwealth *Environment Protection and Biodiversity Conservation Act 1995.*

HBT – hollow-bearing tree.

LGA – Local Government Area.

likely - taken to be a real chance or possibility.

locality - means the area within a 50 kilometre radius of the Study Area.

local population (migratory or nomadic fauna)– the population comprises those individuals that are likely to occur in the Study Area from time to time.

local population (resident fauna)– the population comprises those individuals known or likely to occur in the Study Area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to use habitats in the Study Area.

local population (threatened flora) - the population comprises those individuals occurring in the Study Area or the cluster of individuals that extend into habitat adjoining and contiguous with the Study Area that could reasonably be expected to be cross-pollinating with those in the Study Area.

migratory species – a species specified in the schedules of the EPBC Act.

OEH– NSW Office of Environment & Heritage.

region - means a biogeographical region that has been recognised and documented such as the Interim Biogeographical Regions of Australia (IBRA) (Thackway and Creswell 1995). The Study Area is located within the Cobar Peneplain Bioregion.

SEWP&C– Department of Sustainability, Environment, Water, Population and Communities.

Study Area – For the purpose of this assessment, the Study Area is approximately 1,846 hectares in area and defined on **Map 1**.

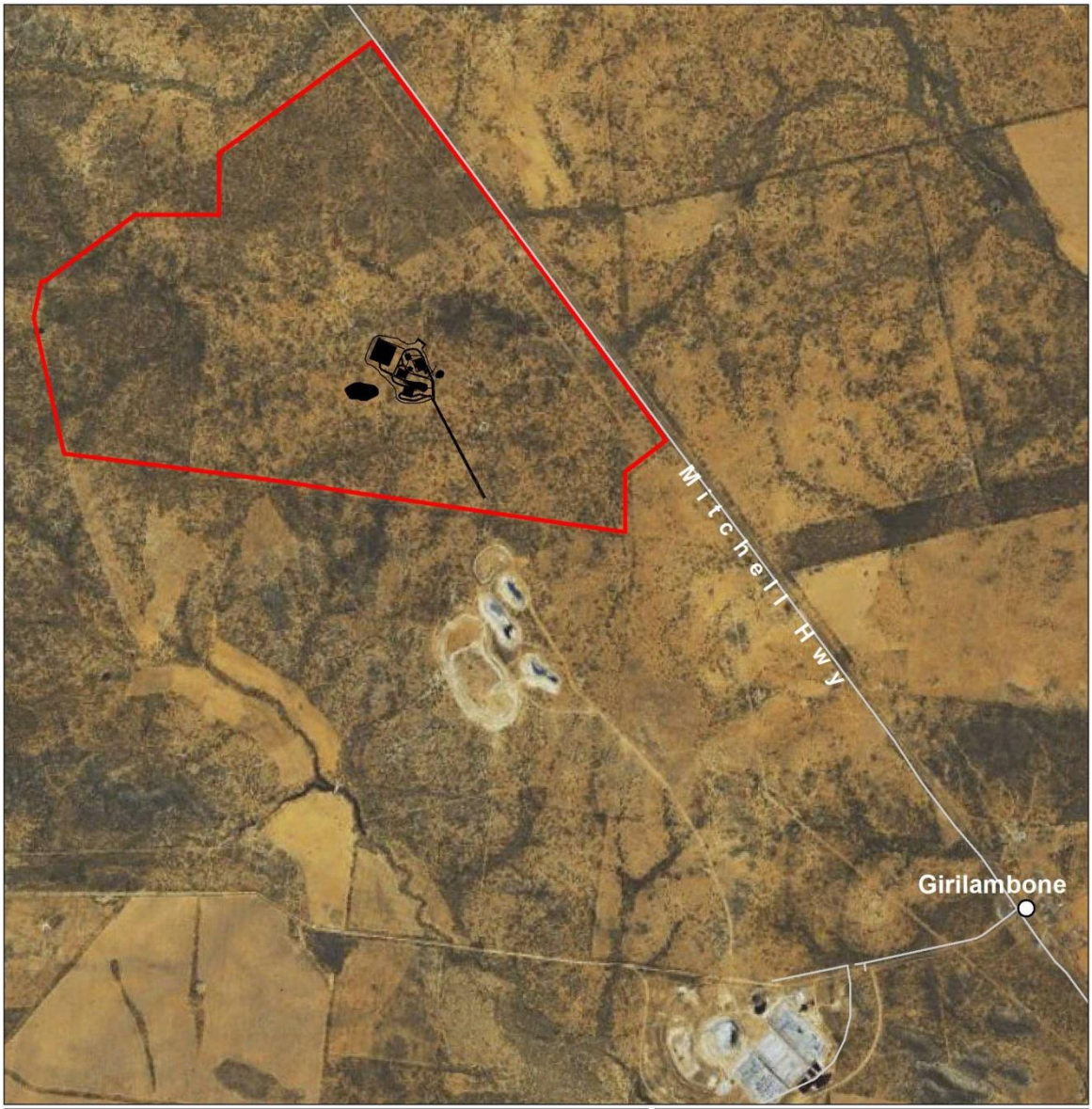
threatened biota - means those threatened species, endangered populations or endangered ecological communities considered known or likely to occur in the Study Area.

threatened species – a species specified in the schedules of the TSC Actor the EPBC Act.

TSC Act – NSW *Threatened Species Conservation Act 1995*.

1.5 QUALIFICATIONS AND EXPERIENCE OF PERSONNEL

The Ecology Assessment was led by Mr. Steve Sass (Principal Ecologist, B.App.Sci (Env.Sci) (Hons)) of EnviroKey. Field surveys were conducted by suitably qualified and experienced personnel. Details of all personnel and their role in the preparation of the Ecology Assessment are provided (see **Appendix 1**).



Legend

Study area

Proposed infrastructure

Map Projection: Transverse Mercator
Horizontal Datum: AGD 1966
Grid: Australian Map Grid, Zone 55

Data sources:
Study area and infrastucture locations: TRL
Aerial image: Google Earth
Roads: OEH Spatial Data Online

Mapping date: 5 February 2014

0 0.5 1 2 Kms

N

EnviroKey

PO Box 7231 Tathra NSW 2550. t: 02 6494 5422

Map 1 Location of the Study Area and Proposed Disturbance Footprint

2 LEGISLATIVE CONTEXT

2.1 THREATENED SPECIES CONSERVATION ACT 1995

The TSC Act specifies seven factors which must be considered by decision-makers regarding the effect of a proposed development or activity on threatened species, populations or ecological communities, or their habitats(DECC 2007). These factors form part of the threatened species assessment process under the EP&A Act and are collectively referred to as the 'Seven-part Test' (DECC 2007).

Consent authorities have a statutory obligation to consider whether a proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats by applying the Seven-part Test. If the determination is made that there is likely to be a significant effect then either;

- A Species Impact Statement (SIS) must be prepared and the concurrence of the Director-General of the NSW Office of Environment and Heritage (OEH) obtained prior to the consent authority making a determination, or
- The proposal may be modified such that a significant effect on threatened species, populations or ecological communities, or their habitats is unlikely (DEC 2004).

This report applies the seven part test to species, populations and communities which may potentially be impacted by the proposal in order to characterise the significance of the impact.

2.2 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act enables the Australian Government to join with the states and territories in providing a national scheme of environment and heritage protection and biodiversity conservation.

Under the EPBC Act, actions that have, or are likely to have a significant impact on a matter of National Environmental Significance (NES) require approval from the Australian Government Minister for the Environment, Heritage and the Arts (DEWHA 2009).

The nine matters of NES that are protected under the EPBC Act are:

- Listed threatened species and communities
- Listed migratory species
- Ramsar wetlands of international importance
- Commonwealth marine environment
- World heritage properties
- National heritage properties

- The Great Barrier Reef Marine Park
- Nuclear actions
- A water resource, in relation to coal seam gas development and large coal mining development.

Chapter 10 provides an assessment to ascertain whether the proposed activity would require referral to the Commonwealth.

2.3 FISHERIES MANAGEMENT ACT 1994

The NSW *Fisheries Management Act 1994* (FM Act) aims to conserve fish stocks, key habitats, threatened species, populations and ecological communities of fish and marine vegetation. It also aims to promote viable commercial fishing, aquaculture industries and recreational fishing.

This Ecology Assessment applies the seven-part test to species, populations and communities which may occur within the Study Area in order to characterise the significance of the impact.

2.4 STATE ENVIRONMENTAL PLANNING POLICY NO. 44

State Environmental Planning Policy (SEPP) No. 44 encourages the conservation and management of natural vegetation areas that provide habitat for Koalas to ensure that permanent free-living populations would be maintained over their present range across 107 local government areas (LGA). Local councils cannot approve development in an area affected by the policy without an investigation of core koala habitat. The policy provides the state-wide approach needed to enable appropriate development to continue, while ensuring there is ongoing protection of koalas and their habitat.

SEPP 44 aims to identify areas of *potential* and *core* Koala Habitat. These are described as follows:

• *Potential Koala Habitat* is defined as areas of native vegetation where the trees listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and

• *Core Koala Habitat* is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females, and recent and historical records of a population.

Bogan LGA is not listed within Schedule 1 of SEPP 44. Therefore, this SEPP is of no relevance to the Study Area and is not considered further.

2.5 ECOLOGICAL SUSTAINABLE DEVELOPMENT

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*. In NSW, the concept has been incorporated in legislation such as the EP&A Act and Regulation.

For the purposes of the EP&A Act and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act* 1991 outline the following principles which can be used to achieve ESD.

(a) The precautionary principle: that if 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.

In the application of the precautionary principle, public and private decisions can be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) Inter-generational equity: that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) Conservation of biological diversity and ecological integrity: that conservation of biological diversity and ecological integrity should be a fundamental consideration.

The aims, structure and content of this report are guided by these principles. The precautionary principle has been adopted in the assessment of impact; all reasonably foreseeable potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been suggested to address it.

3 REGIONAL CONTEXT

3.1 REGIONAL SCALE

3.1.1 Interim Bioregionalisation of Australia

The Study Area is located in the Cobar Peneplain Bioregion of the Interim Bioregionalisation of Australia (IBRA 5.1) (Thackway and Creswell 1995) and within the Canbelego Downs subregion (NPWS 2003). The Bioregion extends from just south of Bourke to near Griffith with a total area of 7,334,664 hectares occupying 9.2% of the state (NPWS 2003). Climatically, the Bioregion is persistently within a dry semi-arid zone, with mean annual rainfall being between 258mm to 537mm with evaporation generally exceeding rainfall (NPWS 2003).

Geologically, the Bioregion is based on Palaeozoic rocks containing a wide range of bedrock types influencing topography (NPWS 2003). This geological base influences the vegetation of the bioregion which is considered regionally distinctive (NPWS 2003). The undulating landscape is generally characterised by mainly open woodlands of Bimble Box, Red Box and White Cypress Pine, Mulga in the more arid areas and Mallee on rocky ridges and sandplains (NPWS 2003).

3.1.2 Vegetation and Flora

The Cobar Peneplain Bioregion has suffered significant vegetation losses, with 33 percent of the woody native vegetation cleared since European Settlement (NPWS 2003). Despite this, the Bioregion currently supports dense shrubby woodlands which support areas of intact understorey and ground vegetation (CVMC 2006).

The most widespread vegetation community are woodlands dominated by Poplar Box (*Eucalyptus populnea*) which also forms communities with, and or intergrades with other species such as White Cypress Pine (*Callitrus glaucophylla*) and Gum Coolabah (*Eucalyptus intertexta*) (Benson *et al.* 2006). However, in the north and west of the Bioregion, Mulga dominates extensive areas where red earths and skeletal soils are present (CVMC 2006). In the east and south-east of the bioregion, rocky hills and gravely ridges form associations with mallee woodlands.

Mallee communities on the sand plains and dune fields of the south-west of the Bioregion extend in broad, discontinuous belts often mixed with belah-rosewood communities (NPWS 2003). Mallee is 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, resulting in the remaining mallee remnants being susceptible to local extinction (Morton *et al.* 1995).

3.1.3 Fauna

The diverse landscape and vegetation of the Cobar Peneplain Bioregion supports a wide variety of fauna species (Foster 2002; Sass 2009b; Sass and Swan 2010). Of the 658 vertebrate fauna species known to occur in the Western Division of NSW, some 405 species

have been recorded within this Bioregion (Dick 2000; Foster 2002; Masters and Foster 2000; NPWS 2000; 2003; Sass 2006; 2009b; Sass and Wilson 2006). Thirty-six vulnerable and seven endangered fauna species occur in the Bioregion, with an additional 64 birds, 12 mammals, 23 reptiles and eight frogs considered as being of conservation concern (Dickman *et al.* 1993; Foster 2002; NPWS 2001a; 2003; Sadlier and Pressey 1994; Smith *et al.* 1994).

3.1.4 Conservation Reserves

The Cobar Peneplain Bioregion has around 182,700 hectares or 2.5 per cent in areas of conservation management. The majority of this is taken up by two national parks, nine nature reserves and one historic site totalling 117,865 hectares or 1.62 per cent of the Bioregion (NPWS 2003). No land holders have entered into voluntary conservation agreements under the *National Parks and Wildlife Act 1*974, however, 11 properties have agreed to wildlife refuges and these collectively occupy an area of approximately 60,100 hectares or 0.82 per cent of the Bioregion (NPWS 2003). Six properties have property vegetation plans (2,481 hectares or 0.03 per cent of the Bioregion) while State Forests and a Flora Reserve occupy an area of 82,842 hectares (1.13%) of the Bioregion (NPWS 2003).

3.2 DISTRICT SCALE

3.2.1 District Habitat Features

3.2.1.1 Watercourses and Wetlands

With the exception of the Bogan River 25 kilometres to the east, there are no major watercourses present within the district. Several minor ephemeral watercourses dissect the district, and are likely to provide locally important habitat for some species of waterbirds from time to time. No permanent watercourses are present within the Study Area.

3.2.1.2 Native Vegetation

Poplar Box Woodland dominates the native vegetation of the district with varying intergrades of Gum Coolabah, Cypress Pine and occasional Mulga. The district vegetation is considered similar to the current state of regional vegetation in that various degrees of clearing for broad-scale agricultural activities such as cropping and grazing has occurred. The district vegetation has also endured modification through feral animals such as goats, rabbits and pigs.

3.2.2 Conservation Reserves in the District

Three State Forests and one Timber reserve are found within the district and all within 40kms of the Study Area. These being Timber Reserve 42497 (4117 hectares, 36km west), Thorndale State Forest (1803 hectares, 30km south), Miandetta State Forest (737 hectares, 36km south), and Girilambone State Forest (943 hectares, 4km east).

3.2.3 Noxious Weeds

A search of the Noxious Weeds Declarations from the NSW Department of Primary Industries (DPI) website was carried out in February 2014 for the Bogan LGA, identifying 88 noxious weeds with the potential to occur within the Study Area (DPI 2014).

One declared noxious weed was identified within the Study Area (see Appendix 3); this was Bathurst Burr (*Xanthium spinosum*). This species is listed as a Class 4 Noxious Weed species on the NSW DPI Noxious Weeds list for the Bogan LGA. Under this listing the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed. Additionally a *Sysimbrium* genus was identified within the Study Area.

3.3 THREATENED SPECIES RECORDS IN THE LOCALITY

Using the OEH Threatened Species, Populations and Ecological Communities of NSW predictor database (3rd February 2014), a total of 42 threatened biota are known or predicted to occur within the Canbelego Downs CMA Subregion of the Central West CMA region. However, the extensive area covered by this CMA subregion is likely to include a wide variety of habitats not present within the Study Area. To refine this search, searches of the NSW BioNet database (incorporating flora records) administered by the NSW Office of Environment and Heritage (OEH) were made on the 3rd February 2014 using a 50 kilometre search area around the Study Area.

This search revealed a total of 28 threatened species comprising 21 species of birds, three species of mammals; and four species of flora.

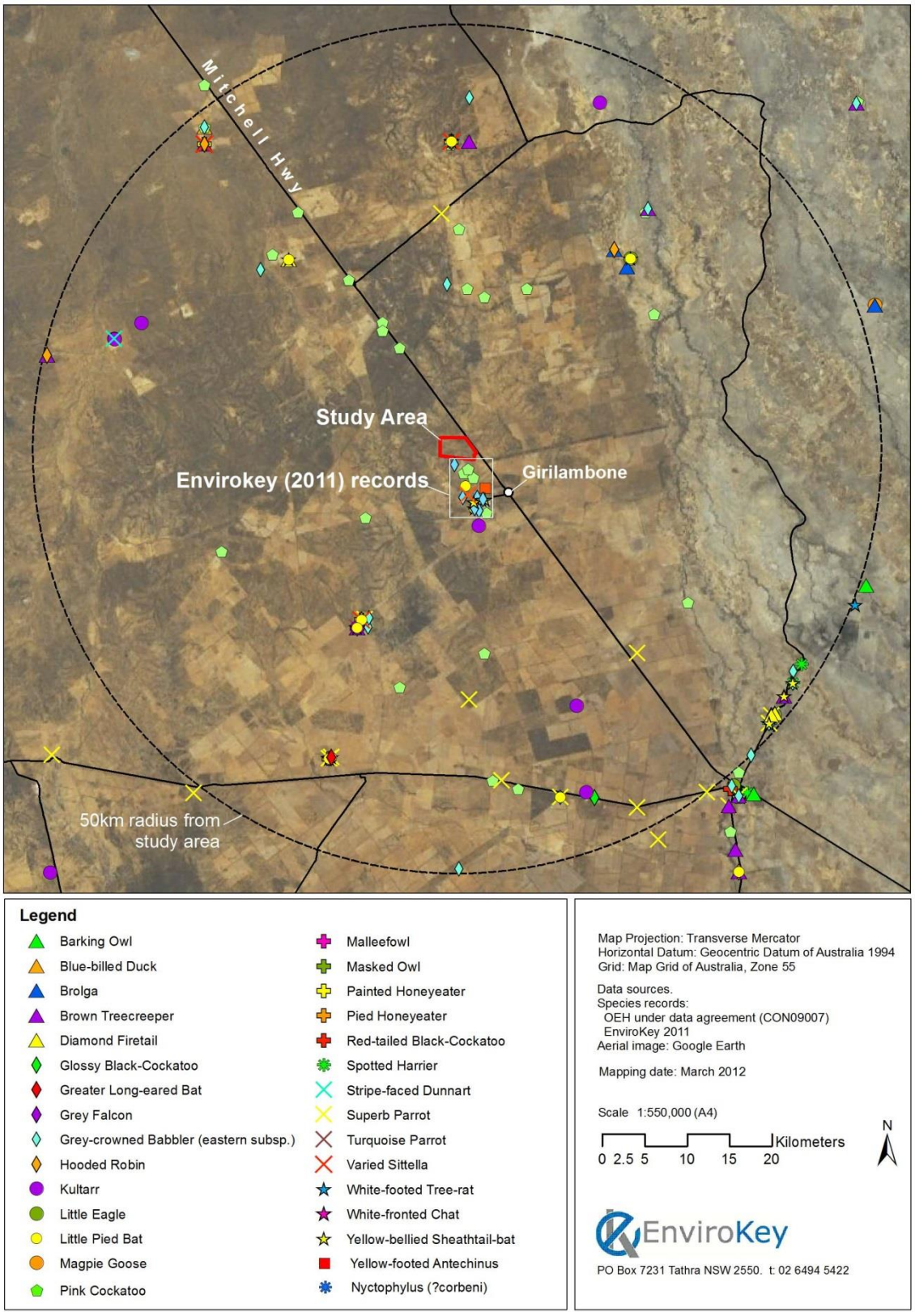
A recent study conducted by EnviroKey at the nearby Murrawombie and North-East Mine also identified a number of species of conservation significance that are not yet showing within the Bionet database (EnviroKey 2011c). The search results from the BioNet database and recent EnviroKey records across the locality are provided (**Map 2 & 3**).

3.4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

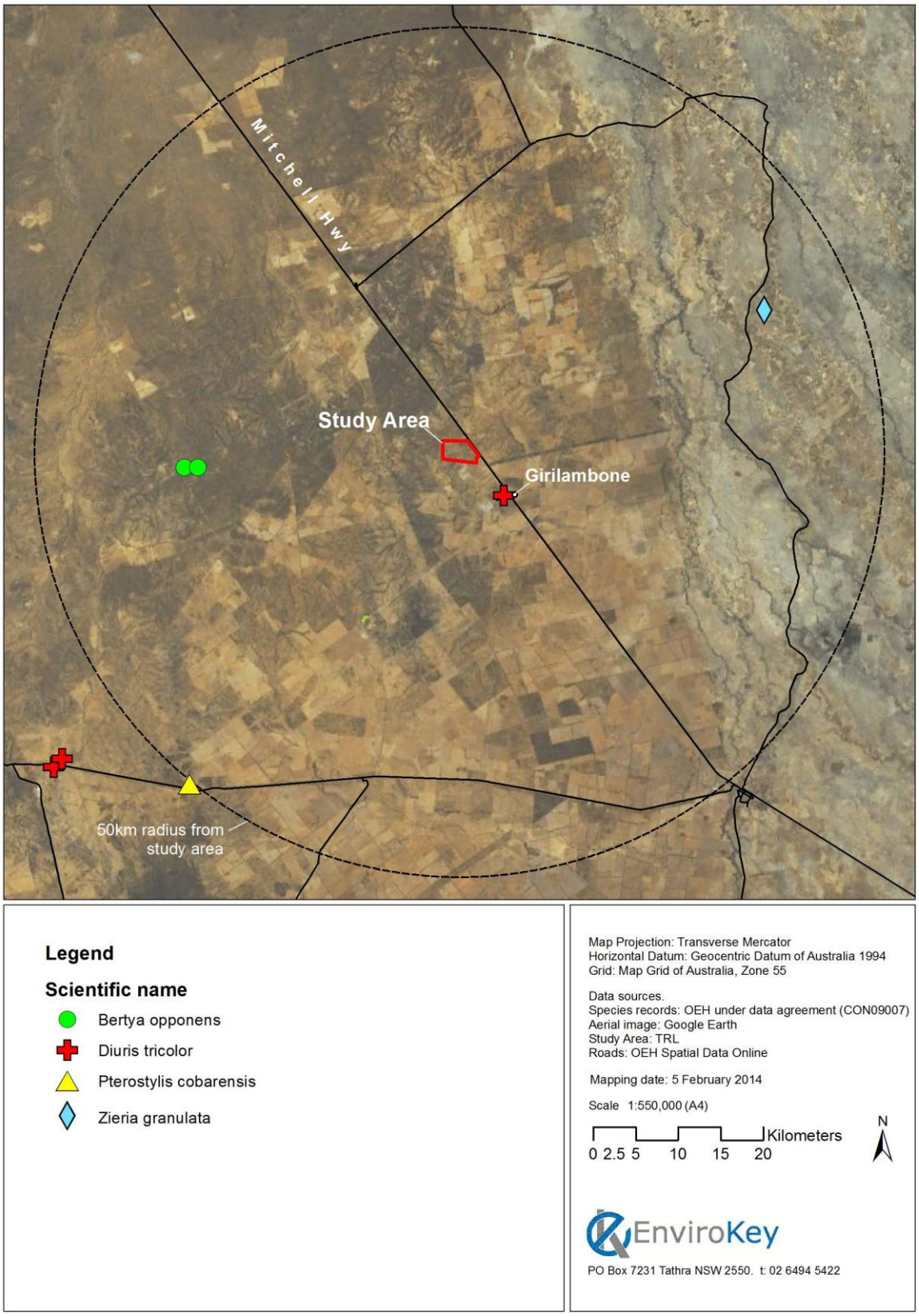
A search on the 3rd February 2014 using the Protected Matters Search Tool provided under the EPBC Act using a 50 kilometre buffer around a point representing the Study Area identifies Matters of National Environmental Significance (NES) (DotE 2014). These can be summarised as follows:

- 4 threatened ecological communities
- 12 threatened species
- 9 migratory species

These are considered further in Chapter 9 with the search results provided in full in Appendix 2.



Map 2 Threatened fauna records in the locality



Map 3 Threatened flora records in the locality

4 EXISTING ENVIRONMENT

4.1 TOPOGRAPHY AND LANDFORM

The Study Area is located within the Cobar Peneplain Bioregion and Canbelego Downs sub-region of the Central West Catchment Management Authority. Within the western NSW land systems, the Study Area is located within the Cobar Land System which in general comprises an undulating pediplain with low ridges, drainage lines and residual peaks (Walker 1991).

Slight relief characterises the Study Area which varies from approximately 230m ASL in the west to approximately 204m ASL in the east.

4.2 GROUND WATER DEPENDENT ECOSYSTEMS

A review of the Atlas of Groundwater Dependent Ecosystems identified that there are no groundwater dependant ecosystems within 25 kilometres of the Study Area.

4.3 GEOLOGY AND SOILS

The Study Area is situated within the Cobar Downs Mitchell Landscape. This landscape is geologically complex comprising slightly undulating rounded ridges and Ordovician and Silurian sedimentary and metamorphic rocks, undulating Devonian sandstone ridges and rounded ridges with siliceous and ferruginous stones from Cretaceous or Tertiary conglomerates (Mitchell 2002).Soils on flatter areas such as the Study Area are generally moderately deep red earths and lithosols. Stony surfaces are infrequent but generally in the vicinity of the mineralisation.

4.4 LAND USE AND PREVIOUS DISTURBANCE

Based on the results of the field survey, the Study Area has been the subject of extensive agricultural activities over many decades. However, in more recent times, grazing pressures have reduced resulting in extensive areas of Cypress Pine and Eucalypt regeneration.

The presence of coppiced canopy trees and ring-barked trees confirms that the Study Area has been previously cleared, and the existing environment is characterised by regrowth vegetation.

Further afield, TRPL operates the Girilambone Copper Mine which is directly adjacent to the Proposal which comprises:

- Murrawombie Open Cut and Underground Portal.
- North East and Larsens Open Cuts.
- Hartmans Open Cut and Portal.

4.5 PREVIOUS ECOLOGICAL STUDIES

It is understood that no previous ecological studies have been undertaken on the 'Avoca' property. A number of reports have been prepared on adjoining land that provide the results of previous ecological studies that are likely to be of relevance to the Study Area given their proximity. These reports include the Environmental Impact Assessments (EIA) (RWC 1990; 1995), an assessment for the ROM Pad extension at North East Mine (EnviroKey 2011a) and a Flora and Fauna Study of the Murrawombie and North East Mine (ML 1280, ML 1383 and MPL 295) (EnviroKey 2011c). The EIA were only partially relied upon (for threatened species only) given that that they were prepared almost 20 years ago. Since that time, multiple taxonomic revisions have occurred and vegetation communities' descriptions have been highly modified, making comparisons difficult.

5 FLORA AND VEGETATION COMMUNITIES

5.1 METHODOLOGY

5.1.1 Field Survey and Mapping

The Study Area was surveyed on two separate occasions. The first survey was conducted between the 13th and the 20th March 2012 and the second survey between the 3rd and the 7th October 2012.

During the first sampling period, field surveys were undertaken by stratifying the Study Area by air photo interpretation and on-ground validation into vegetation communities consistent with those detailed in recent classifications (Benson 2006; 2008; Benson *et al.* 2006).Field data collected was consistent with the methodology outlined within the Biobanking Assessment Methodology and Credit Calculator Operation Manual(DECC 2008). This considers both development sites (within the location of the proposed activity) and potential biobanking sites (within the remainder of the Study Area). At each site, a 50 metre x 20 metre plot combined with a 50 metre step point transect was surveyed in accordance with the Biobanking methodology. The locations of flora plots/transects are provided (**Map 4**). The objective of the second sampling period was on-ground validation of the vegetation communities present within remainder of the Study Area not initially surveyed in March 2012. The second survey was timed to conduct extensive threatened flora surveys across the entire Study Area. Transects were approximately 500 metres in length and walked by two observers for the 500 metres, then returning parallel to the original transect. This survey effort equates to 2,000 metres per transect. A total of 33 transects were conducted in October 2012 totalling 66,000 metres (66 kilometres) of searches representing all vegetation communities and habitat types (see **Map 4**).

Flora species lists were compiled using the random meander method (Cropper 1993), rather than quadrants, to maximise the opportunity of detecting significant or sparsely distributed flora species. Flora was identified using Plants of Western NSW (Cunningham *et al.* 2011)and the online version of the Flora of NSW (PlantNET 2014).

Surveys for flora and vegetation communities were completed under the authority of a current Scientific License issued under Clause 22 of the *National Parks and Wildlife Regulation 2002* and section 132C of the *National Parks and Wildlife Act 1974* by NSW OEH.

Maps showing the approximate extent of vegetation communities were produced during the field surveys and by air-photo interpretation at their completion using the geographic information system (GIS) ArcMap 10.

5.1.2 Nomenclature

Nomenclature within this report follows that used by Benson (2006, 2008) and Benson *et al.* (2006) for vegetation communities and the Plants of Western NSW (Cunningham *et al.* 2011) and the online version of the Flora of NSW for individual species (PlantNET 2014).

5.1.3 Limitations

While this study was completed during Autumn and Spring 2012 when field conditions were conducive to detecting many of the flora that are known to occur in the area, a common limitation of many ecological studies is the short period of time in which they are conducted. When combined with a lack of seasonal sampling this can lead to either low detection rates or false absences being reported. This is also particularly relevant to cryptic flora species that may not have been flowering making detection difficult. For these reasons, it should be recognised that it may be impossible to rule out species absence for some species during field surveys. Further analysis of the potential for species presence based on available habitats and their potential to be impacted by the proposed activity occurs within Chapter 9 and 10.

5.2 RESULTS

5.2.1 Flora Species Richness

A total of 127 flora species were recorded from the Study Area, comprising 114 native species and 13 exotic species. The full flora species list is provided within Appendix 3. Biobanking plot and transect data collected is provided in **Appendix 7**.

5.2.2 Biometric Vegetation Communities

Field surveys revealed the presence of four vegetation community within the Study Area with respect to the classification of Benson *et al.* (2006). These being 'ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion', 'ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion', 'ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion' and 'ID229 –Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion'.

Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion (Biometric WE91)

This community comprised a woodland (occasionally an open woodland) and was generally dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and Gum Coolabah (*Eucalyptus intertexta*), with occasional Kurrajong (*Brachychiton populneus* subsp. *populneus*) and White Cypress Pine (*Callitris glaucophylla*) to 20 metres in height (see

Figure 1).In run-on areas, Gum Coolibah and White Cypress Pine dominated. Shrub cover ranged from sparse to dense, with the most dense cover occurring under canopy trees and/or in run-on areas. The most common shrub species were Wilga (*Geijera parviflora*), Budda (*Eremopholia mitchellii*), Western Golden Wattle (*Acacia decora*) and Ironwood (*Acacia excelsa*). Good rainfall in recent seasons supported a relatively high number and density of native groundcovers, including 20 grass species and various chenopods and herbs.

Some variation in vegetation composition was evident within the Study Area, which generally is associated with subtle differences in topography. Run-on areas often had a relatively dense canopy/midstorey cover that was dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and/or White Cypress Pine (*Callitris glaucophylla*). Whereas, run-off areas generally had a sparser canopy/midstorey cover with Gum Coolabah (*Eucalyptus intertexta*) being a co-dominant with Poplar Box and only scattered White Cypress Pine. Historic disturbance factors probably played a role in this variation also (e.g. some run-on areas were covered with patches of very dense White Cyprus Pine regrowth). Despite this variation, vegetation composition and structure across the entire site aligned more closely to Benson ID 103 than any other vegetation communities described in that classification. This vegetation community dominates the Study Area accounting for 1,798.43 hectares (or 97.45% of the Study Area). The spatial extent is provided (see **Map 5**).

Figure 1 Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion within the Study Area.

ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion (Biometric WE95)

This community is a medium height woodland up to 15 metres tall dominated by White Cypress Pine (*Callitris glaucophylla*) with emergent Poplar Box (*Eucalyptus populnea subsp. bimbil*) (see **Figure 2**). In the Study Area, the understorey is sparse but where present, includes Deane's Wattle (*Acacia deanei*) and hopbush (*Dodonea viscosa*). Ground covers, where present, are dominated by grasses. One threatened flora species was recorded within this vegetation community, the Cobar Greenhood Orchid (*Pterostylis cobarensis*).

Figure 2 Benson ID 72–White Cypress Pine - Poplar Box Woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion within the Study Area.

This vegetation community is rare in the Study Area with only a small patch (1.4 hectares) identified. The spatial extent is provided (see **Map 5**).

ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion (Biometric WE84)

This community is a tall mallee woodland up to 15 metres tall dominated by Green Mallee (*Eucalyptus viridis*) and occasional Gum Coolibah (*Eucalyptus intertexta*) (see **Figure 3**). In the Study Area, the understorey and ground cover is virtually absent with many areas subject to scaling by soil erosion.

This vegetation community occurs in two small patches within the Study Area totalling 16.97 hectares (see **Map 5**).

Figure 3 Benson ID 174–Mallee – Gum Coolibah Woodland on red earth flats of the eastern Cobar Peneplain Bioregion within the Study Area.

ID229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion (Biometric WE20)

This vegetation community is up to 3 metres high and is dominated by Punty Bush, Budda, Silver Cassia and Emubush (see **Figure 4**). The ground cover is sparse and comprises a number of native grasses and occasional forbs. Rock Fern (*Cheilanthes sieberi*) is often present as is the Native Leek (*Bulbinopsis bulbosa*).

This vegetation community occurs in one large patch within the Study Area totalling 29 hectares (see **Map 5**).

Figure 4 Benson ID 229–Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion within the Study Area.

5.2.3 Condition

Using the Biobanking Assessment Methodology and Credit Calculator Operation Manual, the vegetation of the Study Area is considered to be in moderate to good condition. This is due to canopy cover across the entire Study Area being within 25% of respective vegetation benchmarks, regardless of past land use.

5.2.4 Disturbance

The Study Area appears to have been grazed heavily at times in the past. This is based on signs of disturbance including bare soil scalds, soil erosion, multi-stemmed Poplar Box trees (which have coppiced after ringbarking or cutting off near the base) and patches of dense White Cypress pine regrowth. Minor areas occur as derived grassland, probably from more recent land clearing, while the entire Study Area was probably cleared at an earlier time based on the number of coppiced trees. With the current exclusion of grazing, it is likely that the Study Area would continue to become more shrubby and less grassy.

Weeds were sparse across the Study Area and mainly occurred under trees, which is typical where grazing stock compact soil and increase nutrients in these areas while seeking shade and shelter. Despite past land use, the Study Area had a good cover of native grasses,

chenopods and forbs during the field survey, likely influenced by good rainfall in the area during recent seasons.

Small patches of the potentially serious environmental weed Buffel grass (*Cenchrus ciliarus*) occurred sporadically across the Study Area.

5.2.5 Threatened Flora

One threatened flora species was recorded during the extensive field survey. A single Cobar Greenhood Orchid (*Pterostylis cobarensis*) was recorded within the Biometric Vegetation Community Benson ID 72 (**Map 5**). **Map 3** confirms the known presence of four threatened flora species within the locality.

One of the flora species records is likely the result of a spatial data issue, not an accurate record of distribution. The Illawarra Ziera (*Ziera granulata*) is showing as being recorded east of the Bogan River and approximately 40km east of the Study Area (see **Map 3**). This species is endemic to the Illawarra region of NSW where it has been recorded in the Shellharbour and Kiama LGA (OEH 2014a; b). The species is typically located on the coastal plain although occasional sites occupy the slopes of the Illawarra escarpment. This species does not occur in western NSW and is not considered further.

A relatively recent record for Pine Donkey Orchidis known approximately 6 kilometres south of the Study Area (see Map 3). The vegetation community in this area is consistent with Benson ID 103 which dominates the Study Area. Extensive searches totalling 66 kilometres of walking transects failed to reveal the presence of any Pine Donkey Orchid within the Study Area strongly suggesting the Study Area is of little, if any, importance to the species in the locality.

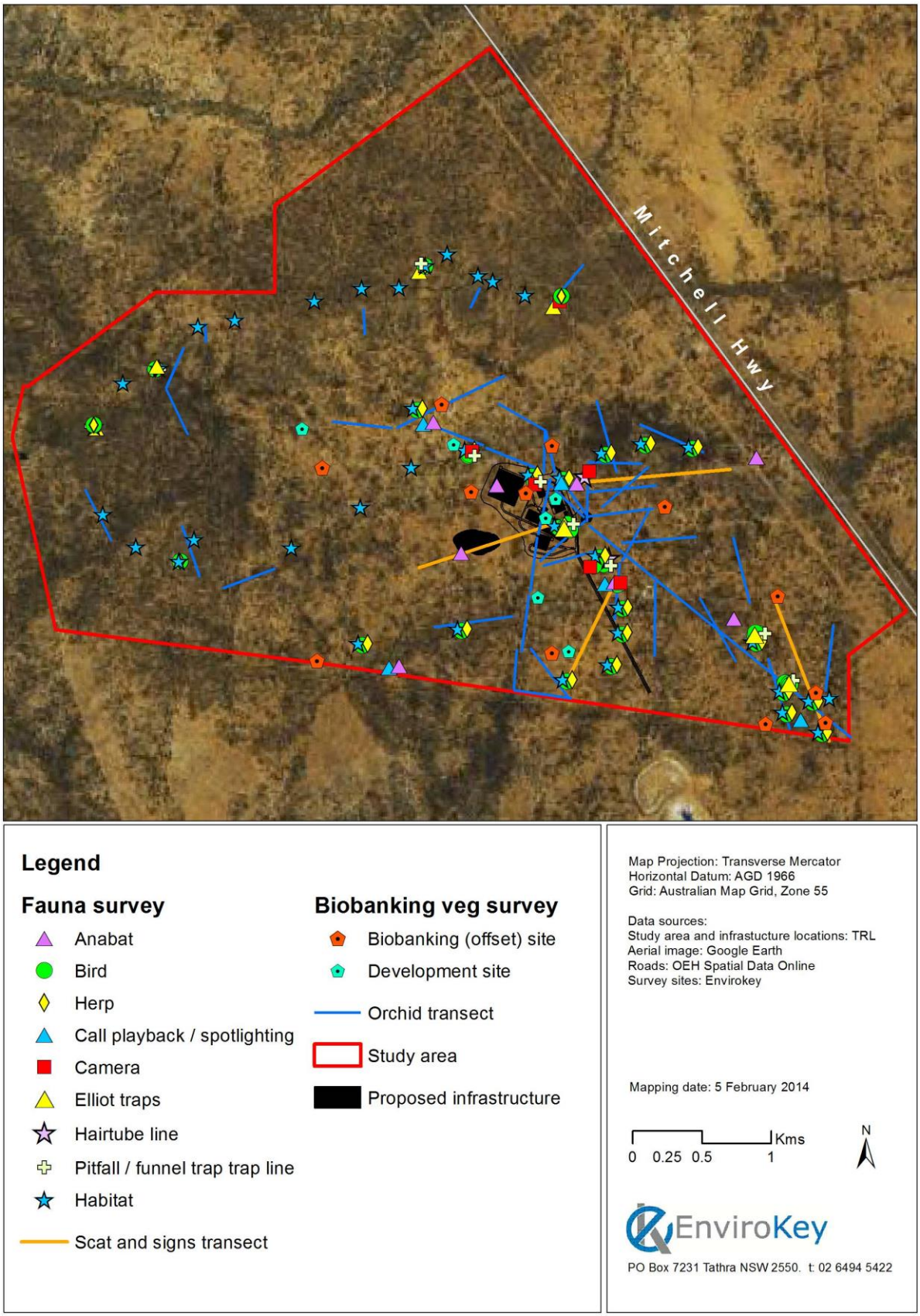
5.2.6 Status of Vegetation Communities

No Threatened Ecological Communities are present within the Study Area.

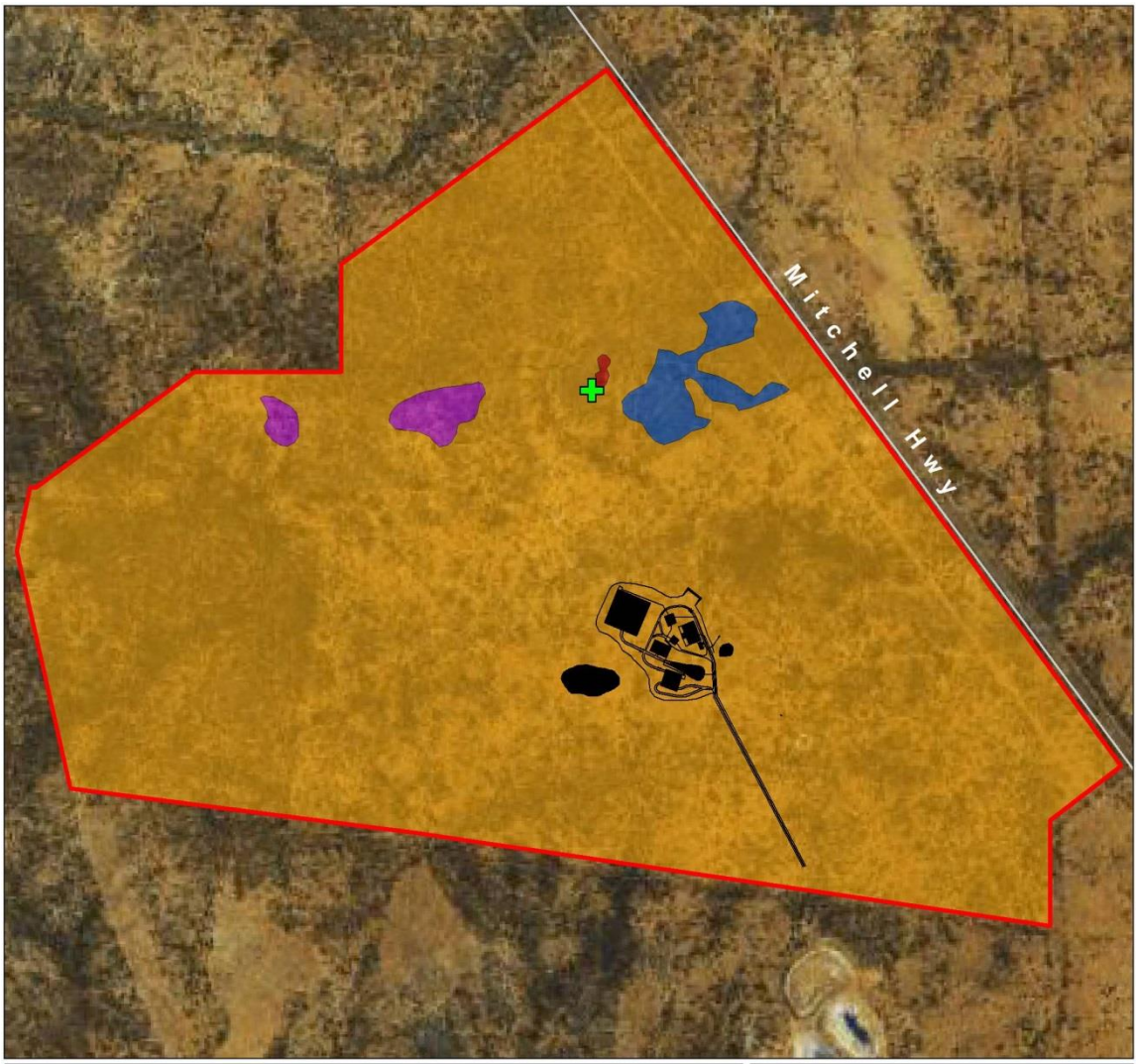
The conservation status of the four vegetation communities present is provided based on Benson *et al.* (2006) (**see Table 2**)

Table 2
Status of the native vegetation communities of the Study Area (from Benson *et al.* 2006).

Biometric Vegetation Type	Pre-1750 Extent in NSW (ha)	Current Extent in NSW (ha)	Extent within NSW Reserves (ha)	Extent within the Study Area (ha)
Benson ID 103 - Poplar Box – Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion	800,000 ha ± 30%	400,000 ha ± 30%	12,980 ha	1,798.43 ha
ID 72 – White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion	200,000 ha ± 50%	120,000 ha ± 50%	13,077 ha	1.4 ha
ID174 – Mallee – Gum Coolibah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	80,000 ha ± 30%	35,000 ha ± 30%	10,880 ha	16.97 ha
Benson ID229 – Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion	1,000 ha ± 30%	200,000 ha ± 30%	9,935 ha	29 ha



Map 4 Locations of field surveys across the Study Area.



Legend

Vegetation community

- Benson Id 103
- Benson Id 72
- Benson Id 174
- Benson Id 229
- Cobar Greenhood
- Proposed infrastructure
- Study area

Map Projection: Transverse Mercator
Horizontal Datum: AGD 1966
Grid: Australian Map Grid, Zone 55

Data sources:
Study area and infrastucture locations: TRL
Aerial image: Google Earth
Roads: OEH Spatial Data Online
Vegetation/species: Envirokey

Mapping date: 5 February 2014

0 0.25 0.5 1 Kms

N

EnviroKey

PO Box 7231 Tathra NSW 2550. t: 02 6494 5422

Map 5 Vegetation Communities of the Study Area

6 FAUNA AND THEIR HABITATS

6.1 METHODOLOGY

Field surveys were completed to develop a comprehensive understanding of fauna and their habitats that occur, or potentially occur within the Study Area on two separate occasions. The first survey was conducted between the 13th and the 20th March 2012 and the second survey between the 3rd and the 7th October 2012. The field surveys were conducted by suitably qualified and experienced ecologists (qualifications provided in **Appendix 1**).

Field surveys were conducted under the authority of a current Scientific License issued under Clause 22 of the *National Parks and Wildlife Regulation 2002* and section 132C of the *National Parks and Wildlife Act 1974* by OEH and an Animal Research Authority approved by, and in accordance with, the Animal Care and Ethics Committee (ACEC) of the Director-General of Industry and Investment NSW.

Field survey design was guided with consideration of the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004) and taxa specific guidelines for frogs (DECC 2009; DEWHA 2010b), birds (SEWP&C 2010) and microchiropteran bats (DEWHA 2010a).

The following sections provide the detail of the methodologies adopted for this assessment. A summary of fauna survey effort is provided (see **Table 4**).

6.1.1 Weather Conditions During Fauna Survey

Weather conditions during the field survey were considered conducive to detecting all fauna species including threatened fauna. Data from the closest weather station was sought (BOM 2014) (Nyngan, approximately 51 km south-east of the Study Area) and is presented (see **Table 3**).

Table 3
Weather conditions during the field survey from the Nyngan Weather Station.

Date	Min Temp (degrees C)	Max Temp (degrees C)	Rainfall (mm)
13/03/12	16.7	31.0	0
14/03/12	18.5	30.3	0
15/03/12	19.0	30.4	0
16/03/12	18.6	31.5	0
17/03/12	17.6	27.0	6.5
18/03/12	15.8	28.0	0
19/03/12	14.0	27.6	0
20/03/12	16.6	30.2	0
03/10/12	6.9	28.0	0

Date	Min Temp (degrees C)	Max Temp (degrees C)	Rainfall (mm)
04/10/12	7.5	31.7	0
05/10/12	14.0	35.0	0
06/10/12	15.7	36.5	0
07/10/12	7.5	22.8	0

6.1.2 Diurnal Birds

Surveys to determine the presence and usage of the Study Area by diurnal birds were conducted. These surveys were completed at 44 locations within the Study Area during the field survey (see **Map 4**) guided by a standardised technique (Watson 2003). Surveys were conducted in either the early morning or late afternoon to coincide with peak bird activity. Observers actively searched for diurnal birds and identified species by sight and by vocalisation during each 20 minute bird survey. Opportunistic data was also collected across during the field survey whenever traversing the Study Area.

6.1.3 Trap Lines

Terrestrial fauna was targeted using eleven trap lines activated across the Study Area (see **Map 4**). Six trap lines comprised of two PVC tubes and four pair of funnel traps set along a 30 metre long x 0.23 metre tall PVC fence (see **Figure 5**) used in the March survey.

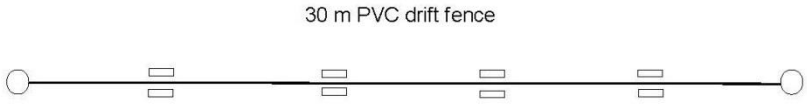


Figure 5 Arrangement of PVC tubes and funnel traps along the 30m long drift fence during the March 2012 survey.

For the October survey, five trap lines comprising four pair of funnel traps set along a 30 metre long x 0.23 metre tall PVC fence were activated.

During the March survey, trap lines were activated for two periods during the field survey to satisfy ACEC approved protocols. These were from the 13th March - 17th March 2012 (four nights/five days) and the 18th March - 20th March 2012 (2 nights/three days). This resulted in a survey effort of 216 trap nights/288 trap days.

During the October survey, trap lines were activated for four consecutive nights resulting in a survey effort of 80 trap nights/100 trap days.

PVC tubes and Funnel traps rather than the more traditional pitfall buckets were chosen given their appropriateness for the target fauna. PVC tubes are more successful in trapping

terrestrial mammal fauna such as Kultarr (NPWS 2002) while Funnel traps have recently been demonstrated to have a very high success rate for sampling reptilian and amphibian fauna (Denny 2005; Sass 2009a; Sass *et al.* in prep; Sass *et al.* in prep.).

6.1.4 Echolocation Call Recording

Microchiropteran bats were targeted by using a 'Titley' Anabat SD1 Echolocation Call Recording Unit coupled to a PDA for active monitoring. Surveys in March 2012 were conducted at eight locations over four nights with each location surveyed for one hour in total on one occasion. Two sites were surveyed each night. In addition, mobile monitoring was also conducted while travelling between the first and second site with the use of an Anabat Car Mount with High Mount Microphone. Surveys in October 2012 were conducted at three locations for one hour in total on one occasion.

The use of Echolocation Call Recording Units is consistent with state and commonwealth guidelines for surveying microchiropteran bats.

All data collected from the Anabat SD1 were then analysed into bat and non-bat origin files. These files were then analysed using the software package AnalookW guided by the 'Bat Calls of New South Wales: Region based guide to echolocation calls of microchiropteran bats' (Pennay *et al.* 2004)and the EnviroKey reference call collection. It should be noted that members of the *Nyctophilus* genus were unable to be identified to species level due to a lack of differentiation between species and are identified to genus level only. Anabat analysis was conducted by Principal Ecologist Steve Sass, who has analysed more than 20,000 files from western NSW.

A call was defined as a sequence of three or more consecutive pulses of similar frequency. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating as follows:

> D = Definite: Species identification not in doubt.
>
> PR = Probable: Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call types.
>
> PO = Possible: Call characteristics are comparable with the species, but there exists a reasonable probability of confusion with one or more bat similar species or the quality or length of call prohibits a confident identification.

Those calls unable to be identified due to poor call quality resulting in a lack of diagnostic features were assigned 'Unidentifiable'.

6.1.5 Hair Tubes

Handi-glaze hair tube hair sampling devices were established at two sites during the March 2012 field survey (see **Map 4**). Handi-glaze hair tubes rather than the more traditional hair tubes were employed during this assessment given their apparent efficiency in attracting animals to enter a device (Mills *et al.* 2002; Ruibal *et al.* 2010).

Each site comprised of 25 handi-glaze hair tube at ground level spread along a transect approximately 250m long. Each hair tube was baited with a mixture of peanut butter, rolled oats and honey to attract small, terrestrial mammals. At each end of the hair tube, double sided tape collected a small hair sample of any animals attracted by the bait.

Any hair samples collected using this method, were sent to hair analysis specialist Barbara Triggs for identification.

Each site was activated for 7 consecutive nights, resulting in a total survey effort of 350 trap nights.

6.1.6 Elliot Trapping

Elliot 'Type A' traps were utilised to target small terrestrial mammalian fauna. Despite some suggesting that Elliot trapping is inappropriate to detect threatened mammals such as the Kultarr, the author has trapped two individual Kultarr at two locations on the Cobar Peneplain using Elliot traps with finely set triggers. One individual was detected in 2006 approximately 90kms north of Cobar (CSU-JCEC 2006a) while a second was trapped in a roadside reserve near Nymagee (S.Sass, unpubl. data). On both occasions, an attractant comprising peanut butter, rolled oats and honey was used within each trap. Elliot traps (with triggers set finely) and baited (with a known attractant) were activated during the March 2012 survey for two periods during the field survey to satisfy OEH guidelines and ACEC approved protocols. These were from the 13th March - 17th March 2012 (four nights/five days) and the 18th March - 20th March 2012 (two nights/three days). Three Elliot trap lines were established with each line containing 25 traps (75 traps in total) (see **Map 4**). Traps remained in the same position for the two survey periods. This methodology resulted in a March survey effort using Elliot traps of 450 trap nights.

Four separate locations were targeted during the October 2012 survey, with each site containing 25 traps (100 traps in total). A total 400 trap nights were completed during the October survey resulting in a total of 850 traps nights across the Study Area.

6.1.7 Motion Activated Infrared Cameras

Motion-activated Infrared cameras are well known for their efficiency in detecting fauna species without the need to set traditional traps (Claridge *et al.* 2004). RECONYX PC900 HyperFire Professional High Output motion-activated infrared cameras were activated at five locations in March 2012 and four locations in October 2012 across the Study Area (see **Map 4**). Cameras were set on high sensitivity with five images captured per motion detected. Cameras were pointed to a bait station containing a mixture of rolled oats, peanut butter and honey (a known attractant for Kultarr and small, terrestrial mammals). Cameras were activated between the 13th – 20th March 2012 (7 nights/9 days) resulting in a survey effort of 35 camera nights/45 camera days and the 3rd – 7th October 2012 resulting in a survey effort of 16 camera nights/20 camera days. The total survey effort completed using this method is 51 camera nights/65 camera days.

6.1.8 Call Playback

Call playback was conducted to target nocturnal fauna. The target species for this assessment were the Masked Owl, Barking Owl, Bush Stone Curlew and Koala. Call playback was undertaken at five sites within the Study Area over 4 nights in March 2012 and three sites over 3 nights in October 2012. In the March 2012 survey, three sites were surveyed each night for the four nights, while the remaining two sites were surveyed only once. In October 2012, all three sites were survey on one occasion. The locations of all surveys within the Study Area are shown (see **Map 4**).

At each location, the Call playback survey commenced with an initial listening period of 10 minutes. The call of a target species was then transmitted intermittently over a period of five minutes, following by a five minute listening period. This was then repeated for each target species.

6.1.9 Spotlighting

Spotlighting was undertaken using a hand-held 50W spotlight by two persons at the conclusion of each call playback survey location for a period of one person hour. A total of eight sites were surveyed. In March 2012, three sites were surveyed each night for the four nights, while the remaining two sites were surveyed only once. In addition, vehicular spotlighting was also conducted while travelling across the Study Area during nocturnal surveys. All survey locations across the Study Area are provided (see **Map 4**).

6.1.10 Herpetofauna Search

Herpetofauna searches were conducted at 29 sites that generally coincided with habitat surveys (see **Map 4**). Each site was systematically searched by an experienced herpetologist for a period of 30 minutes for active and inactive animals. Fallen timber, loose bark, tree and ground hollows, and loose soil were extensively searched(Blomberg and Shine 1996).

6.1.11 Track and Scat Search

Four dedicated Track and Scat Search transects of 1km in length were completed across the Study Area (see **Map 4**) and while conducting the 66km of orchid transects, tracks and scats were also the subject of the search. In addition, any track and scat of interest observed during the field survey while undertaking other survey methods, would be inspected. In the case of scats, identification was made using '*Tracks, Scats and Other Traces: A field guide to Australian Mammals*'(Triggs 2008). Where identification was in doubt, a sample would be collected and sent to the author of that guide and scat specialist Barbara Triggs for further analysis.

6.1.12 Habitat Assessment

An assessment of habitats was conducted at 41 sites across the Study Area (see **Map 4**). Specific variables were qualitatively and quantitatively measured within a 50 metre x 20 metre quadrat that are known for their influence of biodiversity including ground cover attributes, fallen timber (size and lineal metres), mistletoe, hollows, shrub height and density, the composition of the surrounding matrix and past disturbance. Methodology and variables

measured for the habitat assessment was guided by the Biobanking Assessment Methodology (DECC 2008); a tool developed for measuring biodiversity values in woodlands (Oliver 2004). This was modified to suit the nature of the Study Area and the target fauna by incorporation of other measures from various sources (Fischer *et al.* 2004; Fischer *et al.* 2005; Hecnar and M'Closkey 1998; Sass 2003).

6.1.13 Total Survey Effort

A summary of the total survey effort conducted during the field survey is provided (see **Table 4**). This survey effort was guided by theThreatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (working draft)(DEC 2004) with consideration of the size of the Study Area and the vegetation communities and fauna habitats present (see **Table 4**). The diverse range of survey methods used in this study and the survey effort conducted confirms that overall, this assessment is consistent with OEH guidelines.

Table 4
A summary of fauna survey type, effort and target fauna conducted for this assessment.

Survey Type	Total Survey Effort
Diurnal Birds	44 locations for 20 minutes each. Total survey effort was 880 minutes
Trap Lines	March: Six locations over 216 trap nights/288 trap days October: Five locations over 80 trap nights/100 trap days Total survey effort: 296 trap nights/388 trap days.
Echolocation Call Recording	March: 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 survey effort was 13 recording hours plus mobile monitoring. October: Three sites for one hour each. Total 3 hours. Total survey effort: 16 recording hours.
Hair Tubes	March: Two sites (25 tubes each site) over 7 consecutive nights. Total survey effort: 350 trap nights.
Elliot trapping	March: Three sites (25 traps each site) over a total of 450 trap nights. October: Four sites (25 traps each) over a total of 400 trap nights. Total survey effort: 850 trap nights.
Motion Activated Infrared Cameras	March: Five sites over 7 nights/9 days resulting in 35 camera nights/45 camera days. October: Four sites over 4 nights/5days resulting in 16 camera nights/20camera days. Total survey effort: 51 camera nights/65 camera days.
Call Playback	March: 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. October: Three sites for one hour on each occasion. Total effort 3 person hours over three nights. Total survey effort: 17 hours.

Survey Type	Total Survey Effort
Spotlighting	March: 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. October: 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 over 70kms in total
Habitat Assessment	41 sites using a 50m x 20m quadrat

6.1.14 Nomenclature

Nomenclature used within this report follows Morcombe (2004) for birds, Menkhorst & Knight (2010) for mammals (except bats) and for bats, Churchill (2008). For frogs, the latest field guide is used (Tyler and Knight 2009) and for reptiles, the field guide to the reptiles of NSW (Swan *et al.* 2004) with modifications due to recent taxonomic revisions where required (Sass 2011a; b). Where no common name is provided with these texts, a generally accepted name is used.

6.1.15 Limitations

While this study was completed during Autumn and Spring 2012 when field conditions were conducive to detecting many of the fauna that are known to occur in the area, a common limitation of many ecological studies is the short period of time in which they are conducted. When combined with a lack of seasonal sampling this can lead to either low detection rates or false absences being reported. This is also particularly relevant to highly mobile species that may not have been in the Study Area at the time of the survey. For these reasons, it should be recognised that it may be impossible to rule out species absence for some species during field surveys. Further analysis of the potential for species presence based on available habitats occurs within Chapter 9.

6.2 RESULTS

The field surveys within the Study Area have revealed a total of 114 fauna species comprising:

- 63 species of bird
- 25 species of reptile
- 9 species of frog
- 17 species of mammal (including 8 species of microchiropteran bat).

A previous ecological study conducted on directly adjoining land in October 2011 recorded a total of 99 species of fauna (EnviroKey 2011c). By pooling the results of that study (from adjoining land to the south of the study area) to the results of this Ecology Assessment, a

larger suite of fauna are known from the Study Area and surrounds (144 species). These comprised:

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

A full species listed in provided in **Appendix 4**.

6.2.1 Threatened and Migratory Fauna

A total of eight threatened or migratory fauna species (seven definite, one by precautionary principle) were identified within the Study Area from the current study. These were the:

- Pink Cockatoo (*Cacatua leadbeateri*), Vulnerable TSC Act
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Vulnerable TSC Act
- Superb Parrot(*Polytelis swainsonii*), Vulnerable TSC Act, Vulnerable EPBC Act
- Inland Forest Bat (*Vespadelus balstoni*), Vulnerable TSC Act
- Little Pied Bat(*Chalinolobus picatus*), Vulnerable TSC Act
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), Vulnerable TSC Act
- Eastern Long-eared Bat (*Nyctophiluscorbeni),* Vulnerable TSC Act, Vulnerable EPBC Act
- Rainbow Bee-eater (*Merops ornatus*), Migratory EPBC Act

Superb Parrot was particularly common throughout the March field survey being recorded on 21 separate occasions (see **Table 5**). This species was regularly observed feeding within the Study Area. All observations were made prior to 1300hrs on any day and when birds were observed flying through the Study Area, most movements were from the north to north-east through to the south-west with these birds perhaps feeding elsewhere in the locality. Two individuals were observed in the October 2012 survey which is considered unusual given that Superb Parrot migrate back to their breeding grounds in the South-west Slopes, Murrumbidgee and Murray regions (BakerDabb 2011). However, both were juveniles which may explain their absence from the breeding migration.

Table 5
Details of Superb Parrot sightings recorded during the field survey.

Date	Species	Status	Easting	Northing	Details
12/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0810hrs, 6 birds feeding
12/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0812hrs, 12 birds flying north to south
12/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0815hrs, 10 birds flying north-east to south-west
13/03/12	Superb Parrot	V,TSC. V,EPBC	485002	6548118	0745hrs, 3 birds feeding
	Superb Parrot		484834	6548378	0840hrs, 3 birds flying

Date	Species	Status	Easting	Northing	Details
13/03/12		V,TSC. V,EPBC			north to south-west
13/03/12	Superb Parrot	V,TSC. V,EPBC	484098	6548917	0850hrs, 2 birds flying north-east to south-west
13/03/12	Superb Parrot	V,TSC. V,EPBC	484098	6548917	0850hrs, 3 birds feeding
13/03/12	Superb Parrot	V,TSC. V,EPBC	484318	6548866	0910hrs, 3 birds feeding
13/03/12	Superb Parrot	V,TSC. V,EPBC	484169	6548907	0915hrs, 7 birds feeding
13/03/12	Superb Parrot	V,TSC. V,EPBC	484104	6548925	0915hrs, 2 birds flying north-east to south
14/03/12	Superb Parrot	V,TSC. V,EPBC	486425	6547260	0700hrs, 6 birds obs.
15/03/12	Superb Parrot	V,TSC. V,EPBC	484814	6548422	0700hrs, 1 bird calling
15/03/12	Superb Parrot	V,TSC. V,EPBC	484101	6548926	0820hrs, 1 bird feeding
15/03/12	Superb Parrot	V,TSC. V,EPBC	483726	6549244	1100hrs, 2 birds flying south to north
15/03/12	Superb Parrot	V,TSC. V,EPBC	483726	6549244	1100hrs, 4 birds feeding
16/03/12	Superb Parrot	V,TSC. V,EPBC	484789	6548391	0655hrs, 6 birds flying east to west
16/03/12	Superb Parrot	V,TSC. V,EPBC	486197	6547633	0820hrs, 3 birds feeding
17/03/12	Superb Parrot	V,TSC. V,EPBC	486654	6546907	0630hrs, 2 birds heard
17/03/12	Superb Parrot	V,TSC. V,EPBC	484098	6548917	0920hrs, 6 birds feeding
17/03/12	Superb Parrot	V,TSC. V,EPBC	485073	6548130	0710hrs, 2 birds feeding
18/03/12	Superb Parrot	V,TSC. V,EPBC	484814	6548422	0820hrs, 1 bird calling
04/10/12	Superb Parrot	V,TSC. V,EPBC	-31.18139	146.840082	1000, 2 juveniles flying north to south

Grey-crowned Babbler appeared confined to the far north-west and western portions of the Study Area (see **Map 6**). The spatial locations of all threatened and migratory fauna species is provided (see **Map 6**).

6.2.2 Avifauna

The assemblage of birds recorded during this study is considered typical of semi-arid woodlands in western NSW (Sass 2009b). Birds commonly recorded included the Noisy Miner, Apostlebird and Crested Pigeon. A total of 63 species of bird were recorded including three threatened species (Superb Parrot (*Polytelis swainsonii*), Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Pink Cockatoo (*Cacatua leadbeateri*)) and one migratory species (Rainbow Bee-eater (*Merops ornatus*)) (**Appendix 4**). Bird diversity was considerably lower than that recorded during the 2011 study on adjoining land (EnviroKey 2011c) and this is influenced most by the notable absence of many waterbirds despite suitable habitat (earthen tanks) being present. Given the rainfall events across western

NSW over the past 18 months, the most likely explanation is that birds dependant on water (such as egrets, dotterels and ducks) have dispersed to other areas where water is also now present.

6.2.3 Mammals (excluding microchiropteran bats)

Seventeen species of mammal were recorded within the Study Area (**Appendix 4**). Of these, six were introduced species with most considered key threatening processes to native biodiversity (i.e., Feral Goats degrading native vegetation, Red Foxes and House Cat predating on native fauna, Pigs and Rabbits degrading native vegetation and compromising habitat quality).

The Yellow-footed Antechinus was recorded on adjoining land in 2011 and despite it not being listed as a threatened species under the NSW *Threatened Species Conservation Act* 1995, it is regarded as a species of conservation concern in western NSW (Dickman *et al.* 1993). Past disturbance such as clearing and grazing history may provide an explanation as to the notable absence of many mammal species.

6.2.4 Microchiropteran bats

Eight species of microchiropteran bat were recorded within the Study Area from 175 files recorded by Echolocation Call Recording Device (ANABAT SD1) with at least three threatened species recorded (Little Pied Bat, Inland Forest Bat, Yellow-bellied Sheathtail Bat) (see **Table 6** & **Map 6**).

A fourth threatened species is also possible with application of the precautionary principle. Files of a species from the *Nyctophilus* genus were recorded during the field survey. As files from this genus cannot be identified to species level using echolocation calls, we have assumed it to be the single threatened species (South-eastern Long-eared Bat (*Nyctophilus corbeni*) (formerly *N.timoriensis*) that exists within the larger genus.

Combined, the Little Pied Batand Yellow-bellied Sheathtail Bat comprise almost 40% of the files recorded suggesting that both threatened species formed a major component of the microchiropteran bat biota during the field survey. Similarly, Yellow-bellied Sheathtail Bat was the most common microchiropteran bat species recorded on adjoining land (EnviroKey 2011c).

One additional species of microchiropteran bat was recorded on adjoining land in 2011 but not during this field survey (EnviroKey 2011c). This was the Chocolate Wattled Bat (*Chalinolobus morio*).

Table 6
Summary of Echolocation Call Recording Analysis from calls collected during the field survey. Threatened Species marked in BOLD.

Species	Confidence Ranking			
	PO	**PR**	**D**	**Total**
Not Bat (likely insect or wind, but not of bat origin)	-	-	4	4
Unidentifiable (definitely of bat	-	-	24	24

Species	Confidence Ranking			
	PO	**PR**	**D**	**Total**
origin, but file does not contain enough attributes to allow for an identification)				
Chalinolobus gouldii	14	17	15	46
Chalinolobus picatus	**15**	**11**	**4**	**30**
Mormopterus species 4	7	8	9	24
Mormopterus species 3	4	-	-	4
Nyctophilus sp. (?corbeni)	**1**	**1**	**-**	**2**
Saccolaimus flaviventris	**7**	**11**	**4**	**22**
Scotorepens balstoni	3	2	1	6
Scotorepens greyii	3	7	1	11
Vespadelus balstoni	2	-	-	2
			Total	175

6.2.5 Reptiles

Reptile species richness is considered high with 25 species recorded within the Study Area (**Appendix 4**). No threatened reptile species were recorded and none are known from the locality. A scientific manuscript published by the author and one of the field personnel confirms the presence of 40 species of reptile in the same habitat type as the Study Area (Sass and Swan 2010). However, it is noted that the Bioregion is large (approx. 1/3 of NSW) and records for this paper were collected from a variety of sites.

Notable absences within the reptile fauna were pythons, pygopodids, typhlopids and some elapids which can be notoriously difficult to detect. All are known from the locality with previous studies by EnviroKey detecting Inland Carpet Python (*Morelia spilota metcalfei*), two species of typhlopid (*Ramphotyphlops wiedii* and *R.bicolor*), and two species of elapid (EnviroKey 2010b; c; 2011a). TRL staff recently detected the cryptic, but widespread Bandy Bandy (*Vermicella annulata*) (C.Sullivan, Feb 2012, pers.com).

No threatened reptile species were recorded and none are expected to occur here given the absence of suitable habitat (spinifex grasslands).

6.2.6 Frogs

Frog diversity is considered highly diverse with nine species detected during the field survey (**Appendix 4**). Many species were recorded within the vicinity of existing earthen tanks however, numerous tadpoles and metamorphs were observed in and around small ephemeral pools. A number of other frog species are also likely to occur within the Study Area, but the absence of heavy rain immediately prior or during the field survey was likely the reason for their non-detection. Burrowing frogs such as the Crucifix Toad (*Notaden bennettii*), Giant Banjo Frog (*Limnodynastes interioris*) and Common Spadefoot (*Neobatrachus sudelli*) that emerge only after heavy rain events are also likely to occur throughout the Study Area.

A scientific manuscript published by the author and one of the field personnel confirms the presence of 11 species of frog in the same habitat type as the Study Area (Sass and Swan 2010). However, it is noted that the Bioregion is large (approx. 1/3 of NSW) and records for this paper were collected from a variety of sites.

One species of frog, the Salmon-striped Frog (*Limnodynastes salmini*) has not been previously recorded within the Poplar Box Woodlands of the Cobar Peneplain (Sass and Swan 2010). Several individuals were heard calling in the south-eastern corner of the Study Area within an open, grassy area within the woodland habitat.

No threatened frog species were recorded and none are expected to occur here given the absence of suitable habitat.

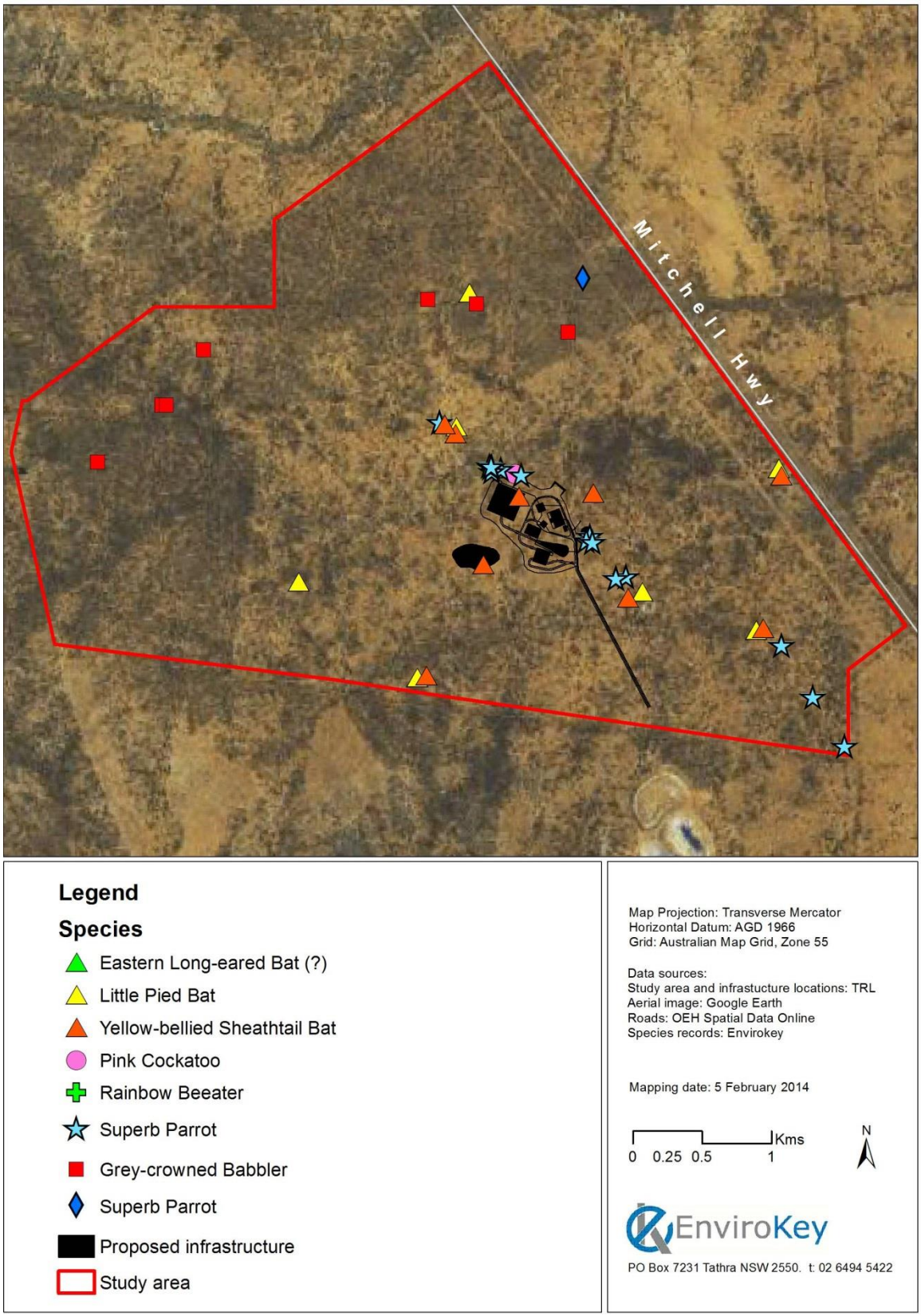
6.2.7 Habitat Assessment

Two fauna habitats are present within the Study Area; Woodland and Shrubland (see **Map 7**). Woodland forms the majority of the Study Area (98.4%). Habitat condition and quality is considered moderate to good across the Study Area given the diversity of microhabitats and the condition of native vegetation influenced by several good seasons. However, canopy trees are generally relatively young in age, hollows are scarce, and most trees are coppiced confirming that broadscale clearing has occurred in the past. Of relevance to arid zone honeyeaters, a paucity of mistletoe was obvious in comparison to other sites within the Nyngan / Hermidale / Girilambone districts.

