aarc ENVIRONMENTAL SOLUTIONS

Aeris RESOURCES

Constellation Project

Environmental Impact Statement



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Summary

S Summary

S.1 Introduction

The Constellation Project (the Project) is a proposed copper mine approximately 20 km north-east of the township of Girilambone and approximately 55 km north-west of Nyngan, within the Bogan Shire Council local government area. The regional location of the Project is shown in Figure S.1, with the Project layout shown in Figure S.2.

The proponent for the proposed Project is Tritton Resources Pty Ltd—a wholly owned subsidiary of Aeris Resources Ltd (Aeris). Aeris is an Australian Securities Exchange listed base and precious metals producer. They own and operate 'Tritton Copper Operations' in central-western New South Wales (NSW) and strategic mining assets and tenements in Western Australia, Victoria and North Queensland.

Tritton Copper Operations functions as a hub and spoke model, with the Tritton Copper Mine serving as the centralised hub (where the processing facility is located), with other surrounding deposits (spokes) supplying ore for processing.

The Project is a proposed new spoke of Tritton Copper Operations approximately 45 km north-east of the existing Tritton Copper Mine (Figure S.1).

The Project proposes to mine copper ore by developing an open cut pit and underground mine. Mined ore will be transported via road to the Tritton Copper Mine for processing via existing road networks as far as practicable (Figure S.2).

Lower-grade oxide ore will be processed by heap leaching at the Project site. Transport of dewatered tailings material from the Tritton Copper Mine back to the Project site (for use in cemented paste fill) will support the underground mining activities at the Project.

The Project proposes to mine an average of 500,000 tonnes of copper ore per annum to replace the depleting production from Aeris' existing Tritton Copper Operations. However, peak volumes of ore transported to the Tritton Copper Mine may be up to 1 million tonnes per annum as open cut mining is completed and underground operations ramp up.

The anticipated mine life is approximately 16 years, inclusive of the initial Project construction period and the rehabilitation/closure period. There is potential for future mine life extensions, as the deposit is developed down plunge (to depth).

Rehabilitation will occur progressively when possible, noting that disturbance associated with the Project site will be very small, comprising an area of approximately 170 hectares.

Aeris wishes to acknowledge a grant for the Project from the NSW Government Critical Minerals and High-Tech Metals Activation Fund, which has contributed to the development of this:

- environmental impact statement (EIS); the
- social impact assessment; and
- studies to optimise resource extraction and processing.

Proudly funded by NSW GOVERNMENT

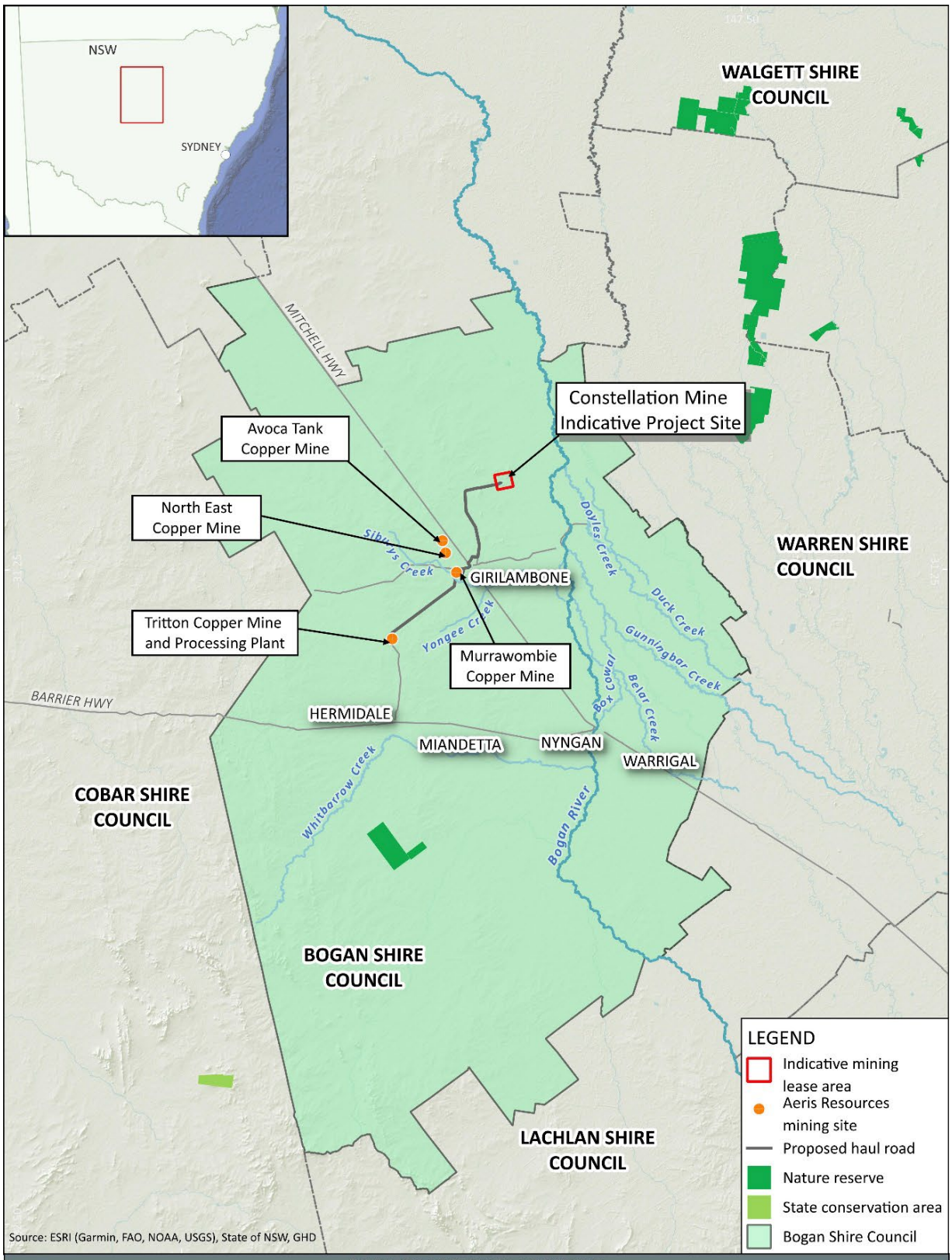


Figure S.1: Project regional location

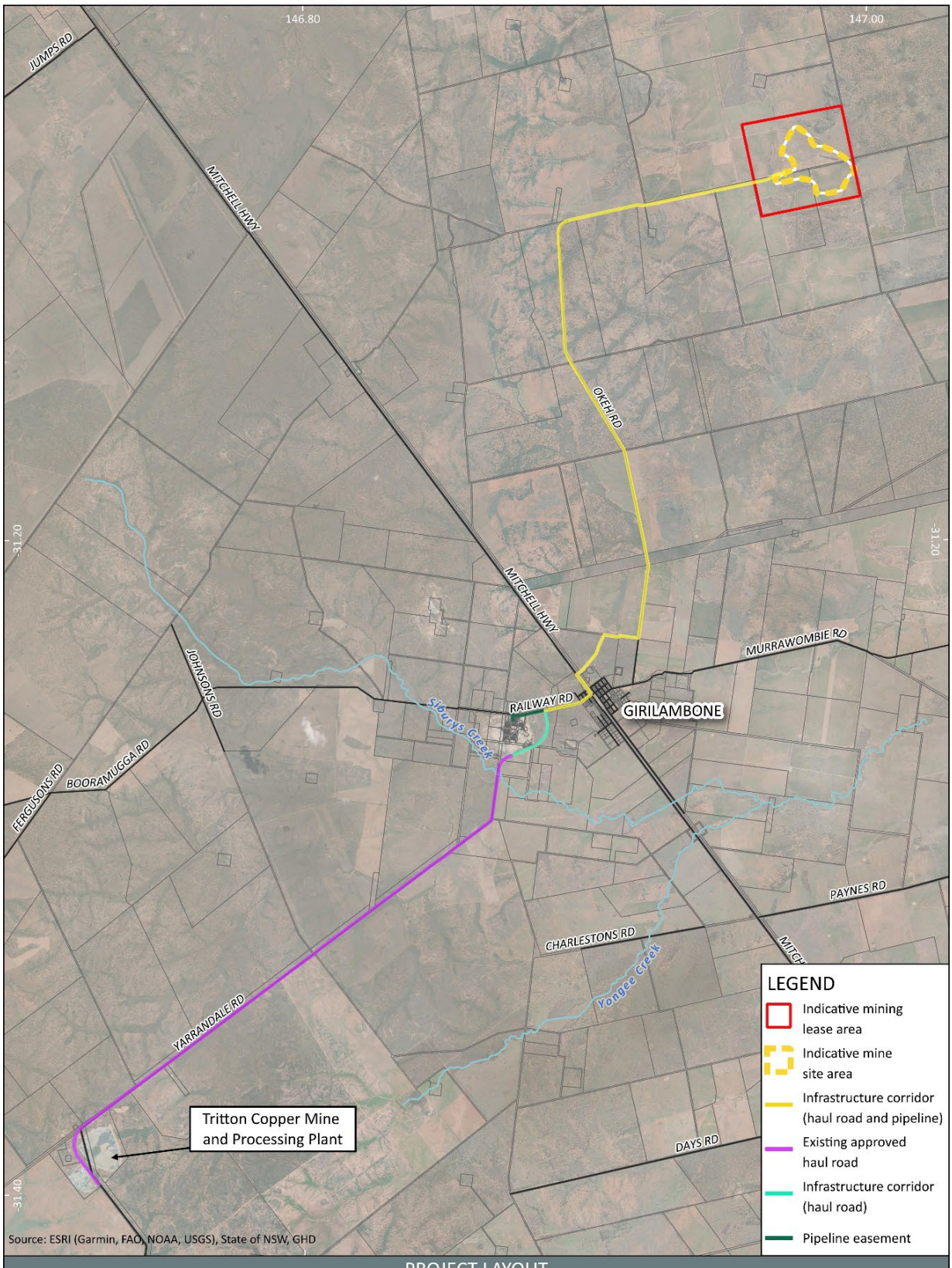


Figure S.2: Project layout

S.2 Tritton Copper Operations

The Tritton Copper Operations hub and spoke mining model currently comprises four copper assets (Table S.1).

Table S.1: Tritton Copper Operations assets

Mine	ML	Grant date	Expiry	Operational status
Tritton Copper Mine	ML1544	22 Dec 2003	21 Dec 2028	Operating
Murrawombie Copper Mine	ML1280	6 Aug 1992	5 Aug 2034	Operating
North East Copper Mine	ML1383	13 Jan 1996	13 Jan 2038	Operating
Avoca Tank Copper Mine	ML1818	5 Nov 2021	5 Nov 2042	Operating

Copper ore mined from the Tritton Copper Operations assets is transported to the centralised processing plant at the Tritton Copper Mine (ML1544). Following processing, copper concentrate is transported by rail to local customers or to the Port of Newcastle for export to international customers.

S.3 Project overview

To mine the copper ore resource, the Project proposes open cut mining a relatively small pit and underground mining using long hole stoping and backfill, which will operate for approximately eight years. The key Project elements are provided in Table S.2.

Table S.2: Summary of the Project

Project element	Summary of the Project
Project mine area	The proposed greenfield Project is in a rural setting and proposed to occur on two freehold properties. These properties are identified as the 'Okeh' property (including Lot 4 of DP751341 and Lot 9 of DP751321) and the 'Windella' property (being Lot 10 of DP 751321). The Project site is sparsely vegetated, with the current land use being sheep grazing and some dryland wheat cropping. The proposed Project surface disturbance area is approximately 170 ha. The Project mine area is within exploration leases (EL) 6126, EL8987 and EL8084 held by Tritton Resources Pty Ltd.
Open cut pit mining method and extent	An open cut mining pit will initially be developed to mine the resource targeted by the proposed Project. The open cut pit is relatively small, with a maximum area of approximately 11.7 ha. The pit shell will have a maximum depth of approximately 110 m to -55 m relative level.
Underground mining method and extent	An underground mine for the Constellation deposit will be developed using long hole, open stoping with backfilling. The average feed rate from the underground mine will be approximately 0.5 million tonne per annum. Underground production may peak at 1 Mtpa in any given period. Access to underground workings will be via a portal in a surface box cut, and a 3,100 m decline—underground workings will be developed to a depth of approximately -280 mRL.
Production	The ore to be processed over the life of the Project is estimated to be 2.4 Mt from the open cut mine and 3.6 Mt from the underground mine.
Resource	Indicated and Inferred: Copper–6.7 million tonnes at 1.85% copper; gold–0.58 grams per tonne; silver–2.9 grams per tonne containing 123 kt Cu metal; 125 koz gold metal; and 620 koz silver metal.

Project element	Summary of the Project
Life of mine	The anticipated mine life is approximately 16 years. This includes an estimated one-year construction period, ten years of mining operations and five years of decommissioning and rehabilitation activities.
Infrastructure corridor	An infrastructure corridor approximately 18 m wide, containing the site access/haul road, a water pipeline and an optic fibre cable, will extend between the Project and the existing Murrawombie Copper Mine.
Site access	The proposed infrastructure corridor will predominantly utilise existing public roads. Operational traffic movements and deliveries to the Project mine site will be via Okeh Road, with a new section of road proposed to be constructed between the Mitchell Highway and Okeh Road. The new section of road, approximately 2,850 m long, will: • divert Project traffic around Girilambone township; and • provide access to the Project for operational and haulage traffic. To support the new section of road, a new intersection on the Mitchell Highway is proposed approximately 830 m north-west of the existing Railway Road and Mitchell Highway intersection. Road upgrades are proposed to the existing Railway Road and Mitchell Highway intersection, which will include a channelised right-hand turning lane (for southbound traffic on the Mitchell Highway). A channelised right-turn treatment is also proposed for the intersection of the new road and Mitchell Highway (for northbound traffic on the Mitchell Highway).
Haulage route and traffic movements	Project ore will be transported by road to the Tritton processing plant at the Tritton Copper Mine using existing public road infrastructure and Aeris' owned roads. Haulage vehicles will operate along the proposed site access route, travelling to the Tritton Copper Mine via Mitchell Highway, Railway Road and Yarrandale Road. Haul vehicles will be AB triple road trains with approximately 70-tonne payloads or B double trucks with approximately 50-tonne payloads. Operational traffic movements will be up to 82 truck movements per day. Concentrate from Tritton will be trucked to Hermidale rail siding and loaded onto rail to Newcastle Port. Copper crystal will be loaded and transported from the Project by road and will continue by either road or rail. The existing rail networks are expected to provide enough transport capacity for the Project. Therefore, no new rail or port facilities will be required.
Off-site processing	Supergene and primary ore will be processed at the Tritton Copper Mine processing facility. Up to approximately 10 Mt of Project ore is expected to be processed at the Tritton processing plant over the life of the Project. The Tritton Copper Mine processing facility operates under DA 41/98 (expiring 21 December 2028). A separate approval has been sought to continue processing at the site and increase the annual processing rate and related activities (outlined in Chapter 1, Introduction, Section 1.6.2). The proposed production volume is to be increased to 1.8 Mtpa, and importing mined materials (ore and waste) is proposed to be 1.8 Mt per year.
On-site processing	Supergene, primary and high-grade ore will be crushed and screened on the run of mine pad. Approximately 2.0 Mt of lower-grade oxide ore from the open cut pit will be processed by heap leaching at the Project site.
Cemented paste fill	Dewatered tailings material from the Tritton processing plant will be backhauled by trucks or road trains to the Project site via the proposed haulage road. The tailings will be screened and mixed with water and a binder in a mobile paste backfill plant at the Project site to produce cemented paste fill. Cemented paste fill will be used in the Project's underground mining activities.
Waste rock management	Approximately 6.1 Mm^3 of waste material will be generated over the life of the Project, from open cut and underground. The capacity of the waste rock emplacement has been designed for the total capacity, if required. The waste rock emplacement will have a height of approximately 35 m above the adjacent land surface (with the top of the waste rock emplacement at approximately 205 mRL) and a maximum disturbance area of approximately 40 ha. Once underground operations commence, preference will be given to storing waste rock underground, where possible. Waste material may also

Project element	Summary of the Project
	be stored within the open cut pit below the final level of the pit lake. Mineralised oxide waste will be stored separately in a mineralised waste pile with a capacity of 0.55 Mm^3.
Water supply	Water supply for the Project will be sourced from direct rainfall, catchment runoff, groundwater inflows, and transfer via a water pipeline between Murrawombie Copper Mine and the Project site (in the infrastructure corridor) which will provide up to 258 ML in peak water demand years (Year 4). Project water demands will be managed within existing water licences held by Aeris. Total annual peak water demand for the Project is estimated to be 613 ML/yr (Year 4).
Water management	The Project's water management system will include: • water storage dams; • a clean water diversion system diverting clean water around disturbed areas and mine site infrastructure; • a catchment drainage system around disturbed areas, to contain mine-affected waters; • a bi-directional water supply pipeline from Murrawombie Copper Mine; • storing sewage from ancillary infrastructure for on-site treatment and on-site disposal or reuse; • erosion and sediment controls during construction and operational phases; and • groundwater dewatering from the underground workings and open cut pit sump to the site water management dams.
General infrastructure	Additional infrastructure to be developed at the Project site will include: • a mine laydown area and workshop; • a run of mine stockpile for mined ore; • a heap leach pad, oxide ore stockpile and crushing area and other processing facility (including process and raffinate ponds and solvent extraction plant); • a paste plant, emulsion storage, and shotcrete batch plant; • topsoil and subsoil stockpiles; • solar farm and on-site power station; and • administrative facilities including offices, amenities, and car park.
Power supply	Mains power will be generated at the Project site using a combination of 6 MW DC solar photovoltaic (PV) (12 ha area) and a 5,000 kVA diesel genset.
Workforce	The Project will provide continued employment to existing Tritton Copper Operations personnel. It will provide an average of approximately 178 full-time equivalent jobs for employees and contractors during operations. Operational employees will work industry-standard 12-hour shifts on seven-day roster cycles. Approximately 95 full-time equivalent contractors will be required during the 12-month construction phase of the Project.
Hours of operation	Mining operations and haulage activities are proposed to occur 24 hours a day, 7 days a week. Construction activities during the Project's construction phase will be undertaken between 06:00 am and 10:00 pm seven days a week.
Capital investment	Approximately $120 million over the life of the mine.

The arrangement of Project infrastructure to support mining operations is shown in Figure S.3.

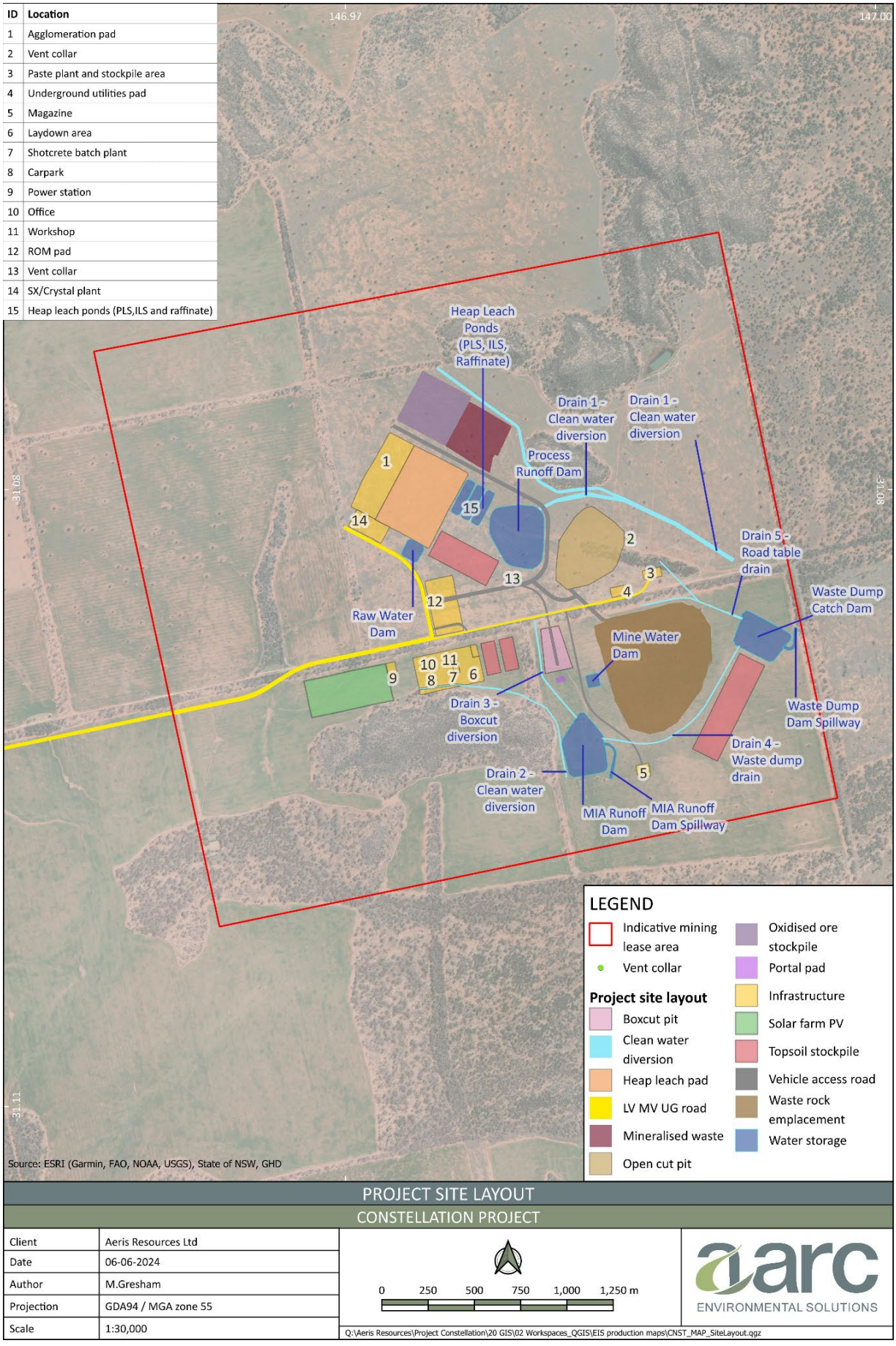


Figure S.3: Project site layout

S.4 Key strategies that have been adopted to avoid, minimise or offset the impacts of the Project

The Project has undertaken and further proposes a range of strategies to avoid, minimise or offset the impacts of the Project.

Specifically, the following strategies have been adopted during the Project design and studies phase to avoid and minimise impacts:

- A range of government and community stakeholders (including local landholders) have and will be engaged to convey concerns associated with the proposed Project. Understanding concerns during the Project design phase will provide an opportunity for stakeholder concerns to be considered and addressed.
- An iterative Project design process has been adopted to enable impact avoidance and minimisation decisions to be made during Project design. As Project engagement and technical studies were undertaken and constraints were identified, the Project layout was adapted (when possible) to avoid and minimise impacts.
- The Project layout has been designed with the smallest disturbance footprint possible, limiting biodiversity impacts and greenhouse gas emissions while still providing all necessary features for the Project.
- The Project layout has been designed to prioritise efficiency in the haulage of material around the site, between the open cut, waste rock emplacement, heap leach and underground mine. Relevant design features include minimising haul distances and road slope limits to minimise fuel consumption and related greenhouse gas emissions.
- Heritage surveys and consultation with registered Aboriginal parties have enabled the Project footprint to be revised, avoiding impacts on several Aboriginal cultural heritage sites.
- Assessment of three potential haulage routes (to transport mined ore from the Project to the Tritton processing facility) was undertaken during ecological and cultural heritage studies. Ultimately, this approach has informed a decision to utilise existing road networks as far as practicable to reduce the potential impact on environmental values significantly.
- The Project haul route (initially 50 m wide) has been reduced to a maximum of 18 m width to work within existing road disturbance. This strategy has enabled significant avoidance of additional land disturbance.
- To minimise impacts to Girilambone township, a new section of haul road has been proposed just north of the township to avoid the need for haulage trucks to traverse Girilambone. This strategy will minimise noise, dust, traffic and visual amenity impacts.
- A new intersection will be developed to manage traffic interactions at the Mitchell Highway/proposed haul road. Works will also be undertaken to upgrade the safety and functionality of the existing Mitchell Highway/Railway Road intersection. Intersection designs have been developed through consultation with Transport for NSW to minimise road safety risks.
- The existing Tritton processing plant will be utilised to process the ore extracted from the Project site. This will maximise efficiency by utilising existing infrastructure and avoid further land disturbance and costs associated with developing a new processing plant.
- The proposed bi-directional water pipeline between the Project mine site and the existing Murrawombie Copper Mine will be in the proposed 18 m wide infrastructure corridor; it will be buried to negate impacts on visual amenity, road safety and fauna movements.
- A solar-powered generation plant is proposed to be developed to reduce potential impacts on the existing (local) electricity network and the Project's scope 2 greenhouse gas emissions.
- The Project is proposed to be a nil-water-release system, with water managed and treated for reuse (supported by the proposed bi-directional pipeline). Maximising water reuse will minimise requirements for pumping and the need for water extraction from rivers, reducing potential greenhouse gas emissions.

- Tailings material will be reused as paste backfill for underground stopes. Alternative backfill paste options would require materials to be quarried from alternative sources with consequential greenhouse gas emissions. The proposed approach, therefore, represents a sustainable reuse of materials and avoidance of greenhouse gases associated with alternative sources of materials.
- Project ore will be transported to the Tritton processing facility by road, and the tailings material generated will be transported back to the Project by the same trucks for reuse. The dual use of these vehicles represents an efficient reuse of transport resources and will avoid greenhouse gas emissions by minimising the fuel for the necessary transport of materials.
- During Project operation, staff access to the site will predominantly be via 12-seater shuttle buses, with approximately 65% of staff movements using this transport form. This arrangement will reduce the potential greenhouse gas emissions compared to staff transport by light vehicles.

The following strategies are planned to be implemented for the Project construction and operational phase to avoid and minimise impacts:

- Management strategies for different waste classes will be implemented. The waste management hierarchy (i.e. avoid, reduce, reuse, recycle, recover, treat and disposal) will be adopted when handling waste.
- A Workforce Accommodation Strategy will be developed to mitigate the impacts on housing demands during the proposed construction phase of the Project.
- Prior to commencing construction, a Traffic Management Plan will be developed to minimise potential road safety impacts and ensure sound road infrastructure performance.
- Various Tritton Copper Operations management plans will be adopted/updated to incorporate the management of Project activities. These management plans will support ongoing minimisation and mitigation of environmental, social, economic and cultural impacts.

When Project impacts on ecological values cannot be suitably mitigated or managed, biodiversity offset mechanisms have been proposed (refer to Chapter 6, Environmental assessment, Section 6.7). Biodiversity offsets have been calculated in accordance with relevant NSW regulations and guidelines to achieve 'no net loss standards'.

S.5 Impact assessment

Comprehensive technical studies have been completed by appropriately qualified and experienced personnel to ensure potential environmental, social and economic impacts associated with the proposed Project have been adequately assessed. Technical studies have also identified management measures to be implemented to avoid and/or mitigate the potential impacts identified.

Findings of the technical studies are summarised in the main body of this EIS, with these reports also attached as appendices to the EIS.

The following sub-sections provide an overview of the key findings of each impact assessment undertaken.

S.5.1 Soil and land capability

A land and soil capability assessment was undertaken for the proposed Project. This assessment included desktop analysis, soil survey and laboratory testing to identify the Project area soil properties, land capability and land suitability. Three soil management units were identified to occur across the Project area, including colluvial, alluvial and sandstone soil management units.

Findings from the assessment indicate that the Project mine site area is predominantly capable of supporting low-impact agricultural uses. Proposed Project activities have the potential to impact land capability in the Project area, with soil erosion and sedimentation considered key potential impacts. Commitments and

management measures have. Therefore. been developed to minimise the Project's impact on land and soil resources.

Following mining, the intention for mine closure and rehabilitation is to reinstate pre-mining native woodland vegetation communities on most of the Project area. Post-mining land uses will, therefore, be compatible with the surrounding land use of grazing native vegetation.

Management measures have been proposed to mitigate the potential impacts of the Project on soil erosion, soil attributes, agriculture and surrounding land uses. The assessment of the Project has determined that stable rehabilitated landforms can be achieved by establishing and maintaining suitable ground cover. With the specified cover that will be applied during the rehabilitation phase, landforms are expected to be erosionally stable.

S.5.2 Subsidence and geotechnical

A subsidence and geotechnical assessment was undertaken for the proposed Project to provide an assessment of subsidence and geotechnical stability risks. The subsidence assessment utilised a combination of industry precedent experience from similar nearby underground mines and the Mathews/Potvin Stability Graph Method. Subsidence was determined to be unlikely, given the adopted stope sizes, sequencing of mining and adequate backfilling of all stopes. The potential impacts associated with subsidence were also anticipated to be low, as the potential surface fracturing and deformation are only considered possible within the open pit footprint.

The stability of proposed structures and other landforms were assessed and predicted to be stable based on their proposed designs, specifically:

- the open pit structure;
- the underground structures;
- the waste rock emplacement; and
- the heap leach pad landform.

Mitigation and management measures will also be implemented to ensure geotechnical performance is in accordance with assessment predictions.

S.5.3 Geochemistry

A geochemical assessment was undertaken for the proposed Project to assess the geochemical characteristics of the mine materials and their risk on the environment, including:

- waste rock;
- tailings;
- oxide ore; and
- heap leach materials.

The overall environmental risk from the mineral materials from the Project site was considered to be low. The majority of waste rock samples analysed, with a combined total of 83%, were considered acid-consuming or non-acid-forming. The geology of the open pit has a low sulphide mineralised volume and low sulphide content. The majority of the open pit is, therefore, geochemically benign in comparison to most other metalliferous projects.

In terms of extracting the underground resource, potentially acid-forming waste materials will be preferentially returned underground to backfill stopes, placed in the open pit after open pit mining is completed, or placed in contained cells in the waste rock emplacement. The minimal exposure of potentially acid-forming materials to oxidation is expected to keep their pH at neutral levels and not pose an environmental risk. Tailings returned to

the Project site (after processing at Tritton Copper Mine) will be managed as paste backfill into the underground void.

Notwithstanding the low potential for geochemical impacts, management strategies have been proposed to minimise potential impacts on the environment. As such, Project geochemical impacts are expected to be minimal.

S.5.4 Groundwater

A groundwater impact assessment was undertaken for the proposed Project, supported by the development of a groundwater model. The groundwater model was a numerical model that followed Australian Groundwater Modelling Guidelines. The model was also subject to independent peer-review, with potential impacts assessed according to the NSW Aquifer Interference Policy.

The modelling predicted groundwater drawdown of 1 m within a radius of approximately 1,700 m at the end of mining (Figure S.4). A further 600 years after mining, the modelling predicts that three registered bores will record drawdown of less than 2 m. Post mining, a pit lake will form in the final void of the open cut mine. The post-mine pit lake will be a terminal sink, where the hydraulic gradient of the groundwater will result in groundwater entering the pit. The pit lake will lose water from evaporation, and no pit lake water will seep into the groundwater. The average pit lake water level is predicted to remain approximately 10 m below the existing pre-mining groundwater level.

The potential impacts from changes to groundwater level and quality meet the NSW Aquifer Interference Policy Level 1, Minimal Impact Considerations and are, therefore, considered acceptable. Given the negligible predicted groundwater impacts, no significant impacts to groundwater-dependent ecosystems or groundwater users are expected. Groundwater monitoring and a water management plan have nonetheless been proposed to monitor local groundwater resources and identify any potentially unforeseen impacts.

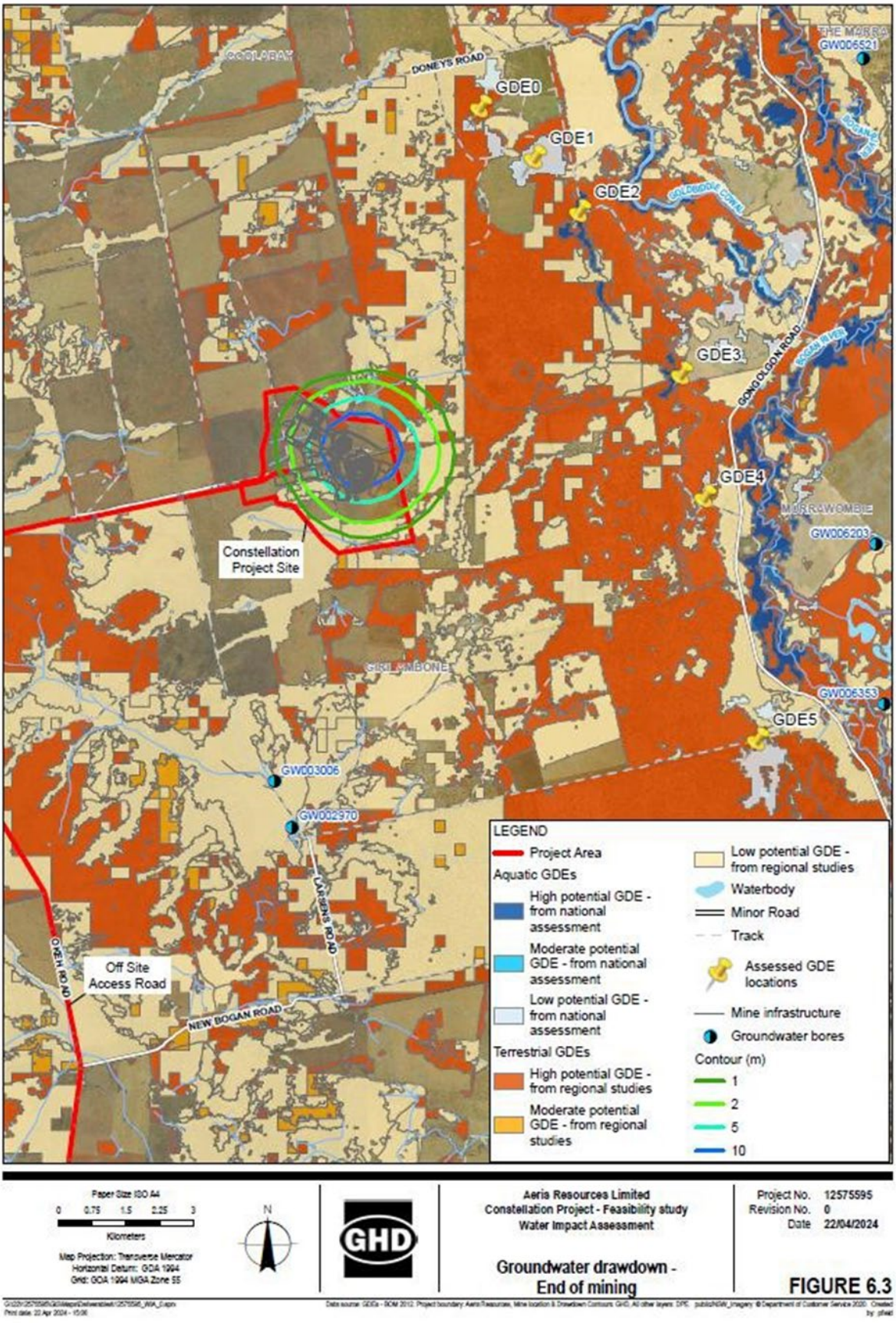


Figure S.4: Groundwater drawdown at the end of mining

S.5.5 Surface water

An assessment of potential surface water impacts was undertaken for the proposed Project. This assessment identified that there are no significant surface water features within the Project site or immediate surroundings.

Project water demands will be met through utilising existing water licences held by Aeris, as well as water captured through on-site storage infrastructure.

A site water balance model was developed to assess the potential for surface water impacts, while a final void water balance model was also developed to assess the performance of the residual pit lake (post-mining). The proposed site water management system is designed as a nil-release water management system, significantly reducing the risk of impacts to the receiving environment. The final void pit lake is predicted to remain at least 22 m below ground level at all times for the modelled 600 years post-mining, with no overtopping or release to the local surface water environment anticipated.

A water management plan (including a surface water monitoring program) is proposed to monitor potential impacts to surface water values throughout the life of the proposed Project.

S.5.6 Flooding

Assessment of flooding impacts was undertaken with two-dimensional numerical modelling of impacts of 20% annual exceedance probability. This assessment predicts negligible changes to floodplain inundation and no negative changes to the flood immunity of the Mitchell Highway.

S.5.7 Water management

The proposed water management system comprises:

- diverting clean water upgradient of disturbance areas;
- collecting water from disturbance areas; and
- moving water for operational needs via an underground, bi-directional pipeline (between the Murrawombie Copper Mine and the proposed Project).

Site water management infrastructure has been designed as nil release (supported by pumped transfers to the Murrawombie Copper Mine). Off-site discharges from site water storages are unlikely, predicted to occur only in very rare rainfall events exceeding the 1% annual exceedance probability design criteria. Sewage will be treated on-site for disposal via irrigation or an evaporation trench.

S.5.8 Biodiversity

A biodiversity development assessment report was prepared by an accredited assessor (in accordance with the biodiversity assessment method) to assess the impacts of the Project on biodiversity values. The survey effort consisted of a desktop assessment and seven field surveys between 2022 and 2023.

Floristic vegetation surveys were conducted to identify field-validated plant community types (PCTs) and targeted surveys were conducted for relevant threatened species.

The field-validated PCTs of the Project area are shown in Figure S.5 to Figure S.7. The Project will impact two PCTs:

1) 97.15 ha of PCT 103 – Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (predominantly as a derived native grassland of this vegetation), and
2) 0.09 ha of PCT 105 - Poplar Box grassy woodland on flats mainly in the Cobar Peneplain Bioregion and Murray Darling Depression Bioregion.

Key measures were incorporated into the Project design to avoid biodiversity impacts as far as practicable.

No 'Threatened Ecological Communities' (*Biodiversity Conservation Act 2016)* or 'Threatened Flora Species' (*Environment Protection and Biodiversity Conservation Act 1999)* were found within the Project area.

It is acknowledged that two threatened fauna species were recorded in the Project area:

1) Major Mitchell Cockatoo; and
2) Southern Whiteface.

Key measures have been incorporated into the Project design to avoid biodiversity impacts. For unavoidable impacts, reasonable and practicable mitigation measures are proposed to minimise potential impacts during all Project phases. Impacts requiring offsets, according to the biodiversity assessment method, total 259 ecosystem credits. The Project design decisions have achieved avoidance of any impacts requiring species credits.

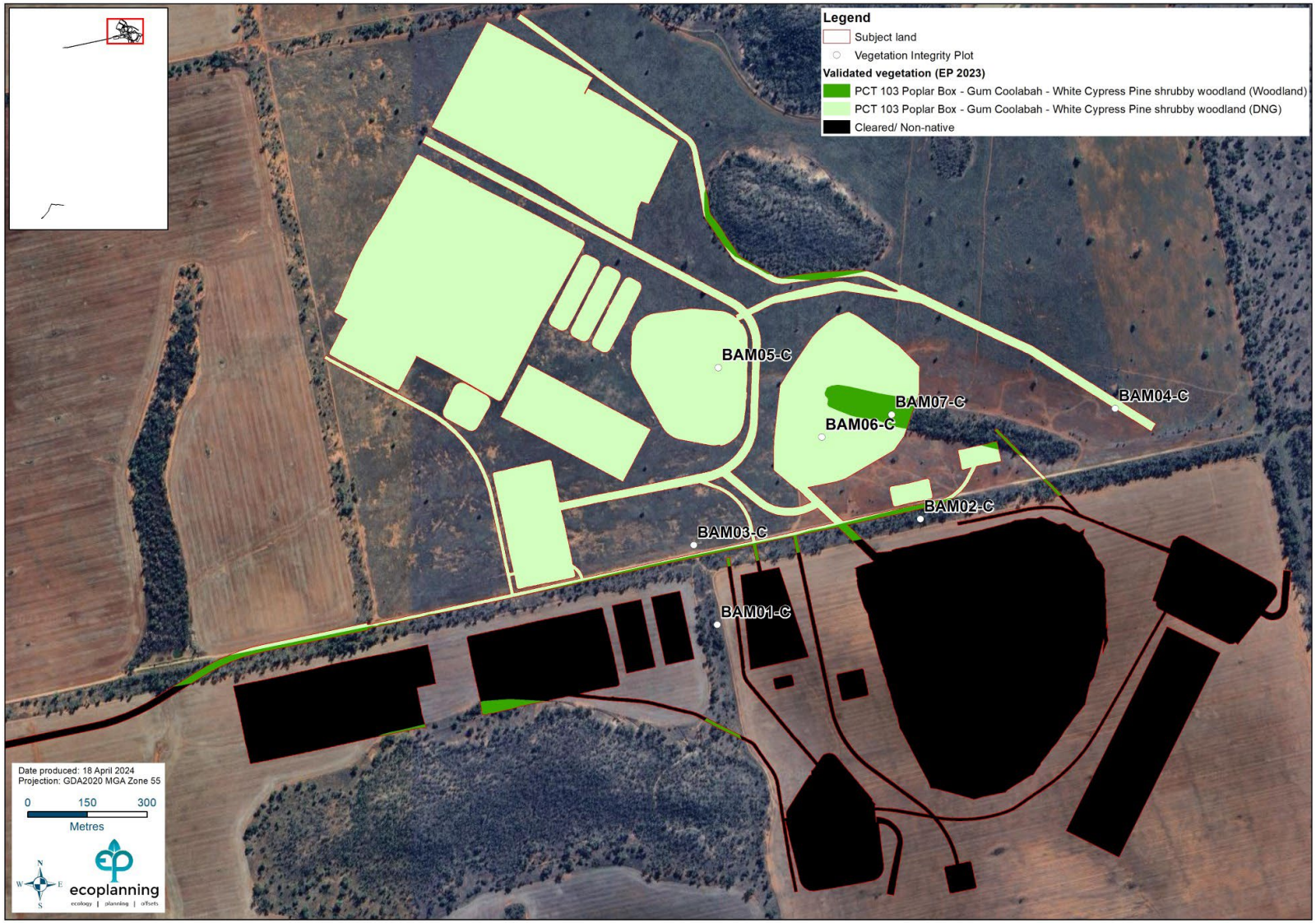


Figure S.5: Field-validated plant community types in the Project site



Figure S.6: Field-validated plant community types northern infrastructure corridor area

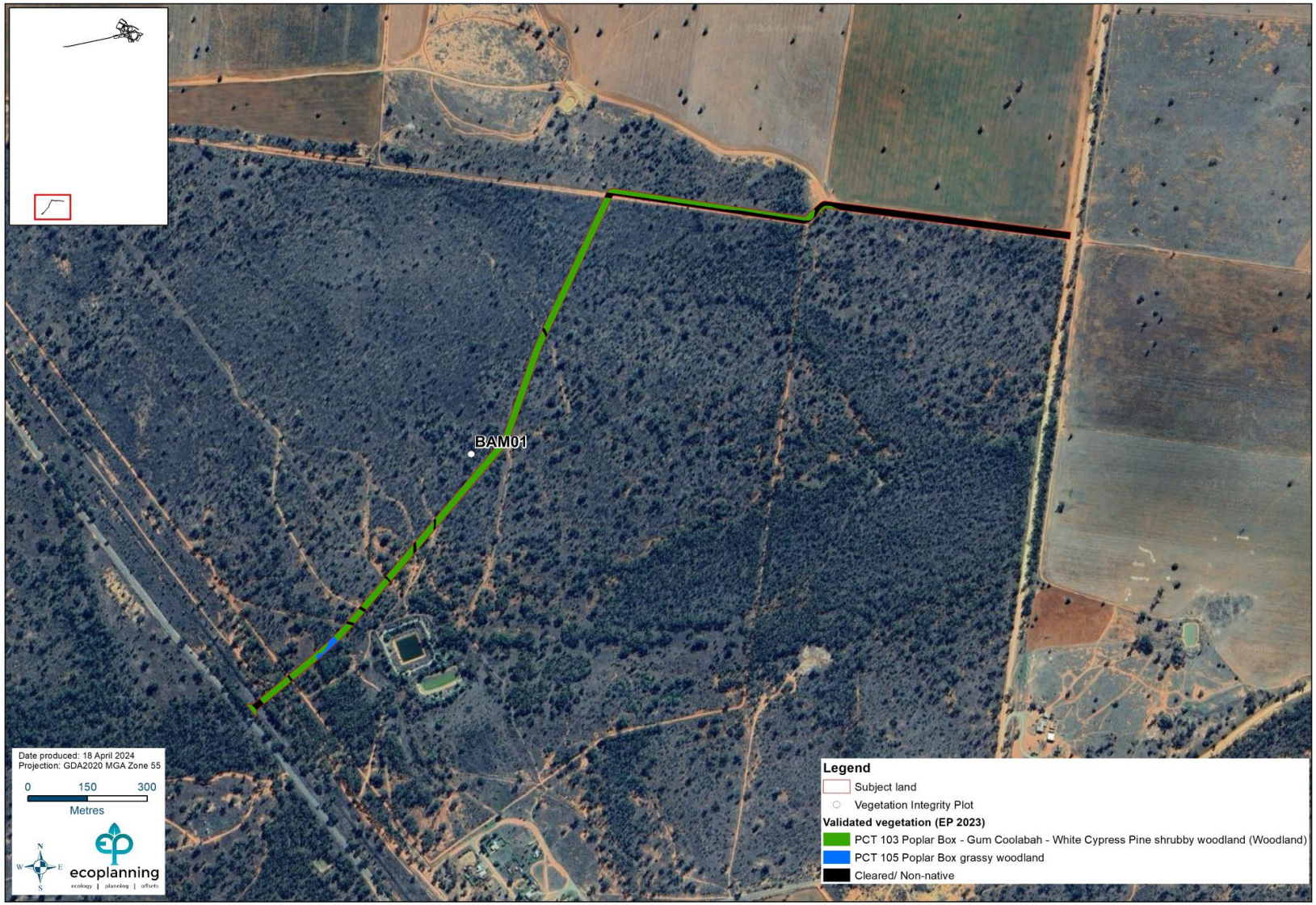


Figure S.7: Field-validated plant community types in the southern infrastructure corridor area

S.5.9 Air quality and greenhouse gases

An air quality impact assessment was undertaken to assess potential air quality impacts on nearby sensitive receptors. Emission sources from the Project include:

- surface activities, such as Project construction;
- topsoil removal and handling;
- open cut mining; and
- vehicle movements.

Air dispersion modelling was utilised to predict potential impacts considering Project emissions in isolation, as well as representing incremental emissions to the existing (baseline) air environment. Results were analysed against NSW EPA air quality criteria and Voluntary Land Acquisition and Mitigation Policy criteria.

Thirty-five sensitive receptors were identified (Figure S.8) in proximity to the Project and proposed haul route. The nearest sensitive receptor to the Project is approximately 4.6 km to the west, and the nearest sensitive receptor to the haul road is approximately 55 m to the west (adjacent to the existing Mitchell Highway).

Results of the air quality assessment found that emissions into the air are expected to comply with all relevant criteria at all sensitive receptors. An additional assessment evaluating potential impacts from airborne metal emissions was also undertaken for the Project. This assessment identified no significant risk of airborne metal emissions.

An Air Quality Management Plan and monitoring program are proposed to monitor ongoing compliance of air quality emissions. Mitigation measures have also been proposed and are expected to be effective in reducing the potential for both dust and airborne metal emissions.

The Project will generate greenhouse gas emissions, which have been estimated in accordance with the National Greenhouse and Energy Reporting framework. The predicted annual scope 1 and scope 2 emissions for the Project's peak emission year represent approximately 0.01% of Australia's total emissions.

Significant greenhouse gas mitigation measures have been incorporated into the Project design, and the Project is considered to provide an important contribution to economy scale emissions avoidance by producing materials critical to global emissions avoidance. The proposed Project is, therefore, expected to be able to comply with applicable greenhouse gas regulations through the application of the proposed measures.

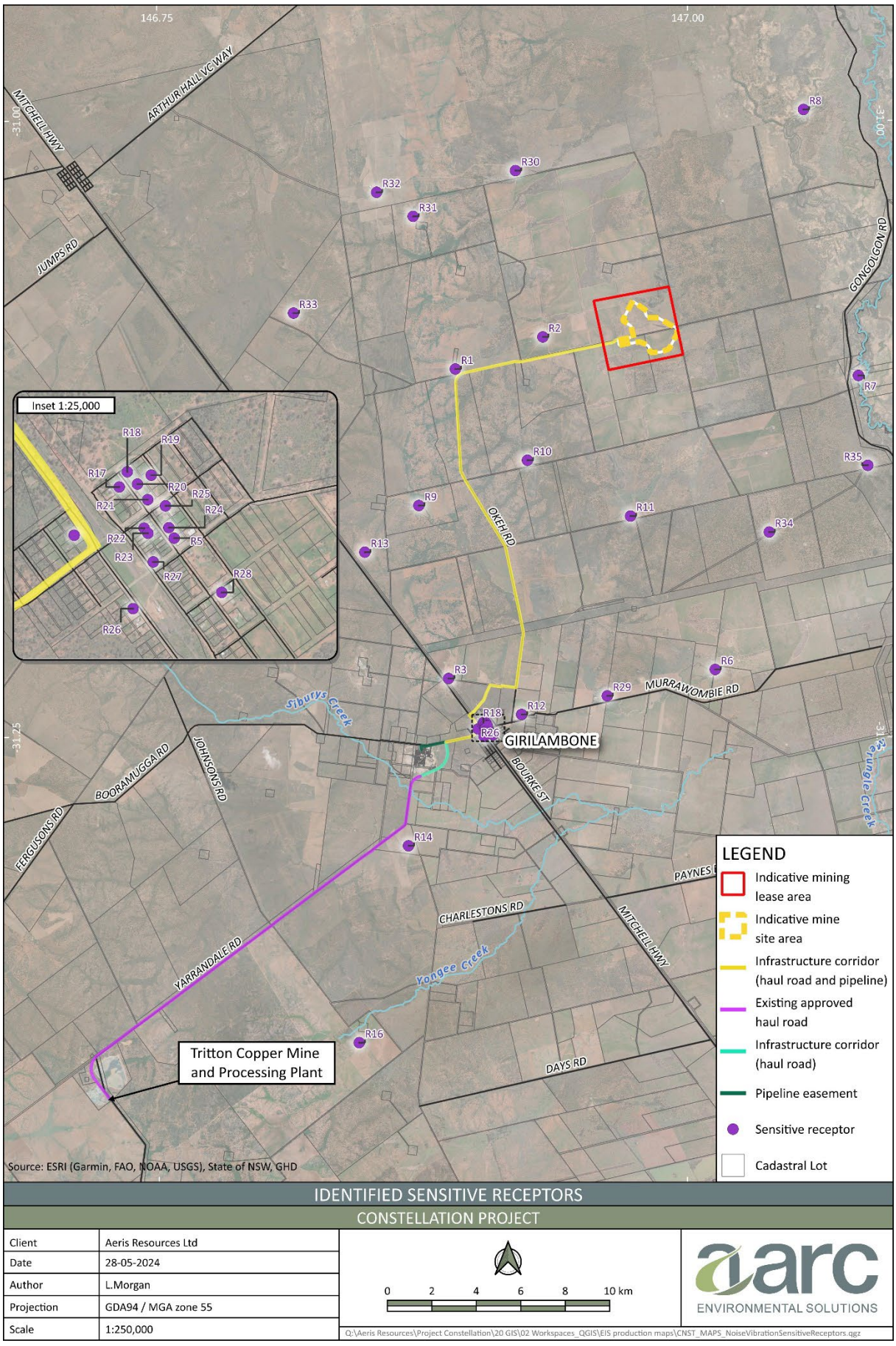


Figure S.8: Identified sensitive receptors

S.5.10 Noise, vibration and blasting

A noise impact assessment was undertaken for the proposed Project, in accordance with the Noise Policy for Industry, the Interim Construction Noise Guideline and the NSW Road Noise Policy. This assessment considered potential noise impacts on sensitive receptors. A blasting impact assessment was also undertaken to assess potential impacts of blasting activities on sensitive receptors.

Thirty-five sensitive receptors were identified (Figure S.8) in proximity to the Project site and proposed haul route.

Modelling of a worst-case noise scenario was adopted to assess the potential impacts of the Project on sensitive receptors. This scenario assumed the maximum number of plant and equipment operating simultaneously at the site, under noise enhancing conditions. Noise impacts were considered for both construction and operational phases of the Project. Modelling results found that noise levels would be within applicable NSW noise criteria at all sensitive receptors. Notwithstanding this, noise mitigation and management measures have been proposed to ensure noise emissions are minimised where possible.

Of the 35 sensitive receptors identified (Figure S.8) nine were identified to be located within the maximum extent potentially impacted by blasting activity. Potential impacts associated with blasting activities were assessed against relevant criteria, including airblast overpressure and ground vibration. The blasting impact assessment concluded that the activities of the Project are suitable to meet relevant criteria, with no additional operational controls or mitigation measures required. Notwithstanding this, the Tritton 'Noise and Vibration Management Plan' is committed to be updated to minimise potential impacts where possible.

S.5.11 Hazard, risk and public safety

Potential off-site risks posed by hazardous materials were assessed through a preliminary hazard assessment. undertaken for the proposed Project. The assessment process followed the Multi-level Risk Assessment framework, evaluating potential risks to people, property and the environment.

Four hazardous material categories were identified to be relevant to the Project:

1) hydrocarbons;
2) chemicals;
3) explosives; and
4) waste.

The risks posed to the off-site environment and the public during the handling, storage and transporting of these hazardous materials have been assessed under different potential incidents, such as:

- spills/leaks;
- Fire;
- explosions; and
- malicious acts.

Potential consequences have been evaluated using a qualitative method, and 28 off-site risks associated with hazardous materials on the environment and public safety were identified:

- 15 class I risks;
- 12 class II risks; and
- 1 class III risk.

After considering mitigation measures, the residual risk of 27 of the 28 hazards were considered to be low (class I), with one risk identified to be class II. The class II risk is associated with potential off-site impact on surface water or soil as a result of the risk of spills/leaks from heap leach facility.

The risks identified were used to guide the environmental assessments undertaken for the EIS, with risks associated with the heap leach facility considered in the geotechnical and water impact assessments.

A number of existing management plans for Tritton Copper Operations are proposed to be revised and updated, while new plans will also be developed as necessary to support the management of risks identified for the Project.

S.5.12 Heritage

An Aboriginal cultural heritage assessment was undertaken for the proposed Project in accordance with NSW statutory processes and guidelines. The assessment was conducted in cooperation with registered Aboriginal parties to identify Aboriginal cultural heritage values.

Searches of the Aboriginal Heritage Information Management System were undertaken in 2021, 2023 and 2024, with no recorded Aboriginal heritage sites identified within the Project site.

An archaeological field survey of the Project area was also undertaken, identifying 45 new Aboriginal cultural heritage sites. Sites identified were predominantly scarred trees, with five sites identified as potential archaeological deposits requiring further subsurface testing.

Potential direct and indirect harm to the identified Aboriginal cultural heritage sites were assessed. The management hierarchy for the conservation principles was used to refine the Project layout, and subsequently avoid impacting 35 sites.

Eleven sites are, therefore, now predicted to be impacted by the proposed Project, including five sites expected to be totally impacted and six expected to be partially impacted.

Impacted sites are considered to have low or moderate scientific significance, low aesthetic significance and low historical significance. Further archaeological testing and salvage in consultation with Aboriginal parties is proposed for impacted sites.

In addition to the potential salvage of impacted sites, management commitments include the establishment of

- ‘no-go zones’;
- ongoing consultation with local Aboriginal parties;
- development of an Aboriginal Heritage Management Plan;
- subsurface testing of potential archaeological deposits, and
- temporary fencing installation.

A historical heritage assessment was also undertaken for the proposed Project. From searches of national, state and local heritage registers, no listed heritage sites were identified to exist within the Project impact area

Site inspections were conducted at the Project site and infrastructure corridor route. They identified two moderate local significance sites in the vicinity of Girilambone, outside of the Project impact area. The historic heritage assessment, therefore, determined that the Project will not impact any significant heritage sites.

S.5.13 Social

A social impact assessment was undertaken for the proposed Project. The assessment was prepared in consultation with Project stakeholders, identified through a scoping exercise. Project stakeholders were engaged through:

- surveys;
- semi-structured interviews;
- online information sharing;
- community meetings; and
- information briefings.

Concerns have been collated during the stakeholder consultation process.

The social impact assessment undertaken for the proposed Project has found that a range of positive and negative impacts are anticipated to arise. The most significant negative impacts are identified to relate to:

- acquisition of freehold land required to execute the Project;
- increased demand for housing in the social locality;
- increased traffic (haul trucks); and
- health and wellbeing (including mental health) impacts on the workforce and landowners (Appendix 10, Social impact assessment).

Following the application of recommended mitigations, however, all identified negative impacts would be reduced to a significance of medium or low.

Positive impacts predicted to arise as a result of the proposed Project were identified to include:

- Increasing permanent population through the operations workforce would have a positive effect on community life.
- Enhancing the contribution of the Project to building social capital and community resilience.
- Contributing to the community by providing employment certainty for existing workers, increasing employment opportunities and, therefore, reducing levels of stress.
- Providing both new and ongoing employment opportunities, while also providing opportunities for local procurement (supporting local and regional business) and providing tax revenue for the NSW economy.

Community engagement and consultation have been, and will continue to be, conducted throughout the EIS process and Project operations. Engagement methods primarily focus on the 'inform' to 'collaborate' approaches and are designed to encourage stakeholder participation in the Project.

Government stakeholders and community stakeholders were identified. Community stakeholders included:

- local landholders;
- the Girilambone community;
- the Nyngan community;
- local community groups;
- Indigenous interest holders; and
- local service providers.

The engagement approach included a combination of:

- community surveys;
- semi-structured interviews;
- information briefings;
- community meetings; and
- communication via phone, email, and social media.

Stakeholder engagement is proposed to continue following approval of the Project, and ongoing engagement is seen as central to enabling negative impacts to be minimised, while also enhancing or maximising positive impacts.

S.5.14 Economics

An economic impact assessment has been undertaken to evaluate the beneficial and adverse impacts of the Project on local, regional, state and national environments.

The assessment utilised a local effects analysis based on regional catchment data to determine economic impacts. Key findings of the economic impact assessment are summarised as follows.

Economic output

- During the construction phase:
    - a total of $144.7 million in output for businesses in the regional catchment and an additional $136.6 million in direct and flow-on output for businesses in NSW outside of the regional catchment; and
    - $62.4 million in gross regional product for the regional catchment and an additional $69.8 million in gross regional product for the rest of NSW, for a total of $132.1 million in gross state product in NSW, attributable to business activity.
- During the operational phase:
    - an average output of $179.5 million per annum in the regional catchment and an additional average output of $122.1 million per annum in direct and flow-on impacts for businesses in NSW outside of the regional catchment; and
    - an annual average of $111.4 million in gross regional product in the regional catchment and an additional $60.0 million in average annual gross regional product for the rest of NSW, for a total of $171.4 million in gross state product per annum in NSW, attributable to business activity.

The proposed Project will also provide significant benefits to local and regional employment, household incomes in the Project locality and Commonwealth and State government revenues.

Adverse impacts as a result of the proposed Project were evaluated for the following:

- agricultural productivity;
- greenhouse gas emissions;
- traffic generation;
- ecosystem services;
- local businesses through competition for resources;
- local property market; and
- local infrastructure and service provision.

While adverse economic impacts may arise as a result of the proposed Project, these impacts were assessed to be of relatively low consequence. Indeed, the economic impacts of the Project are anticipated to be overwhelmingly positive.

S.5.15 Traffic and transport

A traffic impact assessment was undertaken in accordance with relevant guidance documents from Transport for NSW, Roads and Traffic Authority, and Austroads.

Project-generated traffic will include the transport of ore, tailings, equipment and materials, and personnel movements. Project transportation will utilise existing roads (state- and council-controlled) as far as practicable, with a new section of haul road proposed (linking the Mitchell Highway and Okeh Road) to avoid traffic traversing through Girilambone township.

Additional traffic generated by the proposed Project is anticipated to have a very minor impact on the surrounding transport environment. As per the findings of the transport impact assessment:

- Increases to traffic volumes (resultant of the Project) will be minor, with predicted peak traffic volumes (during the AM and PM peak periods) not expected to exceed a total of 36 vehicle movements.
- Impacts on intersection performance are expected to be indiscernible, with modelling demonstrating a Class A level of service across all intersections across all Project phases.
- Impacts on road network performance are expected to be minor, with the modelled level of service predicted to be Class A across all Project phases.
- There are no specific safety concerns with the existing road transport environment that would be exacerbated by the proposed mine.
- Safe intersection sight distances are achievable at both intersections of the Mitchell Highway.
- The turn warrant assessment undertaken indicates basic turn treatments are required for the two Mitchell Highway intersections. Notwithstanding this:
    - a channelised right-turn treatment has been adopted for Mitchell Highway/proposed haulage road intersection (exceeding assessment requirements); and
    - a basic left turn treatment has been adopted for the Mitchell Highway/Railway Road intersection.

A Traffic Management Plan will be prepared prior to the commencement of Project construction to minimise potential road safety impacts and ensure sound road infrastructure performance.

S.5.16 Visual amenity

A visual assessment was undertaken to assess the potential impact on visual amenity from the Project site and haulage route. Methods utilised were adopted from relevant guidance documents. Landscape and visual impacts were evaluated based on the maximum visual impact when all visible features were present at maximum extent and size.

Sensitive receptors in the vicinity of the Project disturbance were determined to be the same with air, noise, vibration and blast (Figure S.8). One potential sensitive receptor is within a 5 km radius of the Project site and 21 potential sensitive receptors are within the same radius of the haulage road.

One receptor is expected to experience a moderate visual impact from the haulage route, and one receptor is expected to experience a moderate to low level visual impact from the Project site.

The visual impacts at other sensitive receptors are expected to be negligible.

With regard to broader landscape impacts, the overall impact of the proposed Project on the surrounding environment is expected to be minimal, with impacts also not proposed to be permanent. Mitigation measures have been proposed to reduce visual amenity impacts at sensitive receptors and in the landscape.

S.5.17 Cumulative impacts

The cumulative impacts of the Project were assessed in accordance with relevant guidance documents, whereby the assessment was proportionate to the scale and significance of the potential cumulative impacts of the proposed Project combined with the impacts of other relevant future projects.

All impact assessments undertaken for the proposed Project have considered existing projects within baseline conditions. Many impacts have also been committed to be mitigated when possible, resulting in impacts to all environmental values being assessed as meeting relevant regulatory requirements. Further, it is considered that there is limited potential for combined incremental impacts to arise on a background of compliance with regulatory requirements.

Future potential projects were also considered in regard to cumulative impact potential. However, they were identified to have limited opportunity to present cumulative impacts with the proposed Project due to both distance and timing considerations. As such, issue-specific, cumulative impact assessment or combined cumulative impact assessment were not considered necessary for the proposed Project.

S.5.18 Rehabilitation and closure

A rehabilitation strategy has been prepared in accordance with the Project Secretary's Environmental Assessment Requirements, with the aim of creating safe, stable and non-polluting post-mining landforms. Aeris is proposing to progressively rehabilitate the land to its pre-mining land use, which is primarily grazing on native/introduced mixed pastures.

While rehabilitating Project land, the Aeris is also aiming to improve the biodiversity values of the area by re-establishing local Indigenous woodland communities as part of the rehabilitation program. Project rehabilitation goals are:

- to remove all Project-related infrastructure not required by the final land use;
- to restore a safe, stable and non-polluting landform;
- to reinstate the soil profile and function, creating landforms that are compatible with the surrounding topography and pre-mining land uses; and
- to establish a landscape that permits the land use of livestock grazing on native/mixed pastures, while also enhancing biodiversity values lost due to past agricultural clearing.

The Project comprises seven identified mining domains, which include:

1) infrastructure areas (54 ha);
2) waste rock emplacements (40 ha);
3) water management areas (30 ha);
4) the heap leach pad (18 ha);
5) underground mine (3 ha);
6) open cut pit (12 ha); and
7) topsoil stockpiles (17 ha).

Six final land uses have been proposed for the seven mining domains, which are summarised as follows:

1) Infrastructure areas will be reinstated to agriculture grazing land use, with the exception of infrastructure identified to be retained (such as sheds, roads and solar farms).
2) The waste rock emplacements and heap leach pad will be rehabilitated as native ecosystems and excluded from grazing:
    a) With the waste rock emplacements rehabilitated as native ecosystems (woodland); and
    b) The heap leach pad and associated liquor ponds rehabilitated as native ecosystems (grassland).
3) Water management structures, including clean water diversions and dams, will be retained for their post-mining beneficial use.
4) The surface disturbance associated with underground mining will be reinstated to an agricultural grazing land use.
5) The final void will be retained. Water quality in the final void is predicted to be mildly acidic and highly saline. Therefore, no beneficial use is expected.
6) The soil stockpiles will be reinstated to an agricultural grazing land use.

The proposed rehabilitated landform is shown in Figure S.9. Rehabilitation and closure methods, objectives and milestones criteria for each final land use have been proposed and detailed.

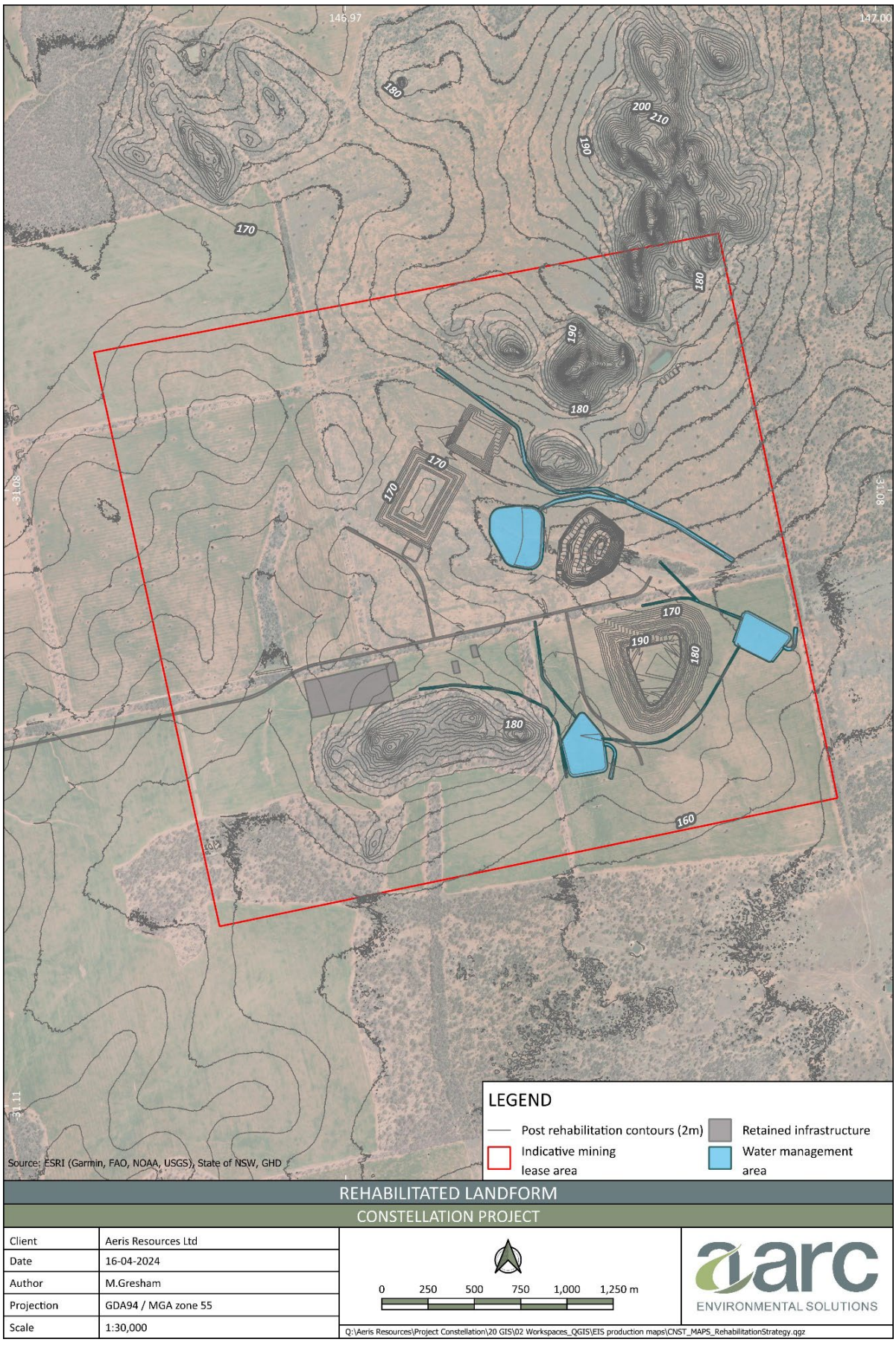


Figure S.9: Rehabilitated landform

S.6 Justification and conclusion

Global demand for copper is forecast to increase in coming years, primarily driven by infrastructure development (particularly from the energy sector), as well as increasing demand for electric vehicles. Copper is, therefore, an important resource in promoting improved living standards and transitioning towards renewable energy.

Copper is considered a 'critical mineral and tech mineral' under the NSW Government's Critical Minerals and High-Tech Metals Strategy 2021. In addition to supporting the demand for copper resources, the proposed Project will provide significant economic benefits to the local, regional, state and national economies.

While the Project is acknowledged to generate some negative impacts on economic, social and environmental values (as assessed in detail throughout this EIS), many impacts have been avoided through the Project design processes adopted. The proposed Project is also considered to embody a commitment to ecologically sustainable development.

Residual impacts have been proposed to be mitigated and managed (through significant commitments) with offsets proposed when necessary.

Investment within regional NSW is also a key strategic outcome, promoting many social advantages and opportunities (locally and regionally).

The proposed Project, therefore, supports a significant opportunity for NSW, while embodying the objectives of ecologically sustainable development.

Project details: Constellation Mine project involving open cut and underground copper mining.

Project name: The Constellation Project

Application number: SSD-41579871

Address of the land in respect of which the development application is made: Okeh Road, Giriliambone

Applicant details

Applicant name: Aeris Resources Pty Ltd

Applicant address: L6, 120 Edward St, Brisbane, Qld 4000

Details of person by whom this EIS was prepared

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Declaration by registered environmental assessment practitioner

Name: David Carberry

Registration number: R80017

Organisation registered with: EIANZ

Declaration

The undersigned declares that this EIS:

- has been prepared in accordance with the Environmental Planning and Assessment Regulation 2021;
- contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the EIS relates;
- does not contain information that is false or misleading;
- addresses the Planning Secretary's environmental assessment requirements (SEARs) for the project;
- identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments;
- has been prepared having regard to the Department's State Significant Development Guidelines - Preparing an Environmental Impact Statement;
- contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development;
- contains a consolidated description of the project in a single chapter of the EIS;
- contains an accurate summary of the findings of any community engagement; and
- contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole.

Signature:



Date: 27th June 2024

Constellation Project

Environmental Impact Statement

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Constellation Project

Environmental Impact Statement



Chapter 1 – Introduction

1 Introduction

The proponent for the proposed Constellation Project (the Project) is Tritton Resources Pty Ltd—a wholly owned subsidiary of Aeris Resources Ltd (Aeris).

Aeris is an Australian Securities Exchange listed base and precious metals producer. Aeris owns and operates 'Tritton Copper Operations' in central-western New South Wales (NSW) and strategic mining assets and tenements in Western Australia, Victoria and North Queensland.

Tritton Copper Operations functions as a hub and spoke model, with 'Tritton Copper Mine' serving as the centralised hub where the processing facility is located, with other surrounding deposits (spokes) supplying ore for processing. The Constellation Project is a proposed new spoke of Tritton Copper Operations.

The proposed Project is located approximately 20 km north-east of the township of Girilambone and approximately 55 km north-west of Nyngan, within the Bogan Shire Council local government area (Figure 1-1). The Project is approximately 45 km north-east of the existing Tritton Copper Mine— with other spokes of Tritton Copper Operations shown in Figure 1-1.

The Project proposes to mine copper ore by developing an open cut pit and underground mine. Mined ore will be transported to the Tritton Copper Mine for processing via existing road networks as far as practicable (Figure 1-2). Lower-grade oxide ore will be processed by heap leaching at the Project site. Transport of dewatered tailings material from Tritton Copper Mine back to the Project site (for use in cemented paste fill) will support the underground mining activities at the Project.

The Project proposes to mine an average of 500,000 tonnes of copper ore per annum to replace depleting production from Aeris' existing Tritton Copper Operations. However, peak volumes of ore transported to the Tritton Copper Mine may be up to 1 million tonnes per annum as open cut mining is completed and underground operations ramp up. The anticipated mine life is approximately 16 years, inclusive of the initial Project construction period and the rehabilitation/closure period. There is potential for future mine life extensions as the deposit is developed down plunge (to depth).

Rehabilitation will occur progressively where possible, noting that disturbance associated with the Project site will be very small, comprising an area of approximately 170 hectares.

Aeris wishes to acknowledge a grant for the Project from the NSW Government Critical Minerals and High-Tech Metals Activation Fund, which has contributed to the development of this:

- environmental impact statement (EIS); the
- social impact assessment; and
- studies to optimise resource extraction and processing.

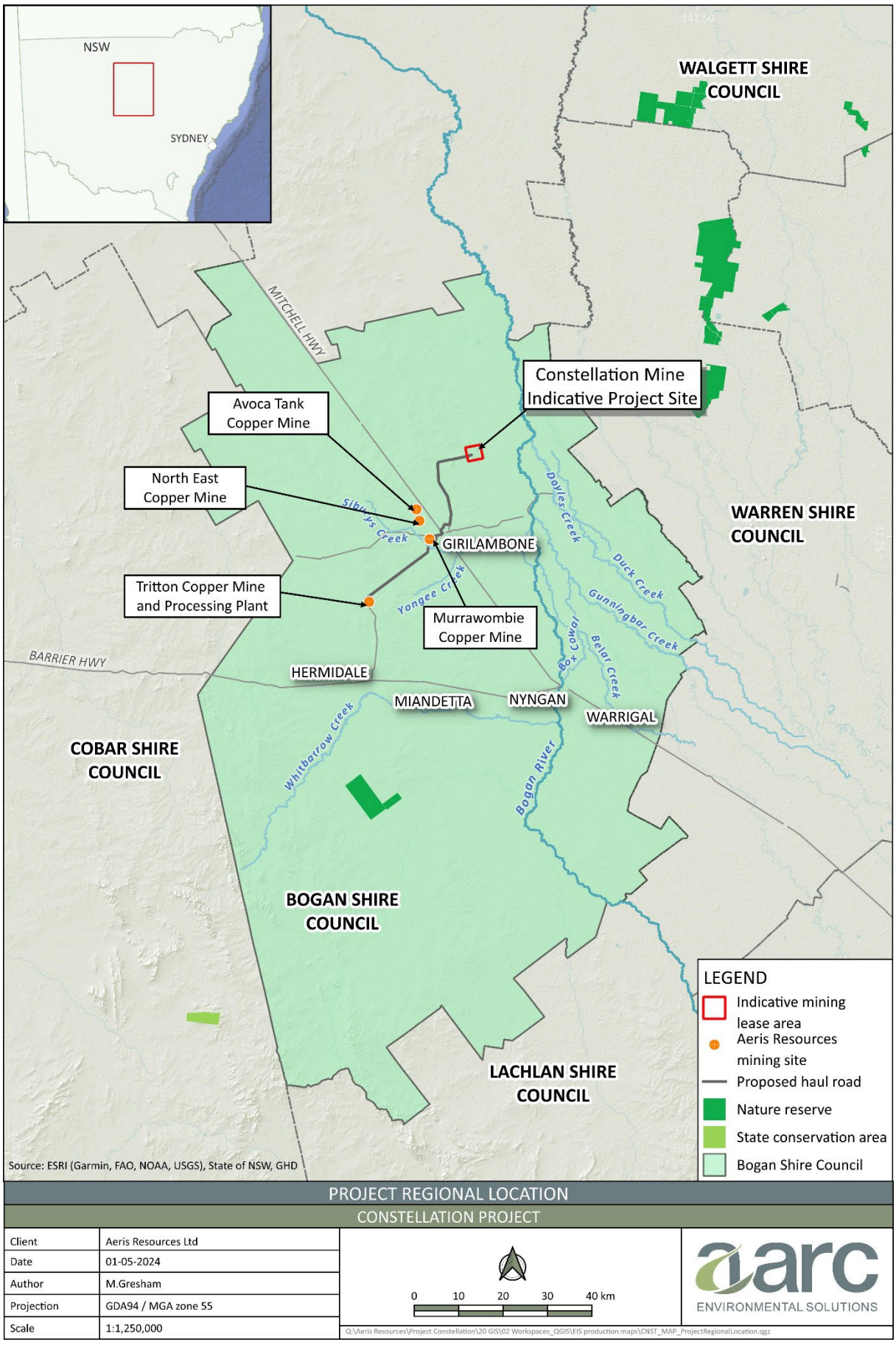


Figure 1-1: Project locality

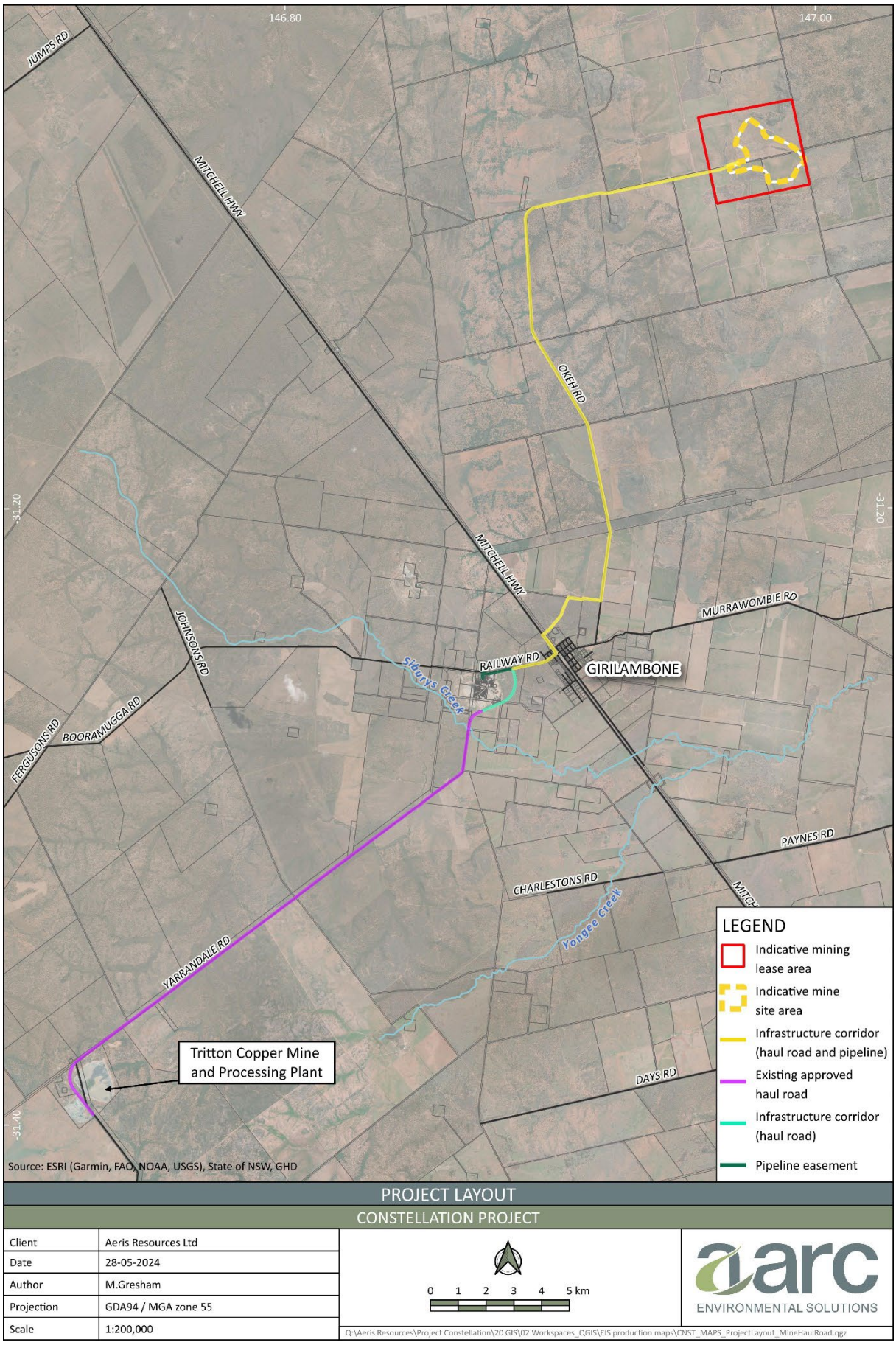


Figure 1-2: Project layout

1.1 Secretary's Environmental Assessment Requirements

The Project has been determined to be a State Significant Development (SSD) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the State Environmental Planning Policy (Planning Systems) 2021, having a capital investment value greater than $30 million.

