TRITTON RESOURCES PTY LTD

ABN 88 100 095 494

Modification Report

for the

Tritton Copper Mine

Modification 8

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

February 2022

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Prepared for:

Tritton Resources Pty Ltd
ABN: 88 100 095 494
Yarrandale Road
HERMIDALE NSW 2831

Telephone: (02) 6838 1100
Fax: (02) 6838 1101
Email: info@straits.com.au

Prepared by:

R.W. Corkery & Co. Pty. Limited
Geological & Environmental Consultants
ABN: 31 002 033 712

Brooklyn Office:
Level 1, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Telephone: (02) 9985 8511
Email: brooklyn@rwcorkery.com

Orange Office:
62 Hill Street
ORANGE NSW 2800

Telephone: (02) 6362 5411
Email: orange@rwcorkery.com

Brisbane Office:
Level 54, 111 Eagle Street
BRISBANE QLD 4000

Telephone: (07) 3205 5400
Email: brisbane@rwcorkery.com

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ACRONYMS

AHD	Australian Height Datum
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DA	Development Application
DPIE	NSW Department of Planning, Industry and Environment
DRG	Division of Resources and Geoscience
EA	Environmental Assessment
EIS	Environmental Impact Statement
EL	Exploration Licence
EPL	Environment Protection Licence
EP&A Act	*Environmental Planning & Assessment Act 1979*
EPA	Environment Protection Authority
ESD	Ecologically Sustainable Development
GDE	Groundwater Dependent Ecosystem
GHD	GHD Pty Ltd
LEP	Local Environmental Plan
MAC	Muller Acoustic Consulting Pty Ltd
MEG	Regional NSW Mining, Exploration and Geoscience
ML	Mining Lease
MOP	Mining Operations Plan
MPL	Mining Purpose Lease
Mtpa	Million tonnes per annum
NAF	non-acid forming
NP&W Act	*National Parks and Wildlife Act 1974*
PAF	potentially acid forming
POEO Act	*Protection of the Environment Operations Act 1997*
ROM Pad	Run-of-mine Pad
RWC	R.W. Corkery & Co. Pty Limited
SEPP	State Environmental Planning Policy
TSF	Tailings Storage Facility

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EXECUTIVE SUMMARY

This *Modification Report* has been prepared by R.W. Corkery & Co. Pty. Limited (RWC) on behalf of Tritton Resources Pty Ltd (the Applicant) who is seeking a modification to Development Application (DA) 41/98 for the Tritton Copper Mine (the Mine) to permit the following.

1. Underground mining of the Budgerygar deposit to access approximately 2.6 million tonnes of copper ore.
2. Installation of additional surface infrastructure to the north of the existing Mine Area noting that no additional surface disturbance would be required for this infrastructure.
3. A raise of approximately 10m to the existing approved Waste Rock Emplacement to account for waste rock expected to be generated.
4. The disposal of drill cuttings transported to the Mine from exploration tenements held by the Applicant and waste material removed / screened from milled ore prior to entering the flotation circuit of the processing plant.
5. An extension to the Mine life to allow for ongoing mining operations until 22 December 2028 which would effectively extend the existing approved Mine life by a further four years.

The proposed modification is being made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), as it is considered that the proposed modification would remain "substantially the same development" as the Project as last modified before transition to Part 4 of the Act (applications submitted by September 2018).

The Budgerygar deposit is located approximately 600m to the northeast of the Tritton deposit and forms part of the same stratigraphic package. Based on the current level of drilling, it is anticipated that a total resource of approximately 2.6Mt is present within the Budgerygar deposit. Mining of the Budgerygar deposit would be considered an extension of the existing underground mining operations, and no additional equipment, haulage trucks or surface disturbance would be required. The currently operating haulage routes and capacities would be able to support transportation of product from the Budgerygar deposit as there would be no increase to annual total extracted materials. An additional 100 heavy vehicle movements each year / two heavy vehicle movements per day is proposed to allow for the importation of drill cuttings from exploration tenements held by the Applicant.

The residual environmental impacts considered of greatest significance are summarised as follows.

Groundwater

Mining of the Budgerygar deposit would alter the groundwater setting of the Mine Site and potentially change aquifer conditions. This may influence the availability and quality of groundwater for current users including registered bores and groundwater dependent ecosystems.

It is noted that the existing operations of the Mine (to a depth of 1.3km below surface level) has not resulted in identifiable impacts (as indicated in groundwater monitoring).

An analytical groundwater assessment has conservatively predicted groundwater inflow to the new underground workings may result in groundwater drawdown in a radius of up to 4 440m. However, considering the remote location of the Mine Site, the significant distance to the nearest landholder bore (approximately 19.4km), the lack of GDEs in the vicinity and the chemical characteristics of the groundwater, the groundwater impacts as a result of the proposed modification are expected to be negligible.

Noise and Air Quality

Crushing and screening of ore and the construction of the waste rock emplacement would generate dust and noise. The height of the waste rock emplacement would be extended by a further 10m above the natural ground surface, potentially creating more wind-generated dust and noise from activities at a higher elevation. These activities would occur for a further four years compared to the existing approved activities.

Due to the isolated nature of the Mine Site, the fact that most mining operations would be undertaken using the same activities and methods as are currently approved and implemented, and the management and mitigations measures that would be implemented to control and potential noise and dust emissions, it is expected that noise and dust emissions from mining operations associated with the proposed modification would continue to be compliant with all relevant criteria.

Visual Amenity

The existing Waste Rock Emplacement would be extended by a further 10m above the natural ground surface from the existing approved elevation of 291.5m AHD to 301.5m AHD. The emplacement would be visible from vantage points on Yarrandale Road for vehicles travelling in both directions.

Based on the relative isolation of the Mine Site and the proposed visual amenity related controls, it is considered that the proposed modification to the Waste Rock Emplacement would not impact significantly on visual amenity. In addition, as all NAF waste rock stored in the Waste Rock Emplacement would be used for rehabilitation and final landform establishment at the time of Mine closure, the Waste Rock Emplacement would only be a temporary feature in the landscape with the final topography to be consistent with the pre-disturbance landform.

In light of the assessment presented throughout the *Modification Report*, it is concluded that the proposed modification to the Tritton Copper Mine could be implemented and operated in a manner that would satisfy all relevant statutory goals and criteria, environmental objectives and reasonable community expectations.

The proposed modification presents an opportunity to access a small but significant mineral deposit using existing infrastructure and mobile equipment. The ongoing operation of the Mine (to 2028) would have the following significant benefits to the local community within the Bogan Shire and NSW.

- Continued mining operations in a location that is separated from private residences and other sensitive and uses.
- The continued employment of 378 personnel (at end 2020), 88% of whom reside in the Bogan Local Government Area and contribute to the diversity and sustainability of the region.

- The continued distribution of the economic benefits of the Mine locally and regionally through the use of local services and businesses.
- The ongoing supply of copper to domestic and international markets that is consistent with the objectives identified in the *Critical Minerals and High-tech Metals Strategy* (Regional NSW, 2021). The copper supply is essential to support growing demand for electricity transmission (supporting the decarbonisation of the power grid) and use in electric vehicles and the renewable energy sector.

It is considered that changes to local amenity or the local experience of the mining operation would be difficult to discern from existing approved operations. It is therefore concluded that the proposed medication would firmly be in the public interest.

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1. INTRODUCTION

1.1 SCOPE

This *Modification Report* has been prepared by R.W. Corkery & Co. Pty. Limited (RWC) on behalf of Tritton Resources Pty Ltd (the Applicant) who is seeking a modification to Development Application (DA) 41/98 for the Tritton Copper Mine (the Mine) to permit the following.

1. Underground mining of the Budgerygar deposit to access approximately 2.6 million tonnes of copper ore. The deposit would be accessed via the existing underground operations at the Tritton Copper Mine, apply the same mining methods and would essentially comprise an extension of existing operations. The rate of underground mining at the Mine would not increase under the proposed modification.
2. Installation of the following surface infrastructure to the north of the existing Mine Area noting that no additional surface disturbance would be required for this infrastructure.
    a) Power supply (overhead or potentially from the existing operation).
    b) Exclusion fence.
    c) Polypipe line for water supply.
    d) Air line (service hole).
    e) Paste line from paste fill plant to ventilation rises.
3. A raise of approximately 10m to the existing approved Waste Rock Emplacement to account for waste rock expected to be generated. The final height of this emplacement would be 30m above the ground surface.
4. Disposal of the following materials within the Tailings Storage Facility (TSF).
    a) Drill cuttings transported to the Mine from exploration drilling activities undertaken within exploration tenements held by the Applicant.
    b) Waste material removed / screened from milled ore prior to entering the flotation circuit of the processing plant.
5. An extension to the Mine life to allow for ongoing mining operations until 22 December 2028 which would effectively extend the existing approved Mine life by a further four years.

In addition to DA 41/98, the Mine also operates in accordance with Mining Lease (ML) 1544, the *Mining Operations Plan for Tritton Copper Mine (ML1544)* (the approved MOP), Environment Protection Licence 11254 and various water access licences and bore licences. The Mine is located approximately 45km northeast of Nyngan and 22km southwest of Girilambone in western NSW. **Figure 1** provides an overview of the locality of the Mine Site and the surrounding mineral authorities.

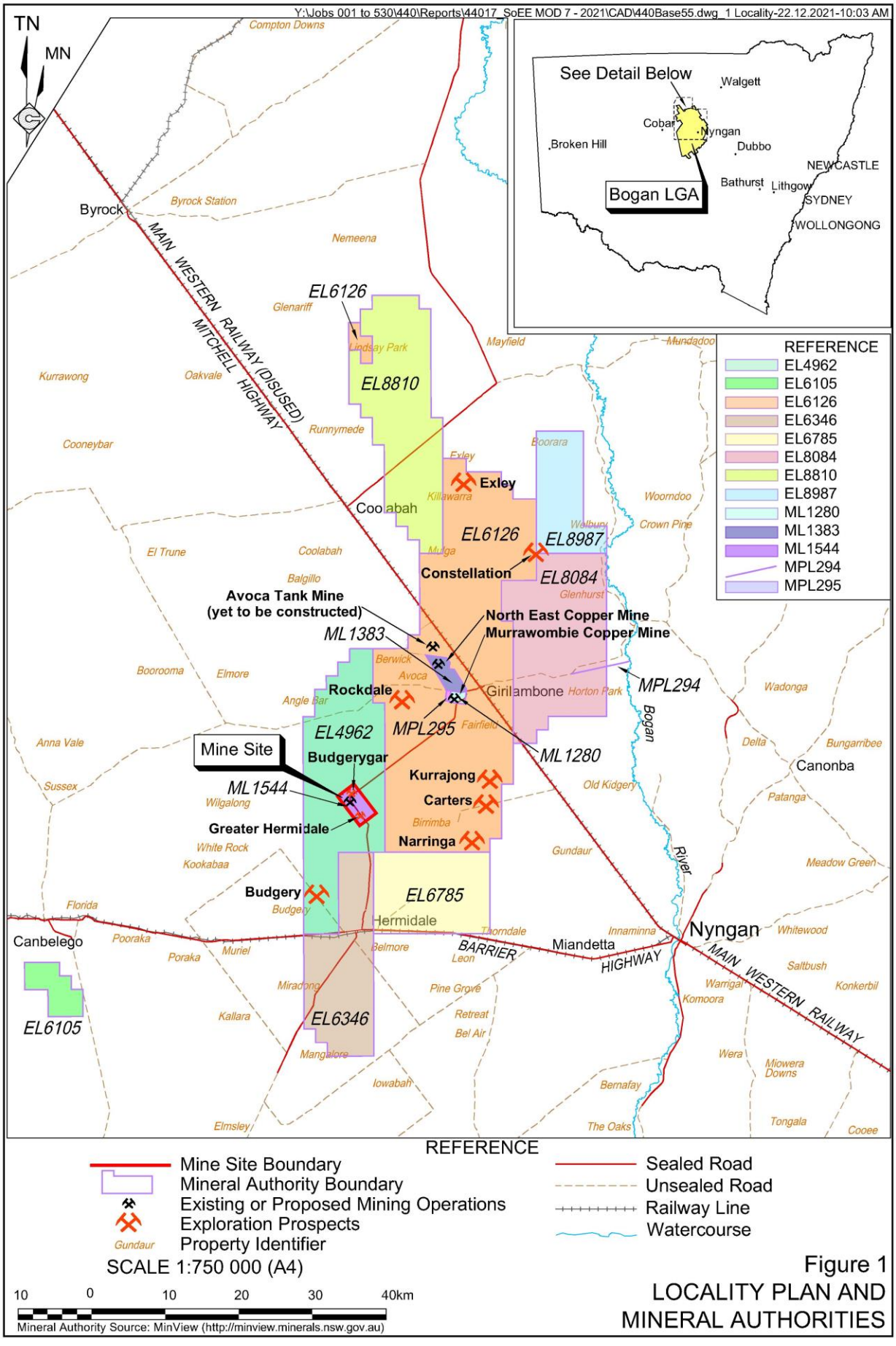


Figure 1
LOCALITY PLAN AND MINERAL AUTHORITIES

The proposed modification is being made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), as it is considered that the proposed modification would remain "substantially the same development" as the Project as last modified before transition to Part 4 of the Act (applications submitted by September 2018). Therefore, the modified consent as of January 2019 (following MOD6 for the export of tailings for paste fill operations at the Murrawombie Mine which met the cut-off date) is the Project against which the test for "substantially the same" is applied. An evaluation of the proposed modification under Section 4.55(2) of the EP&A Act is provided in Section 7.2. The consent authority for the modification application will be the Minister of Planning and Public Spaces (or their delegate).

The information contained in this document relates only to those components of the Mine that would be the subject of the proposed modification. Aspects of the Mine that would not be modified would continue to be undertaken in accordance with DA 41/98, as approved.

1.2 THE APPLICANT

The Applicant, Tritton Resources Pty Ltd, is a wholly owned subsidiary of Aeris Resources Limited (Aeris). The Applicant, through its associated companies, has operated the Tritton and Girilambone Copper Mines since 1992. Aeris is an established copper mining and exploration company listed on the Australian Securities Exchange. Aeris has two 100% owned operational assets, the Tritton Copper Operations in New South Wales, and the Cracow Gold Operations in Queensland. Aeris has an experienced Board and management team focused on operational excellence and strengthening the Company's corporate structure.

The Tritton Copper Operations produce approximately 25 000t of copper concentrate and copper cement annually. The operations incorporate multiple mines and a 1.8Mt per annum processing plant. Tritton Copper Operations also has a strong pipeline of development projects as well as advanced exploration projects.

As a major employer to the local community, Tritton Resources has continued to provide employment to the local community either directly, via engagement of local sub-contractors from Nyngan, Hermidale and Girilambone townships or by prioritising sourcing of required materials from local businesses.

Tritton Resources recorded a total workforce of 371 staff at Murrawombie Copper Mine and 296 staff at Tritton Copper Mine at year end 2021. Of the 378 staff, 88% are residential and contribute to the community of Nyngan whist 12% are staff that travel from elsewhere and reside locally during their rostered working period. Tritton Mines has been actively working towards increasing "local region" employment and believes this is one of the best ways the business can contribute to the community. Since 2012, employment within the local region has increased from 50% to 88%, and Tritton Mines is now contributing more than 50 million dollars each year in salary and wages to the local regions of Nyngan, Hermidale and Girilambone.

1.3 MINE SITE

The Mine Site is coincident with the area of ML 1544 and covers an area of approximately 1 400ha. The Mine Site comprises both freehold land and Crown land. Land ownership within and surrounding the Mine Site is described further in Section 2.2. The Mine Site is bisected by Yarrandale Road, the principal road between Girilambone and Hermidale.

Figure 2 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
- Surge Stockpile
- Non-acid Forming WRE
- Processing Plant
- Settling Pond
- Tailings Storage Facility
- Administration and Workshop
- Paste Fill Plant
- Process Water Ponds

Ore is mined from the existing underground operations, with waste rock used to backfill underground workings. Any excess non-acid-forming waste rock is placed at surface within the Waste Rock Emplacement. Ore is processed using flotation, with tailings discharged to the Tailings Storage Facility or used to produce paste fill that is pumped underground to support mining operations. Approximately 50% of tailings is used in paste fill production, reducing the space required in the 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 Road to the Hermidale rail siding. From the siding, the containers are transported by rail to Newcastle for export to China, India, Japan, Korea or the Philippines.

1.4 EXISTING MINING OPERATIONS

The Applicant controls several exploration licences and mining leases in the vicinity of the Mine Site. It operates the Murrawombie Copper Mine and has recently commenced the development of the Avoca Tank Mine. The North East Copper Mine is currently on care and maintenance.

While each of the Applicant's operations are distinct, they are interconnected, mainly through the use of processing facilities at the Mine Site. The Applicant is approved to receive up to 1 million tonnes of copper ore at the Mine Site each year that has been sourced from its other operations. The operations also share similar environmental settings and risks including geological and aquifer (groundwater) features that have resulted in similarities in management approach and experiences including for rehabilitation.

Approval for the Tritton Copper Mine was granted under DA 41/98 on 1 September 1999 by the then Minister for Planning and Urban Affairs. **Table 1** outlines the existing development approvals for the Mine.

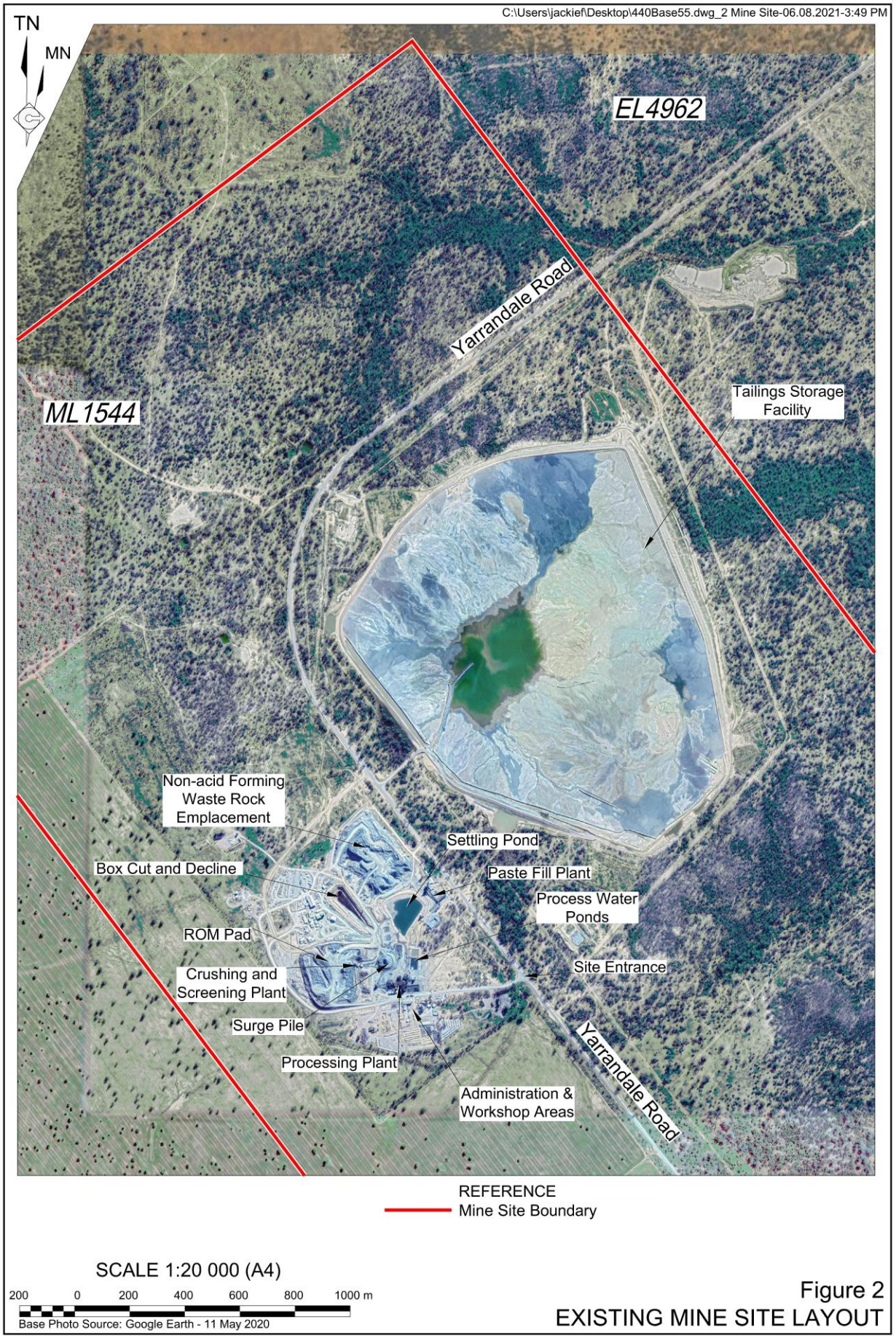


Figure 2
EXISTING MINE SITE LAYOUT

Table 1
Tritton Copper Mine Existing Development Approvals

Approval	DA Number	Grant Date	Expiry Date	Purpose of Approval
Development Consent	DA 41/98	01/09/1999	22/12/2024	Original Tritton Project Development Approval.
Development Consent	DA 30/2004	20/12/2004	29/12/2009	Construction of the Rail Loading Hardstand at the Hermidale Rail Siding for the export of copper concentrate.
Development Consent	DA 029/2007	25/05/2007	24/05/2012	Expansion of the administration facilities at Tritton.
Development Consent	DA 2010/006	25/05/2010	25/5/2015	Construction of a Paste fill Plant for the Tritton underground mine.
Development Consent	DA 2010/028	04/11/2010	4/11/2015	Construction of a Communication Tower at Tritton.
Development Consent	DA 10/2019/021/001	15/01/2020	15/01/2025	Construction and use of Water Pipeline
Development Consent	CDC2021/002	06/04/2021	06/04/2026	New Telecommunication Tower
Source: Tritton Resources Pty Ltd				

DA 41/98 has been modified seven times as follows. Approved dates are identified in parenthesis.

- MOD 1 (26 August 2004) – various minor amendments.
- MOD 2 (22 September 2005) – to permit modifications to concentrate transport operations between the Mine Site and the Hermidale rail siding.
- MOD 3 (12 June 2007) – to permit construction of the existing Non-acid Forming Waste Rock Emplacement and ancillary infrastructure.
- MOD 4 (19 December 2007) – to permit an increase in the throughput for the processing plant from 0.4Mtpa to 1.4Mtpa, as well as an enlarged Tailings Storage Facility and ancillary infrastructure.
- MOD 5 (7 April 2015) – to permit an increase in the height of the Waste Rock Emplacement, importation of ore material, and exportation of waste rock.
- MOD 6 (30 January 2019) – to permit the excavation and export of tailings from the Tailings Storage Facility (TSF) for use in the Paste Fill Plant at the Applicant's Murrawombie Copper Mine
- MOD 7 (12 October 2021) – to permit the construction of two ventilation rises to support underground exploration activities.

Other relevant leases and licences include the following.

- Environment Protection Licence (EPL) 11254.
- Various Water Access Licences and Bore Licences presented in **Table 2**.

Table 2
Water-Related Approvals for the Tritton Mine

Works Approval(s)	Details	Water Access Licence (WAL)	Share components (ML/year)	Water Sharing Plan
80WA716055	Excavation	WAL31041	304	Lachlan Fold Belt MDB Groundwater Source
80WA716044	1 bore, 1 excavation	WAL31090	30	Lachlan Fold Belt MDB Groundwater Source
80WA702816	2 pumps	WAL9374	705	Macquarie and Cudgegong Regulated Rivers Water Source
80WA702816	2 pumps	WAL9375	210	Macquarie and Cudgegong Regulated Rivers Water Source
80WA702816 and 80CA701324	2 pumps	WAL9940	16	Macquarie and Cudgegong Regulated Rivers Water Source

Activities approved under DA 41/98 include the following.

- Extraction of a total of approximately 10.23Mt of copper ore using underground mining techniques.
- Importation of no more than 1Mt of ore material in a calendar year for processing at the Mine.
- Construction and use of a Non-acid Forming Waste Rock Emplacement to a maximum height of 20m above the natural surface or approximately 291m AHD.
- Processing of on-site and imported ore to produce a copper concentrate.
- Construction and use of a Tailings Storage Facility.
- Export of no more than 30 000 tonnes of waste rock from the Mine in a calendar year, generally for the purposes of local road construction and maintenance.
- Transportation of the copper concentrate in shipping containers to the Hermidale rail siding, located approximately 19km to the south of the Tritton Copper Mine, and transportation of that material by train to port for export.
- Export of tailings for paste fill operations at the Murrawombie Mine.

Construction and use of a range of ancillary infrastructure including water management dams and two ventilation rises.

1.5 MANAGEMENT OF INVESTIGATIONS

The preparation of this document has involved a study team managed by Mr Nicholas Warren, M.Env.Sc., M.Bus, B.Sc. Principal Environmental Consultant with RWC, assisted by Mr Caiden O'Connor, B.Sc. (Geology), Senior Environmental Consultant and Mr Samuel Rosek, B.Sc., G.Dip.CB., Graduate Environmental Consultant both with RWC.

Information concerning the existing and proposed operations was provided by Mr Scott Ramsey, Mine Manager for the Tritton Mine and Mr Dean Woods, Senior Environmental Adviser for the Tritton Operations.

2. STRATEGIC CONTEXT

2.1 PROJECT NEED

Copper is identified in the *Critical Minerals and High-tech Metals Strategy* (Regional NSW, 2021) as a critical mineral that is vital for a range of future industries in NSW such as renewable energy, advanced manufacturing and technology enabled primary industries and defence and aerospace industries. Copper mining supports a significant proportion of mining activity and employment in regional NSW with approximately 902 000t of concentrate exported in 2020-21 (Regional NSW, 2021). The outlook for copper demand is strong and declining ore reserves in NSW are expected to increase the importance of copper supply in the coming decade (Regional NSW, 2021).

This regional trend is mirrored by strong demand for copper concentrate from the Tritton Copper Mine with between approximately 23 000tpa and 30 000tpa of concentrate produced since the 2013-2014 financial year. Concentrate produced at the Tritton Copper Mine is principally exported to China, India, Japan, Korea and the Philippines.

The operation of the Tritton Copper Mine results in significant benefits to the Applicant, its shareholders, and employees as well as the local community and State and Federal Governments. These benefits are underpinned by the ongoing employment of approximately 378 personnel at the Mine Site (88% of which reside in the region) and the flow-on effects from this employment and supplies and services purchased to support operations.

The activities included in the proposed modification would result in increased utilisation and recovery of a State-owned resource, increased capability for the Applicant to manage operations in the most cost effective and efficient manner possible, ongoing employment and increased certainty for the Applicant's employees, contractors, and suppliers, as well as those businesses and individuals that rely upon the flow on effects from the Applicant's overall operations.

2.2 GEOLOGY, EXPLORATION AND RESOURCE SIGNIFICANCE

The Budgerygar deposit is hosted within the Narrama Formation which is comprised of Ordovician turbidite sediments with lithologies varying from mudstones, siltstones, to fine-grained sandstone. Occasional basaltic sills intrude the turbidites peripheral to the Budgerygar deposit.

The Budgerygar deposit is located approximately 600m to the northeast of the Tritton deposit and forms part of the same stratigraphic package. An exploration and access decline has been developed from the Tritton decline at approximately 270m below the surface to provide a diamond drilling position and eventual access for production.

Resource drilling has been completed on a 40m x 40m spacing with a total of approximately 22 632m drilled from a total of 87 diamond drill holes with further infill drilling currently being completed. Based on current modelling, it is understood that mineralisation occurs as discrete lenses with a total of eight modelled sulphide lodes with higher grade mineralisation associated with more massive and banded zones. Surrounding these zones is a lower grade copper mineralisation association dominated by pyrite as stringer and disseminated textural zones. This mineralisation is analogous to the adjoining Tritton deposit.

Based on the current level of drilling, an indicated resource comprising 720kt @ 1.7% Cu has been modelled from 195m AHD (approximately 80m below ground level) to -40m AHD, with an inferred resource comprising 1 900kt @ 1.4% Cu modelled to -275m AHD. It is anticipated that a total resource of approximately 2.6Mt @ 1.5% Cu is hosted within the Budgerygar deposit based on the current understanding and exploration depth.

It is considered that the Budgerygar deposit comprises a significant copper resource given its size and location but especially as it is accessible from existing underground operations. Therefore, the proposed modification would not result in any significant changes to surface infrastructure. The Applicant would not need to adjust the current rate of processing at the Mine Site, indicating a 'business as usual' approach to operations above ground. Access to the resource would provide for an additional four years of mining beyond the approved Mine life which and would contribute to the ongoing supply of copper concentrate in NSW and internationally until 2028.

2.3 CENTRAL WEST LOCAL LAND SERVICES LOCAL STRATEGIC PLAN 2016-2021

The Central West Local Land Services *Local Strategic Plan 2016-2021* establishes broad goals for natural resource management in the region, including the following.

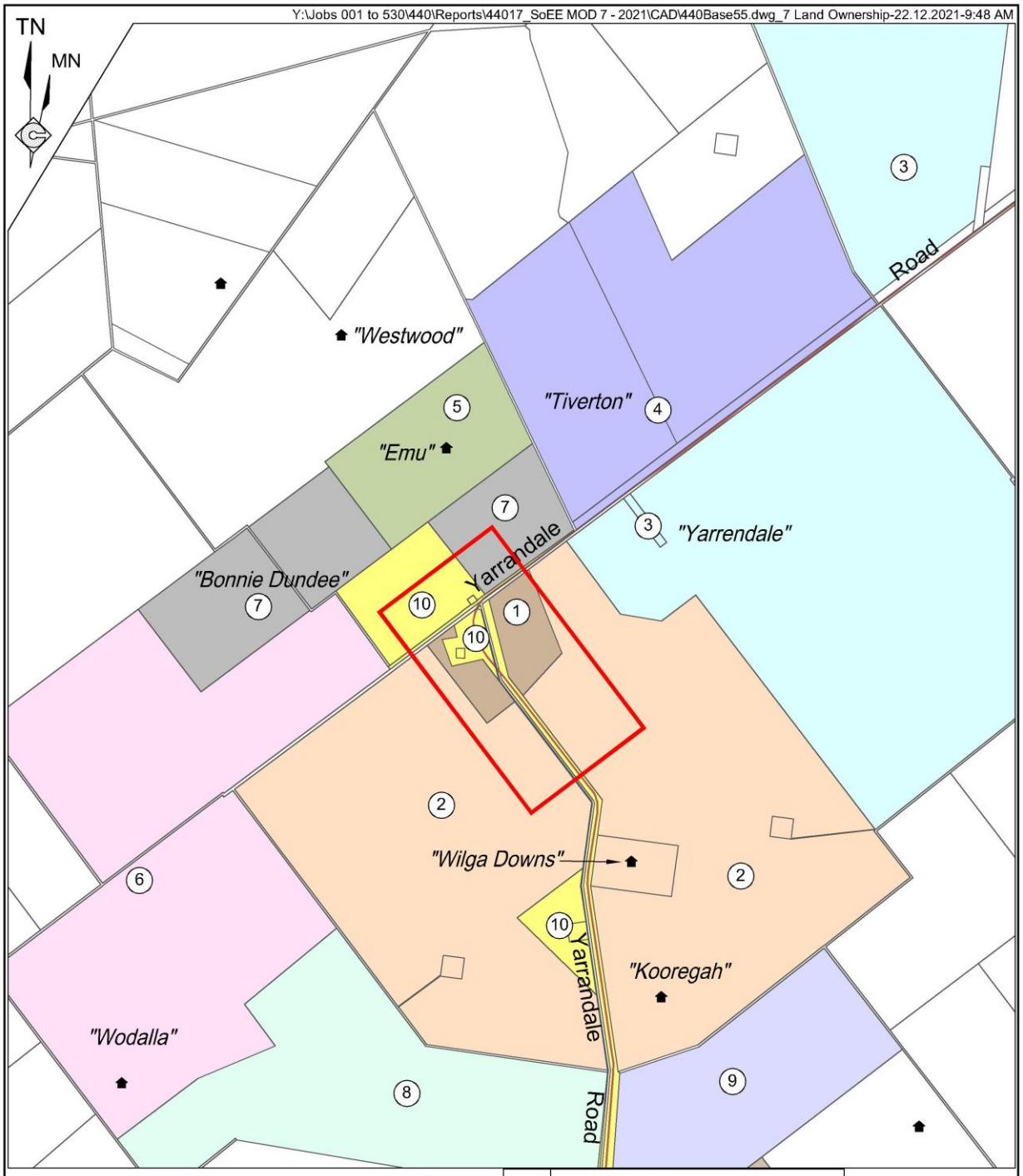
- Resilient, self-reliant and prepared local communities.
- Biosecure, profitable, productive and sustainable primary industries.
- Healthy, diverse and connected natural environments.

The Plan seeks to deliver balanced social, economic and environmental results by ensuring that communities are engaged in the maintenance or improvement of natural resources across the region. The Plan identifies as a regional priority the implementation of programs that support and protect natural resources, including threatened species, endangered ecological communities, cultural values/sites and native vegetation.

The Applicant currently provides substantial contributions to the social and economic setting of the Bogan region. The mining operation at Tritton generates significant local employment and spending on associated consumables and services. Based on the nature of the amendments proposed within the Mine Site, it is anticipated that the proposed modification would not limit the success of natural resource management goals for the Central West but would continue to support the Applicant's contribution social and economic outcomes.

2.4 LAND OWNERSHIP

Figure 3 presents land ownership in the vicinity of the Mine Site. Land within the Mine Site is freehold land owned by the Applicant and Mr Roger Sheather with some Crown land comprising a Travelling Stock Route and the Yarrandale Road reserve. The Mining Lease Boundary is an administrative boundary. All mining activities occur on land owned by the Applicant. Access to the Mine Site is provided directly from Yarrandale Road.



Ref	Landowner
1	Tritton Resources Pty Limited
2	Private Individual
3	Private Individual
4	Private Individual
5	Dom-Pat Holdings Pty Ltd
6	Private Individual
7	Straits Mining Pty Limited
8	Private Individual
9	Private Individual
10	Crown Land

Figure 3
LAND OWNERSHIP
AND RESIDENCES

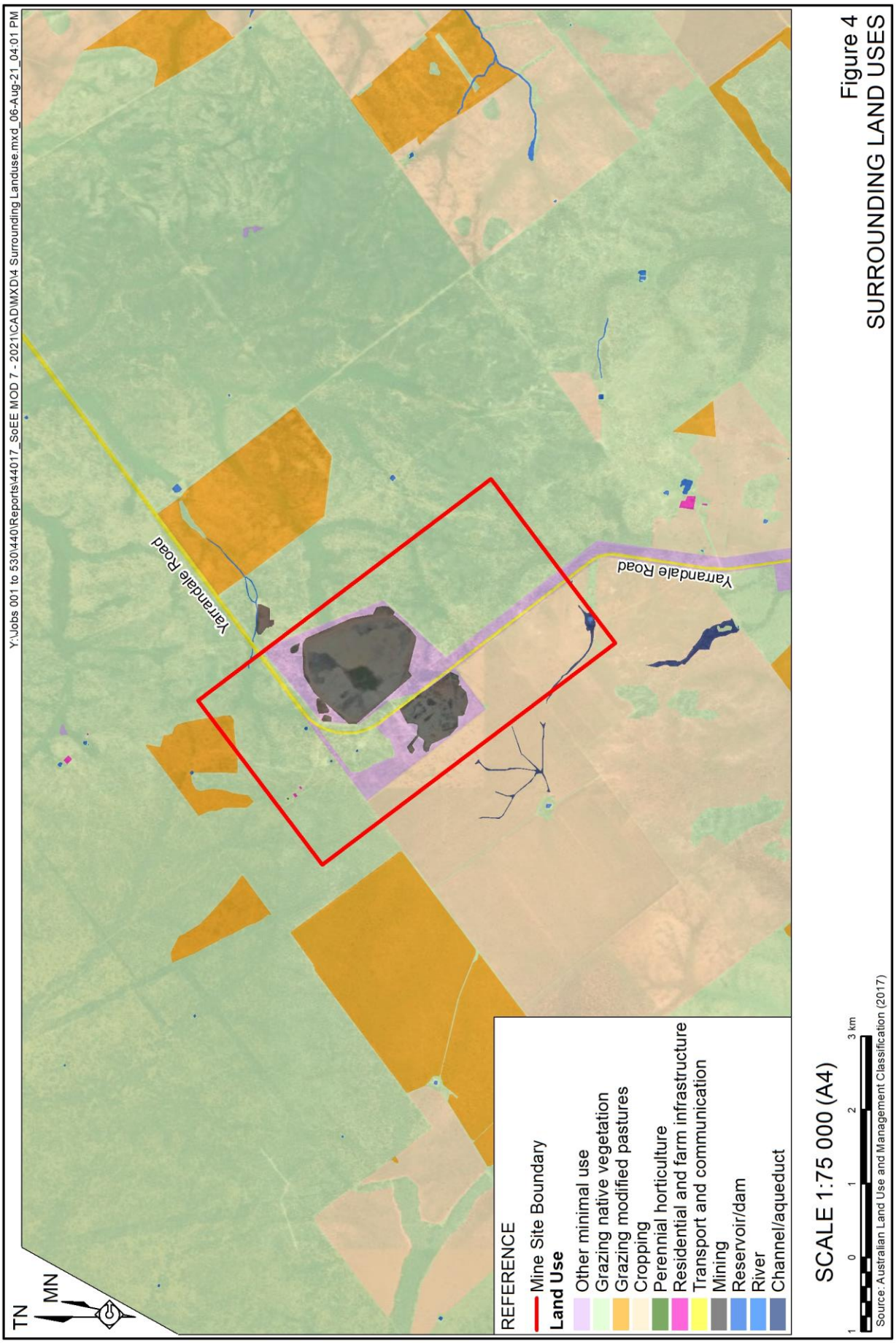
The closest residences to the Mine Site are as follows.

- The "Emu" homestead, located approximately 4.3km north of the Mine Site.
- The "Wilga Downs" residence, located approximately 5.0km to 5.1km southeast of the Mine Site.

There is a reasonable separation distance or "buffer" from existing residences which reduces the risk of potential amenity impacts. The Mine Site has been present in the location since 1998 and is therefore well known to local landholders.

2.5 LAND USES

Figure 4 displays the range of land uses within and surrounding the Mine Site. These include mining activities and primary production which is principally comprised of intermittent wheat cropping and sheep or cattle grazing. No agricultural production is undertaken within the Mine Site.


Y:\Jobs 001 to 530\440\Reports\44017_SoEE MOD 7 - 2021\CAD\MXD\4 Surrounding Landuse.mxd_06-Aug-21_04:01 PM
TN
MN
Yarrandale Road
Yarrandale Road
REFERENCE
Mine Site Boundary
Land Use
Other minimal use
Grazing native vegetation
Grazing modified pastures
Cropping
Perennial horticulture
Residential and farm infrastructure
Transport and communication
Mining
Reservoir/dam
River
Channel/aqueduct
SCALE 1:75 000 (A4)
1 0 1 2 3 km
Source: Australian Land Use and Management Classification (2017)
Figure 4
SURROUNDING LAND USES

3. DESCRIPTION OF THE MODIFICATION

3.1 INTRODUCTION

Tritton is seeking a modification to Development Application (DA) 41/98 to allow for the following.

1. Underground mining of the Budgerygar deposit to access approximately 2.6 million tonnes of copper ore including the installation of surface infrastructure to the north of the existing Mine Area to support underground operations.
2. A raise of approximately 10m to the existing approved Waste Rock Emplacement to account for waste rock expected to be generated.
3. The disposal of drill cuttings transported to the Mine from exploration tenements held by the Applicant and waste material removed / screened from milled ore prior to entering the flotation circuit of the processing plant.
4. An extension to the Mine life to allow for ongoing mining operations until 22 December 2028.

The following subsections provide a description of the approvals required and the proposed modification. No other elements of the Project would be altered as a result of the proposed modification.

Figure 5 presents the proposed Mine Site layout including the footprint of the Budgerygar deposit, the location of surface infrastructure and the indicative design of the Waste Rock Emplacement.

3.2 APPROVALS REQUIRED

The Applicant anticipates that the following modifications would be required to DA 41/98 as a result of the proposed modification.

- The "List of Abbreviations" under Schedule 2 of DA 41/98 would need to be updated to include *Modification Application DA 41/98 MOD 8* and accompanying *Modification Report* to permit the proposed modifications.
- Condition 2(3) would need to be updated to reflect the extension of the mine life to 22 December 2028.

The approved MOP would be required to be updated to reflect the increase of approximately 2.6Mt to the total extracted copper ore, raising of the Waste Rock Emplacement, material disposal within the TSF and extension to the mine life, however, rehabilitation outcomes for the Project would not substantially change. The MOP will be replaced by a Rehabilitation Management Plan prepared in accordance with Division 3 of Schedule 8A of the *Mining Regulation 2016* and guidance provided by the Resources Regulator on the form of these documents. The Rehabilitation Management Plan must be submitted prior to 2 July 2022.

A variation will be required to EPL 11254 to condition the import and disposal of material within the TSF.

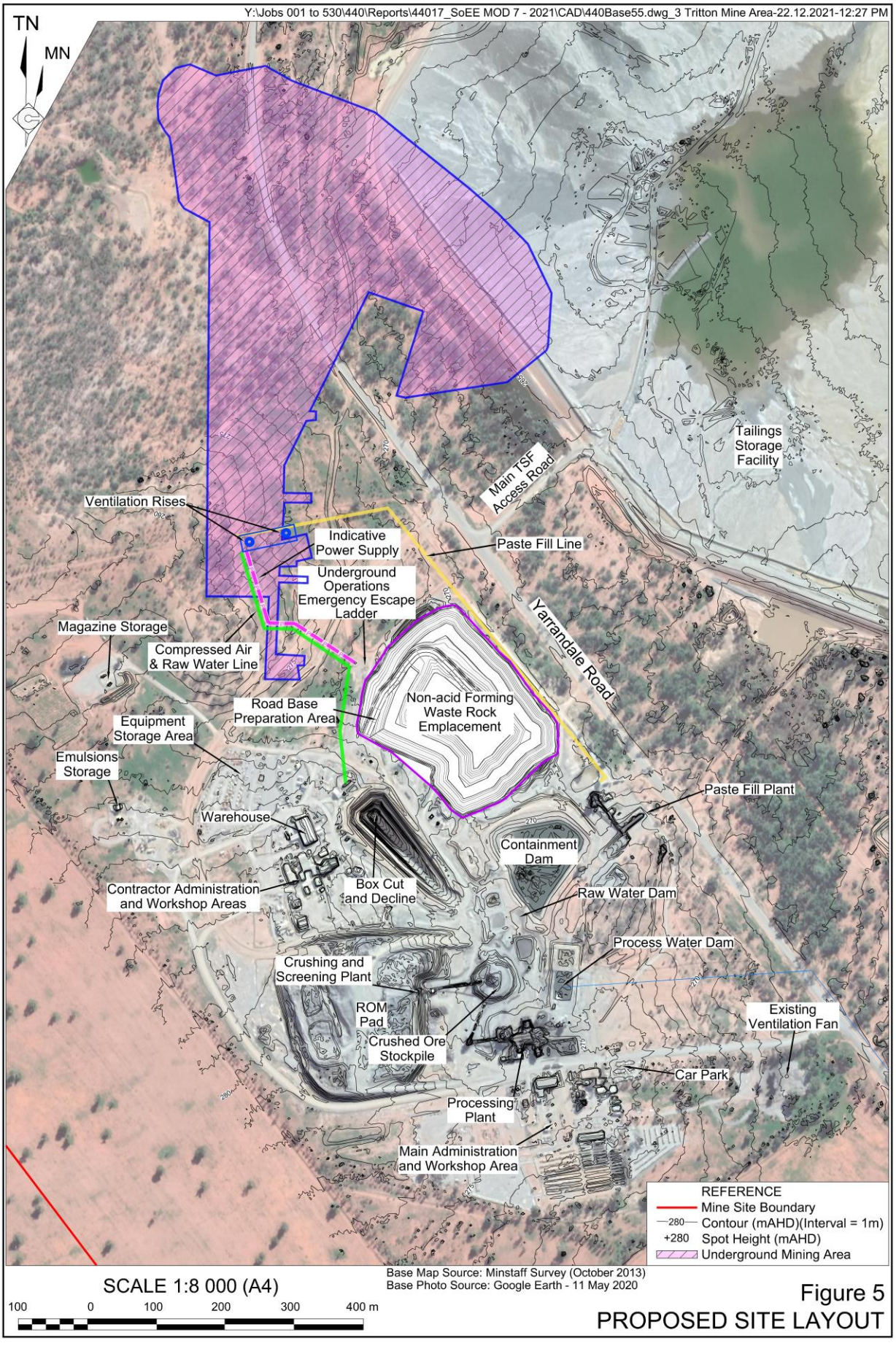


Figure 5
PROPOSED SITE LAYOUT

3.3 PROPOSED MINING OF THE BUDGERYGAR DEPOSIT

The Budgerygar deposit is hosted within the Tritton stratigraphic package and is located approximately 600m northeast of the Tritton deposit. **Figure 6** displays the current understanding of the Budgerygar ore body and the indicative Mine design. **Figure 6** also presents the location of the ore body in relation to existing infrastructure (that is mining would occur approximately 100m below surface in the vicinity of existing Mine infrastructure but in the vicinity of the TSF would be approximately 260m below the surface. The separation between the TSF and proposed operations would ensure that the proposed mining does not compromise the structure or function of the TSF. **Figure 7** displays the location of the Budgerygar deposit in relation to the existing underground workings of the Mine.

The Budgerygar deposit has an Inferred Mineral Resource of 2.6Mt. At surface there are low grade gossanous mineralisation outcrops and portions of the deposit were intermittently mined during the early 1900s. Open cut mining is not proposed to access the deposit as this would not currently be economical. The mineralisation of the Budgerygar deposit is considered analogous to the Tritton deposit and is characterised by a large pyrite-dominant sulphide envelope, which strikes north-south and dips moderately east. Copper mineralisation within the broader pyrite envelope is dominated by chalcopyrite.

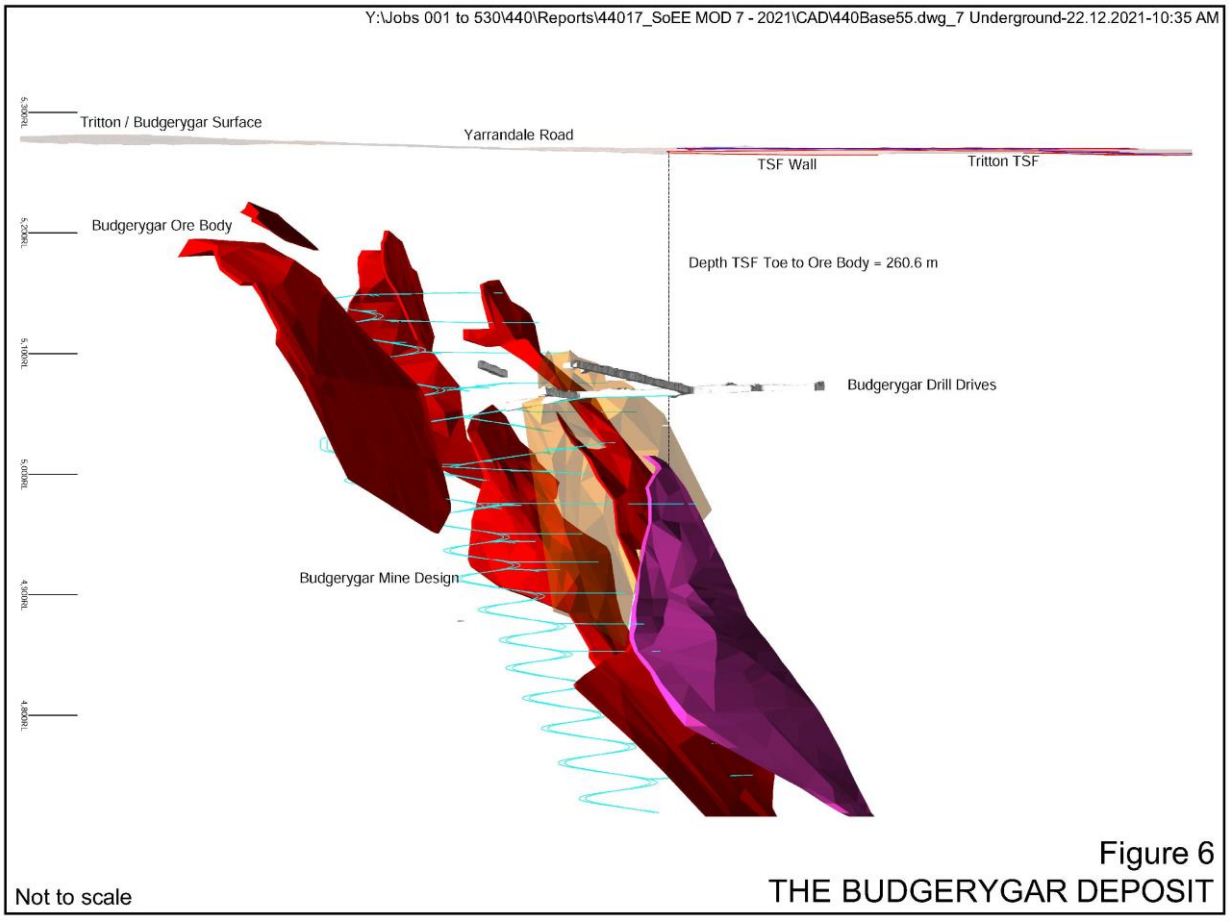


Figure 6
THE BUDGERYGAR DEPOSIT

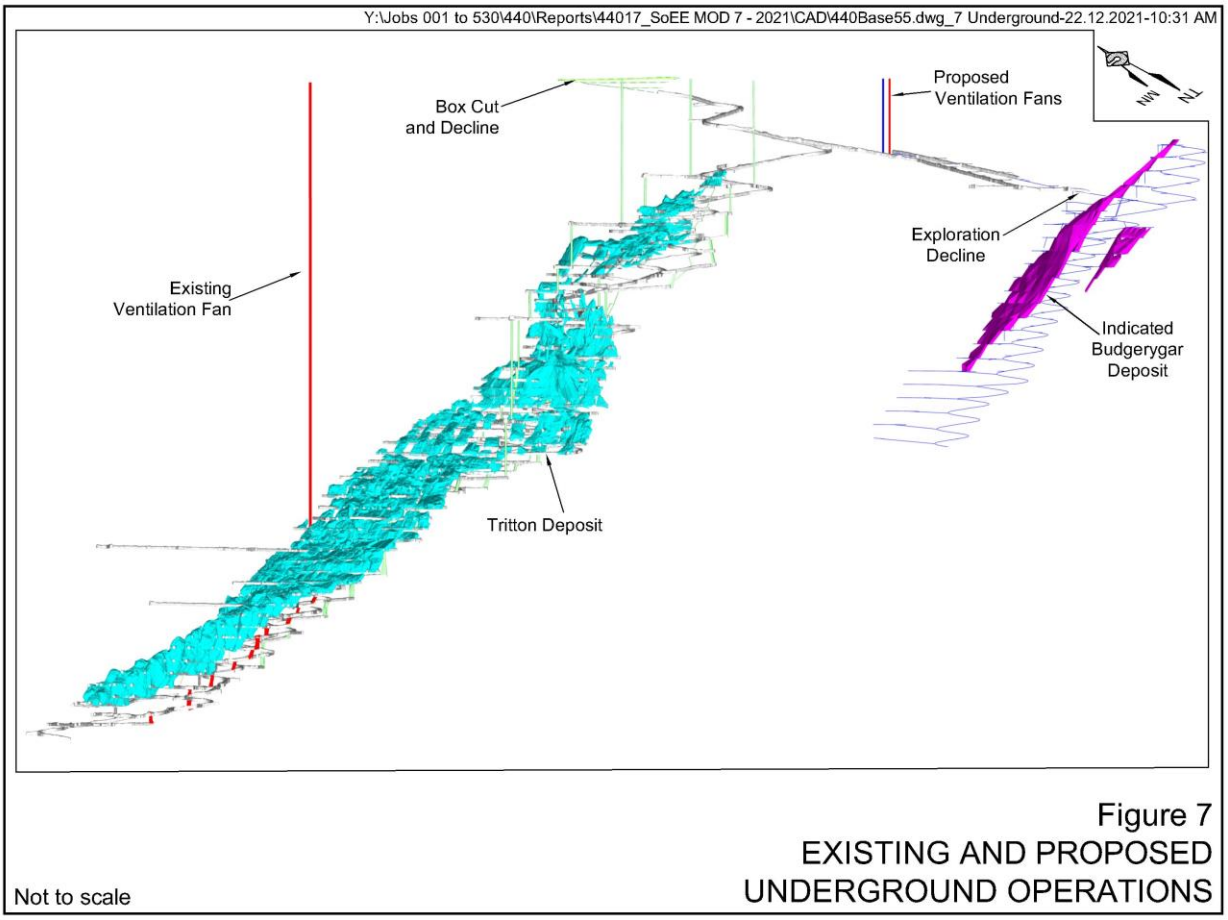


Figure 7
EXISTING AND PROPOSED
UNDERGROUND OPERATIONS

Not to scale

The copper rich zone is known over a strike length of 300 metres and has been traced 800 metres down dip, remaining open at depth. An exploration and access decline has been developed from the Tritton decline at approximately 270m below the surface to provide a diamond drilling position and, should the proposed modification be approved, eventual access to the Budgerygar deposit for production.

As the Budgerygar exploration and access decline has been developed from the Tritton decline, it is expected that, if approved, extraction and transportation of materials from the Budgerygar deposit would be undertaken as follows.

- Extension of the existing approved decline and associated ventilation, egress and other capital development.
- Construction of drives to access the ore body to production.
- Construction of vertical raises for both ventilation, emergency egress and backfill placement purposes.
- Extraction of the ore body using a variety of underground mining methods selected to suit the geometry and value of the ore.
- Backfilling of the mined voids with waste rock, cemented waste rock and/or tailings material as paste fill produced in the Paste Fill Plant.
- Construction of additional ground support using split sets and mesh with cable bolts and shotcrete.

- Installation of surface infrastructure, including power supply, exclusion fence, polypipe line for water supply, air line (service hole) and a paste line from the paste plant to the ventilation rises.
- Transportation of ore and waste rock to surface. Ore will be temporarily stored on the ROM Pad, while waste rock will be placed on the Waste Rock Emplacement. Potentially acid generating waste rock will be managed as per the *Waste Rock Characterisation and Management Plan 2016*.

Mining of the Budgerygar deposit would be considered an extension of the existing underground mining operations, and no additional equipment, haulage trucks or surface disturbance would be required. The currently operating haulage routes and capacities would be able to support transportation of product from the Budgerygar deposit as there would be no increase to annual total extracted materials.

The proposed ongoing mining would be supported by the following services and infrastructure in addition to the current infrastructure. Existing and proposed infrastructure is presented on **Figure 5**. The construction and use of ventilation intake and exhaust rises was approved under a recent modification to the Project and would provide access for these services to the proposed underground workings.

- Power supply (overhead or potentially from the existing operation).
- An exclusion fence around the approved ventilation rises.
- Polypipe line for water supply, consistent with the materials used for existing operations.
- Air line (service hole), consistent with the materials used for existing operations.
- Paste line from paste fill plant that would enter the proposed underground workings via one of the ventilation rises.

No additional surface disturbance (vegetation clearing) would be required for the construction and use of this infrastructure.

3.4 PROPOSED RAISING OF THE WASTE ROCK EMPLACEMENT

To account for the expected increase in non-acid forming (NAF) waste rock associated with mining of the Budgerygar deposit, it is proposed that the existing approved Waste Rock Emplacement would be raised by approximately 10m (to a total elevation of approximately 301.5m AHD).

Management and storage of the additional waste rock would be undertaken in accordance with the *Waste Rock Characterisation and Management Plan 2016*. In summary, the following processes would continue to be implemented.

- Planning for waste rock management in overall mine planning including risk management.
- Segregation of NAF from Potentially Acid Forming (PAF) waste rock during ore grade control drilling and through geological inspections.

- Use of PAF principally for underground backfilling or in paste fill production utilising the Paste Fill Plant.
- Encapsulating any PAF brought to surface for short term storage prior to disposal within the TSF.
- Crushing and use of NAF for road construction or other structures where needed or storage in the Waste Rock Emplacement for use in rehabilitation (capping) of the TSF.