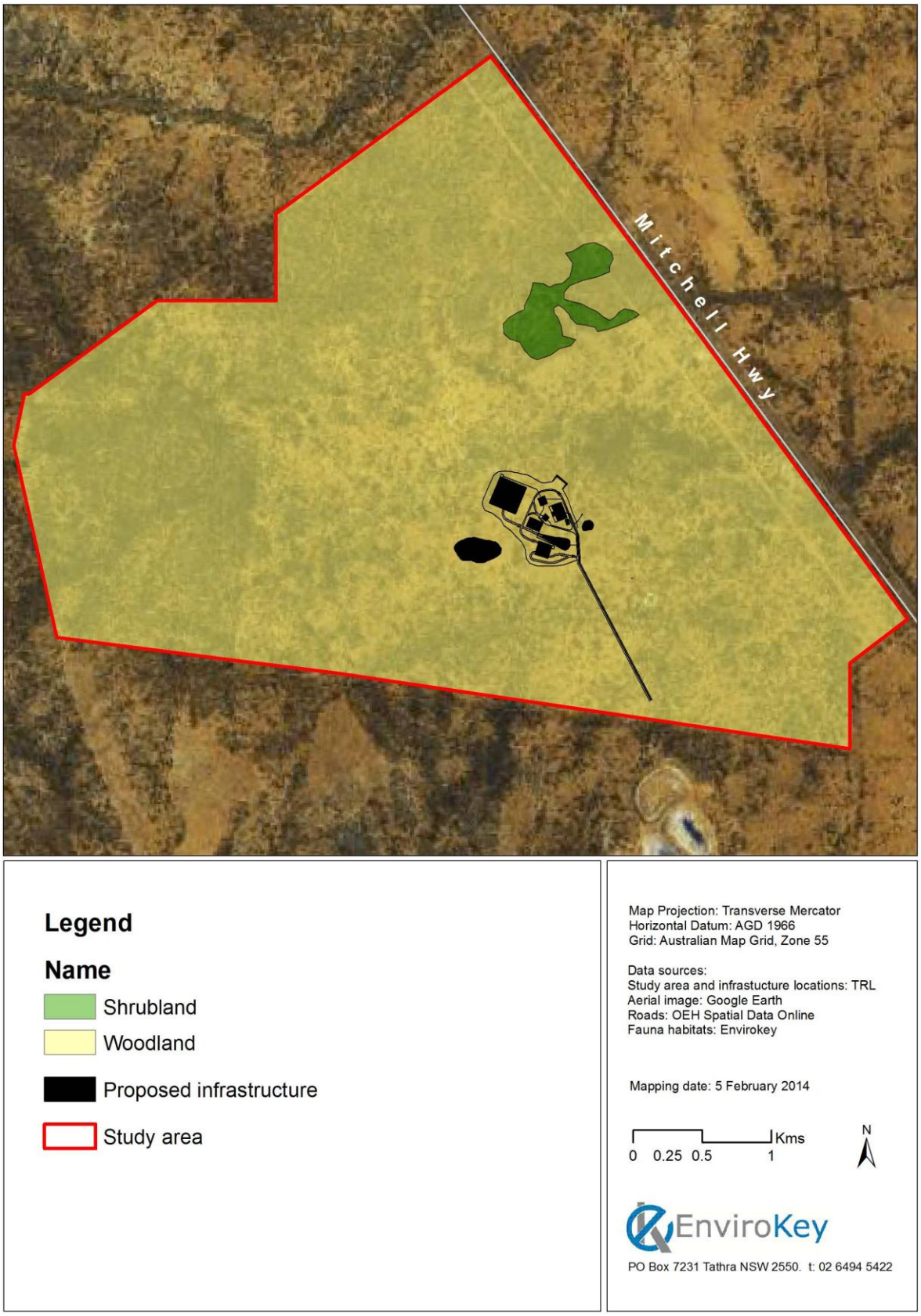
Habitat Assessment data and accompanying site photographs are provided within **Appendix 5**.

6.2.8 Corridors and Connectivity

No specific localised fauna movement corridor was identified within the Study Area during the survey period. A number of Superb Parrot were regularly observed flying from the north and north-east to the south-west. This may suggest that this species is potentially using the Study Area to move elsewhere in the locality. Consistent movements of avifauna were noted within the roadside corridor that is the Mitchell Highway. These were regularly observed while travelling to and from the Study Area. Along this length of road, vegetation within the road reserve remains generally intact in comparison to adjacent lands which have been extensively cleared for agriculture providing some explanation as to the local movements of avifauna. At a landscape scale, the Study Area forms part of a much larger and continuous patch of native vegetation which is likely to strongly contribute to genetic exchange and the movement of individuals across a partially fragmented landscape (see **Map 1**).



Map 6 Locations of threatened and migratory fauna species recorded during the study.



Map 7 Fauna habitats within the Study Area.

7 POTENTIAL IMPACTS

The construction and operation of mining projects can have a range of potential impacts to biodiversity. The potential impacts as a result of the Proposal are summarised below and in the following sections. These include:

- Loss of native vegetation including threatened flora habitat.
- Loss of fauna habitats.
- Direct mortality of protected and threatened fauna.
- Loss of connectivity through the degradation of wildlife and habitat corridors.
- 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.

7.1 LOSS OF VEGETATION AND HABITAT

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 4834 hectares (referred to as the 'Proposed Disturbance Footprint' (**Table 7**). This equates to approximately 1.8% of the Project Site Boundary and Study Area.

These estimates have been calculated based on the footprint of the Proposal using a GIS shapefile overlain onto vegetation community mapping and provided to EnviroKey by RWC. No additional clearing is expected for ancillary facilities.

Table 7
Summary of vegetation loss for the Proposal by Biometric vegetation type and area

Biometric Vegetation Type	Direct loss (hectares)
WE91(Benson 103) Poplar Box-Gum Coolibah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion	34

7.1.1 Threatened Ecological Communities

Of the 34 hectares proposed for clearing, no threatened ecological communities (TEC) as listed by the TSC Act or EPBC Act would be impacted. No TEC occurs within the Study Area.

7.1.2 Threatened Species Habitat

Field surveys to date have identified that the Study Area is utilised by threatened fauna from time to time. All species (with the exception of Grey-crowned Babbler) are highly mobile species that forage over large areas, and are unlikely to be confined to the boundaries of the Study Area, or in some instances, the locality.

For the Grey-crowned Babbler, all observations were made a significant distance from the Proposed Disturbance Footprint. This species generally has small home ranges varying from only one hectares up to 50 hectares dependant on the size of the family 'troupe' and the quality of habitat present (Blackmore and Heinsohn 2007; King 1980; PB 2005). Given this, even with consideration of the largest home range sizes and the records within the Study Area (**Map 6**), the Proposed Disturbance Footprint would be well clear of any of the occupied home ranges.

7.1.3 Hollow-bearing Trees

Based on the results of the field surveys, the Study Area hosts a paucity of hollow-bearing trees (HBT) and this is likely influenced by the past clearing that has occurred for agricultural activity given the coppiced canopy trees and evidence of ring-barking. HBT are generally restricted to 'stags'.

While a site-specific HBT survey has not been completed, surveys in similar vegetation and past land use at the nearby Tritton Copper Mine identified the presence of an average 1.13 HBT per hectare with an average 2.14 hollows per HBT (EnviroKey 2011b). On this basis and with consideration of the Proposed Disturbance Footprint of 34 hectares, it is likely that about 38 HBT containing 81 hollows would be removed as a result of the Proposal. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present equating to approximately 41 HBT and 73 hollows.

7.2 WILDLIFE CONNECTIVITY AND HABITAT FRAGMENTATION

Levels of connectivity and habitat fragmentation can occur at both landscape and patch scale (Lindenmayer and Fischer 2006). Relevant to the Proposal and the existing environment, levels of connectivity would remain given the position of the Proposed Disturbance Footprint and that vegetation adjacent continues to provide landscape and patch scale connectivity.

The Proposal would not result in the fragmentation of any habitat given that the vast majority (98%) of the Study Area would remain unaffected.

7.3 INJURY AND MORTALITY

Fauna injury or mortality can occur during the clearing phase through the removal of habitat and from collision with vehicles during the operation of the Proposal.

7.3.1 Construction Impacts

It is anticipated that some diurnal and mobile fauna species such as birds and larger reptiles may be able to move from the path of construction equipment during any clearing operations, other fauna species such as those that are less mobile and nocturnal, are less likely to move away from clearing activity.

The removal of hollow-bearing trees could result in mortality or injury to any inhabitants. Mitigation measures outlined within Chapter 8 provide a framework for minimising the potential of mortality or injury.

7.3.2 Operational Impacts

Operational impacts are likely to be most associated with vehicular traffic and directly mortality as a result of collisions with vehicles in high operation areas, and minimising access to unsuitable water sources.

Amelioration measures proposed in Chapter 8 provide a framework for minimising potential impacts during the operational stage of the Proposal.

7.4 WEEDS

A total of 13 weed species were recorded from field surveys within the Study Area. The weeds recorded were as follows:

- Scarlet Pimpernetl (*Anagallis arvensis*)
- Greater Beggar's Ticks (*Bidens subalternans*)
- Buffel Grass (*Cenchrus ciliaris*)
- Colocynth (*Citrullus colocynthis*)
- Flaxleaf Fleabane (*Conyza bonariensis*)
- Stinkgrass (*Eragrostis cilianensis*)
- White Horehound (*Marrubium vulgare*)
- Burr Medic (*Medicago polymorpha*)
- Creeping Oxalis (*Oxalis corniculata*)
- A Mustard (*Sisymbrium spp.*)
- Black-berry Nightshade (*Solanum nigrum*)
- Common Sowthistle (*Sonchus oleraceus*)
- Bathurst Burr (*Xanthium spinosum*)

Bathurst Burr (*Xanthium spinosum*) is listed as a Class 4 Noxious Weed species on the NSW Department of Primary Industries (DPI) Noxious Weeds list for the Bogan LGA. Under this listing the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed. There is some potential to disperse seeds and plant material into adjoining areas of native vegetation that are relatively weed-free. The most likely cause would be through the movement of soil by construction vehicles and machinery involved with the initial clearing and earthworks. There is also the potential for disturbance areas to be colonised by weed species which are present within the soil as a seed bank and require a disturbance event to trigger

germination. Weed germination should be suppressed or controlled through mechanical methods such as hand weeding or spraying to allow for the establishment of native species and increase the chance of successful competition. Control methods would be detailed within a Weed Management Plan (see Section 8.1).

7.5 PESTS AND PATHOGENS

Red foxes, Cats, Pigs, Goats and Rabbits are all known from the locality and have been regularly recorded within the Study Area. Five key threatening processes (KTP) as listed by the TSC Act and the EPBC Act relate to the invasion and establishment of these species. The TSC Act KTP relating to these introduced species are listed as follows:

- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)
- Competition and habitat degradation by feral goats (*Capra hircus*)
- Predation by the European red fox (*Vulpes vulpes*)
- Predation by the feral cat (*Felis catus*)
- Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)

The EPBC Act KTP relating to these introduced species are listed as follows:

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Predation by European red fox.
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.

The Proposal may exacerbate these processes for some species given that a new road access would be constructed and that Red Foxes, Cats and Rabbits are known to use roads as a vector for dispersal in vegetated areas.

Pathogens result in disease in flora and fauna and can be found living in organisms such as fungus, bacteria and virus. Two pathogens are known from inland NSW and these are also listed as KTP. These being:

- Dieback caused by Phytophthora (TSC Act and EPBC Act).
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (TSC Act and EPBC Act).

Only the first pathogen may have a potential effect on the flora of the Study Area given the absence of aquatic habitats.

7.6 GROUNDWATER DEPENDENT ECOSYSTEMS

The Proposal is unlikely to result in a significant reduction in both the water flow and water table height given the absence of aquatic habitats.

7.7 NOISE, VIBRATION AND LIGHT

Noise and vibration are likely to result from the Proposal. Given that the Proposed Disturbance Footprint is already likely subject to a background level of noise from the existing mining operations directly adjacent. It is not anticipated that operation noise and vibration would have a significant effect based on our previous studies at the nearby Tritton Mine and Girilambone Copper Mine where threatened species have been recorded foraging and breeding directly adjacent to current operations (EnviroKey 2010b; 2011a; b; c)

Light has the potential to disturb sleeping activity for diurnal fauna and foraging activity for nocturnal fauna. For diurnal fauna, impacts are limited to less than 2% of the Study Area and it is not anticipated that these fauna would be significantly affected. For nocturnal fauna, a recent study at an existing mine site near Cobar found that lighting associated with mine operations provided opportunities for microchiropteran bat foraging as they attracted moths and other flying insects(EnviroKey 2012).

7.8 IMPACT ON RELEVANT 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
- Causes common species, populations or ecological communities to become threatened.

There are a number of listed key threatened processes that are of relevance to aspects of the proposal. These are provided in summary in **Table 8**.

Table 8
Key threatening processes relevant to the Proposal.

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 about 34 hectares 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.
Increased sedimentation and erosion during construction	FM Act	Habitat loss/change	There is some potential for increased sediment to reach minor drainage as a result of the clearing and construction required for the Proposal.
Loss of hollow-bearing trees	TSC Act EPBC Act	Habitat loss	It is likely that up to 38 HBT would be removed.

7.9 CUMULATIVE IMPACTS

Should the Proposal be approved, there is a potential cumulative impact given the proximity of the existing Girilambone Copper Mine. In considering the potential for this impact to negatively affect biodiversity at the landscape scale, it is apparent that the Girilambone Copper Mine and the Proposal are confined to relatively small footprints in comparison to the surrounding landscape. It is unlikely that the Proposal would contribute to a cumulative impact to the local biodiversity at any scale given the position of the Proposed Disturbance Footprint.

8 PROPOSED AMELIORATION MEASURES

Given the nature and extent of the Proposal, the amelioration measures should include the following:

- General land management amelioration measures (eg, pest animal control).
- Amelioration measures to be undertaken prior to commencement of the Proposal (eg, pre-clearance surveys).
- Amelioration measures to be undertaken during the Proposal (eg, clearly marking areas to be cleared and areas to be retained).
- Amelioration measures to be undertaken after the proposed activity has been completed (eg, rehabilitation, monitoring).

Amelioration measures detailed below should be fully implemented to ensure that no '*significant effect*' would occur upon any threatened or migratory biota or their habitats that are known to, or potentially occur within the Study Area. These measures would also ensure that any potential impacts upon other non-threatened flora, vegetation communities, fauna and their habitats would also be minimised.

8.1 GENERAL LAND MANAGEMENT AMELIORATION MEASURES

Two amelioration measures would be prepared and implemented to ensure that no *'significant effect'* would occur upon any threatened biota, or their habitats that are known to occur or could potentially occur within the Study Area.

- Pest Animal Management Plan

A Pest Animal Management Plan (PAMP) would be developed targeting the introduced Fox, Feral Goat, Feral Pig, European Rabbit and Feral Cat. The PAMP objective would be to develop a strategy of implementing on ground works to control these pest species.

- Weed Management Plan

A Weed Management Plan (WMP) would be implemented for the Study Area, specifically focussing upon the removal of noxious weeds and reducing further weed invasion. The objectives within the WMP would include actions to deter the growth of weeds in recently disturbed areas, control measures for any weeds and the transportation of weeds into the Study Area.

8.2 AMELIORATION MEASURES TO BE UNDERTAKEN PRIOR TO COMMENCEMENT OF THE PROPOSAL

Two amelioration measures would be prepared and implemented prior to the undertaking of the Proposal to ensure that no *'significant effect'* would occur upon any threatened biota, or their habitats that are known to occur or could potentially occur within the Study Area.

- Fauna Management Plan

A Fauna Management Plan (FMP) would be prepared with the objective of minimising potential impacts to fauna species during the clearing of native vegetation associated with the Proposal. The FMP should include actions that include a Hollow-bearing Tree Pre-clearance Survey including the use of personnel that are vaccinated for Australian Bat Lyssavirus, and a Vegetation Pre-clearance survey whereby qualified ecologists search the area in front of and directly behind for any fauna species to relocate these fauna to areas of retained vegetation.

- Threatened Species Monitoring Plan

A Threatened Species Monitoring Plan (TSMP) should be prepared with the objective of regularly monitoring the threatened and migratory species that are known to occur within the Project Site Boundary. The monitoring plan should include:

- Bi-annual monitoring in the months of April and September.
- Methods utilised should be conducive to detecting the presence of the threatened and migratory species previously recorded onsite.
- Methodology to monitor change over time, with direct linkages to amelioration measures and mine operations.

8.3 AMELIORATION MEASURES TO BE UNDERTAKEN DURING THE PROPOSAL

A range of amelioration measures are proposed that should be undertaken during the course of the Proposal:

- Implementation of the FMP.
- Implementation of the TSMP.
- Retained vegetation must be clearly marked to ensure no accidental clearing occurs.
- Any machinery required for the Proposal should remain on vehicular access tracks. When no track is available, machinery should be maneuvered to avoid sapling or canopy trees wherever possible.
- Where canopy trees are to be removed, any trees/limbs should be placed in adjacent vegetation improving existing habitats.
- Should it be necessary to remove any HBT during the Proposal, guidelines provided in **Appendix 6** should be implemented to minimise potential risks to microchiropteran bats to an acceptable and manageable level.

- Any noxious weed and other weed material encountered should be destroyed and/or removed from the site using appropriate methods to ensure weeds do not spread into the remainder of the Study Area.
- Sediment and erosion control structures should be installed where deemed appropriate.
- Exposed surface soil should be stabilised as soon as possible to avoid potential erosion. This should include covering with a geomesh material if inclement weather or high rainfall is predicted. If extreme weather conditions are not a risk, soil stabilisation should be undertaken by spreading a locally sourced native grass seed mixture and lightly watering in.

8.4 AMELIORATION MEASURES TO BE UNDERTAKEN AT THE COMPLETION OF THE PROPOSED ACTIVITY

At the completion of the Proposal, a series of rehabilitation and monitoring measures should be implemented within the framework of a Rehabilitation Plan:

- Emphasis should be placed on rehabilitating cleared areas with native species removed as a result of the clearing process. Rehabilitation could include the use of cleared vegetation and the naturally occurring seed bank from redistributed topsoil.
- Exposed surface soil should be stabilised as soon as possible to avoid potential erosion (by mulching, covering or replanting with native species).
- Rehabilitation of the Proposed Disturbance Footprint should be monitored to ensure native vegetation regeneration is successful (e.g. permanent plots can be established to gauge germination success) and to control weed invasion.
- Appropriate compensatory habitat occurs within the Project Site Boundary given that 1,812 hectares remain unaffected by the Proposal.

8.5 BIODIVERSITY OFFSET STRATEGY

A Biodiversity Offset Strategy for the Proposal is not deemed necessary. This is due to the general principles of ‘avoid and minimise’ having been adopted in relation to the design of the Proposed Disturbance Footprint. Further, measures such as the development and implementation of the TSMP and the provision of appropriate compensatory habitat that is the remainder of the Project Site Boundary that would be unaffected by the Proposal (approximately 1,812 hectares), and the implementation of feral animal and weed management, underpin the ‘maintain and improve’ outcome for biodiversity. Combined, these adequately avoid or mitigate impacts on biodiversity.

9 THREATENED AND MIGRATORY BIOTA EVALUATION

9.1 METHODS

When evaluating which threatened and migratory biota are likely to occur within the Study Area, the following factors were taken into consideration:

- The presence of potential habitat
- Condition of and approximate extent of potential habitat
- Species occurrence within Study Area and wider locality
- Results of previous surveys within the Study Area and wider locality
- Knowledge and experience of the Principal Ecologist

The following sources of data identify a number of threatened biota known to, or predicted to occur in the locality:

- OEH Atlas of NSW Wildlife (which includes flora records) using a 50 kilometre radius of the Study Area as the search area (OEH 2014a).
- OEH Threatened Species Predictor database using the Canbelego Downs sub-region of the Central West CMA as the search parameter(OEH 2014b).
- EPBC Act Protected Matters Reporting Tool using a 50 kilometre buffer of the Study Area (DotE 2014).

The following criteria were applied to each entity based on the above:

- No (no suitable habitat within the Study Area and the species not previously recorded within the locality; or in the case of flora, Study Area extensively searched during the appropriate time of year for detection and species not present).
- Unlikely (no suitable habitat is present, species has limited dispersal capability but previously recorded within the locality).
- Possible (suitable habitat within the Study Area and the species known from the locality; or no suitable habitat present but the species is regarded as highly nomadic or has a high dispersal capability).
- Yes (recorded during the field survey).

9.2 RESULTS

Of the threatened and migratory biota compiled from the results of the field survey and the sources of data detailed within section 9.1,

Table 9 identifies that 21 threatened species and three migratory species were found to occur or possibly occur within the Study Area. Given this likelihood of occurrence, there may be some potential for these species to be impacted by the Proposal.

Table 9
Evaluation of the likelihood of threatened and migratory biota occurring within the Study Area.

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
AVIFAUNA				
Australian Bustard *Ardeotis australis* E TSC	Mainly inhabits tussock and hummock grasslands and low shrublands; occasionally seen in pastoral and cropping country.	No	No	Possible
Australian Painted Snipe *Rostratula australis* E TSC V EPBC M EPBC	Inhabits inland and coastal shallow freshwater wetlands, occurring in both ephemeral and permanent wetlands with grass. Generally only seen as a single bird. The breeding wetland areas are the most sensitive to this species.	No	No	No
Australasian Bittern *Botaurus poiciloptilus* E TSC	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.).	No	No	No
Barking Owl *Ninox connivens* V TSC	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 ha, with 2000 ha being more typical in NSW habitats. In western NSW, this species is largely confined to riparian areas where suitable habitat also occurs.	No	Yes	Unlikely
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis* V TSC	This species occupies the upper levels of drier open forest or woodland dominated by Box and Ironbark especially Mugga Ironbark, White Box, Inland Grey Box and Forest Red Gum. Forests of smooth bark, stringybark, ironbark and tea trees are also known to be used. Their feeding territories can be	No	No	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	large, up to 5 ha in area			
Black-breasted Buzzard *Hamirostra melanosternon* V TSC	This species inhabits a range of inland habitats, especially along timbered watercourses but also hunts over grasslands. It is sparsely distributed in areas that have less than 500mm of rainfall, but avoids areas of desert.	No	No	No
Black-tailed Godwit *Limosa limosa* V TSC	This species is primarily coastal dwelling, usually in sheltered bays, estuaries and lagoons with intertidal mudflat/sandflat areas. Inland dwellers require mudflats also where they inhabit areas where water may be less than 10cm deep. Areas of muddy lakes and swamp are also used. The Black-tailed Godwit roosts and loafs on low banks of mud, shell and sandbars and is frequently recorded in a flock mixed with Bar-tailed Godwits.	No	No	No
Blue-billed Duck *Oxyura australis* V TSC	Prefers deep water in large permanent wetlands and swamps.	No	No	No
Brolga *Grus rubicunda* V TSC	The Brolga occurs in large open wetlands, grassy plains, coastal mudflats and irrigated croplands, with less frequent mangrove-studded creeks and estuaries.	No	Yes	Unlikely
Bush Stone Curlew *Burhinus grallarius* E TSC	Inhabits open forests and woodlands with complex microhabitat structure.	No	No	No
Cattle Egret *Ardea ibis* M EPBC	Found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock.	No	No	Unlikely
Chestnut Quail-thrush *Cinclosoma castanotus* V TSC	Occurs in a wide range of arid and semi-arid habitats often in mallee but usually with a dense understorey of shrubs or a spinifex as a ground layer.	No	No	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
Diamond Firetail *Stagonopleura guttata* V TSC	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	No	Yes	Possible
Freckled Duck *Stictonetta naevosa* V TSC	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	No	No	No
Fork-tailed Swift *Apus pacificus* M EPBC	The Fork-tailed Swift mostly occurs over inlands plains, but can sometimes be found in coastal areas. The species is found over dry and open habitats, including riparian woodlands and tea tress swamps, low scrub, heathland or saltmarsh.	No	No	Possible
Glossy Black-cockatoo *Calyptorhynchus lathami* V TSC	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur.	No	Yes	Unlikely
Gilbert's Whistler *Pachycephala inornata* V TSC	This species is widely recorded in Mallee shrublands and also box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum Forests. In the Mallee areas, an understorey of spinifex and low shrubs such as wattles, hakeas, senna and hopbushes are preferred. Its preferred foods are beetles, caterpillars, spiders and ants, occasionally seeds and fruit are eaten. Pairs are thought to defend territories year round and do not appear to venture far from their home area.	No	No	No
Great Egret *Ardea alba* M EPBC	Prefers shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	No	No	No
Grey-crowned Babbler (eastern	Inhabits open forests and woodlands, favouring inland plains with open shrub	Yes	Yes	Yes

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
subspecies) *Pomatostomus temporalis temporalis* V TSC	layer, little ground cover and plenty of fallen timber and leaf litter.			
Grey Falcon *Falco hypoleucos* E TSC	The Grey Falcon preys on other birds, mainly parrots and pigeon but are known to also eat reptiles and mammals. This species is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid areas, although they are sometimes found in open woodlands near the coast. Nest sites are usually high up in living Eucalypt trees near water.	No	Yes	Possible
Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata* V TSC	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	No	Yes	Possible
Latham's Snipe *Gallinago hardwickii* M EPBC	Latham's Snipe are seen in small groups or singly in freshwater wetlands generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. The species is also known to use crops and pasture.	No	No	No
Little Eagle *Hieraaetus morphnoides* V TSC	Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	No	Yes	Possible
Malleefowl *Leipoa ocellata* E TSC V EPBC M EPBC	Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and	No	Yes	Possible

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers.			
Masked Owl *Tyto novaehollandiae* V TSC	Pairs have a large home-range of 500 to 1000 ha. Lives in dry eucalypt forests and woodlands from sea level to 1100m. A forest owl, but often hunts along the edges of forests, including roadsides.	No	Yes	Possible
Painted Honeyeater *Grantiella picta* V TSC	Inhabits Myall, Brigalow, Box-Gum Woodlands and Box-ironbark Forests and is a specialist mistletoe feeder.	No	Yes	Possible
Painted Snipe *Rostratula benghalensis s. lat.* V EPBC M EPBC	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses lignum, low scrub or open timber.	No	No	No
Pied Honeyeater *Certhionyx variegatus* V TSC	This species occurs in areas of arid and semi-arid shrublands dominated by Emu-bush (*Eremophila* sp) and *Grevillea* sp. It also inhabits woodlands, sandhills and inland ranges and granite outcrops. Sometimes it is found in coastal areas of north-western WA.	No	Yes	Possible
Pink Cockatoo *Cacatua leadbeateri* V TSC	Wide range of treed and treeless inlands habitats, within easy reach of water. Nests in tree hollows with nests at least 1km apart with no more than one pair every 30 square kilometres.	Yes	Yes	Yes
Rainbow Bee-eater *Merops ornatus* M EPBC	Most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It can be found on farmlands and the species will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels.	Yes	Yes	Yes
Speckled Warbler *Pyrrholaemus saggitatus* V TSC	The Speckled Warbler lives in a wide range of Eucalyptus dominated woodland communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some Eucalypt regrowth and an open canopy. Large, relatively undisturbed woodland	No	No	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	remnants are required for the species to persist in an area.			
Spotted Harrier *Circus assimilis* V TSC	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland and grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	No	Yes	Possible
Square-tailed Kite *Lophoictinia isura* V TSC	Found in a variety of timbered habitats including woodlands and open forests with a particular preference for timbered watercourses.	No	No	No
Superb Parrot *Polytelis swainsonii* V TSC V EPBC	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box.	Yes	Yes	Yes
Turquoise Parrot *Neophema pulchella* V TSC	Prefer to live on the edge of woodland adjacent to clearings, timbered ridges or creeks in farmland areas. They feed in the shade of trees and spend the majority of their day on the ground searching for food.	No	Yes	Possible
Varied Sittella *Daphoenositta chrysoptera* V TSC	Found in forests and woodlands including mallee and acacia.	No	Yes	Possible
White-bellied Sea-Eagle *Haliaeetus leucogaster* M EPBC	Found in coastal areas and inland waterways where it hunts fish.	No	No	No
White-fronted Chat *Epthianura albifrons*	Usually found foraging on bare or grassy ground in wet areas.	No	Yes	Unlikely

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
V TSC				
White-throated Needletail *Hirundapus caudacutus* M EPBC	For a time it was commonly believed that this species did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity.	No	Yes	Possible
FISH				
Silver Perch *Bidyanus bidyanus* V FM CE EPBC	Prefers fast-flowing, open waters, especially where there are rapids and races, anywhere in the Murray Darling Basin.	No	No	No
Murray Cod *Maccullochella peeli* V EPBC	The Murray Cod has the ability to live in a diverse range of habitats, including clear rocky streams, to slow flowing, turbid rivers and billabongs.	No	Yes	No
MAMMALS				
Koala *Phascolarctos cinereus* V TSC	Inhabit eucalypt woodlands and forests. Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in area.	No	No	No
Brush-tailed Rock Wallaby *Petrogale penicillata* E TSC V EPBC	Found in continuous rocky outcrops throughout their range with foxes reducing habitat availability across their home.	No	Predicted to occur	No
Kultarr *Antechinomys laniger* E TSC	The Kultarr is mouse-sized and has long ears and a dark tuft of fur on the end of its tail. Occurring in arid and semi-arid areas of NSW, abundance of this species appears to be very low. Recent records have been primarily from Cobar and Brewarrina regions. This species is insectivorous and inhabits open country, especially claypans amongst *Acacia* woodlands. Population numbers appear to fluctuate in response to environmental stresses such as drought or flood. Fire	No	Yes	Possible

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
	destroys refuge and habitat which can be hollow logs or tree stumps, under bushes or deep cracks in the soil.			
Stripe-faced Dunnart *Sminthopsis macroura* V TSC	Occurs in native dry grasslands and low dry shrublands, often along drainage lines. During periods of hot weather they shelter in cracks in the soil, in grass tussocks or under rocks and logs	No	Yes	Unlikely
Spotted-tail Quoll *Dasyurus maculatus maculatus* V TSC E EPBC	The species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	No	No	No
Squirrel Glider *Petaurus norfolcensis* V TSC	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or *Acacia* midstorey.	No	No	No
South-eastern Long-eared Bat *Nyctophilus corbeni* V TSC V EPBC	The distribution of the south-eastern form of the Greater Long-eared Bat coincides with the area of the Murray Darling Basin with Pilliga Scrub regions being the most favoured area of habitation. This species roosts in tree hollows, crevices and under loose bark. As a slow flying agile species, it utilises the understorey to hunt for non-flying prey items such as caterpillars and beetles. They will also hunt on the ground. This species is more common where vegetation structure includes box/ironbark/cypress-pine in areas along the western slopes and plains of NSW and southern Queensland.	Yes (with application of the precautionary principle)	Yes	Yes
Little Pied Bat *Chalinolobus picatus* V TSC	Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	Yes	Yes	Yes
Inland Forest Bat *Vespadelus baverstocki*	Roosts in tree hollows and abandoned buildings. Known to roost in very small hollows in stunted trees only a few metres high.	Yes	Yes	Yes

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
V TSC				
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* V TSC	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	Yes	Yes	Yes
FROGS				
Sloane's Froglet *Crinia sloanei* V TSC	This species of amphibian is usually associated with areas of grasslands and woodlands on floodplains.	No	No	No
THREATENED ECOLOGICAL COMMUNITIES				
Artesian Springs Ecological Community E TSC E EPBC	These Artesian communities are restricted to the springs of the Great Artesian Basin in north-western NSW. Fault lines allow emergence of artesian water, which produces mounds of salt and sediment as the water evaporates. The vegetation surrounding these areas is frequently sedges or similar, however trees and shrubs may be adjacent to the spring.	No	No	No
Inland Grey Box Woodland in the Riverina; NSW South Western Slopes; Cobar Peneplain; Nandewar and Brigalow Belt South Bioregions EEC TSC E EPBC	*Eucalyptus macrocarpa* (Inland Grey Box) is often found in conjunction with *E. populnea subsp. bimbil, Callitris glaucophylla, Brachychiton populneus, Allocasuarina leuhmannii* or *E. melliodora* and sometimes *E. albens.* Typically, shrubs are sparse or absent and the groundcovers can be a variable mixture of grasses and herbs. This community generally exists as open woodland 15-25m tall, depending on past clearing and thinning practices.	No	Yes	No
Myall Woodland in the Darling Riverine Plains; Brigalow Belt South; Cobar Peneplain; Murray-Darling Depression; Riverina and NSW South Western Slopes bioregions	This community typically occurs on red-brown earths and heavy grey and brown alluvial soils with low average rainfall (375-500mm). The community structure varies from low woodland and low open woodland to low sparse woodland or open shrubland depending on the quality of the site and the history of disturbance on the site.	No	Yes	No

Common Name **Scientific Name** **Legal Status**	**Habitat**	**Recorded during survey**	**Recorded previously in locality**	**Likelihood of biota occurring within Study Area**
E TSC E EPBC				
FLORA				
A speargrass *Austrostipa metatoris* V TSC V EPBC	This perennial speargrass has a tussock habit and grows to around 1m. This species has a scattered distribution and is found in sandy areas including sandhills and ridges, undulating plains and flat open mallee country with red to red-brown clay-loam to sandy-loam soils. It is associated with a number of other species, including *Eucalyptus populnea, E. intertexta, Callitris glaucophylla, Casuarina cristata, Santalum acuminatum* and *Dodonaea viscosa*.	No	No	No, target flora surveys did not reveal the presence of this species despite numerous grasses being present.
Coolabah Bertya *Bertya opponens* V TSC V EPBC	Known from only four populations in NSW; one of which near Coolabah. Occurs in a range of habitats including stony mallee ridges and cypress forest.	No	Yes	No, target flora surveys did not reveal the presence of this species.
Cobar Greenhood *Pterostylis cobarensis* V TSC	This Greenhood Orchid inhabits mostly eucalypt woodland, open mallee or *Callitris* shrublands occurring on skeletal sandy-loam soils and low stony ridges and slopes. It is associated with species such as *Acacia doratoxylon*, *Senna* sp, *Casuarina cristata* and *Callitris glaucophylla*.	Yes	Yes	Yes
Pine Donkey Orchid *Diuris tricolor* V TSC V EPBC	The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris spp.*). It is found in sandy soils, either on flats or small rises.	No	Yes	No, given extensive searches at suitable time of year failed to detect the species.
Slender Darling-pea *Swainsona murrayana* V TSC V EPBC	The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions.	No	No	No

10 IMPACT ASSESSMENT

10.1 SIGNIFICANCE ASSESSMENTS (TSC ACT)

The EP&A Act includes in Section 5A, seven factors which are to be considered when determining if a proposed development or activity '*is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats'.* These seven factors must be taken into account by consent or determining authorities when considering a development proposal or development application. This enables a decision to be made as to whether there is likely to be a significant effect on the species and hence if a SIS is required (DECC 2007).

Table 9 found that 21 species listed under TSC Act were either known to, or have the potential to occur within the Study Area based on the evaluation completed. These were the:

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

The following section provides significance assessments for these entities.

Australian Bustard

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Australian Bustard is a large, ground-dwelling bird found on open plains across Australia (NPWS 1999a; OEH 2014b; Ziembicki 2010; Ziembicki 2007). It inhabits tussock and hummock grasslands but can also be found in low shrublands and low open grassy woodlands (Morcombe 2004; OEH 2014b). They nest on bare ground, usually in ecotones between grassland and protective shrubland cover (OEH 2014b). Australian Bustard are highly nomadic, dispersing over long distances in response to rainfall and climate. No Australian Bustard were recorded during the field surveys, nor have any been detected in surveys on adjoining land. The species has also not been recorded in the locality (see **Map 2**) but it could use the Study Area from time to time given its highly nomadic nature.

As detailed within **Table 7**, about 34 hectares of woodland would be directly impacted by the Proposal (approximately 1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority not impacted by the Proposal. This relatively minor impact suggests that the Study Area would continue to provide a range of potential habitats should the Australian Bustard occur from time to time given its highly nomadic lifestyle.

Given these factors, it is *unlikely* that the proposed activity could have an adverse effect on the life cycle of the Australian Bustard if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Australian Bustard is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Australian Bustard is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to about 1.8%.

ii) The location of the Proposed Disturbance Footprint and the highly mobile nature of the species suggest that no area of habitat of relevance to Australian Bustard would become fragmented or isolated from other areas of habitat.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area, adjoining land despite extensive field surveys or in the locality (given the absence of records).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Australian Bustard.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for the Australian Bustard. The Proposal is consistent with several priority actions listed for this species. These being feral animal control and weed control.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Australian Bustard. This is the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Australian Bustard provided the amelioration measures detailed within Chapter 8 are implemented.

Diamond Firetail

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South-western Slopes and the North-west Plains and Riverina (OEH 2014b; Reid 1999). They are considered relatively sedentary, however, many populations are known to disperse, especially during drought periods. They are known to build bottle-shaped nests in trees and bushes and preferentially choose mistletoe as a nest site (Cooney and Watson 2005; Cooney *et al.* 2006). It has declined in numbers in many areas and has disappeared from parts of its former range with the species being identified as a 'decliner' in a past review of bird species' status in the NSW sheep-wheatbelt (Reid 1999). No Diamond Firetail was recorded during the comprehensive field surveys during this study or during studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995) suggesting the Study Area is of little, if any importance to this species.

The Proposal would result in the removal of vegetation that has the potential to provide habitat for Diamond Firetail, although a paucity of mistletoe dramatically reduces the potential for breeding. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) and 1,802 hectares would be unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Diamond Firetail if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 of this report are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Diamond Firetail is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Diamond Firetail is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Diamond Firetail, the Proposal would remove about 34 hectares of potential habitat (not known). This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only about 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) No area of occupancy has been detected within the Study Area or on adjoining land despite extensive field surveys which suggests that the habitat is of little, if any importance to the long-term survival of this species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Diamond Firetail.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for Diamond Firetail. The Proposal is consistent with several priority actions listed for this species. These being habitat rehabilitation with fallen timber and that the majority of the Proposal would be conducted within previously cleared land.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Diamond Firetail. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation (which equate to approximately 97% of the Study

Area). In addition, quantities of dead wood that would be removed would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Diamond Firetail provided the amelioration measures detailed within Chapter 8 are fully implemented.

Grey-crowned Babbler

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Grey-crowned Babbler is found on the western slopes of the Great Dividing Range as well as a number of locations in the Hunter Valley where it inhabits woodlands in family groups of up to fifteen individuals (King 1980; OEH 2014b; PB 2005; Robinson 2006). However, groups as large as twenty birds have been recorded in the Hermidale area (EnviroKey 2010c). Family groups, known as 'troupes', maintain territories that can range from as little as one but up to fifty hectares depending on the size of the troupe and the quality of habitat resource present (King 1980). Home ranges are defended all year round, where disputes with neighbouring groups are frequent. Grey-crowned Babblers are particularly widespread in the locality and are commonly detected in the majority of woodland remnants (EnviroKey 2010c). The species is known from adjoining land with a recent study detecting numerous family groups to the south of the Study Area (EnviroKey 2011c). Grey-crowned Babbler were recorded on numerous occasions in the north-west and west of the Study Area, well clear of the Proposed Disturbance Footprint suggesting that no home ranges would be affected by the Proposal.

Nonetheless, loss of habitat is regarded as a key threat to this species. However, Grey-crowned Babbler are known to exist within small home ranges heavily impacted by past clearing events. Recent surveys in the Hermidale area revealed the presence of a troupe within a 1 ha patch of Mulga where an active nest with chicks was recorded (EnviroKey 2010c). That home range had been isolated by past clearing of more than 50 ha of woodland several years prior which had surrounded the remaining patch. At least eight Grey-crowned Babbler were observed bringing food items to an active nest by regularly traversing log piles (the result of clearing) to forage wider than their remaining patch. Further, Grey-crowned Babbler is frequently recorded foraging and breeding near the offices of the Girilambone Copper Mine (just to the south of the Proposal). It is these observations that lead to the

suggestion that Grey-crowned Babbler are, to some degree, resilient to the impacts of habitat loss and habitat fragmentation provided connectivity to other habitats remain.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with only 1.8% directly affected by the Proposal. The location of the Proposal suggests that habitat connectivity would remain high across the Study Area.

While the proposal would result in the removal of vegetation that has the potential to provide habitat for Grey-crowned Babbler in the future and with consideration of the above factors, the known areas of occupancy are well distant of the Proposed Disturbance Footprint. Given this, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Grey-crowned Babbler, such that a viable 'local population' of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are fully implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Grey-crowned Babbler is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Grey-crowned Babbler is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Grey-crowned Babbler, the proposed activity would remove about 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that the area of occupancy is well distant of the Proposed Disturbance Footprint.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Grey-crowned Babbler.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for Grey-crowned Babbler. There are a number of priority actions that have been identified to assist in the recovery of this species. The Proposal is consistent with several priority actions including avoiding impacts to home ranges and high quality habitats.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Grey-crowned Babbler. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Grey-crowned Babbler provided the amelioration measures detailed within Chapter 8 are fully implemented.

Grey Falcon

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Grey Falcon is thought to be sparsely distributed in NSW predominantly within the Murray Darling Basin where it is generally restricted to arid shrublands, grasslands and tree-lined watercourses. Like other falcons, it uses disused nests of other raptors and ravens to nest within, usually in late Winter or early Spring. While not detected during this study or previous studies on adjoining land, a single bird is known from the locality with a record "just west of the Wilga Downs Homestead" near Tritton Copper Mine (CES 1998).

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) and with consideration that 1,802 hectares would be retained and the highly mobile nature of the species, this is negligible.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Grey Falcon if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Grey Falcon is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Grey Falcon is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of potential habitat (not known). This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint and the highly mobile nature of Grey Falcon suggest that no area of habitat would become fragmented or isolated from other areas of habitat.

iii) The habitats affected by the Proposal are unlikely to be of importance to the long-term survival of Grey Falcon given the highly mobile and nomadic nature of the species and the absence of any breeding sites.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Grey Falcon.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for Grey Falcon. The Proposal is consistent with priority actions identified for Grey Falcon including the avoidance of riparian areas and the extensive surveys conducted for birds and nest locations across the area to date.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposal – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Grey Falcon. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be

removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (2%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Grey Falcon provided the amelioration measures detailed within Chapter 8 are fully implemented.

Hooded Robin

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Hooded Robin is known from lightly wooded habitats such as eucalypt woodlands and mallee shrublands (OEH 2014b) and is regularly recorded on the Cobar Peneplain (Sass 2009b). First recognised as a declining woodland bird (Reid 1999), Hooded Robin is now listed as Vulnerable under the TSC Act. It is generally considered that the species requires a structurally diverse habitat including microhabitat such as native grasses, shrubs and fallen timber across a territory a breeding territory of around 10 hectares. Watson *et al.* (2001) believe that the species generally exhibits demanding requirements for both habitat complexity and area (>100ha) which characterise the Study Area. Despite extensive field survey, no Hooded Robin were recorded, nor have previous studies on adjoining land suggesting the habitat present is of little, if any, importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) unaffected by the Proposal.

With consideration of these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Hooded Robin such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the

endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Hooded Robin is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Hooded Robin is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Hooded Robin, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only about 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Hooded Robin.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for the Hooded Robin. The Proposal is consistent with a number of priority actions identified for this species given that only 1.8% of the Study Area would be directly impacted.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Hooded Robin. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Hooded Robin provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Little Eagle</u>

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Little Eagle is found across mainland Australia except in densely forested areas. They nest in tall, living trees, where a large stick nest is built. No Little Eagle were recorded during the extensive field survey or during previous surveys on adjoining land. Additionally, no past or current nesting site was recorded, suggesting the habitat present is of little, if any, importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority not impacted by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Little Eagle if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Little Eagle is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Little Eagle is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the size of the Study Area (approximately 1,836 ha) equating to only 1.8% resulting in the retention of 1,802 hectares.

ii) The location of the Proposed Disturbance Footprint and the mobile nature of Little Eagle suggest that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Little Eagle.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for the Little Eagle. The Proposal is likely to be consistent with a number of priority actions identified for this species given that only 1.8% of the Study Area would be directly impacted.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the proposed activity and Little Eagle. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Little Eagle provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Malleefowl</u>

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Malleefowl is a large, ground dwelling bird that primarily occurs in mallee across southern Australia but is also known to inhabit eucalypt woodlands and acacia shrublands that provide some refuge in the form of dense shrubby understory (Benshemesh 2007; NPWS 1999b; Priddel and Wheeler 1999). Malleefowl vary in the size of their home range which is likely influenced by the level of resource available for them to exploit. These range between 50 and 500 hectares in area. Malleefowl incubate eggs in large mounds that are comprised of large volumes of sandy soil and leaf litter. Males continually add leaf litter to these mounds as the decomposition provides moisture and heat required for successful egg incubation. No Malleefowl or signs of past or current mound building activity were recorded during the extensive field survey. This is consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995).

Only a single record is known from within the locality (CES 1998), which given the widespread clearing and agricultural activity that has occurred over many decades and the presence of feral animals such as foxes and pigs, infers that the locality and indeed the Study Area, is likely to be of little, if any, importance to Malleefowl.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area); none of which comprise of Mallee habitats which are apparently preferred by this species. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) not affected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Malleefowl if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the recommendations within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Malleefowl is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(iii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(iv) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Malleefowl is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of potential (not known) habitat. However, this is marginal at best given that it is woodland, not mallee. Areas of mallee that are present are well distant of the Proposed Disturbance Footprint and would not be affected by the Proposal. This impact is also minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint and the mobile and migratory nature of Malleefowl suggest that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy (individuals or mounds) has been detected within the Study Area or surrounds despite extensive field surveys. Further, mallee (preferred habitat) is well distant of the Proposal. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Malleefowl.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A national recovery plan is currently in place for the Malleefowl (Benshemesh 2007). The Proposal is consistent with the actions with that plan given that it avoids areas of habitat known to support Malleefowl and supports feral animal control.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Malleefowl. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be

removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (2.7%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Malleefowl provided the amelioration measures detailed within Chapter 8 are fully implemented.

Masked Owl

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Masked Owl is widely but sparsely distributed over much of Australia in a range of forest and woodland habitats (Debus 2009; Kavanagh 1996; 2002; Kavanagh and Bamkin 1995; Kavanagh and Murray 1996; Kavanagh and Stanton 1998; 2005; Loyn *et al.* 2001; Parker *et al.* 2007). It is considered to be principally a bird of forest margins, although it has been found within large forest stands, and in sparsely treed areas. The main prey appears to be terrestrial mammals up to the size of a rabbit or potoroo, but it also takes arboreal prey up to common ringtail possum size and birds. The species is currently listed as Vulnerable under the TSC Act. No Masked Owl were recorded during the extensive field survey or during previous surveys on adjoining land suggesting the habitat present is of little, if any, importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) not affected by the Proposal. Masked Owl are known to occupy large home ranges (>1,000 ha) and in the context of the Proposal, the loss of potential (not known) habitat is considered negligible.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Masked Owl if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the

endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Masked Owl is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Masked Owl is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and the large home ranges of this species.

ii) The location of the Proposed Disturbance Footprint and the large home ranges of Masked Owl suggest that no area of habitat would become fragmented or isolated from other areas of habitat, should they occur in the Study Area from time to time.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Masked Owl.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A final recovery plan is in place for Masked Owl (DECC 2006). The Proposal is consistent with this recovery plan in that it would be undertaken outside of a known home range of the species (extensive surveys have failed to reveal the presence of Masked Owl), and would be undertaken outside of high quality habitats.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Masked Owl. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

No hollow-bearing trees provided evidence current or past use such as 'whitewash'. Further, hollows are scarce throughout the Study Area, and those present, are small and unsuitable for Masked Owl.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Masked Owl provided the amelioration measures detailed within Chapter 8 are fully implemented.

Painted Honeyeater

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Painted Honeyeater is a highly nomadic species that lives in Boree, Brigalow, Box-Gum Woodlands and Box-Ironbark Woodlands at low densities throughout its range. Its primary food is the fruit of mistletoes though it will also take some nectar and insects (Oliver *et al.* 2003; Oliver *et al.* 1998). Its distribution is dictated by distribution of mistletoes, which are largely

restricted to older trees, and the seasonality of their fruiting. Despite extensive field survey, no Painted Honeyeater were recorded, nor have previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995)suggesting the habitat present is of little, if any, importance to this species particularly given the paucity of mistletoe.

The Proposal would result in the removal of habitat that has the potential to provide foraging habitat for Painted Honeyeater, although a paucity of mistletoe dramatically reduces this potential. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Painted Honeyeater if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Painted Honeyeater is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Painted Honeyeater is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Painted Honeyeater, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and negligible given the highly nomadic nature of this species.

ii) The location of the Proposed Disturbance Footprint and the nomadism of the species suggest that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys and the paucity of mistletoe. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Painted Honeyeater.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for the Painted Honeyeater.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Painted Honeyeater. This being the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Painted Honeyeater provided the amelioration measures detailed within Chapter 8 are fully implemented.

Pied Honeyeater

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Pied Honeyeater is a widespread species found throughout a variety of vegetation communities across arid and semi-arid regions of NSW with numerous records from across the Cobar Peneplain. Pied Honeyeater are considered highly nomadic and follow the erratic flowering of shrubs where they feed on nectar but also eating saltbush fruits, berries, seeds and insects. As with other semi-arid honeyeaters (Mac Nally and Watson 1997; Oliver *et al.* 2003; Oliver *et al.* 1998; Watson 1997; 2002; Yan 1993), Pied Honeyeaters also rely heavily on mistletoe. Despite extensive field survey, no Pied Honeyeater were recorded, nor have previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995)suggesting the habitat present is of little, if any, importance to this species particularly given the paucity of mistletoe.

The Proposal would result in the removal of habitat that has the potential to provide foraging habitat for Painted Honeyeater, although a paucity of mistletoe dramatically reduces this potential. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Pied Honeyeater such that a viable local population of the species, if one was present, is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Pied Honeyeater is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Pied Honeyeater is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Pied Honeyeater, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and negligible given the highly nomadic nature of this species.

ii) The location of the Proposed Disturbance Footprint and the nomadism of the species suggest that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local, or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys and the paucity of mistletoe. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Pied Honeyeater.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for the Pied Honeyeater.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Pied Honeyeater. This being the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Pied Honeyeater provided the amelioration measures detailed within Chapter 8 are fully implemented.

Pink Cockatoo

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Pink Cockatoo is found in arid and semi-arid zone woodlands dominated by mulga, mallee and box eucalypts, cypress pine or Belah where it feeds primarily on seeds, roots and fruits. Breeding pairs occupy nests at least 1 km apart with densities of about one pair per 30 km^2 recorded (OEH 2014b). One pair of Pink Cockatoo were recorded on a single occasion during the extensive field survey (**Map 6**). Two birds were observed feeding on native grasses before flying south. Of specific relevance to understanding the dynamics of these birds, a 2011 study on adjoining land suggested that a pair of Pink Cockatoo was likely to have a nest site on that site given daily and frequent observations, and that this species is known to exhibit strong fidelity to nesting locations (EnviroKey 2011c). That study, however, did not identify the nesting location. Given this, there is some possibility that the pair of Pink Cockatoo could nest within the Study Area. However, extensive field survey with at least four personnel across the Study Area over a period of 8 days (32-person days), did not reveal any further observations of this species. The single record from this field survey confirms that the Study Area provides a portion of a home range, but with consideration of previous results (EnviroKey 2011c), this pair is likely to be nesting outside of the Study Area on adjoining land. The paucity of hollow-bearing trees with large hollows provides further evidence that this pair do not nest within the Study Area.

Notwithstanding, the Proposal would result in the removal of known foraging habitat for Pink Cockatoo. As detailed within **Error! Reference source not found.**, 34 hectares of woodland would e directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Pink Cockatoo such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Pink Cockatoo is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Pink Cockatoo is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of woodland habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% of the Study Area.

ii) The location of the Proposed Disturbance Footprint and the mobile nature of the Pink Cockatoo suggests that no area of habitat would become fragmented or isolated from other areas of habitat, particularly given the apparent fidelity to adjoining land to the south as detailed.

iii) The habitats affected by the Proposal are unlikely to be of importance to the long-term survival of this species given that the pair recorded during the field survey are likely to be nesting on adjoining land in the south (EnviroKey 2011c). Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Pink Cockatoo.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for the Pink Cockatoo. The Proposal is consistent with a number of priority actions including the protection of nesting sites (located outside of the Study Area) and the control of feral animals such as goats and rabbits.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal

and Pink Cockatoo. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

No hollow-bearing trees provided evidence current or past use such as 'whitewash'. Further, hollows are scarce throughout the Study Area, and those present, are small and unsuitable for Pink Cockatoo.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Pink Cockatoo provided the amelioration measures detailed within Chapter 8 are fully implemented.

Spotted Harrier

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Spotted Harrier occurs in open woodland and grassland habitats across mainland Australia (Morcombe 2004; OEH 2014b). It builds a stick nest in a live trees and breeds in Spring, occasionally Autumn. Despite the extensive field surveys, no Spotted Harrier were recorded or signs of their nesting, which is also consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995). This would suggest the habitat present is of little, if any, importance to this species.

The Proposal would result in the removal of vegetation that has the potential to provide habitat for Spotted Harrier. As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority not impacted by the Proposal ensuring that large areas of potential habitat are maintained. Additionally, no known area of occupied habitat would be removed.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Spotted Harrier if they were present, such that a viable local population of the

species is likely to be placed at risk of extinction provided the recommendations within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Spotted Harrier is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Spotted Harrier is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and negligible given the mobile nature of this species.

ii) The location of the Proposed Disturbance Footprint and the semi-mobile nature of the Spotted Harrier suggest that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Spotted Harrier.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for Spotted Harrier nor have any priority actions identified.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Spotted Harrier. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Spotted Harrier provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Superb Parrot</u>

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Superb Parrots are known to nest in box-gum woodland, riparian woodland and isolated paddock trees, where they may travel as far as 10 kilometre to suitable foraging habitat (CSU 2006; OEH 2014b). In the south-west slopes, their core breeding habitat has been identified as roughly bordered by the towns of Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Other known breeding sites are located within the

corridors of the Murrumbidgee, Murray and Edward Rivers. Migration of these populations occurs at the end of the breeding season, when birds move north toward the Upper Namoi and Gwydir River regions.

Superb Parrot was particularly common throughout the March field survey being recorded on 21 separate occasions with flock size being up to 12 birds (see **Table 5**). This species was regularly observed feeding within the Study Area. All observations were made prior to 1300hrs on any day and when birds were observed flying through the Study Area, most movements were from the north to north-east through to the south-west with these birds perhaps feeding elsewhere in the locality. Two individuals were observed in the October 2012 survey which is considered unusual given that Superb Parrot migrate back to their breeding grounds in the South-west Slopes, Murrumbidgee and Murray regions (BakerDabb 2011). However, both were juveniles which may explain their absence from the breeding migration.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the proposed activity (1.8% of the Study Area), Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal allowing Superb Parrot continued access to foraging habitat during their winter migration given their highly mobile nature. Further, Superb Parrot is seemingly unaffected by human and vehicular activities, and is regularly recorded at Tritton Copper Mine and foraging on roadsides for spilt grain.

Given these factors and the highly mobile nature of the species, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of Superb Parrot such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Superb Parrot is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Superb Parrot is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Superb Parrot, the Proposal would remove 34 hectares of foraging habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8% and the nomadism of the species.

ii) The location of the Proposed Disturbance Footprint and the highly mobile nature of Superb Parrot suggest that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) The habitats affected by the Proposal are unlikely to be of importance to the long-term survival of this species given its migratory nature. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal with as much as 1,802 hectares remaining unaffected.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Superb Parrot.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A national recovery plan has been prepared for the Superb Parrot(BakerDabb 2011). The Proposal is consistent with this plan as it would be undertaken in a region where the species does not breed and therefore, would not affect core breeding habitat. In addition, the Proposal would directly affect a small proportion (1.8%) of the Study Area. The remainder would continue to provide foraging habitat.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP is relevant to the Proposal and Superb Parrot. This being the *Clearing of native vegetation.*

The ‘clearing of native vegetation’ is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%)

of the total Study Area with the majority of woodland within and adjoining being unaffected. This is negligible given the highly nomadic nature of this species.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Superb Parrot provided the amelioration measures detailed within Chapter 8 are fully implemented.

Turquoise Parrot

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Turquoise Parrot occurs from southern Queensland through to northern Victoria where it is known from woodland and riparian habitats particularly those with a grassy or shrubby understorey (OEH 2014b). The species is often seen at the ecotone between woodland and open farmland, along timbered ridges and watercourses. Despite the extensive field surveys, no Turquoise Parrot were recorded. This is also consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995). While numerous ecotones exist through natural clearings, no timber ridges or watercourses are present within the Study Area.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal.

With consideration of these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the species if they were present, such that a viable local population of the species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Turquoise Parrot is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Turquoise Parrot is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Turquoise Parrot, the Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%. No known area of occupancy would be directly impacted.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local, or landscape level.

iii) No area of occupancy has been detected within the Study Area despite extensive field surveys which suggests that the habitat is of little, if any importance to the long-term survival of this species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Turquoise Parrot.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan for the Turquoise Parrot. The Proposal is consistent with several priority actions listed for this species. These being feral animal control, weed control and the retention HBT where possible.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity — mining activity - is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Turquoise Parrot. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

A number of HBT are likely to be removed by the Proposal. Based on calculations detailed in section 7.1.3, it is likely that about 38 HBT containing 81 hollows would be removed as a result of the Proposal. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Turquoise Parrot provided the amelioration measures detailed within Chapter 8 are fully implemented.

Varied Sittella

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Barrett *et al.* 2007; Ford *et al.* 2001). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.

The species was listed as Vulnerable under the TSC Act after long being recognised as a declining woodland bird (Reid 1999). No Varied Sittella were recorded during the comprehensive field surveys during this study or during studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995) suggesting the Study Area is of little, if any importance to this species.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal. Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal. The removal of 1.8% of the Study Area is considered negligible.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Varied Sittella such that a viable local population of the species, if one were present, is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Varied Sittella is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Varied Sittella is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Of relevance to the Varied Sittella, the Proposal would remove 34 hectares of potential habitat (not known). This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) No area of occupancy has been detected within the Study Area or on adjoining land despite extensive field surveys which suggests that the habitat is of little, if any importance to the long-term survival of this species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Varied Sittella.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

At the time of writing, there is no recovery or threat abatement plan or any priority actions identified for the Varied Sittella.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Varied Sittella. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Varied Sittella provided the amelioration measures detailed within Chapter 8 are fully implemented.

Kultarr

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Kultarr was originally distributed in the arid and semi-arid zones of Australia. It has declined regionally in NSW, Queensland and South Australia and is thought to be extinct in the southern part of its range in southern NSW, Victoria and south-eastern South Australia. The species is rare over most of its geographic range and populations appear to fluctuate seasonally (Dickman *et al.* 1993; Dickman *et al.* 2001; NPWS 2002). In NSW, regular records come from near Bourke on the Darling Floodplain, in the Gunderbooka region and around Cobar.

The species inhabits a variety of sparsely vegetated, arid to semi-arid plains on stony, sandy and clayey soils. Its preferred habitats are less disturbed areas, open scrub and mallee woodland, acacia woodlands and shrublands and hummock grasslands with sparse ground cover. Kultarrs are nocturnal and spend the day sheltering in hollow logs or tree stumps, beneath saltbush and spinifex tussocks, soil cracks and in the burrows of other animals including trapdoor spiders, hopping mice, goannas and dragons. Kultarrs are able to enter torpor spontaneously which enables them to conserve energy and water. This ability is also correlated with an extended life span and thus is likely to be an important survival mechanism in arid environments.

Threats to survival for this species include fire which removes refuge sites such as hollow logs and tree stumps. On a larger scale, the alteration of fire regimes since European colonisation has increased the occurrence of infrequent, large-scale fires. Local refuges from which species can recolonise adjoining areas are less likely to persist under such conditions, thereby reducing the survival of populations within isolated areas. Land degradation through cattle grazing does not appear to result in complete removal of the Kultarr from affected areas however less disturbed country is usually preferred. Overstocking of cattle causes considerable destruction of the vegetation and soil structure (e.g. collapse of deep soil cracks), which reduces the availability of shelter sites for this species. Flooding can also eliminate populations locally through drowning or through starvation (as the flooding would also affect food supplies). Recolonisation of such areas is hindered or prevented if populations are isolated. Predation by cats, owls, and foxes is also likely to have an effect on the species.

Despite extensive surveys, no Kultarr were recorded within the Study Area. This is also consistent with previous studies on adjoining land (EnviroKey 2011c; RWC 1990; 1995). Predation by foxes and cats is likely to be occurring, whilst introduced herbivores would continue to contribute to declines in habitat quality. With these threatening processes continuing, any local population of this species (should one exist) is likely to be under a certain level of population stress. Feral animal control is considered vital for the continued survival of Kultarr in the wider locality should it still occur and is recommended within Chapter 8.

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, the Study Area is large in area (approximately 1,836 hectares) with the majority (1,802 hectares) remaining unaffected by the Proposal. This relatively minor impact suggests that the Study Area would continue to provide a range of potential woodland should Kultarr persist.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of the Kultarr such that a viable local population of the species, should one exist, is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Kultarr is not listed as an endangered population. It is listed as Endangered under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Kultarr is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of potential (not known) habitat. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of potential habitat at a local or landscape level.

iii) The habitat affected by the Proposal is unlikely to be of importance to the long-term survival of this species given that no area of occupancy has been detected within the Study Area or adjoining land despite extensive field surveys. Notwithstanding, only 1.8% of the Study Area would be impacted by the Proposal. The continued presence of feral animals such as

foxes, pigs, rabbits and goats, is likely to compromise these habitats further and amelioration measures detailed in Chapter 8 provide a framework to improve habitats in the long-term.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for Kultarr.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A final recovery plan for the Kultarr was prepared in 2002 (NPWS 2002). The Proposal is consistent with the actions within this plan in that extensive surveys have been conducted to date in an attempt to establish the status of Kultarr in the Study Area and adjoining land.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and Kultarr. These are the *Removal of dead wood and dead trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on Kultarr provided the amelioration measures detailed within Chapter 8 are fully implemented.

Microchiropteran Bats (Little Pied Bat, Inland Forest Bat, South-eastern Long-eared Bat, Yellow-bellied Sheathtail Bat)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Yellow-bellied Sheathtail Bat and Little Pied Bat are known to use derelict mine shafts for roosting and maternity purposes (NPWS 2001b) while the South-eastern Long-eared Bat and Inland Forest Bat use tree hollows, crevices and loose bark for roosting (OEH 2014b). The Little Pied Bat will use also utilise tree hollows and crevices (Churchill 2008).

Little Pied Bat and Yellow-bellied Sheathtail Bat were recorded during the field survey by Anabat analysis of echolocation calls. Files of a species from the *Nyctophilus* genus were also recorded during the field survey. As files from this genus cannot be identified to species level using echolocation calls, we have assumed it to be the single threatened species (South-eastern Long-eared Bat (*Nyctophilus corbeni*) (formerly *N.timoriensis*) that exists within the larger genus by application of the precautionary principle.

Combined, the Little Pied Batand Yellow-bellied Sheathtail Bat comprise almost 40% of the files recorded suggesting that both threatened species formed a major component of the microchiropteran bat biota during the field survey. Similarly, Yellow-bellied Sheathtail Bat was the most common microchiropteran bat species recorded on adjoining land (EnviroKey 2011c). In addition, these four species are regularly detected during biodiversity surveys in the wider locality (CSU-JCEC 2006b; EnviroKey 2010a; c)

Microbats are regarded as highly mobile fauna, extending their foraging ranges over tens of kilometres from their roosting site and are unlikely to rely on a single location for foraging (Pavey and Burwell 2004; Pennay and Freeman 2005). While HBT were scarce across the Study Area, those present had small openings and cracks, which provide potential suitable roosts sites for microchiropteran bats.

Given that the Proposal would result in the direct impacts to a minimal 1.8% of the Study Area, impacts to microchiropteran bats are likely to be associated with the removal of HBT or their non-relocation during the clearing process. Should it be necessary to remove any HBT during the Proposal, guidelines provided in **Appendix 6** should be implemented to minimise potential risks to an acceptable and manageable level.

Given these factors, it is *unlikely* that the Proposal could have an adverse effect on the life cycle of these species, such that a viable local population of these species is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

None of these species are listed as an endangered population. They are all listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

None of these species are listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The Proposal would remove 34 hectares of woodland. This impact is minimal in the context of the Study Area (approximately 1,836 hectares) equating to only 1.8%. A number of HBT are likely to be removed by the Proposal. Based on calculations detailed in section 7.1.3, it is likely that about 38 HBT containing 81 hollows would be removed. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat at a local or landscape level.

iii) Foraging habitat is not limited across the Study Area. This is evidenced by the large extent of woodland that comprises the Study Area (approximately 1,836 hectares) and surrounding land across the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for any of the microchiropteran bats considered within this assessment.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan or threatened abatement plan has been prepared for any of the microchiropteran bats that are the subject of this assessment. However, the Proposal is consistent with many of the priority actions identified for these species including the retention of HBT where possible and large areas of potential foraging habitat.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, a number of other KTP are relevant to the Proposal and the microchiropteran bat species the subject of this assessment. These are the *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Clearing of native vegetation.*

The 'removal of dead wood and dead trees' includes the removal of fallen branches and litter as general tidying up and the removal of standing dead trees. Dead wood and dead trees provide essential habitat for a wide variety of native animals. While some dead wood may be removed for the Proposal, no dead wood, fallen timber or other ground vegetation would be removed from areas of retained vegetation. In addition, quantities of dead wood would also be used to enhance areas of retained vegetation.

A number of HBT may be removed by the Proposal. Based on calculations detailed in section 7.1.3, it is likely that about 38 HBT containing 81 hollows would be removed as a result of the Proposal. Using this same extrapolation, as many as 2,085 HBT containing 4,461 hollows may occur across the Study Area. The Proposal would result in the removal of less than 2% of the HBT potentially present.

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected.

With these considerations, it is unlikely that the Proposal would increase the impact of any KTP.

Conclusion

With consideration of all seven factors, the Proposal is '*unlikely'* to have a significant effect on microchiropteran bats provided the amelioration measures detailed within Chapter 8 are fully implemented.

<u>Cobar Greenhood Orchid</u>

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Cobar Greenhood Orchid grows in Cypress woodlands on low stony ridges and slopes in skeletal soils (OEH 2014b). The species is known to occur in very localised populations and was recorded within Biometric Vegetation Community Benson ID 72 in the north-west of the Study Area during target surveys (**Map 5**).

As detailed within **Table 7**, 34 hectares of woodland would be directly impacted by the Proposal (1.8% of the Study Area). Despite this loss, no areas of known habitat occupancy of

Cobar Greenhood Orchid would be affected by the Proposal. The known area of occupancy is well distant of the Proposed Disturbance Footprint. Further, the Study Area is large in area (approximately 1,836 hectares) with the majority of woodland (1,802 hectares) remaining unaffected by the Proposal. This relatively minor impact suggests that the Study Area would continue to provide a range of potential habitats should additional cohorts of this orchid occur. This is considered unlikely given the extensive target surveys completed to date have only revealed the one site.

With consideration of these factors, it is *unlikely* that the proposed activity could have an adverse effect on the life cycle of these species, such that a viable local population of the Pine Donkey Orchid if one were present is likely to be placed at risk of extinction provided the amelioration measures within Chapter 8 are implemented.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The Cobar Greenhood Orchid is not listed as an endangered population. It is listed as Vulnerable under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(iii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(iv) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Cobar Greenhood Orchid is not listed as an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(iv) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(v) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(vi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The proposed activity would remove 34 hectares of woodland; none of which supports any individual Cobar Greenhood Orchids. No known area of occupied habitat would be affected by the Proposal.

ii) The location of the Proposed Disturbance Footprint suggests that no area of habitat would become fragmented or isolated from other areas of habitat.

iii) Extensive target surveys during an appropriate time of the year for detection have revealed the presence of only one cohort of this species within the Study Area. The Proposed Disturbance Footprint is well distant of this location, and as revealed by these surveys, no Cobar Greenhood Orchid are present within that footprint. The retention of 1,802 hectares (97% of the Study Area) allows for ample opportunity for this species to occur throughout the remainder of the Study Area, should it occur there in the future. Nonetheless, the area of known habitat that is assumed to be of greatest importance to the long-term survival of this species would not be removed, fragmented or isolated by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

At the time of writing, there is no critical habitat as listed by the TSC Act for the Cobar Greenhood Orchid.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan or threatened abatement plan has been prepared for the Cobar Greenhood Orchid. However, the Proposal is consistent with many of the priority actions identified for this species including avoidance of known areas of occupancy and the appropriate management of feral animals and noxious weeds.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Whilst the proposed activity – mining activity – is not recognised as a key threatening process (KTP) under schedule 3 of the TSC Act, one KTP are relevant to the Proposal and Pine Cobar Greenhood Orchid. That is the *Clearing of native vegetation.*

The 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biodiversity. Clearing any area of native vegetation, may lead to significant impacts on biological diversity such as habitat fragmentation leading to limited gene flow between small isolated populations, which may lead to a reduction in the potential for biodiversity to adapt to environmental change. The Proposal would result in the removal of a small proportion (1.8%) of the total Study Area with the majority of woodland within and adjoining being unaffected. However, the known location of Cobar Greenhood Orchid present within the Study Area, is well distant of the Proposed Disturbance Footprint and would not be directly or indirectly impacted by the Proposal.

Conclusion

With consideration of all seven factors, the proposed activity is '*unlikely'* to have a significant effect on Cobar Greenhood Orchid provided the amelioration measures detailed within Chapter 8 are fully implemented.

10.2 SIGNIFICANCE ASSESSMENTS (EPBC ACT)

10.2.1 Threatened Species

The Study Area contains potential habitat for three species listed as threatened under the EPBC Act, the Malleefowl (Vulnerable), Superb Parrot (Vulnerable) and South-eastern Long-eared Bat (Vulnerable) (also assessed under the TSC Act in section 10.1). The following section provides significance assessments for these entities.

Malleefowl

Will the action lead to a long-term decrease in the size of an important population of a species?

No. Field surveys to date across the Study Area and on adjoining land have failed to detect Malleefowl, or signs of their past or current presence by an absence of breeding mounds. No mallee habitat is present within or directly adjacent to the Proposed Disturbance Footprint, and given the apparent preference of that habitat and non-detection of the species, the Study Area is considered unlikely to support an 'important population' of this species. As such, it is unlikely that the proposed action could result in a long-term decrease in the size of an important population of Malleefowl.

Will the action reduce the area of occupancy of an important population?

No. The Study Area does not support a population, let alone an important population. The presence of feral animals such as foxes, pigs and goats, degrades the existing environment. The Proposal would result in the removal of 34 hectares of woodland none of which supports any Mallee vegetation communities (a preferred habitat of the Malleefowl). Given this, the proposed action would not reduce an area of occupancy for an important population.

Will the action fragment an existing population into two or more populations?