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) for the Project were issued on 26 May 2022 (application number SSD-41579871). These SEARs have subsequently been updated (extended) on 24 April 2024, retaining the same application number. The final Project SEARs are provided as EIS Attachment 1. Further, Attachment 2 of this EIS describes where each individual SEARs has been addressed (Reconciliation Table).

This EIS has been prepared to support an application under Part 8 of the Environmental Planning and Assessment Regulation 2021 (the Regulation) in accordance with the Department of Planning, Industry and Environment's (DPIE) State significant development guidelines–preparing an environmental impact statement (July 2022).

1.2 Purpose of the EIS

The primary objective of this EIS is to inform government, regulatory agencies, local and regional communities and other stakeholders about the Project so they can make decisions and/or submissions based on the merits of the Project. As part of achieving this objective, this EIS will:

- describe the Project's potential social, economic and environmental impacts;
- identify measures that will be implemented to minimise, mitigate, manage and monitor the Project's potential impacts; and
- address the requirements provided in the Project's SEARs.

1.3 Project applicant

The applicant for the Project is Tritton Resources Pty Ltd—a wholly owned subsidiary of Aeris Resources Limited (ABN: 30 147 131 977). Registered address and postal address:

Aeris Resources Limited
Level 6
120 Edward Street
Brisbane 4000 Qld, Australia.

Aeris owns and operates Tritton Copper Operations in NSW, under the wholly owned subsidiary Tritton Resources Pty Ltd. Tritton Copper Operations currently includes the existing:

- Tritton Copper Mine on Mining Lease (ML) 1544;
- Murrawombie Copper Mine on ML 1280;
- North East Copper Mine on ML 1383; and
- Avoca Tank Copper Mine on ML 1818.

Mined copper ore from satellite mine sites is processed at the existing 1.4 Mtpa capacity, Tritton processing plant.

Further details about Aeris' projects, sustainability policies, environmental reports, corporate governance and investor information are available on the company website: https://www.aerisresources.com.au/.

1.4 Application approach

1.4.1 EIS and studies team

AARC Environmental Solutions Pty Ltd (AARC) has been engaged by Aeris to prepare and submit an EIS to support an SSD application for development consent in accordance with Section 4.12 of the EP&A Act.

Environmental assessments to support the EIS have been completed by AARC and the following supporting consultants:

- Pells Sullivan Meynink Pty Ltd (PSM)—Geotechnical Assessment (including subsidence);
- Ecoplanning Pty Ltd (Ecoplanning—Biodiversity Development Assessment Report;
- Niche Environment and Heritage Pty Ltd (Niche)—Aboriginal Cultural Heritage Assessment Report and the Historic Heritage Assessment;
- GHD Pty Ltd (GHD)—Water Impact Assessment;
- Energy & Water Pty Ltd—Groundwater Modelling Report (Appendix Report);
- Stantec Australia Pty Ltd (Stantec)—Transport Impact Assessment;
- Todoroski Air Sciences Pty Ltd (Todoroski)—Air Quality Impact Assessment and Noise Impact Assessment;
- TAP Consulting (TAP)—Social Impact Assessment;
- AEC Group Pty Ltd (AEC)—Economic Impact Assessment; and
- RGS Environmental Consultants Pty Ltd (RGS)—Geochemical and Pit Lake Modelling Assessment.

1.4.2 Report structure

This EIS has been structured, as shown in Table 1-1, using the guidance provided in the NSW Government's State Significant Development Guidelines–preparing an environmental impact statement (July 2022) and the Project's SEARs.

Table 1-1: Chapter structure of the EIS

Chapter	Title
Summary	
Table of contents	
Chapter 1	Introduction
Chapter 2	Strategic context
Chapter 3	Project description
Chapter 4	Engagement
Chapter 5	Statutory context
Chapter 6	Environmental assessment
Chapter 7	Mitigation and management
Chapter 8	Rehabilitation and closure
Chapter 9	Evaluation and justification

Chapter 10	References
Chapter 11	Acronyms and units

In addition to the chapters that form this EIS, specialist assessment reports are also attached as appendices to the EIS, with various supporting documents included as attachments (Table 1-2).

Table 1-2: EIS attachments and appendices

Appendix/Attachment	Title
Appendices	
Appendix 1	Geotechnical Assessment
Appendix 2	Biodiversity Development Assessment Report
Appendix 3	Aboriginal Cultural Heritage Assessment Report
Appendix 4	Historic Heritage Assessment Report
Appendix 5	Water Impact Assessment
Appendix 6	Blasting Impact Assessment
Appendix 7	Transport Impact Assessment
Appendix 8A	Air Quality Impact Assessment
Appendix 8B	Metals Emissions Assessment
Appendix 9	Noise Impact Assessment
Appendix 10	Social Impact Assessment
Appendix 11	Economic Impact Assessment
Appendix 12	Environmental Risk Assessment
Appendix 13	Preliminary Hazard Analysis
Appendix 14	Greenhouse Gas Assessment
Appendix 15	Geochemical and Pit Lake Modelling Assessment Report
Appendix 16	Visual Impact Assessment
Appendix 17	Land and Soil Capability Assessment
Appendix 18	Rehabilitation and Closure Strategy
Attachments	
Attachment 1	Secretary's Environmental Assessment Requirements (SEARs)
Attachment 2	Secretary's Environmental Assessment Requirements (SEARs) Reconciliation Table
Attachment 3	Stakeholder Engagement Table
Attachment 4	Road Intersections

1.5 Background to the Project

1.5.1 Exploration and copper resource history

The Girilambone basin is one of the richest copper reserves in NSW. Copper resources at Girilambone were first discovered in the late 1800s, followed immediately by mining activities. However, it was not until the late 1900s when a new leaching technology was introduced to Australia that exploration and mining activities at Girilambone and the surrounding area started to boom (McQueen 2018).

The Tritton orebody was discovered in the late 1990s by the Straits/Nord Joint Venture after the nearby Budgerygar mine was explored. It was estimated, between 1993 and 2017, that the total copper extracted from the Girilambone-Tritton area was around 0.4 Mt (McQueen 2018).

Tritton Copper Operations was fully acquired by Straits Resources in 2005, with ownership subsequently passed to Aeris through a corporate restructure. Open cut mining at Tritton Copper Mine was commenced by a previous company in 2004, followed by stope extraction in 2005.

Since 2005, Aeris has progressively developed a hub and spoke network between the Tritton Copper Mine and surrounding satellite mine sites (i.e. Murrawombie, North East and Avoca Tank). With copper ore reserves at existing satellite mine sites anticipated to be exhausted in coming years, the proposed Project to source additional copper ore to supply the Tritton processing plant is critical to ensure the continuity of Tritton Copper Operations.

1.5.2 Site suitability and design constraints

The landscape is gently sloping and suitable to construct and operate the mine surface and associated infrastructure. In addition, the Project area is considered to have limited key environmental constraints, as the proposed location:

- is more than 8 km from the Bogan River;
- has no local or important wetlands on, adjacent to or downstream of the Project site;
- has no identified areas of high conservation value or areas of outstanding biodiversity value;
- has no historical flood impacts, and the Project is not located within the floodplain of the Bogan River;
- has no other significant landscape features, including areas of geological significance (karst, caves, crevices, cliffs, etc.) or soil hazard features within the Project site or the 1,500 m assessment buffer area.

Although the Project will require some fragmented areas of native woodland vegetation to be cleared, such impacts can be minimised, mitigated, and/or offset. The Project site will also be rehabilitated post-mining, consistent with the Rehabilitation and Closure Strategy developed for this EIS.

In developing the conceptual design and implementation, the Project has considered the following environmental and social aspects:

- physical—the fixed location of the orebody and site-specific geological, topographic and climatic factors;
- existing environmental values—groundwater, surface water, biodiversity, soils and air quality;
- social—characteristics, values, land uses, lifestyles, expectations and concerns of community stakeholders;
- cultural heritage—the Aboriginal and non-Indigenous cultural heritage values, expectations and concerns of traditional owners; and
- economic—the commercial viability of the Project and the values, expectations and concerns of Aeris' shareholders, State Government, local landholders and residents and local and regional communities.

These environmental and social aspects have been identified and assessed during baseline studies, field surveys and modelling predictions to verify and ascertain the likely impacts of the Project.

1.5.3 Project land impacts

1.5.3.1 Freehold land

The proposed Project will directly impact three private properties—one of which is owned by Aeris—due to the location of the deposit (mining area) and the supporting infrastructure required to develop the Project:

1) 'Okeh' property—Lot 4 of DP751341 and Lot 9 of DP751321;

2) 'Windella' property—Lot 10 of DP 751321; and

3) Aeris' property—Lot 19 of DP751311, which will support haul road construction.

To enable the proposed Project to be developed on private land holdings (Figure 1-3), Aeris is currently negotiating land access agreements with relevant property owners, consistent with the requirements of the NSW *Mining Act 1992* (Mining Act). The Project layout has been designed to minimise the disturbance footprint as far as practicable. Also, impacts on these properties will be rehabilitated as part of the proposed Project completion, with the majority of land proposed to be returned to agricultural use (consistent with existing land use). Rehabilitation of the proposed Project is discussed in Chapter 8, Rehabilitation and closure.

1.5.3.2 Registered covenants and Crown land

In addition to considering impacts on freehold land, potential impacts on registered covenants and Crown lands have also been considered.

Title searches have been undertaken for all properties directly impacted by the proposed Project to identify any registered covenants and Crown land parcels:

- No land parcels proposed to be impacted by the Project were identified to have registered covenants.
- In regard to Crown land, the Project infrastructure corridor is proposed to traverse Lot 1 of DP879749 (Crown land leased) and Lot 10 of DP48604 (an unformed road in a Category C Crown Reserve) (Figure 1-4).

NSW Crown Lands has been engaged regarding these proposed overlaps, with discussions ongoing. Aeris is committed to working with NSW Crown Lands to ensure their interests are satisfied in respect to these matters.

While it is acknowledged that the proposed haul road will overlap Lot 10, it is noted that this Lot relates to an unformed road. Any future development of a road on Lot 10 will improve the existing access to Lot 10 while not proposing any infrastructure that may compromise future development. Similarly, the proposed haul road on Lot 1 will be along the northern boundary of the lot, which will not impact the operation or function of Lot 1.

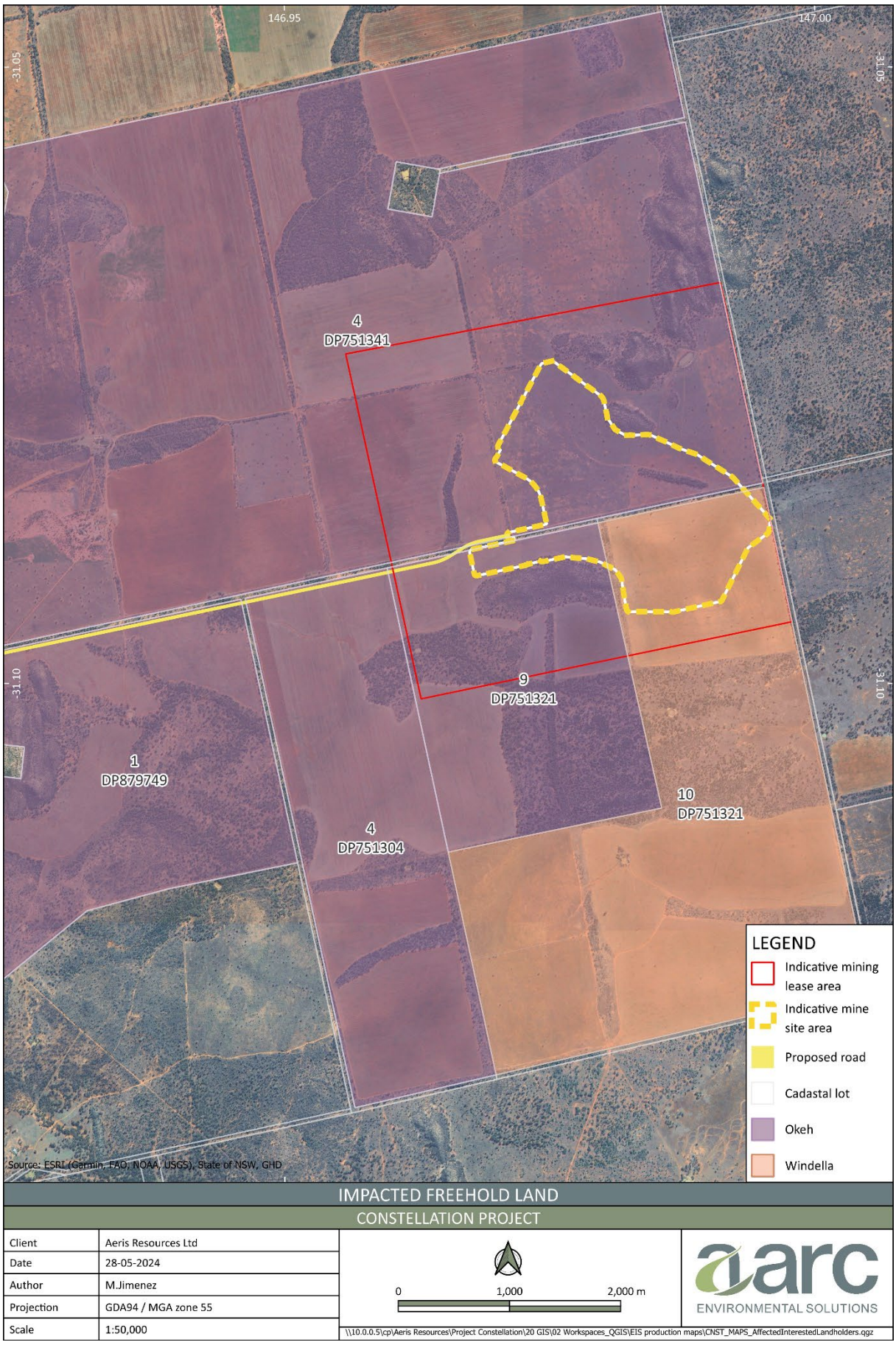


Figure 1-3: Freehold land impacted by the Project

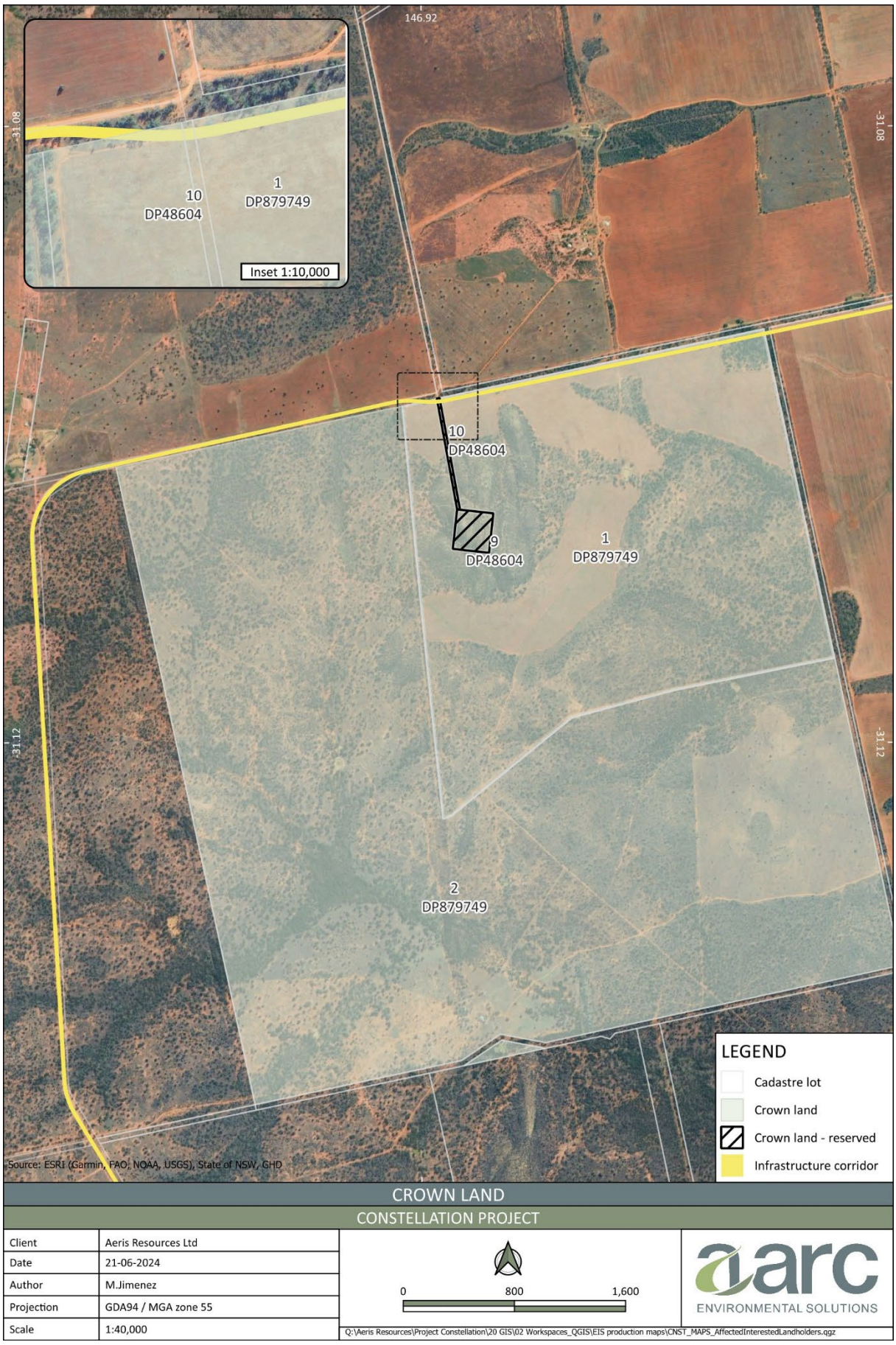


Figure 1-4: Crown land leases

1.5.4 Key strategies that have been adopted to avoid, minimise or offset the impacts of the Project

The Project has undertaken and further proposes a range of strategies to avoid, minimise or offset the impacts of the Project.

Specifically, the following strategies have been adopted during the Project design and studies phase to avoid and minimise impacts:

- A range of government and community stakeholders (including local landholders) have and will be engaged to convey concerns associated with the proposed Project. Understanding concerns during the Project design phase will provide an opportunity for stakeholder concerns to be considered and addressed.
- An iterative Project design process has been adopted to enable impact avoidance and minimisation decisions to be made during Project design. As Project engagement and technical studies were undertaken and constraints were identified, the Project layout was adapted (where possible) to avoid and minimise impacts.
- The Project layout has been designed with the smallest disturbance footprint possible, limiting biodiversity impacts and greenhouse gas emissions while still providing all necessary features for the Project.
- The Project layout has been designed to prioritise efficiency in haulage of material around the site, between the open cut, waste rock emplacement, heap leach and underground mine. Relevant design features include minimisation of haul distances and road slope limits to minimise fuel consumption and related greenhouse gas emissions.
- Heritage surveys and consultation with registered Aboriginal parties have enabled the Project footprint to be revised, avoiding impacts on several Aboriginal cultural heritage sites.
- Assessment of three potential haulage routes (to transport mined ore from the Project to the Tritton processing facility) was undertaken during ecological and cultural heritage studies. Ultimately, this approach has informed a decision to utilise existing road networks as far as practicable to significantly reduce the potential impact on environmental values.
- The Project haul route (originally desired to be 50 m wide) has been reduced to a maximum 18 m width to work within existing road disturbance. This strategy has enabled significant avoidance of additional land disturbance.
- To minimise impacts to Girilambone township, a new section of haul road has been proposed just north of the township to avoid the need for haulage trucks to traverse through Girilambone. This strategy will minimise noise, dust, traffic and visual amenity impacts.
- A new intersection will be developed to manage traffic interactions at the Mitchell Highway/proposed haul road. Works will also be undertaken to upgrade the safety and functionality of the existing Mitchell Highway/Railway Road intersection. Intersection designs have been developed through consultation with Transport for NSW to minimise road safety risks.
- The existing Tritton processing plant will be utilised to process the ore extracted from the Project site. This will maximise the efficiency of utilising existing infrastructure and avoid further land disturbance and costs associated with developing a new processing plant.
- The proposed bi-directional water pipeline between the Project mine site and the existing Murrawombie Copper Mine will be located in the proposed 18 m wide infrastructure corridor; it will be buried to negate impacts on visual amenity, road safety and fauna movements.
- A solar powered generation plant is proposed to be developed to reduce potential impacts on the existing (local) electricity network and the Project's scope 2 greenhouse gas emissions.
- The Project is proposed to be a nil-water-release system, with water managed and treated for reuse (supported by the proposed bi-directional pipeline). Maximising water reuse will minimise requirements for pumping and the need for water extraction from rivers, reducing potential greenhouse gas emissions.

- Tailings material will be reused as paste backfill for underground stopes. Alternative backfill paste options would require materials quarried from alternative sources with consequential greenhouse gas emissions. The proposed approach, therefore, represents a sustainable reuse of materials and avoidance of greenhouse gasses associated with alternative sources of materials.
- Project ore will be transported to the Tritton processing facility by road and the tailings material generated will be transported back to the Project for reuse by the same vehicles. The dual use of these vehicles represents an efficient reuse of transport resources and will avoid greenhouse gas emissions by minimising the fuel for the necessary transport of materials.
- During Project operation, staff access to site will predominantly be via 12-seater shuttle buses, with approximately 65% of staff movements using this transport form. This arrangement will reduce the potential greenhouse gas emissions compared to staff transport by light vehicles.

The following strategies are also planned to be implemented for the Project construction and operational phase to avoid and minimise impacts:

- Management strategies for different waste classes will be implemented. The waste management hierarchy (i.e. avoid, reduce, reuse, recycle, recover, treat and disposal) will be adopted when handling waste.
- A Workforce Accommodation Strategy will be developed to mitigate the impacts on housing demands during the proposed construction phase of the Project.
- Prior to commencing construction, a Traffic Management Plan will be developed to minimise potential road safety impacts and ensure sound road infrastructure performance.
- Various Tritton Copper Operations management plans will be adopted/updated to incorporate the management of Project activities. These management plans will support ongoing minimisation and mitigation of environmental, social, economic and cultural impacts.

When Project impacts on ecological values cannot be suitably mitigated or managed, biodiversity offset mechanisms have been proposed, (refer to Chapter 6, Environmental assessment, Section 6.7). Biodiversity offsets have been calculated in accordance with relevant NSW regulations and guidelines to achieve 'no net loss standards'.

1.6 Description of any related development

1.6.1 Tritton Copper Operations

Tritton Copper Operations hub and spoke mining model currently comprises four copper assets (Table 1-3).

Table 1-3: Tritton Copper Operations assets

Mine	ML	Grant date	Expiry	Operational status
Tritton Copper Mine	ML1544	22 Dec 2003	21 Dec 2028	Operating
Murrawombie Copper Mine	ML1280	6 Aug 1992	5 Aug 2034	Operating
North East Copper Mine	ML1383	13 Jan 1996	13 Jan 2038	Operating
Avoca Tank Copper Mine	ML1818	5 Nov 2021	5 Nov 2042	Operating

Note: An extension of the existing expiry date for ML1544 (through to 2045) has recently been obtained.

As identified, copper ore mined from Tritton Copper Operations assets is transported to the centralised processing plant at Tritton Copper Mine (ML1544). Following processing, copper concentrate is transported by rail to local customers or to the Port of Newcastle for export to international customers.

Existing MLs granted under the Mining Act associated with the four copper assets owned by Tritton Copper Operations are illustrated in Figure 1-5.

These mines are all currently approved to operate under the *Protection of the Environment Operations Act 1997* (POEO Act) (Refer to Section 5.4.1.2), albeit each is in different stages of operation.

Exploration Leases currently held by Aeris are also illustrated in Figure 1-5. Granting of an ML will be required as part of the future approvals for the proposed Project. ML applications are administered under the Mining Act through the NSW Resources Regulator. Aeris will lodge an application for one or more MLs following any future approval of the proposed Project. The indicative mining lease area is shown in Figure 1-5 and the final boundary will be subject to further consultation with the landholders.

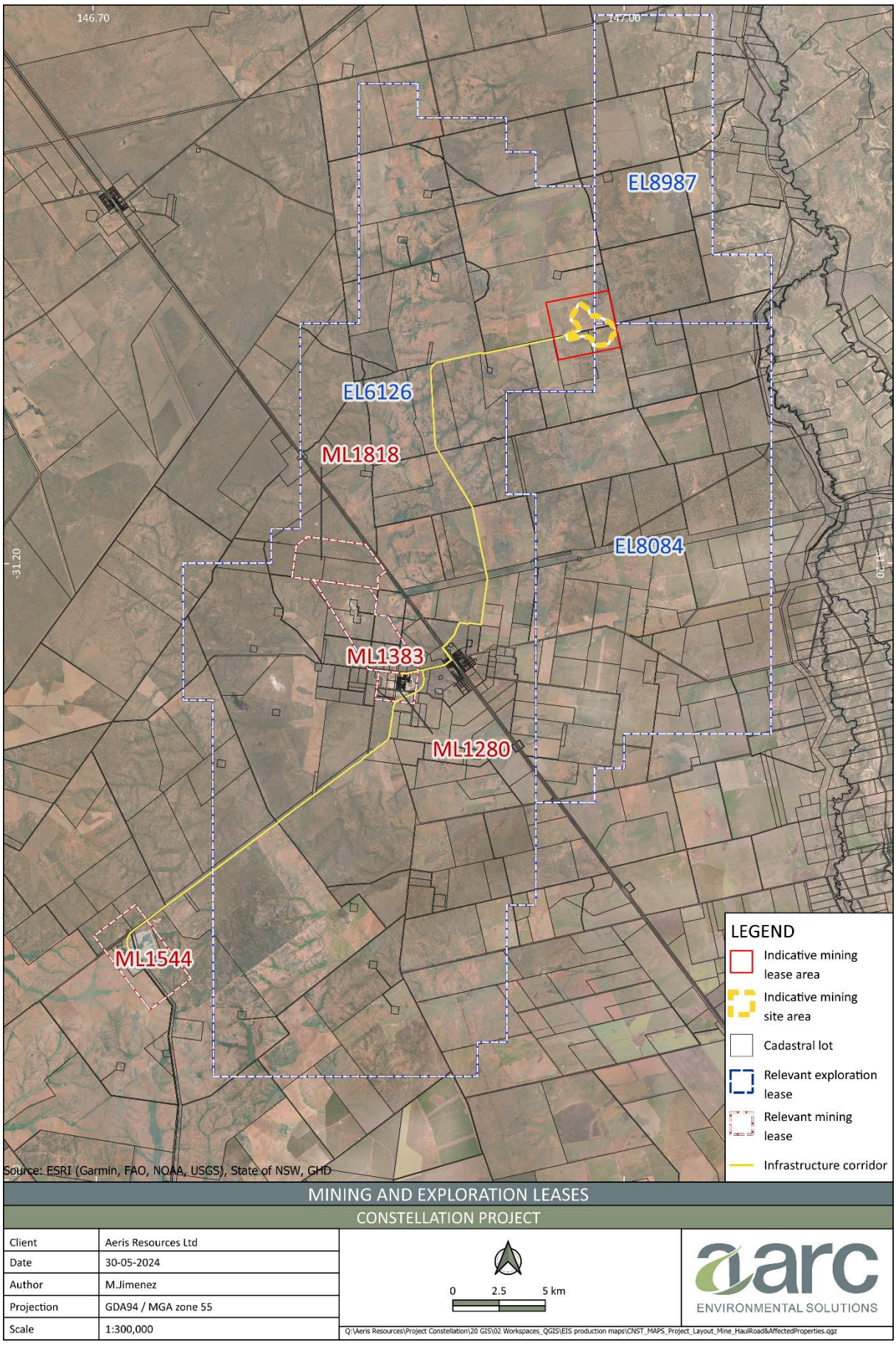


Figure 1-5: Mining and exploration leases

1.6.1.1 Tritton Copper Mine

The Tritton Copper Mine is located near the village of Hermidale, approximately 45 km north-west of Nyngan (Figure 1-1). Tritton Copper Mine was approved under Development Application (DA) 41/98, issued by the then Minister for Urban Affairs and Planning on 1 September 1999. The original DA has been subject to a number of modifications since initial approval as part of the ongoing development of Tritton Copper Operations.

A further modification is currently under assessment for Tritton Copper Mine (identified as Modification 9) regarding the following:

- increasing the annual processing rate from 1.4 Mtpa to 1.8 Mtpa;
- extending the mining operations from December 2028 to December 2036;
- importing mined materials (mineral ore or non-acid forming (NAF) waste rock) of up to 1.8 Mtpa; and
- increasing the maximum elevation of the tailings storage facility from 272 mAHD to 278 mAHD.

Operations at Tritton Copper Mine first commenced in 2004 and have produced approximately 5.6 Mt of copper concentrate through to 2023. While underground mining is still occurring at Tritton Copper Mine, it is anticipated that economic copper reserves in the existing mining area will be exhausted by the end of 2028 (subject to the outcome of Modification 9).

The Tritton Copper Mine operates various infrastructure, including:

- a processing plant;
- a tailings storage facility;
- a crushing and screening plant;
- a waste rock emplacement area;
- a paste fill plant;
- a decline (providing underground access);
- water management infrastructure;
- ore handling and stockpiling areas; and
- an administration and workshop area.

The processing plant at Tritton Copper Mine is a conventional jaw crusher, ball mill and flotation plant. The plant produces approximately 100,000 tonnes of concentrate per year (subject to feed rates).

The Tritton Copper Mine is also developing the Budgerygar deposit, located approximately 600 m north of the Tritton underground and accessed via the Tritton Copper Mine. Mining in the Budgerygar area commenced in 2024, with this resource expected to produce approximately 2.6 Mt of copper concentrate over the life of mining. Mining of Budgerygar will, therefore, support a continuation of (short-term) mining activity at the Tritton Copper Mine. Beyond final mining at the Tritton Copper Mine, this site will remain as a centralised hub for receiving and processing ore from the broader Tritton Copper Operations.

1.6.1.2 Murrawombie Copper Mine

The Murrawombie Copper Mine is located approximately 3.5 km west of the village of Girilambone (Figure 1-1). The Murrawombie Copper Mine was approved under DA 1/91, issued by Bogan Shire Council, on 2 January 1991. The original DA has been subject to a number of modifications since initial approval, as part of the ongoing development of Tritton Copper Operations.

Mining at Murrawombie first commenced in 1992, via open pit mining, and ran through to 1999. Underground mining at Murrawombie Copper Mine subsequently commenced in 2008, producing approximately 5.1 Mt of copper concentrate (through to 2023). Ore mined at Murrawombie continues to be transported to Tritton Copper Mine for processing.

Mining at Murrawombie Copper Mine is currently anticipated to cease in 2026, due to exhaustion of reserves. Notwithstanding this, further investigation into potential additional resources at Murrawombie Copper Mine remains ongoing.

The primary infrastructure at Murrawombie Copper Mine includes: an open cut mining pit; a waste rock emplacement area; a series of heap leach pads and associated infrastructure; a copper cementation plant; water management infrastructure; ore handling and stockpiling areas; and an administration area.

It is proposed that the Project would be connected to the Murrawombie Copper Mine via a bi-directional pipeline, to improve capabilities for water management across these assets.

1.6.1.3 North East Copper Mine

The North East Copper Mine is located approximately 6 km north-west of the village of Girilambone (directly north of Murrawombie Copper Mine) (Figure 1-1). The North East Copper Mine is approved under DA 6/95, issued by Bogan Shire Council in 1995. The original DA has been subject to a number of modifications since initial approval, as part of the ongoing development of Tritton Copper Operations.

Open cut mining at the North East Copper Mine commenced in 1996 and was completed by 2000. From 2007, mining was recommenced using underground extraction methods, albeit stopping in 2008 due to impacts from the global financial crisis. Underground mining again resumed in 2010, with mined ore transported to the Tritton Copper Mine for processing.

The North East Copper Mine is currently trialling the mining of high-grade copper in some pillars, that may result in further mining to 2025.

1.6.1.4 Avoca Tank Copper Mine

The Avoca Tank Mine is located approximately 8 km north-west of the village of Girilambone (north of the North East Copper Mine and accessed via North East Copper Mine portal) (Figure 1-1). The Avoca Tank Copper Mine is approved under DA 10/2015/004/001, issued by Bogan Shire Council on 15 September 2016. The original DA was also subject to a 2021 modification, reducing the scale of disturbance that was initially approved (through utilising existing infrastructure at the North East Copper Mine).

The Avoca Tank Mine has relatively recently commenced development and production and is expected to produce approximately 150 Kt of copper concentrate over the mine life. Supplementary gold and silver ore are also being targeted. Ore mined at Avoca Tank Copper Mine is transported to Tritton Copper Mine for processing.

Infrastructure at Avoca Tank Copper Mine is minimal, including:

- vent rises (for underground ventilation);
- a laydown area; and
- an office block.

Access to the underground mining area at Avoca Tank Copper Mine is via a decline constructed from within the neighbouring North East Copper Mine pit. Existing infrastructure at the adjoining North East Copper Mine that is utilised to support mining at Avoca Tank includes the existing ROM pad, the waste rock emplacement area, a lay down area, and water management infrastructure.

1.6.2 Existing development consent or rights

Development approvals relevant to all assets that constitute Tritton Copper Operations are identified in Section 1.6.1. Other approvals from Tritton Copper Operations that are relevant to the proposed Project include:

- **Centralised processing approval:** The development consent for Tritton Copper Mine authorises the receival of one million tonnes of ore per annum (from satellite sites). Transport of ore from the proposed Project would be up to a maximum of 1 Mtpa in any given year, noting that such a volume would only occur in lieu of any other transport of ore from satellite sites. Received ore will be stored and handled at Tritton Copper Mine. Processing will occur through the on-site processing plant, as per current operations. Separate to this EIS process, approval of a modification (Modification 9) has been sought for Tritton Copper Mine. This modification seeks to:
    - increase the annual processing rate from 1.4 Mtpa to 1.8 Mtpa;
    - authorise the importation of mined materials (mineral ore or NAF waste rock) of up to 1.8 Mtpa; and
    - increase the maximum elevation of the tailings storage facility from 272 mAHD to 278 mAHD.
- **Tailings transport and disposal:** It is proposed that approximately 40% of the tailings generated from the processing of ore at Tritton Copper Mine will be transported back to the Project site (as dry tailings) for paste cementation prior to underground emplacement. The residual tailings generated by the Project (particularly in the early years prior to underground development at the Project site) will be managed and disposed of at the Tritton Copper Mine. An expansion of the existing tailings storage facility at the Tritton Copper Mine has been applied for separately to the EIS process (Modification 9, as outlined above). Transport of tailings from the Tritton Copper Mine is permitted as per the development consent for the Tritton Copper Mine, provided it is in accordance with the code of conduct for the transportation of waste rock and tailings on public roads as prepared in consultation with Transport for NSW, Bogan Shire Council and the Department of Planning and Environment (DPE).
- **Water Access Licences:** Six existing Water Access Licences are in place to support Tritton Copper Operations. The annual allocations are announced annually by Water NSW, based on the announcement volume per share.

  The total share component for the three licences for the Lachlan Fold Belt Groundwater licences is 344 ML:
    - a share component for one High Security Water Licence for 705 ML;
    - a share component for a General Security Water Licence for 210 ML; and
    - a share component for a Supplementary Water Licence for 16 ML.
- **Environmental Protection Licences:** There are two Environmental Protection Licences (EPLs) relevant to existing Tritton Copper Operations:
    - EPL 11254 (for the Tritton Copper Mine); and
    - EPL 1405 (for Murrawombie, North East and Avoca Tank Copper Mines).

To support any future approval of the proposed Project, it is proposed that EPL 1405 would be extended to include the Project site (noting that this EPL regulates all existing satellite sites (or spokes) to Tritton Copper Operations).

Constellation Project

Environmental Impact Statement



Chapter 2 – Strategic Context

2 Strategic context

2.1 Introduction

This chapter describes the key strategic context relating to the Project in accordance with the State significant development guidelines – preparing an environmental impact statement (DPIE 2022a) and the Project SEARs. Strategic context requirements from the Project SEARs are provided in Table 2-1, with references to identify where each item has been addressed.

Table 2-1: Strategic context requirements

Assessment matter	Report locations
A strategic justification of the development, focusing on site selection and the suitability of the proposed site;	Sections 2.3, 2.4, 2.5 and 2.8 and Chapter 9, Evaluation and justification
The terms of any proposed voluntary planning agreement with the relevant local council;	Section 2.7.1
The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses and significant mineral resources;	Section 1.5.2, Sections 2.4 and 2.7 and Section 9.3.6
The strategic need and justification for the development, having regard to the relevant NSW and national policies and guidelines;	Section 2.2 and Chapter 9, Evaluation and justification
Feasible alternatives to the development and its key components, including the consequences of not carrying out the development; and	Section 2.8
An assessment of the likely impacts of all stages of the development, including likely interactions between the development and any other existing, approved or proposed developments in the vicinity, including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice.	Section 2.3, 2.4, 2.6, Chapter 5, Statutory context and Section 6.17

2.2 Need for the Project

Under existing approvals, resources at Tritton Copper Operations are anticipated to be exhausted in approximately three years. Without development of additional resources, Tritton Copper Operations would begin to move towards closure, resulting in significant impacts to local and regional employment, as well as presenting financial impacts to local, regional and state economies.

Copper is an important resource in respect of promoting a higher standard of living domestically and internationally. One tonne of copper is estimated to bring:

- functionality to 40 cars; and
- power 100,000 mobile phones;
- enable operations in 400 computers; and
- distribute electricity to 30 homes (Copper Alliance 2024).

Copper is also identified as a ‘critical mineral and tech metal’ for NSW, as per the NSW Government’s Critical Minerals and High-Tech Metals Strategy (DRNSW 2021).

Investments in critical minerals are vital in enabling NSW's growth industries, like:

- advanced manufacturing;
- batteries;
- defence and aerospace;
- technology-enabled primary industries; and
- renewables.

The future global economy and the pathway to lower emissions will be founded on minerals that NSW is rich in, such as cobalt, rare-earth elements and copper (DRNSW 2021).

Given the strong outlook for copper demand and declining ore reserves, copper supply will have increasing importance over the coming decade due to global electrification driven by decarbonisation and increasing demand from growth of electric vehicles and the renewable energy sector. Given the abundance of copper in NSW and the large, established nature of its market, there is a significant value proposition for NSW from investment in copper (DRNSW 2021).

The proposed Project will, therefore, provide important copper supplies that are consistent with the NSW Government's strategy. Further to this, the Project will:

- provide ongoing employment for the Tritton Copper Operations workforce, supporting employment in the Bogan Shire local government area and surrounding regions;
- contribute to economic growth and community resilience locally while also supporting the regional and state economies (including through payment of taxation and royalties);
- enable the continuation of Tritton Copper Operations, including utilisation of the existing processing facility to maintain operational efficiencies while also reducing environmental impacts associated with developing such new infrastructure; and
- enable the continuation of a regional exploration project designed to discover and define new deposits, further supporting the longer-term provision of social and economic benefits identified above.

2.3 Alignment of the Project to government strategy

This section demonstrates how the Project will align with international conventions and Commonwealth, State and Local Government strategies and policies.

2.3.1 International and Commonwealth strategic considerations

2.3.1.1 United Nations Framework Convention on Climate Change

The 'United Nations Framework Convention on Climate Change' (UNFCCC) entered into force on 21 March 1994, with the ultimate objective being to stabilise greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system" (UNFCCC 1994). The Kyoto Protocol subsequently operationalised the UNFCCC by committing industrialised countries (and economies in transition) to limit and reduce greenhouse gas emissions in accordance with agreed individual targets. Under the protocol, countries must meet their targets primarily through national measures. Australia became a signatory to the Kyoto Protocol in 1997, subsequently ratifying its commitment in 2007.

On 16 June 2022, Australia lodged an updated 'nationally determined contribution' with the UNFCCC Secretariat to formalise our commitment to greenhouse gas emissions targets post-2020. Australia has committed to achieve net zero emissions by 2050 (Australian Government 2022). Greenhouse gas emissions will also be reduced by 43% below 2005 levels by 2030 (Australian Government 2022). Each Australian state has committed to reach net zero by 2050 or earlier. In addition to Australia's 2030 emissions reduction target of 43% below 2005 levels, each state has set interim emissions reduction targets by 2030, with NSW setting their target at 50%. To support the achievement of these reduced emissions, the Australian Government

enacted the *Climate Change Act 2022* to legally establish greenhouse gas emission reduction targets (refer to Chapter 5, Statutory context, Section 5.4.3.2). The NSW Government has legislated emission targets through the *Climate Change (Net Zero Future) Act 2023* (refer to Chapter 5, Statutory context, Section 5.4.3.3).

While the proposed Project will contribute to greenhouse gas emissions, copper is considered an essential metal to support the development of renewable energy technologies. Indeed, copper ore will support Australian and global infrastructure development to produce renewable energy, ultimately facilitating reduced greenhouse gas emissions.

Further, Aeris has made a series of commitments to minimise greenhouse gas emissions produced by the Project; refer Chapter 1, Introduction, Section 1.5.4.

2.3.1.2 Regions at the Ready: Investing in Australia's Future

In 2018, the Commonwealth House of Representatives commissioned a 'Select Committee on Regional Development and Decentralisation'. The intention of this committee was to address the importance of regional development as a support to population decentralisation. The work of the committee culminated in a report entitled 'Regions at the Ready: Investing in Australia's Future' (Commonwealth of Australia 2018). The report identified three critical factors influencing decentralisation being achieved:

1) connectivity;
2) base level services; and
3) amenities of regional cities and towns.

The report also identified types of regional investment that were seen as priorities. Specifically, investment to maintain the status quo was seen as critical. This type of investment is expected to assist in enabling regional towns and cities to provide a universal base level of service and amenity. Indeed, Tritton Copper Operations is an important contributor to the central-western region of NSW and supports significant investment in local and regional centres.

Critically, the proposed Project will provide ongoing employment in the region, and as a result, will maintain and attract population within regional NSW. By providing ongoing employment, the Project will support the commitments of the Commonwealth to maintain the status quo of regional investment (that is already occurring through Tritton Copper Operations). The proposed Project is therefore considered to support the goals of regional development and decentralisation under the Regions at the Ready policy.

2.3.1.3 Orana Strategic Regional Plan 2023-2026

The Commonwealth Government (through the 'Department of Infrastructure, Transport, Regional Development, Communications and the Arts') invests in strategic planning for regional areas (including NSW) through the entity of 'Regional Development Australia'.

Regional Development Australia has developed a strategic regional Plan for the NSW region identified as 'Orana', which extends from Mudgee in the east to Bourke in the west. It comprises the local government areas of:

- Bogan
- Bourke
- Brewarrina
- Cobar
- Coonamble
- Dubbo Region
- Gilgandra
- Mid-Western Region

- Narromine
- Walgett
- Warren; and
- Warrumbungle.

The Orana Strategic Regional Plan 2023–2026 provides a consolidated plan that aims to support the development of the region by:

- increasing regional economic output;
- increasing investment into existing businesses;
- attracting new businesses; and
- ensuring the attraction and retention of the regional workforce and population.

The proposed Project, therefore, aligns with the intent of the Orana Strategic Regional Plan as a key existing and future contributor to the regional economy, employment and population retention.

The Orana Strategic Regional Plan is considered in more detail, with the social impact assessment undertaken for the Project (refer to Chapter 6, Environmental assessment, Section 6.13).

2.3.2 NSW strategic considerations

2.3.2.1 Net Zero Plan

The NSW 'Net Zero Plan' is the foundation for NSW's action on climate change and its goal to reach net zero emissions by 2050. The Net Zero Plan supports initiatives, such as electric vehicles and the development of primary industries (including mining), to support the transition towards renewable energy.

Renewable energy technologies have been developed and introduced to promote net zero emissions in households and industries. Solar panels can now be manufactured on a large scale, and electric vehicles have become more popular—all requiring more supplies of mineral resources, such as copper. The proposed Project can provide copper resources to the market to support the development of renewable energy technologies and assist NSW in achieving net zero goals.

2.3.2.2 Environmental Protection Agency (EPA) Climate Change Policy

The NSW EPA Climate Change Policy has been developed to address climate change and protect the environment, thereby strengthening the regulatory response to acute and chronic impacts of climate change. The policy seeks to achieve the EPA's statutory duty to ensure environmental protection under the Protection of the Environment Operations Act 1997 when exercising its environmental protection licensing functions. The objectives of the policy are detailed in the Climate Change Action Plan.

2.3.2.3 Climate Change Action Plan 2023–26

The NSW EPA Climate Change Action Plan describes how the objectives of the EPA Climate Change Policy will be delivered until the policy and plan are reviewed in 2026, as NSW moves towards achieving net zero emissions by 2050. The plan outlines regulatory actions that will be taken until 2026, including staged actions, starting with initial information gathering from environment protection licensees.

Subsequent actions under the plan include:

- setting emission reduction targets for key industry sectors;
- setting requirements for climate change mitigation; and
- enabling adaptation plans to support the management of change.

2.3.2.4 NSW Minerals Strategy

Global demand for metals is growing. High technology industries require a broad range of elements for smartphones, electric cars, solar panels, batteries, satellites and other applications. Fuelled also by a growing world population, the demand for many minerals is already outstripping supply (DRNSW 2021).

The NSW Minerals Strategy was developed by the NSW Government in 2019 to support the government's development of its natural resources and unlock the state's metals potential. The global demand for copper is projected to steadily increase in the next decade as it is considered an essential resource to support renewable energy technologies and the development of electric vehicles. Australia has the second largest known reserves of copper in the world and is currently the fourth largest producer globally (DPIE 2019). This provides a significant opportunity for the NSW Government to support future renewable energy demand by supplying critical metals such as copper.

From an economic perspective, the NSW Minerals Strategy suggests that greenfield mineral exploration of metals (including copper) should be encouraged, as many current copper mining operations are expected to close over the next 20 years. Further, the NSW Government is targeting to increase the proportion of greenfield exploration (relative to brownfield exploration) by 10 per cent on 2018 levels by 2025. Aeris has made a significant investment into greenfield exploration (remote from its centralised processing hub), aligning with the NSW Minerals Strategy goal of broader exploration activity (consistent with Aeris' hub and spoke model). This is supporting improved exploration coverage across NSW.

In addition to promoting greenfield exploration, the NSW Minerals Strategy seeks to promote investment in the minerals industry of NSW to establish NSW as an attractive destination for mineral explorers and investors. The proposed Project, therefore, supports the NSW Minerals Strategy.

2.3.2.5 Critical Minerals and High-tech Metals Strategy

The NSW Government has developed a Critical Minerals and High-Tech Metals Strategy (DRNSW 2021). This strategy outlines the NSW Government's vision to build on existing potential and position NSW as a major global supplier and processor of critical minerals and high-tech metals well into the future. The strategy defines specific metals as 'critical and high-tech minerals', the demand of which is projected to increase. For NSW, there is strategic interest to invest in developing these metals along with downstream processing and technologies.

Copper is identified as a critical mineral for NSW, particularly for its role in renewable energy technologies and the electric vehicle industry. Combined with having a high recycling rate, copper can promote decarbonisation projects, supporting the ongoing progression towards more sustainable development. The proposed Project, therefore, aligns with the NSW Strategy for sourcing critical minerals.

2.3.2.6 Western Plains Regional Economic Development Strategy

The NSW Government has supported local councils and communities across regional NSW by developing 'Regional Economic Development Strategies' for 38 functional economic regions. The proposed Project (and the Bogan Shire Council area) is within the Western Plains functional economic region.

The government initially released the 'Western Plains Regional Economic Development Strategy' in 2018. The strategy has since been updated in 2023 to capture new data releases and analysis of key events that have occurred since 2018.

Under the 'Western Plains Regional Economic Development Strategy 2023', mining is identified as a key component of the regional economy, presenting a significant opportunity for future regional development. Indeed, a key opportunity identified by the strategy is the continued exploration and approval of new mines and mine expansion projects to support long-term growth in the mining sector (DRNSW 2023).

Further, extension of Tritton Copper Operations (through the Constellation Project) is expressly referenced in the Western Plains Regional Economic Development Strategy 2023 as part of major private investments occurring since 2018. As such, the proposed Project is an important component of the strategy, with any future approval recognised as an opportunity for the region.

2.3.3 Local strategic considerations

2.3.3.1 Bogan Shire Community Strategic Plan 2032

The Bogan Shire Community Strategic Plan 2032 (BSCSP) was adopted on 28 April 2022 to identify the community values, priorities and aspirations for the future. The main purpose of the strategic plan is "to define a particular direction or goal and so to make the necessary decisions on how to allocate our limited resources, including time and money to achieve this goal" (Bogan Shire Council 2022).

The BSCSP was prepared with significant community input, being reflective of shared community values while providing local insight into specific values within the region. The identified community vision is articulated as follows:

> *To provide a comfortable country lifestyle by progressively improving the level of appropriate facilities and services and encouraging growth and economic development that is responsive to the needs of the community.*

Tritton Copper Operations is a key employer and economic contributor to the Bogan Shire and plays an integral role in supporting the achievement of the Bogan Shire Community Strategic Plan 2032. This plan is considered in more detail with the social impact assessment undertaken for the Project (refer to Chapter 6, Environmental assessment, Section 6.13).

2.4 Land use planning considerations

2.4.1 NSW 2021

In 2021, NSW developed a 10-year plan for the state, entitled NSW 2021. The plan was developed around five key strategies:

1) rebuilding the economy;
2) returning quality services;
3) renovating infrastructure;
4) restoring government accountability; and
5) strengthening our local environment and communities (DPC 2011).

A key goal for the rebuilding of the economy was identified to be driving economic growth in regional NSW.

Under NSW 2021, the state is divided into nine planning regions, each with a long-term plan and a supporting implementation plan. The proposed Project is within the Central West and Orana region and managed under the 'Central West and Orana Regional Plan 2041' (DPIE 2022b).

2.4.2 Central West and Orana Regional Plan 2041

The Central West and Orana Regional Plan 2041 provides a guide for land use planning decisions in the region through to 2041. The plan includes 19 local government areas, including the Bogan Shire Council area.

The plan provides a strategic framework to create a healthy, connected and resilient region with a prosperous economy. It focuses on sustainable growth through adaptation to challenges in climate, housing markets and the economy. The plan will be achieved by implementing 23 objectives that target five overarching goals:

1) region-shaping investment;
2) sustainability and resilience;
3) people, centres, housing and communities;

4) prosperity, productivity and innovation; and
5) local government priorities.

The Central West and Orana Regional Plan 2041 recognises the region's strong historical connection with mining and the opportunity presented through the state's critical mineral resources. A key objective of achieving region-shaping investment, therefore, is to sustainably manage extractive resource land and grow the critical minerals sector (DPIE 2022b).

Under the Central West and Orana Regional Plan 2041, natural resource extraction is recognised as a transitional land use, requiring planning throughout the physical and economic life cycle of projects. Several strategies have been developed through the plan to consider and support the sustainable growth of mining in the region, including:

- protecting potential mineral and energy resources from land uses that would sterilise this potential;
- protecting existing and proposed resource extraction projects from land uses that could impact operations;
- protecting road, rail and freight routes from development that could affect current or future extraction and supply-chain movements;
- promoting opportunities for minerals processing within the region;
- addressing water resource constraints and impacts;
- identifying future mine closure dates;
- understanding potential changes to water, economic/skill profiles and demographics; and
- considering land use changes, mine rehabilitation activities and post-mining land use opportunities.

These strategies support the development of the proposed Project and the continued progression of Tritton Copper Operations.

2.4.3 Bogan Local Environmental Plan 2011

Local environmental planning provisions for the Bogan Shire Council area are made under the 'Bogan Local Environmental Plan 2011' (LEP), which aims to:

- protect and promote the use and development of land for arts and cultural activity, including music and other performance arts;
- protect, enhance and conserve agricultural land through the proper management, development and conservation of natural and man-made resources;
- encourage a range of development, including housing, employment, recreation and community facilities, to meet the needs of existing and future residents of Bogan; and
- promote the efficient and equitable provision of public services, infrastructure and amenities.

Under the LEP, the Project site is located within lands classified as Zone RU1 (Primary Production). The objectives of lands zoned RU1 are:

- 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; and
- to minimise conflict between land uses within this zone and land uses within adjoining zones.

Under the LEP, extractive industries are a permitted land use within Zone RU1 (subject to consent). Consent for the development will be via a Development Application, as set out in Chapter 5, Statutory context. This EIS is a key document to support the development application for the proposed Project.

Further, Bogan Shire Council is identified as the owner of key road infrastructure that the Project is proposing to utilise to support haulage activity. While discussions with Bogan Shire Council are currently ongoing, it is anticipated a voluntary planning agreement will be utilised to effect proponent commitments towards upgrading and/or maintaining road infrastructure.

2.4.4 Bogan Shire Council Local Strategic Planning Statement

Existing alongside the LEP, Bogan Shire Council has also developed a Local Strategic Planning Statement 2019 to provide a framework for economic, social and environmental land use needs over the next 20 years (Bogan Shire Council 2022). The statement implements the directions and actions at a local level, based on the Central West and Orana Regional Plan 2036 (revised to 2041).

Mining is one of the largest economic contributors to the Bogan Shire. It drives population growth and provides significant employment. Indeed, Tritton Copper Operations is identified as a major employer for the Bogan Shire, with 22.7% of the workforce employed in mining, with further potential for this to increase. Therefore, the continued operation of the Tritton Copper Mine is not only critical to local economic development, it is also critical to maintaining population and delivering the goals set out in Bogan Shire Council's Local Strategic Planning Statement.

2.4.5 Dark Sky Planning Guideline 2023

An important planning instrument relevant to the Project is the NSW Department of Planning and Environment's Dark Sky Planning Guideline 2023 (DPIE 2023).

The proposed Project is approximately 200 km west of the Siding Spring Observatory, which is on an important vantage point for studying astronomical sources and phenomena. The observatory is on the eastern boundary of the Warrumbungle National Park, and the observatory and the national park are part of Australia's first internationally accredited Dark Sky Park (DPIE 2023).

To protect the dark sky values of the Siding Spring Observatory, the NSW Department of Planning and Environment has developed the 'Dark Sky Planning Guideline 2023' (DPIE 2023). This guideline informs development controls that apply to land within 200 km of the observatory. A consent authority must consult with the observatory director when a development (within 200 km) has the potential to affect the observing conditions at the observatory.

The proposed Project is on the edge of the dark sky region within Bogan Local Government Area (LGA). Lighting design in accordance with the principles suggested in the guideline and mitigation measures of dust emissions have been considered to minimise light pollution, including skyglow, light spill, and glares. Potential impacts to the dark sky region are discussed further in Appendix 16, Visual impact assessment.

2.5 Key features of the surrounding area

The key features of the Project site have been described in Chapter 3, Project description, Section 3.4. The following sections also describe the key features in the surrounding area that could affect the Project or may be affected by the Project.

2.5.1 Local and regional community

2.5.1.1 Population centres

Located in the Bogan Shire Council area, the Project site and the surrounding areas are sparsely populated. The nearest population centre is Nyngan, which is approximately 55 km south-east of the Project. Nyngan is the

administrative centre of the Bogan Shire Council area. The estimated resident population in the town is 1,761 (ABS 2021), with 2,467 people reported as living in the Bogan Shire Council area. The largest industry of employment in the area is copper ore mining (13.2% of the population), followed by:

- sheep and beef farming (7.1%);
- local government administration (5.3%);
- primary education (5.0%); and
- specialised sheep farming (4.0%).

Other towns close to the Project site include:

- Girilambone—approximately 20 km south-west of the Project and adjacent to the infrastructure corridor, with a population of 86;
- Coolabah—approximately 20 km north-west of the Project, with a population of 32; and
- Hermidale—approximately 40 km south-west of the Project, with a population of 127.

2.5.1.2 Land ownership

The Project site is on freehold land that forms part of the 'Okeh' and 'Windella' properties. Aeris is currently negotiating land access agreements with property owners, consistent with the requirements of the Mining Act.

The infrastructure corridor will primarily work within existing road reserves, adjoining a number of freehold and Crown land parcels. Impacts to land are considered in Chapter 6, Environmental assessment, Section 6.1. Potential impacts on Crown land and Crown land covenants are considered in Chapter 1, Introduction, Section 1.5.3.

2.5.1.3 Land uses

Agriculture (cropping and grazing) is the existing land use on the Project site and the predominant land use of the surrounding area. There are several mining operations close to the Project, two of which include the:

- Murrawombie Mine—approximately 18 km south-southwest; and the
- Avoca Tank Mine—approximately 15 km south-west.

Other mining activities in the immediate or local area are part of Tritton Copper Operations.

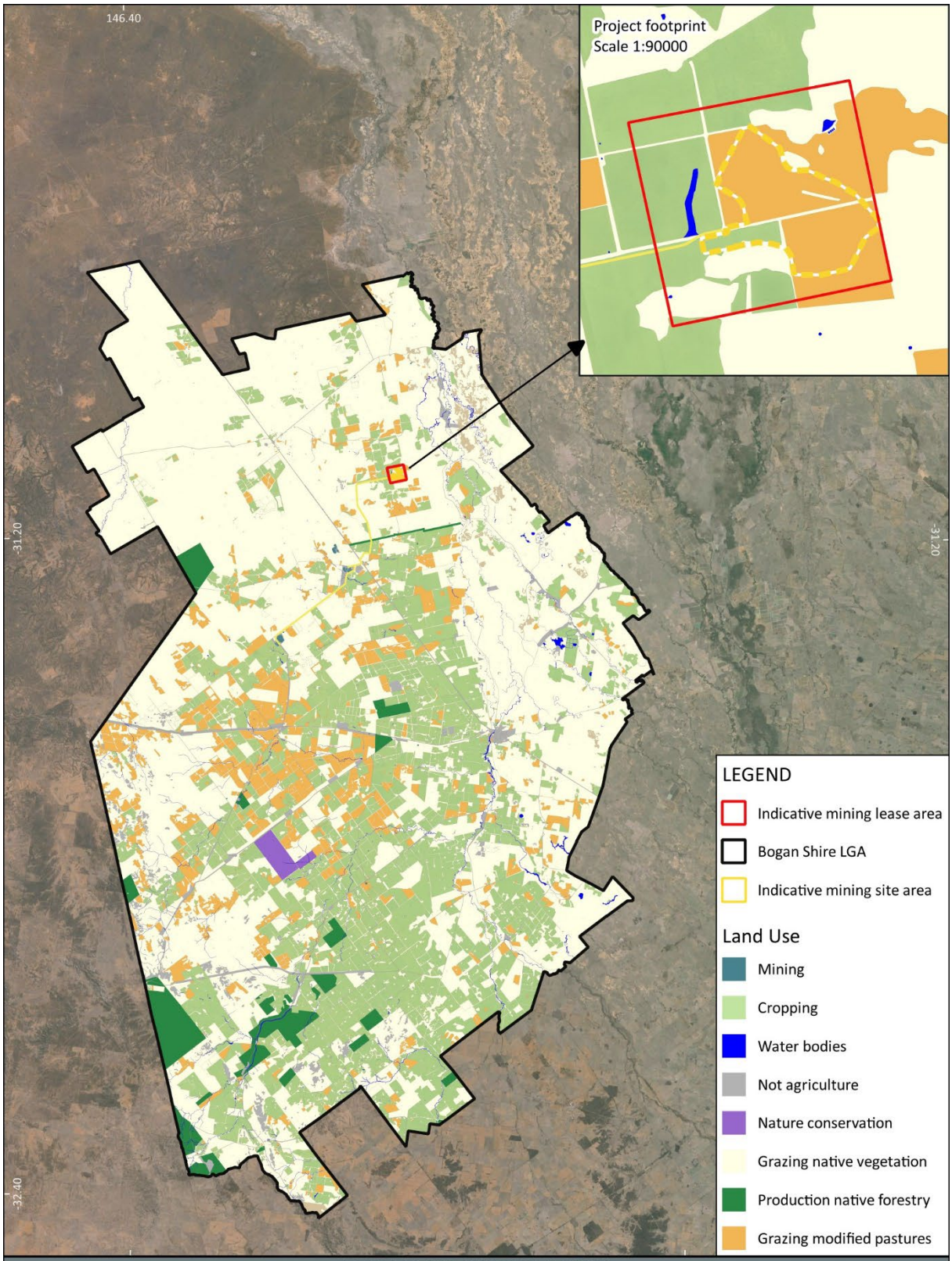
The next operating mining complex (which is not owned or operated by Aeris) is approximately 110 km to the south-west of the proposed Project.

In addition to mining and agriculture, other surrounding land uses include forestry, transportation and residential land. Land uses on the Project site and the surrounding areas are depicted in Figure 2-1.

2.5.2 Natural or built features

In the local and regional surrounds of the Project, key natural features include the:

- the Bogan River and associated tributaries (approximately 8 km north-east of the Project);
- Nalbaugh/Girilambone State Forest (approximately 15 km south-west of the Project, intersecting the haulage and access routes along Okeh Road);
- Thorndale State Forest (approximately 30 km south of the haulage route);
- Macquarie Marshes Nature Reserve (approximately 50 km east of the Project);
- Warrambungle National Park (approximately 190 km east of the Project); and
- Siding Spring Observatory (approximately 200 km east of the Project).



LAND USE IN THE BOGAN SHIRE

CONSTELLATION PROJECT

Client	Aeris Resources Ltd
Date	21-06-2024
Author	M.jimenez
Projection	GDA94 / MGA zone 55
Scale	1:1,200,000

Figure 2-1: Land use in the Bogan LGA

In the local and regional surrounds of the Project, key built infrastructure includes the following:

- Mitchell Highway (approximately 15 km west of the Project), forming part of the haulage route and infrastructure corridor);
- Girilambone township (approximately 20 km south-west of the Project), comprising residential dwellings, a school, a church and other community places);
- Nyngan Solar Plant (approximately 60 km south-east of the Project), one of Australia's largest solar plants; and
- Burrendong Dam (approximately 270 km south-east of the Project), the largest water storage within the broader Macquarie–Bogan Catchment).

2.5.3 Risks and hazards

An environmental risk assessment has been undertaken for the proposed Project, consistent with AS/NZS ISO 31000:2018 and the Multi-level Risk Assessment. This risk assessment is provided as Appendix 12, Environmental risk assessment.

The Project risk assessment has analysed the potential consequences and likelihood of each risk prior to the consideration of any controls or mitigations. A final risk classification was then assigned (based on the consequence and likelihood scores determined) as per Table 2-2.

Table 2-2: Risk classification scheme adopted

			Consequence				
			1	2	3	4	5
			Very Low	Low	Moderate	High	Very High
Likelihood	5	A. Almost certain	Class II	Class II	Class III	Class IV	Class IV
	4	B. Likely	Class I	Class II	Class III	Class IV	Class IV
	3	C. Possible	Class I	Class I	Class II	Class III	Class III
	2	D. Unlikely	Class I	Class I	Class I	Class II	Class III
	1	E. Rare	Class I	Class I	Class I	Class II	Class II

Approximately 75 environmental risks have been identified through the Project risk assessment, with the majority of these risks considered to be Class I and Class II risks (being 'generally acceptable' and 'easily mitigated'). A description of risk classes/rankings is provided in Table 2-3.

Table 2-3: Risk ranking descriptions

Risk ranking	Action
Class IV	**Risk is unacceptable**. The risk requires in-depth technical assessment and planning such that the risk is either avoided through Project design changes or that specific and targeted mitigation measures are detailed and implemented to reduce the risk to an acceptable level. The risk needs to be brought to the attention of the Project Director/CEO for managerial involvement. Very high risks that cannot be reduced are likely to prevent the development of the Project.
Class III	**Risk is generally unacceptable**. Detailed technical assessment should be completed that further evaluates and quantifies the risk, for which appropriate mitigation and management measures can be designed and implemented.

Risk ranking	Action
Class II	**Risk is generally acceptable**. However, investigation is desirable to further understand the risk. The risks can generally be mitigated through the implementation of standard industry mitigation and management measures.
Class I	**Risk is acceptable**. Specialist technical investigation is likely not required. The risk could be managed through routine policies and procedures and industry-standard measures.

Through the Project risk assessment, a total of 14 risks have been classified as Class III, representing the highest level of risk identified for the Project:

- noise (4);
- blasting and vibration (1);
- air quality (2);
- water (1);
- rehabilitation (2);
- biodiversity (1);
- traffic (1);
- social (1); and
- others (1).

Note: All these risks were assessed without mitigations to inform technical studies.

As an outcome of technical studies, the controls (mitigations and management measures) are then proposed to manage residual risks. Further details on the Project risk assessment can be found in Appendix 12, Environmental risk assessment. A summary of all mitigations adopted for the Project is provided in Chapter 7, Mitigation and management.

2.6 Cumulative impact potential

The Cumulative Impact Assessment Guideline for State Significant Projects (DPIE 2022c) provides a framework for assessing cumulative impacts. Approaches to cumulative impact assessments are discussed in detail in Chapter 6, Environmental assessment, Section 6.17.

2.7 Planning agreements

2.7.1 Voluntary planning agreements

While discussions with Bogan Shire Council are ongoing, it is currently anticipated that Aeris will adopt a voluntary planning agreement with the Bogan Shire Council to effect an agreement on road maintenance and upgrade contributions associated with the Project's proposed haulage activity.

2.7.2 Voluntary Land Acquisition and Mitigation Policy

The Voluntary Land Acquisition and Mitigation Policy (VLAMP) must be considered for any state significant development and has been considered for the proposed Project.

Should noise and dust impacts exceed relevant criteria, the VLAMP provides affected landowners with a process to negotiate their agreement with the proponent (including mitigations or management actions), or alternatively, obligations are placed on the proponent to acquire land impacted by the Project.

The Project design has considered and incorporated a number of alternatives as part of seeking to avoid or minimise environmental and social impacts. Community consultation has also informed the proposed Project design.

Assessment of matters that may be subject to the VLAMP is provided in Appendix 8A, Air quality impact assessment and Appendix 9, Noise impact assessment. Outcomes of these assessments are provided in Chapter 6, Environmental assessment, Sections 6.8 and 6.9.

Note: Assessments for the Project have predicted that both the noise and dust levels will comply with assessment criteria, and therefore, the VLAMP will not be applicable for any sensitive receptors.

2.7.3 Landholder bore agreements

As part of the groundwater impact assessment undertaken for the Project, groundwater drawdown has been predicted to occur during mining operations (over 10 years) and for 600 years after the end of mining.

At the end of mining, drawdown in the groundwater table of 1 m is predicted to extend approximately 1,700 m away from the mine workings. Since the closest registered bore to the Project is approximately 8 km to the south, there is no predicted groundwater drawdown at any registered bore at the end of mining.

At 600 years after the end of mining, drawdown in the groundwater table of 1 m is predicted to extend approximately 6,500 m away from the mine workings. Three registered bores are predicted to record some groundwater drawdown at that point in time, although the predicted drawdown at each location is less than 2 m.

Since the modelled groundwater drawdown is less than 2 m at all registered bores, the NSW Aquifer Interference Policy, Level 1 minimal impact considerations for water table/water pressure decline at a water supply, are met, and the impact is considered to be acceptable. As such, no agreements with landholders to address impacts on bore infrastructure are required.

2.8 Feasible alternatives

This section summarises the alternatives that have been considered and justifies why the current Project design is the most optimal.

2.8.1 Do nothing alternative

Should the Project not proceed, ore resources required to maintain Tritton Copper Operations are anticipated to be exhausted within the next three years. This would result in Tritton Copper Operations ceasing operations. The alternative for the Project not to proceed, would therefore result in the following outcomes:

- the identified critical mineral resource would remain undeveloped (impacting strategic plans for regional growth);
- existing employment would significantly reduce as Tritton Copper Operations move towards final rehabilitation and closure (providing a significant financial impact to local and regional communities);
- additional tax revenue from the development would not be realised;
- additional royalties for the state of NSW would not be created;
- negative social impacts may arise for the local community (due to the loss of a major employer); and
- predicted social and environmental positive impacts of the proposed Project would not occur.

2.8.2 Project alternatives considered

2.8.2.1 Site layout alternatives

The Project has adopted an iterative Project design process to enable impacts to be avoided/minimised during design works. This has extended to analysing a number of potential layout alternatives, as well as undertaking technical studies within areas that have ultimately not formed part of the proposed Project design. Alternatives considered for the Project are discussed as follows.

2.8.2.2 Mining method alternatives

During Project feasibility studies, various mining methods were evaluated. This analysis considered:

- geotechnical constraints;
- ore productivity;
- mining parameters; and
- potential environmental impacts.

Design options with and without the open cut pit were evaluated, including various open cut pit sizes.

A design option that included open cut and underground mining methods (with a smaller open cut pit shell) was ultimately identified as the most feasible mine design. This alternative was considered optimal based on:

- overall production;
- an earlier ore production date for supplying feed to the Tritton processing plant (while the Project underground site is developed); and
- the economic value generated by the additional production of the heap leach.

2.8.2.3 Underground stoping

With the design and backfilling of underground stopes (mined tunnels), the availability of backfilling material and costs options were considered. Long-hole stoping with cemented paste backfill was identified as the most suitable alternative based on:

- geometry;
- mining recovery;
- mine waste disposal;
- future environmental risk; and
- cost.

Backfilling underground stopes with cemented paste will minimise the amount of waste being disposed of on the land surface, effectively eliminating subsidence while managing the risk associated with higher sulphide wastes. As it is not practicable to dispose of all mining waste in this manner (due to the later timing of the underground development after the open cut), some waste will still be managed through tailings facilities at Tritton Copper Mine (following processing).

2.8.2.4 Haulage access and pipeline route

Assessment of three potential haulage routes to transport mined ore from the Project to the Tritton processing facility was undertaken during ecological and cultural heritage studies. Ultimately, this approach has informed a decision to utilise existing road networks as far as practicable, significantly reducing the potential impact to biodiversity and cultural heritage values.

The Project haul route (originally designed to be 50 m wide) has been reduced to a maximum of 18 m wide to minimise existing road disturbance. This strategy has enabled significant avoidance of additional land disturbance.

The Project design has responded to potential community concerns relating to haulage trucks travelling through Girilambone township by proposing a new section of road to be developed north of Girilambone township. As such, the impact on noise, dust, traffic and visual amenities will be significantly reduced for Girilambone residents. This is a higher cost option than hauling through Girilambone; however, it has been adopted in response to community engagement regarding the Project.

Pipeline installation and route options were considered, including routes integrated with the proposed access road route and separate from it. An underground pipeline route was ultimately located within existing road disturbance (as far as possible) to avoid the need for new disturbance—further minimising potential impacts to biodiversity and Indigenous heritage. The pipeline will connect to Murrawombie Copper Mine.

While an underground pipeline is a higher cost option than a pipeline on the surface, it will provide an improved safety outcome while also supporting a minimisation of disturbance.

Constructing a new powerline from the Mitchell Highway to the Project site, following the shortest route across remnant vegetation, was also considered. However, alternative plans for on-site power generation were identified as preferred, supporting the minimisation of impacts to biodiversity and Indigenous heritage and the reduced greenhouse gas impacts generated by the selected option of on-site solar and diesel power generation.

2.8.2.5 Processing

Processing of all ore on-site (through development of a new processing plant) was evaluated. Ultimately, however, this was not appealing for the following reasons:

- the relatively short life of the mine;
- availability and utilisation efficiency of the Tritton processing plant;
- increased environmental impact of the Project;
- future development targets; and
- Project capital costs.

Heap leaching of oxide ore at the Project site and processing of sulphide ore at the Tritton processing plant were, therefore, determined to provide the best use of existing infrastructure. It will provide optimal resource recovery and minimise risk of geochemical and environmental impacts from processing sulphide ore at the Project site.

Not having the heap leach pad was also considered likely to result in the lower-grade ore being discarded rather than recovered while increasing the amount of material transported to Tritton Copper Mine for processing. As such, heap leaching at the Project site is proposed.

aarc ENVIRONMENTAL SOLUTIONS

Aeris RESOURCES

Constellation Project

Environmental Impact Statement



Chapter 3 – Project Description

3 Project description

3.1 Introduction

This chapter provides a detailed description of the Constellation development (the Project), in accordance with the State significant development guidelines – preparing an environmental impact statement (DPIE 2022a) and the NSW Planning Secretary's Environmental Assessment Requirements (SEARs) for the Project.

To address the development guidelines, a consolidated description of the Project that the applicant is seeking development consent for is required. This includes the Project overview and a detailed description of the specific characteristics of the Project; specifically:

- physical layout and design;
- uses and activities; and
- timing of Project stages and sequencing.

The Project SEARs requirements and where they have been addressed are listed in Table 3-1.

Table 3-1: SEARs requirements

Assessment matter	**Report locations**
Regional geology including a supporting map, the resource to be extracted, demonstrating efficient resource recovery within environmental constraints;	Sections 3.3.1, 3.3.2, 3.5 and 3.6
Details of the ore and waste rock, including mineralogy and deleterious elements and evidence of geological and grade (or quality) continuity of mineralisation in the deposit;	Sections 3.3.2 and 3.9.2.5
The mine layout and scheduling;	Sections 3.4 and 3.9
Average and maximum annual extraction and processing rates;	Section 3.9.2.1
Details of construction, operation and decommissioning, including any proposed staging of the development or refurbishing of infrastructure over time;	Sections 3.9, 3.9.1, 3.9.2 and 3.9.3
All components, infrastructure, materials, any plant and equipment and activities (including any infrastructure that would be required for the development, but the subject of a separate approvals process);	Sections 3.4, 3.5, 3.6 and 3.7
The likely interactions between the development and any other existing, approved or proposed mining related development in the vicinity of the site, including details of interactions with the Tritton Mine and any approvals required to ensure the development could proceed, noting that the Tritton Mine is currently only approved to undertake mining operations (including processing) until 21 December 2024;	Sections 1.6 and 1.6.2 Section 2.2 Section 3.4.3.3
In addition, the following SEARs are addressed in this chapter:	—
Site plans and maps at an adequate scale showing:	—
the location of the development components;	Figure 1-2 and Figure 3-7
existing infrastructure, land use, and environmental features in the vicinity of the development (including any other existing, approved or proposed infrastructure in the region);	Section 3.4 Section 6.1 and Figures 6-3 and 6-4
A waste (overburden, tailings, leach pad etc.) management strategy;	Section 3.9.2.5

Assessment matter	Report locations
A water management strategy;	Section 3.8 Section 6.5.5
Rehabilitation strategy, including details of the progressive rehabilitation of the site during and following construction and decommissioning;	Sections 3.9 and 3.9.3 Chapter 8, Rehabilitation and closure

3.2 Project overview

The Project elements Aeris is seeking approval for are described in detail in this chapter and summarised in Table 3-2. The Project resource estimations have been prepared from the Constellation Mineral Resource Update (18 August 2022).

Table 3-2: Mining Project summary

Project element	Summary of the Project
Project mine area	The proposed greenfield Project is in a rural setting and is proposed to occur on two freehold properties identified as 'Okeh' property (including Lot 4 of DP751341 and Lot 9 of DP751321) and 'Windella' property (Lot 10 of DP 751321). The Project site is sparsely vegetated, and the current land use is mainly sheep grazing with some dryland wheat cropping in the southern paddocks. The Project mine's total surface disturbance area is approximately 170 ha. The Project mine area is within exploration leases (EL) 6126, EL8987 and EL8084 held by Tritton Resources Pty Ltd.
Open cut pit mining method and extent	An open cut pit for open cut mining of the Project deposit will be developed. The open cut pit will be relatively small, with a maximum area of approximately 11.7 ha. The pit shell will have a maximum depth of approximately 110 m to -55 mRL.
Underground mining method and extent	An underground mine for the Project deposit will be developed using long-hole, open stoping with backfilling. The average feed rate from the underground mine will be 0.5 Mtpa. Underground production may peak up to one Mtpa in any given period. Access to the underground workings will be via a portal in a surface box cut and a 3,100 m long decline. Underground workings are to be developed to a depth of -280 mRL.
Production	The ore to be processed is estimated to be 2.4 Mt from the open cut pit and 3.6 Mt from the underground mine over the proposed life of the mine. This is a maximum annual production of one Mtpa of ore from the Constellation Project.
Resource	Indicated and inferred: • Copper—6.7 million tonnes at 1.85% copper; • gold—0.58 grams per tonne; • silver—2.9 grams per tonne containing 123 kt copper metal; • 125 koz gold metal; and • 620 koz silver metal.
Life of mine	The anticipated mine life is approximately 16 years, which includes: • an estimated one-year construction period; • ten years of mining operations; and • five years of decommissioning and rehabilitation activities.

Project element	Summary of the Project
Infrastructure corridor	A corridor, generally approximately 18 m wide, will extend between the Project mine and the existing Tritton Copper Mine incorporating: • the site access/haul road; • a water pipeline; and • optic fibre cable.
Site access	Within the infrastructure corridor, access to the Project site will predominantly be via existing public roads. Operational traffic movements and deliveries to the Project mine will be via Okeh Road and a new haul road between the Mitchell Highway and Okeh Road. The new section of road, approximately 2,850 m long, will divert Project traffic north around Girilambone township. Once constructed, operational and haulage traffic will access the Project site via a new intersection on the Mitchell Highway. The new intersection will be approximately 830 m north-west of the existing Railway Road and Mitchell Highway intersection. Road upgrades are proposed for the existing Railway Road and Mitchell Highway intersection, which will include a channelised right-hand turn. A channelised right-turn is also proposed for the intersection of the new road and Mitchell Highway. Upgrades to Okeh Road will include road widening within the road easement. Construction traffic movements and deliveries to the Project site will be via Okeh Road, accessed via Murrawombie Road to the east of Girilambone, before the new haul road section is constructed in the first year of the Project (Year 0–construction).
Haulage route and traffic movements	Project ore will be transported to the Tritton processing plant at Tritton Copper Mine via the existing public road infrastructure and Aeris-owned roads. Haul vehicles will operate along the proposed site access route, travelling to Tritton Copper Mine via the Mitchell Highway, Railway Road and Yarrandale Road. Haul vehicles will be AB triple road trains with approximately 70-tonne payloads or B double trucks with approximately 50-tonne payloads. Operational traffic movements will be up to 82 truck movements per day. Concentrate from Tritton will be trucked to Hermidale rail siding and loaded onto rail to Newcastle Port. Copper crystal will be loaded and transported from the Project site by road and will continue by either road or rail. The existing rail networks are expected to provide enough transport capacity for the Project. Therefore, no new rail or port facilities will be required.
Off-site processing	Supergene and primary ore will be processed at the Tritton Copper Mine processing facility. Up to approximately 10 Mt of Project ore is expected to be processed at the Tritton processing plant over the life of the Project. Tritton Copper Mine processing facility operates under DA 41/98 (expiring 21 December 2028). A separate approval has been sought to continue processing at the site and increase the annual processing rate and related activities (refer to Chapter 1, Introduction, Section 1.6.2). The proposed production volume is 1.8 Mtpa.
On-site processing	Supergene, primary and high-grade ore will be crushed and screened on the run-of-mine (ROM) pad. Pre-concentration processes, including dry grinding and flotation to create a concentrate, will be undertaken adjacent to the ROM pad. Approximately 2.0 Mt of lower-grade oxide ore from the open cut pit will be processed by heap leaching at the Project site.
Cemented paste fill	Dewatered tailings material from the Tritton processing plant will be backhauled by trucks or road trains using the proposed haulage road to the Project site. The tailings will be screened and mixed with water and a binder in a mobile paste backfill plant at the Project site to produce cemented paste fill. Cemented paste fill will be used in the Project's underground mining activities.