Consistent with the existing operations, NAF waste rock generated by mining of the Budgerygar deposit would be used in progressive and final rehabilitation activities. As a result, the Waste Rock Emplacement would be reduced to a height consistent with the surrounding topography at the time of mine closure. There would be no significant changes to rehabilitation outcomes as a result of the proposed modification, excluding the removal of minor surface infrastructure.

3.5 DISPOSAL OF MATERIAL WITHIN THE TSF

The proposed modification would permit the disposal of the following materials within the TSF.

- Drill cuttings from exploration drilling activities undertaken within exploration leases held by the Applicant.
- Waste material removed/screened from milled ore prior to entering the flotation circuit of the processing plant.

While the Applicant currently has approval for waste disposal in an on-site landfill, it does not have approval to import waste materials other than waste from the Applicant's Murrawombie Mine. The TSF is an engineered waste disposal structure designed for the emplacement of tailings material in a manner that permits progressive development in a safe and environmentally responsible manner while providing a long-term solution to the potential contamination risks associated with the handling and storage of tailings.

Drill cuttings would principally consist of dry or wet pulverised rock which would be screened for general waste, including plastics, and then transported via truck to the TSF. While drill cuttings generally are benign, they reflect the materials from which the solid matter has been removed and may contain acid generating compounds and therefore risk contamination during long-term storage. It is anticipated that a maximum of 200m^3 of drill cuttings would be disposed of within the TSF each year, however, this rate would vary depending on the exploration focus and the lithology intersected during drilling. It is anticipated that the importation of drill cuttings to the Mine Site would result in an additional 100 heavy vehicle movements each year with a maximum of two movements per day proposed. Drill cuttings would be transported by contractor with drill cuttings suspended in water generally transported within a vacuum truck with the waste then discharged on the surface of the TSF. Dry material would be transported within a tipping truck, or within 100L IBCs on a flatbed truck.

An estimated 120m^3 of mill trash classified as "General Soil Waste – CT 1" would be disposed of within the TSF each year. This material would principally comprise foreign materials that are recovered after the sulfidic ore crushing and milling process such as crushed PVC pipe, detonation cord and rubbish debris associated with mining processes. While similar to general waste, the material screened from the mill may be exposed to acid generating compounds and therefore present a contamination risk.

All drill cuttings and mill trash would be emplaced within discrete cells which would be excavated within the TSF. These cells would be designed to limit impacts to the ongoing function of the facility and would be approximately 1.5m deep and at least 80m from perimeter embankments and 150m from the decant pond. Waste would either be emplaced directly from the truck or by emptying the contents of the IBC's utilising an integrated tool carrier or similar. The IBCs would then be re-used wherever possible, or disposed of appropriately. The location of disposal within the TSF would be dependent on the operational requirements of the facility with disposal locations to be selected based on access and risk of vehicle interactions. Locations which would be encapsuled by tailings in the near future would be preferentially utilised wherever possible. It is also envisaged that waste would be emplaced close to the spine of the TSF and away from the embankment to avoid ponding. An example of access arrangements to the TSF is shown in **Plate 1**.

Given the engineered nature of the TSF and its current long-term use for waste storage and contamination mitigation, this structure is considered an appropriate and beneficial final location for the drill cuttings and mill trash.

Plate 1: Example of Tailings Storage Facility Access Point

Access to the TSF for the disposal activities would be via the existing main access road to the TSF which is an unsealed road (see **Figure 5**). This is also the access location that would be used for the transport of tailings material to the Murrawombie Mine for use in paste fill activities[1].

[1] This activity was the subject of Modification 6 for the Mine and including approval for transport activities using the main TSF access road.

Plate 2 and **Plate 3** provide views of Yarrandale Road towards Girilambone and towards Hermidale. The sight distance at this intersection has not been calculated but is estimated to be over 900m in each direction. Clear access and sight distance is available to vehicles using this road. It is therefore considered that this sight distance would provide excellent visibility of approaching traffic and ensure traffic safety as trucks enter Yarrandale Road at this location.

Plate 2: View to the north from the intersection of Yarrandale Road and the unsealed access road to the Tailings Storage Facility towards Girilambone

It is considered that impacts to road condition and degradation would not change under the proposed modification. Road maintenance would continue to be the responsibility of Bogan Shire Council.

A review of potential impacts of material disposal within the TSF has been prepared by CMW Geosciences and is included in full as **Appendix 1**.

3.6 EXTENSION TO THE MINE LIFE

It is anticipated that mining and processing of the copper ore within the Budgerygar deposit would take approximately six years. Therefore, an extension to the Mine life is proposed to allow for ongoing mining operations until 22 December 2028. That is a further four years would be added to the existing approved Mine life. This assumes commencement of approved mining of the Budgerygar deposit from early 2022.

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Plate 3: View to the south from the intersection of Yarrandale Road and the unsealed access road to the Tailings Storage Facility towards Hermidale

4. STATUTORY CONTEXT

This section identifies the relevant statutory requirements that must be considered by the consent authority before the development application may be determined. The relevant statutory requirements are described in terms of power to grant approval, permissibility, and other required approvals. The section concludes with the statutory compliance matters that must be considered by the consent authority.

4.1 POWER TO GRANT APPROVAL

The proposed modification is being made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), as it is considered that the proposed modification would remain "substantially the same development" as the Project as last modified before transition to Part 4 of the Act (applications submitted by September 2018). Therefore, the modified consent as of January 2019 (following MOD6 for the export of tailings for paste fill operations at the Murrawombie Mine which met the cut-off date) is the Project against which the test for "substantially the same" is applied. Section 4.5 addresses the matters that the consent authority is required to take into consideration under that Section.

4.2 CONSENT AUTHORITY

In accordance with Clause 8A(2) of the *State Environmental Planning Policy (State and Regional Development) 2011* the Independent Planning Commission is the consent authority in respect of an application to modify a development consent that is made by a person who has disclosed a reportable political donation of $1,000 or more.

The Applicant has not made a reportable political donation and therefore the Minister for Planning and Homes (or his delegate) is the consent authority. The Proponent understands that in these circumstances, the Minister has delegated their powers to determine the application to a senior officer of the Department of Planning, Industry and Environment.

4.3 PERMISSIBILITY

The Mine 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 7(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.

4.4 OTHER APPROVALS

Table 3 presents the existing approvals held for the Mine and identifies where modifications to those approvals would be required or where new approvals would be necessary.

Table 3
Existing and Additional Approvals

Approval	Modification/ New Approval Required?	Justification/ Comment
EPL 11254	Variation	A variation will be required to EPL 11254 to condition the import and disposal of material within the TSF.
ML1544	Amendment	All activities proposed under the modification application would occur within the boundary of ML 1544. An amendment to ML 1544 would need to be amended to recognise resource extraction from the Budgerygar deposit. An amendment to the existing Mining Operations Plan would be required.
DA 30/2004	No	No changes are proposed to rail loading at the Hermidale Rial Siding.
DA 029/2007	No	No changes are proposed to administration facilities.
DA 2010/006	No	No changes are proposed to the Paste Fill Plant.
DA 2010/028	No	No changes are proposed to communication towers.
DA 10/2019/021/001	No	No changes are proposed to the existing water pipeline.
CDC2021/002	No	No changes are proposed to communication towers.
Water Access Licences (Lachlan Fold Belt MDB Groundwater Source) 31041 31090	No	No changes proposed to groundwater use.
Water Access Licences (Macquarie and Cudgegong Regulated Rivers Water Source) 9374 9375 9940	No	No changes proposed to surface water use.
Works Approvals: 80WA716055 80WA716044 80WA702816 80WA704315 80CA701324	No	No changes to approved works.
Groundwater Monitoring Bores	Yes	Three new groundwater monitoring bores are proposed. These bores will be required to be licenced under the *Water Management Act 2000.*

4.4.1 Approvals that Cannot be Refused if Consent is Granted

The following approvals relevant to the proposed modification cannot be refused under Section 4.42 of the EP&A Act if consent for the proposed modification is granted.

- **A Mining Lease under the *Mining Act 1992* –** Although all proposed works would occur within the approved boundary of ML1544, following an approval of the proposed modification, an amendment to ML1544 would be required to incorporate approved mining operations under DA 41/98.
- **An Environment Protection Licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* -** The Applicant currently holds EPL 11254 which allows for the scheduled activity "Mining for Minerals – >500 000t to 2 000 000t annual production capacity". The Applicant intends to seek a variation to EPL 11254 to incorporate the import and disposal of material within the TSF

4.4.2 Approvals that are Not Required if Consent is Granted

The following approvals relevant to the proposed modification are not required in accordance with under Section 4.41(1) of the EP&A Act if consent for the proposed modification is granted.

- A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000* – No changes are required to existing water supply approvals, however three groundwater monitoring bores are proposed to be installed following an approval of the proposed modification.

As there would be no additional surface disturbance for the proposed modification, consideration of the need for approvals or permits under the *Heritage Act 1977* or *National Parks and Wildlife Act 1974* relating to impacts to state heritage items or Aboriginal objects, respectively, is not required.

4.5 PRE-CONDITIONS TO GRANTING APPROVAL

Table 4 presents the pre-conditions to the granting of approval that apply to the proposed modification.

4.6 MANDATORY MATTERS FOR CONSIDERATION

Table 5 presents the mandatory matters for consideration by the consent authority that apply to the proposed modification

Table 4
Preconditions to the Granting of Approval

Section/ Clause	Precondition	Relevance
Environmental Planning and Assessment Act 1979		
4.55(2)	A consent authority may, … modify the consent if (a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	The proposed modification is being sought under Section 4.55(2) of the EP&A Act as the Project would remain "substantially the same" as the Project as last modified before transition from a Part 3A Project to a State Significant Development. Therefore, the modified consent as of January 2019 (following MOD6 for the export of tailings for paste fill operations at the Murrawombie Mine which met the cut-off date) is the Project against which the test for "substantially the same" is applied. Under the proposed modification, the Project would remain "substantially the same development" as that approved under DA 41/98 for the following reasons. • The scale of the proposed modification would be relatively minor in comparison to the approved Mine. • The approved mining methods and rate would not change. • It is anticipated there would be only minor changes to the groundwater setting but that impacts would be low risk (that is, for water users including private bore holders and groundwater dependent ecosystems). • The environmental impacts of the Project as modified would be similar to the impacts of the approved Mine with the external experience of the Mine largely unchanged. • The minor environmental impacts that are currently experienced would continue to be managed through conditions of consent.
	(b) it has consulted with the relevant [government authorities]	This is a matter for DPIE to consider during its assessment of the proposed modification.
	(c) it has notified the application in accordance with— i) the regulations, if the regulations so require, or ii) a development control plan	This is a matter for DPIE to consider, however it is anticipated that DPIE will notify the application to relevant stakeholders. In accordance with Clause 11(a) of the *State Environmental Planning Policy (State and Regional Development) 2011*, development control plans are not relevant to SSD applications.

Table 4 (Cont'd)
Preconditions to the Granting of Approval

Section/ Clause	Precondition	Relevance
4.55(2) (Cont'd)	(d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.	This is a matter for the DPIE to consider. However, the Applicant would be pleased to respond to any submissions received by DPIE during the assessment process.
State Environmental Planning Policy No. 55 – Remediation of Land		
7	(1) A consent authority must not consent to the carrying out of any development on land unless— (a) it has considered whether the land is contaminated, and (b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and (c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.	As the areas of surface disturbance have previously been used for agricultural and/or mining, it is highly unlikely that any contamination is present that would require remediation work prior to undertaking the proposed modification.
	(2) Before determining an application for consent to carry out development that would involve a change of use on any of the land specified in subclause (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines.	The proposed modification does not propose a change in use of the land.

Table 5
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
Environmental Planning and Assessment Act 1979		
1.3	Relevant objects of the Act • to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources, • to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment, • to promote the orderly and economic use and development of land, • to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The proposed modification would not limit the achievement of the objects of the EP&A Act and would in effect assist with the achievement of objectives to: • promote the social and economic welfare of the local community through the efficient and continued economic benefits of the operation; and • promote orderly development of the copper resource. Section 7.3 addresses matters relevant to Ecologically Sustainable Development in detail. The proposed modification would encourage the safe, efficient and environmentally responsible operation of the Tritton Copper Mine so that maximum benefit is achieved for the Applicant, the Bogan Shire Council, the local community and the communities of the future. The design of the proposed modification achieves a significant overall benefit and sustainable outcome for the local and wider environment. The proposed modification would not result in significant adverse environmental outcomes. Section 6 presents a detailed analysis of the key environmental aspects that may be affected by the Proposed Modification.
4.15	Relevant environmental planning instruments	See Mining SEPP, SEPP 33 – Hazardous and Offensive Development, SEPP 55 - Remediation of Land and Bogan LEP below.
	Relevant development control plans	In accordance with Clause 11(a) of the *State Environmental Planning Policy (State and Regional Development) 2011*, development control plans are not relevant to SSD applications.

Table 5 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
***Environmental Planning and Assessment Act 1979* (Cont'd)**		
4.15 (Cont'd)	Any planning agreement	There is no Planning Agreement that applies to the Project.
	The regulations	The Regulations have been considered throughout this document.
	The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,	Section 6 presents an assessment of relevant impacts on the natural and built environment and social and economic impacts.
	The suitability of the site for the development,	Operations have been undertaken at the Mine Site since 1998 and the existing operation is approved to continue operating until 21 December 2024.
	Any submissions made in accordance with this Act or the regulations,	This is a matter for the DPIE to consider. However, the Applicant would be pleased to respond to any submissions received by DPIE during the assessment process.
	The public interest.	This is addressed in Section 7.2.2. In summary, however, the proposed modification is considered to be in the public interest through the continued operation of the Mine in a safe and environmentally responsible manner and the provision of ongoing local economic benefits.
Biodiversity Conservation Act 2016		
7.14	The Minister for Planning, when determining in accordance with the *Environmental Planning and Assessment Act 1979* any such application, is to take into consideration under that Act the likely impact of the proposed development on biodiversity values as assessed in the biodiversity development assessment report.	No additional surface disturbance would be required, therefore it is considered that there would be no impacts to biodiversity values as a direct result of the proposed modification and further consideration of biodiversity values and offsetting obligations is not required.

Table 5 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007		
12AB	**Non-discretionary development standards for mining** In accordance with Section 4.15(2) of the EP&A Act, where development would comply with non-discretionary standards specified in an environmental planning instrument a development cannot be refused on the grounds that it does not comply with those standards and conditions of consent must not impose standards that are more onerous than the non-discretionary standards.	
	<u>Cumulative noise level.</u> 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	Changes to cumulative noise levels are not expected. See Section 6.5
	<u>Cumulative air quality level.</u> The development does not result in a cumulative annual average level greater than 30µg/m^3 of PM_{10} for private dwellings.	Changes to dust generation are not expected. See Section 6.6
	<u>Airblast overpressure</u>. 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.	Changes to blasting practices and outcomes are not expected. See Section 6.5

Table 5 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
***State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Cont'd)**		
12AB (Cont'd)	Ground vibration. Ground vibration caused by the development does not exceed: (a) 10mm/sec (peak particle velocity) at any time, and (b) 5mm/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.	Changes to blasting practices and outcomes are not expected. See Section 6.5
	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.	The proposed changes to the groundwater setting and the currently approved groundwater and aquifer interference impacts are considered acceptable. See Section 6.3
12	Consideration is given to: • the existing uses and approved uses of land in the vicinity of the development;	All proposed activities would occur within the existing boundary of ML1544. As there would be no change to surface disturbance there would be no additional risks of incompatible land use.
	• the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and	
	• any ways in which the development may be incompatible with any of those existing, approved or preferred land uses.	
	• The respective public benefits of the development and the existing, approved or preferred land uses are evaluated and compared.	
	• Measures proposed to avoid or minimise any incompatibility are considered.	

Table 5 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
***State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Cont'd)**		
12A	Before determining an application for consent for State significant development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider any applicable provisions of the voluntary land acquisition and mitigation policy.	Not required
13	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. Measures taken by the Proponent to avoid or minimise any incompatibility are considered. The public benefits of the development and any existing or approved mining, petroleum production or extractive industry must be evaluated and compared.	All nearby operations are owned by the Applicant and there is no identified conflict or risk of resource sterilisation
14	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; • impacts on threatened species and biodiversity are avoided or minimised; and • greenhouse gas emissions are minimised and an assessment of the greenhouse gas emissions (including downstream emissions) of the development is provided.	Potential environmental risks and impacts are considered in detail in Section 6. There would be no change to approved impacts to biodiversity and no change to greenhouse gas generation aside from the extended life of the Project and associated emission generation during that time.
15	The efficiency of resource recovery, including the reuse or recycling of material and minimisation of the creation of waste, is considered	The proposed modification would extend the life of an existing operation to access a significant resource. See Section 3.3

Table 5 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 **(Cont'd)**		
16	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. • Limitation of the number of truck movements that occur on roads within residential areas or roads near to schools. The preparation of a code of conduct for the transportation of materials on public roads.	The proposed modification would not change or impact on transport-related matters excluding the extension of the Project life by four years and the proposed change to operational duration and ongoing traffic generation that this entails.
17	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; • the appropriate management of development generated waste; • remediation of any soil contaminated by the development; and • 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.	There would be no change to rehabilitation outcomes for the Project.

Table 5 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
State Environmental Planning Policy No. 33 – Hazardous and Offensive Development		
13	In determining an application to carry out development to which this Part applies, the consent authority must consider (in addition to any other matters specified in the Act or in an environmental planning instrument applying to the development)— (a) current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development, and (b) whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply, and (c) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and (d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), and (e) any likely future use of the land surrounding the development.	The proposed modification would not result in any additional use or storage of hazardous materials within the Mine Site. It is therefore concluded that the proposed modification would not pose a significant risk from hazardous or offensive development and therefore a risk screening is not necessary.

Table 5 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
Bogan Local Environmental Plan 2011		
7.4	**Terrestrial Biodiversity** (3) Before determining a development application for development on land to which this clause applies, the consent authority must consider whether or not the development— a) is likely to have any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and b) is likely to have any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and c) has any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and d) is likely to have any adverse impact on the habitat elements providing connectivity on the land.	Given that the proposed modification would not result in additional disturbance of land, it is expected that the modified activities would not result in additional impacts to biodiversity. Therefore, the proposed modification is not expected to constrain achievement of the objectives of the Bogan LEP.
	(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that— a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or c) if that impact cannot be minimised—the development will be managed to mitigate that impact.	The location of the proposed modification is an approved and operating Mine, and no further surface disturbance is proposed. The development would continue to be managed to avoid or mitigate any significant adverse environmental impact to terrestrial biodiversity

5. ENGAGEMENT

5.1 GOVERNMENT CONSULTATION

The Applicant has consulted with DPIE to seek assessment and information requirements for the proposed modification in accordance with the *State significant development guidelines – preparing a modification report July 2021*. A scoping meeting was held with officers of DPIE on 26 October 2021.

The Applicant also provided a brief presentation on the proposed modification to officers of the Department of Regional NSW – Mining, Exploration and Geoscience on 15 December 2021. The presentation principally covered geological, resource and economic matters relating to the Budgerygar deposit.

The Applicant also consulted with NRAR to confirm the appropriate assessment methodology for determining potential impacts to groundwater during the development of the Budgerygar deposit. In correspondence dated 17 January 2022, NRAR outlined several matters to be addressed in the groundwater assessment and confirmed that an analytical methodology would be appropriate to assess the potential groundwater impacts of the proposed modification. The matters raised by NRAR have been addressed in this document and the Groundwater Assessment prepared by GHD Pty Ltd. A review of the recommendations provided by NRAR and summary of how the assessment has been adapted to address the comments are included in **Appendix 2**.

The Applicant also provides regular briefings to Bogan Shire Council (Council) either directly or through the Community Consultative Committee (which meets to discuss matters pertaining to all of the Applicant's operations in the region). A summary of the Applicant's meetings with the CCC and directly with Council is presented in **Appendix 2**. Council discussions have included a summary of the upcoming planning matters relating to all operations including the proposed modification of operations at the Tritton Mine that are the subject of this document. No issues regarding the proposed modification have been raised in these discussions by Council officers.

5.2 COMMUNITY CONSULTATION

Tritton maintains an open-door policy regarding complaints, questions and feedback to the local community. As such, surrounding landholders are regularly consulted through informal telephone conversations. It is notable that one landowner adjacent to the Mine Site currently provides haulage services to the Company for the transport of concentrate from the Mine Site to the rail siding at Hermidale. In this manner the landowner is kept informed of ongoing operations and regularly interacts with management personnel at the Mine.

Landowners adjacent to the Mine were consulted during the preparation of the Modification Report to notify them of the proposed modification and to determine if there were any concerns to be addressed in the assessment process. No matters of concern relating to the proposed modification were raised during consultation. A log of phone calls made to surrounding landholders is provided in **Appendix 2**.

The Mine's Community Consultative Committee is also kept appraised of the progress of development and planned modification with the meeting on 25 May 2021 covering the status of operations and the need for the proposed extension to mining operations. Planned CCC meetings

in August and November were cancelled due to concerns relating to COVID-19 and the relative difficulty of hosting virtual meetings (due to inconsistent internet and technology access for attendees).

A community meeting was also held in the village of Hermidale on 5 May 2021. This meeting was intended as a general update concerning all of the Applicant's operations and included discussion of the life of Mine for the Tritton Project and the intended expansion to include the Budgerygar deposit.

Given that the proposed modification is predicted to result in only minor changes to the operation and its potential impacts, no broader community consultation has been undertaken.

5.3 COMMUNITY FEEDBACK

Given the current support provided to the local community in terms of employment and spending on services and consumables, the main point of interest in feedback from the community has concerned the life of the Tritton project. No specific environmental concerns were raised in discussions.

5.4 ONGOING CONSULTATION

Following an approval to the proposed modification the following consultation activities would be continued by the Applicant.

- Informal phone or in-person discussions with neighbouring landowners to inform them of progress with the Mine.
- CCC meetings would continue to provide an overview of each of the Applicant's operations and discuss matters relevant to the broader community.
- The Applicant would continue regular briefing discussions with Council officers to discuss matters relating to all of the Applicant's operations.

6. ASSESSMENT OF KEY ENVIRONMENTAL ISSUES

6.1 INTRODUCTION

This section describes the specific environmental features of the Mine Site and its surrounds that may be affected by the proposed modification. Information on existing conditions, proposed safeguards and controls, and potential impacts the proposed modification may have following the implementation of these measures is presented for all relevant issues.

6.2 ENVIRONMENTAL SETTING

6.2.1 Introduction

The assessment of various environmental aspects of the proposed modification throughout this section is reliant upon a range of background information common to many of the key environmental issues. Information relating to the topography, drainage and climate is provided in the following subsection.

6.2.2 Topography and Drainage

Regional Topography and Drainage

The Mine Site is situated in the western plains region of NSW where the regional topography is characterised by a gently undulating landform with low ridges and occasional locally prominent hills (**Figure 7**). The Mine Site is located within the Macquarie–Bogan Catchment, an area of approximately 74 800km^2. The Bogan River rises approximately 19km northwest of Parkes before flowing in a north-northwesterly direction through Nyngan, approximately 45km to the southeast of the Mine Site and eventually meets the Barwon River, approximately 25km northeast of Bourke.

Local and Mine Site Topography and Drainage

Topography and drainage within the Mine Site has largely been disturbed by the approved mining operations. Surface water flows within the Mine Site are managed through erosion and sediment controls established within operational, stockpiling and tailings storage areas.

Local topography is characteristic of the regional topography, featuring gently undulating land with low ridges and occasional locally prominent hills. Elevations vary from approximately 235m AHD to 270m AHD (**Figure 8**).

Local drainage is characterised by ephemeral streams which either terminate in farm dams or, to the east of the Mine Site, flow towards the Bogan River. The closest substantial drainage line to the Mine Site is Sidburys Creek located approximately 20km to the northeast of the Mine Site. Sidburys Creek flows in a south-easterly direction towards the Bogan River. To the north and east of the Mine Site, the majority of the runoff flows are ephemeral, flowing via gullies and overland flow towards Sidburys Creek and other un-named intermittent tributaries of the Bogan River. To the south and west of the Mine Site the majority of ephemeral streams drain towards the south. These may occasionally reach the Whitbarrow Creek, on the southern side of the Barrier Highway, which flows in an easterly direction towards the Bogan River.

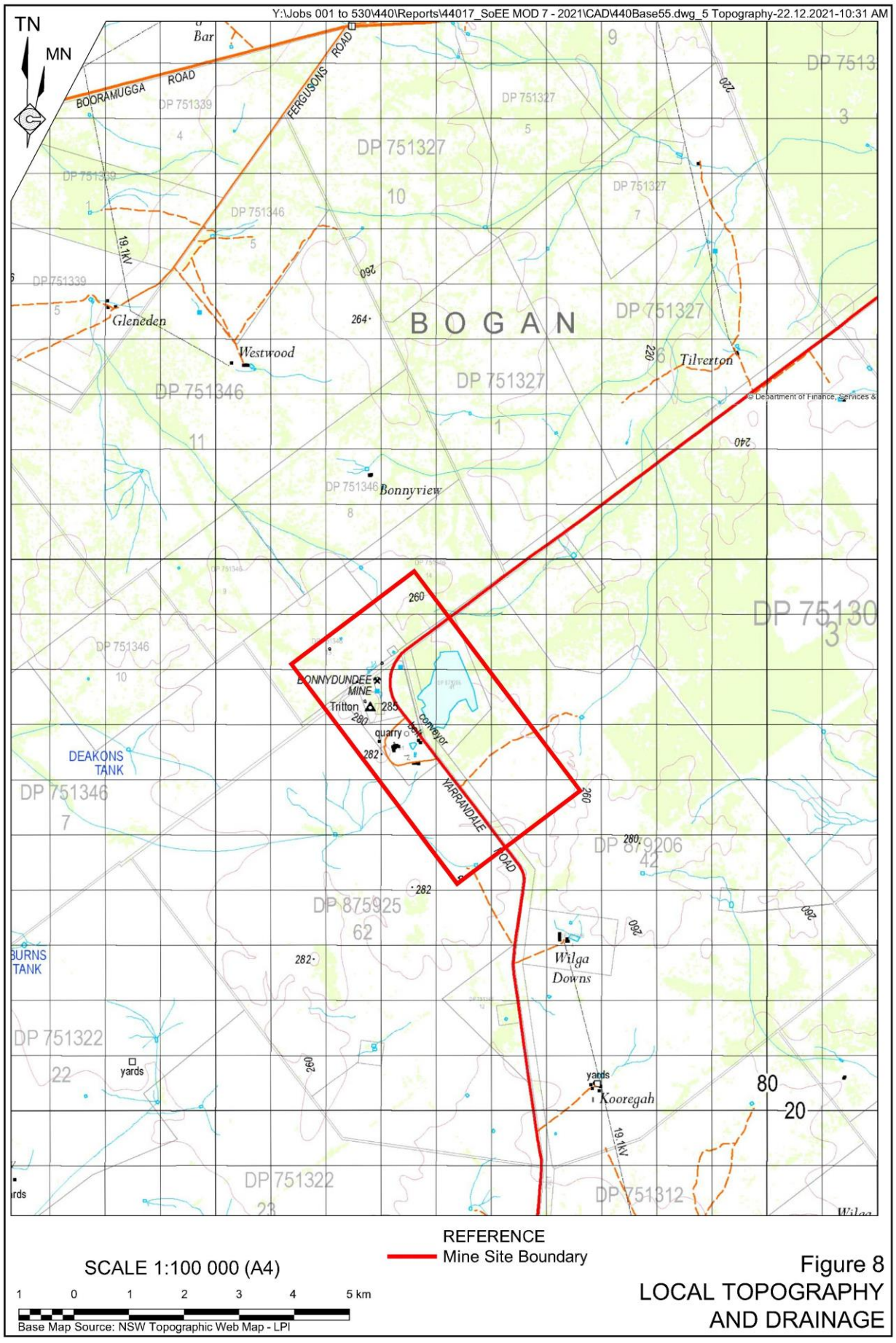


Figure 8
LOCAL TOPOGRAPHY AND DRAINAGE

6.2.3 Climate

Climatic conditions have the potential to influence a range of Mine-related impacts at surrounding residences and on the local environment. The climate in the vicinity of the Mine 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 Mine Site, focusing particularly on those aspects of the climate that are likely to influence the potential Mine-related environmental impacts.

Data Sources

Meteorological data from the following Bureau of Meteorology (BoM) stations is presented in **Table 6**. 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 49km southeast of the Mine Site (temperature, humidity and wind).
- Girilambone (Wongala) Station (Station Number 151158), located approximately 16km to the northeast of the Mine Site (rainfall).

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

Table 6
Monthly Meteorological Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temperature (ºC) [1] (1920 to 2019)													
Mean Maximum	34.4	33.4	30.6	25.7	20.7	17.1	16.5	18.5	22.7	26.7	30.1	33.1	25.8
Mean Minimum	19.6	19.3	16.5	11.9	7.8	5.0	3.8	4.7	7.8	11.5	15.1	17.9	11.7
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] (1879 to 2014)													
Mean rainfall	50.6	47.6	42.2	34.7	36.0	33.2	29.3	29.6	27.7	34.8	36.3	42.8	444.4
Highest daily rainfall	145.0	146.1	89.6	193.2	85.0	63.2	55.1	59.4	54.0	63.0	80.0	102.0	193.2
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).

Temperature and Humidity

Table 6 indicates that January is the hottest month, with a mean maximum temperature of 34.4°C and a mean minimum temperature of 19.6°C. July is the coldest month with a mean maximum temperature of 16.5°C and a mean minimum temperature of 3.8°C. Late autumn, winter and early spring (April to September) is typically the most humid time of the year.

Rainfall and Evaporation

Monthly average rainfall varies between 29.3mm and 50.6mm, 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.

Wind Conditions

Prevailing winds throughout the year are from the south. During the winter and spring, winds from the southeast also feature while during the summer and autumn period winds feature from a variety of directions.

6.3 GROUNDWATER

6.3.1 Introduction

The mining of copper ore from the Budgerygar deposit, located underground at approximately 600m from the existing underground workings has the potential to alter the groundwater setting and adversely impact groundwater users through changes to groundwater availability and quality at registered bores and groundwater dependent ecosystems. A *Groundwater Assessment* was prepared by GHD Pty Ltd (GHD) to support the Modification Report. The full assessment is presented as **Appendix 3** and is hereafter referred to as GHD (2022).

The following subsection provides an overview of the existing environment with respect to groundwater at the Mine Site. Potential impacts from the proposed modification are presented, and management and mitigation measures are proposed to reduce or prevent these impacts. This is followed by discussion of any residual impacts relating to the proposed modification.

6.3.2 Existing Setting

6.3.2.1 Hydrogeology

Groundwater at the Mine Site is limited to joint and/or fracture systems in the indurated Ordovician sediments within the Lachlan Fold Belt and is managed under the *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources Order 2020*. Primary porosity flow is negligible in these rock units except for areas of the original matrix that have undergone alteration through weathering (GHD, 2022).

GHD (2022) reviewed the outcomes of previous aquifer testing at the Mine Site and surrounding operations to establish hydraulic parameters appropriate for use in assessment. Results from pumping tests undertaken for the Tritton TSF, pumping tests at the Murrawombie Mine (also applied for groundwater assessment of the Avoca Tank Mine) and data from more recent

assessment of the New Cobar Complex was considered. The results from these aquifer testing programs were also used to inform a sensitivity analysis of assessment outcomes. The assumed values for aquifer parameters are discussed in more detail in Section 6.3.6 and in Section 6.1.2 of GHD (2022).

6.3.2.2 Surrounding Bores

A total of 62 registered bores have been identified within an approximate 25km radius of the Mine Site. The locations and details of these bores are provided in Section 3.7.1 of GHD (2022). In summary, 53 of these bores comprise part of the monitoring network for the Mine Site and the nearby North East Mine and Murrawombie Copper Mine which are also operated by the Applicant. The remaining 9 bores have been identified as follows.

- Three stock and domestic bores which have been identified as landowner bores, located approximately 26.5km southeast, 26.4km northeast and 19.3km northeast of the Mine Site.
- One dewatering bore associated with the Mine Site.
- Three water supply bores, two of which are associated with the Mine Site and one of which is associated with the Murrawombie Copper Mine.
- Two commercial and industrial bores, one of which is associated with the Mine Site and one of which is associated with the North East Mine.

6.3.2.3 Groundwater Dependent Ecosystems

Review of the background document for the Murray-Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan (DPIW 2012) indicted no high priority Groundwater Dependent Ecosystems (GDEs) within 20km of the Mine Site.

A search of the *Bureau of Meteorology Groundwater Dependent Ecosystem Atlas* identified a number of potential aquatic Groundwater Dependent Ecosystems (GDEs) within 20km of the Mine Site. The closest of these potential GDEs are located approximately 7.5km southeast and 13.3km south of the Mine Site and are classified as low-potential GDEs associated with wetland ecosystems and floodplain water bodies. As a result, their ecosystem type and low potential nature, it is considered unlikely that these potential GDEs would be dependent on the groundwater system associated with the deep groundwater levels within and immediately surrounding the Mine Site.

The *Bureau of Meteorology Groundwater Dependent Ecosystem Atlas* also identifies potential terrestrial GDEs within proximity to the Mine Site. These range from high medium and low potential. The potential GDEs are associated with the vegetation likely to be present. However, GHD (2022) note that it is unlikely that the vegetation in these locations are GDEs given the deep groundwater levels identified in monitoring.

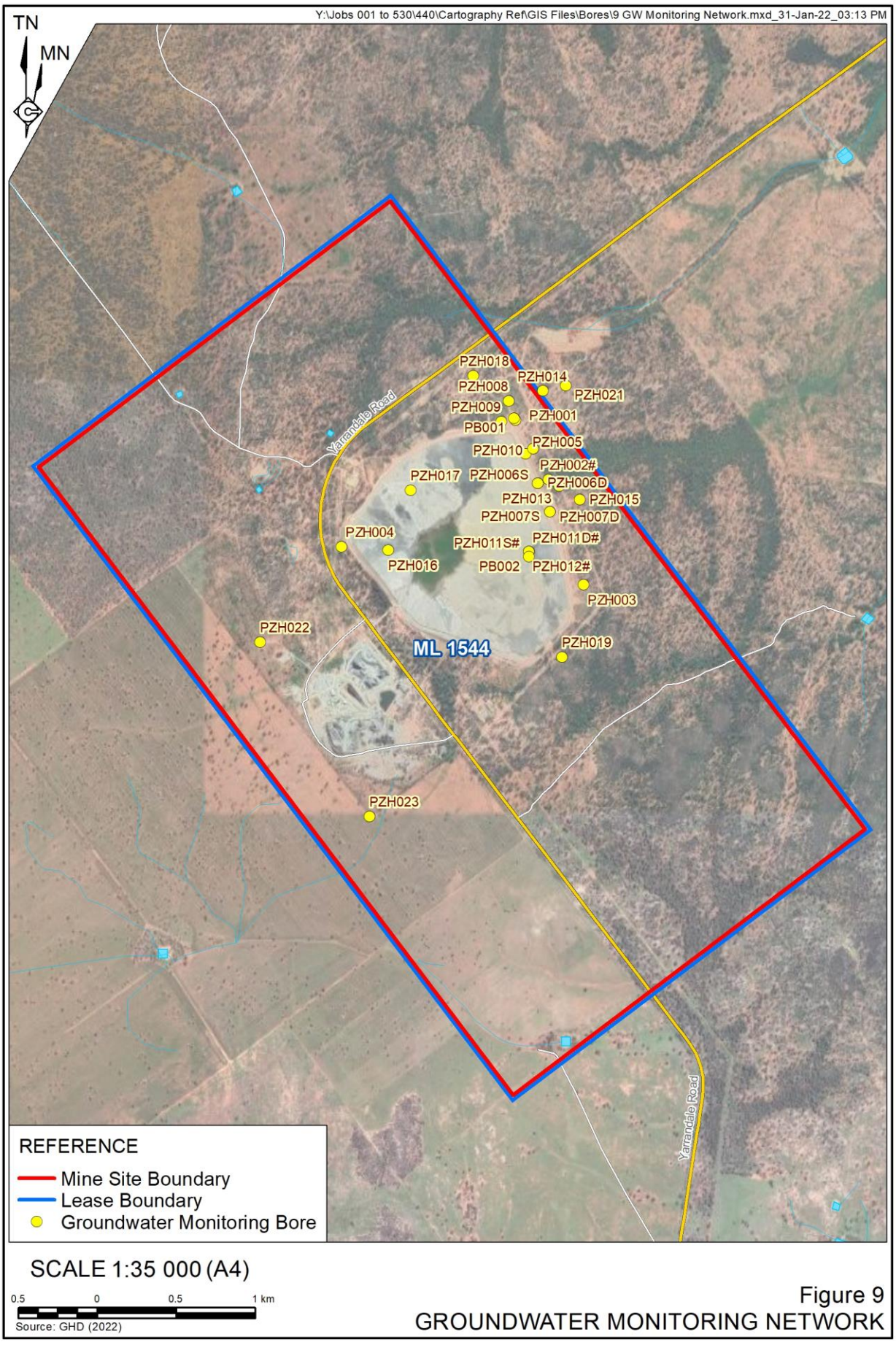


Figure 9
GROUNDWATER MONITORING NETWORK

6.3.2.4 Groundwater Levels

A total of 27 monitoring bores have been installed to monitor water level changes since the construction and operation of the Tailings Storage Facility in December 2004 **(Figure 9**). Monitoring is undertaken quarterly, with results published annually by the Applicant in accordance with EPL 11254. Currently, no bores are pumped in accordance with regulatory approvals.

Section 4.2.1 of GHD (2022) presents a summary of historical water level changes within the groundwater monitoring network. Review of monitoring records indicate that groundwater levels at the Mine Site are typically between 20m to 90m below ground level but may vary between 10m and 140m below ground level. The majority of monitoring bores show an increasing trend in groundwater levels between 2004 and 2021. There is no distinct evidence of drawdown from mining or effects from recent drought conditions. Groundwater reviews undertaken by Earth Environmental Sciences in 2012 and 2013 concluded that the rising groundwater levels are likely attributable to the TSF, as the weight of the TSF is increasing pressure on pore spaces in the underlying uppermost aquifer resulting in a localised groundwater mound. It is noted that groundwater quality monitoring data indicate that rising groundwater levels are not caused by seepage. GHD (2022) note that drawdown in remaining bores may be being offset by mounding in the vicinity of the TSF.

6.3.2.5 Groundwater Inflows

A review of metered groundwater inflow data undertaken by Metso (2020) reports that groundwater take from operations at the Mine Site was approximately 53ML/year, including both aquifer interception (1.2 ML/year) and groundwater entrained in ore (51.7 ML/year). These results indicate that groundwater inflow into the existing Mine Site workings is low, approximately 142 m^3/day.

Review of water transfer data by KH Morgan and Associates (2010) revealed that groundwater inflows have not increased along with the depth of the mine. This could potentially be attributed to a limited aquifer thickness, or a decrease in the hydraulic conductivity of the strata due to a tightening of fractures at depth.

6.3.2.6 Groundwater Quality

Detailed analysis of groundwater quality at the Mine Site is presented in Section 3.2.3 and Appendix B of GHD (2022). In summary, monitoring data indicates that groundwater in the vicinity of the Mine Site is generally brackish to saline and has high electrical conductivity historically ranging from 10 000 µS/cm to 20 000µS/cm. Groundwater pH is generally circumneutral with some historic short term spikes (pH below 5 or pH below 9) recorded but no consistent trends (up or down) are associated these deviations. TDS concentrations range between 5 000 mg/L and 20 000 mg/L. A groundwater review conducted by Earth Environmental Sciences in 2012 and 2013 found no indication of chemical leakage from the TSF.

There are no increasing trends in dissolved metals evident in groundwater monitoring records. No discernible trends in groundwater quality have been observed within monitoring results for arsenic, beryllium, cadmium, chromium, lead, mercury, or vanadium. Gradually decreasing trends have been evident for barium, cobalt, copper, manganese and zinc across most bores. There have been some outlying changes to concentrations of barium, cobalt, manganese, zinc and copper at some individual bores but no consistent trends have been established.

6.3.3 Potential Impacts and Assessment Criteria

Potential groundwater impacts may include impacts to water supply bores and natural ecosystems that are dependent on groundwater. The *Aquifer Interference Policy 2012* (AIP) establishes the minimal impact considerations for groundwater sources. The following potential impacts have been considered for assessment.

- Groundwater level drawdown as a result of inflow to mine workings potentially limiting the availability of groundwater for licenced groundwater users and/or GDEs and other sensitive environmental receptors.
- Impacts to groundwater quality as a result of ongoing mining activities and use of the TSF.
- Cumulative impacts from other mining activities in the locality.

Groundwater yield is very low in the vicinity of the Mine with evidence of minimal groundwater inflow into the existing mine workings and groundwater salinity is between 10 000µS/cm and 20 000µS/cm. Therefore, Level 1 minimal impact considerations for Less Productive Fractured Rock Water Sources under the AIP have been adopted for the groundwater impact assessment (GHD (2022) and are defined as follows:

Water table:

- Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, at a distance of 40m from any high priority GDE or high priority culturally significant site listed in the schedule of the relevant WSP. A maximum of a 2m water table decline cumulatively at any water supply work.
- If more than 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40m from any high priority GDE; or high priority culturally significant site; listed in the schedule of the relevant WSP then appropriate studies (including the hydrogeology, ecological condition and cultural function) will need to 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 2m decline cumulatively at any water supply work, then make good provisions should apply.

Water pressure:

- A cumulative pressure head decline of not more than a 2m decline at any water supply work.
- If the predicted pressure head decline is greater than the requirement 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 provisions apply.

Water quality:

- Any change in groundwater quality should not lower the beneficial use category of the groundwater source, beyond 40 m from the activity.

6.3.4 Conceptual Groundwater Model

Comprehensive data collected from previous investigations and for the preparation of this Modification Report has been used by GHD to establish an understanding of the existing groundwater setting which has been applied to generation of a conceptual hydrogeological model in the vicinity of the Mine Site (GHD, 2022). The conceptual model is presented in **Figure 10** and forms the basis for the inflow and dewatering assessments discussed in Section 6.3.7.

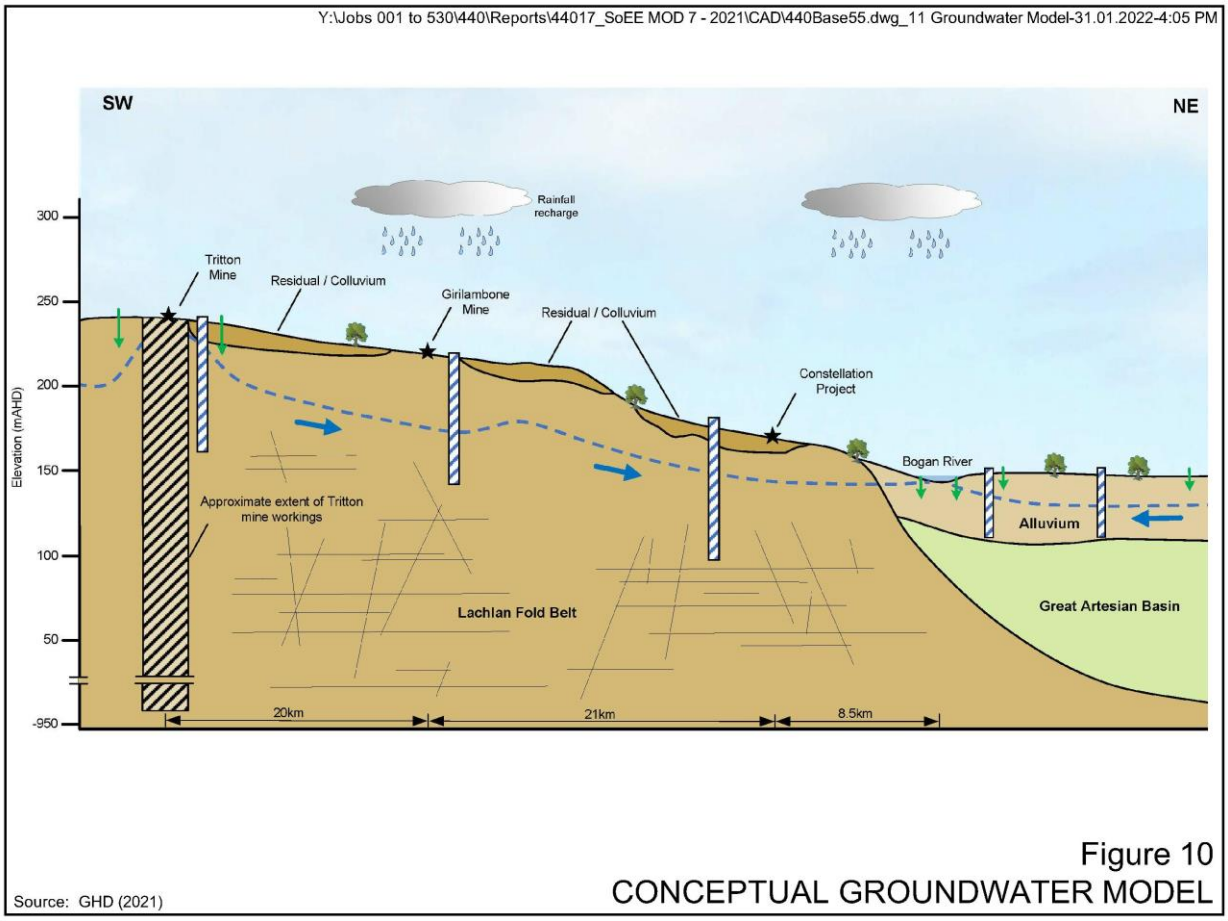


Figure 10
CONCEPTUAL GROUNDWATER MODEL

Source: GHD (2021)

The following provides a general summary of the features of the groundwater setting in the vicinity of the Mine.

- GHD has assumed the presence of residual or unconsolidated materials (colluvium) in places that would act as locations of groundwater recharge.
- Groundwater is predicted to occur generally between 20m to 90m below ground level within a fractured rock aquifer system.
- The regional groundwater table reflects topography with groundwater flowing to the northeast towards the Bogan River.
- Groundwater in the vicinity of the Mine Site is generally brackish to saline, has a generally neutral pH and does not exhibit any indicators of mine-related seepage (such as dissolved metals).
- Mining activity at the Mine Site and at other operations is likely to have caused groundwater sink conditions, drawing groundwater towards open voids (open cut or underground) in the vicinity of the operations.

- Groundwater level monitoring indicates there is groundwater mounding in the vicinity of the TSF. Water quality monitoring in the vicinity of the TSF is consistent with regional monitoring, suggesting that the mounding is caused by the weight of placed tailings on existing fractures and pore spaces and not seepage from the TSF.
- Although the existing underground workings of the Tritton Mine extend to 1.3km below surface, there has been no indication of progressive drawdown in the vicinity of the Mine Site. This is indicative of a low yielding groundwater setting.

6.3.5 Assessment of Impacts

6.3.5.1 Groundwater Inflow

Assessment of inflows into the decline and associated workings was undertaken by GHD using the "equivalent well method" with the methodology detailed in Section 6.1.1 of GHD (2022). This approach uses mathematical equations to provide conservative estimates of groundwater inflow using known aquifer parameters and reasoned assumptions. It is appropriate in simple groundwater settings where consistent outcomes have been experienced or are expected. More complex environments and impacts would require complex groundwater modelling. However, GHD consider an analytical approach would provide a reasonable and conservative approximation of predicted impacts associated with the proposed modification.

In summary, comparison of the predicted groundwater inflow rates to those observed at the existing Tritton underground workings has allowed for the development of conservative estimates of groundwater inflow rates as a result of the proposed modification. To be conservative, GHD (2022) applied two analytical approaches, as follows.

- Method A – Treating the decline as a large diameter shaft (based on the Theis well equation); and
- Method B – Dewatering as a large pit (based on the Jacob-Lohman equation).

Table 7 presents the parameter values adopted for assessment.

Table 7
Summary of Analytical Inputs

Page 1 of 2

Parameter	Value
Transmissivity, T (m^2/day)	Aquifer hydraulic conductivity will be influenced by the proportion of larger water bearing fractures within the rock mass. Based on the results of the pumping test undertaken at Tritton Mine (see Section 3.6.2.1 of GHD (2022)). a transmissivity of 0.1m^2/day has been adopted. To address uncertainties, an uncertainty analysis has been undertaken where a range of transmissivities (T) have been applied. $T = k \times L$ Where: k is aquifer hydraulic conductivity (m/day); and L is aquifer thickness (m). Conservatively assuming an average SWL of 30 m bgl based upon monitoring data and the effective base of the Ordovician rocks as 700m; an aquifer thickness of 670 m has been adopted.

Table 7(Cont'd)
Summary of Analytical Inputs

Parameter	Value
Drawdown required, H (m)	The base of the Tritton Mine workings is 1.4km. However, the effective base of the Ordovician rocks has assumed to be 700m. Below this depth it is assumed that fractures through which groundwater propagates will decrease in size due to the weight of overburden rock. Therefore, a maximum drawdown of 700m has been assumed. The depth of the Budgerygar workings is approximately 700m. Therefore, the drawdown required, H, was not increased for scenarios that include Budgerygar workings.
Radius at which drawdown is required	The outer diameter of the decline at Tritton Mine and Budgerygar is 50m. To take into account stoping, the diameter of the mine workings has been assumed to be 200m. The radius of the workings was not increased with the inclusion of the Budgerygar workings. This is considered a reasonable assumption as the proposed Budgerygar workings are close to the existing Tritton Mine workings.
Elapsed time, t (days)	Mining at Tritton Mine commenced in 2005. The assessment has been undertaken for current conditions (approximately 17 years or 6,205 days), end of approved mining at the end of 2024 (approximately 20 years or 7,300 days) and end of proposed mining at Budgerygar in 2028 (approximately 24 years or 8,760 days).
Storage coefficient (storativity), S (m/m)	Fractured rock aquifers tend to have low groundwater storage, and therefore 1×10^{-4} has been initially adopted. Adopted aquifer storage values from groundwater assessments at surrounding mining operations have been considered. Note that based on a specific storage (Ss) of 1×10^{-6} (1/m) and aquifer thickness of 670 m, the storativity would be 6×10^{-4}. For additional conservativeness (in terms of radius of drawdown), a storativity of 1×10^{-5} has also been adopted.

The results of the groundwater inflow analysis based on the application of the two analytical approaches, have been summarised in **Table 8**. The results indicate that under current conditions the rate of inflow is approximately $140m^3$/day to $150m^3$/day. This corresponds with the current observed rate of inflow into Tritton Mine of $142m^3$/day. Results have been presented for current conditions, end of approved mining and the end of proposed mining. Annual estimates of inflow have been provided based on the predicted daily inflow projected over 365 days, however it is noted that inflows are not likely to occur consistently. A peak annual inflow of 54.75ML is predicted, however given current monitored volumes of inflow, this is likely to be an overestimate. This may be compared to the licence holding of Tritton Resources of 334ML (see Section 1.4). It is noted that the Water Access Licences described in Table 2 and the 334ML entitlement related to groundwater take is currently applied across each of the Applicant's operations. However, as the predicted inflows are generally consistent with existing inflows, the existing entitlements are considered sufficient to cover operational requirements for the modified operations.

The results in **Table 8** also indicate that the rate of inflow into the mine workings would decrease slightly over time. This indicates that post-mining inflows are likely to reduce.

Table 8
Estimated Groundwater Inflow

Time	Time (days)	Transmissivity (m^2/day)	Storativity	Method A			Method B		
				m^3/day	ML/day	ML/yr*	m^3/day	ML/day	ML/yr*
Current conditions	6 205	0.1	1×10^{-4}	150.24	0.15	54.75	140.13	0.14	51.10
End of approved mining	7 300	0.1	1×10^{-4}	146.19	0.15	54.75	136.73	0.14	51.10
End of proposed mining	8 760	0.1	1×10^{-4}	141.89	0.14	51.10	133.11	0.13	47.45
Note * Annual estimate based on predicted daily inflow over 365 days.									
Source: GHD (2022) – After Table 6.2									

In order to test assumptions for transmissivity (the conductivity of the aquifer across its estimated thickness) and storativity (storage potential and therefore indicating release of water from the setting in response to pressure changes), GHD assessed inflow for current conditions under a variety of assumed levels for these parameters and compared predicted inflow to the inflows measured using metered groundwater dewatering of 142m^3/day (see Section 6.3.2.5). **Table 9** presents the outcomes of this review with the results highlighted in grey closely approximating measured inflows.

Table 9
Estimated Inflow – Current Conditions (6 205 days) – Sensitivity Analysis

Transmissivity* (m^2/d)	Storativity	Method A		Method B	
		m^3/day	ML/day	m^3/day	ML/day
0.01	1×10^{-4}	24.66	0.02	21.18	0.02
0.1	1×10^{-4}	150.24	0.15	140.13	0.14
0.15	1×10^{-4}	210.78	0.21	197.91	0.20
1	1×10^{-4}	1078.5	1.08	1032.45	1.03
0.01	1×10^{-5}	15.02	0.02	14.01	0.01
0.1	1×10^{-5}	107.85	0.11	103.24	0.10
0.15	1×10^{-5}	154.12	0.15	147.92	0.15
1	1×10^{-5}	841.1	0.84	814.25	0.81
Note * Transmissivity = average horizontal conductivity x aquifer thickness					
Source: GHD (2022) - Table 6.3					

On the basis of this review, the most likely setting features are:

- transmissivity of 0.1m^2/day with a storativity of 1×10^{-4}; or
- transmissivity of 0.15 m^2/day with a storativity of 1×10^{-5}.

GHD estimated the rate of inflow to the end of approved mining and proposed mining (that is, extended to 2028) with the results presented in **Tables 10** and **11**. These results indicate that for each scenario the rate of inflow will likely decrease over time. Under worst case assumptions, the inflow level is predicted to be as high as 1.06ML per day (using Method A with a transmissivity of 0.1m^2/day with a storativity of 1×10^{-4}).

Table 10
Estimated Inflow – End of Approved Mining (7 300 days) – Sensitivity Analysis

Transmissivity* (m^2/d)	Storativity	Method A		Method B	
		m^3/day	ML/day	m^3/day	ML/day
0.01	1×10^{-4}	23.60	0.02	20.47	0.02
0.1	1×10^{-4}	146.19	0.15	136.73	0.14
0.15	1×10^{-4}	205.45	0.21	193.36	0.19
1	1×10^{-4}	1057.45	1.06	1013.38	1.01
0.01	1×10^{-5}	14.62	0.01	13.67	0.01
0.1	1×10^{-5}	105.75	0.11	101.34	0.10
0.15	1×10^{-5}	151.25	0.15	145.30	0.15
1	1×10^{-5}	828.21	0.83	802.23	0.80
Note * Transmissivity = average horizontal conductivity x aquifer thickness					
Source: GHD (2022) – After Table 6.4					

Table 11
Estimated Inflow – End of Proposed Mining (8 760 days) – Sensitivity Analysis

Transmissivity* (m^2/d)	Storativity	Method A		Method B	
		m^3/day	ML/day	m^3/day	ML/day
0.01	1×10^{-4}	22.51	0.02	19.73	0.02
0.1	1×10^{-4}	141.89	0.14	133.11	0.13
0.15	1×10^{-4}	199.79	0.2	188.48	0.19
1	1×10^{-4}	1034.77	1.03	992.79	0.99
0.01	1×10^{-5}	14.19	0.01	13.31	0.01
0.1	1×10^{-5}	103.48	0.1	99.28	0.1
0.15	1×10^{-5}	148.15	0.15	142.47	0.14
1	1×10^{-5}	814.24	0.81	789.16	0.79
Note * Transmissivity = average horizontal conductivity x aquifer thickness					
Source: GHD (2022) – After Table 6.5					

However, the assessment approach used by GHD (2022) has applied various analytical approaches to assess which assumptions result in groundwater inflow that is consistent with existing records. GHD (2022) is confident that the assumed transmissivity of $0.1m^2$/day with a storativity of 1×10^{-4} remain appropriate for assessment of possible groundwater drawdown impacts presented in Section 6.3.5.2.

6.3.5.2 Groundwater Drawdown

A prediction of dewatering influence at the end of approved mining and the end of proposed mining was undertaken by GHD using assumptions for aquifer transmissivity and storativity that were considered to approximate existing conditions for (see Section 6.3.5.1 review of inflow). Duration has been assumed based on the period of approved and proposed mining. The methodology behind this assessment is described in full in Section 6.2.1 of GHD (2022). Results of this analysis are presented in **Table 12**.