No population (should they occur there) would be fragmented into two or more populations by the Proposal given the mobility of Malleefowl and that only 1.8% of the Study Area would be directly impacted by the action.

Will the action adversely affect habitat critical to the survival of a species?

No. About 34 hectares of Benson ID 103 would be removed. This vegetation community is relatively widespread in the region .

Will the action disrupt the breeding cycle of an important population?

No. As detailed above, no important population occurs within the Study Area, therefore, it is considered unlikely that the proposed action would disrupt the breeding cycle of an 'important population'.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. The proposed action would remove approximately 34 hectares of woodland. However, Malleefowl are highly mobile in nature, widely foraging over tens of kilometres. It is unlikely that the removal of only 1.8% of the Study Area would cause the species to decline. Regardless, the existing environment is unlikely to support a population of this species.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action may increase the abundance of weeds in the area and their spread should be managed via an appropriate framework at outlined in Chapter 8. This impact is manageable and unlikely to be significant.

Will the action introduce disease that may cause the species to decline?

No. Amelioration measures outlined in Chapter 8 suggest that this potential impact is manageable and unlikely to be significant.

Will the action interfere with the recovery of the species?

No. A national recovery plan is currently in place for Malleefowl. The proposed action is consistent with that plan given that it avoids areas of habitat known to support Malleefowl and supports feral animal control.

Superb Parrot

Will the action lead to a long-term decrease in the size of an important population of a species?

No. As detailed within the TSC Act Significance Assessment, Superb Parrot were recorded during the field surveys and observations are consistent with the known migratory movements of this species in the landscape. The proposed action would remove only a small proportion of the Study Area (1.8%) enabling the species to continue foraging during their winter migration. As such, it is unlikely that the proposed action could result in a long-term decrease in the size of an important population, if one should even occur there, of Superb Parrot.

Will the action reduce the area of occupancy of an important population?

No. The proposed action would remove only 1.8% of the Study Area. The Study Area *per se* is unlikely to support an 'important population' given that the species breeds in the Riverina and South-west Slopes region. Given this, the proposed action would not reduce an area of occupancy of an important population.

Will the action fragment an existing population into two or more populations?

No. No population would be fragmented into two or more populations by the Proposal given the highly mobile nature of Superb Parrot.

Will the action adversely affect habitat critical to the survival of a species?

No. Superb Parrot is known to inhabit a variety of vegetation communities and breeding occurs in the South-west slopes and Riverina regions of NSW. The vegetation communities of the

Study Area are relatively widespread in the region. The proposed action would result in the removal of 34 hectares of woodland. However, this equates to only a relatively small proportion of the Study Area (1.8%) which is negligible with consideration of the mobility of the species.

Will the action disrupt the breeding cycle of an important population?

No. The Study Area does not contain any suitable habitat to support breeding activities of the Superb Parrot given that this species breeds elsewhere in NSW. Therefore, it is considered unlikely that the proposed action would disrupt the breeding cycle an 'important population'.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. The proposed action would remove approximately 34 hectares of woodland. Superb Parrot are highly mobile in nature, migrating from the Riverina and South-west slopes region to winter in the Gwydir River and Upper Namoi regions. It is unlikely that the removal of 1.8% of the Study Area would cause the species to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action may increase the abundance of weeds in the area and their spread should be managed via an appropriate framework at outlined in Chapter 8. This impact is manageable and unlikely to be significant.

Will the action introduce disease that may cause the species to decline?

No. Amelioration measures outlined in Chapter 8 suggest that this potential impact is manageable and unlikely to be significant.

Will the action interfere with the recovery of the species?

No. Given the relatively minor extent of vegetation to be removed (1.8% of the Study Area), it is unlikely that the proposed action would have an impact on the recovery of this species.

South-eastern Long-eared Bat

Will the action lead to a long-term decrease in the size of an important population of a species?

No. Two files of *Nyctophilus sp*. were recorded by anabat analysis during the field survey yet it should be remembered that this method does not allow for identification to species level. With consideration of the precautionary principle, it is assumed that these belong to the South-eastern Long-eared Bat, the only *Nyctophilus* sp. listed as threatened in NSW.

The proposed action would remove only a small proportion of the Study Area (1.8%) and the high mobility of microchiropteran bats that can extend their foraging ranges over tens of kilometres would allow them to continue using these resources. Amelioration measures within Chapter 8 provide a framework to minimise potential risks should any microchiropteran bats being using the HBT within the Proposed Disturbance Footprint at the time of clearing. The full

implementation of these measures are considered necessary to minimise potential risks to an acceptable and manageable level.

Given this, it is unlikely that the proposed action could result in a long-term decrease in the size of an important population (should one occur there) of the South-eastern Long-eared Bat.

Will the action reduce the area of occupancy of an important population?

No. Only two files of *Nyctophilus sp*. were recorded by anabat analysis during the field survey. It should be remembered that this method does not allow for identification to species level and a number of species from this genus occur in the locality. Given these low numbers, it is unlikely that an important population occurs within the Study Area, even if the files originated from the threatened *Nyctophilus* sp. Despite the proposed action removing 1.8% of potential habitat within the Study Area, the highly mobile nature of microchiropteran bats suggests that an area of occupancy of an important population (should one even occur) would not be reduced.

Will the action fragment an existing population into two or more populations?

No population (should they occur there) would be fragmented into two or more populations by the proposed activity given the mobility of the South-eastern Long-eared Bat.

Will the action adversely affect habitat critical to the survival of a species?

No. South-eastern Long-eared Bat are known to inhabit a variety of vegetation communities and the vegetation community of the Study Area is relatively widespread in the region. The proposed action would result in the removal of 34 hectares of woodland. However, this equates to only a relatively small proportion of the Study Area (1.8%) which is negligible with consideration of the mobility of the species.

Will the action disrupt the breeding cycle of an important population?

No. Amelioration measures detailed within Chapter 8 provides a framework to minimise the potential for the action to disrupt a breeding cycle of the South-eastern Long-eared Bat should it breed within the Study Area. Therefore, it is considered unlikely that the proposed action would disrupt the breeding cycle an 'important population' (should one even occur there) provided the amelioration measures are fully implemented.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. Microchiropteran bats are highly mobile in nature, widely foraging over tens of kilometres. It is unlikely that the removal of less than 1.8% of the Study Area would cause the species to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The proposed action may increase the abundance of weeds in the area and their spread should be managed via an appropriate framework at outlined in Chapter 8. This impact is manageable and unlikely to be significant.

Will the action introduce disease that may cause the species to decline?

No. Amelioration measures detailed in Chapter 8 suggest that this potential impact is manageable and unlikely to be significant.

Will the action interfere with the recovery of the species?

No. Amelioration measures detailed within Chapter 8 provides a framework to minimise the potential for the action to disrupt a breeding cycle of the South-eastern Long-eared Bat should it breed within the Study Area. It is therefore, unlikely that the Proposal would have an impact on the recovery of this species.

10.2.2 Migratory Species

Protected under several international agreements to which Australia is a signatory, Migratory species are considered Matters of National Environmental Significance under the EPBC Act.

One migratory species was recorded during the field survey (Rainbow Bee-eater) while a further four species were found to potentially occur within the Study Area (Cattle Egret, Fork-tailed Swift, Great Egret and White-throated Needletail) (see **Table 9**). Under the EPBC Act, an action is likely to have a significant impact on a migratory species if it substantially modifies, destroys or isolates an area of important habitat for the species (DEWHA 2009).

For these species, the Study Area is not considered to comprise important habitat as it does not contain:

- Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species.
- Habitat that is of critical importance to the species at particular life-cycle stages.
- Habitat used by a migratory species that is at the limit of the species' range.
- Habitat within an area where the species is declining (DEWHA 2009).

Given this, the impacts of the proposed activity on Rainbow Bee-eater, Cattle Egret, Fork-tailed Swift, Great Egret and White-throated Needletail are not likely to be regarded as significant and are not considered further.

10.3 SUMMARY OF SIGNIFICANCE ASSESSMENTS

10.3.1 Significance Assessments (TSC Act)

Significance Assessments completed in section 10.1 have determined that the proposed activity is *'unlikely'* to have a *'significant effect'* on Australian Bustard, Diamond Firetail, Grey-crowned Babbler, Grey Falcon, Hooded Robin, Little Eagle, Malleefowl, Masked Owl, Painted Honeyeater, Pied Honeyeater, Pink Cockatoo, Spotted Harrier, Superb Parrot, Turquoise Parrot, Varied Sittella, Kultarr, South-eastern Long-eared Bat, Little Pied Bat, Inland Forest

Bat, Yellow-bellied Sheathtail Bat and Cobar Greenhood Orchid provided that the amelioration measures detailed within Chapter 8 are fully implemented.

Therefore, a species impact statement is not required.

10.3.2 Significance Assessments (EPBC Act)

Significance Assessments completed within section 10.2 have determined that the proposed action is *'unlikely'* to have a significant impact on threatened and migratory biota listed by the EPBC Act provided the amelioration measures outlined in Chapter 8 are fully implemented.

Therefore, the Proposal would not require referral to the Commonwealth Minister.

10.4 OTHER MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Protected Matters Search Tool results revealed the presence of listed threatened ecological communities, threatened species and migratory species (**Appendix 2**). These biota have been assessed in Chapter 9 for their potential to occur within the Study Area, and where appropriate, additional assessment has occurred in Section 10.2. Other matters identified by the Protected Matter Search Tool are:

- One Commonwealth Land.
- Eight Listed Marine Species.
- One Place on the RNE.
- 22 Invasive species.

The Proposal would not impact on the Commonwealth Land identified as this occurs well beyond the boundaries of the Study Area.

The Proposal has already considered the potential impacts on the biota identified as Listed Marine Species in Chapter 9 and section 10.2.2.

Goree Area (an indigenous place) is not located within or directly adjacent to the Study Area. It is located at least 30 kilometres east and would not be impacted by the Proposal.

Invasive species are considered throughout various sections of this Ecology Assessment and are *unlikely* to have a significant effect on any matter of NES in combination with the amelioration measures proposed in Chapter 8.

11 CONCLUSION

This Ecology Assessment has adequately considered the ecology of the Study Area by:

- conducting a field assessment that is consistent with OEH guidelines.
- adopting the precautionary principle in the assessment of impact.
- designing appropriate ameliorations measures to mitigate potential impacts to an acceptable level.

This report has determined that the Proposal is unlikely to have a significant effect of any listed threatened species, communities, populations and their habitats in accordance with s5A of the NSW *Environmental Planning & Assessment Act 1979* provided amelioration measures as detailed within Chapter 8 are adopted, implemented and maintained. Therefore, a species impact statement is not required.

This report has also determined that the Proposal is unlikely to have a significant effect of any EPBC Act listed threatened and migratory biota and their habitats. Therefore, a referral to the Commonwealth Environment Minister is not warranted.

Mr. Steve Sass

Director / Principal Ecologist

Envirokey Pty. Ltd.

15th April 2014

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13 APPENDICES

Note: A copy of all Appendices is available on the Project CD

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APPENDIX 1 – QUALIFICATIONS AND EXPERIENCE OF PERSONNEL

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Name and Qualifications	Experience
Steve Sass B.App.Sci (Env.Sci) (Hons) Director / Project Manager / Principal Ecologist Certified Environmental Practitioner, EIANZ Practicing Member, Ecological Consultants Association of NSW (ECA) Biobanking & Biocertification Assessor (OEH)	Steve is a highly experienced Ecologist, having undertaken hundreds of ecological surveys and Biodiversity Assessments across Australia since 1992. Steve has an in-depth working knowledge of environmental and biodiversity legislation across all states and territories which allows him to provide detailed and accurate assessments and formulate practical solutions to clients and specific projects. His expertise extends across the widest range of projects including landscape scale biodiversity surveys and flora and fauna impact assessments in sensitive areas such as the recently approved Silverton Wind Farm, Australia's largest Wind Farm with 600 turbines (~30,000 hectares) near Broken Hill in far western New South Wales. Previous and current research holds Steve in high regard within both the scientific and ecological consultants' community. To date, Steve has published, submitted or has in preparation, twenty-four manuscripts within peer-reviewed scientific journals, most of which are related to threatened species survey, monitoring or management. He is a Council Member of the Ecological Consultants Association of NSW and is a member of the working committee for the development of an Ecological Consultants Accreditation Scheme for NSW consultants in collaboration with the NSW Office of Environment & Heritage (OEH). Steve was recently invited by OEH to become a sitting member of a team to develop a Priority Action Statement for two species listed as Endangered under the NSW *Threatened Species Conservation Act* 1995. He has extensive biodiversity experience in western NSW. He has completed hundreds of surveys across the region including Impact Assessments for numerous mining operations and exploration activities in the Cobar Peneplain. These include the proposed Hera Mine at Nymagee, a biodiversity study of the CSA mine lease at Cobar, Sand extraction at Endeavor Mine near Cobar and the Budgery exploration lease at Hermidale. Close to the Study Area, Steve completed a 2011 flora and fauna study on adjoining land to the south of the Study Area as well as a 2011 Flora and Fauna Assessment for the ROM pad extension. Near Hermidale, Steve has completed numerous biodiversity studies for Tritton Mine including the development of management plans for all three mining leases held by Straits Resources in the locality. Steve has a comprehensive scientific background and is a past Senior technical officer of the Ecology and Biodiversity Group within the Institute for Land, Water and Society, a leading research group at Charles Sturt University. He is also accredited as a Certified Environmental Practitioner by the Environment Institute of Australia and New Zealand, is a Council member of the Ecological Consultants Association of NSW and is part of the working committee seeking accreditation of Ecological Consultants in NSW. For this assessment, Steve was Project Manager, formulated the experimental design, led the extensive field ecology survey in March and October 2012, conducted the echolocation call

Name and Qualifications	Experience
	analysis and was the author of the Ecological Assessment.
Gerry Swan Adv. Herp. Tech Arid Ecologist/Herpetologist Practicing Member, Ecological Consultants Association of NSW (ECA)	Gerry is one of Australia's leading field herpetologists having co-authored numerous field guides including 'A Field Guide to the Reptiles of New South Wales', now in its second edition and the Whitley Award Winning 'A complete guide to Reptiles of Australia', now in its third edition. Gerry is also a highly experienced arid ecologist conversant with a variety of arid and semi-arid mammalian fauna, including the Kultarr which he has previously recorded in the Hermidale area. This includes the trapping and identification of hundreds of mammals along thousands of kilometres of open pipeline trenches in the arid regions of QLD, SA and NT. Sass and Swan have collaborated on a number of ecological surveys, research and Major Project assessments over the past 10 years. Their collaborations have also included research on endangered species such as the Tawny Rock Dragon (*Ctenophorus decresii*), Marble-headed Snake-lizard (*Delma australis*) and Slender Mallee Blue-tongue (*Cyclodomorphus melanops*) and fauna community composition in arid and semi-arid landscapes including the Cobar Peneplain. Gerry conducted the Herpetofauna surveys for this assessment during the March 2012 survey.
Matthew Herring B.App.Sci (Parks, Rec, Her) (Hons) Senior Ecologist	Matthew Herring is a Senior Ecologist with over 13 years' experience working at the landscape scale in western and southern NSW. After graduating from Charles Sturt University with first class honours in 2001, Matt has worked closely with more than 3000 landholders, applying a community wildlife survey and engagement model across 3 million hectares in the Murray River region. Together with various other landscape-scale projects, he has established and completed fauna surveys at more than 1000 biodiversity study sites across 650 farms and public reserves. Matt has published more than 30 papers, books and booklets, mostly as the lead author and he has also reviewed papers and books for *Ecological Management and Restoration* and *Australian Zoologist*. For this project, Matthew conducted the October fauna survey.
Sam Parsell B. Env. Sci. Ecologist Associate Member, Ecological Consultants Association of NSW (ECA)	Sam was employed by EnviroKey as an Ecologist in early 2011 as an Environmental Science graduate of Charles Sturt University. Sam has undertaken a number of relevant projects over the past 11 months under the direction of senior staff. These include fauna monitoring on the Pambula River Floodplain on the NSW south coast, and environmental management and auditing of construction activities at environmentally sensitive locations in NSW and Victoria and the 2011 flora and fauna study on adjoining land. Sam was also a member of the field survey team for an ecological study completed at Tritton Copper Mine in 2011. For this study, Sam was a member of the March 2012 field survey team.
Mark Harris B.App.Sci (Env Res Mgt) Senior Botanist / GIS Analyst	Mark is a highly experienced Botanist having undertaken flora surveys across eastern and central Australia. He has more than 12 years experience in Biodiversity Assessment and Planning. Mark has extensive experience with the flora and vegetation

Name and Qualifications	Experience
Biobanking Assessor (OEH) Practicing Member, Ecological Consultants Association of NSW (ECA)	communities of the region confirmed by his two year tenure with the State-wide Native Vegetation Mapping Project. Mark was responsible for vegetation mapping around the Nyngan, Nymagee and Condobolin districts. His expertise in western NSW flora and vegetation communities resulted in Mark becoming accredited as a BioBanking Assessor (Accred. No. 0062) and he has completed a number of assessments including the completion of calculations for a 400km long electricity infrastructure project in northern NSW. As a Senior Botanist, Mark led the March 2012 flora surveys. Mark is also a highly experienced GIS Analyst and completed the mapping that is included within this report.
Caroline Metzler B. Sc (Comm) (Hons) Senior Botanist Practicing Member, Ecological Consultants Association of NSW (ECA)	Caroline is an experienced Botanist and Field Ecologist having completed surveys in NSW, VIC, QLD, TAS and WA since 2005. In the field, Caroline's botanical skills make her a valuable part of the ecological impact assessment team. She is highly conversant with the flora and vegetation communities of NSW, but her knowledge of plant families and genera have seen Caroline lead many botanical surveys in QLD, TAS and WA. Caroline assisted Mark with the March 2012 flora survey.
Jens Birchall M. Sc (NRM) (on-going) Field Assistant (Botanical)	Jens is currently in the final stages of completing his Masters Degree in Natural Resource Management. He has a variety of field experience including a study of the frog communities across 50 wetlands on the NSW far south coast and botanical surveys for a Biodiversity Study of the CSA Mine north of Cobar (approximately2,500 ha). For this study, Jens assisted with the October 2012 botanical and orchid survey.
Anthony Pascall Field Assistant (Fauna)	Anthony provides field assistance to the ecological team during the March 2012 survey. This includes manual tasks such as installing PVC tubes and pitfall traps under the direction of ecological staff and the cleaning and maintenance of field equipment. Anthony also provides support to the ecological team as a 'second person' during field surveys to ensure compliance with the EnviroKey safe work methods statement where required. Anthony is currently considering study in the field of environmental science.
Adam Wilson Field Assistant (Fauna)	Adam has a wide variety of field assistance through his studies at Charles Sturt University including his involvement with projects as a field assistant to Steve over the past 8 years. He has a keen interest in reptiles which has seen Adam work on a number of field surveys targeting reptiles in western NSW. For this project, Adam provided valuable field assistance to the ecological team during the October 2012 survey.

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APPENDIX 2 – PROTECTED MATTERS SEARCH TOOL RESULTS

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Australian Government
Department of the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

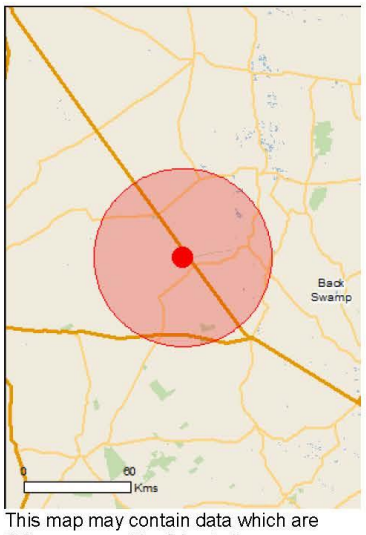
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 06/02/14 12:45:09

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
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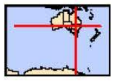

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	12
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	1
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	22
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community likely to occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Fish		

Name	Status	Type of Presence
Bidyanus bidyanus		
Silver Perch, Bidyan [76155]	Critically Endangered	Species or species habitat may occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Mammals		
Nyctophilus corbeni		
South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Plants		
Austrostipa metatoris		
[66704]	Vulnerable	Species or species habitat likely to occur within area
Bertya opponens		
[13792]	Vulnerable	Species or species habitat likely to occur within area
Lepidium monoplocoides		
Winged Pepper-cress [9190]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Xanthomyza phrygia		
Regent Honeyeater [430]	Endangered*	Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within

Name	Threatened	Type of Presence area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Indigenous		
Goree Area	NSW	Indicative Place

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Coordinates

-31.21263 146.84064

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

APPENDIX 3 – FLORA SPECIES RECORDED DURING THE FIELD SURVEY

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Scientific name	Common name
NATIVES	
Abutilon otocarpum	Desert Lantern
Abutilon oxycarpum	Straggly Lantern-bush
Acacia deanei	Deane's Wattle
Acacia decora	Western Golden Wattle
Acacia excelsa	Ironwood
Acacia oswaldii	Miljee
Acacia rigens	Needle Wattle
Alectryon oleifolius	Western Rosewood
Alternanthera denticulata	Lesser Joyweed
Amphipogon caricinus var. *caricinus*	Long Greybeard Grass
Aristida behriana	Bunch Wiregrass
Aristida jerichoensis var. *subspinulifera*	Jericho Wiregrass
Atalaya hemiglauca	Whitewood
Atriplex stipitata	Mallee Saltbush
Austrodanthonia setacea	Smallflower Wallaby Grass
Austrostipa scabra subsp. *scabra*	Rough Speargrass
Austrostipa setacea	Corkscrew Grass
Boerhavia dominii	Tarvine
Bothriochloa macra	Red Grass
Brachychiton populneus	Kurrajong
Brunoniella australis	Blue Trumpet
Bulbinopsis bulbosa	Native Leek
Callitris glaucophylla	White Cypress Pine
Calotis cuneifolia	Purple Burr-Daisy
Calotis lappulacea	Yellow Burr-daisy
Capparis mitchellii	Native Orange
Carex appressa	Tall Sedge
Carex inversa	Knob Sedge
Chamaesyce drummondii	Caustic Weed
Cheilanthes sieberi	Rock Fern
Chenopodium melanocarpum	Black Crumbweed
Chloris truncata	Windmill Grass
Chloris ventricosa	Tall Chloris
Chrysocephalum apiculatum	Common Everlasting
Convolvulus recurvatus subsp. *recurvatus*	
Craspedia haplorrhiza	Billy Buttons
Crinum flaccidum	Darling Lily
Cymbopogon obtectus	Silky Heads
Desmodium varians	Slender Tick-trefoil

Scientific name	Common name
Dianella longifolia	Blueberry Lily
Dichondra repens	Kidney Weed
Digitaria brownii	Cotton Panic Grass
Dodonaea viscosa	Sticky Hop-bush
Einadia hastata	Berry Saltbush
Einadia nutans subsp. *nutans*	Climbing Saltbush
Enneapogon avenaceus	Bottle Washers
Enneapogon intermedius	
Enteropogon acicularis	Curly Windmill Grass
Eragrostis lacunaria	Purple Lovegrass
Eragrostis parviflora	Weeping Lovegrass
Eremophila longifolia	Emubush
Eremophila mitchellii	Budda
Erodium crinitum	Blue Crowfoot
Eucalyptus intertexta	Gum Coolibah
Eucalyptus populnea subsp. *bimbil*	Bimble Box
Eucalyptus viridis	Green Mallee
Evolvulus alsinoides var. *decumbens*	
Fimbristylis dichotoma	Common Fringe-sedge
Geijera parviflora	Wilga
Glossocardia bidens	Cobbler's Tack
Glycine canescens	Silky Glycine
Glycine clandestina	Twining glycine
Glycine tabacina	Variable Glycine
Goodenia cycloptera	Cut-leaf Goodenia
Goodenia glabra	Smooth Goodenia
Harmsiodoxa blennodioides	
Hibiscus sturtii var. *grandiflorus*	
Juncus usitatus	Rush
Lobelia darlingensis	Darling Pratia
Maireana microphylla	Small-leaf Bluebush
Marsdenia australis	Doubah
Oxalis perennans	
Panicum decompositum var. *tenuius*	A Panic grass
Panicum effusum	Hairy Panic
Parsonsia eucalyptophylla	Gargaloo
Paspalidium constrictum	Knottybutt Grass
Phyllanthus lacunarius	
Pimelea microcephala subsp. *microcephala*	Shrubby Rice-flower
Portulaca oleracea	Pigweed
Pterocaulon sphacelatum	Applebush
Pterostylis cobarensis	**Cobar Greenhood Orchid**

Scientific name	Common name
Ptilotus gaudichaudii var. *gaudichaudii*	
Ptilotus obovatus	Smoke Bush
Ptilotus polystachyus var. *polystachyus*	Long Tails
Ptilotus sessilifolius var. *sessilifolius*	
Rhagodia spinescens	Thorny Saltbush
Rostellularia adscendens var. *pogonanthera*	Pink Tongues
Rumex brownii	Swamp Dock
Salsola kali var. *kali*	Buckbush
Santalum acuminatum	Sweet Quandong
Scaevola spinescens	
Sclerolaena birchii	Galvinized Burr
Sclerolaena convexula	Tall Copperburr
Sclerolaena diacantha	Grey Copperburr
Sclerolaena muricata	Black Rolypoly
Senna form taxon *'artemisioides'*	Silver Cassia
Senna form taxon *'filifolia'*	
Sida corrugata	Corrugated Sida
Sida cunninghamii	Ridge Sida
Sida filiformis	
Sigesbeckia australiensis	
Solanum ellipticum	Velvet Potato Bush
Solanum esuriale	Quena
Solanum ferocissimum	Spiny Potato-bush
Solanum parvifolium subsp. *parvifolium*	Nightshade
Sporobolus caroli	Fairy Grass
Themeda australis	Kangaroo Grass
Thyridolepis mitchelliana	Mulga Mitchell Grass
Tragus australianus	Small Burrgrass
Tribulus micrococcus	Spineless Caltrop
Tripogon loliiformis	Fiveminute Grass
Vittadinia cuneata	A Fuzzweed
Wahlenbergia communis	Tufted Bluebell
Wahlenbergia gracilis	Sprawling Bluebell
EXOTIC	
Anagallis arvensis	Scarlet Pimpernel
Bidens subalternans	Greater Beggar's Ticks
Cenchrus ciliaris	Buffel Grass
Citrullus colocynthis	Colocynth
Conyza bonariensis	Flaxleaf Fleabane
Eragrostis cilianensis	Stinkgrass
Marrubium vulgare	White Horehound
Medicago polymorpha	Burr Medic

Scientific name	Common name
Oxalis corniculata	Creeping Oxalis
Sisymbrium spp.	A Mustard
Solanum nigrum	Black-berry Nightshade
Sonchus oleraceus	Common Sowthistle
Xanthium spinosum	Bathurst Burr

APPENDIX 4 – FAUNA SPECIES RECORDED DURING THE FIELD SURVEY AND ON ADJOINING LAND BY ENVIROKEY (2011)

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EK (2011) = study on adjoining land.

EnviroKey. (2011) Flora and Fauna Study: Murrawombie and North East Mine, Girilambone, N.S.W (ML1280, ML1383 & MPL295). *A report prepared by S. Sass, S. Parsell and L. Sass for Tritton Resources Pty. Ltd. Report No. ER.0301. Final Report. Version 1. 12/12/2011.*

Mar 2012: Comprehensive field surveys within the Study Area during March 2012.

Oct 2012: Comprehensive field surveys within the Study Area during October 2012.

*= recorded during the study

#= introduced species

BOLD text = listed as threatened or migratory under the TSC Act and/or EPBC Act

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
AVIFAUNA					
Apostlebird	*Struthidea cinerea*	P	*	*	*
Australasian Grebe	*Tachybaptus novaehollandiae*	P	*	*	*
Australian Magpie	*Gymnorhina tibicen*	P	*	*	*
Australian Owlet-nightjar	*Aegotheles cristatus*	P		*	
Australian Raven	*Corvus coronoides*	P	*	*	*
Australian Reed-warbler	*Acrocephalus australis*	P			*
Australian Ringneck	*Barnardius zonarius*	P	*	*	*
Australian Wood Duck	*Chenonetta jubata*	P	*	*	*
Barn Owl	*Tyto alba*	P	*		
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	P	*		*
Black-fronted Dotterel	*Elseyornis melanops*	P			*
Black-tailed Native-hen	*Gallinula ventralis*	P			*
Blue Bonnet	*Northiella haematogaster*	P	*	*	*
Blue-faced Honeyeater	*Entomyzon cyanotis*	P		*	*
Brown-headed Honeyeater	*Melithreptus brevirostris*	P		*	
Brown Falcon	*Falco berigora*	P			*
Brown Quail	*Coturnix ypsilophora*	P	*		
Budgerigar	*Melopsittacus undulatus*	P		*	
Chestnut-rumped Thornbill	*Acanthiza uropygialis*	P	*	*	*
Cockatiel	*Nymphicus hollandicus*	P	*		*
Common Bronzewing	*Phaps chalcoptera*	P	*	*	*

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Common Starling	*Sturnus vulgaris*	P			*
Crested Pigeon	*Ocyphaps lophotes*	P	*	*	*
Darter	*Anhinga melanogaster*	P			*
Emu	*Dromaius novaehollandiae*	P	*	*	*
Eurasian Coot	*Fulica atra*	P			*
Galah	*Eolophus roseicapilla*	P	*	*	*
Golden Whistler	*Pachycephala pectoralis*	P		*	
Great Egret	***Ardea alba***	**M, EPBC**			*
Grey Butcherbird	*Cracticus torquatus*	P	*	*	*
Grey Fantail	*Rhipidura fuliginosa*	P			*
Grey Shrike-thrush	*Colluricincla harmonica*	P		*	*
Grey Teal	*Anas gracilis*	P			*
Grey-crowned Babbler	***Pomatostomus temporalis temporalis***	**V, TSC**		*	*
Hardhead	*Aythya australis*	P		*	*
Inland Thornbill	*Acanthiza apicalis*	P	*	*	*
Intermediate Egret	*Ardea intermedia*	P			*
Laughing Kookaburra	*Dacelo novaeguineae*	P	*	*	
Little Black Cormorant	*Phalacrocorax sulcirostris*	P			*
Little Button-quail	*Turnix velox*	P	*		
Little Friarbird	*Philemon citreogularis*	P			*
Little Raven	*Corvus mellori*	P	*	*	
Magpie-lark	*Grallina cyanoleuca*	P	*		*
Masked Woodswallow	*Artamus personatus*	P	*	*	
Mistletoebird	*Dicaeum hirundinaceum*	P	*	*	
Mulga Parrot	*Psephotus varius*	P			*
Musk Duck	*Biziura lobata*	P			*
Nankeen Kestrel	*Falco cenchroides*	P	*		
Noisy Miner	*Manorina melanocephala*	P	*	*	*
Pacific Black Duck	*Anas superciliosa*	P		*	*
Peaceful Dove	*Geopelia placida*	P	*		*
Peregrine Falcon	*Falco peregrinus*	P			*
Pied Butcherbird	*Cracticus nigrogularis*	P	*		*
Pied Cormorant	*Phalacrocorax varius*	P			*

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Pink Cockatoo	***Cacatua leadbeateri***	**V, TSC**	*	*	*
Rainbow Bee-eater	***Merops ornatus***	**M, EPBC**	*		
Red-backed Kingfisher	*Todiramphus pyrrhopygia*	P	*		*
Red-capped Robin	*Petroica goodenovii*	P		*	
Red-rumped Parrot	*Psephotus haematonotus*	P	*		*
Red-winged Parrot	*Aprosmictus erythropterus*	P	*		*
Restless Flycatcher	*Myiagra inquieta*	P	*		
Rufous Songlark	*Cincloramphus mathewsi*	P			*
Rufous Whistler	*Pachycephala rufiventris*	P		*	
Singing Honeyeater	*Lichenostomus virescens*	P	*		*
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	P	*	*	*
Spotted Bowerbird	*Chlamydera maculata*	P	*		*
Spotted Pardalote	*Pardalotus punctatus*	P			*
Striated Pardalote	*Pardalotus striatus*	P	*		*
Superb Parrot	***Polytelis swainsonii***	**V, TSC & EPBC**	*	*	
Varied Sittella	***Daphoenositta chrysoptera***	**V, TSC**			*
Variegated Fairy-wren	*Malurus lamberti*	P	*		*
Wedge-tailed Eagle	*Aquila audax*	P	*		
Weebill	*Smicrornis brevirostris*	P		*	*
Welcome Swallow	*Hirundo neoxena*	P	*		*
Western Gerygone	*Gerygone fusca*	P	*	*	*
Whistling Kite	*Haliastur sphenurus*	P	*		*
White-breasted Woodswallow	*Artamus leucorynchus*	P	*		
White-browed Woodswallow	*Artamus superciliosus*	P		*	
White-faced Heron	*Egretta novaehollandiae*	P			*
White-necked Heron	*Ardea pacifica*	P			*
White-plumed Honeyeater	*Lichenostomus penicillatus*	P	*		
White-winged Triller	*Lalage sueurii*	P	*		
Willie Wagtail	*Rhipidura leucophrys*	P			*
Yellow-plumed Honeyeater	*Lichenostomus ornatus*			*	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	P		*	*
Yellow-throated Miner	*Manorina flavigula*	P	*	*	

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Zebra Finch	*Taeniopygia guttata*			*	
MAMMALS (excl. microchiropteran bats)					
#Goat	*Capra hircus*	U	*	*	*
#Red Fox	*Vulpes vulpes*	U	*	*	
#House Cat	*Felis catus*	U	*	*	*
#House Mouse	*Mus musculus*	U		*	*
#Pig	*Sus scrofa*	U	*	*	*
#Rabbit	*Oryctolagus cuniculus*	U	*	*	*
#European Hare	*Lepus europaeus*	U	*	*	
#Sheep	*Ovis aries*	U			*
Eastern Grey Kangaroo	*Macropus giganteus*	P	*	*	*
Red Kangaroo	*Macropus rufus*	P		*	*
Short-beaked Echidna	*Tachyglossus aculeatus*	P			*
Western Grey Kangaroo	*Macropus fuliginosus*	P	*	*	*
Yellow-footed Antechinus	*Antechinus flavipes*	P			*
FROGS					
Broad-palmed Frog	*Litoria latopalmata*	P	*	*	*
Giant Banjo Frog	*Limnodynastes interioris*	P			*
Long-thumbed Frog	*Limnodynastes fletcheri*	P	*		*
Salmon-striped Frog	*Limnodynastes salmini*	P	*		
Green Tree Frog	*Litoria caerulea*	P	*		
Peron's Tree Frog	*Litoria peronii*	P	*	*	*
Red Tree Frog	*Litoria rubella*	P	*	*	*
Barking Marsh Frog	*Limnodynastes fletcheri*			*	
Spotted Grass Frog	*Limnodynastes tasmaniensis*	P	*	*	*
Wrinkled Toadlet	*Uperoleia rugosa*	P	*		*
REPTILES					
Burn’s Dragon	*Amphibolorus burnsi*	P	*	*	
Nobbi Dragon	*Diporiphora nobbi*			*	
Eastern Bearded Dragon	*Pogona barbata*	P		*	
Central Bearded Dragon	*Pogona vitticeps*	P	*	*	*
Wall Lizard	*Cryptoblepharus pannosus*	P	*		
Eastern Striped Skink	*Ctenotus robustus*	P	*	*	*

Common Name	Scientific Name	Status	Mar 2012	Oct 2012	EK (2011)
Tree Skink	*Egernia striolata*	P	*	*	
Three-toed Lerista	*Lerista timida*	P	*		*
Boulenger's Skink	*Morethia boulengeri*	P	*	*	*
Dwarf Skink	*Menetia greyii*	P	*	*	*
Shingleback	*Tiliqua rugosa*	P	*	*	*
Eastern Blue-tongue Lizard	*Tiliqua scincoides*	P	*	*	
Bynoe's Gecko	*Heteronotia binoei*	P	*	*	*
Eastern Stone Gecko	*Diplodactylus furcosus*	P	*	*	
Box-patterned Gecko	*Lucasium steindachneri*	P	*		
Beaked Gecko	*Rhynchoedura ornata*	P	*	*	
Southern Spiny Gecko	*Strophurus intermedius*	P	*	*	*
Hooded Scaly-foot	*Pygopus schraderi*			*	
Dubious Dtella	*Gehyra dubia*	P	*		
Tree Dtella	*Gehyra variegata*	P	*	*	*
Dwyer's Snake	*Parasuta dwyeri*	P	*	*	*
Mulga Snake	*Pseudechis australis*	P		*	*
Strap-snouted Brown Snake	*Pseudonaja aspidorhyncha*	P	*		
Sand Goanna	*Varanus gouldii*	P	*	*	
Lace Monitor	*Varanus varius*	P	*	*	
MICROCHIROPTERAN BATS					
Gould's Wattled Bat	*Chalinolobus gouldii*	P	*	*	*
Chocolate Wattled Bat	*Chalinolobus morio*	P			*
Inland Broad-nosed Bat	*Scotorepens balstoni*	P	*		*
Little Broad-nosed Bat	*Scotorepens greyii*	P	*	*	
Inland Freetail Bat	*Mormopterus species 3*	P		*	*
Little Pied Bat	***Chalinolobus picatus***	**V, TSC**	*	*	*
South-eastern Long-eared Bat	***Nyctophilus ?corbeni (precautionary principle applied as identification can be only applied to Genus using Anabat)***	**V, TSC & EPBC**	*	*	*
Southern Freetail Bat	*Mormopterus species 4*	P	*	*	*
Yellow-bellied Sheathtail Bat	***Saccolamus flaviventris***	**V, TSC**	*		*

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APPENDIX 5 – HABITAT ASSESSMENT DATA SHEETS

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SITE H1

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland Moderate shrub layer of Wilga and Emubush Ground layer dominated by grasses <u>Matrix</u> Similar habitats surround <u>Disturbance</u> Absence of tree hollows suggests previous clearing Evidence of feral pigs feeding within site	

Habitat Variables	**Quantity**
Forbs (% cover)	20
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	2
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	14
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H2

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland Cypress Pine regeneration dense in places Ground layer dominated by grasses <u>Matrix</u> Similar habitats surround <u>Disturbance</u> Absence of tree hollows suggests previous clearing Dense Cypress pine regrowth also suggests past clearing	

Habitat Variables	**Quantity**
Forbs (% cover)	10
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	12
Logs 25-100mm diameter (lineal metres)	40
Logs 101-300mm diameter (No.)	2
Logs 101-300mm diameter (lineal metres)	10
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	2
Hollows (No. visible - any size)	None
Loose bark (yes/no)	No
Shrub height (mean)	1.5m
Shrub density (no. of shrubs)	4
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H3

General Habitat & Site Photo

Bimble Box – Cypress Pine Woodland

Dense Cypress Pine regeneration to 4m in height adjoining H3

Matrix

Existing transmission line easement to north and Highway beyond that

Disturbance

Large logs on ground confirm previous clearing of large trees

Habitat Variables	Quantity
Forbs (% cover)	15
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	10
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	2
Logs 101-300mm diameter (lineal metres)	10
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	9
Mistletoe (No. of clumps)	1
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	3
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H4

General Habitat & Site Photo
Bimble Box Woodland adjacent to Earthen Tank Ground cover dominated by grasses Weed invasion present from Bathurst Burr (noxious) <u>Matrix</u> Open, Grassy Woodland <u>Disturbance</u> Past agricultural disturbance likely given the extent of the noxious weed Bathurst Burr No hollows within trees suggests past clearing.

Habitat Variables	**Quantity**
Forbs (% cover)	15
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	0
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	0
Logs 25-100mm diameter (lineal metres)	0
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	2
Hollows (No. visible - any size)	None
Loose bark (yes/no)	No
Shrub height (mean)	3m
Shrub density (no. of shrubs)	3
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H5

General Habitat & Site Photo	
Open cleared area, likely derived from Bimble Box – Cypress Pine Woodland given the presence of regenerating woodland species. <u>Matrix</u> Existing mine to the south-west, other habitats similar. <u>Disturbance</u> H5 is a derived grassland; the site has been previously cleared likely for agricultural activities.	

Habitat Variables	**Quantity**
Forbs (% cover)	30
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	0
Bare ground (% cover)	0
Logs 25-100mm diameter. (No.)	0
Logs 25-100mm diameter (lineal metres)	0
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	5
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	0
Hollows (No. visible - any size)	1
Loose bark (yes/no)	Yes
Shrub height (mean)	5m
Shrub density (no. of shrubs)	1
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H6

General Habitat & Site Photo	
Open Bimble Box – Cypress Pine Woodland to 15m Mid story is dominated by Cypress Pine regrowth Scattered Wilga and Emubush Ground layer dominated by grasses <u>Matrix</u> Surrounded by similar habitats <u>Disturbance</u> Open clearings suggests past selective clearing	

Habitat Variables	**Quantity**
Forbs (% cover)	13
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	2
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	1.5m
Shrub density (no. of shrubs)	6
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H7

General Habitat & Site Photo	
Bimble Box Woodland with an understory of Wilga and Emubush <u>Matrix</u> Similar to surrounding habitats <u>Disturbance</u> Dense Cypress pine regrowth adjoins suggesting previous clearing	

Habitat Variables	**Quantity**
Forbs (% cover)	45
Grasses (% cover)	35
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	15
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	7
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	12
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	14
Mistletoe (No. of clumps)	3
Hollows (No. visible - any size)	4
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	6
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H8

General Habitat & Site Photo
Bimble Box – Cypress Pine Woodland <u>Matrix</u> Similar to surrounding habitats <u>Disturbance</u> Existing vehicle track adjacent provides lineal access for introduced predators Absence of tree hollows suggests past clearing.

Habitat Variables	**Quantity**
Forbs (% cover)	0
Grasses (% cover)	60
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	30
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	3
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	7
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	14
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H9

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland Matrix Surrounded by similar habitats Disturbance Existing vehicle track provides lineal access for introduced predators Absence of tree hollows confirms past clearing likely from agricultural activities	

Habitat Variables	**Quantity**
Forbs (% cover)	10
Grasses (% cover)	60
Rocks (% cover)	0
Litter (% cover)	20
Bare ground (% cover)	10
Logs 25-100mm diameter. (No.)	5
Logs 25-100mm diameter (lineal metres)	20
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	4
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	5
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	18
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H10

General Habitat & Site Photo	
Bimble Box – Cypress Pine Woodland <u>Matrix</u> Surrounded by similar habitats <u>Disturbance</u> Existing vehicle track provides lineal access for introduced predators Paucity of tree hollows confirms past clearing likely from agricultural activities	
Habitat Variables	**Quantity**
Forbs (% cover)	0
Grasses (% cover)	60
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	30
Logs 25-100mm diameter. (No.)	0
Logs 25-100mm diameter (lineal metres)	0
Logs 101-300mm diameter (No.)	0
Logs 101-300mm diameter (lineal metres)	0
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	0
Hollows (No. visible - any size)	1 (in old stag)
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	30
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H11

General Habitat & Site Photo	
Open Bimble Box Woodland Matrix Surrounded by similar habitats with the exception of existing mine approximately 150m to south. Disturbance Existing vehicle track provides lineal access for introduced predators Most trees small in DBH suggesting past clearing from agricultural activities	

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	75
Rocks (% cover)	0
Litter (% cover)	15
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	1
Logs 25-100mm diameter (lineal metres)	2
Logs 101-300mm diameter (No.)	3
Logs 101-300mm diameter (lineal metres)	6
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	3
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	2
Loose bark (yes/no)	Yes
Shrub height (mean)	3m
Shrub density (no. of shrubs)	25
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H12

General Habitat & Site Photo
Woodland with Bimble Box and Red Box with good quantities of fallen timber. <u>Matrix</u> Surrounded by similar habitats <u>Disturbance</u> Most trees small in DBH suggesting past clearing from agricultural activities. However, some larger trees present implies selective clearing.

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	75
Rocks (% cover)	0
Litter (% cover)	20
Bare ground (% cover)	0
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	20
Logs >300mm diameter (No.)	5
Logs >300mm diameter (lineal metres)	30
Mistletoe (No. of clumps)	No
Hollows (No. visible - any size)	2
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	20
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H13

General Habitat & Site Photo	
Woodland, Open Bimble Box with occasional Cypress Pine <u>Matrix</u> Surround by similar habitats <u>Disturbance</u> All trees relatively small in diameter suggesting past clearing likely from agricultural activities.	

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	70
Rocks (% cover)	0
Litter (% cover)	15
Bare ground (% cover)	10
Logs 25-100mm diameter. (No.)	5
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	20
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	5
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	4
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	30
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H14

General Habitat & Site Photo
Woodland, Open Bimble Box with occasional Cypress Pine <u>Matrix</u> Surround by similar habitats <u>Disturbance</u> All trees relatively small in diameter suggesting past clearing likely from agricultural activities. Existing vehicle track provides lineal access for introduced predators.

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	65
Rocks (% cover)	0
Litter (% cover)	0
Bare ground (% cover)	30
Logs 25-100mm diameter. (No.)	3
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	5
Logs 101-300mm diameter (lineal metres)	15
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	5
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	2
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	20
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H15

General Habitat & Site Photo

Open derived grassland

Matrix

Surrounded by Bimble Box Woodland habitats

Disturbance

Clearing of woodland has created this habitat type.

Existing vehicle track provides lineal access for introduced predators.

Habitat Variables	Quantity
Forbs (% cover)	0
Grasses (% cover)	80
Rocks (% cover)	5
Litter (% cover)	0
Bare ground (% cover)	15
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	2
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	2
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	1
Loose bark (yes/no)	No
Shrub height (mean)	2m
Shrub density (no. of shrubs)	3
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H16

General Habitat & Site Photo
Bimble Box – Cypress Pine Woodland presenting ample signs of regeneration. Matrix Surrounded by similar habitats Disturbance Existing vehicle track provides lineal access for introduced predators.

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	80
Rocks (% cover)	5
Litter (% cover)	5
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	4
Logs 25-100mm diameter (lineal metres)	3
Logs 101-300mm diameter (No.)	3
Logs 101-300mm diameter (lineal metres)	2.5
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	3
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	None
Shrub height (mean)	2m
Shrub density (no. of shrubs)	10
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H17

General Habitat & Site Photo	
Bimble Box Woodland with a healthy, regenerating layer of Bimble Box. Matrix Surrounded by similar habitats but without extensive regenerating Bimble Box. Disturbance Larger trees and regeneration suggest little disturbance has occurred here previously.	
Habitat Variables	**Quantity**
Forbs (% cover)	20
Grasses (% cover)	30
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	40
Logs 25-100mm diameter. (No.)	4
Logs 25-100mm diameter (lineal metres)	6
Logs 101-300mm diameter (No.)	2
Logs 101-300mm diameter (lineal metres)	3
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	3
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	None
Shrub height (mean)	2m
Shrub density (no. of shrubs)	15
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H18

General Habitat & Site Photo
Bimble Box Woodland with a diverse shrub layer. Matrix Surrounded by similar habitats however, extensive Emubush here is uncommon across the Study Area. Disturbance The absence of tree hollows suggests previous clearing has occurred for agricultural activities.

Habitat Variables	**Quantity**
Forbs (% cover)	20
Grasses (% cover)	20
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	50
Logs 25-100mm diameter. (No.)	7
Logs 25-100mm diameter (lineal metres)	11
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	7
Logs >300mm diameter (No.)	1
Logs >300mm diameter (lineal metres)	4
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2m
Shrub density (no. of shrubs)	40
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H19

General Habitat & Site Photo
Open Bimble Box Woodland with grassy areas and patches of dense Emubush. Matrix Surrounded by similar habitats. Disturbance Absence of tree hollows suggests habitat has been previously cleared.

Habitat Variables	**Quantity**
Forbs (% cover)	5
Grasses (% cover)	80
Rocks (% cover)	0
Litter (% cover)	10
Bare ground (% cover)	5
Logs 25-100mm diameter. (No.)	2
Logs 25-100mm diameter (lineal metres)	10
Logs 101-300mm diameter (No.)	1
Logs 101-300mm diameter (lineal metres)	4
Logs >300mm diameter (No.)	0
Logs >300mm diameter (lineal metres)	0
Mistletoe (No. of clumps)	None
Hollows (No. visible - any size)	None
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	15
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

SITE H20

General Habitat & Site Photo

Bimble Box – Cypress Pine Woodland

Matrix

Surrounded by similar habitats

Disturbance

Paucity of tree hollows confirms that this area has also been previously cleared as with the remainder of the Study Area.

Habitat Variables	Quantity
Forbs (% cover)	5
Grasses (% cover)	40
Rocks (% cover)	0
Litter (% cover)	5
Bare ground (% cover)	50
Logs 25-100mm diameter. (No.)	6
Logs 25-100mm diameter (lineal metres)	13
Logs 101-300mm diameter (No.)	4
Logs 101-300mm diameter (lineal metres)	10
Logs >300mm diameter (No.)	2
Logs >300mm diameter (lineal metres)	7
Mistletoe (No. of clumps)	1
Hollows (No. visible - any size)	1
Loose bark (yes/no)	Yes
Shrub height (mean)	2.5m
Shrub density (no. of shrubs)	15
Soil crevices/cracks (lineal metres visible)	None
Soil type (Sand, clay, loam, gravel)	Sandy Clay
Prickly flora (ie, spinifex, acacia - % cover)	None

APPENDIX 6 – GUIDELINES FOR THE REMOVAL OF HOLLOW-BEARING TREES

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GUIDELINES FOR THE REMOVAL OF HOLLOW-BEARING TREES

EnviroKey recommends the removal of hollow bearing trees (HBT) should be avoided where possible. However, where the removal of HBT must take place, EnviroKey recommends the following guidelines:

1. Ensure that a suitably qualified and licensed ecologist (who is vaccinated for Australian bat lyssavirus) is engaged to supervise the removal of HBT. Any bats found must only be handled by a person vaccinated for lyssavirus.
2. Clearly mark the HBT to be removed and/or retained by differentiating with coloured flagging tape.
3. Check for fauna in the zone of disturbance before clearing and scare or remove them before beginning operations.
4. Remove all non-hollow bearing vegetation prior to the removal of HBT.
5. After clearing, re-check to ensure no fauna have become trapped or injured during clearing operations. Any fauna found should be safely located to nearby habitat.
6. Leave HBT standing for at least one night after other clearing to allow any fauna the opportunity to remove themselves after site disturbance.
7. Before felling HBT, tap along trunk using an excavator or loader to scare fauna from the hollows. Repeat several times. The aim of this procedure is to 'substantially' shake the tree. The majority of fauna will exit the tree during this process.
8. Re-check after felling HBT to ensure no fauna have become trapped or injured during clearing operations. Any fauna found should be safely located to nearby habitat.
9. If taking the HBT tree down in stages, the non-hollow-bearing branches should be removed before the hollow-bearing branches are removed.
10. Fell trees into the zone of disturbance to avoid damaging adjacent vegetation and do not push felled vegetation into areas to be retained.
11. Take care when moving equipment near vegetation to be retained.
12. Rather than mulching or burning cleared vegetation, logs from the felled trees should be distributed into areas of vegetation to be retained where it would not be considered a fire hazard. This would provide additional potential habitat for ground dwelling fauna such as reptiles and small mammals.

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APPENDIX 7 – BIOBANKING PLOT/TRANSECT DATA

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PlotName	Native plant spp richness	Native OS %cov	Native MS %cov	Native GC (grasses) %cov	Native GC (shrubs) %cov	Native GC (other) %cov	Exotic % cov	HBT	OS regen	Fallen logs (m)	Latitude	Longitude	Zone
Benchmark	>=35	8 to 30	5 to 35	10 to 25	1 to 15	3 to 15	See manual	>=1	1	>=30			
103-1 d	40	9	10	22	2	26	0	0	1	11	6548928	482783	55
103-3 d	32	35	18	30	0	20	0	2	1	6	6548816	483878	55
103-7 d	25	6	2	18	0	24	1	0	1	6	6547711	484488	55
105-1 d	35	24	1	28	2	24	0	2	1	20	6548423	484615	55
105-2 d	40	0	0	18	0	50	0	0	1	17	6548285	484545	55
105-5 d	27	6	0	38	0	30	2	1	1	3	6547321	484710	55
103-2 off	40	16	3	34	0	14	0	0	1	11	6548646	482927	55
103-4 off	36	15	2	10	0	22	0	0	1	12	6547253	482890	55
103-5 off	28	2	3	20	0	6	1	2	1	12	6547024	486497	55
103-6 off	29	0	4	46	0	16	0	1	1	6	6546796	486131	55
103-8 off	19	8	32	22	0	2	0	0	1	19	6548806	484587	55
103-9 off	28	1	9	14	0	18	0	0	1	7	6548367	485405	55
103-10 off	26	4	5	10	2	12	0	0	1	7	6547720	486219	55
105-3 off	38	16	1	34	0	20	0	1	1	12	6548465	484400	55
105-4 off	20	0	1	46	0	34	0	1	1	20	6546808	486566	55
105-6 off	18	0	0	10	2	38	0	0	1	7	6547309	484587	55
105-8 off	20	3	7	44	2	38	0	0	1	13	6548475	484004	55
105-9 off	29	0	0	58	2	40	0	0	1	0	6549106	483791	55

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Appendix 7

Groundwater Impact Assessment

(Total No. of pages including blank pages = 166)

Note: A colour copy of this Appendix is available on the Project CD

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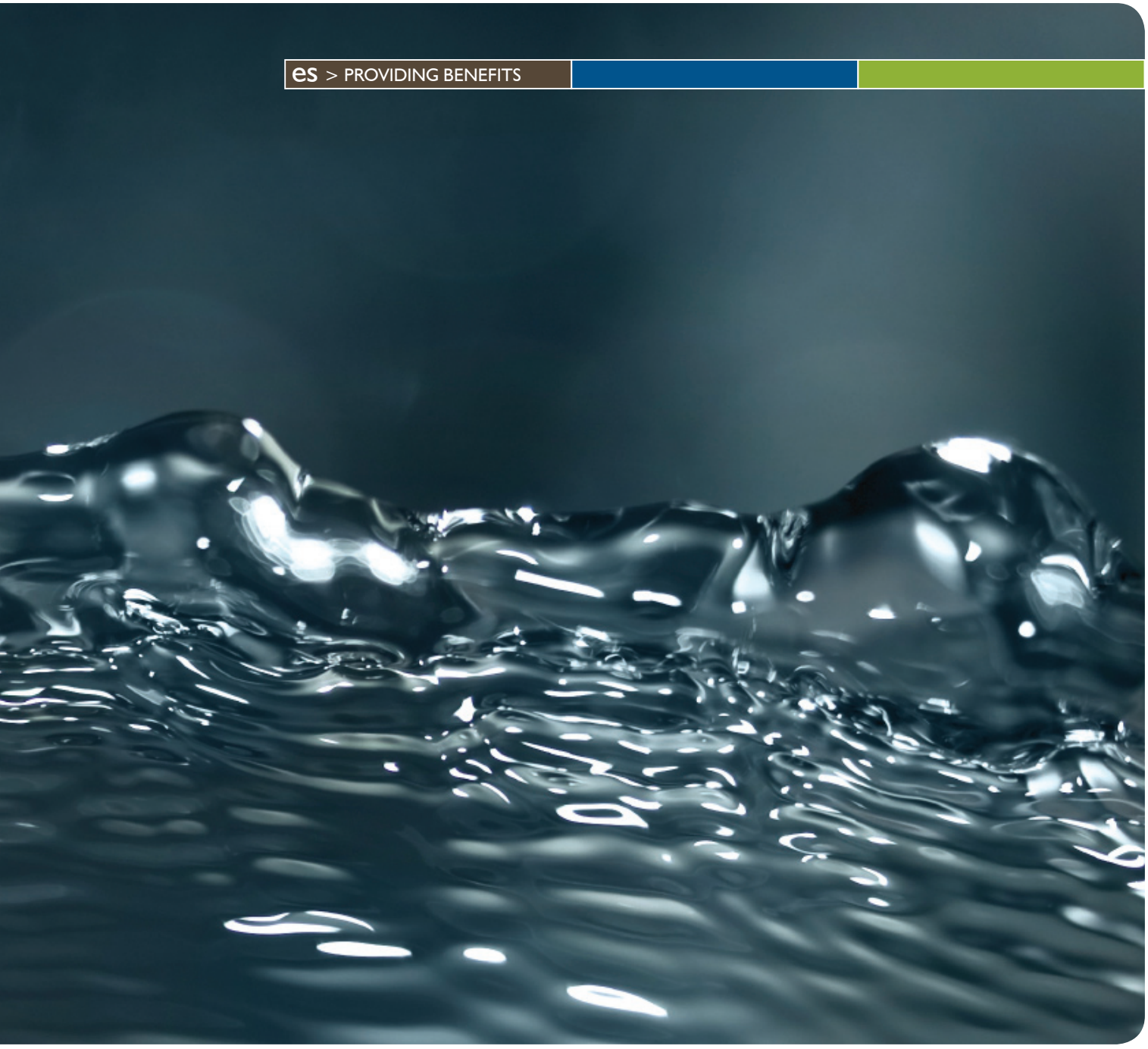
Avoca Tank Groundwater Assessment

Groundwater Impact Assessment

Job Number 13061

Prepared for RW Corkery & Co PTY Ltd | 8 July 2014



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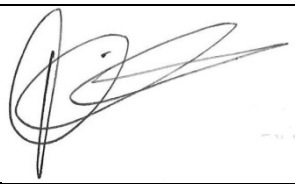
Signed: Reviewer: Tim Chambers Principal Hydrogeologist	
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A Supporting Documentation

Registered Bore Location Plan
Groundwater Dependent Ecosystem Map
Groundwater Vulnerability Map and Explanatory Notes

B Registered Groundwater Bore Details

C Summary of Director General's Requirements

D Detailed Discussion of Water Regulations

1 INTRODUCTION

Environmental Strategies Pty Limited (ES) was commissioned by R.W. Corkery & Co. to conduct a groundwater assessment to provide information for inclusion into an Environmental Impact Statement (EIS) for the Avoca Tank Project (the 'ATP') which will form part of Tritton Resources Pty Ltd (the Applicant's) existing operations, the Girilambone Copper Mine and the Tritton Copper Mine.

The ATP Site is located within the Bogan Shire, Parish of Girilambone, County of Canbelego. Under the provisions of the *Bogan Local Environmental Plan 2011*, the ATP Site is zoned Primary Production (RU1). Mining is a permissible land use within this zone, subject to consent by Council.

The Girilambone Copper Mines are a group of mines located approximately 7km northwest of the village of Girilambone and approximately 55km northwest of Nyngan in western NSW. The Applicant currently operates the Girilambone Copper Mine and the Tritton Copper Mine on mining leases ML1280, ML1383 and ML1544. The Applicant is proposing to develop the ATP approximately 2km to the north-northwest of the existing Girilambone Copper Mine and 24km northeast of its Tritton Copper Mine, (Refer to **Figure 1**).

The Girilambone Copper Mine (Refer to **Figure 2**) includes the following operations:

- Murrawombie Open Cut and Underground Portal
- North East and Larsens Open Cuts
- Hartmans Open Cut and Portal.

The ATP is understood to include subsurface workings (long hole open stope) to approximately 500m depth with attendant surface infrastructure. A proposed site layout of the ATP, including project site boundary and proposed disturbance footprint, is provided in **Figure 3 and Figure 4**.

The proposed development will require approval by a Joint Regional Planning Panel, Bogan Shire Council, with the NSW Office of Water being an approval authority under the integrated development provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The NSW Office of Water has issued a Request for Input into Director General's Requirements (DGR) which details the environmental assessment requirements required to be addressed in an Environmental Impact Statement (EIS). The purpose of this groundwater impact assessment is to "address the Director General's Requirements of the EIS to identify groundwater issues and potential degradation to the groundwater resource."

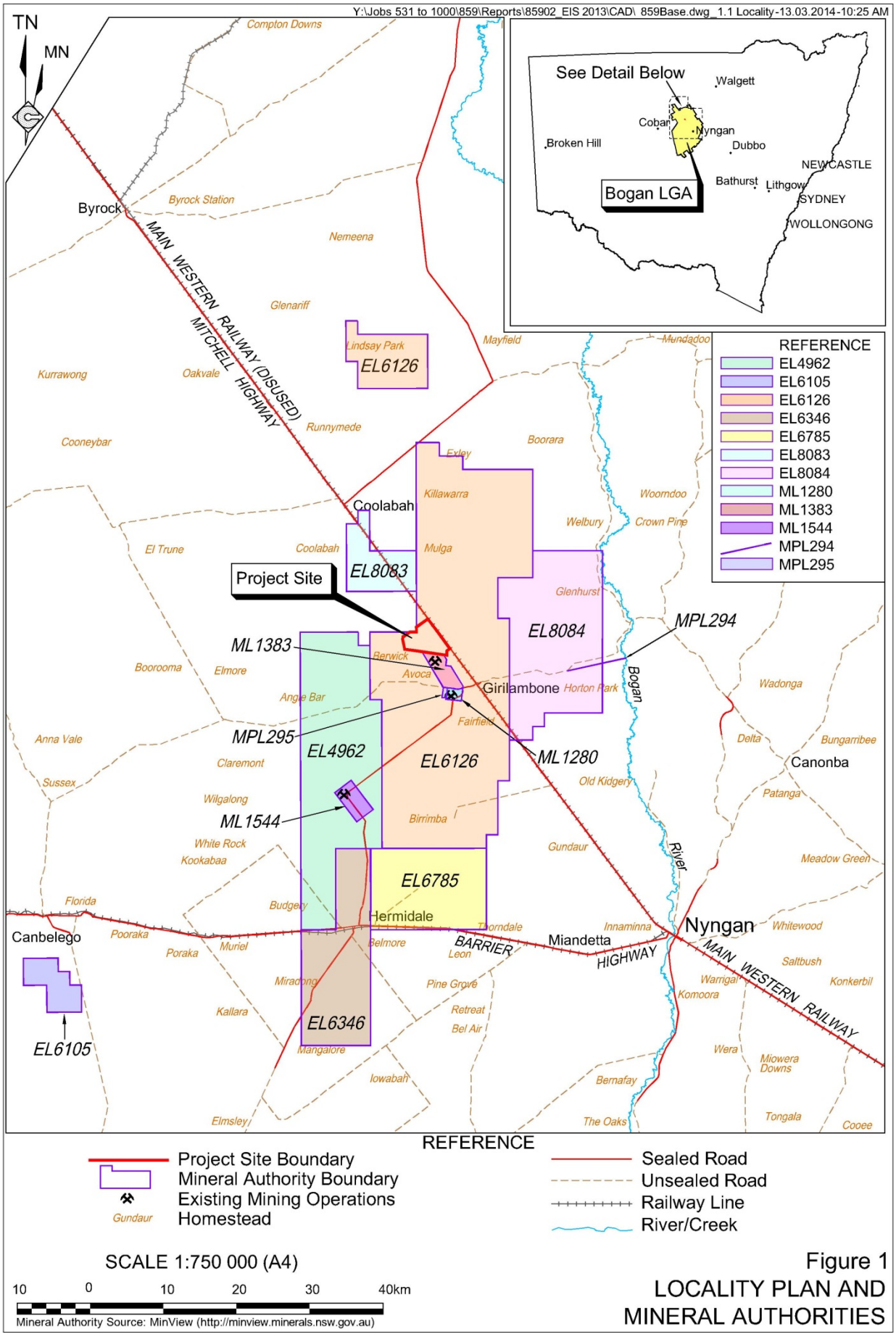


Figure 1
LOCALITY PLAN AND MINERAL AUTHORITIES

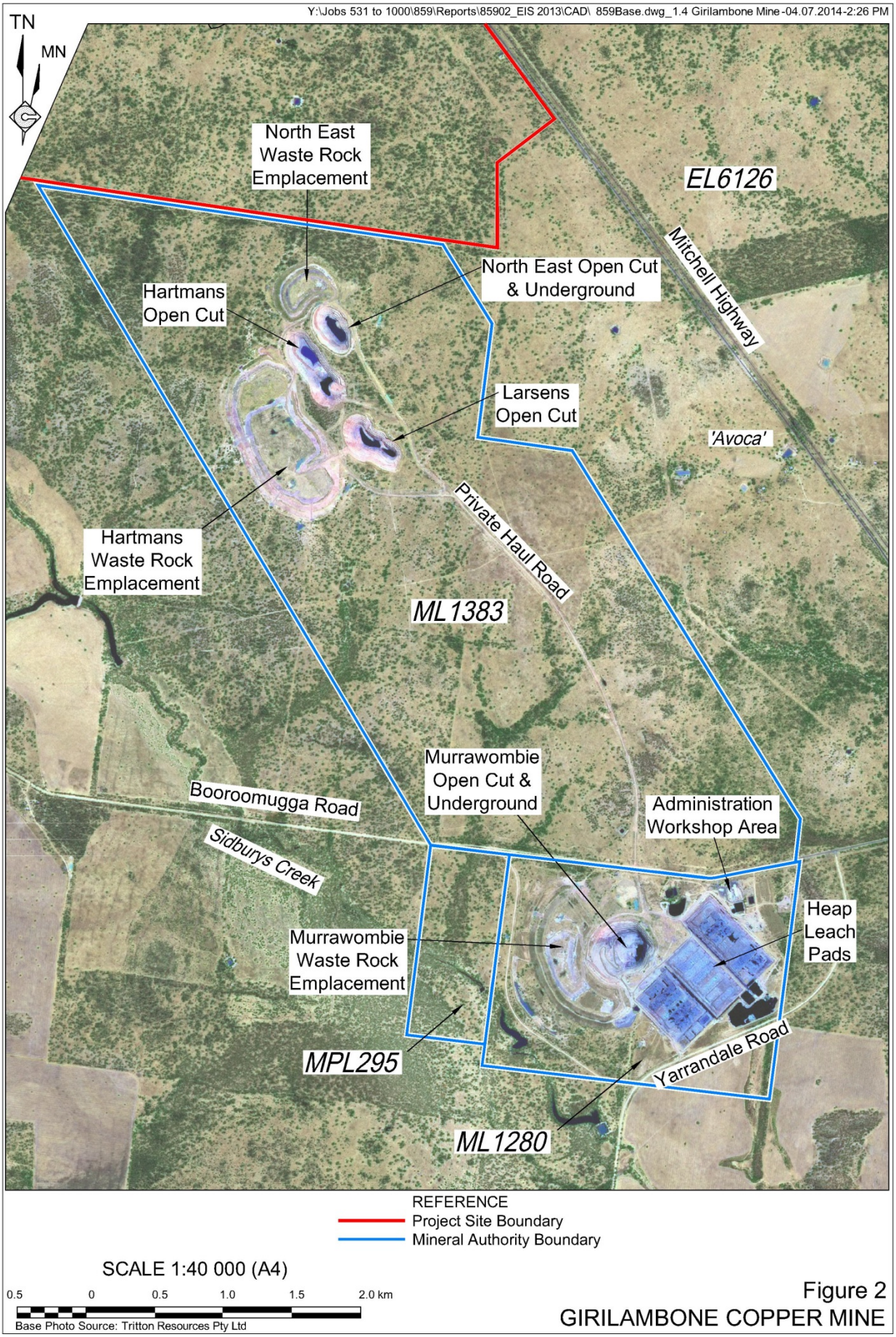


Figure 2
GIRILAMBONE COPPER MINE

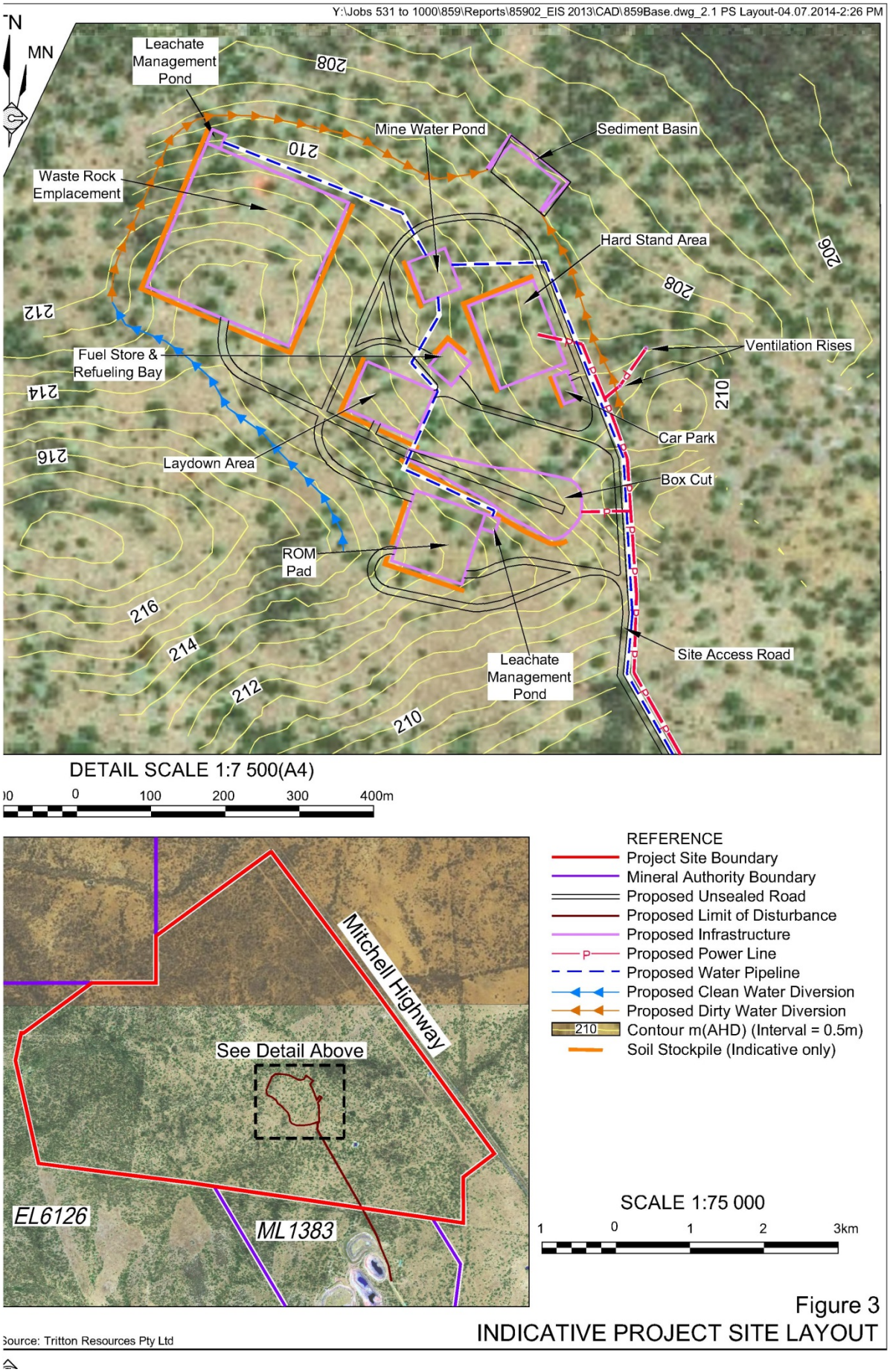


Figure 3
INDICATIVE PROJECT SITE LAYOUT

Source: Tritton Resources Pty Ltd

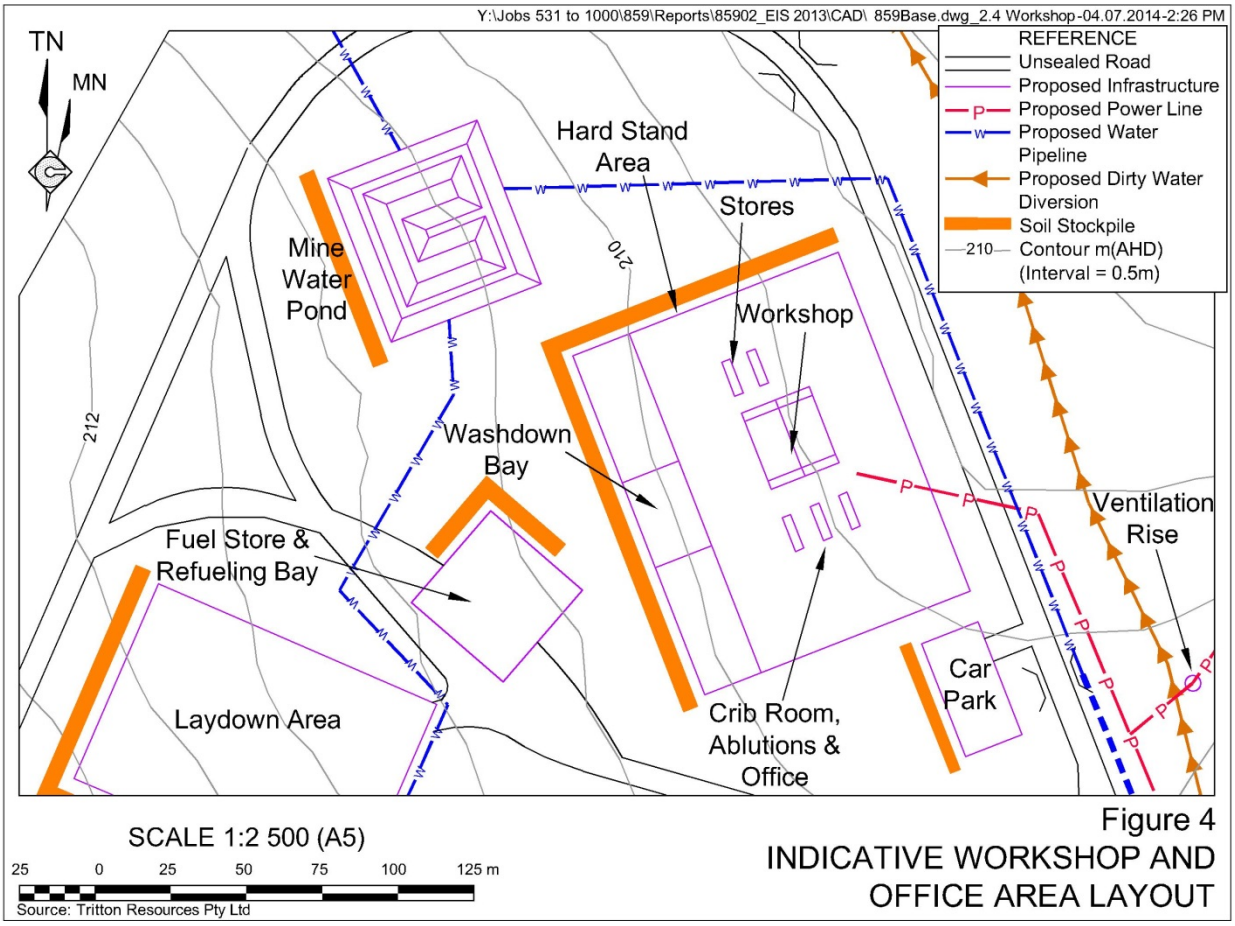


Figure 4
INDICATIVE WORKSHOP AND OFFICE AREA LAYOUT

2 OBJECTIVES

The objective of this report is to provide background information in support of the EIS. The focus of this document is to provide information on the existing environment and constraints for the proposed ATP and provide an assessment of the likely impacts and licences required.