Project element	Summary of the Project
Waste rock management	Approximately 6.1 Mm^3 of waste material will be generated from the open cut and underground mines over the life of the Project. The waste rock emplacement (WRE) has been designed for the total capacity, if required. It will be approximately 35 m above the adjacent land surface (top of the WRE at 205 mRL) and a maximum disturbance area of approximately 40 ha. Once underground operations commence, preference will be given to storing waste rock underground when possible. Waste material may also be stored within the open cut pit below the final level of the pit lake. Mineralised oxide waste will be stored separately in a mineralised waste pile with a capacity of 0.55 Mm^3.
Water supply	Water supply for the Project will be sourced from: • direct rainfall; • catchment runoff; • groundwater inflows; and • transferred via an underground water pipeline in the infrastructure corridor between Murrawombie Copper Mine and the Project, providing up to 258 ML in peak water demand years (Year 4). Project water demands will be managed within existing water licences held by Aeris. Total annual peak water demands for the Project are estimated to be 613 ML/yr (Year 4).
Water management	The Project's water management system will include: • water storage dams; • a clean water diversion system diverting clean water around disturbed areas and mine site infrastructure; • a catchment drainage system around disturbed areas to contain mine-affected waters; • a bi-directional water supply pipeline from Murrawombie Copper Mine; • storing wastewater from ancillary infrastructure for on-site treatment and on-site disposal or reuse; • erosion and sediment controls during construction and operational phases; and • groundwater dewatering from the underground workings and open cut pit sump to the site water management dams.
General infrastructure	Additional infrastructure to be developed at the Project site will include: • a mine laydown area and workshop; • a ROM stockpile for mined ore; • a heap leach pad, oxide ore stockpile and crushing area and other processing facilities, including process and raffinate ponds and solvent extraction plant; • a paste plant, emulsion storage and shotcrete batch plant; • topsoil and subsoil stockpiles; • solar farm and on-site power station; and • administrative facilities, including offices, amenities and a car park.
Power supply	Mains power will be generated at the Project using a combination of 6 MW DC solar photovoltaic (PV) (12 ha area) and a 5,000 kVA diesel genset.
Workforce	The Project will provide continued employment for existing Tritton Copper Operations personnel. It will provide an average of approximately 178 full-time equivalent (FTE) jobs for employees and contractors during operations. Operational employees will work industry-standard 12-hour shifts on seven-day roster cycles. Approximately 95 FTE contractors will be required during the 12-month construction phase of the Project.
Hours of operation	Mining operations and haulage activities are proposed to occur 24 hours a day, seven days a week. Construction activities during the Project construction phase will be undertaken between 6:00 am and 10:00 pm, seven days a week.

Project element	Summary of the Project
Capital investment	Investment will be approximately $120 M over the life of the mine.

3.3 Geology relating to the Project

3.3.1 Regional and local geology

Most of the Girilambone region is covered by colluvial and alluvial sediments with small, scattered areas of weathered bedrock rises (≤ 30m in relief). There are some low hills (30–90 m in relief) and more extensive highly weathered bedrock rises. It is underlain by a relatively poorly known basement composed of Ordovician Girilambone Group rocks with some in-faulted slices of probable Late Silurian to Early Devonian Cobar Supergroup rocks, intruding granites and some Late Devonian outliers or down-faulted blocks (MQueen 2008).

The Girilambone Group consists largely of a range of sediments grouped into turbidites (sedimentary material with alternating source and depositional regime), with some intermediate to mafic (dark coloured, containing magnesium and iron) igneous rocks sporadically spread across the landscape. These rocks have been subjected to at least two phases of deformation and metamorphosed to variable grades (lower greenschist to lower amphibolite facies). Rock types include:

- quartzites;
- arenaceous meta-sediments;
- slates;
- phyllites;
- cherts;
- meta-basalts and
- altered tuffs (Pogson and Felton 1978).

Cobar Supergroup rocks (mostly Kopyje Group) occur in narrow and elongate, faulted synclinal keels within the Girilambone Group rocks (Burton *et al.* 2012). Rock types include:

- conglomerates
- siltstones
- quartzites (including the Coronga Peak Quartzite); and
- felsic volcanic rocks (Florida Volcanics).

Poorly exposed felsic and I-type character granites are known in the northern part of the region and currently considered to be Siluro-Devonian in age (Blevin and Jones 2004; Burton *et al.* 2012). There are several small granite bodies in the west, close to the eastern margin of the Cobar Basin (e.g. Nymagee Igneous Complex and the Tinderra, Wilgaroon, Wave Hill and Beanbah granites).

The Girilambone–Cobar–Nymagee region is one of the richest mineral provinces in NSW. Major deposits occur in the Cobar Basin around Girilambone and at Canbelego and Nymagee (Figure 3-1). However, much of the area has not been explored by modern exploration methods. Exploration has been hampered by the extensive regolith cover as well as poor knowledge of the underlying geology. Most discovered mineral deposits and occurrences have been found:

- on or close to the surface, or
- as deeper extensions to known, smaller outcropping deposits.

A small number of deposits have been discovered beneath thin transported cover or in areas of deeper, partly leached in situ regolith (such as the Tritton deposit). These deposits in the landscape largely lie in a relatively restricted zone (height from 225–325 m above sea level). This zone reflects the range in exposure level of the mineralised rock units in the landscape. There are large areas where the mineralised crust is undercover or deeply weathered, and these remain prospective for further discoveries.

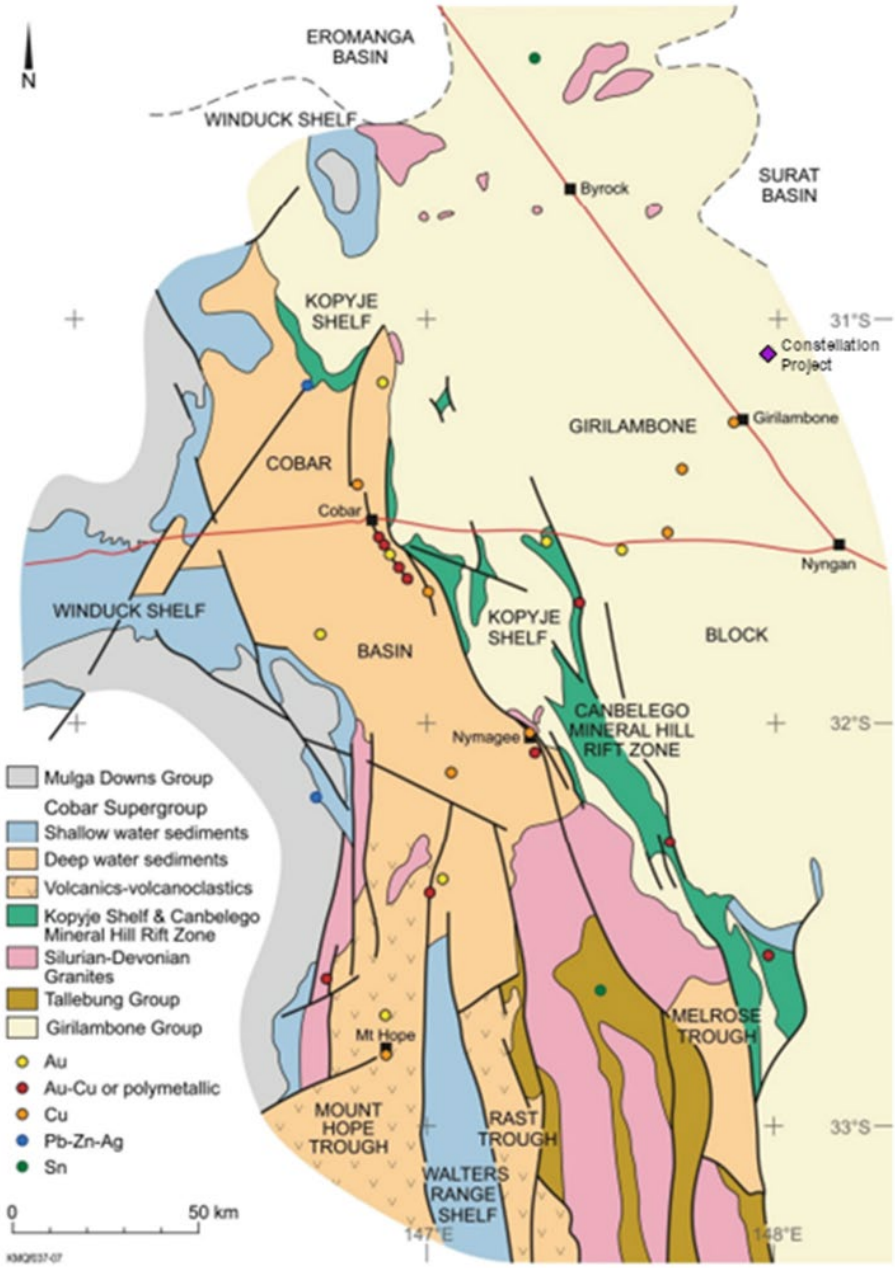


Figure 3-1: Regional geology of the Cobar and Girilambone basins (McQueen 2008)

3.3.1.1 The Girilambone Group (Beds)

The geological facies for the Girilambone Group are summarised in Figure 3-2 (Girilambone "Beds"). The sequence was deposited as a series of sediments in a deep to very deep (slope to basin) marine environment (Burton *et al.* 2012).

Chert horizons in the Girilambone Group indicate deep water and a quiet depositional environment. Primary sedimentary features such as graded bedding (common) and load casts (rare) have been observed. The Girilambone Group lacks strike extensive marker horizons, although the Budgery Sandstone Member is a key unit regionally. This member is a quartz-rich metasandstone to quartzite and has a similar provenance and maximum depositional age to other parts of the Narrama Formation, based on detrital zircon studies (Fraser *et al.* 2014).

Jasper units have been noted at several locations in the Girilambone Group, including being in direct contact with basalts at Mount Dijou (Burton *et al.* 2012).

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

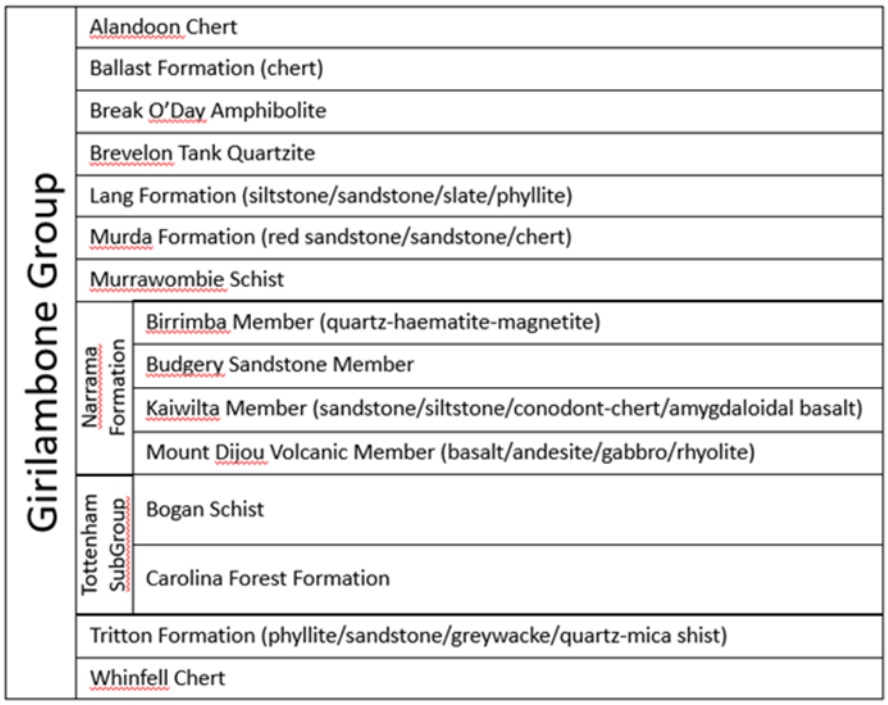


Figure 3-2: Stratigraphic facies of the Girilambone Group

3.3.2 Deposit geology

The Project deposit is in Exploration Licence (EL) 8987, with mineralisation extending into neighbouring (EL) 6126 and (EL) 8084 (Chapter 1, Introduction, Figure 1-3). It bears marked similarities with other copper sulphide deposits discovered in the Tritton Copper Operations tenement package, including the Tritton (+20 Mt) and Murrawombie (+15 Mt) deposits. Both mineralised systems are interpreted to have strong lithological and structural controls on the emplacement of sulphide mineralisation. Mineralisation forms are sheeted with elongated pipe-like geometries and long (continuous) down plunge dimensions.

Copper sulphide deposits within the Tritton Copper Operations, including the Project, appear to correlate with zones of structural complexity, with copper mineralisation appearing to occur late in the structural deformation events. Folding and faulting in these structural domains have accentuated rheological contrasts enabling increased dilation and space for metal-rich fluids to concentrate/precipitate sulphides.

Sulphide textures within the Project deposit vary from disseminated through to massive. The dominant sulphide mineral is pyrite, with lesser chalcopyrite + / - pyrrhotite and sphalerite. Gold mineralisation is associated with pyrite and does not necessarily correlate with chalcopyrite. Occasional magnetite occurrences occur within the sulphide package.

The discrete lack of any well-developed soil profile or recent major erosional event has had the effect of limiting the extent of a secondary dispersion halo. A constrained oxide and/or supergene horizon has developed over the primary sulphide body. The oxide horizon forms a sub-horizontal blanket over the top of the central mineralisation trend. Copper minerals within the oxide domain are dominated by malachite and azurite. The highest copper grades are interpreted to form where the mineralised system extends to the surface. Native copper has been identified in some drill cores; however, it is not considered to be prevalent in the oxide domain.

Within the oxide domain, the copper minerals include:

- malachite
- azurite
- minor chrysocolla; and
- native copper.

Underlying the oxide horizon is a copper-enriched supergene domain characterised by the presence of chalcocite.

The highest apparent grades of copper occur in the chalcocite domain and the quartz-rich sulphide zones with a chalcopyrite breccia-infill.

The primary sulphide system plunges moderately to the south-east (~30°on average) and consists of two main provinces not discretely independent from each other mineralogically. However, one dips moderately to the east and weakly to the north and the other steeply to the south.

On the northern edge of the Project deposit in the south-dipping province, distinctive graphite and carbonate units have been identified footwall to the sulphide mineralisation and have been used as marker beds to close out the extent of the mineralised system, as shown in Figure 3-3. Figure 3-3 also depicts the different copper domains, including:

- oxide (green);
- supergene (purple); and
- primary sulphide (orange).

The Project mineralised system has been traced 1,100 m down plunge and up to 300 m along the strike. The deposit remains open down plunge.

Previously reported downhole electromagnetic (DHEM) surveying detected two large conductive bodies below the drilling base. Copper sulphide mineralisation was intersected by drilling and targeting one of the modelled DHEM plates, which has provided strong evidence that the Project deposit continues further down plunge below current drilling.

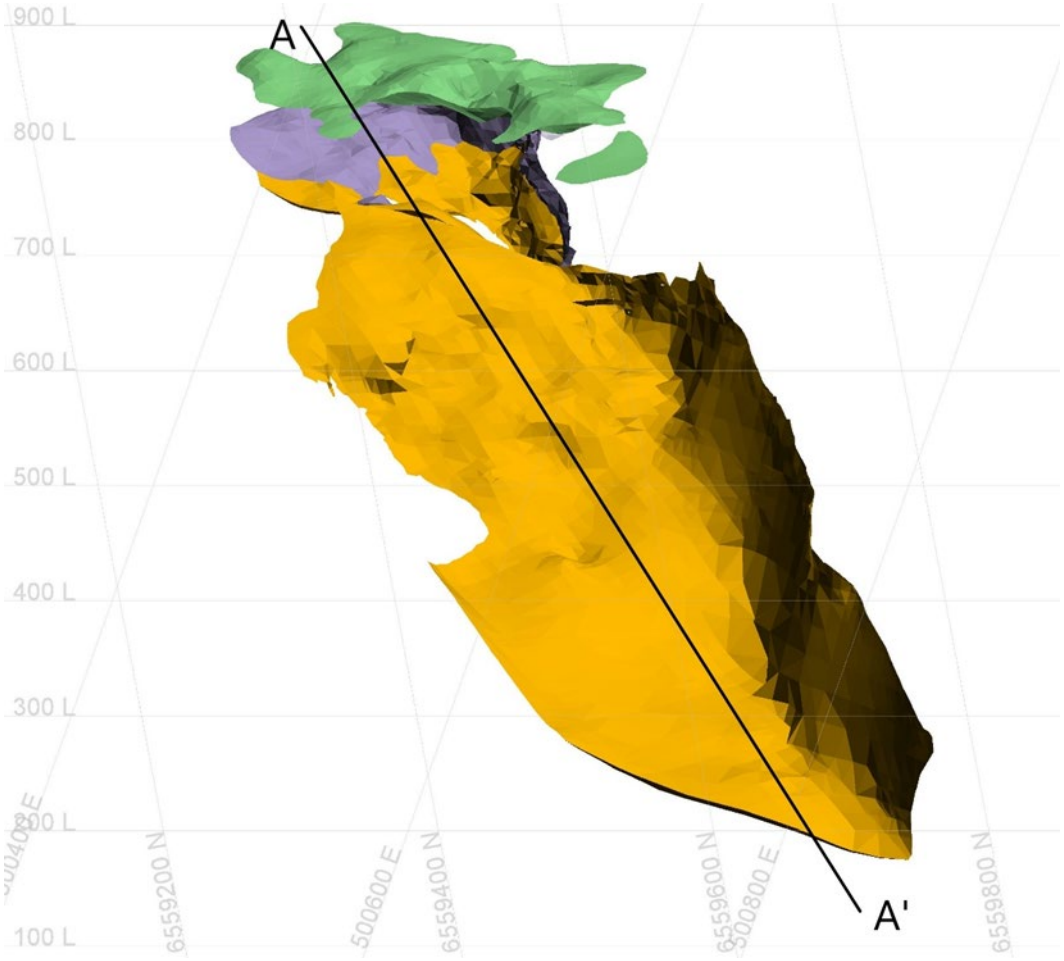


Figure 3-3: Oblique view looking north-east at the Project deposit showing the different copper domains

3.3.2.1 Mineralisation

Copper mineralisation at the Constellation deposit is hosted within three different copper domains, defined by the dominant copper minerals as:

- oxide;
- supergene; and
- primary.

The oxide domain forms a flat lying tabular body from near surface (<5m) to approximately 40 m below surface. The oxide domain is host to a variety of copper minerals, dominated by azurite and malachite with lesser amounts of native copper and chrysocolla. Malachite and azurite commonly form thin (<1cm) veinlets or sparse disseminations throughout the host rock. The supergene domain is dominated by chalcocite, which occurs in a range of different texture types, including disseminations, bands, and semi-massive. In places, the supergene domain contains some azurite/malachite and chalcopyrite, indicating portions of the supergene domain are a mixture of different all three copper domain types. Pyrite is commonly associated with chalcocite within the supergene domain.

The primary sulphide domain is the largest modelled copper domain at the Project deposit. Sulphide textures vary from disseminated/stringer pyrite grading to banded, semi-massive and massive pyrite (Figure 3-4). Chalcopyrite is closely associated with pyrite-forming disseminations, stringer veinlets and erratic remobilised accumulations. Higher grade chalcopyrite is typically associated with either massive pyrite or remobilised chalcopyrite/quartz breccia, commonly referred to as Durch Bewegung texture.

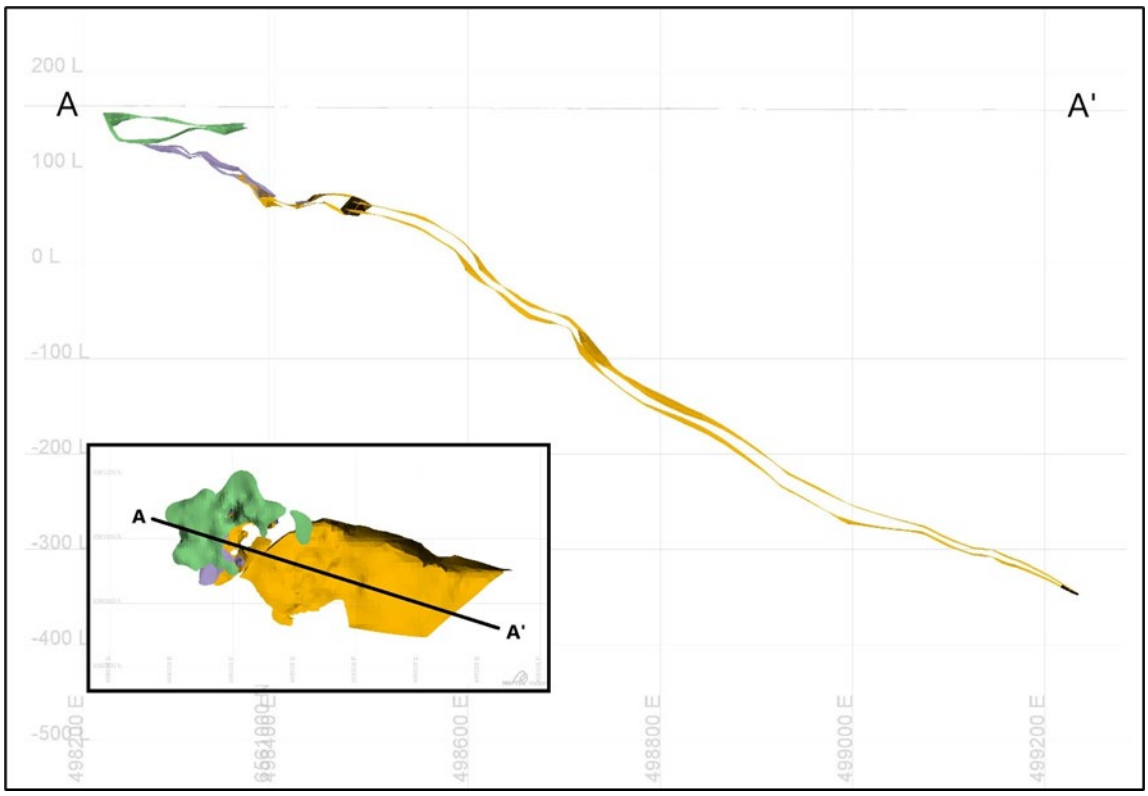


Figure 3-4: Representation of the Project mineralised system (cross-section looking north).

3.3.2.2 Constellation mineral resource

A Mineral Resource Estimate (MRE) was reported in August 2022 for the Project in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves 2012 (JORC Code) (Table 3-3 and Figure 3-5). The August 2022 Project MRE contains:

- 6.7 million tonnes at 1.85% copper, 0.58 g/t gold and 2.9 g/t silver;
- 123 thousand tonnes of copper metal;
- 125 thousand ounces of gold metal;
- 620 thousand ounces of silver metal; and
- oxide, supergene and primary mineralisation.

The mineral resource is based on an exploration and resource definition drill program totalling 173 drillholes, which has intersected:

- oxide (copper hydroxides);
- supergene (chalcocite); and
- primary copper (chalcopyrite) mineralisation.

The geometry of the sulphide mineralised system at the Project is largely characterised by a gently dipping (~35°) body to the south-east. As the geological understanding of the deposit increased with additional drillhole data, particularly within the upper 150 m of the deposit, it became apparent the sulphide body changes orientation from gently dipping to sub-vertical. The sub-vertical body has been confirmed to 150 m below the surface. Below this depth, there is no drilling intersecting the interpreted extension of the sub-vertical sulphide body.

The geological understanding of the “vertical zone” of the mineralised system is still in progress and requires further drilling to more confidently understand the mineralised geometry and grade distributions.

The MRE is classified as Indicated and Inferred materials in accordance with the JORC Code:

- Indicated and Inferred materials are constrained in an open pit reporting shell.
- Inferred material is predominantly reported below the pit shell.

Copper, gold, silver, zinc, iron and sulphur have been estimated within the MRE.

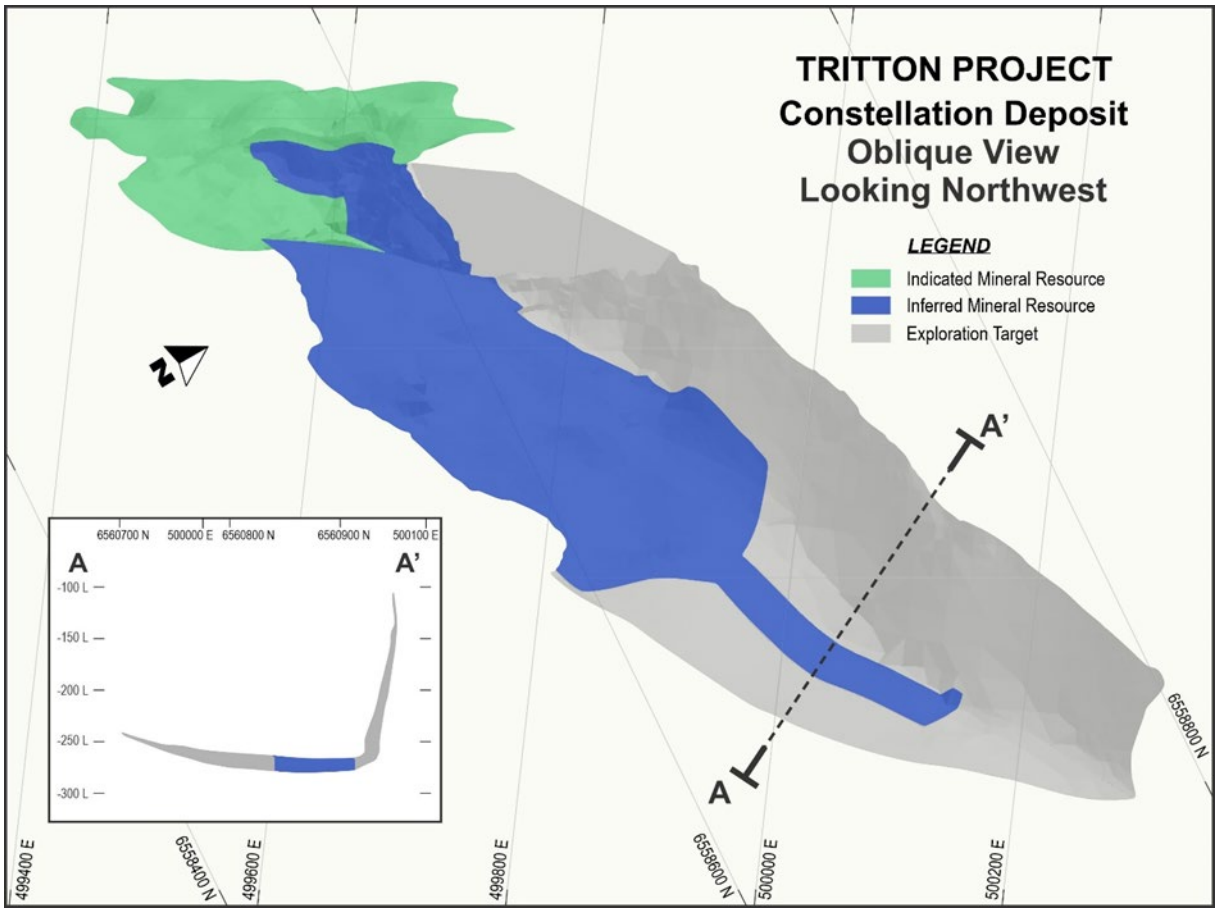


Figure 3-5: Constellation reported mineral resource indicated and inferred

Table 3-3: Constellation mineral resource

AUGUST 2022 CONSTELLATION MINERAL RESOURCE									
Mineralisation type	**Resource category**	**Cutoff grade (Cu%)**	**Tonnage (kt)**	**Cu (%)**	**Au (g/t)**	**Ag (g/t)**	**Cu metal (kt)**	**Au metal (koz)**	**Ag metal (koz)**
Oxide	Indicated	0.2	1,600	0.6	0.1	0.7	10	7	36
	Inferred								
Primary/ Supergene	Indicated	0.3	510	2.3	1.1	4.4	12	14	69
	Inferred		1,000	3.5	0.6	3.3	29	29	125
Subtotal (O/P)	Indicated	various	2,110	1.0	0.3	1.5	22	21	104
	Inferred		1,000	2.8	0.9	3.7	29	29	125
	Total		3,110	1.6	0.5	2.2	51	50	229
Primary/ Supergene	Indicated	0.9	130	2.1	1.1	4.9	3	5	20
	Inferred		3,300	2.1	0.7	3.5	70	70	371
	Total		3,500	2.1	0.7	3.5	72	75	392
Total (O/P & U/G)	Indicated	various	2,300	1.1	0.4	1.7	25	26	125
	Inferred		4,400	2.2	0.7	3.5	99	99	496
	Total		6,700	1.8	0.6	2.9	123	125	620

3.3.2.3 Resource recovery

Open cut and underground mining methods, similar to the method utilised at Murrawombie Copper Mine and Tritton Copper Mine, are proposed to optimise extraction from the Project mineral resource while minimising environmental impacts.

The Project mine plan represents efficient resource recovery:

- It utilises industry-standard mine planning and optimisation techniques to ensure optimised resource extraction.
- Processing and economic parameters have been carefully considered to determine the marginal economic cutoff grades and ensure that any resource that will add value is extracted.
- Alternative processing options have been investigated (including heap leach and ore sorting) that present potential to improve the economic viability of lower-grade material and to lower the cutoff grade.
- The underground method includes using paste fill to maximise recovery.

Appropriate economic and technical justifications have been completed for the proposed mining/production scheme:

- Industry-standard optimisation techniques will be used to design the open cut pit and underground mine.
- Ore will be selected using the marginal economic cut off for the open cut and underground mines plans.
- Resources that would not be economic to extract due to physical constraints, such as the location of infrastructure or the WRE, will be excluded or sterilised.
- The mine plan is based on optimising the transition from open cut to underground.

3.4 Project area and layout

The Project comprises the following:

- Project mine site (as shown in Figure 3-6 and described in Chapter 1, Introduction, Section 1.5.3);
- infrastructure corridor containing the site access/haul road, water pipeline and optic fibre cable between the Project mine site and the existing Murrawombie Copper Mine (Chapter 1, Introduction, Figure 1-2); and
- proposed haul road in the infrastructure corridor connecting to an existing approved haul road between the Murrawombie Copper Mine and Tritton Copper Mine (Chapter 1, Introduction, Figure 1-2).

Ore processing at the Tritton Copper Mine and water management at the Murrawombie Copper Mine will be managed with existing approvals and licences and modifications to those licences (refer to Chapter 1, Introduction, Section 1.6.2).

3.4.1 Project mine site

The Project mine site will support open cut and underground mining (Figure 3-6). Mining will initially be by an open cut pit followed by underground mining accessed by the portal pad in the box cut.

A series of haul roads will enable mining vehicles and equipment to transport

- mined ore to the ROM stockpile pad prior to crushing and screening and hauling to the off-site processing plant; and
- waste rock to the WRE.

Lower-grade ore will be processed on-site by heap leaching. There will be ancillary infrastructure to support the mining and processing activities. The following will be required for processing:

- agglomeration pad;
- heap leach pad;
- associated processing facilities, including water storage; and
- solvent extraction (SX)/crystal plant.

On-site processing activities are further described in Section 3.9.2.2.

Ancillary facilities on the mine site will include:

- a mine laydown area and workshop; and
- administrative facilities, including offices, amenities, and car park.

Topsoil stockpiles will be used to store the soil removed during the site clearing and preparatory earthworks.

A paste plant and emulsion storage tanks will prepare the tailings to be returned to the underground mine area; a shotcrete batch plant will prepare concrete for the underground mine.

Power will be supplied to the site from a solar farm and generator and via an on-site power station (to be located with the solar farm).

The mining and ancillary activities will be supported by water management, storage and pipeline infrastructure during construction and operations and at closure. The Project water management system will include:

- water storage dams;
- a clean water diversion system diverting clean water around disturbed areas and mine site infrastructure;
- a catchment drainage system around disturbed areas to contain mine-affected waters;
- a water supply pipeline from the Murrawombie Copper Mine;
- wastewater storage from ancillary infrastructure for on-site treatment and on-site disposal or reuse;
- erosion and sediment controls during construction and operational phases; and
- groundwater dewatering from the underground workings and open cut pit sump to the site water management dams.

Further details regarding water management are described in Section 3.8 and Chapter 6, Environmental assessment, Section 6.5 Surface water.

The water pipeline, to be located in the infrastructure corridor between the Project mine site and the Murrawombie Copper Mine, will enable water to be transferred to and from the Project mine site (refer to Sections 3.4.3.2 and 3.4.2).

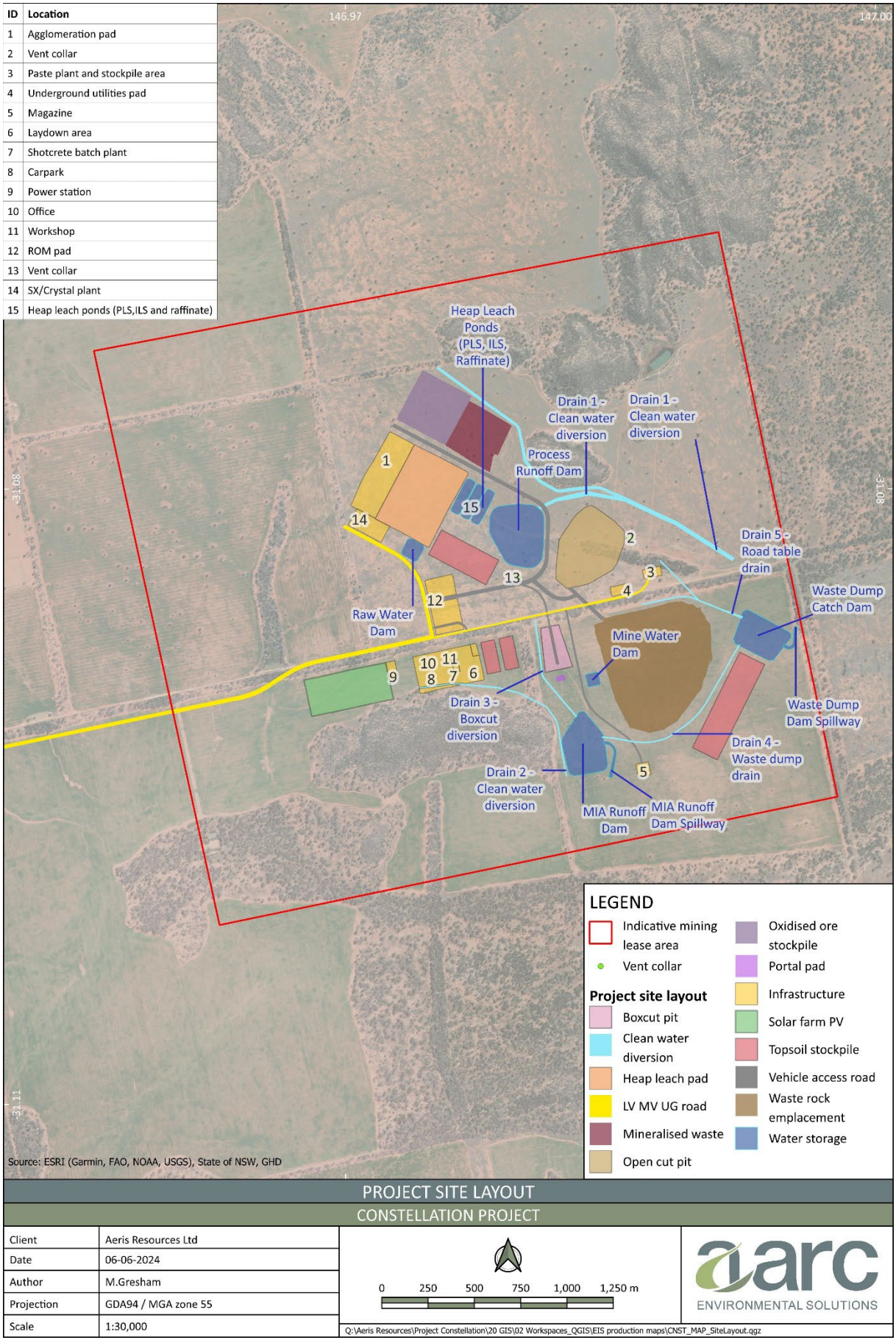


Figure 3-6: Project site layout and disturbance extent

3.4.2 Infrastructure corridor

An infrastructure corridor, generally 18 m wide, between the Project mine site and the existing Murrawombie Copper Mine will contain the site access/haul route and an buried water pipeline with an optic fibre cable (Figure 1-2 and Figure 3-7).

The infrastructure corridor will be aligned with existing roads from the Project mine site to the Mitchell Highway.

Approximately 800 m north of Girilambone, there will be one 2,850 m long greenfield section of the corridor connecting the existing Okeh Road to the Mitchell Highway.

At the entrance to the Project mine site, the infrastructure corridor will be south of the existing road to avoid remnant vegetation. The alignment has been selected to avoid and minimise disturbing remnant vegetation adjacent to the roads and minimise direct impact on properties and stakeholders along the route.

South of the Mitchell Highway, the infrastructure corridor follows the Railway Road to the Murrawombie Copper Mine (Figure 1-2).

At the entrance to the Murrawombie Copper Mine, there will be a section of buried pipeline and optic fibre cable only, as that section will not be the haul road.

The infrastructure corridor containing the new haul road will follow Yarrandale Road, to the existing haul road from Murrawombie to the Tritton Copper Mine (Section 3.4.3.3).

Throughout the life of the Project, the bi-directional water supply pipeline will provide a contingency water supply to meet site water demands and transfer excess contaminated water to the Murrawombie Copper Mine.

The pipeline would be buried in a trench generally adjacent to the road, and it is proposed to cross under the Mitchell Highway.

A pump would be located at either end of the pipeline. At the Mitchell Highway road crossing, the buried pipeline would be under the Mitchell Highway. Steel enveloper pipes may be required for mechanical protection at road crossings. The pipeline would transport potentially contaminated water; therefore sleeving may be required at watercourse crossings and flow meters for end-to-end leak detection. Water supply by the water pipeline is further described in Section 3.8.3.

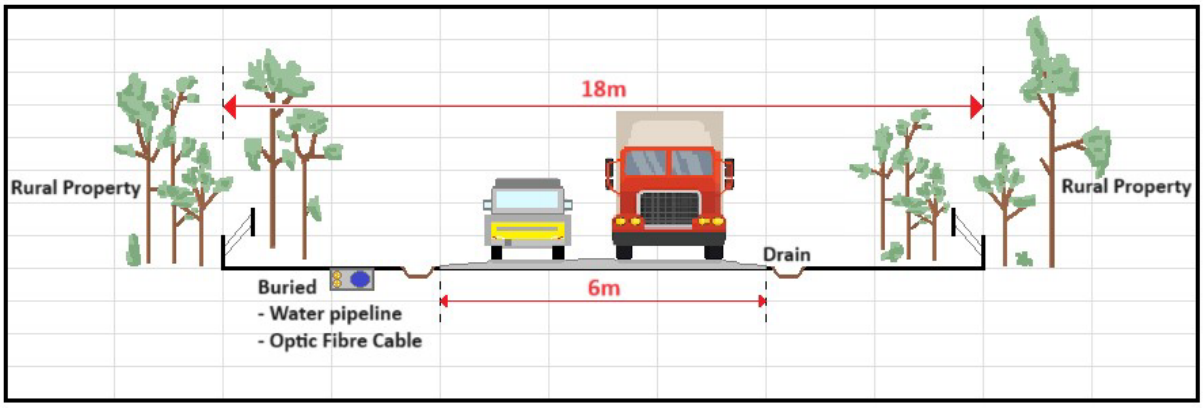


Figure 3-7: Indicative Infrastructure corridor

3.4.3 Haul route

The proposed haul route from the Project site to the Tritton Copper Mine will utilise public and private roads, including a section of previously approved haul road used by other Tritton Copper Operations in the region—the Avoca Tank Copper Mine and the Murrawombie Copper Mine (Figure 3-8). To support haulage activities, there will be:

- a road upgrade between the Project site and the Mitchell Highway;
- a new T intersection to link the proposed haul road with the eastern side of the Mitchell Highway (north of Girilambone); and
- an upgrade to the intersection of the Mitchell Highway with Railway Road (west of Girilambone).

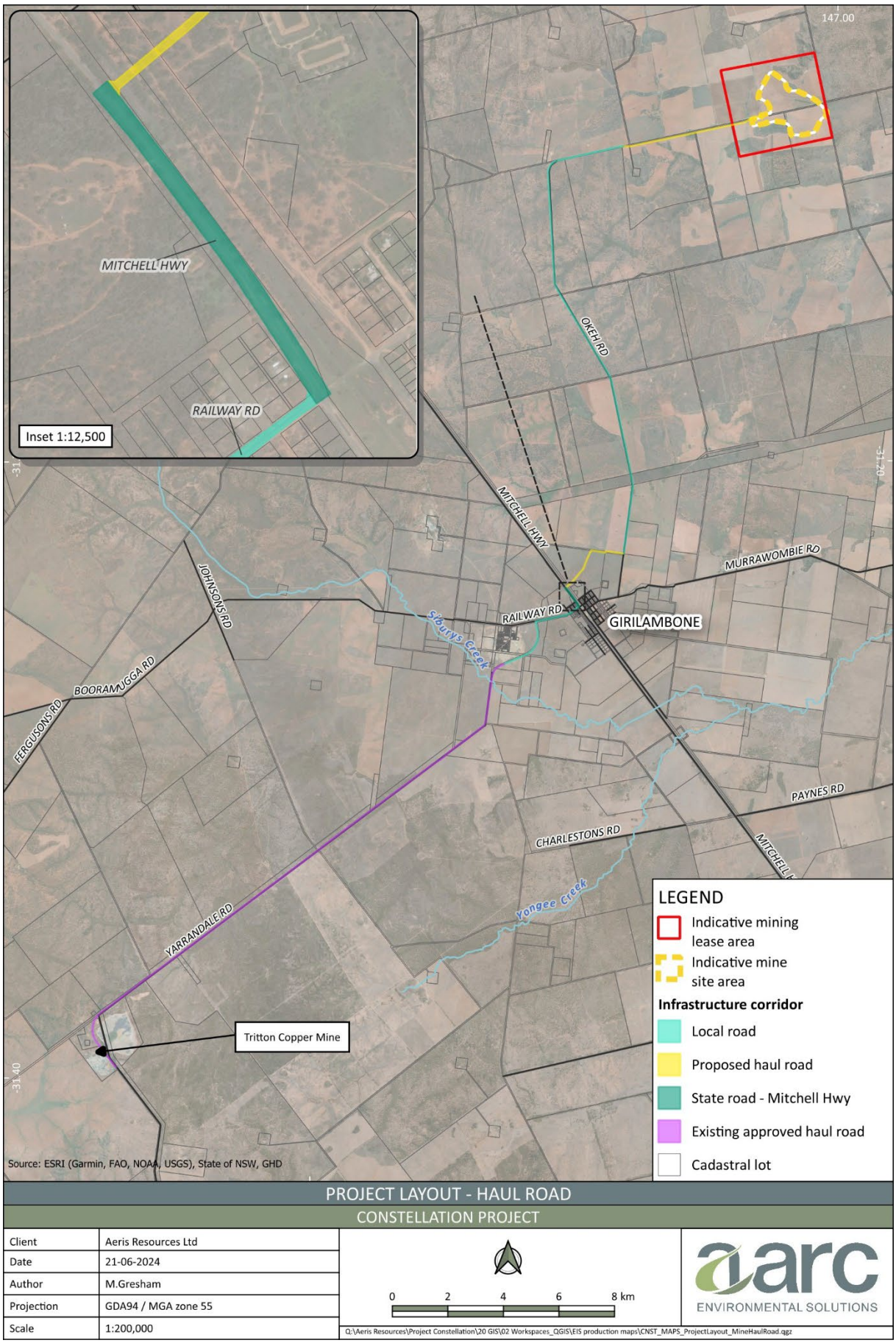


Figure 3-8: Proposed haul route

3.4.3.1 Road upgrades and new roads

Upgrades to the existing Okeh Road (from the intersection of the new road, north to the Project site) will be completed to accommodate Project haulage activities within the 18 m infrastructure corridor and the existing road disturbance footprint.

Opportunities to reduce the extent of clearing (e.g. by installing safety barriers around large trees) will be reviewed during detailed design development.

A new section of road will be built from the Okeh Road and the Mitchell Highway intersection on the Mitchell Highway, approximately 800 m north of Girilambone. The new 2,850 m section connecting to the existing Okeh Road will be used for a haul route and site access. The road will be unsealed, consistent with the Okeh Road.

The haul road to be built in the infrastructure corridor will be constructed and maintained in accordance with industry standards. An appropriate traffic management plan will be implemented prior to construction to address the stages of the Project, including:

- construction;
- maintenance;
- operation, and
- decommissioning.

The plan will also address safe haulage in dry and wet weather, focusing on but not limited to:

- speed limits;
- intersections;
- bends and lines of sight;
- gradients, and
- separation of heavy vehicles and light vehicles when necessary.

3.4.3.2 Intersection upgrades on the Mitchell Highway

The new T intersection on the Mitchell Highway/new haul road will include a short channelised right-turn treatment. Further design details are provided in Chapter 6, Environmental assessment, Section 6.15, Transport and Attachment 4, Road intersections.

An intersection upgrade will also be completed for the Mitchell Highway and Railway Road intersection to optimise road safety for operational traffic and other road users. Upgrades will include a short channelised right-turn on the approach to the Railway Road from the Project site. Some clearing and road widening will be needed to accommodate the intersection upgrades. Further design details are provided in Chapter 6, Environmental assessment, Section 6.15, Transport, and Attachment 4, Road intersections.

3.4.3.3 Existing haul route

The approved, existing haul route commences south of the Murrawombie Copper Mine on Yarrandale Road. The haul route from the Murrawombie Copper Mine to the Tritton Copper Mine will not require any upgrades.

The proposed haul route and the existing approved haul road are illustrated in Chapter 1, Introduction, Figure 1-2 and further described in Chapter 6, Environmental assessment, Section 6.15, Transport.

3.4.4 Extent of disturbance

The Project's physical layout and disturbance extent is shown in Figure 3-6. Disturbance associated with the Project will be limited to:

- the Project site area of 170 ha;
- a new section of infrastructure corridor and haul road west of Girilambone town (3.65 ha);
- a section of haul road at the entrance to the Project site (approximately 1.4 ha), refer to Chapter 1, Introduction, Figure 1-2); and
- upgrades to the existing road infrastructure and buried pipeline; specifically:
    - the infrastructure corridor between the Murrawombie Copper Mine and the Project mine site, and
    - the 0.08 ha for the pipeline near Murrawombie Copper Mine).

To minimise disturbance, the proposed haul route from the Project site to the Tritton Copper Mine will utilise public and private roads, including a section of the existing haul road used by other Tritton Copper Operations in the region:

- Avoca Tank Copper Mine; and
- Murrawombie Copper Mine.

The Project design elements implemented to avoid and minimise impacts to environmental values are outlined in Chapter 1, Introduction, Section 1.5.2.

3.5 Open cut mine

Open cut mining, using conventional hard rock techniques, will target the relatively shallow oxide mineralisation, mining down to approximately 55 mRL.

The indicative design of the open cut pit is shown in Figure 3-9 and was selected as:

- the open cut pit is relatively small;
- the total material movement is approximately 14 Mt; and
- the mining rate has been scheduled to maximise the production rate of feed to the Tritton.

The open cut pit will be a terrace mining operation with 10 m bench intervals. A two-way ramp 25 m wide will be constructed, entering the pit from the south-west. The pit benches and ramp design parameters are based on accommodating Caterpillar 777G haul trucks during mining operations.

The uppermost benches will provide waste rock zones of moderate dimensions that lend themselves to bulk mining, and some ore is expected to be present in continuous zones that may also be amenable to productive mining.

Waste rock from the open cut pit will be hauled from the pit and managed in the WRE, proposed to be located immediately south of the open cut pit. A small proportion of waste rock from the open cut pit may be crushed for:

- construction aggregate;
- road base and sheeting; and
- blast hole stemming.

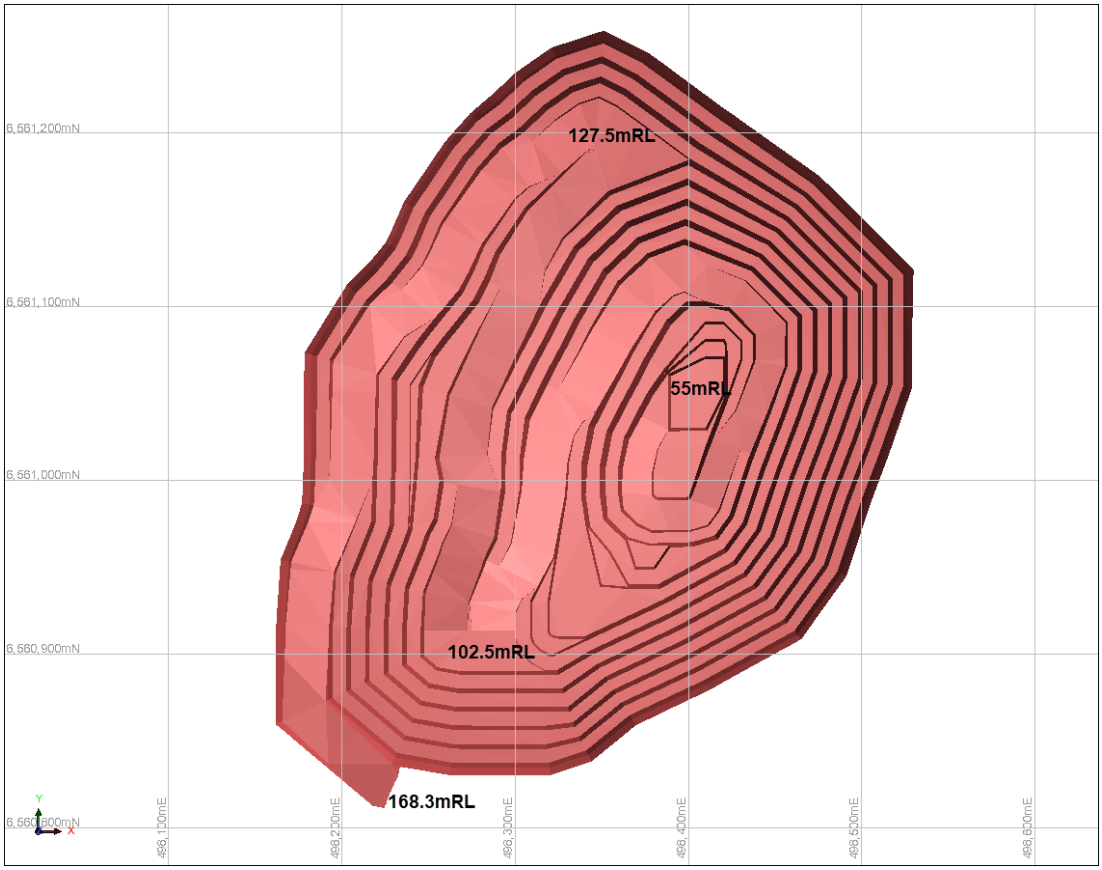


Figure 3-9: Indicative open cut pit design

3.5.1 Open cut mining methods and pre-mining activities

Developing the open cut pit, and open cut mining will require the following activities:

- **Sediment control:** The main sediment and water controls will be installed prior to any vegetation or soil being disturbed.
- **Surface drainage:** Surface drainage will be designed to ultimately re-enter natural systems, except for contaminated residual leachate from heap leach pads that will drain to the pit. Sediment containment structures will be operational and maintained until vegetation is established.
- **Vegetation clearing:** Vegetation will be cleared immediately prior to topsoil stripping, during the first year of mining. This process will make all mining and dumping areas available, providing flexibility to schedule the open cut mining and waste rock dumping. Existing vegetation in the open cut pit footprint is generally composed of previously cleared and a highly modified derived native grassland, with a limited area of native woodland vegetation. A detailed vegetation and topsoil management plan will be developed for the Project.
- **Topsoil management:** Topsoil of suitable quality as a growth medium to use in rehabilitation activities, typically to a depth of 200 to 300 mm, will be stripped from the open cut pit footprint. This will be completed by a combination of scraper, excavator, bulldozer, loader, and truck, as appropriate; and a water cart for dust suppression. Topsoil will be stockpiled separately from other soil sources. Topsoil will be managed in accordance with specific soil management, stockpiling and re-application procedures developed for the Project (refer to Chapter 6 Environmental assessment, Section 6.1 Soil and land capability).
- **Subsoils and regolith stripping and stockpiling:** These materials will be stripped and stockpiled separately for potential use as low permeability materials and growth/cover material. Excess material (including topsoil at the site) for site rehabilitation could be moved to Murrawombie Copper Mine site to use for site rehabilitation.
- **Grade control:** Grade control sampling would be undertaken by reverse circulation drilling in advance of the mining benches. Samples would be analysed to define ore zones for markout. Drill holes would be approximately 60 m hole depth to cover benches. Grade control and marking out of ore zones would be undertaken prior to mine production.
- **Drilling and blasting:** Open cut mining will use conventional drilling and blasting techniques for productive excavation. Drilling and blasting will generally be conducted on 5 m high benches, and potentially 10 m benches in the broader upper benches, with blast holes drilled using top-hammer hydraulic drill rigs. Conventional non-electric initiation products will be used for most blasts, while wet conditions after prolonged rainfall or due to groundwater may necessitate using emulsion explosives. Explosive materials will include initiating products, ammonium nitrate fuel oil and emulsion explosives. They will be stored in a dedicated magazine that will be located at an appropriate distance from other operational activities. Refer to Appendix 13 Preliminary hazard analysis.
- **Stemming material:** Material will be obtained by crushing and screening suitable aggregates sourced from hard rock at or near the Project. Standard commercial products will be used with the principal blasting agent, ammonium nitrate and fuel oil. Blasts will be fired during the dayshift only. The exclusion zone for personnel around the blast would depend on the specifics of the shot and the material; however, it is expected to typically be around 500 m. A comprehensive blasting procedure will be implemented as part of the mine safety management plan to ensure the safety of personnel and equipment in and around the mine during blasts.
- **Loading and hauling:** Blasted waste rock and ore will be loaded and hauled by a mining fleet likely to comprise a 100 t to 200 t class diesel hydraulic excavator loading 90 t rigid dump trucks. An example would be a 107 t Komatsu PC1250SE-8R excavator loading 90 t Caterpillar 777 dump trucks. The different ore types and waste rock types will be mined and stockpiled separately. The priority will be to mine the open cut down to a depth of 30 to 40 m to expose supergene/chalcocite ore, which will then be mined at a rate of 0.5 Mtpa. Chalcocite ore will be stockpiled on the ROM pad to the west of the open cut for haulage to the Tritton processing plant. Oxide ore that is mined in the upper benches prior to commissioning of the heap leach facilities will be placed in a stockpile adjacent to the heap leach pad in a temporary oxide ore

stockpile. After commissioning of the heap leach facilities, oxide ore will be hauled to the heap leach crusher area, and either directly tipped into the crusher or placed in a stockpile for subsequent rehandling to the crusher.

- **Mined supergene/chalcocite ore**: Material will be hauled and stockpiled on the ROM pad in preparation for hauling to the Tritton processing plant.
- **Waste rock:** This material will be hauled to the WRE.

At the completion of mining, the final open cut pit will be a relatively small void. The final void will remain as a permanent terminal sink (pit lake) to groundwater (Figure 3-10). Although the pit lake is in direct contact with a fractured rock aquifer with geological structures, it does not necessarily increase the risk of seepage to the surrounding groundwater environment. Groundwater will only flow from a higher elevation or pressure to a lower elevation or pressure, regardless of the hydraulic conductivity of the aquifer. Therefore, seepage from the pit lake to the adjacent aquifer is not expected (refer to Chapter 6 Environmental assessment, Section 6.4 groundwater).

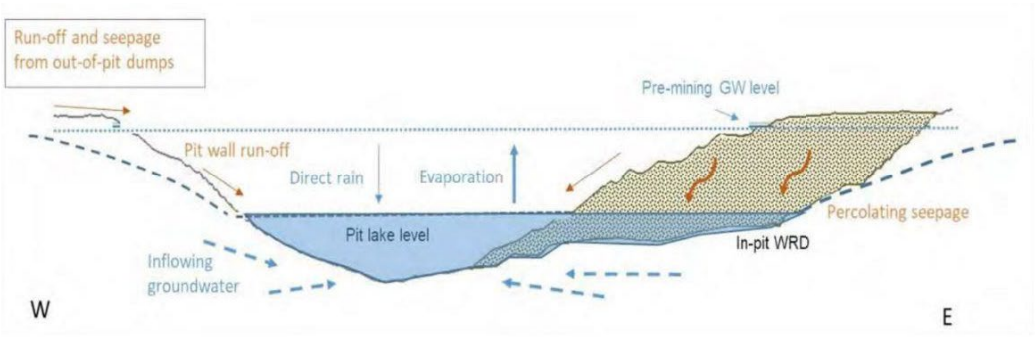


Figure 3-10: Schematic of typical pit lake sink

Rehabilitating Project infrastructure and mining activities is discussed in Chapter 8 Rehabilitation and closure.

3.5.2 Open cut mining equipment

The proposed open cut mining fleet will generally consist of rigid-body mining trucks loaded by hydraulic excavators.

The proposed main open cut mining fleet will likely include those listed the below—or an equivalent combination, depending on the contractor and mining fleet available at the time of operations:

- 200 t class excavator—primary mover (e.g. Hitachi EX1900 or similar);
- 100 t class excavator—additional capacity (e.g. Komatsu PC1250 or similar);
- 90 t class trucks x 5 (e.g. Caterpillar 777 or similar); and
- top-hammer diesel hydraulic drill (e.g. Epiroc FlexiROC T45 or similar) capable of drilling ø89mm to ø127mm blast holes.

Ancillary vehicles and equipment that are proposed to support the open cut mining fleet could include:

- tracked dozer (e.g. 1 x Caterpillar D10 or D9 and 1 x D8 or similar);
- grader (e.g. Caterpillar 14M or similar);
- water cart;
- wheel loader (e.g. Caterpillar 990 or similar) for ancillary loading and ROM rehandle to crusher;
- compactor;
- explosives truck;

- integrated tool carrier (e.g. Caterpillar 950 or 938 or similar);
- 4WD single and dual cab utilitys;
- 4WD troop carrier/ambulance;
- minibus;
- bobcat;
- rough terrain crane—15 tonne capacity; and
- forklift—2 tonne capacity.

Makes and models of equipment are representative only of the classes and sizes of equipment proposed, and the final selection will depend on financial analysis at the time of purchase.

3.6 Underground mine

3.6.1 Underground mining method

The underground mine will target the supergene material approximately 100 m below ground, extending to approximately 450 m (Figure 3-4). The conventional long-hole stoping with fill mining method will be used for the Project because it offers good resource recovery and a lower cost for mining, compared to other methods, given the narrow and flat-dipping ore body.

The underground mining target will be an average rate of 0.5 Mtpa, which may be up to one Mtpa in a year. The total lateral development is estimated to be 20.3 km, and the total vertical development is estimated to be 0.9 km.

Long-hole stoping will involve drilling and blasting with long holes, extracting the blasted ore to form stable open voids, or stopes, at regular intervals along the orebody. The dimensions of each stope will be dependent on the geotechnical conditions of the wall rock, the backs and the stress conditions.

Once the stable limit has been reached in one of the stope dimensions, the stope cannot be expanded further. The stopes will be filled to maintain stability and allow the adjacent ore to be extracted.

The general sequence of long-hole stoping with fill is described below and illustrated in Figure 3-11 and Figure 3-12.

- Drilling and blasting with long holes will be undertaken (Figure 3-11: Steps 1 and 2).
- The blasted ore will be ‘mucked’ out from the bottom of the stope (Figure 3-11: Steps 3 and 4). Efficient mucking depends on the blasted ore drilling to the drawpoint (Figure 3-12, Step 5).
- Completed stopes will be filled mainly using cemented paste fill (CPF) produced from tailings (Figure 3-12: Steps 6, 7 and 8). CPF will be the primary material used for backfilling; however, some supplementary backfilling will be done with underground waste rock.
- Waste rock generated from underground mining will supplement other backfill material.
- PAF_{HC} material will be prioritised as waste rock backfill material (refer to Chapter 6, Environmental assessment, Section 6.3 Geochemistry). This material will preferentially remain underground and be used for backfilling secondary stopes. Waste rock from the underground may be stored in the WRE for final emplacement. Managing other underground waste rock material is discussed in Section 3.9.2.5.
- Following processing at the Tritton processing plant, reclaimed dry tailings will be hauled back to the Project for screening and mixing with water and binder in a mobile paste backfill plant. An overview of the proposed CPF system is provided in Section 3.9.2.5.3.

Aeris will undertake further detailed geotechnical assessments on the design of the underground mine during the design phase prior to commencing underground mining.

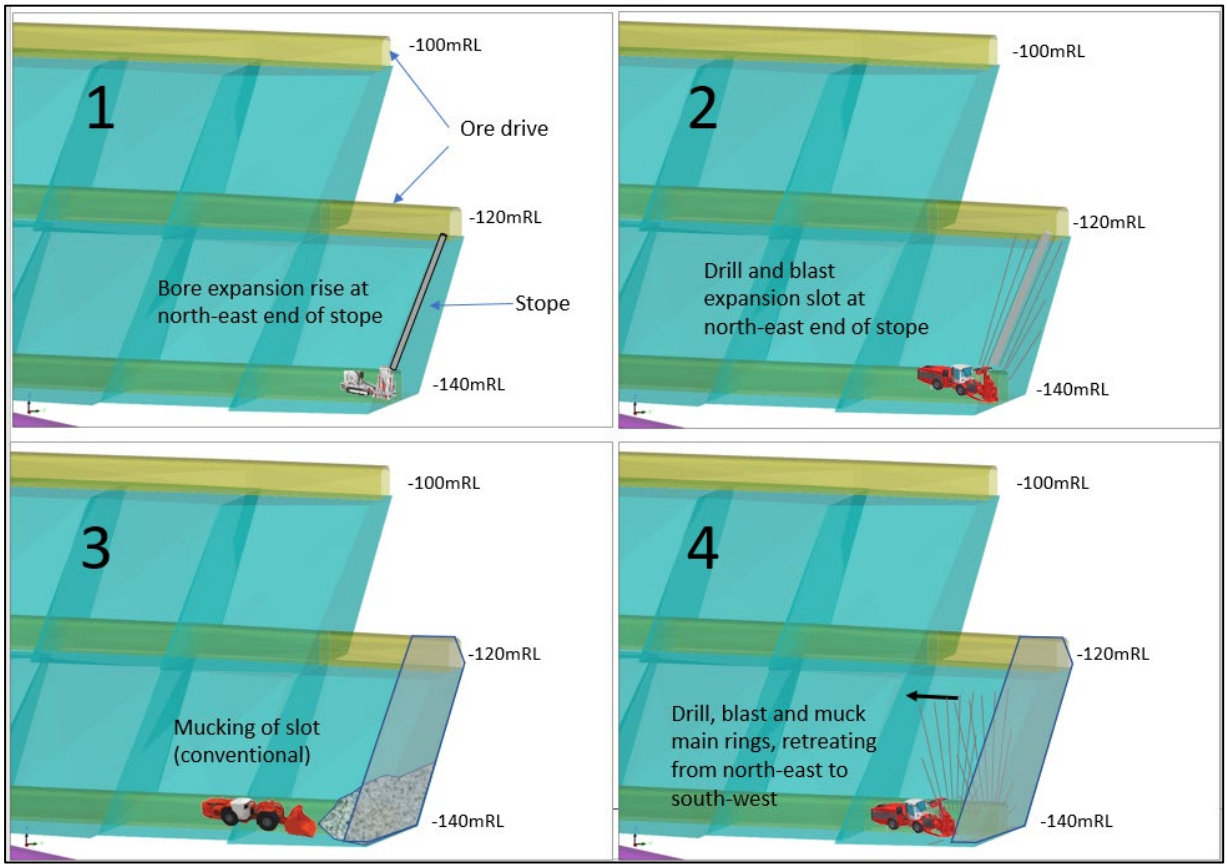


Figure 3-11: General sequence of long-hole stoping activities to initiate production

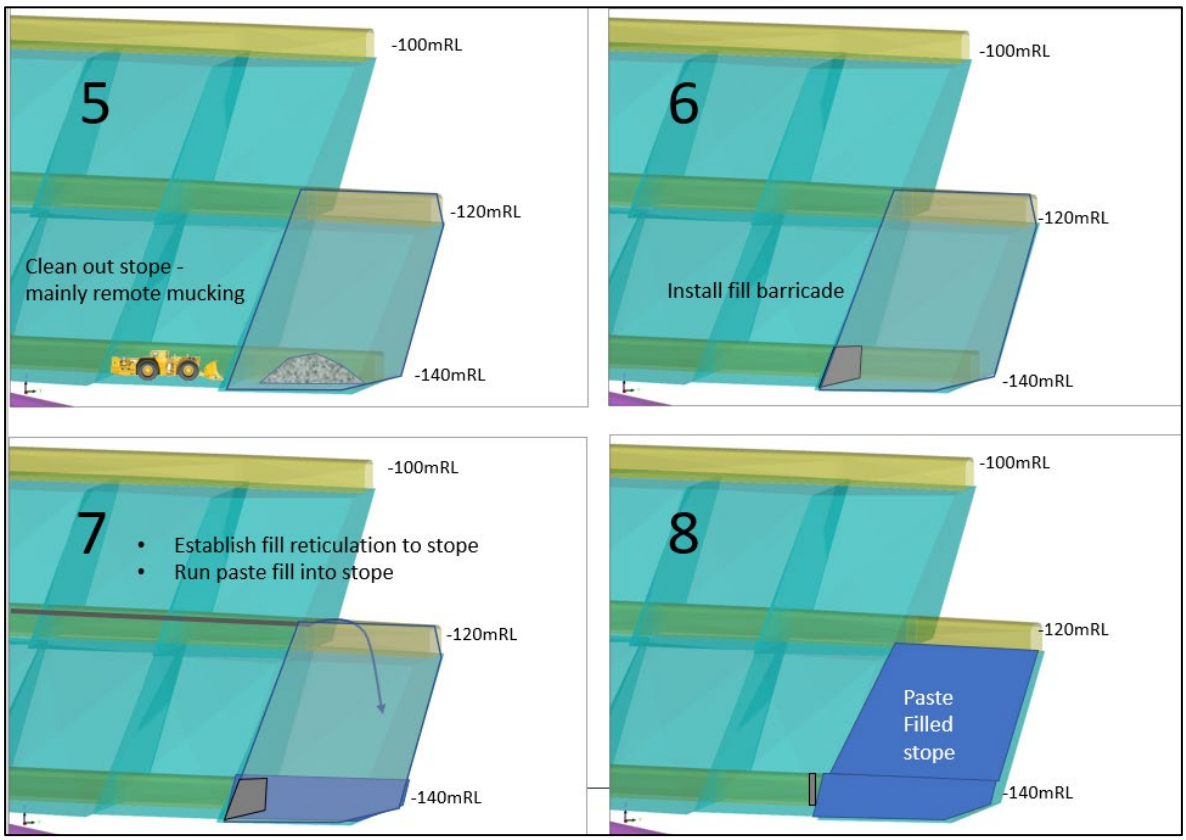


Figure 3-12: General sequence of long-hole stoping activities for filling

3.6.2 Underground mine dewatering

Water will flow into the underground mine from surface rainfall runoff into the box cut, groundwater and from water used in mine operations. The water will be collected in the mine at sumps on each level's main access. Electric, submersible pumps will pump the water to the main pumping stations equipped with settling tanks and Mono® pumps. They will pump the water up to the Mine Dam adjacent to the portal/box cut area via polyethylene (PE) pipelines.

After settling, the water will be used for dust suppression or other non-potable uses. Water quality will be monitored and treated as required.

Decline faces and other downgrade development faces will be dewatered with submersible electric face pumps that will remove water to the level sumps or directly to the main pump stations. A detailed underground dewatering design will be prepared during the design phase prior to commencing underground mining.

3.6.3 Box cut, portal, underground decline

Access to the underground mine is proposed to be via an underground decline and associated portal within the box cut pit (Figure 3-13). The box cut is proposed to be external to the open cut pit. The underground decline will enable personnel, mining equipment, materials and ore to be transported between the underground and surface. The box cut, portal and decline will be constructed at a similar time to the open cut pit (i.e. during the first year of operations).

The box cut will be constructed via conventional surface excavator and truck methods. Drill and blast techniques will be used in harder areas as required. The walls of the box cut will slope approximately 40°. The box cut roadway is proposed to have a 1:10 gradient down to the portal, being a gentler gradient than typical to allow for poorer conditions during inclement weather.

The portal floor is proposed to be 15 m below ground surface, providing 9.5 m of cover above the decline back of the portal. The portal walls will be near-vertical and be stabilised with substantial:

- rock bolting;
- cable bolting;
- meshing and
- shotcreting.

The portal will be constructed via drill and blast methods using typical:

- underground mining equipment;
- drilling jumbo;
- front-end loader;
- trucks; and
- other ancillary machines.

Ventilation will initially be provided by secondary ventilation fans and flexible ducting within the box cut. The area at the start of the decline will likely require intensive ground support, such as steel sets or similar. The underground decline is proposed to be approximately 5 m wide and 5.5 m high, with an approximate 1:7 gradient to the base of the mine. The overall length of the decline will be approximately 3.1 km.

Level accesses at approximately 20 m vertical intervals will be constructed. On each level, there will be a:

- truck loading bay;
- stockpile bays;
- a sump; and
- return ventilation access.

On each level, a single or dual (if required) ore drive will be developed on north and south of the main access crosscut. Mine loading bays will be required if the ore drive distance exceeds 120 m from the main access crosscut.

During construction and excavating of the underground mine, a fresh air ventilation system will be established from crosscuts off the main decline (refer to Section 3.6.4). Initially, the fresh air rise (FAR) will be used as a return air rise (RAR) until the return air rise is mined to 0 mRL.

An indicative underground design is shown in Figure 3-13 and Figure 3-14.

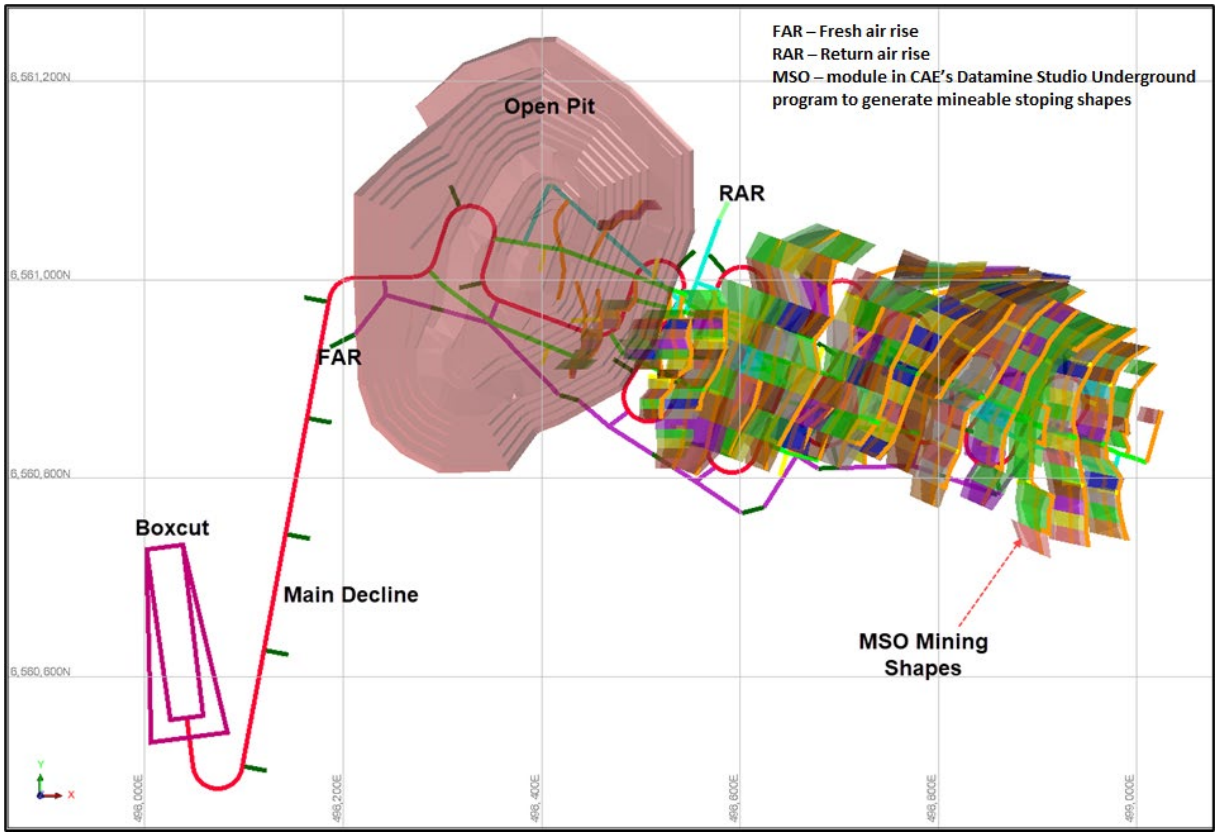


Figure 3-13: Open cut and underground design (plan view)

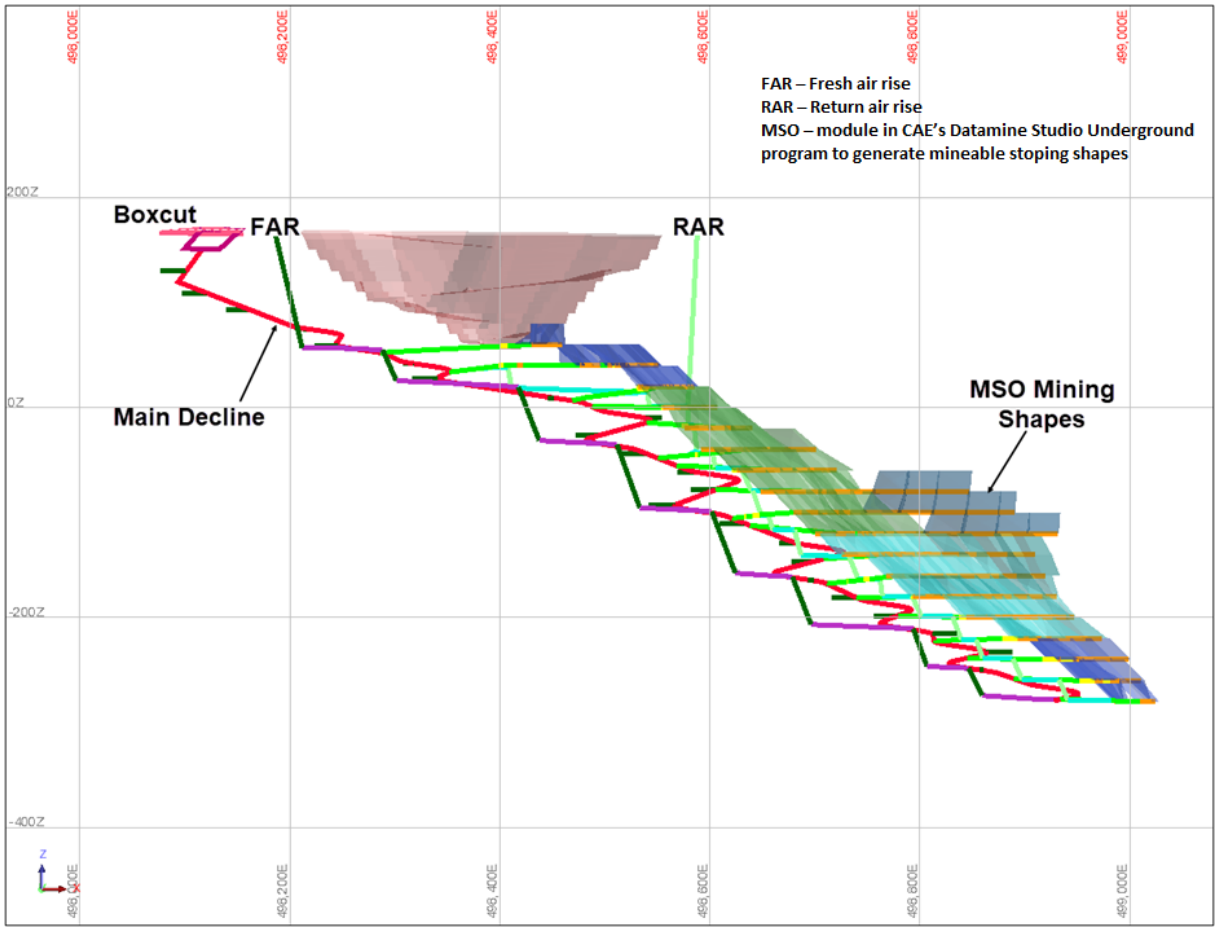


Figure 3-14: Open cut and underground design (cross-section looking north)

3.6.4 Underground ventilation system

The underground ventilation system will feature a primary and secondary network. The primary ventilation network will draw fresh air through the decline and FAR and exhausting return air via primary fans positioned at the collar of the main RAR on the surface. The two main surface ventilation rises will be positioned to provide sufficient separation from the proposed open cut pit and known adverse geological structures.

To ventilate each level, secondary fans will be hung in the main crosscut access to push air to each working face via flexible ventilation ducts. Return air from the working area will be exhausted through the RAR to the surface.

Constructing the ventilation shafts will use a range of equipment:

- a raisebore rig;
- a front-end loader; and
- supporting vehicles.

Rock material excavated from constructing the ventilation shafts will be removed to the surface for storage in the WRE for final emplacement or return to underground.

Detailed ventilation analysis will be completed during the feasibility study phase.

3.6.5 Underground mining equipment

The proposed underground mining fleet is industry-standard for productive mining operations:

- twin boom jumbos x 2 (e.g. Sandvik DD421 or similar) to develop headings;
- 17 t–21 t LHD units x 2 (e.g. Sandvik LH517/621 or similar) to remove blasted rock from all development headings and stopes and possibly to backfill stopes;
- 10 t LHD unit to assist the main LHD fleet;
- 45 t–50t trucks x 4 (e.g. Sandvik TH551 or similar) during peak production to transport broken rock from the underground to surface ROM or waste dump locations;
- long-hole drill rig (e.g. Sandvik DL421 or similar) to drill production blastholes;
- cable bolt drill rig (e.g. Sandvik DS421 or similar);
- box hole drill or alternative for stope expansion raises if required;
- dedicated charge-up unit;
- diamond drill rig;
- integrated tool carrier;
- shotcreter;
- grader;
- agitator truck;
- watercart;
- 4WD single and dual cab utilitys; and
- 4WD troop carrier/ambulance.