Table 12
Estimated Extent of Dewatering

Time	Time (days)	Transmissivity (m^2/day)	Storativity	Extent of dewatering (m)
Current conditions	6 205	0.1	1×10^{-4}	3 737
End of approved mining	7 300	0.1	1×10^{-4}	4 053
End of proposed mining	8 760	0.1	1×10^{-4}	4 440
Source: GHD (2022) – After Table 6.6				

The current estimated extent of dewatering is approximately 3.7km. Based on the most likely storativity and transmissivity parameters of the local aquifer as identified above, the predicted drawdown at the end of proposed mining is likely 4 440m. The closest landholder bore is 19.3km from Tritton Mine. Therefore, based on the results of the analysis, drawdown due to approved and proposed mining would not impact any landholder bores. **Figure 11** presents regional groundwater levels, the predicted radius of drawdown and the closest landholder bore (GW026890).

A further sensitivity analysis was undertaken to consider the range of outcomes possible under various assumptions for transmissivity and storativity of the aquifer. Under "worst case" aquifer parameter assumptions, results indicate that the predicted level of dewatering may extend up to 44 396m, however, the predicted rate of inflow associated with these assumptions is significantly higher than locally observed levels. A drawdown of this magnitude would require a daily inflow of 814.24 m^3/day, in contrast with the observed daily inflow levels of 142m^3/day. Therefore, the worst-case scenario of a radial drawdown of 44 396m day is unlikely to occur.

It is of note that the Mine Site has been operating for 15 years, possesses an extensive groundwater monitoring network and has current workings significantly larger and deeper than the Budgerygar deposit. Historically, there has been limited drawdown detected in the vicinity of the Mine Site, therefore, it is likely that the drawdown associated with the proposed modification will be less than the levels predicted.

On the basis of the above, GHD (2022) considers that the proposed activity would satisfy the Level 1 minimal impact considerations under the AIP for groundwater levels and pressure head decline at a registered water supply work.

6.3.5.3 Groundwater Dependent Ecosystems

There are no known high priority Groundwater Dependent Ecosystems (GDEs) within 20km of Mine Site and a review of broad scale mapping did not identify any known GDEs within 20km of Mine Site. Therefore, the assessment criteria specified in the AIP is satisfied for high priority GDEs.

A search of the Groundwater Dependent Ecosystem Atlas was undertaken to identify aquatic and terrestrial GDEs within 20km of the Budgerygar Deposit. The search identified a number of potential GDEs within proximity of the Budgerygar Deposit. The location of potential GDEs within the radius of drawdown is shown on **Figure 12**.

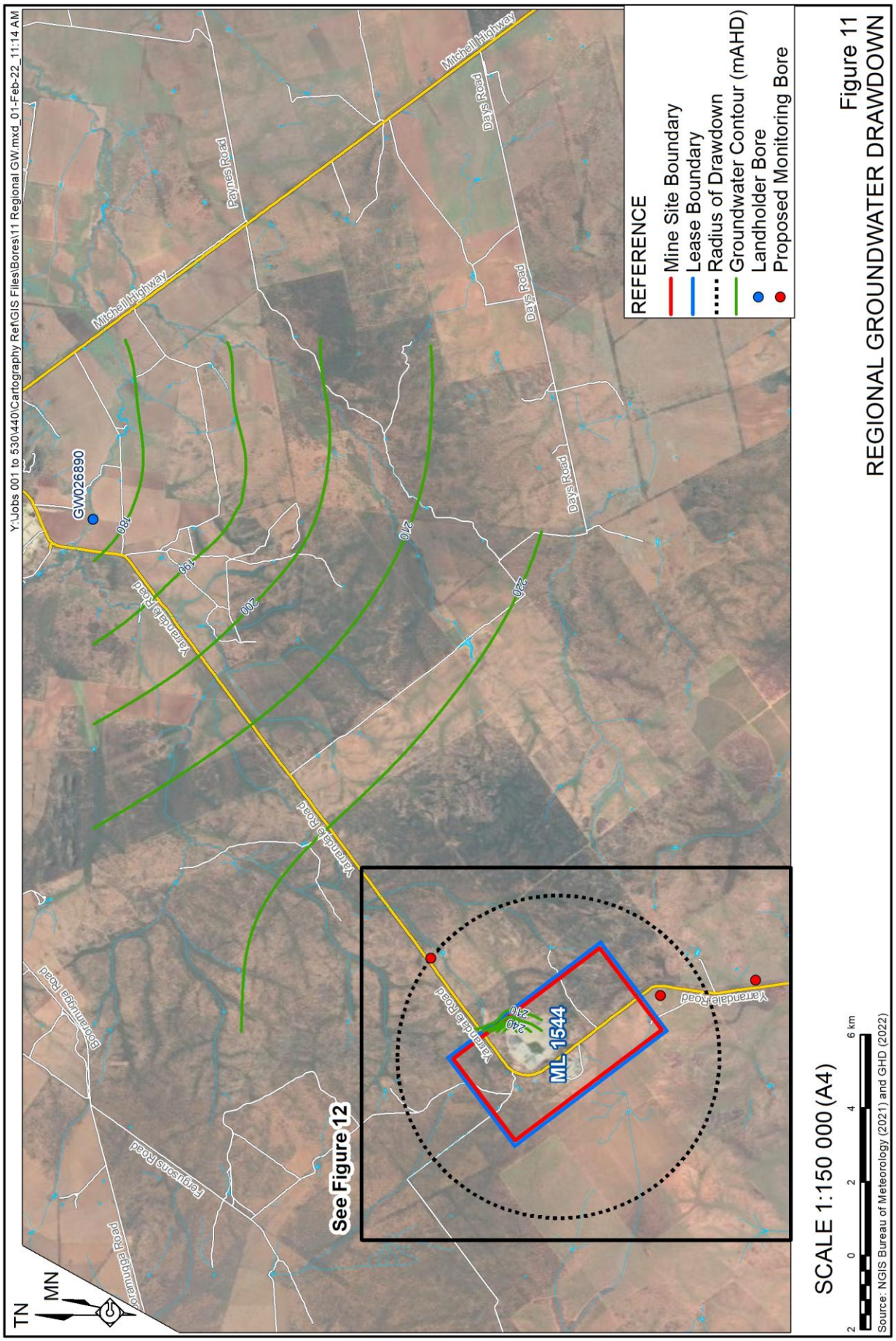


Figure 11
REGIONAL GROUNDWATER DRAWDOWN

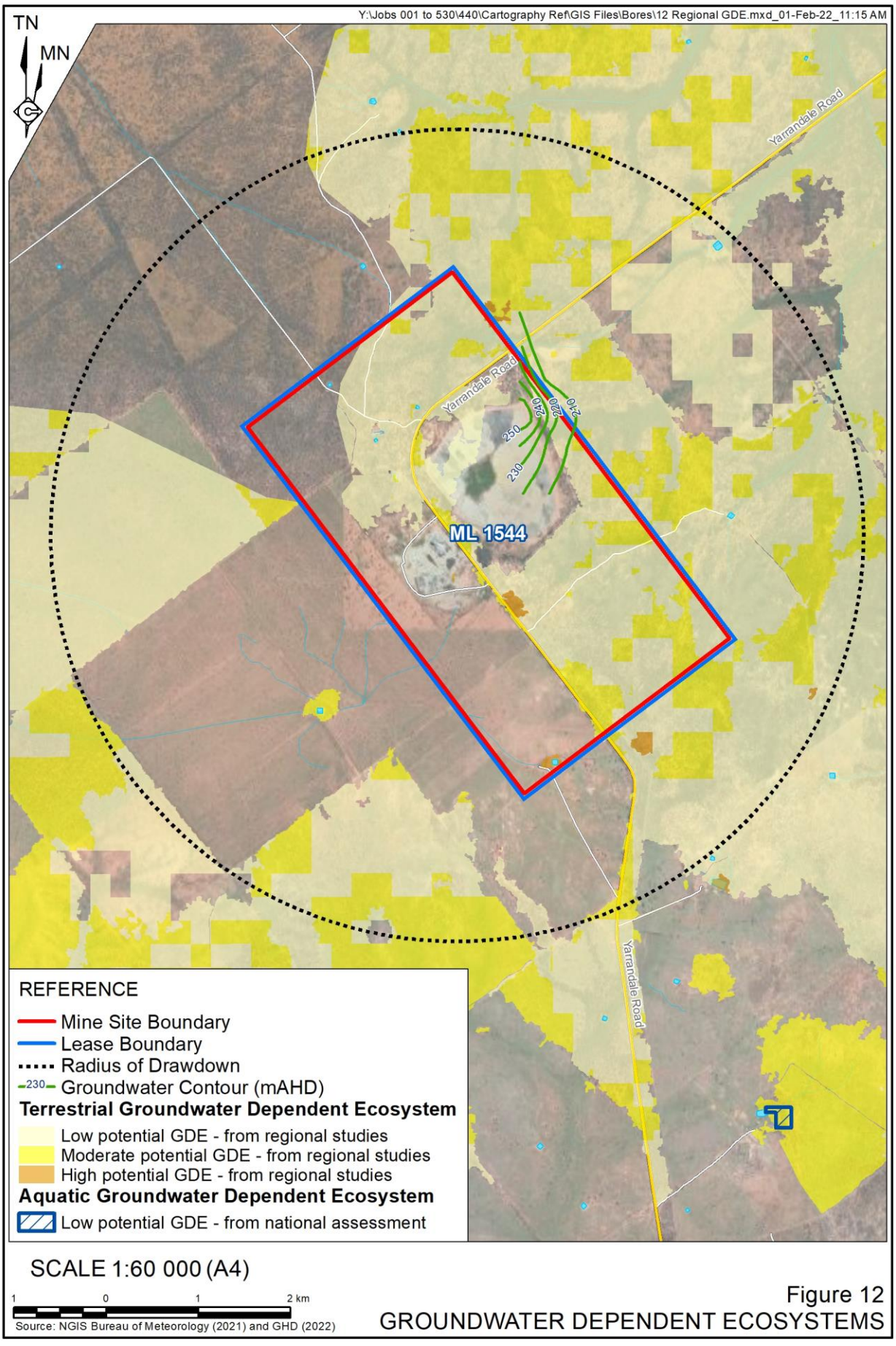


Figure 12
GROUNDWATER DEPENDENT ECOSYSTEMS

GHD (2022) concluded there was unlikely to be impacts to potential terrestrial of aquatic GDEs as a result of the proposed mining of the Budgerygar deposit as:

- the measured groundwater levels (mainly 20m to 90m below ground level but in some cases 10m to 140m below ground level) are beyond the reasonable limit of tree rooting depths; and
- the two low-potential aquatic GDEs are beyond the predicted extent of groundwater drawdown.

On this basis, GHD (2022) considers that the proposed activity would satisfy the Level 1 minimal impact considerations under the AIP for groundwater levels and pressure head decline impacts for groundwater dependent ecosystems.

6.3.5.4 Groundwater Quality

Groundwater levels at the Mine Site have shown a mostly increasing trend since the start of mining. Therefore, it is considered unlikely that significant oxidation has occurred through exposure of metal sulphides to oxygen. Only the access decline represents an opportunity for new areas above the water table to be exposed to air.

Given the history of groundwater quality monitoring indicates not evidence of impacts from mining and there are no substantial changes to mining methods proposed, GHD (2022) considered that possible changes to groundwater quality would not reduce the beneficial use category of groundwater within 40m of the Mine and therefore would meet the Level 1 minimal impact considerations for groundwater quality from the AIP

6.3.5.5 Post-Mining Impacts

Predictions of groundwater inflows indicate any inflow is likely to decline over time and therefore post-mining impacts are not likely to exceed those currently experienced. As groundwater levels slowly recover in areas that have been mined, regional groundwater levels would recover.

6.3.5.6 Cumulative Impacts

The closest mining operation to the Mine is the Murrawombie Copper Mine located 20km to the northeast. The most likely radius of influence of drawdown is 4.4m from the Budgerygar deposit and therefore it is not considered likely that cumulative impacts would occur. GHD (2022) considered that no specific assessment of cumulative impacts was required.

6.3.6 Mitigation and Management Measures

Three additional monitoring bores would be installed at distances ranging from 2km to 5km from the Budgerygar deposit to enable monitoring of potential groundwater drawdown from mining activities. The indicative locations of these bores are presented in **Figure 9**. Additionally, the Applicant would enter negotiations with the landholder of bore GW026890 to allow for monitoring of any potential drawdown at this bore.

In addition to the installation and monitoring of the above bores, the Applicant would continue and expand the existing flow monitoring program at the Mine Site to include the metering of water transfers into and out of the Budgerygar workings. This expanded monitoring program would allow for quantitative calculation of groundwater inflows into the mine workings.

6.3.7 Conclusion

Based on analytical assessment of predicted groundwater inflow rates and radial extent of dewatering, GHD (2022) has made the following conclusions in relation to the proposed modification.

- The proposed mining of the Budgerygar deposit may result in drawdown in a radius of 4 440m.
- As noted in Section 6.3.2.2 the closest registered private bore is located 19.3km northeast of the Mine Site. Therefore, impacts to private bore users would not be expected to occur.
- There are unlikely to be impacts to known or potential GDEs in the vicinity of the Mine Site.
- Potential impacts to groundwater quality would be limited to the immediate vicinity of the Mine Site and therefore would not reduce the beneficial use category of the groundwater source.
- Post-mining groundwater inflow would reduce over time once mining has ended as regional groundwater levels gradually recover.
- Due to the distance between the Mine Site and other nearby operations (20km+), cumulative impacts would not be expected.

Considering the remote location of the Mine Site, the significant distance to the nearest landholder bore (approximately 19.3km), the lack of GDEs in the vicinity and the chemical characteristics of the groundwater, it is anticipated that groundwater impacts as a result of the proposed modification would be negligible.

It is noted that GHD (2022) concludes that the proposed modification would meet the Level 1 minimal impact considerations from the NSW Aquifer Interference Policy for impacts to landholder bores, GDEs and groundwater quality.

6.4 SURFACE WATER

6.4.1 Introduction

The following subsection provides an overview of the existing environment with respect to surface water at the Mine Site. The contamination of surface water resources as a result of the excavation of cells within the TSF for the emplacement of drill cuttings and mill trash has been identified as a potential risk. Potential impacts from the proposed modification are presented, and additional mitigation and management measures are proposed to reduce or prevent these impacts. This is followed by discussion of any residual impacts relating to the proposed modification, and how these impacts will be monitored.

6.4.2 Existing Setting

6.4.2.1 Surface Water

Most watercourses in the vicinity of the Mine Site are ephemeral and therefore create few issues with diversion of clean water from the Mine Site. The Mine operates under zero discharge conditions and therefore does not impact the surrounding environment.

Surface water management structures at the Mine Site are designed to separately manage clean water, dirty water and contaminated water in order to meet the following objectives.

- Divert clean water from disturbed areas.
- Collect coarse sediments in runoff from disturbed areas.
- Collect any chemicals or process solution within the system and contain on site.
- Reuse water where practicable for processing or dust control.

Clean water diversion banks or drains have been constructed to divert clean surface water around operational areas and away from the Mine Site and reduce catchment size. Dirty water diversion drains or banks have been constructed to ensure that all potentially sediment-laden or contaminated water is collected and reused.

Sediment retention basins have been constructed to capture and store water from catchments where there are exposed soils but with little or no risk of contamination occurring. These basins were designed with sufficient capacity to contain a 5-day, 90^{th} percentile rainfall event based on 100 years of Nyngan rainfall data, in addition to 2 years of anticipated soil loss.

Containment dams have been constructed to capture runoff from catchments containing potentially contaminating material and were designed to contain the runoff from a 100-year, 72-hour storm event. Water levels are maintained at a low level to ensure sufficient available freeboard for rainfall events.

All chemical and fuel storage areas are bunded, and the tailings pipeline lies within a bunded corridor

Surface water monitoring is regularly conducted at six locations in and around the Mine Site. Weekly inspections of water management structures are conducted to ensure that:

- structures are intact and are diverting clean water as intended;
- dam levels are below freeboard limits;
- pumping systems are operational; and
- structures are free of terrestrial fauna.

The TSF is regularly monitored and has been constructed to limit the risk of failure.

6.4.3 Potential Impacts

The primary potential impact to surface water that may result from the proposed modification would be damage to the TSF perimeter embankment or lining resulting from excavation of tailings material, leading to potential leakage of tailings and possible contamination of surface water resources.

6.4.4 Mitigation and Management Measures

Risks to water quality from the proposed modification relate principally to potential contamination or failure of the TSF. These risks are currently managed through the design and operational control measures described in the existing approved Water Management Plan, Erosion and Sediment Control Plan, and Waste Rock Characterisation and Management Plan and would be continued under the proposed modification. Additional management and mitigation measures that would be implemented under the proposed modification to manage and mitigate potential impacts to surface water and groundwater include the following.

- All excavation and emplacement activities would be located a minimum of:
  - 80m from the inner edge of the embankment; and
  - 150m from the inner edge of the decant pond.

  to ensure that water does not pond next to the perimeter embankments, and to allow for unimpeded future embankment construction.
- Excavate the tailings material to a maximum depth of 1.5m. The liner is 5.9m to 10.9m below the current surface level ensuring any risk of liner disruption is negligible.
- Conduct weekly visual inspections of the cells to ensure that water is not ponding in them or near the perimeter embankment following deposition.
- Backfill the cells with waste material well in advance of any normal cyclic tailings deposition being undertaken in that area.
- Maintain an accurate plan of the location of cells, dates when tailings depositions started and ceased, and the outcomes of visual inspections.

6.4.5 Assessment of Impacts

Based on the proposed operational controls, it is considered that the proposed activities would not result in significant risk to the stability of the TSF embankments or damage the lining of the TSF.

6.4.5.1 Monitoring

The Applicant would continue to monitor surface water and groundwater quality. These results would continue to be reported in the Annual Environmental Management Report which is distributed to all applicable regulatory authorities.

6.5 NOISE AND VIBRATION

6.5.1 Introduction

The following subsection provides an overview of the existing environment with respect to noise and vibration at the Mine Site. Potential impacts from the proposed modification are presented, and management and mitigation measures are proposed to reduce or prevent these impacts. This is followed by discussion of any residual impacts relating to the proposed modification.

6.5.2 Existing Setting

The noise environment around the Mine Site is influenced by typical rural activities such as ploughing, harvesting and transportation, together with noise associated with stock, insects and birds. Wind in trees and distant traffic also contribute to the local noise climate.

Within the Mine Site, operational noise is generated by:

- transportation of ore and waste rock;
- crushing, grinding and processing of ore;
- construction and use of the tailings storage facility; and
- transportation of copper concentrate to the rail siding.

Underground activities at the Mine Site currently require irregular blasting activities at a depth of at least 100m below ground level.

6.5.3 Potential Impacts

It is anticipated that noise generated by operational activities including mining and the ore and waste rock handling and haulage, processing and the transportation of processed ore would not change substantially under the proposed modification. The only changes to these approved activities would involve the excavation of discrete cells and subsequent disposal of drill cuttings and mill trash within the TSF and the prolonging of activities to 2028, a further four years of operations. Construction of an additional 10m lift of the Waste Rock Emplacement would involve a similar approach to the current management of the emplacement, with the only difference being that construction would occur ultimately at an elevation 30m above ground level (see Section 3.4).

It is noted that annual noise monitoring is undertaken for the Mine in accordance with Condition L3 of EPL 11254. The results of this monitoring indicate that mining and processing operations are generally inaudible at monitoring locations and operational noise emissions generated by the Mine are compliant with all criteria (MAC, 2021).

Potential blasting impacts associated with ongoing operations would include blast vibration caused by the firing of explosives to fragment copper ore. Airblast overpressure is unlikely to be experienced at the surface.

6.5.4 Mitigation and Management Measures

The following mitigation measures would continue to be implemented to reduce potential impacts on sensitive receptors.

- Promptly respond to any complaint relating to noise or blasting.
- Undertake all proposed activities in accordance with existing plans and approvals including the Noise and Vibration Management Plan.

6.5.5 Assessment of Impacts

Due to the isolated nature of the Mine Site, the fact that most mining operations take place underground, and that mining of the Budgerygar deposit would be undertaken using the same activities and methods as are currently approved and implemented, it is expected that noise emissions and blast vibration from mining operations associated with the proposed modification would continue to be compliant with all relevant criteria.

6.6 AIR QUALITY

6.6.1 Introduction

The following subsection provides an overview of the existing environment with respect to air quality at the Mine Site. Potential impacts from the proposed modification are presented, and management and mitigation measures are proposed to reduce or prevent these impacts. This is followed by discussion of any residual impacts relating to the proposed modification.

6.6.2 Existing Setting

The Mine Site is located in an area with a warm semi-arid climate where high evaporation rates can cause dust lift off from wind erosion and other ground-disturbing activities. Mine-related activities that may enhance dust lift off include:

- ore and waste rock handling and haulage;
- construction and management of stockpiles;
- processing of ore and waste rock; and
- movement of vehicles on unsealed roads.

Other sources of air pollution generated through Mine-related activities include:

- exhaust emissions from diesel and other petrol combustion;
- emissions from the existing exhaust ventilation rise;
- fumes from blasting; and
- fumes from reagents used in the processing plant.

An assessment of air quality at the Tritton Copper Mine was completed by Heggies Pty Ltd (2007) in conjunction with the SoEE for the Tritton Expansion Project–Stage 2. The assessment considered particulate matter and deposited dust emissions that would result from activities involved in the expansion of mining activities. Heggies (2007) concluded the following in relation to air quality at the Mine Site at all the nearest non-Project related residences.

- Cumulative 24-hour average PM_{10} would be less than 41.0μg/m^3.
- Cumulative Annual Average PM_{10} would be less than 18.1μg/m^3.
- Cumulative annual average deposited dust would be less than 2.6g/m^2/month.

6.6.3 Potential Impacts

It is anticipated that air emissions would be generated by Mine-related activities including the handling of ore and waste rock processing and the transportation of concentrate. These activities would not change in scale or intensity under the proposed modification. The only changes to these approved activities would involve the excavation of discrete cells and subsequent disposal of drill cuttings and mill trash within the TSF and the prolonging of activities to 2028, a further four years of operations. In addition, no additional land would be disturbed.

6.6.4 Mitigation and Management Measures

The tailings material stored in the TSF has a moisture content of approximately 15%. As a result, there have been no issues with dust emissions from the TSF during its operating history. The moisture content of the tailings material would be high enough to limit dust emissions during hauling and unloading of material onto the TSF. The following mitigation measures would be implemented to minimise potential air quality impacts.

- Visually inspect disposal areas within the TSF on a weekly basis to ensure that no visible dust is emitted.
- Apply water from a water cart to the excavation / disposal area, TSF embankment, access ramp and haul route during dry and / or windy conditions to suppress dust lift-off.
- Limit operations where practicable during periods of high wind.
- Ensure that the exhausts of equipment used on the TSF are diverted away from the ground surface so as not to generate dust.
- Ensure that all trucks transporting drill cuttings / mill trash to the TSF have their loads covered.
- Undertake underground ventilation at the minimum rate required for safe operation of the mining activities.
- Promptly respond to any complaint relating to air quality.
- Undertake all proposed activities in accordance with existing plans and approvals including the Air Quality Management Plan.

6.6.5 Assessment of Impacts

Due to the isolated nature of the Mine Site, the fact that most mining operations would be undertaken using the same activities and methods as are currently approved and implemented, and the additional management and mitigations measures that would be implemented to control and potential dust emissions, it is expected that air emissions from mining operations associated with the proposed modification would continue to be compliant with all relevant criteria.

6.7 VISUAL AMENITY

6.7.1 Introduction

The following subsection provides an overview of the existing environment with respect to visual amenity at the Mine Site. Potential impacts from the proposed modification are presented, and management and mitigation measures are proposed to reduce or prevent these impacts. This is followed by discussion of any residual impacts relating to the proposed modification.

6.7.2 Existing Setting

Visual amenity impacts of the existing approved operations are limited to obstructed views of Mine infrastructure from vehicles travelling on Yarrandale Road. The principal components of the Mine Site that are visible from Yarrandale Road are as follows.

- the southern end of the Tailings Storage Facility;
- the Waste Rock Emplacement;
- the Processing Plant;
- the mullock Stockpile Areas;
- the Hoisting Shaft Headframe and Winder; and
- the Administration and Workshop area.

Considering the remote location of the Mine Site, these visual amenity impacts have previously been assessed to be acceptable.

6.7.3 Potential Impacts

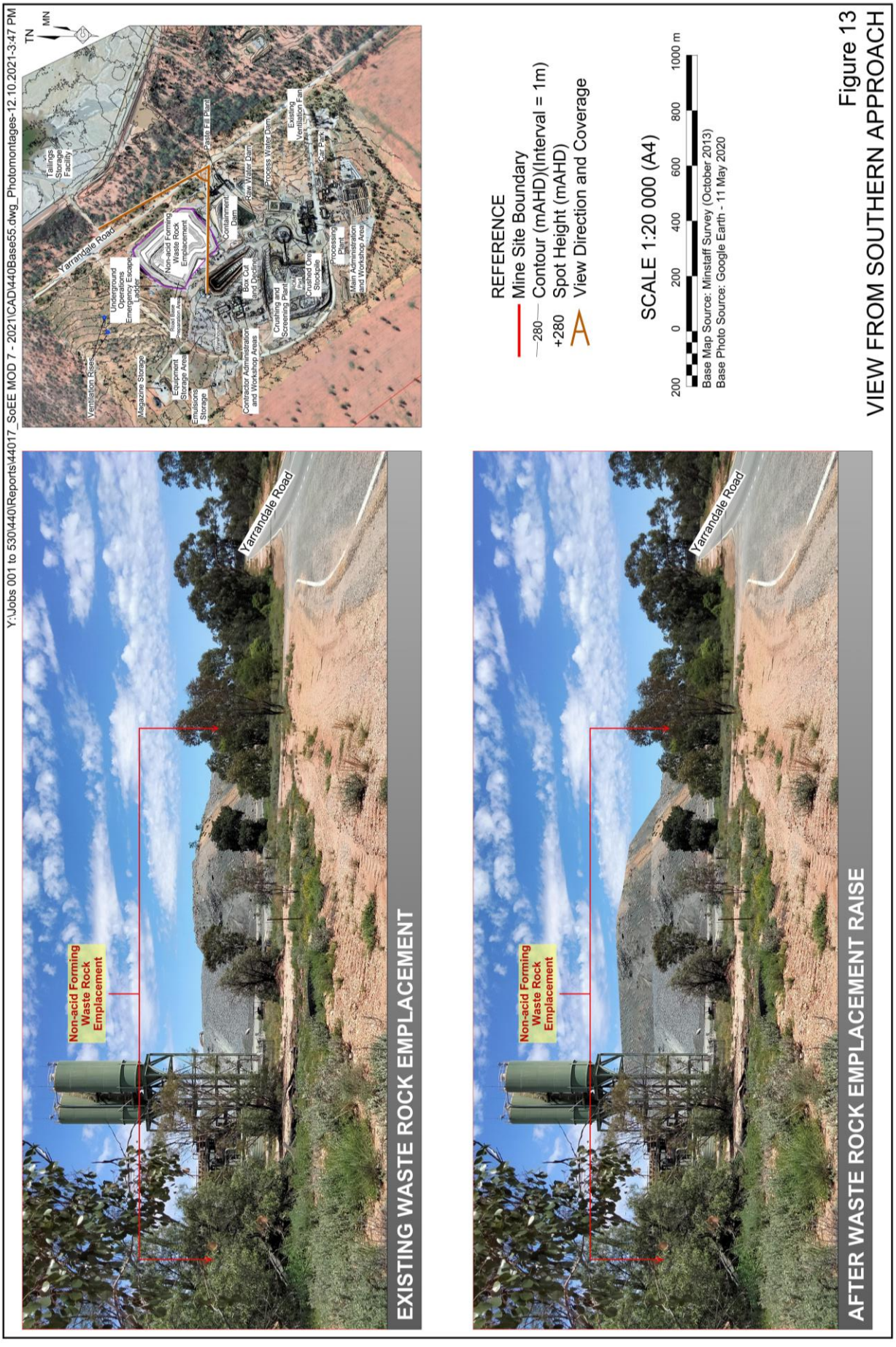
The proposed modification would result in an increase in the elevation of the Waste Rock Emplacement. The increased size of the emplacement would be visible to users of Yarrandale Road. However, the emplacement would not be visible form surrounding residences.

The existing views along Yarrandale Road are provided in **Figures 13** and **14** as well as indicative views of the Waste Rock Emplacement at the proposed final elevation of 30m above ground level or 301.5m AHD.

6.7.4 Mitigation and Management Measures

The following mitigation measures would be implemented to minimise potential visual amenity impacts.

- Promptly respond to any complaint relating to visual amenity.
- Undertake all proposed activities in accordance with existing plans and approvals including the approved MOP/RMP.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TN
MN
Yarrandale Road
Tailings Storage Facility
Underground Operations Emergency Escape Ladder
Non-acid Forming Waste Rock Emplacement
Road base Extraction Area
Equipment Storage Area
Emulsion Storage
Magazine Storage
Ventilation Rises
Box cut and Decline
Crushing and Screening Plant
Pad
Crushed Ore Stockpile
Contractor Administration and Workshop Areas
Containment Dam
Raw Water Dam
Process Water Dam
Paste Fill Plant
Existing Ventilation Rise
Car Park
Processing Plant
Main Administration and Workshop Area
REFERENCE
Mine Site Boundary
280 Contour (mAHD)(Interval = 1m)
+280 Spot Height (mAHD)
View Direction and Coverage
SCALE 1:20 000 (A4)
200 0 200 400 600 800 1000 m
Base Map Source: Minstaff Survey (October 2013)
Base Photo Source: Google Earth - 11 May 2020
Figure 13
VIEW FROM SOUTHERN APPROACH
EXISTING WASTE ROCK EMPLACEMENT
AFTER WASTE ROCK EMPLACEMENT RAISE


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TN
MN
Tailings Storage Facility
Yarrandale Road
Underground Development Portals
Emergency Escape Ladder
Non-acid Forming Waste Rock Emplacement
Containment Dam
Process Water Dam
Raw Water Dam
Paste Fill Plant
Existing Ventilation Fan
Car Park
Box Cut and Portals
Crushed Ore Stockpile
Crushing and Screening Plant
Processing Plant
Main Administration and Workshop Area
Contractor Administration and Workshop Areas
Equipment Storage Areas
Emulsions Storage
Magazine Storage
Ventilation Risers
REFERENCE
Mine Site Boundary
280 Contour (mAHD)(Interval = 1m)
+280 Spot Height (mAHD)
A View Direction and Coverage
SCALE 1:20 000 (A4)
200 0 200 400 600 800 1000 m
Base Map Source: Minstaff Survey (October 2013)
Base Photo Source: Google Earth - 11 May 2020
Figure 14
VIEW FROM NORTHERN APPROACH
Non-acid Forming Waste Rock Emplacement
Yarrandale Road
EXISTING WASTE ROCK EMPLACEMENT
Non-acid Forming Waste Rock Emplacement
Yarrandale Road
AFTER WASTE ROCK EMPLACEMENT RAISE

6.7.5 Assessment of Impacts

Based on the relative isolation of the Mine Site and the proposed visual amenity related controls, it is considered that the proposed modification to the Waste Rock Emplacement would not impact significantly on visual amenity. In addition, as all NAF waste rock stored in the Waste Rock Emplacement would be used for rehabilitation and final landform establishment at the time of Mine closure, the Waste Rock Emplacement would only be a temporary feature in the landscape with the final topography to be consistent with the pre-disturbance landform.

6.8 GENERAL ENVIRONMENTAL ISSUES

The Applicant considers that the remaining environmental impacts associated with the ongoing operations under DA 41/98, as modified, would remain generally consistent with existing approved operations.

Table 13 presents an overview of these issues. For each issue the Applicant's objectives in managing environmental aspects, a description of the existing environment, an overview of environmental management and mitigation measures that would be implemented and an assessment of potential residual impacts after implementation of management and mitigation measures are provided.

Table 13
Assessment of Impacts for Remaining Environmental Issues

Objectives	Existing Environment	Management/Mitigation Measures	Impact Assessment
TRANSPORTATION AND TRAFFIC			
To ensure that appropriate measures are taken to manage traffic generated by the Mine.	The transportation of the copper concentrate in sealed shipping containers from the Mine Site to the Hermidale rail siding is approved under DA 41/98. All transportation relating to the importation of ore to the Mine Site would be managed through approvals for the individual mines.	The proposed modification would result in a maximum of 100 additional heavy vehicle movements per year and a maximum of two heavy vehicle movements per day. These vehicle are likely to already use Yarrandale Road for access to the Mitchell Highway or the Barrier Highway. Due to the minor increase in traffic levels and the remote nature of the Mine Site, existing mitigation measures are considered to be sufficient.	Given that a maximum of 100 additional heavy vehicle movements per year and a maximum of two additional heavy vehicle movements per day would be generated, the proposed modification is not expected to result in significant changes to existing transportation levels or significant impacts additional to existing operations approved under DA 41/98. The proposed access arrangements would provide for clear access and sight distance. The minor change to traffic levels (which likely already use Yarrandale Road) would not substantially increase road degradation or reduce the productive life of Yarrandale Road.
SOIL AND LAND CAPABILITY			
To ensure that the proposed modification includes an environmentally sound approach to soil management and rehabilitation.	The Mine is an active mine site. Soil resources have been previously stripped and soil stockpiles established. Progressive and final rehabilitation is described in the approved MOP.	The proposed modification would not result in the disturbance of any additional land. In addition, the progressive and final rehabilitation measures identified in the approved MOP would continue to be implemented. As a result, no soil or land capability-specific management measures are proposed.	Given that the proposed modification would not result in the disturbance of any additional land, the Applicant considers that the proposed modification would have no impact to existing soil and land capability.

Table 13 (Cont'd)
Assessment of Impacts for Remaining Environmental Issues

Objectives	Existing Environment	Management/Mitigation Measures	Impact Assessment
ABORIGINAL HERITAGE			
To identify any sites of Aboriginal heritage value and consider the area within a regional Aboriginal heritage context.	No known sites or artefacts of Aboriginal cultural heritage value are located within the Mine Site nor are any relevant Aboriginal cultural heritage values known to apply over the land on which the Mine Site is situated.	As previous assessments have not identified any Aboriginal sites within the areas of approved disturbance and as the proposed modification would not disturb additional land, no additional control measures are required. Existing protocols relating to the unexpected discovery of sites or artefacts with Aboriginal cultural heritage value would continue to be implemented.	The proposed modification would not result in disturbance of additional areas. As a result, there would be no impact expected as a result of the proposed modification.
BIODIVERSITY			
To ensure the proposed modification does not adversely impact native flora and fauna, their habitat or other biodiversity values in the vicinity of the Mine Site.	The surface infrastructure development of the Mine Site has been completed and is operating such that any vegetation clearing and other disturbance to land which may act as a habitat to native fauna has been completed.	The proposed modification would not result in the clearing of vegetation or otherwise result in the removal of habitat that would impact native flora and fauna. No additional mitigation measures are considered necessary.	The proposed modification is not expected to impact biodiversity values in the vicinity of the Mine Site.
SOCIO-ECONOMIC			
To identify any positive or negative social or economic impacts that may result from the proposed modification and ensure that social equity is maintained.	The assessment prepared for the EIS submitted with the original development application in 1998 concluded that the operation of the Mine would not adversely affect the population of the Bogan Shire or the availability of housing and community services. The provision of employment, operational and maintenance spending and royalties was expected to provide significant direct and indirect benefits to the community.	As the proposed modification would result in only minor changes to the approved Mine, it is not considered that any additional mitigation or management measures are necessary.	The proposed modification would enable the continued efficient operation of the Tritton Copper Mine and consequently the continued distribution of the economic benefits of the Mine.

7. EVALUATION OF MERITS

7.1 INTRODUCTION

As a conclusion to the *Modification Report*, the 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 Project is undertaken by firstly assessing the statutory requirements that apply to the modification through consideration of:

- Section 4.55(2) of the EP&A Act in relation to the permissibility of modification to development consent for State significant development; and
- Section 4.15(1) of the EP&A Act in relation to the evaluation of applications for development in general.

The Project is then evaluated as a whole against the principles of Ecologically Sustainable Development (ESD) in order to provide further guidance as to the acceptability of the Project.

Section 7.4 presents the justification of the Project and revisits any residual impacts on the biophysical and social environment as a result of the proposed modification and reviews the Project against the objects of the EP&A Act.

7.2 STATUTORY REQUIREMENTS

7.2.1 Section 4.55(2) Considerations (EP&A Act)

As described in Section 1.1, the proposed modification is being made under Section 4.55(2) of the EP&A Act which is provided in full below.

> *(2)* ***Other modifications.*** *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if -*
>
> *a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and*
>
> *b) it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and*
>
> *c) it has notified the application in accordance with:*
>
> *(i) the regulations, if the regulation so require, or*
>
> *(ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*
>
> *d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.*

The following subsections provide an evaluation of the proposed modification against these provisions.

Substantially the Same Development

Under the proposed modification, the Project would remain "substantially the same development" as that approved under DA 41/98 for the following reasons.

- The scale of the proposed modification would be relatively minor in comparison to the approved Mine.
- The approved mining methods and rate would not change.
- It is anticipated there would be only minor changes to the groundwater setting but that impacts would be low risk (that is, for water users including private bore holders and groundwater dependent ecosystems).
- The environmental impacts of the Project as modified would be similar to the impacts of the approved Mine with the external experience of the Mine largely unchanged.
- The minor environmental impacts that are currently experienced would continue to be managed through conditions of consent.

Consultation with the relevant Minister, public authority or approval body

This is a matter for DPIE to consider during its assessment of the proposed modification.

Notification of the Application

This is a matter for DPIE to consider, however it is anticipated that DPIE will notify the application to relevant stakeholders.

Submissions Regarding the Proposed Modification

This is a matter for the DPIE to consider. However, the Applicant would be pleased to respond to any submissions received by DPIE during the assessment process.

7.2.2 Section 4.15(1) Considerations (EP&A Act)

Section 4.15(1) of the EP&A Act sets out the matters for consideration by a consent authority when determining an application for development consent.

> *(1)* ***Matters for consideration—general***
>
> *In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:*
>
> *(a) the provisions of:*
>
> *(i) any environmental planning instrument, and*
>
> *(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 Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and*

(iii) any development control plan, and

(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and

(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), and

(v) (Repealed)

that apply to the land to which the development application relates,

(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,

(c) the suitability of the site for the development,

(d) any submissions made in accordance with this Act or the regulations,

(e) the public interest.

The following subsections provide an evaluation of the proposed modification against these provisions.

Environmental Planning Instruments, Plans and Regulations (Section 4.15(1a))

All relevant environmental planning instruments, plans and regulations are addressed in Section 4. In summary, the proposed modification is permissible and consistent with the aims and objectives of relevant local and State environmental legislation and guidelines.

Likely Impacts of the Development (Section 4.15(1b))

Section 6 provides an assessment of the environmental factors potentially impacted by the proposed modification. The proposed management and mitigations measures would limit potential environmental impacts and the modification would not generate adverse environmental impacts beyond those already approved for the Mine.

Suitability of the Site (Section 4.15(1c))

Operations have been undertaken at the Mine Site since 1998 and the existing operation is approved to continue operating until 21 December 2024.

Submissions (Section 4.15(1d))

It is anticipated that DPIE will take any submissions into consideration during the assessment of this application.

The Public Interest (Section 4.15(1e))

The Applicant considers that the proposed modification serves the public interest as it would allow for the continued safe and efficient operation of the Mine. The Mine has an important role in the local community and currently employs 378 personnel (at year end 2020). Employment of local personnel provides additional flow-on benefits to the local community. Additionally, the environmental outcomes would be consistent with existing Mine operations resulting in no additional significant impacts and an improved environmental outcome from the disposal of waste materials in the TSF, a structure designed to store waste and limit contamination.

It is therefore concluded that the proposed modification is in the public interest through the continued operation of the Mine in a safe and environmentally responsible manner and the provision of ongoing local economic benefits.

7.3 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

7.3.1 Introduction

Sustainable practices by industry, all levels of government and the community are recognised to be important for the future prosperity and well-being of the world. The principles of Ecologically Sustainable Development (ESD), recognised for over two decades, are based upon meeting the needs of the current generation while conserving our ecosystems for the benefit of future generations. In order to achieve sustainable development, recognition needs to be placed upon the integration of both short-term and long-term environmental, economic, social and equitable objectives.

The four principles of sustainable development are as follows.

- The precautionary principle.
- The principle of intergenerational equity.
- The principle of the conservation of biodiversity and ecological integrity.
- The principle for the improved valuation, pricing and incentive mechanisms.

7.3.2 Precautionary Principle

Satisfaction of the precautionary principle rests on the available understanding of environmental risk and the assessment of consequences of management. In order to satisfy this principle, emphasis must be placed on anticipation and prevention of environmental damage where uncertainty exists, rather than reacting to it. The Applicant has applied extensive experience, developed through existing operations and comprehensive knowledge of the existing environment, to plan the proposed modification and to mitigate potential risks to the environment. Where uncertainty existed a conservative approach to assessment was assumed and justified with programs for ongoing management and monitoring to occur in the event of unexpected outcomes.

The Applicant has designed control measures to anticipate potential environmental impacts relating to activities proposed under the proposed modification, which are detailed in Section 6.

The precautionary principle has been considered during all stages of the design and assessment of the proposed modification. The approach adopted provides a high degree of certainty that the proposed modification would not result in any major unforeseen impacts.

7.3.3 Inter-generational Equity

Inter-generational 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. This provides for both inter-generational (between generations) and intra-generational (within generations) equity considerations.

Equity within generations requires that the economic and social benefits of the development be distributed appropriately among all members of the community. Equity between generations requires that the non-material well-being or "quality of life" of existing and future residents of the local community would be maintained throughout and beyond the life of the proposed modification.

Both elements of social equity are addressed through the design of the proposed modification itself, the implementation of operational safeguards to mitigate any short-term or long-term environmental impacts, and the proposed rehabilitation of the areas directly disturbed.

Examples of matters relating to inter-generational equity that are relevant to the proposed modification are provided below.

- The Applicant seeks to undertake development and operations in a manner that minimises adverse impacts on the local environment throughout and beyond the operational life of the Mine. This approach enables the Applicant to develop the Mine to maximise economic and social benefits while ensuring beneficial environmental values are preserved for future generations.
- Mining of the Budgerygar deposit would be undertaken in a manner consistent with existing underground operations. It is predicted that groundwater inflow rates may result in drawdown in a radius of up to 4 440m. However, considering the remote location of the Mine, the significant distance to the nearest landholder bore (approximately 19.4km), the lack of GDEs in the vicinity and the chemical characteristics of the groundwater, the groundwater impacts as a result of the proposed modification are expected to be negligible.
- The installation of surface infrastructure and the raise of the Waste Rock Emplacement would ensure the continued safe and efficient operation of the Tritton Copper Mine. The proposed activities would be undertaken within previously disturbed areas, thus ensuring impacts to biodiversity and heritage values are avoided.

The proposed modification would allow for the continued safe and efficient extraction of raw materials used to produce products that would not only benefit today's generation but many generations to come. In addition, the employment and economic benefits of operations at the Tritton Copper Mine would continue to provide the flow on effects from supply and services while providing a source of revenue outside of the Bogan Shire, enabling future growth and development that would benefit the existing and future generations.

7.3.4 Conservation of Biodiversity and Ecological Integrity

The protection of biodiversity and maintenance of ecological processes and systems are central goals of sustainability. It is important that developments do not threaten the integrity of the ecological system as a whole or the conservation of threatened species in the short- or long-term.

The proposed modification would not lead to disturbance of additional land or vegetation clearing. It is considered that the proposed modification would not result in significant impacts to local flora and fauna.

7.3.5 Improved Valuation and Pricing of Environmental Resources

The issues that form the basis of this principle relate to the acceptance that the polluter pays, all resources are appropriately valued, cost-effective environmental stewardship is adopted, and the adoption of user-pays principles based upon the full life cycle of the costs.

The value placed by the Applicant on environmental resources is evident in the following elements of the proposed modification.

- The proposed modification would allow for mining operations to continue in a profitable, safe and environmentally responsible manner.
- The proposed modification has been designed to minimise surface disturbance and waste handling at the surface.
- The assessment of various potential impacts has addressed the likely residual effects on the environment. This assessment has considered the necessary environmental safeguards and measures to be implemented to prevent irreversible damage to the environment within and surrounding the Mine Site.

The Applicant proposes to continue operations at the Tritton Copper Mine in a manner that minimises environmental impacts in the direct vicinity of the Mine. The proposed ongoing monitoring of environmental attributes at the Mine provides a proactive approach to maintaining environmental assets. Ultimate rehabilitation of the Mine would provide a final landform that blends with the surrounding environment and provides suitable habitat for native flora and fauna.

7.3.6 Conclusion

The proposed modification would encourage the safe, efficient and environmentally responsible operation of the Tritton Copper Mine so that maximum benefit is achieved for the Applicant, the Bogan Shire Council, the local community and the communities of the future. The design of the proposed modification achieves a significant overall benefit and sustainable outcome for the local and wider environment.

7.4 JUSTIFICATION OF THE PROPOSED MODIFICATION

7.4.1 Introduction

In assessing whether the development and operation of the proposed modification is justified, consideration has been given both to biophysical and socio-economic factors including the predicted residual impacts on the local and wider environment and the potential benefits of the proposed modification. This section also considers the consequences of the proposed modification not proceeding.

7.4.2 Biophysical Considerations

Section 6 presents a range of residual impacts on the biophysical environment that are predicted should the Mine continue to operate in the manner proposed and, after the adoption of a number of design and operational procedures and mitigation measures. The residual impacts considered of greatest significance, and the proposed management of these, are summarised as follows.

Groundwater

An analytical groundwater assessment has predicted groundwater inflow rates may result in drawdown in a radius of up to 4 440m. However, considering the remote location of the Mine Site, the significant distance to the nearest landholder bore (approximately 19.4km), the lack of GDEs in the vicinity and the chemical characteristics of the groundwater, the groundwater impacts as a result of the proposed modification are expected to be negligible.

Surface Water

The excavation activities involved in the proposed modification carry the risk of damaging the lining or embankment of the TSF, which could potentially result in tailings or leachate leakage and consequential contamination of surface water and groundwater resources. Management and mitigation measures that would be implemented to control this risk and prevent associated impacts include excavating at minimum distances from the inner edge of the embankment and decant pond and to maximum depths, regular visual inspections, and maintaining accurate records of all activities. With these controls, the proposed activities would not pose a significant risk to the integrity of the TSF.

Noise and Air Quality

Due to the isolated nature of the Mine Site, the fact that most mining operations would be undertaken using the same activities and methods as are currently approved and implemented, and the management and mitigations measures that would be implemented to control and potential noise and dust emissions, it is expected that noise and dust emissions from mining operations associated with the proposed modification would continue to be compliant with all relevant criteria.

Visual Amenity

Based on the relative isolation of the Mine Site and the proposed visual amenity related controls, it is considered that the proposed modification to the Waste Rock Emplacement would not impact significantly on visual amenity. In addition, as all NAF waste rock stored in the Waste Rock Emplacement would be used for rehabilitation and final landform establishment at the time of Mine closure, the Waste Rock Emplacement would only be a temporary feature in the landscape with the final topography to be consistent with the pre-disturbance landform.

7.4.3 Socio-economic Considerations

The social and economic implications of the proposed modification are on balance overwhelmingly positive. The proposed modification would enable the continued efficient operation of the Tritton Copper Mine and consequently the continued distribution of the economic benefits of the Mine. Any changes to local amenity or the local experience of the mining operation would be difficult to discern from existing approved operations.

7.4.4 Consequences of Not Proceeding with the Proposed Modification

The consequences of not proceeding with the proposed modification relate principally to the loss of a significant resource and operational efficiencies that are expected to be generated by the proposed activities. If the proposed modification were not to proceed, these benefits would be forgone. Minor changes to local amenity would be avoided in this scenario.

Should the placement of drill cuttings and waste material removed / screened from milled ore within the TSF not proceed, this material would need to be disposed in local landfills or in the approved on-site landfill (waste removed from mill screening only). This would result in additional unnecessary costs and reject a beneficial environmental outcome for disposal of these materials.

7.5 OBJECTS OF THE EP&A ACT

The objects of the EP&A Act are described in Section 1.3 of the Act as follows.

The objects of this Act are as follows:

a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,

b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,

c) to promote the orderly and economic use and development of land,

d) to promote the delivery and maintenance of affordable housing,

e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,

f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),

g) to promote good design and amenity of the built environment,

h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,

i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,

j) to provide increased opportunity for community participation in environmental planning and assessment.

The proposed modification would not limit the achievement of the objects of the EP&A Act and would in effect assist with the achievement of objectives to:

- promote the social and economic welfare of the local community through the efficient and continued economic benefits of the operation; and
- promote orderly development of the copper resource.

7.6 CONCLUSION

In light of the assessment presented throughout the *Modification Report*, it is concluded that the proposed modification to the Tritton Copper Mine could be implemented and operated in a manner that would satisfy all relevant statutory goals and criteria, environmental objectives and reasonable community expectations.

The proposed modification presents an opportunity to access a small but significant mineral deposit using existing infrastructure and mobile equipment. The ongoing operation of the Mine (to 2028) would have the following significant benefits to the local community within the Bogan Shire and NSW.

- Continued mining operations in a location that is separated from private residences and other sensitive and uses.
- The continued employment of 378 personnel (at end 2020), 88% of whom reside in the Bogan Local Government Area and contribute to the diversity and sustainability of the region.
- The continued distribution of the economic benefits of the Mine locally and regionally through the use of local services and businesses.
- The ongoing supply of copper to domestic and international markets that is consistent with the objectives identified in the *Critical Minerals and High-tech Metals Strategy* (Regional NSW, 2021). The copper supply is essential to support growing demand for electricity transmission (supporting the decarbonisation of the power grid) and use in electric vehicles and the renewable energy sector.

In addition, disposal of specific waste materials within the TSF, as needed, would provide a beneficial solution to the disposal needs of this material, avoid the need to place it in landfills (on-site or off-site) that may not have the same level of protection from contamination risks and would not compromise the structure or function of the TSF.

It is considered that changes to local amenity or the local experience of the mining operation would be difficult to discern from existing approved operations. It is therefore concluded that the proposed medication would firmly be in the public interest.

8. REFERENCES

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Regional NSW (2021). *Critical Minerals and High-tech Metals Strategy,* NSW Government - https://www.nsw.gov.au/sites/default/files/2021-11/NSW%20Critical%20Minerals%20and%20High%20Tech%20Metals%20Strategy.pdf

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Singh, R. N., and Atkins, A. S., (1983). *Analytical techniques for the estimation of mine water inflow*. International Journal of Mining Engineering, 1985, Vol 3., pp 65-77

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Appendices

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Appendix 1

Waste Disposal in TD1 Tritton Mine, NSW

(Total No. of pages including blank pages = 6)

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22 December 2021 Document Ref: PER2021-0387AB Rev 0

Tritton Resources Pty Ltd
Yarrandale Road,
Hermidale 2831 NSW

Attention: Dean Woods

Dear Dean

RE: WASTE DISPOSAL IN TD1

TRITTON MINE, NSW

This letter provides a discussion and recommendations regarding the disposal of mill trash and drill cuttings in the active Tailings Dam 1 (TD1) at the Tritton mine. Tritton Mine is located west of Nyngan near Hermidale in NSW. The mine is operated by Tritton Resources Pty Ltd.

Mill trash can be described as foreign materials that are recovered after the ore crushing and milling process. It generally comprises crushed PVC pipe, detonation cord and rubbish debris associated with mining processes. The waste doesn't exceed the CT1 guidelines for any of the reported analytes and is classified as General Soil Waste CT1. An estimated 120m^3 of mill trash classified as "General Soil Waste – CT 1 would be disposed of within TD1 each year

The drill cuttings will be from exploration drilling activities undertaken within exploration leases held by TRPL. It is anticipated that a maximum of 200m^3 of drill cuttings would be disposed of within the TD1 each year, however, this rate would vary depending on the exploration focus and the lithology intersected during drilling. Drill cuttings would principally consist of dry or wet pulverised rock which would be screened for general waste, including plastics, and then transported via truck to TD1.

TD1 is an existing valley type storage facility where the main embankment has dammed a small valley in its upper reaches. TD1 is surrounded by perimeter embankments and the catchment reporting into TD1 is from incident rainfall only. The TD1 tailings area is approximately 130 ha. Tailings deposition into TD1 utilises multi-point spigotting or discharges. TD1 has a central decant area with decant water recovered and returned to the plant for re-use in processing.

The following recommendations are made with respect to disposal of drill cuttings and mill trash in TD1:

- The waste should be disposed of in excavations away from the perimeter embankments (min 80 m, nom. 100 m). The excavations should be nominally 1.5 m deep.
- The waste should not be disposed of such that it becomes saturated by the decant pond i.e. excavations should also be away from the decant pond (min. 150 m).
- A marked-up plan shows a schematic of the proposed excavations and waste disposal location.

Provided the waste is disposed in TD1 as recommended, the risk of embankment instability of TD1 caused by waste disposal is assessed as very low (i.e. the risk is considered acceptable). We trust the above meets your requirement, should you have any queries please contact the undersigned.

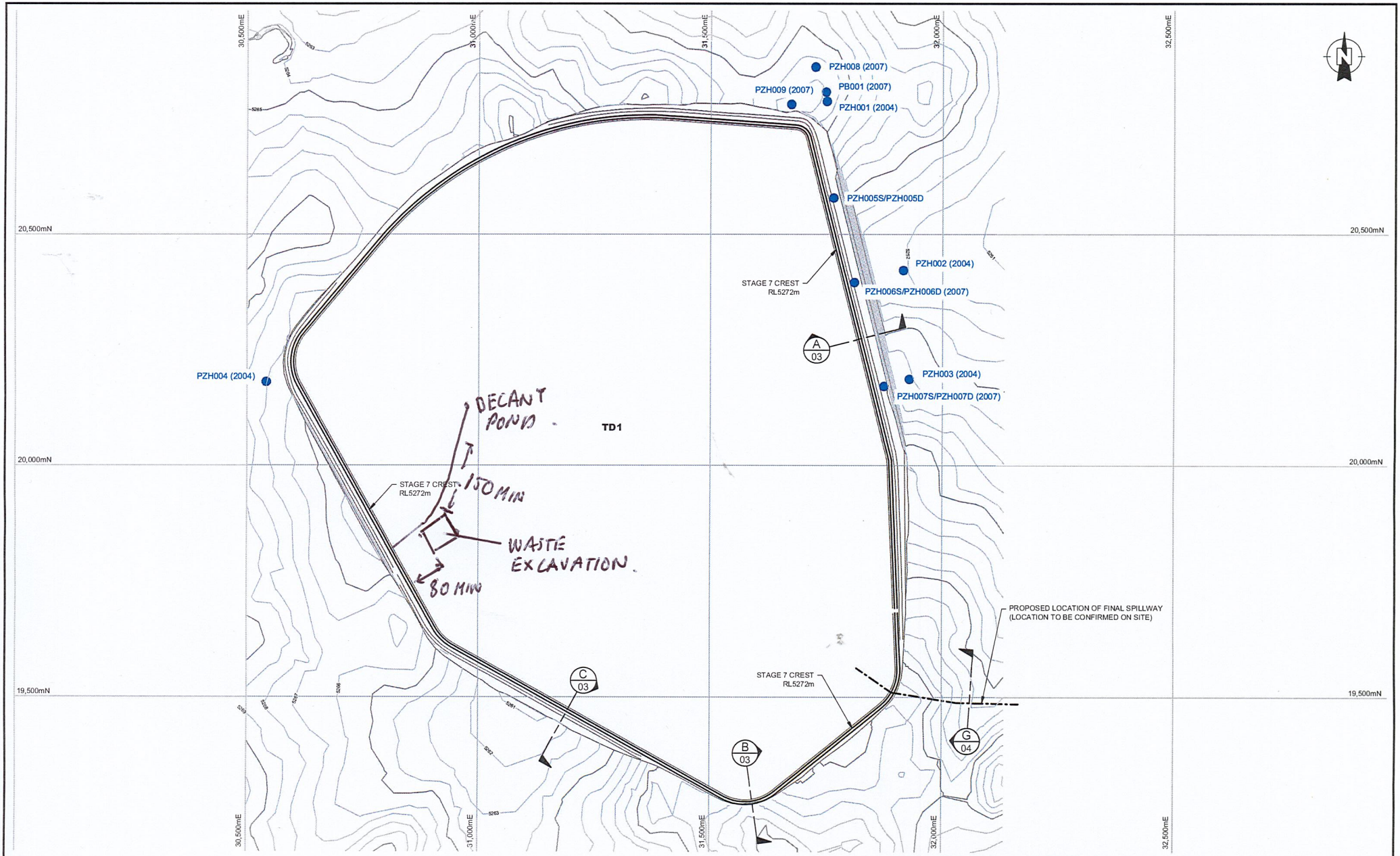
For and on behalf of CMW Geosciences

Christopher Hogg

Principal Tailings Engineer

Attachments: Marked-up Plan

Distribution: 1 electronic copy to Tritton Resources Pty Ltd via email
Original held at CMW Geosciences



LEGEND:

PZH004 EXISTING PIEZOMETER

NOTES:

1. EXISTING DECANT ACCESSWAY TO BE RAISED AS REQUIRED BY SITE DICTATED CONDITIONS

1:7500 0 75 150 225 300 375 m

CMW Geosciences

CLIENT: TRITTON RESOURCES PTY LTD		DRAWN: DE	PROJECT: PER2017-0066
PROJECT: RAISING OF TD1, STAGES 6 AND 7 TRITTON COPPER MINE		CHECKED: CH	DRAWING: 02
		REVISION: 0	SCALE: 1:7500
TITLE: GENERAL ARRANGEMENT - STAGE 7		DATE: 09.11.17	SHEET: A3 L

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Appendix 2

Consultation

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OUT22/318

Nick Warren
Principal Environmental Consultant
RW Corkery & Co

nick@rwcorkery.com

Dear Mr Warren

Tritton Mine Mod 8
Groundwater Assessment

I refer to your email of 19 November 2021 to the Department of Planning and Environment (DPE) Water and the Natural Resources Access Regulator (NRAR) about the above matter.