This report has been specifically prepared to provide a description of the existing groundwater environment, including:

- Bores within and surrounding the ATP Site;
- Springs and outflow zones;
- Groundwater dependent ecosystems;
- Aquifers underlying and in the vicinity of the project site; and
- Water quality in identified aquifers.

The objectives of the groundwater impact assessment include:

- An assessment of the likely short term and long term impacts of the proposed development on groundwater resources in the vicinity of the project site; and
- Advice in relation to licencing issues, including what licences will be required, and allocations be sought.

3 SCOPE OF WORKS

In order to meet the required objectives of this report, the following scope of work has been conducted:

1. Review of the ATP Site setting;
2. Review of registered bores and construction details, and internally held bore records at the Applicant's surrounding mining operations;
3. Review of groundwater dewatering activities required to operate the existing subsurface mines in the area;
4. Examination of available maps of groundwater dependent ecosystems, as well as review of topographic and geological maps to identify any potential groundwater discharge areas not formally mapped;
5. Review of existing groundwater data obtained for the other mine workings operated by the Applicant in the area to supplement the regional data available from the bore logs.
6. Perform hydrogeological calculations using proven formulae to estimate potential effects on local groundwater systems using the available understanding of the site geology and hydrogeology, and available estimates of the amount of water required to dewater similar mine workings in the region;

7. Cross reference the predicted effects on the local groundwater system against the existing environment and constraints to determine the potential effects of required dewatering activities;
8. Review of legislation and guidance (particularly the Aquifer Interference Policy issued under the *Water Management Act 2000*) and including the NSW State Groundwater Policy Framework, State Groundwater Quality Protection Policy, State Groundwater Quantity Management Policy and ARMCANZ/ANZECC National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia; and
9. Communication with the NSW Office of Water to discuss licensing requirements for the proposed ATP Site.

4 PROJECT SITE SETTING

The ATP Site is located approximately 2km north of the Girilambone Copper Mine and 24km northeast of its Tritton Copper Mine, 7km northwest of the village of Girilambone, and approximately 55km northwest of Nyngan, along the Mitchell Highway. The site is located in the Central Western Plains of NSW, approximately 620 km west of Sydney, in the Cobar Peneplain Bioregion. This region encompasses the townships of Cobar, Nymagee, Byrock, Girilambone, Lake Cargelligo and Rankins Springs with Louth and Tottenham lying at its boundary.

4.1 GEOLOGY AND SOILS

The Girilambone region is located within the western portion of the Lachlan Fold Belt which consists of Cambrian to Lower Carboniferous rock successions. The eastern margin is truncated by the present coastline in the south and is overlapped by the Permo-Triassic succession of the Sydney Basin and its northern equivalents; The northern margin is overlain by the Mesozoic Great Artesian Basin succession; the southern margin is truncated by the present Tasmanian coastline, and is overlain by Permian and younger successions. The western margin is largely covered by the mainly Cainozoic Murray Basin successions. The final stage of sedimentation and tectonism is the Kanmantoo Fold Belt and the oldest geological activity in the Lachlan Fold Belt are contemporaneous.

Soils in the Girilambone - Hermidale area vary in depth and characteristics with their position in the landscape and are underlain by the Girilambone Group. The Ordovician Girilambone Group consists of rhythmically bedded, poorly sorted, fine to coarse-grained quartzose sandstone with subordinate quartzo-feldspathic sandstone, siltstone and chert, together with minor intercalated basic volcanics and minor conglomerate, marl and serpentinite (Khider & McPhail 2005). These rocks have been weathered to saprolite that forms the rises and low hills (Chan et al. 2002).

In the Girilambone - Hermidale area, the Girilambone Group is overlain by shallow marine volcanic sediments of the Kopyje Group (Suppel & Gilligan 1993). There are also shallow alluvial deposits overlying the Girilambone and Kopyje Groups that are mainly associated with the present-day drainage pattern of Whitbarrow and Pangee Creeks, which generally flow to

the north and northeast of the study area (Chan et al. 2002). A Cambrian-Ordovician sequence of dominantly siliciclastic rock types which have undergone low grade greenschist facies metamorphism outcrops in the area.

Both the Tritton Copper Mine and Girilambone Copper Mine represent the Cobar and Mineshaft Land Systems as described by Walker (1991). Soils of the Cobar Land System are shallow gravely loamy soils, grading to deeper acid and neutral red earths with hardpans down slope and in drainage lines. Soils of the Mineshaft Land System comprise shallow stony, sandy and loamy soils which deepen slightly along drainage lines.

4.2 TOPOGRAPHY

The regional topography is characterised by a gently undulating pediplain with shallow drainage depressions, low ridges and occasional locally prominent hills. The most prominent hill in the region is The Brothers, with an elevation of approximately 287m AHD, located approximately 7.5km to the southwest of the ATP Site. Elevations at the ATP Site, within the limit of disturbance area, range from approximately 215 mAHD in the southwest to 208 mAHD at the northeast (Refer to **Figure 3**).

4.3 CLIMATE

The regional climate is dry continental with hot summers and mild winters. The hottest months occur in both January and February with July being the coldest month (Refer to **Figure 5**). The ATP Site lies in a region that is neither dominated strongly by winter nor summer rainfall, with precipitation events distributed relatively evenly throughout the year (*Straits 2009)*. ES note that over half of the precipitation reported during 2012 observed between February and March, suggesting a summer dominated rainfall cycle was occurring at that time (Refer to **Figure 6**).

The long term mean average annual rainfall for the area is 446.6mm recorded at the Bureau of Meteorology (BOM) Nyngan Airport automatic weather station (Site 051039), approximately 55km south east of the ATP Site. In general, the average rainfall pattern for Nyngan is somewhat variable when taken over a short duration of years. The records which average over many years and a longer time duration than the annual average tend to show that rainfall is distributed relatively evenly throughout the year with slightly higher rainfall occurring in the summer months (Refer to **Figure 3**).

As reported in Straits (2009) the 1 in 100 year rainfall event from 1979 is measured at 2.87mm of rain per hour for 72hrs. Four of these rainfall events have occurred in the area over the past 100 years (*Straits 2009)*.

Based on climatic data from the BOM Nyngan Airport weather station, January is typically the hottest month with an average of 34°C. Winters are mild. July is the coolest month with a mean daily maximum temperature of 16.4°C (Refer to **Figure 5**).

Figure 5: Average Maximum temperatures recorded at Nyngan Airport for 2012

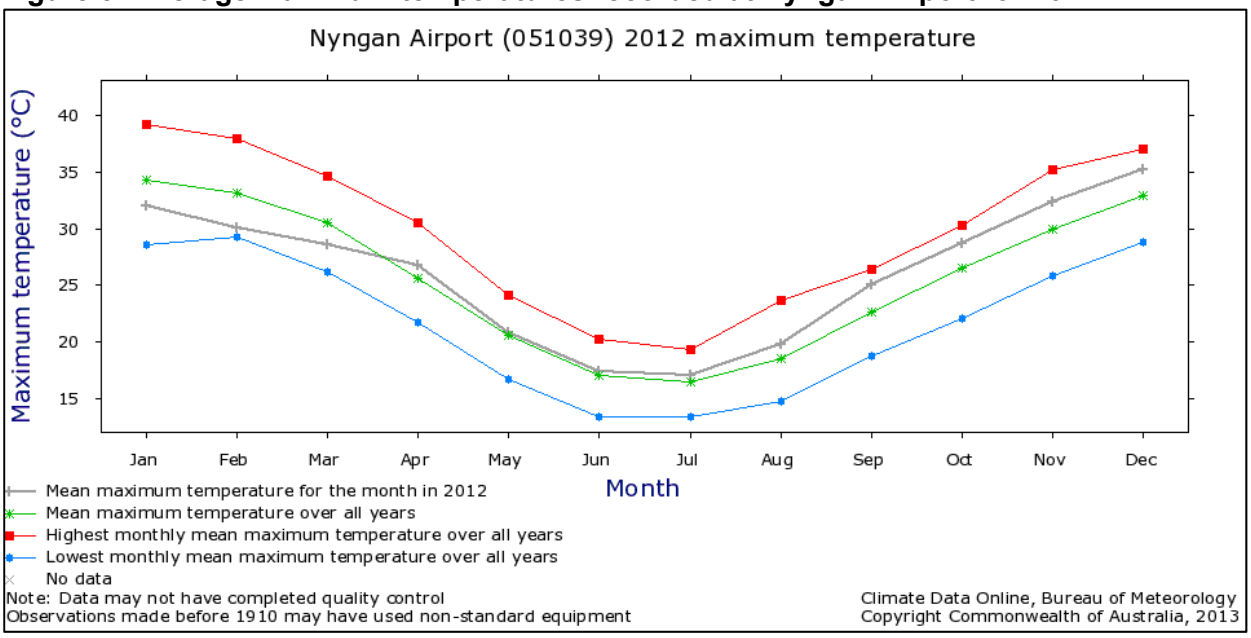
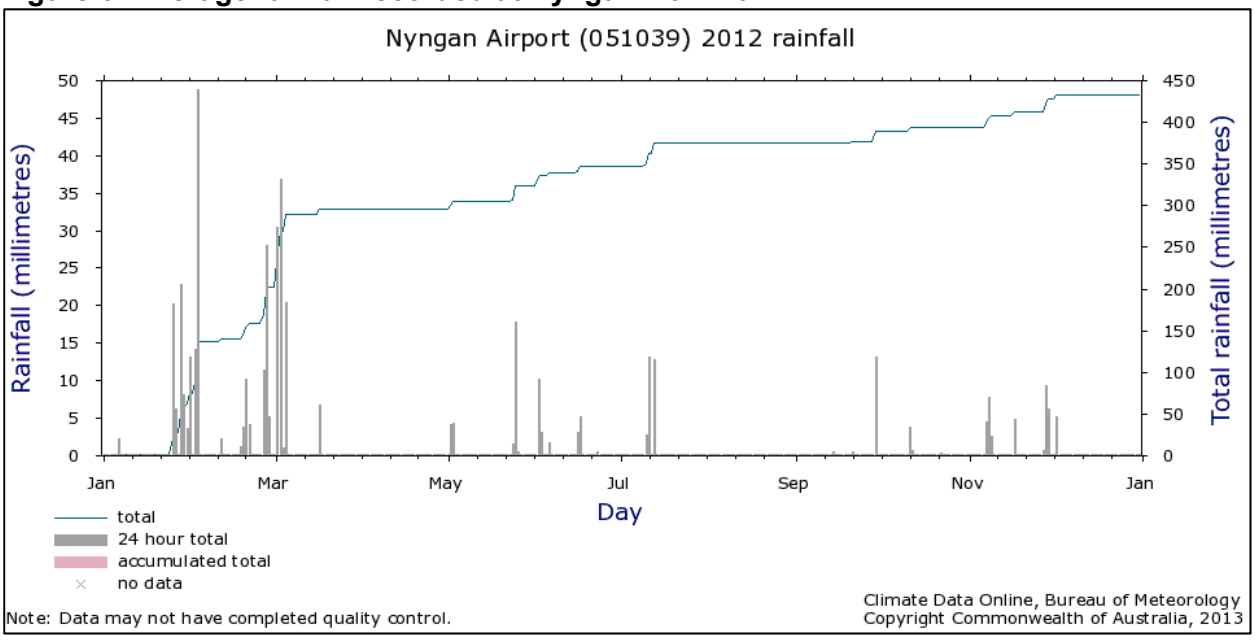


Figure 6: Average rainfall recorded at Nyngan from 2012



5 REVIEW OF REGISTERED BORES

5.1 SUMMARY

In February 2012, OTEK Australia Pty Ltd (OTEK) conducted a Site Information Review and Land Assessment of the Girilambone Copper Mine, including the Murrawombie Pit and the North East Pits (North East Pit, Larsens Pit, and Hartmans Pit) and associated infrastructure. OTEK found that the standing water levels around the Girilambone Copper Mine operations range between 5m and 26m below surface whilst wells in surrounding the ATP Site range between 18m to 127m below surface.

Based on standing water levels, the relative location of Siburys Creek and the predominant bedrock fracture patterns, the primary lateral axis of shallow bedrock groundwater flow beneath the site is likely to the north and west. It is likely that there is vertical migration between the shallow and deeper bedrock aquifers but that could not be assessed at the time of reporting.

R.W. Corkery & Co (May, 2012) summarised that the groundwater environment surrounding the ATP Site at the time of writing their report, may be described as follows.

- Twelve registered bores were located within 10km of the ATP Site. Of these bores, 11 are associated with the company's operations and one is a private bore used for stock purposes.
- Groundwater levels are typically between 8m and 39m below surface, indicating that groundwater is unlikely to discharge to surface or support groundwater dependent ecosystems.
- Groundwater quality is described in one bore only where it is identified as "salty".
- Groundwater is typically hosted within fractured rock aquifers.
- Groundwater yields are typically between 0.01L/s and 1.5L/s.

Water bearing zones during construction of the wells at the Girilambone Copper Mine ranged from 41m to 59m below surface level and have a fracture permeability zone thickness of 6m.

Wells in the 10km of the Girilambone Copper Mine, generally to the south also have a fracture permeability zone thickness of 6m that reduces to shallower depths down catchment from the site. GW042880 is down gradient on the opposite side of the Siburys Creek watershed and intercepts the alluvial system associated with the creek.

5.2 ONSITE REGISTERED BORES

OTEK (2012) found that many of the piezometer wells used for mine monitoring purposes at the North East Pit do not have readily available construction details and were not registered on the NSW Groundwater Works Summary Database. However at the time of writing the report, there are currently three (3) existing monitoring bores listed on the http://nratlas.nsw.gov.au located within the ATP Project Site boundary as shown in **Table 5-1**.

Table 5-1: Onsite Groundwater Bores

Works Request No.	Licence Number	Depth to Water – Standing Water Level (SWL) (m)	Water Bearing Zone (m)	Total Depth (m)
GW805056	80BL620335	39.97	29-65	66.00
GW805057	80BL620336	35.95	47-53	54.00
GW805058	80BL620335	31.04	41-47	48.00
Source: data provided by Tritton				

The onsite groundwater bore locations are provided in Figure 7 below and **Appendix B** for work summary information.

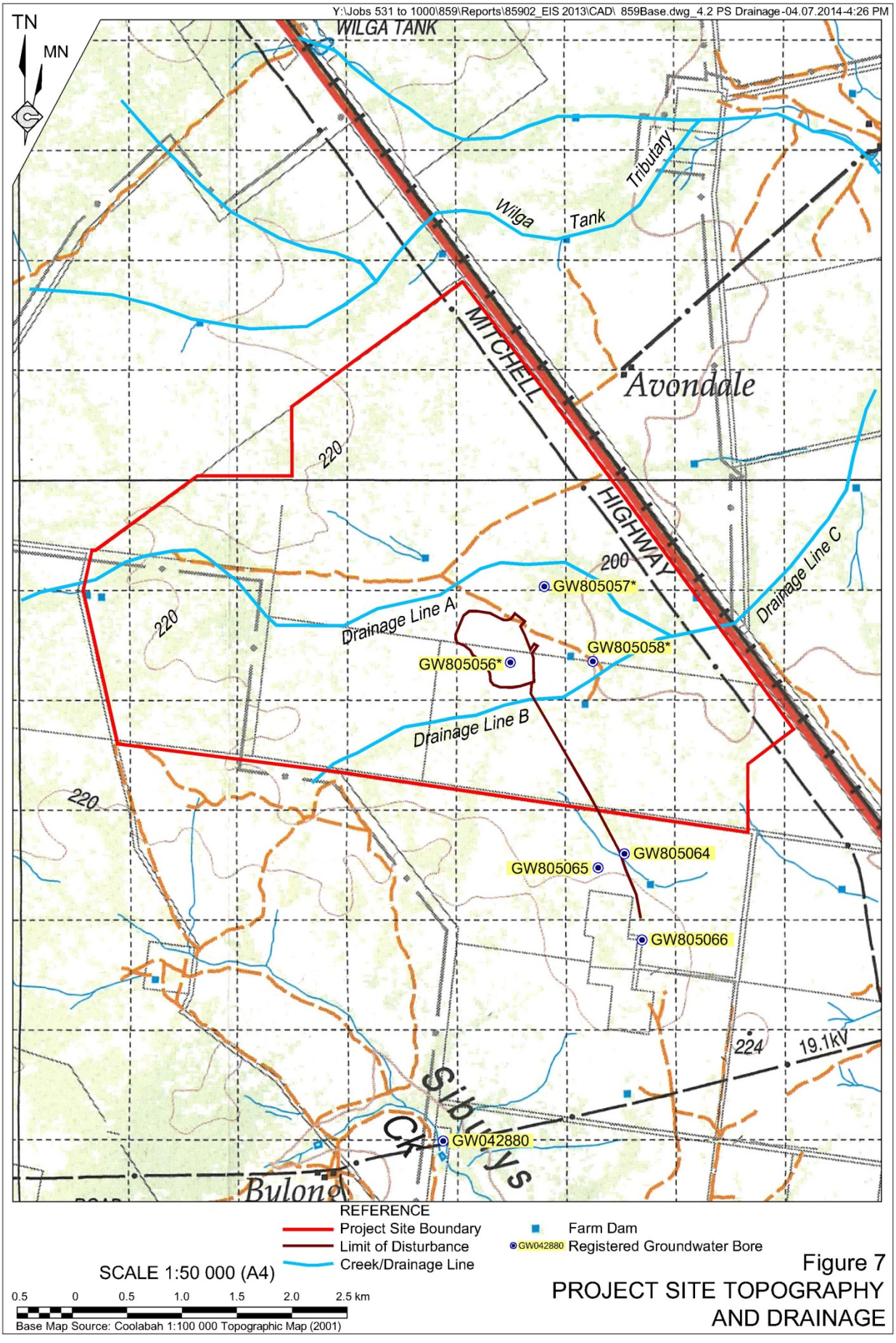


Figure 7
PROJECT SITE TOPOGRAPHY AND DRAINAGE

5.3 OFFSITE REGISTERED BORES

A further 24 groundwater bores listed on the http://nratlas.nsw.gov.au are located within a 20km radius of the Project Site. The majority of these are within the Applicant's current operation at the Girilambone Copper Mine, refer **Table 5-2** and **Appendix B** for work summary information.

Table 5-2: Groundwater Bores Located on Adjoining Properties

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
Note: N.R indicates no result				
Source: http://nratlas.nsw.gov.au				

The nearest groundwater water supply bore (GW026890), which 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 screened within the

fractured rock formation which the ATP Site will intercept. The nearest water supply bore (GW002970), which is registered for stock purposes and within fractured rock, is located approximately 15km to the east of the ATP Site.

6 AQUIFERS AND WATER QUALITY

Groundwater is present predominantly in the bedrock aquifer where groundwater occurs in secondary porosity features (predominantly faults and fractures). Some shallow seepage water may be present at the interface of soils (typically clays derived from weathering of the bedrock) and competent bedrock. This interface seepage is of low yield and is not generally regarded as a water supply aquifer.

6.1 PROJECT SITE

Groundwater quality data obtained by the Applicant in the initial assessment of the bores at the Project Site has been summarised in Table 6-1 presenting the average pH, electrical conductivity (EC) and total dissolved solids (TDS) for each of the bores based on five rounds of monitoring data (November 2012, December 2012, January 2013, February 2013 and March 2013):

Table 6-1: Summary of Average Groundwater Quality at ATP Site Bores

Local Bore ID	Average pH	Average EC (μS/cm)	TDS (mg/L)
GW805056	7.7	20,560	12,920
GW805057	7.6	23,660	14,680
GW805058	7.8	21,480	13,340
Source: The Applicant			

6.2 ADJACENT SITES

Based on March 2013 monitoring data from 32 wells (at the Girilambone Copper Mine site), salinity, measured as total dissolved solids or TDS, has a median value of 13,000 mg/L (electrical conductivity, EC, of 21,000 μS /cm) and is above 4,000 mg/L (EC 7,000 μS/cm) at all locations with an exception between the heap leach pads and Murrawombie Pit) with a TDS of 912 mg/L. Historical measurements in this location range up to 21,000 mg/L. There is a substantial body of monthly monitoring data which is consistent with this assessment, obtained by the Applicant as monitoring data under their existing EPL licence. The data is available on request.

The salinity of the deep fractured groundwater renders it unsuitable for potable or irrigation use. The Australian Drinking Water Guidelines (NHMRC, 2011) indicate an aesthetic barrier to water consumption at a TDS level of 500 mg/L.

NSW DEC (2008) *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination* indicate that the NSW EPA considers potable use to be a

potential groundwater use where TDS values range up to 2,000 mg/L. Given that the site groundwater is highly saline (TDS mean of 13,000 mg/L) potable use can be ruled out.

With respect to agricultural use, water salinity of over 8,100 μS/cm (TDS 5,000 mg/L) is classified as "extreme salinity" not suitable for irrigation, even of highly salt tolerant crops (ANZECC & ARMCANZ, 2000). The potential use of site groundwater for irrigation can therefore be ruled out.

ANZECC & ARMCANZ (2000) also indicate that whilst TDS values below 4,000 mg/L are suitable for beef cattle, sheep, pigs and horses, loss of production can occur where TDS values are above 6,000 mg/L (10,000 mg/L for sheep). The groundwater is therefore of marginal use and is limited to use for stock watering if at all. The salinity is sufficient, however, to render the water quality as marginal even for that use.

7 CATCHMENTS AND DRAINAGE

7.1 RIVER CATCHMENTS

The ATP ore deposits are located within the 73,300 km^2 Macquarie River catchment, which is part of the Murray-Darling Drainage Division and Murray-Darling Basin. The regional sub-catchment is the Bogan River catchment which flows from south to north through the town of Nyngan (Refer to **Figure 1** and **Figure 8**).

The Bogan River maintains its own catchment within the Macquarie River catchment, running roughly parallel to the Macquarie River, and is connected to the Macquarie River via tributaries, one of which is Gunningbar Creek. Gunningbar Creek is a major water source for the Tritton Copper Mines complex.

Flow in the Bogan River increases with distance downstream, as a result of the regulated supplies of water that enter the lower Bogan River via the Albert Priest Canal, Gunningbar Creek and Duck Creek. Upstream of these effluents at Neurie Plains near Nyngan the mean daily flow is 241 ML, while downstream at Gongolgon the mean flow is over 700 ML/day

There are two primary water storages in the Macquarie River catchment comprising of;

- Windamere Dam on the Cudgegong River (capacity 368,000 ML): and
- Burrendong Dam at the junction of the Macquarie and Cudgegong Rivers (capacity 1,189,000 ML).

These two storages provide security of supply to downstream water users. Water use in the Macquarie River is regulated under the *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003,* made under the *Water Management Act 2000.*

The main surface water resources in the Girilambone area are ephemeral tributary creeks. There are also numerous small to moderate sized surface water storage dams located on properties throughout the area which are filled by rainfall run-off. The water quality in these dams is considered to be good with low salinity, near neutral pH and low metal concentration (Green, et.al. 2011).

Figure 8 The Macquarie Bogan Catchment.

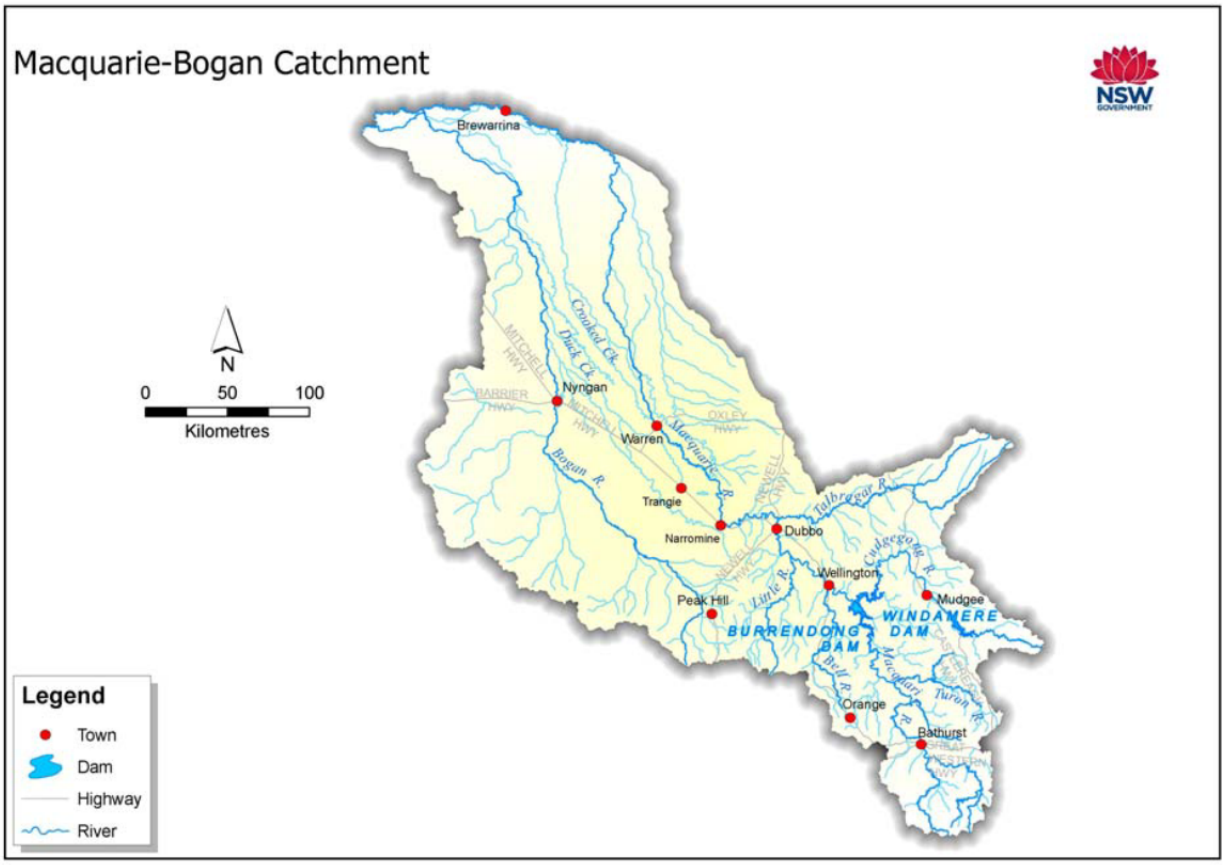


Figure Source: Green D., Petrovic J., Moss P., Burrell M. (2011) *Water resources and management overview: Macquarie-Bogan catchment*, NSW Office of Water, Sydney

7.2 GROUNDWATER CATCHMENTS

The Macquarie-Bogan catchment (refer to) is generally unfavourable for the development of groundwater resources with aquifers in the alluvium being thin and low yielding, and is underlain by fractured rock which yields very little groundwater Water Resources Commission (WRC) 1984 (WRC 1984).

The NSW Murray-Darling Basin (MDB) fractured rock groundwater sources (**Figure 9**) are located within the NSW portion of the MDB. The waters in this groundwater source include all groundwater contained in:

- the Adelaide Fold Belt MDB Groundwater Source
- the Inverell Basalt Groundwater Source
- the Kanmantoo Fold Belt MDB Groundwater Source
- the Lachlan Fold Belt MDB Groundwater Source
- the Liverpool Ranges Basalt MDB Groundwater Source
- the New England Fold Belt MDB Groundwater Source
- the Orange Basalt Groundwater Source
- the Warrumbungle Basalt Groundwater Source
- the Yass Catchment Groundwater Source, and
- the Young Granite Groundwater Source

Figure 9 Groundwater aquifer types of the Macquarie-Bogan catchment

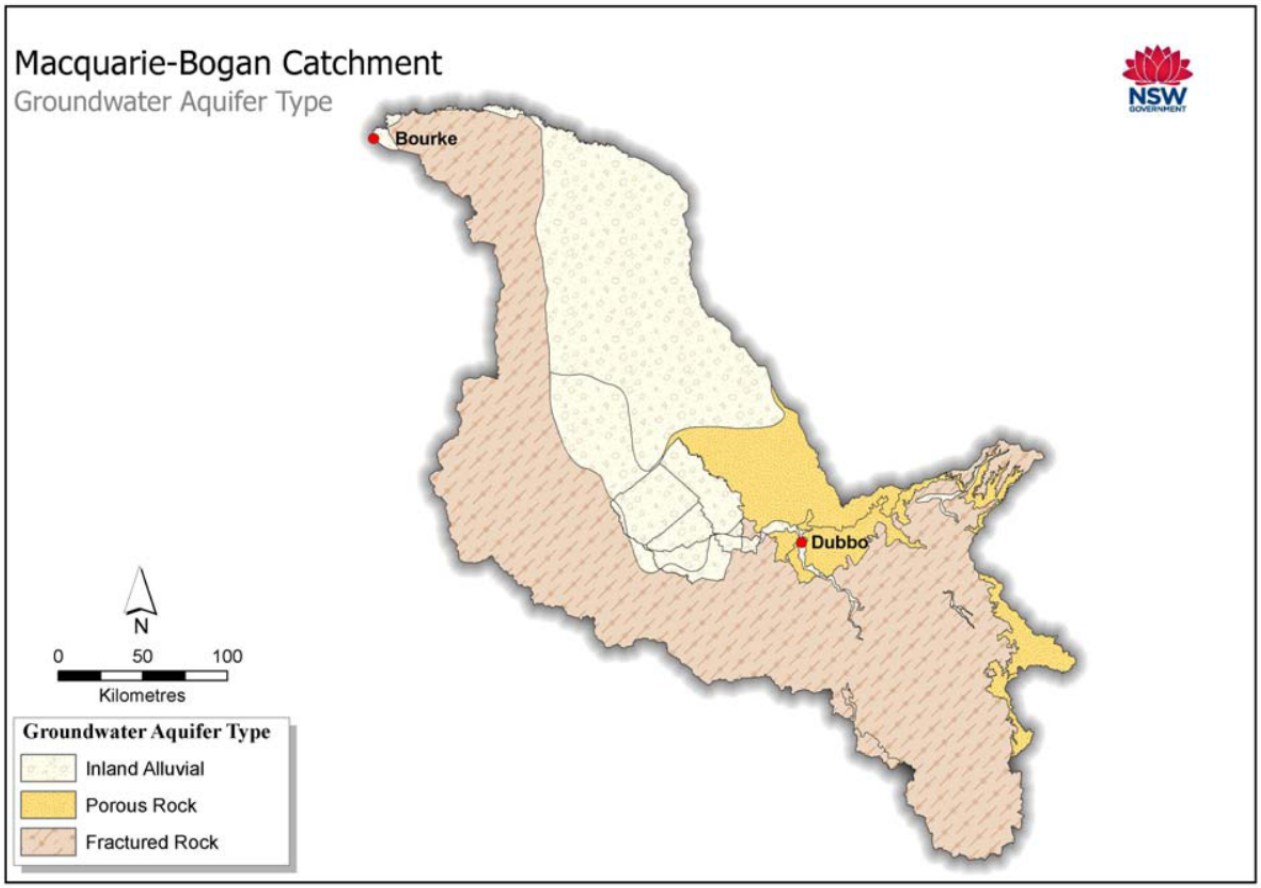


Figure Source: Green D., Petrovic J., Moss P., Burrell M. (2011) Water resources and management overview: Macquarie-Bogan catchment, NSW Office of Water, Sydney.

The Girilambone region is located within the western portion of the Lachlan Fold Belt. The Lachlan Fold Belt MDB Groundwater Source consists of a fractured rock aquifer with a low to moderate level of connection between surface and groundwater. Estimated travel time between groundwater and surface water is considered to be years to a decade. The Lachlan Fold Belt MDB Groundwater Source covers an area of 16,722,000 hectares.

Regional groundwater in the vicinity of the Project Site is low yield and highly saline with EC levels generally between 20,000 and 25,000 µs/cm (Green et.al., 2011). This is consistent with measurements at the Project Site.

The primary permeability of the Girilambone Group rocks is low, with the secondary permeability controlled by fractures, faults and foliation being much higher as highlighted by observations of inflows to underground workings at Tritton and Girilambone operations. The regional groundwater flow direction is thought to be towards the west and northwest. 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).

RWC (2012) found that the local hydrogeology is likely to be controlled by the dominant north-northeast trending foliation and faults as well as bedding which dip to the east southeast. The material above the base of weathering is generally thought to be of higher bulk permeability

than the fresh rock beneath, ie, although permeability is still low, due to weathering, is likely to be less structurally controlled. The fresh (relatively) underlying rock is generally of low permeability with groundwater movement controlled by secondary permeability along foliation, fracturing, bedding and faults.

7.3 PROJECT SITE DRAINAGE

The Project Site lies entirely within the watershed north of Siburys Creek, a tributary of the Bogan River. Siburys Creek which is the closest substantial drainage line to Project Site is situated to the south of Murrawombie. The creek flows in a south easterly direction towards the Bogan River and has a catchment area of 385 km^2.

The project site slopes very gently to the east, with the elevation of the western boundary of the site between 215mAHD and 220mAHD and the elevation of the eastern boundary of the exploration site between 200mAHD and 195mAHD. Surface water within the proposed project site is restricted to two dams and a number of small ephemeral streams. After rainfall events, run-off flows as sheet wash rather than channelised flow. Three dams (refer to **Figure 7**) used for stock watering exist within the Project Site (RWC 2012).

The catchment (refer to **Figure 10**) in the local area has a mixture of cleared and woodland areas, both of which tend to have low infiltration rates. As a consequence, runoff is a high percentage of rainfall and tends to produce high peak flows over a short period of time after rain. After rainfall events, runoff on the Project Site tends to flow as sheet wash. Numerous small to moderate sized surface water storage dams are located throughout the area. These fill rapidly during high flow events (RWC, May 2012).

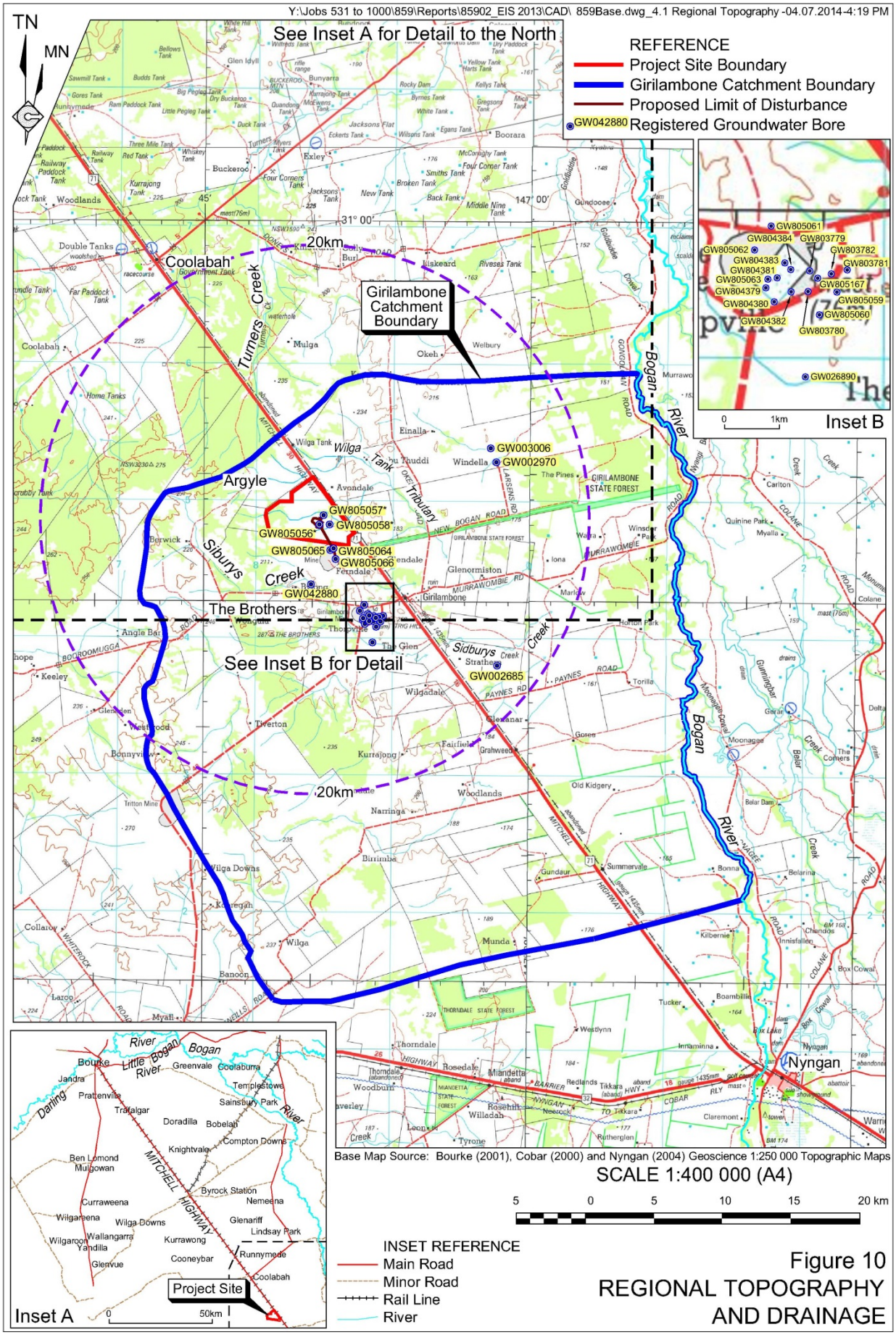


Figure 10
REGIONAL TOPOGRAPHY AND DRAINAGE

The existing surface water management systems at Tritton Copper Mine and Girilambone Copper Mine aim to segregate clean, dirty and contaminated runoff (Refer to **Section 9** for further information on the Applicant's de-watering activities). The following definitions have been adopted for the various runoff types:

- Clean water is defined as runoff from undisturbed bushland catchments.
- Dirty water is defined as runoff from disturbed areas and includes runoff from the waste rock emplacements and stockpiles. This water may contain elevated levels of suspended solids.
- Contaminated water is defined as runoff generated from the processing facilities, open cuts and underground operations. This water may be contaminated by suspended solids, salts and heavy metals etc.

Clean runoff from undisturbed sub-catchments is diverted around disturbed areas to the extent practicable. Dirty water runoff is captured in sediment dams to encourage the settling of suspended solids. Runoff from large storm events overtops sediment dams and generally discharges to downstream containment dams (rather than offsite).

Contaminated water is captured in containment dams or the open cuts. Containment dams at the Girilambone Copper Mine generally overflow offsite, however, Tritton Resources has advised that overflows are rare and occur in emergency situations only (*Straits 2009)*.

8 ECOSYSTEMS

8.1 REGIONAL

The Macquarie-Bogan Catchment previous to European settlement supported a complex mosaic of forests, temperate and semi-arid woodlands, wetlands, shrublands, heaths and grasslands. Large scale clearing and subsequent degradation has reduced many of these vegetation communities to isolated remnants on the less fertile and productive soils. National parks and reserves protect nearly 1,300 km^2 of habitat within the Macquarie-Bogan catchment. Most of the protected areas are found in the upper section of the Macquarie-Bogan catchment.

The aquatic and terrestrial environments of the Macquarie-Bogan Catchment support a range of threatened species and ecological communities that are protected under the *Threatened Species Conservation Act (TSC Act)1995*. Within the Central West CMA region (which includes the Macquarie, Bogan and Castlereagh) there are 42 threatened plant species with 17 of these listed as endangered. The majority of these are associated with the slopes and ranges of the upper catchment. Vegetation communities in the Lower Bogan catchments have been heavily affected by clearing and the remaining native vegetation therefore increases in significance.

8.2 SPRINGS AND OUTFLOW ZONES

No springs or outflow zones were identified in the vicinity of the Project Site.

The search of groundwater dependant ecosystems (See **Section 8.3** below and **Appendix A**) revealed that rivers ten kilometres or more from the site have a low potential of being groundwater fed.

8.3 GROUNDWATER DEPENDANT ECOSYSTEMS

No groundwater dependant ecosystems are apparent in the vicinity of the site. Environmental Strategies conducted a search of the Groundwater Dependent Ecosystems Atlas (Australian Government, Bureau of Meteorology, http://www.bom.gov.au/jsp/weave/gde.html). The area surrounding the Project Site is shown in **Appendix A** and it is apparent that no groundwater dependant ecosystems occur in the vicinity of the Project Site.

8.4 GROUNDWATER VULNERABILITY

Review of the Groundwater Vulnerability Map for the Macquarie catchment published by the Department of Land and Water Conservation, Dubbo, indicates that the area of the Project Site is an area of generally low groundwater vulnerability.

A copy of the groundwater vulnerability map is included in **Appendix A.**

8.5 STYGOFAUNA

Animal species that rely on groundwater are less well known and included invertebrates and microscopic organisms (stygofauna) that live within the pore spaces that make up an aquifer. These organisms can play an important role in maintaining aquifer health and function by keeping pore spaces free from silt and through their role in chemical and nutrient cycling processes (DLWC, April 2002). Stygofauna are likely to be present within the fractured rock aquifer at the ATP Site, however, species abundance and distribution have not been confirmed through testing at the ATP site.

The groundwater quality at the ATP site is understood to be saline (with an EC ranging between 20,560 and 23,660 µS/cm). In the Pilbara and Yilgarn regions in WA, studies have indicated that stygofauna will not be present unless the salinity is less than 60,000 mg/L (Western Australia EPA 2007). Populations in Queensland have been detected in aquifers with EC as high as 19,000 µs/cm, but results indicate that the likelihood of stygofauna presence is significantly lower in aquifers with elevated salinity (Bennison 2012). Results from elsewhere in Australia indicate that stygofauna have been recorded in groundwater with EC levels of 86,900 µS/cm and 74,000 µS/cm (Moulds 2010) but this occurred in only two samples. Based on the saline conditions of groundwater at the site, species abundance and distribution are likely to be low.

9 DEWATERING ACTIVITIES – ADJACENT OPERATIONS

Currently the Project Site has no dewatering infrastructure, but such will be required as the project is developed. It is assumed that the site dewatering system will connect to the existing Tritton Resources Water Management System via the Girilambone North system during development and operation. As discussed in **Section 4**, the existing surface water management system used by Tritton Resources aims to segregate clean, dirty and contaminated runoff and the ATP system will do likewise.

Parsons Brinckerhoff (PB) (August 2011) was commissioned by Tritton Resources, to undertake a water balance assessment of the Tritton Copper Mines surface water management system and to prepare a surface water management plan (SWMP) incorporating improvements.

Based on discussions with the Applicant, PB established that the current pumping system was not automated, and as a result the actual pumping regime may differ from the modelled pumping rules used to create SWMP.

Groundwater intercepted by underground operations at the existing Tritton Mine workings is pumped to the surface and stored as a reticulation system. In the event of potential overflow pipework enables water to be sent to either the Tailings Storage Facility or drainage channels which enables waters to flow into the Tritton Containment Dam.

Information provided from the applicant indicated that the current groundwater make for the Tritton Mine was 111.138 ML per annum, based on the overall average of monthly measurements and estimates. This calculated average groundwater pumping rate from the Tritton Mine equates to approximately 3.524 L per second.

PB concluded that the general water cycle of the system at the Girilambone Copper Mine is as follows.

Hartmans Pit:

- Has a local catchment area of 15.3 ha.
- Supplies water for mining operations at Girilambone North.
- When Hartmans Pit sump volume is less than approximately 10 ML, water from North East Pit and Larsens Pit is pumped in to meet demands.
- Pumping to Hartmans Pit ceases when Hartmans Pit sump volume exceeds 10 ML.
- When Hartmans Pit sump volume exceeds 146 ML as a result of local rainfall-runoff, Hartmans Pit is dewatered to Larsens Pit.
- Results indicate that total dissolved solids, sulphate, chloride, cadmium, cobalt, copper and nickel all exceeded the guideline limit for the relevant criteria and therefore cannot be considered suitable for reuse involving stock or irrigation.

North East Pit:

- Has a local catchment of 8.6 ha.
- Completed to depths of approximately 80 to 126mbgl.
- Annual groundwater make is 87 ML/yr.
- Is generally maintained at less than 10 ML. If Hartmans Pit calls for water, North East Pit pumps to Hartmans Pit if it has water available.
- When the volume of North East Pit exceeds 10 ML, North East Pit is dewatered to Larsens Pit.
- Water stored in North East Pit is reused for mining operations at North Murrawombie.
- The pH is stable ranging between 7 – 8 pH units. EC was also shown to have a stable trend, ranging between 14,000 and 27,000µS/cm.

Larsens Pit:

- Has a local catchment of 11.7 ha.
- Receives water dewatered from Hartmans Pit and North East Pit during wet periods, as well as overflows from sediment dams SB1 and SB2.
- Also receives groundwater make (17 ML/yr), and runoff from the local catchment.

- Water is pumped from Larsens Pit to supply mining operations at North Murrawombie during dry periods when Hartmans Pit sump has inadequate water to meet demands.
- The only other outflow from Larsens Pit is evaporation.
- The bund around Larsens Pit has a local catchment of 39.1 ha.

Murrawombie:

Groundwater make to Larsens and North East declines (some 64 ML/year) is pumped to Hartmans Pit for reuse onsite at Girilambone North, or to Larsens Pit for storage.

Tritton Resources has advised that 64 ML/yr is required at Hartmans Pit to supply underground mining operations at Girilambone North. This water is sourced from groundwater dewatering from Larsens and North East declines.

Currently there is no potable water use at the Project Site or Girilambone North sites, however potable water is trucked to Tritton Mine complex and is utilised in the administration and amenities buildings. Wastewater is treated in onsite septic systems and effluent is reused onsite. Tritton Resources has advised that the potable water demand is 13.8 ML/yr. Tritton Resources currently has a zero discharge policy for dirty and contaminated water, (PB, August 2011).

In the Straits Tritton Dec 2011 - *Annual Environmental Management Report*, the North East piezometers recorded stable groundwater levels. Piezometers located in close proximity to dewatering activities of the northern pits showed an expected groundwater sink. However, piezometers surrounding the North East pits do not appear to be affected by adjacent mining activities with the exception of GNR012 (located equidistant at approximately 180m from Hartmans and North East Pits). Drawdown in this piezometer was affected by operational dewatering at Hartmans pit and was expected to resume on cessation of dewatering activities.

OTEK (2012) confirmed this forming the opinion “it appears that the North East Pit mining operations has had little to no impact on shallow groundwater quality in the vicinity of the pits. The measured contaminants of potential concern (COPC) values in all wells generally correspond to background concentrations and pH is consistently around neutral. It appears that the lateral extent of dissolved COPCs in the shallow aquifer around the North East Pits has been delineated to show no impact”.

10 CONSTRAINTS

There are no identified environmental constraints relating to groundwater in the vicinity of the Avoca Tank development site.

The local groundwater occurs in:

a) Alluvium associated with creek lines and would not be affected by mine activities; and
b) In bedrock fracture systems at depth, which are too saline for beneficial use.

Bores within the area are either owned by Straits Tritton and used for monitoring of mine activities, or are screened in shallow alluvium which would not be affected by changes to the

groundwater system in bedrock at depth, and used for stock watering. There is a marginal potential for the use of groundwater for stock watering (sheep).

No springs or groundwater outflow zones were identified in the vicinity of the Project Site.

No groundwater dependent ecosystems are identified in the vicinity of the Project Site.

10.1 NEAREST WATER SUPPLY WORKS

The nearest groundwater water supply bore (GW026890), which is registered for stock purposes is located approximately 8.5km southeast of the proposed ATP Site. Based on the drilling logs, this bore is screened within an unconsolidated formation and not screened within the fractured rock formation the Avoca Tank Mine will intercept, and it will therefore not be affected by the proposed mine. The nearest water supply bore (GW002970), which is registered for stock purposes and within fractured rock, is located approximately 15km to the east of the ATP Site.

10.2 NEAREST GROUNDWATER DEPENDENT ECOSYSTEM

Based on a review of **Appendix 3** - Map of High Priority GDEs of the WSP for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012), there are no high priority GDEs within at least 150km of the site (including springs, geothermal springs, wetlands and karst) associated with the fractured rock groundwater source). The nearest high priority GDE (spring or geothermal spring) within the NSW Murray-Darling Basin Fractured Rock Groundwater Sources is located approximately 150km to the west of the site.

11 PROPOSED PROJECT SITE DEVELOPMENT

ES understands that the proposed mine excavation development would comprise the following:

- Construction and use of a boxcut and underground portal with a maximum depth of approximately 30m and would require extraction of approximately 200,000 bank cubic metres (bcm) of waste rock; and
- Extraction of the economically recoverable resources to a depth of approximately 500m below ground level using underground long hole open stope mining techniques.

Based on a review of the Avoca Tank Preliminary Mining Schedule, following the initial 30m box cut ES' understanding of the indicative mine construction schedule is listed in **Table 11-1** below.

Table 11-1: Proposed Schedule of Mine Construction

Month of Completion	Base Depth of Mine Development
6 (183 days)	100m
15 (458 days)	200m
27 (824 days)	300m
42 (1281 days)	400m
63 (1922 days)	~500m

12 RELEVANT LEGISLATION, REGULATION AND POLICY FOR GROUNDWATER

12.1 INTRODUCTION

To facilitate the proposed mine development, in relation to impacts of groundwater resources, the following statutory requirements need to be achieved in order to address the NSW Office of Water DGR (provided in full in **Appendix C**).

There are two key pieces of legislation and regulation that control the use and development of land in NSW:

- *Environmental Planning and Assessment Act (1979)* (EP&A Act); and
- *Environmental Planning and Assessment Regulation (2000)* (EP&A Reg).

There are two key parts of legislation for the management of groundwater in NSW:

- *Water Act (1912)*; and
- *Water Management Act 2000* (WMA 2000).

In addition to the above Acts, the relevant plans, policies and regulation are considered the main tools which assist in implementing and defining the provisions of the WMA:

- The Water Management (General) Regulation (2011);
- Water Sharing Plans:
    - 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):
        - Lower Bogan River Water Source (2012);
- The NSW State Groundwater Dependent Ecosystem Policy (2002);
- The *NSW Aquifer Interference Policy 2012* (September 2012);
- The NSW Groundwater Policy Framework Document – General (1997);
- The NSW Groundwater Quality Protection Policy (1998);
- The NSW State Rivers and Estuaries Policy (1993); and
- The NSW Wetlands Policy (2010)

A detailed discussion of the regulatory framework as it applies to the project site is presented in **Appendix D** and should be read to provide complete context. Brief summaries and aspects of the regulatory environment directly relating to the ATP are discussed in the sections below.

12.2 WATER MANAGEMENT ACT (2000)

The Water Management Act (2000) – the WMA – is comprehensive water legislation to guide water management activities. The objectives of the WMA were the sustainable and integrated management of the state's water for the benefit of both present and future generations. Under the WMA, the ATP will entail aquifer interference activities as groundwater bearing zones will be intercepted during the proposed works.

A person who is engaged in an aquifer interference activity in connection with the mining or extraction of any material is exempt from section 91A (1) of the Act in relation to the using of water from an aquifer if the water is used in accordance with an aquifer interference approval with respect to that activity.

Aquifer interference approval from the NSW Office of Water will therefore be required for the ATP.

12.3 WATER SHARING PLANS

WSPs are being progressively developed for rivers and groundwater systems across NSW following the introduction of the WMA. Water Sharing Plans made under the WMA are being prepared as Minister's plans under Section 50 of the Act. These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water.

WSPs provide a legislative basis for sharing water between the environment and consumptive purposes. Under the WMA, a plan for the sharing of water must protect each water source and its dependent ecosystems and must protect basic landholder rights.

The Project Site is located within the following WSPs:

- Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012) – *Lachlan Fold Belt MDB Groundwater Source*; and
- Water Sharing Plan for the Macquarie-Bogan Unregulated and Alluvial Water Sources (2012) – *Lower Bogan River Water Source.*

The DGR relating to the WSP was to demonstrate how the mining proposal is consistent with the relevant access and trading rules of the WSP. Accordingly, groundwater abstraction licences for the ATP will need to be consistent the WSP for the Lachlan Fold Belt MDB Groundwater Source (see Section 12.5.1).

12.3.1 Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012) – Lachlan Fold Belt MDB Groundwater Source

The NSW Murray-Darling Basin (MDB) fractured rock groundwater sources are located within the NSW portion of the MDB (as detailed in **Section 7.2**).

The Lachlan Fold Belt MDB Groundwater Source covers an area of 16,722,000 hectares. The Project Site is located within the western portion of the Lachlan Fold Belt MDB Groundwater Source which consists of fractured rock aquifer with a low to moderate level of connection between surface and groundwater.

The long-term average annual extraction limit (LTAAEL) for the Lachlan Fold Belt MDB Groundwater Source, which determines the amount of groundwater that can be potentially made available for annual extraction, is 821,250ML per year. Trading of water is permitted within the Lachlan Fold Belt MDB Groundwater Source zone.

Based on a review of **Appendix 3** Map of High Priority GDEs of the WSP for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012), there are no high priority GDEs

within at least 150km of the site (including springs, geothermal springs, wetlands and karst) associated with the fractured rock groundwater source.

12.3.2 Water Sharing Plan for the Macquarie-Bogan Unregulated and Alluvial Water Sources (2012)

The Project Site is located within the boundary of the WSP for the Macquarie-Bogan Unregulated and Alluvial Water Sources, however, is not located within the alluvial groundwater source zones (Cudgegong Alluvial, Talbragar Alluvial, Bell Alluvial or the Upper Macquarie Alluvial).

No GDEs have been identified for the four alluvial groundwater sources included in the Macquarie-Bogan Unregulated and Alluvial Water Sources WSP.

The proposed mine is situated within a fractured rock aquifer, with low to moderate level of connection between surface and groundwater and is not within the listed alluvial groundwater source zones specified in the WSP. The potential groundwater impact of the proposed mine is not relevant to this WSP.

12.4 NSW STATE GROUNDWATER DEPENDENT ECOSYSTEMS POLICY (2002)

Base on the DGRs from the NSW Office of Water, the potential impacts to Groundwater Dependent Ecosystems (GDEs) must be considered.

As demonstrated in **Section 8.3 and 10.2** of this report no high priority GDEs are apparent in the vicinity of the site (within 150km).

12.5 NSW AQUIFER INTERFERENCE POLICY (2012)

The purpose of the *NSW Aquifer Interference Policy 2012* is to explain the role and requirements of the Minister administering the WMA in the water licensing and assessment processes for aquifer interference activities under the WMA and other relevant legislative frameworks. The *NSW Aquifer Interference Policy 2012*:

1. clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation; and
2. establishes and objectively defines considerations in assessing and providing advice on whether more than minimal impacts might occur to a key water-dependent asset.

The ATP activities will result in aquifer interference under the NSW Aquifer Interference Policy (2012) as groundwater will be removed from at least one aquifer. Accordingly, groundwater licencing will be required (see Section 12.5.1 below).

12.5.1 Licensing of Water Taken Through Aquifer Interference

A water licence is required under the WMA (unless an exemption applies or water is being taken under a basic landholder right) where any act by a person carrying out an aquifer interference activity causes:

- the removal of water from a water source; or
- the movement of water from one part of an aquifer to another part of an aquifer; or

- the movement of water from one water source to another water source, such as:
  - from an aquifer to an adjacent aquifer; or
  - from an aquifer to a river/lake; or
  - from a river/lake to an aquifer.

A licence for the removal of water from a water source will be required for the ATP.

12.5.2 Aquifer Impact Assessment

The WMA includes the concept of ensuring "no more than minimal harm" for both the granting of water access licences and the granting of aquifer interference approvals. Aquifer interference approvals are not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems, as a consequence of its being interfered with in the course of the activities to which the approval relates.

Whilst aquifer interference approvals are not required to be granted, the minimal harm test under the WMA is not activated for the assessment of impacts. Therefore, this Policy establishes and objectively defines minimal impact considerations as they relate to water-dependent assets and these considerations will be used as the basis for providing advice to the Minister.

Within the WMA, *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities* are categorised into type of groundwater sources and are presented in **Table 12-1** below:

Table 12-1: Highly and Less Productive Groundwater Source Types

Highly Productive	Less Productive

• Alluvial;
• Coastal Sands;
• Porous Rock;
  ○ Great Artesian Basin - Eastern Recharge and Southern Recharge;
  ○ Great Artesian Basin – Surat, Warrego and Central;
  ○ other porous rock; and
• Fractured Rock.
	• Alluvial;
	• Porous Rock; and
	• Fractured Rock.

The proposed mine development is considered to be located in a Less Productive groundwater source type due to the elevated TDS (>1,500mg/L) and low yield (based on the known sustainable discharge rates reported during the pumping test at Girilambone mine site (ES, June 2013).

In addition to the requirements listed in *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities* (refer to **Table 2, Appendix D**), the following issues also require consideration:

- acidity issues to arise, for example exposure of acid sulphate soils (unlikely at the ATP); and

- waterlogging or water table rise to occur, which could potentially affect land use, groundwater dependent ecosystems and other aquifer interference activities. Specific limits will be determined on a case-by-case basis, depending on the sensitivity of the surrounding land and groundwater dependent ecosystems to waterlogging and other aquifer interference activities to water intrusion.

The second dot point will apply to licencing of groundwater make from the ATP.

12.5.3 Requirements for Aquifer Impact Assessment

A risk management approach to assessing the potential impacts of aquifer interference activities was adopted, where the level of detail required to be provided by the proponent is proportional to a combination of the likelihood of impacts occurring on water sources, users and dependent ecosystems and the potential consequences of these impacts.

As defined under the WMA, the proposed development is located within a confined fractured rock aquifer system, which does not have a 'water table' and the piezometric surface represents 'water pressure' rather than the level at which water will be encountered during excavation or drilling. As such, assuming negligible connectivity with overlying unconsolidated formations, ES consider that only groundwater pressure and groundwater quality minimal impact considerations apply for the proposed Avoca Tank Mine development.

13 GROUNDWATER INFLOW AND DRAWDOWN IMPACTS

The measured standing water level in the three groundwater bores (GW805056, GW805057 and GW805058) within the proposed footprint of the mine ranged from 31.04m to 39.97m bgl, with an average level of 35.65m bgl (refer to **Table 5-1**, **Section 5.2**).

The drilling logs indicated that the shallowest water bearing zone was encountered between 29m bgl (GW805056) and 47m bgl (GW805056) and extended to the depth of drilling (generally 1m below water bearing zone). The existence of water bearing fracture zones below the depth of 66m is unknown.

When water bearing fractured zones are encountered in the walls and/or base of the mine, the piezometric head would need to be lowered to allow excavation of the mine to proceed. Assuming the average standing water level 35.65m bgl is representative of the piezometric head in the vicinity of the mine, the head would have to be lowered to the base of the water bearing fractured zone or in absence of known fractured zones the base of the mine, which would require 464.35m of drawdown assuming continuous water bearing strata to the base of mine. Note that this is a highly conservative assumption and that discrete and discontinuous water bearing zones are more likely.

13.1 CONCEPTUAL MODEL

It is necessary to establish a conceptual understanding of the processes that would take place in the proposed mine in order to assess potential dewatering requirements and associated potential drawdown impacts to groundwater.

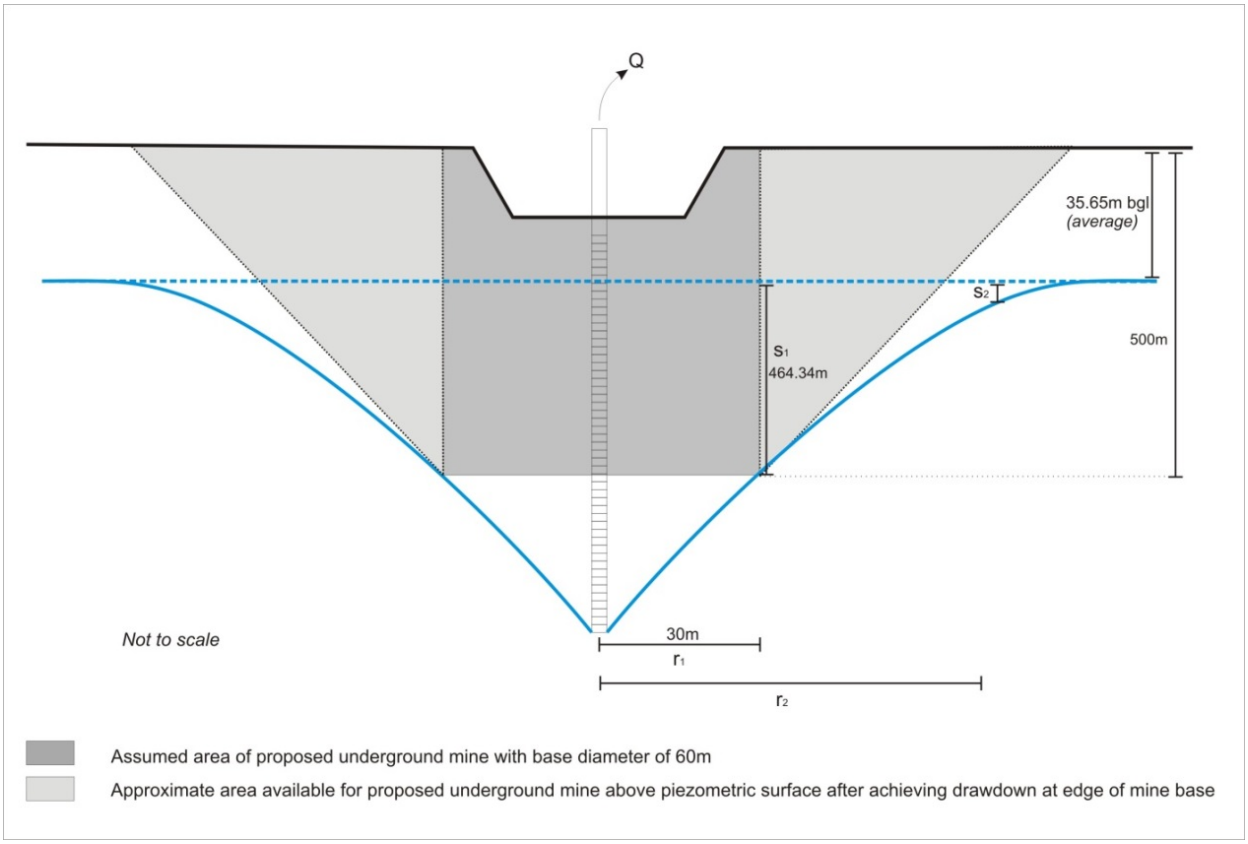
To quantitatively estimate the volume of water of groundwater inflow that would need to be removed from the mine to completely dewater it and predict drawdown surrounding the mine, a

theoretical dewatering bore is located in the centre of the mine development. The cone of depression resulting after pumping (or groundwater inflow) was required to be below the assumed depth (500m bgl) and width (radius of 30m) of the proposed mine development to achieve effective dewatering. The radius was selected based on advice from the Applicant reflecting the proposed mine dimensions.

Based on the proposed development requirements listed in **Section 11**, the estimated lateral extent of the interpreted edge of mineralisation during the initial exploration works documented in a media release (Straits, April 2012) and approximate current mine development lateral extent at Tritton Mine, for the purposes of this assessment, ES have assumed that the proposed mine extends to 500m below ground level (bgl) and with a basal footprint of 0.28ha (assuming a circular area between the three groundwater investigation boreholes, which has a diameter of 60m). This assumed area of the proposed Avoca mine has a maximum underground diameter of 60m with the radius at the base of the mine (r_1) excavation assumed to be 30m. A conceptual diagram of the proposed mine development is provided in **Figure 11** below.

Transient numerical modelling was completed as the mine excavation works are proposed to be completed on a staged schedule, which is listed in **Table 11-1.**

Figure 11: Groundwater Conceptual Model for Quantitative Assessment of Groundwater Inflow and Drawdown



13.1.1 Groundwater Inflow

The amount of groundwater inflow will depend on the depth of the mine, the storage of water in the adjacent fractured rock aquifer, and the transmissivity of the surrounding fractured rock. Based on the results of aquifer testing within fractured rock at nearby Girilambone Mine site

(ES, June 2013) significant volumes (>1ML/day) of groundwater are unlikely to seep into the mine. Information provided from Tritton Mine Resources indicated that the current groundwater make and subsequent discharge rate for the Tritton Mine was calculated to be 0.304ML/day (3.524L/second) which correlates with the aquifer testing results described above.

If groundwater bearing strata was encountered, the most significant seepage would come from localised fractures with potentially limited interconnectivity and storage capacity.

The formation is considered to become more massive with depth, with fractured zones likely to decrease in frequency with depth. The hydraulic conductivity is likely to decrease with depth, particularly in the zone of the ore body.

Considering that the frequency, thickness and depth of water bearing fractured zones below 66m is unknown, a conservative assumption that the water bearing fractured zones are vertically interconnected and extend to the base of the mine, with a water bearing fracture zone thickness of 1m every 100m in mine depth (totalling a saturated thickness of 5m) has been made to approximate homogenous aquifer conditions.

13.1.2 Rainfall

Surface features of the Avoca Tank mine would be constructed in a manner which directs surface water (from rainfall) away from the proposed box cut and mine. This is important to maintain stability in the walls of the box cut. As such, rain inputs to the mine inflow would be restricted to rain that falls directly within the bounds of the box cut. Only some of the rain that falls within the box cut would drain to the base of the box cut and negligible amounts within the mine itself. A large portion of rainfall is likely to evaporate either on the walls or from small pools that may accumulate on the berms. The amount of rain water that reaches the bottom of the proposed box cut would depend primarily on the intensity and duration of the rainfall event, and the amount of evaporation occurring. For example, a large proportion of rain that falls in a low intensity short duration event would stick to the walls and berms of the proposed box cut and would not flow to the base of the proposed box cut. Rain that falls in a long duration, high intensity events has much greater chance of being able to flow to the base of the proposed box cut.

As such, groundwater inflow calculated within this report does not include errant stormwater and reflects only groundwater drawn from the aquifer.

13.1.3 Evaporation

Evaporation is considered to be negligible at the majority of groundwater encountered would be during the underground mine excavation works.

13.1.4 Excavation

If saturated rock is encountered within the mine, some water will be removed with the waste rock and ore, but the amount is considered to be negligible and ignored in this assessment as groundwater is expected to be confined within secondary porosity.

13.2 QUALITATIVE ASSESSMENT OF GROUNDWATER INFLOWS

Based on the results of pumping test data (**Section 13.3.1**) and known groundwater inflows from nearby mines targeting similar deposits within the same formation, ES understand that it is unlikely that significant volumes of groundwater will enter the proposed mine.

ES understand that the proposed ATP Site is comparable in both size and setting to the Applicants surrounding operations. The proposed Avoca Tank mine is located approximately 2.5km north of the North Girilambone Mine Site. Groundwater make estimates have been provided by the Applicant (reported by PB, April 2011), for the three current Tritton Resource mine sites, and are provided in **Table 13-1** below. More recent information provided from the applicant indicated that the average groundwater make for the Tritton Mine was measured at 111ML/yr (which is within one order of magnitude of the estimated groundwater make of 52ML/yr). This calculated average groundwater pumping rate from the Tritton Mine equates to approximately 3.524 L per second.

Table 13-1: Groundwater Make Estimates (for life of mine)

Site	Mine	Annual Groundwater Make (ML/yr)
Girilambone North Mine	Larsons Pit	17
	North East Pit	87
Girilambone Mine	Murrawombie Pit	130
Tritton Mine	Tritton Mine	52 (111)*

*Annual groundwater make based on monthly measurements provided by the Applicant

Based on the measured groundwater make at Tritton Mine (111ML/yr) and estimated groundwater inflow volumes at the two other Tritton Resource mine sites, Girilambone North Mine (104ML/yr) and Girilambone Mine (130ML/yr), a similar volume of groundwater make is expected at the proposed ATP mine.

ES have performed the following quantitative groundwater assessment (**Section 13.3 below**) using aquifer parameters from the fractured rock formation, derived from a pumping test conducted at nearby Girilambone Copper Mine. These values are considered representative of the formation encountered at ATP as site specific measurements has not yet been concluded.

13.3 QUANTITATIVE ASSESSMENT OF GROUNDWATER INFLOWS AND DRAWDOWN

Both Steady State numerical modelling and Time-Variant modelling was conducted to estimate groundwater inflows and predict drawdown as a results of the proposed mine excavation and groundwater abstraction.

The following equations were used to estimate the groundwater inflows and predict drawdown:

- Theis Equation (1935) – Unsteady-state Flow
- Cooper-Jacob Equation (1946) – Unsteady-state Flow (modified Theis Equation)
- Thiem Equation (1906) – Steady State Flow

13.3.1 Aquifer Parameters

In the absence of site specific data, parameters used in the quantitative modelling for the fractured bedrock aquifer adopted from the Girilambone Pumping Test Report (ES, June 2013), are listed in **Table 13-2** below. A range of values were reported, which are represented by Value 1 and Value 2, solutions matched to close and distant observation wells respectively.

Table 13-2: Fractured Rock Aquifer Parameters

Parameter	Value 1	Value 2
Hydraulic Conductivity (m/day)	0.483	0.781
Specific Storage	4.563×10^{-6}	1.565×10^{-6}

The *storativity* (S) of a confined aquifer (or aquitard) is defined as the volume of water released from storage per unit surface area of a confined aquifer (or aquitard) per unit decline in hydraulic head. Storativity is also known by the terms coefficient of storage and storage coefficient.

In a confined aquifer (or aquitard), storativity is defined as:

$$S = S_s b$$

where S_s is the *Specific Storage* and b is aquifer (or aquitard) thickness. Specific storage is the volume of water that a unit volume of aquifer (or aquitard) releases from storage under a unit decline in head by the expansion of water and compression of the soil or rock skeleton. It is therefore a measure of the water holding capacity of the aquifer.

Transmissivity is the product of the average hydraulic conductivity K and the saturated thickness of the aquifer (D). Consequently, transmissivity is the rate of flow under a unit hydraulic gradient through a cross-section of unit width over the whole saturated thickness of the aquifer. The transmissivity defined as:

$$T = Kb$$

where K is the hydraulic conductivity and b is the aquifer thickness.

Based on a saturated aquifer thickness (combined water bearing fracture zone thickness to the base of the mine at 500m) assumed to be 5m (based on the assumed aquifer thickness of 1m per 100m depth), the transmissivity and storativity values were estimated and are listed in **Table 13-3**.