Makes and models of equipment are representative only of the classes and sizes of equipment proposed, and the final selection will depend on financial analysis at the time.

3.7 Project site infrastructure

In addition to the Project open cut mine pit and the underground mine, surface site infrastructure is described in this section.

3.7.1 Mine site haul roads

Mine site haul roads, as indicated in Figure 3-6, will be sized to industry-standard width according to the fleet contracted or purchased for the operations.

The Project plans for a 25 m wide haul road to cater for haulage trucks and other heavy vehicles. The main haul roads will be sized for 90 t open cut haul trucks with provision for dual lane travel of haul trucks, drainage and bunding.

The final constructed width will depend on final confirmation of open pit truck sizing. Underground haul road width will be less than that of the open pit haul road width and will be sized to suit underground trucks. In-pit ramps may use a single lane for some sections of the pit.

Mine site haul roads will be required for:

- ore and oxide haulage from the open cut to the oxide ore stockpile;
- supergene and primary ore haulage from the open cut to the ROM pad;

- primary ore haulage from the underground portal to the ROM pad;
- waste rock haulage from the open cut and underground to the WRE;
- movement of open cut heavy vehicles between the infrastructure area and the open cut and WRE;
- movement of B double vehicles dumping paste fill in the underground mine and circuiting back to the ROM pad; and
- movement of underground heavy vehicles between the underground facilities area and the underground portal, which will be constructed according to industry standards.

3.7.2 Run-of-Mine pad

The ROM copper ore handling and stockpiling area will be adjacent to the open cut pit ramp exits and underground portal.

Supergene and primary ore types from the open cut and underground operations will be hauled and stockpiled on the ROM pad.

ROM copper ore will be stored in separate fingers on the ROM pad according to processing requirements. The ore types will be reclaimed, loaded onto road trains and hauled to Tritton Copper Mine for processing. The schedule indicates that the maximum ROM stockpile required is approximately 0.5 Mt.

Oxide ore will not be stockpiled on the ROM pad. It will be stockpiled in the oxidised ore stockpile area adjacent to the heap leach area in preparation for heap leaching (as discussed in Sections 3.7.3 and 3.9.2.2).

3.7.3 Heap leach pad, agglomeration pad, oxidised ore stockpile, heap leach ponds

The Project proposes to maximise resource recovery by heap leaching an estimated 2.0 Mt of oxide ore at the Project site. This will improve the economic viability of the oxide material.

The heap leach facility will be adjacent to the oxidised ore stockpile. Ancillary infrastructure for the heap leach pad facility will include:

- a crushing circuit;
- an agglomeration pad;
- an SX plant; and
- six processing ponds (indicated as three water ponds in Figure 3-6) for managing the:
    - pregnant liquor solution (PLS);
    - intermediate leach solution (ILS); and
    - raffinate.

The heap leach process is outlined in Section 3.9.2.2.4.

3.7.4 Paste plant and stockpile area

A paste plant, stockpile area and emulsion storage will prepare the tailings for storage in the underground mine.

Backhauled trucks from Tritton Copper Mine will unload the tailings at the stockpile area (Figure 3-6). A paste fill will be made from the tailings. The paste plant will be positioned immediately above the orebody to permit gravity feed of paste into the underground mine. The required paste plant footprint is nominally 40 m x 40 m, and it will be a prepared tailings storage pad. Further detail is provided in Section 3.9.2.5.3.

3.7.5 Soil stockpiles

Topsoil, deeper subsoil and weathered regolith material, suitable for use in rehabilitation, will be stored separately as they are stripped from disturbed areas.

Four stockpile areas have been identified to store all the material that will be stripped from the site (Figure 3-6). It is estimated that the total stripped topsoil volume will be 1,520,00 m^3. Approximately 140,000 m^2 or 14 ha will be required for the topsoil stockpiles (with a 2.0 m height).

Topsoil and subsoil to be stripped from disturbed areas will be stockpiled and managed, as outlined in Section 3.9.1.1.

3.7.6 Other site facilities

The surface facilities at the Project mine site will include a contractor facilities area for the open cut mine and an Aeris office and underground facilities area (refer to Figure 3-6).

The contractor facilities area for the open cut mine will include infrastructures, such as:

- contractor buildings;
- workshop;
- washbay;
- tyre bay;
- fuel storage and dispensing;
- oil and lubricant storage and dispensing; and
- warehouse.

The Aeris office and underground facilities area will include infrastructures, such as:

- mine administration offices:
  - safety and training rooms;
  - environment and water management room;
  - heap leach and ore haulage office;
  - training room;
  - crib room;
- underground workshop;
- mine technical service offices for:
  - mine planning;
  - geology and grade control;
  - geotechnical;
  - surveys;
  - core shed;
- maintenance office;
- ablutions; and
- first aid and emergency services.

The locations for the mine facilities have considered operational requirements, such as access to the underground mine and the open cut pit, to minimise disturbance to surrounding native vegetation and cultural heritage values.

The underground mine will not be deep enough to warrant underground-located service facilities, such as workshops, meal rooms and fuelling stations. Service bays for routine servicing of slow-tramming drill rigs will be established.

3.7.6.1 Emergency facilities

Emergency facilities, including first aid and rescue, will be established at the Aeris office and include the following:

- emergency response vehicle;
- rescue equipment;
- firefighting equipment;
- breathing apparatus; and
- training equipment.

On-site emergency services will operate in conjunction with those of Aeris' Tritton Copper Mine and the NSW emergency services. They will respond to any emergencies in the open cut and underground mine workings, as well as surface mine facilities and the administration area, including emergencies involving:

- transporting and storing fuel;
- explosives; and other
- hazardous materials.

Refuge chambers will also be established in areas underground where personnel will have access to FAR infrastructure.

An underground escapeway will be constructed, such as a modular ladderway, providing a second means of egress if the primary means of egress is inaccessible.

3.7.6.2 Compressed air system in the underground mine area

A compressed air system will be installed to supply compressed air for:

- pneumatic equipment;
- clearing out holes;
- cleaning off blasting benches; and
- supplying air to underground mine refuge chambers that will be required as part of the mine's emergency management system.

The compressed air will be reticulated through the underground mine in a pipe appropriately rated for the pressure.

The surface workshops will also be equipped with smaller air compressors for the operation of:

- pneumatic wrenches;
- hoists;
- tyre inflaters; and
- lubrication systems.

3.7.6.3 Communication system

A comprehensive and efficient communication system will be installed throughout the surface and underground mine using the most up-to-date technology and similar systems used at other Aeris operations to, facilitate operational and response requirements:

- emergency communications and response;
- traffic management;
- integrated infrastructure control;
- breakdown and maintenance information, including condition monitoring;
- blasting clearance and control;
- equipment and personnel location; and
- vehicle, refuge chambers and key infrastructure communications.

An optic fibre cable will be buried in a trench in the infrastructure corridor for communication and data transfer between the Project mine site and the Murrawombie Copper Mine.

3.7.6.4 Explosives storage and manufacture areas

The Project will require appropriate storage facilities for bulk explosives, packaged explosives and storage of detonators in accordance with relevant standards and regulations.

The storage facilities will be required for the open cut and underground operations and will include appropriate security fencing and safety bunds.

Explosives storage arrangements and decisions about the need for ammonium nitrate storage and an explosives manufacturing plant on-site will be resolved in accordance with current explosives supply to the Tritton Copper Mine and its other satellite mines.

Provisional locations for the explosives magazine and storage of ammonium nitrate, including emulsion, are shown in Figure 3-6. There is a separation of approximately:

- 500 m between the ammonium nitrate emulsion storage area and the eastern side of the open cut; and
- 1,500 m between the ammonium nitrate emulsion storage area and the mine facilities area.

Separation areas and locations for the explosive storage areas will be designed in accordance with AS 2187 Explosives–Storage, transport and use, considering the following factors:

1) type of explosives or agents stored;
2) quantity of explosives/agents stored;
3) type of facility that is the subject of concern (e.g. office area, power station, processing facility); and
4) access, transport and security.

3.7.6.5 Shotcrete batch plant

There will be a shotcrete batch plant to prepare concrete for the underground mine. The shotcrete batch plant will be in infrastructure area 7 in proximity to underground activities in an area nominally 40 m x 40 m.

3.7.6.6 Electricity supply infrastructure

Electricity to the Project will be available via mains power generated in the Project mine site. Power will be generated by a solar PV system (solar farm) and diesel genset(s).

During construction, the Project will operate with diesel power generation. Once the solar farm has been built in the first year of construction (Project Year 0), it will contribute to power generation. The total surface power requirement is estimated to peak at 1.7 MW, excluding power for the heap leach operations.

The diesel genset(s) will be sized to support the full load on-site. During operations, it is expected that the Project will operate with solar power during the day and diesel genset at night. If required, grid connection will occur by aerial powerlines along the haul route.

An electrical substation will be built on-site to provide electricity to the underground mine via an 11 kV aerial powerline. It will also initially provide power to the adjacent underground portal to supply power (1,000 V) to fans, pumps and jumbo starter boxes. An 11 kV ring main system will be developed as the underground development advances, which will be fed from an 11 kV portal substation. As underground mining progresses, substations (11 kV to 1,000 V) will be constructed, with each servicing up to four levels. It has been estimated that the total power consumption for underground mining will be approximately 3 MW:

- including allowances for the paste plant and surface workshop; and
- excluding offices, open cut and open cut workshop.

3.8 Water management

This section describes water use requirements and infrastructure that will be used to supply and manage water for the Project.

A site-specific water management plan outlining regulatory requirements, consent conditions, monitoring and quality management will be prepared and implemented to ensure water quality is suitable for appropriate reuse.

3.8.1 Water use requirements

A site water balance model was prepared to estimate the volume of water required over the life of the Project. Water inputs and outputs in Table 3-4 summarise the water demands for the Project.

Water requirements have been estimated for the first year of open cut mining, Year 4 of underground mining and the peak water demand year (Table 3-4). Total annual peak water demands for the Project are estimated to be 613 ML/yr (Year 4). Further details relating to water demand and the water balance model are in Appendix 5, Water impact assessment.

Construction water demands will be for:

- dust suppression;
- vehicle washdown; and
- materials, such as concrete.

Operational water demands will be for:

- staff amenities;
- underground mining operations;
- dust suppression;
- ore processing;
- heap leach;
- pre-concentrator;
- paste fill/concrete batch plants; and
- vehicle washdown.

Table 3-4: Annual average water balance summary

Water Management Element	Year 1 Annual Transfers (ML/year)	Year 4 Annual Transfers (ML/year)
Inputs		
Direct rainfall	46	34
Catchment runoff	127	127
Groundwater inflows	105	194
Transfer from the Murrawombie Copper Mine	66	258
Total inputs	**344**	**613**
Outputs		
Evaporation	97	95
Uncontrolled off-site discharge	0	0
Dust suppression, potable water/irrigated treated sewerage effluent from amenities, vehicle wash down, paste fill plant, pre-concentrator use, heap leach loss, ore moisture loss	186	481
Transfer to Murrawombie Copper Mine	5	0
Underground ventilation losses, underground seepage loss	0	64
Total outputs	**288**	**640**

3.8.2 Water supply

Sources of water for the Project during operations include:

- Rainfall;
- Runoff;
- groundwater inflows into the workings; and
- water supplied from the Murrawombie Copper Mine using a bi-directional water pipeline between the Murrawombie Copper Mine and the Project.

The Project water management system has been designed to include reticulation of contaminated water to satisfy the site water demands, such as heap leach and paste fill plant water usage. If no reticulation were implemented, the frequency of off-site discharges from dirty and contaminated water storages would likely increase.

The average in the peak water demand year (Year 4) is 258 ML, represented as inflows from the Murrawombie Copper Mine.

The cumulative annual total probability distribution of water from the Murrawombie Copper Mine for the peak water demand year (Year 4) is presented in Figure 3-15. The cumulative volume required from the Murrawombie Copper Mine in the peak water demand year is unlikely to exceed 359 ML.

Water demands during pipeline construction will be met by:

- capturing incidental rainfall and runoff in the Project water management system; and
- water truck deliveries from the existing Tritton Copper Operations.

Mine water for surface operations will be supplied from the Project's raw water dam via PE pipe to specific infrastructure:

- pre-concentrator plant;
- washdown area;
- paste plant;
- amenities; and
- dust suppression (Figure 3-15).

The water management system has been designed to include reticulation of contaminated water to satisfy water demands, such as heap leach and paste fill plant water usage.

Water for dust suppression by water truck will be supplied from a standpipe at the raw water dam, as well as via the pipe from the raw water dam.

Mine water will be supplied to the underground mine by a pipeline from the Project's raw water dam. It will be distributed underground using a network of PE pipe via the decline and fed to the levels.

Pressure reduction devices will be installed at regular depth intervals as required to maintain water pressure within pipeline specifications.

The water will be used underground for:

- drilling;
- cleaning out blast holes;
- washing down faces and benches;
- washing down muck piles;
- dust suppression;
- equipment cleaning, and
- general washdown and cleaning activities.

No production bores have been planned for construction at this stage, given local groundwater sources are expected to be low yielding near the Project orebody. However, production bores are an option for supplementing water supply and will be investigated if required.

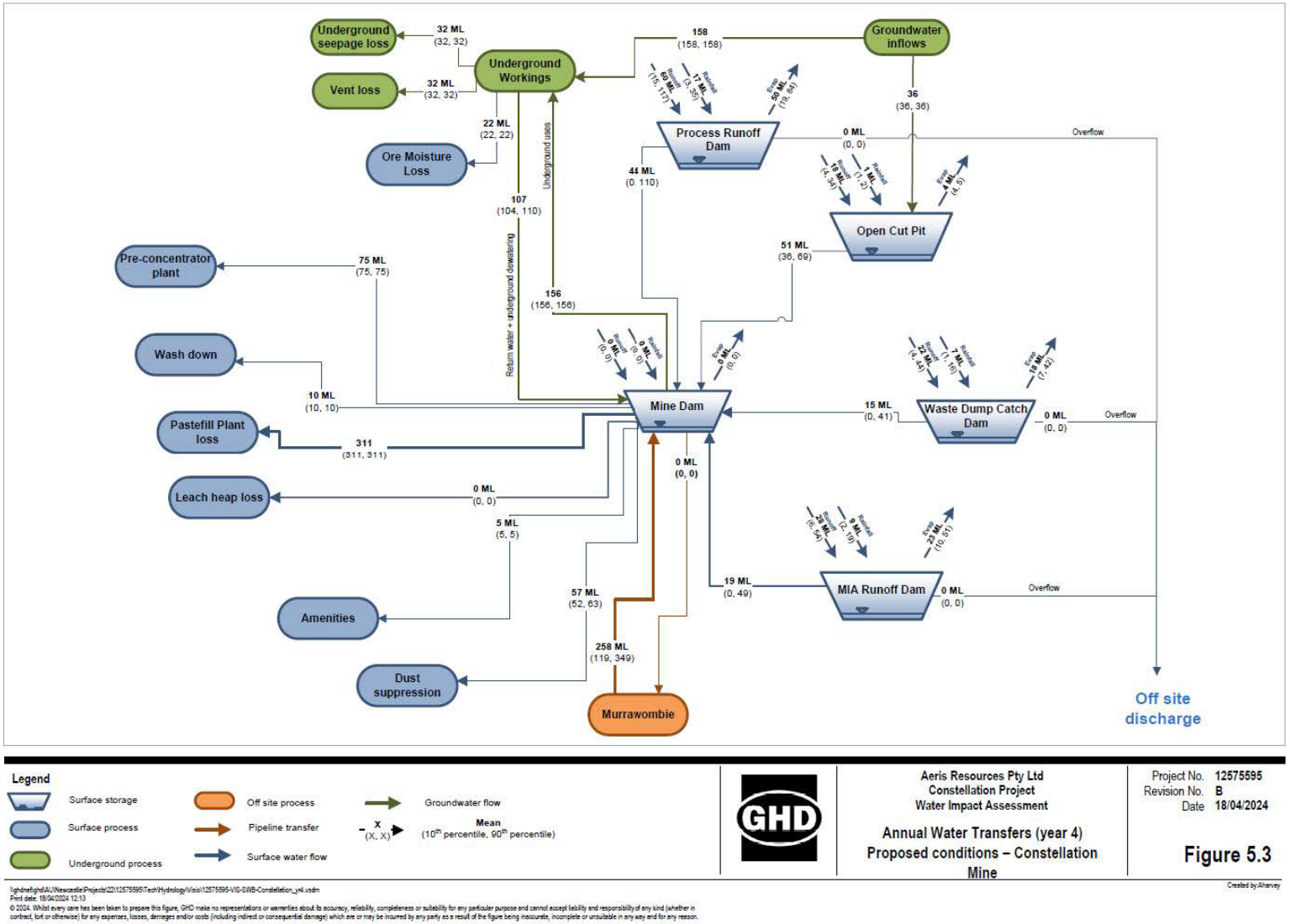


Figure 3-15: Annual water transfers (Year 4 peak water demand year)

3.8.3 Water supply pipeline

Off-site water supply will be required to meet operational water demands when a water deficit occurs on-site. External water would be required when water sources, such as rainfall, runoff or groundwater interception, cannot meet site demands. Supply will be via a bi-directional pipeline between the Project and the Murrawombie Copper Mine. The pipeline will be approximately 31 km, and the alignment will follow the off-site access/haul road, as described in Section 3.4.2. Two pump stations would be required at each end of the pipeline at the Murrawombie Copper Mine and the Project.

The bi-directional pipeline would also be used to recirculate water from the Project to the Murrawombie Copper Mine to minimise water use.

The water pipeline would use existing water management infrastructure and water licensing associated with the Murrawombie Copper Mine, as water demands during operations at the Murrawombie Copper Mine decline.

Water supplied to the Murrawombie Copper Mine sourced from the Lower Bogan River Water Source is licensed by three water access licences (WALs). Cumulatively, the mine is authorised to extract 931 units/ML of water from the Lower Bogan River.

An existing pumping station on the Bogan River, approximately 24 km east of the Murrawombie Copper Mine, pumps water under licence to the Murrawombie Copper Mine where it is stored in a raw water dam. A water supply pipeline is proposed to connect the Project mine site to the existing raw water supply at the Murrawombie Copper Mine.

During the maximum water demand year, no water transfer from the Project to the Murrawombie Copper Mine will be required, as water captured in the Project water management system will likely satisfy the site water demands.

During the minimum water demand year, the maximum simulated water transferred from the Project to the Murrawombie Copper Mine is estimated to be approximately 38 ML.

Groundwater inflows to Aeris operations are taken under three WALs from the Lachlan Fold Belt MDB groundwater source. The water available under these licences form part of the water balance for Murrawombie and may be available to be supplied to the Project via the pipeline. The groundwater take for the Project will also be under these WALs.

3.8.4 Site water management infrastructure system

Water management infrastructure to manage clean water, dirty water and mine-affected water is discussed in the following sections.

The proposed water management strategy (Figure 3-16) seeks to minimise the incidental capture of clean water by utilising clean water diversions upgradient of the disturbance area. At the same time, dirty and mine-affected water from disturbed or mining process areas in contaminated water capture drains and storages will be collected to prevent discharge of that water from the Project site.

3.8.4.1 Clean water management

Clean water, being surface runoff from catchment areas upgradient of the disturbance area, will be diverted around the site without treatment, when practicable. In accordance with the WM Act, no surface water harvesting of clean water is proposed. No additional clean water is proposed to be acquired.

Two open clean water diversions are proposed to the north and south of the site (Figure 3-16) to divert water around the disturbance area. It is likely these clean water diversions would be developed during the construction phase, prior to other works being undertaken to minimise down gradient catchment areas, which will later become disturbed.

3.8.4.2 Dirty water management

Dirty water, being surface runoff from areas of disturbance, will generally occur during construction activities. Five dirty water drains are proposed within the site to divert dirty water during the construction period. The proposed site water storages would act as dirty water or sediment basins during the construction phase. During the operational period, these drains would intercept contaminated water flows and divert these to the site water storages (Figure 3-16).

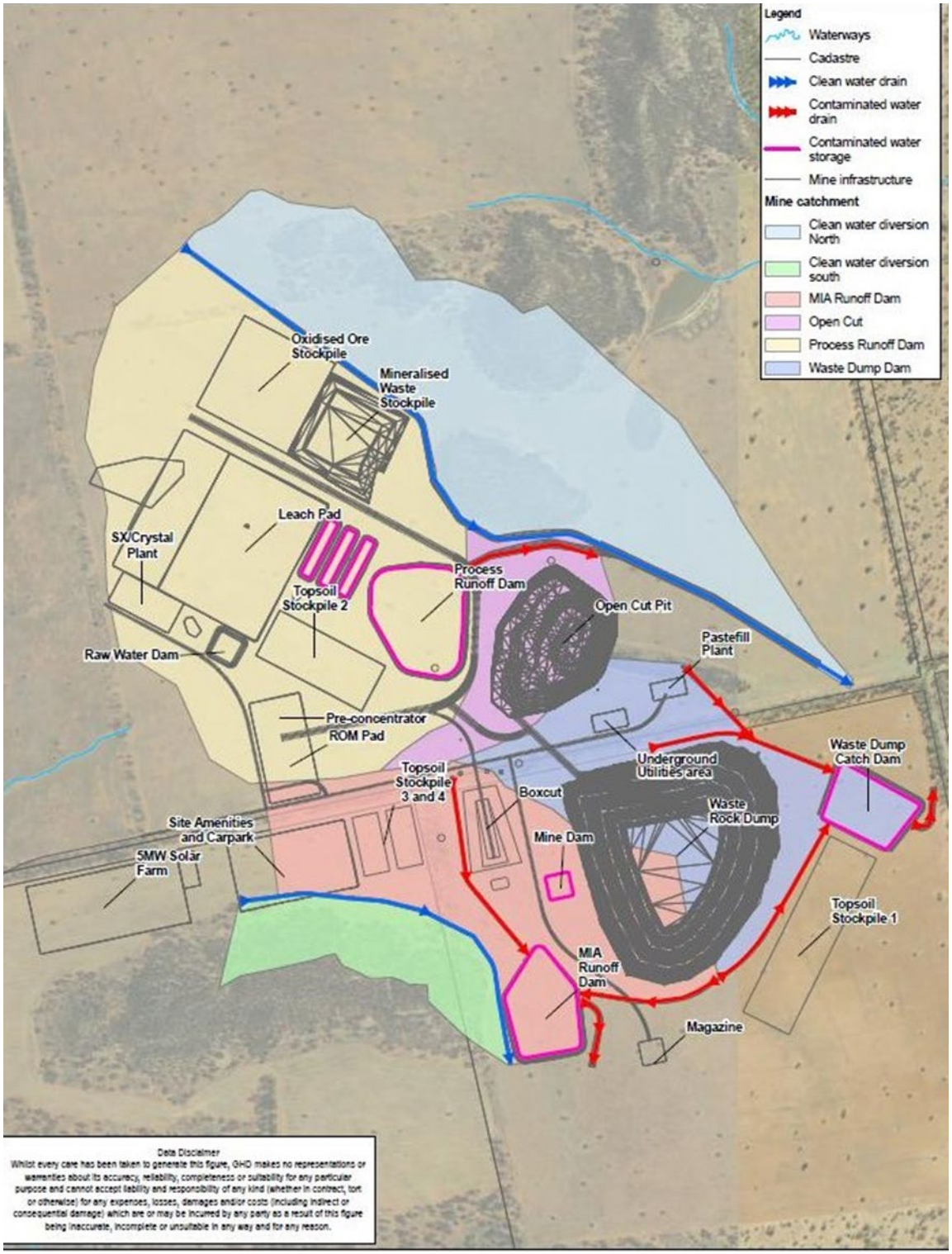


Figure 3-16: Water management system

3.8.4.3 Contaminated water management

Contaminated (processed, or mine-affected) water is categorised by the increased likelihood of elevated concentrations of dissolved metals from contact with ore and waste rock. Contaminated water also includes water that is potentially impacted by acid from the ore extraction process or hydrocarbons. The contaminated water management system has been designed to mitigate the risk of contaminated water discharging from the Project site (Figure 3-16).

Processing facilities will be placed upgradient of the pit to ensure overflow is captured by the contaminated water management system during heavy rainfall; facilities such as:

- heap leach pad
- SX/Crystal plant
- pre-concentrator
- ore, and
- waste stockpiles

The contaminated water management system will capture contaminated water in contaminated drains and direct these flows to the contaminated water storages, specifically the:

- Mine Dam;
- Process Runoff Dam;
- Waste Dump Dam;
- MIA Runoff Dam; and
- heap leach ponds.

The system has been designed as nil discharge (with the maximum practicable design criteria) to minimise the potential for off-site discharge of potentially contaminated water. The specific design measures are:

- Hydraulic capacity diversion drains for clean water and dirty water capture drains will contain the design peak flow for the 1% AEP design rainfall event.
- An environmental containment freeboard will contain the design runoff volume for the 1% AEP, 72-hour duration design rainfall event. The Process Runoff Dam, Waste Dump Dam and the MIA Runoff Dam are each sized to contain this design rainfall event.
- The Mine Dam is a turkey nest dam design with a nominal capacity of 10 ML for operational purposes. The Mine Dam will be operated with a freeboard to contain direct rainfall.
- Pumps will recirculate contaminated water for appropriate reuse from contaminated water storages that are intended to reduce the likelihood of off-site discharges.

The capacity, and catchment area of each contaminated site water storage are shown in Table 3-5.

Table 3-5: Water storages

Storage	Capacity (ML)	Catchment area (ha)
MIA Runoff Dam	116.5	63.4
Process Runoff Dam	249.1	124.6
Waste Dump Dam	90.2	50.7
Mine Dam	10 (nominal)	Direct rainfall only

Contaminated runoff from the following areas will be diverted to the site water storages (Figure 3-16):

- Runoff from the MIA will be directed to the MIA Runoff Dam, including surface flows from the workshop, washdown bay, laydown area, topsoil stockpiles and carpark.
- Runoff from the WRE will flow to either the Waste Dump Dam or the MIA Runoff Dam via a contaminated water drain.
- Runoff from the processing area may be potentially contaminated by interacting with ore stockpiles and heap leach piles. These flows will be directed to the Process Runoff Dam.
- Runoff from the box cut will flow down the decline and be dewatered as part of the underground dewatering system for the Mine Dam. An internal contaminated water drain will direct catchment runoff to the MIA Runoff Dam to minimise the volume of water intercepted by the box cut.

Contaminated process water leached from the heap leaching processes will be captured in the heap leach ponds. This includes the PLS, ILS and raffinate ponds. The system has been designed so that if wet weather conditions cause the heap leach ponds to overflow, the overflow will be captured by the Process Runoff Dam.

Excess water is expected to be transferred off-site via the pipeline and sent to the Murrawombie Copper Mine when required. This would be triggered when site water management structures are at a triggering threshold (i.e. 80% full or some other site-defined value). While the site water management infrastructure has been designed as nil discharge (including through pumped transfers to the Murrawombie Copper Mine), off-site discharges from site water storages may still occur in rainfall events exceeding the 1% annual exceedance probability.

Project water impacts have been assessed in Chapter 6, Environmental assessment, Section 6.5.9, Water management measures.

3.8.5 Sewage treatment

Wastewater would be generated from staff facilities and construction activities. Release of wastewater off-site would potentially result in elevated nutrient levels. Wastewater would therefore be collected for treatment and on-site disposal or reuse.

Sewage from the administration buildings and bathhouse will be conveyed by gravity to an aerated wastewater treatment system. Wastewater will be treated through several phases. Treated effluent will be disposed of on-site via irrigation or to an evaporation trench.

A water treatment plant is proposed to manage potable water and wastewater with a volume of 5 ML/yr.

Disposal methods (such as discharge to an evaporation trench) and monitoring programs will be undertaken in accordance with EPA (2004) and ANZECC/ARMCANZ (1997 and 2000). The effluent will be monitored to ensure it meets the standards before discharge or reuse for irrigation.

3.9 Project schedule and staging

The Indicative Project schedule is based on Project years in preference to calendar years. The Project stages are outlined in Figure 3-17. Each stage is described in further detail in Sections 3.9.1 to 3.9.3.

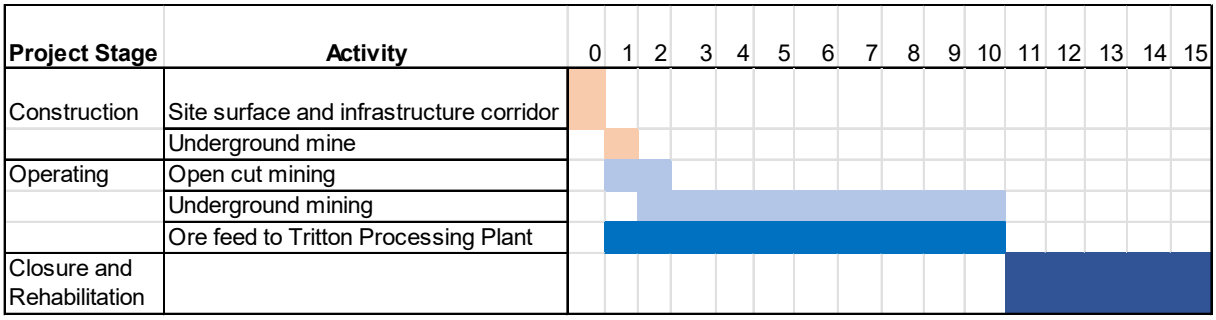


Figure 3-17: Project stages and Project activities (years)

Construction activities are scheduled to commence in 2025 (Year 0–Year 1), subject to completing all required Project approvals.

All surface construction activities are estimated to be completed in a 12-month period, inclusive of site construction and the infrastructure corridor for the road and pipeline development activities. Proposed construction activities are detailed in Section 3.9.1.

Underground construction activities will commence indicatively in Year 1 (Figure 3-17) by developing the box cut and portal, decline and underground workings. Underground mining operations will commence in Year 2.

The open cut pit will be developed indicatively in Year 1 during the development of the underground mine. Open cut pit operations will commence in Year 1 (Figure 3-17), and it is estimated to be operating for just over two years (into the start of Year 3).

The Project's open cut pit and underground mineral resources are expected to support production for approximately ten years, commencing indicatively in Year 1. There is potential for mine life extensions as the deposit is developed at depth underground. The first ore feed to the Tritton processing plant is scheduled to occur in the fourth quarter of Year 1 from the open cut pit.

Decommissioning and final rehabilitation activities will be completed during an estimated 5-year period at the end of the Project's operational life in Year 11 (indicatively 2036–2037). Rehabilitation will occur progressively when possible. For further detail, refer to Section 3.9.3.

3.9.1 Construction stage of the Project

Project construction activities will include developing:

- site preparation, including clear and grade and earthworks for all pads, including the MIA and surface infrastructure (Section 3.9.1.1);
- the 2,850 m section of the new road for site access to bypass Girilambone town and upgrading existing roads in the infrastructure corridor (Section 3.9.1.2);
- the underground water supply pipeline between the Project mine site and the Murrawombie Copper Mine in the infrastructure corridor (3.9.1.2);
- water management infrastructure, including clean water diversions, dirty water diversions and water storage facilities and pipelines (3.8.4);
- buildings and installing the heap leach facilities, paste plant, stockpile area and the other site facilities, such as offices and emergency facilities, laydowns, solar farm and power station, explosives storage area identified in Section 3.7; and
- the box cut and portal to enable underground access development, then the decline and underground workings, the underground ventilation system and underground mining infrastructure (Section 3.6).

A description of key Project construction activities, additional to the details referred to, is provided in Sections 3.9.1.1 and 3.9.1.2.

3.9.1.1 Project mine site area roads, pads and preparatory earthworks

Access roads, haul roads, laydown areas and other preparatory earthworks will be constructed during the first year of the Project (Year 0). Surface preparatory works for the roads and pads to support the infrastructure will include:

- **Erosion and sediment control:** The main sediment and water controls, including clean water diversions, will be installed prior to any vegetation or soil being disturbed. Erosion control and sediment containment structures will be operational and maintained until vegetation established.
- **Vegetation clearing:** Vegetation will be cleared immediately prior to topsoil stripping.
- **Topsoil management:** Topsoil of suitable quality as growth medium will be used in site rehabilitation activities, typically to a depth of 200 to 300 mm. It will be stripped from the surface infrastructure footprint by a scraper, excavator, bulldozer, loader and truck as appropriate. A water cart may be used for dust suppression.

  Topsoil will be stockpiled separately from other soil sources and managed in accordance with soil management, stockpiling and re-application procedures developed for the Project (refer to Chapter 6, Section 6.1, Soil and land capability and Chapter 7, Mitigation and management).
- **Subsoils and regolith stripping and stockpiling:** These materials will be stripped and stockpiled separately. Stockpiled material, including topsoil, that will be in excess to rehabilitation requirements on-site would be transferred to the Murrawombie Copper Mine for rehabilitation use.
- **Haul roads:** These will be constructed and maintained using a grader and water cart. Construction will also include using a scraper, excavator, bulldozer, loader, compactor and trucks . An appropriate traffic management plan will be implemented to address safe haulage in dry and wet weather, focusing on but not limited to:
  - speed limits;
  - intersections;
  - bends and lines of sight;
  - gradients; and
  - separating heavy vehicles and light vehicles.

  Quarried material may be moved from the Murrawombie Copper Mine for use on roads and hard stands, as required. Excess material may be transferred to the Murrawombie Copper Mine from the Project when available.

3.9.1.2 Construction site access and haul road

Access from the Mitchell Highway to the Project mine site will generally be via existing roads. However, a new section of road will be required to be built that will intersection the Mitchell Highway, approximately 800 m north of Girilambone.

The road, including the new 2,850 m section and the Mitchell Highway/new haul road intersection with its short channelised right-turn lane, will be constructed, as shown Attachment 4. The new road will be an unsealed road, consistent with the existing Okeh Road. The water supply pipeline and optic fibre cable will be constructed in a trench adjacent to the road, and they will traverse under the haul road in the infrastructure corridor.

Intersection upgrades will be completed for the Mitchell Highway/Railway Road intersection to optimise road safety for operational traffic and other road users.

Upgrades will include a short channelised right-turn lane on the approach to the Railway Road from the Project site. Some site preparation and road widening will be needed to accommodate these intersection upgrades (refer to Attachment 4, Road intersections).

Upgrades to the existing Okeh Road (from the intersection of the new road, north to the Project mine site) will be completed to accommodate Project haulage activities. This will include some road widening to provide an 18 m infrastructure corridor width throughout the Okeh Road section.

Opportunities to further reduce the extent of clearing (e.g. through the use of safety barriers around large trees) will be reviewed during detailed design development.

The road will be constructed and maintained in accordance with industry standards. An appropriate traffic management plan will be implemented prior to construction to address the life of the Project, including:

- construction
- maintenance
- operation; and
- decommissioning.

The management plan will also address safe haulage in dry and wet weather, focusing on but not limited to:

- speed limits;
- intersections;
- bends and lines of sight;
- gradients; and
- separation of heavy vehicles and light vehicles when necessary.

During road construction and upgrade activities, construction traffic and deliveries to the Project will be via Okeh Road and through Girilambone for a limited time (indicatively 6 months).

3.9.2 Operations

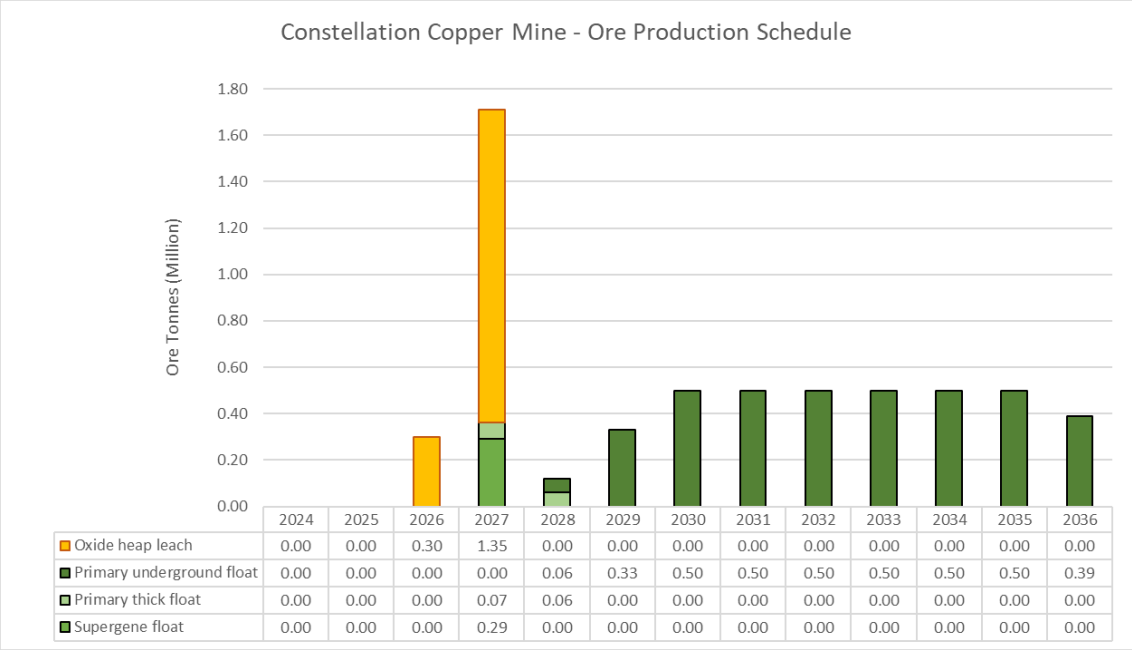
3.9.2.1 Mining schedule and sequence

The Project mineral resource spans a considerable range of depth, from oxide mineralisation starting within 10 m below the ground surface to primary mineralisation at a depth of nearly 500 m below ground surface. The upper part of these resources is amenable to open cut mining. However, as the strip ratio increases with depth, the open cut mining cost per tonne of ore increases and underground extraction becomes more economically favourable. Mining methods for open cut and underground mining are discussed in Sections 3.5.1 and 3.6.1.

Developing the underground mine will commence when the open cut pit is operating, enabling underground operations to continue once the open cut pit is completed. The mining of the open cut prior to the underground will provide initial mill feed until the underground mine is developed. An overview of the proposed mine schedule for the Project's underground and open cut mining operations is presented in Figure 3-18. The potential mining inventories in the open cut and underground mining areas are approximately 3.6 Mt and 2.4 Mt respectively for a total potential mining inventory of approximately 6 Mt. The provisional mine schedule and sequence is based on maintaining a total annual product output of approximately 0.5 Mt.

Commencing with open cut mining operations, the lower-grade ore will be placed on the oxidised ore stockpile, then stacked on to the heap leach pad. Processing of the lower-grade ore is discussed in Section 3.9.2.2.4.

Mined supergene/chalcocite ore will be hauled from the underground mine and stockpiled on the ROM pad for crushing (Section 3.9.2.2).



	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Oxide heap leach	0.00	0.00	0.30	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Primary underground float	0.00	0.00	0.00	0.00	0.06	0.33	0.50	0.50	0.50	0.50	0.50	0.50	0.39
Primary thick float	0.00	0.00	0.00	0.07	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Supergene float	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3-18: Mining production schedule

3.9.2.2 Processing

3.9.2.2.1. Crushing and screening

Supergene, primary and high-grade ore will be crushed and screened on the ROM pad. The crushing and screening of ore will be undertaken between the open cut contractor facilities area and the ROM pad.

Copper ore stockpiled on the ROM pad will be reclaimed and blended at determined ratios to optimise downstream processes. A conventional mobile crushing circuit will be used to crush mined ore to a maximum size of 100 mm, with crushed ore stockpiled on a coarse ore stockpile. The coarse ore will be used as feed for the pre-concentration facility (refer to Section 3.9.2.2.2) or trucked to the Tritton processing plant at the Tritton Copper Mine.

3.9.2.2.2. Pre-concentration

The pre-concentration facility will be located adjacent to the ROM pad. Pre-concentration options are being evaluated as they may increase resource recovery and upgrade ore feed grades of material trucked to the Tritton processing plant. Coarse particle flotation for pre-concentration will be used and is described as follows:

- Crushed ore will be fed into a dry grinding circuit for further size reduction, targeting a maximum partile size of 500µm.
- Ground ore will be combined with water to create a slurry and pumped to the flotation circuit. The flotation process will use a pH modifier (hydrated lime), collector (potassium amly xanthate) and frother (methyl isobutly carbinol) to recovery valuable minerals to the froth concentrate. The pre-concentration process will also recover gold and silver from the Project ore.
- Flotation concentrates will be dewatered through a filtration system, targeting a moisture content of 10% (w/w). Concentrates will be trucked to the Tritton mill for additional processing.
- Flotation tailings will similarly be dewatered through a filtration system targeting a moisture content of 10% (w/w). Tailings will be utilised as underground backfill, removing the need for a tailings storage facility.
- Filter filtrate water will be recycled back to the process water circuit.

- Tailings will be hauled to the paste plant.

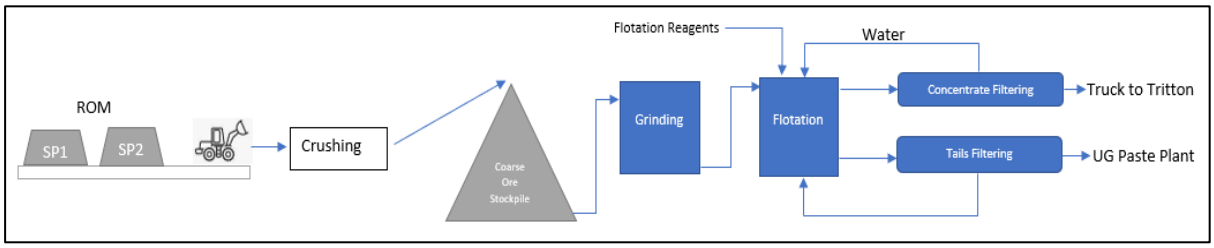


Figure 3-19: Indicative pre-concentration process

3.9.2.2.3. Off-site processing

Tritton Copper Operations aims to maintain copper ore feed to its existing processing plant at a rate of up to 1.8 Mtpa. Ore from the Project will contribute to the feed at an average rate of 0.5 Mtpa, peaking at one Mtpa (refer to Chapter 1, Introduction, Section 1.6.1).

Methods for copper ore processing at the Tritton processing plant will remain unchanged. Over the life of the Project, an estimated 4.19 Mt of ore will be processed off-site at the Tritton Copper Mine processing plant.

Copper ore stockpiled on the ROM pad at the Project will be loaded onto road-registered trucks, sized up to AB triples with 70 t payloads. The road trucks will transport the copper ore to the Tritton processing plant along the road infrastructure (detailed in Section 3.4.3). This will include the proposed haul route and the existing approved haul route currently used by the Avoca Tank Copper Mine and Murrawombie Copper Mine. Road trucks will operate 24 hours a day, seven days a week, four truck movements an hour, with a maximum of 82 movements per day (refer to Chapter 6, Environmental assessment, Section 6.15 for details on Project traffic).

Processing of Project ore at the Tritton processing plant will occur under separate approvals held by the Tritton Copper Mine; therefore this is not in the scope of the Project EIS. This includes managing tailings produced from processing the Project ore at the Tritton processing plant.

Tailings generated from the Project will be managed in the existing tailings storage facility (TSF) at the Tritton Copper Mine, with some tailings being backhauled to the Project to use as underground backfill (Section 3.9.2.5.3).

Processed concentrate will be transported to the port via rail from Hermidale rail siding near the Tritton Copper Mine (refer to Section 3.11).

3.9.2.2.4. Heap leaching

All oxide ore, estimated at 2.0 Mt, will remain on the Project mine site for handling and processing in the heap leach pad and facility (refer to Section 3.7.3 for heap leaching facilities).

The ore in the proposed heap leach pad will not contain sulphide minerals, so the acid mine drainage (AMD) risks posed by this material are much lower than heap leach pads that do contain residual sulphide minerals.

The base of the pad will be prepared with fine material (a maximum size of 38 mm and a moderate to high fine content [200 mesh] of at least 20%) to prevent any damage to the liner to be laid on the pad. The base will be graded and rolled flat and designed with sufficient slope angles to facilitate drainage across the pad to the treatment ponds. The conceptual design (Figure 3-20) features a nominal 1.0° lateral slope from the north to the south, flowing to the PLS pond.

The HDPE liner will be a minimum 1.5 mm thick and installed by a suitably qualified contractor. During installation and prior to use, the liner will be inspected for weld integrity and punctures. A leak detection system will be installed under the liner. The launders at the end of the cells will be lined to enable the leachate to flow freely to the PLS ponds. Weekly inspections of the liner and leak detection system will be undertaken. The heap leach pad design will incorporate up to three lifts (approximately 8 m each) with a maximum design

height of 24 m. The slopes will incorporate an overall angle of no greater than approximately 21° for protection/stability during rainfall events. The rehabilitation and closure of the HLP landform are described in Chapter 8, Rehabilitation and closure.

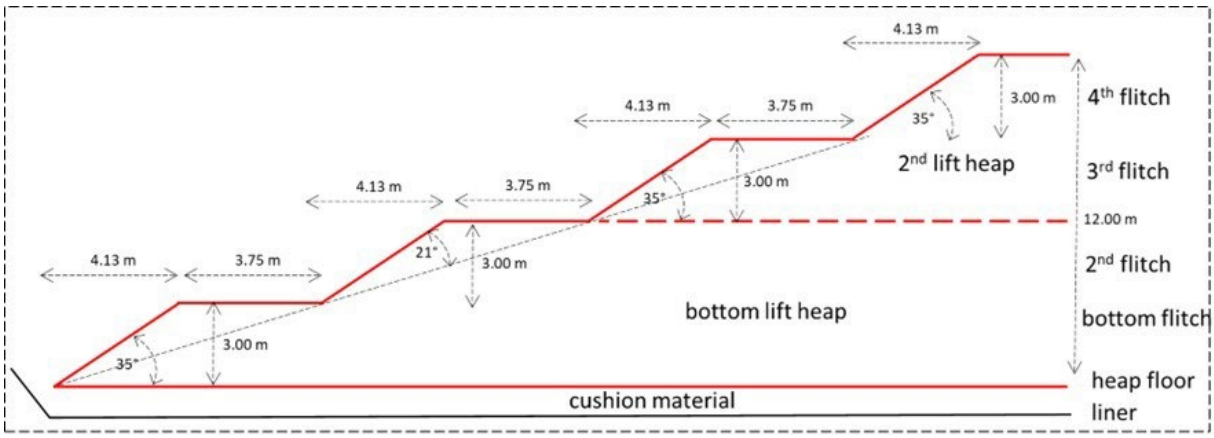


Figure 3-20: Conceptual design of heap leach pad

The heap leaching process is summarised as follows:

1) At the heap leach area, oxide ore will be placed in a stockpile from where it will be reclaimed by front-end loaders and crushed and placed on the heap leach pad by a stacker or dump truck.

2) At the heap leach facility, a modular agglomerator will be used as required to pre-treat crushed ore with sulphuric acid and water prior to stacking on the heap. This will cause the ore to form into porous lumps, known as agglomerates, that have better leaching characteristics than non-agglomerated ore.

3) Crushed ore will be stacked on the heap leach pad according to the final stacking sequence, stacking in sections 90 m x 300 m and moving east to west (Figure 3-20). On completion of the first lift at approximately 12 months and after spent-heap surface preparation, stacking will recommence for the second lift heaps. Similarly, the third lift will stack on top of the second lift after spent-heap surface preparation.

4) Once a panel has been filled with ore to the desired height, the conveying and stacking system is moved laterally to commence stacking the next panel, and the pipework through which solution is applied to the heap is placed onto the heap surface.

5) The process of leaching or solubilising the copper in the ore is carried out in two stages:

    a) a dilute sulphuric acid solution with a pH of approximately two and a low copper concentration (raffinate) will be pumped from the raffinate pond (Figure 3-6) and used to irrigate ore panels that have already been partially leached. The runoff from the panels contains an intermediate concentration of copper–ILS.

    b) the ILS is collected in a storage pond before being pumped back to the heap and used to irrigate fresh ore panels not previously leached. The runoff from the fresh ore panels contains copper, known as PLS, and is collected in another pond adjacent to the ILS pond prior to being pumped to the solvent pond adjacent to the ILS pond and to the SX processing plant.

    The six ponds to be used for the heap leaching process (PLS, ILS and raffinate) are shown in Figure 3-6.

6) Raffinate is used to irrigate the heap leach. Sulphuric acid is added to the raffinate pond to increase the acid concentration, and it will be pumped onto the heaps through dripper lines and/or wobbler sprinkler systems at targeted rates (i.e. 10L /m2 /h). The rate varies depending on:

    a) pump capacity;

b) pressure of dripper lines;

c) distance between dripper lines;

d) pressure loss along riser mains; and

e) permeability of the heap to the raffinate.

Regular daily inspections and weekly maintenance of the irrigation system may be required.

7) The leaching of the copper from the ore takes place as the sulphuric acid solution percolates through the ore stacked on the heap. Oxide ore is acid leached and sulphide ore is ferric leached by the action of bacteria. The length of time required for the leaching process depends on the grade of the ore and ambient temperature.

8) Solvent extraction will occur using an SX plant with four mixer-settlers, two electrolyte filters and a crud treatment area. Copper-enriched leachate solution will be stored in the PLS ponds and pumped through the SX circuit for processing. The SX circuit will concentrate and purify the leachate solution through a two-staged extract and strip process. Once the solution has completed this circuit, the advanced electrolyte will proceed to the copper sulphate crystalliser circuit for further processing. Reject solution from the extract stage will be used to recommence irrigation of the heap leach pads once more H_2SO_4 (sulphuric acid) has been added to the solution.

9) As copper crystal production declines, the feasibility of installing a copper cementation plant at the heap leach facility will be assessed. The plant would be used to replace the product from the SX crystal plant. The process would utilise standard industry practices and methods.

3.9.2.3 Hazardous substances

The hazardous substances used by the Project mainly include hydrocarbons, chemicals and explosives. Fuel will be stored on-site in fuel tanks for the open cut and underground fleet, general site light and heavy vehicles, and power generators.

A preliminary list of the hazardous substances, storage type and storage capacity is provided in Chapter 6, Environmental assessment, Section 6.11, Hazards and safety, and Appendix 13, Preliminary hazard analysis.

3.9.2.4 Non-mining waste management

Non-mining waste generated by the Project may include waste tyres, fuel, scrap food, and scrap construction materials. Based on the Waste Classification Guidelines (EPA 2014), waste identified across the Project stages has been classified into:

- special waste;
- liquid waste;
- hazardous waste;
- general putrescible solid waste; and
- general non-putrescible solid waste.

The existing waste management plan for Tritton Copper Mine will be revised to include the proposed management of waste generated from the Constellation Project.

Non-mining waste and its management strategies are discussed in Chapter 6, Environmental assessment, Section 6.10, Non-mining waste.

3.9.2.5 Waste rock management strategy

The Project will selectively manage and store waste rock material from the open cut pit and underground mine. The mine material, balance by a geochemical class for the combined open pit and underground operations (Table 3-6), estimates that there are 6.1 M Loose Cubic Metres (assuming 2.7 specific gravity (SG) and a swell factor of 1.35) of waste rock.

Geochemical analysis results indicate that most of the waste rock samples analysed are acid consuming (AC) or non-acid forming (NAF). The block model indicates there will be approximately 6.4% combined potentially acid forming–high capacity (PAF_{HC}) and PAF mine waste and 10.5% potentially acid forming–low capacity (PAF_{LC}) mine waste. The PAF_{LC} mine waste is only marginally PAF (Table 3-6).

Approximately 83.1% of the mine materials are NAF, estimated to be 52.1% non-acid forming–low capacity (NAF_{LC}), 18.9% NAF or 12.1% AC (Table 3-6). Further details are provided in Chapter 6, Environmental assessment, Section 6.3 Geochemistry, and Appendix 15, Geochemical and pit lake modelling assessment report.

Table 3-6: Volumetric breakdown of open pit and underground waste rockby geochemical classification

Geochemical Classification		In-situ volume BCM	Bulked volume LCM	% of Total
AC	Acid Consuming	546,907	738,324	12.1%
NAF	Non-Acid Forming	855,011	1,154,264	18.9%
NAF_{LC}	NAF (Low Capacity)	2,351,840	3,174,984	52.1%
PAF_{LC}	Potentially Acid Forming (Low Capacity)	474,455	640,514	10.5%
PAF	Potentially Acid Forming	176,736	238,593	3.9%
PAF_{HC}	Potentially Acid Forming (High Capacity)	112,326	151,640	2.5%
	Total	4,517,274	6,098,320	100%

Waste rock generated from the open cut pit will be managed in the proposed WRE (Section 3.9.2.5.1). A small proportion of NAF waste rock may be crushed into construction aggregate to use as a road base, sheeting and blast hole stemming.

Competent NAF rock from the open pit will be utilised for the construction of water drains within the mine area and on the WRE, such as rock armouring some slopes to maximise stability and minimise erosion.

AC waste rock may be used at the heap leach pad as part of closure planning activities.

Management of waste rock from the underground mine will vary during the life of the Project. During the initial development of the underground mine, underground waste rock will be hauled to the surface and stored in the WRE, as the stope voids will be inadequate to place uncemented waste rock fill. PAF (PAF and PAF_{HC}) materials generated from underground mining operations will be placed:

- within the WRE PAF cells (while the open pit is in operation);
- within the base of the open pit void (following the cessation of open pit mining); or
- preferentially utilised for the backfill of underground stopes.

NAF materials, competent AC and NAF rock will be retained in a separate stockpile for rehabilitation and ancillary purposes. The NAF material may be blended with PAFLC to encapsulate PAF and PAFHC cells and form growth medium layers of the WRE. The ancillary purposes for NAF materials may include:

- road construction (including the required upgrade of Okeh Road);
- transport to other Aeris mine sites;
- other off-site uses when deemed suitable; and
- construction of laydown yards, drainage structures and rock armouring (for slope stability).

The specific use of materials will be subject to assessments of their suitability as required. The proposed rehabilitation strategy for the Southern WRE is discussed in Chapter 8, Rehabilitation and closure.

3.9.2.5.1. Waste rock emplacement

The WRE will be constructed to a maximum height of approximately 45 m high (205 RL), composed of up to five lifts and have a footprint of approximately 33 ha. It will have a capacity of approximately 6.1 million cubic metres and be able to contain all mine waste from the open pit and underground mine and mine rehabilitation materials (AC, NAF and NAF_{LC} regolith and rock units).

The proposed design of the WRE includes five benches, the lowest with a 5 m lift and the remaining with 10 m lifts (Figure 3-21). The maximum height and shape of the WRE will be similar to surrounding hills.

The following management measures will be implemented to manage risks associated with PAF materials:

- Prior to placing waste rock materials, excavation and mechanical compaction of base materials (after the topsoil and subsoil are removed) will be required to "key-in" the WRE and slope the excavated floor towards the open pit. The intent of this is to direct all seepage through the WRE into the final void.
- Operational procedures will be developed to assess and identify waste materials as either NAF or PAF according to the definitions in Appendix 15, Geochemical and pit lake modelling assessment report.
- Operational procedures will be developed to ensure PAF and NAF materials are segregated and selectively handled so there is no cross-contamination or errors made in the handling and placement of materials.
- A 5 m layer of NAF material will be placed at the base of the WRE before placing PAF_{HC} and PAF material.
- The PAF_{HC} waste is the most reactive and will be contained with PAF waste in the centre of the WRE (Figure 3-21) and covered with a 0.5 m thick low permeability seal (10-8 m/s.) (subsoils) and trafficked to achieve 95% standard Proctor compaction. PAF materials are to be placed in lifts to optimise mechanical compaction.
- PAF_{LC} will be blended with NAF and used as cover material.
- The top of each cell may be shaped to a 3-–5% grade. It will then be sheeted in compacted (trafficked) clay-rich subsoil to maximise lateral, rather than vertical, movement of water inside the WRE so that toe and basal seepage is reduced. When possible, the low permeability seal may be sloped to shed any seepage waters to the north to facilitate passive post-closure flow of seepage towards the open pit (i.e. north of the natural watershed).
- PAF material is to be preferentially contained in the centre of the WRE and not extend under any shaped batters.
- The PAF waste will be covered by a minimum of 3 m NAF mine waste (blended with PAF_{LC}) and placed vertically above the encapsulated PAF cell.
- Outer surfaces, including the top tier, will have a 2 m store and release soil cover system (achieving a total cover of > 5 m).

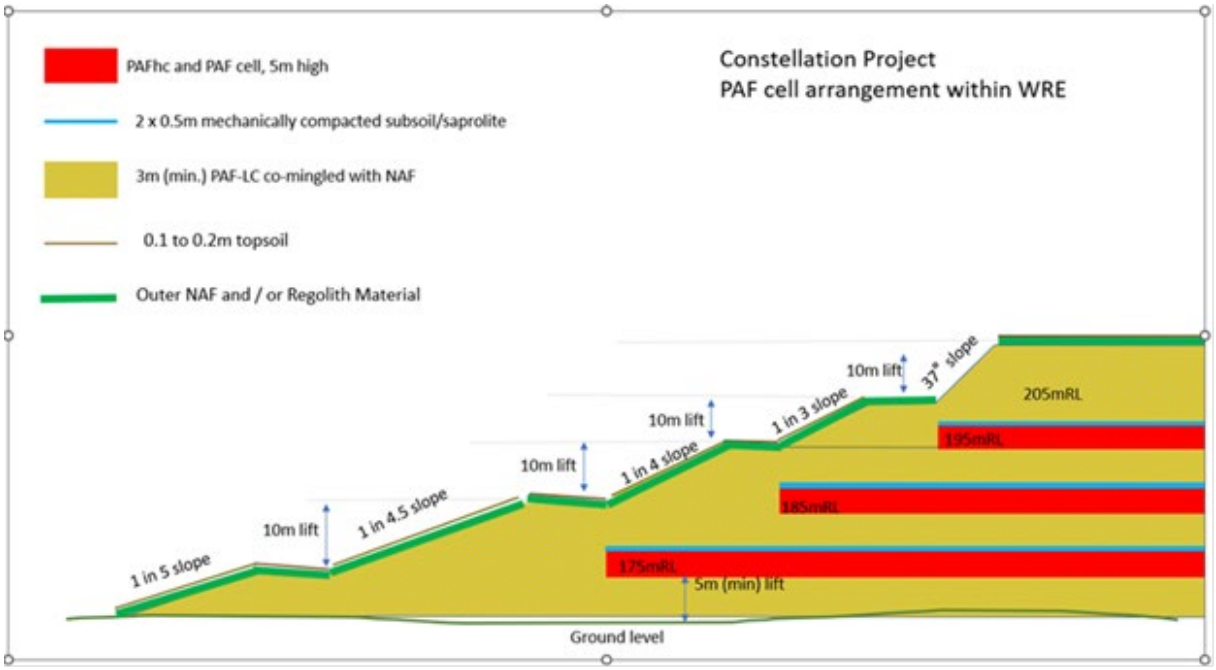


Figure 3-21: WRE landform design

3.9.2.5.2. Mineralised waste stockpile (MWS)

The MWS will store low-grade mineralised (oxide) material, which at some stage in the future may be viable for placement on the heap leach pad for metal extraction.

The MWS will be constructed to a maximum height of approximately 25 m and occupy an unrehabilitated footprint of approximately 7.4 ha (Figure 3-22).

The MWS material will be a low-grade 'oxide ore' that does not contain elevated sulphides, so there is negligible risk of generating AMD conditions.

Risks associated with the closure and rehabilitation of the MWS include the ongoing release of seepage (containing elevated metals, such as copper) from the MWS and inability to establish a stable landform capable of sustaining vegetation in the long term. Management measures for these risks are included in Chapter 8, Rehabilitation and closure.

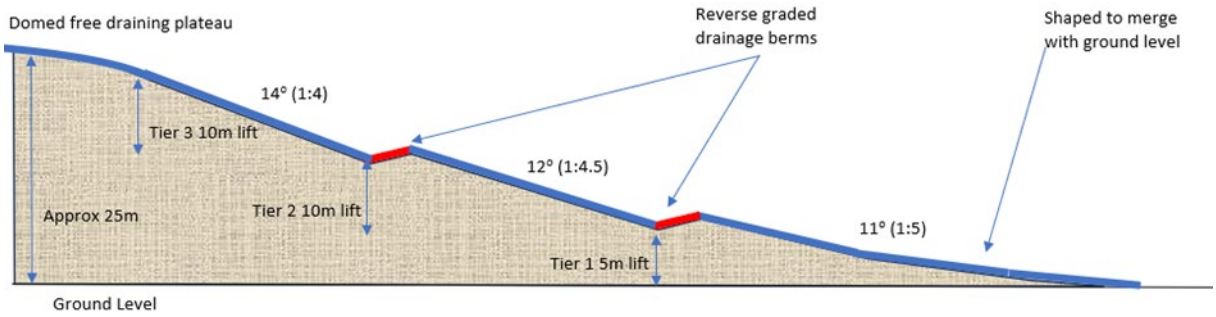


Figure 3-22: MWS landform design

3.9.2.5.3. Cement paste fill

Tailings from the Tritton processing plant (and potentially the pre-concentration facility) are proposed to be prepared as CPF to backfill the underground stopes at the Project underground mine. Backfilling the

underground stopes using CPF has the advantages of providing flexibility in stope sequencing and reducing mine wastes to be managed at surface.

The Project proposes to backhaul 50% (approximately 1.5 Mt) of reclaimed dry tailings from the Tritton processing plant, while approximately 50% of the Project tailings will be contained in the future lifts of the Tritton Copper Mine TSF (Figure 3-23).

After backhauling to the Project site, tailings will be stored temporarily on a prepared tailings storage pad (refer to Figure 3-6 and Section 3.7.4). Only a small quantity of tailings will be stored at any one time due to the potential for tailings oxidation. Given a typical stope volume in the order of 3,000 m^3 no more than 5,000 m^3 of tailings will be stored at the Project site. The stockpile height will be approximately 3 m.

The tailings storage pad will typically have the following engineered vertical construction profile:

- an engineered under-drainage layer at the base;
- approximately 1 m of crushed rock (to assist drainage) in a different colour to the tailings laid above the drainage layer;
- approximately 1 m of tailings over the rock layer (ideally low sulphide material) to protect operators from bogging the crushed rock; and
- the tailings stockpile placed above the tailings layer.

Stored tailings at the Project will be prepared as CPF using a mobile paste backfill plant. The mobile paste backfill plant will be used to screen and mix these tailings with water and a binder.

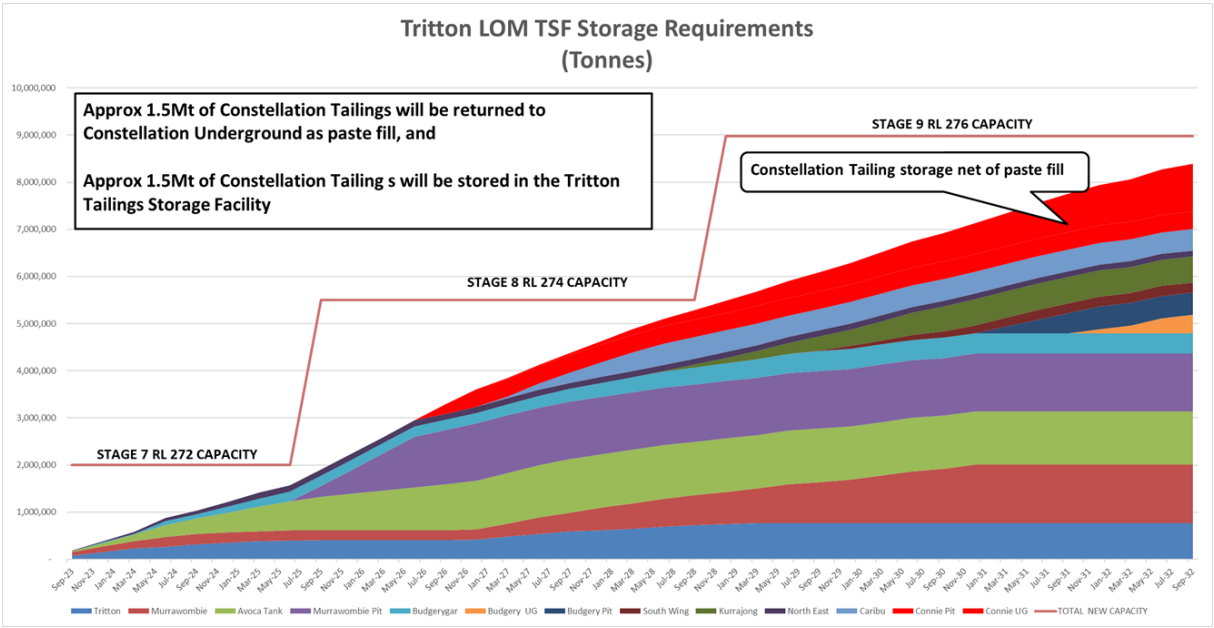


Figure 3-23: Estimated volume of tailings at Tritton Copper Operations

3.9.3 Closure and rehabilitation

Decommissioning and final rehabilitation activities will be completed during an estimated five-year period at the end of the Project's operational life. Disturbance caused by the Project will be small in scale, with approximately 170 ha available to rehabilitate.

Rehabilitation will occur progressively during the operational phases of the Project when possible—this will include large portions of the WRE. During operational phases, the viability of metal recovery from the MWS will be considered. Should a decision be made that the MWS will not be processed, it and the oxidised ore stockpile

and agglomeration pad may be available for early rehabilitation. The remainder of the surface infrastructure will be required for the active mine life and will be decommissioned and rehabilitated from year 11 onwards.

Chapter 8, Rehabilitation and closure provides information on:

- post-mining land uses;
- landforms and rehabilitation objectives;
- progressive rehabilitation; and
- rehabilitation methods.

3.10 Workforce

There will be a two workforces required for the Project:

- a construction workforce; and
- an operational workforce.

3.10.1 Construction workforce

A construction workforce of up to 95 personnel is expected during the Project construction phase (Table 3-7), involving:

- civil works;
- site buildings and infrastructure construction;
- boxcut, portal and decline development; and
- equipment assembly.

The construction workforce is likely to include:

- earthmoving and heavy equipment operators;
- structural steel and welding trades workers;
- geologists, project managers, safety officers, engineers and environmental scientists;
- carpenters, scaffolders, painters, plumbers and electrical trades workers;
- concreters; and
- construction, mine tunnelling and mining labourers.

Table 3-7: Estimated total workforce during construction

Labour	Total (FTE)
Direct (on-site construction workforce)	90
Indirect (client/project management)	5
Total	**95**

3.10.2 Operational workforce

An annual average of 178 FTE positions is expected during peak operation times. A breakdown of the operational workforce is provided in Table 3-8.

Table 3-8: Estimated total workforce during operation

Labour	Annual Average at Peak (FTE)
Mining	117
Transport	23
Processing	38
Total	**178**

3.10.3 Workforce accommodation

For those in the Project workforce who do not live locally, accommodation will be available at the Tritton Copper Mine village during operations.

Based on historical and current workforce statistics from the existing Tritton Copper Mine operation, it is expected that within the operating phase of the Project, the following situations may apply:

- Approximately 49% of the workforce will be DIDO/FIFO primarily from the NSW Central Coast regions and reside in the accommodation village.
- Approximately 51% of the workforce will choose to reside in surrounding local communities, including Cobar, Nyngan, Hermidale and Girilambone
- Currently the accommodation village has 30 single units, as well as recreation and dining facilities. A Nyngan motel can provide a further 49 rooms on a permanent basis, some with double accommodation but all single occupancy. This totals 79 rooms.

3.10.4 Rostering

Construction rosters are expected to be based on 12-hour shifts:

- Surface construction activities will generally be undertaken during the hours of 6 am to 10 pm, seven days a week.
- Drift and shaft sinking activities will operate 24 hours a day, seven days a week.
- Blasting activity will be limited to daytime hours.

Operation rosters will be based around two rosters, depending on the work roles. There will be a seven-day, four-panel roster for operators, direct supervisors and maintenance. A four-panel roster is an equal-time roster requiring one crew on the day shift, one crew on the night shift and two crews on days off.

Throughout the operations phase of the Project, operating hours will be 24 hours a day, seven days a week. Operational employees will work industry-standard 12-hour shifts on their seven-day roster cycles.

Management, technical services, clerical and support staff will operate on a five days on, two days off roster.

3.10.5 Workforce transport

During the peak period of the construction phase, 25 vehicles (23 light vehicles and two buses) per day will be inbound in the morning and outbound in the afternoon.

During operations, it is expected that 65% of staff will use staff shuttle buses to commute to and from the Project site. Operational personnel will commute to the Project by four shuttle buses, including:

- a 12-seater shuttle running return from Nyngan;
- a 9-seater shuttle running return from Cobar; and
- two 48-seater coaches running return from Nyngan (via the Tritton Copper Mine).

Some workers will travel by private vehicles, with some carpooling expected. For further details on traffic generation during construction and operations, refer to Chapter 6, Environmental Assessment, Section 6.15 Transport.

FIFO personnel will use air transport to and from the Project site or the accommodation village. Dubbo airport is the nearest airport.

3.11 Transporting ore, tailings and product

The ore extracted from the Project site will be hauled on the proposed haul roads to the Tritton processing plant via private and public roads. Existing road networks will be used as much as possible. The tailings generated during processing at the Tritton processing plant will be backhauled to the Project site on the same haul roads. The construction of the haul roads is discussed in Section 3.4.3.1.

The operational haul route is proposed to cross a railway corridor. However, the existing rail line (former Main Western Railway) from Nyngan Junction to Byrock is currently not being used (refer to Chapter 6, Environmental assessment, Section 6.15, Transport). Therefore, vehicles accessing the nearest state road (Mitchell Highway) from the proposed haul road will not pass over any operational level crossings.

The haul route, traffic generated during the construction and operational stages of the Project and transport impacts are described in Chapter 6.15, Environmental assessment, Section 6.15, Transport.

Concentrate from the Tritton processing plant will be trucked to Hermidale rail siding and loaded onto rail to transport to Newcastle Port. Copper crystal will be loaded and transported from the Project by either road or rail.

The existing rail networks are expected to provide enough transport capacity for the Project. Therefore, no new rail or port facilities will be required.

Constellation Project

Environmental Impact Statement



Chapter 4 – Engagement

4 Engagement

4.1 Introduction

This chapter describes the key community and stakeholder engagement undertaken for the Project. The engagement requirements for the EIS, as identified in the Project SEARs, are provided in Table 4-1.

Table 4-1: Project SEARs

Assessment requirements	Report locations
During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups, Registered Aboriginal Parties (RAPs) affected landowners and holders of existing mining and exploration authorities.	Section 4.2 and 4.4
The EIS must describe: 1. the consultation process and the issues raised; and 2. identify where the design of the infrastructure has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	 Section 4.3 Section 4.4.1 Discussed throughout this chapter
The EIS must detail the engagement undertaken and demonstrate how it was consistent with the Department's Undertaking Engagement Guide: Guidance for State Significant Projects (DPIE, 2022d). The EIS must detail how issues raised and feedback provided have been considered and responded to for the development.	Section 4.3 and 4.4 Section 4.4 and Chapter 6 Environmental assessment, Section 6.13.

Note: A Social Impact Assessment (SIA) has been undertaken for the Project. The SIA for the Project is attached to this EIS as Appendix 10, Social impact assessment. The outcomes of the SIA are discussed in Chapter 6, Environmental assessment, Section 6.13.

As part of the SIA, and in addition to it, a range of engagements have been undertaken to support stakeholder understanding of the Project and participating in the process. Stakeholder engagement has been carried out in accordance with the Undertaking Engagement Guidelines for State Significant Projects (DPIE 2022d) and the State significant development guidelines – preparing an environmental impact statement (DPIE 2022a).

4.1.1 Objectives

The NSW Government's Undertaking Engagement Guidelines for State Significant Projects (DPIE 2022d) seeks to support proponents by undertaking "engagement that is meaningful, proportionate and tailored to the needs of the community, councils and government agencies". These objectives have underpinned the engagement developed and executed for the Project.

Aeris is committed to engaging with the community during the planning, construction, operation and decommissioning phases of the Project. This approach is consistent with community and stakeholder engagement that continues to be undertaken for Tritton Copper Operations.

4.2 Stakeholder identification

To inform engagement methods, processes and actions for the Project, a scoping exercise was undertaken to identify stakeholders, and to nominate their potential interest(s) in the Project. This exercise was undertaken for two broad stakeholder groups, being government stakeholders and community stakeholders. These are discussed in the following Sections 4.2.1 and 4.2.2.

4.2.1 Government stakeholders

Government stakeholders for the Project include councils, government agencies, and other authorities considered to hold a current or future interest in the Project. Government stakeholders for the Project, as well as their areas of interest, are identified in Table 4-2.

Table 4-2: Government stakeholders identified for the Project

Agency or authority	Engagement interest
Commonwealth Department of Climate Change, Energy, the Environment and Water	Assessment and advice on controlled actions (impacts on Matters of National Environmental Significance)
Department of Planning, Housing and Infrastructure (DPHI)	
Planning NSW	Approval authority for the Project (formerly DPE)
Independent Planning Commission	Potential assessment body for the Project
Crown lands	Interfaces and potential impacts upon Crown land
Department of Regional NSW (DoR)	
Mining, Exploration and Geoscience (MEG)	Branch of DoR that assesses and determines mining Projects (and executes the NSW strategic policy for mining) MEG also administers the following bodies:
Resources Regulator	Assessment and advice on proposed rehabilitation Regulator of the Mining Operations Plan; Rehabilitation Management Plan; and Rehabilitation Security Deposit
Rehabilitation and Securities Panel (RASP)	Assessment and advice on the Rehabilitation Strategy
Mine Development Panel (MDP)	Assessment and advice on proposed mine development
Resource and Economic Assessment (REA)	Assessment and advice on proposed resource development and financial elements of the proposed Project
NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW)	
Environment & Heritage	Assessment and advice on cultural heritage matters, including the Aboriginal Cultural Heritage Assessment Report
Environmental Protection Authority	Regulator and interest holder for the operation of the Project, including the Environmental Protection Licence
NSW Biodiversity Conservation Trust	Assessment and advice on biodiversity matters, including the Biodiversity Development Assessment Report and offset matters
Water NSW	Water access and licensing approval and administration

Agency or authority	Engagement interest
Bogan Shire Council	Approval authority for the Project Owner of infrastructure proposed to be used to support the Project (e.g. council-controlled roads) Representative of Bogan Shire Council residents & local values
Transport for NSW	Interfaces and potential impacts upon the State-controlled Mitchell Highway
UGL Regional Linx	Owner of disused rail crossing infrastructure (on Project haul route)
Emergency Services Nyngan Police Station Nyngan Fire Station (NSW Fire and Rescue) Nyngan Ambulance Station	Access to emergency services may be impacted by the Project (e.g. social, economic, other impacts)

4.2.2 Community stakeholders

Community stakeholders for the Project include local landholders, community organisations or groups, local Indigenous interest holders, local service providers, business representatives, emergency services and other interested or impacted parties. Community stakeholders for the Project, as well as their identified areas of interest, are identified through Table 4-3.

Table 4-3: Community stakeholders identified for the Project

Stakeholder group	Engagement interest
Local landholders	
Owners of 'Okeh' property (Lot 4 DP751341; Lot 9 DP 751321; Lot 4 DP 751304; and Lot 1 DP879749)	Property is directly impacted by the Project (located on this property)
Owners of 'Windella' property (Lot 10 DP751321)	Property is directly impacted by the Project (located on this property)
Owners of 'Eulo' property (Lot 13 DP751345)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Einalla' property (Lot 2 DP879749 and Lot 3 DP751304)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Karingal' property (Lots 1 and 5 of DP751304)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Yumba Thuddi' property (Lots 11 and 12 of DP751343)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 1617 Okeh Road (Lot 2 of DP751345)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Mulga' property (Lot 4 of DP751345)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Bald Hill' property and 'Partial Avondale' (Lot 6 of DP751343)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Glendale' property (Lot 10 of DP751343 and Lot 13 of DP751311)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Neilly's' property (Lots 1,4 and 5 of DP751311)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Courtlands' property (Lot 4 and Lot 7 of DP751353, and Lot 9 of DP751315)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Glenormiston' property (Lots 6-11 of DP751311 and Lots 14 & 15 of DP751336)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Owners of 'Wilgadale' property (Lots 9-12 of DP751353, Lot 24 of DP751315, and Lot 27 of DP44917)	Property is potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Other properties identified within the noise, air, visual amenity or traffic assessments	Properties are potentially affected by the Project (e.g. noise, air, visual, traffic, other impacts)
Girilambone community	The community of Girilambone is potentially impacted by the Project (e.g. social, economic, noise, air, visual, traffic, other impacts)
Nyngan community	The community of Nyngan is potentially impacted by the Project (e.g. social, economic, other impacts)

Stakeholder group	Engagement interest
Community organisations/groups Girilambone Community Association Orana Joint Organisation of Councils Regional Development Australia – Orana Country Women's Association Isolated Children's Parents Association P& F Association AVOCA Community Consultative Committee	A range of local community groups are potentially impacted by the Project (e.g. social, economic, other impacts)
Local Indigenous interest holders NTSCORP Limited (legal representative for the Ngemba, Ngiyampaa, Wangaaypuwan, Wayilwan) Bogan Aboriginal Corporation Nyngan Local Aboriginal Land Council Nyngan Local Aboriginal Education Consultative Group	Local Indigenous community members and interest holders are potentially impacted by the Project (through impacts on heritage artefacts or values, potential loss of access to heritage places, and social, economic and other impacts)
Local service providers Girilambone Public School Nyngan High School Nyngan Community Services Action Group (Interagency) Nyngan Health Service (Hospital) Bogan Shire Medical Centre (Nyngan) Nyngan Community Hub Barnados	Local service providers (and access to local services) are potentially impacted by the Project (e.g. social, economic, traffic, other impacts)
Businesses and employment Regional Development Australia (RDA) –Orana	Local and regional businesses (employers) are potentially impacted by the Project (e.g. social, economic, and other impacts)
Housing Local and regional community members Local Realtors	Access to, and affordability of, housing may be impacted by the Project (e.g. social, economic, other impacts)

Note: A map showing properties directly impacted by the Project is provided in Chapter 1, Introduction, Figure 1-3.

4.3 Engagement methodology

The spectrum of public participation provided by the 'International Association for Public Participation – Code of Ethics for Public Participation Practitioners' (IAP2 2018) defines how different levels of public engagement increasingly impact the influence of stakeholders on the decision-making process. The IAP2 identifies five discrete levels of engagement:

1) inform;

2) consult;

3) involve;

4) collaborate; and

5) empower.

Engagement methods adopted for the Project have primarily focused on the 'inform' to 'collaborate' components of the IAP2 spectrum. Engagement methods adopted were also designed to encourage stakeholder participation in the Project. When possible, engagement methods were adapted to work with the needs of individual stakeholders; specifically:

- a community survey;
- semi-structured interviews;
- information briefings;
- community meetings;
- phone calls;
- emails; and
- website and social media posts.

These engagement methods are further discussed in Sections 4.3.1 to 4.3.7.