Tritton Resources is seeking approval to modify the existing extent of underground operations at the Tritton Mine, to access and mine the Budgerygar Deposit, northeast of the existing operations.

The Baseline Groundwater Assessment indicates that, due to depth to groundwater, poor groundwater quality, and preliminary drawdown estimates, the proposed modification likely presents a low-risk to groundwater.

Based on the information provided, we believe that the analytical methodology is appropriate to assess potential groundwater impacts of the proposed modification. However, the Modification Report will need to include additional and supporting evidence to ensure we retain confidence in the analytical drawdown methodologies and impact assessment. Further information and recommendations can be found in **Attachment A.**

Any further referrals to DPE Water and NRAR can be sent by email to water.assessments@dpie.nsw.gov.au. or to the following coordinating officer within DPE Water:

Alistair Drew – Project Officer
E: alistair.drew@dpie.nsw.gov.au

Yours sincerely

E Rogers

Liz Rogers
Manager, Assessments, Knowledge Division
Department of Planning and Environment: Water
17 January 2022

NSW Department of Planning & Environment
Level 31 4 Parramatta Square, 12 Darcy St, Parramatta 2150
water.assessments@dpie.nsw.gov.au ABN: 20 770 707 468

Attachment A

Detailed advice to DPE Planning & Assessment regarding the Tritton Mine Mod 8 Groundwater Assessment

1.0 Parameters

1.1 Recommendations – Prior to Determination

The proponent should:

- Explicitly state the assumed values/ranges for transmissivity, aquifer thickness, hydraulic conductivity and storativity used in the assessment.
- Demonstrate the appropriateness of aquifer parameter assumptions with results and analysis of a suitable, local pumping test.

1.2 Explanation

The method of estimation, derivation and presentation of aquifer parameters used in the analytical assessment and whether they accurately represent the hydrogeological conditions for the area is not clear. The parameters are reported in various ways, however it is unclear what the exact source of the estimation is and how the parameters are applied in the analytical drawdown predictions. Groundwater pumping tests should be undertaken to better support the parameterisation of the analytical assessment.

2.0 Inflows

2.1 Recommendation – Prior to Determination

The proponent should:

- Explicitly state what the predicted mine inflows will be including the methods used to measure or estimate mine inflows.

2.2 Explanation

A range of groundwater inflows for the project were provided, however the accuracy and uncertainty of the predicted inflows as a result of the proposed modification is unclear.

3.0 Groundwater Levels

3.1 Recommendation – Prior to Determination

The proponent should:

- Provide clear details of regional groundwater levels within possible radius of influence and clarify presentation of localised data. This should include a groundwater contour map of adequate resolution and extent identifying the 2 m cumulative drawdown radius. Hydrograph data should be reported in metres below ground level.

3.2 Explanation

The data provided does not present a clear picture of localised or regional groundwater levels or flow directions. Groundwater level data beyond a distance of ~2 Km from the proposed Budgerygar workings was not provided.

Section 3.2.1 of the assessment states that groundwater levels are generally within 30-90 metres below ground level (mbgl). This is contradicted by Figure 3.2 which indicates that localised groundwater levels range between 20 – 140 mbgl. Figure 3.3 shows data for a separate set of bores in mAHD - inconsistent with the reference datum in Figure 3.2 and with no reference to ground levels. Similarly, hydrographs presented in the appendices use inconsistent datum references.

Presentation of a groundwater contour map in mAHD with an extent of possible drawdown would significantly aid review. The minimal impact considerations of the Aquifer Interference Policy require a cumulative pressure head decline of not less that 2m decline at any water supply work. To clearly demonstrate that identified water supply works will not be significantly impacted, the maximum extent of 2m predicted drawdown should be determined.

4.0 Groundwater Dependent Ecosystems (GDEs)

4.1 Recommendation – Prior to Determination

The proponent should:

- Provide additional evidence to support the assertion that the proposed development poses a low risk to nearby GDEs.

4.2 Explanation

Section 2.7.2.2 and Figure 8 indicates the presence of multiple high potential terrestrial GDEs with proximity to the project, however the predicted impact on these is not satisfactorily discussed or supported by the report.

Two high potential aquatic GDEs are noted in the text as having a distance of 7.5km and 13.2km from the site. The reviewer was unable to identify these in Figure 2.8 as indicated. Additional evidence should be provided to support the assertion that these are unlikely to be impacted by the project.

5.0 Water Entitlement

5.1 Recommendation – Prior to Determination

- The groundwater assessment in the Modification Report should predict the maximum annual water take during operations, during closure and after equilibrium has been reached.

5.2 Explanation

The proponent will need to hold sufficient water entitlement to account for this water take. Ongoing verification of predictions based on observed data, water balance reviews and updates to the groundwater model may vary the water entitlement requirements.

End Attachment A

Table A2-1
Matters Raised by NRAR in Consultation

Matter	Recommendation	Comment	Section of MOD Report / GHD (2022)
Aquifer Parameters	• Explicitly state the assumed values/ranges for transmissivity, aquifer thickness, hydraulic conductivity and storativity used in the assessment.	A table has been added to the Groundwater Assessment and Modification Report that lists the aquifer parameters assumed for assessment under each of the scenarios considered (current/end of approved mining and end of proposed mining)	Table 5 and Section 6.3.3 of MOD Report and Table 6.2, and Section 6.1.3 as well as Table 6.6 and Section 6.2.2 of GHD (2022)
	• Demonstrate the appropriateness of aquifer parameter assumptions with results and analysis of a suitable, local pumping test.	Review of site records identified a groundwater pumping test undertaken in the vicinity of the TSF by SMEC in 2008. The testing was done to investigate groundwater in the vicinity of the TSF but provides an indication of aquifer parameters that may be applied in the Groundwater Assessment. The outcomes of this test further support the outcomes of the Groundwater Assessment.	Section 6.3.2.1 of the MOD Report and Section 3.6.2.1 of GHD (2022)
Inflows	• Explicitly state what the predicted mine inflows will be including the methods used to measure or estimate mine inflows.	The outcomes of assessment present the most likely outcome for mine inflows with a sensitivity analysis now presented to consider variations in the aquifer parameter assumptions. Inflows of up to 0.14ML per day are considered likely which may be compared to Tritton Resources' current licence entitlement of 334ML/yr (based on 1ML per share).	Table 5 and Section 6.3.2.4 of MOD Report and Table 6.2 and Section 6.1.3 of GHD (2022)
Groundwater Levels	• Provide clear details of regional groundwater levels within possible radius of influence and clarify presentation of localised data. This should include a groundwater contour map of adequate resolution and extent identifying the 2m cumulative drawdown radius. Hydrograph data should be reported in metres below ground level.	Review of groundwater level data indicates that groundwater levels at Tritton Mine are generally within 20m to 90m below ground level (bgl) but can vary from 10mbgl to 140mbgl. The maximum extent of groundwater drawdown is approximately 4 440m. Note that the analytical method adopted estimates the maximum extent of groundwater drawdown, which is essentially the 0m drawdown contour. A groundwater drawdown of 2m would therefore occur closer to the mine than the 0m contour, and therefore the drawdown extent of 4 440m is more conservative that the 2m drawdown contour.	Section 6.3.3.1 of MOD Report and Section 4.2.1 and Section 6.2 of GHD (2022)

Table A2-1 (Cont'd)
Matters Raised by NRAR in Consultation

Matter	Recommendation	Comment	Section of MOD Report / GHD (2022)
Groundwater Dependent Ecosystems	• Provide additional evidence to support the assertion that the proposed development poses a low risk to nearby GDEs.	The report notes the absence of high priority GDEs recorded in the WSP and broad scale mapping within 20km of the Mine. Therefore the assessment criteria specified in the Aquifer Interference Policy is satisfied. There are areas mapped as having potential GDEs based on vegetation mapping and aquatic habitats. The likelihood of adverse impact to potential GDEs has been assessed as being low based on the following. • Given the deep groundwater levels it is considered unlikely that these vegetative communities are GDEs. Additionally, given the deep groundwater levels it is considered unlikely that there would be any connection between groundwater and the ephemeral drainage lines and watercourses in the vicinity of Tritton Mine and Budgerygar. • The two low-potential aquatic GDEs at distances of approximately 7.5 km southeast and 13.3 km south of Tritton Mine are beyond the predicted extent of groundwater drawdown.	Section 6.3.5.3 of the MOD Report and Section 6.4.2 of GHD (2022)
Water Entitlement	• The groundwater assessment in the Modification Report should predict the maximum annual water take during operations, during closure and after equilibrium has been reached.	Maximum annual water take has been added to Table 8 of the Modification Report and Table 6.2 of GHD (2022). However, it is noted that daily inflows are not likely to remain consistent over a full year and this estimate is considered appropriate for the purposes of predictive assessment and as average values for daily inflow are presented.	Section 6.3.5.1 and Table 8 of the MOD Report and Section 6.1.3 and Table 6.2 of GHD (2022)

Aeris
TRITTON OPERATIONS

File Note

Subject:	Community Consultation For Tritton Mine in 2021
Date:	26/01/2022

Date	Forum	Agenda and Discussion Items
23-Feb 21	Community Consultation Committee (Tritton Rep; D Hume)	-Tritton Operations activity update - Workforce snapshot - Upcoming projects and developments - Community requests and concerns
05-May 21	Hermidale Village Community Meeting (Tritton Rep; D Hume)	- Community projects update (BSC) and discussion - Priorities for grant funding & donations - Brief update on Tritton Mine Operations and new projects to extend life of the Tritton mine in particular (Budgerygar)
25-May 21	Community Consultation Committee (Tritton Rep; T Breaden, D Woods)	- Tritton Operations activity update - Workforce snapshot - Upcoming projects and developments - Community requests and concerns
24-Jun 21	Consultation with Bogan Shire Council Reps (Tritton Rep; D Hume, T Breaden)	-Status of new projects – - Tritton / Budgerygar overview of proposed new surface infrastructure. - Murrawombie / Avoca Tank - Constellation copper deposit (new discovery)
12-Aug 21	Consultation with Bogan Shire Council Reps (Tritton Rep; D Hume, B Thorpe)	-Tritton Operations activity update - Tritton / Budgerygar mine extension project update - Proposed new surface infrastructure. - other changes (expansion of mining footprint) - Workforce considerations + extra (minimal) local accommodation requirements anticipated
14-Oct 21	Consultation with Bogan Shire Council Reps (Tritton Rep; D Hume)	Community collaboration project opportunities Status of mine life extension projects – - Avoca Tank – works underway - Tritton (Budgerygar) – works and permitting update - Murrawombie pit cutback - Constellation project

*Quarterly Community Consultation meetings for August and November 2021 were cancelled after all meeting invitations were declined due mainly to concern regarding risk of holding face to face meetings.

David Hume
General Manager

Aeris Resources Limited
Level 2, HQ South Tower, 520 Wickham Street, Fortitude Valley QLD 4006 Australia
Box 14, 520 Wickham Street, Fortitude Valley, QLD 4006
E: info@aerisresources.com.au **T:** +61 7 3034 6200 **F:** +61 7 3034 6290
TRITTON MINES Yarrandale Road, Hermidale NSW 2825 Australia
E:admin@tritton.com.au **T:**+61 2 6838 1100 **F:**+61 2 6838 1101 **aerisresources.com.au**

Table A2-2
Landholder Consultation

Property Name	Associate Lots and Plan	Occupied	Mod 8 Comments	Call Log
Kooregah	Lot 42 DP879206, Lot 62 DP875925	Yes	Landowner advised that he was fully supportive of the positive outcomes that would come from continued mining at Tritton and was happy to support in any way he could. Scott Ramsay to call in to KPC yard during the week to discuss the Budgerygar plans in more detail.	Called 12:45pm (24/1/2022) no answer, left a message. Called 4:25pm (25/1/2022) no answer, left a message. Called 12:58pm (27/1/2022) no answer, left a message. Called 8:15am (31/1/2022). Land owner returned call, duration of call 15 minutes.
Wilga Downs	Lot 4 DP751346	Yes		
Emu	Lot 8 DP751346	Partially	Landowner advised that he could hear the mine on occasion but wasn't overly concerned about the noise the development would cause given the distance from the premises. Landowner wasn't concerned about the height of the WRE. Landowner advised that he visited and stayed at the property intermittently. Landowner advised he had developed a good relationship with the Exploration Department. I advised i would email him a copy of the Modification report when it is submitted.	Called 12:48pm (24/1/2022) no answer, left a message. Returned call 12:50pm (24/1/2022), advised he would call back shortly as he was driving. Received call 12:48pm (24/1/2022), duration of call 14 minutes.

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Appendix 3

Budgerygar Deposit – Groundwater Assessment

prepared by GHD Pty Ltd

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Tritton Copper Project Modification 8

Budgerygar Deposit – Groundwater Assessment

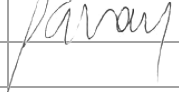
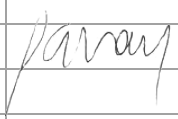
Aeris Resources Limited

01 February 2022

→ **The Power of Commitment**

GHD Pty Ltd | ABN 39 008 488 373
GHD Tower, Level 3, 24 Honeysuckle Drive
Newcastle, New South Wales 2300, Australia
T +61 2 4979 9999 | **F** +61 2 9475 0725 | **E** ntlmail@ghd.com | **ghd.com**

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	0	I Gilmore	S Gray		S Gray		23/12/21
S3	1	I Gilmore	S Gray		S Gray		01/02/22

Abbreviations

Acronym	Definition
AHD	Australian Height Datum
AIP	Aquifer Interference Policy
bgl	Below ground level
BoM	Bureau of Meteorology
CRD	Cumulative Rainfall Departure
CSS	Culturally Significant Sites
EC	Electrical conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
GDE	Groundwater Dependent Ecosystem
GHD	GHD Pty Ltd
km	Kilometres
L/s	Litre per second
LGA	Local Government Area
m	Metres
m/day	Metre per day
m^2/day	Metres squared per day
m^3/day	Metres cubed per day
MDB	Murray Darling Basin
mg/L	Milligrams per litre
MGA	Map Grid of Australia
ML	Megalitre
mm	Millimetres
POEO Act	Protection of the Environment Operations Act 1997
REF	Review of Environmental Factors
ROM	Run of Mine
SSD	State Significant Development
SWL	Standing water level
TSF	Tailings storage facility
WAL	Water Access Licence
WSP	Water Sharing Plans
WM Act	Water Management Act 2000
µS/cm	Microsiemens per centimetre

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1. Introduction

1.1 Background

The Tritton Copper Operations is operated by Tritton Resources Pty Ltd (Tritton Resources), a wholly owned subsidiary of Aeris Resources. The Tritton Copper Operations is located approximately 50 kilometres northwest of Nyngan, NSW, shown in Figure 1-1. Tritton Resources is currently undertaking mining activities at the Tritton Copper Mine (Tritton Mine) under Development Application (DA) 41/98.

Tritton is seeking to modify the existing extent of underground operations at the Tritton Mine to access and mine the Budgerygar Deposit located to the north of the existing operations but within the approved mining lease area (ML 1544). The following presents a summary of the scope of the proposed modification.

1. Underground mining of the Budgerygar deposit to access approximately 2.6 million tonnes of copper ore. The deposit would be accessed via the existing underground operations at the Tritton Mine, apply the same mining methods and would essentially comprise an extension of existing operations. The rate of underground mining at the Tritton Mine would not increase under the proposed modification.
2. The following surface infrastructure to the north of the existing Mine Area would be required. No additional surface disturbance would be required for this infrastructure:
    a. Power supply (overhead or potentially from the existing operation)
    b. Exclusion fence
    c. Polypipe line for water supply
    d. Air line (service hole)
    e. Paste line from paste fill plant to ventilation rises
3. A raise of approximately 10 m to the existing approved Waste Rock Emplacement to account for waste rock expected to be generated. The final height of this emplacement would be 30 m above the ground surface.
4. It is anticipated that mining and processing of the copper ore within the Budgerygar deposit would take approximately six years. Therefore, an extension to the Project life is proposed to allow for ongoing mining operations until 22 December 2028. That is a further four years would be added to the existing approved Mine.

GHD Pty Ltd (GHD) has been engaged by Tritton Resources to undertake a groundwater assessment to support the modification application for DA 41/98 (MOD8). A Modification Report for MOD8 is being prepared by R.W. Corkery & Co. This groundwater assessment will support the Modification Report and application.

1.2 Purpose of this report

The purpose of this report is to provide a groundwater assessment to support the modification application (MOD8) for Development Approval (DA) 41/98 for Tritton Mine.

1.3 Scope

The scope of the groundwater assessment is as follows:

– Review available geological maps, exploration data, and hydrogeological reports for the Budgerygar Deposit and existing operations at Tritton Mine.
– Undertake searches of the groundwater bore and Groundwater Dependent Ecosystem (GDE) online databases and identify groundwater receptors.
– Provide a description of the existing groundwater environment, including a summary of monitoring data from site bores, inflows to current and historical workings and groundwater receptors in the vicinity of the mine.
– Develop a conceptual groundwater model including sensitive groundwater users.
– Classification of the groundwater source under the NSW Aquifer Interference Policy.

– Assess the rate of groundwater inflow and radius of drawdown due to the proposed and existing mine workings using appropriate analytical methods.
– Assess potential impacts on identified groundwater receptors including assessment of impacts against the groundwater level and quality criteria in the NSW Aquifer Interference Policy.
– Identify any additional groundwater licensing requirements.

1.4 Limitations

This report has been prepared by GHD for Aeris Resources Limited and may only be used and relied on by Aeris Resources Limited for the purpose agreed between GHD and Aeris Resources Limited as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Aeris Resources Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

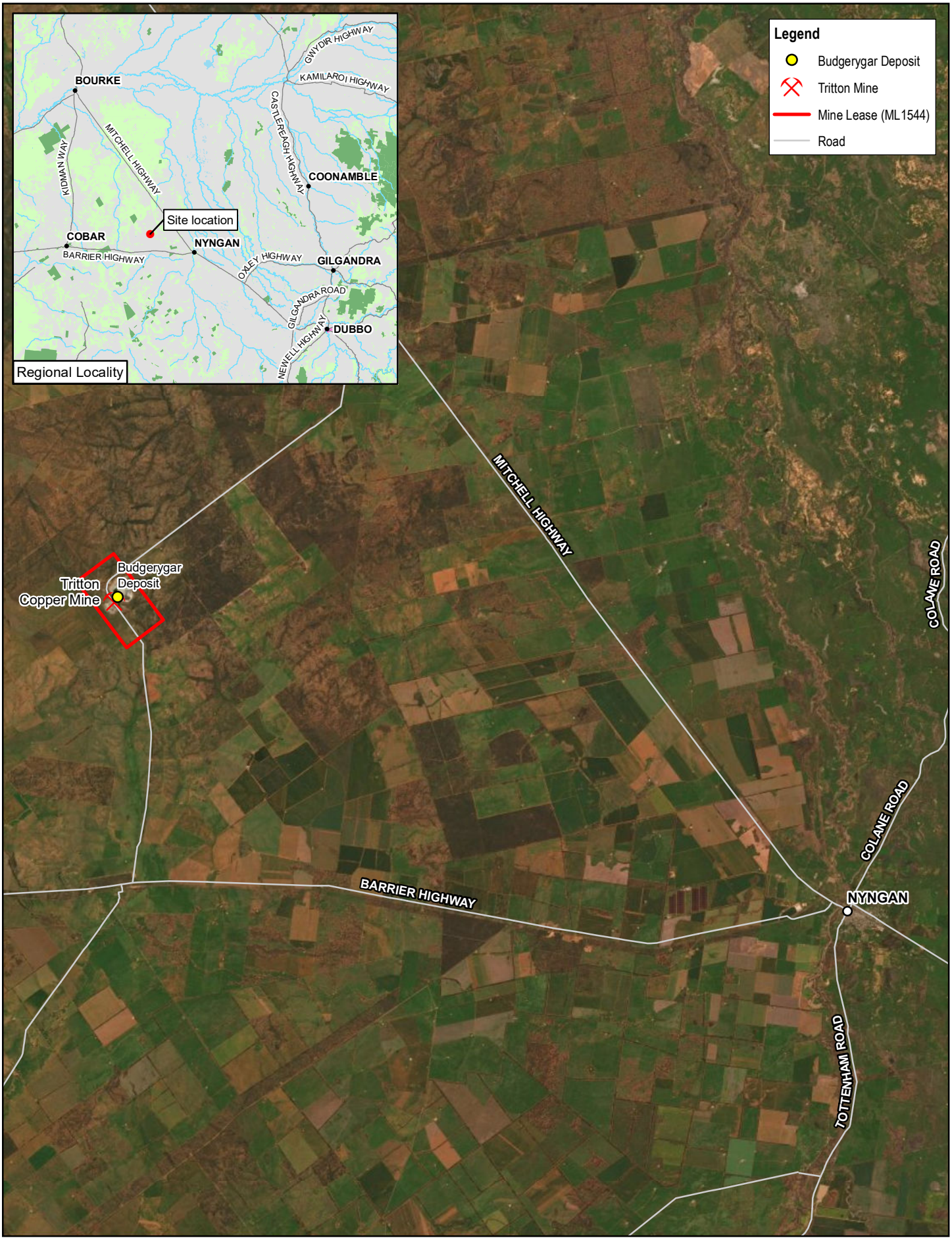
The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Aeris Resources Limited and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Tritton Resources Pty Ltd
Tritton Copper Project Modification 8
Groundwater Impact Assessment

Project No. **12555629**
Revision No. **0**
Date **01 Feb 2022**

Locality Plan

Figure 1.1

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Print date: 01 Feb 2022 - 09:33

Data source: Tritton: Mine Lease Bdy, 2021; Geoscience Australia: 250k Topographic Data Series 3, 2006; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: fmackay

2. Regulatory context

2.1 Legislation

2.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the core legislation relating to planning and development activities in NSW and provides the statutory framework under which development proposals are assessed. The EP&A Act aims to encourage the proper management, development and conservation of resources, environmental protection and ecologically sustainable development.

2.1.2 Water Management Act 2000

The aim of the *Water Management Act 2000* (WM Act) is to ensure that water resources are conserved and properly managed for sustainable use benefiting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and in-stream uses as well as to provide for protection of catchment conditions.

Historically, the *Water Act 1912* was the main legislation for managing water resources in NSW, however, this Act has been progressively phased out and replaced by water sharing plans (WSPs) under the WM Act. Once a WSP commenced, existing licences under the *Water Act 1912* were converted to water access licences (WALs), water supply works and use approval (controlled activity approvals) under the WM Act. All new WALs and controlled activity approvals are also issued under the WM Act.

2.1.2.1 Water sharing plans

Fresh water sources throughout NSW are managed via WSPs under the WM Act. Provisions within WSPs provide water to support the ecological processes and environmental needs of GDEs and waterways. WSPs also regulate how the water available for extraction is shared between the environment, basic landholder rights, town water supplies and commercial uses. Key rules within the WSPs specify when licence holders can access water and how water can be traded.

Tritton Mine and the Budgerygar Deposit falls within the porous and fractured groundwater sources of the Lachlan Fold Belt MDB groundwater source, a sub-area of the WSP for the NSW Murray Darling Basin (MDB) Fractured Rock Groundwater Sources. This WSP commenced in July 2011 and was updated in June 2020 and regulates the interception and extraction of groundwater within the defined WSP area. Tritton Mine and the Budgerygar Deposit are located outside the Great Artesian Basin.

Therefore, the interference and extraction of groundwater at Tritton Mine and the Budgerygar Deposit require an access licence under the WM Act.

2.1.2.1.1 Tritton Mine

Tritton Mine holds a WAL administered under the WM Act for groundwater extraction. Table 2.1 summarises the groundwater approvals and WAL currently held by Tritton Mine under the WM Act. The excavation in Table 2.1 refers to the underground workings at Tritton Mine. Tritton Mine also holds a number of surface water approvals and licences as outlined in Table 2.1.

Table 2.1 Tritton Mine groundwater approvals and licences

Works approval	Details	Location	Water Access Licence (WAL)	Share components (ML/year)	WSP
80WA716055	Excavation	Lot 139, DP 751315 Lot 138, DP 751315 Lot 2, DP 751315 Lot 147, DP 824129	WAL31041	304	Lachlan Fold Belt MDB Groundwater Source
80WA716044	1 bore, 1 excavation	Lot 41, DP 879206 Lot 61, DP 875925	WAL31090	30	Lachlan Fold Belt MDB Groundwater Source
80WA702816	2 pumps	Lot 24, DP 753423	WAL9374	705	Macquarie and Cudgegong Regulated Rivers Water Source
80WA704315	Diversion channel	Lot 5, DP 1216294			
80WA702816	2 pumps	Lot 24, DP 753423	WAL9375	210	Macquarie and Cudgegong Regulated Rivers Water Source
80WA702816	2 pumps	Lot 24, DP 753423	WAL9940	16	Macquarie and Cudgegong Regulated Rivers Water Source
80CA701324	2 pumps	Lot 39, DP 751320 Lot 24, DP 753423			

The NSW MDB Fractured Rock Groundwater Sources Water Sharing Plan (WSP) allows for the carryover of 10% of the remaining entitlement from one year to the next.

Since Tritton Resources is the holder of WAL31041 and WAL31090 and the proponent for the Project, WAL31041 and WAL31090 can be changed to amend the share component to consider whether WAL31041 and WAL31090 is sufficient to share in extracting groundwater that is encountered in the Budgerygar workings. Section 6.5 provides further detail on this matter.

2.1.2.2 Water Management (General) Regulation 2018

Section 91 of the WM Act details the requirements for controlled activity approval to carry out work on waterfront land, which includes the bed of any river, lake or estuary and any land within 40 m of its high water mark. The Budgerygar Deposit is located greater than 40 m of any mapped watercourse. Additionally, clause 42 of the Water Management (General) Regulation 2018 exempts activities carried out in accordance with any lease or licence under the *Mining Act 1992*. Furthermore, an activity approval under Section 91 of the WM Act is not required where a State Significant Development (SSD) approval is given.

Thus, controlled activity approvals will not be required for the drilling and construction of the proposed mine workings. However, it remains an offence to harm waterfront land when carrying out an exempt controlled activity.

2.2 Policies

2.2.1 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) was finalised in September 2012 and clarifies the water licensing and approval requirements for aquifer interference activities in NSW, including the taking of water from an aquifer in the course of carrying out mining.

The Policy outlines the water licensing requirements under the WM Act. A water licence is required whether water is taken for consumptive use or whether it is taken incidentally by the aquifer interference activity (such as groundwater filling a void), even where that water is not being used consumptively as part of the activity's operation. Under the WM Act, a water licence gives its holder a share of the total entitlement available for extraction from the groundwater source. The WAL must hold sufficient share component and water allocation to account for the take of water from the relevant water source at all times.

Sufficient access licences must be held to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased. Many mining operations continue to take water from groundwater sources after operations have ceased. This take of water continues until an aquifer system reaches equilibrium and must be licensed.

The NSW AIP requires that potential impacts on groundwater sources, including their users and GDEs, be assessed against minimal impact considerations, outlined in Table 1 of the Policy. If the predicted impacts meet the Level 1 minimal impact considerations, then these impacts will be considered as acceptable. The adopted Level 1 minimal impact considerations for the Project are discussed in Section 6.3.

2.2.2 NSW State Groundwater Policy

The objective of the NSW State Groundwater Policy Framework Document is to manage the State's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW. The NSW groundwater policy has three parts:

– NSW Groundwater Quantity Protection Policy
– NSW Groundwater Quality Protection Policy
– NSW Groundwater Dependent Ecosystems Policy

2.2.2.1 NSW Groundwater Quantity Protection Policy

The principles of this policy include:

– Maintain total groundwater use within the sustainable yield of the aquifer from which it is withdrawn.
– Groundwater extraction shall be managed to prevent unacceptable local impacts.
– All groundwater extraction for water supply is to be licensed. Transfers of licensed entitlements may be allowed depending on the physical constraints of the groundwater system.

2.2.2.2 NSW Groundwater Quality Protection Policy

The objective of this policy is the ecologically sustainable management of the State's groundwater resources so as to:

– Slow, halt or reverse any degradation in groundwater resources.
– Direct potentially polluting activities to the most appropriate local geological setting so as to minimise the risk to groundwater.
– Establish a methodology for reviewing new developments with respect to their potential impact on water resources that will provide protection to the resource commensurate with both the threat that the development poses and the value of the resource.
– Establish triggers for the use of more advanced groundwater protection tools such as groundwater vulnerability maps or groundwater protection zones.

2.2.2.3 NSW Groundwater Dependent Ecosystems Policy

This policy was designed to protect ecosystems that are dependent on groundwater as a primary water source so that the ecological processes and biodiversity of these ecosystems are maintained or restored for the benefit of present and future generations. It provides guidance on how to protect and manage groundwater dependent ecosystems in a practical sense.

Analysis of the application of the NSW GDEs Policy to this groundwater assessment is outlined in Section 3.7.2.

3. Regional environment

3.1 Topography and land use

The Tritton Mine is located about 50 km northwest of the township of Nyngan in the Bogan Local Government Area (LGA) of NSW as presented in Figure 1-1. The topography in the vicinity of the Budgerygar Deposit is generally flat with gentle undulating rises and depressions with elevations generally from approximately 250 m AHD to 280 m AHD. The elevation generally drops gradually away from the site in all directions, however, is less gradual to the east.

Land use within and surrounding the area includes:

– Sparsely scattered rural residences
– Agriculture (livestock grazing)
– Thorndale Nature preserve (23.4 km southwest of the Budgerygar Deposit area)

3.2 Climate

For this assessment, monthly meteorological data from May 1901 to August 2021 were obtained from the Australian Bureau of Meteorology (BoM) from the Nyngan Airport station (station no. 51039). This is the closest station (located at Lat: 31.55° S, Lon: 147.20° E and elevation of 173 m AHD) to the Budgerygar Deposit. The Nyngan Airport station is located approximately 47 km south-south east from the Budgerygar Deposit area. This site was selected due to its proximity as well as quality and period of available data. Average monthly rainfall and historical annual rainfall recorded between 1901 and 2020 are shown in Figure 3-1 and Figure 3-2 respectively.

As shown in Figure 3-1, rainfall at this location is characterised by a discernible annual cycle distribution, with higher rainfall trends in the October to March period and decreasing during the April to September period. Average monthly rainfall calculated between 1901 and 2020 varies between 27 mm in September and August to 50 mm in January. The average annual rainfall between 1901 and 2020 is 437 mm.

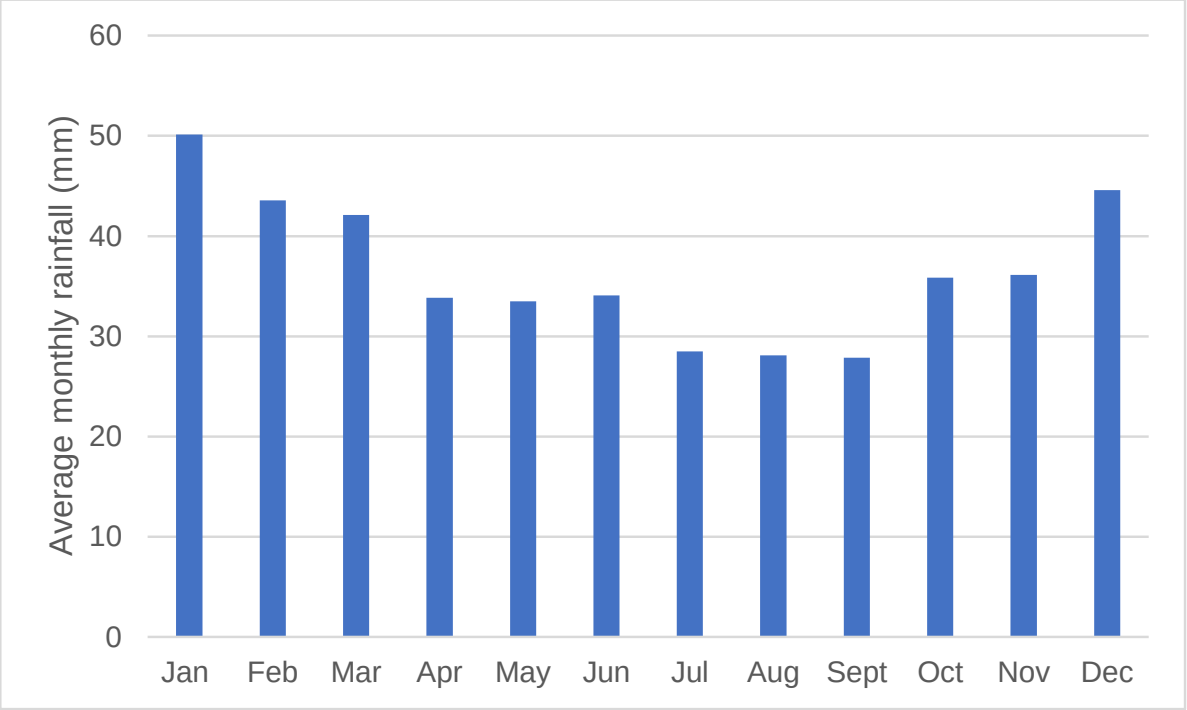


Figure 3-1 Monthly average rainfall

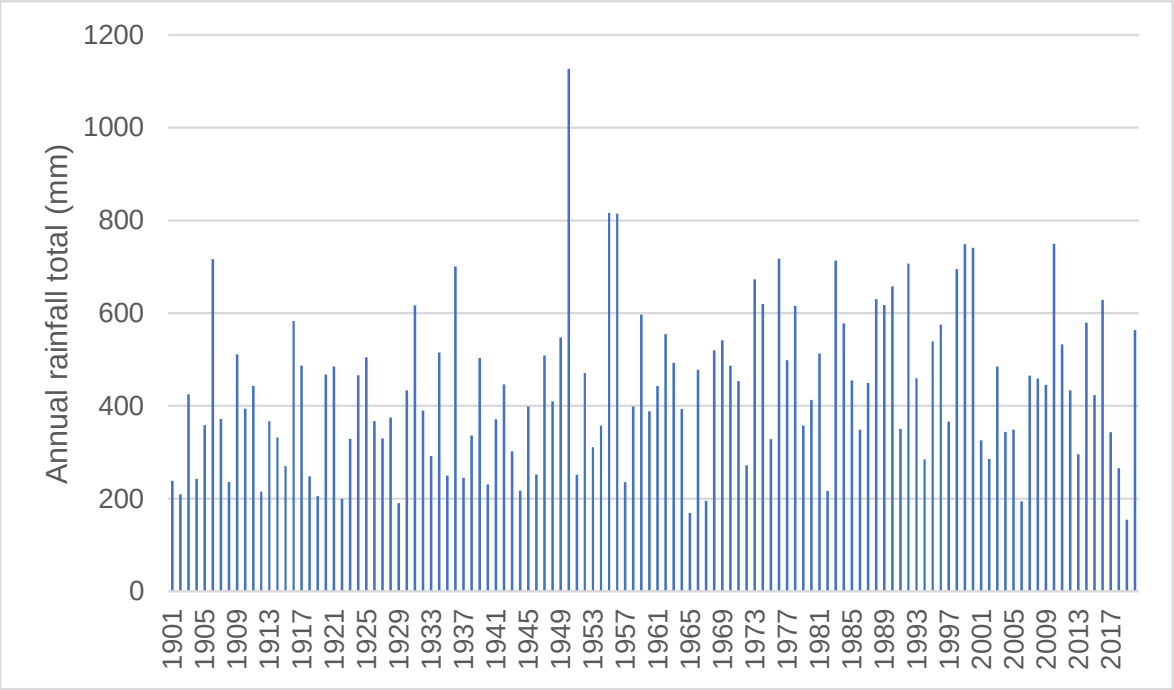


Figure 3-2 Historical annual rainfall total

The average annual evaporation total was obtained from the BoM Nyngan Airport station (station no. 51039) from a dataset covering the years 1970 to 2020, and had an average annual evaporation of 2,094 mm. This corresponds to an average annual moisture deficit (the difference between average annual rainfall and average annual evaporation) of 1,657 mm.

Average daily pan evaporation is compared to average daily rainfall calculated from the historical rainfall record in Figure 3-3. As shown in Figure 3-3 evaporation varies seasonally, having higher evaporation in summer compared to winter. The site has an average monthly net rainfall deficit in all parts of the year.

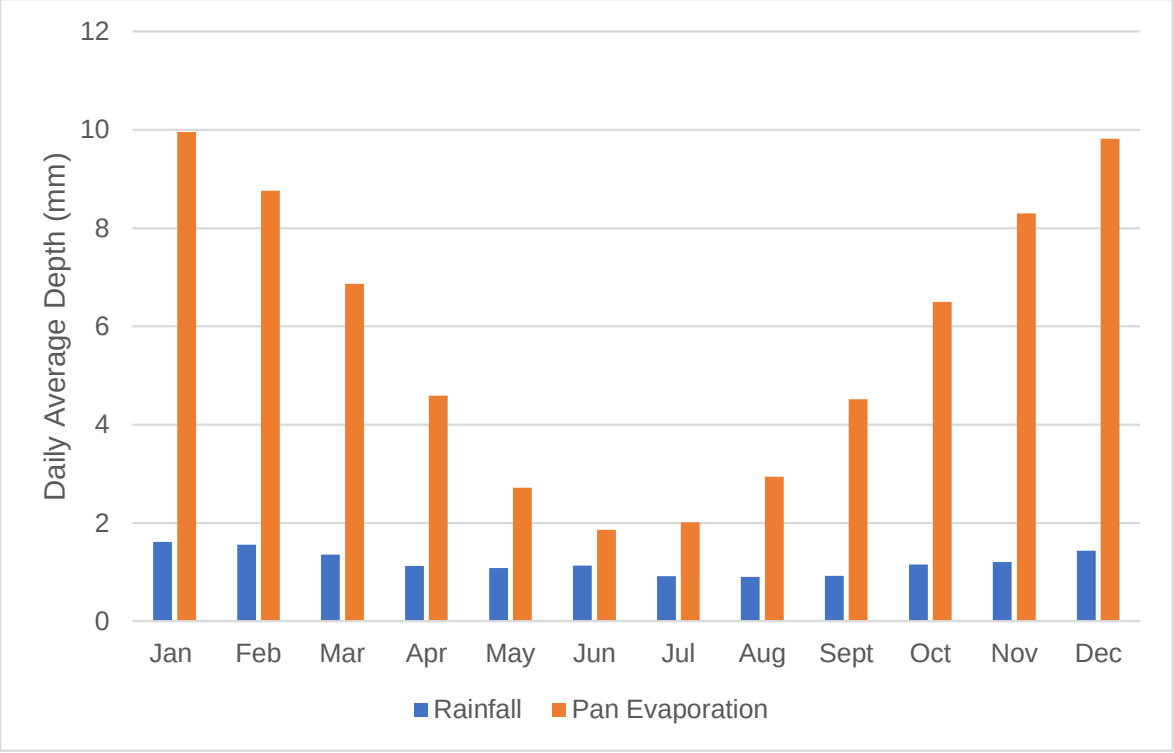


Figure 3-3 Monthly evaporation recorded at BOM station 51039

The monthly rainfall dataset was used to generate a Cumulative Rainfall Departure (CRD) curve. CRD is the monthly accumulation of the difference between the observed monthly rainfall and the long-term average monthly rainfall. Any increase in the CRD reflects above average rainfall while a decrease in CRD reflects below average rainfall. A constant or steady CRD curve represents average rainfall. The CRD curve only deviates from zero due to atypical (above and below average) rainfall. The CRD over the period 2010 to 2020 is shown in Figure 3-4.

As shown in Figure 3-4, the CRD curve was generally decreasing between mid-2016 and early 2020 indicating below average rainfall conditions. This reflects the recent drought conditions in western NSW. The CRD curve increased in early 2020 reflecting a period of above average rainfall.

Figure 3-4 *Cumulative rainfall departure curve*

3.3 Hydrology and waterways

Tritton Mine is located within the Bogan River catchment. There are no identified, permanent watercourses or drainage lines running through the extent of the Budgerygar Deposit. There are a number of unnamed topographic drainage lines with limited stream connectivity within the vicinity of the Tritton Mine, as shown in Figure 3-6. These drainage lines generally flow downhill from the Tritton Mine in all directions, consistent with the topographical fall of the area. These drainage lines flow towards various ephemeral tributaries of major watercourses including:

- Unnamed drainage line, flowing towards a tributary of Siburys Creek, approximately 0.7 km southeast of the Budgerygar Deposit within the eastern extent of ML1544. The Siburys Creek tributaries flow in a southeast direction.
- Unnamed tributaries of Whitbarrow Creek that flow south of the Budgerygar Deposit. Whitabarrow Creek is located approximately 12.3 km to the southwest and 9.8 km to the south of the Budgerygar Deposit.
- The area to the north-west of the Budgerygar Deposit that drains towards unnamed tributaries of Mulga Creek.

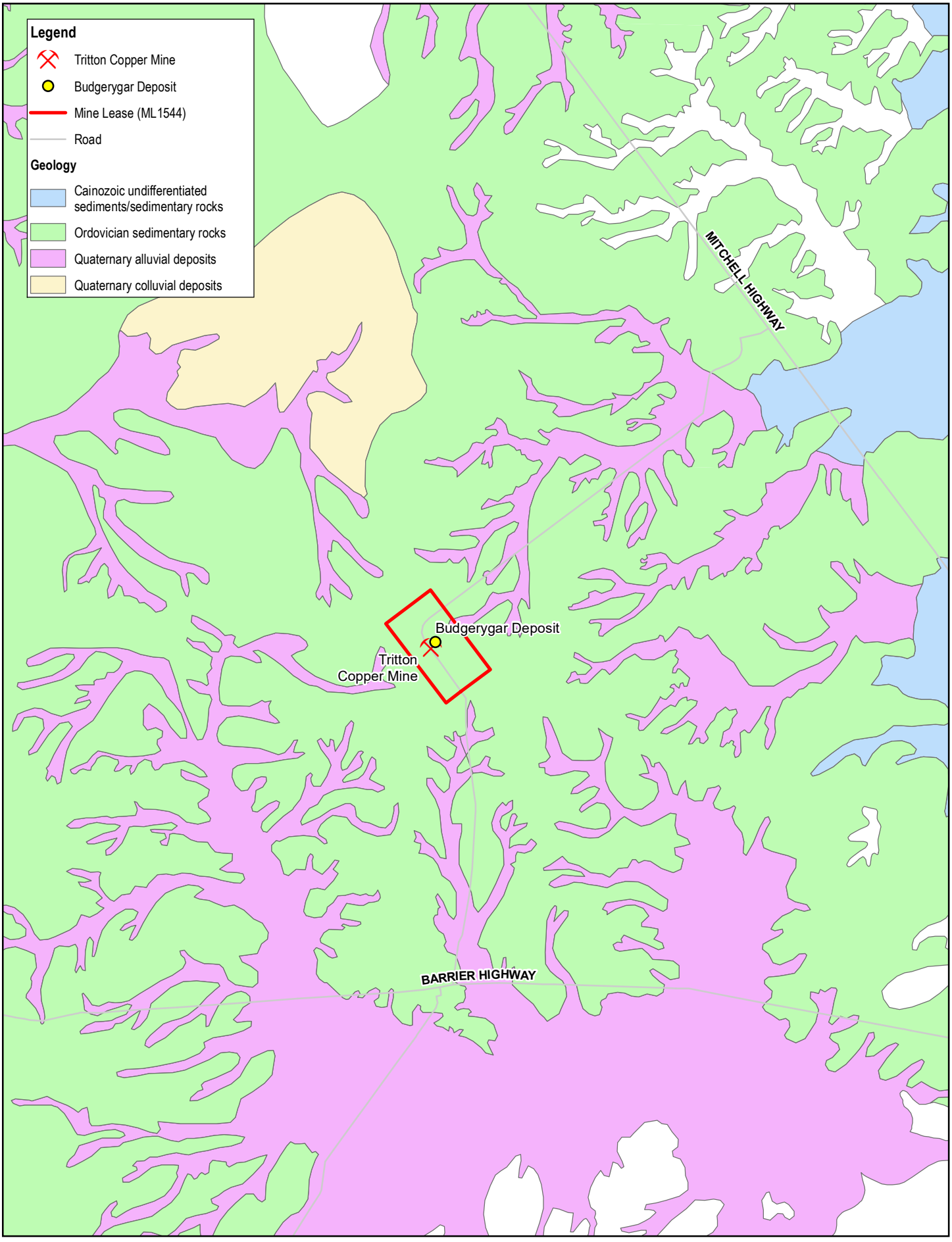
Due to the depth to groundwater (refer Section 4.2.1), interactions between surface water and groundwater at the Budgerygar Deposit are unlikely.

3.4 Geology

3.4.1 Regional setting

Tritton Mine is located in the Lachlan Fold Belt. Quaternary colluvial and alluvial sediments and Ordovician rocks of the Narrama Formation outcrop in the vicinity of Tritton Mine as shown in Figure 3-5 (Gilmore et al, 2018). The Narrama Formation forms part of the Girilambone Group, a highly prospective ground for base metal deposits in NSW. The Narrama Formation consists of metamorphosed turbidites of micaceous quartzose sandstone, siltstone and claystone. The regional.

The shallow alluvial sediments in the vicinity of Tritton Mine are limited to the vicinity of watercourses including tributaries of Siburys Creek, Whitbarrow Creek and Mulga Creek.



Paper Size ISO A4

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Regional Geology

Figure 3.5

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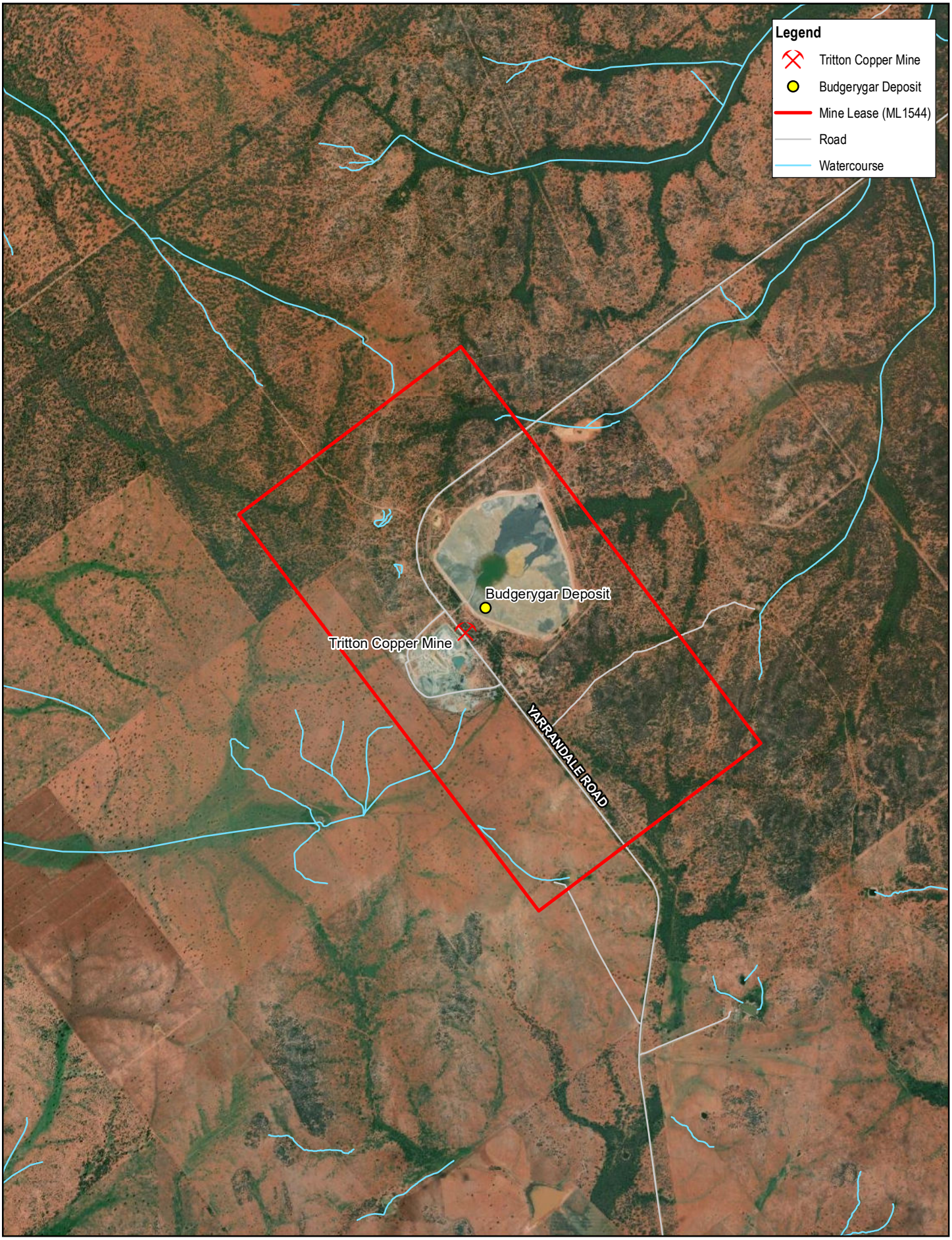
Data source: Tritton: Mine Lease Bdy, 2021; DPI: Geology , 2010; Geoscience Australia: 250k Topographic Data Series 3, 2006 . Created by: fmackay



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Kilometers

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Hydrology

Figure 3.6

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Data source: Tritton: Mine Lease Bdy, 2021; LPI: DTDB, 2017; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: fmackay

3.5 Surrounding mining operations

Aeris Resources undertakes mining and geological exploration activities at a number of sites surrounding the existing Tritton Mine and Budgerygar Deposit Project, including:

– Murrawombie Underground Mine – approximately 20 km northeast of Tritton Mine
– North East Mine – approximately 21 km northeast of Tritton Mine (4 km north of Murrawombie Underground Mine)
– Avoca Tank Underground Mine Project – 24 km northeast of Tritton Mine (4 km northwest of Murrawombie Underground Mine)
– Budgery Deposit Mining Project – 20 km south of Tritton Mine
– Constellation Deposit – approximately 40 km east of Tritton Mine

Murrawombie Underground Mine is the secondary production source to Tritton Mine. An Open Pit Mine Project at Murrawombie has obtained both Local and State Government regulatory approvals. The North East Mine has since been decommissioned with the exhaustion of the ore deposit.

In addition to the Budgerygar Deposit Project, mining project exploration is currently being undertaken at the Constellation Deposit and Budgery Open Pit Mining Project. Avoca Tank Underground Mine Project has received DA approval. Prefeasibility studies are yet to be undertaken for the Budgery Open Pit Mining Project.

3.6 Hydrogeology

Groundwater at the Tritton Mine site occurs predominantly in fractured rock aquifers (i.e. faults and fractures) within the Lachlan Fold Belt. The groundwater is managed under the NSW Murray-Darling Basin Fractured Rock Groundwater Sources WSP. Groundwater within the fractured rock aquifer is stored and moves through fractures, joints, bedding plains, faults and cavities within the rock mass.

Based on available monitoring data at Tritton Mine (Section 4.2.1), groundwater levels are quite deep, generally 20 m to 90 m below ground level (bgl). Groundwater is brackish to saline with electrical conductivity (EC) historically ranging from 10,000 to 20,000 µS/cm.

3.6.1 Aquifer type

The indurated Ordovician sediments constitute a fractured rock aquifer where groundwater is stored and transmitted via fractures, joints and other discontinuities within the rock mass.

Primary porosity flow (that is, movement between grains) is mostly negligible in these materials except where the original matrix has been altered by weathering. On a local scale, the hydraulic character of the aquifers may vary because of:

– Weathering
– Nature of fracturing (size, density, persistence, infilling)
– Nature of their formation, such as dykes, karst, and contact metamorphism
– Tectonic history
– Local variations in lithology

Geological processes including deformation and weathering phases may enhance or reduce the permeability of these aquifers. Highly weathered rocks tend to have fractures with clay coatings or infillings, and these tend to impede groundwater movement.

3.6.2 Aquifer hydraulic parameters

Parameters from groundwater studies at Tritton Mine and surrounding mining operations have been reviewed to determine the aquifer parameters.

3.6.2.1 Tritton Mine pumping test

A pumping test was undertaken by Tritton Mine personnel with the results of the pumping test analysed by SMEC (2008). A 10 day pumping test was undertaken at bore PB001 with over 11 days of recovery monitored. As part of the pumping test, groundwater levels were monitored at the pumping bore (PB001) and at a number of observation bores including PZH001, PZH002, PZH008, PZH009, PZH010, PZH011, PZH005. Details of the pumping bore and observation bore are provided in Section 4.1.1 and locations are shown in Figure 4-1.

The results of the analysis of the pumping test are shown in Table 3.1.

Table 3.1 Tritton Mine pumping test (SMEC, 2008)

Transmissivity (m^2/day)	Permeability (m/day)	Storativity
0.13 – 0.18	0.002 – 0.003	12.88

The typical storativity of a confined aquifer, which varies with specific storage and aquifer thickness, ranges from 5×10^{-5} to 5×10^{-3} (Todd 1980). Therefore, the calculated value for storativity in Table 3.1 is considered to be very high and possibly erroneous. Therefore, this value has been disregarded for the purpose of our assessment.

Finally, it is notable that the pumping test included monitoring of responses to pumping in six nearby monitoring bores. Only one bore showed a response to the pumping with initial decline in groundwater levels followed by recovery during continued pumping. While these outcomes are not uncommon, they are further indicative of a groundwater setting controlled by structures and foliation with limited permeability.

3.6.2.2 Avoca Tank

The Avoca Tank Groundwater Assessment (ES, 2014) adopted aquifer parameters from pumping tests at Girilambone Mine. Girilambone Mine is located approximately 20 km north-east of Tritton Mine. A range of values were reported, which are represented by Value 1 and Value 2 in Table 3.2. Solutions matched to close and distant observation wells respectively (ES, 2014).

The adopted aquifer parameters were utilised in analytical equations to estimate the rate of groundwater inflow and radius of drawdown due to proposed workings at Avoca Tank.

Table 3.2 Fractured rock aquifer parameters (ES, 2014)

Parameter	Value 1	Value 2
Hydraulic conductivity (m/day)	0.483	0.781
Specific storage (1/m)	4.563×10^{-6}	1.565×10^{-6}

3.6.2.3 New Cobar Complex

Slug testing was undertaken at monitoring bores at the New Cobar Complex as part of the *New Cobar Complex Project Groundwater Assessment* (EMM, 2020). Based on the results of the slug testing at six monitoring bores the effective hydraulic conductivity was estimated to be between 1.2 and 5.4 x 10^{-4} m/day. EMM (2020) noted that the monitoring bores are preferentially screened across the highest yielding sections of the intersected lithology.

The modelled aquifer parameters from the calibrated numerical groundwater model for the New Cobar Complex (EMM, 2020) are summarised in Table 3.3.

Table 3.3 New Cobar Complex modelled aquifer properties (EMM, 2020)

Hydrostratigraphic unit	Horizontal hydraulic conductivity (m/day)	Specific storage (1/m)
Weathered fractured rock	0.015	1.3×10^{-5}
Fractured rock	7.39×10^{-4}	1.3×10^{-5}
Fractured rock -500 to -1000 m AHD	1×10^{-5}	1.3×10^{-5}
Fractured rock below -1000 m AHD	1×10^{-6}	1.3×10^{-5}

3.7 Environmental values of groundwater

3.7.1 Landholder bores

A search of the Australian Groundwater Explorer (BoM 2021a) and Water NSW Real Time Data (Water NSW 2021) was undertaken to identify registered bores near the Budgerygar Deposit. The search identified 62 bores within an approximate 25 km radius.