Table 13-3: Estimated Aquifer Parameters

Parameter	Value 1	Value 2
Transmissivity (m^2/day)	2.415	3.905
Storativity	2.2815×10^{-5}	7.825×10^{-6}

13.3.2 Assumptions and Limitations of Quantitative Assessment Methodology

The analytical assessments of groundwater inflows and predicted drawdown presented **Section 13.3.3**, **Section 13.3.4** and **Section 13.3.5** rely on the assumptions outlined below.

It is assumed that water bearing strata will have a uniform transmissivity and storativity, based on the ranges determined from a pumping test at Girilambone (ES, June 2013) which are provided in **Section 13.3.1** above. The intermittent nature of water bearing zones likely to be encountered within the fractured rock formations indicates that the impacted aquifer is not homogenous and infinite. As such, the transmissivity and storage of water bearing zones below the depth of the investigation at Girilambone is unknown.

The assumptions and conditions underlying the quantitative methods in the following sections are:

- The saturated thickness of the aquifer (combined water bearing fracture zone thickness to the base of the mine) was assumed to be 5m (1m metre of saturated thickness for every 100m in depth);
- That the fractured water bearing zone extents to the base of the mine (500m);
- The aquifer is confined;
- The aquifer has a seemingly infinite areal extent;
- The aquifer is a homogenous, isotropic and of uniform thickness over the area influenced by the dewatering;
- Prior to pumping, the piezometric surface is horizontal over the area that will influenced by the dewatering;
- The aquifer is pumped at a constant discharge rate; and
- The well penetrated the entire thickness of the aquifer and thus receives water by horizontal flow;

The analytical methods used to assess potential groundwater inflows ignore the points raised in the qualitative assessment of the aquifer testing data and are therefore considered to be very conservative, and representative of worst case scenarios (maximum dewatering requirements) based on the assumed mine dimensions.

13.3.3 Theis Equation

The Theis equation was used to estimate the flux of groundwater (Q) that would be required to be removed from the mine excavation to completely dewater the assumed void based on the proposed schedule of works plan (transient, unsteady state flow model). Based on the estimated groundwater flux (Q) required to dewater the excavation, the expected drawdown was then determined at different distances from the mine to determine the potential impact to nearby receptors.

In addition to the assumptions listed in **Section 13.3.2** above, the following limiting conditions also apply:

- The water removed from storage is discharged instantaneously with decline of head;
- The diameter of the well is small, i.e. the storage in the well can be neglected; and
- The flow to the well is in unsteady state, i.e. the drawdown differences with time are not negligible, nor is the hydraulic gradient constant with time.

The Theis Equation used to estimate the groundwater inflow and predict drawdown is presented below:

$$s = \frac{Q}{4\pi T} W(u)$$

$$u = \frac{r^2 S}{4Tt}$$

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)

13.3.3.1 Groundwater Inflow – Dewater Mine Void

The estimated groundwater inflow volumes are presented in **Table 13-4** below.

The initial piezometric level (average of 3 bores) used in the model was 35.65m, with a mine base radius (r_1) of 30m. The groundwater inflow was calculated at the expected schedule milestone depths as indicated by Tritton Resources.

Table 13-4: Estimated Groundwater Inflow Volumes using Theis Equation.

Mine Excavation Schedule Months	Depth of Mine Excavation (m)	Required Depth of Drawdown (m) at r_1	Estimated Groundwater Inflow (ML/day)	
			T=2.415 S=2.2815x10^{-5}	T=3.905 S=7.825x10^{-6}
6 (183 days)	100	64.35	0.18	0.26
15 (458 days)	200	164.35	0.43	0.61
27 (824 days)	300	264.35	0.65	0.94
42 (1281 days)	400	364.35	0.87	1.26
63 (1922 days)	500	464.35	1.07 (12.4L/s)	1.55 (18L/s)

Based on the above, the estimated groundwater inflow ranged between 1.07ML/day (392ML/yr) and 1.55ML/day (567ML/yr). ES note that the estimated groundwater inflow values are based on limited site specific data and conservative assumptions which result in the overestimation of groundwater inflows. Actual groundwater inflows are likely to be lower than those predicted above, which are likely to be in the order of the measured groundwater make at Tritton Mine (111ML/yr) and estimated groundwater inflow volumes at the two other Tritton Resource mines, Girilambone North Mine (104ML/yr) and Girilambone Mine (130ML/yr). These volumes are within one order of magnitude of the conservative estimate presented here.

13.3.3.2 Drawdown Extent

The piezometric drawdown extent predicted using the Theis equation, based on the maximum estimated groundwater inflow volumes determined in **Section 13.3.3.2**, and the qualitative groundwater make calculated from the Tritton Mine are presented in **Table 13-5** below.

Table 13-5: Predicted Drawdown at 63 months of Mine Operation using Theis Equation.

Distance From Mine Centre (km)	Drawdown at 63 Months			
	T=2.415 S=2.2815x10^{-5}		T=3.905 S=7.825x10^{-6}	
	Q=1.07 ML/day (12.4L/s)	Q=0.304 ML/day (3.524L/s)*	Q=1.55 ML/day (18L/s)	Q=0.304 ML/day (3.524L/s)*
0.5	265	75	287	56
1	217	61	243	48
2	168	48	199	39
4	119	34	156	30
8	72	20	112	22
16	31	9	70	14
32	5	1.5	31	6.2
35	3.5	<1	27	5.3
43	1.2	-	18	3.6
44.5	<1	-	17	3.4
56	-	-	9.5	1.9
67.6	-	-	5.1	<1
94.5	-	-	<1	-

*Qualitative average groundwater make calculation from the Tritton Mine.

Based on the above, the estimated maximum groundwater drawdown extent (considered to be negligible where drawdown is <1m) ranged between approximately 35km and 94.5km. ES note that the numerical models assumes infinite lateral continuity, however, the fractured rock aquifer located at the site is likely to be highly heterogeneous and laterally discontinuous. As such, the actual drawdown extent resulting from the proposed mine is likely to be less than that that predicted above, limited to the lateral extent of the interconnected fractured water bearing zones.

13.3.4 Cooper-Jacob Equation

The Cooper-Jacob Equation, which is based on the Theis formula, was used to estimate the flux of groundwater (Q) that would be required to be removed from the mine excavation to completely dewater the assumed void based on the proposed schedule of works plan (transient, unsteady state flow model). Based on the estimated groundwater flux (Q) required to dewater the excavation, the expected drawdown was then determined at different distances from the mine to determine the potential impact to nearby receptors.

In addition to the assumptions listed in **Section 13.3.2** above, the following limiting conditions also apply:

- The flow to the well is in unsteady state;
- The values of u are small (u<0.01) i.e. r is small and t is sufficiently large.

- The water removed from storage is discharged instantaneously with decline of head;
- The diameter of the well is small, i.e. the storage in the well can be neglected; and

The condition that u will be small in confined aquifer is usually satisfied at moderate distances from the well within an hour or less.

The Cooper-Jacob Equation used to estimate the groundwater inflow and predict drawdown is presented below:

$$s = \frac{2.3Q}{4\pi T} log \frac{2.25Tt}{r^2 S}$$

Q= m^3/day

s= drawdown (m)

T= transmissivity (m^2/day)

r= radius (m)

S= storativity (dimensionless)

t= time (days)

13.3.4.1 Groundwater Inflow – Dewater Mine Void

The estimated groundwater inflow volumes are pretend in **Table 13-6** below.

The initial piezometric level (average of 3 bores) used in the model was 35.65m, with a mine base radius (r_1) of 30m. The groundwater inflow was calculated at the expected schedule milestone depths as indicated by Tritton Resources.

Table 13-6: Estimated Groundwater Inflow Volumes using Cooper-Jacob Equation.

Mine Excavation Schedule Months	Depth of Mine Excavation (m)	Required Depth of Drawdown (m) at r_1	Estimated Groundwater Inflow (ML/day)	
			T=2.415 S=2.2815x10^{-5}	T=3.905 S=7.825x10^{-6}
6 (183 days)	100	64.35	0.18	0.26
15 (458 days)	200	164.35	0.43	0.61
27 (824 days)	300	264.35	0.65	0.94
42 (1281 days)	400	364.35	0.87	1.26
63 (1922 days)	500	464.35	1.07 (12.4L/s)	1.55 (18L/s)

Based on the above, the estimated groundwater inflow ranged between 1.07ML/day (392ML/yr) and 1.55ML/day (567ML/yr). These values match those estimated using the Theis equation, and are considered to be an overestimation of actual groundwater inflows likely to occur. Actual groundwater inflows are likely to be lower than those predicted above, which are likely to be in the order of the calculated groundwater make at Tritton Mine (111ML/yr) and estimated groundwater inflow volumes at the two other Tritton Resource mines, Girilambone

North Mine (107ML/yr) and Girilambone Mine (130ML/yr). These volumes are within one order of magnitude of the conservative estimate presented here.

13.3.4.2 Drawdown Extent

The piezometric drawdown extent predicted using the Theis equation, based on the maximum estimated groundwater inflow flux determined in **Section 13.3.3.2**, are presented in **Table 13-7** below.

Table 13-7: Predicted Drawdown at 63 months of Mine Operation using Cooper-Jacob Equation.

Distance From Mine Centre (km)	Drawdown at 63 Months (m)			
	T=2.415 S=2.2815x10^{-5}		T=3.905 S=7.825x10^{-6}	
	Q=1.07 ML/day (12.4L/s)	Q=0.304 ML/day (3.524L/s)*	Q=1.55 ML/day (18L/s)	Q=0.304 ML/day (3.524L/s)*
0.5	265	75	286	56
1	217	61	243	48
2	168	48	199	39
4	119	34	155	30
8	70	20	111	22
15	25	7	67	14
20.4	3.4	<1	56	10
21.1	<1	-	50	9.8
32	-	-	24	4.6
42.9	-	-	5	<1
45.8	-	-	<1	-

Based on the above, the estimated maximum groundwater drawdown (to <1m) extent ranged between approximately 20.4km and 45.8km. ES note that the predicted drawdown assumes infinite lateral continuity, however, the fractured rock aquifer located at the site is likely to be highly heterogeneous and laterally discontinuous. As such, the actual drawdown extent resulting from the proposed mine is likely to be less than that that predicted above.

13.3.5 Thiem's Equation (1906)

The Thiem equation was used to determine the maximum drawdown distance based on the estimated groundwater inflow volumes (Q) determined in **Section 13.3.3** and **Section 13.3.4**. The Thiem equation is based on the assumptions listed in **Section 13.3.2** and also assumes that the flow to the well is in steady state.

$$Q = \frac{2\pi T(s_1 - s_2)}{2.3Log(r_2/r_1)}$$

Q= m^3/day

s= drawdown (m)

T= transmissivity (m^2/day)

r= radius (m)

S= storativity (dimensionless)

t= time (days)

Based on Theis and Cooper-Jacob estimates for groundwater inflows ranging between 1.07 and 1.55ML/day after 63 months of construction, the maximum extent of drawdown was predicted and presented in **Table 13-8** below.

Table 13-8: Predicted Maximum Drawdown Distance at Maximum Estimated Groundwater Inflow Rates.

Aquifer Assumptions	Groundwater Inflow (ML/day)	Maximum Drawdown Distance (<1m) from Centre of Mine (km)
T=2.415	1.073	21.1
T=3.905	1.552	45.7

The above maximum drawdown values are similar to those calculated using the Cooper-Jacob equation. ES note that the predicted drawdown assumes infinite lateral continuity, however, the fractured rock aquifer located at the site is likely to be highly heterogeneous and laterally discontinuous. As such, the actual drawdown extent resulting from the proposed mine is likely to be less than that that predicted above.

14 POTENTIAL IMPACTS ON GROUNDWATER QUALITY

ES understand Tritton Resources would comply with all relevant industry guidelines to ensure the potential for degradation of groundwater quality at the Mine Site is minimised.

The proposed Avoca Tank mine has potential to be a 'short circuit' for potential contaminants to enter the subsurface and any underlying aquifers.

If groundwater bearing strata are encountered within the ATP mine there is potential for groundwater chemistry to change as the hydraulic head is lowered below the top of the water bearing zone within the proposed mine and rock become exposed to the atmosphere. These potential impacts to groundwater quality are assessed in the following sections.

14.1 POTENTIAL CHEMICAL IMPACTS

The main potential source of groundwater contamination within the proposed underground workings would be the spill of fuel or other hazardous substances. ES understand that the Applicant proposes to use a dedicated fuel store and refuelling bay at the ATP site (refer to **Figure 2.4**).

Refuelling for more mobile equipment should be undertaken in designated bunded areas above ground. Refuelling of less mobile equipment should be undertaken at the work site by a dedicated service vehicle. Spill kits should be kept on site to mitigate any spills from machinery

working within the box cut. Spill response procedures would be documented in an Environmental Management Plan for the site.

The proposed underground workings and proposed mine infrastructure such as the waste rock emplacement, leachate management ponds and mine water pond also pose some potential risk to groundwater quality. There is potential that chemicals from these sources may migrate through the soil profile into the underlying groundwater system, however, ES understands that the infrastructure will be constructed to regulatory standards to minimise and mitigate potential groundwater contamination. Routine groundwater monitoring would be required to identify any potential impacts to groundwater throughout the construction, operation and post closure of the ATP mine. ES recommends that a groundwater management plan be prepared for the commencement of mining at ATP Site. The plan should address the need for groundwater level and quality monitoring between the proposed mine and the potential groundwater receptors. The plan should also outline measures that would be put in place to prevent and/or manage and potential contamination issues such as chemical spills within the mine. The plan should also outline post mining measures that would be undertaken to prevent ongoing impacts to groundwater levels and/or groundwater quality.

14.2 POTENTIAL GEOCHEMICAL IMPACTS

The potential acid generating material (sulfidic ores) is likely to be located within or in close proximity to the ore body. Most of the potentially acid generating material will be removed from the mine such that the rock forming the walls of the mine should be mostly free of acid generating material. In addition, groundwater levels would have to be lowered before oxidation would occur. In this situation the local groundwater gradient would be towards the open cut, so potential for any groundwater impacts to reach sensitive receptors is low.

If oxidation of sulphur rich rock causes any loss of groundwater quality the potential impacts could be mitigated by covering the sulphur rich rock with a clay cover and/or water.

15 CONCLUSIONS

Based on the current measured groundwater inflow at the nearby Tritton Mine site (111ML/yr) and the estimated groundwater inflow volumes at two (2) other nearby mines sites (Girilambone North Mine and Girilambone Mine), which target the same mineralisation and are of similar scale in size, the groundwater inflows expected at the proposed ATP Mine are likely to be in the range of 104ML/yr to 130ML/yr.

Quantitative numerical modelling was undertaken to estimate groundwater inflow volumes and predict drawdown at the proposed ATP Mine. The quantitative modelling has estimated groundwater inflow volumes of between 392ML/yr to 567ML/yr, and maximum extent of drawdown (to <1m) between 20.4km and 94.5km from the mine centre.

Given the inherent constraints with the quantitative modelling, such as the conservative model assumptions of infinite lateral extent of water bearing fractures and homogenous, isotropic and of uniform thickness, together with limited site data of unknown vertical extent of water bearing zones, frequency and thickness of water bearing zones, the estimated groundwater inflows and drawdown extents are considered to overestimate actual conditions. Without the collection of further site specific groundwater data and additional modelling of increased complexity, ES consider that the most likely groundwater inflow volumes should be estimated from the current known groundwater inflow volumes at the nearby mine sites. As such, the most likely groundwater take volume is estimated to be 111ML/yr, the average known groundwater inflow from the nearby Tritton Mine site.

In addition to the above, given that the fractured rock aquifer is unlikely to be laterally continuous with limited vertical connectivity, the predicted drawdown extent of between 20.4km and 94.5km from the centre of the mine using the estimated maximum groundwater inflow is considered overestimate actual drawdown extent. As such, ES consider that the most likely maximum extent of drawdown to <1m will be less than 20.4km (the estimated minimum drawndown extent) from the ATP mine centre.

Based on the above conclusions and the inherent limitations of the quantitative assessment, the most likely estimate of groundwater inflow volumes and maximum drawdown extent (<1m) are presented in **Table 15-1** below.

Table 15-1: Most Likely Groundwater Inflow and Drawdown Extent

Most Likely Groundwater Take (ML/yr)	Most Likely Extent of Drawdown (<1m) from Mine Centre (km)
111*	20.4**

* based on qualitative assessment
** based on quantitative assessment using Cooper-Jacob method with qualitative inflow rate of 3.52L/s.

ES consider that groundwater licences for 111ML/yr be obtained from the Lachlan Fold Belt MDB Groundwater Source, located within the NSW Murray-Darling Basin Fractured Rock Groundwater Sources, for the proposed Avoca Mine development. Routine monitoring of groundwater discharge rates from the mine should be undertaken during construction and if the actual measured groundwater take volumes digress from the estimated groundwater inflows above, the volume of groundwater licences should be amended to reflect actual groundwater take.

All proposed groundwater works, including bores for the purpose of investigation, extraction, dewatering, testing or monitoring must be identified and an approval obtained from the NSW Office of Water prior to their installation. This applies to any groundwater monitoring wells that are required to be installed as part of the groundwater management plan.

Based on the findings of the quantitative assessment in comparison to the *NSW Aquifer Interference Policy 2012* (September 2012) NSW *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities*, the following conclusion are made:

1. **Water Pressure (Drawdown)**: The nearest groundwater water supply bore (GW026890), which is registered for stock purposes, is located approximately 8.5km southeast of the proposed ATP Mine. Based on the drilling logs, this bore is screened within an unconsolidated formation and not screened within the fractured rock formation the ATP Mine will intercept, and it will therefore not be effected by the proposed mine. The nearest water supply bore (GW002970), which is registered for stock purposes and within fractured rock, is located approximately 15km to the east. The estimated drawdown at this location, based on the Cooper-Jacob method with inflow rates of 3.524L/s, was 20.4m of drawdown in pressure head. Considering that the bore extends to a depth of 61.3m with the top of water bearing zone encountered at 21.3 it is assumed that there is 40m of available head for pumping. Whilst the estimated drawdown exceeds the minimal impact consideration of 2m of drawdown, based on the above, sufficient available head 19.6m will likely to be available for its intended use if 20.4m of drawdown would occur.
   Furthermore, considering that the estimated drawdown from the model was considered to overestimate the actual drawdown likely to occur as the fractured water bearing zone is likely to be discontinuous and limited in lateral extent, ES consider that the drawdown at this nearest water supply bore will be less than the estimated 20.4m. As such, ES consider that the proposed ATP Mine is unlikely to result in more than minimal impact to groundwater pressure and not to adversely affect any water supply bores.

2. **Water Quality**: The proposed Avoca Tank Mine is unlikely to lower the current beneficial use of the groundwater which is currently considered marginal use for stock watering, though is more likely to be unsuitable for any stock purpose. Based on a review of **Appendix 3** Map of High Priority GDEs of the WSP for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012), there are no high priority GDEs within at least 150km of the site (including springs, geothermal springs, wetlands and karst) associated with the fractured rock groundwater source. There is likely to be minimal impact on groundwater quality to the deep fractured rock aquifer at the proposed ATP mine as it is unlikely to be vulnerable to contamination as there would be a groundwater pressure gradient toward the void during and after the mine closure. This would result in groundwater flow toward the void. If any contamination does occur within the mine void, it is unlikely to migrate from the mine site.
   Considering that the maximum predicted drawdown extent (<1m) was between 20.4km and 94.5km, the proposed ATP Mine is unlikely to result in an impact to groundwater quality or groundwater availability to potential receptors including GDEs.

16 RECOMMENDATIONS

16.1 GROUNDWATER ABSTRACTION LICENCES

ES recommends that groundwater licences should be obtained to allow for the abstraction of 111ML/yr of groundwater from the NSW Murray-Darling Basin Fractured Rock Groundwater Sources – Lachlan Fold Belt MDB Groundwater Source. Groundwater allocations must be obtained from within the Lachlan Fold Belt MDB Groundwater Source.

16.2 GROUNDWATER MONITORING

Routine continuous monitoring and recording of groundwater discharge rates from the mine should be undertaken during construction and if the actual measured groundwater take volumes digress from the estimated groundwater inflows above, the volume of groundwater licences should be adjusted to reflect actual groundwater take.

16.3 GROUNDWATER MANAGEMENT

ES recommends that a groundwater management plan be prepared for the commencement of mining at the ATP Site. The plan should address the need for groundwater level and quality monitoring between the proposed mine and the potential groundwater receptors. The plan should also outline measures that would be put in place to prevent and/or manage and potential contamination issues such as chemical spills within the mine. The plan should also outline post mining measures that would be undertaken to prevent ongoing impacts to groundwater levels and/or groundwater quality.

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APPENDIX A – SUPPORTING DOCUMENTATION

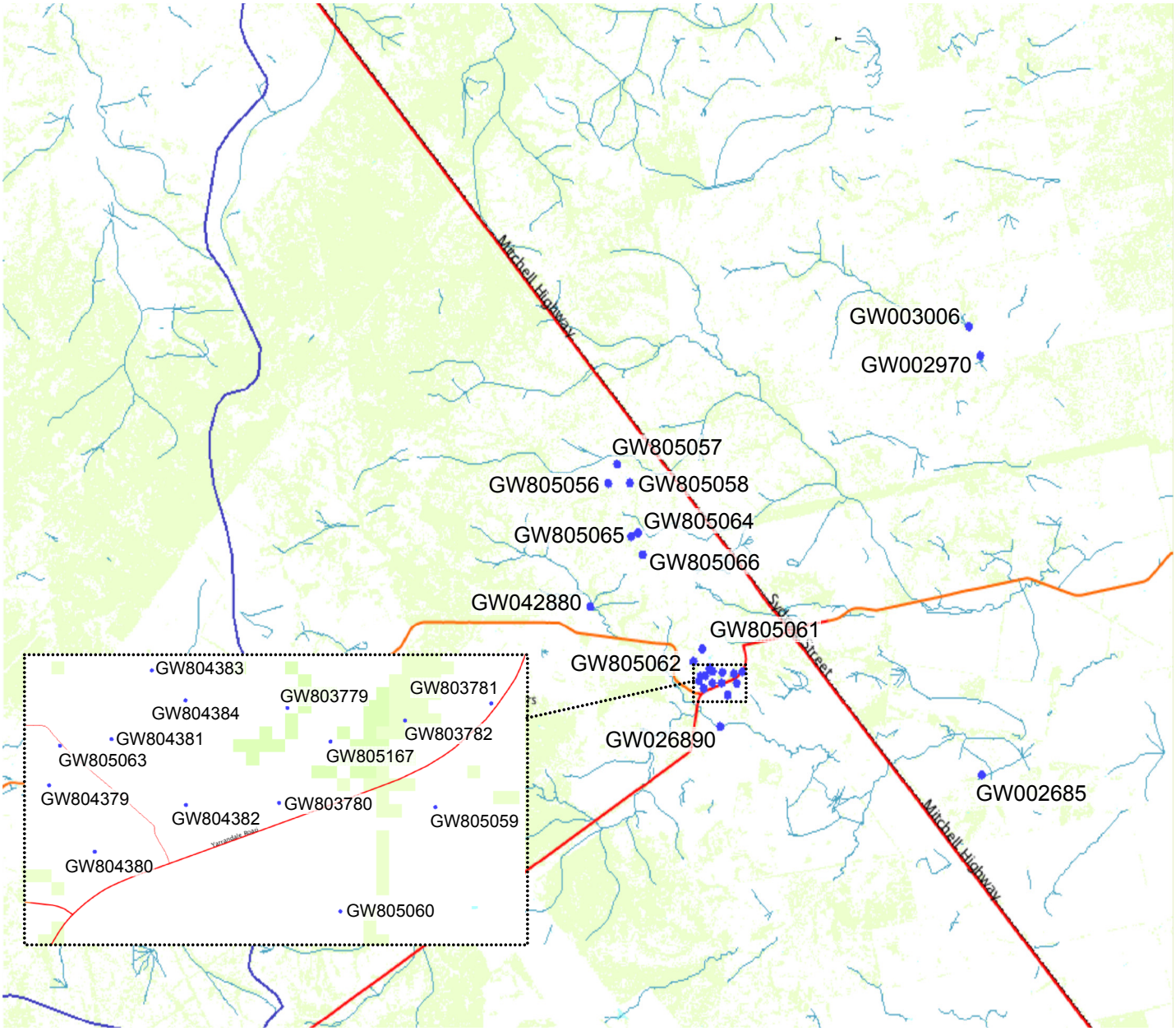
EnvironmentalStrategies
PROVIDING BENEFITS

REGISTERED BORE LOCATIONS

Groundwater Impact Assessment

Avoca Tank Groundwater Assessment

FIGURE 1



Map created with the NSW Natural Resource Atlas – www.nratlas.nsw.gov.au 2/02/2014. Copyright © 2013 New South Wales Government.
Map has been compiled from various sources and may contain errors or omissions. No representation is made as to its accuracy or suitability.

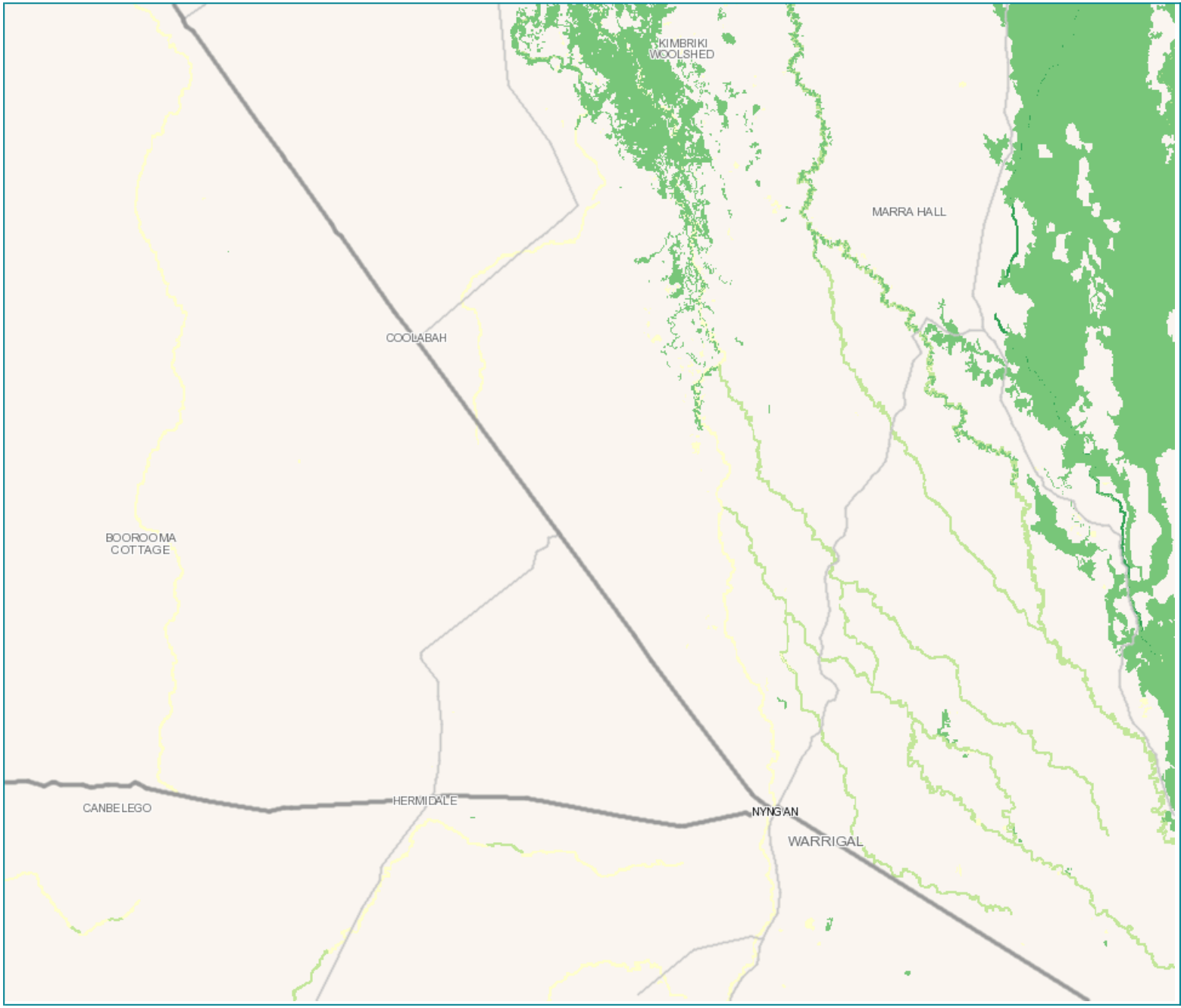
0km 5km 10km 15km 20km 25km 30km 35km 40km

KEY

- Registered Groundwater Bore

Australian Government
Bureau of Meteorology

Groundwater Dependent Ecosystem Map Report



N

Girilambone

GDE, Reliant on surface expression of groundwater (rivers, springs, wetlands)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction

GDE, Reliant on subsurface groundwater (vegetation)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction
- No Ecosystems analysed

GDE, Subterranean (Cave & Aquifers)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- No Ecosystems analysed

1:844,563

Metres 20,000 40,000 60,000

Data source - Data are assumed to be correct as supplied from Commonwealth, State and Territory data suppliers or referenced projects.

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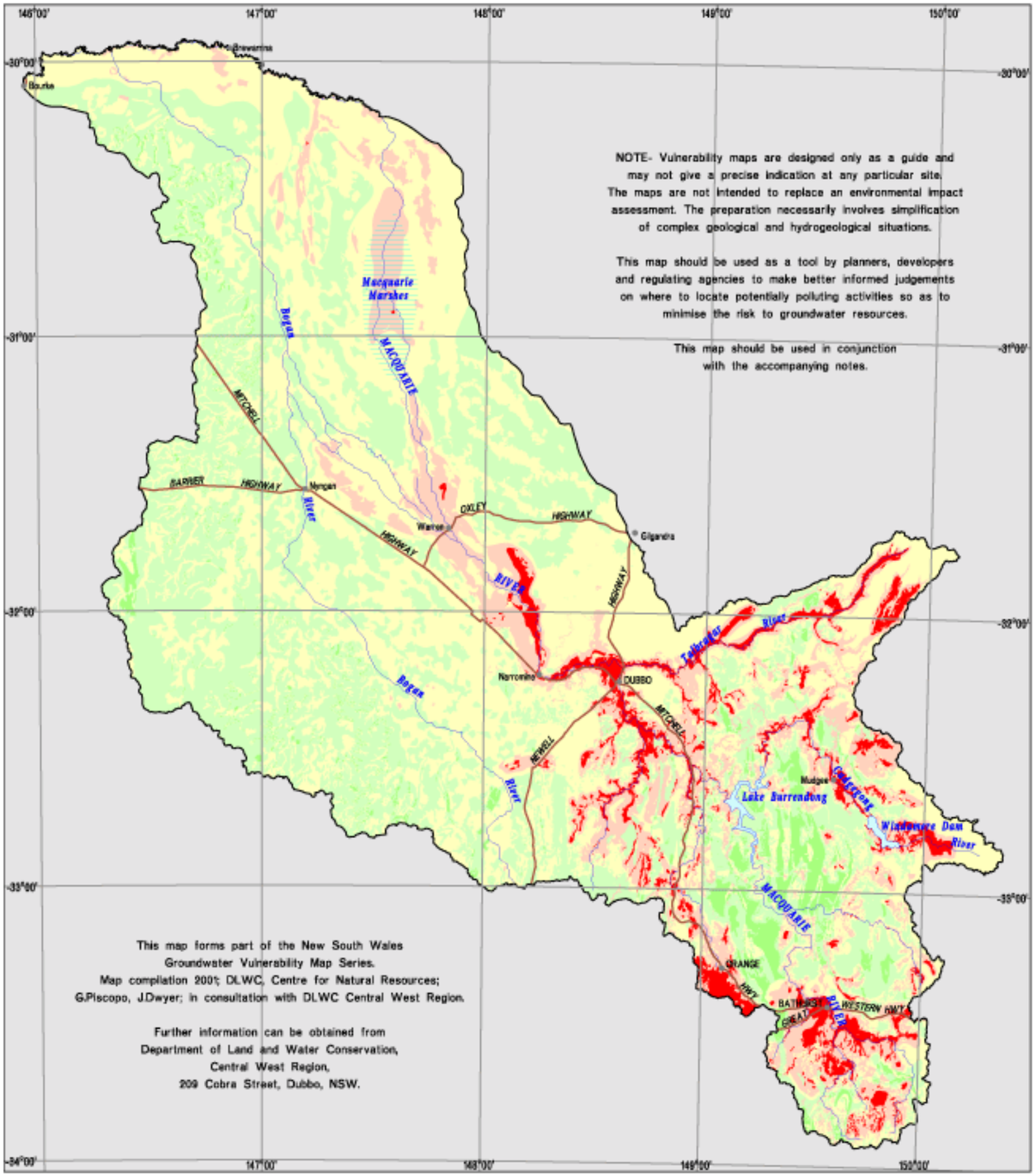
Date: 24 October, 2013



NOTE- Vulnerability maps are designed only as a guide and may not give a precise indication at any particular site. The maps are not intended to replace an environmental impact assessment. The preparation necessarily involves simplification of complex geological and hydrogeological situations.

This map should be used as a tool by planners, developers and regulating agencies to make better informed judgements on where to locate potentially polluting activities so as to minimise the risk to groundwater resources.

This map should be used in conjunction with the accompanying notes.

This map forms part of the New South Wales Groundwater Vulnerability Map Series.
Map compilation 2001; DLWC, Centre for Natural Resources; G.Piscopo, J.Dwyer; in consultation with DLWC Central West Region.

Further information can be obtained from
Department of Land and Water Conservation,
Central West Region,
209 Cobra Street, Dubbo, NSW.

LAND & WATER CONSERVATION

GROUNDWATER VULNERABILITY
MACQUARIE CATCHMENT

MAP LOCALITY

VULNERABILITY RATING

- Low
- Low moderate
- Moderate
- Moderately high
- High

SCALE

20 0 20 40 60 80 100

kilometres

Universal Transverse Mercator Projection

GO TO NOTES

GO TO MAP

LAND & WATER CONSERVATION

Groundwater vulnerability map explanatory notes

Macquarie Catchment

NSW Department of Land and Water Conservation

Groundwater vulnerability map explanatory notes

Macquarie Catchment

Prepared by:
Gennaro Piscopo

NSW Department of Land and Water Conservation

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1. Introduction

The Macquarie Catchment Groundwater Vulnerability Map has been produced as part of the implementation of the *Water Management Act 2000,* introduced in an effort to achieve more sustainable water use. The ultimate aim, as part of this implementation, is to complete vulnerability and availability mapping for the whole State of NSW.

There are a variety of uses of the groundwater resources within the catchment, ranging from stock and domestic use to irrigation, town water supply, mining and industrial use, as well as environmental and recreational uses.

Groundwater vulnerability mapping has proven to be a technique in assisting the development of groundwater protection strategies as outlined in the *1995 Guidelines for Groundwater Protection in Australia* (ARMCANZ and ANZECC). These guidelines are part of the National Water Quality Management Strategy.

Groundwater vulnerability mapping is used as a guide in determining which areas are more susceptible to groundwater contamination within the mapped area.

It should be noted that groundwater vulnerability maps are accurate to the scale at which they are produced. The Department of Land and Water Conservation (DLWC) does not endorse the expansion of this scale.

The preparation of groundwater vulnerability maps involves the simplification of complex geologic and hydrogeologic situations. It is therefore important to take into account local site conditions when assessing a particular development. Vulnerability maps are designed only as a guide and are not intended to replace an environmental impact assessment.

GEOGRAPHIC SETTING

The Macquarie Catchment is located in the central northern portion of NSW and encompasses approximately 67,000 square kilometres. It is bordered by the Castlereagh Catchment to the north, the Lachlan Catchment to the south, and the Darling Catchment to the west. The Macquarie Catchment contains two main river courses, the Macquarie River and the Bogan River. These two rivers generally run parallel to each other, with the Bogan located southwest of the Macquarie. These rivers have numerous creeks crossing from one to the other distributing flows. The major tributaries joining the Macquarie in the upper reaches include, the Talbragar River near Dunedoo, Cudgegong River near Mudgee, Turon River near Bathurst, and the Bell and Little Rivers near Wellington.

Major townships encompassed by the Macquarie Catchment include, Bathurst, Mudgee, Orange, Wellington, Dubbo, Warren, Nyngan, and Brewarrina.

The majority of groundwater usage in the Macquarie Catchment is for irrigation purposes. This water is typically abstracted from the alluvial aquifers that are predominant over much of the western portion of the catchment. The presence of this alluvium has resulted in the topography being of very low gradients. The fractured rocks of the Lachlan Fold Belt control the topography east of Narromine, and, as a result, some of this terrain is steep and mountainous.

Rainfall within the Catchment varies from moderately high (around 950 mm/yr) in the east along the Great Dividing Range, to low (<350 mm/yr) in the northwest around Bourke. In general, the climate is

one of cool, moderately wet to dry winters, and hot, dry to very dry summers. This gives an indication of how important the use of groundwater is to the region.

2. Groundwater vulnerability maps

WHY DO WE NEED THEM?

Pressure for the development of the concept of groundwater vulnerability has been generated by the worldwide concern about the problems of groundwater contamination. Groundwater quality issues are receiving widespread attention, and hydrogeologic information is essential for the effective protection and management of groundwater quality. Effective protection should be primarily aimed at the prevention of problems and requires a sound information base to determine, on a continuous basis, the groundwater quality problems that exist and those that may develop in the future.

Groundwater vulnerability maps are used as a guide for the location of future developments in an area, in order to minimise the impact the projected development will have on the surrounding water resources.

The *Draft Guidelines for Groundwater Protection* (AWRC, 1992) states that the 'amount of protection to be afforded an aquifer should be commensurate with both the risk the aquifer is under and the value that the community places on the aquifer'. It should be remembered that, as groundwaters are often linked to surface waters, they too are also indirectly protected by the appropriate siting and management of potentially polluting industry.

GROUNDWATER VULNERABILITY MAPPING

Almost all groundwater resources are vulnerable to various degrees. Vulnerability of groundwater is a relative, dimensionless property that is not directly measurable. It is assessed by using the DRASTIC technique, explained in detail in these notes. The accuracy of its assessment depends, above all, on the amount and quality of representative and reliable data available. The required data is often not available and thus scale of mapping is often limited to broad scale catchment maps.

The fundamental concept of groundwater vulnerability is that some land areas are more vulnerable to groundwater contamination than others. The ultimate goal of the vulnerability map is the subdivision of an area into several units showing the differential potential for a specified purpose and use. Results of vulnerability assessment are portrayed on a map showing various homogeneous areas, sometimes called cells or polygons, which have different levels of vulnerability. Vulnerability maps show only the relative vulnerability of areas within the same map, and do not represent absolute values that can be compared between maps.

The original concept of groundwater vulnerability was based on the assumption that the physical environment may provide some degree of protection (*referred to as the barrier zone*) with regard to contaminants (*the threat*) entering the subsurface water (*groundwater resource*). The earth materials may act as natural filters to screen out some contaminants. Water infiltrating at the land surface may be contaminated but is naturally purified to some degree as it percolates through the soil and other fine grained materials in the unsaturated zone.

A groundwater vulnerability map has been developed for the Macquarie Catchment as part of the implementation of the *Water Management Act 2000*. This will provide the Department of Urban

Affairs and Planning (DUAP),the Catchment Management Board, the Councils of the Macquarie Catchment, and other regulating agencies with a regional tool using a Geographical Information System (GIS) for determining the suitability of various developments in the region in a spatial context. In order to achieve this, a number of spatial attributes need to be mapped, such as geology, depth to watertable, soil properties, slope and any other attribute considered relevant. These are then weighted, and ranked, and are combined to produce a final ranking value using the appropriate algorithm, which defines the groundwater vulnerability. The method used for creating the Macquarie Catchment groundwater vulnerability map is a modification of the DRASTIC approach, first devised by the US EPA.

The following section discusses the modified DRASTIC approach in relation to the Macquarie Catchment study.

VULNERABILITY MAPPING—AN ANALYSIS OF THE DRASTIC TECHNIQUE

The DRASTIC vulnerability mapping technique can generally be referred to as a composite description of all the major geologic and hydrogeologic factors that affect and control groundwater movement, into, through, and out of an area. Similar hydrogeologic parameters therefore produce similar vulnerability. It involves the overlaying of various hydrogeologic settings that are available at the time of the map's production, via a Geographical Information System (GIS).

Each hydrogeologic setting describes topography, soil type, bedrock type, estimate of rainfall and net recharge, depth to watertable (DTWT), aquifer yield, relative hydraulic conductivity (K) and any particular features associated with the setting that are available.

DRASTIC is an acronym for the most important mappable features within the hydrogeologic setting which control groundwater pollution.

These features are:

- D Depth to watertable
- R (Net) Recharge
- A Aquifer media
- S Soil media
- T Topography (slope)
- I Impact of Vadose Zone Media
- C Conductivity (Hydraulic) of Aquifer.

To assess groundwater pollution potential within hydrogeologic settings, numerical ranking is used on the DRASTIC features. There are 3 significant parts, Weights, Ranges, and Ratings.

Weights

Each DRASTIC feature is assigned a weight relative to each other in order of importance from 1–5; the most significant is allocated five, the least significant is allocated one.

The DRASTIC technique, by its inference, attempts to identify those features important in determining vulnerability of groundwater resources. However, each study area will need to be assessed as to the importance of each specific feature for its area. For example, topography is obviously more important in a mountainous area than in the flat plains country. Also, some features will be taken into consideration in the production of other features. For example, topography will influence the

production of a depth to watertable map in a fractured rock terrain, as well as represent itself in a topographic (slope) map.

Table 1. Assigned weights for DRASTIC features for the Macquarie Catchment

Feature	Weight
Depth to watertable	4
Net recharge	2
Aquifer media	5
Soil media	2
Topography	1
Impact of Vadose Zone media	5
Hydraulic conductivity of aquifer	Not used

Ranges

For each DRASTIC feature, ranges or significant media types for the feature's upper and lower limits within the catchment have been devised based on its impact on pollution potential.

Ratings

The ratings for each DRASTIC feature are assigned a value between 1 and 10. The rating enables the ranking of the ranges found in each DRASTIC feature map. These ratings provide a relative assessment between ranges in each feature.

The DRASTIC Index, that is the pollution potential (*vulnerability*) at any one cell or polygon on the map, is determined as:

Pollution Potential = DrDw + RrRw + ArAw + SrSw + TrTw + IrIw + CrCw
where r = rating and w = weight

The computed (*via GIS*) DRASTIC index identifies areas which are likely to be susceptible to groundwater contamination relative to one another. *The higher the DRASTIC index the greater the groundwater pollution potential.*

It must be remembered that the DRASTIC technique provides a relative evaluation tool and is not designed to provide absolute answers. It offers planners and developers a categorisation of areas, based on the level of site investigation expectation, when considering the groundwater resources for an area.

FEATURE DEFINITION

Depth to watertable

This is an important feature as it determines the depth of material through which a contaminant must travel before reaching the watertable. In general, attenuation capacity increases as the depth to water increases. This is due to the fact that deeper water levels result in a longer travel time, therefore residence time, for any potential contaminant. The presence of low permeability layers, which confine aquifers, will also limit the travel of contaminants into an aquifer. Where an aquifer is confined, depth

to water should be redefined as the depth to the top of the aquifer. For semi-confined aquifers a decision must be made as to whether it is more appropriate to consider the aquifer as unconfined or confined.

The Depth to Watertable (DTWT) feature, for the Macquarie Catchment, was created by combining actual DTWT data with topography as the principal surface aquifers are located in unconsolidated sediments and fractured aquifers, and are therefore considered to be unconfined. The groundwater is predominantly contained in the fractured and unconsolidated sediment aquifer system, which generally recharge locally. A depth to watertable map was constructed from the departmental records of standing water levels, with 5 metre contour intervals.

Recharge

Net Recharge represents the amount of water that penetrates the ground surface and reaches the watertable. This recharge water is available to transport a contaminant vertically to the watertable and horizontally within the aquifer. In addition, it controls the volume of water available for dispersion and dilution of the contaminant in the vadose and saturated zones. In general, the greater the recharge, the greater the potential for groundwater pollution.

The components incorporated in the recharge feature for the Macquarie Catchment were slope, rainfall and soil permeability. A more detailed breakdown of the factors employed, as well as the resulting equation and ratings are discussed in the range and ratings tables devised for the Catchment.

Aquifer media

Aquifer medium governs the route and path length (*groundwater flow system*), within the aquifer. The path length is important in determining the time available for attenuation processes, such as sorption, reactivity, and dispersion, to occur. The aquifer medium also influences the amount of effective surface area of materials with which the contaminant may come in contact within the aquifer. The route which a contaminant will take can be strongly influenced by fracturing, porosity, or by an interconnected series of openings which may provide preferential pathways for groundwater flow.

For the Macquarie Catchment, the aquifer media was defined by its geology. Geology has been grouped into 8 broad categories including, alluvium 1 and 2 (*unconsolidated sediments of varying permeabilities*), porous consolidated sediments (*sedimentary rocks*), limestone, volcanic (*Tertiary volcanics differentiated from other volcanic rocks due to their columnar nature*), plutonic/igneous 2 classes (*Carboniferous intrusions*, *Devonian to Ordovician aged intrusions*) and metasediments (*fractured Palaeozoic rocks including volcanics*).

Soil media

Soil has a significant impact on the amount of recharge which can infiltrate to the watertable, and hence on contaminant movement. The presence of fine-textured materials, such as silts and clays, can decrease relative soil permeability and restrict contaminant migration. Moreover, where the soil zone is thick, the attenuation processes of filtration, biodegradation, sorption, and volatilisation may be significant. Soil media can be described in terms of its textural classification and ranked in order of pollution potential.

For the Macquarie Catchment vulnerability map, a soil permeability map was produced using 1:250,000 soil landform information (MDBSIS, 1999). The map was compiled by approximating soil permeability for soil landforms in the Macquarie Catchment. A soil scientist from the CNR Cowra Research Station (Dr Brian Murphy) classified the soil landforms of the catchment into five classes.

This map was suitable to be used for the soil media vulnerability feature map, as well as a component map for the development of the impact of Vadose Zone map.

Topography

Topography is considered as the slope, and slope variability of the land surface. Topography helps to control pollutant run off or retention on the surface. Slopes that provide a greater opportunity for contaminants to infiltrate will be associated with higher groundwater pollution potential. Topography influences soil development and therefore has an effect on contaminant attenuation.

Slope percentages for the Macquarie Catchment were calculated using the Digital Elevation Model (DEM) data. Slope was then classified and ranked for use in the topography component map.

Impact of the Vadose Zone

The Vadose Zone refers to the zone above the watertable which is unsaturated or discontinuously saturated. The type of Vadose Zone media determines the attenuation characteristics of the material including the typical soil horizon and rock above the watertable. The media also controls the path length and routing, thus affecting the time available for attenuation and the quantity of material encountered. The routing is strongly influenced by any fracturing present.

The factors considered important in defining the impact of Vadose Zone in the Macquarie Catchment include soil permeability, and depth to watertable. A more detailed breakdown of the factors employed, as well as the resulting equation and ratings, are discussed in the range and rating tables devised for the Catchment.

Hydraulic conductivity

Hydraulic conductivity is defined as the ability of aquifer materials to transmit water, which in turn, controls the rate at which groundwater will flow under a given hydraulic gradient. The rate at which the groundwater flows, also controls the rate at which it enters the aquifer. Hydraulic conductivity is controlled by the amount and interconnection of void spaces within the aquifer that may occur as a consequence of intergranular porosity, fracturing and/or bedding planes.

For the purposes of the Macquarie Catchment groundwater vulnerability map, hydraulic conductivity has been incorporated into the soil media map in the form of soil permeability. The absence of spatially complete data for hydraulic conductivity has meant that this component of the map has been removed. The soil media component map has been classified into ranges where high permeability is associated with higher pollution potential and slow permeability is associated with lower pollution potential.

3. Range and rating tables for the Macquarie Catchment groundwater vulnerability map

Within the Macquarie Catchment, the features, which were deemed important in the development of the groundwater vulnerability map, included depth to watertable, recharge, aquifer media, soil media, topography, and impact of Vadose Zone.

Ranges and ratings for the DTWT, topography, and aquifer media are given in Tables 2, 3, and 4 respectively.

Table 2. Ranges and ratings for depth to watertable

Range (m)	Rating
< 5	10
5–10	8
10–15	6
15–20	4
>20	1
Weight 4	

Table 3. Ranges and ratings for topography

Range (slope %)	Rating
< 2	10
2–0	8
10–20	5
20–33	2
>33	1
Weight 1	

Table 4. Ranges and ratings for aquifer media

Range (geology type)	Rating
Alluvium 1	10
Alluvium 2	6
Porous Sedimentary	6
Limestone	9
Volcanic (Tertiary)	7
Igneous 1 (Carboniferous)	5
Igneous 2 (Palaezoic)	3
Metasediments	1
Weight 5	

The derivation of the Recharge, Vadose Zone Impact, and Soil Media maps is discussed in the following text.

RECHARGE

This feature is generated as a map, which is specific to the study area. The map is generated from an equation that incorporates available features, which are believed to be important to the recharge component of the study area. The equation calculates the ability of an area to act as a recharge zone relative to another area. The factors used to generate the recharge map for the Macquarie Catchment

include slope, soil permeability and rainfall. DTWT and aquifer media are considered to be minor contributors. However, as they are used as other component maps, they will not be used in the recharge map. Assigning relative permeability factors to the basic soil classification groups within the catchment has created the soil permeability map.

The following equation is used to generate a *recharge value*. This recharge value is then grouped into a range of values that are given a rating for use in the final DRASTIC calculation.

Recharge value = Slope % + Rainfall + Soil permeability
Where:

Slope

Range (%)	Factor
<2	4
2–10	3
10–33	2
> 33	1

Rainfall

Range (mm)	Factor
>850	4
700–850	3
500–700	2
<500	1

Soil permeability

Range	Factor
High	5
Mod-high	4
Moderate	3
Slow	2
Very slow	1

The maximum recharge value is: 13
The minimum recharge value is: 3
The rating table for recharge is shown in Table 5.

Table 5. Ranges and ratings for recharge

Range	Rating
11–13	10
9–11	8
7–9	5
5–7	3
3–5	1
Weight 2	

IMPACT OF VADOSE ZONE

As discussed previously this feature attempts to classify that zone of soil and regolith (*saprolite*) found above the watertable, known as the Vadose Zone, with regard to its ability to allow any potential contaminant to move to the aquifer. The Vadose Zone for the purposes of the Macquarie Catchment vulnerability map incorporates soil permeability and DTWT. The equation used incorporates the factors believed to be important to the Vadose Zone for the study area. The equation provides a *Vadose Zone Value* for a particular area that is defined by these factors, and is relative to another zone within the context of the study area. This *Vadose Zone Value* is then grouped into a range of values, which are given a rating for use in the final DRASTIC calculation.

Impact of Vadose Zone = Soil Permeability + DTWT
Where:

- Soil attenuation type is unavailable at the required scale, and it does not exist over the entire catchment. Hence soil permeability is used, and factored for its contribution to the Vadose Zone impact.
- Depth to watertable has previously been used, but it is factored for its contribution to the Vadose Zone impact.

Soil permeability

Range	Factor
High	5
Mod-high	4
Moderate	3
Slow	2
Very slow	1

Depth to watertable (m)

Range	Factor
< 5	5
5–10	4
10–15	3
15–20	2
>20	1

The maximum *Vadose Zone impact value* is: 10
The minimum *Vadose Zone impact value* is: 2
The ratings for *Vadose Zone impact* are displayed in Table 6.

Table 6. Ranges and ratings for Vadose Zone impact

Range	Rating
8–10	10
6–8	8
4–6	5
3–4	3
2–3	1
Weight 5	

SOIL MEDIA

The soils feature attempts to classify the unique soil of the study area with regard to its ability to allow any potential contaminant to move through this zone towards the aquifer. The soil media component map for the Macquarie Catchment was constructed using 1:250,000 soil landform data from the Murray Darling Basin Soil Information Strategy (MDBSIS, 1999). Soil landforms were assessed as to their likely saturated soil permeability for the dominant soil landform. These were then classified into one of the five classes listed as follows.

The ranges and ratings for soils have been classified as outlined in Table 7.

Table 7. Ranges and ratings for permeability in soil media

Range	Factor
High	10
Mod-high	8
Moderate	6
Slow	4
Very slow	1
Weight 2	1

4. Groundwater vulnerability classification in the Macquarie Catchment

Five classes of vulnerability ranking have been chosen to describe the relative assessment of the probability of a groundwater resource to contamination: '*low*', '*moderately low*', '*moderate',* '*moderately high*' and '*high*'. These classes are shown as distinct colours on the vulnerability map.

HIGH

High vulnerability ranked groundwater resources are predominantly found in the unconfined, shallow, highly permeable aquifers or highly fractured locally recharged basaltic and granite terrains. Quaternary alluvial aquifers in the upland river systems of the catchment are characterised by permeable soils and shallow depth to watertable. They include alluvial aquifers associated with the Macquarie River from Lake Burrendong down to Narromine, and extending some 60 km north towards Warren; and the alluvium of Talbragar and Cudgegong Rivers from the headwaters at Windamere Dam. The fractured rock terrains around Orange and Bathurst are also considered highly vulnerable due to relatively high recharge potential and shallow watertable.

MODERATELY HIGH

Moderately high vulnerability ranked groundwater resources are similarly characterised by mostly unconfined and shallow fractured groundwater systems in the upland part of the catchment. This vulnerability class is not limited to one geological group and in fact reflects the importance of depth to watertable and the Vadose Zone on groundwater vulnerability. Areas where these conditions occur include the meta-sedimentary terrains north of Orange and granite terrains around Bathurst, Mudgee, and the Macquarie River from Narromine down to and encompassing the Macquarie Marshes.

MODERATE

Moderate vulnerability areas are associated generally with moderate slopes, porous geology, watertable greater than 10 metres, and moderate recharge. This vulnerability class includes the Tertiary basaltic terrains upstream of Coolah as well as the Triassic and Jurassic sedimentary rocks of the Sydney and Great Artesian Basins (GAB intake beds). Although depth to water is relatively deep in the GAB intake beds, care should be taken when siting development in these areas due to the nature of the GAB's importance as a groundwater resource to the farming community. This area is considered very sensitive due to its recharge potential. A considerable part of the south of the basin is recharged from this area and thus development should be carefully considered for its pollution potential prior to consent being granted. Alluvium downstream of Dubbo with moderate to slow soil permeability and low rainfall also falls into this class.

LOW–MODERATE

Low–Moderate vulnerability is the dominant classification with the majority of the western part of the catchment falling into this category. Fractured Palaeozoic meta-sediments and the wide expanses of alluvium west of Narromine characterised by low rainfall, flat slopes and an often-deep watertable are in this class. The meta-sediments (including the Palaeozoic volcanics) in the upland part of the catchment also largely fall within this classification class due to a deeper watertable and steep slopes.

LOW

Low vulnerability ranked groundwater resources are generally characterised by a deep watertable, meta-sedimentary geology and very steep slopes (i.e. greater than 33% slope). These areas are limited to the upland part of the catchment upstream of Lake Burrendong.

LEVEL OF ASSESSMENT REQUIRED

Groundwater vulnerability maps do not consider the chemical nature of the pollutant in assessing vulnerability. They are concerned only with the hydrogeologic setting, which makes the groundwater susceptible to contamination from a surface source.

When a development application is being prepared, or considered, it is important that the impact of the development, on both surface and groundwater resources is assessed. It is important to know who uses these resources (beneficial use) and the current groundwater quality. Potentially polluting groundwater developments should not be allowed within highly vulnerable areas. Where such activities are proposed, significant engineering measures would be necessary to minimise the risks of pollution.

The following Table is a guide to the amount of groundwater assessment required for a development that requires consent in any of the five-aquifer vulnerability classes.

Table 8. Groundwater assessment for developments that require consent

Vulnerability classification	Groundwater assessment requirements
Low	Groundwater contamination assessment report A desk study is required to identify the concerns and potential risk to groundwater or the environment, and the need for any further action to be presented in the development application. A standard format hydrogeological report would most likely result.
Low-moderate	Site investigation with monitoring A potential risk is indicated by the vulnerability map requiring site investigation and groundwater monitoring. The extent of work should involve a limited amount of site investigation, soil and water sampling and testing, definition of flow systems and reporting, in addition to a desk study.
Moderate	Detailed site investigation and monitoring For moderate vulnerability areas, or where the previous levels of investigation indicate a demonstrated risk to groundwater, a detailed groundwater site investigation is required. The work should include an ongoing monitoring program, details on the protection design factors, (natural attenuation, physical barriers, etc) in addition to the previous levels of investigation.
Moderately high	Demonstrated groundwater protection system The risk to groundwater, as demonstrated by the vulnerability map, is an area in which contamination to groundwater cannot be tolerated. The work should include a desk study, detailed site investigation, and implementation of an on-going monitoring program, as indicated above. In addition, the protection design system incorporating natural attenuation, hydraulic barriers, physical barriers etc, needs to be demonstrated, to be effective. The proposal will need to include a feasibility plan for a clean-up, in addition to a detailed monitoring and ongoing assessment program.
High	Demonstrated remedial action plan/prohibition This classification identifies the area as having a potential risk so great as to warrant a demonstrated remedial action plan. The work should include a desk study, site investigations, ongoing monitoring, plus a demonstrated remedial action plan for clean-up, which analyses the effectiveness of the remediation approach in achieving designated water quality criteria. The financial capacity of the responsible party to enact the plan should also be evaluated. In the event that the risk to groundwater is unacceptable, an activity may be banned by the responsible authority.

Source: Modified from the Australian Water Resources Council (AWRC), *Draft Guidelines for Groundwater Protection*, (1992).

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APPENDIX B – REGISTERED GROUNDWATER BORE DETAILS

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 4, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW026890

Works Details (top)

GROUNDWATER NUMBER	GW026890
LIC-NUM	80WA709380
AUTHORISED-PURPOSES	STOCK
INTENDED-PURPOSES	STOCK
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1966-01-01
FINAL-DEPTH (metres)	27.40
DRILLED-DEPTH (metres)	27.40
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	FERNDALE
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6539593.00
EASTING	488295.00
LATITUDE	31 16' 40"
LONGITUDE	146 52' 37"
GS-MAP	0037D2
AMG-ZONE	55
COORD-SOURCE	GD.,ACC.MAP
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	1

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	1

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
22.30	22.90	0.60	Unconsolidated	9.10		0.16			Over 14000 ppm
26.10	27.50	1.40	Unconsolidated	9.10		0.16			Over 14000 ppm

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.85	0.85	Loam Red Sandy		
0.85	3.35	2.50	Clay Red Gravel		
3.35	7.16	3.81	Gravel Hard Bands		
7.16	9.30	2.14	Clay Yellow		
9.30	13.72	4.42	Rock Yellow		
13.72	22.25	8.53	Clay		
22.25	22.86	0.61	Sand Coarse Water Supply		
22.86	26.06	3.20	Clay		
26.06	27.43	1.37	Sand Coarse Water Supply		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW042880

Works Details (top)

GROUNDWATER NUMBER	GW042880
LIC-NUM	80BL106391
AUTHORISED-PURPOSES	MINING
INTENDED-PURPOSES	INDUSTRIAL
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1975-10-01
FINAL-DEPTH (metres)	62.00
DRILLED-DEPTH (metres)	62.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6543836.00
EASTING	483793.00
LATITUDE	31 14' 22"

LONGITUDE	146 49' 47"
GS-MAP	0037D1
AMG-ZONE	55
COORD-SOURCE	GD.,ACC.MAP
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	108

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	108

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	Threaded Steel	-0.30	40.70	152			Suspended in Clamps
1	1	Opening	Slots - Vertical	35.00	41.00	152		1	SL: 0mm; A: 8mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
22.00	62.00	40.00	Fractured	18.00					Salty

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	6.00	6.00	Soil Clayey Quartz Veined Schist Very Weathered Chloritic		
6.00	8.00	2.00	Schist Weathered Chloritic Quartz Veined		
8.00	10.00	2.00	Schist Weathered Chloritic Quartz Veined		
10.00	14.00	4.00	Schist Weathered Chloritic Quartz Veined		
14.00	16.00	2.00	Schist Weathered Chloritic Chloritic Quartz Veined		
16.00	22.00	6.00	Schist Weathered Chloritic Quartz Veined		

22.00	40.00	18.00	Schist Weathered Chloritic Water Supply Quartz Veined
40.00	48.00	8.00	Schist Chloritic Water Supply Quartz Veined Fresh
48.00	62.00	14.00	Schist Chloritic Water Supply Quartz Veined

---

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW803779

Works Details (top)

GROUNDWATER NUMBER	GW803779
LIC-NUM	80BL245099
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2008-09-25
FINAL-DEPTH (metres)	40.00
DRILLED-DEPTH (metres)	40.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIRILAMBONE COPPER MINE
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	11.00
SALINITY	
YIELD	1.00

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541519.00
EASTING	488373.00
LATITUDE	31 15' 38"

LONGITUDE	146 52' 40"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22//861603

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	21 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	3.00	200			Rotary Air
1		Hole	Hole	3.00	40.00	120			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 9	0.00	25.00	80	74		Glued; Seated on Bottom; End cap
1	1	Opening	Slots - Diagonal	25.00	40.00	80			PVC Class 9; Sawn; SL: 150mm; A: 2mm; Glued
1		Annulus	Crushed Aggregate	0.00	9.00	120	80		
1		Annulus	Bentonite	9.00	10.00	120	80		
1		Annulus	Waterworn/Rounded	10.00	40.00	120	80		Graded; GS: 5-7mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
26.00	28.00	2.00		11.00		1.00		1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	2.00	2.00	Fill, backfill		
2.00	40.00	38.00	Sandstone, weathered		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW803780

Works Details (top)

GROUNDWATER NUMBER	GW803780
LIC-NUM	80BL245100
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2008-09-24
FINAL-DEPTH (metres)	40.00
DRILLED-DEPTH (metres)	40.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIRILAMBONE COPPER MINE
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	10.60
SALINITY	
YIELD	0.10

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541148.00
EASTING	488345.00
LATITUDE	31 15' 50"

LONGITUDE	146 52' 39"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	21//861603

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	3.00	200			Rotary Air
1		Hole	Hole	3.00	40.00	120			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 9	0.00	25.00	80	74		Glued; Seated on Bottom; End cap
1	1	Opening	Slots - Diagonal	25.00	40.00	80			PVC Class 9; Sawn; SL: 150mm; A: 2mm; Glued
1		Annulus	Crushed Aggregate	0.00	9.00	120	80		
1		Annulus	Bentonite	9.00	10.00	120	80		
1		Annulus	Waterworn/Rounded	10.00	40.00	120	80		Graded; GS: 5-7mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
31.00	32.00	1.00		10.60		0.10		1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Clay, red		
1.00	2.00	1.00	Gravel, red		
2.00	40.00	38.00	Sandstone, weathered		

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW803781

Works Details (top)

GROUNDWATER NUMBER	GW803781
LIC-NUM	80BL245098
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2008-09-27
FINAL-DEPTH (metres)	40.00
DRILLED-DEPTH (metres)	40.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIRILAMBONE COPPER MINE
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	39.00
SALINITY	
YIELD	0.01

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541537.00
EASTING	489056.00
LATITUDE	31 15' 37"

LONGITUDE	146 53' 6"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	Rd Adj 22//861603

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	3.00	200			Rotary Air
1		Hole	Hole	3.00	40.00	120			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 9	0.00	25.00	80	74		Glued; Seated on Bottom; End cap
1	1	Opening	Slots - Diagonal	25.00	40.00	80			PVC Class 9; Sawn; SL: 150mm; A: 2mm; Glued
1		Annulus	Crushed Aggregate	0.00	9.00	120	80		
1		Annulus	Bentonite	9.00	10.00	120	80		
1		Annulus	Waterworn/Rounded	10.00	40.00	120	80		Graded; GS: 5-7mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
39.00	40.00	1.00		39.00		0.01		1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Clay, red		
1.00	40.00	39.00	Sandstone, weathered		

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 4, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW803782

Works Details (top)

GROUNDWATER NUMBER	GW803782
LIC-NUM	80BL245097
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2008-09-26
FINAL-DEPTH (metres)	40.00
DRILLED-DEPTH (metres)	40.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIRILAMBONE COPPER MINE
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	8.00
SALINITY	
YIELD	0.10

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541470.00
EASTING	488767.00
LATITUDE	31 15' 39"
LONGITUDE	146 52' 55"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22//861603

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	3.00	200			Rotary Air
1		Hole	Hole	3.00	40.00	120			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 9	0.00	25.00	80	74		Glued; Seated on Bottom; End cap
1	1	Opening	Slots - Diagonal	25.00	40.00	80			PVC Class 9; Sawn; SL: 150mm; A: 2mm; Glued
1		Annulus	Crushed Aggregate	0.00	9.00	120	80		
1		Annulus	Bentonite	9.00	10.00	120	80		
1		Annulus	Waterworn/Rounded	10.00	40.00	120	80		Graded; GS: 5-7mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
28.00	29.00	1.00		8.00		0.10		1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Clay, red		
1.00	40.00	39.00	Sandstone, weathered		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW804379

Works Details (top)

GROUNDWATER NUMBER	GW804379
LIC-NUM	80BL245970
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rot. Rev. Circ. Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2010-08-11
FINAL-DEPTH (metres)	61.00
DRILLED-DEPTH (metres)	61.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541216.00
EASTING	487574.00
LATITUDE	31 15' 48"

LONGITUDE	146 52' 10"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	1//822426

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	61.00	125			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 12	0.00	61.00	89	79		Screwed and Glued; Driven into Hole; Seated on Bottom; End cap
1	1	Opening	Slots - Horizontal	43.00	61.00	89			PVC Class 12; Casing - Drilled Holes; SL: 70mm; A: 1mm; Screwed and Glued
1		Annulus	Waterworn/Rounded	0.00	61.00	125	89		Graded; GS: 3.2-6.4mm
1		Annulus	Bentonite	30.00	40.00	125	89		

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
47.00	52.00	5.00							

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Colluvium		
1.00	52.00	51.00	Schist, highly oxidised, with minor quartz throughout, high quartz 21-38m, water @ 47m		
52.00	61.00	9.00	Schist, fresh		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW804380

Works Details (top)

GROUNDWATER NUMBER	GW804380
LIC-NUM	80BL245970
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rot. Rev. Circ. Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2010-08-11
FINAL-DEPTH (metres)	61.00
DRILLED-DEPTH (metres)	61.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	870.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6540957.00
EASTING	487727.00
LATITUDE	31 15' 56"

LONGITUDE	146 52' 16"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	21//861603

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	61.00	125			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 12	0.00	61.00	89	79		Screwed and Glued; Driven into Hole; Seated on Bottom; End cap
1	1	Opening	Slots - Horizontal	43.00	61.00	89			PVC Class 12; Casing - Drilled Holes; SL: 70mm; A: 1mm; Screwed and Glued
1		Annulus	Waterworn/Rounded	0.00	61.00	125	89		Graded; GS: 3.2-6.4mm
1		Annulus	Bentonite	30.00	40.00	125	89		

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
55.00	57.00	2.00							870.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	2.00	2.00	Colluvium		
2.00	57.00	55.00	Schist, oxidised & minor quartz, high quartz 8-9m, 11-13m, 27, 31-33m, 36m, 38m, 41, 44-48m, 50, 52-53m, 55m		
57.00	61.00	4.00	Schist, fresh		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW804381

Works Details (top)

GROUNDWATER NUMBER	GW804381
LIC-NUM	80BL245970
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rot. Rev. Circ. Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2010-08-12
FINAL-DEPTH (metres)	52.00
DRILLED-DEPTH (metres)	52.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	10000.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541396.00
EASTING	487783.00
LATITUDE	31 15' 42"

LONGITUDE	146 52' 18"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	2/3/986

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	52.00	125			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 12	0.00	52.00	89	79		Screwed and Glued; Driven into Hole; Seated on Bottom; End cap
1	1	Opening	Slots - Horizontal	29.00	52.00	89			PVC Class 12; Casing - Hand Sawn Slot; SL: 70mm; A: 1mm; Screwed and Glued
1		Annulus	Waterworn/Rounded	0.00	52.00	125	89		Graded; GS: 3.2-6.4mm
1		Annulus	Bentonite	20.00	25.00	125	89		

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
34.00	47.00	13.00							

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Colluvium		
1.00	47.00	46.00	Schist, oxidised & minor quartz, high quartz @9m, 11-12m, 19m, 33m & water at 34m		
47.00	52.00	5.00	Schist, fresh		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW804382

Works Details (top)

GROUNDWATER NUMBER	GW804382
LIC-NUM	80BL245970
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rot. Rev. Circ. Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2010-08-13
FINAL-DEPTH (metres)	52.00
DRILLED-DEPTH (metres)	52.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	9170.00
YIELD	1.50

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541140.00
EASTING	488033.00
LATITUDE	31 15' 50"

LONGITUDE	146 52' 27"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	21//861603

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	52.00	125			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 12	0.00	52.00	89	79		Screwed and Glued; Driven into Hole; Seated on Bottom; End cap
1	1	Opening	Slots - Horizontal	28.00	52.00	89			PVC Class 12; Casing - Hand Sawn Slot; SL: 70mm; A: 1mm; Screwed and Glued
1		Annulus	Waterworn/Rounded	0.00	52.00	125	89		Graded; GS: 3.2-6.4mm
1		Annulus	Bentonite	20.00	25.00	125	89		

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
34.00	47.00	13.00				1.50			9170.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Colluvium		
1.00	47.00	46.00	Schist, oxidised, & minor quartz, high quartz @ 16m & 33m, water # 34m		
47.00	52.00	5.00	Schist, fresh		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW804383

Works Details (top)

GROUNDWATER NUMBER	GW804383
LIC-NUM	80BL245970
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rot. Rev. Circ. Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2010-08-13
FINAL-DEPTH (metres)	40.00
DRILLED-DEPTH (metres)	40.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	6220.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541665.00
EASTING	487918.00
LATITUDE	31 15' 33"

LONGITUDE	146 52' 23"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	7/5/986

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	40.00	125			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 12	0.00	40.00	89	79		Screwed and Glued; Driven into Hole; Seated on Bottom; End cap
1	1	Opening	Slots - Horizontal	22.00	40.00	89			PVC Class 12; Casing - Hand Sawn Slot; SL: 70mm; A: 1mm; Screwed and Glued
1		Annulus	Waterworn/Rounded	0.00	40.00	125	89		Graded; GS: 3.2-6.4mm
1		Annulus	Bentonite	15.00	20.00	125	89		

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
25.00	33.00	8.00							6220.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Colluvium		
1.00	8.00	7.00	Sandstone, oxidised & minor quartz, high quartz @ 5m, 7m & 8m,		
8.00	33.00	25.00	Schist, oxidised, high quartz @ 9, 11, 14, 18, 20, 21, 28 & 33m, water @ 25m		
33.00	40.00	7.00	Schist, fresh		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, July 5, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW804384

Works Details (top)

GROUNDWATER NUMBER	GW804384
LIC-NUM	80BL245970
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Rot. Rev. Circ. Air
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2010-08-13
FINAL-DEPTH (metres)	43.00
DRILLED-DEPTH (metres)	43.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	9160.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541548.00
EASTING	488031.00
LATITUDE	31 15' 37"

LONGITUDE	146 52' 27"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	6/10/986

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	43.00	125			Rot. Rev. Circ. Air
1	1	Casing	PVC Class 12	0.00	43.00	89	79		Screwed and Glued; Driven into Hole; Seated on Bottom; End cap
1	1	Opening	Slots - Horizontal	25.00	43.00	89			PVC Class 12; Casing - Hand Sawn Slot; SL: 70mm; A: 1mm; Screwed and Glued
1		Annulus	Waterworn/Rounded	0.00	43.00	125	89		Graded; GS: 3.2-6.4mm
1		Annulus	Bentonite	15.00	25.00	125	89		

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
31.00	39.00	8.00							9160.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	2.00	2.00	Colluvium		
2.00	26.00	24.00	Sandstone, oxidised, & minor quartz, high quartz @ 6m, 8m, 11m & 26m		
26.00	39.00	13.00	Schist, oxidised, water @ 31m		
39.00	43.00	4.00	Schist, fresh		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Tuesday, July 2, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805056

Works Details (top)

GROUNDWATER NUMBER	GW805056
LIC-NUM	80BL620335
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-07-24
FINAL-DEPTH (metres)	66.00
DRILLED-DEPTH (metres)	66.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	AVOCA TANK
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	39.97
SALINITY	10688.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6548184.00
EASTING	484403.00
LATITUDE	31 12' 1"