4.3.1 Community survey

A community survey was prepared for the Project as part of the scope of the SIA. The community survey was targeted towards the broader community and all identified stakeholders (refer to Table 4-2 and Table 4-3). The survey was also promoted through social media and online platforms, and a hard copy information sheet (with links to the survey) was delivered to all post office boxes at the Girilambone Post Office. The survey included questions relating to:

- social fabric;
- why people like living in their community;
- key aspects of the community (e.g. housing, employment);
- positive and negative impacts of the Project; and
- changes, impacts or benefits to social and economic aspects of the community.

Findings from the community survey are discussed in Section 4.4.1 and in Appendix 10, Social impact assessment.

4.3.2 Semi-structured interviews

Semi-structured interviews were adopted as a primary means of stakeholder engagement for the Project. As shown in Table 4-3, stakeholders targeted for semi-structured interviews included:

- potentially impacted landholders;
- community organisations and groups;
- local Indigenous interest holders;
- local service providers;

- local businesses; and
- local emergency services.

Semi-structured interviews were conducted in person (when possible) and via phone. Approximately 37 semi-structured interviews were undertaken for the Project. Emails were also sent to all stakeholders and follow-up phone calls were made.

Stakeholders who participated in semi-structured interviews are identified in Table 4-4.

Table 4-4: Semi-structured interview participants

Stakeholder group	Engagement interest
Local landholders	Owners of 'Okeh' property Owners of 'Windella' property Owners of 'Eulo' property Owners of 'Einalla' property Owners of 'Karingal' property Owners of 'Yumba Thuddi' property Owners of 1617 Okeh Road Owners of 'Mulga' property Owners of 'Bald Hill' and 'Partial Avondale' properties Owners of 'Glendale' property Owners of 'Neilly's' property Owners of 'Courtlands' property Owners of 'Glenormiston' property Owners of 'Wilgadale' property
Bogan Shire Council	Director Development and Environmental Services Director People and Community Services Director Engineering Services Director Finance and Corporate Services
Community organisations/groups	Girilambone Community Association Regional Development Australia–Orana AVOCA Community Consultative Committee
Local Indigenous interest holders	NTSCORP Limited (legal representative for the Ngemba, Ngiyampaa, Wangaaypuwan, Wayilwan) Nyngan Local Aboriginal Land Council Nyngan Local Aboriginal Education Consultative Group

Stakeholder group	Engagement interest
Local service providers	Girilambone Public School Nyngan High School Nyngan Community Services Action Group (Interagency) Bogan Shire Medical Centre (Nyngan) Nyngan Community Hub Barnados
Housing	Aspect Property Richardson and Sinclair Landmark
Emergency services	Nyngan Police Station

Outcomes from the semi-structured interviews are discussed in Section 4.4 and Appendix 10, Social impact assessment.

4.3.3 Information briefings

Extensive information briefings were undertaken for the Project, structured to address the interests of individual stakeholders. The stakeholders and the matters discussed are identified in Table 4-5.

Table 4-5: Information briefings conducted for the Project

Stakeholder	Matters discussed	Timing
Local landholders	Provide information about the proposed Project and EIS process Discuss scope of potential impacts Obtain landholder input on potential impacts, benefits and mitigations	May 2022 November 2022 February 2023 April–May 2024
Community organisations/ groups	Provide information about the proposed Project and EIS process Enable community members to contribute their views on the scope of potential social impacts and benefits Collect information on social baseline values	May 2022 November 2022 February 2023 April–May 2024
Local Indigenous interest holders	Provide information about the proposed Project and EIS process Identify Aboriginal cultural heritage values Seek inputs on opportunities for economic and community development Identify potential impacts and benefits	November 2022 June 2023 (ACHAR review)

Stakeholder	Matters discussed	Timing
Bogan Shire Council	Provide information about the proposed Project Discuss the SIA scope and seek inputs on local issues and the focus of assessment Provide an update on the EIS process and schedule Provide a briefing on draft SIA findings (I.e. impacts, opportunities and mitigations identified) for discussion with Councils and seek feedback	February 2022 June 2024
Department of Planning, Housing and Infrastructure (DPHI) Planning NSW Crown Lands	Provide information about the proposed Project and update on the status of the EIS Discuss potential impacts of the Project Provide a briefing on draft SIA findings (i.e. impacts, opportunities and mitigations identified) and seek feedback Discuss Project interfaces with Crown Land Seek feedback on improvement opportunities and mitigations	February 2022 (DPE) June 2023 (DPE) May 2024 (DPHI) April 2024 (Crown lands)
Department of Regional NSW (DoR) Mining, Exploration and Geoscience (MEG) Resources Regulator Mine Development Panel (MDP) Rehabilitation and Securities Panel (RASP)	Provide information about the proposed Project and update on the status of the EIS Discuss potential impacts of the Project Undertake a Resource and Economic Assessment (REA) with MEG to ensure the efficient and optimised development of the resource Provide a briefing to the MDP (through MEG) and receive feedback to guide EIS finalisation Present a detailed rehabilitation strategy to the RASP and receive feedback to guide EIS finalisation Seek feedback on improvement opportunities and mitigations	February 2022 June 2023 November 2023 March 2024 (MDP & REA) April 2024 (RASP)
NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) Environment & Heritage Environmental Protection Authority NSW Biodiversity Conservation Trust (BCT) Water NSW	Provide information about the proposed Project and update on the status of the EIS Discuss potential impacts of the Project (noise, air, visual amenity, etc.) and seek feedback on impact assessment (EPA) Discuss potential impacts of the Project (ecology) and seek feedback on impact assessment and offset outcomes (BCT) Discuss potential impacts of the Project (water access and licensing) and seek feedback (Water NSW) Seek feedback on improvement opportunities and mitigations	November 2022 February 2023 Proposed for May 2024 (pending confirmation of EPA availability) May 2024 (BCT)

Stakeholder	Matters discussed	Timing
Transport for NSW	Provide information about the proposed Project and update the status of the EIS Discuss potential transport impacts and infrastructure interfaces and designs Seek feedback on improvement opportunities and mitigations Obtain information regarding intersection design detail for submission	May 2023 April 2024
Local service providers	Provide information about the proposed Project Collect information on social baseline values as they relate to social infrastructure (facilities and services) Potential implications of the proposal for the provision of community, health and emergency services.	November 2022 February 2023
Businesses and employment	Provide information about the proposed Project Identify businesses' (including farmers) views on potential impacts and opportunities.	February 2023
Emergency services	Provide information about the proposed Project Understand demand and capacity on emergency services	November 2022 February 2023
UGL Linx	Provide information about the proposed Project and update the status of the EIS Identify interface with disused rail line and seek feedback by email.	May 2024

Note: An early information briefing was conducted with most elected representatives during 2022. Further discussions with elected representatives are anticipated to occur as opportunities are presented in 2024.

4.3.4 Community meetings

A community meeting was undertaken for the Project on 22 June 2022 to introduce the Project and obtain initial feedback from stakeholders. The meeting was conducted in Girilambone, with nine attendees. The community meeting was advertised to the community by letters (dropped in mailboxes), via email if available, and on the Girilambone Community Association Facebook page.

Discussions with Girilambone community members have also continued (through different forums), providing an opportunity for the local community to discuss the Project. The General Manager of Tritton Copper Mine met with Girilambone residents on 7 April 2024. There were also discussions at the Tritton Community Consultation Committee meetings in February and May 2024. Minutes of these meetings are available online (via the Aeris website).

4.3.5 Phone calls

When face-to-face meetings were not possible, phone calls were undertaken to ensure all community members were notified of the Project and relevant information. Stakeholders who were only available by phone often resided outside the Project region (e.g. Sydney).

Phone calls were conducted with stakeholders who were absent from semi-structured interviews and community meetings to ensure all identified stakeholders had an opportunity to have their say. Phone calls are

also made to landowners to manage property access (for assessments), follow up on queries, and/or provide updated information.

4.3.6 Emails

Stakeholders are emailed with information on upcoming engagement activities and to provide follow-up information.

An email address is available for local residents, stakeholders and interested parties to submit enquiries and concerns related to the Project.

4.3.7 Websites and social media

A webpage for Tritton Copper Operations (https://www.aerisresources.com.au/assets/tritton-copper-operations) provides Project updates to stakeholders, such as::

- providing stakeholders with information on the Project (including this EIS);
- providing stakeholders with information on future engagement opportunities; and
- providing stakeholders with ongoing updates on Project activities.

The Project webpage and Tritton Copper Operations social media (Facebook) will be updated regularly as the Project progresses or changes are made to Project operations. The Project webpage can be accessed through the Aeris website.

4.4 Stakeholder engagement findings

Given the detailed nature of feedback received across the range of Project stakeholders, a standalone summary of stakeholder feedback is provided in EIS Attachment 3, Summary of key feedback from stakeholders. Stakeholder feedback is also considered in more detail in Appendix 10, Social impact assessment, and Chapter 6, Environmental assessment, Section 6.13.

To support an understanding of stakeholder engagement findings, feedback from each stakeholder group has been classified by the relevant area of interest or concern, as presented in Table 4-6. Classification of feedback by interest area has identified that the most frequently raised concern from stakeholders is the issue of housing (access and affordability). The stakeholder group with the broadest range of concerns about the Project were local landholders, specifically regarding:

- areas of potential impact on properties;
- livestock management and movement;
- safety and traffic considerations;
- potential noise and air quality impacts;
- housing access and affordability;
- potential impacts on heritage;
- closure and rehabilitation planning;
- potential water impacts;
- effectiveness of communication; and
- haul truck movements).

Detailed consideration of stakeholder feedback is considered in more detail in Appendix 10, Social impact assessment and Chapter 6, Environmental assessment, Section 6.13.

In addition to identifying concerns about the proposed Project, stakeholder engagement has provided an important opportunity to understand existing social conditions. This feedback has assisted in identifying the following:

- Social fabric—the community is largely family oriented, safe and possesses a strong sense of identity.
- Why people like living in their community—sense of identity, small town, peace and social relationships.
- Key aspects of the community—it was generally indicated that businesses are doing well, there are adequate employment opportunities, the quality of life is good, and the environment is healthy and clean. However, it was determined that there is a need for more medical staff and adequate housing to meet demand, and roads connecting communities are not safe or in good condition.
- Positive and negative impacts of the Project—it was generally agreed that the Project will have a positive impact on employment and training opportunities, and most agreed the Project will have a positive impact on local businesses and the economy.

Table 4-6: Summary of key feedback from landholders

Stakeholder group	Property	Livestock	Safety	Noise and dust	Housing	Heritage	Mine closure and rehabilitation	Water	Project communication	Training and employment	Truck movements	Change of demographic
Landholder	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
Community organisations/groups												
Local Indigenous interest holders					✓					✓		
Bogan Shire Council					✓		✓	✓	✓		✓	
Local service providers			✓		✓							✓
Businesses and employment					✓					✓		
Housing agents					✓							
Emergency services					✓							
EIS reference	*1.5.3.1 and 6.13.7*	*6.13.7*	*6.13.7, 6.15.5, and 6.15.6*	*6.13.7, 6.8 and 6.9*	*6.13.7 and 6.14.9*	*6.13.7, 6.12.2.5.1 and 6.12.3.8*	*6.13.7 and 8.4*	*6.13.7, 6.4.6 and 6.5.6*	*6.13.7, 4.3, 4.4 and 4.5*	*6.13.7 and 6.14.9*	*6.13.7, 6.14.8, 6.15.4.3, 6.15.6 and 6.15.7*	*6.13.7, 6.14.6 and 6.14.9*

4.4.1 Infrastructure design amendments

As an outcome of stakeholder engagement, a number of design changes were made to the Project to avoid and /or mitigate potential impacts. Specifically, the following infrastructure design amendments have been adopted:

- Heritage surveys and consultation with RAPs have enabled the Project footprint to be revised, avoiding impacts to several Aboriginal cultural heritage sites.
- The Project haul route (originally designed to be 50 m wide) has been reduced to a maximum of 18 m wide to minimise existing road disturbance. This strategy has enabled significant avoidance of additional land disturbance.
- To minimise impacts to Girilambone township (resultant of proposed road haulage), a new section of haul road has been proposed just north of Girilambone township to avoid the need for haulage trucks to traverse through Girilambone. This strategy minimises noise, dust, traffic and visual amenity impacts.
- New road intersections are proposed to be developed to manage traffic interactions of the Project with the State-controlled Mitchell Highway. Intersection designs have been developed through consultation with Transport for NSW to minimise road safety risks.
- The existing Tritton processing plant will be utilised to process the ore extracted from the Project site to maximise efficiencies of utilising existing infrastructure.
- The proposed water pipeline between the Project mine site and the existing Murrawombie Mine will be in the proposed 18 m infrastructure corridor to minimise additional disturbance.
- A solar power generation plant is proposed to be developed to reduce potential impacts on the existing, local electricity network and the Project's scope 2 greenhouse gas emissions.

While some flexibility in Project design has been embraced, it is noted that not all Project infrastructure can be located to avoid (or mitigate) impacts. Indeed, the location of the proposed Project site is fixed due to the presence of the copper resource being targeted. It is also necessary for supporting infrastructure to exist in close proximity to this mining area.

4.5 Ongoing stakeholder engagement

Stakeholder engagement is proposed to continue following approval of the Project. Ongoing stakeholder engagement is intended to provide opportunities for interested or affected parties to raise concerns, provide feedback or identify opportunities to foster Project success.

Aeris' commitments in respect of ongoing engagement include:

- offering to meet regularly with representatives of the Girilambone Community Association;
- facilitating opportunities for interaction between Constellation employees and local residents to contribute positively to community cohesion and development;
- conducting an annual resident Community Information Session, commencing prior to construction and continuing during at least the first three years of the Project's operation, to provide a Project update and address potential issues or concerns;
- providing stakeholders direct access to Project representatives (when required) to answer questions about the Project and its potential impacts; and
- through the existing Tritton Community Consultative Committee, building relationships that support communication, information sharing and feedback to assist decision-making regarding construction and operational impacts.

A Stakeholder Impact Management Plan (SIMP) will be developed for the Project to assist in the future management of social impacts and benefits. The SIMP will include a program of monitoring potential social impacts over the life of the Project, as well as facilitating the identification of any unanticipated social impacts.

Ongoing stakeholder consultation and engagement for the Project will continue in accordance with the Undertaking Engagement Guidelines for State Significant Projects (DPIE 2022d).

Constellation Project

Environmental Impact Statement



Chapter 5 – Statutory Context

5 Statutory context

5.1 Introduction

In accordance with the NSW Planning Secretary's Environmental Assessment Requirements (SEARS) for the Project and the NSW State significant development guidelines – preparing an environmental impact statement (DPIE 2022a), this chapter provides an overview of the statutory context relevant to the Project.

The statutory context requirements of the Project SEARs, as well as where each requirement is addressed within this EIS, is provided in Table 5-1.

Table 5-1: SEARs requirements

Assessment matter	Report locations
Details of the approvals that must be obtained before the development may commence.	Sections 5.1.1 and 5.4
Consideration of the development against all relevant environmental planning instruments.	Sections 5.5 and 5.6
Details of water access licences (WAL) held to account for any take of water when required or demonstration that WAL can be obtained prior to take of water occurring. This should include an assessment of the current market depth when water entitlement is required to be purchased. Any exemptions, or exclusions, to requiring approvals or licenses under the *Water Management Act 2000* should be detailed by the applicant.	Section 5.4.3.5

5.1.1 Overview of approvals required

In accordance with the NSW State significant development guidelines – preparing an environmental impact statement (DPIE 2022a), several different categories of statutory requirements are recommended for consideration for the Project, as set out in Table 5-2.

Table 5-2: Relevant statutory requirements

Category	Statutory requirements
Authority to grant approval	EP&A Act EP&A Regulations *Refer to Section 5.2.*
Permissibility of the proposed Project	State Environmental Planning Policy (Resources and Energy) 2021 *Refer to Section 5.3.2.* Bogan Local Environmental Plan 2011 *Refer to Section 5.3.4.*

Category	Statutory requirements
Other relevant approvals	Consistent approvals: • *Mining Act 1992* • *Protection of the Environment Operations Act 1997* • *Roads Act 1993* • *Pipelines Act 1967.* *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* Other approvals considered: • *Native Title Act 1993 (Cth)* • *Climate Change Act 2022 (Cth)* • *Climate Change (Net Zero Future) Act 2023* • *Biodiversity Conservation Act 2016* • *Water Management Act 2000.* Approvals that do not apply—*refer to Section 5.4*
Pre-condition to exercising the power to grant approval	Matters that must be satisfied before the consent authority may exercise its power—*refer to Section 5.5.*
Mandatory matters for consideration	Matters that the consent authority must consider when making its decision—refer to Section 5.6.

These categories and their identified statutory requirements are discussed further in the following sections.

Any future expansion for mining of the deeper ore body underlying the Project would be considered as a modification undertaken in accordance with relevant statutory requirements, and does not form part of the proposed Project.

5.2 Authority to grant approval

Authority to grant approval of the proposed Project within the existing NSW statutory environment is provided through the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation).

5.2.1 NSW Environmental Planning and Assessment Act 1979

The NSW EP&A Act defines its objectives in Section 1.3. The Act seeks to promote the proper management of the state's natural resources and environment while also facilitating sustainable development.

The EP&A Act, in conjunction with the EP&A Regulation, provides the statutory framework for planning approvals and environmental impact assessment in NSW. This legislation is administered by the Department of Planning, Housing and Infrastructure (DPHI)—formerly the Department of Planning and Environment (DPE) and various state and local government authorities.

Under Section 4.15 of the EP&A Act, several matters are listed as mandatory for a consent authority to consider when evaluating and determining a development application. Relevant matters for consideration and where they have been addressed in this EIS are provided in Table 5-6.

5.2.1.1 State significant development (SSD)

Under Part 4, Division 4.7 of the EP&A Act, provisions are made regarding developments that are considered of state significance. Specifically, Section 4.36(2) provides that a development is considered an SSD if it is declared to be so under a State Environmental Planning Policy (SEPP).

SEPP (Planning Systems) 2021, Schedule 1, Section 5 (3)(b) declares that in the context of mining, an SSD is declared if the proposed development has a capital investment value more than $30 million. Capital expenditure for the Project will exceed $30 million; therefore, the Project is considered an SSD. This is consistent with the SEARs granted for the Project.

5.2.1.2 Consent authority for SSD

The consent authority for an SSD is established under Division 4.2, Section 4.5(a) of the EP&A Act. In accordance with this section, the consent authority for an SSD Project will be the Minister for Planning and Public Spaces (as represented by the DPHI)—unless an environmental planning instrument (EPI) declares the type of development to be of a nature that must be assessed by the Independent Planning Commission (IPC).

Note: Under Chapter 2, Section 2.7(1) of the SEPP (Planning Systems) 2021, the IPC is declared as the consent authority for any of the following SSD projects:

1) development in respect of which the council of the area in which the development is to be carried out has duly made a submission by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act; or

2) development in respect of which at least 50 submissions (other than from a council) have duly been made by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act; or

3) development the subject of a development application made by a person who has disclosed a reportable political donation, under Section 10.4 of the Act, in connection with the development application.

At this stage, it is not anticipated that the IPC will be the consent authority for the Project, however it is acknowledge that this cannot be determined until completion of the EIS public exhibition process.

5.2.1.3 Development application (DA)

A DA for an SSD must be accompanied by an EIS in accordance with Section 4.12(8) of the EP&A Act. Further, the EIS must be prepared in accordance with any relevant guidelines prepared under the EP&A Regulation. Notably, this includes the State significant development guidelines – preparing an environmental impact statement (DPIE 2022a).

The DA for the Project will be submitted to the NSW DPHI (as the relevant delegate for the Minister of Planning and Public Spaces). The DPHI will then distribute the DA to relevant referral authorities. Of these referral authorities, it is noted that the DoR is a central player in the approval process for the proposed Project. At the local government level, Bogan Shire Council is also a critical stakeholder in the DA process.

5.2.1.4 EIS preparation

Before preparing an EIS, an applicant must request SEARs from the Secretary of DPHI, which specifies the matters that must be addressed in the EIS. The SEARs for the Project were issued by DPHI in May 2022. The SEARs and where they have been addressed in this EIS are provided in Attachment 2, SEARs reconciliation table.

Following amendments to the EP&A Act during 2021, changes to the EIS process have been progressively occurring in recent years. A key component of these changes has been the introduction of the rapid assessment framework, which is designed to make assessing major projects quicker and more efficient while improving the quality of assessments, engagement and customer service (DPE 2024).

Key components of the rapid assessment framework relevant to the Project include:

- new environmental impact assessment guidelines to improve the quality of assessments and documentation (e.g. DPIE 2022a);

- enhanced quality assurance for environmental assessment via a new accreditation system for registered practitioners; and
- a two-year expiry for SEARs to ensure environmental impact statements are always based on current considerations.

This EIS has been prepared in accordance with Part 8 of the EP&A Regulation and the Department's State significant development guidelines to ensure it meets the minimum content requirements.

As part of the registered practitioner's system, all EISs for SSD projects must now be reviewed by a Registered Environmental Assessment Practitioner (REAP) prior to submission. The role of the REAP review is to ensure that a project's EIS is prepared to a high standard and that it includes all the necessary information to assess the project. This is intended to assist projects in moving more efficiently through the planning process (DPE 2024). The Project has prepared this EIS in accordance with DPIE 2022a while also utilising a REAP to support the EIS preparation and delivery. The declaration from the registered practitioner is provided in Summary, Section S.7.

To support the submission of this EIS, Aeris has also undertaken a number of statutory-based engagement processes in conjunction with DPHI and DoR NSW, including:

- a Mine Development Panel session; and
- a Resources and Economic Assessment.

These processes are discussed in Chapter 4, Engagement, Section 4.3.

5.3 Permissibility of the proposed Project

While the proposed Project is ultimately assessed and determined under the EP&A Act, the Project must also be considered permissible under relevant state, regional or local plans, including:

- SEPP (Planning Systems) 2021;
- SEPP (Resources and Energy) 2021; and
- Bogan Local Environmental Plan 2011 (LEP).

5.3.1 SEPP (Planning Systems) 2021

The SEPP Planning systems establish processes to identify state or regionally significant developments. As identified in Section 5.2.1, the proposed Project is considered an SSD. Determination of a project as an SSD establishes specific approval processes to assess and potentially permit the proposed Project. SSD approval processes are discussed in Section 5.2.

5.3.2 SEPP (Resources and Energy) 2021

Under Section 2.9(1) of the SEPP (Resources and Energy) 2021, mining development may be carried out if it is approved by a development consent. Relevant to the proposed Project, the following mining purposes are considered permissible:

- underground mining (carried out on any land);
- mining carried out on land where agriculture or industry is carried out (with or without development consent); or
- mining carried out on land with facilities for the processing or transporting of minerals or mineral-bearing ores (with or without development consent)—but only if they were mined from that land or adjoining land.

As such, the proposed Project is considered permissible under the SEPP (Resources and Energy) 2021.

Note: Section 2.10(1) of SEPP (Resources and Energy) 2021 provides that:

> If a local environmental plan provides that development for the purposes of mining may be carried out on land (with development consent) if provisions of that plan are satisfied, […] development for that purpose may be carried out on that land (with development consent) without those provisions having to be satisfied.

As such, the SEPP (Resources and Energy) 2021 may become relevant to permissibility when considering the operation of an LEP.

5.3.3 SEPP (Transport and Infrastructure) 2021

The Transport and Infrastructure SEPP governs the development and management of transport and infrastructure in NSW. Section 2.119 of the SEPP (Transport and Infrastructure) sets out requirements and guidelines for the consent authority to assess and determine a DA in the transport and infrastructure sector (refer to Table 5-5).

5.3.4 Bogan LEP

Local environmental planning provisions for the Bogan Shire Council area are made under the Bogan LEP. The Bogan LEP is introduced and discussed in Chapter 2, Strategic context, Section 2.3.3.

Under the Bogan LEP, the Project site is within lands classified as Zone RU1 (Primary Production). Open cut mining and extractive industries are identified as permitted land uses within Zone RU1, subject to consent. Consent for mining and/or extractive industries that are considered an SSD is via a DA, as discussed in Section 5.2.

5.4 Other relevant approvals

A number of other relevant approvals have also been considered in respect of authorising the activities proposed by the Project. The approvals have been grouped into the following categories:

1) Consistent approvals—approvals under NSW legislation that cannot be refused if the Project is approved, providing they are substantially consistent with the approval granted.

2) EPBC Act approval—approval required under Commonwealth legislation.

3) Other approvals—approvals that are not expressly integrated into an SSD assessment under the EP&A Act (e.g. WAL under the *Water Management Act 2000*).

4) Approvals not required—approvals under NSW legislation that are not required as the Project is undergoing assessment as an SSD.

5.4.1 Consistent approvals

Under Section 4.42 of the EP&A Act, the following relevant approvals must be applied consistently with the development consent granted by the consent authority.

5.4.1.1 Mining Act 1992

Granting of a mining lease will be required as part of the approvals for the proposed Project. ML applications are administered through the NSW Resources Regulator. An ML may only be granted once development consent for the Project has been obtained. Aeris will lodge an application for one or more MLs following any future approval of the Project.

As per Section 4.42(1) of the EP&A Act, an ML (under the Mining Act) cannot be refused if it is necessary to carry out an SSD development consent, and the activity is substantially consistent with that consent. Section 25 of the Mining Regulation 2016 sets out the requirements of an ML application.

5.4.1.2 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) seeks to protect, restore and enhance the quality of the environment in NSW while maintaining ecologically sustainable development. Relevantly, the POEO Act provides a regulatory framework for environmental protection, including the requirement for mining operations to obtain an EPL, which provides conditions that regulate activities likely to impact the environment or cause pollution.

Tritton Copper Operations is currently approved to operate (mining for minerals) under the POEO Act through EPL 4501 and EPL 11254. The proposed Project will include activities of mining, processing and handling of minerals, which are defined as scheduled activities under Clause 29 of Schedule 1 in the POEO Act. The existing EPLs for Tritton Copper Operations will require amendments to include MLs/Lots related to the Project site.

Under Section 4.42(1)(e) of the EP&A Act, a consent under the POEO Act cannot be refused if it is necessary for the carrying out of an SSD development consent, and the activity is substantially consistent with that consent.

5.4.1.3 Roads Act 1993

The NSW *Roads Act 1993* (Roads Act) regulates the carrying out of various activities in, on and over public roads. Further, Section 138 of the Roads Act requires the consent of the appropriate road authority in respect to works proposed on a public road.

For the Project, the haulage route would utilise existing council-controlled road infrastructure (Bogan Shire Council) as well as the state-controlled Mitchell Highway. Under Section 4.42(1) of the EP&A Act, a consent under Section 138 of the Roads Act cannot be refused if it is necessary to carry out an SSD development consent, and the activity is substantially consistent with that consent.

In respect of potential impacts to council-controlled road infrastructure, it is noted that consultation with Bogan Shire Council was ongoing at the time of finalising this EIS. In respect of potential impacts to the state-controlled Mitchell Highway, consultation has been undertaken with Transport for NSW during EIS development. This consultation has resulted in the intersection designs proposed for the Project. Potential impacts to road infrastructure are discussed in detail in Appendix 7, Transport impact assessment and Chapter 6, Environmental assessment, Section 6.15.

5.4.1.4 Pipelines Act 1967

The NSW *Pipelines Act 1976* (Pipelines Act) administers the construction, operation and maintenance of pipelines. A bi-directional water supply pipeline is proposed for the Project to enable the transfer of water between the Project and the existing Murrawombie Copper Mine. This pipeline is intended to improve water management capabilities for the Project site.

The pipeline proposed for the Project will be buried within the haulage/infrastructure corridor, which is owned by Bogan Shire Council. However, where the infrastructure corridor interfaces with the Mitchell Highway, the pipeline is proposed to be installed within existing culverts under the highway to avoid the need for disturbance of the Mitchell Highway road surface. **Note:** Designing the pipeline installation in this way will mitigate additional impacts on ecological and cultural heritage values (concentrating infrastructure disturbance as much as possible).

Under Section 4.42(1)(g) of the EP&A Act, a consent under the Pipelines Act cannot be refused if it is necessary to carry out an SSD development consent, and the activity is substantially consistent with that consent.

5.4.2 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) affects Australia's commitments to protect and manage matters of national environmental significance (MNES), specifically:

- World Heritage properties;
- places listed on the National Heritage Register;
- wetlands of international significance listed under the Ramsar Convention;
- listed threatened species and ecological communities;
- listed migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (such as uranium mining); and
- water resources in relation to coal seam gas or large coal mining developments (known as the 'water trigger').

Under the EPBC Act, actions which will, or are likely to, have a significant impact on MNES must be referred to the Commonwealth Minister for the Environment and Water for approval. The EPBC Act is administered by DCCEEW.

An assessment of potential impacts on MNES is detailed in Appendix 2, Biodiversity development assessment report. This is also summarised in Chapter 6, Environmental assessment, Section 6.7. A pre-referral meeting has been planned with the Commonwealth DCCEEW to discuss potential impacts on MNES.

5.4.3 Other approvals considered

This section considers other potential approvals that may be required, which are not expressly integrated into the SSD assessment process under the EP&A Act.

5.4.3.1 Native Title Act 1993

The *Native Title Act 1993* (NT Act) is the primary Commonwealth legislation that recognises and protects native title. Individuals or organisations are able to submit native title claims to the Federal Court under Section 13 of the NT Act.

There is an active (i.e. non-finalised) native title claim that encompasses approximately 95,000 km^2 of the Project region, including the Project site. This claim is identified as the Ngemba, Ngiyampaa, Wangaaypuwan and Wayilwan native title determination application (NC2012/001). Importantly, however, Lot 4 of DP 751341 and Lots 9 and 10 of DP 751321 (on which the Project site is located) are identified as freehold land. As such, the native title has been extinguished. Notwithstanding this, representatives of the Ngemba, Ngiyampaa, Wangaaypuwan and Wayilwan people have been consulted as part of the proposed Project, as detailed in Appendix 3, Aboriginal and cultural heritage assessment.

5.4.3.2 Climate Change Act 2022

The Commonwealth's *Climate Change Act 2022* (Climate Change Act) has recently come into force to give effect to Australia's international Greenhouse gas (GHG) emissions reduction targets. The objective of the Climate Change Act is to advance an effective and progressive response to climate change, drawing on the best available scientific knowledge.

While approval under the Climate Change Act is not required for the Project, emissions resultant of the Project must be considered against national targets. GHG emissions associated with the Project are detailed in Appendix 14, Greenhouse gas assessment and summarised in Chapter 6, Environmental assessment, Section 6.8.

5.4.3.3 Climate Change (Net Zero Future) Act 2023

The NSW *Climate Change (Net Zero Future) Act 2023* (CCNZF Act) was recently passed by the NSW Parliament to give effect to the commitments under the 2015 Paris Agreement and increase NSW's ability to adapt to the impacts of climate change.

Section 9 of the CCNZF Act legislates NSW's primary targets to reduce GHG emissions by:

- 50 percent by 2023;
- 70 percent by 2035; and to
- achieve net zero GHG emissions by 2050.

It also allows for interim targets to be prescribed in regulations.

The CCNZF Act also establishes the 'Net Zero Commission', being an independent agency responsible for monitoring the state's progress towards targets and making recommendations to support the achievement of reduction targets. As part of its function, the Net Zero Commission is empowered to provide advice to NSW government departments on SSD projects. While approval for the Project is not required under the CCNZF Act, emissions resultant of the Project must be considered against legislated NSW targets. GHG emissions associated with the Project are detailed in Appendix 14, Greenhouse gas assessment and summarised in Chapter 6, Environmental assessment, Section 6.8.

5.4.3.4 Biodiversity Conservation Act 2016

The *NSW Biodiversity Conservation Act 2016* (BC Act) was established to maintain a healthy, productive and resilient environment for the greatest wellbeing of the community, now and into the future, consistent with the principles of ecologically sustainable development.

Under the BC Act, Section 7.9 provides that a biodiversity development assessment report (BDAR) is required to support an application for an SSD. Accordingly, a BDAR has been prepared for the proposed Project and is attached as Appendix 2, with further discussions on biodiversity impacts provided in Chapter 6, Environmental assessment, Section 6.7.

5.4.3.5 Water Management Act 2000

The objectives of the *Water Management Act 2000* (NSW) (WM Act) are to provide for the sustainable and integrated management of NSW's water sources for the benefit of current and future generations.

To take surface water for a mining purpose, a WAL will be required. Water licence availability (for the Project area) is subject to the 'Macquarie–Bogan Unregulated Rivers Water Sources' Water Sharing Plan.

Currently, Tritton Copper Operations holds a number of WALs that authorise the take of water. These licences relate to the North East, Murrawombie (Girilambone) and Tritton Copper Mine sites, as detailed in Table 5-3.

Table 5-3: Existing WALs for Tritton Copper Operations

Site	Instrument	Instrument number	Date of approval	Date of expiry	Site	Purpose
MCM	Water Access Licence	WAL9374	24/02/2005	Ongoing	Tritton and Girilambone	High Security Water Licence (705 ML)

Site	Instrument	Instrument number	Date of approval	Date of expiry	Site	Purpose
MCM	Water Access Licence	WAL9375	24/02/2005	Ongoing	Tritton and Girilambone	General Security Water Licence (210 ML)
MCM	Water Access Licence	WAL9940	1/07/2004	Ongoing	Tritton and Girilambone	Supplementary Water Licence (16 ML)
MCM	Water Access Licence	WAL31041	16/01/2012	Ongoing	Tritton and Girilambone	LFB Groundwater (304 ML)
TCM	Water Access Licence	WAL31090	16/01/2012	Ongoing	Tritton	LFB Groundwater (30 ML)
MCM	Water Access Licence	WAL31049	16/01/2012	Ongoing	Girilambone	LFB Groundwater (10 ML)

Note: TCM = Tritton Copper Mine; MCM = Murrawombie Copper Mine

To support the Project, water is proposed to be supplied from Murrawombie Copper Mine site (Girrilambone), through a bi-directional pipeline. Authorisation for this water will be primarily through existing WALs. However, if water security cannot be achieved during the Project operation years, additional share components may be required for surface water resources. A water balance for the Project is provided in Appendix 5, Water impact assessment.

An Aquifer Interference Approval under Section 91(3) of the WM Act is forecast to be required for the Project to account for groundwater inflows to the open cut pit and underground mine workings (resultant of the mining process). Groundwater modelling for the Project (including an estimation of groundwater inflows) is provided in Appendix 5, Water impact assessment.

5.4.3.5.1. NSW Aquifer Interference Policy

The NSW AIP sets out the requirements for obtaining water licences for aquifer interference activities in NSW. The AIP establishes (and objectively defines) considerations for assessing and providing advice on whether 'more than minimal impacts' might occur to a key water-dependent asset. The AIP applies to all aquifer interference activities, including open cut mining and underground mine development.

The AIP requires that all water taken by aquifer interference activities is accounted for within the extraction limits set out in the relevant water sharing plan. Water take is then licensed through a WAL issued under the WM Act. In accordance with the AIP, the volume of water taken from a water source(s) needs to be predicted prior to project approval and then measured and reported in annual returns or environmental management reports. Predictions of groundwater taken for the Project are provided in Appendix 5, Water impact assessment. A WAL to authorise the proposed aquifer interference for the Project will be sought independently of this EIS process, prior to commencement.

5.4.4 Approvals that do not apply

In addition to approvals already identified and discussed, it is important to acknowledge that the EP&A Act also identifies certain NSW authorisations that are not required for SSD projects. These are briefly outlined in Table 5-4.

Table 5-4: Legislative approvals which do not apply to the Project

Act	Approval not required
Fisheries Management Act 1994	A permit under Sections 201, 205 or 219.
Heritage Act 1977	An approval under Part 4 An 'excavation permit' under Section 139.
National Parks and Wildlife Act 1974	An 'Aboriginal heritage impact permit' under Section 90.
Water Management Act 2000	A 'water use approval' under Section 89 A 'water management work approval' under Section 90 An 'activity approval' (other than an 'aquifer interference approval') under Section 91.
Rural Fires Act 1997	A 'bush fire safety authority' under Section 100B.

5.5 Pre-conditions to exercising the power to grant approval

As part of the assessment of the proposed Project, the approval authority is required to take into consideration a number of pre-conditions, which must be met to allow the proposed development to proceed to assessment. These pre-conditions are set out in Table 5-5, with references to where each consideration is addressed within this EIS.

Table 5-5: Pre-conditions table

Statutory reference	Pre-condition	Considerations	Section in EIS
State Environmental Planning Policy (Resources and Energy) 2021	**Part 2.2, Section 2.9, Development permissible with consent**	Mining development (including underground mining or mining carried out on land where development for the purposes of agriculture or industry may be carried out) is permissible, subject to development consent. Development consent for the proposed Project is being sought under the EP&A Act.	Section 5.2.1, EP&A Act; Section 5.3, Permissibility
	Part 2.3, Section 2.16, Non-discretionary development standards for mining	Non-discretionary development standards have been established for mining projects in the areas of: • cumulative noise levels; • cumulative air quality levels; • airblast overpressure; • ground vibration; and • aquifer interference. Non-discretionary development standards must be met by the proposed Project.	Section 6.9, Noise blasting and vibration; Section 6.9.4.1, Operational noise Section 6.8, Air quality; Section 6.8.7, Air quality impact assessment; Section 6.4, Groundwater
	Part 2.3, Section 2.17, Compatibility of proposed mine, petroleum production or extractive industry with other land uses	Before determining a consent for a mining project, potential impacts on other land uses must be considered.	Section 6.1, Soil and land suitability; Section 6.1.6, Potential impacts Section 8.4.2, Mining and final land use domains
	Part 2.3, Section 2.18, Consideration of voluntary land acquisition and mitigation policy	Before determining a consent for an SSD mining project, consideration must be given to the *Voluntary land acquisition and mitigation policy (VLAMP)*.	Section 6.8, Air quality; Section 6.8.4.2, VLAMP Section 6.9, Noise blasting and vibration; Section 6.8.4.1, VLAMP

Statutory reference	Pre-condition	Considerations	Section in EIS
	Part 2.3, Section 2.19, Compatibility of proposed development with mining, petroleum production or extractive industry	Before determining a development consent, consideration must be given to the compatibility of the proposed Project with other mining, petroleum production or extractive industries (either current or of future potential).	Section 2.5, Key features of the surrounding area Section 1.5.2, Site suitability and design constraints
	Part 2.3, Section 2.20, Natural resource management and environmental management	Before determining a consent for a mining project, consideration must be given to potential impacts on: • significant water resources (surface water and/or groundwater); • threatened species and biodiversity; and • greenhouse gas emissions. Potential impacts associated with these matters have been considered in various sections of this EIS.	Section 6.4, Groundwater; Section 6.5, Surface water; Appendix 5, Water impact assessment Section 6.7, Biodiversity; Appendix 2, Biodiversity development assessment report Section 6.8, Air quality; Appendix 14, Greenhouse gas assessment
	Part 2.3, Section 2.21, Resource recovery	Before determining a consent for a mining project, consideration must be given to the efficiency of the proposed resource recovery, the reuse or recycling of material and the minimisation of waste.	Section 3.3.2.3, Resource recovery
	Part 2.3, Section 2.22, Transport	Before granting consent to a mining project, consideration must be given to whether transportation activities require restriction or regulation. Transportation of mine materials on public roads will require referral of the DA to relevant infrastructure owners: • Bogan Shire Council for locally-controlled roads; and • Transport for NSW for the state-controlled Mitchell Highway.	Section 3.10.5, Workforce transport; Section 3.11, Transporting ore, tailing and product; Appendix 7, Traffic impact assessment Section 6.15, Transport; Section 6.15.6, Management and mitigation strategies
	Part 2.3, Section 2.23, Rehabilitation	Before granting consent to a mining project, consideration must be given to whether conditions are necessary to regulate: • rehabilitation outcomes; • waste management practices; • contaminated land management; or • public safety risks. These considerations are assessed in various sections of this EIS.	Section 8.4, Rehabilitation strategy Section 6.10, Non-mining waste; Section 6.3, Geochemistry; Section 6.11, Hazards and safety

Statutory reference	Pre-condition	Considerations	Section in EIS
State Environmental Planning Policy (Transport and Infrastructure) 2021	**Section 2.119, Development with frontage to classified road**	Development consent must not be granted on land that has frontage to a classified road, unless the safety, efficiency and ongoing operation of that road is not adversely affected. Traffic noise and vehicle emissions should also be considered in respect of development adjacent to classified roads. Potential impacts associated with these matters have been considered in various sections of this EIS.	Section 6.15, Transport; Section 6.15.4, Project traffic Section 6.8, Air quality Section 6.9, Noise, blasting and vibration Section 1.5.4, Key strategies to avoid, minimise or offset impacts
Bogan LEP 2011 Part 5–Miscellaneous provisions	**Section 5.21, Flood planning**	Development consent must not be granted on land identified as being within the 'flood planning area' for the Bogan Shire. No areas of the Project site have been identified as being within a defined flood planning area.	N/A

5.6 Mandatory matters for consideration

During the assessment and determination of a DA, a consent authority is required to undertake consideration of a series of mandatory matters. These mandatory considerations are provided in Table 5-6.

Table 5-6: Mandatory considerations

Statutory reference	Mandatory consideration	Section in EIS
Considerations under the EP&A Act and Regulations		
EP&A Act: Objectives Section 1.3	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.	Chapter 2, Strategic context
	To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Chapter 6, Environmental assessment
	To promote the orderly and economic use and development of land.	Section 6.14, Economic
	To protect the environment, including the conservation of threatened and other species of native animals and plants and ecological communities and their habitats.	Section 6.7, Biodiversity
	To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	Section 6.12, Cultural heritage
	To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government.	Section 5.2, Authority to grant approval
	To provide increased opportunity for community participation in environmental planning and assessment.	Chapter 4, Engagement
EP&A Act: Evaluation Section 4.15	A consent authority must consider the provisions of any relevant environmental planning instruments. For the proposed Project these include: • State Environmental Planning Policy (Resources and Energy) 2021; • State Environmental Planning Policy (Planning Systems) 2021; • State Environmental Planning Policy (Resilience and Hazards) 2021; • State Environmental Planning Policy (Transport and Infrastructure) 2021; and • Bogan Local Environmental Plan 2011.	Section 5.5, Pre-conditions to exercising the power to grant approval Section 5.6, Mandatory matters for consideration Section 2.4.3, Bogan LEP
	Any relevant development control plan must be considered (e.g. the Bogan Shire Council Development Control Plan 2012).	Section 2.10 in the State Environmental Planning Policy (Planning Systems) 2021 provides that development control plans do not apply to an SSD.
	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.	Section 2.7, Planning agreements

Statutory reference	Mandatory consideration	Section in EIS
	The EP&A Regulations (to the extent that they prescribe matters for the purposes of this paragraph).	Section 5.2, Authority to grant approval
	The likely impacts of the development, including environmental impacts on the natural and built environments and social and economic impacts on the locality.	Chapter 6, Environmental Assessment
	The suitability of the site for the development.	Section 2.4, Land use planning considerations
	Any submissions made in accordance with the EP&A Act or Regulations. **Note:** This EIS will be exhibited for public comment as part of the statutory approval process under the EP&A Act.	Section 5.2, Authority to grant approval
	The public interest.	Chapter 2, Strategic Context
Considerations under EPIs		
State Environmental Planning Policy (Resilience and Hazards) 2021	**Part 3, Section 3.12, Matters for consideration by consent authorities** The proposed Project is considered a 'potentially hazardous industry' for the purposes of the SEPP (Resilience and Hazards) 2021. Before granting consent to a potentially hazardous industry project, a range of factors, including a Preliminary Hazard Analysis prepared for the Project, must be considered.	Section 6.11, Hazards and safety; Appendix 13, Preliminary hazard analysis, Section 1.4 Chapter 8, Rehabilitation and closure
	Chapter 4, Section 4.6, Contamination and remediation to be considered in determining development application Before granting consent to a mining project, potential existence of contaminated land must be considered. The proposed Project is not within an area identified to be contaminated land (based on searches of the NSW EPA Contaminated Land Record).	Section 6.1, Soil and land suitability; Section 6.1.4.3, Land use and vegetation
Bogan LEP Part 7, Additional local provisions	**Section 7.4, Terrestrial biodiversity** Development consent must not be granted on land identified as having biodiversity sensitivity, unless the consent authority is satisfied that potential impacts to terrestrial biodiversity values will be avoided, minimised and/or mitigated. Small areas of the Project site have been identified as having 'Moderate Biodiversity Sensitivity' (Bogan LEP 2011).	Section 6.7, Biodiversity; Appendix 2, Biodiversity development assessment report

Statutory reference	Mandatory consideration	Section in EIS
	Section 7.5, Groundwater vulnerability Development consent must not be granted on land identified as having groundwater vulnerability, unless the consent authority is satisfied that potential impacts to groundwater values will be avoided, minimised and/or mitigated. The proposed Project is not within an area identified as having groundwater vulnerability.	N/A
	Section 7.6, Riparian land and watercourses Development consent must not be granted on land identified as being riparian land and watercourses, unless the consent authority is satisfied that potential impacts to groundwater values will be avoided, minimised and/or mitigated. The proposed Project is not within an area identified as riparian land or a watercourse.	N/A
	Section 7.7, Wetlands Before determining a development consent, the consent authority must consider potential impacts to sensitive wetlands (Bogan LEP 2011). The proposed Project is not within an area identified as sensitive wetlands.	N/A
	Section 7.8, Airspace operations Development consent must not be granted unless the consent authority is satisfied that the proposed development will not penetrate the Limitation or Operations Surface of Nyngan Airport. The proposed Project is not within the areas identified as the Limitation or Operations Surface of the Nyngan Airport.	N/A
	Section 7.9, Essential services Development consent must not be granted unless the consent authority is satisfied that any of the following essential services are available, or that adequate arrangements have been made to make them available when required: a) the supply of water; b) the supply of electricity; c) the disposal and management of sewage; d) stormwater drainage or on-site conservation; and e) suitable road access. Potential impacts associated with these matters have been considered in various Sections of this EIS.	Chapter 3, Project description Section 5.4.3.5, Water management act Section 6.10, Non-mining waste; Section 6.10.6, Waste management strategies Section 6.5, Surface water Section 6.15, Transport.
Considerations under other legislation		
Native Title Act 1993 (Cth)		Section 5.4.3.1
Climate Change Act 2022 (Cth)		Section 5.4.3.2
Climate Change (Net Zero Future) Act 2023		Section 5.4.3.3

Statutory reference	Mandatory consideration	Section in EIS
Biodiversity Conservation Act 2016		Section 5.4.3.4
Water Management Act 2000		Section 5.4.3.5

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Constellation Project

Environmental Impact Statement



Chapter 6 – Environmental Assessment

6 Environmental assessment

6.1 Soil and land capability

6.1.1 Introduction

This section identifies the potential impacts of the Project on land and soil capability and landform stability based on the Land and Soil Capability Assessment (LSCA) undertaken by AARC. The LSCA is provided as Appendix 17, Land and soil capability assessment.

6.1.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires an assessment of the impacts associated with the Project on land and soil capability. The specific requirements and the section where they have been addressed are in Table 6-1.

Table 6-1: Assessment requirements

Assessment matter	Report locations
Land and soils, including the following: • assessment of the likely impacts of the development on the soils • land capability of the site and surrounds • description of the mitigation and management measures to prevent, control or minimise impacts of the development;	Sections 6.1.5.2 6.1.6 and 6.1.7 Appendix 17, Land and soil capability assessment
An assessment of the likely impacts of the development on agriculture;	Section 6.1.6 Appendix 17, Land and soil capability assessment
The likely impact of the development on landforms (topography), including the long-term geotechnical stability of any new landforms on site; and	Section 6.1.5.3 Appendix 1, Geotechnical assessment Appendix 17, Land and soil capability assessment
The compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Part 2.3 of the State Environmental Planning Policy (Resources and Energy) 2021;	Section 6.1.6.2 Appendix 17, Land and soil capability assessment

6.1.3 Methodology

The LSCA was conducted in the defined study area as shown in Figure 6-1. The study area consists of:

- the Project mine site area (except for an area of 203 ha due to landholder access constraints); and
- the footprint of the new section of the infrastructure corridor.

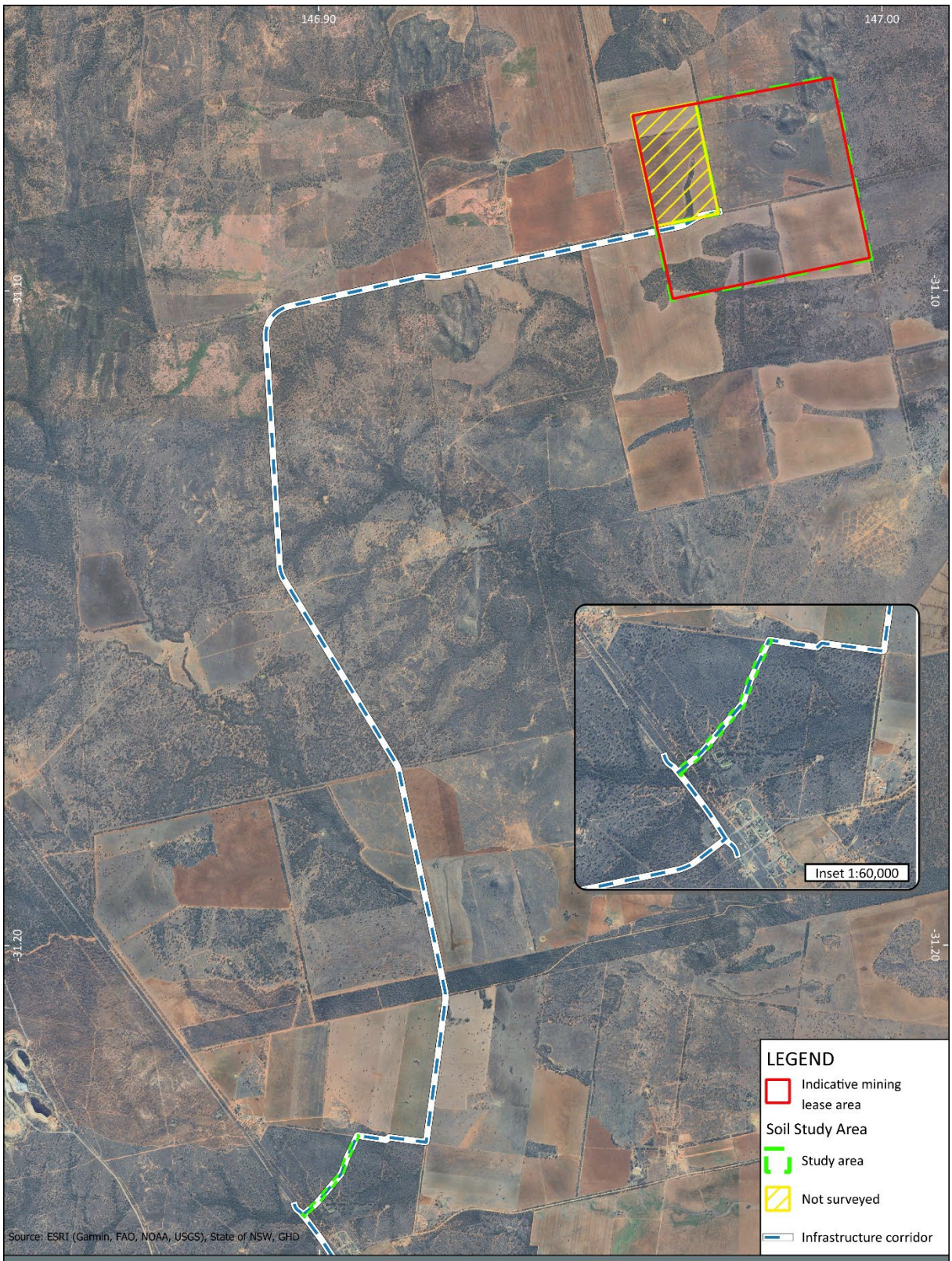


Figure 6-1: LSCA study area

A desktop analysis, based on background research and publicly available biophysical information, was conducted. The soil survey followed the procedures in the Australian Soil and Land Survey Field Handbook (National Committee on Soil and Terrain 2009) and the Guidelines for Surveying Soil and Land Resources (McKenzie *et al.* 2008).

In accordance with the guidelines, the final mapping scale of 1:25,000 and a minimum sampling density of one site per 25 ha was adopted. A total of 35 ground observations were taken for the Project mine site area and one observation for the proposed infrastructure corridor. Soil sampling from eight sites were analysed for physical and chemical analyses, using Australasian soil and plant analysis council-approved methods.

Soil management units (SMU) were based on grouping soils of like-soil morphology, parent material and land attributes in accordance with Hewitt *et al.* (2008). Land capability of each SMU was assessed in accordance with the methodology described in The Land and Soil Capability Assessment Scheme – second approximation (OEH 2012). The assessment considered and determined the on-site and off-site limitations and hazards of the land:

1) water erosion susceptibility;
2) wind erosion susceptibility;
3) soil structure;
4) soil acidification susceptibility;
5) salinity status and susceptibility;
6) waterlogging susceptibility;
7) shallow soils/rockiness; and
8) mass movement susceptibility.

For each limitation, a land and soil capability (LSC) class has been assigned, with 1 being the least hazard and 8 being the greatest hazard. This is based on data collected during the:

- field survey;
- laboratory analysis of representative soil samples; and
- information collected during the desktop assessment.

Erosional stability of sloped landforms was assessed using a Revised Universal Soil Loss Equation (RUSLE). During the erosion assessment, a maximum tolerable soil loss of 10 t/ha/yr was adopted as acceptable for mining rehabilitation (*Lu et al.* 2001).

6.1.4 Existing environment

6.1.4.1 Climate

The average annual rainfall in the study area is 434.3 mm, with a relatively consistent average of 36 mm/month (Figure 6-2). Evaporation significantly exceeds rainfall throughout the year, and soil is potentially in water deficit at all times. The average maximum temperature is highest in January (35 °C) and lowest in July (17 °C). The average minimum temperature is 20 °C in summer months and 4 °C in winter months (Figure 6-2).

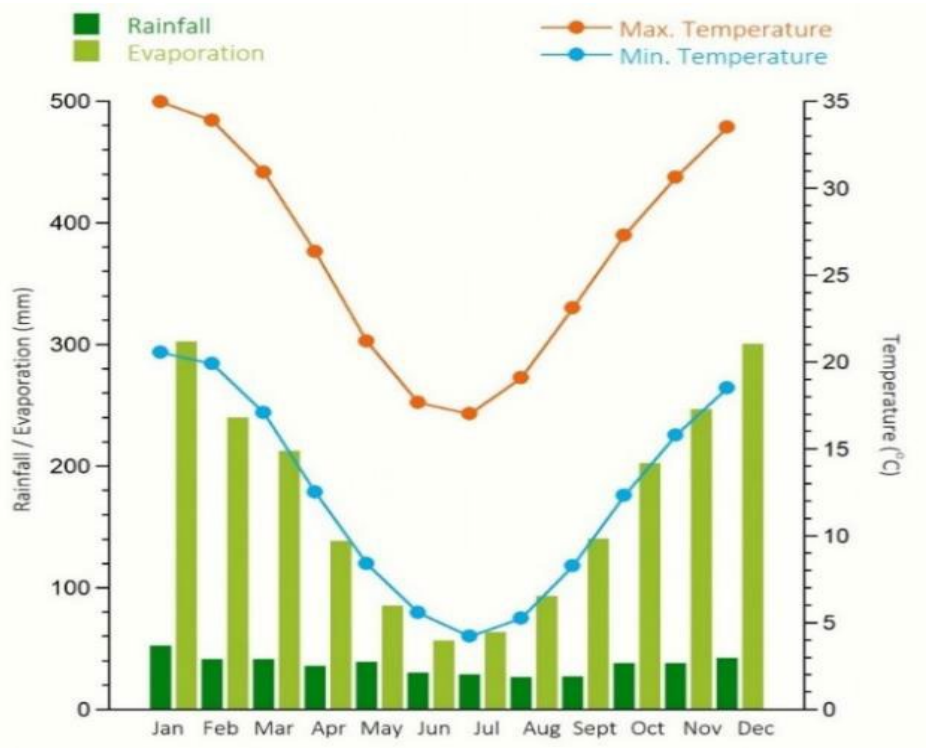


Figure 6-2: Climate data from SILO/Long Paddock at 146.95 °E – 31.10 °S (GDA2020)

6.1.4.2 Geomorphology and topography

A detailed geological description of the Project mine site is provided in Chapter 3, Project description, Section 3.3. The Project is located within the central-western plains of NSW, with the majority of the site being within the Cobar land system (Walker 1991). In this area, the landscape is characterised as undulating pediplains (a coalescence of concave, low-gradient, rock pediments) with low ridges, drainage lines and residual high peaks and locally prominent sandstone–quartzite hills. The topography of the Project site is largely subdued undulating plains interspersed with low hills of around 30–40 m high. The proposed infrastructure corridor is located on a slightly higher elevation, from 180 mAHD (Figure 6-3).

6.1.4.3 Land use and vegetation

The Project is relatively sparsely vegetated, and the current land use is mainly sheep grazing with some dryland wheat cropping in the southern paddocks (Chapter 2, Statutory context, Figure 2-1).

Vegetation in this area is dominated by a native grassland derived from previous clearing of the vegetation community 'Poplar box – gum coolabah – white cypress pine shrubby woodland' (Plant Community Type (PCT) 103). This modified form is represented by a very sparse canopy and shrub layer, over a ground layer of smaller shrubs, grasses and forbs.

The infrastructure corridor is vegetated with 'intact' PCT 103 woodland areas, consisting of mature, shrubby woodland with a dominant canopy of *Eucalyptus populnea* sbsp.*bimbil*.

Callitris glaucophylla generally forms dense, variably aged stands of young trees, and the shrub layer is dominated by open to sparse *Geijera parviflora* (Wilga) and *Sclerolaena birchii* (Galvanised Burr).

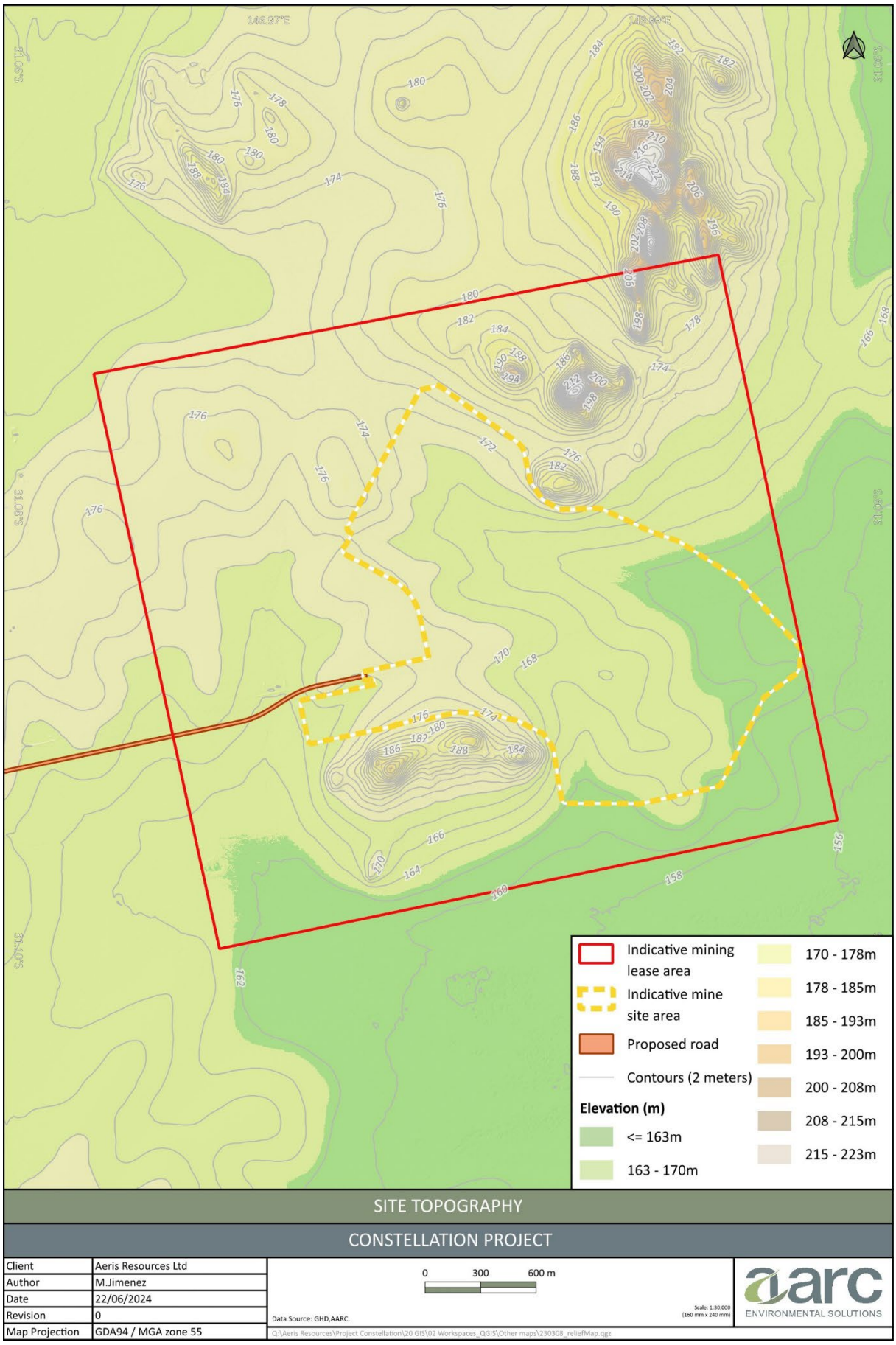


Figure 6-3: Topography of Project mine site area

6.1.4.4 Contaminated land

A search of the NSW Contaminated Land Record (NSW EPA) did not identify any land contamination within the proposed Project site or its surrounds. The Project mine site is a greenfield site that is currently used for agricultural activities. Field observations did not identify any historical infrastructure that may indicate land contamination risks, such as fuel storage areas, sheep dips or potential landfill areas. Given the nature of previous land use and survey results, the site is considered not to have existing contamination.

6.1.5 Results

6.1.5.1 Soil survey outcomes

The study area is predominantly colluvial SMU, with some alluvial SMU and sandstone SMU (Table 6-2 and Figure 6-4). A detailed description of each SMU is provided in Appendix 17, Land and soil capability assessment.

Table 6-2: SMUs identified within the survey area

SMU	Surface area (ha)	Proportion of Project area (%)
Colluvial	666	61.4
Alluvial	37	3.4
Sandstone	179	16.5
Not surveyed	203	18.7
Total	**1,085**	**100**

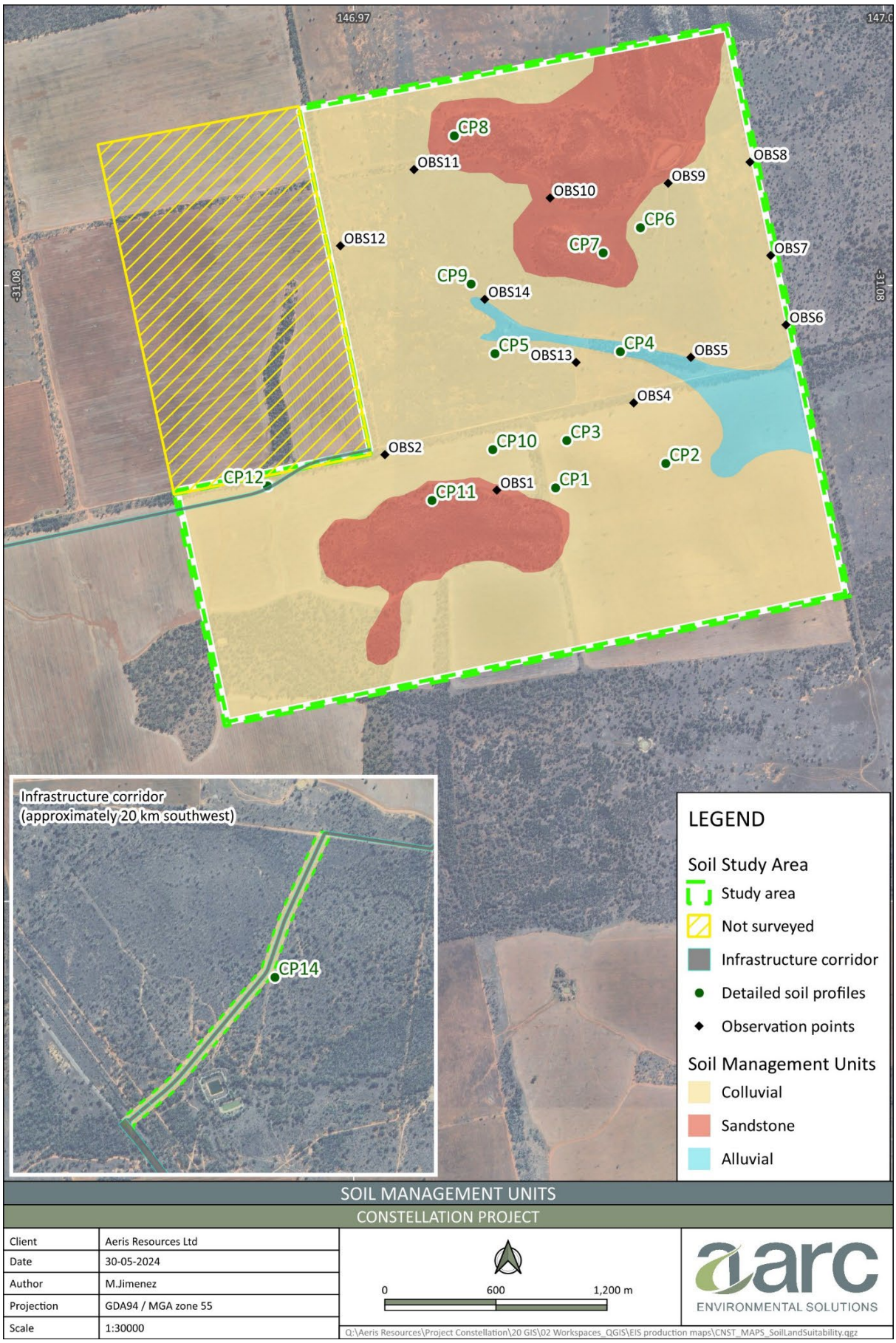


Figure 6-4: Soil management units

6.1.5.2 Land and soil capability (LSC) assessment

LSC was evaluated for each SMU using the eight biophysical features, as shown in Table 6-3. The final land capability rating has been determined by the rating of the most limiting feature. The distribution of land capability classes determined in the survey area is shown in Figure 6-5.

The LSCA concluded that:

- A total of 37 ha, or 3.4%, of the survey area is moderately capable of restricted cultivation (alluvial SMU, LSC class 4).
- A total of 666 ha, or 61.4%, of land is capable of low-impact agricultural uses, such as grazing or forestry (colluvial SMU, LSC class 6).
- The remaining 179 ha, or 16.5%, of the survey area has little to no agricultural potential (sandstone SMU, LSC class 7). The distribution of the LSC classes is mainly distinguished by soil surface texture, soil depth and slope.
- The alluvial SMU occurs in areas where medium surface soil textures, deeper soil profiles and level slopes have been observed while remaining SMUs are restricted by unfavourable variations of these attributes, contributing to higher LSC classes.

The land suitability assessment indicates that the land is generally capable of supporting grazing and modified pastureland use. Opportunistic cropping may be supported in the alluvial SMU and more clay areas of the colluvial SMU. These two land uses are the pre-mining land use of the Project and surrounding land.

Table 6-3: Summary of LSC assessment

Limitation	Colluvial	Alluvial	Sandstone
Water erosion	3	3	7
Wind erosion	6	3	6
Soil structure	3	3	3
Soil acidification	3	3	3
Salinity	3	3	3
Waterlogging	1	2	1
Shallow soils and rockiness	6	4	7
Mass movement	1	1	7
Overall capability rating	**6** (Low capability land)	**4** (Moderate capability land)	**7** (Very low capability land)

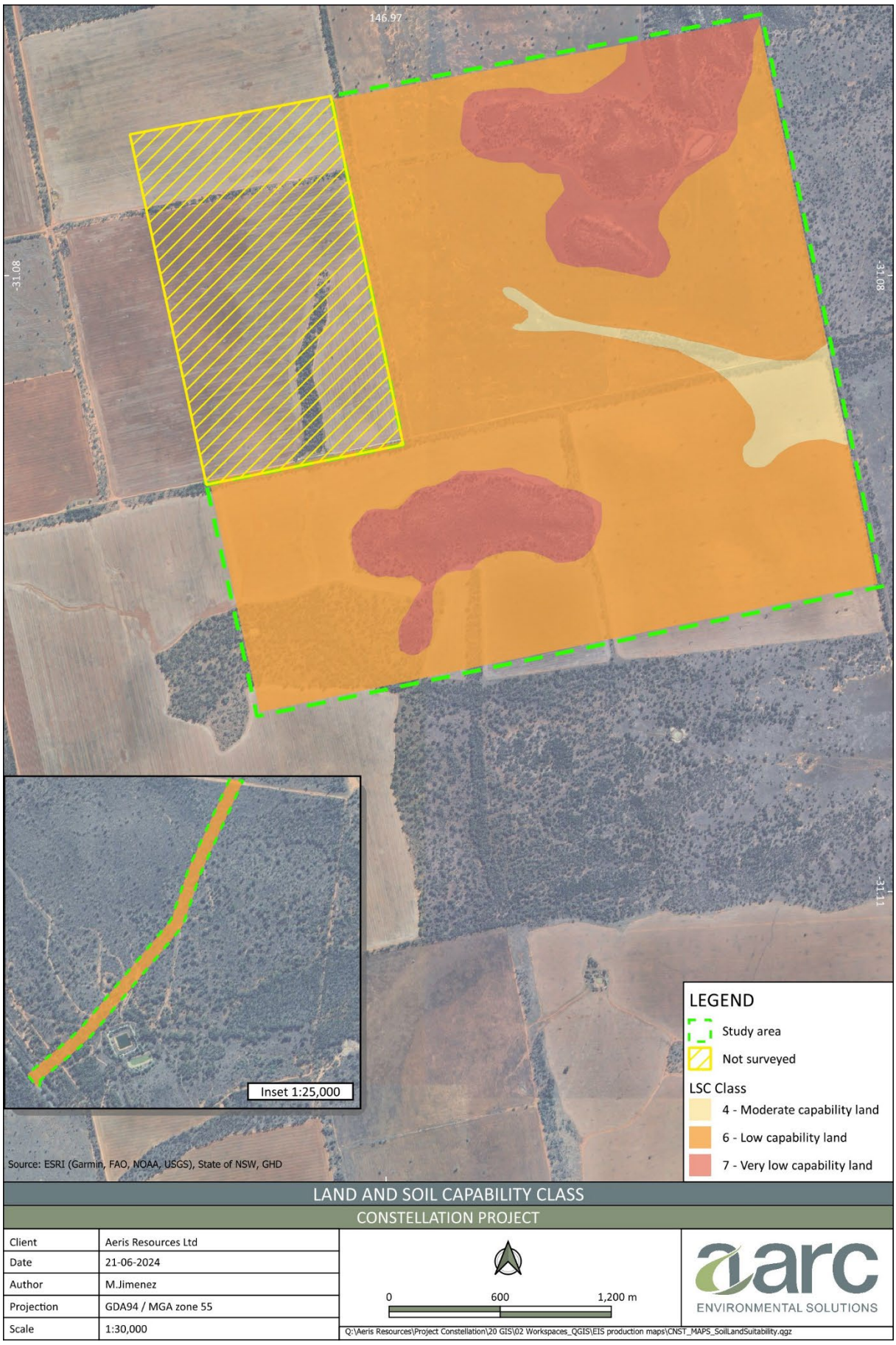


Figure 6-5: Spatial distribution of LSC classes in survey area

6.1.5.3 Landform stability assessment

The erosional stability assessment used the RUSLE to predict the erosional stability of the proposed waste rock emplacement and identify suitable groundcover for rehabilitation.

The assessment determined that stable rehabilitated landforms can be achieved by establishing and maintaining ground cover, including vegetation, litter, cryptogamic crusts and rock. Based on the assessment, the following minimum criteria were identified to be required for the rehabilitated landforms:

- 60% established and persistent ground cover where colluvial SMU soil material is used on 1:4 slope gradients; and
- 60–65% established and persistent ground cover where alluvial SMU soil material is used on 1:5 slope gradients.

Further details of the design and stability of geotechnical structures, including waste rock emplacement, are provided in Chapter 6, Environmental assessment, Section 6.2 and Chapter 8, Rehabilitation and closure.

6.1.5.4 Soil stripping

Topsoil stripping will be carried out to retain suitable topsoil to use in rehabilitation. Recommended topsoil stripping depths for each SMU have been identified from the chemical and physical characteristics. Indicative volumes of topsoil for each SMU to be recovered from disturbance areas are estimated in Table 6-4.

Table 6-4: Recommended topsoil stripping depth and estimated volumes

SMU	Maximum topsoil material stripping depth (m)	Limitation	Indicative maximum disturbance area (m^2)	Indicative maximum soil volume (m^3)
Colluvial	0.5	Soil depth/ viability	2,710,000	1,355,000
Alluvial	0.5	Soil depth/ viability	330,000	165,000
Sandstone	Not recommended	Soil depth/ rockiness	nil	nil
Total stripped topsoil volume				**1,520,000**

6.1.6 Potential impacts

6.1.6.1 Soil erosion and soil attribute impacts

Proposed activities have the potential to impact land capability in the Project area. With the specified vegetation cover to be applied during the rehabilitation phase, the elevated landforms are expected to be erosionally stable.

Erosion may be exacerbated by the following other Project activities:

- clearing vegetation and disturbing stable topsoil;
- constructing roads and vehicle tracks;
- constructing infrastructure (including drainage to divert surface water);
- soil stripping and stockpiling;
- constructing elevated landforms; and
- inappropriate rehabilitation methodologies (e.g. insufficient vegetation cover).

Topsoil and/or subsoil stripping may negatively impact the chemical and physical attributes of the soil; for example:

- loss of soil physical structure due to excavation and handling;
- loss of soil seedbank due to altered soil chemical and physical attributes;
- loss of soil resource where infrastructure is planned or buried beneath stockpiles; and
- soil compaction as a result of heavy vehicle and machinery use.

6.1.6.2 Agriculture and surrounding land use impacts

Based on the LSCA outcome, the Project is largely composed of land capable of low-impact land uses, such as grazing and nature conservation (LSC class 6). Although the southern paddocks of the survey area have been previously cropped, the land is considered unsustainably productive due to restrictive soil attributes and reliance on regular fertiliser application. The Project is not expected to impact agricultural productivity, as the land is assessed as unsuitable to sustain cropping.

During the mine closure and rehabilitation stage of the Project, as discussed in Chapter 8, Rehabilitation and closure:

- The dominant pre-mining land use of agriculture and grazing of native and introduced pastures will be reinstated.
- The heap leach pad will be rehabilitated to a native ecosystem (grassland) that will exclude grazing.
- The waste rock emplacement will be rehabilitated to a native ecosystem (woodland).
- Other mining domains are proposed to be retained as water management areas and infrastructure areas.
- The open cut pit will become a final void.

6.1.7 Commitments and management measures

The following commitments and management measures to manage potential impacts to land resources (Sections 6.1.7.1 to 6.1.7.5) have been developed in accordance with the Best Practice Erosion and Sediment Control Guideline (IECA 2008) and Australian Standard AS 1289 Methods of testing soils for engineering purposes, Part 0: Definitions and general requirements.

6.1.7.1 Soil stabilisation and protection

To minimise soil erosion and control sediment loss, Aeris will undertake the following measures:

- limit land clearing to the minimum area of land required for the safe operation of the Project;
- undertake progressive rehabilitation, where practicable, as mining operations are completed and land becomes available;
- place soil stockpiles away from drainage areas, roads, machinery, transport corridors and stock grazing areas;
- divert overland flow/runoff around disturbed areas;
- use sediment control structures to minimise the release of water and suspended sediments into the receiving environment;
- directly place soil material with additional organic matter on the areas to be rehabilitated to help preserve the seed bank; and
- seed soil material as soon as possible after placing onto rehabilitated areas.

Disturbed areas will be revegetated according to proposed post-mining land uses. Rehabilitated areas will achieve:

- a minimum ground cover of 60% for colluvial SMU; and
- a minimum ground cover of 65% for alluvial SMU, which will be placed on flatter gradients and/or shorter lengths.

An erosion and sedimentation control plan (ESCP) will be developed in accordance with the IECA and Australian Standard AS 1289 Methods of testing soils for engineering purposes, Part 0: Definitions and general requirements, which will include appropriate soil stabilisation and protection methods.

6.1.7.2 Topsoil stripping

Soil stripping will be carried out in accordance with the Tritton Operations Land Management Plan, which will be updated to incorporate topsoil recommendations for the Project. The following strategies will be adopted:

- Handling of stripped soil material will be minimised.
- Stripping will be timed to avoid periods of excessive rain or prolonged dry periods, when practicable.
- Areas to be stripped will be delineated and the date of stripping will be recorded.
- Soil material will be stripped with its existing ground cover vegetation, where practicable, and after stockpiling, soil material will be revegetated with its stockpile cover-crop vegetation.

6.1.7.3 Topsoil stockpiling

Topsoil stockpiling will be carried out in accordance with the Tritton Operations Land Management Plan, which will be updated to incorporate topsoil recommendations for the Project. The following strategies will be adopted:

- Stockpiles will generally be less than 2 m high and constructed and positioned in a manner that encourages controlled water drainage, discourages erosion and has appropriate erosion and sediment controls.
- Stockpile materials will be delineated to allow soil types (e.g. topsoil or subsoil stockpiles) to be separated.
- Soil erosion and sedimentation control measures for stockpiles will be adopted; specifically:
    - Suitable non-erosive drainage conditions will be established during high rainfall periods (e.g. diversion of up-slope stormwater runoff).
    - Complete and continuous vegetation cover and/or mulch (e.g. hydro-mulching, rock mulching) will be established (minimum of 70%).
    - Erosion control blankets, mats and mesh will be used (e.g. geofabric, jute matting, coir blankets).
    - Chemical stabilisers will be used as soil binders (e.g. lime, polymer soil stabilisation solutions);
- Topsoil stockpiles will be tested for soil properties if stockpiled for longer than six months.
- Where soil material has been identified as requiring significant amelioration, the areas where they have been stockpiled and/or re-spread will be delineated and recorded to ensure the appropriate treatments are subsequently applied.
- Stockpiles will be monitored and managed for erosion and weeds in accordance with the Tritton Operations Weed Management Plan.

6.1.7.4 Topsoil placement

Placing a minimum 100 to 200 mm of topsoil over rehabilitation areas is recommended. This will ensure the growth medium is of sufficient depth to hold water and support revegetation. The following soil placement recommendations are provided:

- Progressive rehabilitation will be undertaken to minimise the period topsoils are stored in stockpiles.
- Where practicable, stripped soil material will be directly placed in prepared rehabilitation areas, rather than stockpiled.
- Appropriate placement of soil types will be adopted for rehabilitation (e.g. subsoils placed underneath topsoils).
- Fertilisers, soil ameliorants and an appropriate seed mix will be applied where topsoil testing identifies limitations to rehabilitation success.

6.1.7.5 Soil amelioration

Applying ameliorants can improve the soil properties and subsequent rehabilitation success. The soil amelioration practices recommended in Appendix 17, Land and soil capability assessment, will be incorporated into the Tritton Operations Land Management Plan and adopted for the Project. Recommendations include:

- applying low-grade, coarse granular gypsum before initial stripping for colluvial and alluvial SMUs;
- applying fertiliser with corresponding agricultural lime, when topsoil testing identifies nutrient limitations; and
- applying organic matter when topsoil testing identifies limitations requiring treatment.