Registered bores are shown in Figure 3-7 and bore details are summarised in Table 3.4. Registered bore depths range between 4.5 m and 198 m, with the majority of bores having depths greater than 50 m. Fifty-three bores are registered as monitoring, and form part of the monitoring network for Tritton Mine, North East Mine and Murrawombie Copper Mine. One of these monitoring bores is reported to be abandoned and is located within the vicinity of the Tailings Storage Facility (TSF) at the Tritton Mine.

The search identified three stock and domestic bores, one dewatering bore, three water supply bores and two commercial and industrial bores.

Of these bores, the three stock and domestic bores, GW060847, GW002685 and GW026890, have been identified as landholder bores and are located approximately 26.5 km southeast, 26.4 km northeast and 19.3 km northeast of Tritton Mine, respectively. Details of the stock and domestic bores are summarised in Table 3.5.

The dewatering bore, GW804744, is associated with Tritton Mine. The dewatering bore was installed in 2011 to a depth of 98 m, within sandstone.

Of the identified water supply bores, two are associated with Tritton Mine (GW805083 and GW804745) and one is associated with Murrawombie (GW805167). The Tritton Mine water supply bores are drilled to depths of 110 m and 30 m respectively and are listed as functional. The Murrawombie water supply bore is installed to a depth of 17.6 m.

The commercial and industrial bore GW804177 has been identified to be associated with Tritton Mine. The Tritton Mine commercial and industrial bore is installed to a depth of 110 m. The industrial bore GW042880 is considered to be associated with North East Mine, based on the location of this bore. GW042880 is installed in the weathered to fresh schist rock to a depth of 62 m.

Table 3.4 Registered bore details

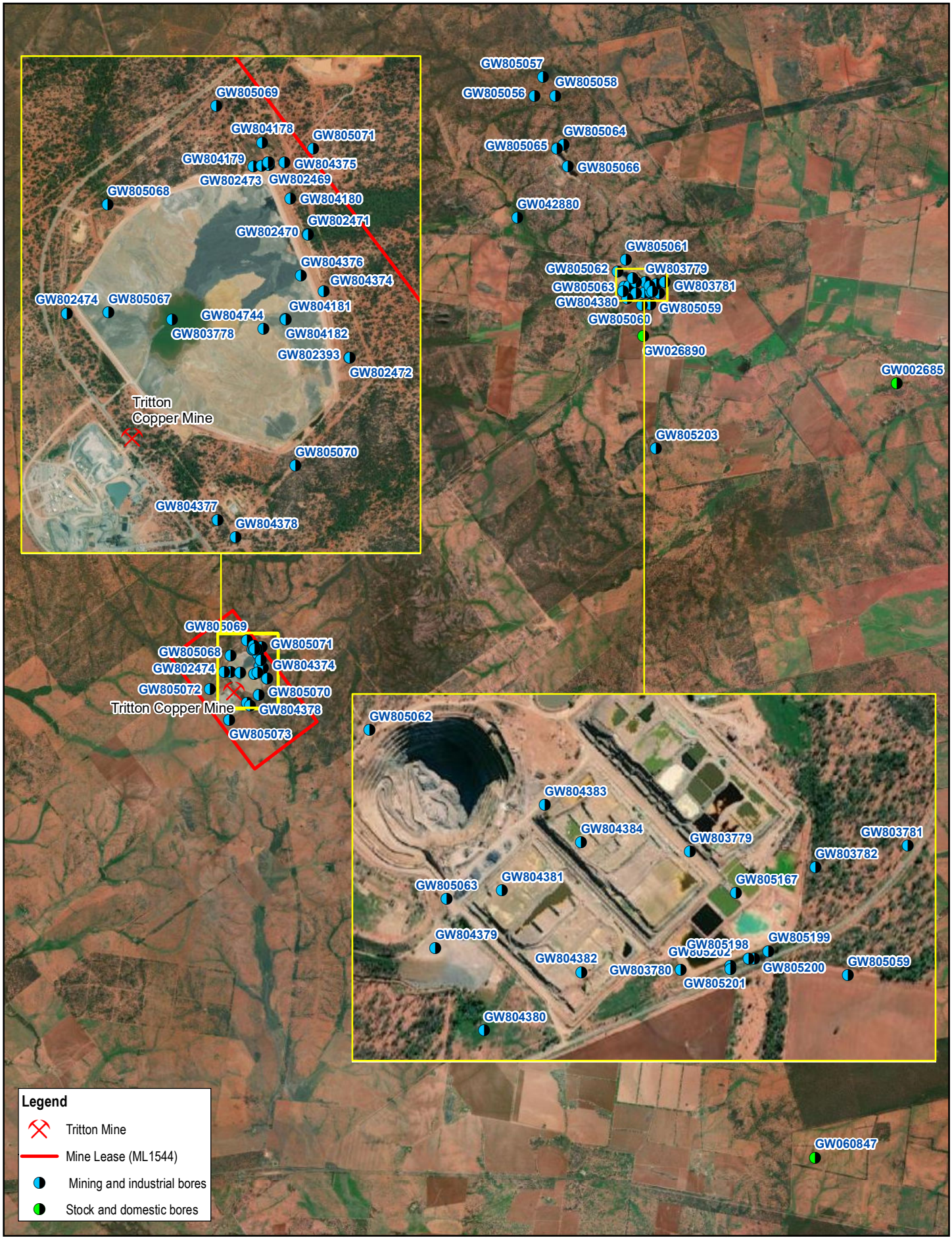
Bore	Bore depth (m)	Drilled Date	Purpose	Status	Proximity to	Latitude	Longitude
GW805200	35	2/05/2013	Monitoring	Functional	Murrawombie	-31.263556	146.88
GW805202	20	2/05/2013	Monitoring	Functional	Murrawombie	-31.263759	146.8792
GW805071	106	27/06/2012	Monitoring	Functional	Tritton	-31.377939	146.7333
GW805201	15	2/05/2013	Monitoring	Functional	Murrawombie	-31.263841	146.8792
GW803780	40	24/09/2008	Monitoring	Functional	Murrawombie	-31.263866	146.8776
GW805064	82	28/06/2012	Monitoring	Functional	North East	-31.21603	146.8472
GW805063	132	29/06/2012	Monitoring	Functional	Murrawombie	-31.261856	146.8699
GW804381	52	12/08/2010	Monitoring	Functional	Murrawombie	-31.261623	146.8717
GW804181	4.5	29/09/2007	Monitoring	Functional	Tritton	-31.38625	146.7317
GW804179	100	27/09/2007	Monitoring	Functional	Tritton	-31.378798	146.7299
GW026890	27.4	1/01/1966	Stock and Domestic	Unknown	Landholder	-31.277892	146.877
GW805061	37	29/06/2012	Monitoring	Functional	Murrawombie	-31.253122	146.8705
GW804180	100	28/09/2007	Monitoring	Functional	Tritton	-31.380363	146.732
GW804377	100	28/07/2010	Monitoring	Functional	Tritton	-31.396054	146.7278
GW802469	5	1/01/2004	Monitoring	Functional	Tritton	-31.378725	146.7308
GW804376	40	14/08/2010	Monitoring	Functional	Tritton	-31.384127	146.7326
GW804744	98	15/12/2011	Dewatering	Functional	Tritton	-31.386712	146.7304
GW805057	54	23/07/2012	Monitoring	Functional	North East	-31.194114	146.8395
GW805065	87	28/06/2012	Monitoring	Functional	North East	-31.217173	146.8446
GW804382	52	13/08/2010	Monitoring	Functional	Murrawombie	-31.263935	146.8743
GW805069	48	22/07/2012	Monitoring	Functional	Tritton	-31.375834	146.7278
GW805073	138	30/06/2012	Monitoring	Functional	Tritton	-31.401444	146.7212
GW804374	73	15/08/2010	Monitoring	Functional	Tritton	-31.384914	146.7339
GW805070	114	28/06/2012	Monitoring	Functional	Tritton	-31.393401	146.7322
GW805067	198	30/06/2012	Monitoring	Abandoned	Tritton	-31.385917	146.7216
GW805198	15.5	30/04/2013	Monitoring	Functional	Murrawombie	-31.263544	146.8798

Bore	Bore depth (m)	Drilled Date	Purpose	Status	Proximity to	Latitude	Longitude
GW805059	22	28/06/2012	Monitoring	Functional	Murrawombie	-31.264016	146.8831
GW805060	19	27/06/2012	Monitoring	Functional	Murrawombie	-31.267685	146.8797
GW805083	110	1/10/2007	Water Supply	Functioning	Tritton	-31.378601	146.7308
GW804375	73	15/08/2010	Monitoring	Functional	Tritton	-31.378612	146.7317
GW805062	139	28/06/2012	Monitoring	Functional	Murrawombie	-31.257071	146.8673
GW802471	5	1/01/2004	Monitoring	Functional	Tritton	-31.382113	146.733
GW060847	74	1/02/1985	Stock and Domestic	Unknown	Landholder	-31.543169	146.9415
GW803782	40	26/09/2008	Monitoring	Functional	Murrawombie	-31.260965	146.882
GW804380	61	11/08/2010	Monitoring	Functional	Murrawombie	-31.265583	146.8711
GW803779	40	25/09/2008	Monitoring	Functional	Murrawombie	-31.260519	146.8779
GW804177	110	1/10/2007	Commercial and Industrial – mining	Functioning	Tritton	-31.37861	146.7307
GW805058	48	24/07/2012	Monitoring	Functional	North East	-31.200255	146.8442
GW805056	66	24/07/2012	Monitoring	Functional	North East	-31.200335	146.8363
GW805167	17.56	17/06/2009	Water Supply – environment rehabilitation	Functional	Murrawombie	-31.261702	146.8794
GW805199	15.5	30/04/2013	Monitoring	Functional	Murrawombie	-31.263344	146.8805
GW804384	43	13/08/2010	Monitoring	Functional	Murrawombie	-31.260254	146.8743
GW803778	100	22/09/2008	Monitoring	Functional	Tritton	-31.386259	146.7252
GW805066	132	27/06/2012	Monitoring	Functional	North East	-31.223106	146.8488
GW804383	40	13/08/2010	Monitoring	Functional	Murrawombie	-31.259197	146.8731
GW805072	114	27/06/2012	Monitoring	Functional	Tritton	-31.391476	146.7139
GW802474	90	1/01/2004	Monitoring	Functional	Tritton	-31.385939	146.7192
GW804182	100	29/09/2007	Monitoring	Functional	Tritton	-31.386254	146.7317
GW802393	90	1/01/2004	Monitoring	Functional	Tritton	-31.388145	146.7353
GW804379	61	11/08/2010	Monitoring	Functional	Murrawombie	-31.263244	146.8695
GW802473	5	1/01/2004	Monitoring	Functional	Tritton	-31.37876	146.7304

Bore	Bore depth (m)	Drilled Date	Purpose	Status	Proximity to	Latitude	Longitude
GW802472	90	1/01/2004	Monitoring	Functional	Tritton	-31.388147	146.7354
GW804378	115	29/07/2010	Monitoring	Functional	Tritton	-31.396904	146.7288
GW802470	90	1/01/2004	Monitoring	Functional	Tritton	-31.382136	146.733
GW804178	100	29/09/2007	Monitoring	Functional	Tritton	-31.377617	146.7304
GW805203	20	3/05/2013	Monitoring	Functional	Murrawombie	-31.314211	146.8817
GW002685	86.9	1/08/1929	Stock and Domestic	Unknown	Landholder	-31.293169	146.9723
GW805204	16	3/05/2013	Monitoring	Functional	Murrawombie	-31.267775	146.8765
GW803781	40	27/09/2008	Monitoring	Functional	Murrawombie	-31.260363	146.885
GW805068	134	10/09/2012	Monitoring	Functional	Tritton	-31.380657	146.7216
GW042880	62	1/10/1975	Commercial and Industrial	Unknown	North East	-31.239559	146.8298
GW804745	31	1/07/2005	Water Supply	Functioning	Tritton	-31.378614	146.7307

Table 3.5 Stock and domestic bores

Bore	Bore depth (m)	Drilled date	Purpose	Latitude	Longitude	Distance from Tritton Mine (km)
GW060847	74	1/02/1985	Stock and Domestic	-31.543169	146.9415	26.5
GW002685	86.9	1/08/1929	Stock and Domestic	-31.293169	146.9723	26.4
GW026890	27.4	1/01/1966	Stock and Domestic	-31.277892	146.877	19.3



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Kilometers

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Grid: GDA 1994 MGA Zone 55

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Registered bore search

Figure 3.7

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Data source: Tritton: Mine Lease Bdy, 2021; BOM: Registered Borse, 2019; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Created by: Sara Askarimarnanir

3.7.2 Groundwater dependent ecosystem (GDE)

3.7.2.1 Definition

A GDE is an ecosystem which has its species composition and natural ecological processes determined by groundwater. That is, GDEs are natural ecosystems that require access to groundwater to meet all (obligatory), or some (facultative) of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. If the availability of groundwater to GDEs is reduced, or if the quality is allowed to deteriorate, these ecosystems will be impacted.

It is widely acknowledged that a poor understanding exists in recognising GDEs, or understanding the hydrogeological processes affecting GDEs, or their environmental water requirements. GDEs can be broadly grouped into three categories:

– Ecosystems that depend on the surface expression of groundwater:
  - Swamps and wetlands can be sites of groundwater discharge and may represent GDEs. The sites may be permanent or ephemeral systems that receive seasonal or continuous groundwater contribution to water ponding or shallow water tables. Tidal flats and inshore waters may also be sites of groundwater discharge. Wetlands can include ecosystems on potential acid sulphate soils and in these cases maintenance of high water levels may be required to prevent waters from becoming acidic.
  - Permanent or ephemeral stream systems may receive seasonal or continuous groundwater contribution to flow as baseflow. Interaction would depend upon the nature of stream bed and underlying aquifer material and the relative water level heads in the aquifer and the stream.
– Ecosystems that depend on the subsurface presence of groundwater. Terrestrial vegetation such as trees and woodlands may be supported either seasonally or permanently by groundwater. These may comprise shallow or deep-rooted communities that use groundwater to meet some or all of their water requirements. Animals may depend upon such vegetation and therefore indirectly depend upon groundwater. Groundwater quality generally needs to be high to sustain vegetation growth.
– Ecosystems that reside within a groundwater resource. These are referred to as hypogean ecosystems. Micro-organisms in groundwater systems can exert a direct influence on water quality, for example, stygofauna typically found in karstic, fractured rock or alluvial aquifers.

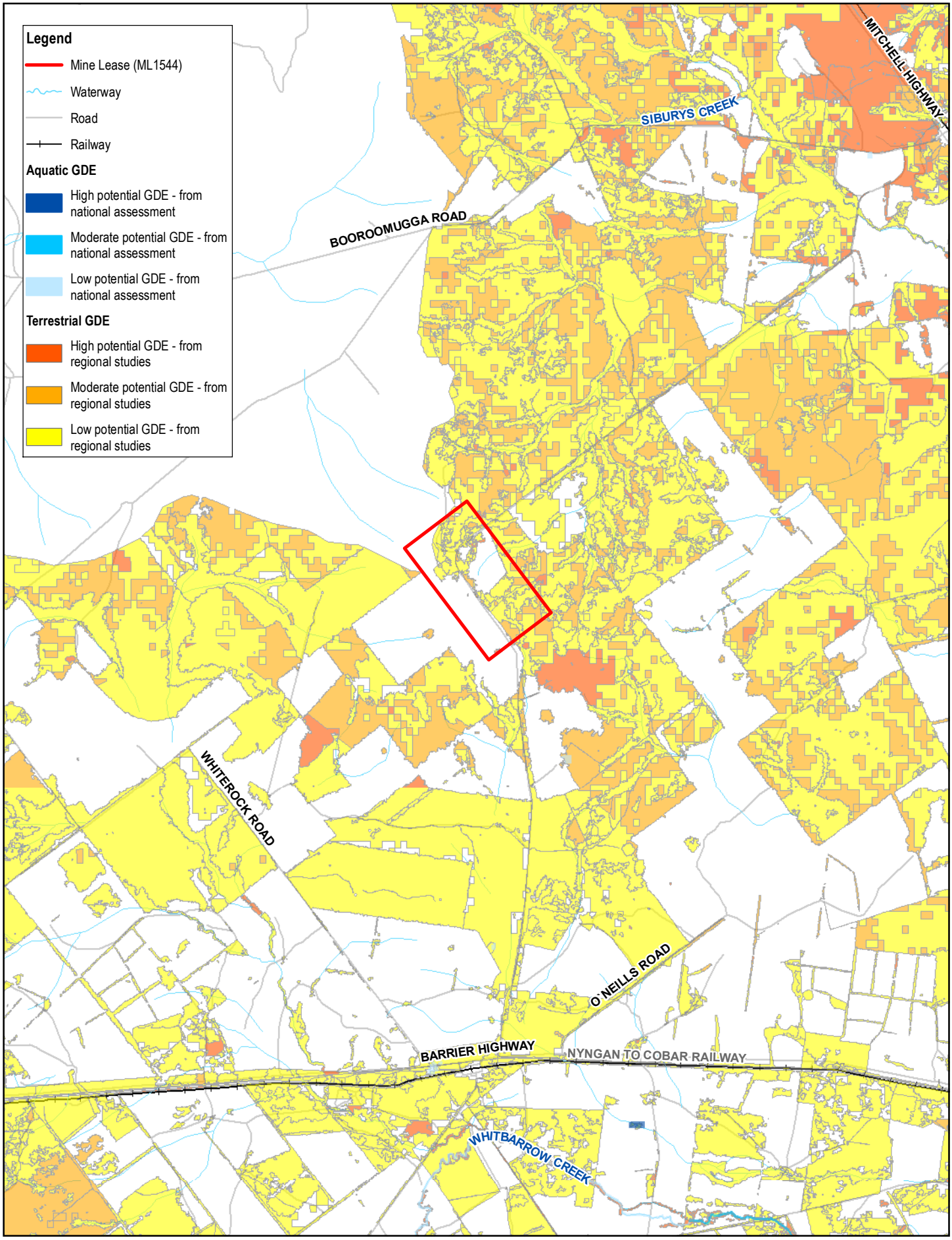
3.7.2.2 Occurrence within the region

A search of the Groundwater Dependent Ecosystem Atlas (BoM 2021b) was undertaken to identify aquatic GDEs within 20 kilometres of the Budgerygar Deposit. The search identified a number of potential aquatic GDEs within proximity of the Budgerygar Deposit, including two low-potential GDEs approximately 7.5 km southeast and 13.3 km south. The location of these GDEs is shown on Figure 3-8. These GDEs are associated with wetland ecosystems and floodplain water bodies. Given the ecosystem type and low potential nature of the GDEs, it is considered unlikely that these aquatic organisms are dependent on the deep groundwater levels near the site.

There were no other known aquatic GDEs identified within 20 kilometres of the study area.

Potential GDEs are identified based on regional assessments of groundwater levels, remote sensing of vegetation and surface topography. A search of the Groundwater Dependent Ecosystem Atlas (BoM 2021b) was undertaken to identify terrestrial GDEs near the Budgerygar Deposit. The search identified a number of low-potential terrestrial GDEs in the vicinity of the Budgerygar Deposit. The location of these potential GDEs are shown in Figure 3-8. Figure 3-8 shows that the Budgerygar Deposit lies within a low to moderate potential GDE occurrence zone - from regional studies. Low potential GDEs identified within proximity to the Budgerygar Deposit include species such as Eucalyptus gracilis. Moderate potential GDEs situated within the Lachlan Fold Belt groundwater management area, identified within proximity to the Budgerygar Deposit, include species of Eucalyptus populena subsp., bimbil, Eucalyptus intertexta and Casuarina cristata. High potential GDEs were also identified to the east and south east of the Budgerygar Deposit. These GDEs are located within the NSW Murray Darling Basin groundwater management areas and include species such as Eucalyptus socialis, Eucalyptus Dumosa and Geijera parviflora. It is considered unlikely that these vegetative communities are GDEs given the deep water levels identified at the site.

The background document for the Murray-Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan (DPIW 2012) was also reviewed to identify any high priority GDEs within the Lachlan Fold Belt groundwater source. There were no listed high priority GDEs within or near the Budgerygar Deposit.



Paper Size ISO A4

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Groundwater dependent ecosystems

Figure 3.8

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Data source: Tritton: Mine Lease Bdy, 2021; LPI: DTDB, 2017; BOM: Registered Borse, 2019; . Created by: Sara Askarimarnani

4. Groundwater management and monitoring

4.1 Groundwater monitoring network

4.1.1 Monitoring bores

The groundwater monitoring program at the Tritton Mine includes twenty-eight groundwater monitoring bores, with most of these being installed between 2004 and 2010. Groundwater monitoring bore details are included in Table 4.1 and locations are shown in Figure 4-1. Based on the bore depth, it is assumed that all monitoring bores, except PZH011S, are installed in the fractured rock aquifer. PZH011S is assumed to be installed in the shallow colluvial sediments.

Table 4.1 Tritton Mine groundwater monitoring bores

Bore number	Easting	Northing	TOC (mAHD)	Depth (m)	Year Installed	Initial water level (RLm)	Initial water level-depth (m)
PZH001	474,405	6,528,393	264.487	90	2004	186.84	Dry*
PZH002[#]	474,614	6,528,016	254.412	90	2004	186.66	61.5
PZH003	474,838	6,527,350	267.995	90	2004	181.5	Dry*
PZH004	473,302	6,527,591	269.521	90	2004	187.47	Dry*
PZH005	474,471	6,528,181	264.784	N/A	2007	230.68	34.17
PZH006D	474,548	6,527,994	264.588	N/A	2007	214.97	49.65
PZH006S	474,548	6,527,994	264.588	N/A	2008	248.12	16.34
PZH007D	474,625	6,527,811	264.817	N/A	2007	195.4	69.45
PZH007S	474,625	6,527,811	264.817	N/A	2008	252.71	12.66
PZH008	474,364	6,528,516	262.422	100	2007	202.28	60.22
PZH009	474,315	6,528,385	263.016	100	2007	211.06	52.02
PZH010	474,517	6,528,212	258.169	100	2007	207.2	51.05
PZH011D[#]	474,490	6,527,559	264.205	100	2007	225.73	38.17
PZH011S[#]	474,490	6,527,559	264.205	4.5	2007	Dry	Dry
PZH012[#]	474,490	6,527,559	264.205	100	2007	200.2	38.17
PZH013	474,683	6,527,976	254.609	40	2010	Dry	Dry
PZH014	474,579	6,528,579	256.722	73	2010	197.1	59.62
PZH015	474,813	6,527,889	256.081	73	2010	187.93	68.15
PZH016	473,598	6,527,569	N/A	198	2012	N/A	N/A
PZH017	473,742	6,527,949	N/A	134	2012	N/A	N/A
PZH018	474,137	6,528,676	N/A	48	2012	N/A	N/A
PZH019	474,700	6,526,889	N/A	114	2012	N/A	N/A
PZH020	N/A	N/A	N/A	N/A	2012	N/A	N/A
PZH021	474,724	6,528,613	N/A	106	2012	N/A	N/A
PZH022	472,786	6,526,984	N/A	114	2012	N/A	N/A
PZH023	473,480	6,525,879	N/A	138	2012	N/A	N/A
PB001	474,396	6,528,406	263.92	110	2007	N/A	43.78
PB002	474,491	6,527,527	N/A	N/A	2011	N/A	N/A

Note to table:
m bgl: metres below ground level
MGA: Map grid of Australia
[#] Decommissioned in June 2014
N/A denotes data not available
* Dry but the holes moist and natural ingress of water may have occurred with time after their installation

4.1.2 Monitoring program

The groundwater monitoring bores are monitored quarterly for groundwater levels and quality. Groundwater quality monitoring includes physical parameters (electrical conductivity, pH and total dissolved solids), major ions (bicarbonate, carbonate, chloride, sulfate, calcium, magnesium, potassium and sodium) and selected dissolved metals including arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, vanadium and zinc. The monitoring results are discussed in Section 4.2.

Paper Size ISO A4

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Groundwater monitoring network

Figure 4.1

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Data source: Tritton: Mine Lease Bdy, 2021; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: fmackay

4.2 Monitoring results

4.2.1 Groundwater levels

Groundwater levels have been monitored at Tritton Mine since March 2005. Observed groundwater levels (depth to groundwater) are shown in Figure 4-2 and Figure 4-3. Groundwater elevations for all bores that do have surveyed top of casing elevations are also shown in Figure 4-4. Groundwater levels plotted as metres below ground level for all bores are also plotted with CRD in Appendix A.

Review of groundwater level data indicates that groundwater levels at Tritton Mine are generally within 20 m to 90 m below ground level (bgl) but can vary from 10 m bgl to 140 m bgl. Review of groundwater levels indicates that there are increasing trends in groundwater level at a number of monitoring bores. Review of monitoring data has attributed the tailings storage facility (TSF) to these rising groundwater levels (KH Morgan and Associates, 2010; Environmental Earth Sciences, 2013). Available groundwater level and quality data indicates that the weight of the TSF is increasing pressure on pore spaces in the underlying uppermost aquifer resulting in a localised groundwater mound (Environmental Earth Sciences, 2013).

Review of the groundwater level data does not indicate any evidence of drawdown due to mining with the potential exception of decreasing trend at PZH004 between March 2005 and December 2006 and at PZH023. At the remaining groundwater monitoring bores, it is likely that any drawdown due to mining is being offset by the impact from the TSF.

The drought conditions between mid-2016 and early 2020 have not impacted on groundwater levels at the site with groundwater levels generally stable over this period.

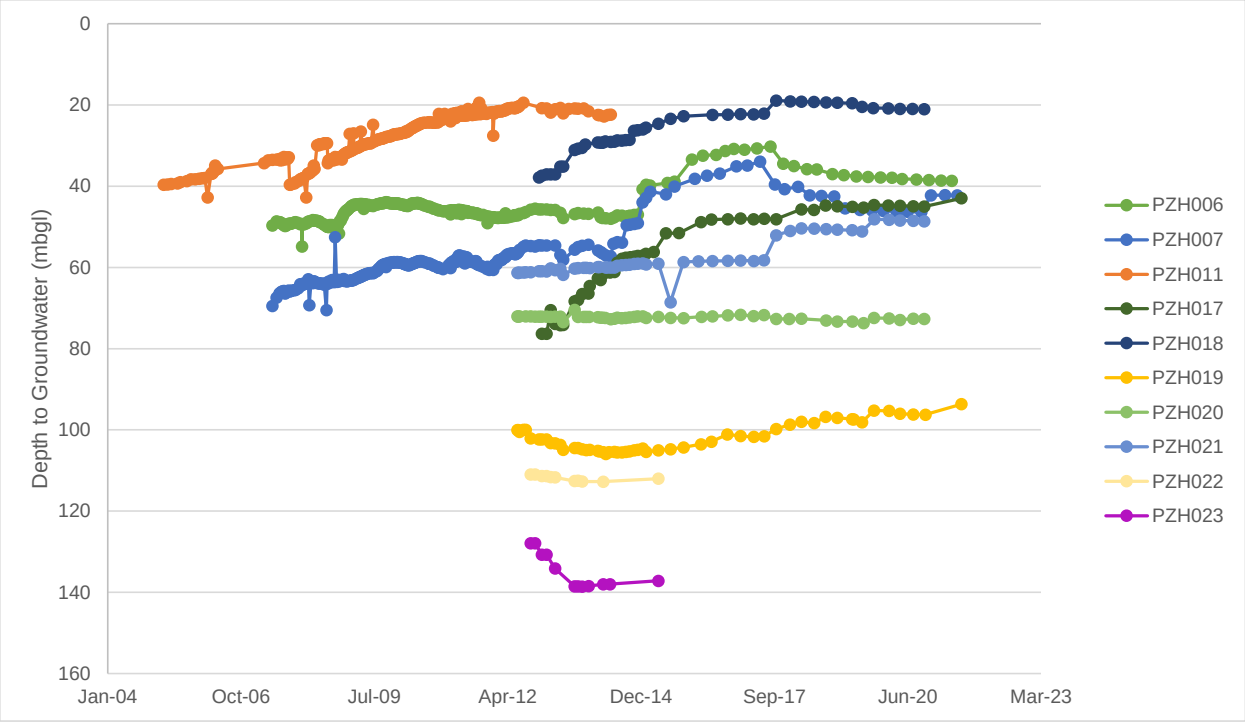


Figure 4-2 Groundwater levels – Tritton Mine (non-surveyed bores)

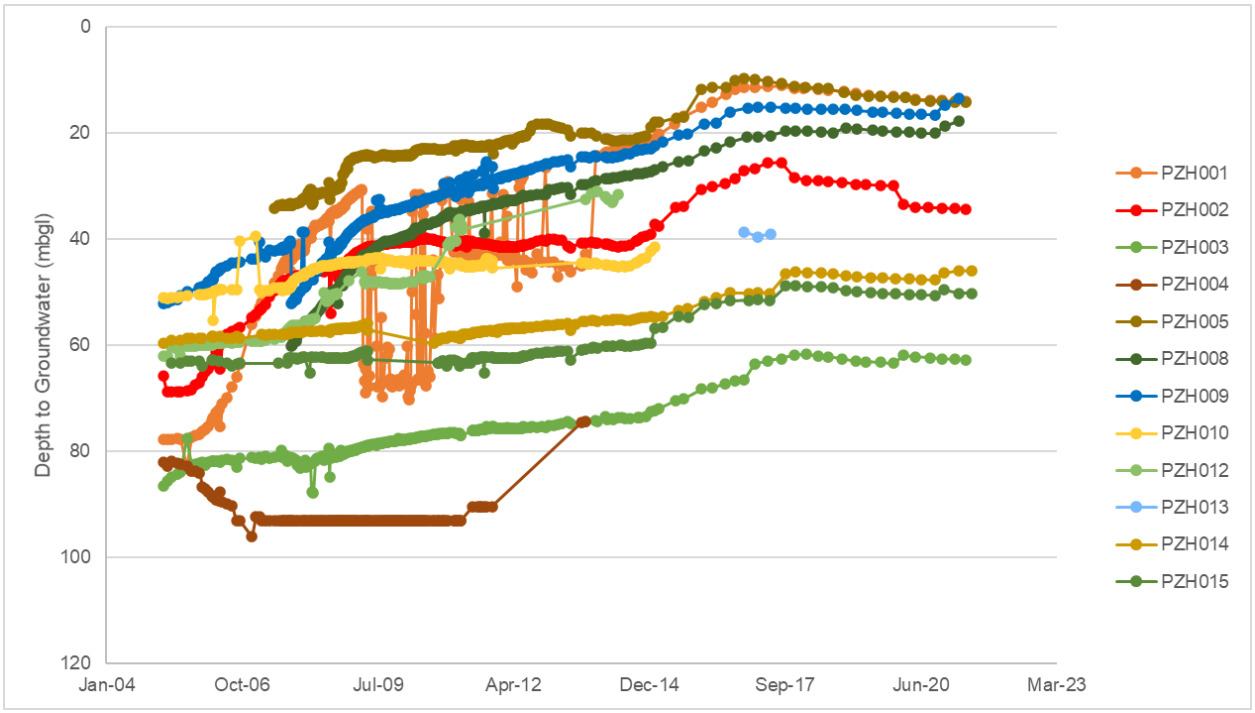


Figure 4-3 Groundwater levels – Tritton Mine (surveyed bores)

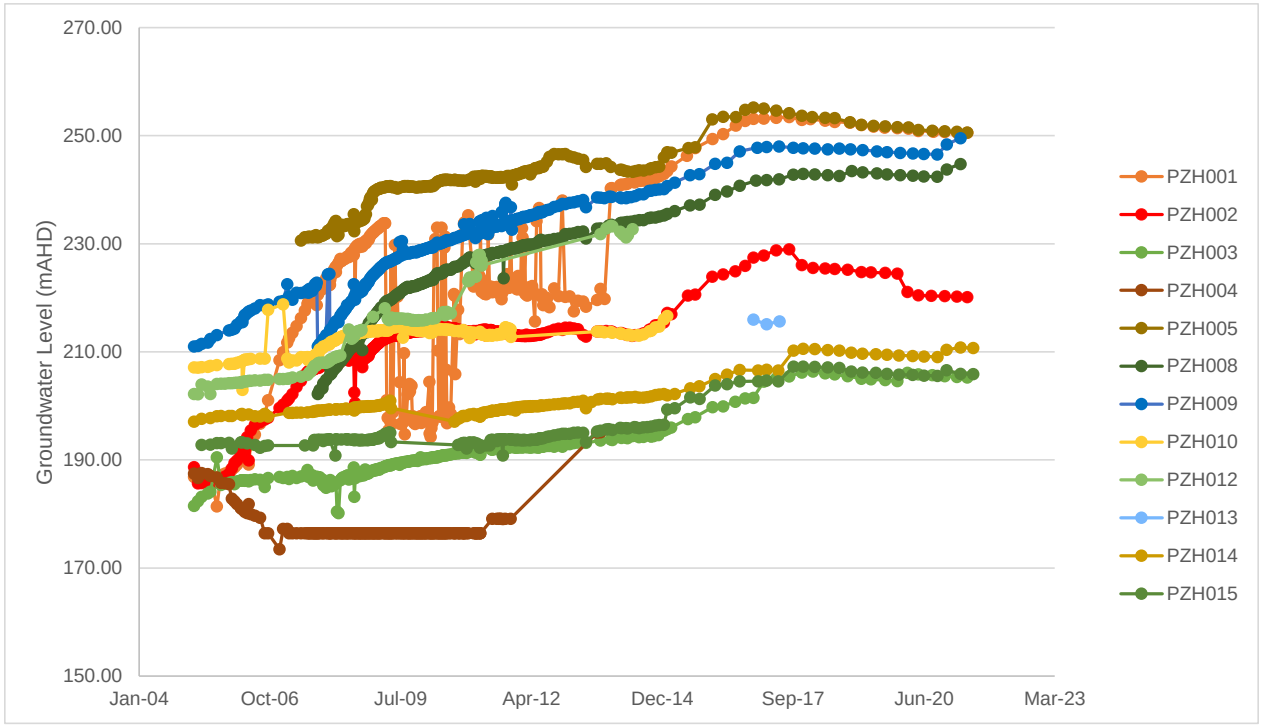


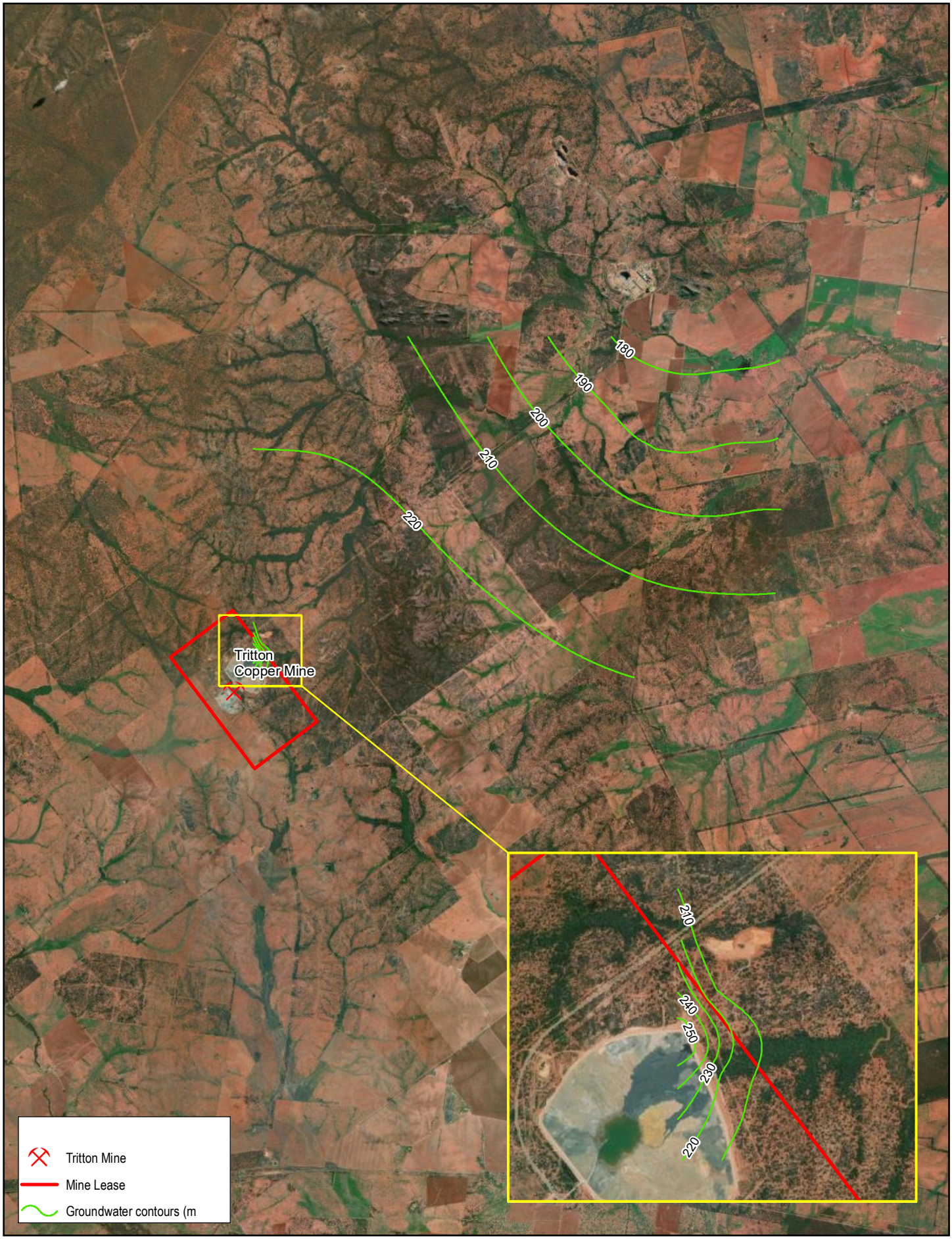
Figure 4-4 Groundwater levels (m AHD) – Tritton Mine (surveyed bores)

Regional groundwater levels in the vicinity of Tritton Mine are shown in Figure 4-5. The regional groundwater contours have been plotted using data from the Tritton Mine monitoring bores and from available groundwater levels at surrounding landholder bores from Water NSW (2021). The regional groundwater contours indicate that groundwater is mounded at the TSF as discussed above. Groundwater flow is towards the north-east. The groundwater flow direction corresponds with topography.

4.2.2 Tritton Mine groundwater inflows

A review of metered groundwater inflow data was undertaken by Metso (2020). Metso reported that groundwater take from the Tritton Mine workings was 53 ML/year. This take included both aquifer interception (1.2 ML/year) and groundwater entrained in ore (51.7 ML/year). Overall, this indicates that the rate of groundwater inflow into the existing Tritton Mine workings is low, approximately 142 m^3/day.

Review of water transfer data by KH Morgan and Associates (2010) found that between 26 March and 13 November 2009 the rate of groundwater inflow into the Tritton Mine workings was 501 m^3/day. Since 2009, as the mine has increased with depth, groundwater inflows have not increased. This may indicate that there is either a limited aquifer thickness, or that the hydraulic conductivity of the strata decreases with depth due to tightening of fractures at depth.



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0 1 2 3 4

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Transverse Mercator

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GHD

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Date **01 Feb 2022**

Regional groundwater levels

Figure 4.5

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Data source: Tritton: Mine Lease Bdy, 2021; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: Sara Askarimarnani

4.2.3 Groundwater quality

Groundwater quality has been monitored at Tritton Mine since December 2004. A summary of groundwater quality trends at Tritton Mine has been undertaken for the monitored physicochemical, major ions and dissolved metals parameters. Groundwater quality data are plotted for each parameter in Appendix B.

4.2.3.1 Physicochemical parameters

Physicochemical parameters are monitored quarterly at Tritton Mine and include pH, Electrical Conductivity (EC) and Total Dissolved Solids (TDS).

Based on monitoring results, pH at Tritton Mine is circumneutral and is generally consistent across all bores. Some spikes in pH have been observed, which deviate from this trend. Increased pH levels (greater than pH 9) have historically been observed at PZH003, PZH006, PZH014, PZH017, PZH018 and PZH21. Some decreased pH levels (less than pH 5) have also been observed at PZH006 in March 2008 and April 2019.

Groundwater at Tritton Mine is brackish to saline with EC historically ranging from 10,000 to 20,000 µS/cm. Overall trends based on the monitoring data at Tritton Mine show that EC has decreased slightly over the period since monitoring began. Sites with elevated EC in comparison to the general trends observed include PZH017 and PZH018. At PZH017, monitoring results have ranged from 15,000 to 20,000 µS/cm. EC has been more elevated at PZH018, with monitoring results generally greater than 20,000 µS/cm. PZ017 is installed 148 mbgl while PZH018 is installed to a depth of 48 mbgl. Both these bores are located immediately north of the TSF.

TDS concentrations range between 5,000 mg/L and 20,000 mg/L based on the monitoring data. The majority of concentrations within the monitoring bores have historically been less than 15,000 mg/L, with the exception of PZH018. The concentrations of TDS at Tritton Mine are consistent with concentrations of EC and mineral ion salts.

Review of groundwater quality data by Environmental Earth Sciences (2013) indicated that groundwater geochemical signatures and concentrations were very stable from 2008 to 2013, with only minor localised temporal fluctuations. The review undertaken by Environmental Earth Sciences (2013) indicated that between 2008 and 2013 the only location that has detected any potential indicators of chemical leakage from the TSF is bore PZH003 to the south-east (relatively elevated sulfate, SO_4), however this impact has stabilised since July 2010 and appears to be diminishing with time. Therefore, based on the review of groundwater quality undertaken by Environmental Earth Sciences (2013), the TSF is not impacting on groundwater quality.

4.2.3.2 Dissolved metals

A suite of dissolved metals is sampled quarterly at Tritton Mine within all functional monitoring bores.

No discernible trends in groundwater quality have been observed within monitoring results for arsenic, beryllium, cadmium, chromium, lead, mercury, or vanadium. Groundwater quality for these dissolved metals is relatively consistent across all sampling events.

Decreasing concentrations have been observed for some of the dissolved metal analytes. Concentrations decreased rapidly by an order of magnitude at some bores between the period of December 2006 and July 2009. After this period, gradual decreasing concentrations have been observed for barium, cobalt, copper, manganese and zinc across most of the bores.

Sites with the consistently highest concentrations of barium include PZH007 and PZH021. Concentrations at all other bores are typically below 0.1 mg/L.

Decreasing trends of cobalt have been observed at PZH001 since December 2004, as well as PZH003 and PZH007 since November 2007. All other monitoring results have been consistent across monitoring events. All recorded concentrations of cobalt have been below 0.1 mg/L since November 2013 with the exception of one elevated monitoring result in November 2020 at PZH001.

Increased concentrations of copper were evident at PZH003 and PZH007 between the period of 2006 and 2009. Since July 2009, copper concentrations at all bores have remained consistently below 0.2 mg/L, with two elevated concentrations recorded at PZH013 during consecutive monitoring events, November 2016 and March 2017.

Manganese concentrations have been most elevated following installation at PZH003 (2004) and PZH015 (2010) (greater than 1 mg/L). Concentrations have also been elevated at PZH021 since its installation in 2012 and has only decreased slightly over the monitoring period. Notably, concentrations at PZH003, PZH014 and PZH015 have decreased significantly, by two orders of magnitude to the most recent monitoring period.

Concentrations of zinc have decreased over the period of monitoring. Initial high concentrations (greater than 5 mg/L) were recorded from December 2004 to September 2006 at bores PZH001 to PZH004. These concentrations have typically decreased to within the range of 0.05 to 0.4 mg/L. Concentrations at other locations have exhibited decreasing trends or been consistent with previous monitoring periods. Zinc concentrations have been below 1 mg/L at all sites except for one spike in November 2018 at PZH003.

There are no increasing trends in dissolved metals evident.

5. Conceptual model

The preliminary conceptual site model has been developed and is shown in Figure 5-1. The conceptualisation is a tool that formalises an understanding of the major components of a hydrogeological system, their interaction and how external changes can modify the system. They can often be a highly simplified way of expressing what is known about a system, and can assist in defining (and/or testing hypotheses regarding) the critical components that make up the structures, processes and interactions, the relationships of cause and effect, and more generally how a system works.

Available geological data has been compiled based on the Tritton Mine geological model and regional geological mapping. In terms of the geology, a thin cover of Quaternary sediments has been shown overlying the Ordovician bedrock. The later comprises indurated siltstones, sandstones and claystones and constitutes a fractured rock aquifer. The model indicates that the upper part of the bedrock is weathered. In terms of fracturing the fracture density variations with depth and fracture orientations relative to bedding are unknown.

Based on available monitoring data (Section 4.2.1) the groundwater levels are generally deep with groundwater levels 20 m to 90 m bgl.

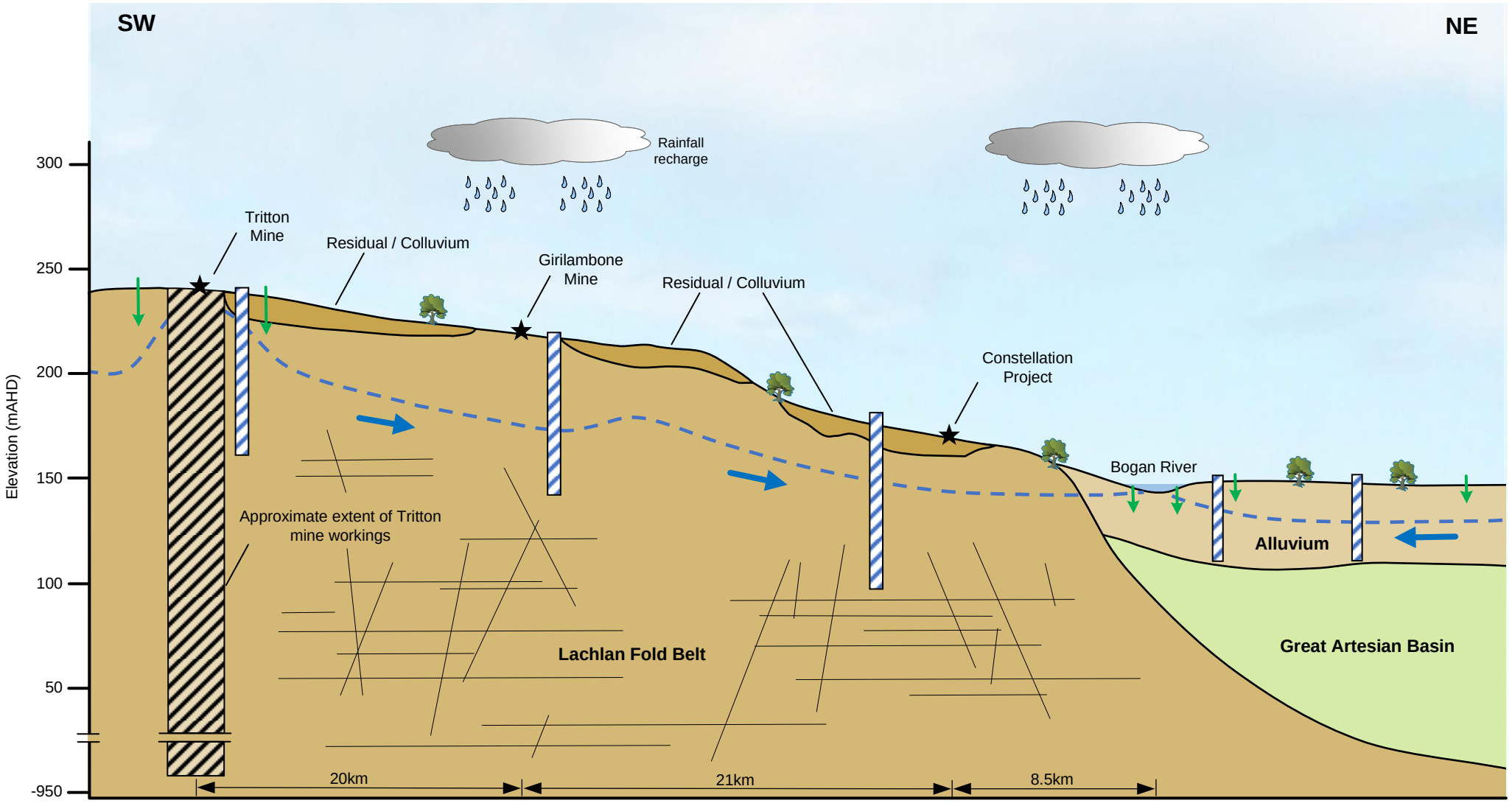
It is not possible to determine the saturated thickness of the Ordovician sediments based on available information, however, permeabilities are expected to decrease with depth as overburden pressure would tend to close and tighten fractures. Observed groundwater inflows into the Tritton Mine workings are low, indicating that the fractured rock aquifer is low yielding.

The regional water table at Tritton Mine reflects topography with groundwater flowing towards the northeast. It is likely that the TSF at Tritton Mine has locally impacted on groundwater levels, with the weight of the TSF increasing pressure on pore spaces in the underlying uppermost aquifer resulting in a localised groundwater mound.

Based on the available groundwater quality monitoring data (Section 4.2.3), the beneficial use category is industrial use due to the saline groundwater. There are no stock and domestic bores within 19 km of Tritton Mine. There are no permanent waterways near the project area and groundwater levels are considered to be too deep to support terrestrial vegetation or interact with waterways.

The existing Tritton Mine workings extends below the regional water table. Groundwater intercepted by the existing workings is pumped back to the surface. This has likely resulted in gradual dewatering around the workings and decline in the regional water table as groundwater migrates towards the ‘sink’. Drawdown due to mining has potentially been observed at PZH004 between March 2005 and December 2006 and at PZH023. At the remaining groundwater monitoring bores, it is likely that any drawdown due to mining is being offset by the impact from the TSF. The proposed Budgerygar workings are located 600 m from the existing Tritton Mine workings. The Budgerygar workings will be within this zone of groundwater depressurisation due to the existing Tritton Mine workings.

The Budgerygar workings will result in the continued dewatering of the regional water table. The proposed methodology for assessing these impacts is discussed in Section 6.



Production bore / Monitoring bore

Approximate water table

Fractured rock

Recharge / leakage

Groundwater flow

Tritton Resources Pty Ltd
Tritton Copper Project
Mod 8 Groundwater Assessment

Conceptual cross-section

Project No. **12555629**
Revision No. **0**
Date **29/09/2021**

Figure 5.1

Created by: JMacatanong

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6. Impact assessment

This section summarises the predicted impacts of the Project. Potential impacts of the Project have been predicted utilising the methodology outlined in Section 6.1.1 and 6.2.1.

6.1 Prediction of groundwater inflow

6.1.1 Method

The assessment of inflows into the decline and associated workings has been undertaken using analytical techniques. The existing Tritton Mine workings and proposed Budgerygar workings have been assessed cumulatively. Given the ability to compare predictions of rate of inflow to observations at the existing Tritton Mine workings, the analytical equations will be able to develop conservative estimates of groundwater drawdown and rate of groundwater inflow due to the Project. Considering the distance to registered landholder bores (over 19 km) and the lack of GDEs due to the deep groundwater levels, it is considered that the risk to identified groundwater receptors due to the Project is very low. Therefore, the level of complexity of analytical equations is appropriate to assess this risk.

Analytical techniques require the simplification of the complex hydrogeology and geometry of the mine workings by applying a range of assumptions. At its simplest, the approach treats the development as an equivalent well. This method has been documented by Singh and Atkins (1983) and has been applied. The conceptualisation of the underground workings has been shown in Figure 6-1, i.e., the downward spiralling decline would be simplified and approximated as a vertically orientated cylinder. As the Budgerygar and Tritton Mine workings will be connected by a decline drive, it was considered appropriate to treat the existing and proposed workings as one set of workings. Two analytical approaches have been applied:

a. Treating the decline as a large diameter shaft

Solution based around the Theis well equation.

b. Dewatering as a large pit

Solution based around the Jacob-Lohman equation.

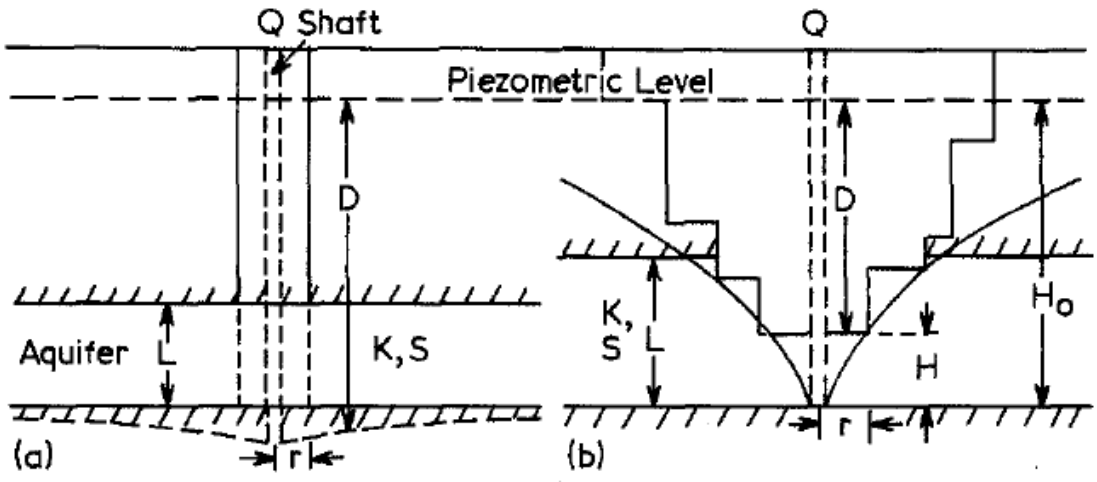


Figure 6-1 Analytical conceptualisation of the workings

The limitations of the equivalent well approach are:

– The aquifer has a seemingly infinite areal extent.
– The aquifer is homogeneous, isotropic and of uniform thickness over the area influenced by the exploration decline.
– Prior to pumping, the piezometric surface and/or phreatic surface are horizontal over the area influenced by the mine workings.
– The aquifer is pumped at a constant discharge rate.
– The imaginary well fully penetrates the aquifer and water flows to the well from the entire thickness of the aquifer by horizontal flow.
– Water removed from storage is discharged instantaneously with decline of head.

In this case, it is considered that these limitations are likely to overpredict impacts and produce a conservative result rather than underpredict outcomes or ignore complex features that would have a substantial impact. Given the nature of the setting as described in Section 3, this approach is considered acceptable.

6.1.2 Analytical inputs

A summary of the analytical inputs into the analytical methods has been provided in Table 6.1.

Table 6.1 Summary of analytical inputs

Parameter	Value
Transmissivity, T (m^2/day)	Aquifer hydraulic conductivity will be influenced by the proportion of larger water bearing fractures within the rock mass. Based on the results of the pumping test undertaken at Tritton Mine (Section 3.6.2.1) a transmissivity of 0.1 m^2/day has been adopted. To address uncertainties, an uncertainty analysis has been undertaken where a range of transmissivities (T) have been applied. $T = k \times L$ Where: k is aquifer hydraulic conductivity (m/day); and L is aquifer thickness (m). Conservatively assuming an average SWL of 30 m bgl based upon monitoring data and the effective base of the Ordovician rocks as 700 m; an aquifer thickness of 670 m has been adopted.
Drawdown required, H (m)	The base of the Tritton Mine workings is 1.4 km. However, the effective base of the Ordovician rocks has assumed to be 700 m. Below this depth it is assumed that fractures through which groundwater propagates will decrease in size due to the weight of overburden rock. Therefore, a maximum drawdown of 700 m has been assumed. The depth of the Budgerygar workings is approximately 700 m. Therefore, the drawdown required, H, was not increased for scenarios that include Budgerygar workings.
Radius at which drawdown is required	The outer diameter of the decline at Tritton Mine and Budgerygar is 50 m. To take into account stoping, the diameter of the mine workings has been assumed to be 200 m. The radius of the workings was not increased with the inclusion of the Budgerygar workings. This is considered a reasonable assumption as the proposed Budgerygar workings are close to the existing Tritton Mine workings.
Elapsed time, t (days)	Mining at Tritton Mine commenced in 2005. The assessment has been undertaken for current conditions (approximately 17 years or 6,205 days), end of approved mining at the end of 2024 (approximately 20 years or 7,300 days) and end of proposed mining at Budgerygar in 2028 (approximately 24 years or 8,760 days).
Storage coefficient (storativity), S (m/m)	Fractured rock aquifers tend to have low groundwater storage, and therefore 1×10^{-4} has been initially adopted. Adopted aquifer storage values from groundwater assessments at surrounding mining operations have been considered (Section 3.6.2). Note that based on a specific storage (Ss) of 1×10^{-6} (1/m) and aquifer thickness of 670 m, the storativity would be 6×10^{-4}. For additional conservativeness (in terms of radius of drawdown), a storativity of 1×10^{-5} has also been adopted.