LONGITUDE	146 50' 11"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	144//751315

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	144 751315

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	66.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	59.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	59.00	65.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	51.00	53.00	125	89		
1		Annulus	Waterworn/Rounded	53.00	66.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
59.00	65.00	6.00		39.97				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	2.00	2.00	Siltstone, extremely weathered, red
2.00	15.00	13.00	Siltstone, heavily weathered, white/brown
15.00	31.00	16.00	Siltstone, moderately weathered, white/brown
31.00	57.00	26.00	Siltstone, weakley weathered, grey/white
57.00	60.00	3.00	Siltstone, fresh, grey/white
60.00	66.00	6.00	Siltstone, fractured

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Groundwater Works Summary

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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805057

Works Details (top)

GROUNDWATER NUMBER	GW805057
LIC-NUM	80BL620336
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-07-23
FINAL-DEPTH (metres)	54.00
DRILLED-DEPTH (metres)	54.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	AVOCA TANK
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	35.95
SALINITY	10707.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6548874.00
EASTING	484713.00
LATITUDE	31 11' 39"

LONGITUDE	146 50' 22"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	10//751315

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	10 751315

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	54.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	47.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	47.00	53.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	44.00	45.00	125	89		
1		Annulus	Waterworn/Rounded	45.00	54.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
47.00	53.00	6.00		35.95				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	2.00	2.00	Siltstone, extremely weathered, brown/red
2.00	35.00	33.00	Siltstone, moderately weathered, white/brown
35.00	48.00	13.00	Siltstone, moderately weathered, grey/brown/white
48.00	54.00	6.00	Siltstone, fractured

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Groundwater Works Summary

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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805058

Works Details (top)

GROUNDWATER NUMBER	GW805058
LIC-NUM	80BL620335
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-07-24
FINAL-DEPTH (metres)	48.00
DRILLED-DEPTH (metres)	48.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	AVOCA TANK
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	31.04
SALINITY	9856.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6548194.00
EASTING	485153.00
LATITUDE	31 12' 1"

LONGITUDE	146 50' 39"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	144//751315

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	144 751315

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	48.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	41.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	41.00	47.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	33.00	35.00	125	89		
1		Annulus	Waterworn/Rounded	35.00	48.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
41.00	47.00	6.00		31.04				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	2.00	2.00	Siltstone, extremely weathered, red/white
2.00	26.00	24.00	Siltstone, weakly weathered, grey
26.00	32.00	6.00	Siltstone, moderately weathered, grey/brown
32.00	38.00	6.00	Siltstone, weakly weathered, grey
38.00	42.00	4.00	Siltstone, fresh, grey
42.00	48.00	6.00	Siltstone, fractured

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805059

Works Details (top)

GROUNDWATER NUMBER	GW805059
LIC-NUM	80BL620337
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-28
FINAL-DEPTH (metres)	22.00
DRILLED-DEPTH (metres)	22.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIRILAMBONE LEACHATE PONDS
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	11.78
SALINITY	19200.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541132.00
EASTING	488869.00
LATITUDE	31 15' 50"

LONGITUDE	146 52' 59"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	35//864483

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	36 864483

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	22.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	15.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	15.00	21.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	12.00	13.00	125	89		
1		Annulus	Waterworn/Rounded	13.00	22.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
15.00	21.00	6.00		11.78				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	1.00	1.00	Topsoil, surface, red/brown
1.00	16.00	15.00	Siltstone, moderately weathered, brown/grey
16.00	22.00	6.00	Siltstone, fractured

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805060

Works Details (top)

GROUNDWATER NUMBER	GW805060
LIC-NUM	80BL620338
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-27
FINAL-DEPTH (metres)	19.00
DRILLED-DEPTH (metres)	19.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIRILAMBONE LEACHATE PONDS
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	9.32
SALINITY	19840.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6540725.00
EASTING	488551.00
LATITUDE	31 16' 4"

LONGITUDE	146 52' 47"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	2//833281

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	2 833281

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	19.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	12.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	12.00	18.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	8.00	10.00	125	89		
1		Annulus	Waterworn/Rounded	10.00	19.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
12.00	18.00	6.00		9.32				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	2.00	2.00	Siltstone, extremely weathered, red/brown
2.00	13.00	11.00	Siltstone, moderately weathered
13.00	19.00	6.00	Siltstone, fractured

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805061

Works Details (top)

GROUNDWATER NUMBER	GW805061
LIC-NUM	80BL620307
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-29
FINAL-DEPTH (metres)	37.00
DRILLED-DEPTH (metres)	37.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	24.00
SALINITY	4992.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6542338.00
EASTING	487672.00
LATITUDE	31 15' 11"

LONGITUDE	146 52' 14"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	Rd Adj 3//751315

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	3 751315

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	37.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	30.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	30.00	36.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	26.00	28.00	125	89		
1		Annulus	Waterworn/Rounded	28.00	37.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
30.00	36.00	6.00		24.00				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	1.00	1.00	Topsoil, surface, red/brown
1.00	3.00	2.00	Siltstone, heavily weathered, yellow/brown
3.00	8.00	5.00	Siltstone, heavily weathered, yellow/white
8.00	18.00	10.00	Siltstone, heavily weathered, white/light brown
18.00	24.00	6.00	Siltstone, heavily weathered, brown/red/grey
24.00	27.00	3.00	Siltstone, heavily weathered, white/grey
27.00	30.00	3.00	Siltstone, moderately weathered, brown/red/grey
30.00	32.00	2.00	Siltstone, moderately weathered, brown/white/grey
32.00	37.00	5.00	Siltstone, fractured

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805062

Works Details (top)

GROUNDWATER NUMBER	GW805062
LIC-NUM	80BL620255
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-28
FINAL-DEPTH (metres)	139.00
DRILLED-DEPTH (metres)	139.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	78.46
SALINITY	16640.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541900.00
EASTING	487368.00
LATITUDE	31 15' 25"

LONGITUDE	146 52' 2"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	3//751315

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	2 751315

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	139.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	132.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	132.00	138.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	128.00	130.00	125	89		
1		Annulus	Waterworn/Rounded	130.00	139.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
132.00	138.00	6.00		78.46				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	17.00	17.00	Siltstone, heavily weathered, orange/white
17.00	65.00	48.00	Siltstone, moderately weathered, orange/grey
65.00	83.00	18.00	Siltstone, weakly weathered, grey/red
83.00	111.00	28.00	Siltstone, bleached, limonite, light grey
111.00	121.00	10.00	Siltstone, hgihly bleached limonite, light grey/green
121.00	133.00	12.00	Siltstone, weakly weathered, grey/red
133.00	139.00	6.00	Siltstone, fractured

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805063

Works Details (top)

GROUNDWATER NUMBER	GW805063
LIC-NUM	80BL620255
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-29
FINAL-DEPTH (metres)	132.00
DRILLED-DEPTH (metres)	132.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	26.77
SALINITY	12992.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6541370.00
EASTING	487610.00
LATITUDE	31 15' 43"

LONGITUDE	146 52' 11"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	1//822428

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	2 751315

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	132.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	125.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	125.00	131.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	121.00	123.00	125	89		
1		Annulus	Waterworn/Rounded	123.00	132.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
125.00	131.00	6.00		26.77				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	1.00	1.00	Topsoil, extremely weathered
1.00	14.00	13.00	Siltstone, moderately weathered, orange/grey
14.00	35.00	21.00	Siltstone, moderately weathered, light red/grey
35.00	40.00	5.00	Siltstone, moderately weathered, grey/white
40.00	126.00	86.00	Siltstone, weakly weathered, grey/white
126.00	132.00	6.00	Siltstone, fractured

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805064

Works Details (top)

GROUNDWATER NUMBER	GW805064
LIC-NUM	80BL620254
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-28
FINAL-DEPTH (metres)	82.00
DRILLED-DEPTH (metres)	82.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	64.10
SALINITY	12160.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6546446.00
EASTING	485442.00
LATITUDE	31 12' 58"

LONGITUDE	146 50' 50"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	138//751315

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	147 824129

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	82.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	75.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	75.00	81.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	74.00	76.00	125	89		
1		Annulus	Waterworn/Rounded	76.00	82.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
75.00	81.00	6.00		64.10				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	4.00	4.00	Siltstone, extremely weathered, red
4.00	48.00	44.00	Siltstone, moderately weathered, orange/white
48.00	76.00	28.00	Siltstone, weakly weathered, light grey/orange/white
76.00	82.00	6.00	Siltstone, fractured

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805066

Works Details (top)

GROUNDWATER NUMBER	GW805066
LIC-NUM	80BL620254
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-27
FINAL-DEPTH (metres)	132.00
DRILLED-DEPTH (metres)	132.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	127.00
SALINITY	9600.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6545662.00
EASTING	485601.00
LATITUDE	31 13' 23"

LONGITUDE	146 50' 56"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	147//824129

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	147 824129

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	132.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	125.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	125.00	131.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	120.00	122.00	125	89		
1		Annulus	Waterworn/Rounded	122.00	132.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
125.00	131.00	6.00		127.00				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	Topsoil, surface, red/brown		
1.00	45.00	44.00	Siltstone, heavily weathered, light brown		
45.00	52.00	7.00	Siltstone, moderately weathered, brown/grey/black		
52.00	60.00	8.00	Siltstone, heavily weathered, light brown		
60.00	86.00	26.00	Siltstone, moderately weathered, brown/grey/white		
86.00	125.00	39.00	Siltstone, grey/black		
125.00	132.00	7.00	Siltstone, fractured		

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805167

Works Details (top)

GROUNDWATER NUMBER	GW805167
LIC-NUM	80WA716017
AUTHORISED-PURPOSES	ENVIRONMENT REHABILITATION
INTENDED-PURPOSES	ENVIRONMENT REHABILITATION
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2009-06-17
FINAL-DEPTH (metres)	17.56
DRILLED-DEPTH (metres)	17.56
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIRILAMBONE COPPER MINE
GWMA	811 - CENTRAL WEST FRACTURED ROCKS
GW-ZONE	-
STANDING-WATER-LEVEL	7.94
SALINITY	
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	R.L. at W.L.M.Pt.
NORTHING	6541388.00
EASTING	488517.00
LATITUDE	31 15' 42"
LONGITUDE	146 52' 46"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22//861603

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	22 861603

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	17.56	200			(Unknown)
1	1	Casing	P.V.C.	0.00	0.00	200			

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

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Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Tuesday, July 2, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW805065

Works Details (top)

GROUNDWATER NUMBER	GW805065
LIC-NUM	80BL620254
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Mines
COMMENCE-DATE	
COMPLETION-DATE	2012-06-28
FINAL-DEPTH (metres)	87.00
DRILLED-DEPTH (metres)	87.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	YARRANDALE ROAD
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	82.00
SALINITY	6400.00
YIELD	

Site Details (top)

REGION	80 - MACQUARIE-WESTERN
RIVER-BASIN	421 - MACQUARIE RIVER
AREA-DISTRICT	
CMA-MAP	8235
GRID-ZONE	55/2
SCALE	1:100,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6546319.00
EASTING	485201.00
LATITUDE	31 13' 2"

LONGITUDE	146 50' 41"
GS-MAP	
AMG-ZONE	55
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	138//751315

Licensed (top)

COUNTY	CANBELEGO
PARISH	GIDALAMBONE
PORTION-LOT-DP	147 824129

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	87.00	125			Down Hole Hammer
1	1	Casing	PVC Class 12	0.00	80.00	89	79		Screwed; Seated; End cap
1	1	Opening	Slots - Horizontal	80.00	86.00	89			PVC Class 12; Mechanically Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite	77.00	78.00	125	89		
1		Annulus	Waterworn/Rounded	78.00	87.00	125	89		Graded; GS: 2-3mm; Q: .2m³

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
80.00	86.00	6.00		82.00				1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	2.00	2.00	Topsoil, surface, red/brown
2.00	46.00	44.00	Siltstone, heavily weathered, yellow/white/light brown
46.00	70.00	24.00	Siltstone, moderately weathered, light brown/yellow/grey/white
70.00	80.00	10.00	Siltstone, grey/yellow/blue
80.00	85.00	5.00	Siltstone, fractured
85.00	87.00	2.00	Siltstone, grey/yellow/blue

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APPENDIX C – SUMMARY OF DIRECTOR GENERAL'S REQUIREMENTS

WATER		
Environment Protection Authority 04/09/2013	**The Proposal** • Provide details of the project that are essential for predicting and assessing impacts to waters:	**Section 1-11**
	a) including the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, Including the risks they pose to Water Quality Objectives in the ambient waters (as defined on www.environment.nsw.gov.au/ieo.using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000).	**Section 6 & 14**
	b) the management of discharges with potential for water impacts.	**Section 7**
	c) drainage works and associated infrastructure; land-forming	**Section 7**
	d) and excavations; working capacity of structures; and water resource requirements of the proposal.	**Section 9 & 11**
	• Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts eg effluent ponds) and showing potential areas of modification of contours, drainage etc.	**Figures 1-4**
	• Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.	**Section 9**
	The Location • Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: www.environment.nsw.gov.au/ieo should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.	**Section 7**
	The Environmental Issues **Describe Baseline Conditions** Describe existing surface and groundwater quality - an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts). *Note: Methods of sampling and analysis need to conform with an accepted standard (e.g. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECCW 2004) or be approved and analyses undertaken by accredited laboratories).* • Provide site drainage details and surface runoff yield.	**Section 6** **Section 7**

	• State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: www.environment.nsw.gov.au/ieo. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.	**Section 6**
	• State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 Guidelines for Fresh and Marine Water Quality (http://www.deh.gov.au/water/quality/nwqms/volume1.html)(Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.	**Section 6.2 & 14**
	• State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries (www.hrc.nsw.gov.au) or the NSW Salinity Strategy (DLWC, 2000) (www.dlwc.nsw.gov.au/care/salinity/#Strategy).	**Section 12 & Appendix D**
	• Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.	**NA**
	• Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include: a) lake or estuary flushing characteristics. b) specific human uses (e.g. exact location of drinking water offtake). c) sensitive ecosystems or species conservation values. d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc.	**NA**

	e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment.	**Section 5, 6, 7, 8, and 9**
	f) historic river flow data where available for the catchment.	**NA**
	Assess impacts	**Section 14**
	• No proposal should breach clause 120 of the Protection of the *Environment Operations Act 1997* (Le. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).	
	• Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.	**Section 14 & 16**
	• Include a rationale, along with relevant calculations, supporting the prediction of the discharges.	**Section 14 & 15**
	• Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).	**Section 14 & 15**
	• Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).	
	• Identify any potential impacts on quality or quantity of groundwater describing their source.	**Section 14 & 15**
	• Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible, impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.	
	• Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.	
	• Containment of spills and leaks shall be in accordance with the technical guidelines section 'Bunding and Spill Management' of the Authorised Officers Manual (EPA, 1995) (http://www.environment.nsw.gov.au/mao/bundingspill.htm) and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.	
	• The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered: a) will the proposal protect Water Quality and River, Flow Objectives where they are currently achieved in the ambient waters; and b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.	

	• Consult with the EPA as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The EPA will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment. *Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.* • Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines. • Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact. • Reference should be made to relevant guidelines e.g. Managing Urban Storm water: Soils and Construction (Landcom, 2004), and Guidelines for Fresh and Marine Water Quality ANZECC 2000).	
	Describe management and mitigation measures • Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls. • Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies. • Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements. • Outline pollution control measures relating to storage of materials, possibility of accidental spills (eg preparation of contingency plans), appropriate disposal methods, and generation of leachate. • Describe hydrological impact mitigation measures including: a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition). b) minimising runoff. c) minimising reductions or modifications to flow regimes. d) avoiding modifications to groundwater. • Describe groundwater impact mitigation measures including: a) site selection. b) retention of native vegetation and revegetation. c) artificial recharge.	**Section 14 & 16**

	d) providing surface storages with impervious linings. e) monitoring program. Describe geomorphological impact mitigation measures including: a) site selection. b) erosion and sediment controls. c) minimising instream works. d) treating existing accelerated erosion and deposition. e) monitoring program.	**Section 14 & 16**
	• Any proposed monitoring should be undertaken in accordance with the Approved Methods for the *Sampling and Analysis of Water Pollutants in NSW* (DECCW 2004).	**Section 14 & 16**
Office of Water 03/10/2013	NSW Office of Water requires the EIS for the proposal to demonstrate the following: 1. Adequate and secure water supply for the proposal. Confirmation that water supplies for construction and operation are sourced from an appropriately authorised and reliable supply.	
	2. Identification of site water demands, water sources (surface and groundwater), water disposal methods and water storage structures in the form of a water balance. The water balance is to outline the proposed water management on the site and to also include details of any water reticulation infrastructure that supplies water to and within the site.	**Section 13**
	3. An impact assessment on adjacent licensed water users (surface and groundwater), riparian ecosystems and groundwater-dependent ecosystems. This is to meet the requirements of relevant state policy such as the NSW Aquifer Interference Policy, in addition to the objects and principles of the *Water Management Act 2000* which can be accessed at the following link: http://www.water.nsw.gov.au/vVater-managementiLaw-andPolicy/default.aspx.	**Section 13 & 15**
	4. An assessment of the potential to intercept groundwater and predicted maximum annual dewatering volumes, water quality and disposal/retention methods. This is to also include the modelled zone of influence for a number of stages both during mining operations and post mine life until equilibrium is achieved. This is to meet the requirements of the NSW Aquifer Interference Policy.	**Section 13 & 15**
	5. An impact assessment of the construction, operation and final landform of the proposed onsite waste rock emplacement, water management ponds and other potentially contaminating facilities. This is to include an assessment of the processing, management and disposal of potentially contaminating materials at the Tritton Copper Mine.	
	6. An assessment of any proposed modification to surface water management including modelling of redistribution of waters and an assessment of impact on neighbouring properties and the associated watercourse and floodplain.	

	7. An impact assessment of any proposed works within or adjacent to watercourses and adequate provision of buffer requirements. This is to also include proposed pipelines and temporary or permanent vehicle crossings within the project application area. Ability to achieve the principles of the *Water Management Act 2000* and the requirements of the "Guidelines for Controlled Activities on Waterfront Land' will be required. The relevant guidelines can be accessed at the following link: http://www.water.nsw.gov.au/WaterLicensing/Approvals/Controlled-activities/default.aspx.	
	8. Preparation of a surface water management plan and groundwater management plan to integrate the proposed water balance and management for the site and to identify adequate mitigating and monitoring requirements for both water quality and water volume.	**Section 14**
	9. Existing and proposed water licensing requirements in accordance with the *Water Act 1912* and *Water Management Act 2000* (whichever is relevant). This is to demonstrate that existing licences (include licence numbers) and licensed uses are appropriate, and to identify where additional licences are proposed. The proponent will be required to ensure they hold adequate licensed entitlement commensurate with the anticipated volume of groundwater take prior to this take occurring. Groundwater take includes the volume of water intercepted by the proposed activities both via the underground mine and any extraction bores, in addition to any ongoing take induced by groundwater inflows and evaporative loss when the mine workings begin to fill. The maximum annual requirements need to be regularly reviewed through updates of modelling and reviews of metering data.	**Section 13 & 15**
	10. Adequate mitigating and monitoring requirements to address surface water and groundwater impacts.	**Section 14, 15 & 16**
	Groundwater Source The assessment is required to identify groundwater issues and potential degradation to the groundwater source and provide the following:	
	• Details of the predicted highest groundwater table at the development site.	**Section 13**
	• Details of any works likely to intercept, connect with or result in pollutants infiltrating into the groundwater sources.	**Section 13**
	• Details of any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.	**Section 13**
	• Describe the flow directions and rates and the physical and chemical characteristics of the groundwater source.	**Section 6 & 13**
	• Details of the predicted impacts of any final landform on the groundwater regime.	**Section 13**
	• Details of the existing groundwater users within the area (including the environment) and include details of any potential impacts on these users.	**Section 5 & 13**
	• Assessment of the quality of the groundwater for the local groundwater catchment.	**Section 5 & 6**
	• Details of how the proposed development will not potentially diminish the current quality of groundwater, both in the short and long term.	**Section 14 & 15**
	• Details on preventing groundwater pollution so that remediation is not required.	**Section 14**

	• Quantification of impacts on groundwater dependent ecosystems (GDEs).	**Section 8, 13 & 15**
	• Details on protective measures to minimise any impacts on groundwater dependent ecosystems.	**Section 15**
	• Details of proposed methods of the disposal of waste water and approval from the relevant authority.	**Section 7**
	• Assessment of the potential for saline intrusion of the groundwater and measures to prevent such intrusion into the groundwater aquifer.	**Section 6**
	• Details of the results of any models or predictive tools used to predict groundwater drawdown, inflows to the site and impacts on affected water sources.	**Section 13**
	Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:	**Section 13 & 15**
	Details of any proposed monitoring programs, including water levels and quality data.	**Section 16**
	• Reporting procedures for any monitoring program including mechanism for transfer of information.	**Section 16**
	• Description of the remedial measures or contingency plans proposed.	**Section 16**
	Licensing	**Section 15**
	• All proposed groundwater works, including bores for the purpose of investigation, extraction, dewatering, testing or monitoring must be identified in the proposal and an approval obtained from the Office of Water prior to their installation. Approved SSD and SSI projects may be excluded from the requirement for approvals due to Section 89J and 115ZG of the *Environmental Planning and Assessment Act 1979*.	
	• All predicted groundwater take must be accounted for through adequate licensing.	**Section 15**
	Groundwater Dependent Ecosystems (GDEs) The assessment is required to identify any impacts on GDEs. GDEs are ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater.	**Section 8, 12, 15, 16 & Appendix D**
	GDEs represent a vital component of the natural environment. GDEs can vary dramatically in how they depend on groundwater from having occasional or no apparent dependence through to being entirely dependent. GDEs occur across both the surface and subsurface landscapes ranging in area from a few metres to many kilometres. Increasingly, it is being recognised that surface and groundwaters are often interlinked and aquatic ecosystems may have a dependence on both.	
	Ecosystems that can depend on groundwater and that may support threatened or endangered species, communities and populations, include:	
	• Terrestrial vegetation that show seasonal or episodic reliance on groundwater.	
	• River base flow systems which are aquatic and riparian ecosystems in or adjacent to streams/rivers dependent on the input of	

	groundwater to base flows. • Aquifer and cave ecosystems. • Wetlands. • Estuarine and near-shore marine discharge ecosystems. • Fauna which directly depend on groundwater as a source of drinking water or that live within water which provide a source. The *NSW Aquifer Interference Policy and* the *NSW Groundwater Dependent Ecosystem Policy* provides guidance on the protection and management of GDEs. It sets out management objectives and principles to: • Ensure the most vulnerable and valuable ecosystems are protected. • Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity. • Ensure sufficient groundwater of suitable quality is available to ecosystems when needed. • Ensure the *precautionary principle* is applied to protect GDEs, particularly the dynamics of flow and availability and the species reliant on these attributes. A number of gazetted WSPs list and map priority GDEs and set out the management strategies and actions for sharing and protecting groundwater quality, quantity and dependent ecosystems. As indicated above, any GDEs that may be affected significantly need to be clearly identified and the impacts quantified to enable proper assessment.	
	Surface Water The Office of Water is responsible for the management of rivers, estuaries, wetlands and adjacent riverine plains so they can sustain environmental, social and economic uses for the people in New South Wales.	**NA**
	<u>Watercourse/Riparian</u> The assessment is required to consider the impact of the proposal on the watercourses and associated riparian vegetation within the site and provide the following: • Identify the sources of surface water. • Details of stream order (using the Strahler System). • Details of any proposed surface water extraction, including quantity, purpose, location of existing pumps, dams, diversions, cuttings and levees. • Details of available surface water licences that could be purchased to account for any proposed extractions. • Detailed description of any proposed development or diversion works including all construction, clearing, draining, excavation and filling. • An assessment of the impacts of the proposed methods of excavation, construction and material placement on the watercourse and associated vegetation.	**NA**

	• A detailed description of all potential water related environmental impacts of any proposed development in terms of riparian vegetation, sediment movement, water quality and hydrologic regime. • A description of the design features and measures to be incorporated into any proposed development to guard against anything more than minimal long term actual and potential environmental disturbances, particularly in respect of maintaining the natural hydrologic regime and sediment movement patterns and the identification of riparian buffers. (See note below). • Details of the impact on water quality and remedial measures proposed to address more than minimal adverse effects. Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. The protection or restoration of vegetated riparian areas is important to maintain or improve the geomorphic form and ecological functions of watercourses through a range of hydrologic conditions in normal seasons and also in extreme events. Refer to NSW Office of Water Guidelines for Controlled Activities (July 2012) available via: http://www.water.nsw.gov.auiWater-Licensing/Approvals/Controlled-activitles/default.aspx	

APPENDIX D – DETAILED DISCUSSION OF WATER REGULATIONS

RELEVANT LEGISLATION, REGULATION AND POLICY FOR GROUNDWATER

INTRODUCTION

To facilitate the proposed mine development, in relation to impacts of groundwater resources, the following statutory requirements need to be achieved in order to address the NSW Office of Water DGR (provided in full in **Appendix C**).

There are two key pieces of legislation and regulation that control the use and development of land in NSW:

- *Environmental Planning and Assessment Act (1979)* (EP&A Act); and
- *Environmental Planning and Assessment Regulation (2000)* (EP&A Reg).

There are two key parts of legislation for the management of groundwater in NSW:

- *Water Act (1912)*; and
- *Water Management Act 2000* (WMA 2000).

In addition to the above Acts, the relevant plans, policies and regulation are considered the main tools which assist in implementing and defining the provisions of the WMA:

- The Water Management (General) Regulation (2011);
- Water Sharing Plans:
    - 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):
        - Lower Bogan River Water Source (2012);
- The NSW State Groundwater Dependent Ecosystem Policy (2002);
- The *NSW Aquifer Interference Policy 2012* (September 2012);
- The NSW Groundwater Policy Framework Document – General (1997);
- The NSW Groundwater Quality Protection Policy (1998);
- The NSW State Rivers and Estuaries Policy (1993); and
- The NSW Wetlands Policy (2010)

THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT (1979)

The *Environmental Planning and Assessment Act (1979)* requires the potential effects on groundwater of proposed developments to be assessed as part of the environment impact assessment process. The EP&A Act establishes the hierarchy of planning instruments that apply to the Proposal. These instruments and all relevant legislation applying to the proposal are summarised in the following sections. It also provides for the preparation of environmental planning instruments which may control, restrict or limit development at local, regional and State levels. The EP&A Act also applies to State government agencies issuing approvals, including licences for groundwater extraction.

THE WATER ACT (1912)

The Water Act (1912) came into force at the turn of the last century and represented a different era in water management in NSW. The Water Act (1912) is being progressively phased out and replaced by the WMA, however, some provisions remain in force.

WATER MANAGEMENT ACT (2000)

The Water Management Act (200) – the WMA – is comprehensive water legislation to guide water management activities. The objectives of the WMA were the sustainable and integrated management of the state's water for the benefit of both present and future generations, in particular:

- to apply the principles of ecologically sustainable development;
- to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality;
- to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including:
    - benefits to the environment;
    - benefits to urban communities, agriculture, fisheries, industry and recreation;
    - benefits to culture and heritage;
    - benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water;
- to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources;
- to provide for the orderly, efficient and equitable sharing of water from water sources;
- to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna;
- to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users; and
- to encourage best practice in the management and use of water.

To achieve the objectives, the WMA recognises the need to allocate and provide water for the environmental health of rivers and groundwater systems, whilst also providing licence holders with access to water and greater opportunities to trade water through the separation of water licences from land. The main tool the WMA provides for managing the State's water resources are the Water Sharing Plans (refer to **Section 12.3**). The Water Sharing Plans (WSP) are used to set out the rules for the sharing of water in a particular water source between water users and the environment and rules for the trading of water in a particular water source. When a WSP commences the Water Act (1912) is superseded by the WMA. WSPs have been developed for all the major regulated river systems, their associated major aquifers and a number of unregulated systems.

The WMA defines an aquifer as a ‘geological structure or formation, or an artificial landfill, that is permeated with water or is capable of being permeated with water. This differs from the well held belief that an aquifer is an economic supply of groundwater capable of pumping for a beneficial use.

Due to major changes required by the legislation, the Act has been progressively implemented. Since 1 July 2004 the new licensing and approvals system has been in effect in those areas of NSW covered by operational WSP.

To assist in implementing and defining the provisions of the WMA, regulations have been made, including:

- Water Management (General) Regulation 2011, which supersedes two former Regulations with some amendments: the Water Management (General) Regulation 2004 and the Water Management (Water Supply Authorities) Regulation 2004.

An aquifer interference regulation took effect in NSW on 30 June 2011. The Water Management (General) Regulation 2011 defines an "aquifer interference activity" as:

a) the extraction of sand,
b) the extraction of road base material.

In addition, the WMA defines an "aquifer inference activity" 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 in the course of carrying out mining or any other activity prescribed by the regulations

In relation to aquifer interference activities, the WMA specifies that:

a) the carrying out of aquifer interference activities must avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land must be rehabilitated, and
b) the impacts of the carrying out of aquifer interference activities on other water users must be avoided or minimised.

An aquifer interference approval confers a right on its holder to carry out one or more specified aquifer interference activities at a specified location, or in a specified area, in the course of carrying out specified activities (including mining operations).The *NSW Aquifer Interference Policy 2012* was released in September 2012 (refer to **Section 12.5**). This policy sets out the requirements for assessing the impacts of aquifer interference activities on water resources.

For the purposes of section 96 (a) of the Act, the matters to be taken into consideration by the Minister in considering whether or not to grant an aquifer interference approval include whether the amount of water taken in the course of carrying out the aquifer interference activity to which the approval relates will exceed the total extraction limit for the aquifer set out in any relevant management plan (e.g. WSPs). An aquifer interference approval is not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to the aquifer, or its dependent ecosystems, as a consequence of its being interfered with in the course of the activities to which the approval relates.

It is understood that unsaturated flow and perched groundwater are excluded from the aquifer interference policy.

A person who is engaged in an aquifer interference activity in connection with the mining or extraction of any material is exempt from section 91A (1) of the Act in relation to the using of water from an aquifer if the water is used in accordance with an aquifer interference approval with respect to that activity.

This reform was implemented to ensure equitable sharing of groundwater amongst all water users. The Water Management (General) Regulation 2004 has now been replaced by the Water Management (General) Regulation 2011.

WATER SHARING PLANS

WSPs are being progressively developed for rivers and groundwater systems across NSW following the introduction of the WMA. Water Sharing Plans made under the WMA are being prepared as Minister's plans under Section 50 of the Act. These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water.

WSPs provide a legislative basis for sharing water between the environment and consumptive purposes. Under the WMA, a plan for the sharing of water must protect each water source and its dependent ecosystems and must protect basic landholder rights.

WSPs also recognise the economic benefits that commercial users such as irrigation and industry can bring to a region. Upon commencement, access licences held under the Water Act 1912 are converted to access licences under the WMA and land and water rights are separated. This facilitates the trade of access licences and can encourage more efficient use of water resources. It also allows new industries to develop as water can move to its highest value use.

In conjunction with other provisions of the WMA, WSPs also set rules so that commercial users can continue to operate productively. In general, commercial licences under the WMA are granted in perpetuity, providing greater commercial security of water access entitlements. These WSPs aim to:

- clarify the rights of the environment, basic landholder rights users, town water suppliers and other licensed users;
- define the long-term average annual extraction limit (LTAAEL) for water sources;
- set rules to manage impacts of extraction; and
- facilitate the trading of water between users.

WSPs have been developed for major aquifers in NSW with each of these plans divided into 'groundwater sources'. Water sharing plans for groundwater specify:

- water sources covered by the plan;
- environmental water provisions;
- requirements for water for basic landholder rights;
- requirements for water for extraction under access licences;

- limits to the availability of water – determining long-term extraction limits;
- limits to the availability of water – available water determinations;
- rules for granting access licences;
- rules for managing access licences;
- rules for water supply work approvals;
- access licence dealing rules;
- mandatory conditions on access licences and water supply work approvals; and
- rules on how the plan may be amended;

The Project Site is located within the following WSPs:

- Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012) – *Lachlan Fold Belt MDB Groundwater Source*; and
- Water Sharing Plan for the Macquarie-Bogan Unregulated and Alluvial Water Sources (2012) – *Lower Bogan River Water Source.*

The DGR relating to the WSP was to demonstrate how the mining proposal is consistent with the relevant access and trading rules of the WSP.

Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012) – Lachlan Fold Belt MDB Groundwater Source

The NSW Murray-Darling Basin (MDB) fractured rock groundwater sources are located within the NSW portion of the MDB (as detailed in **Section 7.2**).

The Lachlan Fold Belt MDB Groundwater Source covers an area of 16,722,000 hectares. The Project Site is located within the western portion of the Lachlan Fold Belt MDB Groundwater Source which consists of fractured rock aquifer with a low to moderate level of connection between surface and groundwater.

The long-term average annual extraction limit (LTAAEL) for the Lachlan Fold Belt MDB Groundwater Source, which determines the annual amount of groundwater that can be potentially made available for extraction, was 821,250ML/year. Trading of water is permitted within the Lachlan Fold Belt MDB Groundwater Source zone.

Based on a review of **Appendix A** Map of High Priority GDEs of the WSP for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2012), there are no high priority GDEs within at least 150km of the site (including springs, geothermal springs, wetlands and karst) associated with the fractured rock groundwater source.

Water Sharing Plan for the Macquarie-Bogan Unregulated and Alluvial Water Sources (2012)

The Project Site is located within the boundary of the WSP for the Macquarie-Bogan Unregulated and Alluvial Water Sources, however, is not located within the alluvial groundwater source zones (Cudgegong Alluvial, Talbragar Alluvial, Bell Alluvial or the Upper Macquarie Alluvial).

No GDEs have been identified for the four alluvial groundwater sources included in the Macquarie-Bogan Unregulated and Alluvial Water Sources WSP.

The proposed mine is situated within a fractured rock aquifer, with low to moderate level of connection between surface and groundwater and is not within the listed alluvial groundwater source zones specified in the WSP. The potential groundwater impact of the proposed mine is not relevant to this WSP.

NSW STATE GROUNDWATER DEPENDENT ECOSYSTEMS POLICY (2002)

Base on the DGRs from the NSW Office of Water, the potential impacts to Groundwater Dependent Ecosystems (GDEs) must be considered.

As demonstrated in **Section 8.3 and 10.2** of this report no high priority GDEs are apparent in the vicinity of the site (within 150km).

NSW AQUIFER INTERFERENCE POLICY (2012)

The purpose of the *NSW Aquifer Interference Policy 2012* is to explain the role and requirements of the Minister administering the WMA in the water licensing and assessment processes for aquifer interference activities under the WMA and other relevant legislative frameworks. The *NSW Aquifer Interference Policy 2012*:

3. clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation; and
4. establishes and objectively defines considerations in assessing and providing advice on whether more than minimal impacts might occur to a key water-dependent asset.

Under the WMA an aquifer is defined as a geological structure or formation, or an artificial landfill, that is permeated with water or is capable of being permeated with water. More generally, the term 'aquifer' is commonly understood to mean a groundwater system that is sufficiently permeable to allow water to move within it, and which can yield productive volumes of groundwater. Groundwater is all water that occurs beneath the ground surface in the saturated zone. A groundwater system is any type of saturated geological formation that can yield anywhere from low to high volumes of water. For the purposes of the *NSW Aquifer Interference Policy 2012*, the term aquifer has the same meaning as groundwater system and includes low yielding and saline systems.

Aquifer interference activities may take water from the water source in which they exist as well as connected groundwater and surface water sources. Even where there is no take of water, aquifer interference activities can still affect the functioning of aquifers which can impact water users and dependent ecosystems.

Licensing of Water Taken Through Aquifer Interference

A water licence is required under the WMA (unless an exemption applies or water is being taken under a basic landholder right) where any act by a person carrying out an aquifer interference activity causes:

- the removal of water from a water source; or
- the movement of water from one part of an aquifer to another part of an aquifer; or
- the movement of water from one water source to another water source, such as:
    - from an aquifer to an adjacent aquifer; or
    - from an aquifer to a river/lake; or

- from a river/lake to an aquifer.

Assessment Process for Aquifer Interference Activities

The NSW Office of Water's assessment of impacts on water sources and water dependent ecosystems and subsequent advice and proposed conditions of approval as input to the planning process for a project is based on an "account for, mitigate, avoid/ prevent, and remediate" approach. In practice this means the assessment and subsequent advice will be based on the proponents':

1. (a) ability to demonstrate that they have the ability to obtain the necessary licences in order to account for the take of water from any relevant water source.; or
   (b) ability to demonstrate that the proposal has been designed in such a way as to prevent the take of water where applicants are unable to meet the requirements specified in point 1 above; and
2. ability to demonstrate that adequate arrangements will be in place to ensure that the minimal impact considerations specified in *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities* are achieved; and
3. proposed remedial actions for impacts greater than those that were predicted as part of the relevant approval. The assessment will include:

(a) consideration of the potential types and risks of unforeseen impacts that may occur during the operational phase or post-closure of the aquifer interference activity; and

(b) whether the proposed mitigation, prevention or avoidance strategies will minimise these risks; and

(c) whether the proposed remedial actions are adequate, should the proposed risk minimisation strategies in (b) fail; and

(d) advice on what further mitigation, prevention, avoidance or remedial actions may be required; and

(e) appropriate conditions that maintain any mitigation, prevention, avoidance or remediation actions until they are no longer required to keep the impacts at or below the predicted levels.

Aquifer Impact Assessment

The WMA includes the concept of ensuring "no more than minimal harm" for both the granting of water access licences and the granting of aquifer interference approvals. Aquifer interference approvals are not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems, as a consequence of its being interfered with in the course of the activities to which the approval relates.

Whilst aquifer interference approvals are not required to be granted, the minimal harm test under the WMA is not activated for the assessment of impacts. Therefore, this Policy establishes and objectively defines minimal impact considerations as they relate to water-dependent assets and these considerations will be used as the basis for providing advice to the Minister.

The minimal impact considerations have been developed for impacts on groundwater sources, connected water sources, and their dependent ecosystems, culturally significant sites and water users.

The potential impacts of the aquifer interference activity are assessed against the minimal impact considerations specified in *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities*, as well as any specific rules in a relevant WSP.

For each of the highly productive and less productive groundwater sources thresholds for key minimal impact considerations have been developed. These thresholds deal with water table and groundwater pressure drawdown as well as groundwater and surface water quality changes.

This Policy will adopt an adaptive management approach to the minimal impact considerations which means they will be regularly reviewed and updated, if required, based on scientific information and experience during implementation.

Groundwater Source Categories

The policy divides groundwater sources into two categories, "highly productive" and "less productive". Highly productive groundwater is defined in this Policy as a groundwater source that is declared in the Regulations and based on the following criteria:

a) has total dissolved solids of less than 1,500 mg/L, and
b) contains water supply works that can yield water at a rate greater than 5 L/sec.

Furthermore, the *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities* are categorised into type of groundwater sources and are presented in **Table D** below:

Table D1: Highly and Less Productive Groundwater Source Types

Highly Productive	Less Productive

• Alluvial;
• Coastal Sands;
• Porous Rock;
  ○ Great Artesian Basin - Eastern Recharge and Southern Recharge;
  ○ Great Artesian Basin – Surat, Warrego and Central;
  ○ other porous rock; and
• Fractured Rock.
	• Alluvial;
	• Porous Rock; and
	• Fractured Rock.

The proposed mine development is considered to be located in a Less Productive groundwater source type due to the elevated TDS (>1,500mg/L) and low yield (based on the known sustainable discharge rates reported during the pumping test at Girilambone mine site (ES, June 2013).

In addition to the requirements listed in *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities*, the following issue also require consideration:

- acidity issues to arise, for example exposure of acid sulphate soils; and
- waterlogging or water table rise to occur, which could potentially affect land use, groundwater dependent ecosystems and other aquifer interference activities. Specific limits will be determined on a case-by-case basis, depending on the sensitivity of the surrounding land and groundwater dependent ecosystems to waterlogging and other aquifer interference activities to water intrusion.

Requirements for Aquifer Impact Assessment

A risk management approach to assessing the potential impacts of aquifer interference activities was adopted, where the level of detail required to be provided by the proponent is proportional to a combination of the likelihood of impacts occurring on water sources, users and dependent ecosystems and the potential consequences of these impacts.

The following information is required to enable the assessment of the proposed mining development against the minimal impact considerations in *Table 1 – Minimal Impact Considerations for Aquifer Interference Activities of a Less Productive Groundwater Source in Porous and Fractured Rock*:

- establishment of baseline groundwater conditions including groundwater depth, quality and flow based on sampling of all existing bores in the area potentially affected by the activity, any existing monitoring bores and any new monitoring bores that may be required under an authorisation issued under the Mining Act 1992 or the Petroleum (Onshore) Act 1991;
- a strategy for complying with any water access rules applying to relevant categories of water access licences, as specified in relevant water sharing plans. For example, returning water of an acceptable quality to the affected water source during periods when flows are at levels below which water users are not permitted to pump;
- details of potential water level, quality or pressure drawdown impacts on nearby water users who are exercising their right to take water under a basic landholder right. Consideration will need to be given to any relevant distance restriction requirements that may be specified in any relevant water sharing plan or any remediation measures to address these impacts;
- details of potential water level, quality or pressure drawdown impacts on nearby licensed water users in connected groundwater and surface water sources;
- details of potential water level, quality or pressure drawdown impacts on groundwater dependent ecosystems;
- details of potential for increased saline or contaminated water inflows to aquifers and highly connected river systems;
- details of the potential to cause or enhance hydraulic connection between aquifers;
- details of the potential for river bank instability, or high wall instability or failure to occur; and
- provide estimates of all quantities of water that are likely to be taken from any water source during and following cessation of the activity and all predicted impacts associated with the activity

Table D2: Summary of Less Productive Groundwater Sources for Fractured Rock Water Sources Requirements for Minimal Impact Considerations for Aquifer Interference Activities.

Minimal Impact Consideration	Requirement
Water Table	1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variation, 40m from any: (a) high priority GDE; or(a) high priority GDE; or (b) high priority culturally significant site; listed in the schedule of the relevant WSP 2. If more than 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40m from any: a) high priority GDE; or(a) high priority GDE; or (b) high priority culturally significant site; listed in the schedule of the relevant WSP if appropriate studies demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than a 2m decline cumulatively at any water supply work then make good provisions should apply.
Water Pressure	1. A cumulative pressure head decline of not more than 2m decline, at any water supply work. 2. If the predicted head decline is greater than requirement 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provision apply.
Water Quality	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity. 2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

The proposed development is located within a confined fractured rock aquifer system, which does not have a 'water table' and the piezometric surface represents 'water pressure' rather than the depth at which water would be encountered during excavation or drilling. As such, assuming negligible connectivity with overlying unconsolidated formations, ES consider that only groundwater pressure and groundwater quality minimal impact considerations apply for the proposed Avoca Tank Mine development.

Appendix 8

Noise and Blasting Assessment

(Total No. of pages including blank pages = 50)

Note: A colour copy of this Appendix is available on the Project CD

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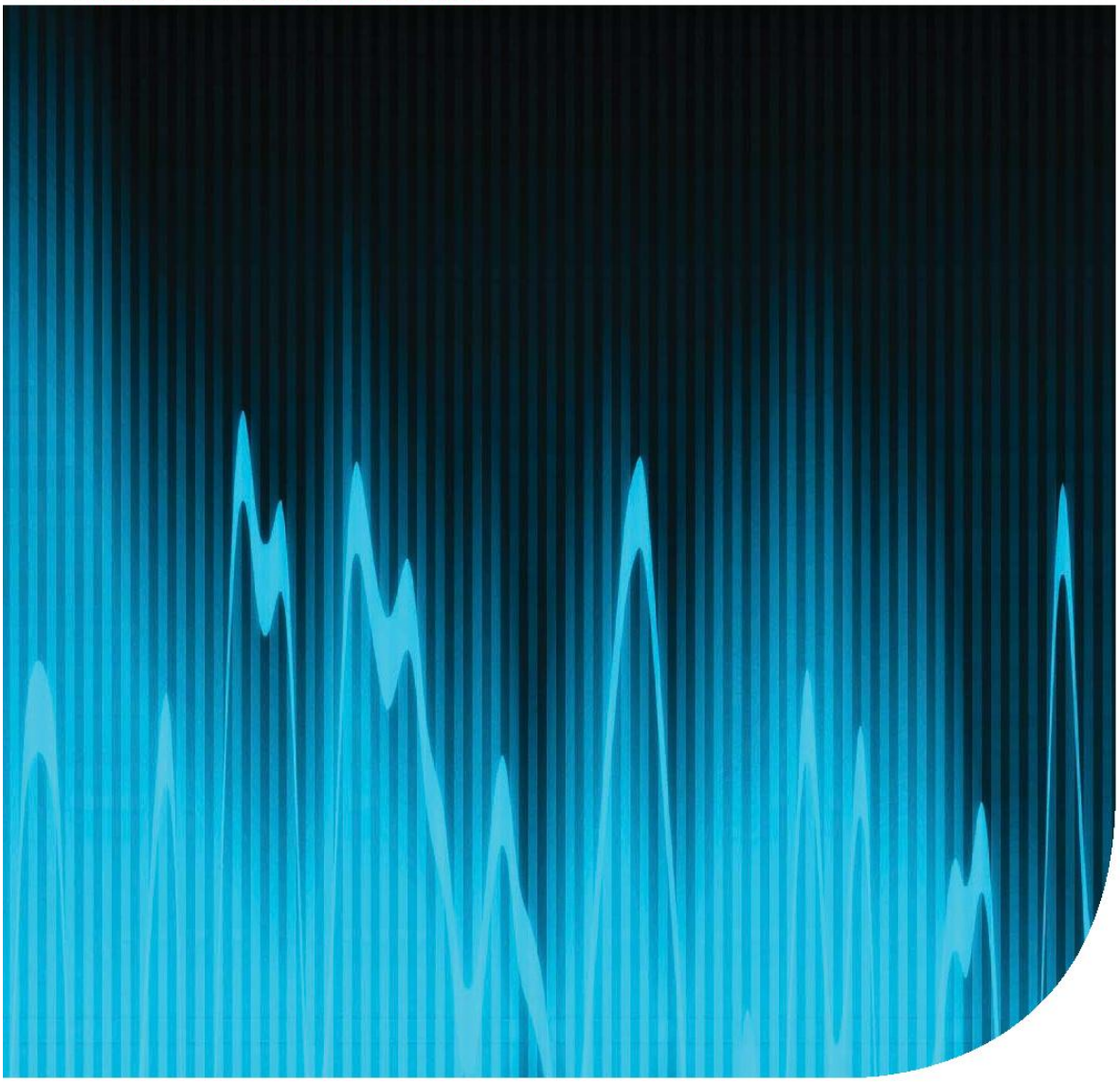
Avoca Tank Project

Noise impact assessment

Prepared for Tritton Resources Pty Ltd | 15 July 2014



Planning + Environment + Acoustics

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Avoca Tank Project

Noise impact assessment

Prepared for Tritton Resources Pty Ltd | 15 July 2014

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Avoca Tank Project

Final

Report H13121RP1|Prepared for Tritton Resources Pty Ltd|15 July 2014

Prepared by	**Teanuanua Villierme**	Approved by	**Najah Ishac**
Position	Acoustic Consultant	Position	Managing Director
Signature		Signature	
Date	15/7/2014	Date	15/7/2014

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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A Sound power levels and single octave frequencies for all plant items

Abbreviation or term	Definition
ABL	The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{90} statistical noise levels.
ANZECC	Australian and New Zealand Environment Conservation Council
Tritton	Tritton Resources Pty Ltd (the Applicant)
Day period[1]	Monday–Saturday: 7am to 6pm, on Sundays and public holidays: 8am to 6pm.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
DGRs	Director General Requirements
DP&I	Department of Planning and Infrastructure
EIS	Environmental Impact Statement
EMM	EMGA Mitchell McLennan Pty Limited
EP&A Act	*Environmental and Planning Assessment Act 1979* (NSW)
Evening period[1]	Monday–Saturday: 6pm to 10pm, on Sundays and public holidays: 6pm to 10pm.
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
L_1	The noise level exceeded for 1% of the time.
L_{10}	The noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level.
L_{90}	The noise level that is exceeded 90% of the time. Commonly referred to as the background noise level.
L_{eq}	The energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The $L_{eq(15min)}$ descriptor refers to an L_{eq} noise level measured over a 15-minute period.
L_{max}	The maximum sound pressure level received during a measuring interval.
Night period[1]	Monday–Saturday: 10pm to 7 am, on Sundays and public holidays: 10 pm to 8am.
EPA	The NSW Environment Protection Authority (formerly the Environment Protection Authority and the Department of Environment, Climate Change and Water).
PSNL	The project-specific noise levels (PSNL) are criteria for a particular industrial noise source or industry. The PSNL is the lower of either the intrusive criteria or amenity criteria.
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
RNP	Road Noise Policy
Sound power level (Lw)	A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.
The Proposal	The Avoca Tank Project
Vibration	A motion that can be measured in terms of its displacement, velocity or acceleration. The common unit for velocity is millimetres per second (mm/s).

Notes: 1. Excludes road traffic noise where Day: 7 am to 10 pm; Night: 10 pm to 7 am.

1 Introduction

EMGA Mitchell McLennan Pty Limited (EMM) has been engaged by RW Corkery & Co Pty Ltd (RW Corkery) to complete a Noise Impact Assessment (NIA) for the proposed Avoca Tank Project (the Proposal) to be developed and operated by Tritton Resources Pty Ltd (Tritton).

The Proposal is a greenfield site located 2km north of Tritton's existing Girilambone Copper Mine and 24km northeast of its Tritton Copper Mine, approximately 7km northwest of the village of Girilambone and 55 km north-west of Nyngan in central NSW (see Figure 1.1), where an underground mine would be developed and provide ore to the existing processing plant currently in use at the Tritton Copper Mine.

1.1 Director-General's requirements

A summary of the Director-General's requirements (DGRs) and relevant agency assessment requirements pertaining to noise from the Proposal are summarised in Table 1.1. The table also shows their relevance to the assessment, comments/justification for their inclusion or exclusion in the assessment and where they have been addressed in this report.

Table 1.1 DGRs for assessment of noise impacts

Authority/agency	Requirements	Assessed	Comments	Relevant report section
Environment Protection Authority (EPA)	**The proposal**			
	Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.	√	Provided	4.2, 4.3 and 5.5
	Specify the times of operation for all phases of the development and for all noise producing activities.	√	Provided	1.3.4
	For projects with a significant potential traffic noise impact provide details of road alignment and land use along the proposed road and measurement locations - diagrams should be to a scale sufficient to delineate individual residential blocks.	X	Traffic noise impact not significant	5.5.2
	The location			
	Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.	√	Provided	2.1
	Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.	√	Provided	2.1
	The environmental issues - describe baseline conditions			
	Determine the existing background (L90) and ambient (Leq) noise levels in accordance with the *NSW Industrial Noise Policy*.	X	Default INP RBL of 30 dB	2.3
	Determine the existing road traffic noise levels in accordance with the NSW Environmental Criteria for Road Traffic Noise, where road traffic noise impacts may occur.	√	Provided	5.5

Table 1.1 DGRs for assessment of noise impacts

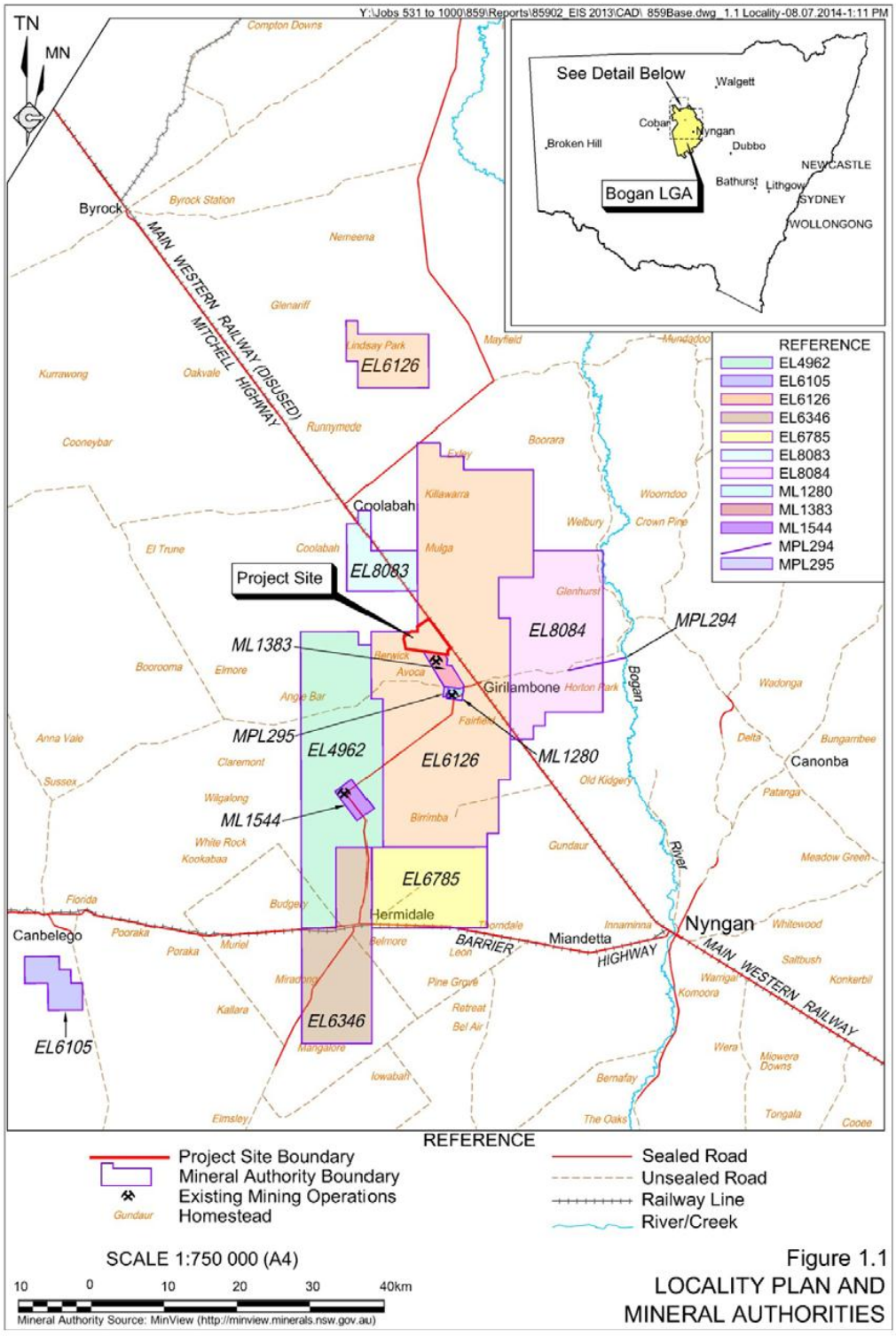
Authority/agency	Requirements	Assessed	Comments	Relevant report section
Environment Protection Authority (EPA)	The noise impact assessment report should provide details of all monitoring of existing ambient noise levels.	X	No ambient monitoring	2.3
	Assess impacts			
	Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:			
	a) determination of the intrusive criterion for each identified potentially affected receiver.	√	Provided	3.1.2
	b) selection and justification of the appropriate amenity category for each identified potentially affected receiver.	√	Provided	3.1.3
	c) determination of the amenity criterion for each receiver.	√	Provided	3.1.3
	d) determination of the appropriate sleep disturbance limit.	√	Provided	3.4
	Maximum noise levels during night-time period (10 pm-7 am) should be assessed to analyse possible affects on sleep. Where L1(1 min) noise levels from the site are less than 15 dB above the background L90 noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise*.	√	Provided	5.3
	Determine expected noise level and noise character (eg tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:			
	a) site establishment.	√	Provided	5.4.1
	b) operational phases.	√	Provided	5.1
	c) transport including traffic noise generated by the Proposal.	√	Provided	5.5
	Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).	√	Provided	Appendix A
	Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is 'not the most adverse condition.	√	Provided	Chapter 5
	The noise impact assessment report should include:			
	a) a plan showing the assumed location of each noise source for each prediction scenario.	√	Provided	Figure 4.1

Table 1.1 DGRs for assessment of noise impacts

Authority/agency	Requirements	Assessed	Comments	Relevant report section
Environment Protection Authority (EPA)	b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site.	√	Provided	4.2.1, 4.3.2
	c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc.	√	Provided	Chapter 4
	d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or Sound Plan computer models are adopted, the approach should be appropriately justified and validated.	√	Provided	4.1
	e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions.	√	Provided	4.2
	f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate.	√	Provided	5.1
	g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived.	X	No significant level of noise impact	5.1
	h) an assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy*:	√	Provided	5.1
	Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.	√	All noise criteria met	5.1-5.4
	The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.	X	All noise criteria met	5.1-5.4
	Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:	X	All noise criteria met	5.1-5.4
	For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.	√	Provided	5.5
Environment Protection Authority (EPA)	Where blasting is intended an assessment in accordance with the Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990) should be undertaken. Blast design details should be included ie	√	Provided	5.4.2

Table 1.1 DGRs for assessment of noise impacts

Authority/agency	Requirements	Assessed	Comments	Relevant report section
	bench height, burden spacing, spacing burden ratio, blast hole diameter, inclination and spacing, type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.			
	Describe management and mitigation measures			
	Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.	X	All noise criteria met	5.1-5.4
	For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:	X	Road traffic noise criteria met	5.1-5.4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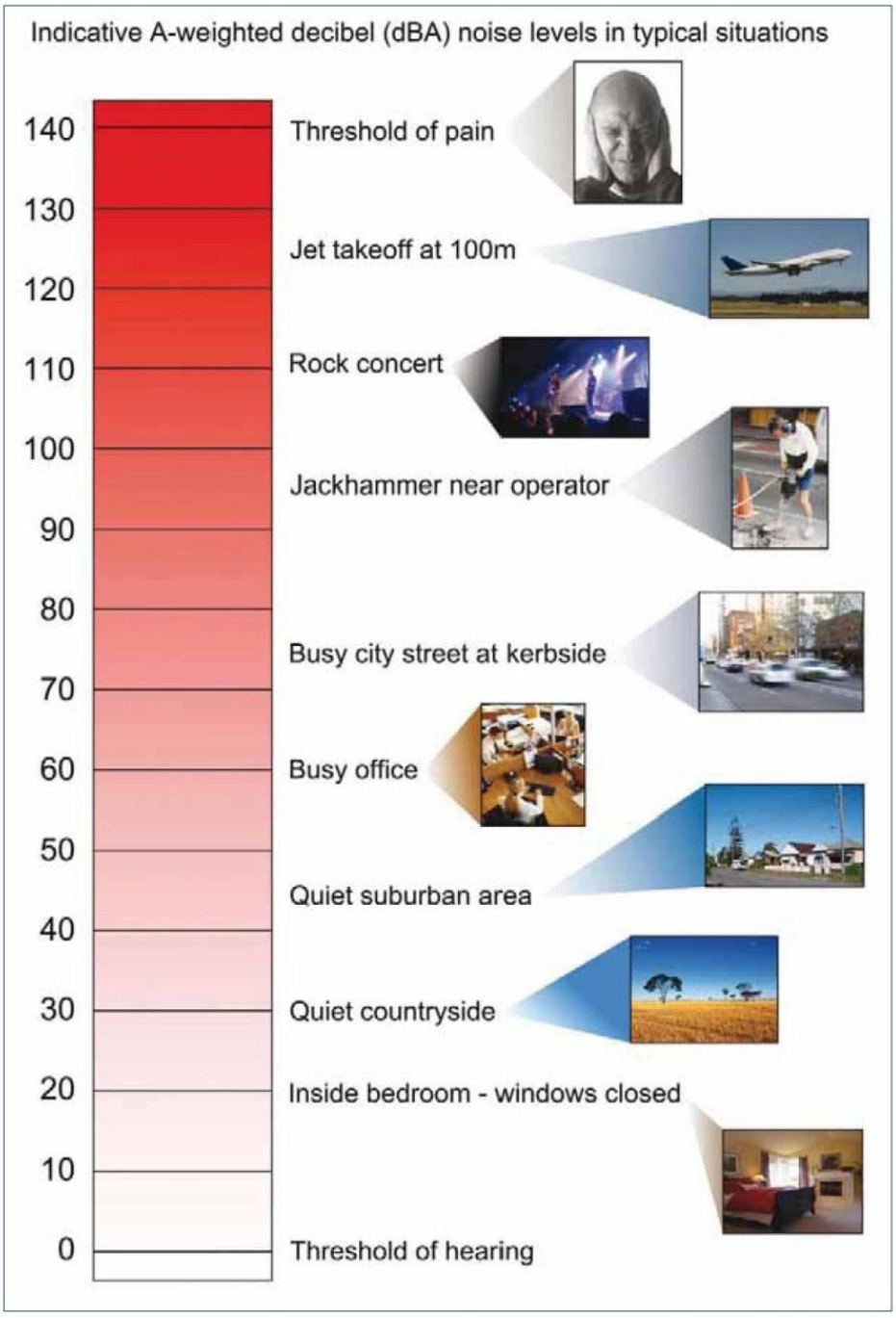
TN
MN
See Detail Below
Walgett
Coban
Nyngan
Broken Hill
Dubbo
NEWCASTLE
Bathurst
Lithgow
SYDNEY
Bogan LGA
WOLLONGONG
Compton Downs
Byrock
Byrock Station
Nemeena
Glenariff
MAIN WESTERN RAILWAY (DISUSED)
MITCHELL HIGHWAY
Lindsay Park
EL6126
Mayfield
Myndadoo
Kurrawong
Oakvale
Runnymede
Cooneybar
Boorara
Exley
Killawarra
Coolabah
Woomdoo
Welbury
Crown Pine
El Trune
Coolabah
Mulga
EL8083
Project Site
Glenhurst
EL8084
MPL294
ML1383
Berwick
Avoca
Girilambone
Horton Park
Boorooma
Elmore
Angle Bar
Fairfield
Wadonga
Bogan
MPL295
EL4962
EL6126
ML1280
Anna Vale
Claremont
Delta
Bungambee
Canonba
Sussex
Old Kidgery
Patanga
Wilgalong
ML1544
Birrimba
White Rock
Kookabaa
Gundaur
Meadow Green
EL6785
Florida
Budgery
Hermidale
Canbelego
Pooraka
Muriel
Belmore
Leon
BARRIER
HIGHWAY
Miandetta
Innamincka
Nyngan
Whitewood
MAIN WESTERN RAILWAY
Saltbush
Konkerbil
Warrigal
Komoora
Miradora
Pine Grove
Kallara
Retreat
Bel Air
EL6346
EL6105
Mangalore
Wera
Miowera Downs
Iowabah
Bernafay
Elmsley
The Oaks
Tongala
Cooee
REFERENCE
EL4962
EL6105
EL6126
EL6346
EL6785
EL8083
EL8084
ML1280
ML1383
ML1544
MPL294
MPL295
REFERENCE
Project Site Boundary
Mineral Authority Boundary
Existing Mining Operations
Homestead
Sealed Road
Unsealed Road
Railway Line
River/Creek
SCALE 1:750 000 (A4)
10 0 10 20 30 40km
Mineral Authority Source: MinView (http://minview.minerals.nsw.gov.au)
Figure 1.1
LOCALITY PLAN AND
MINERAL AUTHORITIES

1.2 Common noise levels

Examples of common noise levels are provided in Figure 1.2.



Source : NSW Road Noise Policy (DECCW, 2011)

Figure 1.2 Common noise levels

It is useful to have an appreciation of decibels, the unit of noise measurement. Table 1.2 gives some practical indication of what an average person perceives about changes in noise levels.

Table 1.2 Perceived change in noise

Change in sound level (dB)	Perceived change in noise
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times as loud (or quarter) as loud

1.3 Description of the proposal

1.3.1 Proposal overview and application area

The Proposal comprises an underground mining operation and would extract up to a maximum of 368,000 tonnes per annum, with all the ore transported by road to Tritton Copper Mine's existing processing plant. The land on which the proposed underground mine and associated infrastructure would be established is collectively referred to as the Project Site.

The Proposal can be divided into two distinct phases, being the site establishment and construction phase and the operational phase. It is envisaged that the site establishment and construction phase would take up to 12 weeks with the overall life of the Proposal projected at 6 years following construction. The following provides an overview of the activities to be undertaken during these two phases.

1.3.2 Project site establishment and construction

The following provides a list of principal site establishment and construction phase components and activities to be undertaken as part of the Proposal (and illustrated on Figure 1.3):

- Construction of a box cut and underground portal;
- Construction of a Run-of-Mine (ROM) pad;
- Construction of a Waste Rock Emplacement (WRE);
- Construction of a sediment basin and associated drainage channels;
- Construction of two leachate management ponds and a mine water management pond;
- Construction of a ventilation fan and emergency access shaft;
- Extension of the existing infrastructure from the Girilambone Copper Mine (ie site access road, water pipeline and transmission lines).
- Extraction of approximately 1.3Mt of waste rock and ore from the underground operations;
- A conventional method of transportation is proposed using haul trucks to haul the ore from the underground operations to the ROM Pad were road registered trucks (road trains) transporting the ore to the existing Tritton Copper Mine for processing.

The maximum development footprint on the Project Site would be approximately 33.6 ha. It should be noted that this does not included the Project Site Access Road. The size of each disturbance areas associated with the Project Site is as follows:

- BoxCut Portal and Decline – 1.2 ha;
- WRE and Leachate Management Pond – 4.4 ha;
- ROM Pad and Leachate Management Pond – 1.1 ha;
- Mine Water Management Pond - 0.3 ha;
- Workshop, Office and Carpark Area - 1.0 ha;
- Laydown Area - 0.7 ha;
- Sedimentation Pond - 0.5 ha; and
- Fuel Store and Refuelling Bay - 0.2 ha.

1.3.3 Product dispatch

Once the ore has been extracted and hauled to the ROM pad, it would be loaded onto Tritton's fleet of two road registered road trains (52t net capacity) and transported to the existing processing plant at the Tritton Copper Mine for processing. The ore would be transported to the Tritton Copper Mine on internal haul roads and the public Yarrandale Road, which connects Girilambone Copper Mine and Tritton Copper Mine.

Table 1.3 shows the anticipated number of daily road trains movements associated with the transportation of ore at a maximum mining rate of approximately 368 000t per annum.

Table 1.3 Daily road train movements

Road transport	Transport route	Loaded	Empty / return	Total
Road trains	Internal access roads and Yarrandale Road	40	40	80

1.3.4 Workforce and operating hours

The proposed site establishment and construction phase workforce would average between 10 and 12 people per day shift. No night time (10:00pm – 7:00am) construction operations are proposed.

The proposed operational workforce is estimated to employ between 25 and 30 people over two shifts over a 24 hour period.

Project Site establishment and construction phase is expected to generally occur between 7 am and 10 pm, seven days per week. However, inaudible construction activities may be undertaken outside these hours (eg electrical installation work).

Mining operations would be undertaken 24 hours per day, seven days per week. It should be noted that this includes the transport of material from the Project Site to Tritton Copper mine for processing.

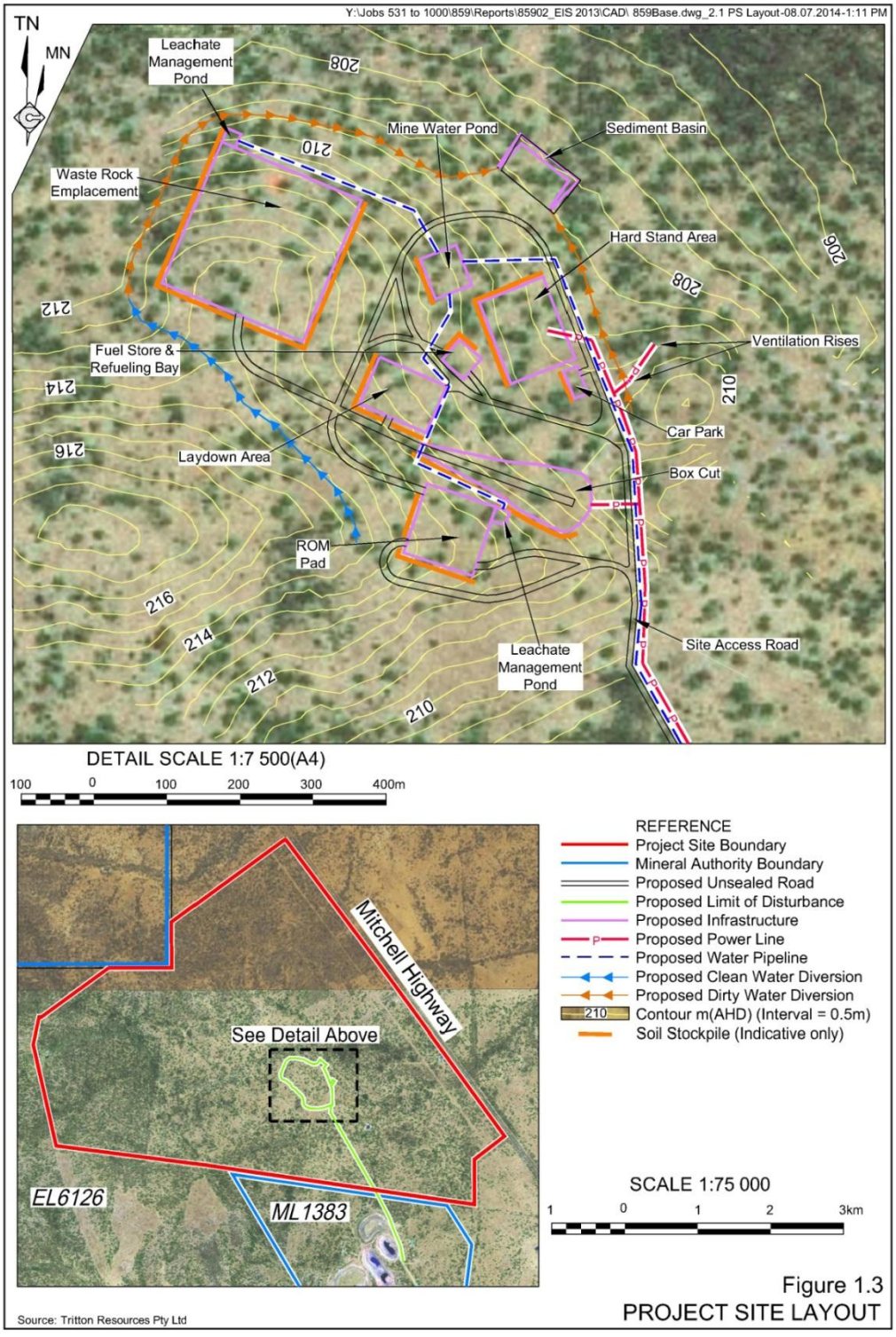


Figure 1.3
PROJECT SITE LAYOUT

2 Existing environment

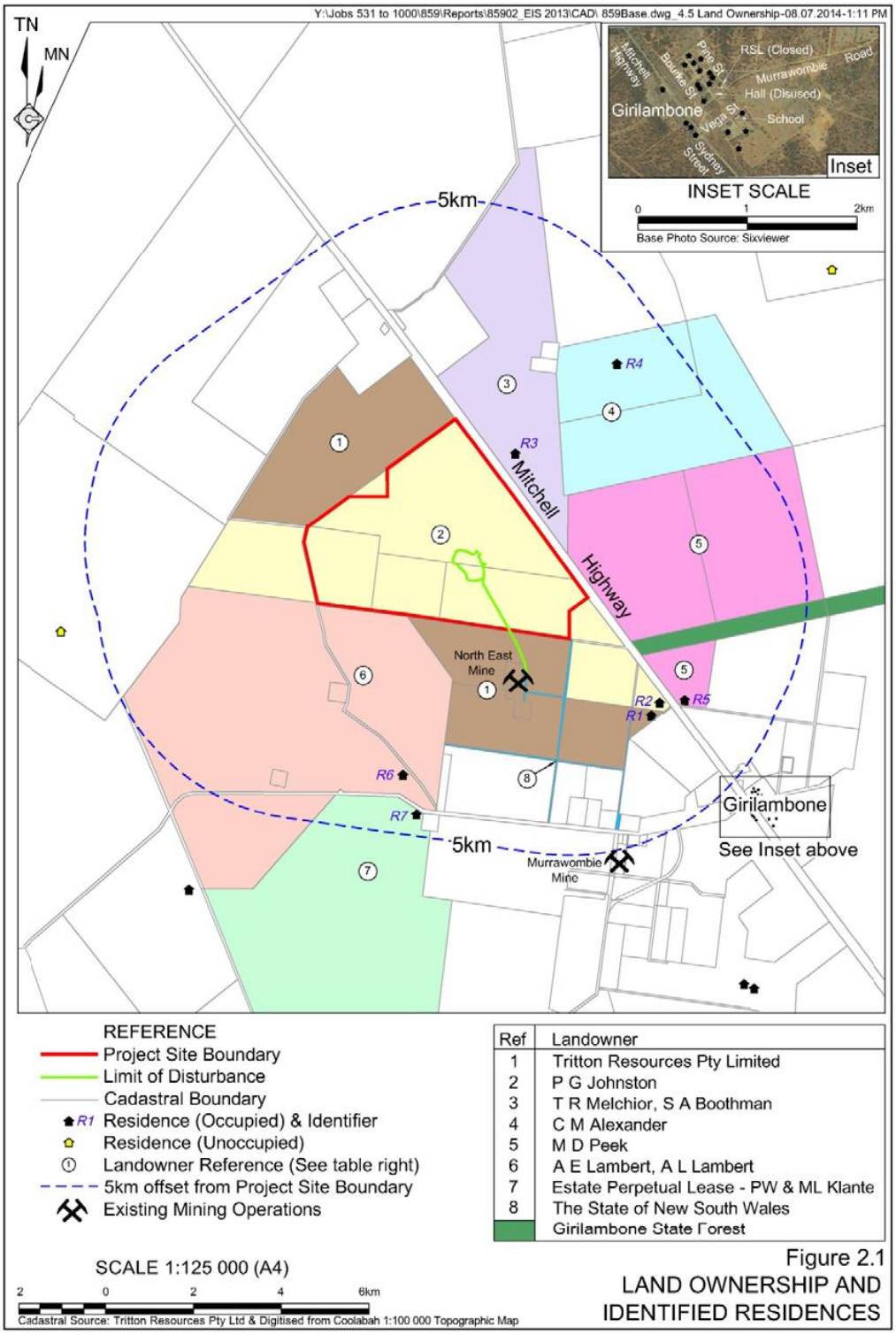
2.1 Sensitive residences

Several residences surrounding the Proposal have the potential to be impacted by Project Site noise. Table 2.1 presents the nearest sensitive residences surrounding the Project Site. It should be noted that the Girilambone village is located approximately 7km southeast from the Project Site (nearest noise source) and Project Site noise is anticipated to have no impact on the village.