6.1.8 Conclusion

The soil types and land suitability of the Project have been identified, with the findings indicating that the Project mine site area is predominantly capable of supporting low-impact agricultural uses (class 6).

Following mining, the intention for mine closure and rehabilitation is to reinstate pre-mining native woodland vegetation communities on most of the Project area. The post-mining land uses will be compatible with the surrounding land use of grazing native vegetation.

The erosional stability assessment used the RUSLE to predict the erosional stability of the proposed waste rock emplacement landform and identify suitable groundcover for rehabilitation. The assessment determined that stable rehabilitated landforms can be achieved by establishing and maintaining ground cover, including vegetation, litter, cryptogamic crusts and rock.

With the specified cover that will be applied during the rehabilitation phase, the elevated landforms are expected to be erosionally stable.

Proposed activities have the potential to impact land capability in the Project area. Soil erosion and sedimentation are considered the main potential impacts. Commitments and management measures to manage potential impacts on land resources have been developed in accordance with the Best Practice Erosion and Sediment Control Guideline (IECA 2008) and Australian Standard AS 1289.

Management measures to address soil stabilisation, topsoil and soil amelioration will be implemented to minimise the Project's impact on land and soil.

6.2 Subsidence and geotechnical assessment

6.2.1 Introduction

This section summarises key findings of the Geotechnical Assessment (Appendix 1) that has assessed landform stability and the potential risk of subsidence from the Project.

6.2.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires an assessment of the impacts associated with the Project on landform stability, including the potential to cause subsidence. The specific requirements relating to the section and where they have been addressed are detailed in Table 6-5.

Table 6-5: Assessment requirements

Assessment matter	Report locations
Subsidence—the likely subsidence effects and the potential consequences of these effects and impacts on the natural and built environment, paying particular attention to features that are considered to have significant economic, social, cultural or environmental value, taking into consideration:	Sections 6.2.4 and 6.2.5 Appendix 1, Geotechnical assessment, Sections 6 to 10
• recorded regional and historic subsidence levels, impacts and environmental consequences;	Sections 6.2.3 and 6.2.5.2 Appendix 1, Geotechnical assessment, Section 8.3.
• geotechnical assessments that support mining methods and mine design;	Sections 6.2.4, 6.2.5and 6.2.6 Appendix 1, Geotechnical assessment, Section 7 and 8
• potential extent of fracturing of the strata above the underground mine; and	Section 6.2.5.2 Appendix 1, Geotechnical assessment, Section 8.3
• implementation of a comprehensive subsidence monitoring program capable of detecting vertical, horizontal and far-field subsidence movements.	Sections 6.2.5.2 and 6.2.6.2 Appendix 1, Geotechnical assessment, Sections 8.3 and 8.7.5
Land and soils—the likely impact on landforms (topography), including the long-term geotechnical stability of any new landforms on-site.	Section 6.2.5 Appendix 1, Geotechnical assessment, Sections 7 and 9

6.2.3 Existing environment

The lithology at the Constellation deposit comprises:

- chlorite-sericite altered pelites;
- siltstones;
- fine-grained sandstones; and
- minor intrusive basaltic sills.

Mineralisation is characterised by pyrite-chalcopyrite, sulphide-dominated assemblages of varying quantities with three different mineralised domains:

1) an oxide copper domain (to about 45 m below the surface)
2) an underlying supergene copper horizon (extending about 80 m below the surface); and
3) an underlying primary copper sulphide lens.

Post-mineralisation faulting has been identified; with the dominant group being a gentle west-dipping fault set with an apparent dip-slip movement.

Note: No mining has occurred in this area to date; thus, there is no recorded historical subsidence.

6.2.4 Assessment approach

The geotechnical assessment has relied on modelling for open pit slope and underground designs. The primary components for the modelling comprised

- geology;
- rock mass;
- structure;
- hydrogeology; and
- in situ stress.

A summary of the model inputs is provided in Table 6-6, with a detailed description provided in Appendix 1, Geotechnical assessment.

Table 6-6: Model component summary

Model component	Method summary
Rock mass and geology	The geotechnical soil and rock mass model comprised eight rock mass units of similar lithology, weathering, strength and degree of fracturing. Both open pit and underground mining was modelled. A generalised Hoek-Brown failure criterion was adopted; the material parameters were based on the available borehole, laboratory testing and structure data.
Structure	The structure model was developed to assist with the slope design. The model identified and analysed major structures (e.g. fault and shear zones) and defect shear strengths, based on the regional scale geology understanding, observations from exposures at other nearby mine sites and local borehole structural data, including oriented core and borehole televiewer data. Major structure sets were identified (fault and shear zones). Two conceptual fault surfaces were assessed and found to be advantageously oriented for pit wall stability and not subject to further assessment.
Hydrology	Empirical assessments of groundwater inflows to the open pit and underground mine workings were defined by hydraulic conductivities and considered in the conceptual hydrogeological model framework. Characterisation of rock mass hydraulic conductivity was investigated by packer tests in cored boreholes and slug tests in standpipe piezometers. For the open pit inflow assessments, diffusive inflow was calculated from the Dupuit solution for radial flow into a circular excavation, and localised inflow through fault zones was calculated using a Darcy Flow equation.
In situ stress	In situ stress measurements were used from a nearby underground mine, about 40 km south-west of Constellation.

The modelling has provided the basis for the empirical geotechnical assessments, which include:

- an open pit slope stability assessment;
- an underground geotechnical assessment, including:
  - subsidence assessment; and
- a geotechnical assessment of the proposed landforms for:
  - the Waste Rock Emplacement (WRE); and
  - the heap leach pad (HLP).

6.2.5 Predicted impacts

The geotechnical assessment modelling predicted stability for aspects of the Project design, described in Sections 6.2.5.1 to 6.2.5.4.

6.2.5.1 Open pit slope stability assessment

As a result of the open pit stability assessment, slope designs for the open pit were incorporated into the open pit design. These design recommendations are provided in Appendix 1, Geotechnical assessment. In summary, the assessment considered open pit wall stability as controlled by two failure mechanisms:

1) combined structure rock mass failure; and
2) rock mass failure in moderately weathered rock in the top 45 m of the pit.

The slope design acceptance criteria adopted for the assessment were according to industry standards. Specified design acceptance criteria were derived from the assessment including:

- Bench design angles of 47°; and
- Inter-ramp design angle of 23°.

These design criteria are conservative, given the performance of historic pit slopes in the region.

Operational risk management measures proposed for the recommended slope designs are provided in Section 6.2.6.1.

For mine closure, the open pit landform will be enclosed by a bund, and a pit lake will form in the void, which is considered beneficial for long-term slope stability.

6.2.5.2 Underground geotechnical and subsidence assessment

Underground stope stability was assessed using the Matthews/Polvin Stability Graph method and input conditions based on similar nearby underground mines. The assessment identified recommended stope dimensions, which will be stable for the proposed mining purposes. Recommended dimensions and support requirements for other underground structures, including access declines, shafts, raise bores and crown pillars, are provided in the assessment. Measures to manage underground stability, as an outcome of the assessment, are proposed in Section 6.2.6.2.

Large surface deformation or subsidence of more than 500 mm is unlikely for the Project because of the proposed mining method and stope sizes. The fracturing of the strata above the underground mining is most likely to be in the already-disturbed open pit footprint. The proposed mining method includes backfilling, where completed stopes will be filled mainly using cemented paste fill produced from tailings and supplemented by backfilling with underground waste rock (refer to Chapter 3, Project description, Section 3.6.1). The subsidence assessment identified that the proposed backfilling will limit the extent of fracturing and subsequent subsidence.

Significant subsidence attributable to the crown pillar (the rock between the open cut pit and the underground mine) could only occur if it was to fail. In this adverse, unexpected case, deformation would be expected only within the open pit footprint. Crown pillar design recommendations have therefore been provided to prevent failure and any consequent deformation.

The consequence of any surface subsidence occurring within the open cut footprint is considered negligible. Any conservation significant matters such as biodiversity, Aboriginal heritage or historic heritage within the open cut footprint would already be disturbed by the open cut mining and no further impact would occur because of subsidence.

Excessive surface deformation is unlikely with the adopted mining methods. The consequence of such deformations is assessed to be low, and the risks associated with subsidence are considered to be low. A comprehensive subsidence monitoring program to detect vertical, horizontal and far-field subsidence movements is not considered appropriate, and a fit-for-purpose program is provided in Section 6.2.6.2.

6.2.5.3 Geotechnical assessment of the waste rock emplacement landform

The proposed slope angles of the WRE are based on closure design requirements that include erosion management and the capacity to store potentially acid forming (PAF) waste rock material. The selected closure overall slope angles (maximum 1:4) and bench face angles (1:3) are flatter and less than what is required for geotechnical stability globally. The proposed height of the WRE design is up to 45 m, and the design aims to establish a landform that is similar in height, area and shape to the surrounding landforms. The long-term geotechnical stability of the slope angles is considered adequate, based on the shallow slopes, limited dump height and advantageous geotechnical conditions.

6.2.5.4 Geotechnical assessment of the heap leach pad landform

The proposed slope angles of the HLP landform are based on closure requirements that include erosion management. The closure overall slope angle (maximum 1:6) and bench angles (1 vertical:4 horizontal) are flatter than required for geotechnical global stability. The proposed height of the HLP landform is up to 24 m. The long-term geotechnical stability of the proposed slope angles is considered adequate, based on the shallow slopes, limited dump height and advantageous geotechnical conditions.

6.2.6 Mitigation and management measures

To ensure the geotechnical performance is in accord with the predictions of the Geotechnical Assessment (Appendix 1), the following management measures in Sections 6.2.6.1 to 6.2.6.3 will be adopted.

6.2.6.1 Mitigation and management measures for open pit stability

Operational controls for the open pit will be adopted as follows:

- Active monitoring will be undertaken of pit walls using applicable industry methods, with a minimum of prism monitoring.
- Should significant instability develop, additional slope stability monitoring methods will be considered.
- Geotechnical mapping of structures will be conducted to identify possible instability mechanisms.
- Pit slope performance will be reviewed during mining to confirm the appropriateness of the design and identify any potential instabilities.
- The long-term groundwater level immediately behind the pit slope will be monitored using applicable industry methods. Horizontal drain holes may be required if pore pressures build up to unacceptable levels, particularly around major structures.
- Measures will be taken to control rockfall risk, including appropriate blasting methods, thorough scaling of walls post blasting and cleaning of berms to maximise catch capacity.
- Internal reporting of adopted open pit stability controls will be conducted quarterly.

- A void management plan will be prepared to address the interaction between simultaneous open pit and underground mining operations.
- A ground control management plan will be developed, which will include void management procedures and monitoring requirements.

6.2.6.2 Mitigation and management measures for underground stability

Management measures will be adopted in relation to underground stability as follows:

- Stopes will be non-personnel entry, with all equipment remotely operated from outside the stope, in accordance with normal underground mining processes.
- Surface prism monitoring on sensitive receptors will be undertaken in combination with open pit prism monitoring. The prism monitoring will effectively measure subsidence, consistent with industry best practices.
- Stopes will be backfilled in accordance with the methodologies recommended in Appendix 1, Geotechnical assessment, Section 9.7.1.
- Ongoing stope monitoring (including stope over break) will be monitored, and designs will be reviewed in accordance with monitoring results.
- Geotechnical reviews will be conducted quarterly to annually.

6.2.6.3 Geotechnical stability of waste rock emplacement and heap leach pad landforms

The WRE and HLP landforms will be designed in accordance with good construction practices for water management, including:

- limiting water ponding;
- avoiding the creation of perched water tables; and
- surface water management with reverse-graded berms, drains and drop structures.

6.2.7 Conclusion

The geotechnical and subsidence assessment was undertaken by developing geotechnical models. The stability of the open pit structure, the underground structures, the WRE and the HLP landform are predicted to be stable based on the proposed designs.

Subsidence was determined to be unlikely because of the proposed mining methods and controls. Therefore, no significant economic, social, cultural or environmental impact is expected. Mitigation and management measures will be implemented to ensure the geotechnical performance is in accord with the assessment predictions.

6.3 Geochemistry

6.3.1 Introduction

A geochemistry assessment was undertaken to characterise the geochemical and physical properties of mineral and waste materials and assist with waste rock emplacement design and rehabilitation. The assessment was prepared in accordance with the following guidance documents:

- NSW Resource Regulator guidelines, including;
    - Amendment to Mining Regulation 2016. Mining Amendment (Standard Conditions of Mining Leases – Rehabilitation) Regulation 2021, 2 July;
    - Rehabilitation objectives, rehabilitation completion criteria and final landform and rehabilitation plan for large mines (NSW Resource Regulator 2021a);
    - Rehabilitation management plan for large mines (NSW Resource Regulator 2021b);
    - Annual rehabilitation report and forward program for large mines (NSW Resource Regulator 2021c);
    - Rehabilitation objectives and rehabilitation completion criteria (NSW Resource Regulator 2021d); and
    - other industry specific guidance documents.

The geochemical assessment is provided in Appendix 15, Geochemical and pit lake modelling assessment.

6.3.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) for the Project includes those relating to the assessment of potential impacts associated with mineral materials. The specific requirements relating to the section and where they have been addressed are detailed in Table 6-7.

Table 6-7: Assessment requirements

Assessment matter	Report locations
Details of the ore and waste rock, including mineralogy and deleterious elements and evidence of geological and grade (or quality) continuity of mineralisation in the deposit	Sections 6.3.5 and 6.3.6 Appendix 15, Geochemical and pit lake modelling assessment, Section 9.2
A waste (overburden, tailings, leach pad etc.) management strategy	Section 6.3.6 Appendix 15, Geochemical and pit lake modelling assessment, Section 9.8

6.3.3 Existing environment

The geology of the proposed open cut pit is dominated by pelite and psammite, with some quartz veins and quartzite.

The underground deposit is characterised by pyrite-chalcopyrite, sulphide-dominated assemblages of varying quantities. Two distinct sulphide packages identified at Constellation include:

1) a broad pyrite-dominated halo; and
2) an internal high-grade, massive sulphide lens.

The massive sulphide lens has limited strike length in the range of 70 m. The down plunge extent is approximately 1,000 m. Peripheral to this is a disseminated/banded pyrite-dominated halo. Drilling has traced the pyrite halo approximately 500 m along the strike to the north. A majority of copper mineralisation discovered at the Project to date is contained within the massive sulphide lens.

Regolith material (including pedolith and saprolith), which will be recovered from the open cut footprint, is suitable for use in construction and rehabilitation.

The regional, local and deposit geology of the Project is detailed in Chapter 3, Project description, Section 3.3.

6.3.4 Methodology

The purpose of the geochemical assessment was to:

- quantify the soil geochemical and physical properties of the mine materials;
- evaluate the potential risk of beneficial and deleterious mine materials to produce acid and metalliferous drainage (AMD);
- assess the mine materials to optimise their use for rehabilitation;
- outline waste management and rehabilitation objectives to inform management of the waste streams encountered; and
- outline storage regimes of topsoil and soil cover for the rehabilitated landforms.

The assessment relied on a drilling, sampling and testing program that covered:

- materials in the mining areas;
- footprints of the infrastructure areas, and
- representative tailings and heap leach material.

6.3.4.1 Sampling program

The following data and samples assisted in quantifying the chemistry of the topsoil and subsoil in the pedolith, saprolite, saprock in saprolith and mineral materials within the footprint of the open pit and infrastructure areas.

Regolith program

- Pedolith auger program:
  - topsoil x eight samples,
  - subsoil x 14 samples
  - assay data from Aeris completed in 2021, containing 347 datapoints from surface to 7.2 m below ground level, across locations within and around the pit.
- Saprolith drill hole program:
  - diamond core regolith samples from nine holes, including 17 samples for saprolite and six samples for saprock.

Mine materials

Assay data from the reverse circulation drilling program, containing 7,904 datapoints.

Samples from the potential pit shell, refined by depth and waste (from the geological database provided by Aeris)

- Static sample program:
  - 150 samples for geochemical analysis, covering lithologies such as clay and clay loams, gravel, pelite, psammite and quartz vein.
- Kinetic sample program:
  - Nine samples for Kinetic leach column (KLC) analysis, three of which were potential acid forming samples.

Tailing samples

- Two 20L buckets of tailings slurry comprising solid tailings and supernatant from Tritton (a material representative of the tailings which will be produced by and re-used by the Project as cemented paste fill).
- Two samples of floatation tailings from sulphide ore, and one sample of tailings from oxide ore.

Oxide ore

One sample received.

Heap leach material

A spent heap leach sample that is likely to have a pH of < 4.5 after the spent ore is washed.

A total of 198 samples were received and used for the following analytical tests.

6.3.4.2 Analytical program

Static and kinetic geochemical analyses were conducted to:

- characterise the properties of mineral materials and soils;
- evaluate the potential for AMD; and
- determine the risks and opportunities of mine materials for their use in rehabilitation.

Total (whole rock) element concentrations have been provided by the Aeris Constellation geological databases for the metalliferous drainage assessment. The geochemical analytic testing program of samples, including the number of analyses were:

- Static geochemical analyses of regolith:
  - acid base account (45 analyses);
  - soil fertility analyses (45 analyses);
  - shake flask extraction leach method (9 analyses); and
  - physical analyses (9 analyses).

- Static geochemical analyses of waste rock:
  - acid base account (150 analyses); and
  - shake flask extraction leach method (150 analyses).
- Static geochemical analyses of tailings, water and tailings paste:
  - acid base account (5 analyses);
  - multi-element analyses (2 analyses);
  - shake flask extraction leach method (4 analyses);
  - cyanide analyses (4 analyses); and
  - quantitative x-ray diffraction mineralogy (2 analyses).
- KLC analyses for tailings and waste rock (9 analyses).

The materials were classified for net acid producing potential according to the criteria shown in Table 6-8.

Table 6-8: Net acid producing potential classification method

Geochemical classification	**NAPP (kg H_2SO_4/t)**
Acid Consuming (AC)	< - 50
Non-Acid Forming (NAF)	> - 50 ≤ -10
NAF (Low Capacity) (NAF_{LC})	> - 10 ≤ 0
Potentially Acid Forming (Low Capacity) (PAF_{LC})	> 0 ≤ 10
PAF (PAF)	> 10 ≤ 50
PAF (High Capacity) (PAF_{HC})	> 50

6.3.5 Geochemistry of mine materials

Sections 6.3.5.1 to 6.3.5.6 describe the geochemistry of mine materials for the Project.

6.3.5.1 Material balance

The mine waste schedule and mass balance identify the low overall mass of PAF material and low sulphide concentrations in PAF mine waste that will be generated from the open pit.

NAF and acid consuming materials comprise 83.1%, PAF (low capacity) materials comprise 10.5%, and PAF materials comprise 6.1% of the waste rock materials, respectively. Material balances from the proposed mining and stockpiling verify that the material balance for rehabilitation should not be in deficit.

6.3.5.2 Soil and regolith

All soil/regolith samples are acid consuming or non-acid forming. The multi-element auger assay database provides an extensive dataset to verify metal and metalloid concentrations in the topsoil, subsoil and saprolite zones. Water soluble metal and metalloid analysis indicate that there is no enrichment in regolith samples, with the exception of copper, which is representative of the baseline concentrations for the Project.

6.3.5.3 Waste rock

Most of the waste rock samples analysed are acid consuming or non-acid forming (refer to Chapter 3, Project description, Section 3.9.2.5).

A small number of samples of potentially acid-forming mine waste are associated with pelite and some psammite lithologies. Water soluble shake flask extraction and KLC analyses verified that minor/moderate mobility occurs with arsenic, copper, cobalt and zinc; lower levels of mobilisation occur with antimony, manganese, molybdenum and nickel.

Waste rock has low saline drainage potential. The low proportion of mineralised waste rock in what will become the final pit shell at the end of open pit mining and the low proportion of mine waste in the waste rock emplacement (5% of the 4.2 million bank cubic metres) have verified there is a low potential for the open pit or the waste rock emplacement to produce acid metalliferous drainage.

Waste rock generated from the open cut pit will be managed in the proposed WRE. The WRE has been designed to enable all PAF waste to be emplaced in cells within the landform. The top of each cell will be shaped to a 3–5% grade then sheeted in compacted clay-rich subsoil. This will maximise lateral, rather than vertical, movement of water inside the landform so that toe and basal seepage is reduced.

Management of waste rock from the underground mine will vary during the life of the Project. During the initial development of the underground mine, underground waste rock will be hauled to the surface and stored in the WRE, as the stope voids will be inadequate to place uncemented waste rock fill. As underground mining progresses, PAF (PAF and PAF_{HC}) materials generated from underground mining operations will be preferentially returned underground.

The minimal exposure of PAF materials to oxidation is expected to keep their pH at neutral levels and not pose an environmental risk (refer to Chapter 3, Project description, Section 3.9.2.5).

6.3.5.4 Tailings material

The tailings material generated by the Project will be backhauled from the Tritton Copper Mine to the Project area, stockpiled on a 45 m x 45 m lined pad, processed to produce paste tailings and deposited in the underground workings.

The representative tailings samples initially have an alkaline pH and are classified as potentially acid-forming - high capacity. When the tailings become acidic, the leachate is elevated in:

- aluminium;
- cadmium;
- cobalt;
- chromium;
- copper;
- manganese;
- nickel;
- lead;
- selenium; and
- zinc.

Tritton Copper Mine representative tailings samples (without the addition of cement to convert them into non-acid forming tailings as paste fill) had an initial pH of approximately 7.5. At the end of the KLC test period, the final pH was approximately 2.0.

6.3.5.5 Oxide ore

The samples of the oxide ore, which will be stockpiled at the site, indicate that it is non-acid forming (low capacity) with low total acid neutralising capacity and contains essentially no sulphide sulphur. AMD risks posed by the material are low.

6.3.5.6 Heap leach material

As stated in Section 6.3.5.5, the ore (mineralised waste) to be placed in the proposed heap leach pad has a low risk of AMD (refer to Section 6.3.5.6). Representative samples of spent and washed heap leach material of oxide copper ore with negligible sulphide mineral content were analysed. The material will be leached with acid and, at the cessation of the leaching process, will likely have a pH of < 4.5. Results indicate the samples are acid forming with an initial pH of 3.8. Copper in the KLC samples was approximately 70 mg/L on the first leach event and 5 mg/L after the fourth leach event. The heap leach material does not contain sulphide minerals, and the KLC work program verifies the heap leach material will not generate any additional acid or any additional neutralisation.

For the Project, after completion of leaching (irrigation), the heap leach pad seepage will continue to drain to the high-density, polyethylene-lined liquor ponds. During dry periods, prior to placement of the cover system, the seepage flow rate is likely to be low enough that the water will evaporate from the ponds. During heavier rainfall, the ponds will passively drain towards the open pit. The construction of a suitable store and release cover will minimise the potential for water to pass through the cover system into the heap leach material below the cover. The local climate conditions will facilitate this design objective because annual average evaporation greatly exceeds annual average rainfall. Once the cover system is placed on the heap leach landform (post closure), seepage volumes will diminish over time and will passively drain towards the open pit.

6.3.6 Potential impacts and management measures

The geochemistry of the mineral materials has been assessed for potential environmental hazards, as shown in Table 6-9. Management strategies are proposed for each mineral material/hazard.

Table 6-9: Key findings, potential impacts and management strategies for each mineral material

Mineral material	Potential impacts	Management strategies
Soil/regolith	• Soil used in the cover system can be susceptible to erosion. • Soil stockpiles can be lost over the mine life or utilised for construction work resulting in material deficits.	• No special geochemical management measures for soil/regolith are required. From a mine waste geochemistry perspective, the soils are suitable for use in WRE rehabilitation—subject to appropriate soil handling and amelioration as described in Appendix 17, Land and soil capability assessment.
Waste rock	• Failure to build on mine material assessment after approvals are attained can contribute to poor environmental outcomes. • Poor environmental outcomes can be associated with acid drainage but also from neutral metalliferous and or saline drainage.	• During the operational phase, geochemical sampling and analysis will be completed for representative samples from exploration, resource drilling and drill and blast holes for any areas such as the proposed decline and final pit wall where additional information is required to verify AMD potential. • The geochemical data from this waste rock will be added to the resource/mine waste block model to increase the understanding of the mine waste breakdown for each mine waste class. • Development waste and mine waste from the underground deposit will be analysed and classified before this material is placed into the WRE. • The WRE will be designed to enable all PAF waste to be emplaced in PAF cells within the WRE to minimise the potential for sulphide-bearing mine waste to be exposed to oxygen and water so that long-term AMD issues are minimised to the extent possible. • PAF materials will preferentially be returned underground to backfill stopes. • Surface water, groundwater and process water sources will be monitored over the mine life to track changes in water chemistry. If changes occur this will trigger additional monitoring to verify the cause of the AMD so mitigation measures can be implemented. • At mine closure any seepage from the HLP and the WRE will be directed to the final void—unless the surface water testing indicates the water is suitable for release into the receiving environment.
Oxide ore	• Oxide ore has the potential to leach copper even if the ore retains circumneutral pH.	• Where low-grade oxide ore is stockpiled and processed later in the mine life, the water management system will contain all runoff from stockpile areas within the process runoff catchment area.

Mineral material	Potential impacts	Management strategies
Tailings material (based on material from Tritton processing plant and representative of the material that will be generated and used by the Project)	• The Tritton tailings sample analysed produced acid water < pH 4.5 in six months. • Tritton tailings should not be stockpiled at the Constellation site for extended periods before they are converted to paste tailings for backfilling to underground workings.	• Tritton Copper Mine tailings should be analysed for geochemical parameters each week at the plant to track its geochemical properties. • Tailings will be processed as quickly as possible after transport to the Project site to minimise weathering and oxidisation.
Heap leach pad	• Water released from the HLP will contain elevated acidity and copper, leading to surface and groundwater impacts.	• The proposed HLP design is described in Chapter 3, Project description, Section 3.9.2.2.4. • The rehabilitation methods for the HLP are described in Chapter 8, Rehabilitation and closure, Section 8.4.4.4. • Beyond the proposed design of the HLP and proposed rehabilitation, no special geochemical management measures for the HLP are required to manage impacts.

6.3.7 Conclusion

An assessment of the Project mineral materials was undertaken in accordance with the relevant guidance documents. The geochemical characteristics of the mineral materials have been described, and the risk of potential impacts from these materials has been assessed.

The overall environmental risk from mineral materials is low. Most of the waste rock samples analysed with a combined total of 83% are acid consuming or non-acid forming. The geology of the open pit has low sulphide mineralised volume and content; much of the open pit is geochemically benign in relation to most other metalliferous projects.

In terms of extracting the underground resource, PAF materials will be preferentially:

- returned underground to backfill stopes;
- placed in the open pit after open pit mining is completed; or
- placed in PAF cells in the WRE.

The minimal exposure of PAF materials to oxidation is expected to keep their pH at neutral levels and not pose an environmental risk. Similarly to disposing of underground waste rock PAF materials, tailings will also be returned as paste backfill into the underground void.

Notwithstanding the low potential impacts of the Project, management strategies have been proposed to minimise potential impacts on the environment.

6.4 Groundwater

6.4.1 Introduction

An assessment of groundwater impacts, namely a water and mass balance assessment of groundwater flows in the post-mine pit lake, was completed in accordance with relevant guidance documents and is provided in Appendix 5, Water impact assessment.

A water and mass balance of the post-mine pit lake was developed by RGS Pty Ltd, as detailed in Appendix 15, Geochemical and pit lake modelling assessment.

6.4.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires an assessment of the impacts of the Project on groundwater resources. The specific requirements and the sections where they have been addressed are detailed in Table 6-10.

Table 6-10: Groundwater assessment requirements

Assessment matter	**Report locations**
Describe all works/activities that may intercept, extract, use, divert or receive surface water and/or groundwater. This includes the description of any development, activities or structures that will intercept, interfere with or remove groundwater, both temporary and permanent.	Section 6.4.5.1 Appendix 5, Water impact assessment, Sections 6.3 and 6.4
Detail all water take for the life of the development. This is to include water taken directly and indirectly and from the relevant water source when water entitlements are required to account for the water take. If the water is to be taken from an alternative source, confirmation should be provided by the supplier that the appropriate volumes can be obtained.	Section 6.4.5.1 Appendix 5, Water impact assessment, Section 6.4.4
Detail water access licences (WALs) held that account for any take of water when required or demonstrate that WALs can be obtained prior to take of water occurring. This should include an assessment of the current market depth when water entitlement is required to be purchased. Any exemptions or exclusions to requiring approvals or licences under the *Water Management Act 2000* should be detailed by the applicant.	Section 6.4.5.5. Appendix 5, Water impact assessment, Section 6.6
Assess groundwater conditions that provide an understanding of groundwater level across the site under a range of wet and dry conditions.	Section 6.4.3.3. Appendix 5, Water impact assessment, Section 6.1.1
Assess impacts on: • surface and ground water sources (quality and quantity); • related infrastructure; • adjacent licensed water users; • basic landholder rights; • watercourses; • riparian land; • groundwater-dependent ecosystems; and • ground water levels, including measures proposed to reduce and mitigate these impacts, having regard to the Aquifer Interference Policy.	Sections 6.4.5 and 6.4.6. Appendix 5, Water impact assessment, Sections 6.5 and 8.2.3

Assessment matter	Report locations
Describe the measures proposed, including monitoring activities and methodologies, to ensure the development can operate in accordance with the requirements of any relevant water sharing plan (WSP) or water source embargo.	Section 6.4.5.5. Appendix 5, Water impact assessment, Section 8.1
Describe the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	Section 6.4.6 Appendix 5, Water impact assessment, Section 8.2.3

6.4.3 Existing groundwater environment

6.4.3.1 Hydrogeology

Groundwater at the Project site occurs predominantly in fractured rock aquifers (i.e. faults and fractures) within the Lachlan Fold Belt and is managed under the 'NSW Murray Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan'. The fractured nature of the rocks restricts or blocks the groundwater flow, which would otherwise be expected to generally flow east towards the Bogan River following the topography.

No shallow water strike observations were recorded in available information, indicating there is no shallow or perched groundwater at the Project site. The fractured rock groundwater source underlying the Project site is low yielding and predominantly brackish to saline. To the east of the Project site, the fractured rock aquifer is generally overlain by the great artesian basin, which is overlain by alluvial aquifers.

6.4.3.2 Groundwater quality

Groundwater quality was described from the results of monitoring at five monitoring bores (BH005, BH013, BH015, BH016, and BH017) between March 2022 and June 2023. The location of the monitoring bore network is shown in Figure 6-6 and bore characteristics in Table 6-11. The monitoring parameters included:

- Arsenic
- Barium
- Beryllium
- Boron
- Cadmium
- Calcium
- Chloride
- Chromium
- Cobalt
- Copper
- Electrical Conductivity
- Iron
- Lead
- Magnesium
- Mercury
- Nickel
- Nitrate as N
- Nitrite + Nitrate as CaCO3
- pH
- Potassium
- Selenium
- Sodium
- Sulphate
- Total Dissolved Solids
- Vanadium

The results indicate that the water was slightly alkaline and saline, with the exception of bore BH005 that was nearly neutral to brackish. Overall, the beneficial use (e.g. potable and irrigation use) of the groundwater is limited due to the high salinity, dominant ions at most bores, being sodium and chloride (Figure 6-7) and dissolved metal concentrations being generally low, with elevated concentrations likely to be attributable to elevated detection limits.

Table 6-11: Groundwater monitoring bores

Bore	Easting MGA Zone 56	Northing MGA Zone 56	Bore elevation (mAHD)	Hole depth (m)	Screened elevation (mAHD)	Screened lithology
BH005	498262	6560960	165.0	75.7	115–103	unknown
BH013	499420	6560991	159.5	102.5	129.5–126.5	Soft green volcanic
					69.5–63.5	
BH015	501086	6562513	155.0	54.4	128–119	Light brown siltstone and weathered grey volcanics
BH016	495070	6562651	167.0	72.5	116–113	Grey weathered volcanics
					110–107	Grey blue volcanics
BH017	497224	6557784	161.0	69.5	140–137	Bands of sandstone siltstone and quartz
					113–107	Grey volcanics

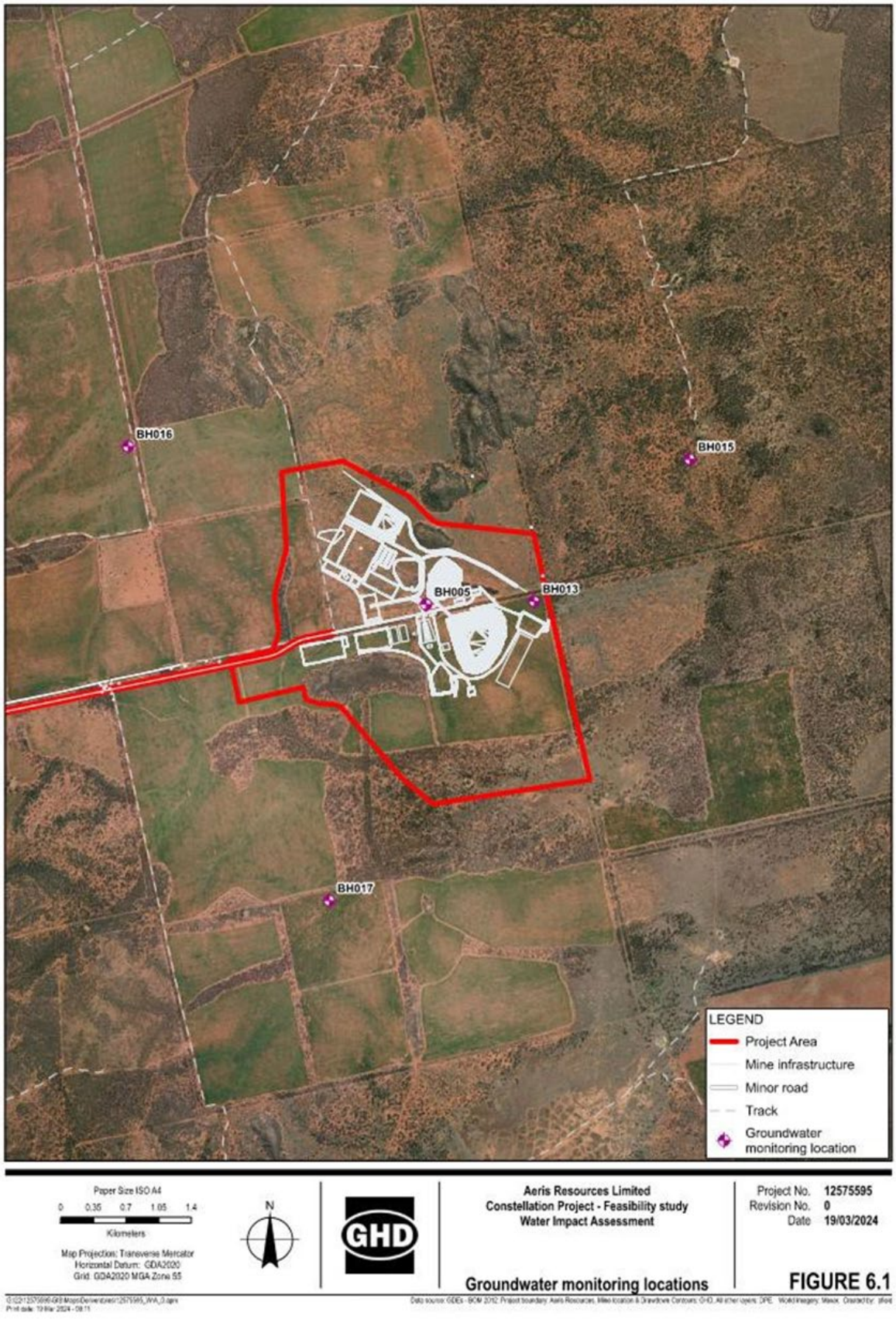


Figure 6-6: Groundwater monitoring bores

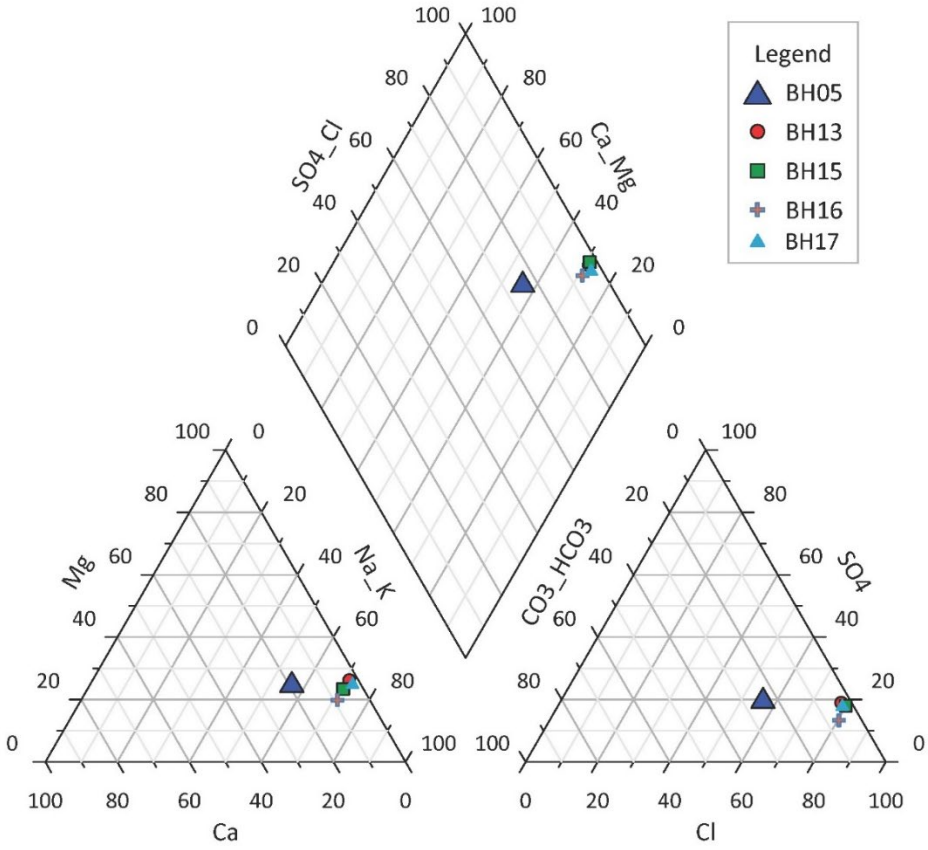


Figure 6-7: Piper diagram

6.4.3.3 Groundwater levels and flow regimes

Based on the on-site monitoring of observation bores for both wet and dry seasons, the groundwater table in the vicinity of the Project site is approximately 10–25 m below ground level. Groundwater levels are consistently above the level of water strikes and do not appear to respond to short-term rainfall, which suggests there is some confinement of the aquifer. The groundwater level contours indicate groundwater inflows in the north-east direction towards the Bogan River.

6.4.3.4 Groundwater receptors

Groundwater dependent assets and groundwater dependent ecosystems (GDEs) are within the vicinity of the Project site. These features were considered as potential groundwater receptors for the impact assessment. The potential groundwater receptors are discussed in Sections 6.4.3.4.1 and 6.4.3.4.2.

6.4.3.4.1. Landholder bores

A search of Australian groundwater borehole data identified 20 registered bores within an approximate 20 km radius around the Project site (Table 6-12 and Figure 6-8). Registered bores include:

- seven bores for water supply;
- six for exploration;
- five for stock and domestic; and
- two unknown landholder bores.

The majority of the bores are to the south-east of the Project site, with bore depths ranging between 10 m and 165 m.

The closest landholder bore is approximately 8 km south of the Project, with a depth of 86 m (bore GW003006.1.1). The work summary for this bore suggests it has encountered unconsolidated sediment (clay) to a depth of approximately 30 m and is underlain by slate and quartz.

Table 6-12: Landholder bores

Bore	Bore Depth (m)	Drilled Date	Purpose	Status	Latitude	Longitude
GW006524.1.1	27.4	1/06/1938	Water Supply	Unknown	147.1362	-31.0101
GW006520.1.1	35.1	1/05/1938	Water Supply	Unknown	147.1509	-30.9996
GW006521.1.1	38.1	1/11/1938	Water Supply	Unknown	147.1051	-31.0051
GW003014.1.1	123.1	1/02/1931	Stock and Domestic	Unknown	146.9284	-30.9671
GW011818.1.1	10.4	1/01/1950	Water Supply	Functioning	147.0365	-30.8968
GW006203.1.1	49.4	1/08/1937	Stock and Domestic	Unknown	147.1081	-31.1026
GW006650.1.1	164.6	1/09/1940	Unknown	Unknown	147.1801	-31.1682
GW006514.1.1	82.6	1/11/1937	Water Supply	Unknown	147.1331	-31.1304
GW006522.1.1	42.7	1/08/1937	Stock and Domestic	Unknown	147.14452	-31.0787
GW006338.1.1	76.2	1/08/1937	Water Supply	Non-functional	147.1609	-31.1093
GW006353.1.1	57.9	1/10/1937	Water Supply	Unknown	147.1101	-31.1348
GW006694.1.1	130.2	1/02/1941	Stock and Domestic	Unknown	147.18230	-31.1598
GW003006.1.1	86	1/01/1931	Unknown	Unknown	146.9676	-31.1504
GW002970.1.1	61.3	1/11/1930	Stock and Domestic	Unknown	146.9718	-31.1596
GW805057.1.1	54	23/07/2012	Exploration	Functional	146.8395	-31.1941
GW805065.1.1	87	28/06/2012	Exploration	Functional	146.8446	-31.2172
GW805058.1.1	48	24/07/2012	Exploration	Functional	146.8442	-31.2003
GW805066.1.1	132	27/06/2012	Exploration	Functional	146.8488	-31.2231
GW805056.1.1	66	24/07/2012	Exploration	Functional	146.8363	-31.2003
GW805064.1.1	82	28/06/2012	Exploration	Functional	146.8471	-31.216

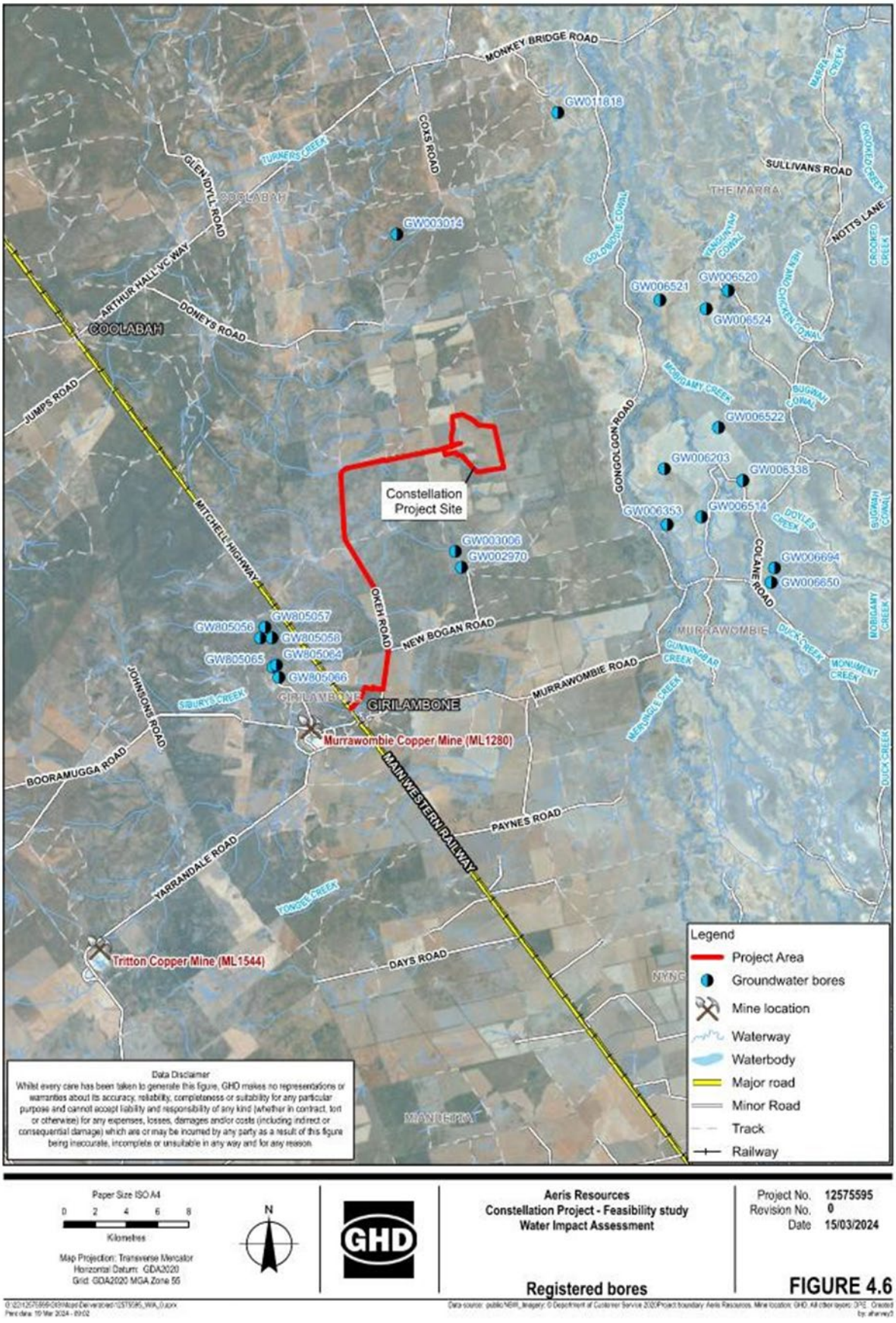


Figure 6-8: Landowner bores

6.4.3.4.2. Groundwater Dependent Ecosystems

A search of GDEs through the Sharing and Enabling Environmental Data NSW database was undertaken to identify both terrestrial and aquatic GDEs within 20 km of the Project site. Potential terrestrial and aquatic GDEs are identified within the search area, as shown in Figure 6-9.

Based on the lack of observed shallow groundwater resources (refer to Section 6.4.3.1) and the likelihood of confinement of the groundwater source (refer to Section 6.4.3.2), the level of dependence of the potential terrestrial GDEs on groundwater is likely to be low.

Riparian vegetation associated with the Bogan River (9 km east of the Project site) is identified as high-potential aquatic GDEs. They are considered unlikely to be dependent on groundwater resources. This is due to the lack of shallow groundwater resources and that the vegetation is considered primarily dependent on surface water flows of the Bogan River and its associated ephemeral flow channels (refer to Section 6.4.3.1).

A review of high-priority GDEs listed in the Murray Darling Basin Fractured Rock water sharing plan (WSP) for the Lachlan Fold Belt Murray Darling Basin Groundwater Source indicates that the closest high-priority GDE to the Project site is the Pulpulla Spring approximately 160 km west of the Project site.

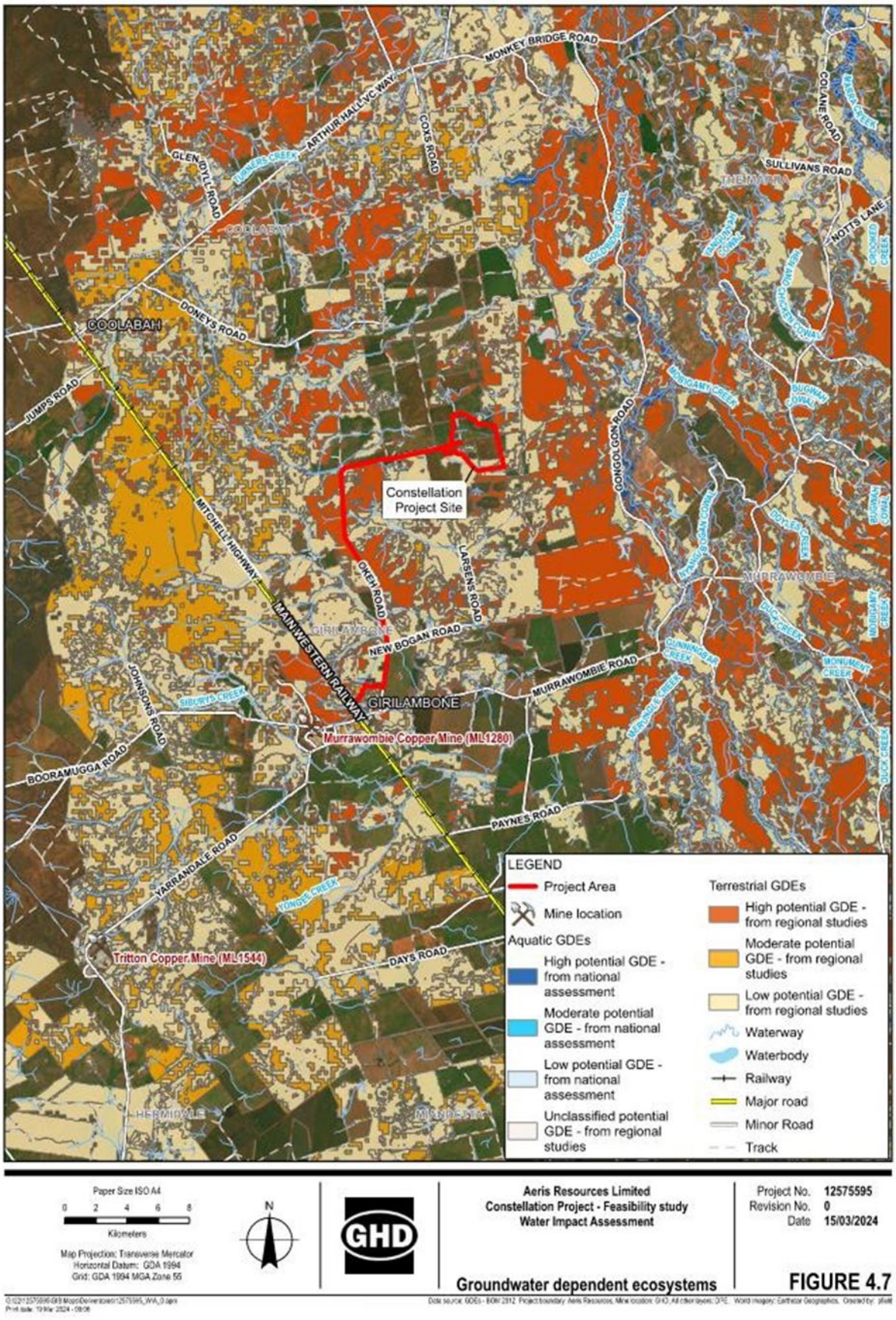


Figure 6-9: Potential GDEs identified from Sharing and Enabling Environmental Data NSW database

6.4.3.5 Hydraulic testing

Packer tests and slug tests results indicate that the hydraulic conductivity for slightly weathered to fresh rock range from 0.001 to 4 m/day.

6.4.4 Assessment approach

The groundwater assessment considered the following guidance documents:

- NSW State Groundwater Policy (DLWC 1997):
  - NSW Groundwater Quantity Management Policy;
  - NSW Groundwater Quality Protection Policy;
  - NSW Groundwater Dependent Ecosystems Policy;
- NSW Aquifer Interference Policy (DPI 2012);
- Groundwater assessment toolbox for major projects in NSW (DPE 2022);
- Australian groundwater modelling guidelines (Barnett *et al.* 2012); and
- Guidelines for the Assessment & Management of Groundwater Contamination (DEC 2007).

6.4.4.1 Conceptual hydrogeological model

The conceptual hydrogeological model for the groundwater regime of the Project area (Figure 6-10) indicates that the water table within fractured rock occurs between depths of 10 to 50 m below ground level, with the direction of water flowing from east and north-east towards the Bogan River.

Groundwater monitoring bores indicate there is some confinement of the groundwater source, so interception of groundwater during mining may not occur until below the level of the water table. Rainfall recharge to the fractured rock aquifer is likely to be minimal. Rainfall recharge and river leakage likely occur within the alluvium to the east of the Project site. Within this area, there may also be inflow to fractured rock aquifers from the downward percolation of groundwater from overlying alluvium. Discharge from aquifers occurs:

- at the break of slope;
- in drainage lines;
- via production bores; or
- where structural or stratigraphic conditions allow.

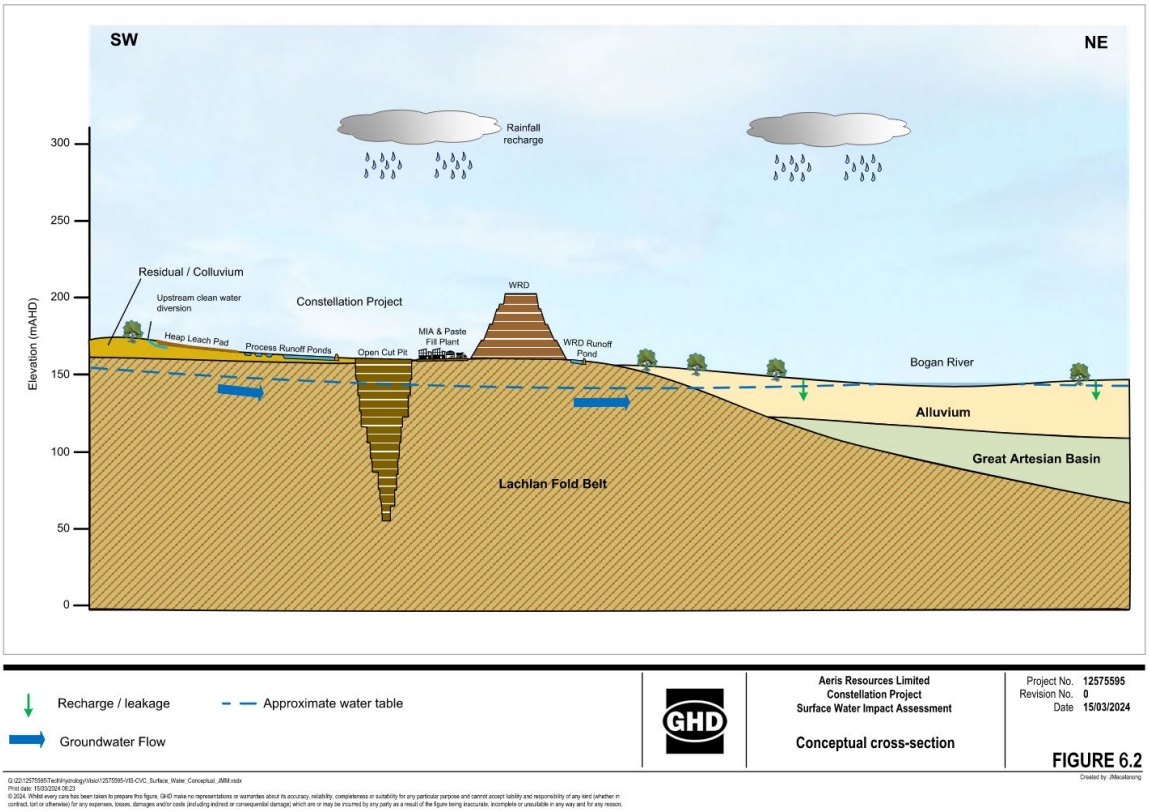


Figure 6-10: Conceptual groundwater model

6.4.4.1.1. Recharge and discharge

The alluvium aquifer east of the Project site is likely to receive recharge from rainfall and river leakage.

The fractured rock aquifer of the groundwater system of the Project is considered likely to receive little to no recharge from rainfall but may receive some percolation from the overlying alluvium in the area.

Discharge occurs:

- at the break of slope;
- in drainage lines;
- through production bores; or
- where favourable structural or stratigraphic conditions allow.

However, there is limited natural groundwater discharge to surface water bodies near the Project site due to the depth to groundwater.

The degree of hydraulic connectivity between the great artesian basin and above aquifers (i.e. alluvium and fractured rock aquifers) is unknown, but water quality in these aquifers suggests they are likely to be poorly connected.

6.4.4.2 Groundwater numerical model

A numerical groundwater flow model was developed using MODFLOW-USG with Groundwater Vistas (version 8.3) as the graphical interface (provided as appendix to Appendix 5, Water impact assessment):

- The model lateral extent was 40 km by 38 km.

- The grid size near the mine site was 31.25 m.
- The coarse grid size at locations away from the mining area was 1,000 m.
- Along the Bogan River, the grid size was 125 m.

Ten model layers were used. The Bogan River was modelled as a river boundary condition, and smaller creeks in alluvium were modelled as drain boundary conditions.

Three recharge zones were applied after being derived from the model calibration. Rainfall recharge in the area is negligible and, based on site monitoring data, rainfall has minimal impact on groundwater table level fluctuations. Therefore, climate change modelling was not included in the groundwater model.

Pit dewatering was simulated with a drain boundary condition, and water level recovery was simulated using the general head boundary condition, with the head values derived from the pit lake water balance. The model was integrated with the pit lake model (refer to Section 6.4.4.3) so that inputs and outputs from the groundwater system are aligned with the evolution of the pit lake.

6.4.4.2.1. Model calibration and sensitivity analysis

The model was calibrated in the steady-state and transient calibration using the automated parameters estimation software:

- Steady-state model calibration resulted in a scaled root mean square error of 2.7% (generally accepted value is less than 10%).
- Transient model calibration resulted in a scaled root mean square error of 8.5%.

Sensitivity analysis on model calibration was performed post-model calibration. The result of the sensitivity analysis showed that the recharge rate was the most sensitive parameter to the model calibration.

6.4.4.2.2. Uncertainty analysis

Uncertainty analysis was conducted to assess the potential ranges in mine inflow rates. The range in inflow rates represented approximately an order of magnitude difference from the base case. The modelled range is due to the large range of parameters adopted for the uncertainty analysis.

6.4.4.2.3. Peer review

The numerical model was peer-reviewed, and the findings of the model are detailed in Appendix 5, Water impact assessment.

6.4.4.3 Pit lake water and mass balance

The water and mass balance for the pit lake was developed and is detailed in Appendix 15, Geochemical and pit lake modelling assessment.

A numerical model of water balance and water quality of the pit lake was developed using GoldSim. The model was developed on daily timesteps and ran for up to 600 years after mining. The climate data used in the model was obtained from a historical dataset and used stochastically to enable probabilistic climate outcomes to be evaluated. The parameters included in the model were selected by interrogating all available data from the geochemical assessment. The model provided information for the assessment of potential groundwater impacts of the pit lake, which is summarised in Section 6.4.5.3.

6.4.5 Impact assessment

The impact assessment was conducted against the Level 1 minimal impact considerations for less productive Fractured Rock Water Sources in the Aquifer Interference Policy. If the predicted potential impacts are less than the Level 1 minimal impact considerations, the impacts are considered acceptable. Impacts of groundwater level and groundwater quality changes and cumulative impacts have been assessed against the adopted impact assessment criteria.

6.4.5.1 Groundwater inflow

Predicted groundwater inflow rates into the open cut and underground mines were derived from the base case modelling scenario (Table 6-13). Modelling predicted combined (open cut and underground) mine inflow rate increases from 104.6 ML per year in the first year of mining to a maximum of 309.2 ML per year after nine years.

The average mine inflow rate over the active mining period is 218 ML per year. The post-mining (during recovery) inflow rate is predicted to gradually decrease from 170 m^3 per day (at the start of the recovery) to 45 m^3 per day (at the end of the recovery).

The uncertainty analysis predicted inflow rates will range from 24 ML per year to 1,846 ML per year. The results of the uncertainty runs are presented as a guide only for contingency measures. For the purposes of impact assessment and predictions of mine inflows, the base case results have been adopted.

Table 6-13: Modelled groundwater inflow

Year of mining	Open cut (ML/year)	Underground workings (ML/year)	Total (ML/year)
1	104.6	0	104.6
2	148.4	0	148.4
3	59.8	105	164.8
4	36.4	157.5	193.9
5	29.2	178.2	207.4
6	25	209.6	234.6
7	22.1	229.7	251.8
8	19.7	252.7	272.3
9	17.8	291.4	309.2
10	15.1	275.8	290.9

6.4.5.2 Groundwater drawdown

Dewatering the mining areas will result in groundwater drawdown in the vicinity of the Project.

The modelled groundwater drawdown at the end of mining and 600 years post-mining is shown in Figure 6-11 and Figure 6-12.

A modelled drawdown of 1 m is expected to reach approximately 1,700 m from the pit at the end of mining (10 years of mining) and 6,500 m away 600 years after the end of mining (Figure 6-12).

Post-mining, long-term residual drawdown at the pit is approximately 10 m.

The mine workings will be dewatered during mining, and groundwater levels in the mine workings will, therefore, be lower than presented in Figure 6-11 and Figure 6-12.

The predicted drawdown was assessed for potential impacts on landholder bores and GDEs (refer to Section 6.4.5.2.1).

6.4.5.2.1. Landholder bores

There is no predicted groundwater drawdown at landowner bores at the end of mining. Three registered bores are predicted to record some groundwater drawdown at 600 years after the end of mining, although the predicted drawdown at each location is less than 2 m (Figure 6-12).

Since the modelled groundwater drawdown is less than 2 m at all registered bores 600 years after mining, the NSW Aquifer Interference Policy Level 1 minimal impact for water table/water pressure decline at a water supply work is met and the impact is considered acceptable.

The range of predictions from the uncertainty analysis included a worst-case scenario, maximum potential drawdown of 4.9 m at the most affected landholder bore (GW003006) 600 years after mining. The results of the uncertainty runs are presented as a guide only for contingency measures. For the purposes of drawdown predictions and impact assessment, the base case results have been adopted.

6.4.5.2.2. Groundwater Dependent Ecosystems

The closest high-priority GDE to the Project site is the Pulpulla Spring approximately 160 km west of the Project site. There are no high-priority GDEs in the area of predicted groundwater drawdown from the Project, and the NSW Aquifer Interference Policy Level 1 minimal impact for the water table is met.

Note: Potential GDEs are to the east of the Project site, and groundwater drawdown of up to 0.66 m is predicted at 600 years after the end of mining (Figure 6-12). However, given the relatively deep groundwater levels and the likelihood of aquifer confinement, it is considered unlikely these terrestrial and aquatic communities are GDEs.

The range of predictions from the uncertainty analysis included a worst-case scenario, maximum potential drawdown of 5.1 m at the potential GDE location, with the most potential for drawdown impact at 600 years after mining. The results of the uncertainty runs are presented as a guide only for contingency measures. For the purposes of drawdown predictions and impact assessment, the base case results have been adopted.

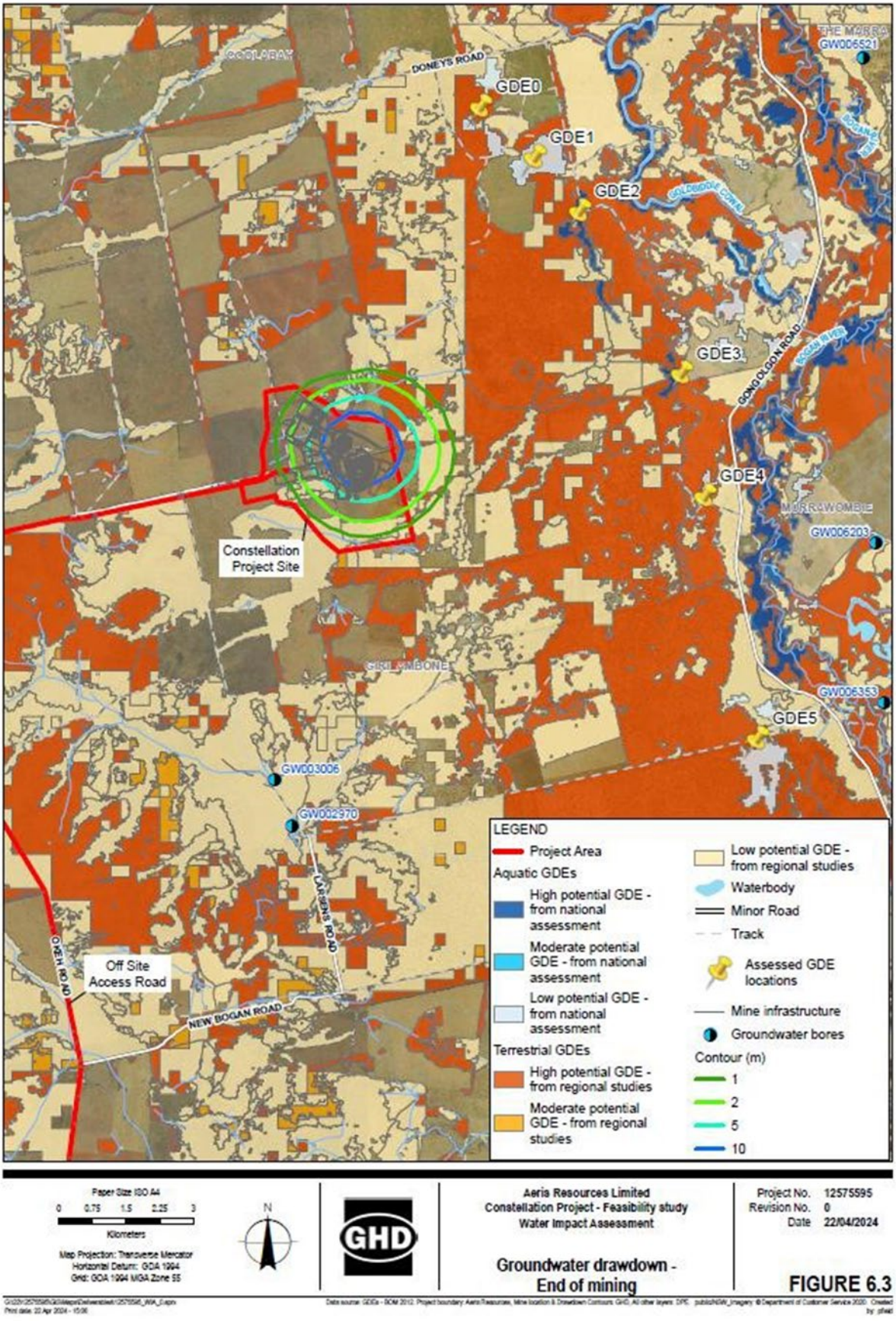


Figure 6-11: Groundwater drawdown at end of mining

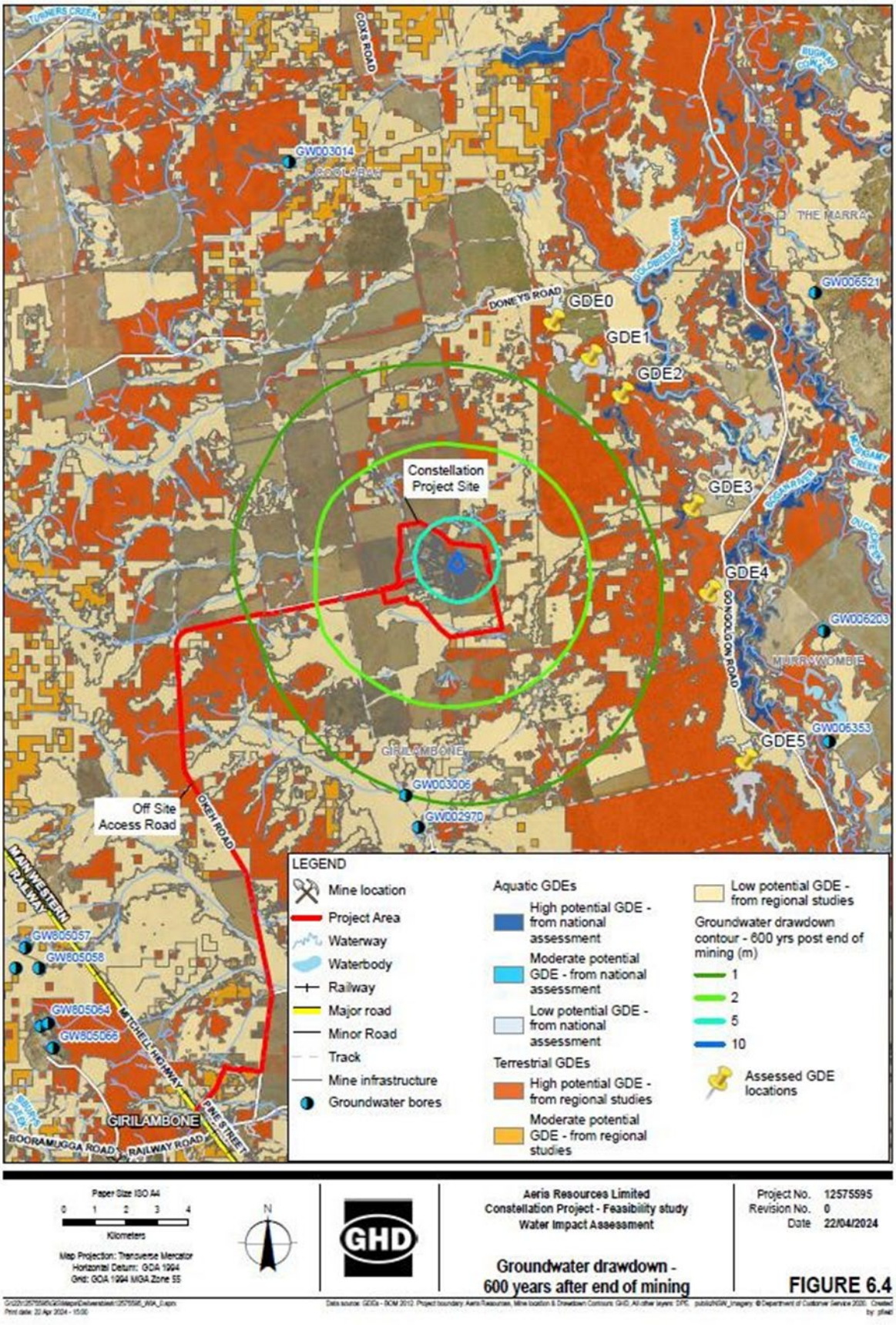


Figure 6-12: Groundwater drawdown 600 years post-mining

6.4.5.3 The pit lake

The final pit lake will receive direct rainfall, long-term groundwater inflows, surface water runoff and seepage from the WRE and HLP.

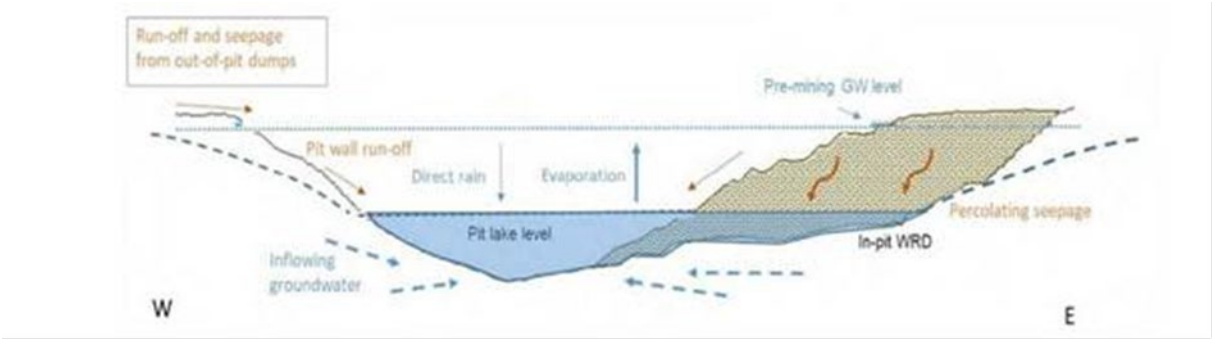
Diversion drains will minimise surface water runoff into the pit lake. The main output from the pit lake is evaporation.

The water and mass balance predicts water level in the pit lake to rise over time as groundwater levels recover.

Over the 600-year post-mining modelling period, the average pit lake water level is predicted to remain approximately 10 m below the existing pre-mining groundwater level. The pit lake will operate as a permanent hydraulic sink or terminal sink to groundwater.

Under very wet conditions, the pit lake may temporarily reach a level of up to approximately 143 m AHD (at least 22 m below ground level), which may reduce the hydraulic gradient towards the pit lake; however, it is still likely to remain a sink. Refer to Chapter 6, Environmental assessment, Section 6.5.7.8 for further details of pit lake water quality. Rehabilitation of the open cut pit is discussed in Chapter 8, Rehabilitation and closure, Section 8.4.4.6.

The concept of a terminal sink is based on the hydraulic gradient of the groundwater table and not on the characteristics of the aquifer medium (Figure 6-13). Although the pit lake is in direct contact with a fractured rock aquifer with geological structures, it does not necessarily increase the risk of seepage to the surrounding groundwater environment. Groundwater will only flow from a higher elevation or pressure to a lower elevation or pressure, regardless of the hydraulic conductivity of the aquifer.



Notes: Figure is indicating the pit lake water level and groundwater inflows. GW – Groundwater, in pit WRD (waste rock dump) does not represent the waste rock management for the Project.

Figure 6-13: Schematic of typical pit lake sink

6.4.5.4 Groundwater quality changes

Based on the groundwater modelling and geochemical test work undertaken, the overall risk of groundwater quality impact associated with the development of the Project is low.

There is a low potential for the open pit and WRE to generate acid and metalliferous drainage post-mining, which could impact water quality (refer to Chapter 6, Environmental assessment, Section 6.3, Geochemistry).

Declining seepage from the rehabilitated WRE and HLP will be passively drained to the final void (pit lake) for containment. Post-mining, the final void will operate as a hydraulic sink to groundwater and, therefore, seepage from the pit lake to the adjacent aquifer is not expected (refer to Section 6.4.5.3).

Given the predicted performance of the water management system and the existing groundwater quality, the groundwater impact assessment (refer to Appendix 5, Water impact assessment) considers that the Project will not lower the beneficial use category of the groundwater source, and the impacts on groundwater quality will meet the NSW AIP Level 1 minimal impact groundwater quality.

6.4.5.5 Licensing requirements

Assessment of the licensing requirements for groundwater take has considered the year of maximum modelled take. Aeris holds water access licences (WALs) for 334 ML per year (refer to Chapter 5, Statutory context, Section 5.4.3.5).

Project Year 9 is predicted to be the maximum groundwater take year, and a summary of take is shown in Table 6-14.

The total predicted groundwater take in Project Year 9 is 309.2 ML/year. It is likely that additional groundwater licences from the Lachlan Fold Belt Murray Darling Basin Groundwater Source will be required for the Project, given groundwater take is likely to exceed current water access licence in combination with groundwater take at other Aeris operations.

The need to obtain additional groundwater licences may be reviewed closer to Year 9 of operations when it is likely other local Aeris operations will have ceased. Notwithstanding, there is sufficient market depth in the Lachlan Fold Belt Murray Darling Basin Groundwater Source to secure additional WAL entitlement. During the 2021/2022 water year, groundwater trades of up to 400 ML occurred within the water source, with the median trade between 2015 and 2022 being 333 ML/year.

Actual groundwater inflows may be less than the predicted base case modelled inflows to the pit, in which case, the additional water access licence required will be lower.

Table 6-14: Summary of groundwater take—Project Year 9

Water management element	Groundwater take (m^3/day)	Groundwater take (ML/year)
Underground mining inflows	798.4	291.4
Open cut mining inflows	48.8	17.8
Total	847.2	309.2

6.4.6 Commitments and management measures

The groundwater assessment has identified that potential impacts will be minimised or avoided by the following design considerations:

- the relatively short mine life and period of active dewatering of mine workings (10 years);
- locating the mining area at least 8 km from the closest registered bore and a significant distance from the closest high-priority GDE; and
- ensuring the final pit lake will act as a groundwater sink, so there is no flow gradient from the pit lake to the groundwater source.

The following measures to manage potential impacts during Project construction, operation and decommissioning will be implemented:

- The small volume of PAF waste within the WRE will be emplaced in PAF cells and covered with a low permeability seal to minimise the exposure of sulphide-bearing mine waste to oxygen and water while minimising the potential for seepage of AMD to the receiving environment.
- Acidic seepage from the HLP will be minimised by containing the material on-site and constructing a water-shedding cover.
- Tailings transported to the site from Tritton will be processed into a paste on a lined pad as soon as practicable and emplaced underground to minimise oxidation.

6.4.6.1 Groundwater monitoring

Continued monitoring of the existing groundwater monitoring network (Table 6-11 and Figure 6-6) is considered sufficient to detect groundwater drawdown and quality impacts during mining operations and provide observation data to validate the groundwater model. The proposed program of monitoring for the life of the Project will include:

- continued monitoring of the existing groundwater monitoring network (Table 6-11) during mining operations including:
    - annual review of the monitoring program, including assessing whether additional monitoring bores are required;
    - installing meters to transfer water into and out of the mine workings during operations to allow modelled and actual inflow to be compared;
    - quarterly monitoring of groundwater levels at the existing monitoring bore network;
    - quarterly monitoring of groundwater quality for the parameters used for the baseline monitoring program (with the exception of total suspended solids and turbidity) at the existing monitoring bore network; and
- climate monitoring by an automated on-site weather station to support site water management and implementing the site water balance (refer to Section 6.5.5).

6.4.6.2 Water management plan

Management plans to manage potential impacts to groundwater resources are proposed. The management plans will also manage surface water impacts, and details of the proposed plans are provided in Section 6.5.9.

6.4.6.3 Groundwater model verification and review

The predictions of the groundwater model will be reviewed after two years of mining. The groundwater model review will include a comparison between the modelling results, groundwater monitoring data and mine dewatering volumes.

Data collected during monitoring programs may be incorporated to improve the model, and, if required, the model will be revised to improve the fit between observed and modelled dewatering volumes and groundwater levels.

6.4.7 Conclusion

The Project has the potential to impact local and regional groundwater sources and sensitive receptors. The potential impacts were assessed utilising a numerical groundwater model according to the NSW Aquifer Interference Policy and the Project SEARs. The results show that the Project will cause a drawdown of 1 m with a radius of approximately 1,700 m at the end of mining and extend approximately 6,500 m at 600 years post-mining.

The post-mine pit lake will be a terminal sink and the average pit lake water level is predicted to remain approximately 10 m below the existing pre-mining groundwater level. The potential impacts from changes to groundwater level and quality meet the NSW Aquifer Interference Policy Level 1 minimal impact considerations and are, therefore, considered not significant and acceptable.

Groundwater monitoring and management plans have been proposed to monitor the groundwater resources and manage potential impacts during Project operation.

Additional groundwater licences may be required to support the on-site operations. The market depth is sufficient in the Lachlan Fold Belt Murray Darling Basin Groundwater Source for additional licences if they are needed.

6.5 Surface water

6.5.1 Introduction

An assessment of surface water impacts has been completed in accordance with relevant guidance documents and is provided in Appendix 5, Water impact assessment.

The final void water balance and water quality model that was used to assess potential water impacts on the post-mine pit lake (pit lake) was developed and is detailed in Appendix 15, Geochemical and pit lake modelling assessment.

6.5.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires an assessment of impacts of the Project on surface water resources. The specific requirements and the sections where they have been addressed are detailed in Table 6-15.