6.1.3 Results

The results of the groundwater inflow analysis based on the application of the two analytical approaches identified in Section 6.1.1, have been summarised in Table 6.2. The results indicate that under current conditions the rate of inflow is approximately 140 to 150 m^3/day. This corresponds with the current observed rate of inflow into Tritton Mine of 142 m^3/day. Results have been presented for current conditions, end of approved mining and the end of proposed mining. The results indicate that the rate of inflow into the mine workings will slightly decrease over time.

Groundwater inflow estimates for the equilibrium condition have not been determined, however based on the decreasing trend over time it is likely that the equilibrium inflow will be less than the inflows presented in Table 6.2. It is likely that estimates for current operations (140 to 150 m^3/day) represent a peak with inflows decreasing over time to negligible levels.

Table 6.2 Estimated inflow

Time	Time (days)	Transmissivity (m^2/day)	Storativity	Method a			Method b		
				m^3/day	ML/day	ML/yr[1]	m^3/day	ML/day	ML/yr[1]
Current conditions	6,205	0.1	1×10^{-4}	150.24	0.15	54.75	140.13	0.14	51.10
End of approved mining	7,300	0.1	1×10^{-4}	146.19	0.15	54.75	136.73	0.14	51.10
End of proposed mining	8,760	0.1	1×10^{-4}	141.89	0.14	51.10	133.11	0.13	47.45

[1] annual estimate based on predicted daily inflow over 365 days

6.1.4 Sensitivity analysis

A sensitivity analysis has been undertaken to estimate the potential range of groundwater inflows into the workings based on the analytical approaches.

The results of the sensitivity analysis for current conditions, based on the application of the two analytical approaches identified in Section 6.1.1, have been summarised in Table 6.3. As discussed in Section 4.2.2, the current observed rate of inflow into Tritton Mine is 142 m^3/day. The estimates that most closely correspond to the observed rate of inflow are shown in Table 6.3 in grey. Therefore, based on the results of the analytical equations, the most likely transmissivity is 0.1 m^2/day with storativity of 1×10^{-4} or a transmissivity of 0.15 m^2/day with storativity of 1×10^{-5}. However, as noted in Table 6.1 the higher storativity value of 1×10^{-4} is more likely based on aquifer testing data. This corresponds with the adopted parameters for the analysis presented in Section 6.1.3.

Table 6.3 Estimated inflow – current conditions (t = 6,205 days) – sensitivity analysis

Transmissivity (m^2/day)	Storativity	Method a		Method b	
		m^3/day	ML/day	m^3/day	ML/day
0.01	1×10^{-4}	24.66	0.02	21.18	0.02
0.1	1×10^{-4}	150.24	0.15	140.13	0.14
0.15	1×10^{-4}	210.78	0.21	197.91	0.20
1	1×10^{-4}	1078.5	1.08	1032.45	1.03
0.01	1×10^{-5}	15.02	0.02	14.01	0.01
0.1	1×10^{-5}	107.85	0.11	103.24	0.10
0.15	1×10^{-5}	154.12	0.15	147.92	0.15
1	1×10^{-5}	841.1	0.84	814.25	0.81

Note to table: Estimated rate of inflow that provides closest fit to observed inflow is highlighted in grey.

The predicted inflows are sensitive to the transmissivity of the aquifer, with a more permeable aquifer resulting in greater inflows. There is essentially no difference in the volumes estimated by the two methods, which is expected given they have similar theoretical backgrounds. Reducing the storativity by an order of magnitude does not result in a substantial change to the inflow quantity.

The sensitivity analysis for estimating the rate of inflow has also been undertaken for the end of approved mining (Table 6.4) and the end of proposed mining (including Tritton Mine and Budgerygar) (Table 6.5). The results indicate that the rate of inflow will likely decrease over time.

Table 6.4 Estimated inflow – end of approved mining (t = 7,300 days) – sensitivity analysis

Transmissivity (m^2/d)	Storativity	Method a		Method b	
		m^3/day	ML/day	m^3/day	ML/day
0.01	1×10^{-4}	23.60	0.02	20.47	0.02
0.1	1×10^{-4}	146.19	0.15	136.73	0.14
0.15	1×10^{-4}	205.45	0.21	193.36	0.19
1	1×10^{-4}	1057.45	1.06	1013.38	1.01
0.01	1×10^{-5}	14.62	0.01	13.67	0.01
0.1	1×10^{-5}	105.75	0.11	101.34	0.10
0.15	1×10^{-5}	151.25	0.15	145.30	0.15
1	1×10^{-5}	828.21	0.83	802.23	0.80

Table 6.5 Estimated inflow – end of proposed mining (t = 8,760 days) – sensitivity analysis

Transmissivity (m^2/d)	Storativity	Method a		Method b	
		m^3/day	ML/day	m^3/day	ML/day
0.01	1×10^{-4}	22.51	0.02	19.73	0.02
0.1	1×10^{-4}	141.89	0.14	133.11	0.13
0.15	1×10^{-4}	199.79	0.20	188.48	0.19
1	1×10^{-4}	1034.77	1.03	992.79	0.99
0.01	1×10^{-5}	14.19	0.01	13.31	0.01
0.1	1×10^{-5}	103.48	0.10	99.28	0.10
0.15	1×10^{-5}	148.15	0.15	142.47	0.14
1	1×10^{-5}	814.24	0.81	789.16	0.79

6.2 Prediction of dewatering influence

6.2.1 Method

An approximation of the Theis equation (to the same form of the Dupuit-Forchheimer radial flow equation) to determine the radius of influence (R_o) was applied, as per equation 1.

5. $$R_0 = \sqrt{\frac{2.25kLt}{S}}$$

Where:

kL = Transmissivity (m^2/day)

t = Pumping duration (days)

S = Aquifer storativity (dimensionless)

The analytical inputs are the aquifer transmissivity, storativity, depth of mining and pumping duration, which are summarised in Table 6.1. Similarly, to the analysis for rate of inflow, the calculation has been undertaken for a range of pumping durations including current conditions, end of approved mining and end of proposed mining (including existing Tritton Mine workings and proposed Budgerygar workings). The formula assumes radial groundwater flow into the decline.

6.2.2 Results

The extent of predicted drawdown has been summarised in Table 6.6. The current estimated extent of dewatering is approximately 3.7 km. The extent of dewatering is predicted to increase over time to approximately 4.4 km as dewatering continues.

Table 6.6 Estimated extent of dewatering

Time	Time (days)	Transmissivity (m^2/day)	Storativity	Extent of dewatering (m)
Current conditions	6,205	0.1	1×10^{-4}	3,737
End of approved mining	7,300	0.1	1×10^{-4}	4,053
End of proposed mining	8,760	0.1	1×10^{-4}	4,440

The maximum extent of groundwater drawdown (approximately 4,440 m) is shown in Figure 6-2. Note that the analytical method adopted estimates the maximum extent of groundwater drawdown, which is essentially the 0 m drawdown contour. A groundwater drawdown of 2 m would therefore occur closer to the mine that the 0 m contour, and therefore the drawdown extent shown in Figure 6-2 is more conservative that the 2 m drawdown contour.

6.2.3 Sensitivity analysis

A sensitivity analysis has been undertaken to estimate the potential range of extent of dewatering based on the analytical approaches. The results of the sensitivity analysis are shown in Table 6.7.

The analysis does indicate that assuming worst case aquifer parameters, the extent of predicted dewatering may extend up to 44,396 m at the end of proposed mining. However, as shown in Table 6.3, the predicted rate of inflow associated with these parameters (transmissivity of 1 m^2/day and storativity of 1×10^{-5}) under current conditions is 814 m^3/day. This rate of inflow is significantly higher than the current observed rate of groundwater inflow of 142 m^3/day. Therefore, the aquifer parameters associated with an extent of dewatering of 44,396 m are considered unlikely to occur at the site. Therefore, a radius of drawdown of 44,396 m is not expected to occur.

It is noted that there is no obvious source of recharge (permanent waterway or lake) that could mitigate the expansion of the cone of depression.

Table 6.7 Estimated extent of dewatering (m) – sensitivity analysis

Storativity	Transmissivity (m^2/day)			
	0.01	0.1	0.15	1
Current conditions (t = 6,205 days)				
1×10^{-4}	1,182	3,737	4,576	11,816
1×10^{-5}	3737	11816	14471	37,365
End of approved mining (t = 7,300)				
1×10^{-4}	1,282	4,053	4,964	12,816
1×10^{-5}	4,053	12,816	15,696	40,528
End of proposed mining (t = 8,760)				
1×10^{-4}	1,404	4,440	5,437	14,039
1×10^{-5}	4,440	14,039	17,195	44,396

As discussed in Section 6.2.2, the most likely estimate for the radius of drawdown at the end of proposed mining is 4,440 m. The closest landholder bore is 19.3 km from Tritton Mine. Therefore, based on the results of the analysis, drawdown due to approved and proposed mining will not impact on any landholder bores.

The current Tritton Mine has already been operating for over 15 years. There is an extensive groundwater monitoring network, the existing workings are larger and deeper than Budgerygar, and there has been no or limited drawdown detected. Therefore, it is likely that drawdown associated with Budgerygar will be less than predicted drawdown in Table 6.7.

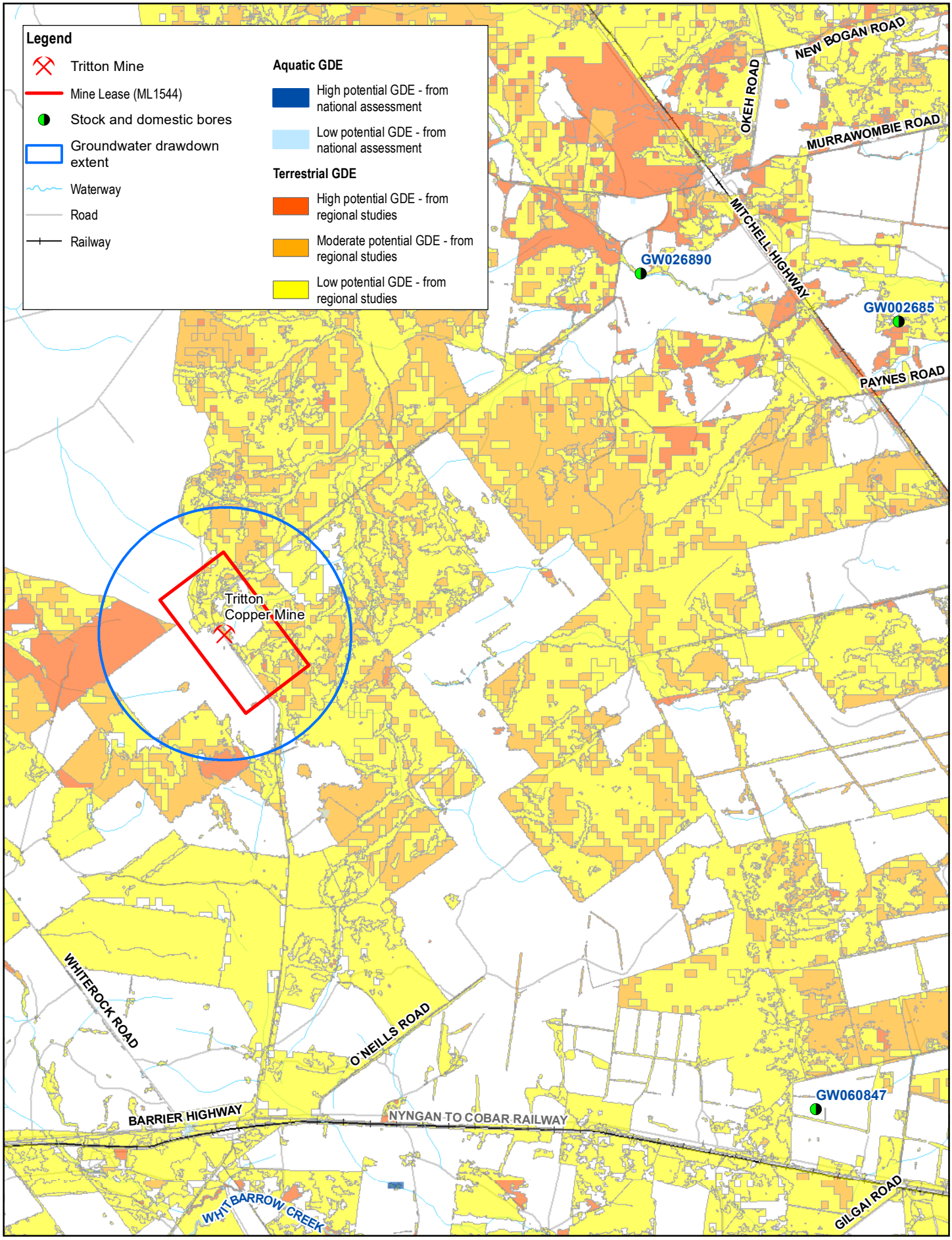
6.3 Impact assessment criteria

The potential impacts have been assessed in accordance with the NSW AIP. The AIP requires that potential impacts on groundwater sources, including their users and GDEs, be assessed against minimal impact considerations, outlined in Table 1 of the policy. If the predicted impacts meet the Level 1 minimal impact considerations, then these impacts will be considered as acceptable.

Based on the hydrogeological environment at Tritton Mine and Budgerygar discussed in Section 5 groundwater yield is very low with minimal groundwater inflow into the existing mine workings and groundwater salinity is between 10,000 and 20,000 µS/cm. Therefore, Level 1 minimal impact considerations for Less Productive Fractured Rock Water Sources have been adopted for the groundwater impact assessment and are defined as follows:

– Water table:
  - Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, at a distance of 40 m from any high priority GDE or high priority culturally significant site listed in the schedule of the relevant WSP. A maximum of a 2 m water table decline cumulatively at any water supply work.
  - If more than 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40 m from any high priority GDE; or high priority culturally significant site; listed in the schedule of the relevant WSP then appropriate studies (including the hydrogeology, ecological condition and cultural function) will need to 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 2 m decline cumulatively at any water supply work, then make good provisions should apply.
– Water pressure:
  - A cumulative pressure head decline of not more than a 2 m decline at any water supply work.
– If the predicted pressure head decline is greater than the requirement 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 provisions apply.Water quality:
  - Any change in groundwater quality should not lower the beneficial use category of the groundwater source, beyond 40 m from the activity.

If the above condition 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 work.



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Date **01 Feb 2022**

Groundwater drawdown extent

Figure 6.2

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Data source: Tritton: Mine Lease Bdy, 2021; LPI: DTDB, 2017; BOM: Registered Borse, 2019; . Created by: Sara Askarimarnani

6.4 Discussion of impacts

6.4.1 Impact to existing groundwater users

When an excavation is to occur below the groundwater table, the geologic materials need to be dewatered (become unsaturated). The lowering of the groundwater level (pressure) results in the creation of a hydraulic gradient towards the excavation or tunnel, and groundwater moves from high pressure to low pressure. This results in groundwater inflow, and a decline in groundwater levels remote from the seepage face (or dewatering point). The decline in water level is referred to as the 'drawdown cone' or 'cone of depression' around the pumping bore, or drawdown zone around an excavation.

The extent of drawdown depends primarily on the nature of the aquifer, the pumping rate and pumping duration. If the aquifer system consists of fractured rock, or is of odd shape, the shape and extent of drawdown may vary in certain preferential directions. If the drawdown extends a certain distance from the extraction centre such that it intersects other bores or (in the case of unconfined aquifers) it intersects with environmental features such as creeks, rivers and dependent ecosystems, it is said to have interfered with these features.

It is important to understand the term drawdown (lowering of the water level in the aquifer due to removal of groundwater) and limitations in predicting drawdown. The extent of influence is time-dependent, and therefore dependent on construction depths and size, and construction progress (or excavation and ground support) rates/time periods considered.

The extent and magnitude of drawdown is not only dependent on the aquifer hydraulic parameters (principally transmissivity, storativity and homogeneity), but also factors such as leakage between adjoining aquifers and aquitards and interactions with hydraulically connected waterways/discharge features. Where hydrogeological systems become more complex, the accuracy of the drawdown predictions may be impacted by the presence of these complex features listed above.

The closest stock and domestic bores to Tritton Mine and Budgerygar are:

– GW060847 located approximately 26.5 km southeast of Tritton Mine
– GW002685 located approximately 26.4 km northeast of Tritton Mine
– GW026890 located approximately 19.3 km northeast of Tritton Mine

As discussed in Section 6.2.2, based on the likely aquifer parameters, the predicted radius of drawdown at the end of mining at Budgerygar is 4,440 m. As the closest stock and domestic bore is 19.3 km from Tritton Mine, the proposed workings will not result in drawdown at any stock and domestic bores (refer Figure 6-2). Therefore, the impacts of the Project meet the Level 1 minimal impact considerations from the NSW AIP for landholder bores outlined in Section 6.3.

6.4.2 Impacts to GDEs

The likelihood of adverse impact to GDEs was assessed as being low. This was based upon the following lines of evidence:

– A review of broad scale mapping and the WSP did not identify high priority GDEs within 20 km of Tritton Mine and Budgerygar.
– There are potential aquatic and terrestrial GDEs in the vicinity of Tritton Mine and Budgerygar and potential terrestrial GDEs within the extent of groundwater drawdown as shown in Figure 6-2. However, given the deep groundwater levels it is considered unlikely that these vegetative communities are GDEs. Additionally, given the deep groundwater levels it is considered unlikely that there would be any connection between groundwater and the ephemeral drainage lines and watercourses in the vicinity of Tritton Mine and Budgerygar. The deep groundwater levels (typically 20 m to 90 m bgl) in the Ordovician sediments are beyond the reasonable limit of tree rooting depths.
– The two low-potential aquatic GDEs at distances of approximately 7.5 km southeast and 13.3 km south of Tritton Mine are beyond the predicted extent of groundwater drawdown.

Based on the above, it is considered that potential impacts of the Project meet the Level 1 minimal impact considerations for GDEs from the NSW AIP outlined in Section 6.3.

6.4.3 Impact to groundwater quality

Owing to it being a mineralised province, it is not uncommon for native groundwater to be naturally elevated with heavy metals.

Mineralisation is commonly in the form of metal sulfides, e.g. principally in the form of pyrite. The geological materials are stable when undisturbed or located below the water table. However, when oxygen is introduced, the sulphides oxidise to sulphate, with resultant materials having low pH and potentially high concentrations of the heavy metals. Groundwater leaching through these materials may mobilise pH and heavy metals into the environment. However, groundwater levels at the site have increased since the start of mining due to the weight of the TSF. Therefore, it is considered unlikely that significant oxidation has occurred.

Additionally, there is no decreasing trend in pH at Tritton Mine, indicating that pH and heavy metals have not mobilised into the environment at Tritton Mine. Therefore, it is considered unlikely that pH and heavy metals will mobilise into the environment at Budgerygar.

Following the end of dewatering, the Tritton Mine and Budgerygar workings will be sealed. Oxidation will cease once the portal and vent rises are sealed. As a result, acid mine drainage post closure is unlikely to be a significant risk.

As the potential impacts on groundwater quality will be limited to the immediate vicinity of the exploration decline, the Project will not lower the beneficial use category of the groundwater source. Therefore, impacts on groundwater quality will meet the Level 1 minimal impact considerations for groundwater quality from the NSW AIP as outlined in Section 6.3.

6.4.4 Post mining

Post mining groundwater inflow will be less than or similar to groundwater inflow during mining. Therefore, post mining groundwater inflow is predicted to be approximately 0.14 ML/day. The rate of groundwater inflow would decline over time following the end of mining as regional groundwater levels gradually recover.

6.4.5 Cumulative impacts

Noting that the prediction and assessment of impacts includes both Tritton Mine and Budgerygar, the closest neighbouring mining operation is Girilambone Mine. Girilambone Mine is located approximately 20 km north-east of Tritton Mine. As discussed in Section 6.2.2, based on the likely aquifer parameters, the predicted radius of drawdown at the end of mining at Budgerygar is 4,440 m. Therefore, due to the distance between Tritton Mine and Girilambone Mine no further cumulative impact assessment has been undertaken.

6.5 Water sharing plan licensing requirements

The total groundwater WAL entitlement held by Tritton Resources is 334 ML/year (refer to Section 2.1.2.1).

As discussed in Section 6.1, the current rate of inflow into the mine workings is 0.14 ML/day (51.1 ML/year). The assessment indicates that the rate of groundwater inflow will likely gradually decrease over time. Therefore, Tritton Resources holds sufficient WAL volume for the Tritton Mine and Budgerygar.

If groundwater inflows into the Budgerygar workings are higher than predicted, Tritton Resources may be required to obtain additional WAL volume. The market depth of the Lachlan Fold Belt Groundwater Source is sufficient that additional WAL volume would be able to be obtained.

7. Mitigation measures

7.1 Groundwater monitoring

Regardless of the currently observed inflow conditions and conservative assessment of radius of drawdown, there have been a range of assumptions made in completing the assessment. In order to confirm that these assumptions have been appropriate, monitoring of any changes to groundwater levels is proposed.

To monitor for impacts from the proposed Budgerygar workings, additional monitoring bores would be installed around the mine. It is recommended that these bores are installed at distances of 2 km to 5 km from the proposed Budgerygar workings. Monitoring of these bores would enable potential radial drawdown from the mine to be monitored and trends in water levels identified prior to impacts occurring at privately-owned bores. Locations of proposed bores are provided in Table 7.1 and shown in Figure 7-1.

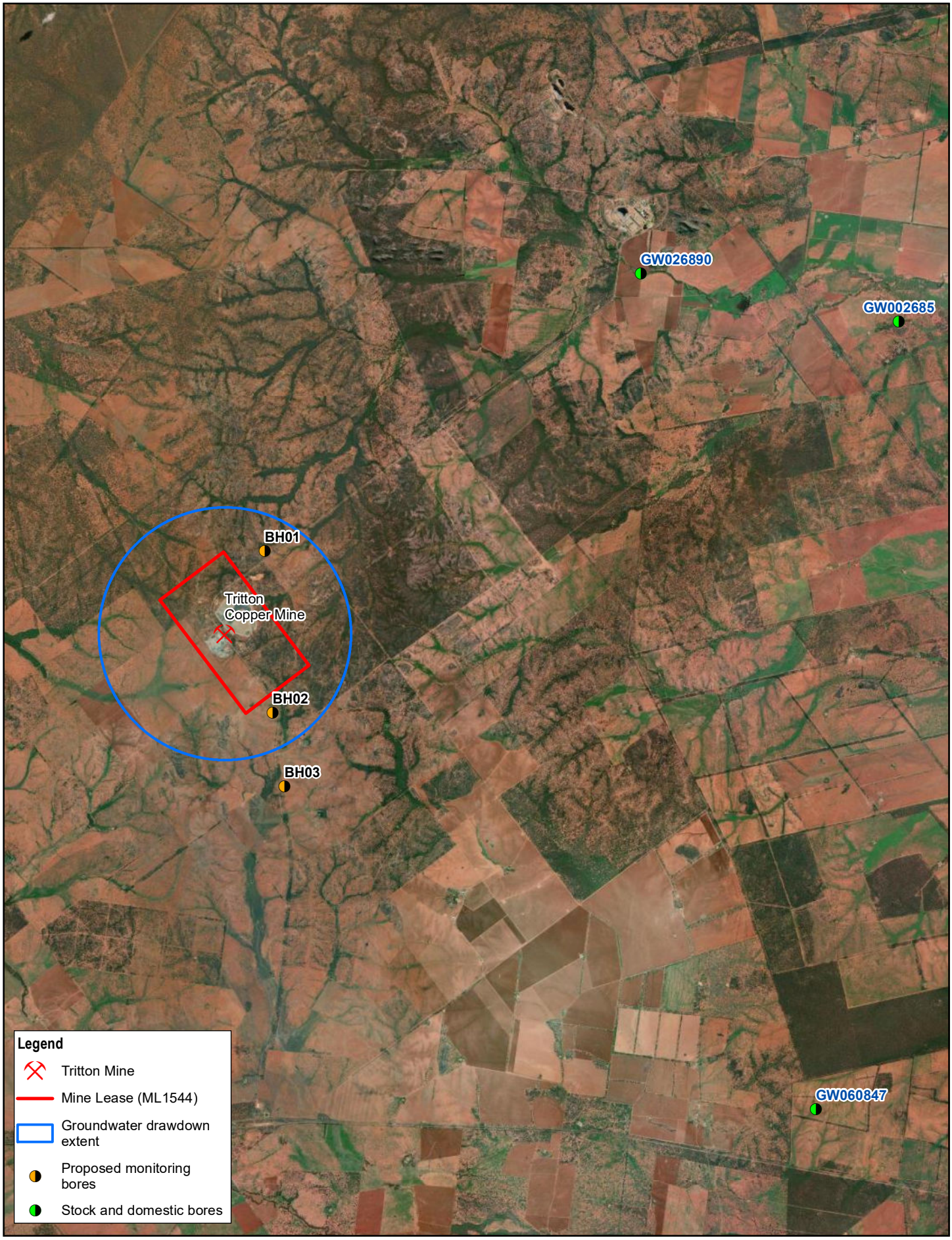
In addition to this, if access can be arranged Tritton Mine could liaise with the landholder of bore GW026890 which is closest to the mine, to monitor for potential drawdown at this bore.

Table 7.1 Proposed monitoring bores

Bore	Easting	Northing
BH01	475055	6529825
BH02	475340	6524150
BH03	475760	6521550

7.2 Flow monitoring

The existing flow monitoring program at Tritton Mine should be continued. In addition, the flow monitoring program should be expanded as required to include metering of water transfers into and out of the Budgerygar workings. This will allow the rate of groundwater inflow into the Buderygar workings to be calculated. The rate of groundwater inflow into the Budgerygar workings will be approximately equal to the difference between water transferred out and water transferred into the Budgerygar workings.



Paper Size ISO A4

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Tritton Resources Pty Ltd
Tritton Copper Project Modification 8
Groundwater Impact Assessment

Project No. **12555629**
Revision No. **0**
Date **01 Feb 2022**

Proposed monitoring bores

Figure 7.1

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Print date: 01 Feb 2022 - 09:45

Data source: Tritton: Mine Lease Bdy, 2021; BOM: Registered Borse, 2019; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Created by: Sara Askarimarnanir

8. Conclusions

8.1 Hydrogeological setting

The Tritton Mine and Budgerygar workings are located within indurated Ordovician sediments. These sandstone, siltstone and claystones form a fractured rock aquifer. Based on monitoring data at Tritton Mine, the groundwater levels at the site are deep, generally from 20 m to 90 m bgl, but can vary from 10 m bgl to 140 m bgl. Groundwater yield is inferred to be very low, with limited groundwater inflow into the existing Tritton Mine workings observed.

Groundwater at the site is saline with monitoring data at Tritton Mine indicating salinity of 10,000 to 20,000 µS/cm. There is limited groundwater development in the region, however three stock and domestic bores within approximately 25 km of Tritton Mine have been identified on public groundwater databases.

8.2 Impact assessment approach

As part of the impact assessment, analytical modelling was undertaken to quantify groundwater inflows into Tritton Mine and Budgerygar and the dewatering radius of influence. Initially, the rate of groundwater inflow was calculated for current conditions. Broad ranges of aquifer parameters were used to estimate a wide range of inflows into the existing Tritton Mine workings. Estimated inflows were compared to the current rate of groundwater inflows at Tritton Mine (0.14 ML/day). Based on the results of the analytical equations, the most likely transmissivity was determined to be 0.1 m^2/day with storativity of 1×10^{-4}.

Adopting the most likely aquifer parameters, future rates of inflow into the Tritton Mine and Budgerygar workings were estimated. Groundwater inflow is predicted to be approximately 0.14 ML/day and remain consistent with current conditions. The results of the analysis indicated that the rate of inflow into the mine workings will very gradually decrease over time.

Additionally, the radius of influence due to mining at Tritton Mine and Budgerygar was calculated using the most likely aquifer parameters. The radius of influence was calculated as 4,440 m at the end of proposed mining at Budgerygar.

8.3 Summary of impacts

Inference of impacts on landholder bores were assessed as being low. The closest stock and domestic bore to Tritton Mine is GW026890 located approximately 19.3 km northeast of Tritton Mine. This bore is outside the predicted radius of drawdown due to mining at Tritton Mine and Budgerygar.

The likelihood of adverse impact to GDEs was assessed as being low. This was based upon an absence of identified GDEs (based upon regional mapping), and the depth to groundwater.

Based on estimated likely rate of groundwater inflow (0.14 ML/day or 51.1 ML/year), Tritton Resources holds sufficient WAL volume for groundwater inflow into the Budgerygar workings considering Tritton Resources' current licence entitlement of 334ML/yr (based on 1ML per share).

Sensitivity analysis has been undertaken on estimates of the potential extent of dewatering and dewatering influence based on the analytical approach to assessment. While worst case assumptions for dewatering influence could result in impacts at privately-owned groundwater works or GDEs, the assumptions are considered highly unlikely and therefore would not constrain development of the Tritton Mine. Regardless, a program of additional groundwater monitoring has been proposed to ensure that any substantial changes to the groundwater setting are identified before impacts propagate to private groundwater users or GDEs.

9. References

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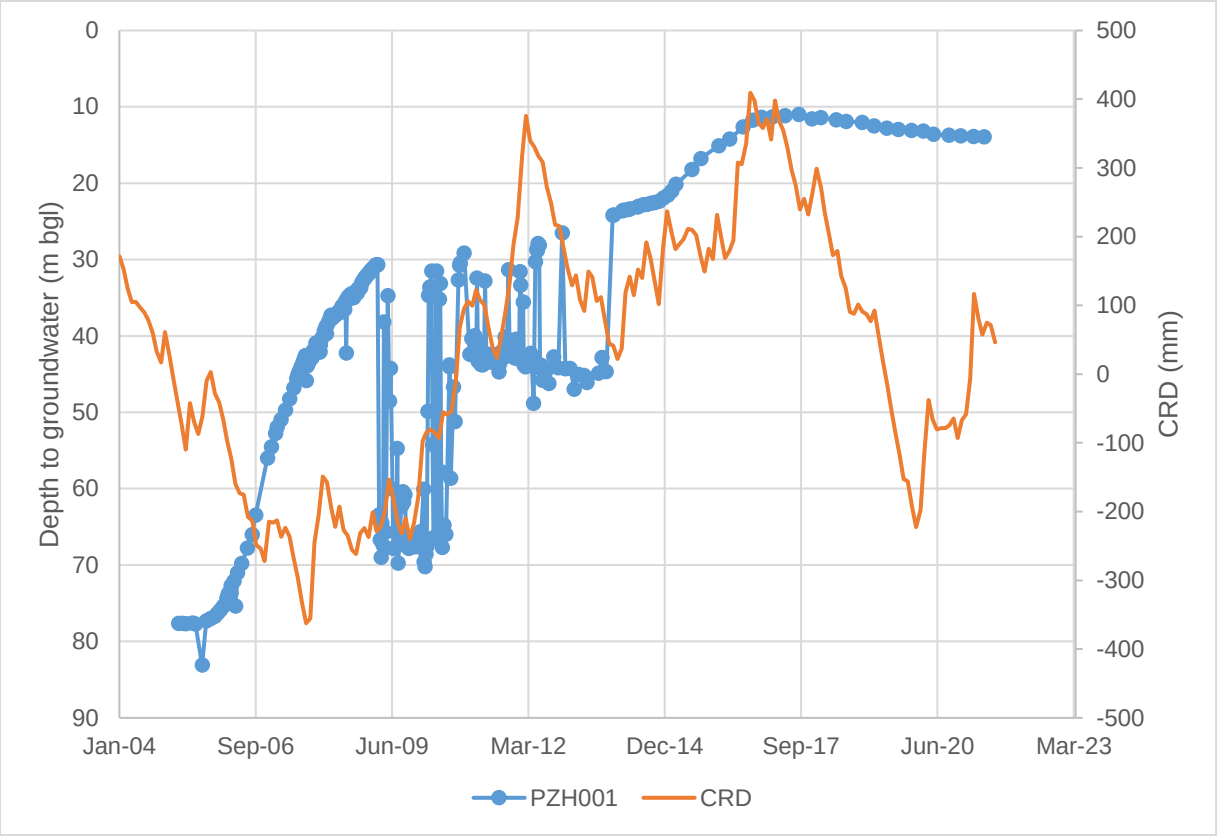
Appendices