Table 2.1 Residences and MGA coordinates

Residences	Description	Easting	Northing	Distance to project site (km) (closest disturbance)
R1	Private residence	488604	6545101	5.0
R2	Private residence	488804	6545250	5.0
R3	Private residence	485502	6550984	2.4
R4	Private residence	487827	6553240	5.3
R6	Private residence	489237	6545308	5.5
R7	Private residence	482857	6543708	5.6

Figure 2.1 provides a locality plan identifying land ownership and the identified residences surrounding the Project Site.


Y:\Jobs 531 to 1000\859\Reports\85902_EIS 2013\CAD\ 859Base.dwg_4.5 Land Ownership-08.07.2014-1:11 PM
TN
MN
Inset
INSET SCALE
0 1 2km
Base Photo Source: Sixviewer
Girilambone
RSL (Closed)
Murrawombie Road
Hall (Disused)
School
Mitchell Highway
Bourke St
Pine St
Vega St
Sydney Street
5km
R1
R2
R3
R4
R5
R6
R7
Mitchell Highway
North East Mine
Murrawombie Mine
Girilambone
See Inset above
REFERENCE
Project Site Boundary
Limit of Disturbance
Cadastral Boundary
R1 Residence (Occupied) & Identifier
Residence (Unoccupied)
Landowner Reference (See table right)
5km offset from Project Site Boundary
Existing Mining Operations
Ref Landowner
1 Tritton Resources Pty Limited
2 P G Johnston
3 T R Melchior, S A Boothman
4 C M Alexander
5 M D Peek
6 A E Lambert, A L Lambert
7 Estate Perpetual Lease - PW & ML Klante
8 The State of New South Wales
Girilambone State Forest
SCALE 1:125 000 (A4)
2 0 2 4 6km
Cadastral Source: Tritton Resources Pty Ltd & Digitised from Coolabah 1:100 000 Topographic Map
Figure 2.1
LAND OWNERSHIP AND IDENTIFIED RESIDENCES

2.2 Residences adjacent to transport routes

During the operational phase, road traffic noise associated with the transport of ore between the Project Site and Tritton Copper Mine has the potential to generate elevated noise levels at three identified residences along Yarrandale Road. The nearest residence identified by Tritton as 'Tiverton' is located approximately 700 m from the road as shown within Inset 2 of Figure 2.1.

During the site establishment and construction phase, construction deliveries and employee movements are expected to occur from Nyngan (50%) via the Mitchell Highway, and Cobar (50%) via the Barrier Highway and Yarrandale Road. It should be noted that these activities are anticipated to have no impact on residences on Yarrandale Road. However, residences located along the Barrier Highway and Mitchell Highway could be potentially impacted by noise associated with these movements, as they are situated closer to the road.

2.3 Noise environment

In the absence of noise logging data, the default INP background noise level of 30 dB(A) was adopted for all residences surrounding the Project Site in accordance with Section 3.1 of the INP. Table 2.2 presents the adopted rating background levels (RBL) for all residences surrounding the Project Site.

Table 2.2 Adopted project rating background levels (RBL)

Residence	Time period	RBL, dB(A)
All residences	Day	30
	Evening	30
	Night	30

3 Noise criteria

3.1 Operational noise

3.1.1 Overview

Industrial sites in NSW are regulated by the Department of Planning and Infrastructure (DP&I) or the NSW Environment Protection Authority (EPA) and usually have a set of conditions for operations that include noise limits. These limits are normally derived from operational noise criteria that apply at sensitive residences. They are based on guidelines stipulated in the *Industrial Noise Policy* (INP) (EPA 2000) or noise levels that can be achieved at a specific site following the application of all reasonable and feasible noise mitigation.

The INP provides guidelines for assessing industrial facilities which have been adopted for this assessment. It states the following with respect to the criteria:

> *'They are not mandatory, and an application for a noise producing development is not determined purely on the basis of compliance or otherwise with the noise criteria. Numerous other factors need to be taken into account in the determination. These factors include economic consequences, other environmental effects and the social worth of the development.'*

Assessment criteria depend on the existing amenity of areas potentially affected by a proposed development. Assessment criteria for sensitive residences near industry are based on the following objectives:

- Protection of the community from excessive intrusive noise; and
- Preservation of amenity for specific land uses.

To ensure these objectives are met, the EPA provides two separate criteria: namely the intrusiveness criteria and the amenity criteria. A fundamental difference between the intrusiveness and the amenity criteria is the time period they relate to:

- Intrusiveness criteria — apply over 15 minutes in any assessment period; and
- Amenity criteria — apply to the entire assessment period (day, evening and night).

3.1.2 Intrusiveness

The intrusiveness criteria require that $L_{eq(15\text{-}min)}$ noise levels from a newly introduced source during the day, evening and night do not exceed the existing rating background level (RBL) by more than 5 dB. This is expressed as: $L_{eq(15\text{-}min)} \leq RBL + 5 - K$

where $L_{eq(15\text{-}min)}$ is the L_{eq} noise level from the source (ie Project Site), measured over a 15 minute period and K is a series of adjustments for various noise characteristics.

Table 3.1 presents the base intrusive criteria for the Proposal.

Table 3.1 Base intrusive criteria

Residence	Time period	RBL, dB(A)	Intrusive criteria dB(A), $L_{eq(15\text{-}min)}$
All residences	Day	30	35
	Evening	30	35
	Night	30	35

3.1.3 Amenity

The amenity assessment is based on noise criteria specific to the land use. The criteria relate only to industrial noise and exclude non-related site noise, including road or rail noise. Where measured existing industrial noise approaches the base amenity criteria, it needs to be demonstrated that noise levels from new industries would not be an additional contributor to existing industrial noise.

Residences potentially affected by the Proposal are covered by the EPA's rural amenity category. The base amenity criteria for all residences are given in Table 3.2.

Table 3.2 Base amenity criteria

Residence	Indicative area	Time period	Recommended noise level dB(A), $L_{eq,period}$	
			Acceptable	Maximum
All residences	Rural	Day	50	55
		Evening	45	50
		Night	40	45

Source: INP (EPA, 2000)

3.1.4 Project specific noise level

The project-specific noise level (PSNL) is the lower of the calculated intrusive or amenity criteria. The intrusive criteria are therefore adopted as the PSNL for the Proposal. The PSNL are presented in Table 3.3.

Table 3.3 Project specific noise levels (PSNL)

Residence	Time period	RBL dB(A)	Intrusive criteria dB(A), $L_{eq(15min)}$
All residences	Day	30	35
	Evening	30	35
	Night	30	35

3.2 Low frequency noise

Section 4 of the INP provides guidelines for applying 'modifying factor' adjustments to account for low frequency noise emissions. The INP states that where there is a difference of 15 decibels or more between 'C' weighted and 'A' weighted levels, then a correction factor of 5 dB is applicable. Section 4.2 of this report provides an assessment of low frequency noise for the Proposal.

3.3 Cumulative noise criteria

To limit continuing increases in industrial noise within a particular area, combined industrial noise should not exceed the amenity criteria levels specified in Table 2.1 from Section 2.2 of the INP. Girilambone Copper Mine is situated approximately 7 km south-east of the Project Site and has the potential to impact residences R1, R2, R5, R6 and R7. Therefore, cumulative operational noise has been considered for these residences and compared against the INP's acceptable and recommended maximum amenity criteria levels. This assessment has adopted the rural type amenity criteria for all residences (Refer to Table 3.2).

3.4 Sleep disturbance

The most important potential impact of intermittent noise that needs to be considered is disturbing the sleep of nearby residents. The EPA provides guidance on assessing sleep disturbance for industrial sites. The EPA nominates that a screening criteria of background noise level (L_{90}) plus 15 dB shall apply to maximum noise events from the site which are to be calculated at one metre from the bedroom facade at the nearest residential properties. Where noise levels have been calculated above the screening criteria, additional analysis should be undertaken, referencing guidance on maximum noise levels and sleep disturbance listed in the RNP (EPA, 2011). This guidance states:

- Maximum internal noise levels below 50 to 55dB(A) are unlikely to wake sleeping occupants; and
- One or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect the health and well being of occupant's significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that even with a partially open window, internal noise levels are 10dB lower than external noise levels. Therefore, external noise levels in the order of 60-65 dB(A) calculated at the facade of a residence are unlikely to cause sleep disturbance affects at worst case (ie with windows open). Similarly, the World Health Organisation (WHO, 1999) suggest that levels below 45 dB(A) inside homes are unlikely to wake sleeping occupants.

The descriptors L_{max} and L_1 may be considered interchangeable which is accepted by EPA.

If noise levels over the screening criteria were identified, then additional analysis would consider factors such as:

- How often the events would occur;
- The time the events would occur (between 10 pm and 7 am); and
- Whether there are times of day when there is a clear change in the noise environment.

Based on a RBL of 30 dB(A), the NIA has adopted a sleep disturbance criterion of 45 dB(A) L_{max} for all residences.

3.5 Noise and vibration criteria for infrastructure construction

3.5.1 Noise criteria for infrastructure construction

Construction noise is generally assessed in accordance with the *Interim Construction Noise Guideline*(ICNG), (EPA 2009). Section 2.2 of the ICNG recommends the following standard hours for construction activities:

- Monday to Friday 7:00am to 6:00pm;
- Saturday 8:00am to 1:00pm; and
- no construction work is to take place on Sundays or public holidays.

The ICNG recommends that noise levels at residences as a result of construction activities during standard working hours are limited to an $L_{eq(15\text{-}min)}$ of RBL+10 dB(A) with a highly noise-affected maximum of 75 dB(A). Furthermore, it is recommended that outside of these standard hours, noise at residences is to be limited to an $L_{eq(15\text{-}min)}$ of RBL+5 dB(A), and only where out-of-hours works can be strongly justified.

Noise associated with construction activities for mining or extractive industries are often assessed as operational noise, as emissions from plant and associated equipment are similar. Therefore construction activities for the site establishment and construction phase of the Proposal have been assessed using the same criteria as for operational activities, that is RBL+5 dB(A). The hours of operation for the site establishment and construction phase are between 7:00am and 10:00pm.

3.5.2 Vibration criteria for infrastructure construction

In the absence of an Australian Standard for structural effects from construction vibration, the construction vibration assessment has referenced German Standard DIN 4150-3 1999 "*Structural Vibration Part 3: Effects of Vibration on Structures*".

3.6 Blasting

The Proposal includes blasting for the construction of a box cut and underground portal during the site establishment and construction phase. It should be noted that blasting would also be used to extract the ore and waste rock from underground during the operational phase. The limits adopted by EPA for blasting are provided in the Australian and New Zealand Environment Conservation Council (ANZECC) guidelines *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC 1990).

The blasting limits address two main effects of blasting:

- Airblast noise overpressure; and
- Ground vibration.

3.6.1 Airblast

The recommended maximum vibration level for airblast is 115 dB linear peak. The vibration level of 115 dB may be exceeded on up to 5% of the total number of blasts over 12months. However, the level should not exceed 120 dB linear peak at any time. A summary of airblast limits are provided in Table 3.4.

Table 3.4 Airblast overpressure

Airblast overpressure level dB(L_{peak})	Allowable exceedance
115	5% of the total number of blasts over 12 months
120	0%

3.6.2 Ground vibration

Peak particle velocity (PPV) from ground vibration should not exceed 5 mm/s for more than 5% of the total number of blasts over 12 months. However, the maximum level should not exceed 10 mm/s at any time. A summary of ground vibration limits are provided in Table 3.5.

Table 3.5 Ground vibration limits

PPV (mm/s)	Allowable exceedance
5	5% of the total number of blasts over 12 months
10	0%

3.7 Road traffic

3.7.1 Assessment criteria

The road traffic noise assessment has been conducted in accordance with the NSW EPA's *Road Noise Policy* (RNP) (EPA 2011).

The freeway/arterial/sub-arterial road type was adopted for the Mitchell Highway and Barrier Highway, whereas the local road type was adopted for Yarrandale Road. Table 3.6 presents the road noise assessment criteria reproduced from Table 3 of the RNP relevant to this road type.

Table 3.6 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{eq(15\text{-}hr)}$ 60 (external)	$L_{eq(9\text{-}hr)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments.	$L_{eq(15\text{-}hr)}$ 55 (external)	$L_{eq(9\text{-}hr)}$ 50 (external)

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

3.7.2 Relative increase criteria

In addition to meeting the assessment criteria, any significant increase in total traffic noise at residences must be considered. Residences experiencing increases in total traffic noise levels above those presented in Table 3.7 should be considered for mitigation. It should be noted that the relative increase criterion does not apply to local roads, as per Section 2.4 of the RNP.

Table 3.7 Relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase - dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads and transit ways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{eq(15\text{-}hr)}$+12 dB (external)	Existing traffic $L_{eq(9\text{-}hr)}$+ 12 dB (external)

4 Noise modelling methodology and parameters

4.1 Overview

This section presents the methods and base parameters used to model noise emissions from the Proposal, including the effect of applicable meteorological conditions. The assessment was conducted in accordance with the NSW INP.

Noise modelling was based on three-dimensional digitised ground contours of the surrounding land and mine plans of the Project Site. The plans represent snapshots, with equipment placed at various locations and heights, representing realistic 'worst-case' operating scenarios for the site establishment and construction stage and operational stage of the Proposal.

Noise predictions were carried out using Brüel and Kjær Predictor Version 8.14 noise prediction software. 'Predictor' calculates total noise levels at residences from the concurrent operation of multiple noise sources. The model considers factors such as:

- The lateral and vertical location of plant;
- Source-to-residence distances;
- Ground effects;
- Atmospheric absorption;
- Topography of the mine and surrounding area; and
- Applicable meteorological conditions.

4.2 Meteorology

Noise propagation over distance can be significantly affected by the prevailing weather conditions. Of most interest are source to residence winds, the presence of temperature inversions and drainage flow effects, as these conditions can enhance received noise levels. To account for these phenomena, the INP specifies meteorological analysis procedures to determine the prevalent weather conditions that enhance noise propagation in a particular area, with a view to determining whether they can be described as a feature of the Proposal area.

4.2.1 Wind

Wind has the potential to increase noise impacts at a residence when it is relatively light and stable and blows from the direction of the noise source. As the strength of the wind increases the noise produced by the wind usually obscures noise from most industrial and transport sources.

The INP requires that winds at or below 3m/s with an occurrence greater than 30 per cent of the time be assessed. In the absence of historical meteorological data for the area, worst case wind conditions was adopted for each residence, that is 3 m/s wind speed from the direction of the noise source.

4.2.2 Temperature inversions

During temperature gradient conditions (eg temperature inversions), noise levels at residences may increase or decrease compared with noise during calm conditions. This change is due to refraction caused by the varying speed of sound with increasing height above ground. The noise level received increases under temperature inversion conditions. The INP states that the assessment of the impact of temperature inversions be confined to the night-time noise assessment period.

In the absence of historical meteorological data for the area, the default inversion parameter for 'F' class stability was considered in the NIA. However, the INP suggests that for areas classed as arid/semi-arid (ie areas with <500 mm average rainfall), 'G' class stability should also be assessed. Therefore the 'G' class stability inversion parameter has been adopted.

4.2.3 Drainage flow winds

Drainage flow winds are applicable only when a development is at higher altitude than a residence with no intervening topography. Drainage flow winds were considered applicable for the Project Site and therefore a 1 m/s drainage flow has been included in the model combined with a G class stability inversion. This has the potential to increase noise levels further at the residences. The exceptions are residences R6 and R7 due to intervening topography between the site and these residences. Therefore drainage flow was only included in the noise model for residences R1 to R5.

4.3 Operational noise modelling

4.3.1 Modelled sound power levels

The results presented assume the maximum number of plant and equipment are operating simultaneously and at full power. In practice, such operating scenarios would rarely occur. The noise predictions are therefore conservative.

The plans used for modelling are considered representative of the operational stage over the life of the Proposal. The noise model was configured to predict the total L_{eq} noise levels from all operational activities at the nearest residences. All operational activities are proposed to occur 24 hours, seven days per week. It should be noted that blasting is not included in the noise model and is assessed separately.

Table 4.1 summarises the acoustically significant noise sources and associated sound power levels for the Proposal. Appendix A provides indicative plant and equipment model details and total single octave sound power levels.

Table 4.1 Plant sound power levels - operational phase

Description	Reference	Units	Lw, $L_{eq(15\text{-}min)}$, dB(A)
Grader - Cat 14H	5	1	104
Haul truck - 50 t	3	2	111
Road train	6	2	102
Front-end loader (FEL) - Cat 998	7	1	108
Generator - 800KVa	8	2	113
Ventilation fan - 500 kW/1.5 kPa	9	1	104

4.3.2 Low frequency analysis for operational plant items

Another consideration in assessing operational noise is the potential of 'low' frequency content. The INP recommends a 5 dB penalty if sources are perceived to exhibit low frequency noise at residences, defined by received dB(C) noise being 15 dB or more than received dB(A) noise levels. Results in Section 5.1 (Table 5.1) include a modifying factor of 5 dB for low frequency associated with the operation of the ventilation fan. It should be noted that the ventilation fan to be used by Tritton is unlikely to contain low frequency components, although it has been assumed in this assessment.

4.4 Construction noise modelling

4.4.1 Overview

It is expected that the site establishment and construction phase would take between 6 and 12 weeks to complete. All construction activities were assessed against the operational noise criteria (ie background + 5 dB(A)). Construction noise modelling assumed that all construction activities would occur at the same time, and all plant items would be running at full power. It should be noted that blasting is not included in the noise model and is assessed separately.

4.4.2 Construction plant sound power levels

Table 4.2 summarises noise sources and associated sound power levels for typical plant used in the construction phase of the Proposal. Appendix A provides indicative plant and equipment model details and single octave sound power levels.

Table 4.2 Plant sound power levels - construction

Description	Reference	Units	Lw, $L_{eq(15\text{-}min)}$, dB(A)
Blast drill rig	1	1	115
Excavator	2	1	107
Haul truck - 50 t	3	2	111
Bulldozer	4	1	111
Grader	5	1	104

Figure 4.1 provides the location of plant items for the site establishment and construction phase and the operation phase.

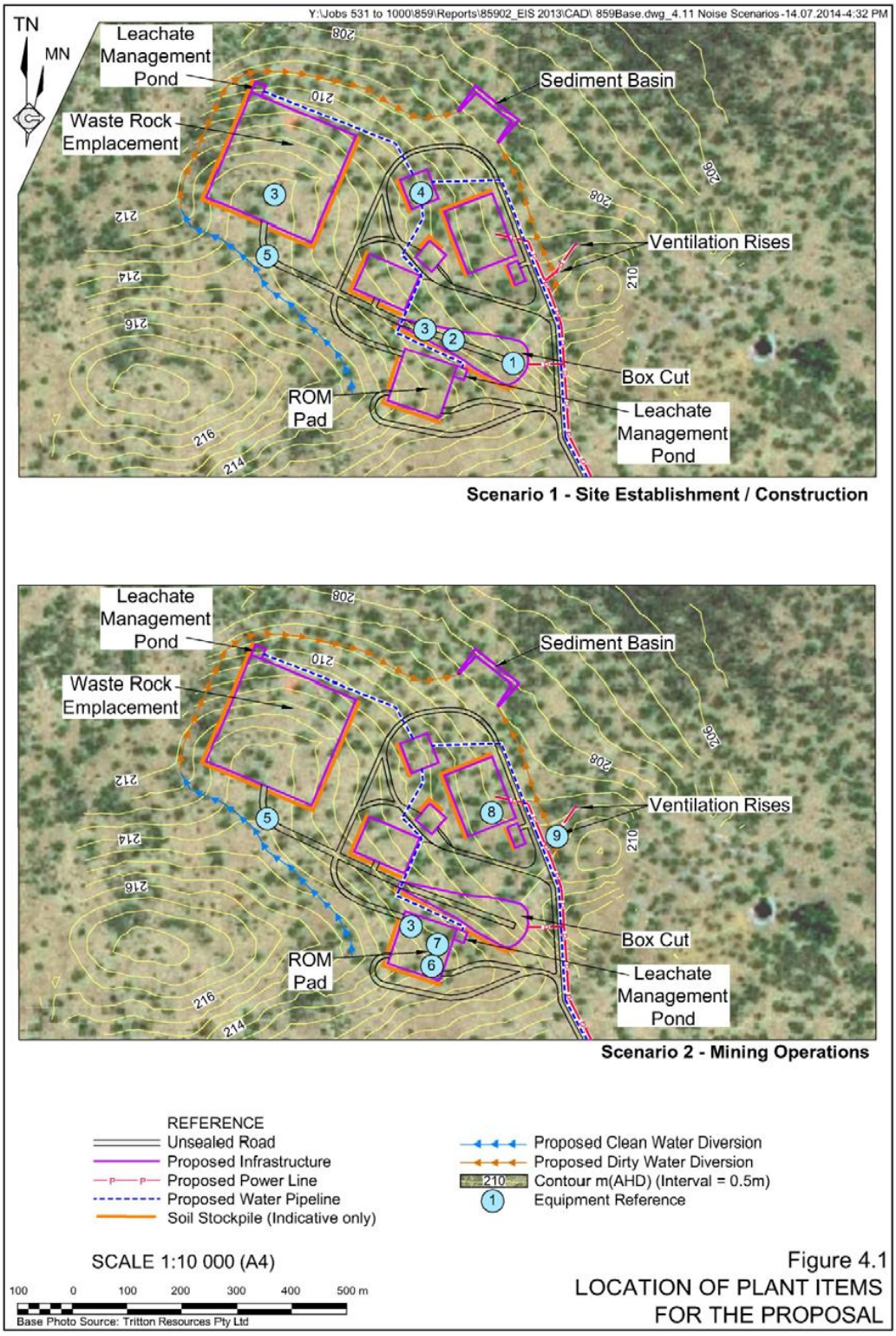


Figure 4.1
LOCATION OF PLANT ITEMS FOR THE PROPOSAL

5 Noise impact assessment results

5.1 Operations noise modelling results

The predicted noise levels for each assessed meteorological condition are provided in Table 5.1 for privately owned residences. It should be noted that following a low frequency analysis of plant items, predicted noise levels from operational activities have been adjusted to include a 5 dB penalty factor for potential low frequency noise component associated with the operation of the ventilation fan.

Noise results are presented according to the following meteorological scenarios:

- Day: calm, wind 3 m/s from source to residence; and
- Night: calm, wind 3 m/s from source to residence, G class stability inversion (with 1 m/s drainage flow applied for R1 to R5).

Table 5.1 Predicted operational noise levels - dB(A), $L_{eq(15\text{-}min)}$

ID	PSNL[1]	Day		Night		
		Calm[2]	Wind[3]	Calm[2]	Wind[3]	Inversion
R1	35	<35	<35	<35	<35	<35[4]
R2	35	<35	<35	<35	<35	<35[4]
R3	35	<35	<35	<35	<35	<35[4]
R4	35	<35	<35	<35	<35	<35[4]
R5	35	<35	<35	<35	<35	<35[4]
R6	35	<35	<35	<35	<35	<35
R7	35	<35	<35	<35	<35	<35

Notes: *1.PSNL for all assessment periods.*
2. Calm: no wind or temperature gradient.
3. Winds: 3 m/s from source to residence.
4. Including 1 m/s drainage flow from source to residence.
5. All results include modification factor correction (+5 dB(A)) due to low frequency noise from ventilation fan.

The predicted noise levels show that all residences would experience noise levels below the operational criteria for all assessment periods.

5.2 Cumulative noise

Following a review of noise emissions from the Proposal predicted noise levels at residences R1, R2, R5, R6 and R7 are acoustically insignificant, therefore levels received at residences from Girilambone Copper Mine would not increase. It should be noted that this assessment assumes that Girilambone Copper Mine noise emissions satisfy criteria at these residences, which has been consistent with Girilambone Copper Mine's annual reporting within its Annual Environmental Management Report.

5.3 Sleep disturbance assessment

People asleep in their homes may be disturbed by intermittent noises. The likely source on the Project Site that has the potential to generate significant L_{max} events is associated with loading of road trains by the Front end loader (FEL) at the ROM pad.

The maximum sound power level of a typical road truck being loaded by a FEL has previously been measured to be 124 dB(A)L_{max}. Predicted L_{max} noise levels from a road train being loaded by a FEL at residences were based on the typical position used when loading a road train at the ROM pad. Predictions were based on a single event, rather than the simultaneous operation of a number of plant items, because of the low probability of more than one maximum noise event occurring concurrently.

Maximum noise levels at privately owned residences were modelled for the same meteorological conditions as for the operational scenario and are presented in Table 5.2.

Table 5.2 Predicted maximum noise from intermittent sources at all residences - dB(A), L_{max}

Residence ID	L_{max} criterion, dB(A)	Day		Night		
		Calm[1]	Wind[2]	Calm[1]	Wind[2]	Inversion
R1	45	<35	<35	<35	<35	<35[3]
R2	45	<35	<35	<35	<35	<35[3]
R3	45	<35	<35	<35	<35	<35[3]
R4	45	<35	<35	<35	<35	<35[3]
R5	45	<35	<35	<35	<35	<35[3]
R6	45	<35	<35	<35	<35	<35
R7	45	<35	<35	<35	<35	<35

Notes: *1. Calm: no wind or temperature gradient.*
2. Winds: 3 m/s from source to residence.
3. Including 1 m/s drainage flow from source to residence.

Noise modelling identified that L_{max} noise levels associated with road train loading operations satisfy the sleep disturbance criteria at all nearest residences.

5.4 Construction

5.4.1 Construction noise and vibration

The noise model was configured to predict the total L_{eq} noise levels from all construction activities at surrounding residences for applicable meteorological conditions identified in Section 4.1.

The predicted noise levels from the construction activities are presented in Table 5.3. The levels represent the noise levels during construction activities over a 15 minute assessment period.

Table 5.3 Predicted construction noise levels - dB(A), Leq(15-min)

Residence ID	Construction criteria	Calm[1]	Wind[2]	Inversion (night only)
R1	35	<35	<35	<35[3]
R2	35	<35	<35	<35[3]
R3	35	<35	<35	<35[3]
R4	35	<35	<35	<35[3]
R5	35	<35	<35	<35[3]
R6	35	<35	<35	<35
R7	35	<35	<35	<35

The results show that noise generated by construction activities satisfy the relevant criteria at the nearest residences.

Vibration from construction activities, including surface infrastructure construction and material deliveries, is not expected to be significant and would satisfy the relevant criteria at all residences.

5.4.2 Blasting

Blast design will be managed by site personnel, and hence corresponding airblast overpressure and ground vibration can be controlled. Blast overpressure and vibration results have been calculated using the method given in the *AS2187-2: Explosives – Storage and use Part 2: Use of explosives, 2006 and ICI Explosives Blasting Guide*, as applicable to blasting in hard rock. This formula has been shown to be conservative in calculating overpressure and vibration.

The relevant formulae are as follows:

PVS = $K (R/Q^{0.5})^{-1.6}$

dB = $164.2 - 24(\log_{10} R - 0.33 \log_{10} Q)$

Where,

PVS = peak vector sum ground vibration level (mm/s)

dB = peak airblast level (dB Linear)

K = factor applied according to blasting type

R = distance between charge and residence (m)

Q = charge mass per delay (kg) or maximum instantaneous charge (MIC)

It should be noted that a K factor of 5000 (heavily confined blasting) was used to calculate levels associated with blasting during the extraction process.

This assessment provides a maximum instantaneous charge (MIC) where blast limits would be satisfied at the nearest residence R3 for each phase of the Proposal. Table 5.4 provides the MIC where blasting derived overpressure and vibration levels would satisfy the relevant criteria.

Table 5.4 Maximum MIC to satisfy ANZECC criteria at R3

Proposal phase	Activity	Distance from blast to privately owned residence R3 (m)	Max MIC (kg)	Derived overpressure (dB(L)peak)	Derived vibration PPV (mm/s)
Construction	Box cut and portal	2,400	1,000	107	5
Operational	Extraction process	2,400	1,000	107	5
		Criteria		115	5

The blast overpressure and vibration calculations identify that the use of a maximum MIC of 1,000 kg or less would results in compliance with the ANZECC blasting criteria at the nearest residence R3 during the construction of the box cut and underground portal, and for the extraction of ore and waste rock material during the operational phase. It should be noted that Tritton would not require as much MIC to complete each activity. Therefore, it is predicted that blast overpressure and vibration levels would satisfy ANZECC blasting limits at all privately owned residences.

Notwithstanding, the proposed MIC blast patterns should be designed specifically to meet the relevant criteria at the closest residence.

5.5 Road traffic noise

5.5.1 Road traffic scenarios

Residences potentially impacted by noise associated with the transport of ROM between the Project Site and Tritton Copper Mine during the operation phase include those located along Yarrandale Road. The nearest residence identified as 'Tiverton' is located approximately 700 m from the road as shown on Figure 2.2. It is assumed that 40 road trains loads (80 road train movements) of ore would be transported daily from the Project Site to Tritton Copper Mine, via Yarrandale Road. This is equivalent to 3.3 road train movements per hour over a 24 hour period.

It is also assumed that 30 employees (60 light vehicle (LV) movements) would be travelling daily during the operation phase from the Girilambone village and local surrounds (ie travelling through Girilambone) and return from the Project Site. The nearest residence in Girilambone is located 15 m away from the Mitchell Highway. It is assumed that light vehicle movements would be during shift change and would occur in the space of one hour.

Residences within the Girilambone village may also be affected by road traffic noise associated with construction deliveries during the site establishment and construction phase. It is assumed that there would be two construction deliveries per day, one delivery (two heavy vehicle (HV) movements) from Cobar via the Barrier Highway and Yarrandale Road, and one delivery (two HV movements) from Nyngan via the Mitchell Highway. It is anticipated that these movements would occur in the space of one hour past the nearest residences situated 15 m from the road. It should be noted that construction deliveries would be restricted to the day period only (7:00am to 10:00pm).

During the site establishment and construction phase, 12 employees (24 LV movements) from Girilambone and local surrounds (i.e. travelling from or through Girilambone) would travel to and from the Project Site daily.

Table 5.5 provides the road traffic scenarios and daily vehicle movements associated with each phase of the Proposal.

Table 5.5 Road traffic scenarios and daily vehicle movements associated with the proposal

Proposal phase	Road traffic scenario	Residence area	Road	Distance to road (m)	HV movements1	LV movements1
Operation	Road train ROM transport	Yarrandale Road	Yarrandale Road	700	3.3 (road trains)	n/a[2]
Operation	Employee (shift change)	Girilambone village	Mitchell Highway	15	n/a[2]	60
Site establishment	HV deliveries (from Nyngan) and employee movements	Mitchell Highway	Mitchell Highway	15	2[3]	6[3]
Site establishment	HV deliveries (from Cobar)	Barrier Highway	Barrier Highway	15	2[3]	6[3]

Notes: 1. Vehicle movements are assumed to occur within the space of one hour.
2. No Proposal related traffic movement is expected for this vehicle type.
3. No Proposal related traffic movement is expected during the night-time period.

5.5.2 Road traffic noise results

The Calculation of Road Traffic Noise (CORTN) (UK Department of Transport, 1988) method was used to predict the L_{eq} noise levels at the closest residences for additional traffic travelling along Yarrandale Road, the Mitchell Highway and the Barrier Highway. CORTN, which was developed by the UK Department of Transport, considers traffic flow volume, average speed, percentage of heavy vehicles and road gradient to establish noise source strength, and includes attenuation due to distance, ground, atmospheric absorption and screening from buildings or barriers.

i Yarrandale Road

Existing road traffic noise data for Yarrandale Road were obtained from the "*Road Train Noise Assessment*" prepared by Bridges Acoustics in October 2013 for Tritton's Girilambone Mine. Existing road traffic noise level was calculated to be 46.6 dB(A) at the nearest residence 'Tiverton' located 700 m away from the road, inclusive of Girilambone Mine trucks (3.3 road train movements per hour). The assessment results included a5 dB correction factor to account for enhancing effects associated with winds and temperature inversion. Noise levels generated by Girilambone Mine were calculated to be 39.8 dB(A) at 'Tiverton'. The proposed truck flow for Girilambone Mine is identical to the Proposal's (Refer to Table 5.5), therefore for consistency, has been adopted for this Proposal.

To account for the proposed Girilambone Mines' transport operations (increase from 3.3 movements per hour to 14 movements per hour currently submitted for adequacy), this assessment will assume two scenarios for future traffic movements. These include:

1. Existing road traffic noise level (including Girilambone Mines' current transport operations) combined with road traffic noise level associated with the Proposal; and

2. Future ambient road traffic noise level (assuming a modification of Girilambone Mines' current transport operations is approved) combined with road traffic noise level associated with the Proposal.

The results of the traffic noise levels for these two scenarios are presented in Table 5.6.

Table 5.6 Operational road traffic noise levels at the nearest residence for Yarrandale road

Scenario	Road section	Distance to nearest residence (m)	Assessment criteria	Existing traffic noise including Girilambone Mine	Proposal related traffic noise	Future combined traffic noise	Difference between existing and future combined
			Day $L_{eq(15\text{-hour})}$, dB(A)				
1	Yarrandale Rd	700	55	46.6[1]	39.8	47.4	0.8
2	Yarrandale Rd	700	55	48.8[2]	39.8	49.3	0.5
			Night $L_{eq(9\text{-hour})}$, dB(A)				
1	Yarrandale Rd	700	50	46.6[1]	39.8	47.4	0.8
2	Yarrandale Rd	700	50	48.8[2]	39.8	49.3	0.5

Notes: 1. Includes Girilambone Mines' current transport operations.
2. Includes modification of Girilambone Mines' current transport operations.

The predicted road traffic noise levels satisfy the RNP criteria at all residences on Yarrandale Road for each scenario.

ii Mitchell Highway and Barrier Highway

Existing noise levels for the Mitchell Highway and the Barrier Highway were calculated using traffic data obtained from the RTA's "*Traffic volume data for Western Region 2002*" (RTA 2003).It should be noted that this assessment assumes that all movements from this document are light vehicles.

The results of the traffic noise calculations for each route are presented in Table 5.7 for the closest privately owned residences for the day and night assessment periods.

Table 5.7 Operational road traffic noise levels at the nearest residences for the Mitchell Highway and the Barrier Highway

Proposal phase	Road section	Distance to nearest residence (m)	Assessment criteria	Existing traffic noise including Girilambone Mine	Calculated Proposal related traffic noise	Future combined traffic noise	Difference between existing and future combined
			Day $L_{eq(15\text{-hour})}$, dB(A)				
Operations	Mitchell Hwy	15	60	48.1	53.9	54.9	6.8
Site establishment	Mitchell Hwy	15	60	49.5	48.7	53.7	4.2
Site establishment	Barrier Hwy	15	60	51.4	48.7	54.6	3.2
			Night $L_{eq(9\text{-hour})}$, dB(A)				

Table 5.7 Operational road traffic noise levels at the nearest residences for the Mitchell Highway and the Barrier Highway

Proposal phase	Road section	Distance to nearest residence (m)	Assessment criteria	Existing traffic noise including Girilambone Mine	Calculated Proposal related traffic noise	Future combined traffic noise	Difference between existing and future combined
			Day $L_{eq(15\text{-hour})}$, dB(A)				
Operations	Mitchell Hwy	15	55	47.6	53.9	54.8	7.2
Site establishment[1]	Mitchell Hwy	15	55	n/a	n/a	n/a	n/a
Site establishment[1]	Barrier Hwy	15	55	n/a	n/a	n/a	n/a

Notes: 1. No Proposal related traffic movement is expected during the night-time period.

The predicted road traffic noise levels satisfy the RNP criteria at all residences situated along the Barrier Highway and the Mitchell Highway. The differences between the existing and future combined noise levels are also below the relative increase criteria listed in Table 3.7.

6 Conclusion

The noise impact assessment demonstrates that predicted noise levels satisfy the operational criteria at all assessed residences and for all assessed meteorological conditions during both the site establishment and construction and operational stages.

Sleep disturbance impact from maximum noise level events has been assessed and predicted levels are expected to satisfy the relevant criteria at all private residences.

Road traffic noise associated with the Proposal, during either the establishment phase or the operational phase, is predicted to comply with relevant goals for all residences.

Blast overpressure and vibration calculations identify that the MIC required to construct the box cut and underground portal, and to extract material from underground reserves, would satisfy ANZECC blasting limits at all residences at a maximum MIC of 1000kg. It is understood that Tritton is committed to design blasting events specifically to meet the relevant ANZECC guidelines at nearby residences.

References

Australian and New Zealand Environment Council (ANZECC) 1990, *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.*

Australian Standards 2006, AS2187-2: *Explosives – Storage and use Part 2: Use of explosives.*

Bridges Acoustics, 2013, *Road Train Noise Assessment.*

Department of Transport Welsh Office, 1988, *The calculation of Road traffic Noise*.

ICI Technical Services, 1995, *ICI Explosives Blasting Guide*.

NSW Department of Environment and Climate Change (DECC), 2009, *Interim Construction Noise Guideline.*

NSW Environment Protection Authority (EPA) 2000, *NSW Industrial Noise Policy*.

New South Wales Roads and Traffic Authority (NSW RTA) 2001, *Noise Management Manual.*

NSW Department of Environment, Climate Change and Water (DECCW) (now EPA) 2011,*Road Noise Policy*.

NSW Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: A Technical Guideline.*

Road and Traffic Authority New South Wales, 2003, *Traffic and Volume Data for Western Region 2002.*

World Health Organisation (WHO), 1999, *Guidelines for Community Noise.*

Appendix A

Sound power levels and single octave frequencies for all plant items

Table A.1 Sound power levels and single octave frequencies for all plant items

Plant item	Sound power level - single octave (dB(Z)) frequency (Hz)								Total	
	63	125	250	500	1K	2K	4 k	8K	dB(Z)	dB(A)
Construction										
Blast drill rig	109	114	118	112	109	108	101	93	121	115
Excavator	107	108	107	104	101	100	94	86	114	107
Haul truck	111	115	114	108	105	103	96	87	120	111
Bulldozer	116	116	107	107	107	104	96	86	120	111
Grader	101	105	106	100	99	96	89	82	112	104
Operation										
Grader	101	105	106	100	99	96	89	82	112	104
Underground haul truck	106	118	115	108	100	97	93	82	121	111
Road train	115	111	99	92	93	96	91	86	117	102
FEL	123	110	108	107	107	104	99	91	125	111
Generator	101	112	115	111	107	103	97	88	118	113
Ventilation fan	116	116	107	98	93	91	88	81	121	104

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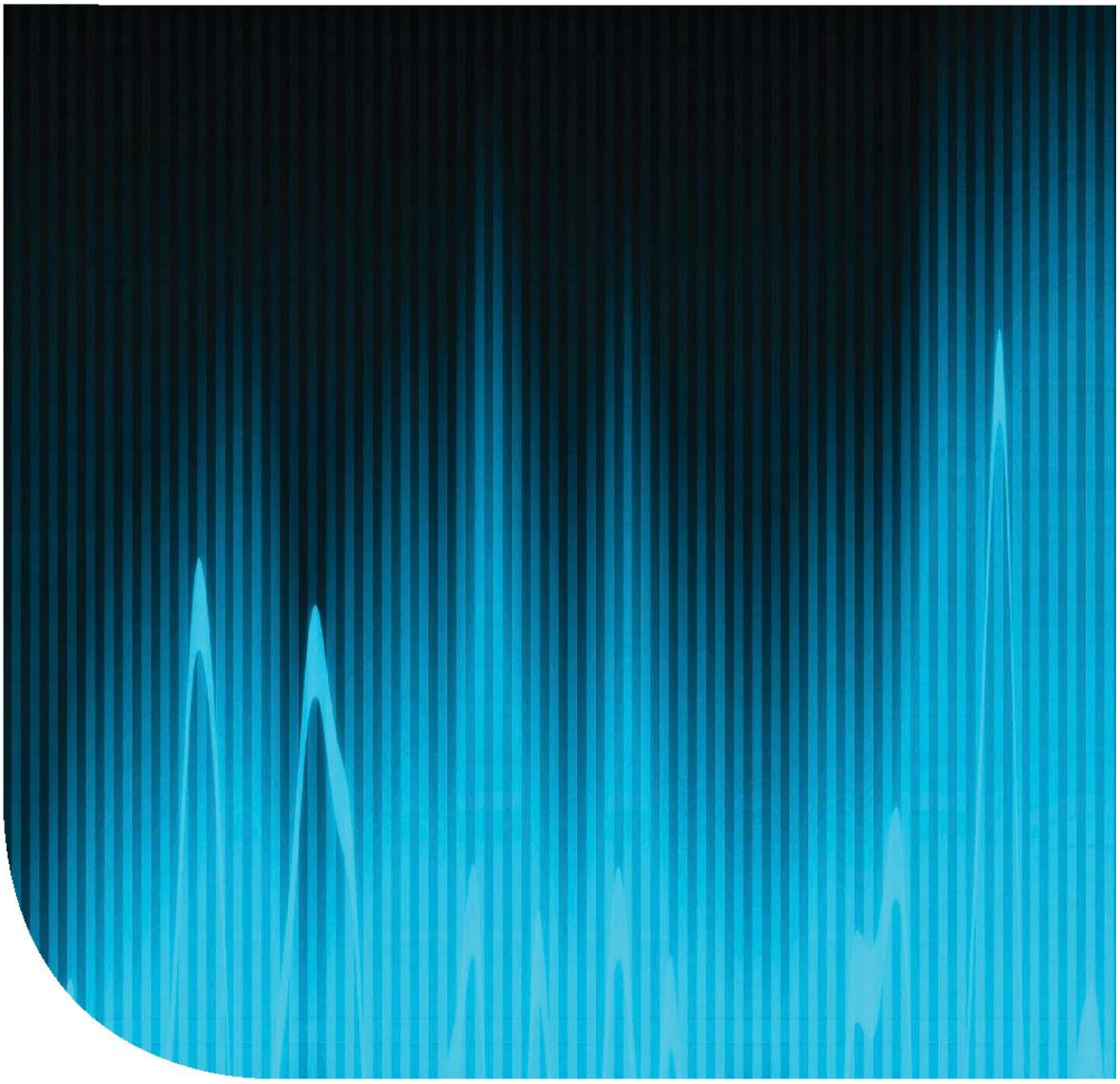

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Appendix 9

Historic Heritage Assessment Report

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OnSite
Cultural Heritage Management

Historic Heritage Assessment Report
Avoca Tank Project
Environmental Impact Statement

Tritton Resources, Girilambone,
Bogan Shire NSW 2831

A report prepared for
RW Corkery & Co Pty Limited
Geological and Environmental Consultants
and Tritton Resources Pty Ltd

May 2014

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EXECUTIVE SUMMARY

INTRODUCTION

R.W. Corkery and Co is preparing an Environmental Impact Statement (EIS) for Tritton Resources Pty Ltd (the Applicant) to undertake mining activity at an identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project (the Proposal). On Site Cultural Heritage Management Pty Ltd (On Site CHM) has been engaged by RW Corkery and Co Pty Limited and Tritton Resources to prepare an Historic Heritage Assessment to inform the EIS about the management of historic heritage places and values within the Avoca Tank Project Site.

The information presented in this Historic Heritage Assessment has built upon the assessment (On Site CHM 2013) originally prepared for the exploration phase and Review of Environmental Factors (REF) that preceded the EIS. The survey and assessment processes and to inform the Proposal was undertaken in a two stage assessment process between March and August of 2012 and September 2012 and January 2013.

The results and recommendations of that assessment (On Site CHM 2013) were considered in the final design of the Proposal which has avoided all identified historic heritage places and values. This report describes the historic heritage assessment processes undertaken by On Site CHM for the Avoca Tank Project and provides management strategies to ensure the conservation of identified historic heritage places within the Avoca Tank Project Site during the development and operation of the Proposal.

The Avoca Tank Project Site is located approximately 4 kilometres northwest of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire NSW 2831. The Project Site covers an area of 1846 ha (18.46 km^2) and the Proposed Disturbance Footprint covers an area of 33.6 ha (0.336 km^2). Proposed extraction will occur underground meaning that the Proposed Disturbance Footprint will only cover a small percentage (1.8%) of the entire Project Site. The Avoca Tank Project Site occurs across Lots 135 and 144 (DP 751315) and part Lots 10 (DP 751315) and part Lot 3 (DP 751342). The Project Site is situated on the Coolabah 8235 1:100,000 map sheet.

OBJECTIVES, SCOPE AND METHODOLOGY

The objectives of this Study are to provide information about the historic (non-Aboriginal) archaeological, historical and physical aspects of the study area so as to provide:

- An understanding of the heritage values and the potential archaeology of the study area;
- An assessment of the historical heritage and archaeological values of identified sites within the study area;

- The identification for impact by the proposed project, and of the potential for triggering the relics provisions and statutory permit requirements according to the *NSW Heritage Act 1977*; and
- Appropriate heritage and archaeological management options and strategies

The scope of works and methodology adopted for the project as per the proposal included:

- Historical research of the study area;
- Field survey investigation;
- Assessment of identified heritage and archaeological sites;
- A statement of heritage impact, where applicable, for individual sites;
- The provision of recommendations to avoid, minimise or mitigate against any impact; and
- The identification of any legislative requirements under the *NSW Heritage Act 1977*.

This Historic Heritage Assessment study is based around investigations of the archaeological, historical and physical contexts of the project components. Each context has been investigated individually and the information drawn together and analysed with reference to established guidelines of the Office of Environment and Heritage (OEH). These investigations have been carried out in three stages:

Stage 1: included a desktop study consisting of investigation into the archaeological and historical contexts to inform Stage 2.

Stage 2: included investigation of the physical context through a field survey of the study area and documented by photography and documentation of individual sites as appropriate.

Stage 3: involved reporting and formal assessment of identified heritage and potential archaeological sites in accordance with the standard requirements of the NSW Heritage Manual endorsed by the NSW Heritage Council.

OVERVIEW OF STUDY RESULTS

The heritage inventory searches and desktop investigations conducted for Stage 1 of the methodology did not identify any particular areas of historical activity or target areas for the field survey investigation. The historic heritage survey was therefore conducted in conjunction with the Aboriginal heritage survey to provide coverage across the survey area.

The total length of all survey transects walked across the Avoca Tank Study Area (18.62km^2) was 63.5 kms. Based on the 100 metres wide survey transect it is estimated that 6.35km^2, or 34.1% of the Avoca Tank Study Area was surveyed during the investigations. Approximately 66% of the Proposed Disturbance Footprint was also subject to survey.

The desktop research into the Study Area identified that the subject land was part of the 'Bogan Gold Fields'. It was therefore considered likely that the Study Area was not only used for grazing purposes, but also for mining or at the very least mineral prospecting. Neither the research nor survey of the Study Area identified any localities or definitive evidence of mining activities.

This study has identified a total of three historic heritage places within the Avoca Tank Study Area and all of these items are considered to result from pastoral activity. Avoca Tank 4 consists of a scar tree, historic artefacts near a modified waterhole. The site has been interpreted as an Aboriginal stockman's camp and it is quite probable that the isolated glass artefacts at Avoca Tank 6 and 7 were also deposited by Aboriginal stockmen, although this remains conjecture.

This study has shown that historic heritage sites and artefacts are sparsely distributed across the Avoca Tank Project Site and no foci points of historic activity were located. From this perspective the historic potential of the Project Site and Proposed Disturbance Footprint to contain further historic sites and artefacts, is considered to be low.

HERITAGE MANAGEMENT OVERVIEW

There are three important principles to consider in regard to the management of heritage within a planning and development process:

1. The legislative obligations under NSW law to take appropriate action to manage heritage items.

2. Heritage significance is based on established assessment criteria. If the value of a heritage item is not clear, a precautionary approach should be adopted until a definitive assessment can be made.

3. Management of an item should be based on the significance of the item and practical realities for its conservation. Management does not preclude adaptive reuse or the installation of modern facilities. It does not preclude demolition where there is no feasible alternative.

STATUTORY CONSIDERATIONS

The *NSW Heritage Act 1977* (Section 4) defines "environmental heritage" to mean those places, buildings, works, relics, moveable objects, and precincts, of historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value that are assessed as significant to the State of New South Wales, significant within the local area.

Avoca Tank 4 has been assessed as significant at the local level, may contain relics and is considered subject to the provisions of the *NSW Heritage Act 1977.* This site was also identified in the Aboriginal Cultural Heritage Assessment (On Site CHM 2014) and is being

managed and conserved under the *NSW National Parks and Wildlife Act*. Given the site will not be disturbed by the Proposal however the relics provision (s139) will not be triggered and no approvals will be required.

Avoca Tank 6 and 7 being isolated glass artefacts are considered to have a low level of significance. None of these places and items will be impacted upon by the Proposal.

HERITAGE MANAGEMENT RECOMMENDATIONS

Management recommendations are provided for each site in **Section 5.0** and a summary of identified sites and their management is provided below in the **Executive Summary Table.**

This study has also been undertaken with a focus upon the elimination and/or reduction of negative impact upon any archaeological and/or heritage values need for additional detailed study and the potential for triggering the relic's provisions of the *NSW Heritage Act 1977.*

The objective of management recommendations is to provide a reasonable, balanced and precautionary approach that will appropriately address the potential for the exposure of archaeological resources (relics), and to trigger a due diligence heritage management response as a consequence of the Proposal.

In this instance the potential for the exposure of archaeological resources (relics) is considered to be low. The application of statutory considerations to the Proposal, with reference to the definitions contained in Section 4 of the *NSW Heritage Act 1977* is considered below:

1. The proponent should consider preparing a due diligence heritage management response strategy to respond the low possibility of exposing relics during earthworks or locating further items within the Project Site. As well as detailing response protocols, the strategy should include information to be transmitted to site personnel as part of any inductions so they are aware of the possibility and protocols.

2. Due diligence heritage management and the *NSW Heritage Act 1977* requires that if unexpected **relics** are exposed during any project works, that work is suspended and appropriate heritage personnel consider the need to inform the Heritage Branch of the NSW Office of Environment and Heritage. In this case, additional archaeological assessment and approvals may be required.

Executive Summary table for identified historic sites within Avoca Tank Project Site, assessed significance, impacts and recommendations

Site Name	Site Features	Cultural Significance	Impacts of Proposed Disturbance	Summary of mitigation strategy
Avoca Tank 4	Historic Scar Tree and Aboriginal Stockman's camp	Moderate / Local Significance	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents. Undertake specific conservation management planning to mitigate the risk of fire (See Aboriginal Cultural Heritage Assessment – On Site CHM 2014).
Avoca Tank 6	Historic glass fragment	Low	None	Location will be avoided. Develop and implement appropriate management strategies. Incorporate into relevant management systems and documents.
Avoca Tank 7	Historic glass bottle (1939)	Low	None	Location will be avoided. Develop and implement appropriate management strategies. Incorporate into relevant management systems and documents.

1.0 INTRODUCTION

R.W. Corkery and Co is preparing an Environmental Impact Statement (EIS) for Tritton Resources Pty Ltd (the Applicant) to undertake mining activity at an identified resource to the north of its Girilambone Copper Mine, currently referred to as the Avoca Tank Project (the Proposal). On Site Cultural Heritage Management Pty Ltd (On Site CHM) has been engaged by RW Corkery and Co Pty Limited and Tritton Resources to prepare an Historic Heritage Assessment to inform the EIS about the management of historic (non-Aboriginal) heritage places values within the Avoca Tank Project Site.

The information presented in this Historic Heritage Assessment has built upon the survey originally undertaken for the exploration phase and Review of Environmental Factors (REF) that preceded this EIS. The baseline survey and assessment process undertaken for the exploration phase extended across the entire Avoca Tank Project Site including the Proposed Disturbance Footprint described in **Section 1.1** and displayed in **Figures 1.1** and **1.2.** The results of that survey were considered in the final design of the Proposal which has avoided all identified historic and values.

This report describes the historic heritage assessment processes undertaken by On Site CHM for the Avoca Tank Project and provides management strategies to ensure the conservation of identified Aboriginal places within the Avoca Tank Project Site during the development and operation of the Proposal.

1.1 OVER VIEW OF THE AVOCA TANK PROJECT

The Avoca Tank Project Site is located approximately 4 kilometres northwest of Girilambone NSW 2831 along the Mitchell Highway within the Bogan Shire NSW 2831. The Avoca Tank Project Site covers an area of 1846 ha (18.46 km^2) and the Proposed Disturbance Footprint covering an area of 33.6 ha (0.336 km^2) (See **Figure 1.1**. and **1.2**). Proposed extraction will occur underground meaning that the Proposed Disturbance Footprint will only cover a small percentage (1.8%) of the entire Project Site.

The Avoca Tank Project Site occurs across Lots 135 and 144 (DP 751315) and part Lots 10 (DP 751315) and part Lot 3 (DP 751342). The Project Site is situated on the Coolabah 8235 1:100,000 map sheet.

The Proposal would include the following Key Components (**Figure 1.2**):

- 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 Yarrandale Road.
- 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.
- 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 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.

Figure 1.1: Avoca Tank Project Site. Project Site Boundary shown in red outline and Proposed Disturbance Footprint, including the proposed haul road are shown by the light blue line.

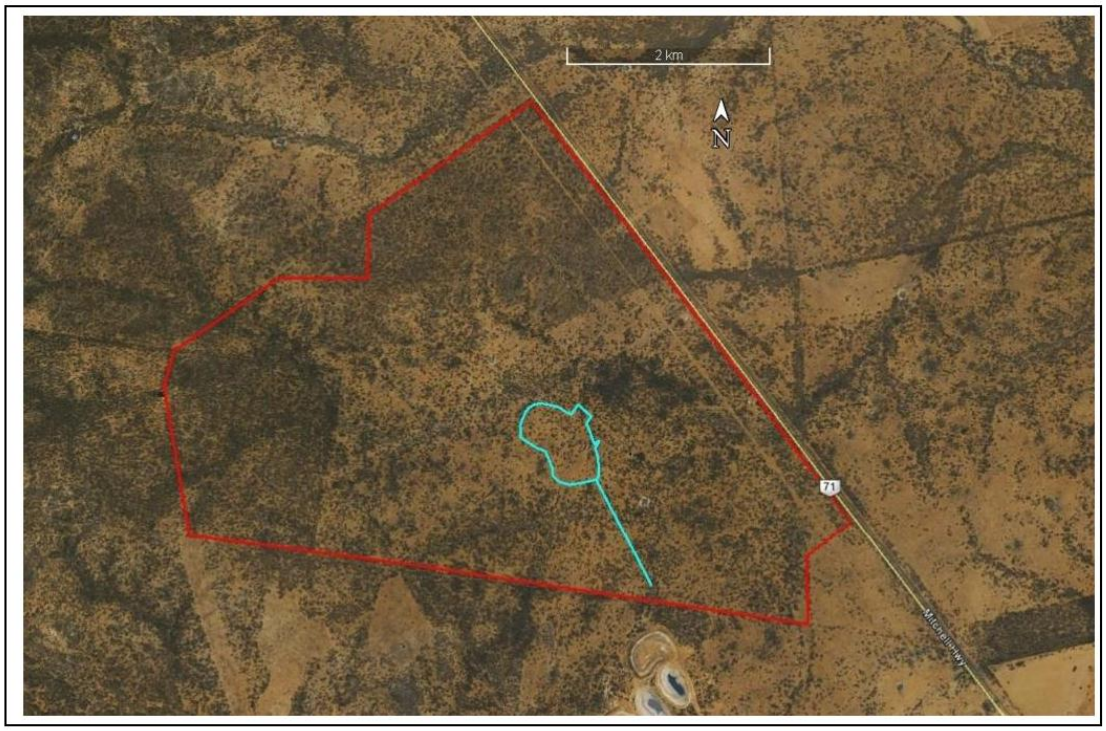
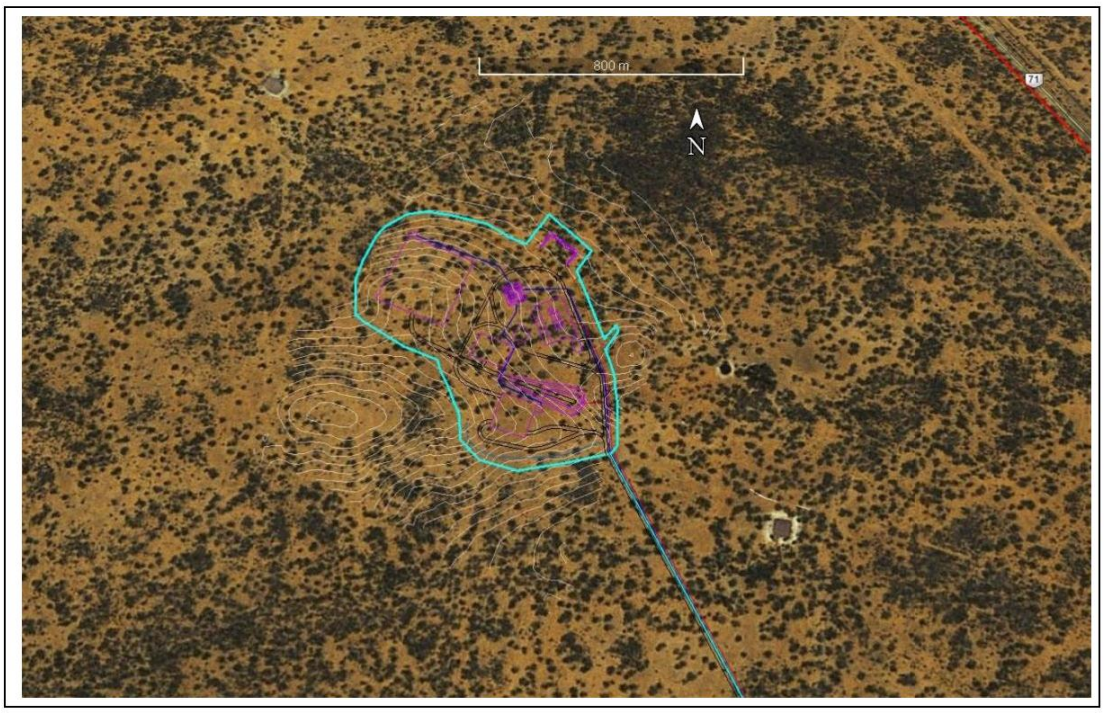


Figure 1.2: Proposed Disturbance Footprint and proposed haul road shown by the light blue line. Project components described in Section 1.1 shown within light blue line.



1.2 OBJECTIVES OF THE HISTORIC HERITAGE ASSESSMENT

The objectives of this study are to provide information about the historic (non-Aboriginal) archaeological, historical and physical aspects of the study area so as to provide:

- An understanding of the heritage values and the potential archaeology of the Study Area;
- An assessment of the historical heritage and archaeological values of identified sites within the Study Area;
- The identification for impact by the proposed project, and of the potential for triggering the relics provisions and statutory permit requirements according to the *NSW Heritage Act 1977*; and
- Appropriate heritage and archaeological management options and strategies

1.3 SCOPE AND METHODOLOGY

The scope of works and methodology adopted for this Study as per the proposal included:

- Historical research of the Study Area;
- Field survey investigation;

- Preliminary assessment of identified heritage and archaeological sites (built, landscape and sub-surface);
- A statement of heritage impact, where applicable, for individual sites;
- The provision of recommendations to avoid, minimise or mitigate against any impact; and
- The identification of any legislative requirements under the *NSW Heritage Act 1977*.

This historic heritage assessment study is based around investigations of the archaeological, historical and physical contexts of the project components. Each context has been investigated individually and the information drawn together and analysed with reference to established guidelines of the Office of Environment and Heritage (OEH). These investigations have been carried out in three stages. In brief, the proposed methodology has included:

Stage 1: included a desktop study consisting of investigation into the archaeological and historical contexts. Research of the historical context was drawn from primary and secondary historical accounts (including historical maps and plans) and through additional research of historical newspapers, and other local sources and archives. Research of the archaeological context was compiled from records and reports of available heritage and archaeological studies, and from statutory and non-statutory databases such as State and Local inventory listings including relevant Local Environmental Plans. The preparation of the historical and archaeological contexts of the report guided the field survey process and provided an indication of target areas (if any) for inspection during Stage 2.

Stage 2: included investigation of the physical context through a field survey of the study area and documented by photography, documentation and mapping of individual sites as appropriate. The site survey was guided by the results of Stage 1 (as appropriate) whereby identified target areas were inspected and recorded to the degree required for assessment. The survey was recorded by photography and where required, identified heritage sites were recorded by location and extent, and by preliminary surface survey. The need to investigate sub-surface features and the need for any additional investigation would form part of the recommendations of the report.

Stage 3: involved reporting and formal assessment of identified heritage and potential archaeological sites in accordance with the standard requirements of the NSW Heritage Manual endorsed by the NSW Heritage Council.

1.4 STATUTORY CONTROLS

Relic's provisions – NSW Heritage Act 1977

Archaeological relics fall within the definition of *environmental heritage* which is protected under the *NSW Heritage Act 1977*. The act provides that environmental heritage may be places, buildings, works, relics, moveable objects, and precincts of State or local heritage significance. The Act further provides measures for the protection and management of the different types of environmental heritage, and this is dependent upon the type of item under investigation.

The entire *Act* serves to protect heritage but historical archaeological remains are additionally protected from being moved or excavated through the operation of the *relic's* provisions. These provisions protect unidentified relics which may form part of the environmental heritage in NSW, but which may not have been listed on statutory registers or databases.

Section 4(1) of the *NSW Heritage Act 1977* defines a relic as:

Any deposit, artefact, object or material evidence that:

> *relates to the settlement of the area that comprises NSW, not being Aboriginal settlement; and is of State or local heritage significance.*

According to the Act no disturbance or excavation may proceed that may expose or discover relics except with an Excavation Permit and that an excavation permit is required, if a relic is:

> *listed on the State Heritage Register, pursuant to s60 and s63 of the Act; and*
> *not listed on the State Heritage Register, pursuant to s140 and s141 of the Act.*

In circumstances where there is little likelihood that relics exist or that such relics are unlikely to have heritage value, and/or that disturbance will result in a minor impact and/or where excavation involves removal of fill only, the Act makes provision for the granting of an exception to an excavation permit under s139 (4).

Works that would result in negative impact to heritage values may require statutory approval under the NSW Heritage Act 1977 and any other item that is suspected to be a "relic" must be managed under the Act.

1.5 REPORT STRUCTURE

Section 2 provides a historical context study. This has been prepared from the review of existing reports, investigation of current statutory and non-statutory heritage databases and historical research.

Section 3 gives an overview of the heritage assessment process and the way in which heritage values (significance) are derived. **Section 4** provides and discusses the results of inventory searches.

Section 5 presents the results of site survey. It provides an individual site description and some interpretation of the results where possible. Based on the synthesis of the contextual studies, together with the survey results, a assessment of heritage significance and Statement of Heritage Impact (SOHI) assessment is provided.

Section 6 focuses on the management of the heritage values of the study area by considering the relevant legislative requirements, the heritage issues that may arise in the event of disturbance or of unknown sites, and through the recommendation of appropriate management strategies.

1.6 BACKGROUND TO THIS HISTORIC HERITAGE ASSESSMENT

The Historic Heritage survey and assessment processes documented in this report were conducted in two stages (Stage 1 and Stage 2) and were conducted concurrently with the Aboriginal Cultural Heritage Assessment processes.

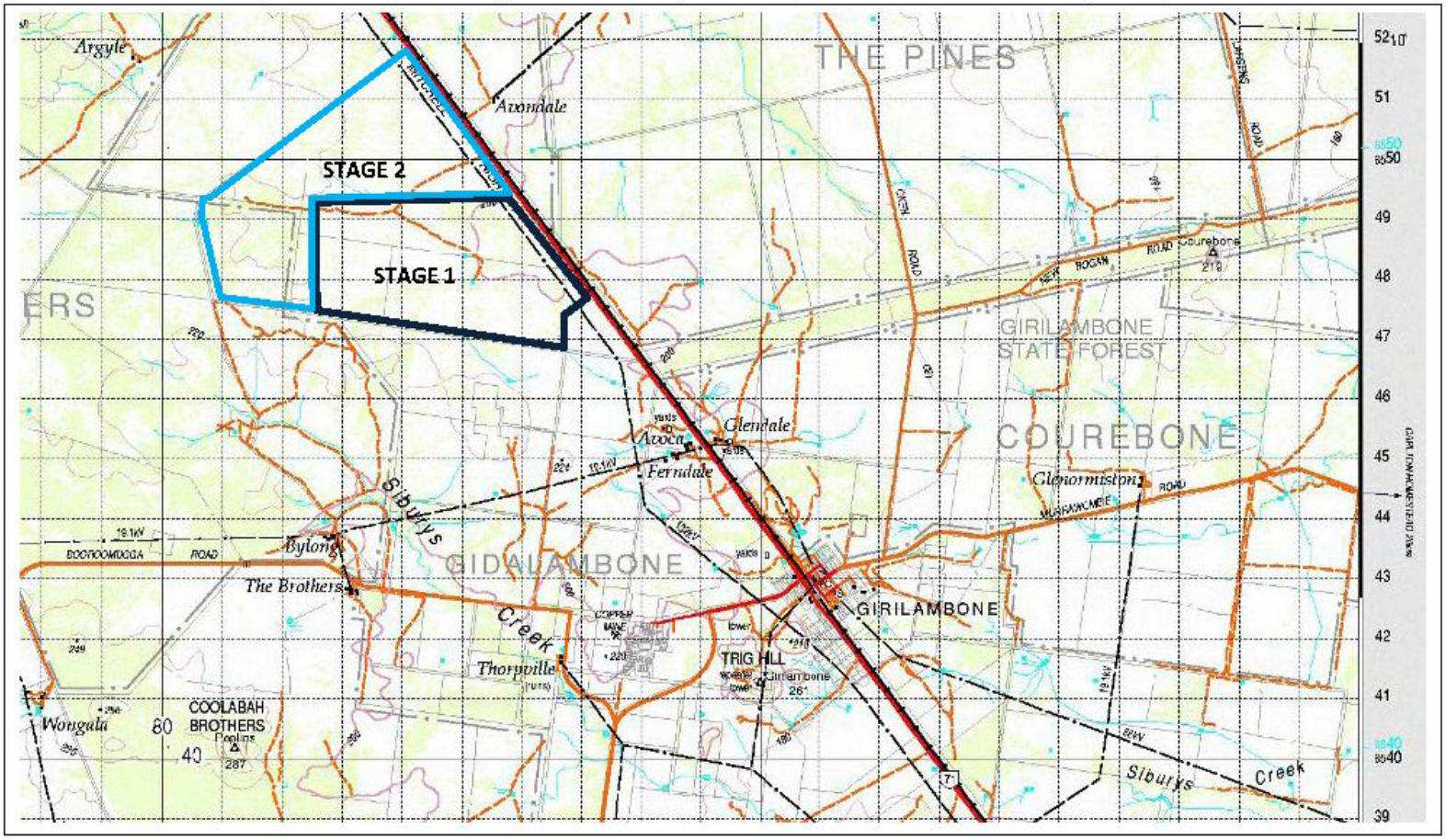
The survey and assessment for the Stage 1 assessment area occurred between March and August of 2012 and Stage 2 was undertaken between September 2012 and January 2013. The results of the Stage 1 and Stage 2 assessments have been combined to produce a single assessment report for the current Avoca Tank Project Site and to inform the EIS. Some of the assessment processes undertaken by On Site CHM for Stage 1 and 2 are still described separately within some sections of this report to demonstrate and explain the survey process.

At the time of the surveys, the combined assessment areas of Stage 1 and 2 was 18.62km^2, slightly more than the current Project Site described in **Section 1.1** and shown in **Figure 1.1.** The Stage 1 Avoca Tank assessment area covered approximately 8.72km^2 across part of Lots 10, 135 and 144 (DP 751315) and the Stage 2 assessment area covered approximately 9.90 km^2 across part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315). The Avoca Tank assessment areas (Stages 1 and 2) are situated on the Coolabah 8235 1:100,000 map sheet and a map showing their location is shown in **Figure 1.3**.

1.7 PERSONNEL AND AUTHORSHIP

Gerard Niemoeller Principal Heritage Consultant of On Site CHM managed the project and led the research, fieldwork and preparation of this assessment report. Craig Reid, Assistant Archaeologist OSCHM assisted in the field work for Stage 1 and, Kate Duca Assistant Archaeologist On Site CHM assisted in the field work for Stage 2. David Tutchener, Archaeologist of On Site CHM undertook the majority of background historical and archival research and prepared sections of this report.

Figure 1.3: Avoca Tank assessment area (18.62km^2) assessed by On Site CHM (Stages 1 and 2). Stage 1 assessment area (8.72km^2) across part of Lots 10, 135 and 144 (DP 751315) is shown in the dark blue polygon. The Stage 2 assessment area is shown in the light blue polygon (9.90 km^2), across part of Lot 3 (DP 751342), Lots 10 and 135 (DP 751315) on the Coolabah 8235 1:100,000 map sheet.



2.0 HISTORICAL CONTEXT

This historical context has been compiled through the combined research of primary source material, secondary source literature. The history of the Study Area falls within the broader historical context of the mining and pastoral history of NSW. The impact of both industries on the development of the region and the Study Area is therefore discussed. In overview, the elements considered relevant to the historical context of the Study Area:

- Mining areas in New South Wales;
- General patterns of settlement in a mining district;
- Pastoral areas in New South Wales;
- Aboriginal regional history;
- Regional history;
- Site history;
- Later 20th Century land use

2.1 MINING AREAS IN NEW SOUTH WALES

The impact of the 19th Century mining boom in NSW was complex and went well beyond the economic ramifications. Mining changed the landscape of early NSW, as forests were cleared, rivers and streams were silted over and heavy metals were introduced during the refinement process (McGowan, 2001). The early mining boom was also responsible for the clearing of land for agricultural purposes in order to feed the miners and the creation and growth of small towns across NSW. These towns provided services and supplies to the miners and many towns took on a multicultural composition due to the influx of immigrants from all over the world who came to work the goldfields.