Table 6-15: Water assessment requirements

Assessment matter	Report locations
Describe works/activities that may intercept, extract, use, divert or receive surface water and/or groundwater. This includes the description of any development, activities or structures that will intercept, interfere with or remove groundwater, both temporary and permanent	Sections 6.5.5, 6.5.6 and 6.5.7 Appendix 5, Water impact assessment, Section 5
Detail all water take for the life of the development. This is to include water taken directly and indirectly and from the relevant water source when water entitlements are required to account for the water take. If the water is to be taken from an alternative source, confirmation should be provided by the supplier that the appropriate volumes can be obtained.	Section 6.5.8 Appendix 5 Water impact assessment, Section 5.6
Detail water access licences (WALs) held that account for any take of water when required, or demonstrate that WALs can be obtained prior to take of water occurring. This should include an assessment of the current market depth when water entitlement is required to be purchased. Any exemptions or exclusions to requiring approvals or licenses under the *Water Management Act 2000* should be detailed by the applicant;	Section 6.5.8 Appendix 5, Water impact assessment, Section 5.6
Assess impacts on: • surface and ground water sources (quality and quantity); • related infrastructure; • adjacent licensed water users; • basic landholder rights; • watercourses; • riparian land; • groundwater-dependent ecosystems; and • ground water levels, including measures proposed to reduce and mitigate these impacts, having regard to the Aquifer Interference Policy;	Section 6.5.7 Appendix 5, Water impact assessment, Section 5.5
Describe and consolidate site water balance, including: • site water demands; • water disposal methods (inclusive of volume and frequency of any water discharges); • water supply and transfer infrastructure and water storage structures; and • measures to minimise water use.	Section 6.5.6 Appendix 5, Water impact assessment, Section 5

Assessment matter	Report locations
Describe the measures proposed, including monitoring activities and methodologies, to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo.	Sections 6.5.8 and 6.5.9 Appendix 5, Water impact assessment, Section 5.6
Describe the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	Section 6.5.5 Appendix 5, Water impact assessment, Section 5.5
Describe construction erosion and sediment controls, how the impacts of the development on areas of erosion, salinity or acid-sulphate risk or erodible soils types would be managed and any contingency requirements to address residual impacts.	Sections 6.5.7.6, 6.5.7.7 and 6.5.9.3 Appendix 5, Water impact assessment, Section 8.3
Identify impacts of all waterfront land works, including consideration of the Guidelines for Controlled Activities on Waterfront Land (NRAR 2018);	Section 6.5.7.5 Appendix 5, Water impact assessment, Section 5.5

6.5.3 Existing environment

6.5.3.1 Climate and watercourses

The climate and topography of the Project area are described in Chapter 6, Environmental assessment, Section 6.1.4.

Note: The Project area has an average annual moisture deficit of 1,196 mm. Evaporation is strongly seasonal with higher evaporation and greater moisture deficit in summer months.

The Project is in the Macquarie–Bogan River catchment in the lower Bogan River catchment. The Macquarie River headwaters in the Great Dividing Range, south of Bathurst, flow in a north-westerly direction for 960 km, joining the Barwon River near Brewarrina.

The Bogan River headwaters in the Hervey Range near Peak Hill flows north-west to Nyngan, parallel to the Macquarie River. The Bogan River is approximately 8 km east of the Project. This river and associated ephemeral tributary creeks characterise the surface water environment of the local region of the Project.

The Project is near the lower reaches of the major regulated river of Gunningbar Creek and Duck Creek, which are regulated by the Warren Weir as distributaries of the Macquarie River, before joining as tributaries of the unregulated Bogan River. Downstream, the Bogan River is met by Turners Creek, joining Tarrion Creek approximately 50 km west of Brewarrina.

The location of the Project site in relation to the regional watercourses is shown in Figure 6-14, while the local topography and drainage lines are shown in Figure 6-15. There are some first-order watercourses in the Project mine site. However, these are ephemeral and appear to be disconnected from defined creek lines, and there are no mapped watercourses connecting these ephemeral watercourses to the Bogan River. Given the lack of watercourse connectivity, the potential surface water flow paths downstream of the Project were mapped using spatial statistics to identify a possible discharge pathway from the Project mine site (Figure 6-16).

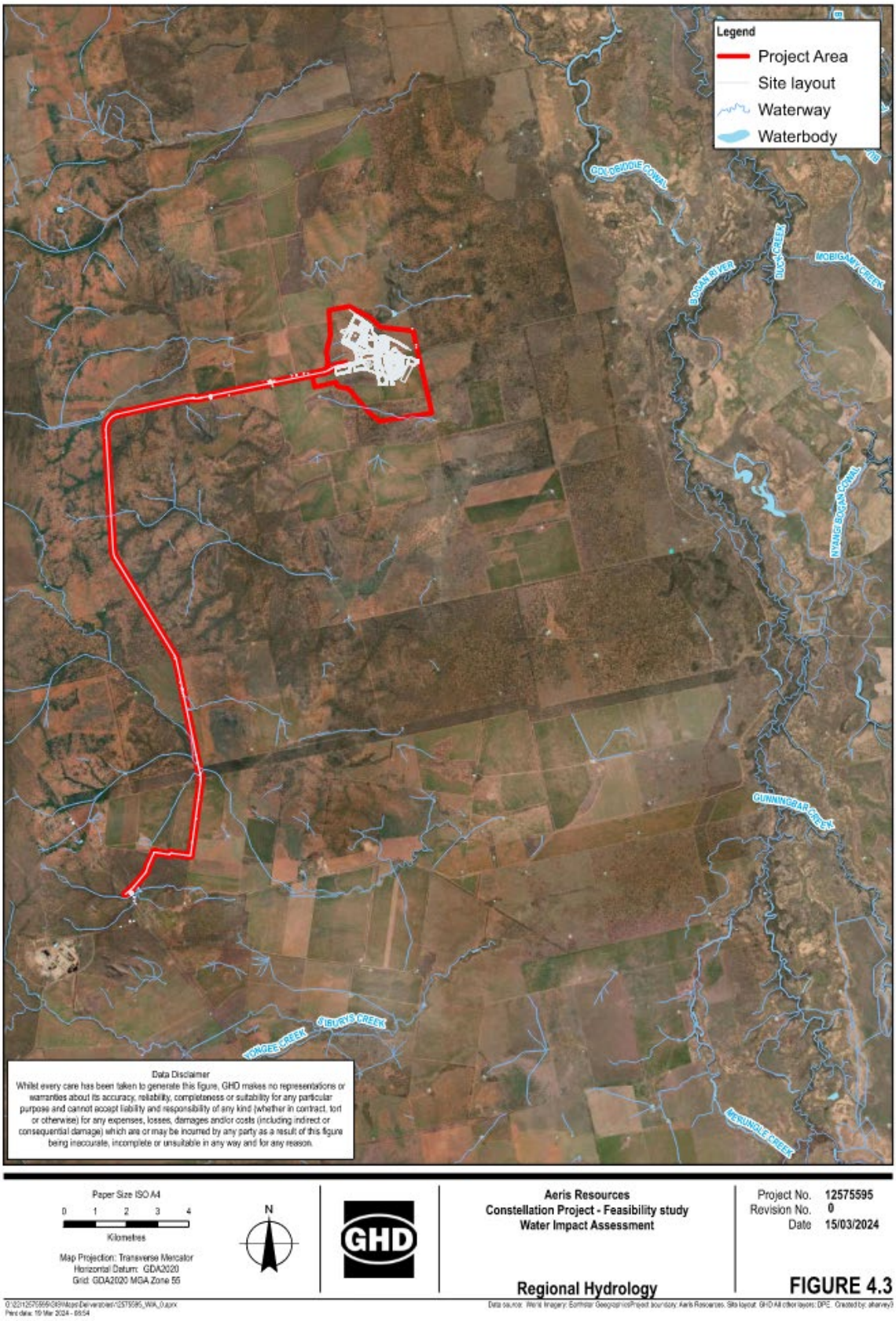


Figure 6-14: Regional hydrology

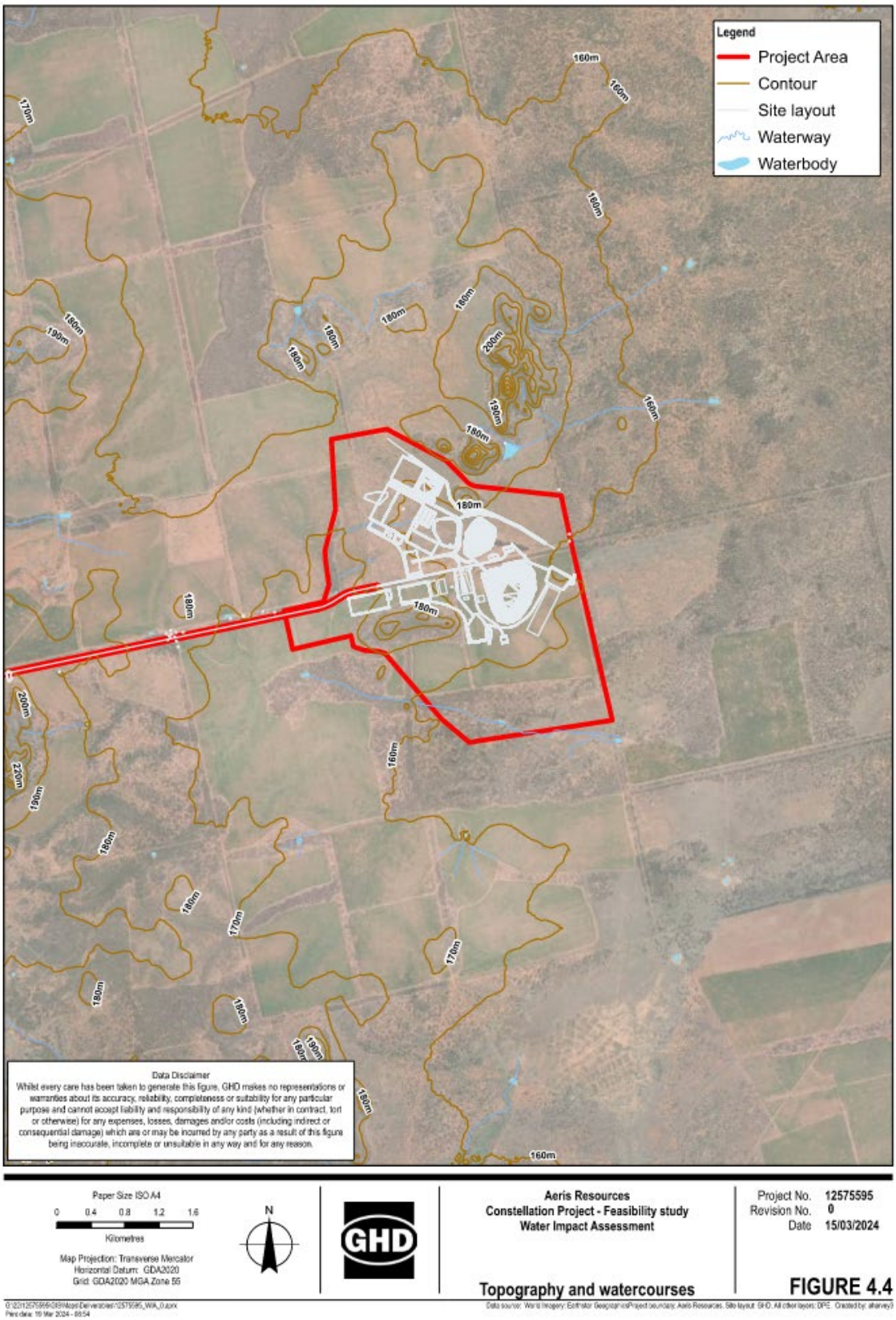


Figure 6-15: Topography and watercourses

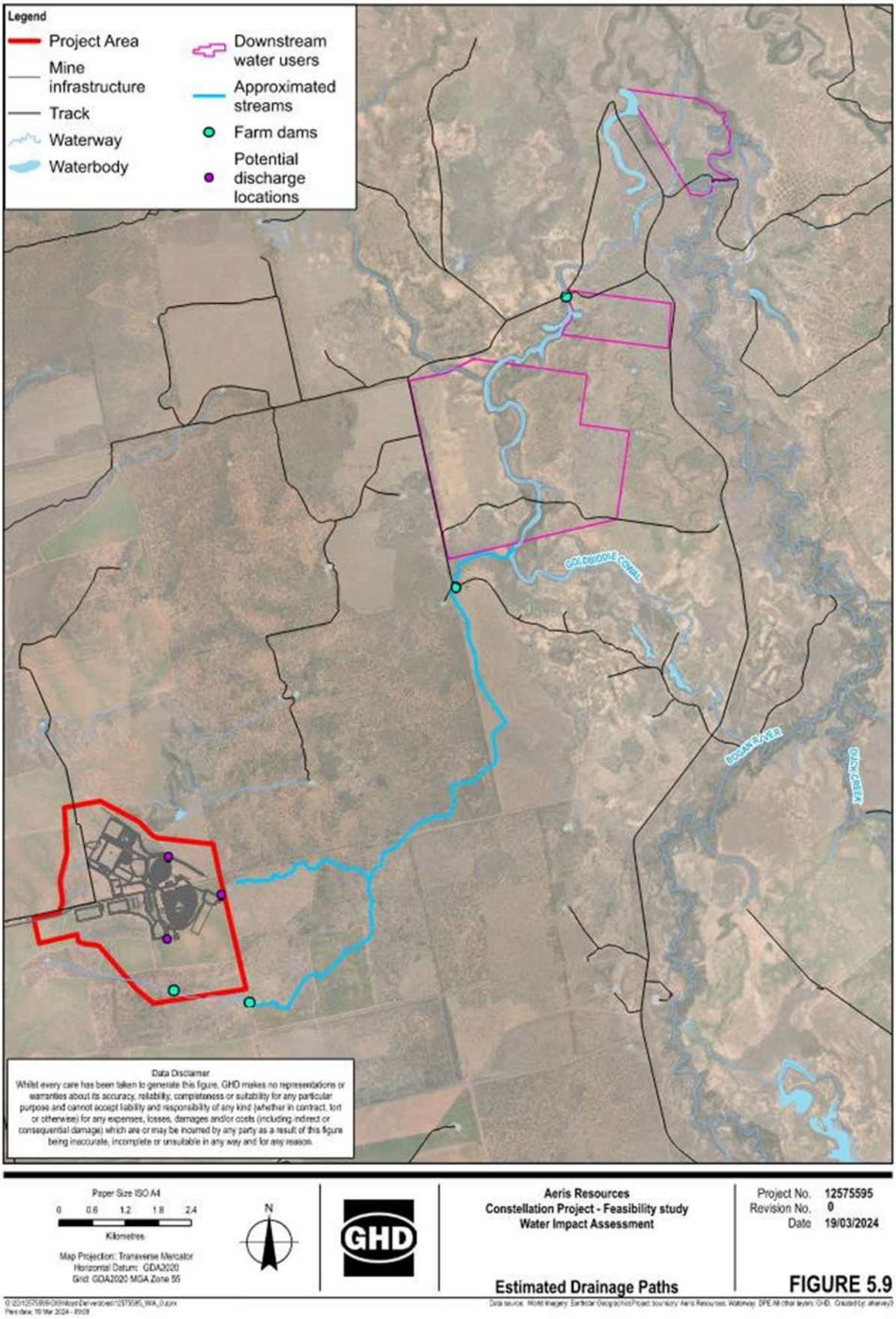


Figure 6-16: Estimated drainage paths

6.5.3.2 Existing surface water users

There are four NSW water register WALs for users within 10 km downstream of the Project. Three lots hold water supply works and water use approvals for irrigation purposes. The remaining approvals are associated with water storages.

6.5.3.3 Water quality

Due to the ephemeral nature of the watercourses that lack consistent water flow, no baseline water quality monitoring has been undertaken upstream, downstream or within the Project area.

No relevant water quality data was available from the Bogan Shire Council or nearby Aeris operations.

Note: Due to the lack of surface water resources, the assessment has been based on a downstream, risk-based approach to water users and receptors.

6.5.4 Assessment approach

The surface water impact assessment has specifically addressed the 'NSW Government Water Quality and River Flow Objectives' (DECCW 2006).

The Project is in the catchment of an uncontrolled stream in the Macquarie–Bogan River catchment. The Project is also near the lower reaches of the major regulated waterways of the Gunningbar Creek and Duck Creek that are regulated by the Warren Weir as distributaries of the Macquarie River, before joining as tributaries of the unregulated Bogan River.

The assessment has considered potential impacts against the objectives applicable to uncontrolled streams for flow objectives and both uncontrolled streams and major regulated rivers for quality objectives.

Besides the water quality and river flow objectives, other relevant guidance documents include:

- NSW State Rivers and Estuary Policy (WRC 1993);
- Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC 2006);
- National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000b);
- National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000c);
- National Water Quality Management Strategy: Australian Guidelines for Sewerage Systems – Effluent Management (ARMCANZ 1997);
- National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ 2000);
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA 2022);
- Managing Urban Stormwater: Soils & Construction (Landcom 2004) and associated Volumes 2A to 2E (DECC);
- Managing Urban Stormwater: Treatment Techniques (EPA 2004);
- Managing Urban Stormwater: Source Control (EPA 1998);
- Guidelines for Controlled Activities on Waterfront Land (NRAR 2018);
- Flood Risk Management Manual (DPIE 2022e);
- Floodplain Risk Management Guidelines (DPE 2023); and
- Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning (OEH 2017).

6.5.4.1 Site water balance model

A site water balance model was developed to assess the effectiveness of the water management system and quantify the potential impacts under a range of rainfall conditions. The model inputs were:

- rainfall and evaporation;
- catchments used for each water management feature (as described in Section 6.5.5);
- Project staging;
- groundwater inflows as determined by modelling (refer to Section 6.4.4.2); and
- Project water demands.

The full description of the site water balance model is provided in Appendix 5, Water impact assessment.

6.5.4.2 Final void water balance and quality model

A water balance and water quality model were developed for the final void pit lake, as described in Section 6.4.4.3 and detailed in Appendix 15, Geochemical and pit lake modelling assessment. The model has provided information for the assessment of surface water impacts of the pit lake, as summarised in Section 6.5.7.8.

6.5.5 Water management system

The proposed site water management strategy is described in Chapter 3, Project description, Section 3.8.4 and further detailed in Appendix 5, Water impact assessment. In summary:

- The proposed Project site water management system comprises:
  - diverting clean water upgradient of disturbance areas;
  - collecting water from disturbance areas; and
  - moving water for operational water demands via a bi-directional pipeline between the Murrawombie Copper Mine and the Project;
- Site water management infrastructure has been designed as nil discharge (including through pumped transfers to the Murrawombie Copper Mine);
- Off-site discharges from site water storages may occur in rainfall events exceeding the 1% annual exceedance probability (AEP) design criteria; and
- Sewage will be treated on site for disposal via irrigation or an evaporation trench.

The expected effectiveness of the water management system at the Project site to minimise off-site discharges has been assessed using the site water balance assessment.

6.5.6 Site water balance

The site water demands were simulated for a nominal 10-year period from the commencement of open cut mining operations. The annual average water balance for both the minimum water demand year (Year 1) and peak water demand year (Year 4) are presented in Table 6-16 and the annual water balance for the peak water demand year (Year 4) is shown schematically in Chapter 3, Project description, Figure 3-16.

For the peak water demand year (Table 6-16), the peak water inflows are from the Murrawombie Copper Mine, representing 42% of all inflows, followed by groundwater inflows representing 32%. Catchment runoff contributes approximately 21% to site water inflows, while direct rainfall contributes 6%. The majority (51%) of the water inflows are required for use in the paste fill plant, while the next greatest demand is for use in the pre-concentrator (12%). Approximately 15% of all inflows may be lost to evaporation from storages during the peak water demand year.

Table 6-16: Annual average water balance

Water Management Element	Year 1 Annual Transfers (ML/year)	Year 4 Annual Transfers (ML/year)
Inputs		
Direct rainfall	46	34
Catchment runoff	127	127
Groundwater inflows	105	194
Transfer from the Murrawombie Copper Mine	66	258
Total inputs	344	613
Outputs		
Evaporation	97	95
Uncontrolled off-site discharge	0	0
Dust suppression	58	57
Potable water/irrigated treated sewage effluent from amenities	5	5
Transfer to the Murrawombie Copper Mine	5	0
Paste fill plant	0	311
Pre-concentrator use	0	75
Heap leach net loss	90	0
Vehicle washdown	10	10
Ore moisture loss	23	22
Underground ventilation losses	0	32
Underground seepage loss	0	32
Total outputs	288	640
Change in storage		
Surface water storages	56	-27
Total change in storage	56	-27
Balance		
Inputs – outputs – change in storage	0	0

6.5.6.1 Site water demands

The water management system has been designed to reticulate contaminated water to satisfy the site water demands, such as heap leach and paste fill plant water usage. The design of this system has been integrated with off-site bi-directional transfers from the Murrawombie Copper Mine. Consequently, water use has been minimised as far as practicable to reduce the required volume of externally sourced water. If no reticulation

were implemented, the frequency of off-site discharges from dirty and contaminated water storages would likely increase.

On average in the peak water demand year (Year 4), the site water demands are 258 ML, represented as inflows from the Murrawombie Copper Mine (Table 6-16). The annual cumulative probability distribution of peak water demand, or the maximum water demand that may be encountered in the unlikely event of extreme conditions, has been calculated and is unlikely to exceed 359 ML. This probability of annual peak water demand has been considered regarding water licensing requirements in Section 6.5.8.

During the maximum water demand year, no transfers to the Murrawombie Copper Mine were simulated in the water balance model—although all water captured in the water management system and transferred from the Murrawombie Copper Mine is required to satisfy the site water demands.

6.5.6.2 Excess water management

On average in the minimum water demand year, transfers of approximately 5 ML of water to the Murrawombie Copper Mine were simulated. During the minimum water demand year, the maximum simulated water transfers to the Murrawombie Copper Mine were approximately 38 ML. However, considering predicted groundwater inflows to mining operations, which peak in Year 2, the peak water transfers to the Murrawombie Copper Mine were predicted for Year 2, with a maximum simulated transfer of 99 ML.

Note: Transfers to the Murrawombie Copper Mine may be more likely to occur during wet weather conditions that cannot be predicted by the water balance model. It is expected that such transfers would be able to be managed in the void at the Murrawombie Copper Mine. There is also additional contingency in pipeline transfers to the Aeris North East Copper Mine from the Murrawombie Copper Mine, if required.

6.5.6.2.1. Potential off-site discharges

The site water balance model was used to estimate the likelihood of off-site discharge from the MIA Runoff Dam, the Waste Dump Dam and the Process Runoff Dam.

While each storage has been designed to the 1% AEP 72-hour duration storm design criteria, in rare rainfall events (exceeding the nominated design criteria) each of these storages may still have the potential to discharge off site.

Off-site discharge potential was assessed for each year of operations. The peak year for off-site discharge corresponded to Year 3 of operations when simulated rainfall was greatest for all years of operation and site water demands remained relatively low. On average in Year 3, 1 ML of off-site discharges were simulated for the modelled period. The modelled likelihood and volume of discharge for Year 3 are shown in Table 6-17.

The maximum annual off-site discharge for Year 3 shows potential for up to 36 ML/year to be discharged off site. This is due to rainfall events exceeding the site storage design criteria (i.e. greater than the 1% AEP, 72-hour design storm). It is possible that this discharge volume could be transferred to the Murrawombie Copper Mine to reduce the volume of water discharged off site. However, this was not modelled given the required water demands for the Project. Decision-making on site would likely prevent such discharges. However, during extreme rainfall, regardless of infrastructure size, pumping may be unable to dewater storages and transfer off site efficiently. It is also likely that the Murrawombie Copper Mine storage capacity would be reduced in a minimum water demand year. As contingency, following the cessation of open cut mining, the pit may be used to store excess water if considered safe to do so.

Table 6-17: Interpretation of discharge potential

Probability of exceeding	Total annual off-site discharge potential (ML)	Interpretation
0.05–1.0	0	There is a modelled 95% chance that no water would be discharged from site.
0.04	0–4	There is a modelled 4% chance that up to 4 ML would be discharged from site.
0.03	4–12	There is a modelled 3% chance that up to 12 ML would be discharged from site.
0.02	12–31	There is a modelled 2% chance that up to 31 ML would be discharged from site.
0.01	31–36	There is a modelled 1% chance that up to 36 ML would be discharged from site during Year 3.

6.5.7 Impact assessment

The surface water impact assessment was conducted against 'NSW Government Water Quality and River Flow Objectives' (DECCW 2006), referring to objectives applicable to uncontrolled streams for flow objectives and applicable to uncontrolled streams and major regulated rivers for quality objectives.

6.5.7.1 Site water management

The proposed site water management system has been designed to mitigate (as far as practicable) off-site discharges. The dirty and contaminated water management system (including water storages) have been sized to achieve a 1% AEP design rainfall event environmental containment capacity. Use of the off-site bi-directional water supply pipeline will manage excess contaminated water via transfers to the Murrawombie Copper Mine throughout the life of the Project.

The relevant NSW River Flow Objective relating to site water management is to 'minimise the effects of dams on water quality'.

The Project water management system (including dams for the capture and containment of contaminated runoff) is unlikely to impact downstream water quality, as no off-site releases will occur except potentially for rare rainfall events exceeding the design criteria. During unlikely discharge events, it is expected the greater Bogan River catchment will be inundated with an impacted quality of water (unrelated to the mine), predominantly associated with high-flow conditions in the water source. The catchment is expected to have naturally exacerbated levels of sediment-entrained metals under such high-flow conditions. Therefore, the impact of any discharges would likely be imperceptible compared to the background catchment conditions.

6.5.7.2 Hydrology and flow regimes

The proposed excision of the dirty water catchment area from the overall catchment area of the Bogan River is negligible, which would, therefore, lead to negligible changes in natural low and high-flow conditions in downstream watercourses from the Project.

No direct disturbance of pools in creeks, rivers or wetlands would occur. Diverting clean water around disturbed areas will minimise the dirty water catchment required to be removed from the Bogan River catchment.

The relevant NSW River Flow Objective related to hydrology and flow regimes are shown in Table 6-18. In summary, the Project is unlikely to impact the existing river flow characteristics of the Bogan River.

Table 6-18: NSW river flow objectives relevant to hydrology and flow regimes

River flow objective	Project impact summary
Protect natural low flows	The Project will excise a relatively small catchment area that is unlikely to notably reduce low flows in downstream watercourses.
Protect important rises in water levels	The Project will excise a relatively small catchment area that is unlikely to reduce moderate and high flows in downstream watercourses.
Maintain wetland and floodplain inundation	The Project will not disturb any wetlands. Minor changes to inundation depths on floodplains were modelled for the off-site access road and are considered negligible. The Project will not impact the Macquarie Marshes 70 km west of the Project site on the eastern side of the Bogan River.
Mimic natural drying in temporary waterways	Highly infrequent off-site discharges would only occur when rainfall exceeds the nominated design criteria. Ephemeral watercourses downstream of the Project are unlikely to experience changes to the duration or seasonal nature of drying periods as a result of these discharges.
Maintain natural flow variability	No defined watercourses exist downstream of the excised dirty water catchment area of the Project. No changes to minor streams could occur. It is unlikely that the removal of this minor catchment area would result in notable changes to flow variability in the Goldbiddie Cowal.
Maintain natural rates of change in water levels	Infrequent off-site discharges would only occur when rainfall exceeds the nominated design criteria. Discharges would be unlikely to alter river heights past what would be naturally observed in a rare rainfall event in the Goldbiddie Cowal.

6.5.7.3 Surface water quality

The water management system has been designed to minimise the potential for changes to the surface water quality in downstream watercourses. Sleeving within the bi-directional water supply pipeline would be used to prevent leakage to watercourses (Chapter 3, Project description, Section 3.4.2).

The assessment considered the relevant NSW Water Quality Objectives, and the assessment outcome of each objective is shown in Table 6-19. The Project is considered unlikely to impact aquatic ecosystems or visual amenity of the receiving waters.

Table 6-19: NSW Water Quality Objectives relevant to surface water quality

Water quality objective	Project impact summary
Aquatic ecosystems	Changes to the long-term ecological condition of the Goldbiddie Cowal are expected to be negligible, with: • no off-site discharges expected (with the exception of potential discharges occurring in rainfall events exceeding the nominated design criteria); and • minimal changes to catchments (Section 6.5.6.2) and flooding in the vicinity of the Project (Chapter 6, Environmental assessment, Section 6.6 Flooding). The Project is approximately 8 km from the Goldbiddie Cowal, and it is not in the riparian zone. There are no mapped watercourses in the 8 km buffer. Unmapped ephemeral drainage lines are unlikely to support aquatic ecosystems in the long-term. Therefore, no change to the long-term ecological condition in support of aquatic ecosystems within the Goldbiddie Cowal and riparian zone is expected during the construction stage or life of Project.
Visual amenity	The distance of the site from receiving waters and the sizing of on-site water containment infrastructure would require minimal dirty water discharges entering the receiving environment, as outlined in Section 6.5.6. Therefore, changes to the visual amenity of the Goldbiddie Cowal are unlikely.

6.5.7.4 Downstream surface water users

Given that the Project is unlikely to have detrimental impacts on water quality (refer to Section 6.5.7.3), the Project is not expected to impact the suitability of water for downstream surface water users. The potential Project impacts for downstream surface water users on the Goldbiddie Cowal with respect to the relevant NSW River water quality objectives are presented in Table 6-20.

Table 6-20: NSW Water Quality Objectives relevant to downstream surface water users

Water quality objective	Project impact summary
Secondary contact recreation	It is unlikely that the Project would affect secondary contact recreation activities in the Goldbiddie Cowal. As outlined in Section 6.5.6, off-site discharges during construction and operation are unlikely to occur. Therefore, minimal changes to water quality are anticipated.
Primary contact recreation	It is unlikely that the Project would affect primary contact recreation activities in the Goldbiddie Cowal. As outlined in Section 6.5.6, off-site discharges during construction and operation are unlikely to occur. Therefore, minimal changes to water quality are anticipated.
Livestock water supply	Water supply for livestock likely occurs in the vicinity of the Project site. As outlined in Section 6.5.6, off-site discharges during construction and operation are unlikely to occur. Water quality changes are unlikely to occur. This is due to clean water diversions continuing to allow water to flow within the catchment following sufficient rainfall and the broader catchment inundation characteristics during rainfall.
Irrigation water supply	Irrigation occurs in the vicinity of the Project site from the Goldbiddie Cowal. The Project is not expected to impact irrigation quality suitability. Therefore, water users are not expected to be impacted.
Aquatic foods (cooked)	The Project is not likely to affect water quality where aquatic foods are possibly gathered downstream in the Goldbiddie Cowal or further downstream from there.

6.5.7.5 Watercourses and riparian land

A portion of the Project area intersects some ephemeral first-order mapped watercourses. The majority of the catchment flows draining to these mapped drainage lines will not be affected by the Project. One small portion of the first-order drainage line would be intercepted by the Project infrastructure. This ephemeral watercourse predominantly drains away from the Project area and would be unlikely to sustain riparian vegetation in the long-term. Also, it does not appear to have defined connectivity to other major watercourses. It is unlikely that this watercourse would sustain or convey water beyond periods of rainfall. Clean water flows, which would otherwise have been intercepted by a portion of this drainage line, are to be diverted around the Project disturbance areas infrastructure. This will minimise the site requirements for dirty water management and divert clean water flows to downstream areas where riparian vegetation may exist. Therefore, direct impacts due to constructing and operating the Project on waterfront land downstream of watercourses and riparian land is not expected.

In the location of the existing roads for the infrastructure corridor, no changes to infrastructure are proposed; therefore, no change or impact to watercourses or riparian land would occur.

At the new off-site access road, minor elevation changes are expected (refer to Chapter 6, Environmental assessment, Section 6.6 Flooding). These changes were modelled to have minimal impact on flood inundation depths and velocities. Maintenance of flood inundation for areas where the road would intercept existing ephemeral watercourses were modelled to occur. The ephemeral nature of these drainage lines indicates riparian communities are unlikely to be supported long-term in the vicinity of the new off-site access road. Therefore, there are no expected direct impacts on riparian land and watercourses or indirect impacts (changes to water quantity or quality) on areas near the new off-site access road.

6.5.7.6 Acid-sulphate soil assessment

The Project area was assessed for the potential presence of acid-sulphate soils using acid-sulphate soil risk mapping (DPE 2023). Soil chemistry testing was conducted for the soil and land suitability, including for characteristics of acid-sulphate soils. The mapping resources identified some acidification hazard for the Project area soils; however, soil testing identified no characteristics of acid-sulphate soils.

6.5.7.7 Salinity assessment

The location of the Project site was assessed for the potential presence of salinity using mapping datasets. Regionally, the Bogan River, east of the Project, is classed as having a high overall salinity hazard and land salinity (DPE 2023). However, the proposed site is in the Hydrogeological Landscapes of the Western Central West Catchment – Girilambone that falls under a low salinity hazard class, indicating minimal salinity impacts have been identified for the area (OEH 2013). Given the described risks for the wider catchment, the salinity risk of soil disturbance during construction is projected to be low.

6.5.7.8 Final void and pit lake development

The final pit lake will receive direct rainfall, long-term groundwater inflows, surface water runoff and seepage from the WRE and HLP. Diversion drains will minimise the input of surface water runoff into the pit lake. The dominant output from the pit lake will be by evaporation.

The water and mass balance for the pit lake predicts water level in the pit lake is predicted to rise over time as groundwater levels recover. Over the 600-year, post-mining modelling period, the average pit lake water level is predicted to remain approximately 10 m below the existing pre-mining groundwater level, and it will not overtop. Under very wet conditions, the pit lake may temporarily reach a level of up to approximately 143 m AHD, or 22 m below ground level.

Key findings of the pit lake water quality modelling include:

- The pH of the pit lake water would be in the order of pH 4.3 at 100 years.
- The total dissolved solids concentration would be in the order of 7,000 to 10,000 mg/L at 100 years.
- As there is no loss of major ions or metals, the total dissolved solids would increase by evapoconcentration and be in the order of 25,000 to 44,000 mg/L at 600 years.
- A 100 years, mass balance concentrations of arsenic, copper and zinc would be:
    - 0.206 to 0.280 mg/L for arsenic;
    - 1.2 to 1.6 mg/L for copper; and
    - 1.8 to 2.4 mg/L for zinc.

The pit lake is modelled to be unlikely to provide a beneficial reuse due to evapoconcentration and increasing salinity and solute concentrations over time. However, it will not overtop or release any water into the receiving environment as a result of overtopping. Given that the pit lake is modelled to never release water to the receiving environment, no impacts from the pit lake are expected. The potential groundwater impacts of the pit lake are discussed in Section 6.5.3.

6.5.8 Water licensing and take

The Project is intended to replace the depleting resources at the Murrawombie Copper Mine. It is likely that water demands at that mine will decrease as water demands at the Project increase.

However, the added demands of dust suppression and heap leaching at the Project in addition to an increase in ore throughput (and associated water demands) at the Tritton Copper Mine mill may exceed the current water use at the Murrawombie Copper Mine.

Aeris is currently reviewing their existing WALs to determine where efficiencies can be made and shared across operations.

Aeris currently holds 931 ML share components within the Lower Bogan River Water Source, from which existing operations are supplied. This share is held over three WALs (refer to Chapter 5, Statutory context, Section 5.4.3.5).

The overall maximum water take to be sourced externally from the Project is 359 ML/year. It is likely that this additional 359 ML/year will be sourced from the existing surface water licences held by Aeris. In the unlikely event that water security cannot be achieved within the limits of the existing licences held by Aeris, alternative solutions will be considered, including:

- seeking additional share components from the market;
- supplementing water supply using groundwater, or
- scaling of production to water availability.

6.5.9 Commitments and management measures

The surface water assessment identified that the potential impacts would be minimised or avoided by the following design considerations:

- Minimising the Project area footprint as far as practicable to reduce the interception of the excised catchment area from the Goldbiddie Cowal and the wider Bogan River catchment.
- Incorporating clean water diversions into the Project layout to prevent mixing of clean water with dirty, contaminated and wastewater on site, which will minimise the excised clean water catchment area.
- Designing all surface water storages for the purpose of stormwater and mine water management to accommodate the 1% AEP 72-hour design storm. The design of the site water management storages will prevent off-site discharges that (depending on discharge volume) may reach the Goldbiddie Cowal.
- Designing the off-site access road so that it can be maintained (following inundation events). This maintenance is commensurate with other trafficked unsealed mining access roads following inundation with rainfall or floodwaters.

The surface water assessment provides the following measures to manage potential impacts during Project construction, operation and decommissioning:

- During construction, erosion and sediment control measures will be implemented, as per Landcom (2004) and DECC (2008), to minimise the potential for sediment migrating off site.
- Site water management storages will be dewatered to the pit sump prior to forecast rainfall events.
- A baseline and operational surface water monitoring program has been developed (Section 6.5.9.1).

6.5.9.1 Surface water monitoring

A surface water monitoring program for the purpose of monitoring the success of avoidance of surface water impacts is proposed, based on the recommendations of Appendix 5, Water impact assessment.

6.5.9.1.1. Surface water quantity

Monitoring of the frequency and quantity of surface water transferred on and off site, and internal site transfers will be undertaken. The following quantities will be monitored:

- transfers in both directions to and from the Project using the off-site water supply pipeline;
- transfers in and out of the open cut pit and underground mine to ensure compliance with groundwater licensing;

- internal site transfers and individual storage inventory for annual review of the site water balance, including:
  - manual mechanical flow meter readings recorded monthly; and
  - monthly observations of water levels in water storages using a level board.

6.5.9.1.2. Surface water quality

The surface water quality monitoring requirements will be specified in the site water management plan (refer to Section 6.5.9.2) and include:

- Baseline surface water quality will be monitored quarterly from the locations identified in Appendix 5, Water impact assessment and in Table 6-21 and Figure 6-17.
- Water will be monitored and analysed for:
  - electrical conductivity;
  - pH;
  - salinity;
  - total suspended solids;
  - total hardness;
  - turbidity;
  - dissolved oxygen;
  - acidity;
  - alkalinity;
  - calcium;
  - magnesium;
  - sodium, potassium;
  - sulphate;
  - chloride;
  - antimony;
  - aluminium;
  - arsenic;
  - Barium;
  - beryllium;
  - boron;
  - cadmium;
  - chromium;
  - cobalt;
  - copper;
  - lead;
  - iron;
  - manganese;
  - mercury;
  - molybdenum;
  - nickel;
  - selenium;
  - silver;
  - vanadium;
  - zinc;
  - total nitrogen;
  - nitrate and nitrite;
  - total Kjeldahl nitrogen;
  - total phosphorus; and
  - oil and grease
- Where proposed monitoring locations are inaccessible due to landholder access agreements, suitable alternative monitoring locations will be investigated.
- Baseline surface water quality data will be used to derive site-specific trigger values.
- Construction and operational surface water quality will be monitored on a discharge event basis.
- Treated effluent disposal will be monitored in accordance with EPA (2004) and ANZECC/ARMCANZ (1997 and 2000).

Table 6-21: Proposed water quality monitoring locations

Monitoring site	Nominal coordinates (GDA 2020 MGA zone 55)		Location
	Easting	Northing	
GCUS	504893	6566748	Upstream monitoring on Goldbiddie Cowal.
GCDS	504953	6567161	Downstream monitoring on Goldbiddie Cowal.
D01	498721	6559055	Farm dam within, and close to, the Project's southern boundary.

Monitoring site	Nominal coordinates (GDA 2020 MGA zone 55)		Location
	Easting	Northing	
D02	500093	6558850	Farm dam outside the Project's southern boundary. May require landholder access agreement.
D03	503823	6566382	Farm dam outside the Project's boundary. May require landholder access agreement.
D04	500024	6561066	Potential monitoring location on unmapped tributary downstream of northern clean water diversion.
GCUS	504893	6566748	Upstream monitoring on Goldbiddie Cowal.

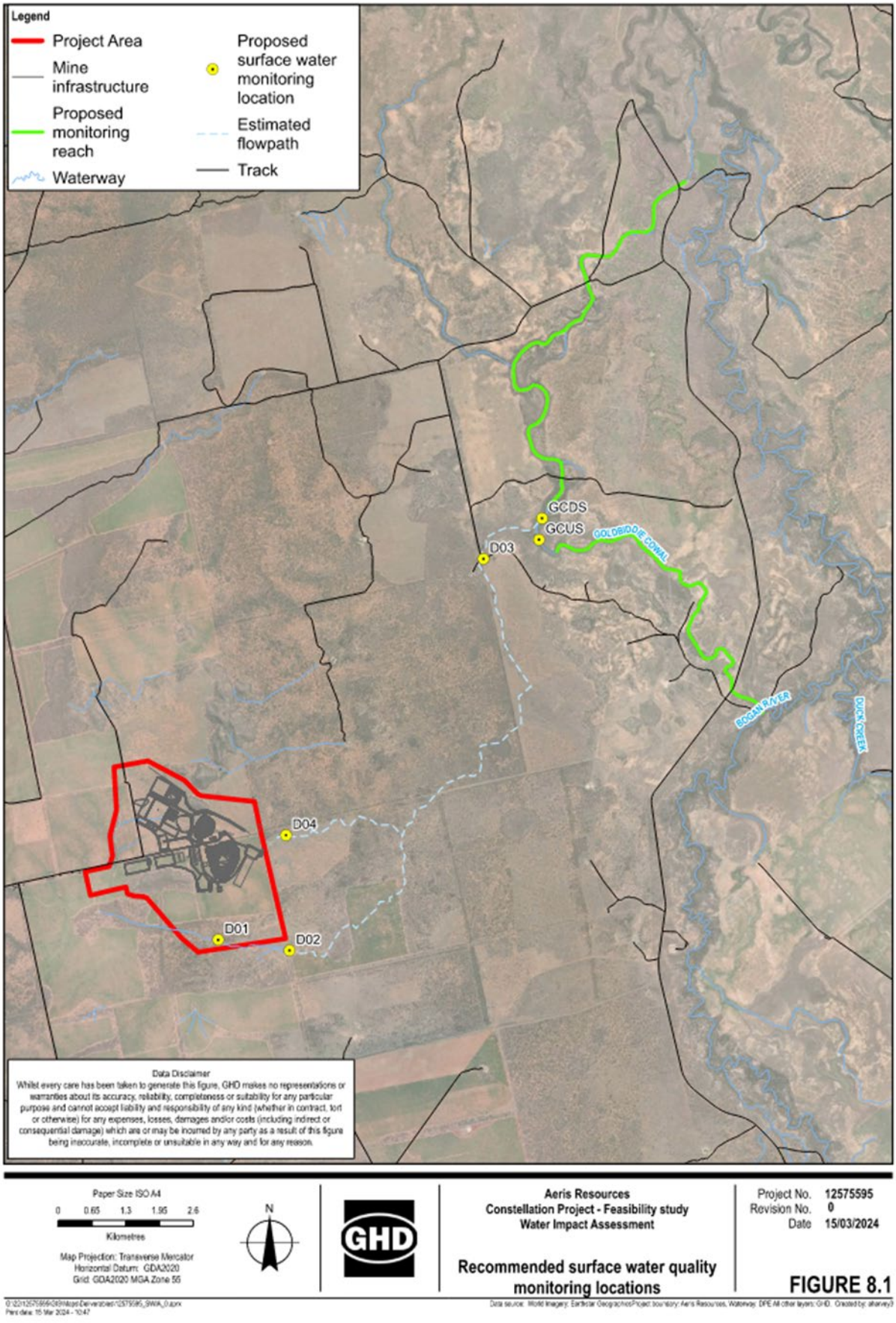


Figure 6-17: Proposed surface water quality monitoring locations

6.5.9.2 Water management plan

A water management plan will be prepared for the Project and address management requirements to demonstrate compliance with regulatory requirements. The water management plan will be reviewed every three years or as a result of any regulatory requirements or significant changes to water management practices. Trigger action response plans will be included in the water management plan regarding situations with the potential to cause impacts to water resources.

6.5.9.3 Construction environmental management plan

A construction environmental management plan will be required for the construction phase of the Project, and include:

- A detailed erosion and sediment control plan (ESCP), based on specific construction methodologies. The objective of the ESCP is to ensure that appropriate structures and programs of work are in place to:
  - identify activities that could cause erosion and generate sediment;
  - describe the location, function and capacity of erosion and sediment control structures required to minimise soil erosion and the potential for transport of sediment downstream;
  - manage impacts of construction on identified areas of existing erosion, salinity or acid-sulphate risk or erodible soils types;
  - ensure erosion and sediment control structures are appropriately maintained;
  - fulfil the statutory conditions of the Project approval; and
  - consider industry standard practice, specifically:
    - Landcom (2004). Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition; and
    - Department of Environment and Climate Change 2008. Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries.
- A stockpile management plan, outlining measures to:
  - manage stockpiles, including locations, separation of waste types, sediment controls and stabilisation;
  - minimise the quantity, lifespan and size of stockpiles;
  - stabilise stockpiles, establish appropriate sediment controls, and suppress dust as required; and
  - locate stockpiles away from drainage lines, waterways and areas where they may be susceptible to wind erosion.
- Sediment basin management, including:
  - processes for dewatering of water that has accumulated on site and from sediment basins.
- Spill management, including:
  - measures to manage accidental spills, including the requirement to maintain materials such as spill kits;
  - procedures for spill incident management; containment of spills and leaks shall be in accordance with VIC EPA's guidelines section 'Bunding and Spill Management';
  - preventative controls for spills, such as alarm systems, regular training and routine inspection of potential contamination sources; and
  - procedures for cleaning up potential contamination sources and, where possible, removal of the contamination source.
- Water quality sampling, including:
  - collecting baseline data as per Section 6.5.9.1; and

- event-based construction water quality sampling (for sedimentation suite) for:
  - forecasted rainfall events to enact preventative water management measures to prevent the discharge of dirty water; and
  - induced uncontrolled discharges during the unlikely event of rainfall.

6.5.9.4 Water balance model review

The water balance model will be run annually with recent site data and revised every three years. The average predicted water balance for the Project will be included in the water management plan and the results for each year will be reported in the annual review for the Project.

6.5.10 Conclusion

The Project has limited potential to impact the surface water receiving environment due to the site location, the design considerations to prevent the release of water, and the lack of surface water features in the Project footprint.

A site water balance model was developed to assess the potential for surface water impacts, and a final void water balance model was used to assess the performance of the post-mine pit lake. The proposed site water management is predicted to avoid potential impacts, primarily by a nil-release water management system. To manage the unlikely potential impacts from rare release events due to rainfall exceeding the design criteria, a water management plan (including a surface water monitoring program) is proposed to manage unlikely potential impacts through the life of the Project.

Project water demands will be met by replacing the depleting resource at the Murrawombie Copper Mine using existing water licences held by Aeris.

6.6 Flooding

6.6.1 Introduction and assessment requirements

A detailed assessment of flooding impacts is provided in Appendix 5, Water impact assessment.

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires an assessment of impacts to flood regimes. The water assessment requirements and reference to relevant EIS sections are provided in Table 6-22.

Table 6-22: Water assessment requirements

Assessment matter	Report locations
Likely flooding impacts of the development;	Section 6.6.4 Appendix 5, Water impact assessment, Section 5.3.2

6.6.2 Assessment approach

The assessment was undertaken according to the Floodplain Development Manual (DPIE 2022e), which replaced the 2005 Office of Environment and Heritage Floodplain Development Manual.

An impact assessment of the Project mine disturbance area and the infrastructure corridor has been undertaken to identify potential catchment scale impacts associated with surface water flow and flooding.

The potential flood receptors were identified, and flood impacts were assessed qualitatively for the new section of haul road and numerically for the existing off-site access roads.

For the numerical assessment, two-dimensional flood modelling was undertaken using the hydraulic program TUFLOW with peak flows developed in a hydrologic XP-RAFTS model.

A flood assessment was undertaken to assess the impact of the 20% AEP design storm event. Less frequent design storms were not assessed, as the new haul road and existing off-site access roads would be inundated in such events. The inputs, methodology and results are detailed in Appendix 5, Water impact assessment.

6.6.3 Existing environment

The Project is within the lower Bogan River catchment, approximately 500 km downstream of the headwaters in Peak Hill, NSW. The Project site is within 8 km of the Bogan River; notably though, it is not within historic flood mapping for the river. There are no existing council flood studies of the area.

The infrastructure corridor predominantly follows existing public roads and is within areas likely to undergo some flooding. During flood events, the existing roads that form part of the infrastructure corridor are unlikely to be trafficable.

The existing flood condition in the vicinity of the new section of haul road indicates flood inundation along the Mitchell Highway (near the proposed intersection) up to 1.75 m during the modelled 20% AEP event. Velocities along the Mitchell Highway (near the proposed intersection) of up to 0.9 m/s were modelled to occur. In the proposed new section of haul road, flood inundation depths of 0.5 m were modelled to occur during the 20% AEP event. Velocities in this location are up to 0.3 m/s.

6.6.4 Impact assessment

The potential flooding impacts of the Project site and the infrastructure corridor were assessed from the results of the flood modelling. Potential flooding impacts arising from the Project relate to changes in extent, inundation and an increase in potential velocity and scour.

6.6.4.1 Project site

The Project site is not likely to be affected by floodwaters based on the relatively elevated site when compared to the Bogan River and evidenced by historical flood mapping.

The Project will excise catchment from local drainage, which will reduce peak flows in the localised area. However, it will not excise a material portion of the peak flows that would otherwise flow to the Goldbiddie Cowal (an anabranch of the Bogan River), and the change is considered negligible to flood flows in the region.

The proposed Project site design includes two clean water diversion drains to contain drainage within the pre-development catchment, with no change expected to flood flows as a result. Therefore, the potential impacts to downstream flooding are minimal.

The design has considered the potential for local scouring immediately downstream of the outlet of the clean water diversion. A permanent layer of large angular rock (rip rap) to armour, stabilise and protect the soil surface at the outlets will be installed to minimise potential scouring, as per standard industry practice and Landcom (2004).

6.6.4.2 Infrastructure corridor

Under existing conditions, flooding is modelled to occur along the Mitchell Highway and other existing roads that will form the Project infrastructure corridor (Section 6.6.3). Within the infrastructure corridor, there are no proposed changes to existing roads. Therefore, there are no expected impacts to flooding in these areas from the Project.

The new section of the haul road represents a change from existing conditions with the potential for changes in flooding impacts. Minor changes to the flood depth and velocity are expected at one location near the proposed new section of haul road and the Mitchell Highway intersection. The resulting flood depth and velocity afflux (change in flood as a result of the proposed development) are indicated in Figure 6-18 and Figure 6-19.

Depth increases of up to 0.25 m may occur as a result of the new section of haul road, north-east of the intersection with the Mitchell Highway. These increases are likely related to changes in surface elevation of the new road. As a result, depth decreases up to 1.2 m may occur at the intersection of the new section of haul road and the Mitchell Highway.

Flood waters approach the Mitchell Highway from the west. Prior to the intersection with the new section of haul road, under existing conditions, water ponds along the road to a depth of 2 m. Flood waters may also exit the highway to the south of the proposed access road along the drainage line (Figure 6-18). Under the proposed conditions, some flood waters will flow from the Mitchell Highway along the proposed access road. This change in flow direction will lead to an increase in flood depth north-east of the Mitchell Highway.

However, the changes to flood inundation in this area from the Project are considered to have a minor impact. The area would be inundated in either scenario (existing and proposed conditions), making the area inaccessible, but no infrastructure would be impacted.

Only the 20% AEP flood velocity changes are expected to impact Okeh Creek Road (Figure 6-19) due to compaction and regrading of the road compared to pre-developed conditions. The velocity of flood waters in this location is expected to be 0.5 m/s and up to 1 m/s over the road. There are no negative changes to the flood immunity of the Mitchell Highway identified as a result of the proposed new section of haul road.

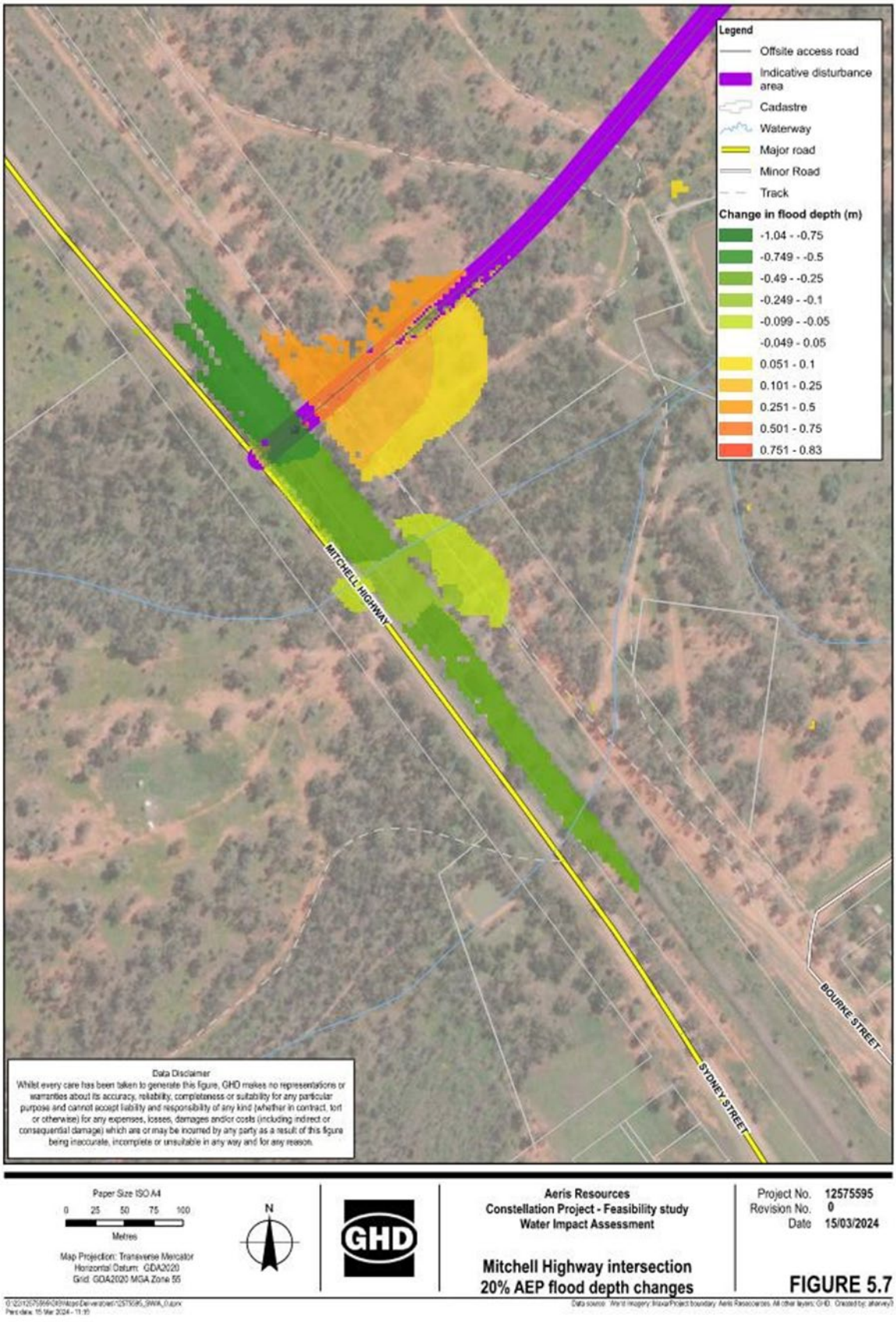


Figure 6-18: Mitchell Highway intersection flood depth changes

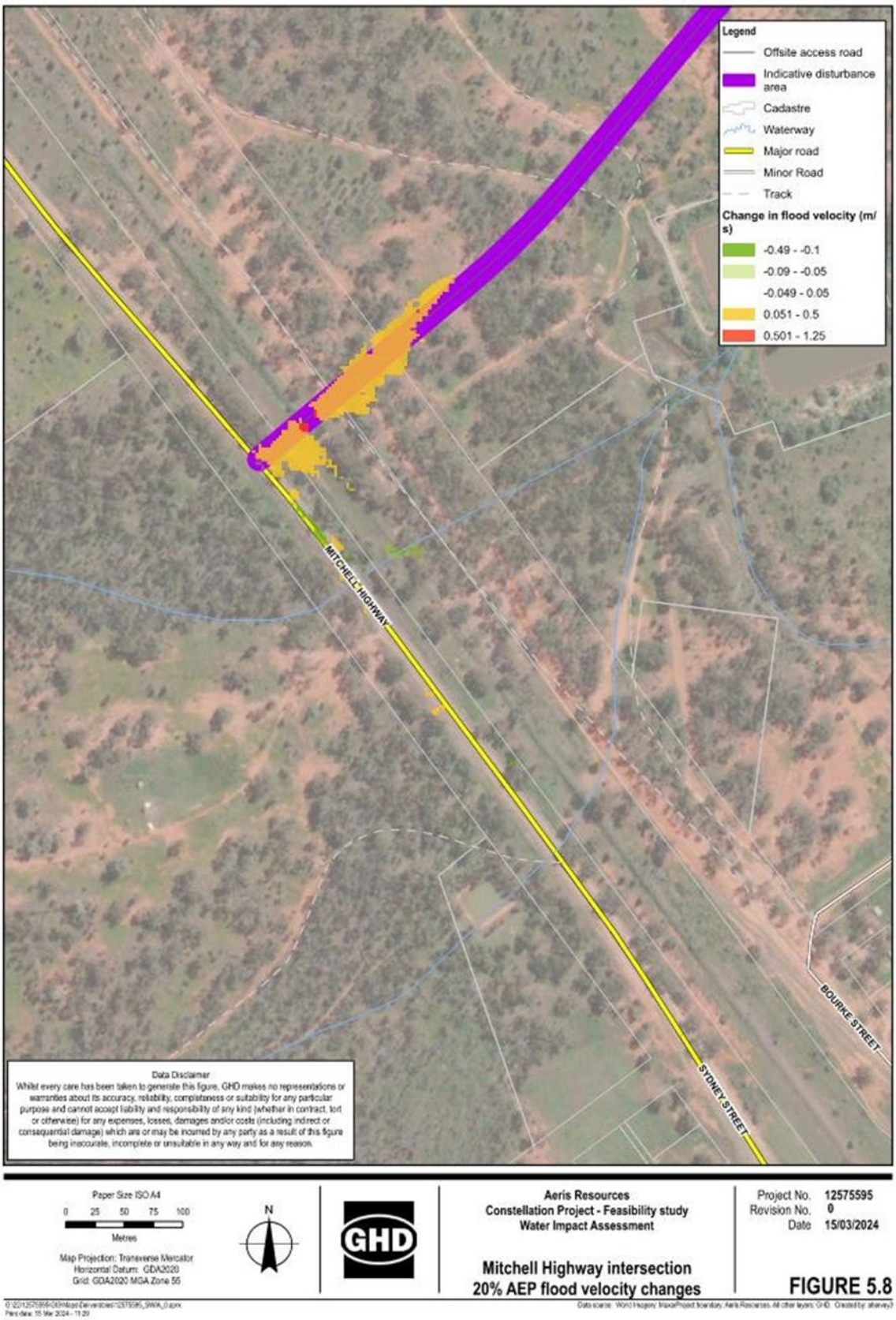


Figure 6-19: Mitchell Highway intersection flood velocity changes

6.6.5 Commitments and management measures

The new section of haul road to the east of the Mitchell Highway has been designed to be maintained following inundation events. This maintenance will be commensurate with other trafficked, unsealed mining access roads following inundation with rainfall or floodwaters.

The design of the access road is predicted not to significantly alter flooding behaviour (within the assessed events). There are no negative changes to the flood immunity of the Mitchell Highway identified as a result of the Project.

As the assessment identified negligible Project impacts to flooding, there are no proposed ongoing management measures to address flooding impacts.

6.6.6 Conclusion

A flooding assessment in accordance with relevant guidance documents and relying on numerical modelling of the impacts of 20% AEP flood events identified negligible changes to floodplain inundation associated with the Project.

Given that the Project site is unlikely to be impacted by floodwaters and the infrastructure corridor is predicted to undergo similar flooding as under present conditions, no ongoing management measures are proposed.

6.7 Biodiversity

6.7.1 Introduction

The Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act) and NSW Biodiversity Conservation Regulation 2017 (BC Regulation) and is consistent with the Biodiversity Assessment Method (BAM) (DPIE 2020). The BDAR was prepared by Bruce Mullins, an Accredited Assessor (BAAS17024). The BDAR is provided in Appendix 2.

6.7.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires biodiversity impacts to be assessed, and the requirements are provided in Table 6-23.

Table 6-23: Biodiversity assessment requirements

Assessment matter	Report locations
Likely biodiversity impacts of the development in accordance with the Biodiversity Assessment Method (BAM) and documented in a BDAR.	Section 6.7.6 Appendix 2, BDAR, Section 7
A strategy to offset any residual impacts of the development in accordance with the offset rules under the Biodiversity Offsets Scheme, including details of any potential biodiversity stewardship sites for retiring biodiversity credits.	Section 6.7.9 Appendix 2, BDAR, Section 7

6.7.3 Study context

The study area for the BDAR was the Project area (presented as 'subject land' in Figure 6-20, Figure 6-21, and Figure 6-22) and portions of the infrastructure corridor within existing road easements (Figure 6-22 and Figure 6-23) with associated buffer areas.

The assessment included the Project mine area, where the mine and associated infrastructure will be located, and the infrastructure corridor that predominantly follows existing roads (such as Okeh Road).

The study area also included the proposed new disturbance area associated with the land to be disturbed for the deviation around the town of Girilambone, including buffer areas. A detailed explanation of the extent of Project disturbance is provided in Chapter 3, Project description, Section 3.4.4.



Figure 6-20: Project area and infrastructure corridor at entrance to Okeh Road



Figure 6-21: Project area (south) infrastructure corridor

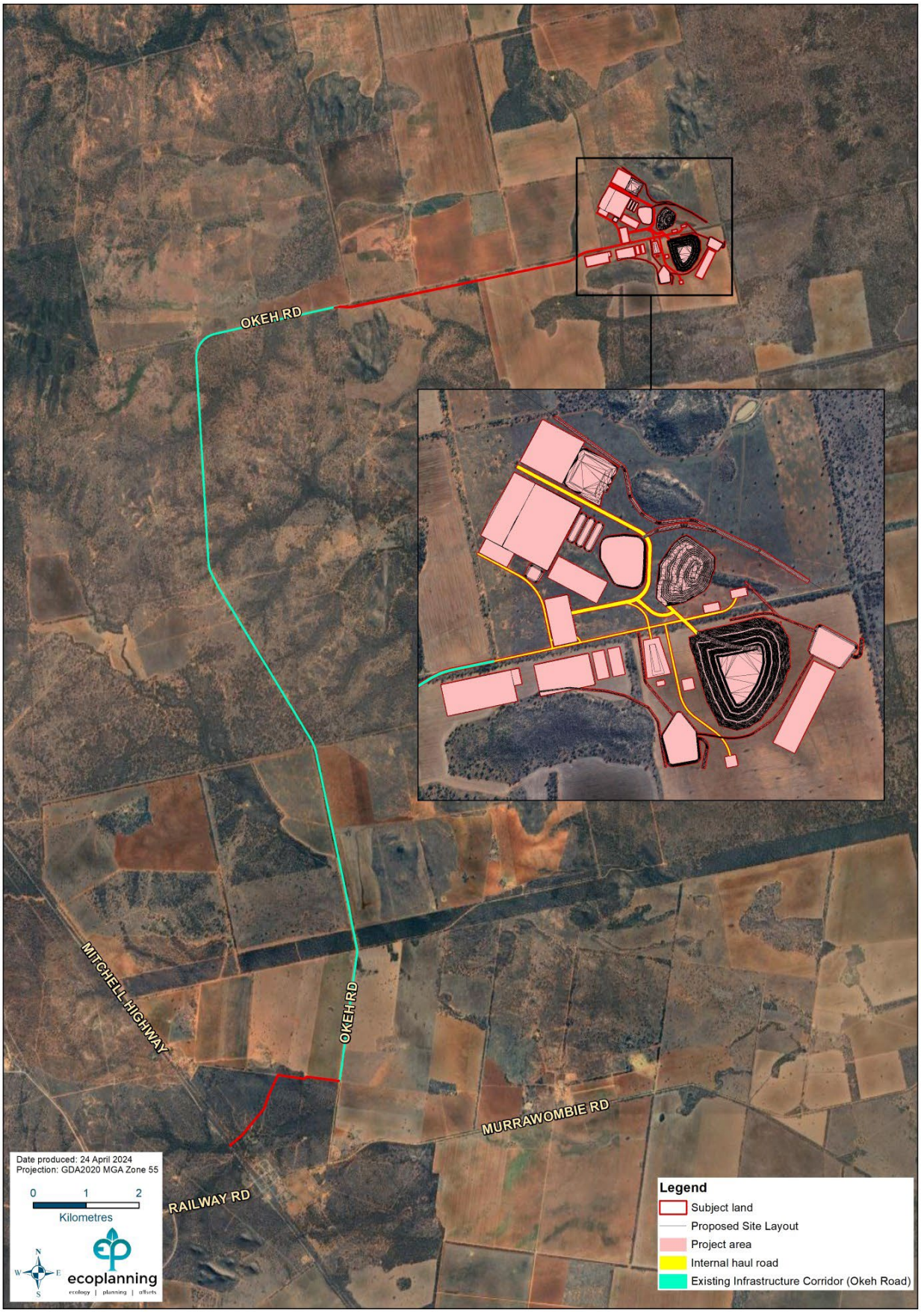


Figure 6-22: Project area overview

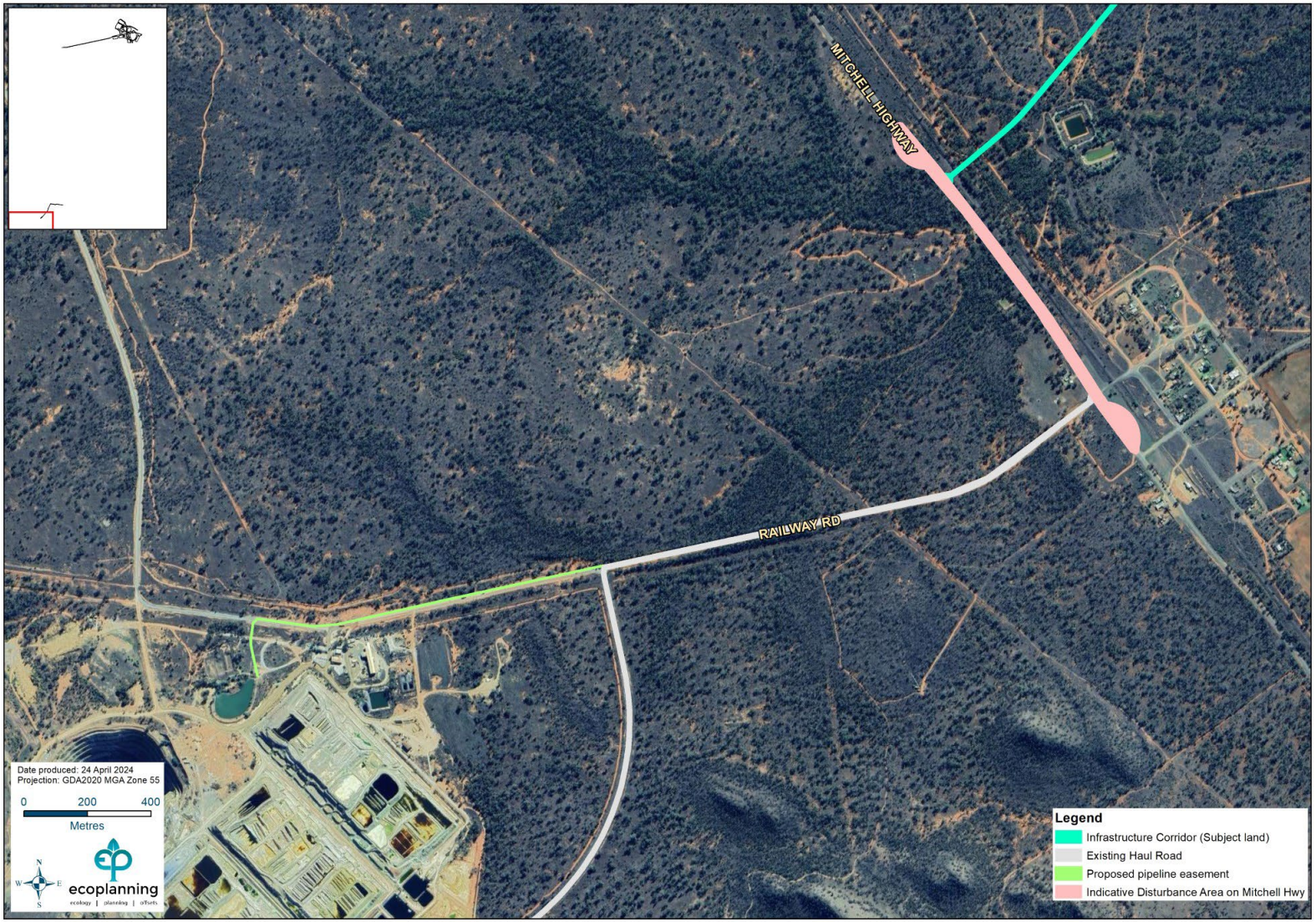


Figure 6-23: Off-site buried pipeline to the Murrawombie entrance

6.7.4 Existing environment

The Project is in the Bogan Shire Local Government Area and is zoned RU1 –Primary Production under the Bogan Local Environmental Plan 2011. The site is within a large expanse of rural lands stretching between Nyngan and Bourke, which is north-west of the Project.

The Project is surrounded by cleared agricultural lands used for grazing or cropping and largely contiguous areas of native woodland.

The landscape is gently undulating, with rocky rises occurring east of the Project. The Bogan River is approximately 8 km east of the Project at its closest point. To the north of the Project, low rocky hills, which are largely uncleared, are surrounded by cleared agricultural fields on flat lands.

The portions of the Project resulting in disturbance and a surrounding 5 km buffer area are mapped as being approximately 52% native vegetation (Figure 6-24).

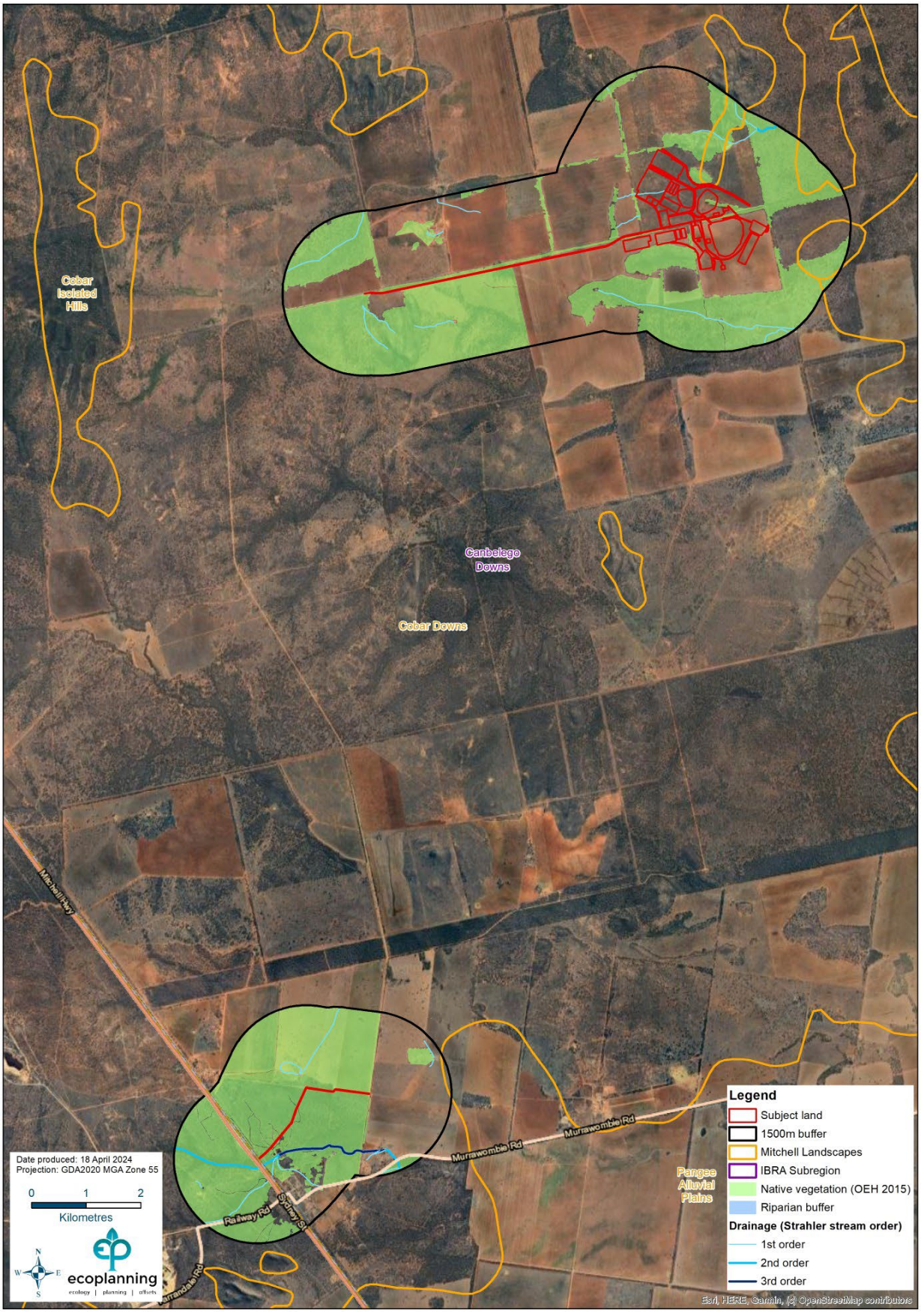


Figure 6-24: Mapped watercourses and native vegetation within a 5 km radius (OEH 2015)

6.7.5 Assessment approach

In accordance with Section 3.1 of the BAM, several features have been assessed in the 1,500 m assessment buffer surrounding the Project area.

The Project is in the Conbelego Downs interim biogeographic regionalisation for Australia (IBRA) subregion (version 7.0), part of the Cobar Peneplain IBRA region. The characteristics of this region were used for the BAM calculations.

Other features were considered in the assessment buffer area when appropriate, such as:

- rivers;
- streams;
- estuaries;
- wetlands;
- habitat connectivity;
- karst areas; or
- areas of outstanding biodiversity value.

6.7.5.1 Survey methodology

Ecoplanning conducted seven separate field surveys to assess the Project area between October 2021 and October 2023:

- 8–10 October 2021;
- 30 August–2 September 2022;
- 4–7 October 2022;
- 10–13 October 2022;
- 29 March 2023;
- 26–28 September 2023; and
- 26 October 2023.

The survey was undertaken in accordance with BAM (DPIE 2020) guidance materials, and 17 plot-based floristic vegetation surveys were undertaken. Field verification of Plant Community Types (PCTs) was undertaken in accordance with the PCT classification, described in the BioNet Vegetation Classification (DPIE 2021).

Targeted threatened fauna surveys and opportunistic observations were made in conjunction with the floristic survey work. The surveys also included targeted surveys for hollow-bearing trees (HBTs).

6.7.5.2 Plant Community Types

A total of 97.24 ha of the 182.83 ha of the study area within the Project (53%) was identified as supporting native vegetation, with the remainder identified as cleared land.

Two woodland PCTs were identified in the Project area (Table 6-24), with three distinct vegetation zones described for PCT 103. The distribution of PCTs is shown in Figure 6-25, Figure 6-26 and Figure 6-27.

No BC Act-listed threatened ecological communities (TECs) are associated with any of the PCTs in the Project area.

Table 6-24: PCTs in the Project area

PCT	Vegetation formation & class	Vegetation zone	Area (ha)	Vegetation integrity plots
Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (PCT 103)	Semi-arid Woodlands (Shrubby sub-formation) Western Peneplain Woodlands	Woodland	8.2	3
		Open woodland	1.16	1
		Derived Native Grassland (DNG)	87.79	5
Poplar Box grassy woodland on flats mainly in the Cobar Peneplain Bioregion and Murray Darling Depression Bioregion (PCT 105)	Semi-arid Woodlands (Shrubby sub-formation) Western Peneplain Woodlands	Intact	0.09	1
Total native vegetation			**97.24**	**10**
Cleared land (No PCT)			85.59	N/A
Total area of the Project area			**182.83**	**10**

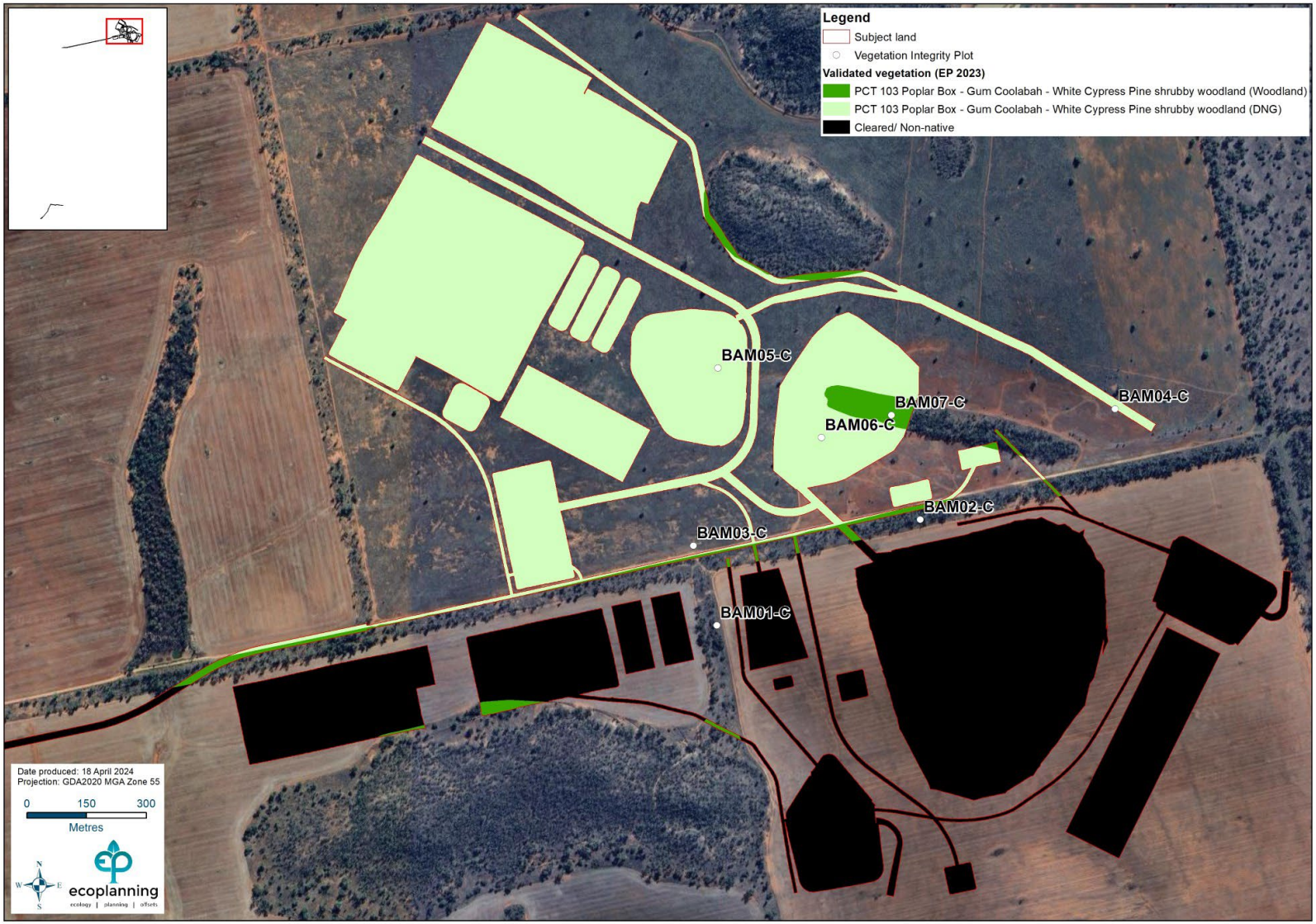


Figure 6-25: Field-validated PCTs in the Project footprint



Figure 6-26: Field-validated PCTs in the northern infrastructure corridor footprint

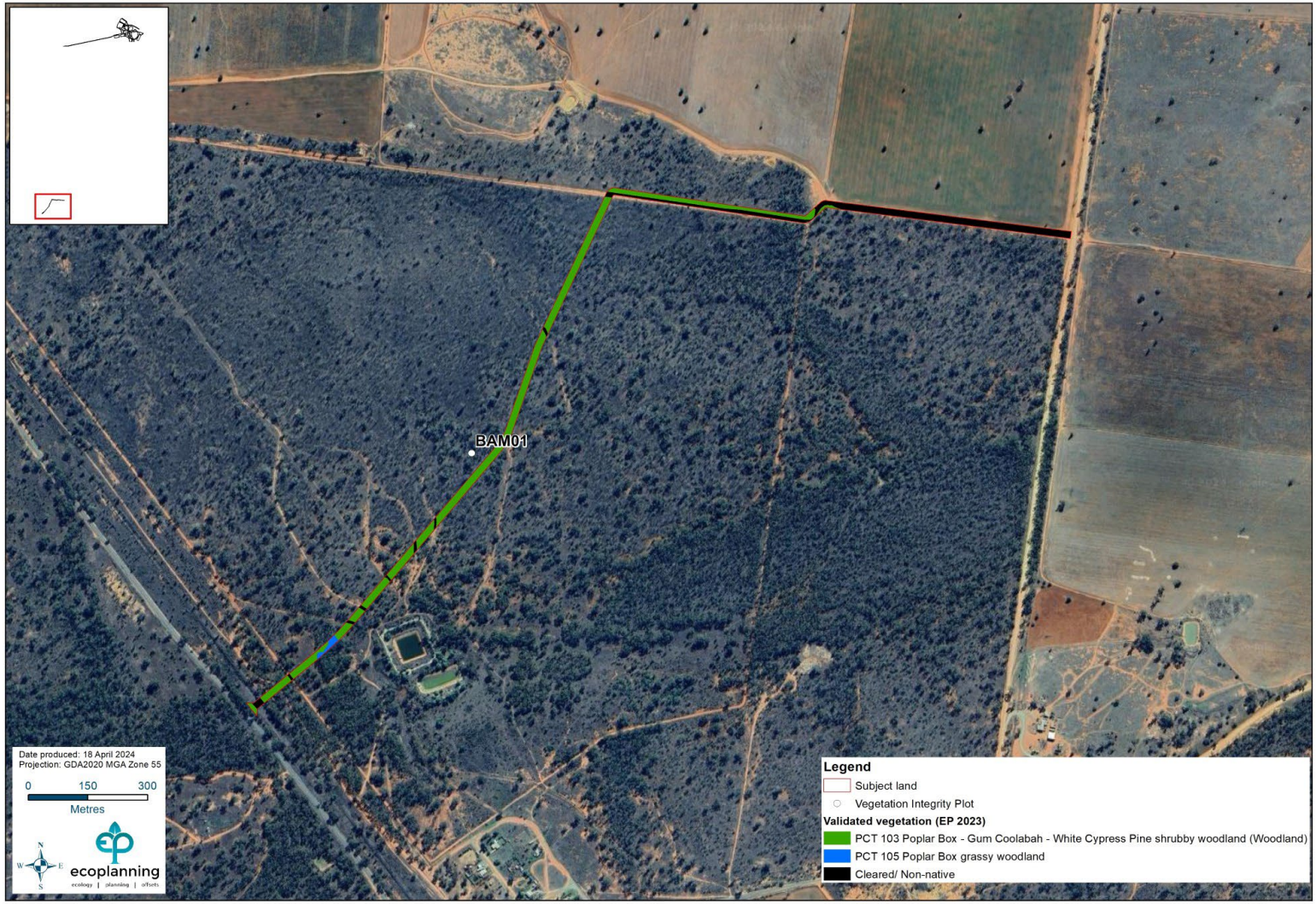


Figure 6-27: Field-validated PCTs in the southern infrastructure corridor footprint

6.7.5.3 Vegetation zones

In accordance with the BAM, vegetation zones in the PCTs were identified and mapped according to variations in the broad condition state of vegetation polygons. Three vegetation zones were identified for PCT 103 and one vegetation zone for PCT 105 (Table 6-24).