Appendix A

Groundwater Level Hydrographs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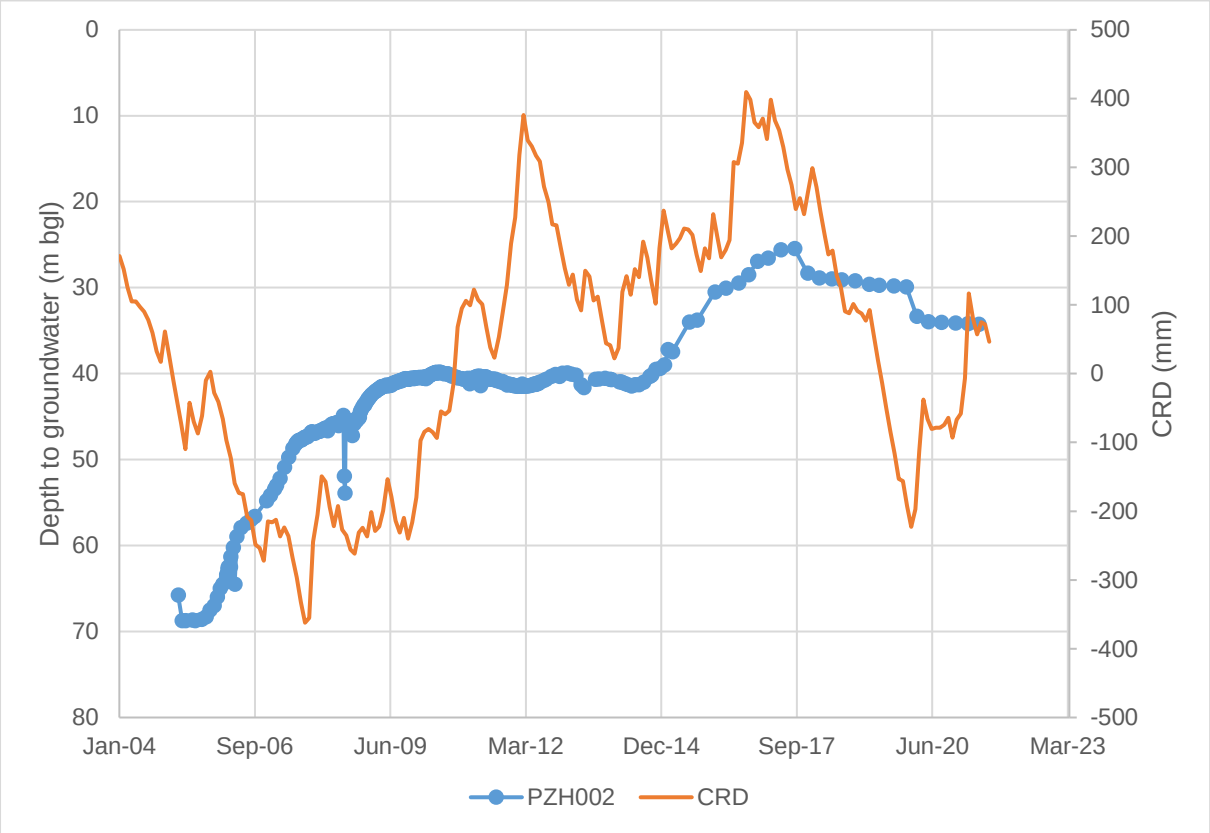
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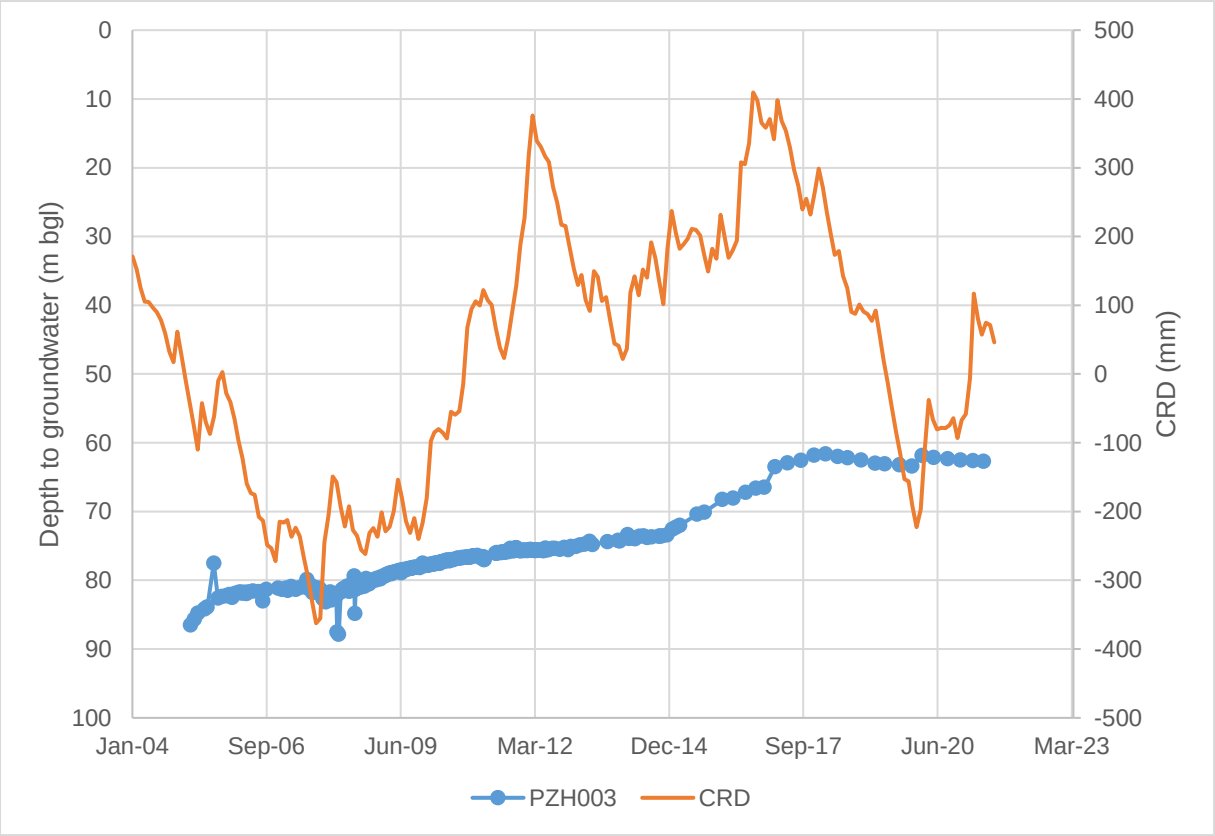
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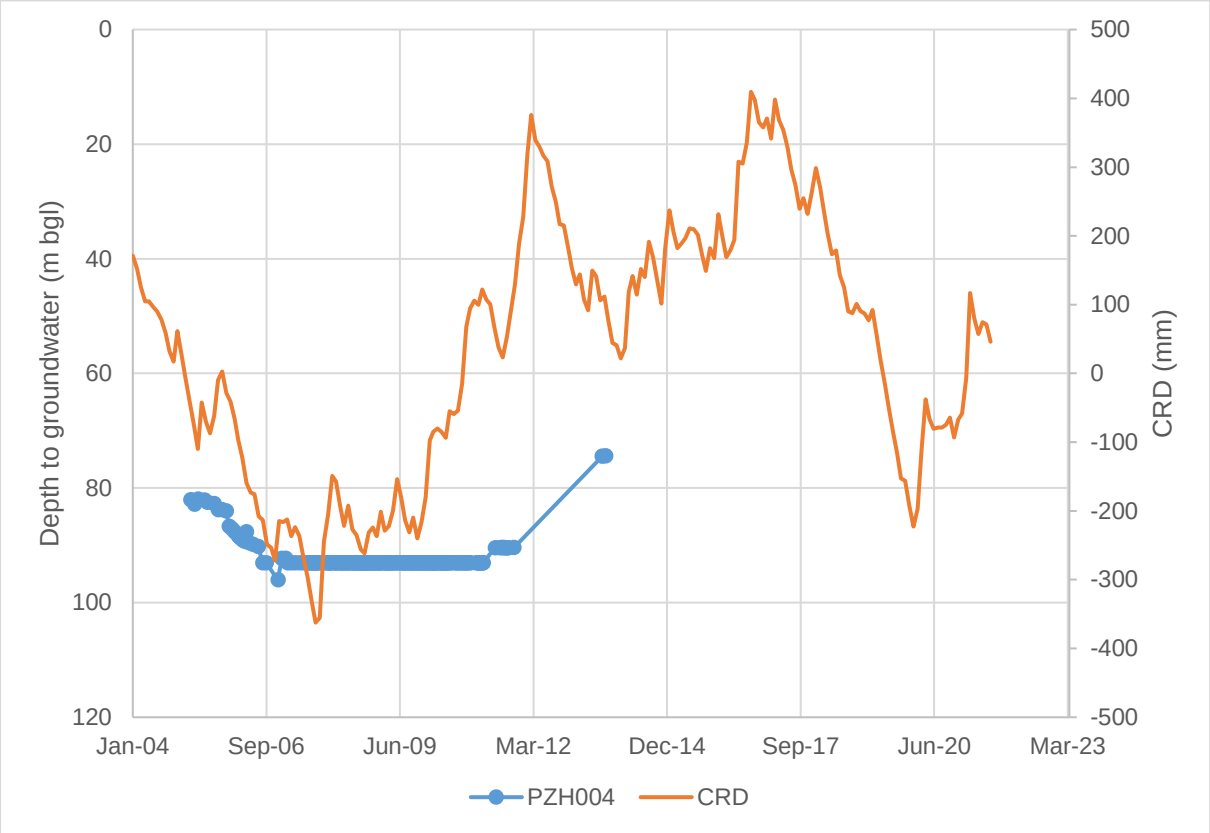
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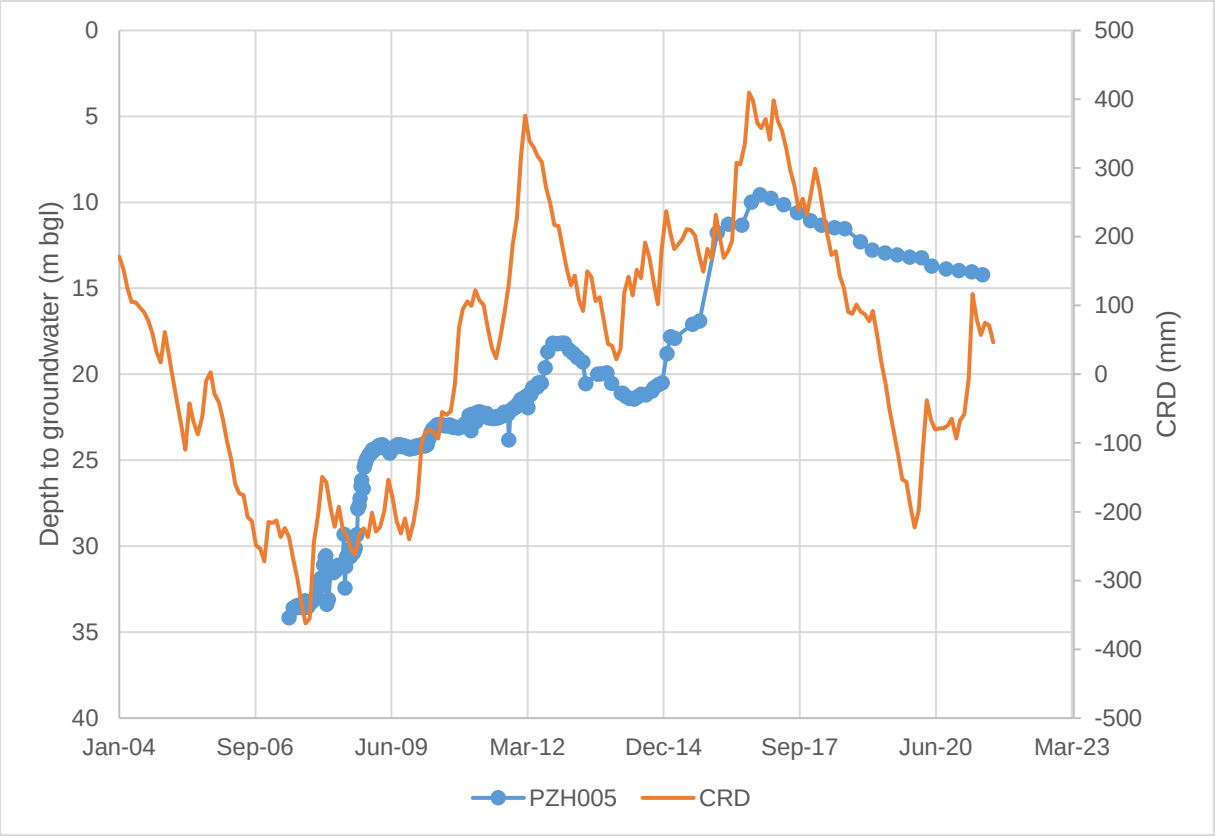
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Depth to groundwater (mbgl)
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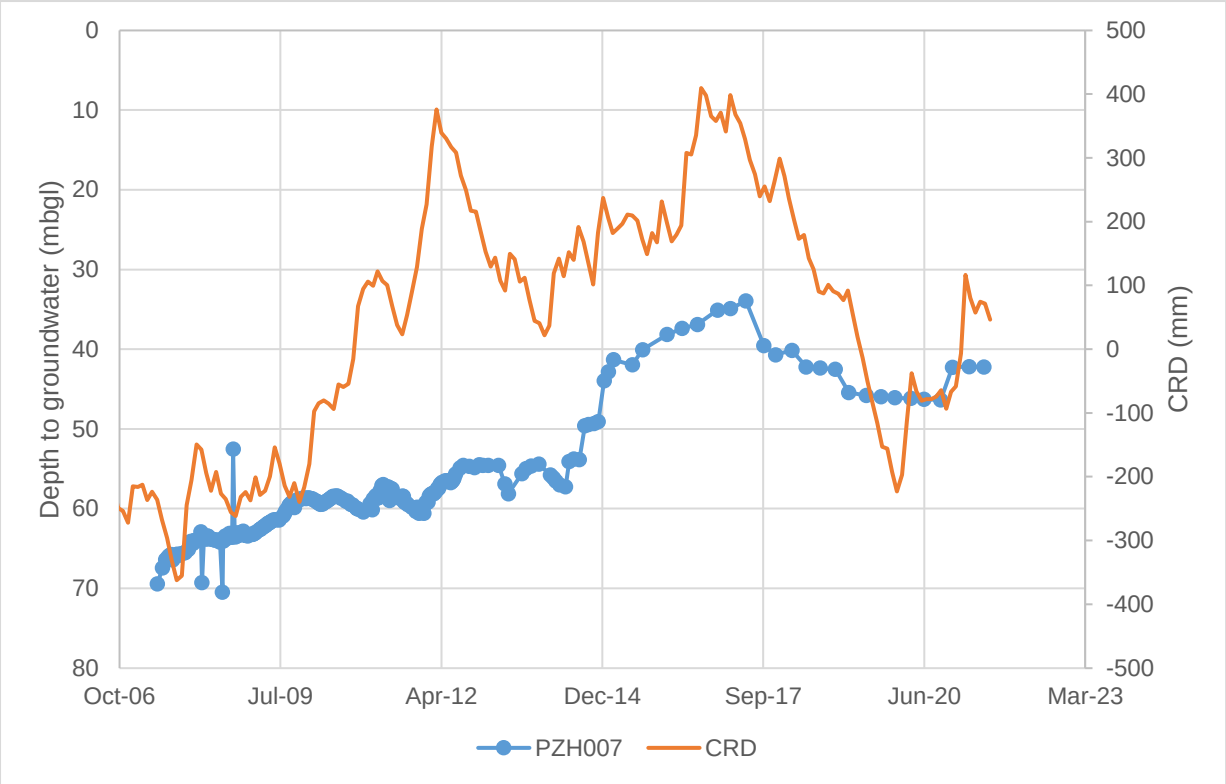
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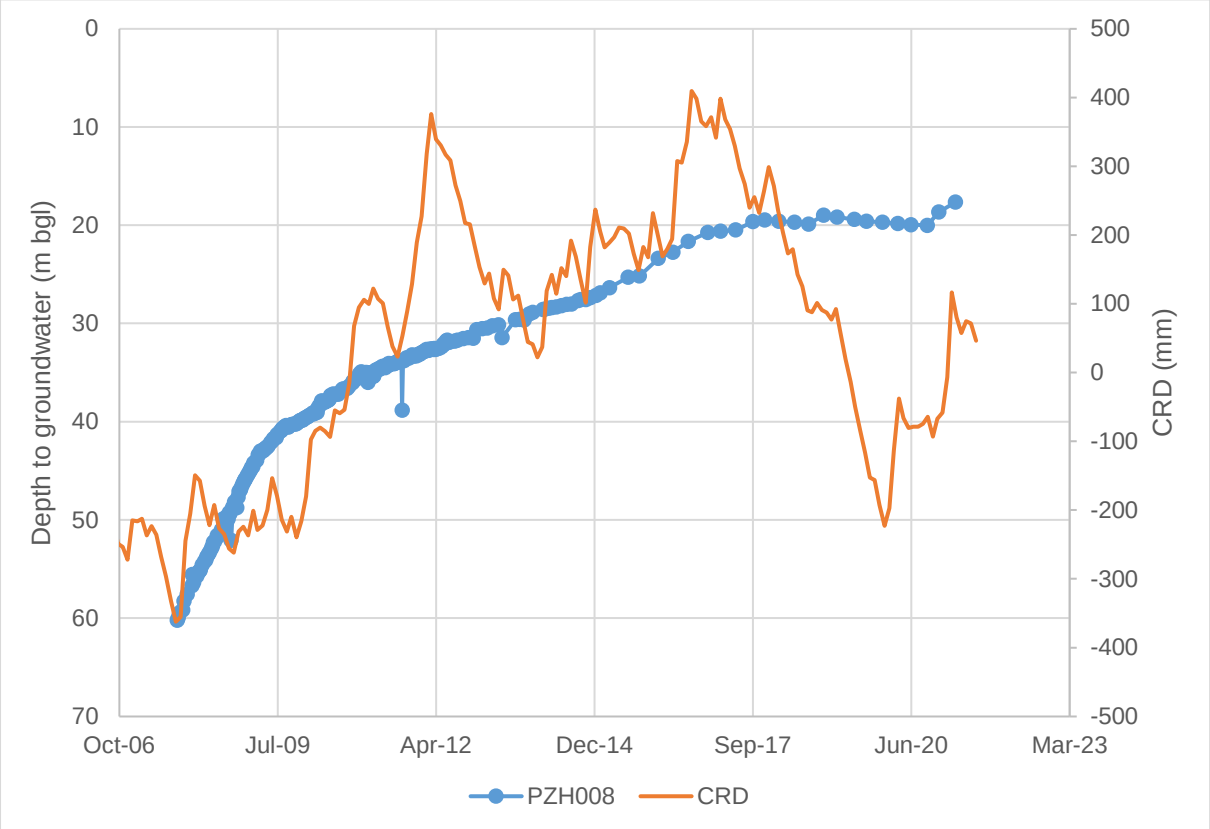
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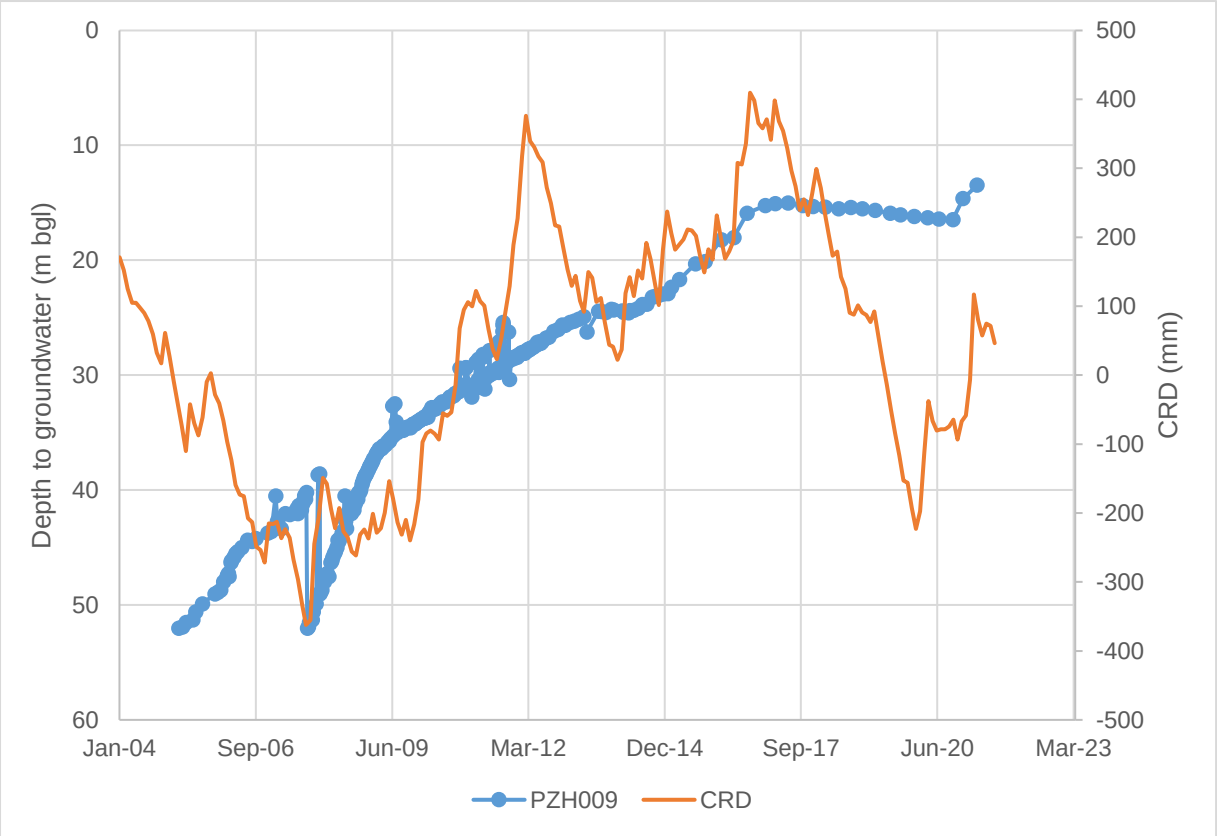
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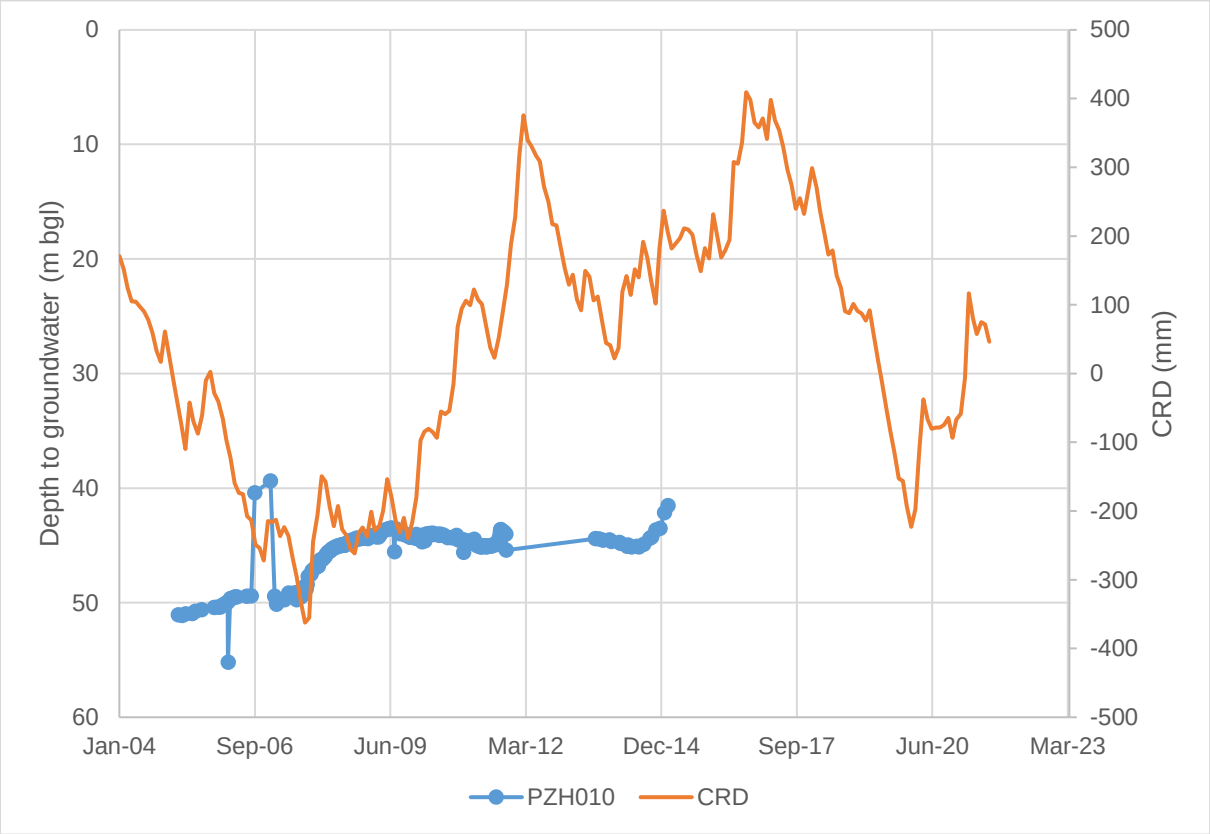
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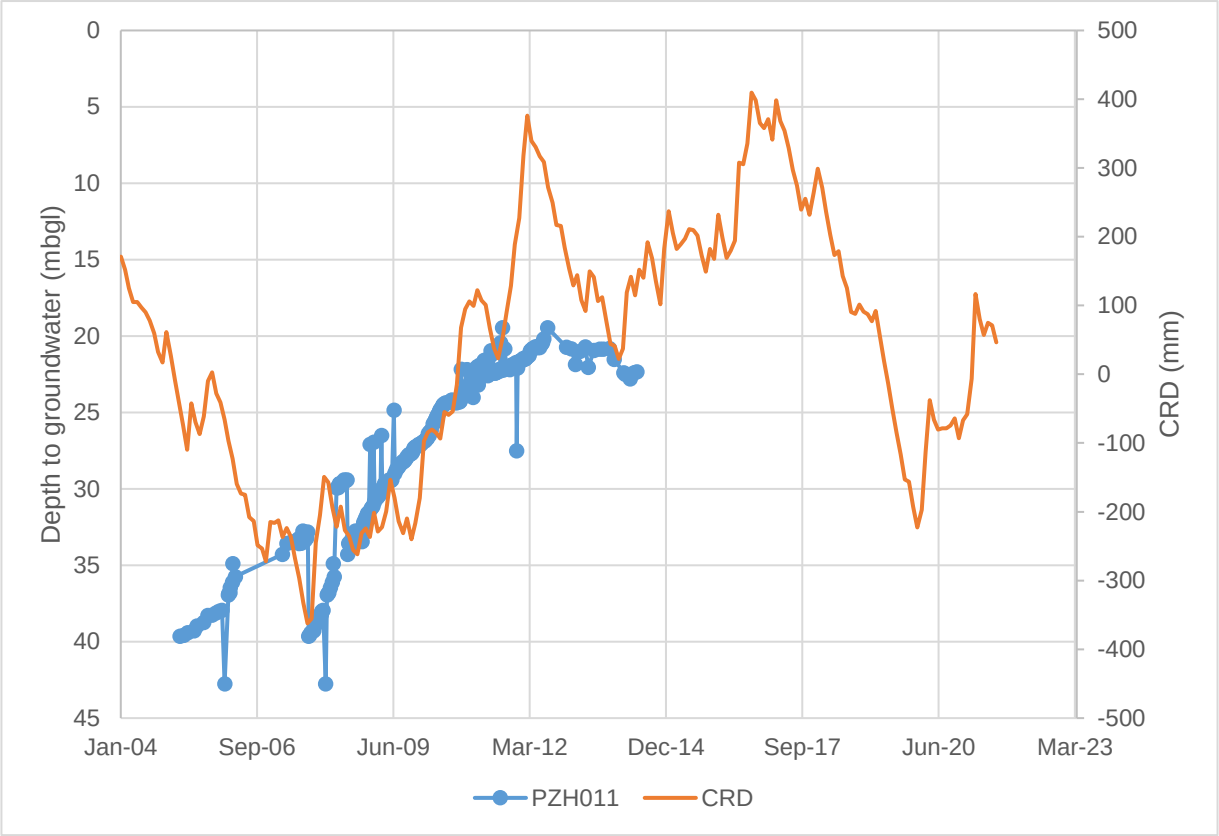
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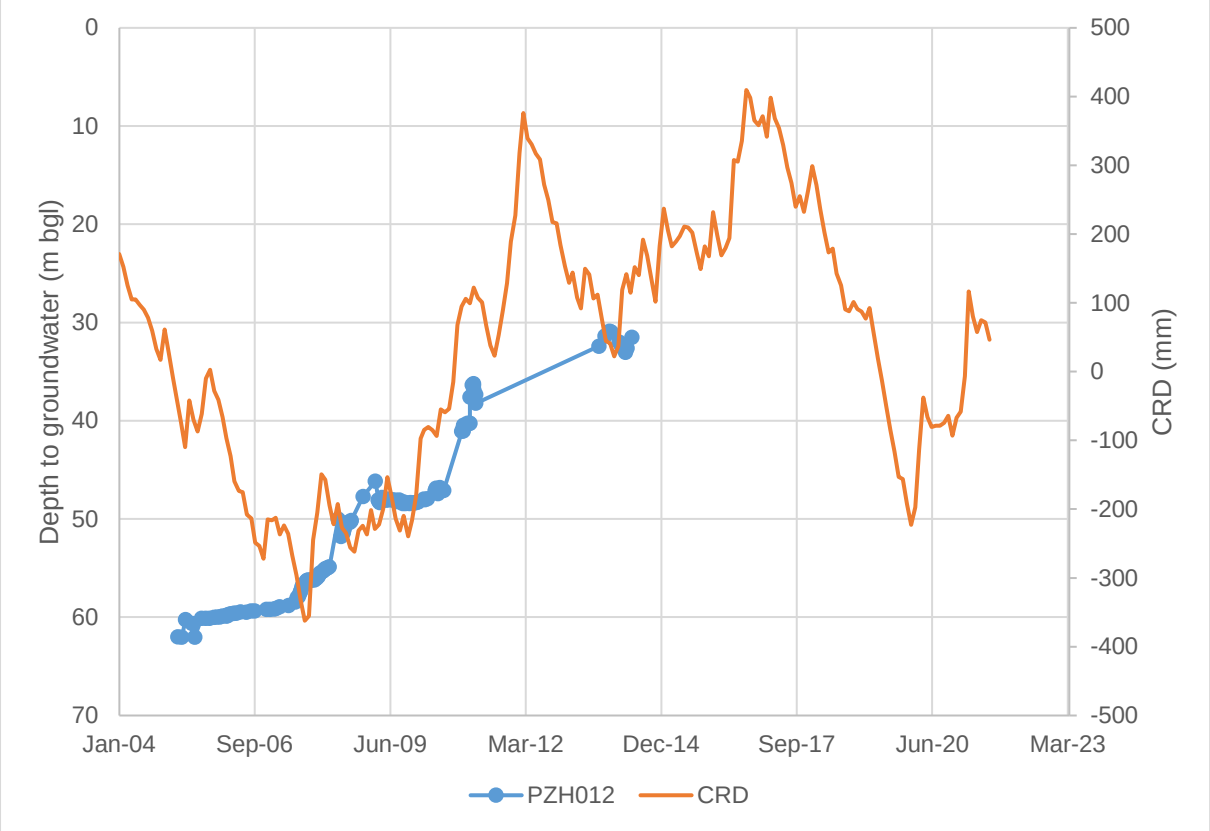
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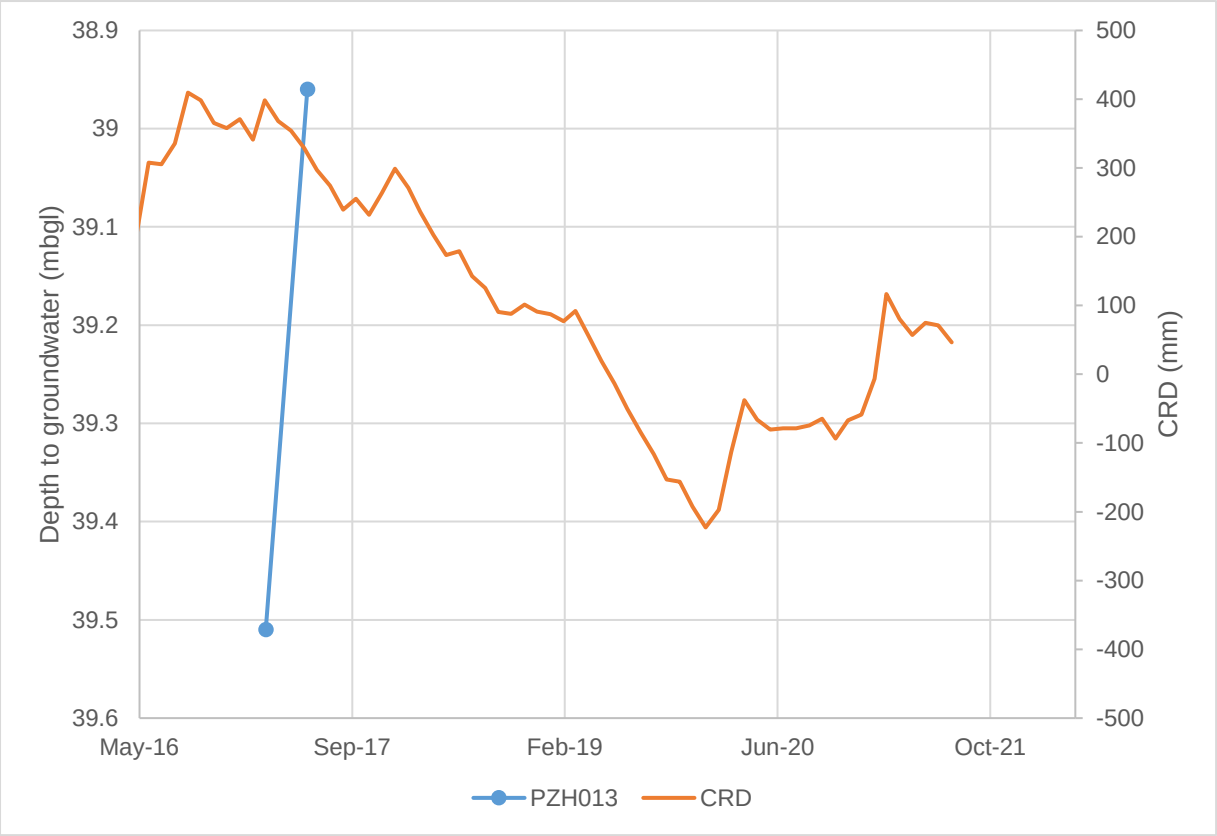
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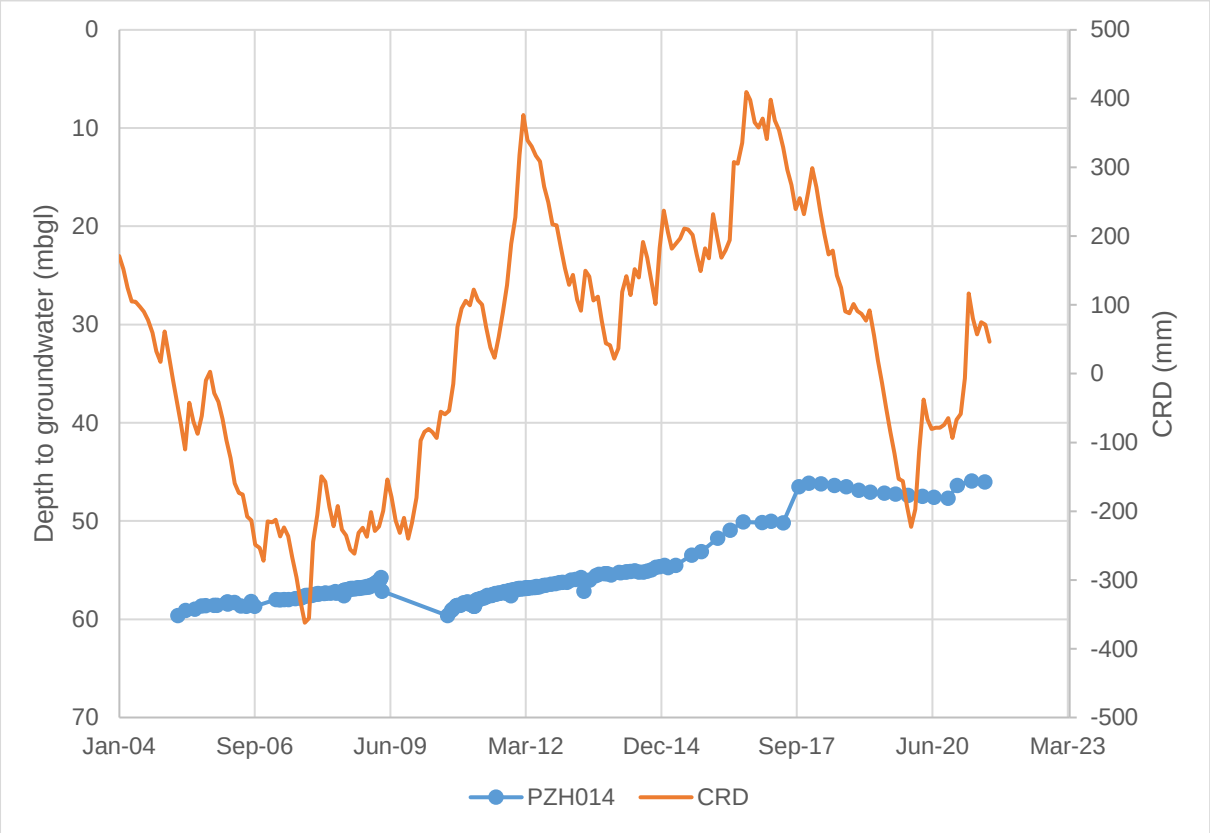
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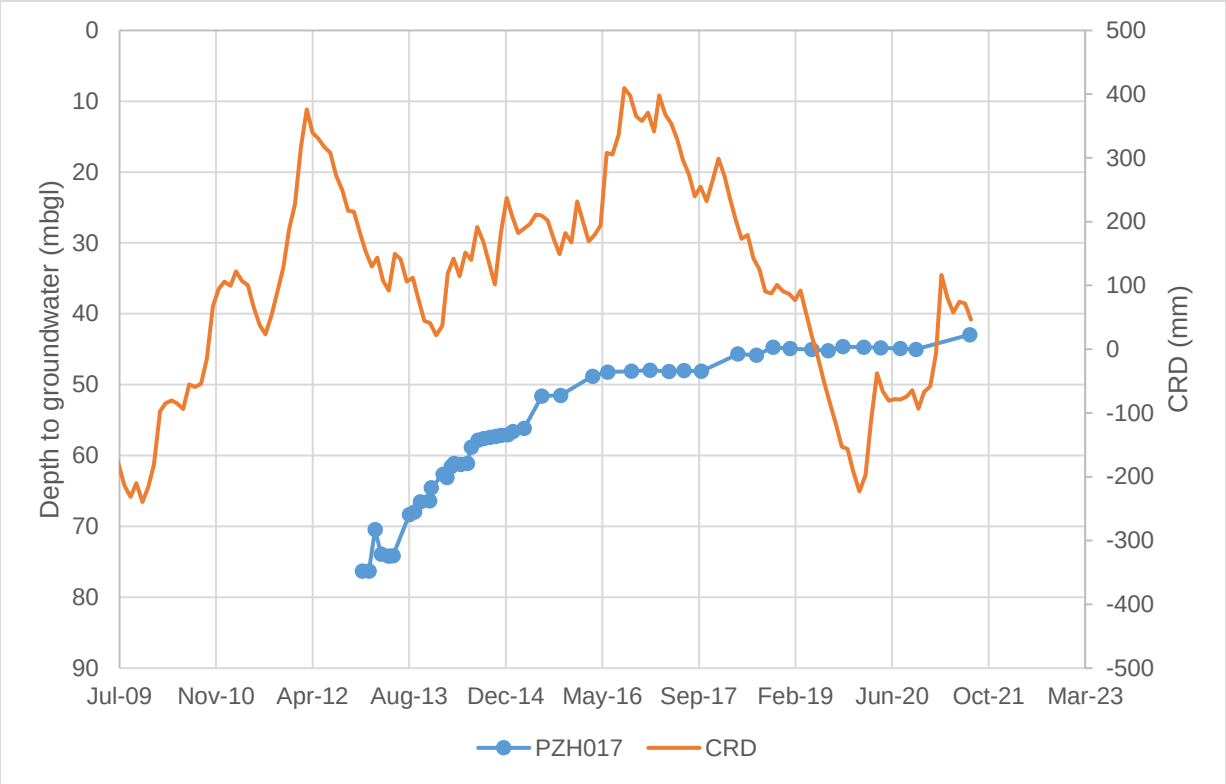
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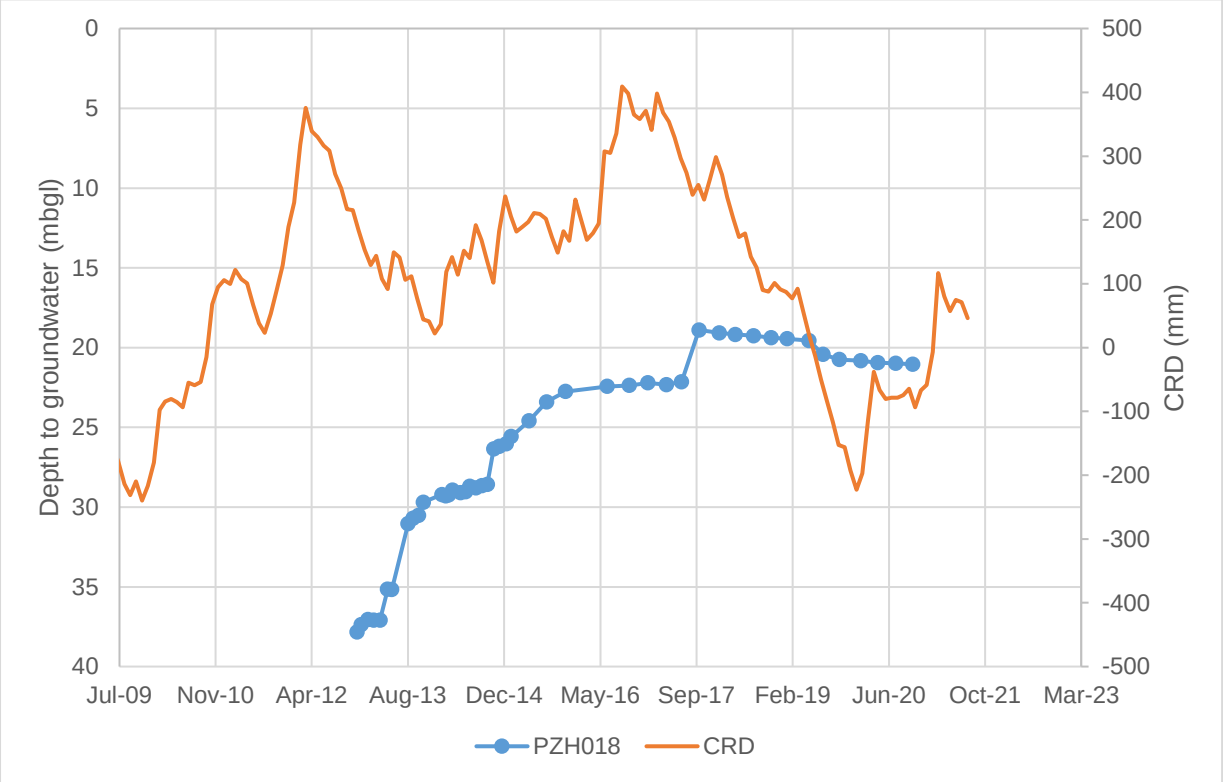
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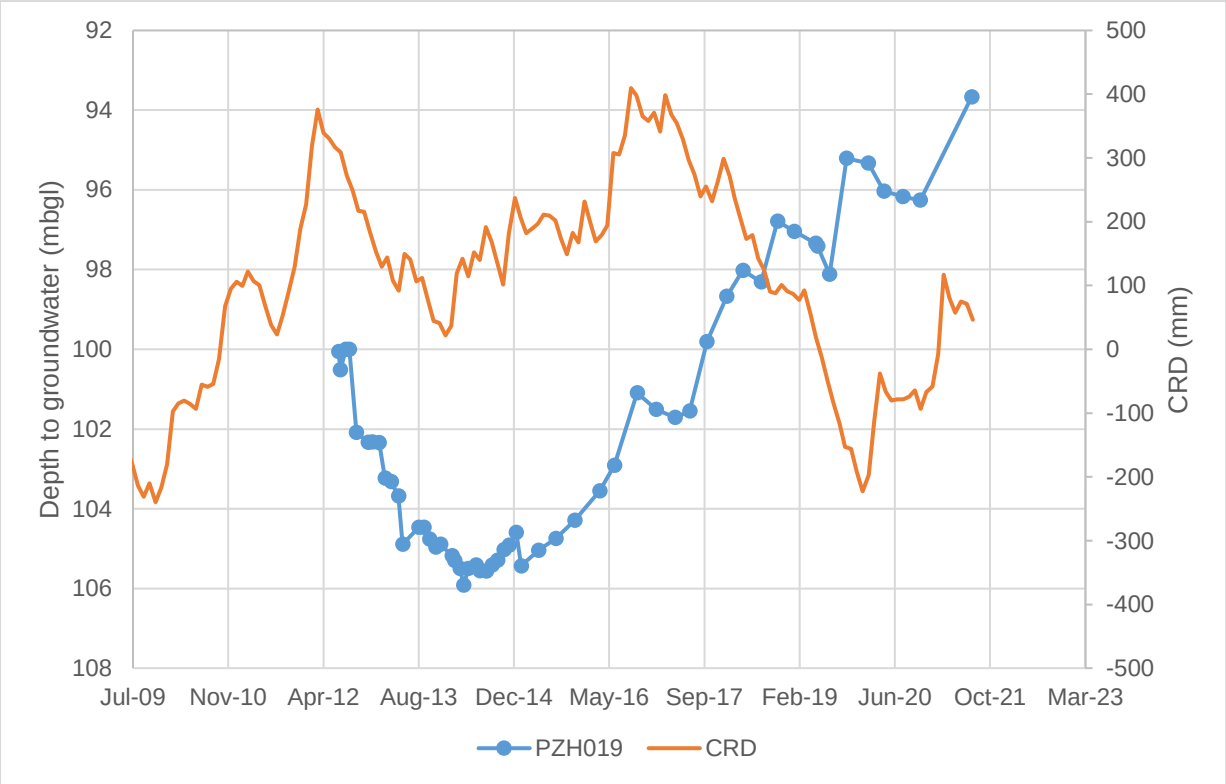
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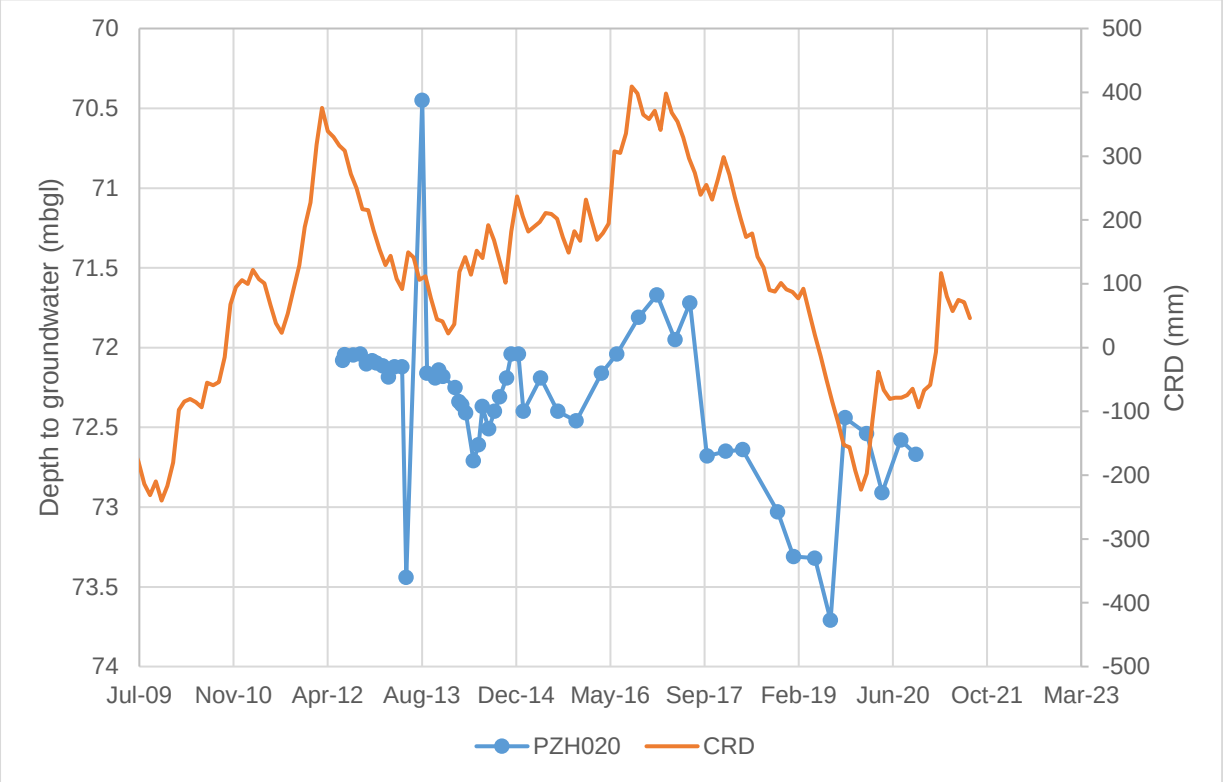
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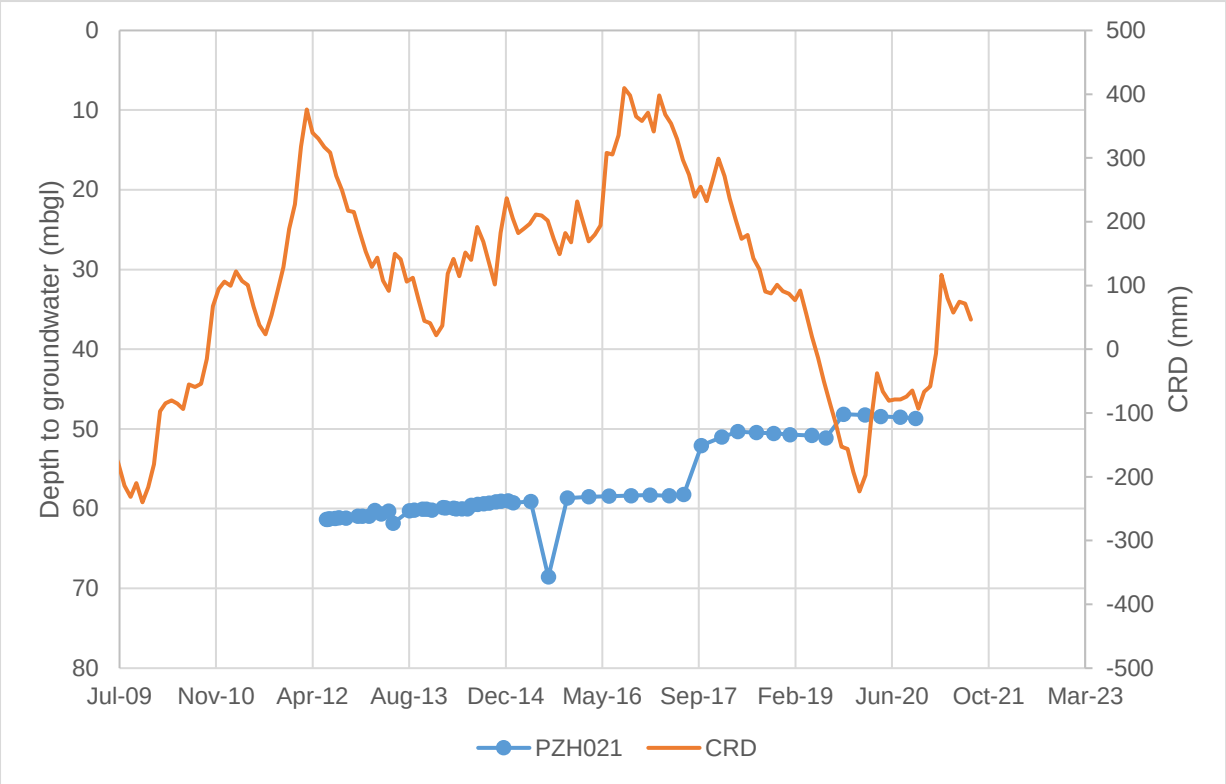
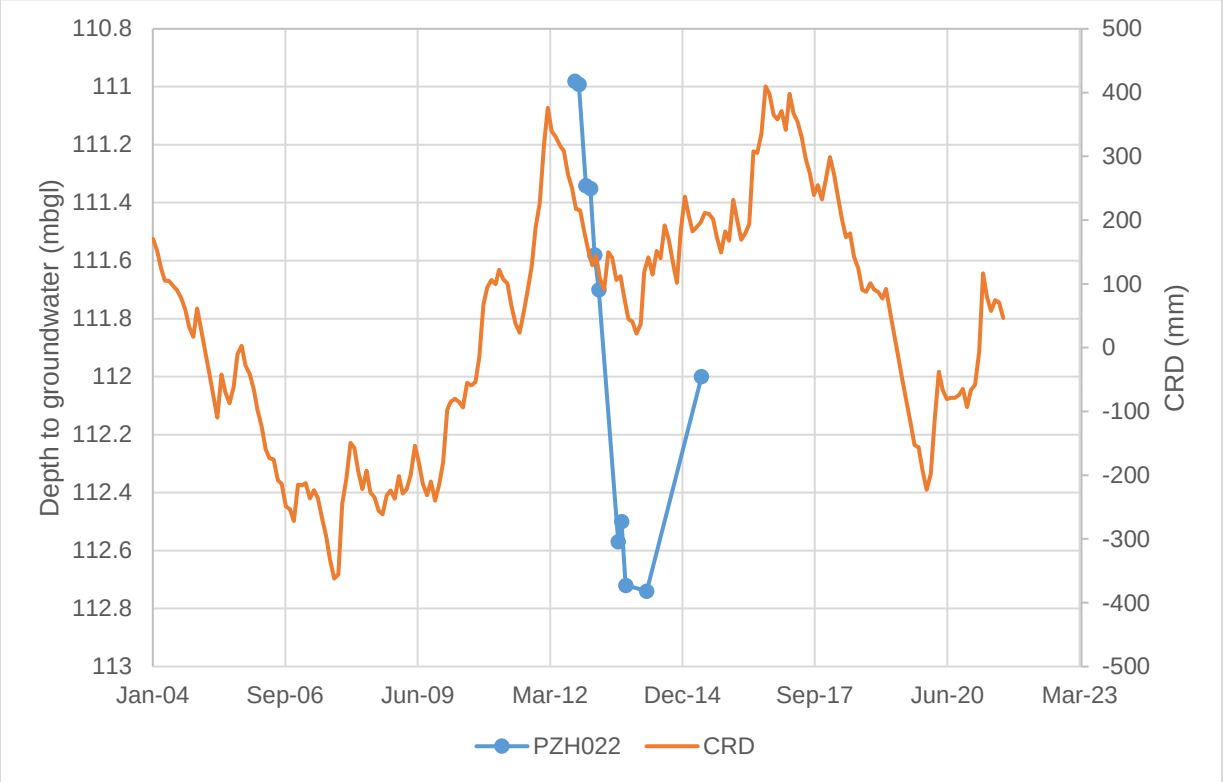
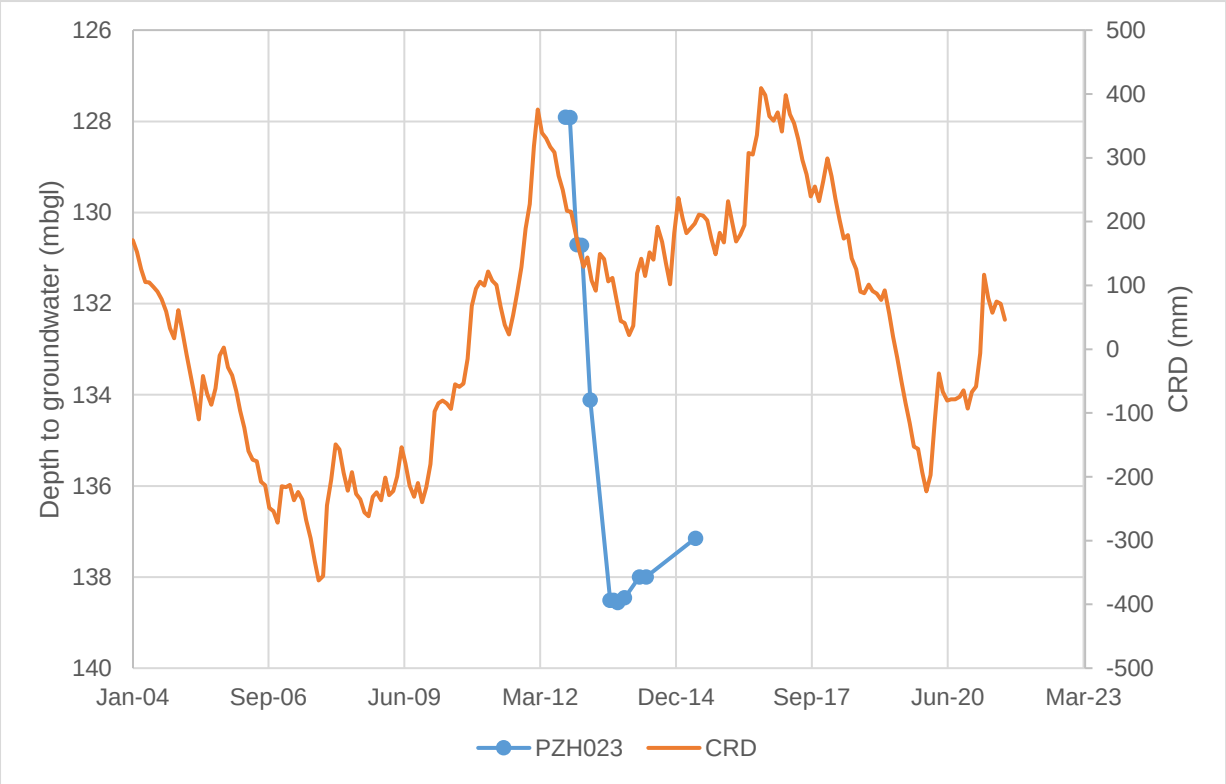
72.5
73
73.5
74
Depth to groundwater (mbgl)
500
400
300
200
100
0
-100
-200
-300
-400
-500
CRD (mm)
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Jun-20
Oct-21
Mar-23
PZH020
CRD


0
10
20
30
40
50
60
70
80
Depth to groundwater (mbgl)
500
400
300
200
100
0
-100
-200
-300
-400
-500
CRD (mm)
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Jun-20
Oct-21
Mar-23
PZH021
CRD

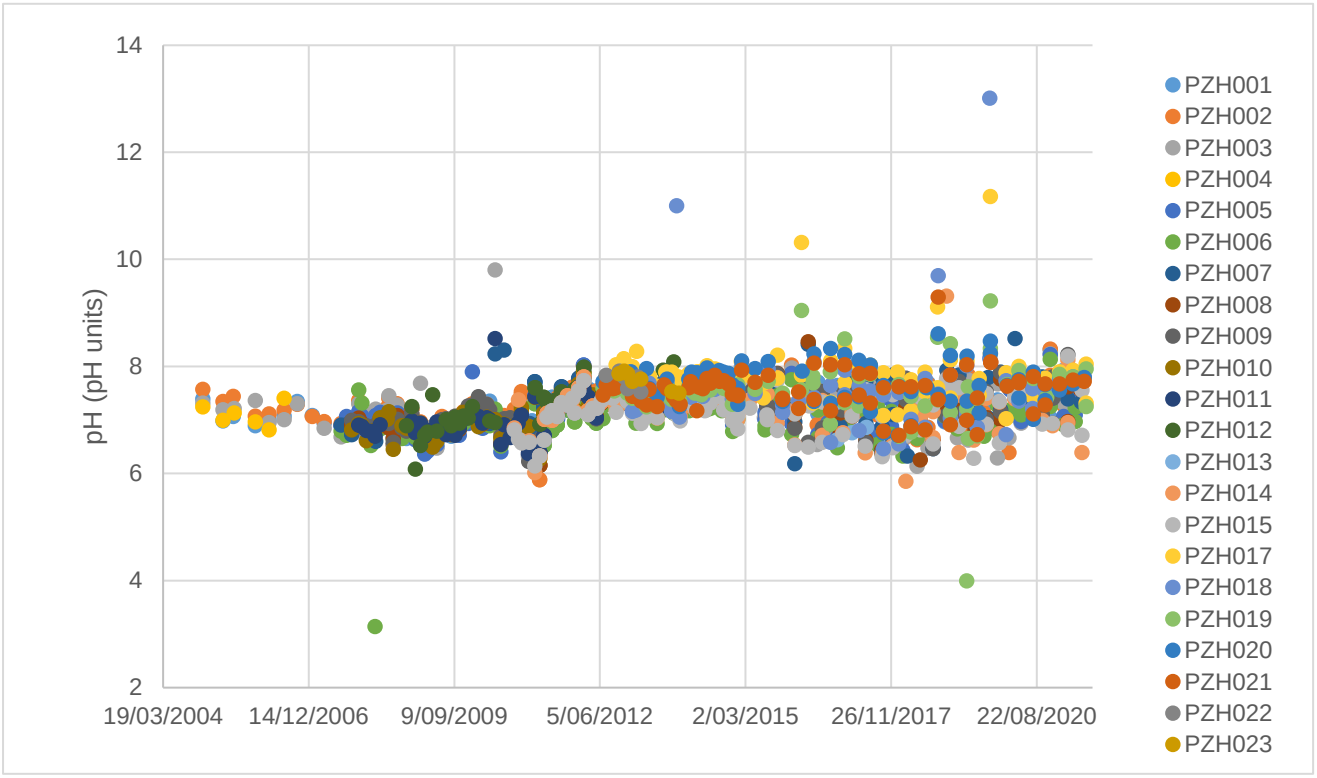

110.8
111
111.2
111.4
111.6
111.8
112
112.2
112.4
112.6
112.8
113
Depth to groundwater (mbgl)
500
400
300
200
100
0
-100
-200
-300
-400
-500
CRD (mm)
Jan-04
Sep-06
Jun-09
Mar-12
Dec-14
Sep-17
Jun-20
Mar-23
PZH022
CRD

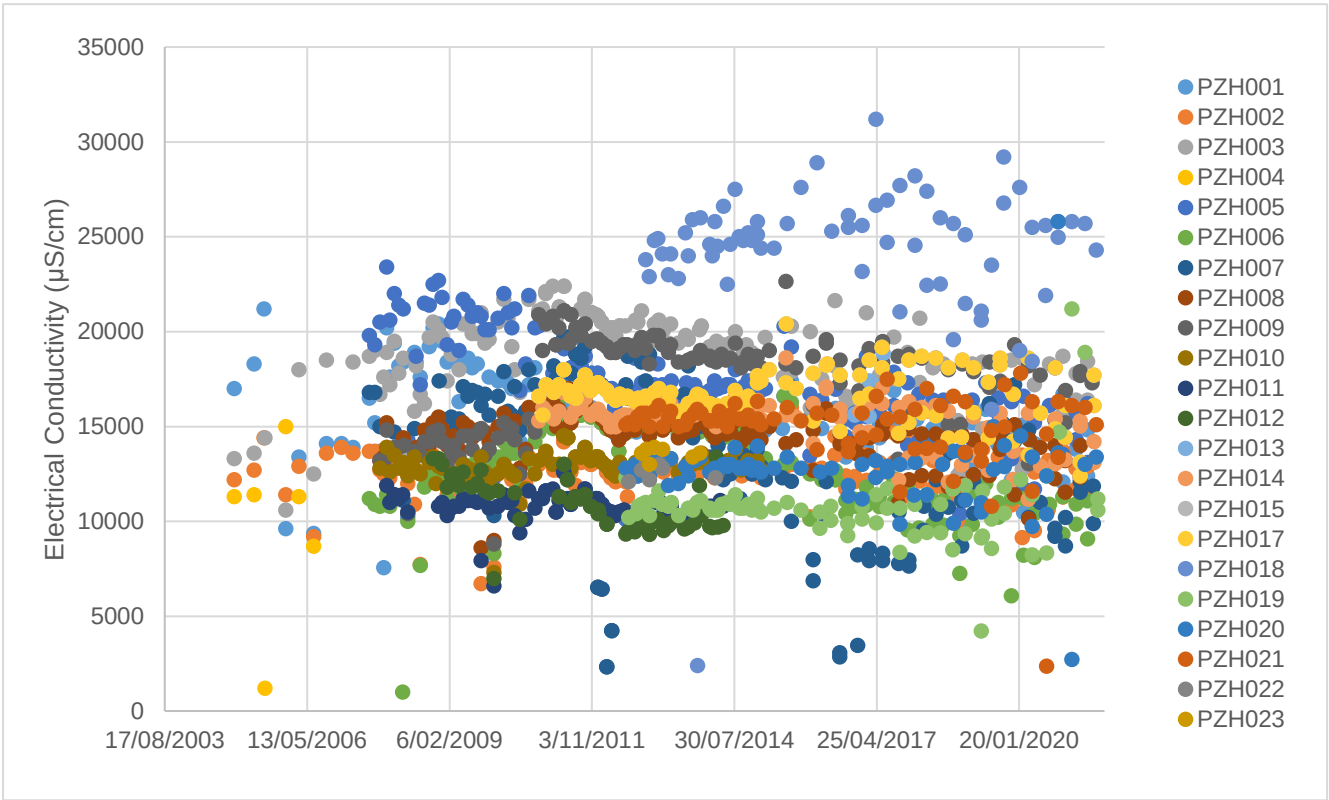

126
128
130
132
134
136
138
140
Depth to groundwater (mbgl)
500
400
300
200
100
0
-100
-200
-300
-400
-500
CRD (mm)
Jan-04
Sep-06
Jun-09
Mar-12
Dec-14
Sep-17
Jun-20
Mar-23
PZH023
CRD

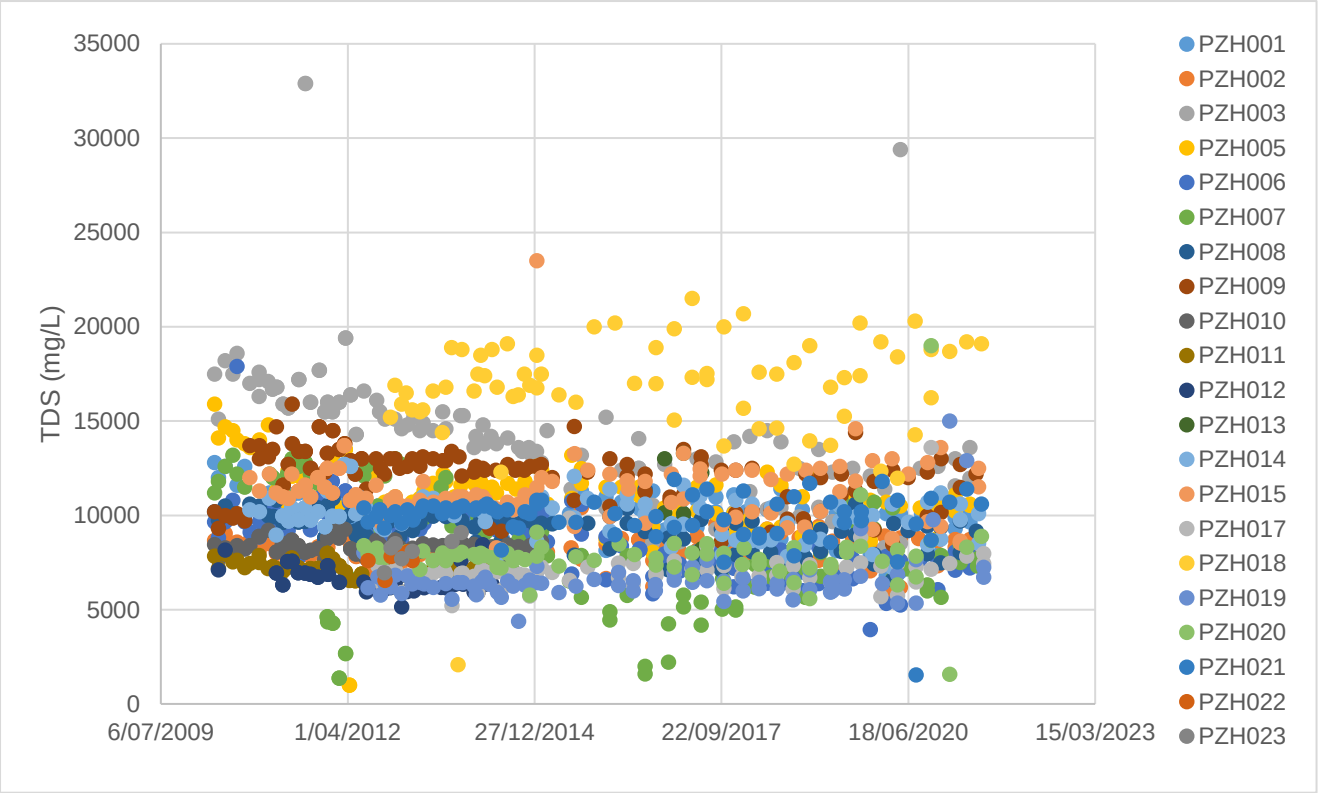
Appendix B

Groundwater quality

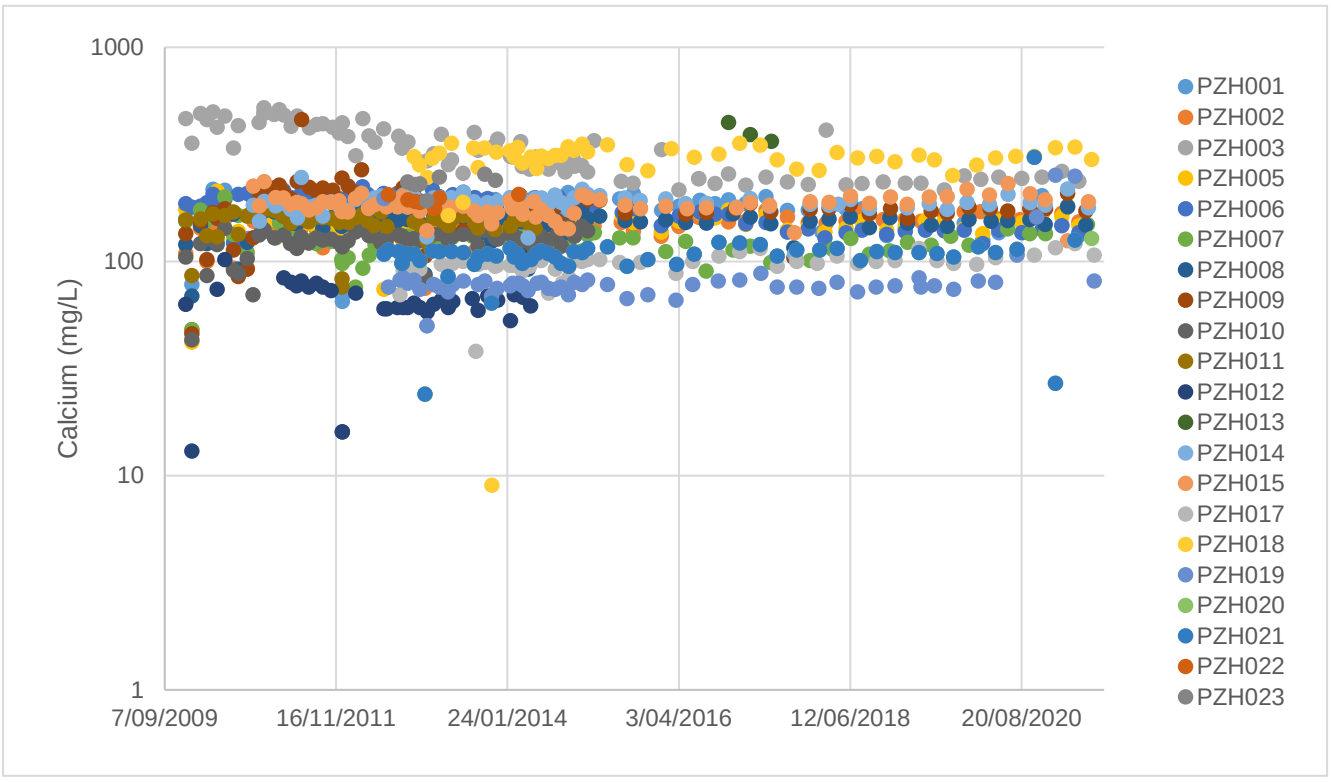
Physicochemical

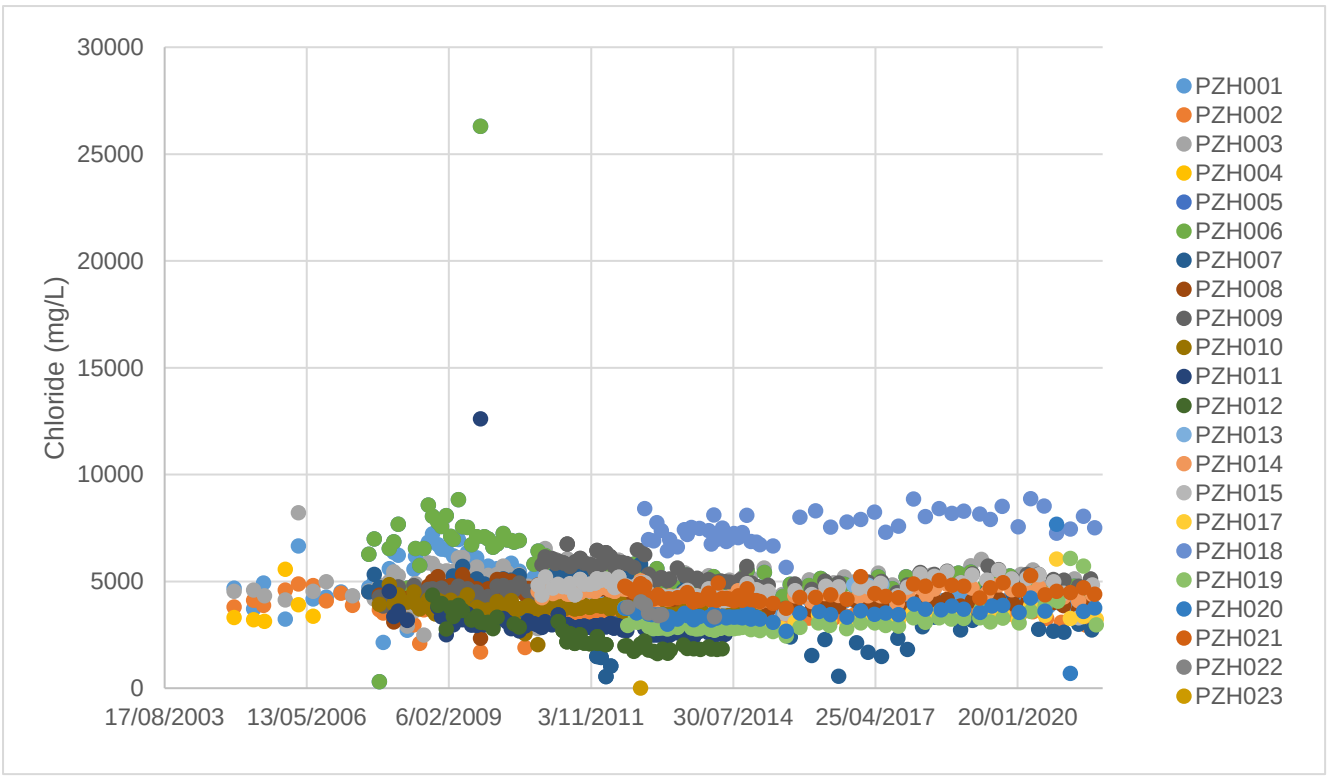


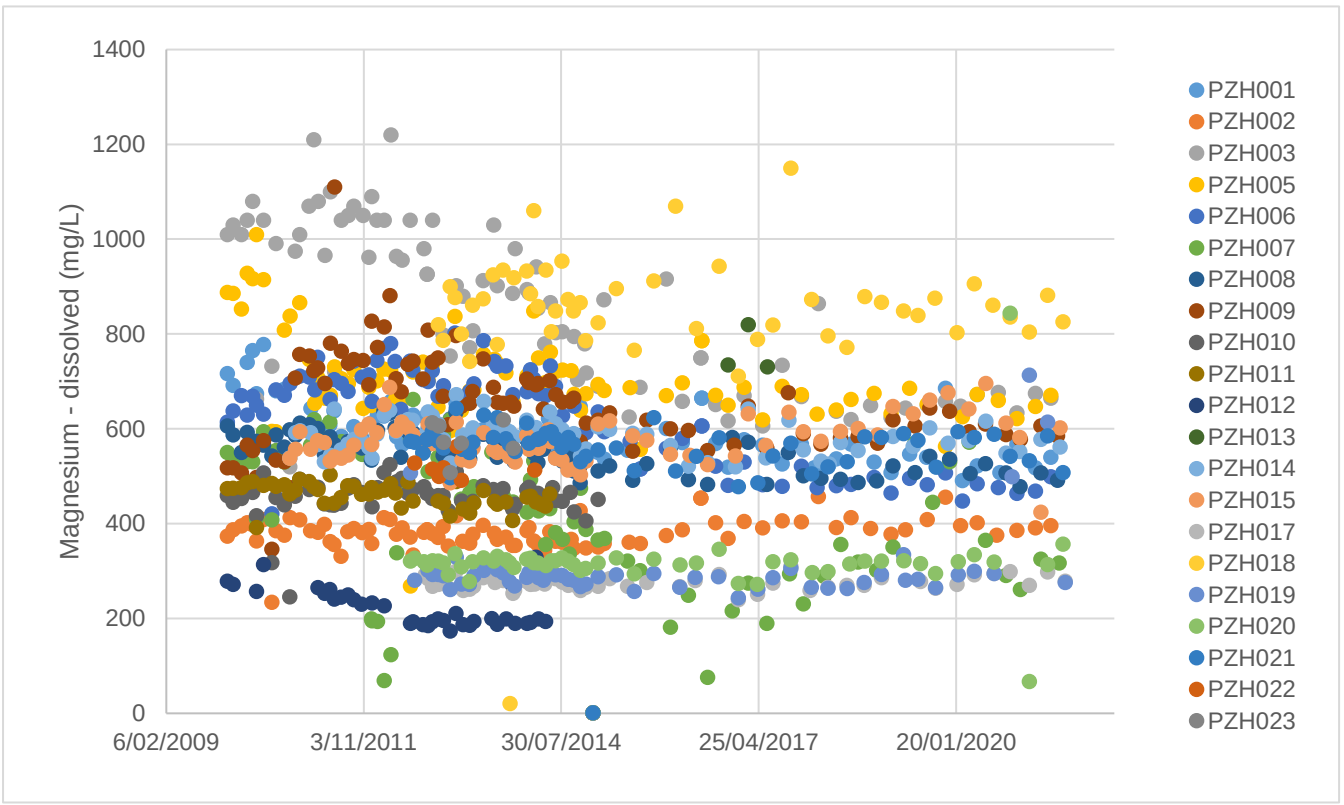


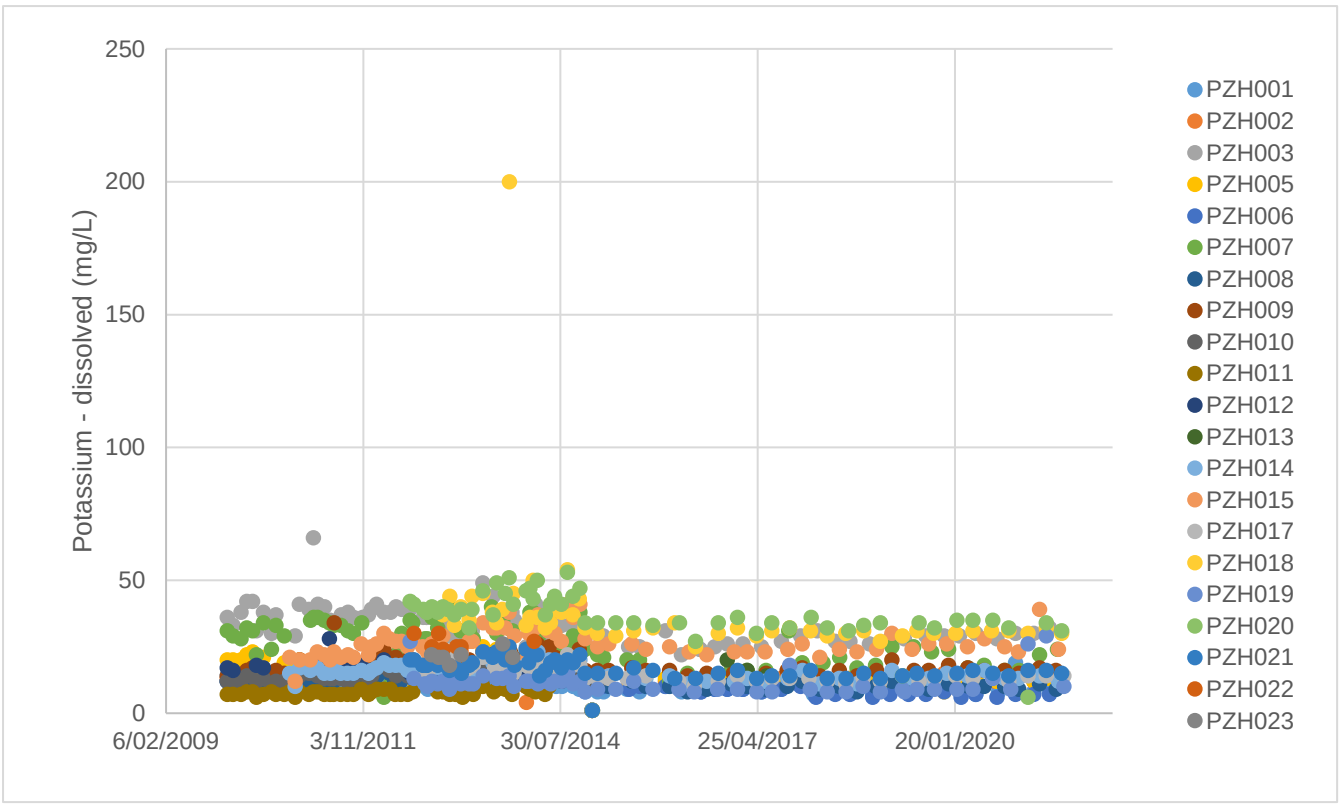

35000
30000
25000
20000
15000
10000
5000
0
TDS (mg/L)
6/07/2009
1/04/2012
27/12/2014
22/09/2017
18/06/2020
15/03/2023
PZH001
PZH002
PZH003
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023