Copper mining began in Australia in the 1840s, when copper was discovered in NSW at Copper Hill near Molong (1844-1845), and at other sites in the Bathurst area. Gold and copper have been continuously mined around Orange since the early 1850s. Further north, the region of Gunnedah has been mined continuously since the 1870s. Cobar in the north west of NSW has also been a stronghold of mining since the 1870s with the discovery of copper, followed by gold, lead, zinc and silver (NSW Mineral Council, 2012). There are three important mining belts in the Cobar area, the 'Cobar belt', 'Canbelego belt' and 'Girilambone belt'. The area's current two major mines, Elura and CSA , are both within the Cobar belt. The first mineral exploration in the region was to the north of Cobar, and was by prospecting parties financed by businessmen based in Bourke, prior to the discovery of copper and the establishment of a town in Cobar. Uneconomical gold traces were early discovered near Gongolgon and there is also recorded to have been an early gold search in the Billagoe ranges, probably in 1866 (NSW DPI, 2007). General settlement of the area followed soon after workable deposits were discovered.

The years 1906-1907 were ones of peak exploration activity in terms of tenement grant numbers. This followed discovery of rich ore at CSA mine in 1905; and in 1906 several

important developments including the recapitalisation of the Great Cobar Mine in England, the re-vitilisation of the Girilambone copper mine, and establishment of the Budgery copper mine (NSW DPI, 2007).

The mining boom and great surge in prospecting at that time soon came to a halt upon the fall of copper prices in 1908. The 1920s-1950s included some particularly difficult and lean times for mining, but also a strong revival of gold demand during the 1930s general economic depression. What followed was a quiet period for the industry between 1952 and 1965, when none of the large mines in the Cobar area operated.

2.2 GENERAL PATTERNS OF SETTLEMENT IN A MINING DISTRICT

McGowan (1992) identified the general pattern of settlement associated with mining districts. The establishment of ore processing facilities and residential areas closely followed this phase. Associated with this first phase were the establishment of some public facilities and the arrival of private enterprise such as hotels and shops.

The second phase of settlement development arose from the further development of community cohesion and involved the establishment of more substantial institutions such as schools, churches, meeting halls and cemeteries. Public facilities such as schools, churches, post offices, halls, hotels, picnic and recreation grounds are important indicators of community. Mining leases were often re-worked many times over and hence there was a cycle of abandonment and re-establishment at the majority of mining sites.

Decline was the final phase with the cessation and or removal of public infrastructure and departure of the population, due to the decline in productivity. When the mining leases were abandoned, some mining townships were also abandoned. Other townships survived and thrived to become commercial centres.

An important aspect of the heritage and history of mining sites is the aspect of community and the relationship between the separate settlements associated with both alluvial and reef mining. Individual settlements were spread over a considerable distance of rugged and broken terrain. McGowan (1992), however, identified that these isolated settlements were in fact linked through the movement of people, equipment and on occasion buildings that were moved between them. McGowan reasonably asserts such settlements cannot be viewed in isolation but rather, as part of a wider community.

Also according to McGowan (1992), the remnant material evidence alone does not provide a clear indication of the links between the mining settlements and that it is only through the investigation of archival documents that these links became apparent (Niemoeller et al, 2012).

2.3 PASTORAL AREAS IN NEW SOUTH WALES

Although resource mining in NSW has been important to the development of the state, the pastoral industry has been equally integral to its development. It is important to consider this background in conjunction with the heritage of mining in order to develop a complete contextual understanding of the Avoca Tank area.

The first governor of New South Wales, Arthur Phillip in 1792 had the power to grant land in the new settlement of Port Jackson (Roberts, 1968). These land grants were enacted in an attempt to make the settlement self-sufficient. Pastoralism, rather than agriculture, emerged in this early period as the dominant land-based industry for over a century in the colony of New South Wales (Harrison, 2004).

The successful exploitation of sheep and wool as a resource was achieved not long after settlement. This in turn led to the expansion of settlements and pastoral land use into the grasslands of central NSW by squatters in the 1820s and 1830s. This was hastened by the international demand for Australian wool (Goodall, 1995: 65).

As settlers ventured beyond the limits of location, Aboriginal people targeted their stock as new sources of food. The penalties for attacks on stock, or indeed settlers, were in many cases extreme. In 1824, Aboriginal resistance to pastoralism west of the Great Dividing Range was met with a proclamation of martial law, the NSW colonial government's strongest military response to pastoralist complaints (Harrison, 2004). Even still by 1846–49, there were 1866 squatters' runs in New South Wales and from 1860 to 1890 the success of the colonies' wool industry accompanied intensified European land use (Roberts, 1970: 362).

As the colony developed infrastructure (railroads, roads, local administration) and the price of wool depreciated around 1900, government investment and William Farrer's wheat experiments turned wheat into a viable cash crop (Roberts, 1968: 312). For pastoralists, however, high debts and falling produce prices had savaged the wool industry. The inflated demand for land, combined with the competitive trade offered by Sydney's markets meant that by 1900, the trend price for land in New South Wales was £14 per acre, compared to under £2 in Victoria (Harrison, 2004).

The transportation of convict labour to NSW ended in during the 1840s, and the discovery of gold in the 1850s produced an employment gap in the pastoral industry that was met by Indigenous men and women (Harrison, 2004).

The work itself was often only seasonal and mostly poorly paid. Often after time pastoralists came to appreciate the in depth Indigenous knowledge of the land including water sources, which made it possible to transport stock over long distances. In later years, as more European workers became available, pastoralists reduced the cash component of Aboriginal

workers' wages to virtually nothing, or entrapped it in the accounts book of the property store (Goodall, 1995).

Figure 2.1: W H Watts, 'Aboriginal workers, Willandra Station, Hillston area, New South Wales', c 1880. (Harrison, 2004: 33)

By the 1930s, in most parts of NSW nearly all of the Indigenous pastoral workers were either fringe dwellers or 'clients' of the Aborigines Protection Board (Harrison, 2004). This was due to number of factors including; The Soldier Settlement Scheme which was used as away of settling returned soldiers in the country after both world wars, and the simple fact that family sized blocks of land needed less people to work them than the larger pastoral properties had done in earlier periods (Brock, 1995). With the introduction of various technologies by the 1950's the swathes of jobs were lost in both the agricultural and pastoral industries, for example mechanized harvesters, the widespread use of motorbikes instead of horses and road trains eliminated the need for droving almost completely.

2.4 INDIGENOUS REGIONAL HISTORY

The Avoca Tank Area has a long indigenous occupation record and has been documented in some detail since white occupation. This short section will outline the Aboriginal occupation of the area by drawing on historical, ethno-historical and anthropological records of the Ngiyampaa Wangaaypuwan and their neighbours.

It is recorded that The Bogan River Wiradjuri, the Ngiyampaa Wangaaypuwan's eastern neighbours suffered during significant conflict with early white settlers in the region. The early contact history in this region from 1835 the 1920's is characterized by conflict between indigenous people and white settlers regarding land use (Native Title Tribunal, 1998). Throughout this period the indigenous population of the area had decreased significantly (See **Table 2.1**). The Indigenous people in the area often lived on cattle stations controlled by the Aborigines Protection Board (APB). This was due to a government ruling during the economic depression of 1929-1936 that Aboriginal families could only receive unemployment relief at

APB stations. These stations were later subdivided and sold off, forcing the indigenous population to move from station to station looking for work (Beckett et al, 2003). During the post depression era many local indigenous people were able to find work on stations located on or near their traditional lands, by the 1970's however the government began a program of relocation and consequently the population was dispersed widely.

Table 2.1: Aboriginal population figures (Beckett et al, 2003)

Center	1882	1891	1896	1900	1915
Cobar	17	?	65	72	28
Brewarrina	175	?	197	111	?
Louth	118	133	133*	60	–
Bourke	258	24			
Byrock & Bourke	?	?	24	52	–
Byrock	–	–	–	–	35
Nyngan	?	216	30	16	–
Mossgiel	96	114	98	70	109
Ivanhoe	?	?	?	33	43

2.5 REGIONAL HISTORY

Charles Sturt first named the River Bogan in 1828, yet it was explorer and surveyor Major Mitchell documented early European exploration of the Bogan region (Bogan Shire Council, 2012). Mitchell first surveyed the area in 1835 and many settlers came closely behind, but due to the resistance of the local indigenous groups many cattle runs were given up and later taken reclaimed by other graziers, making it difficult to record all the changes that occurred (Nyngan Historical Society, 1983). The European relationship with local indigenous groups on the lower Bogan River was strained by conflict and, as a result, and after multiple massacres and retaliations in the area the government cancelled a number of pastoral licenses in 1845 (About NSW, 2012). The area surrounding the Bogan River was difficult to settle in a number of ways as the early graziers of West Bogan County not only had difficulties attempting to subdue the local Indigenous groups, but they also suffered through anthrax outbreaks among their sheep and cattle herds, which devastated livestock numbers (Nyngan Historical Society, 1983).

The Bogan River is evident in the popular culture of early NSW and Henry Lawson mentions the Bogan River in three stories, The Mystery of Dave Regan, Poisonous Jimmy Gets Left and The Babies in the Bush. While Tom Collins (Joseph Furphy) also mentions the Bogan River in Such Is Life that was published in 1902 but written in Shepparton in 1896-97 (Rathbone, 2010). Lawson also named a character Bogan Bill, which may have been instrumental in the word "bogan" entering the Australian vernacular.

As with any region establishing itself the names of towns, places and boundaries are all fluid in nature. This is particularly evident in the study area of Avoca. The Parish Maps indicate that the study area is in fact within the parish of Gidalambone, which is within the County of Canbelego, within the Land District of Nyngan that is within the Bogan Shire. When the area of the town of Girilambone was settled near the copper-mine of the same name, there was no Shire, no County and no Land District. Girilambone mine was at its inception essentially a private town, with no police or government. The Municipality of Nyngan was proclaimed on February 17, 1891 with Nyngan having a population of 1355, and in 1906 the Bogan Shire was incorporated (Bogan Shire Council, 2012).

Thomas Hartman, Charles Campbell and George Gibbs discovered copper in the Cobar area in 1869. Thomas Hartman, from his experience at Cobar, later recognised the outcrop of the Girilambone copper deposit, in 1875. At Cobar, both copper (1869-1870) and gold (1871) were discovered in close succession. Other early mines commenced production following the establishment of the Great Cobar Mine, at the following times: Girilambone 1881, Chesney 1887, Occidental (later New Occidental) 1889, Cobar Gold Mine (later New Cobar) 1890, Mt Drysdale 1893, Mt Pleasant 1895, Young Australian 1896, the Peak (Blue Lode) 1896, Mt Boppy 1898, Queen Bee 1902, CSA 1905, Tinto 1906, Gladstone 1908 (NSW DPI, 2007).

George Hunter (**Figure**) joined Thomas Hartman in 1880 and the Girilambone mine was established soon after in 1881 (Heckendorf, K. 1980;3). By 1883 there were 130 men and boys working the mine. There was no town water supply for Girilambone until the 1950's and up until then the local population survived on rainwater tanks, which were often low during drought seasons. Water was such a scare commodity that in 1882 a cask of water sold for the high price of 2s 6d (Sydney Mail, March 18 1882). The mine, however, continued to prosper until approximately 1907. Between 1881 and 1907 the Girilambone mine produced 58,408 tons of ore (Heckendorf, K. 1980). In 1917 over 100 ton of ore was removed from the mine, no mining activity has been recorded since.

The present town of Girilambone came about when the railway line came to the area in 1883 (See **Figure** 2.2**2.2**). Although the Girilambone mine had been the centre of public activity until this time slowly the public amenities in the area began to be constructed around the railway station.

Figure 2.2: Girilambone railway station, Christmas Eve 1908 (Heckendorf, K. 1980).

Figure 2.3: Outside the Girilambone mine, George Hunter is seated third from the right (Heckendorf, K. 1980).

2.6 SITE HISTORY

This investigation into the site history for the study area is divided into two stages: Stage 1 (Lot 135 and subsequently 144 and 10) and Stage 2 investigations (Lot 3).

Stage 1

An early Parish Map of Gidalambone indicates that the land units in the activity area of the Avoca Tank Project Stage 1 was marked as Lot 135 and was wholly owned by a Kenneth MacKinnon as early as 1910 and had a total area of 4087 acres (See **Error! Reference source not found.**). The Sydney Morning Herald on Tuesday 14 January 1919 notes that upon his death Kenneth McKinnon, grazier, bequeathed his property to his widow Catherine McKinnon and two sons Malcolm (See **Figure** and **2.5**) and Donald.

Figure 2.4: shows Malcolm McKinnon's teams tank sinking on 'Welbury' in approximately 1930 (Heckendorf, K. 1980;).

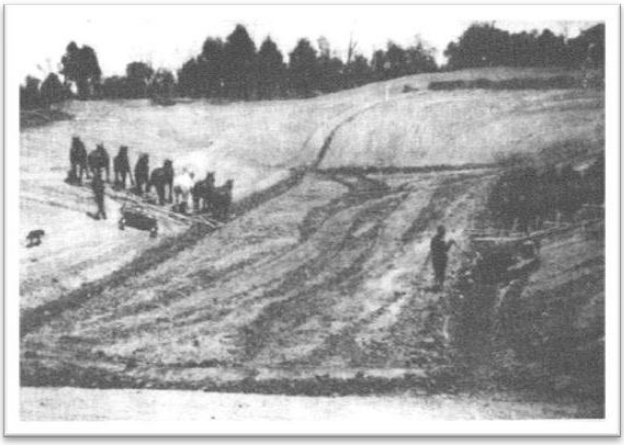


Figure 2.5: Image of Malcolm McKinnon's teams with wool from 'Lemongrove' (Heckendorf, K. 1980).

A later Parish Map in 1916 (See **Error! Reference source not found.**) indicates that the original Lot 135 was subdivided as early as 1907 into three parcels; Lot 10 (Acres 2563), Lot 135 (502 Acres) and Lot 144 (1022 Acres). Lot 144 was acquired by The Australian Bank of Commerce (See **Error! Reference source not found.**) and repurchased by at a later date by MacKinnon, Fuller and Lanson as illustrated by a 1937 parish map (See Error! Reference source not found.).

It would appear likely that the activity area under investigation was not only used for grazing purposes, but also for mining or at the very least mineral prospecting. The activity area, which incorporates the Avoca Tank project area, is clearly marked as part of the Bogan Gold Fields on the map of West Bogan (See Error! Reference source not found.). It is also noted in a local history of the region (Heckendorf, K. 1980) that at Avoca, 3 miles NNW of Girilambone traces of gold were found.

It is also quite possible that the MacKinnon family (the name was most probably also spelt McKinnon) was related to the Alec McKinnon who held the licence for the Railway Hotel (also known as the Girilambone Hotel) from 1881 to 1921 (Heckendorf, K. 1980; 28).

Stage 2

Is located to the south western corner of McKinnon's block, Lot 3 that comprises an area of 1575 acres is marked in 1910 as under the control of H. Thorpe, and may have utilized for mining purposes at some point (See **Error! Reference source not found.**). This block falls into a different parish division from the Stage 1 investigation and is included in the Parish of The Brothers. This is most likely the Henry Thorpe who also owned the block directly to the north of the activity area. A Parish map of the Brothers in 1911 (**Error! Reference source not found.**) shows that this portion of the activity area was now a Crown Lease under the name of J.H. Ferguson. Later Parish maps of the Brothers Parish (See **Error! Reference source not found.**, **Error! Reference source not found.**) indicate that Lot 3 was still listed under the name J.H. Ferguson in 1926 and 1957.

In 1900 the Girilambone Primary School photo (See Figure) a pupil named Mary Thorpe is listed as Mary Thorpe (McKinnon) of 'Glendale', most likely indicating a marriage later in life into the McKinnon family, perhaps coincidently there is a Tom McKinnon of 'Glendale' is also shown in the photo (Heckendorf, K. 1980; 48). 'Glendale' appears to be an agricultural property within Girilambone. It would also appear that both the Thorpe's and McKinnon's had a hand in the businesses of Girilambone in stores and hotels respectively (Heckendorf, K. 1980; 19).

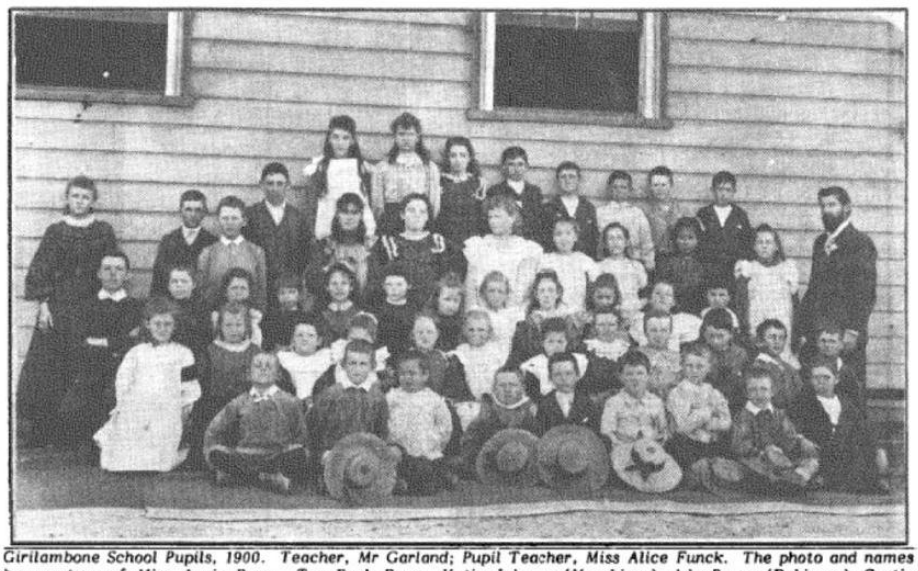
It would appear that the Thorpe family had a substantial impact on the town of Girilambone as it is known that the 'Thorpe boys had a butchery and other retail based interests in the town' (Heckendorf, K. 1980; 17). It is also quite likely that William Henry Thorpe who was postmaster of Girilambone form 1921-24 was a descendant of Henry Thorpe (Heckendorf, K. 1980; 39).

2.1 LATER 20TH CENTURY LAND USE

The area of Bogan in the later 20th Century has been utilized mostly for agricultural purposes and mining. For instance during the 1980's the price of copper was pushed to record highs because of supply disruptions such as the Bougainville conflict. This stimulated the slackened local interest in copper exploration, and Nord Pacific Ltd commenced work aimed at bringing the old Girilambone copper mine back into production as an open cut mine (NSW DPI, 2007).

The greater area of Nyngan has suffered from a number of major floods in the 1990's, in order to combat this a levee was built to protect against future flooding of the Bogan River (Bogan Shire Council, 2012).

Figure 2.6: 1900 the Girilambone Primary School photo (Heckendorf, K. 1980; 48)



Girilambone School Pupils, 1900. Teacher, Mr Garland; Pupil Teacher, Miss Alice Funck. The photo and names by courtesy of Miss Annie Begg. Top Back Row: Katie Johnson (Murchison), Ada Payne (Robinson), Gertie Sinclair, Bill Gibson, Tom Begg and Joe Power at the end. The three boys at Katie Johnson's right-hand from L to R are Dave Gibson, Alex Milligan and Donald Murchison. In front of Katie Johnson myself Annie Begg, Ettie Sinclair and Laura Radburn (Robinson) and next to her is Lizzie Hansard (Murchison), Mary McDonald, Alice Eldridge and Mary Thorpe (McKinnon) of "Glendale". Next Row: Miss Alice Funck, pupil teacher; can't remember the boy's name in front of her; but the girl next to him is Gracie Lewis, next Dovie McDonald, Willie Rimmer, Emily Peacock, Nita Rimmer, Addie Hodder, Milty Gibson, Mary Sinclair, Jean Begg, but can't remember the next two girls. Next Row: Simpie McDonald with black band on arm for her mother's death, next to her is Rose Power, Vera Egan, Gracie Davis, Ida Power (Mrs Vern Dicker) Maggie Gibson, Ruby Murchison (Williamson), Jim Robinson, Tom Murchison, Tom McKinnon of "Glendale", David Milligan, Walter Eldridge. Next Row: George Milligan, Harry Sinclair, Les Power, Bill Begg, Dave Garland (teacher's son), Bob Sinclair, Phil Carmichael, Harry Rimmer's brother and Jim Power.

3.0 HERITAGE SIGNIFICANCE ASSESSMENT

3.1 INTRODUCTION

The assessment of the heritage values of an item or site depend upon the assessment of its significance together with the potential it may possess to expand the existing level of knowledge. An appreciation of these factors assists in the estimation of the impact that any disturbance, damage or destruction may have on such heritage values.

Fundamental to any consideration of the heritage values of a site is an appreciation of the impact of the NSW Heritage Act, 1977 (the Act) which defines heritage items to be:

> *Those buildings, works, relics or places of historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance for the state of New South Wales.*

Heritage items can be broadly interpreted as features, items, landforms and the like that possess characteristics that are presently of value and likely to be valued by future generations, making it worthy of special effort to conserve. These valued characteristics can originate from past associations and/or present circumstances, and do not necessarily have to be old.

3.2 ASSESSMENT OF HERITAGE SIGNIFICANCE

An assessment of significance is undertaken to understand if and explain why a particular site or item is important, and to enable appropriate best practice heritage management to be determined. Considerations relevant to a heritage significance assessment include whether a site, or the fabric contained within a site, contributes knowledge or has the potential to do so.

An assessment of significance is influenced by the environmental and historical context of the site at the time of the assessment. In this light, significance can be seen as a variable quality. It follows that the evaluation of heritage significance is not a static value, but rather is evolutionary as a function of changing community perspectives and cultural values.

3.2.1 Assessment Criteria

The NSW heritage assessment criterion encompasses the four values in the Australia ICOMOS[1] Burra Charter and these four broad values are used to assess the heritage significance of an item. It is important for items to be assessed against these values to ensure consistency

[1] ICOMOS – International Council on Monuments and Sites

across the State. While all four values should be referred to during an assessment, in most cases items will be significant under only one or two values. The four values are:

- historic significance;
- aesthetic significance;
- scientific significance; and
- social significance.

In order to apply a standardised approach to the assessment of these four values relative to items and individual elements within or contributing to items, the NSW Heritage Office (2001:9) has defined a series of seven criteria that will be used by the Heritage Council of NSW as an assessment format within NSW. To be assessed as having heritage significance, an item must meet at least one of the criteria detailed below.

Historic significance is identified by:

Criterion (a) the importance of an item in the course or pattern of the cultural or natural history of NSW or a local area.

Criterion (b) the existence of a strong or special association between an item and the life or works of a person or group of persons important in NSW or a local area.

Aesthetic significance is identified by:

Criterion (c) the importance of an item in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW or a local area.

Social significance is identified by:

Criterion (d) the existence of a strong or special association between an item and the social, cultural or spiritual essence of a particular community or cultural group within NSW or a local area.

Scientific significance is identified by:

Criterion (e) the potential of an item to provide information that will contribute to an understanding of the cultural or natural history of NSW or a local area.

3.2.2 Degree of significance

In addition to the above criteria, in order to describe the degree of significance, an item may be assessed as being either 'Rare' or 'Representative' within its

community/cultural/geographical level as distinguished by criterion (f) for rarity or (g) for representativeness.

Thus, degree of significance is identified by either:

Rarity

Criterion (f) the quality of an item to possess uncommon, rare or endangered aspects of the cultural or natural history of NSW or a local area; or

Representativeness

Criterion (g) the demonstration by an item of the principal characteristics of a class of cultural or natural place or cultural or natural environment within NSW or a local area.

3.2.3 Level of Significance

Another aspect of assessment of significance is the level of significance of an item. Level is assessable in two classifications pursuant to NSW Heritage Office (2001) depending upon the breadth of its identifiable cultural, community, historical or geographical context.

Local level identifies the item as being significant within an identifiable local and/or regional cultural and/or community group and/or historical/geographical heritage context;

State level identifies the item as being significant within an identifiable State-wide cultural and/or community group and/or historical/geographical heritage context;

but on a broader front, recognition of an item at the:

National level identifies the item as being significant within an identifiable national cultural and/or community group and/or historical/geographical heritage context;

International level identifies the item as having implications of significance for an identifiable cultural and/or community group both nationally and abroad and/or a world-wide historical/geographical heritage context.

3.2.4 Condition and Integrity

An assessment of condition and integrity of resources contributes to the overall assessment of significance. *Condition* considers the physical state of the fabric of the resource and its potential for survival. *Integrity* observes the degree to which the residual material evidence is an appropriate representation of the resource in its original form. *Potential Impact* assesses

the nature and extent to which the resource will be modified as the result of the projected development.

Condition:

The condition of heritage resources and/or individual elements that have been identified above is assessed on a five-stage scale, that is to say:

[i.] *intact*, where the material evidence allows a complete recording of the resource without archaeological hypothesis;

[ii.] *substantially intact*, where the material evidence is incomplete but the recording of material evidence will be sufficient to allow an accurate archaeological reconstruction, with hypotheses based on the archaeological record only;

[iii.] *standing ruin*, where the material evidence is incomplete and the recording of material evidence will be sufficient to define the footprint of the resource and some of its elevations and features but will be insufficient to allow an accurate archaeological reconstruction of the resource without hypotheses based on the archaeological record and on a range of outside sources

[iv.] *ruin*, where the material evidence is incomplete and the recording of material evidence may be sufficient to define part, or the whole, of the footprint of the resource but will be insufficient to allow an archaeological reconstruction of the resource/its features, perhaps spatially and certainly vertically, without hypotheses based on the archaeological record and on a range of outside sources, and in circumstances where the validation of the reconstruction cannot be assured.

[v.] *archaeological site*, implying a mostly sub-surface residue, where the material evidence suggest the former presence of an archaeological resource that cannot be defined without sub-surface investigation.

Integrity:

In order to support an assessment of significance, an item's key attributes must retain a discernible degree of integrity. That is, a relic must retain material associated with the historical development that has remained largely unchanged and/or undisturbed over time. The integrity of archaeological resources and/or individual elements that have been identified during this study have been assessed on a five-stage scale from intact through to none as defined below.

[i.] *Intact*, where the resource has remained virtually unchanged its form and/or design and/or function can be totally discerned from the material evidence;

[ii.] *Minor Modification*, where the resource has been modified or deteriorated cosmetically and/or in a manner that does not inhibit the discernment of its form and/or design and/or function by archaeological interpretation of the material evidence;

[iii.] *Material Modification*, where the resource has been modified so that its form and/or design and/or function cannot be discerned only by archaeological interpretation and without reference to external sources;

[iv.] *Major Modification*, where the resource has been so modified that attempted discernment of its form and/or design and/or function cannot be achieved by archaeological interpretation of the material evidence and requires a heavy reliance on external sources and in circumstances where discernment one or more elements may be equivocal;

[v.] *None*, where the integrity of the resource has been completely destroyed and the evidence for its form and/or design and/or function is totally external.

It should be noted that where the resource is wholly archaeological, that is entirely sub-surface, integrity cannot reasonably be assessed prior to excavation.

3.3 ASSESSMENT OF HERITAGE IMPACT

Generally, a statement of heritage impact (SOHI) is prepared to assist in the review and approval process when there is a perception that a proposed project could impact upon the heritage values of an item or site. The purpose of a SOHI is to explain how the heritage value of an item might be affected by the proposal. Impact may be positive when an item is to be conserved or enhanced, or impact may be detrimental if the site is to be disturbed or destroyed.

A preliminary assessment of heritage impact seeks to identify whether the disturbance or destruction of an item or site could reasonably be expected to result in a negative impact to assessed heritage values. It then identifies any requirement for additional information in order to inform a more detailed SOHI to further address the guidelines of the NSW Heritage Manual in reference to specific project plans.

The accepted guidelines specify that the following statements are addressed in a SOHI in response to a proposed project:

- *The following aspects of the proposal respect or enhance the heritage significance of the study area for the following reasons.*

- *The following aspects of the proposal could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts.*

- *The following sympathetic solutions have been considered and discounted for the following reasons.*

4.0 INVENTORY SEARCHES

Heritage registers and inventories are lists of identified items of heritage significance. These registers may provide information on comparative sites that can be used to assist in the evaluation of the relative significance of the site.

Registers and inventories relevant to this study are:

- Bogan Local Environmental Plan 2011
- State Heritage Register and State Heritage Inventory; and
- The Australian Heritage Database.

A summary of inventory search results for the Avoca Tank Study Area is provided in **Table 4.1**.

Table 4.1 - Summary of Inventory Search Results for the Avoca Tank Study Area

Heritage Register	Listed	Assessed Significance
State Heritage Register	No	NA
State Heritage Inventory	No	NA
Bogan LEP 2011	No	NA
Australian Heritage Database	No	NA

Searches for each Register using the Bogan Local Government Area as a criterion reveals a number of sites within the Bogan Shire. All but one of these sites is near Nyngan. None of these sites are within the Girilambone region and the Avoca Tank Study Area. The results of these inventories searches are included at **Appendix 2.**

4.1.1 State Heritage Register and State Heritage Inventory

The State Heritage Register (SHR) is managed by the NSW Heritage Council and comprises a list of heritage items of particular importance to the people of NSW. Items appearing on the SHR are considered significant to the State and are afforded statutory protection.

The State Heritage Inventory (SHI) is a listing of heritage items within NSW and is also managed by the NSW Heritage Council. It comprises a database of heritage items listed by Local Government and State Agencies across NSW as the result of heritage studies. Items listed on the SHI are considered locally significant and subject to protection through local government processes.

A search of the SHR and SHI showed that there are no heritage listed sites near Girilambone or close to the Avoca Tank Study Area. A wider search of the SHR and SHI for the Bogan Shire returned a number of listed heritage sites, all of which were located near Nyngan and some considerable distance from the Study Area.

4.1.2 Bogan Local Environmental Plan 2011

Local environmental plans (LEPs) provide a framework for development controls in their local area. Heritage schedules within an LEP provide for the identification and protection of heritage items.

Clause 5.10 (1) of the Bogan Valley LEP 2011 provides objectives for Heritage Conservation as:

(a) to conserve the environmental heritage of Bogan,
(b) to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,
(c) to conserve archaeological sites,
(d) to conserve Aboriginal objects and Aboriginal places of heritage significance.

A search of the Schedule 5 of the Bogan LEP 2011 shows four heritage items listed for the Nyngan area and none of which are near Girilambone or close to the Avoca Tank Study Area. These places are also listed on the SHR and SHI.

4.1.3 The Australian Heritage Database

The Australian Heritage Council is an independent agency within the Department of the Environment. The Council is the principal adviser to the Australian Government on heritage matters. The Council assesses nominations for the National Heritage List, and the Commonwealth Heritage List. The Council is responsible for the Australian Heritage Places Inventory (AHPI) and the Australian Heritage Database (AHD) both of which are non-statutory archives.

A search of the Australian Heritage Database for the Bogan Shire LGA shows 5 heritage places, all of which are listed on Register of the National Estate (non-statutory archive). Full listing details are provided at **Appendix 2**. None of these listed places are near Girilambone or close to the Avoca Tank Study Area.

5.0 SURVEY METHODOLOGY AND RESULTS

5.1 SURVEY METHODOLOGY

The desktop investigations conducted for Stage 1 of the methodology (described in **Section 1.3**) did not identify any particular areas of historical activity or target areas for investigation. The historic heritage survey was therefore conducted in conjunction with the Aboriginal heritage survey to provide coverage across the survey area.

The survey strategies for the Stage 1 and Stage 2 Study Areas was designed with consideration to the potential disturbance of the exploratory drilling program. The drill lines formed the basis for the survey transects which were extended towards the boundaries of the Study Area to achieve greater coverage over the Study Area. The location of transects conducted across Study Area and the Proposed Disturbance Footprint are shown in **Figure 5.1.**

A pedestrian archaeological survey of the Avoca Tank Study Area (Stage 1) was conducted between 26 and 30 April 2012 by On Site Cultural Heritage Management Principal Heritage Consultant / Archaeologist, Gerard Niemoeller and Assistant Archaeologist Craig Reid.

A pedestrian archaeological survey of the Avoca Tank Study Area (Stage 2) was conducted between 29 October and 2 November 2012 by On Site Cultural Heritage Management Principal Heritage Consultant / Archaeologist Gerard Niemoeller and Assistant Archaeologist Kate Duca.

Representatives of the Nyngan Local Aboriginal Land Council and Bogan Aboriginal Corporation also participated in the entire archaeological survey and were present during the recording of all sites. Representatives were:

Sheila Couley – Chair, Nyngan Local Aboriginal Land Council
Lesly Ryan – CEO, Bogan Aboriginal Corporation
Deputy Chair, Nyngan Local Aboriginal Land Council

Neville Merritt of the Ngemba/Ngiyampaa Native Title claim group also participated in the fieldwork for the Stage 2 survey.

At least one but usually 2 to 3 representatives of Tritton/Straits participated and assisted in the survey every day over these survey periods.

The survey consisted of a series of transects north south along the proposed drill lines, spaced approximately 200 metres apart. Survey participants were spaced approximately 10 to 20 metres apart providing good survey coverage along each of the drill lines across the Avoca Tank project area. Each participant was therefore able to survey approximately 20 metres in width and allowing survey of approximately 100 metres in width per transect.

Transects were generally in straight lines along the drill lines but particular attention was also afforded to interesting features within the landscape such as prominent clearings or exposures, gravel lags or concentrations, deflations or other areas of erosion, large trees potentially bearing scars. This sometimes resulted in a meandering transect.

5.2 RESULTS

The total length of all survey transects walked across the Avoca Tank Study Area (Stages 1 and 2 (18.62km^2) was 63.5 kms. Based on the 100 metres wide survey transect it is estimated that 6.35km^2, or 34.1% of the 18.62 km^2 Avoca Tank Study Area was surveyed during the Stage 1 and 2 investigations.

A total of 4 transects conducted as part of the Stage 1 study traversed the Proposed Disturbance Footprint. Based on the 100 metres wide survey transect it is calculated that the Stage 1 transects covered approx 221,900m^2 (0.222km^2 or 66%) of the 0.336 km^2 Proposed Disturbance Footprint. Survey coverage of the Study Area is shown in **Figure 5.1.**

A total of three historic sites were recorded during this survey. None of these sites are within the Proposed Disturbance Footprint and will not be impacted upon by the proposal. Summary details of these sites is provided in **Table 5.1** and their location is shown in **Figure 5.2.**

Table 5.1: Summary details for historic sites recorded during this survey. Datum is GDA 94. Grid references recorded by On Site CHM.

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

Figure 5.1: Pedestrian survey transects by On Site CHM. Stage 1 Study Area survey transects shown in yellow, Stage 2 shown in green. Red dots show previously recorded AHIMS Sites. Current Project Site Boundary shown in red and Proposed Disturbance Footprint shown in light blue. Orange line west of Mitchell Highway is power easement.

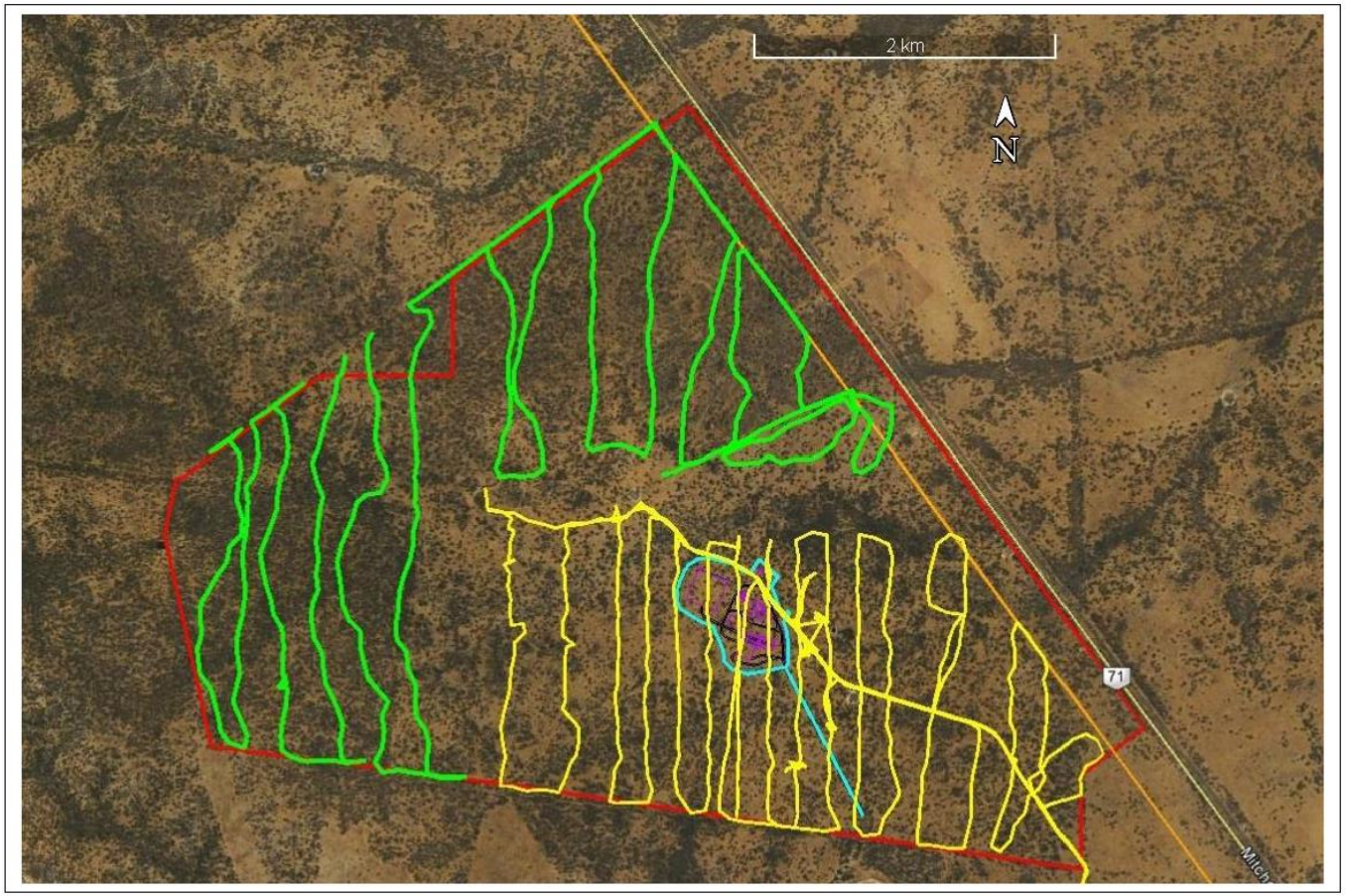
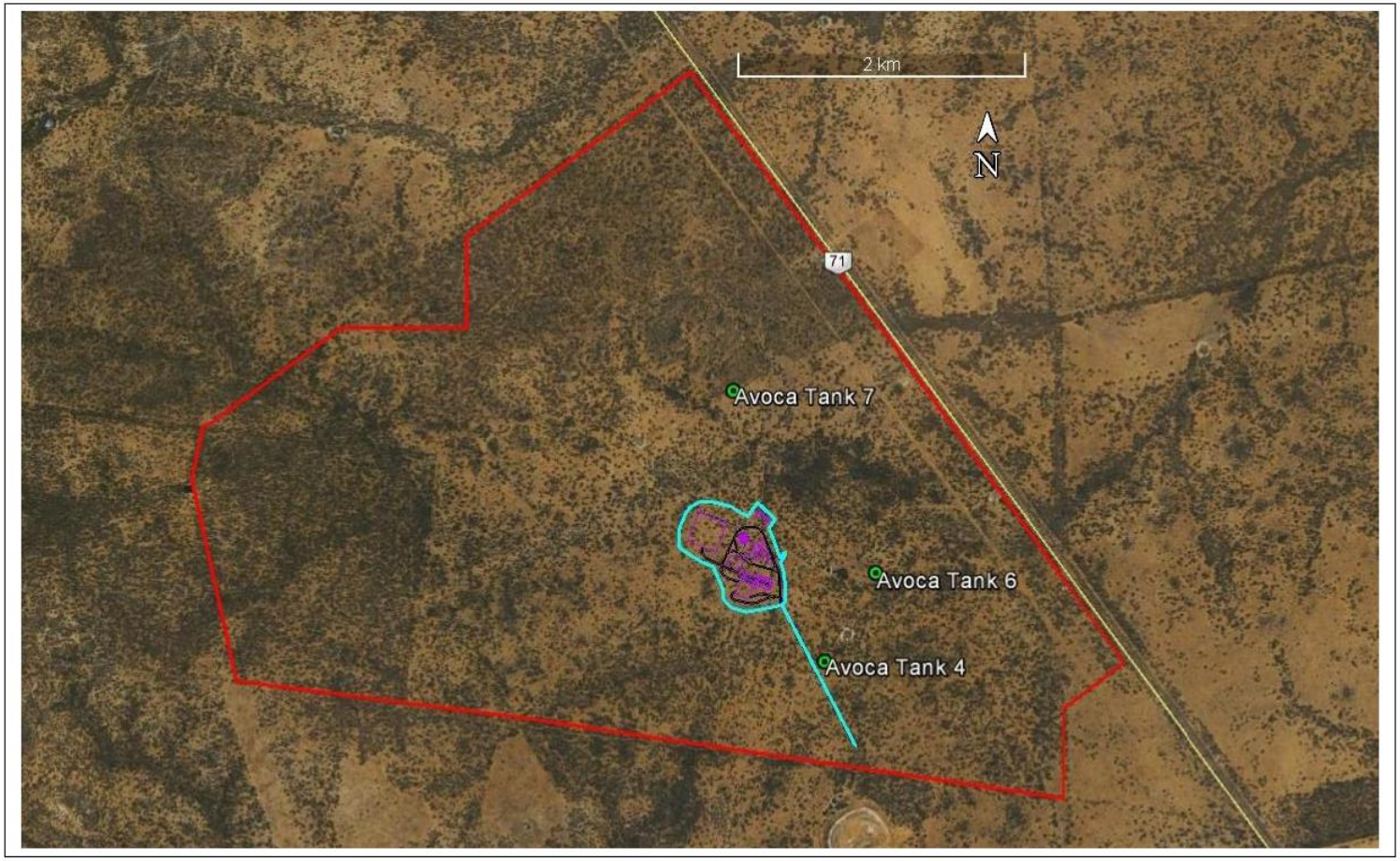


Figure 5.2: Historic sites recorded within the Avoca Tank Project Site by On Site CHM (green dots). Project Site Boundary shown in red and Proposed Disturbance Footprint shown in light blue.



5.3 SITE DESCRIPTIONS

5.3.1 *Avoca Tank 4*

Grid Reference: *55 485027 E, 6547775 N (GDA 94)*
Site Type: *Historic scar tree, Aboriginal stockmen's camp and dam*

Site Description:
The site is located at a low point within a wide grassy plain and consists of two small waterholes at the end of an ephemeral drainage line. The western water hole is a natural soak and at a low point in landscape. The eastern waterhole appears to be either entirely man made or heavily modified soak evidence by the spoil heaps around the northern, eastern and southern boundary of the waterhole.

Some additional historic material also occurs in association with the waterhole. A small white earthenware ceramic jar base and three small blackened rocks which may have been used as part of a campfire (see Plates 5.5 and 5.6) were located between the waterholes and amongst a group of trees occur. Five burnt nodules across an area of 2 square metres, indicating a potential hearth, were located approximately 10 metres to the north east of the scar tree

An iron strip wedge was also located 1.5 metres north west from the base of the scar tree. The iron strip measured 250mm Long x 40mm wide and 15mm thick tapering to a thin edge at one end. The function or origin of this "wedge" is unclear but the general form, tapered edge and association with the scar tree suggest that it may have been used in the extraction of the bark from the tree. An alternative explanation of the iron strip is use for locking cart wheels in place. An historic flattened tin can was also found nearby. The area does not show any intensive use or particular features that may indicate repeated use or excavation potential.

Scar Tree:
A large dead tree bearing a scar occurs on the north west margin of the eastern soak. The scar is 2.1 metres long and extends around 81% of the trunk. The bottom of the scar begins 40 cm from the ground and extends up the tree to approximately 2.5 metres above the ground. An epicormic or subsidiary stem extends from the base of the scar. Recorded attributes for the scar and tree are provided below.

Scar Length	210 cm
Scar circumference around tree at midpoint of scar	112 cm
Circumference of tree at midpoint of scar	138 cm
Scar Depth (min and maximum)	30mm, 60mm

The tree has been ring barked and displays several isolated and distinct axe marks above the ring barking and on remaining dead bark (xylem) running the length of the scar. These marks were made by a sharp, straight and even edge, characteristics more distinctive of a steel axe.

No tool marks are visible on the scar and it is therefore difficult to discern whether this scar was produced using a stone or steel axe. It is also difficult to discern whether the removal of bark and the ring barking of the host tree are related.

The size and shape of the removed bark, a large rectangle, suggests use for a temporary shelter. The steel axe marks on the tree and presence of several historic artefacts suggest that the scar was probably produced in historic times. The absence of stone tools or other pre-contact Aboriginal occupation materials does not refute a historical date.

Aboriginal community members present suggested that the evidence represented the remains of an Aboriginal stockmen's camp. Aboriginal people were widely employed in the region during the 1900s to ring bark trees and clear land. Certainly some large dead ring barked trees were noted across the Study Area.

Heritage Assessment:

The waterholes and surrounding area is heavily vegetated and grassed and does not appear subject to the erosion that covers much of the survey area. The scar tree is dead, degrading and in relatively poor condition. The Stockman's Camp was likely to have been occupied for a short period and is not considered to have any archaeological subsurface potential of significance. This site was also assessed as part of the Aboriginal Cultural Heritage Assessment (On Site CHM 2014) and was considered to moderate level of cultural significance. The scar tree has moderate to high rarity values and significance to the Aboriginal community members. The Aboriginal Stockmen's camp also has historical, social and aesthetic values to Aboriginal community members.

This site is considered significant at the **local level.**

Statement of Heritage Impact:

Avoca Tank 4 is approximately 480 metres south east of the Proposed Disturbance Footprint and will therefore not be directly impacted by the Proposal. The site is however approximately 60 metres east of the proposed haul road and therefore has the potential to be accidentally disturbed through ancillary activities.

To protect this site during the development and operation of the Proposal it is recommended that the proponent:

- Cordon off the site to prevent accidental disturbance through entry by any vehicles or unauthorised persons.
- Inform Tritton personnel of the location and designate this area is a "no go zone".
- Develop appropriate management strategies to ensure the long term conservation of this site.

More detailed discussion about the development of management strategies for this site was included in the Aboriginal Cultural Heritage Assessment (On Site CHM 2014).

Avoca Tank 4

Plate 5.3 (above)
Waterhole with scar tree at left

Plate 5.4 (right)
Scar tree located at dam

Plate 5.5 (above)
Tapered iron strip (wedge) located near scar tree.

Plate 5.6 (right)
Camping location between waterholes. Pink flags show ceramic jar in foreground and blackened rocks in background.

Plate 5.7 (below)
Ceramic jar

5.3.2 *Avoca Tank 6*

Grid Reference: *55 485381 E, 6548386 N*
Site Type: *Historic glass fragment*

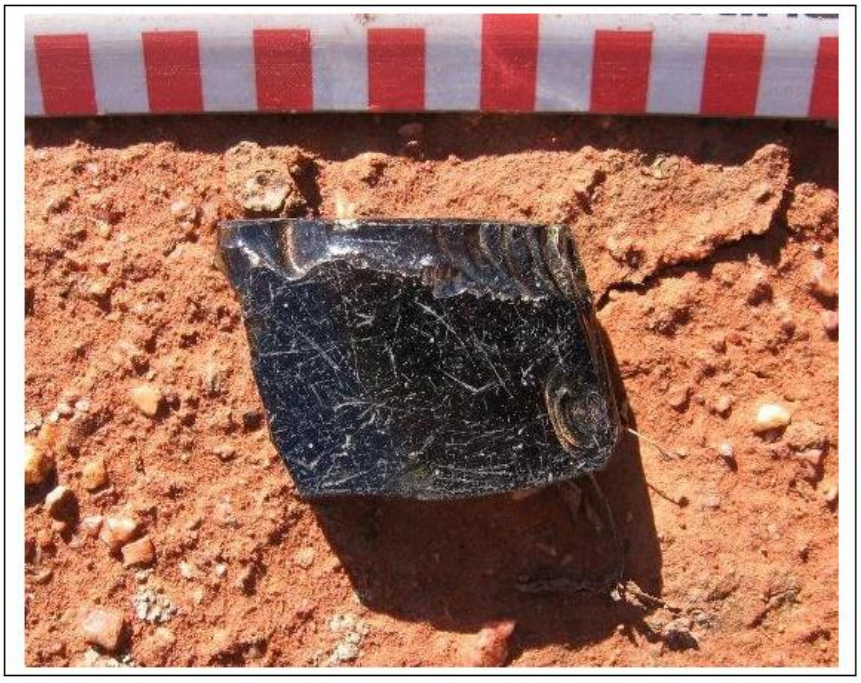
Site Description:
Isolated piece of thick green bottle glass (30 x 22 x 5mm) circa 1900. An extensive search of the surrounding area (100 metres) failed to locate any additional historic material.

Heritage Assessment
The historic fragment is likely to result from historical pastoral activities across the Study Area. The isolated fragment can add little information about these activities and fragments of historic glass cannot be considered unusual or rare across regional NSW. This site is considered to have a low level of significance.

Statement of Heritage Impact:
The locality is approximately 600 metres east of the Proposed Disturbance Footprint and will therefore not be impacted upon by the Proposal.

To protect this site during the development and operation of the Proposal it is recommended that the proponent include information within any induction about the presence and treatment of historic artefacts within the Project Site. Historic artefacts should not be disturbed and their location should be reported.

Plate 5.8 (below) Isolated piece of thick green bottle glass



5.3.3 *Avoca Tank 7*

Grid Reference: *55 484392 E, 6549640N (GDA 94)*
Site Type: *Historic glass bottle*

Site Description:
Site consists of a near complete brown glass bottle with minor damage to the lip. The bottle was located within an open flat woodland area displaying high density of quartz gravels. Observation across the study area suggests that areas with high density of quartz gravels are generally more open than areas without quartz gravels.

The bottle displays Embossed lettering is displayed on the base, around the sides of the base and shoulder of the bottle. THIS BOTTLE IS THE PROPERTY OF is embossed around the shoulder and THE N.S.W BOTTLE COMPANY PTY LTD is embossed around the sides at the base. A date of 1939 is embossed on the base.

An extensive search surrounding area (100 metres) failed to locate any additional historic occupation material indicating that bottle deposition / discard was likely part of an isolated event.

Heritage Assessment
The historic bottle is likely to result from historical pastoral activities across the Study Area. The bottle can add little information about these activities and historic bottles from this period cannot be considered unusual or rare across regional NSW. This site is considered to have a low level of significance.

Statement of Heritage Impact:
The locality is approximately 700 metres north of the Proposed Disturbance Footprint and will therefore not be impacted upon by the Proposal.

To protect this site during the development and operation of the Proposal it is recommended that the proponent include information within any induction about the presence and treatment of historic artefacts within the Project Site. Historic artefacts should not be disturbed and their location should be reported.

Plate 5.9 (above)
Brown glass beer bottle with THIS BOTTLE IS THE PROPERTY OF embossed around shoulder and THE N.S.W BOTTLE COMPANY PTY LTD is embossed around sides at the base

Plate 5.10 (left)
Bottle base showing embossed date of 1939.

6.0 HERITAGE MANAGEMENT

6.1 OVERVIEW OF STUDY RESULTS AND DISCUSSION

The desktop research into the Study Area identified that the subject land were part of the Bogan Gold Fields. It was therefore considered likely that the Study Area was not only used for grazing purposes, but also for mining or at the very least mineral prospecting. However, neither the research nor the survey of the Study Area identify any localities or definitive evidence of mining activity. This study has identified a total of three heritage places within the Avoca Tank Study Area and all of these items are considered to result from pastoral activity.

Avoca Tank 4 has been interpreted as an Aboriginal stockman's camp and it is quite probable that the isolated glass artefacts at Avoca Tank 6 and 7 were also deposited by Aboriginal stockmen, although this remains conjecture. This study has shown that historic heritage sites and artefacts are sparsely distributed across the Study Area and no foci points of historic activity were located. From this perspective the historic potential of the study area to contain further historic sites and artefacts, is considered to be low.

Avoca Tank 4 has been assessed as significant at the local level. Avoca Tank 6 and 7 being isolated glass artefacts are considered to have a low level of significance. None of these places and items will be impacted upon by the Proposal.

6.2 HERITAGE MANAGEMENT OVERVIEW

There are three important principles to consider in regard to the management of heritage within a planning process:

1. The legislative obligations under NSW law to take appropriate action to manage heritage items.

2. Heritage significance is based on established assessment criteria. If the value of a heritage item is not clear, a precautionary approach should be adopted until a definitive assessment can be made.

3. Management of an item should be based on the significance of the item and practical realities for its conservation. Management does not preclude adaptive reuse or the installation of modern facilities. It does not preclude demolition where there is no feasible alternative.

6.3 STATUTORY CONSIDERATIONS

The *NSW Heritage Act 1977* (Section 4) defines "environmental heritage" to mean those places, buildings, works, relics, moveable objects, and precincts, of historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value that are assessed as significant to the State of New South Wales, significant within the local area. Ideally, significant heritage resources should remain undisturbed and be conserved *in situ* within the framework of the Burra Charter.

In this instance none of the identified places (Avoca Tank 4, 6 and 7) will be impacted upon by the Proposal and are able to be conserved.

Avoca Tank 4 has been assessed as significant at the local level, may contain relics and is considered subject to the provisions of the *NSW Heritage Act 1977.* This site was also identified in the Aboriginal Cultural Heritage Assessment (On Site CHM 2014) and is being managed under the *NSW National Parks and Wildlife Act.* Given the site will not be disturbed by the Proposal however the relics provision (s139) will not be triggered and no approvals will be required.

6.4 HERITAGE MANAGEMENT RECOMMENDATIONS

Recommendations for each individual site were made in **Section 5.0** and a summary of individual site recommendations is provided below in **Table 6.1.**

This study has been undertaken with a focus upon the elimination and/or reduction of negative impact upon any archaeological and/or heritage values need for additional detailed study and the potential for triggering the relic's provisions of the *NSW Heritage Act 1977:*

> *(NB: it is an offence under Section 139 of the Heritage Act (NSW) to disturb or excavate any land knowing or having reasonable cause to suspect that activity will result in a relic being discovered, exposed, moved, damaged or destroyed with the prior consent of the Heritage Council of NSW. If any historical relics are found during the course of development, excavation work should cease immediately and advice should be sought as to whether an approval under Section 140 of the Heritage Act 1977 (NSW) prior to work recommencing.)*

The objective of management recommendations is to provide a reasonable, balanced and precautionary approach that will appropriately address the potential for the exposure of archaeological resources (relics), and to trigger a due diligence heritage management response as a consequence of the Proposal.

In this instance the potential for the exposure of archaeological resources (relics) is considered to be low. The application of statutory considerations to the Proposal, with

reference to the definitions contained in Section 4 of the *NSW Heritage Act 1977* is considered below:

1. The proponent should consider preparing a due diligence heritage management response strategy to respond the possibility of exposing relics during earthworks or locating further items within the Project Site. As well as detailing response protocols, the strategy should include information to be transmitted to site personnel as part of any inductions so they are aware of the possibility and protocols.

2. Due diligence heritage management and the *NSW Heritage Act 1977* requires that if unexpected **relics** are exposed during any project works, that work is suspended and appropriate heritage personnel consider the need to inform the Heritage Branch of the NSW Office of Environment and Heritage. In this case, additional archaeological assessment and approvals may be required.

Table 6.1. Summary table for identified historic sites within Avoca Tank Project Site, assessed significance, impacts and recommendations

Site Name	Site Features	Cultural Significance	Impacts of Proposed Disturbance	Summary of mitigation strategy
Avoca Tank 4	Historic Scar Tree and Aboriginal Stockman's camp	Moderate / Local Significance	None	Upgrade existing fencing. Develop and implement appropriate conservation management strategies and incorporate into relevant management systems and documents. Undertake specific conservation management planning to mitigate the risk of fire (See Aboriginal Cultural Heritage Assessment – On Site CHM 2014).
Avoca Tank 6	Historic glass fragment	Low	None	Location will be avoided. Develop and implement appropriate management strategies. Incorporate into relevant management systems and documents.
Avoca Tank 7	Historic glass bottle (1939)	Low	None	Location will be avoided. Develop and implement appropriate management strategies. Incorporate into relevant management systems and documents.

7.0 REFERENCES

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Historical Parish Maps

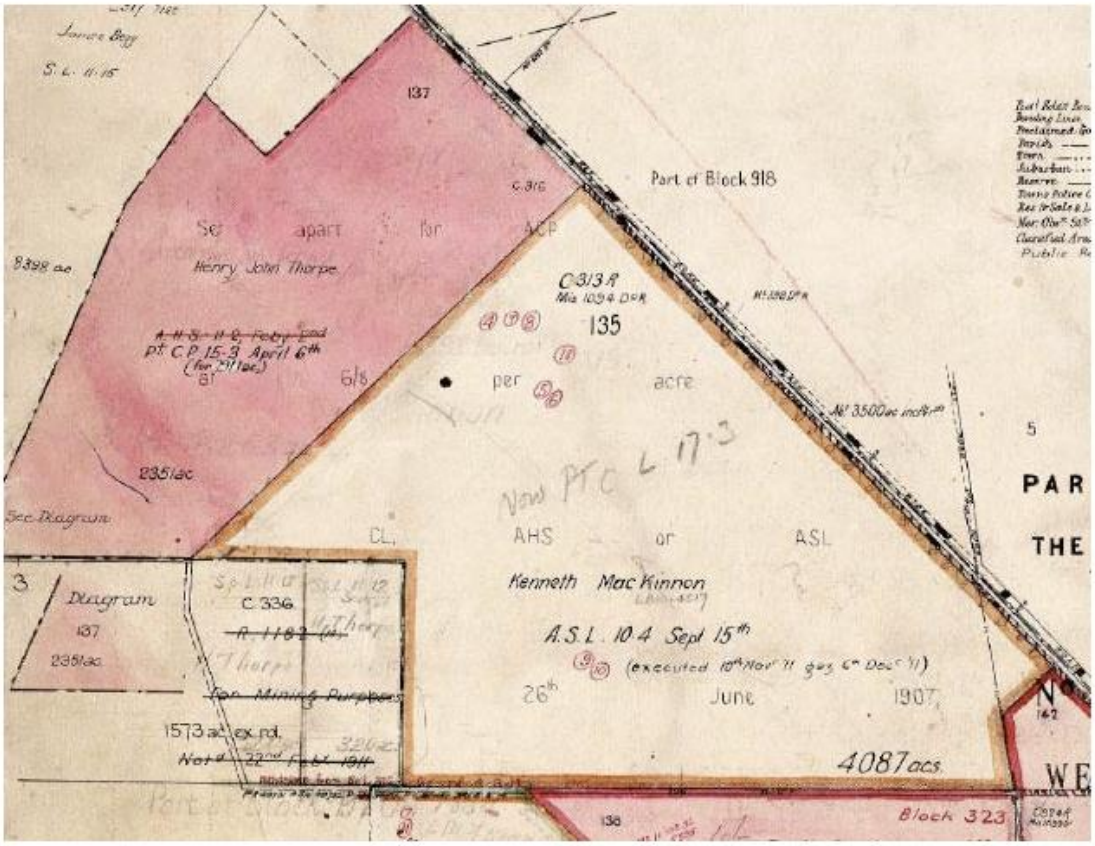
Parish of Gidalambone Maps: 1910, 1916 and 1937

Parish of The Brothers Maps: 1911, 1926 and 1957

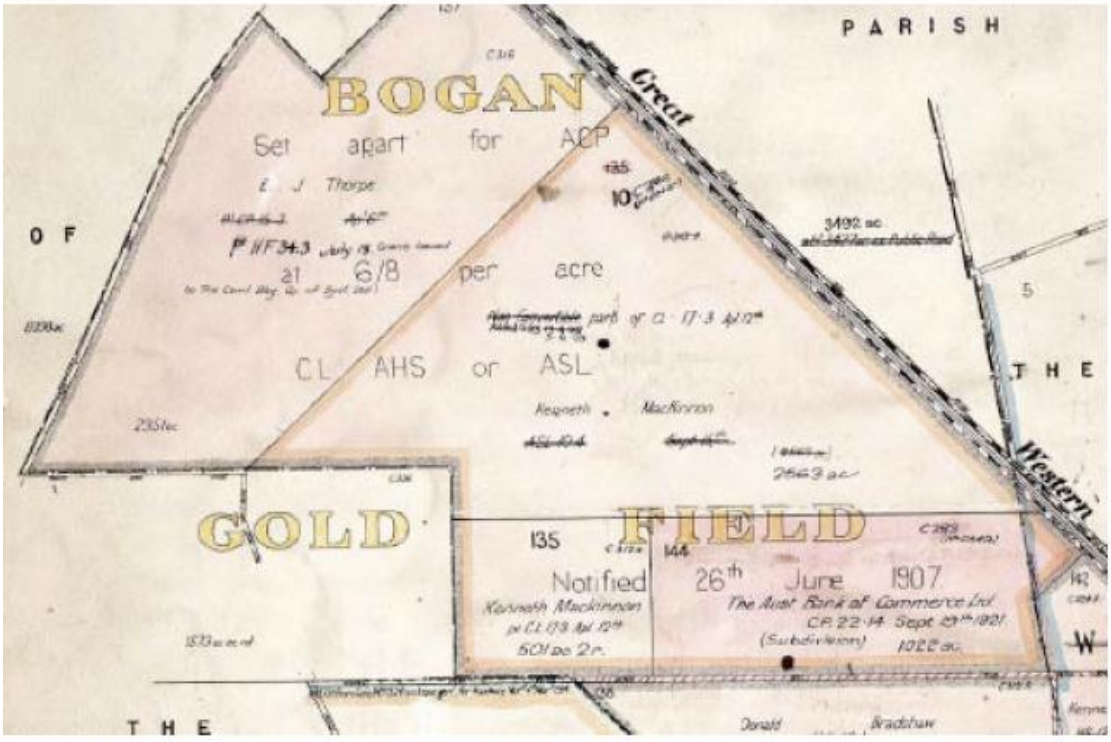
Parish of Gidalambone Parish Maps 2nd, 3rd and 4th Edition

APPENDIX 1

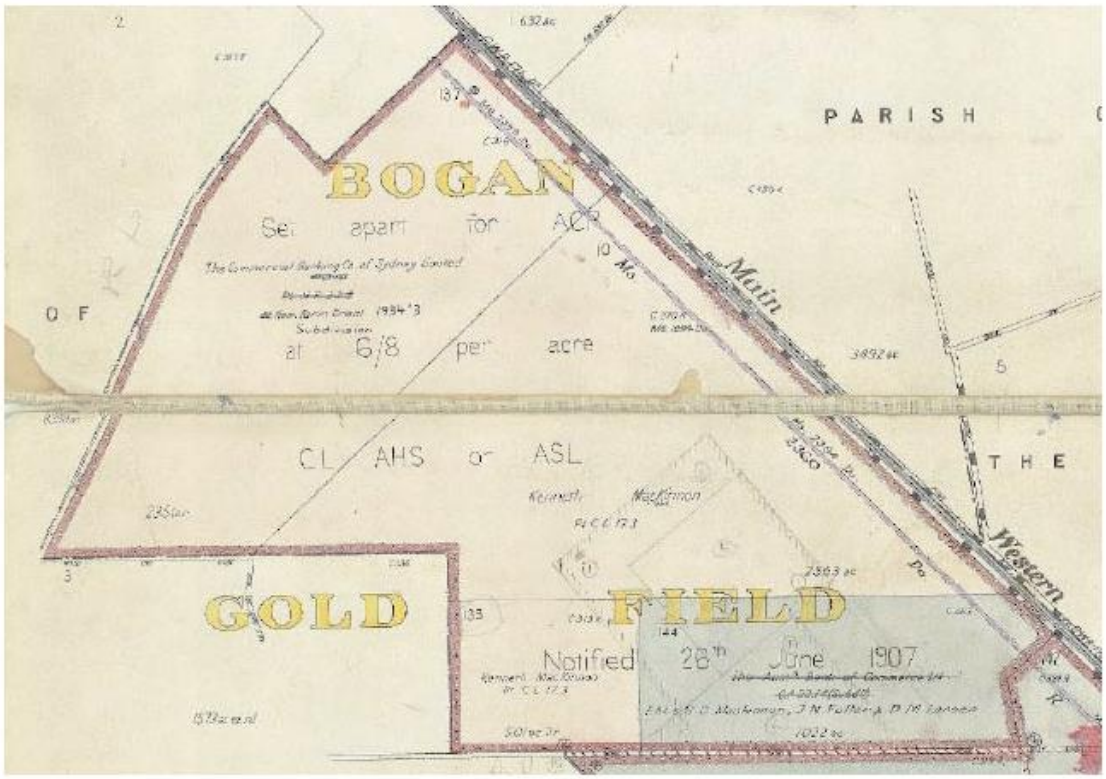
Appendix 1A: Parish of Gidalambone 1910 Map



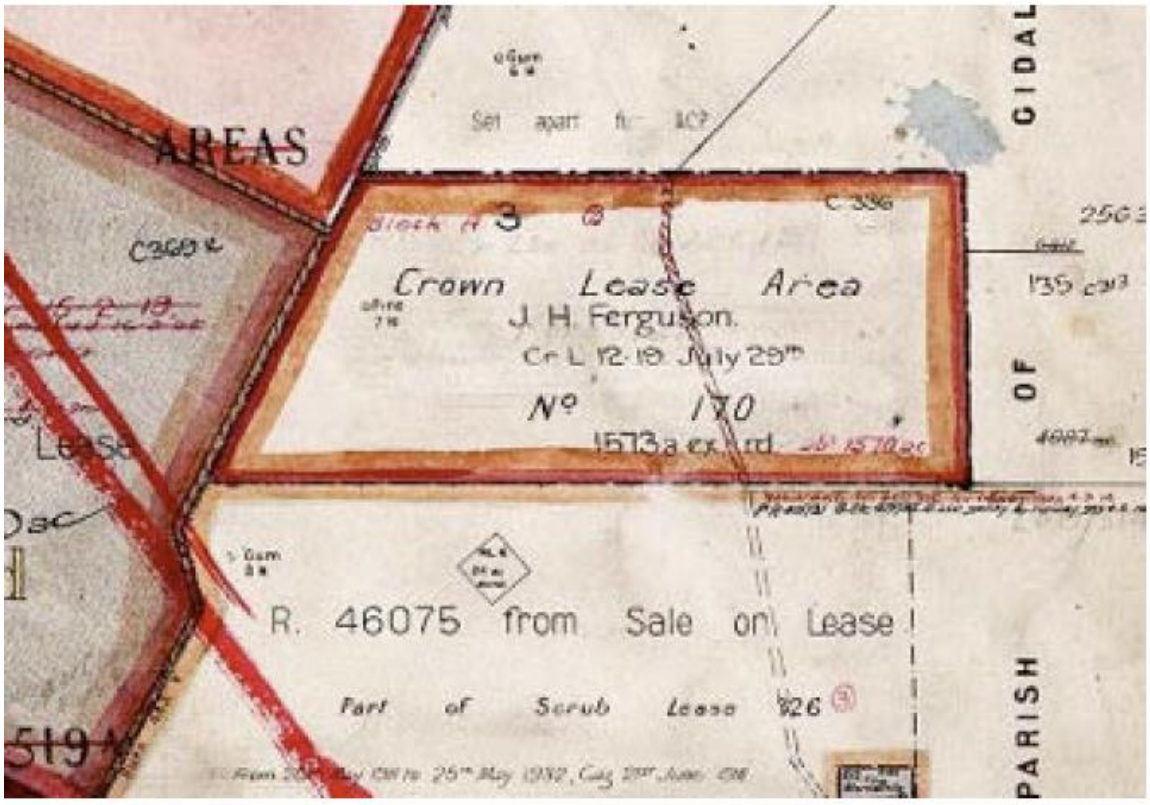
Appendix 1B: Parish of Gidalambone 1916 Map



Appendix 1C: Parish of Gidalambone 1937 Map

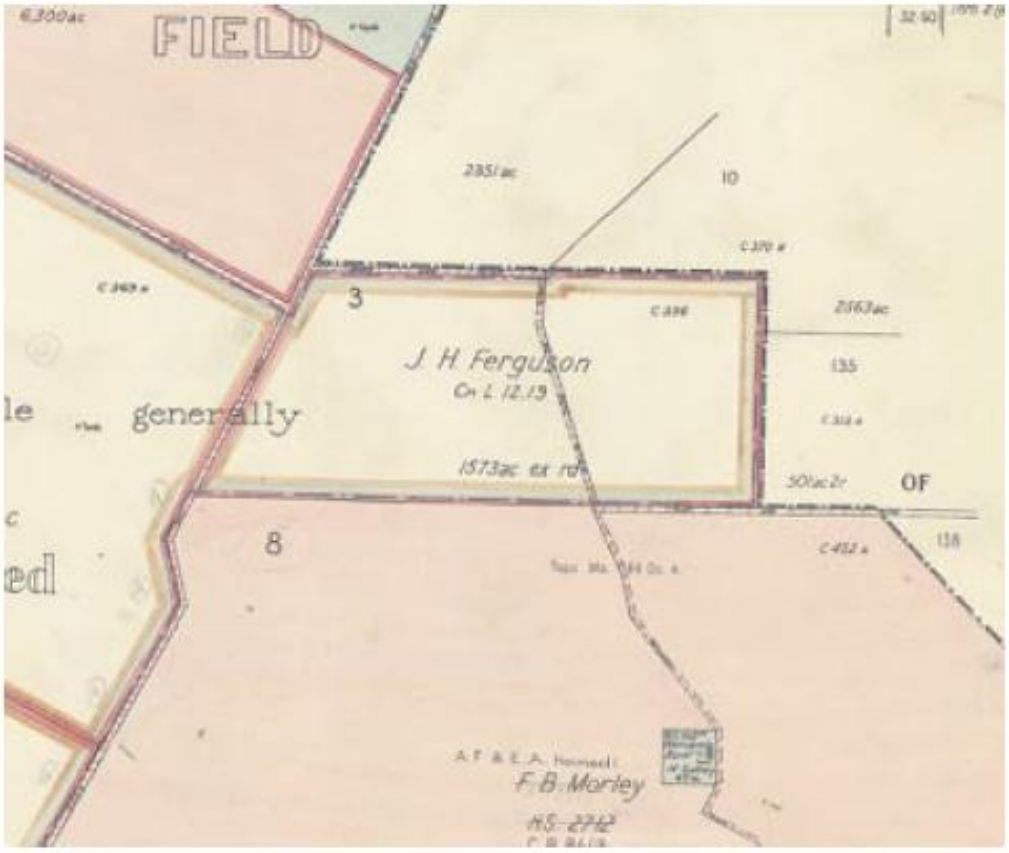


Appendix 1D: Parish Map of The Brothers 1911



Appendix 1E: Parish Map of The Brothers 1926

Appendix 1F: Parish Map of The Brothers 1957



APPENDIX 2

NSW GOVERNMENT Environment & Heritage

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Search for NSW heritage

Return to search page where you can refine/broaden your search. ItemName
0

Statutory listed items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into two sections.

- **Section 1**. contains items listed by the **heritage council** under the NSW Heritage Act. This includes listing on the state heritage register, an interim heritage order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Branch.
- **Section 2**. contains items listed by **local councils & shires and state government agencies**. This section may also contain additional information on some of the items listed in the first section.

Section 1. Items listed under the NSW Heritage Act.

Your search returned 2 records.

Item name	Address	Suburb	LGA	SHR
Chinese Graves and Burner at Nyngan Cemetery	Cemetery Road	Nyngan	Bogan	01783
Nyngan Court House	Cobar Street	Nyngan	Bogan	00797

ItemName 0

Section 2. Items listed by Local Government and State Agencies.

Your search returned 5 records.

Item name	Address	Suburb	LGA	Information source
Gongolgon Weir	Bogan River	Nyngan	Bogan	SGOV
Nyngan Courthouse	Cobar Street	Nyngan	Bogan	SGOV
Nyngan Railway Precinct	Pangee Street	Nyngan	Bogan	SGOV
Nyngan Railway Station	Pangee Street	Nyngan	Bogan	GAZ
Overhead footbridge & goods shed	Pangee Street	Nyngan	Bogan	GAZ

There was a total of 7 records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.
Note: The Heritage Branch seeks to keep the State Heritage Inventory (SHI) up to date, however the latest listings in Local and Regional Evironmental Plans (LEPs and REPs) may not yet be included. Always check with the relevant local council or shire for the most recent listings.

Search Results

5 results found.

Ballast Chert Quarry Barrier Hwy	Hermidale, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Belar Creek Myalls Nyngan - Brewarrina Rd	Nyngan, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Indigenous Place	Folkstone Station via Nyngan, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Indigenous Place	Nyngan, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Quanda Nature Reserve	Hermidale, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)

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