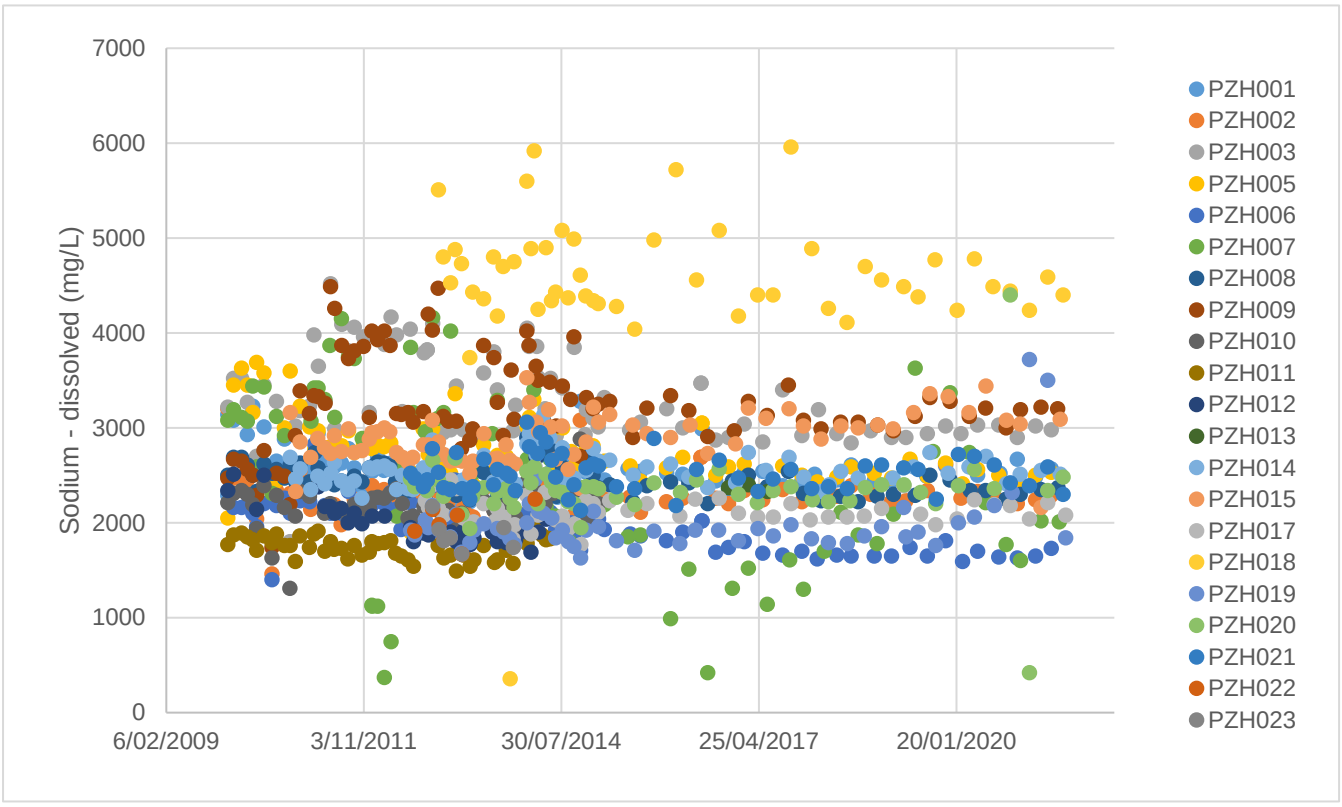
Major ions

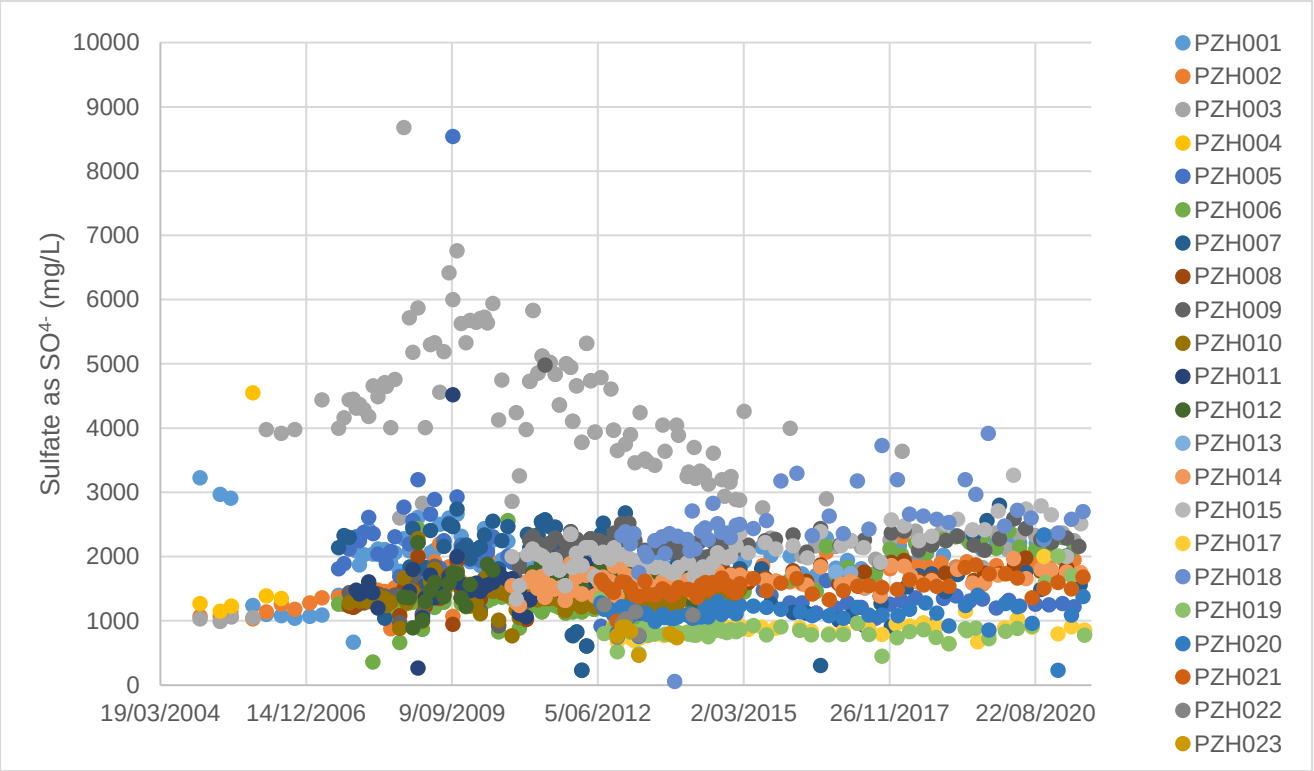

1000
100
10
1
Calcium (mg/L)
7/09/2009
16/11/2011
24/01/2014
3/04/2016
12/06/2018
20/08/2020
PZH001
PZH002
PZH003
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023


Chloride (mg/L)
30000
25000
20000
15000
10000
5000
0
17/08/2003
13/05/2006
6/02/2009
3/11/2011
30/07/2014
25/04/2017
20/01/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023

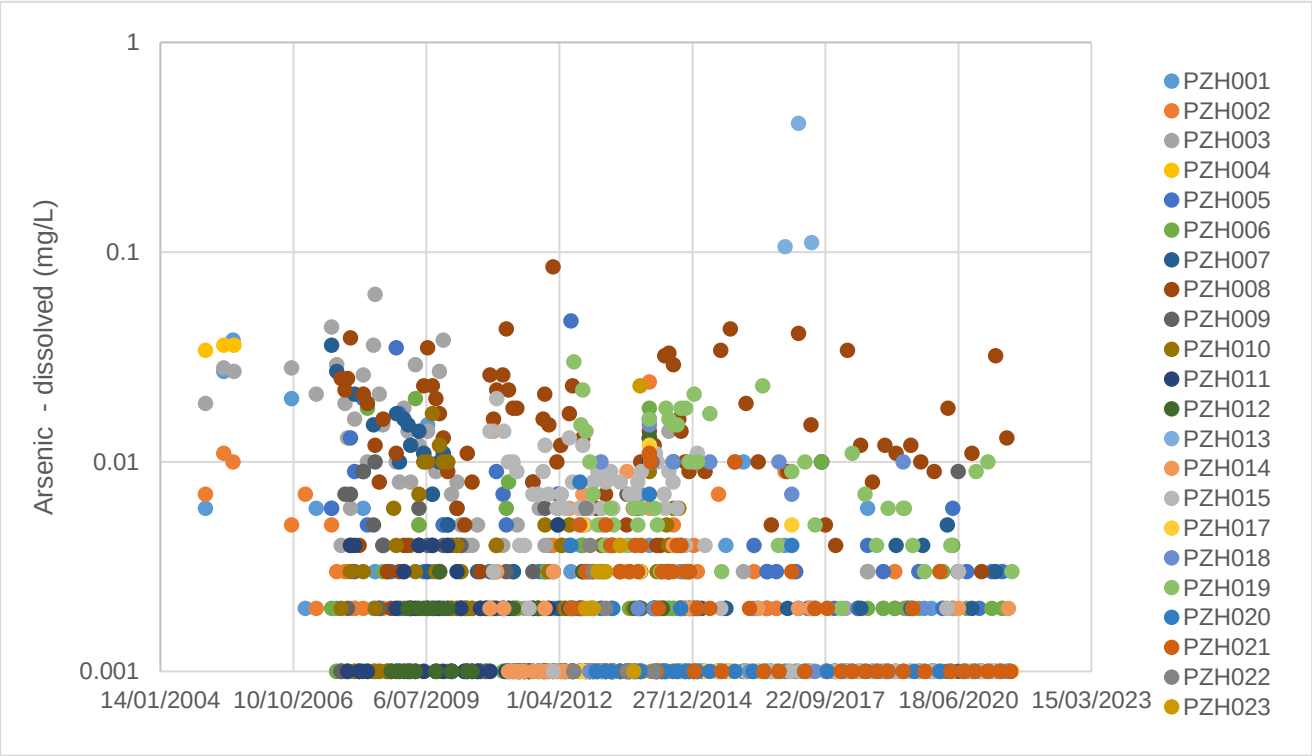

Magnesium - dissolved (mg/L)
1400
1200
1000
800
600
400
200
0
6/02/2009
3/11/2011
30/07/2014
25/04/2017
20/01/2020
PZH001
PZH002
PZH003
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023

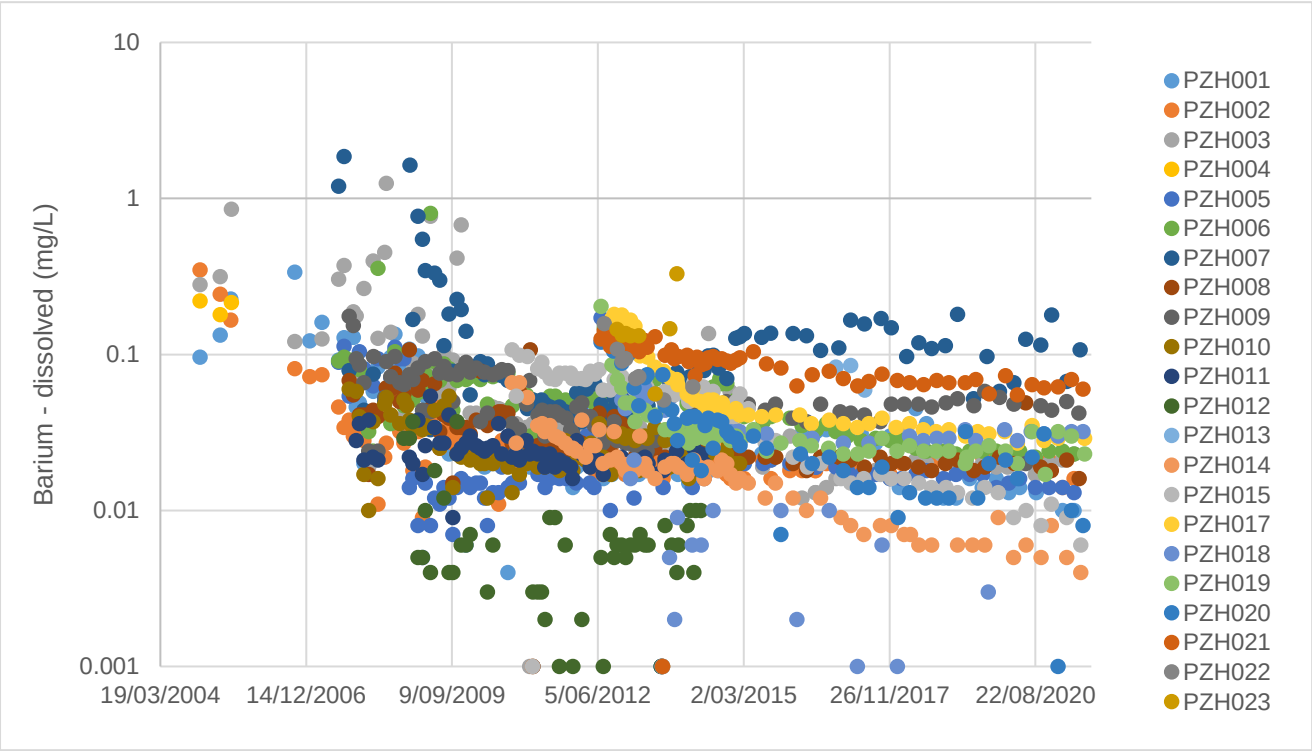

Potassium - dissolved (mg/L)
250
200
150
100
50
0
6/02/2009
3/11/2011
30/07/2014
25/04/2017
20/01/2020
PZH001
PZH002
PZH003
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023

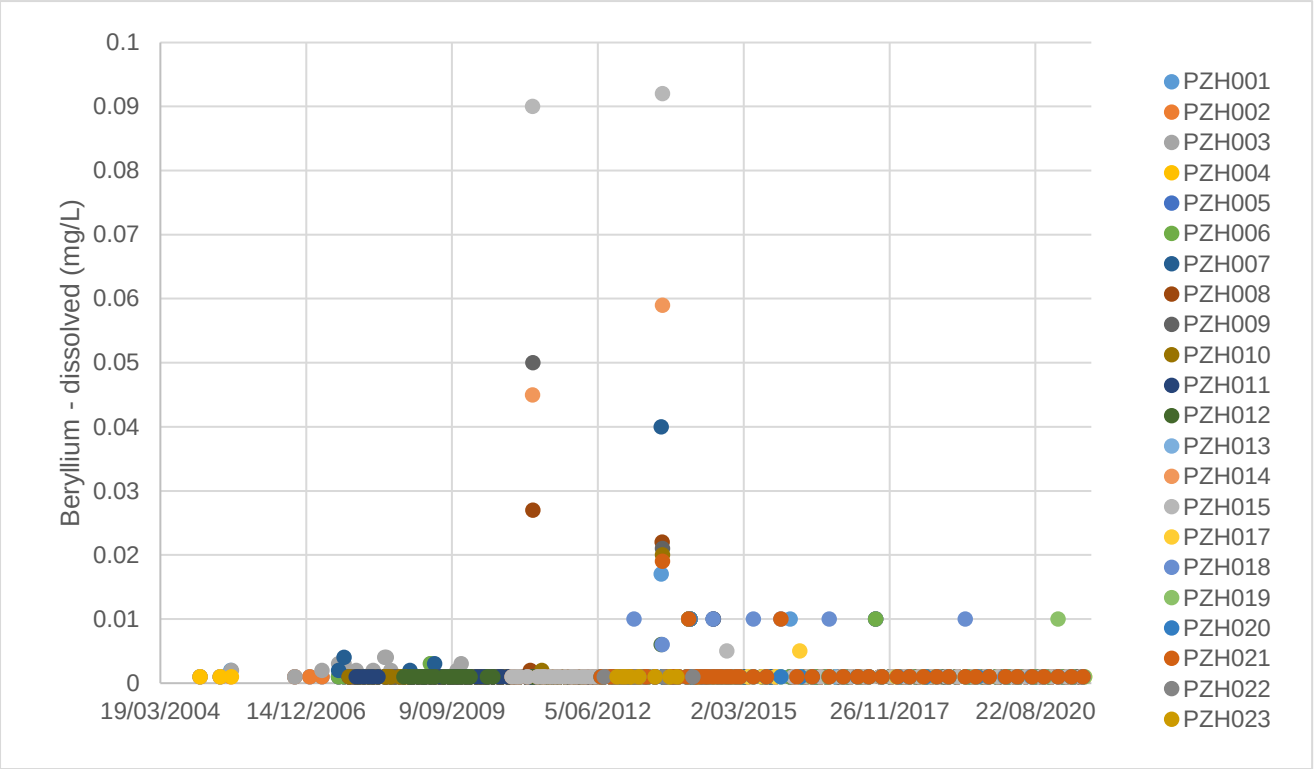

Sodium - dissolved (mg/L)
7000
6000
5000
4000
3000
2000
1000
0
6/02/2009
3/11/2011
30/07/2014
25/04/2017
20/01/2020
PZH001
PZH002
PZH003
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023

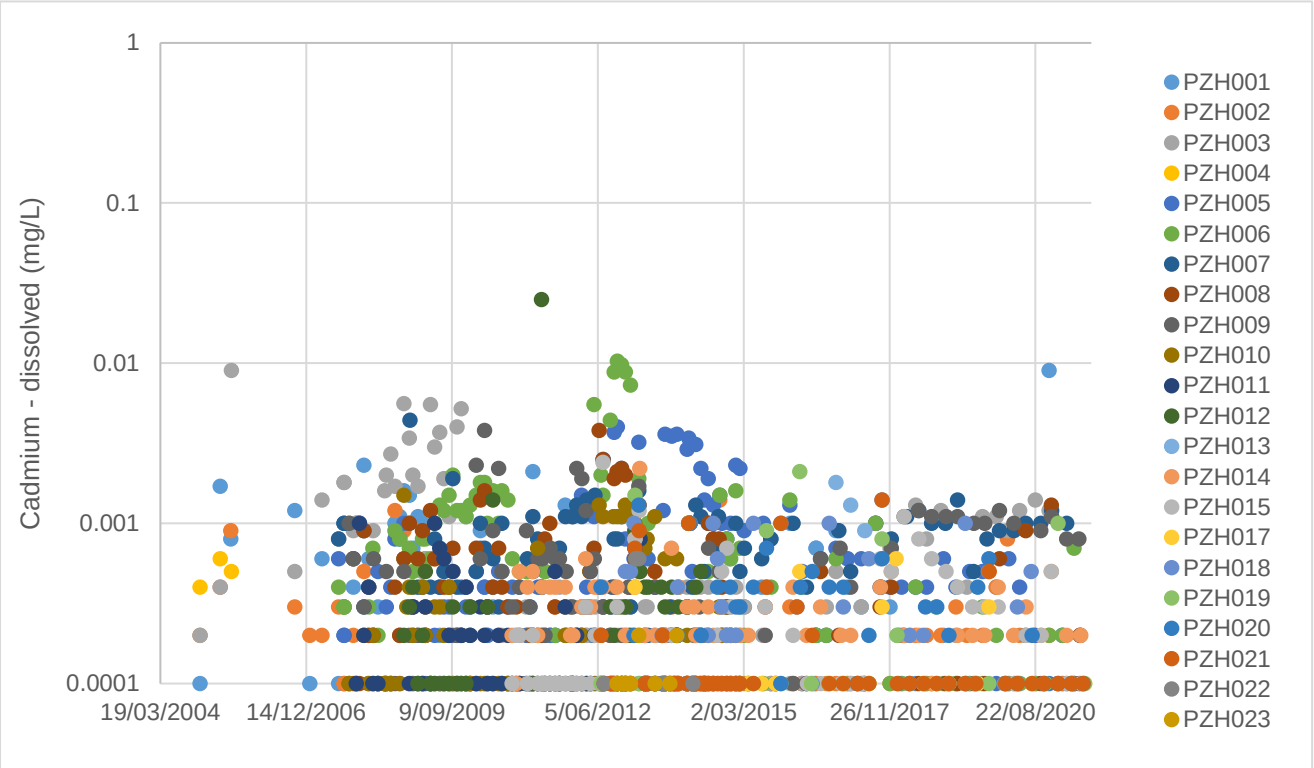

10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Sulfate as SO4- (mg/L)
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023

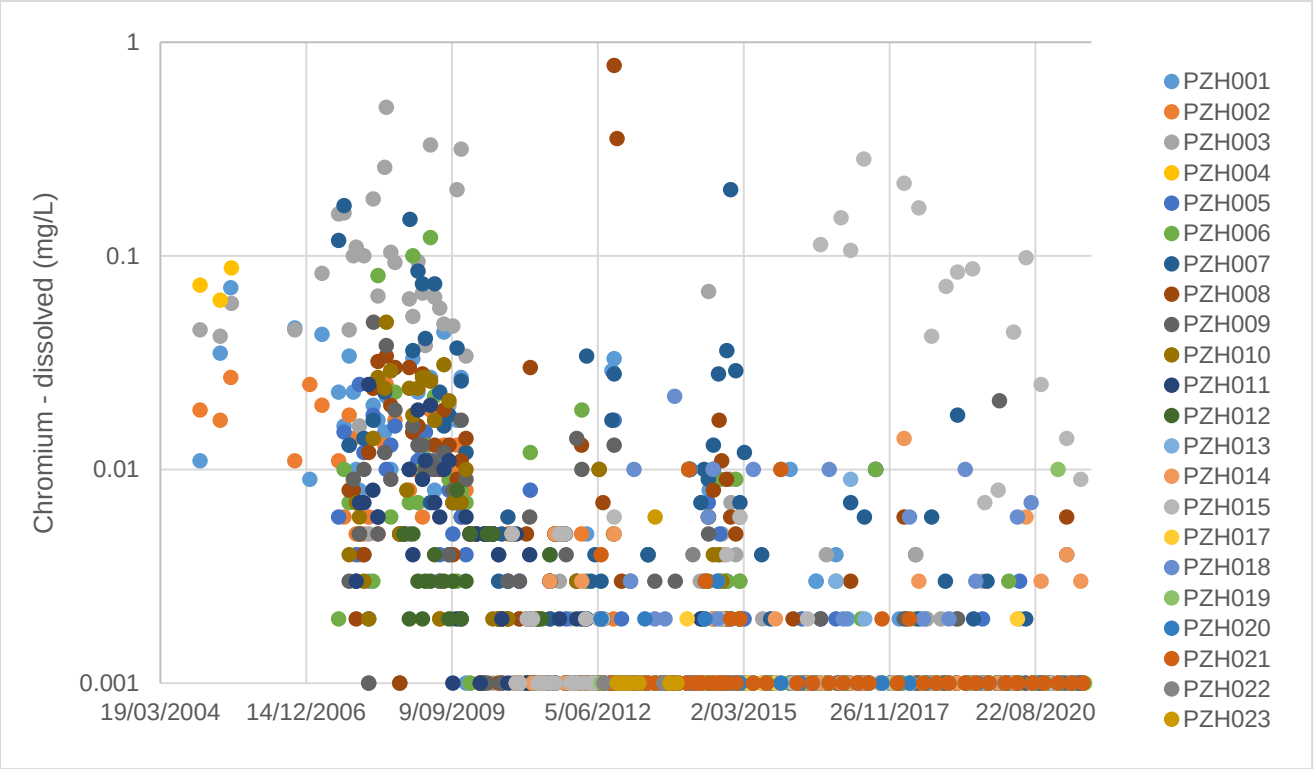
Dissolved metals

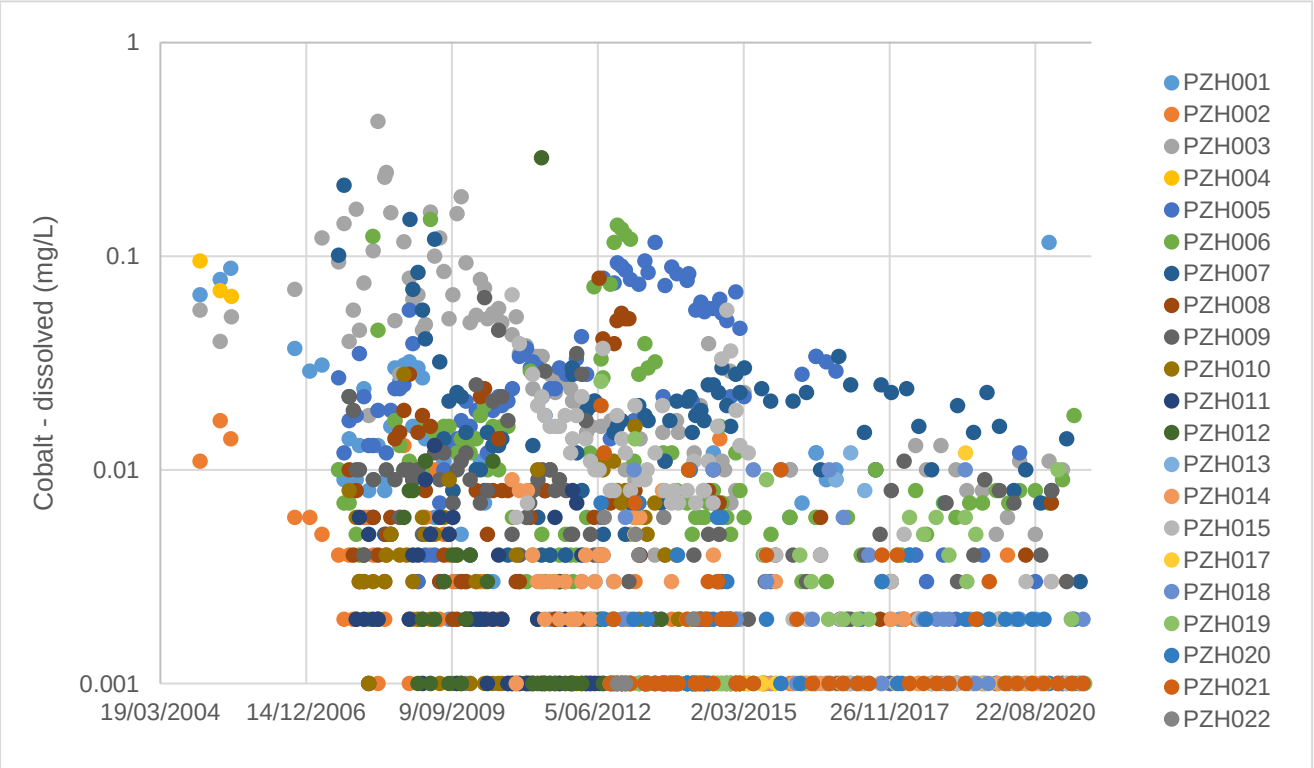


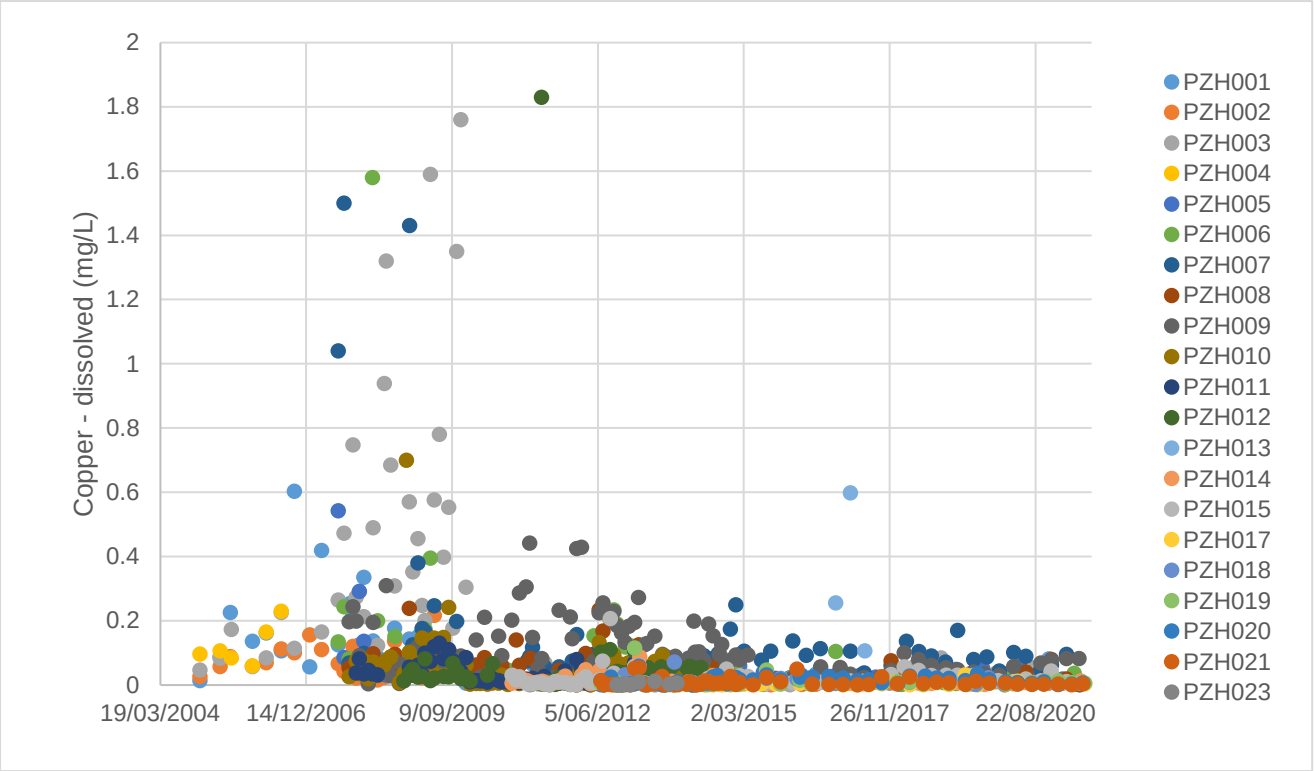


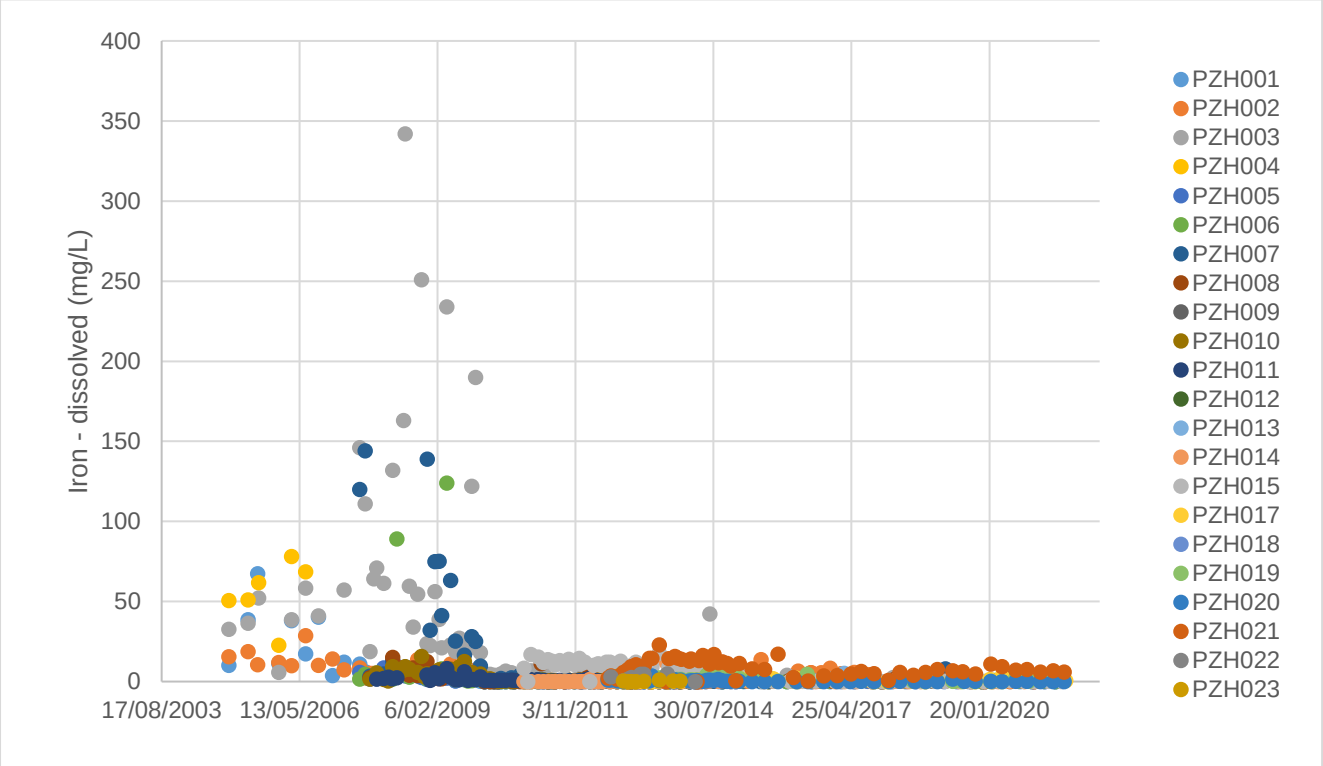

Beryllium - dissolved (mg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023

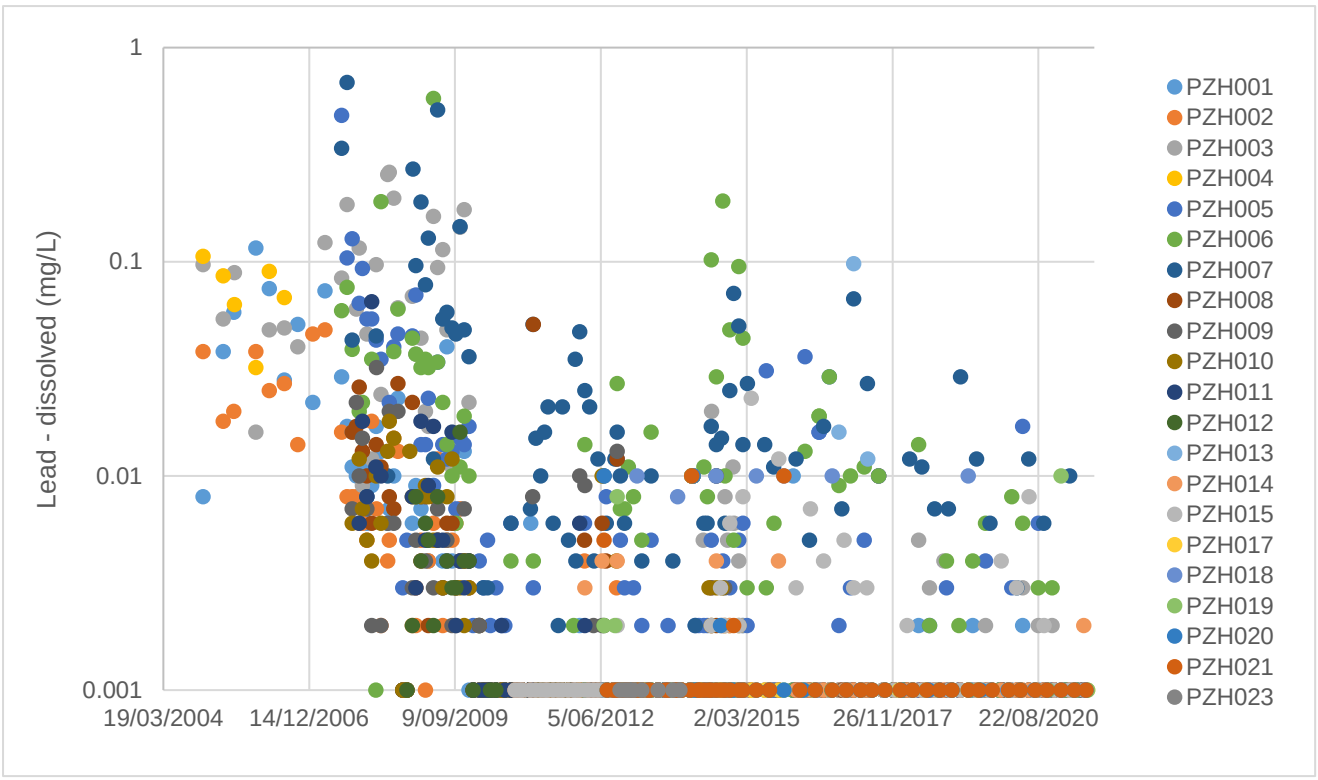

Cadmium - dissolved (mg/L)
1
0.1
0.01
0.001
0.0001
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023


Chromium - dissolved (mg/L)
1
0.1
0.01
0.001
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023


Cobalt - dissolved (mg/L)
1
0.1
0.01
0.001
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022


Copper - dissolved (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH023


Iron - dissolved (mg/L)
400
350
300
250
200
150
100
50
0
17/08/2003
13/05/2006
6/02/2009
3/11/2011
30/07/2014
25/04/2017
20/01/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023


Lead - dissolved (mg/L)
1
0.1
0.01
0.001
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
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PZH018
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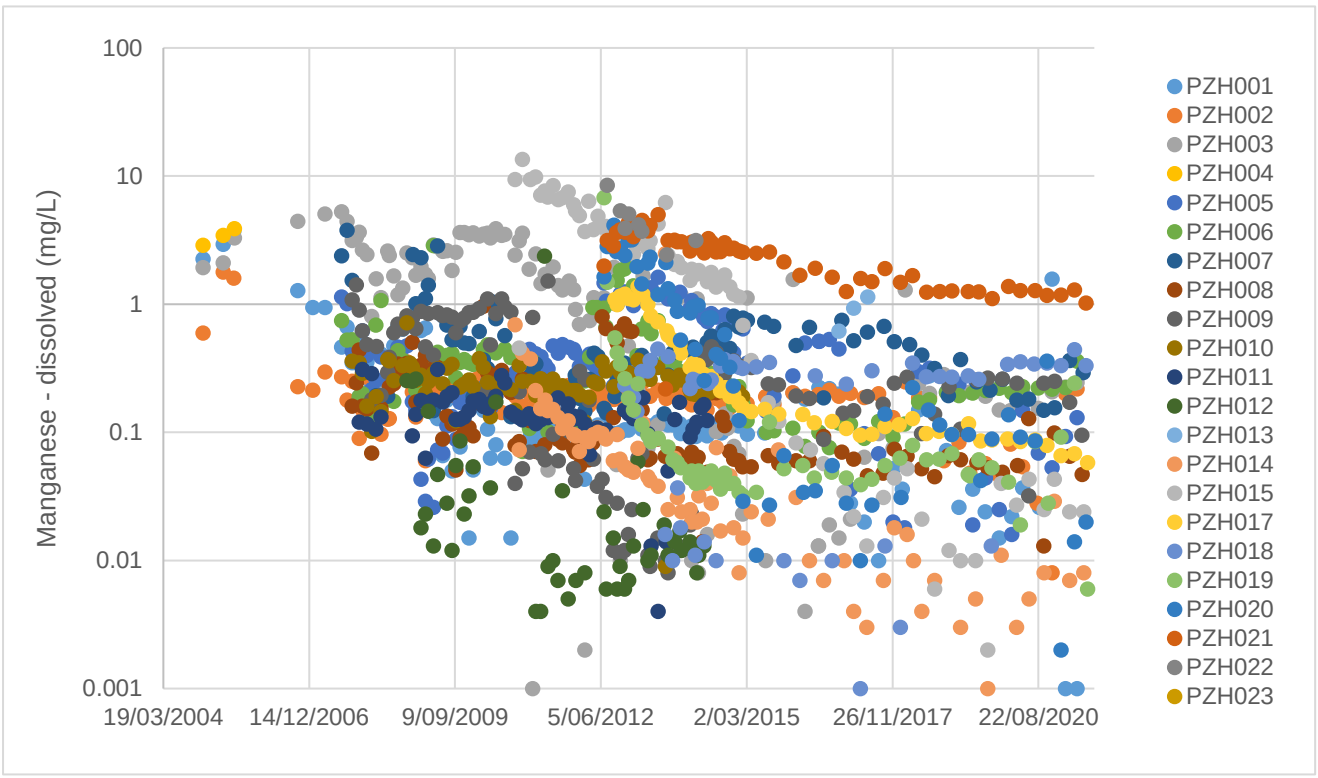
PZH020
PZH021
PZH023


Manganese - dissolved (mg/L)
100
10
1
0.1
0.01
0.001
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
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PZH009
PZH010
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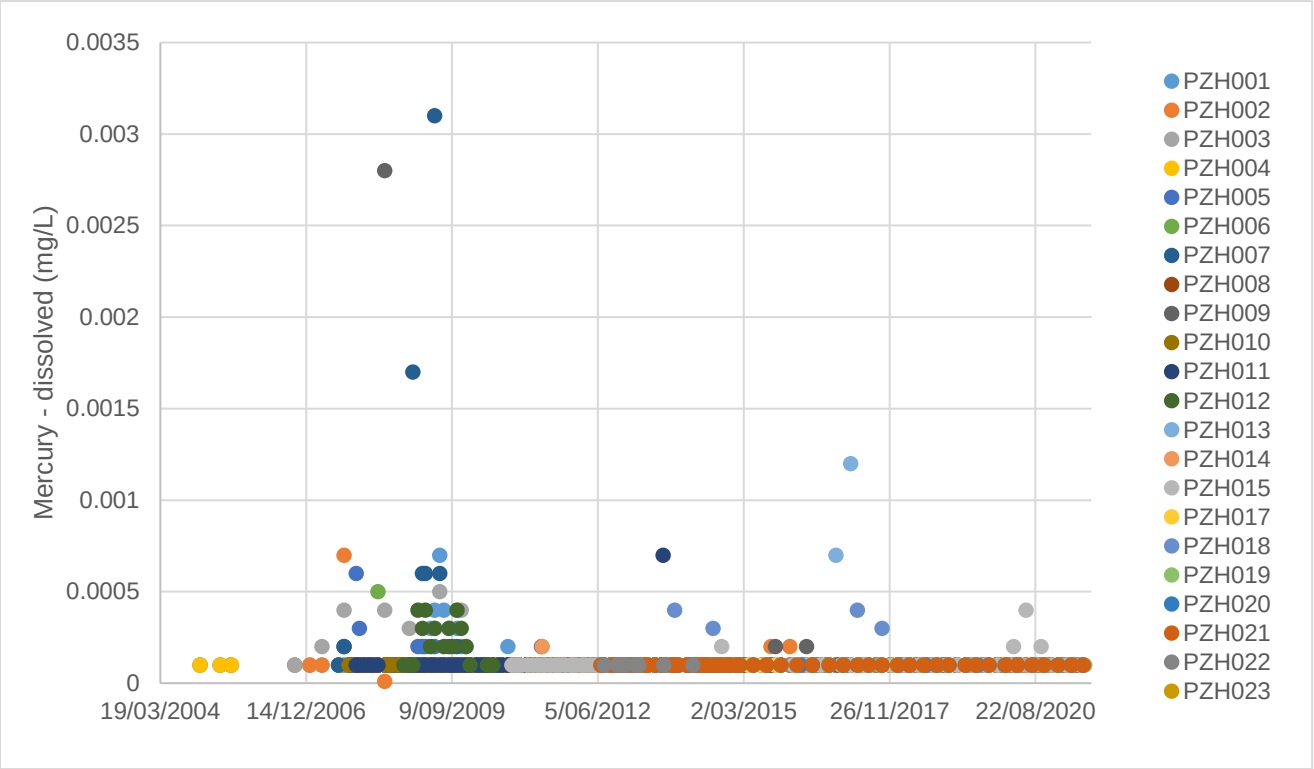
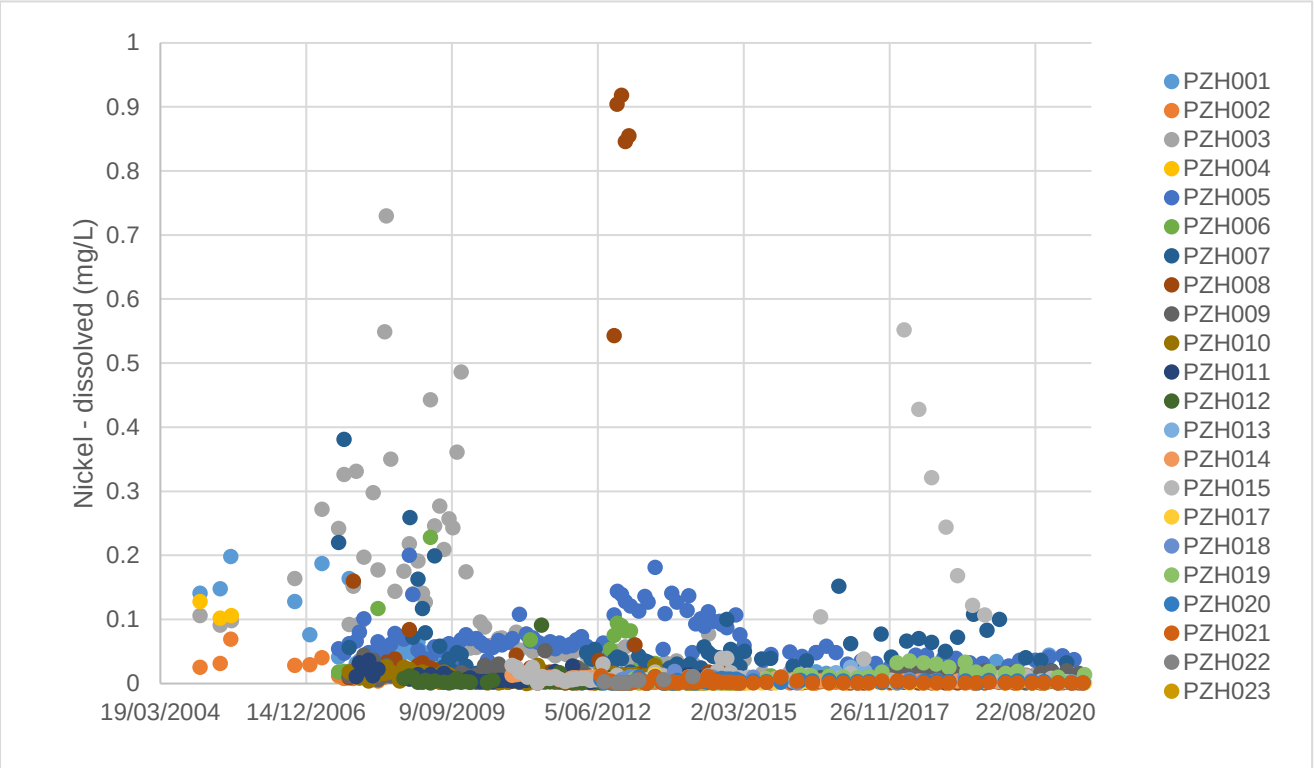
PZH022
PZH023


Mercury - dissolved (mg/L)
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023


Nickel - dissolved (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
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PZH015
PZH017
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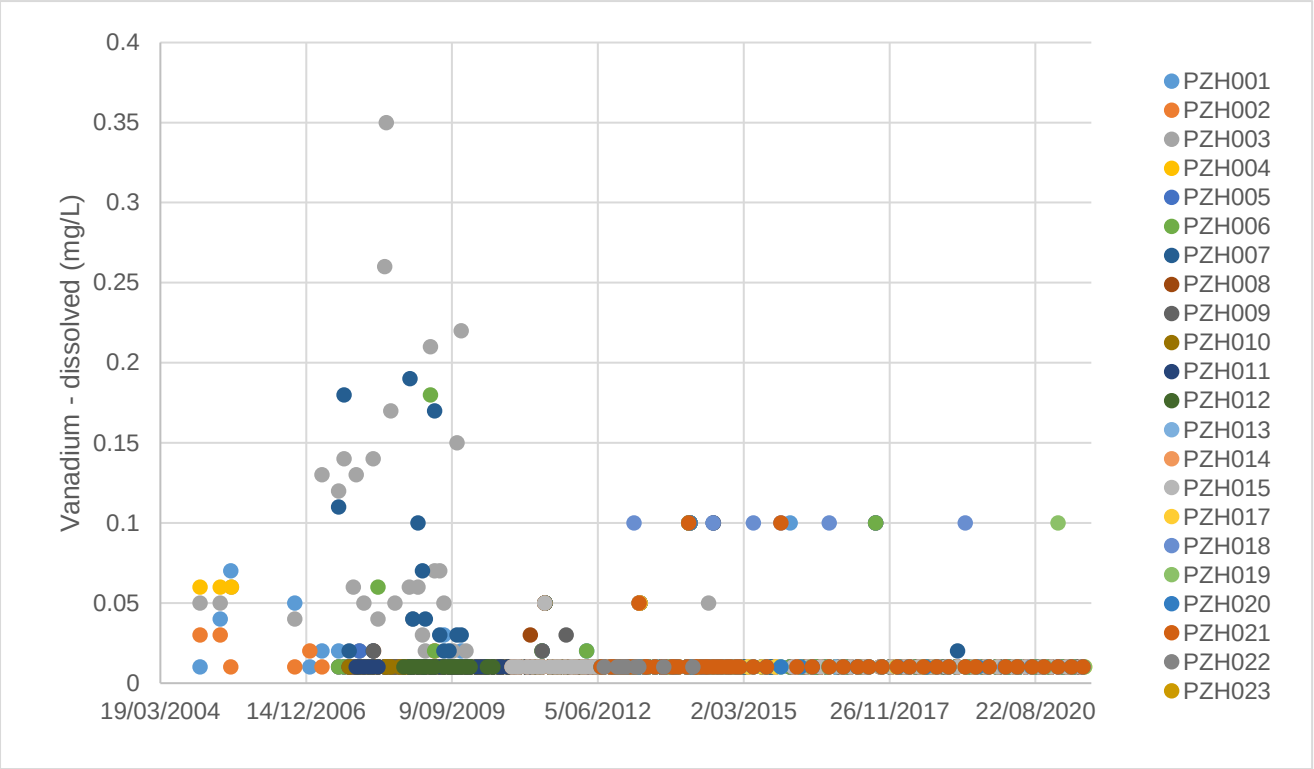
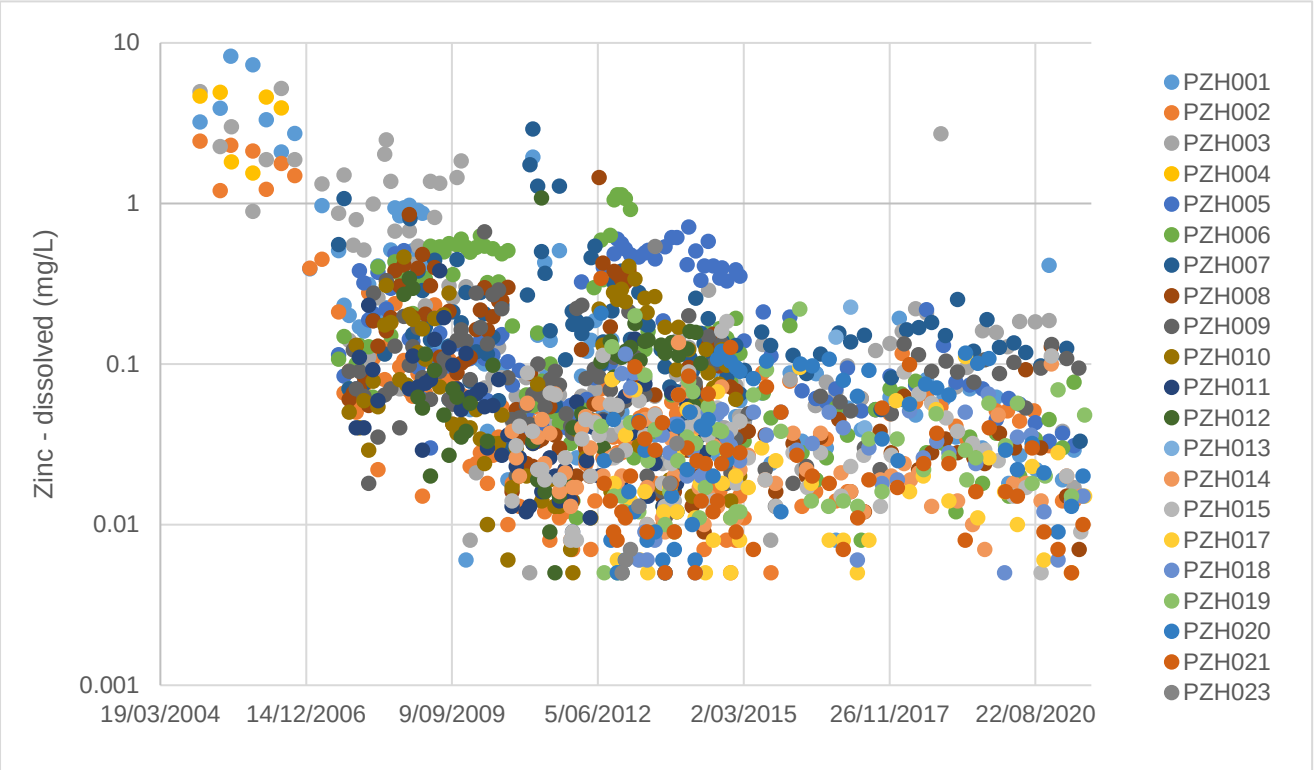
PZH019
PZH020
PZH021
PZH022
PZH023


Vanadium - dissolved (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH022
PZH023


Zinc - dissolved (mg/L)
10
1
0.1
0.01
0.001
19/03/2004
14/12/2006
9/09/2009
5/06/2012
2/03/2015
26/11/2017
22/08/2020
PZH001
PZH002
PZH003
PZH004
PZH005
PZH006
PZH007
PZH008
PZH009
PZH010
PZH011
PZH012
PZH013
PZH014
PZH015
PZH017
PZH018
PZH019
PZH020
PZH021
PZH023

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