An appropriate number of vegetation integrity plots were surveyed for each zone, and 10 standard 20 x 50 m BAM plots were completed (refer to Table 6-24). Given the small size of each vegetation zone, and the linear orientation of much of the Project along the proposed infrastructure corridor, plots were orientated as best as possible to capture the most representative parts of each zone and avoid ecotones, zone boundaries and disturbances, such as tracks.

Cleared land had no vegetation zone and was not subject to survey plots.

6.7.5.4 Hollow-bearing trees

The presence of HBTs was assessed within each vegetation zone. The survey counted and mapped HBTs along the proposed infrastructure corridor and within the Project area (Table 6-25)—27 HBTs were recorded in the Project area.

Table 6-25: Number of HBTs identified in the Project area

Location	No. of HBTs
Project mine site area to be impacted	0
Infrastructure corridor	10
Outside of proposed infrastructure corridor (within 10 m)	17
Total HBTs	**27**

6.7.5.5 Threatened species

Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species:

1) Ecosystem credit species: When the likelihood of occurrence of a species or elements of suitable habitats for the species can be predicted by vegetation surrogates and landscape features or a targeted survey has a low probability of detection. Targeted surveys are not required for ecosystem species, and potential impacts on these species are assessed in conjunction with impacts on PCTs.

2) Species credit species: When the likelihood of occurrence of a species or elements of suitable habitats for the species cannot be confidently predicted by vegetation surrogates and landscape features but can be reliably detected by a survey. A targeted survey or an expert report is required to confirm the presence or absence of these species on the subject land.

Only Major Mitchell's Cockatoo is recognised as a candidate species credit species for PCTs found in the study area (refer to section 6.7.5.8).

For some threatened species, they are identifiable as both ecosystem and species credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species' foraging habitat is an ecosystem credit, while their breeding habitat represents a species credit.

Threatened species considered in the assessment for their likelihood to occur in the subject area were identified from the following sources:

- Threatened Species Database Search for the Conbelego Downs IBRA subregion Interim Biogeographic Regionalisation for Australia;

- The DPIE Threatened Biodiversity Data Collection;
- The BAM calculator;
- DPIE BioNet species records; and
- The EPBC Act Protected Matter Search Tool.

The process for identifying threatened species that required assessment was undertaken using the BAM calculator. The PCTs identified within the Project area, patch size and native vegetation cover, as outlined in Section 3 of the BAM, were entered into the BAM calculator, and a preliminary list of ecosystem and species credit species was tabulated. The assessment of habitat constraints for ecosystem credit species predicted to occur is shown in Table 6-28.

The EPBC Act Protected Matters Search Tool generated a report for a 25 km buffer area and also identified the following as having the potential to occur within the Project area:

- four TECs;
- 29 threatened species; and
- seven migratory species.

EPBC Act migratory species are considered unlikely to occur or be impacted by the Project. The field survey results ruled out the presence of all EPBC Act-protected matters, with the exception of the Major Mitchell Cockatoo (*Lophochroa leadbeateri leadbeateri*) and the Southern Whiteface (*Aphelocephala leucopsis*).

The results of the significant impact assessment, using the EPBC Act significant impact guidelines (DotE 2013) indicate the Project is unlikely to have a significant impact on the species. Aeris is progressing discussions with the Commonwealth DCCEEW regarding potential impacts to Matters of National Environmental Significance.

No BC Act-listed TECs are associated with any of the PCTs within the Project area.

6.7.5.6 Field survey threatened species

6.7.5.6.1. Threatened fauna species

The Project area was surveyed for habitat for threatened species identified as requiring assessment. Species-specific surveys were conducted in accordance with the BAM taxa-specific guidelines. In addition to meandering surveys and opportunistic observations, targeted survey effort was made via:

- song meters deployed for the following dates:
  - 29 August 2022–2 September 2022;
  - 30 August 2022–2 September 2022;
  - 4 October 2022–11 October 2022;
  - 3 October 2022 –23 November 2022.
- diurnal surveys;
- hollow-bearing tree assessment;
- hollow watching; and
- chorus census surveys.

The survey periods, methodology and timing of targeted fauna survey techniques are shown in Table 6-26.

With the exception of the EPBC Act-listed Major Mitchell Cockatoo and Southern Whiteface, no threatened fauna or flora species were recorded in the Project area or potential impact areas.

6.7.5.6.2. Threatened flora species

Targeted surveys for candidate threatened flora species were conducted within the Project site and sections of the proposed road for the infrastructure corridor.

The surveys were undertaken by parallel line field traverses at a distance of 5 to 10 m apart, as per guidelines outlined by DPIE (2020). Reference populations for relevant potential threatened plant species were visited prior to surveys to confirm that relevant species were flowering at the time of surveys. The targeted flora survey tracks are provided in Appendix 2, BDAR.

The survey periods for threatened flora species are shown in Table 6-27, and the Department's threatened species survey guidelines indicate that threatened candidate species *Diuris tricolour*, *Pterostylis cobarensis* and *Sida rohlenae* (shrub Sida) were detectible at the time of the survey.

Table 6-26: Candidate species survey periods, methodology and timing

Candidate species	Survey technique based on requirements and survey guidelines	Survey period according to BAM Calculator denoted as 'Y', blue shading is field survey timing											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lophochroa leadbeateri Major Mitchell's Cockatoo	• Deployment of four song meter mini devices at various locations within subject land (Figure 6-28) across a total of 23 nights. • Opportunistic diurnal survey during survey period. • Hollow watching *a Eucalyptus intertexta* where a pair were observed foraging. • Traverses to detect Major Mitchell's Cockatoo throughout the subject land during the survey period.									Y	Y	Y	Y
Burhinus grallarius Bush Stone Curlew	• Deployment of four song meter mini devices at various locations within subject land (Figure 6-28) across a total of 23 nights. • Opportunistic diurnal survey during survey period. • Traverses throughout the subject land during the survey period.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Calyptorhynchus lathami Glossy Black-Cockatoo	• Deployment of four song meter mini devices at various locations within subject land (Figure 6-28) across a total of 23 nights. • Opportunistic diurnal survey during survey period. • Traverses throughout the subject land during the survey period.	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Hieraaetus morphnoides Little Eagle	• Visual search for raptor stick nests. • Opportunistic diurnal survey during survey period.								Y	Y	Y		
Ninox connivens Barking Owl	• Deployment of four song meter mini devices at various locations within subject land (Figure 6-28) across a total of 23 nights.					Y	Y	Y	Y	Y	Y	Y	Y
Tyto novaehollandiae Masked Owl	• Deployment of four song meter mini devices at various locations within subject land (Figure 6-28) across a total of 23 nights.					Y	Y	Y	Y				

Candidate species	Survey technique based on requirements and survey guidelines	Survey period according to BAM Calculator denoted as 'Y', blue shading is field survey timing											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crinia sloanei Sloane's Froglet	• Deployment of four song meter mini devices at various locations within subject land (Figure 6-28) across a total of 23 nights following above average rainfall. • Opportunistic chorus census surveys.							Y	Y				

Table 6-27: Survey periods for confirmed candidate threatened plant species

Threatened species	**Survey period according to BAM calculator denoted as 'Y', blue shading is field survey timing**											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Diuris tricolour Pine Donkey Orchid									Y	Y		
Pterostylis cobarensis Greenhood Orchid										Y		
Sida rohlenae Shrub Sida	Y	Y							Y	Y	Y	Y

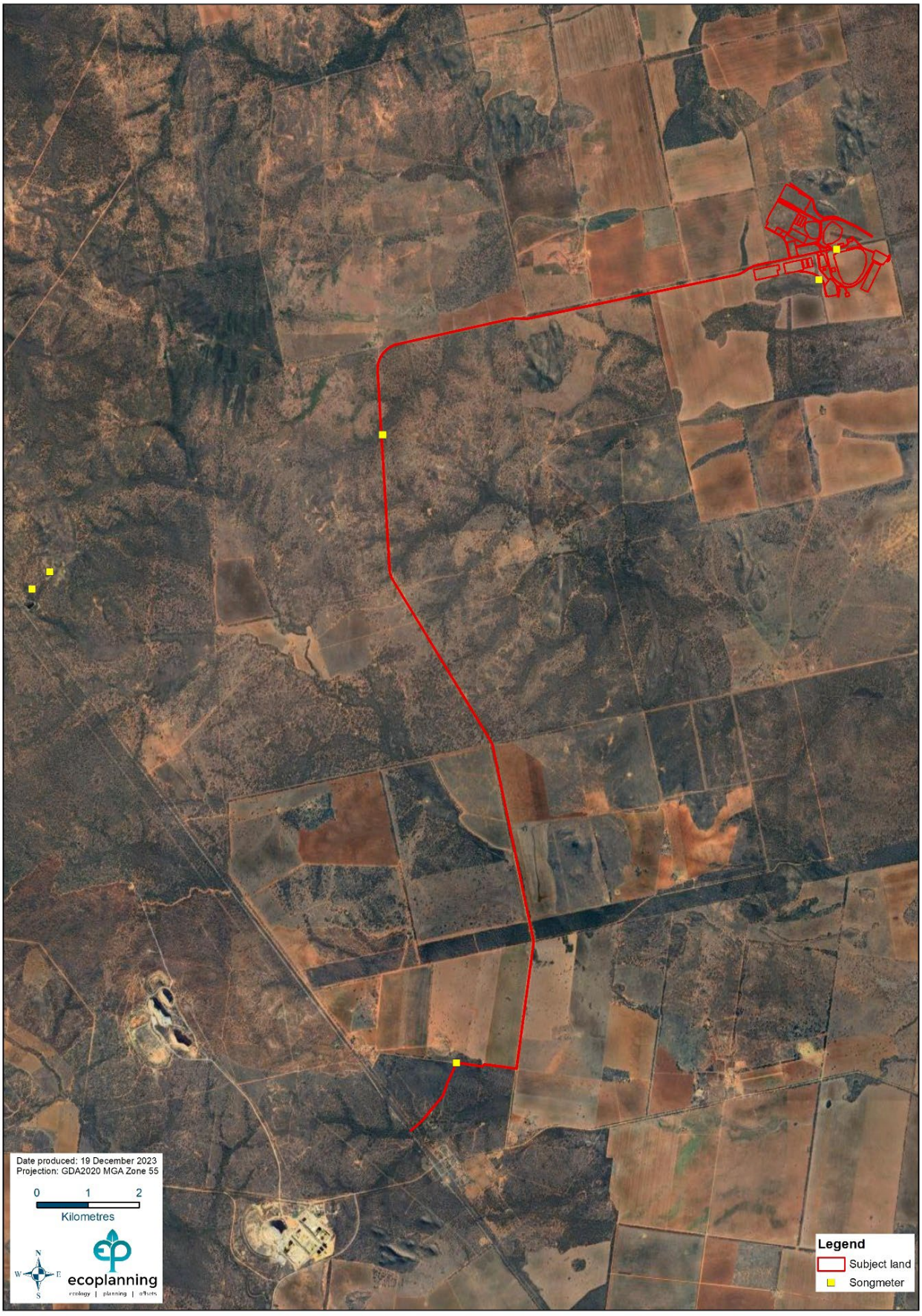


Figure 6-28: Song meter survey locations

6.7.5.7 Ecosystem credit species

Ecosystem credit species are threatened species that are predicted to occur from vegetation surrogates or landscape features or have a low probability of detection from targeted surveys. The biodiversity risk weighting for each ecosystem credit species is based on the sensitivity to gain, as per the criteria in Appendix I of the BAM.

Twenty-three ecosystem credit species were predicted to occur within the Project area. Twenty species were retained based on habitat constraints. The ecosystem species retained for the Project area are listed in Table 6-28.

Table 6-28: Assessment of habitat constraints and geographic limitations of ecosystem credit species

Scientific name/Common name	Habitat constraints	Geographic limitations	Sensitivity to gain class	Maintained as an ecosystem credit species	Status	
					BC Act	EPBC Act
Antechinomys laniger Kultarr	—	—	High	Yes	E	-
Aphelocephala leucopsis leucopsis Southern Whiteface	—	—	—	—	V	V
Artamus cyanopterus cyanopterus Dusky Woodswallow	—	—	Moderate	Yes	V	—
Calyptorhynchus lathami Glossy Black-Cockatoo (foraging)	Presence of Allocasuarina and Casuarina species	—	High	No—Casuarina not present	V	—
Certhionyx variegatus Pied Honeyeater	—	—	Moderate	Yes	V	—
Chalinolobus picatus Little Pied Bat	—	—	High	Yes	V	—
Chthonicola sagittata Speckled Warbler	—	East and south of Cobar	High	Yes	V	—
Circus assimilis Spotted Harrier	—	—	Moderate	Yes	V	—
Daphoenositta chrysoptera Varied Sittella	—	—	Moderate	Yes	V	—
Falco hypoleucos Grey Falcon	—	—	Moderate	Yes	E	—
Falco subniger Black Falcon	—	—	Moderate	Yes	V	—

Scientific name/Common name	Habitat constraints	Geographic limitations	Sensitivity to gain class	Maintained as an ecosystem credit species	Status	
					BC Act	EPBC Act
Grantiella picta Painted Honeyeater	Mistletoes present at a density of greater than five mistletoes per hectare	—	Moderate	No	V	V
Haliaeetus leucogaster White-bellied Sea- Eagle (foraging)	Within 1 km of a river, lake, large dam or creek, wetlands and coastlines	—	High	No	V	—
Hamirostra melanosternon Black-breasted Buzzard (foraging)	—	—	Moderate	Yes	V	—
Hieraaetus morphnoides Little Eagle (foraging)	—	—	Moderate	Yes	V	—
Lophochroa leadbeateri Major Mitchell's Cockatoo (foraging)	—	—	Moderate	Yes	V	—
Lophoictinia isura Square-tailed Kite (foraging)	—	—	Moderate	Yes	V	—
Melanodryas cucullata cucullata Hooded Robin (south-eastern form)	—	—	Moderate	Yes	V	—
Polytelis swainsonii Superb Parrot	—	—	Moderate	Yes	V	—
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	—	—	Moderate	Yes	V	—
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	—	—	High	Yes	V	—
Sminthopsis macroura Striped-faced Dunnart	—	—	High	Yes	V	—

Scientific name/Common name	Habitat constraints	Geographic limitations	Sensitivity to gain class	Maintained as an ecosystem credit species	Status	
					BC Act	EPBC Act
Stagonopleura guttata Diamond Firetail	—	—	Moderate	Yes	V	—

6.7.5.8 Candidate species

Candidate species (species credit species) are threatened species that cannot be reliably predicted from habitat surrogates, and their presence is to be assessed through habitat assessment and targeted surveys.

In accordance with Sections 5.2.2 and 5.2.3 of the BAM, a candidate species credit species can be considered unlikely to occur within the Project area when the habitat is substantially degraded or an expert report identifies that the species is unlikely to be present.

A candidate species credit species that is not considered to have a suitable habitat in accordance with Section 5.2.2 of the BAM does not require further assessment. The reasons for determining that candidate species credit species are unlikely to have suitable habitat within the Project area (or specific vegetation zones) are provided in Table 6-29.

The BAM calculator generated 20 potential candidate species credit species for the Project area. Of the 20 candidate species credit species predicted to occur, nine have been retained (Table 6-29).

Table 6-29: Habitat constraints and geographic limitations of candidate species

Scientific name/ Common name	Habitat constraints	Geographic limitations	Maintained as a Candidate Species Credit Species
Acacia curranii Curly-bark Wattle	Rocky slopes and ridges, or within 100 m of break of slope	—	No—suitable habitat is not present within the Project area (Section 5.2.2 (2b) of the BAM). No rocky habitats were found within the Project area or within 100 m of the Project area (DPIE 2022f). The survey was not observed during field survey.
Antaresia stimsoni Stimson's Python	Areas within 500 m of rocks or gibber	—	No—suitable habitat is not present within the Project area (Section 5.2.2 (2b) of the BAM). No rocky habitat areas were found within the Project area or within 500 m of the Project area.
Ardeotis australis Australian Bustard	—	—	No—this species has been assessed as vagrant in the Canbelego Downs IBRA subregion (Section 5.2.2 (2c) of the BAM) (DPIE 2022g).
Burhinus grallarius Bush Stone-curlew	Fallen/standing dead timber, including logs	—	Yes
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	Living or dead trees with hollows greater than 15 cm in diameter and greater than 8 m above ground	—	No—while there are HBTs that might be suitable, Allocasuarina and Casuarina species are absent from the Project area and 1,500 m buffer. The species was not detected in the surveys within the Project area.

Scientific name/ Common name	Habitat constraints	Geographic limitations	Maintained as a Candidate Species Credit Species
Crinia sloanei Sloane's Froglet	Semi-permanent/ ephemeral wet areas containing relatively shallow sections with submergent and emergent vegetation, or within 500 m of wet areas Swamps within 500 m of waterbodies	—	No—the species was not detected during surveys of the Project area and surrounds or recorded in the Cobar Peneplain Bioregion. The nearest records to the site are along the Crooked Creek, over 80 km south-east of the Project..
Diuris tricolour Pine Donkey Orchid	—	—	Yes
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines	—	No—the Project is not within 1 km of any rivers, lakes, large dams or creeks, wetlands or coastlines (Section 5.2.2 (2b) of the BAM).
Hamirostra melanosternon Black-breasted Buzzard (Breeding)	Land within 40 m of riparian woodland on inland watercourses/ waterholes containing dead or dying eucalypts	—	No—the Project is not within 40 m of any riparian woodland habitats (Section 5.2.2 (2b) of the BAM). Further, no stick nests were recorded on the Project site during habitat surveys.
Hieraaetus morphnoides Little Eagle (Breeding)	Nest trees—live, (occasionally dead) large old trees within vegetation	—	Yes
Lepidium monoplocoides Winged Peppercress	—	—	No—suitable habitat is not present within the Project area (Section 5.2.2 (2b) of the BAM). The plant is known to occur on seasonally moist to waterlogged sites. Found in wetland–grassland communities on waterlogged grey-brown clay soils. The entirety of the Project area is underlain by Calcarosol soils. As such, suitable habitat is not present within the Project area.
Lophochroa leadbeateri Major Mitchell's Cockatoo (Breeding)	Living or dead trees with hollows greater than 10 cm in diameter	—	Yes
Lophoictinia isura Square-tailed Kite (Breeding)	Nest trees	—	No—the Project area does not adjoin any watercourses representing breeding habitat (Section 5.2.2 (2b) of the BAM). Breeding is from July to February, with nest sites generally located along or near watercourses. No watercourses representing suitable breeding habitat occur within the Project area.

Scientific name/ Common name	Habitat constraints	Geographic limitations	Maintained as a Candidate Species Credit Species
Ninox connivens Barking Owl (Breeding)	Living or dead trees with hollows greater than 20 cm in diameter and greater than 4 m above the ground	—	Yes
Phascolarctos cinereus Koala (Breeding)	Areas identified via survey as important habitat (see comments)	—	No—this species has not been recorded in the Cobar Peneplain Bioregion. Records indicate that the nearest species to the site are along the Bogan River over 80 km north-east of the Project. While food trees, including *Eucalyptus populnea*, are the dominant canopy on the site, Koalas have not been recorded in the drier plains and flats of the Cobar Peneplain Bioregion, which are distant from and substantially different to the riparian areas where koalas are found further east (Section 5.2.3 (2a(i)) of the BAM).
Polytelis swainsonii Superb Parrot (Breeding)	Living or *dead E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5 cm in diameter Greater than 4 m above ground or trees with a DBH of greater than 30 cm	—	No—the subject land is outside the known breeding range of this species, as described in the Conservation Advice (TSSC 2016). Records of Superb Parrot in the region relate to non-breeding dispersal of the species (Section 5.2.2 (2b) of the BAM).
Pterostylis cobarensis Greenhood Orchid	—	—	Yes
Sida rohlenae Shrub Sida	—	—	Yes
Tyto novaehollandiae Masked Owl (Breeding)	Living or dead trees with hollows greater than 20 cm in diameter and greater than 4 m above the ground	—	Yes

6.7.6 Potential impacts

The proposed development will directly impact the following PCTs:

- 97.15 ha of PCT 103 - Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion; and
- 0.09 ha of PCT 105 - Poplar Box grassy woodland on flats mainly in the Cobar Peneplain Bioregion and Murray Darling Depression Bioregion.

The Project will disturb an additional 85.59 ha of cleared land, which will not impact native PCT or associated breeding or foraging habitat for threatened species. There is no calculated offset liability for the disturbance to cleared land.

6.7.6.1 Indirect impacts

Potential indirect impacts include, but are not limited to:

- noise pollution and vibration;
- dust;
- erosion; and
- runoff associated with the stockpiles and disturbed earth.

Indirect impacts will be managed by developing appropriate mitigation measures maintained through proposed environmental management plans (Section 6.7.8.2).

6.7.6.2 Prescribed impacts

Prescribed impacts, as defined under Clause 6.1 of the BC Regulation and Section 6 of the BAM, include impacts on biodiversity values in addition to or instead of impacts from clearing vegetation or habitat. The assessment for prescribed biodiversity impacts for the Project is provided in Table 6-30.

Table 6-30: Prescribed biodiversity impacts

Prescribed biodiversity impacts	Presence within the Project area
1. The impacts of development on the following habitat of threatened species or ecological communities: a) karst, caves, crevices, cliffs, rocks and other geological features of significance;	The Project area does not contain areas of karst, caves, cliffs, crevices, rocks or other geological areas of significance.
b) human-made structures;	The Project area does not contain human-made structures and, therefore, does not have the potential to host threatened fauna species that use human-made structures.
c) non-native vegetation;	Non-native vegetation within the Project area includes those mapped as 'cleared' and 'non-native'. Non-native vegetation within the Project area does not conform to any ecological community, nor is it likely to support any threatened species that may occur. Therefore, the Project's proposed impact on non-native vegetation within the site does not constitute a prescribed biodiversity impact.

Prescribed biodiversity impacts	Presence within the Project area
d) the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range (impacts of development on movement of threatened species that maintains their lifecycle *BC Regulation*;	The subject land is linear in shape and extends northward from around the Murrawombie Copper Mine and North East Copper Mine into a large contiguous tract of woodland—much of which is an existing public road (see Figure 6-24). The development, therefore, has some potential to impact connectivity within the southern part of the Project near the Mitchell Highway where the proposal haul road does not include part of an existing road. Vegetation within the remainder of the Project area occurs in an already fragmented condition, with large areas of cleared land present. Much of the Project area has been previously cleared and is disturbed. The primary barrier to connectivity introduced into the landscape will be the proposed infrastructure corridor near the Mitchell Highway. Note: New barriers to connectivity introduced from this will be very limited, with: • the proposed haul road to predominantly use existing public road infrastructure; and • a very small section of new road proposed to connect Okeh Road to the Mitchell Highway, approximately 800 m north of the existing intersection at Girilambone. The proposed infrastructure corridor will be approximately 18 m wide, with haulage vehicle movements to be limited to approximately 82 movements per day. As such, the potential for the development to result in a significant impact on the movement of threatened species (such as a potential vehicle strike on the proposed haul road) is negligible. The development is unlikely to restrict the movement of threatened species such that it impacts their lifecycle.

Prescribed biodiversity impacts	Presence within the Project area
e) the impacts of the Project on water quality, water bodies and hydrological processes that sustain threatened species and TECs (including from subsidence or subsidence resulting from underground mining or other development);	One minor drainage feature is within the Project, and infrastructure corridor sections following existing public roads intersect watercourses. The assessment of impacts on water and flooding is presented in Sections 6.9 to 6.6. Project impacts on surface waters is considered negligible, given the proposed water management and erosion and sediment control measures (refer to Section 6.5). Impacts on groundwater are considered negligible (refer to Section 6.9) and flooding impacts are similarly predicted negligible (Section 6.6). Assessment of potential subsidence impacts is presented in Section 6.2. Given the proposed mining methods, there is low risk of subsidence occurring. Generally, the undeveloped area has low variation in relief, and sheetwash from areas of higher elevation to lower elevation areas (including flooding of small depressions in the landscape) may occur during heavy rainfall. This mapping shows that the Project area is intercepted by three separate unnamed first order streams, two separate second order streams and one fourth order and above level stream in the south of the site (Figure 6-24). All these streams are ephemeral; most carried water in spring 2022 but were dry in autumn 2023. Surface water impact assessment for the Project indicates that the development will have negligible changes on hydrological processes, water bodies and water quality (Appendix 5, Water impact assessment). The Project site is unlikely to be impacted by floodwaters, with only minor changes to floodplain inundation and velocities in localised areas along the proposed haul road. Surface water quality impacts are unlikely, given that the Project infrastructure has been designed to contain major rainfall events. During the construction phase, the development has potential to impact water quality on a local scale through disturbance of soils. A Surface Water Impact assessment has been committed to a Construction Environmental Management Plan for the mitigation of soil and water impacts. Subsidence resulting from the development is likely to be minimal (Appendix, 1 Geotechnical assessment).
f) the impacts of wind turbine strike on threatened and protected animals;	No wind turbines are proposed.
g) the impacts of vehicle strike on threatened species or fauna that are part of a threatened ecological community.	The development will include the construction of a haul road upgrade (where necessary) of approximately 18 m wide. The majority of this haul road upgrade will apply to the existing public road and private tracks, which are currently being used by the public and landholders within the area. During operation, haulage vehicle movements will be limited to approximately 82 movements per day. As such, the potential that the development may result in a significant impact on the movement of a threatened species, such as Major Mitchell Cockatoo, via vehicle strike along the proposed haul road, is negligible. According to the Conservation Advice for this species, vehicle strike is considered a 'minor' consequence (DAWE 2023). **Note:** Vehicle movements associated with mining operations will replace existing vehicle movements to and from the Murrawombie Copper Mine along the existing haul road vehicle track. The development is unlikely to increase the risk of vehicle strikes on threatened species, such as Major Mitchell Cockatoo, that it impacts a local population.

6.7.7 Avoidance and minimisation of impacts

Key measures incorporated into the Project design to avoid biodiversity impacts include the following, which are detailed in Chapter 2, Strategic context, Section 2.8.2:

- Minimise the footprint of the infrastructure corridor by;
    - reducing the infrastructure corridor footprint from the original design width of 50 m to the final proposed design width of 18 m;
    - using existing road networks as much as practicable;
    - avoiding any impacts on threatened plants identified in preliminary surveys (the Greenhood Orchid) through the reduction in infrastructure corridor design width along the Okeh Road;
    - reducing the impacts to 94% of HBTs, initially identified to be impacted through the reduction in infrastructure corridor design width along the existing Okeh Road and the proposed connection to the Mitchell Highway, which reduced the proposed clearing of 159 trees to only 10 trees;
    - burying of the bi-directional pipeline within the infrastructure corridor; and
    - using on-site power generation rather than powerline connection from the Mitchell Highway across remnant vegetation.
- Backfill underground stopes to minimise required waste rock emplacements.
- Design waste rock disposal dump to minimise overall disturbance footprint and allow progressive rehabilitation.
- Use the existing processing facility at the Tritton Copper Mine.
- Select a smaller open cut pit shell option.

6.7.8 Mitigation and management measures

Reasonable and practicable mitigation measures to be undertaken for the Project are outlined in Section 6.7.8.1 and Section 6.7.8.2.

6.7.8.1 Pre-clearance surveys and clearing protocols

Appropriate pre-clearance protocols will be put in place at the time of vegetation clearing. Pre-clearance surveys will confirm the absence of any nesting fauna in trees to be removed. The clearing protocols will include soft-felling techniques and clearing supervision where habitat trees (where nests or other habitat features are identified) are to be removed.

Soft-felling techniques will be adaptive depending on site species conditions but will typically include:

- marking all habitat trees to be cleared and demarcating the clearing boundary to avoid removing or impacting trees to be retained;
- removing the ground-layer and mid-storey vegetation (under-scrubbing) around habitat trees;
- tapping or nudging habitat trees by heavy machinery prior to their removal;
- controlled tree felling using machinery will be implemented to keep hollows intact and limit potential impacts to nesting fauna. Soft felling involves the use of machinery (blade, claw or bucket) positioned at the base of the tree trunk over the structural roots. The position of the machinery on the roots controls the slow drop of the tree; and
- inspecting lowered habitat trees, and capturing and releasing any fauna species present. Injured wildlife is to be taken to an appropriately qualified wildlife carer or the nearest veterinary clinic.

Clearing habitat trees by bulldozing with or without linked chains will not be permitted to prevent increased likelihood of injury or death to fauna;

6.7.8.2 General mitigation measures

In addition to the avoidance and minimisation of potential impacts through Project design and pre-clearance protocols, general mitigation measures have been proposed in Sections 6.7.8.2.1 to 6.7.8.2.10.

6.7.8.2.1. Erosion and sediment control

An erosion and sediment control plan will be prepared and implemented during all Project phases. The erosion and sediment management measures are detailed in Chapter 6, Environmental assessment, Section 6.1, Soil and land capability.

6.7.8.2.2. Air quality management

The Air Quality Management Plan to be developed for the site will ensure that dust levels remain below the relevant criteria for various incremental and cumulative dust metrics at all sensitive receptor locations. The plan will include management to cover:

- general management measures;
- exposed areas and stockpile management measures;
- material handling management measures;
- hauling activities management measures; and
- maintenance of machinery and plant to minimise air pollution.

For more detailed information, refer to Chapter 6, Environmental assessment, Section 6.8, Air quality and greenhouse gas.

6.7.8.2.3. Noise management

As there is no significant noise impact predicted for the Project, no additional operational controls or mitigation measures are considered needed to adequately manage noise impacts. However, measures are proposed to minimise potential noise impacts relating to:

- plant and equipment;
- incident and complaint management;
- unusually noisy activity; and
- maintenance of machinery and plant to minimise noise pollution.

For more detailed information, refer to Chapter 6, Environmental assessment, Section 6.9, Noise and vibration.

6.7.8.2.4. Traffic management

A Traffic Management Plan will be prepared prior to the commencement of construction to manage potential traffic impacts.

In addition, to reduce the potential safety risks at the Mitchell Highway/proposed haulage road intersection, the following strategies have been proposed:

- construction of a short channelised right-turn (CHR) treatment to ensure the adequate warrant.
- no basic left-turn (BAL) or widening of the road at the proposed intersection.

For more detailed information, refer to Chapter 6, Environmental assessment, Section 6.15, Transport.

6.7.8.2.5. Weed management

The Tritton Mine Operations Weed Management Plan will be updated to include management of the Project area and implemented during all Project phases. The performance outcomes of the weed management plans will include:

- controlling all existing weed locations;
- ensuring no new noxious weed infestations are established; and
- ensuring rehabilitation areas are free of noxious weeds.

6.7.8.2.6. Hollow-bearing tree salvage and reuse

When clearing within the Aeris block results in the removal of HBTs with the potential to be Major Mitchell's Cockatoo habitat trees, the HBT will be reused and/or replaced. Salvage and reuse options for HBTs will be assessed, based on the characteristics of trees cleared for the Project.

If suitable, HBTs will be cut and capped, then erected as tree hollows or ground habitats. Nest boxes may also compensate for the HBTs removed. A minimum replacement strategy of 1:1 for every hollow removed will be targeted and should include at least 10 hollows or nest boxes suitable for Major Mitchell's Cockatoo.

6.7.8.2.7. Construction Environmental Management Plan

A Construction Environmental Management Plan will be prepared prior to clearing native vegetation. The Construction Environmental Management Plan will include the following:

- identifying necessary hold points to ensure all biodiversity management actions are met (i.e. pre-clearing surveys followed by stage clearing of vegetation);
- clearing of HBTs to be supervised by a suitably qualified ecologist following the removal of non-habitat vegetation;
- issuing a stop work order if a Major Mitchells Cockatoo is identified utilising a hollow-bearing tree during clearance works;
- preparing maps to identify construction limits and environmentally sensitive areas;
- implementing measures to avoid and minimise indirect impacts to biodiversity values adjacent to the Project site; and
- ensuring the site induction procedure adequately informs Project workers regarding flora and fauna management.

6.7.8.2.8. Flora and Fauna Management Plan

A Flora and Fauna Management Plan will be prepared and approved prior to clearing native vegetation and threatened species habitat within the Project area. The plan will include provision to maintain habitat for native species, in particular the Major Mitchell's Cockatoo. Habitat maintenance will include assurance that clearing is restricted to approved disturbance areas.

The plan will include management methods for dealing with injured fauna. When injured animals are identified, the relevant local wildlife rescue agency (e.g. WIRES) and/or veterinary surgery will be contacted as soon as practical and immediate care will be provided to the animal.

6.7.8.2.9. Bushfire Management Plan

Aeris will update the Tritton Operations Bushfire Management Plan to include the Project areas:

- the Aeris block where the new road is proposed; and
- the impacts on conservation significant species location.

The plan will provide for the management and control of fire hazards by:

- monitoring and maintaining areas for bushfire hazards;
- identifying the response to control outbreaks of fires; and
- protecting the biodiversity habitat within the Aeris block from fire damage.

6.7.8.2.10. General mitigation measures

Site inductions during construction will include a briefing regarding the local fauna of the site and protocols to be undertaken if fauna is encountered.

Vegetation occurring within the first 30 m of the boundary of the Project area will be monitored to ensure it is not being indirectly impacted by construction for the development (e.g. establishment of weeds, erosion and sedimentation or from earthworks).

When impacts are detected, the Project ecologist would prepare an adaptive management plan to avoid further impacts.

6.7.9 Biodiversity credit summary

The Project will cause biodiversity impacts requiring offsets according to the BAM. The required offsets have been identified using the BAM calculator, and the ecosystem credits required to offset the proposal are provided in Table 6-31.

A total of 259 ecosystem credits is required to offset the proposed development. The Project design decisions have achieved avoidance of any impacts requiring species credits.

Table 6-31: Ecosystem credits summary and credit profiles

PCT	Condition class	Credits required
PCT 103 Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland, mainly in the Cobar Peneplain Bioregion	Woodland	232
	Open woodland	25
	DNG	0
	Sub-total	257
PCT 105 Poplar Box grassy woodland on flats, mainly in the Cobar Peneplain Bioregion and Murray Darling Depression Bioregion	Intact	2
	Sub-total	2
	Total ecosystem credits required	**259**

6.7.10 Conclusion

The assessment of Project biodiversity impacts is provided in full in Appendix 2, BDAR. The Project design has avoided any impacts requiring species credits offsets. A total of 259 ecosystem credits are required.

6.8 Air quality and greenhouse gas

6.8.1 Introduction

An air quality impact assessment was completed by Todoroski Air Sciences Pty Ltd to assess the potential impacts of the Project on air quality. This assessment was prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2022b). The assessment is provided in Appendix 8A, Air quality impact assessment.

An assessment of the potential for emissions of metals in dust was also completed by Todoroski Air Sciences Pty Ltd. This assessment addresses the outcomes of the recent Parliamentary Inquiry on the 'Current and potential impacts of gold, silver, lead and zinc mining on human health, land, air and water quality in New South Wales' (PLC 2023). The assessment is provided in Appendix 8B, Metal emissions assessment.

Further, a greenhouse gas assessment was completed by AARC Environmental Solutions Pty Ltd to assess the potential greenhouse gas impacts of the Project. This assessment was prepared in accordance with the NSW Planning Secretary's Environmental Assessment Requirements (SEARs) and the National Greenhouse and Energy Reporting framework. The assessment is provided in Appendix 14, Greenhouse gas assessment.

6.8.2 Assessment requirements

The Project SEARs includes requirements related to assessing impacts to air quality and greenhouse gas emissions. These requirements are provided in Table 6-32.

Table 6-32: Air quality assessment requirements

Assessment matter	Report locations
Assess the likely air quality impacts of the development, including cumulative impacts from nearby developments, in accordance with the 'Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW' (2016) (or its latest version) and having regard to the NSW Government's Voluntary Land Acquisition and Mitigation Policy	Section 6.8.7 Section 6.8.7.3 (cumulative impacts) Sections 6.8.4.1 and 6.8.7.4 (VLAMP)
Assess the ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations Act 1997* and the Protection of the Environment Operations (Clean Air) Regulation 2010	Section 6.8.7 Appendix 8A, Air quality assessment, Section 7
Assess the likely greenhouse gas impacts of the development, including measures to minimise emissions	Section 6.8.9 Appendix 14, Greenhouse gas assessment, Sections 3 and 4
Describe the measures that would be implemented to monitor and report on air emissions (including fugitive dust and greenhouse gases) of the development;	Sections 6.8.8 and 6.8.10 Appendix 8A, Air quality assessment, Section 8 and Appendix 14, Greenhouse gas assessment, Section 4

Air quality assessment

6.8.3 Existing environment

The Project site is characterised as rural, with scattered residential dwellings. The topography is relatively flat with undulating hills to the west of the Project.

Land use within the Project site is primarily agriculture (grazing and cropping activity), some mining as well as urban settlements. The existing air quality of the Project is, therefore, currently influenced by the following activities:

- agriculture;
- mining;
- anthropogenic activities, including:
    - motor vehicles;
    - transport on unsealed roads;
    - domestic wood heaters;
- natural events, including:
    - bushfires; and
    - dust storms.

6.8.3.1 Local meteorological conditions

Long-term climatic data from the closest Bureau of Meteorology weather station (Cobar Airport Automatic Weather Station, Site No. 048237) has been analysed to characterise the local climate of the Project site.

Annually, winds predominantly follow a north-east to south-west axis at the Project site. Annual average windspeed is approximately 17 km per hour (as recorded in the afternoons) with humidity averaging 57 % at 9 am and 34 % at 3 pm (across all seasons). Annual rainfall for the Project site is 351 mm.

Note: The Cobar Airport weather station meteorological data from the year 2021 was used for dispersion modelling. This year was identified by recording conditions closest to the long-term averages for the relevant climatic variables. The meteorological modelling methodology undertaken for the Project applied prognostic model data from The Air Pollution Model, supported by surface observations.

6.8.3.2 Baseline air quality

A regular ambient air quality monitoring dataset was not available close to the Project. The nearest publicly available air quality monitoring data is the NSW Government monitors operating at Narrabri, Gunnedah and Orange. These monitors are approximately 285 km north-east (Narrabri), 313 km east (Gunnedah) and 313 km south-east (Orange) from the Project.

As per the 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales' (EPA 2022b) in the absence of site-specific monitoring data, data obtained from the closest monitoring station/s can be used to characterise the ambient background air quality levels for the Project. This has been necessary to develop baseline air quality conditions for the Project. However, the dust deposition monitoring data from the region (Tritton, the Murrawombie and Avoca Tank mining areas) was used to further inform background air quality conditions developed for the Project.

The monitoring stations used to inform baseline air quality conditions are considered to provide a conservative estimate of the local baseline (i.e. worse than what is existing), as they are closer to urban centres than the Project. Therefore, they represent potentially higher air emissions sources from traffic, industrial, commercial and urban activities. As such, a conservative estimate of background air quality conditions has been adopted for the Project. Background air quality levels developed for the Project are shown in Table 6-33.

Table 6-33: Summary of background air quality levels

Pollutant	Background level	Units
Annual average Total Suspended Particulates (TSP)	25.1	ug/m^3
24 hr average PM_{10}	Daily varying	—
Annual average PM_{10}	7.0	ug/m^3
24 hr average $PM_{2.5}$	Daily varying	—
Annual average $PM_{2.5}$	3.1	ug/m^3
Annual average deposited dust	1.4	g/m^2/month

6.8.4 Relevant air quality criteria

Air quality criteria are benchmarks set to protect the general health and amenities of the community. Air quality criteria relevant to the Project are provided in the 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales' (EPA 2022b), as shown in Table 6-34.

Table 6-34: NSW EPA air quality impact assessment criteria

Pollutant	Averaging period	Impact	Criterion
TSP	Annual	Total	90 ug/m^3
PM_{10}	Annual	Total	25 ug/m^3
	24 hour	Total	50 ug/m^3
$PM_{2.5}$	Annual	Total	8 ug/m^3
	24 hour	Total	25 ug/m^3
Deposited dust	Annual	Incremental	2 g/m^2/month
		Total	4 g/m^2/month

Source: EPA 2022b
Ug/m^3 = micrograms per cubic metre
g/m^2/month = grams per square metre per month

6.8.4.1 Voluntary land acquisition and mitigation policy

The NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments (NSW Government 2018) describes the NSW Government's policy for voluntary mitigation and land acquisition to address particulate matter impacts from state significant mining, petroleum and extractive industry developments. The NSW VLAMP is introduced in Chapter 2, Strategic context, Section 2.7.2.

VLAMP criteria for particulate matter mitigation are provided in Table 6-35, while criteria for particulate matter acquisition are provided in Table 6-36.

Table 6-35: VLAMP particulate matter mitigation criteria

Pollutant	Averaging period	Mitigation criterion		Impact type
$PM_{2.5}$	Annual	8 ug/m^3*		Human health
$PM_{2.5}$	24 hour	25 ug/m^3**		Human health
PM_{10}	Annual	25 ug/m^3*		Human health
PM_{10}	24 hour	50 ug/m^3**		Human health
TSP	Annual	90 ug/m^3*		Amenity
Deposited dust	Annual	2 g/m^2/month**	4 g/m^2/month*	Amenity

Source: NSW Government 2018
**Cumulative impact (i.e. increase in concentration due to the development, plus background concentrations due to all other sources).*
***Incremental impact (i.e. increase in concentrations due to the development alone) with zero allowable exceedances of the criteria over the life of the development.*

Table 6-36: VLAMP particulate matter acquisition criteria

Pollutant	Averaging period	Mitigation criterion		Impact type
$PM_{2.5}$	Annual	8 ug/m^3*		Human health
$PM_{2.5}$	24 hour	25 ug/m^3**		Human health
PM_{10}	Annual	25 ug/m^3*		Human health
PM_{10}	24 hour	50 ug/m^3**		Human health
TSP	Annual	90 ug/m^3*		Amenity
Deposited dust	Annual	2 g/m^2/month**	4 g/m^2/month*	Amenity

Source: NSW Government 2018
**Cumulative impact (i.e. increase in concentration due to the development, plus background concentrations due to all other sources).*
***Incremental impact (i.e. increase in concentrations due to the development alone) with up to five allowable exceedances over the life of the development.*

Note: Both mitigation and acquisition criteria are identical here, with the exception of the footnotes for the 24-hour average $PM_{2.5}$ and PM_{10}. While mitigation criteria prohibit any exceedances of the criteria, acquisition criteria allow up to five exceedances over the life of the development. Another notable distinction between the two sets of criteria is that they apply to existing residences or, in the case of the acquisition criteria, land where a residence can be built.

VLAMP rights may apply at any residence on privately owned land or any workplace on privately owned land when, even with best practice management, the development contributes to exceedances of the relevant criteria. In regard to acquisition criteria, these extend to impacts that may occur on more than 25% of the land where there is a dwelling or where a dwelling could be built under existing planning controls. An assessment of VLAMP criteria for the Project is provided in Section 6.8.7.4.

6.8.5 Sensitive receptors

A total of 35 sensitive receptors were identified to exist within the proximity of the Project and proposed haul route. The location of sensitive receptors is shown in Figure 6-29 and Table 6-37.

Note: The nearest residential dwelling to the Project site is approximately 4.6 km to the west (identified as R2). The nearest dwelling to the haul road is approximately 55 m to the west (identified as R15), noting that the haul road here is the existing Mitchell Highway.

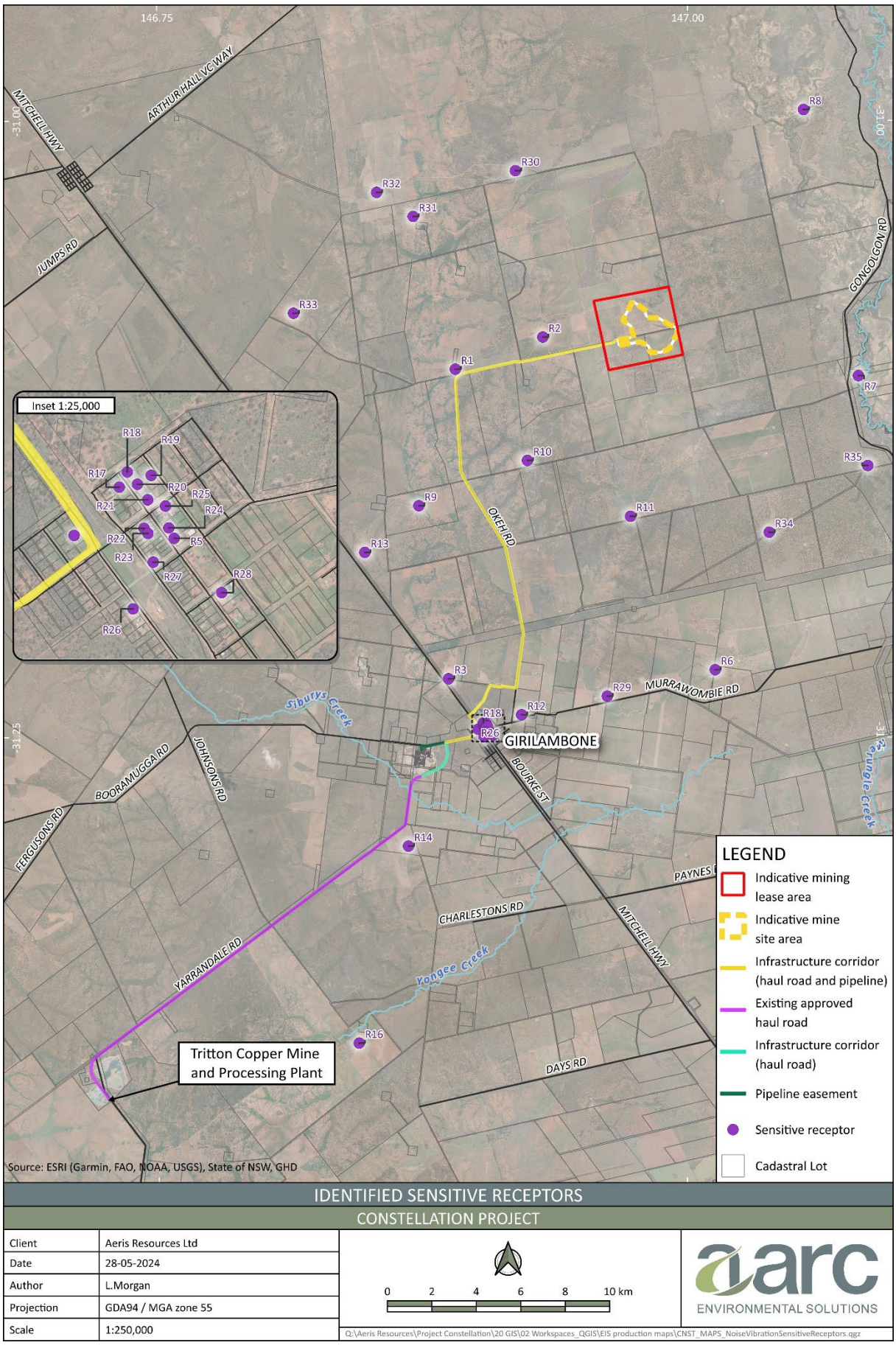


Figure 6-29: Air quality sensitive receptors

Table 6-37: Sensitive receptors identified for the Project

Receptor location ID	X-coordinates (m)	Y-coordinates (m)	Approximate distance from Project site (km)	Approximate distance from haul road (km)	Receptor classification
R1	489555	6559218	8.7	0.3	Homestead
R2	493490	6560660	4.6	0.9	Homestead
R3	489251	6545304	18	1.8	Homestead
R5	491032	6543023	19.3	0.7	Residence
R6	501245	6545711	15.6	8.8	Homestead
R7	507687	6558927	9.8	11.8	Homestead
R8	505215	6570886	12.2	14.0	Homestead
R9	487912	6553080	12.9	2.5	Homestead
R10	492797	6555115	7.9	3.0	Residence
R11	497434	6552606	8.4	5.8	Homestead
R12	492536	6543686	18.2	1.2	Industrial
R13	485483	6550982	16.1	5.8	Homestead
R14	487446	6537784	25.5	0.8	Homestead
R15	490582	6543036	19.5	0.05	Residence
R16	485231	6528933	34.6	6.6	Homestead
R17	490785	6543253	19.2	0.2	Residence
R18	490821	6543321	19.1	0.3	Residence
R19	490929	6543306	19.1	0.4	Residence
R20	490867	6543266	19.1	0.3	Residence
R21	490913	6543196	19.2	0.3	Residence
R22	490897	6543068	19.3	0.2	Residence
R23	490914	6543045	19.3	0.2	Residence
R24	491008	6543070	19.3	0.3	Residence
R25	490993	6543168	19.2	0.4	Residence
R26	490847	6542706	19.7	0.3	Residence
R27	490938	6542916	19.4	0.3	Residence
R28	491246	6542779	19.5	0.6	School
R29	496389	6544522	15.0	5.9	Homestead
R30	492258	6568137	6.9	8.5	Residence

Receptor location ID	X-coordinates (m)	Y-coordinates (m)	Approximate distance from Project site (km)	Approximate distance from haul road (km)	Receptor classification
R31	487654	6566080	9.0	7.5	Residence
R32	486012	6567161	10.9	9.1	Residence
R33	482275	6561731	13.5	7.9	Residence
R34	503675	6551890	9.4	11.7	Residence
R35	508109	6554886	10.0	16.7	Residence

6.8.6 Air quality assessment criteria

6.8.6.1 Emission sources and pollutants

The production schedule for the Project (as defined in Chapter 3, Project description) proposes open cut mining for approximately two years, followed by underground mining activities. For the purposes of the air quality assessment, it has, therefore, been assumed that the maximum waste rock placement at the site will occur simultaneously with maximum ore production being dispatched to the Tritton Copper Mine processing facility. This modelling assumption represents a worst-case scenario for air quality due to the potential for maximum dust generation.

Significant dust-generating activities associated with the Project have been identified as follows:

- topsoil removal and handling;
- open cut mining (including excavating, handling, transporting and stockpiling of material);
- loading/unloading of material;
- crushing and screening;
- off-site haulage of material on unsealed roads (to and from Tritton);
- general vehicle movements; and
- windblown dust from exposed areas and stockpiles.

As the haul route sections of the Mitchell Highway and Yarrandale Road are both sealed roads, they will generate negligible dust emissions. These areas have, therefore, been excluded from the air quality modelling undertaken for the Project.

Dust emissions estimates were calculated by analysing various types of dust-generating activities and applying locally-developed and international air quality dust generation standards. The impacts of the pollutant sources were determined against the relevant impact assessment criteria in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2022b).

6.8.7 Air quality impact assessment

Air dispersion modelling using the CALPUFF model was applied to predict the potential for off-site dust impacts on the surrounding area due to Project operations. The Project air quality modelling methodology is further detailed in Appendix 8A, Air quality impact assessment, Section 6.3.

The dispersion modelling predicted the impacts of the Project in isolation (incremental impact) and the Project in consideration of other sources (cumulative impact). Meteorological conditions associated with dust generation (such as windspeed, temperature, mixing height) and level of dust generation were included in calculated emission rates. The assessment was conducted on modelled maximum 24-hour average levels based on the highest predicted 24-hour average concentrations and the highest impact day of the modelling period. In this regard, the modelling is considered to be conservative.

An additional assessment was undertaken to evaluate the potential impacts of airborne metal emissions on air quality (refer to Appendix 8B, Metal emissions assessment) using an approach to address the outcomes of the Parliamentary Inquiry (PLC 2023).

6.8.7.1 Maximum 24-hour and annual average dust concentrations

Modelled results show that minimal incremental effects would arise at sensitive receptor locations, resultant of both the Project and off-site haulage activities (Table 6-38). The predicted cumulative results indicate that all the assessed receptors are predicted to experience levels below the relevant criteria for each of the assessed dust metrics. These findings apply to:

- maximum 24-hour average $PM_{2.5}$ and PM_{10} concentrations;
- annual average $PM_{2.5}$, PM_{10} and Total Suspended Particulates (TSP) concentrations; and
- annual average dust (insoluble solids) deposition rates.

Table 6-38: Dust dispersion modelling results

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/mth)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	DD* (g/m²/mth)
	Incremental						Cumulative			
	24-hr ave.	Ann. ave.	24-hr ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.
	Air quality impact criteria									
	—	—	—	—	—	2	8	25	90	4
R1	1.5	0.2	11.3	1.8	3.8	0.1	3.3	8.8	28.9	1.5
R2	3.3	0.4	19.9	2.9	6.1	0.2	3.5	9.9	31.2	1.6
R3	0.5	0.1	4.3	0.6	1.2	<0.1	3.2	7.6	26.3	1.4
R4	0.4	0.1	3.2	0.5	1.0	<0.1	3.2	7.5	26.1	1.4
R5	0.8	0.1	7.7	0.6	1.2	<0.1	3.2	7.6	26.3	1.4
R6	0.3	<0.1	1.6	0.1	0.2	<0.1	3.1	7.1	25.3	1.4
R7	0.6	<0.1	3.5	0.2	0.3	<0.1	3.1	7.2	25.4	1.4
R8	0.4	<0.1	2.4	0.2	0.3	<0.1	3.1	7.2	25.4	1.4
R9	0.8	0.1	5.4	0.8	1.5	<0.1	3.2	7.8	26.6	1.4
R10	0.8	0.1	4.7	0.7	1.3	0.1	3.2	7.7	26.4	1.5
R11	0.5	0.1	3.3	0.4	0.6	<0.1	3.2	7.4	25.7	1.4
R12	0.7	0.1	6.5	0.5	1.2	<0.1	3.2	7.5	26.3	1.4
R13	0.4	<0.1	2.7	0.3	0.5	<0.1	3.1	7.3	25.6	1.4
R15	1.1	0.1	10.6	0.9	2.3	0.1	3.2	7.9	27.4	1.5
R17	1.5	0.1	14.2	1.2	3.0	0.1	3.2	8.2	28.1	1.5
R18	1.7	0.1	16.1	1.3	3.4	0.1	3.2	8.3	28.5	1.5
R19	1.2	0.1	11.4	1.0	2.4	0.1	3.2	8.0	27.5	1.5
R20	1.3	0.1	12.6	1.0	2.5	0.1	3.2	8.0	27.6	1.5
R21	1.0	0.1	9.6	0.8	1.9	0.1	3.2	7.8	27.0	1.5
R22	1.0	0.1	9.6	0.7	1.5	0.1	3.2	7.7	26.6	1.5
R23	1.0	0.1	9.3	0.6	1.4	0.1	3.2	7.6	26.5	1.5
R24	0.9	0.1	8.1	0.6	1.3	<0.1	3.2	7.6	26.4	1.4
R25	0.9	0.1	8.2	0.7	1.6	0.1	3.2	7.7	26.7	1.5
R26	0.5	<0.1	4.9	0.4	0.8	<0.1	3.1	7.4	25.9	1.4
R27	0.9	0.1	8.1	0.5	1.1	<0.1	3.2	7.5	26.2	1.4

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/mth)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	DD* (g/m²/mth)
	Incremental						Cumulative			
	24-hr ave.	Ann. ave.	24-hr ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.
	Air quality impact criteria									
	—	—	—	—	—	2	8	25	90	4
R28	0.6	<0.1	5.2	0.4	0.7	<0.1	3.1	7.4	25.8	1.4
R29	0.3	0.0	2.0	0.2	0.4	<0.1	3.1	7.2	25.5	1.4
R30	0.8	0.1	4.4	0.4	0.6	<0.1	3.2	7.4	25.7	1.4
R31	0.6	<0.1	3.3	0.3	0.4	<0.1	3.1	7.3	25.5	1.4
R32	0.4	<0.1	2.4	0.2	0.3	<0.1	3.1	7.2	25.4	1.4
R33	0.4	<0.1	2.4	0.2	0.3	<0.1	3.1	7.2	25.4	1.4
R34	0.5	<0.1	2.6	0.2	0.2	<0.1	3.1	7.2	25.3	1.4
R35	0.4	<0.1	2.3	0.1	0.2	<0.1	3.1	7.1	25.3	1.4

As reasonably expected, the greatest incremental impacts are predicted to be experienced at receptors closest to the Project's activities (e.g. R2) and the haul route (e.g. R1, R17 and R18).

Note: While R15 is the receptor closest to the haul route, predicted dust impacts significantly reduce as trucks travelling on the haul route join the Mitchell Highway (a sealed road) north of Girilambone. This reinforces the benefit derived from the proposed new section of haul road (north of Girilambone) to mitigate air quality impacts on the Girilambone township.

6.8.7.2 Total 24-hour cumulative dust impact

The modelled results for the incremental 24-hour average $PM_{2.5}$ and PM_{10} concentrations indicate no predicted exceedances of the relevant criterion at the sensitive receptors for the assessed scenarios. However, these maximum measured 24-hour concentrations from the baseline dataset adopted have in the past exceeded (or came close to) the relevant criteria. As a result, the NSW EPA Level 1 contemporaneous assessment approach (EPA 2022b) of adding maximum background levels to maximum predicted levels from the Project would show levels above the criterion, even without the Project.

As such, the Level 2 contemporaneous assessment approach was applied (EPA 2022b) to assess potential $PM_{2.5}$ and PM_{10} impacts. The level 2 assessment involves matching one year of ambient air quality monitoring data with meteorological data for the same period. This was undertaken for the receptor most impacted by the Project (R2). Results of this assessment are provided in Table 6-39.

Table 6-39: Maximum number of additional days above 24 hr average

Receptor ID	$PM_{2.5}$	PM_{10}
R2	0	0

This assessment indicates that the Project does not increase the number of days above the 24-hour average criterion at the assessed receptor (R2) for $PM_{2.5}$ and PM_{10}. Based on this result, it can be inferred that the

Project does not increase the number of days above the 24-hour average $PM_{2.5}$ and PM_{10} criterion at any sensitive receiver.

While R2 is the closest receptor to the Project, the residence is approximately 4.6 km from the Project and approximately 900 m from the haul road (the existing Okeh Road section). Further, local meteorological conditions are favourable to predicted air quality conditions, with dominant winds (which follow a north-east to south-west axis) not anticipated to facilitate the transfer of dust emissions towards R2.

6.8.7.3 Emissions from other mining operations

In addition to the Project, air emissions from nearby approved mining operations (Murrawombie Copper Mine, Avoca Tank Copper Mine and Tritton Copper Mine) were also considered in relation to potential cumulative impacts.

In this regard, background dust levels used for the assessment were inclusive of dust generated from nearby approved mining operations (refer to Appendix 8A, Air quality impact assessment, Section 5.3). As such, applying the incremental contribution from the Project to these background levels adequately represents the cumulative contribution.

Further to this, there is limited potential for cumulative air quality impacts due of the Project's:

- isolated nature of operations;
- distance from surrounding residences;
- application of management measures; and
- application of operational controls.

6.8.7.4 Assessment of VLAMP criteria

An assessment of VLAMP criteria was undertaken for the Project, with particulate matter levels calculated in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2022b).

Predictions of particulate matter levels (for $PM_{2.5}$ and PM_{10}) at all sensitive receptor locations (as per Table 6-38) illustrates that exceedance of VLAMP criteria is not anticipated.

6.8.7.5 Metal emissions impact

Airborne metal emissions are typically generated from the same activities that generate dust emissions—that is, during the extraction, handling and processing of material.

For the proposed open cut mining activity, overburden and waste rock have been identified as having a minimal composition of metals. Ore will also be extracted mechanically, so no associated activities are expected to generate significant airborne metal emissions. For underground operations, intensive processing will occur only on the surface, with no underground processing to influence ventilation air. Hence, the potential for generating material metal emissions from the Project is expected to be minimal.

For the airborne dust emissions that may be generated at the site, any potential metal dispersion would be limited, due to the relative density of particles containing heavier metals. Indeed, any airborne materials containing metals would be likely to deposit closer to the source, as opposed to the general dust emissions modelled in the Air Quality Impact Assessment (Appendix 8A). Therefore, it is inferred that no significant impact of metal emissions is anticipated, and the proposed dust emission mitigations are expected to be effective to minimise any potential impacts of metal emissions.

6.8.8 Air quality commitments and management measures

Aeris is committed to undertake reasonable and practicable dust mitigation measures, as follows:

General management measures

- Activities will be assessed during adverse weather conditions and modified as required (e.g. cease activity when reasonable levels of dust cannot be maintained using the available means).
- Weather forecasts will be checked prior to undertaking material handling or processing.
- Engines of on-site vehicles and plant will be switched off when not in use for extended periods.
- Vehicles and plant will be fitted with pollution reduction devices when practicable.
- Vehicles will be maintained and serviced to an appropriate standard.
- Visual monitoring of activities will be undertaken to identify dust generation.

Exposed areas and stockpile management measures:

- The extent of exposed surfaces and stockpiles will be kept to a minimum.
- Exposed areas and stockpiles will be dampened with water as far as is practicable if dust emissions are visible.
- Dust generation will be minimised by undertaking rehabilitation earthworks when topsoil and subsoil stockpiles are moist and/or wind speed is below 10 m/s.

Material handling management measures:

- Drop heights will be reduced from loading and handling equipment when practical.
- Material will be dampened during handling when it is excessively dusty.

Hauling activities management measures:

- Unsealed haul roads (including the haul route from the Project site to the Mitchell Highway) should be watered using water carts such that the road surface has sufficient moisture to minimise on-road dust generation but not so much as to cause mud/dirt track washout to occur.
- Regularly inspect haul roads to ensure they remain in good operational condition.
- Driveways and hardstand areas to be swept/cleaned regularly as required.
- Vehicle traffic is to be restricted to designated routes.
- Speed limits are to be enforced.
- Vehicle loads are to be covered when travelling off site.

The Air Quality Management Plan developed for the site will seek to ensure that dust levels remain below the relevant criteria at all sensitive receptor locations. The above dust control measures are also expected to be effective in reducing potential airborne metal emissions.

Greenhouse gas assessment

6.8.9 Greenhouse gases

A greenhouse gas assessment was undertaken for the Project by AARC Environmental Solutions Pty Ltd to assess the potential greenhouse gas impacts. This assessment was prepared in accordance with the Project SEARs and according to the National Greenhouse and Energy Reporting framework. The assessment report is provided in Appendix 14, Greenhouse gas assessment.

The assessment included emission sources assessed as scope 1, scope 2 and scope 3 emissions. These emissions sources are briefly identified as follows:

- **Scope 1** emissions are direct GHG emissions from the proposed Project, such as the use of diesel, explosives and the generation of fugitive emissions through the mining process.
- **Scope 2** emissions are indirect emissions from the generation of purchased electricity (noting that this is not proposed to occur for the Project).
- **Scope 3** emissions are indirect GHG emissions generated as a result of activities undertaken either upstream or downstream of the proposed Project, (e.g. the use of copper produced by the Project).

Annual scope 1 and 2 emissions for the Project's peak emission year represent approximately 0.01% of Australia's total emissions. The contributing sources for the peak year (Project Year 2) are (in order of emissions):

- Scope 1 emissions:
  - Site power as diesel fuel combustion—23.0 kilotonnes CO^2-e;
  - Diesel fuel combustion—13.9 kilotonnes CO^2-e; and
  - Explosives—0.25 kilotonnes CO^2-e.
- Scope 3 emissions:
  - Sea transport to end user—2.1 kilotonnes CO^2-e;
  - Rail transport to port—0.81 kilotonnes CO^2-e; and
  - Transport concentrate to the Tritton Copper Mine processing plant—0.04 kilotonnes CO^2-e.

The principal emissions sources are:

- site power from the diesel generator; and
- diesel fuel usage in the mining fleet.

6.8.10 Greenhouse gases commitments and management measures

6.8.10.1 Contributions to economy-scale emission avoidance

In accordance with the NSW *Climate Change (Net Zero Future) Act 2023* (as introduced in Chapter 5, Statutory Context, Section 5.4.3.3), the NSW Government has developed the NSW Net Zero Plan, Stage 1: 2020–2030 (DPIE 2020b). This Plan is the foundation of NSWs action on climate change, and it outlines the NSW Government's plan for the economy and emissions reduction during the period, which is ultimately to achieve net zero emissions by 2050. There are four priorities under the plan to reach this goal:

1) Drive the uptake of emissions reduction technologies that also support economic growth and reduce the cost of living and doing business.

2) Empower consumers and businesses to make sustainable choices.
3) Invest in the next wave of emissions reduction innovation to ensure economic prosperity from decarbonisation beyond 2030.
4) Ensure the NSW Government leads by example.

Priorities one to three are reliant on the:

- availability of low-carbon technologies
- economy-wide adoption of such technologies; and
- cost of these technologies decreasing.

Key to this is the production of materials that support the electrification of the economy and allows low-carbon technologies to outcompete emission-intensive alternatives.

Copper is an essential metal for low-carbon technologies and renewable energy production, with uses in all aspects of electrification of society, including:

- manufacture of batteries (including electric vehicle batteries)
- solar photovoltaic systems; and
- wind turbines.

Accordingly, copper is identified as a critical mineral for NSW under the Critical Minerals and High-Tech Metals Strategy (DRNSW 2021).

The Project is also essential to allow the continued operation of the Tritton Copper Mine processing facility, which will facilitate continued copper and essential minerals production in the region (and in NSW) beyond the lifetime of the Project. The copper produced by the Project will also be available to international markets to support the ongoing development of low-carbon technologies. In this regard, the Project will facilitate the avoidance of future greenhouse gas emissions in NSW to support the achievement of the NSW emissions plan, as well as contribute to global emissions avoidance.

6.8.10.2 Project design emission avoidance

Several Project design considerations have been adopted to support the minimisation of greenhouse gas emissions. These strategies, along with the rationale of Project design decisions with respect to greenhouse gas emissions, are discussed in Sections 6.8.10.2.1 to 6.8.10.2.8.

6.8.10.2.1. Power supply infrastructure

Five potential power supply options were considered for the Project:

1) grid power with backup diesel generator for essential loads;
2) grid power with solar PV and a backup diesel generator for essential loads;
3) off-grid solar PV with a diesel generator;
4) off-grid solar PV with battery storage and a diesel generator; and
5) wind power generation.

Wind power was determined not to be viable for the Project due to a combination of low wind speeds, reliability and capital costs. Considerations for grid connection included the available capacity of the existing grid, which identified that there was currently insufficient capacity. Upgrading the existing grid to be able to supply the necessary capacity would have significant capital and time implications for the Project. Solar PV

options provided the advantage of long-term economic benefits and disadvantages in terms of large capital investment, particularly if battery storage is required for nighttime supply.

Indicative relative costs of power supply options 1 to 4 were estimated through a Project options study conducted in 2022 and are shown in Table 6-40.

Table 6-40: Power supply options relative costs summary

Option	Capital costs as % of option 1*	Annual costs as % of option 1*	Net costs^ as % of option 1*
Option 1: grid power with diesel generator backup	100%		
Option 2: hybrid grid and solar PV with diesel generator backup	155%	68%	94%
Option 3: solar PV and diesel generator	71%	212%	168%
Option 4: solar PV and battery storage with diesel generator backup	638%	16%	206%

*Excluding additional capital costs to upgrade the grid.
^ Net costs account for predicted changes in annual costs over infrastructure life.

Option 3, consisting of off-grid solar PV (providing 30% of the site requirements and diesel generator providing the remaining 70%) was selected for the Project. This option is considered to effectively satisfy maximum power demand without a large excess generation, which would be wasted without battery storage capacity or grid connection. The chosen option represents:

- a low total capital cost option (approximately 71% of option 1);
- a high annual cost for the life of mine (approximately 212% of the cost of option 1);
- a high net cost (approximately 168% of option 1);
- a substantial capital outlay for the solar component upfront (approximately $2 million), which the alternative options do not incur as an initial cost.

Therefore, the chosen option can be considered to achieve the positive outcome of reduced greenhouse gas emissions through solar power generation at the outlay of the initial capital expense for the solar plant, while retaining the required reliability of on-site diesel power generation. The solar PV set-up is expected to generate approximately 11,290 MWh per year. Given that the diesel generator will emit approximately 726 kg of CO_2 per MWh (refer to Appendix 14, Greenhouse gas assessment), solar generation is considered to represent avoidance of approximately eight kilotonnes of CO_2-e per year.

Option 4, which would have provided the greatest greenhouse gas emission minimisation, is considered prohibitively expensive largely due to the capital cost of the battery component.

6.8.10.2.2. Maintenance of existing infrastructure

On-site processing options were considered during the Project design. The life of mine, status of Tritton processing plant and transport requirements were considerations for potential options.

Continued use of the existing processing infrastructure at Tritton, rather than constructing facilities at the Constellation site, represents a considerable avoidance of emissions. New processing facilities at Constellation would have resulted in emissions from the additional project footprint size, associated fuel use for construction and emissions associated with the construction materials. These emissions are avoided by the adoption of the proposed design, and potential future emissions are avoided by maintaining the Tritton processing facility for the processing of ore from other future satellite deposits in the region.

6.8.10.2.3. Water management

The Project is proposed to be a nil water release site, with water managed and treated for reuse. A bi-directional pipeline to Aeris' Murrawombie Mine is also proposed to provide/receive Project water when on-site management is unable to achieve requirements.

Maximising water reuse will minimise requirements for pumping to and from Murrawombie, as well as minimise the need to draw on local water sources under licensing arrangements. Pumping to and from the Murrawombie Copper Mine or local river systems will generate greenhouse gas emissions, so the proposed management strategy is, therefore, designed to minimise potential emissions.

6.8.10.2.4. Tailings reuse

Tailings material will be reused as paste backfill for underground stopes. Alternative backfill paste options would require obtaining materials quarried from alternative sources, with consequential greenhouse gas emissions. The proposed approach, therefore, represents a sustainable reuse of materials and avoidance of greenhouse gases associated with alternative sources of materials.

6.8.10.2.5. Haul truck dual use

Project ore will be transported to the Tritton processing facility by road, with some tailings material subsequently transported back to the Project by the same haulage vehicles. Using these vehicles in both directions of travel represents an efficient use of transport resources and will avoid greenhouse gas emissions by minimising the fuel for the necessary transport of materials.

6.8.10.2.6. Site transport

During Project operation, staff access to the site will predominantly be via a 12-seater shuttle bus, with approximately 65% of staff movements in this transport form. This arrangement will reduce the potential greenhouse gas emissions compared to staff transport by light vehicles.

6.8.10.2.7. Site layout design

The Project layout has been designed to minimise the disturbance footprint, which concurrently minimises greenhouse gas emissions. The Project footprint is considered to be the smallest possible while still providing all necessary functionality; therefore minimising potential greenhouse gas emissions resulting from vegetation clearing.

The Project layout has also been designed to prioritise efficiency in the haulage of material around the site between the:

- open cut;
- waste rock emplacement;
- heap leach; and
- underground mine.

Relevant design features include the minimisation of haul distances, as well as the minimisation of road slopes. The proposed approach will minimise fuel consumption for haulage and consequently minimise greenhouse gas emissions.

6.8.10.2.8. Haulage and access route design

Multiple options for the access and haulage route were considered during the decision-making process, taking into account the requirements of the following:

- landholders;
- Bogan Shire Council; and
- Transport for NSW.

The route adopted aims to minimise disturbance and travel distances by using the existing road network as much as possible. These design decisions minimise potential greenhouse gas emissions by reducing the Project disturbance footprint and associated vegetation clearing; therefore, minimising fuel use for transport by adopting the shortest feasible haulage route.

The initial haul road design was for a width of up to 50 m for the portions of the new road sections. Consideration of the consequences of clearing vegetation for this road width ultimately led to a reduction of 18 m. The decision to use the narrower road design achieves a reduction of approximately 28 ha in clearing of mature eucalypt woodland. A conservative estimation of carbon stock for this vegetation is equivalent to 70 tonnes of carbon dioxide per hectare (Peeters and Butler 2014). The redesign of the haul road is, therefore, conservatively considered to represent the avoidance of at least 1,960 tonnes of CO_2-e.

6.8.10.3 Potential emission avoidance measures

The NSW EPA Climate Change Action Plan 2023-26 (EPA 2023) outlines staged actions with consequence for greenhouse gas emission reporting and management. Under the plan, there are no current reporting or mitigation requirements. However, future emission reductions targets will likely be set, and a climate change mitigation and adaptation plan may be required.

Reasonable and practicable greenhouse gas emission mitigation measures are recommended in Appendix 14, Greenhouse gas assessment. These measures will provide a basis for a climate change mitigation and adaptation plan, which is understood to be a likely future requirement for the Project to conform with the NSW Climate Change Action Plan 2023–26 (EPA 2023). Aeris will, therefore, undertake the proposed measures:

Equipment and energy efficiency management measures

- Energy efficiency will be an included criterion when selecting diesel and electric powered motors and other equipment for purchase.
- Energy efficiency will be an included criterion when selecting mining tools and heavy mining equipment.
- The potential for alternate mining tools and heavy mining equipment and their application in the mining process will be reviewed, including the potential for multi-functional mining tools presenting opportunity in reduced fuel consumption for day-to-day operations.
- Energy-efficient lighting and controls will be installed where practicable.

Mine planning management measures:

- Haul routing will be optimised to reduce material rehandling, equipment utilisation, fuel demand and consumption.
- Vegetation clearing will be minimised.
- Undertake progressive rehabilitation will be undertaken, including the rehabilitation of land as soon as practicable.

Mine operations management measures:

- Fuel products that promote and deliver efficiency in consumption (i.e. premium fuels, additives etc.) will be used when practicable in the mining and associated processes.
- Heavy mining equipment will be maintained to design criteria and efficiency through effective maintenance strategies and practices.
- Electrical equipment will be maintained to retain energy efficiency.

- Blasting practices and technology will be reviewed so that designs are optimised to ensure that blasting energies are best utilised in material movement (e.g. directional/cast blasting techniques).
- Capture, storage and reuse of rain and pit water will occur for use in mining operations (e.g. road watering, compaction).
- Recycled water will be utilised in the processing operations to reduce off-site pumping requirements.
- Effective stock holding, management and logistic processes will be implemented (focusing on 'critical insurance' stock, freight consolidation and minimising ad hoc freight transport).
- Local personnel will be engaged to operate the mine when suitable.

New technology management measures:

- Current and future technologies will be reviewed to maximise efficiencies and minimise greenhouse gas emissions from heavy mining equipment and ancillary equipment design and technology.
- Solar energy will be used to replace small diesel plants or extend battery life at remote monitoring and control stations.

6.8.11 Conclusion

The Project mining and transport activities will generate dust emissions, which have been modelled in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2022b). Air dispersion modelling using the CALPUFF model was applied to predict the potential for off-site dust impacts in the surrounding area due to the operation of the Project. The predicted dust levels in the surrounding environment associated with the Project, including the off-site haulage of material to the Tritton processing facility, are low and would comply with the applicable criteria at the assessed receivers. Therefore, no unacceptable level of environmental harm or impact to sensitive receptors is predicted.

Appropriate dust management measures will also be maintained by the Project to ensure it minimises the potential occurrence of excessive air emissions from the site. Cumulative air quality impacts were also considered unlikely to arise because of the proposed Project.

In addition to 'dust-related' air quality emissions, consideration was given to potential airborne metal emissions in response to the recent NSW Parliamentary Inquiry (PLC 2023). In this regard, the Project was considered to have a low potential for any adverse impacts from metal emissions to air.

The Project will generate greenhouse gas emissions, which were estimated in accordance with the National Greenhouse and Energy Reporting framework. The predicted annual scope 1 and scope 2 emissions for the Project's peak emission year represent approximately 0.01% of Australia's total emissions.

Significant greenhouse gas mitigation measures have been incorporated into the Project design, and the Project is considered to provide an important contribution to economy-scale emissions avoidance by producing materials critical to global emissions avoidance. The proposed Project is, therefore, expected to be able to comply with applicable greenhouse gas regulations through the application of the proposed measures.

6.9 Noise and vibration

6.9.1 Introduction

A noise impact assessment was completed by Todoroski Air Sciences Pty Ltd to assess potential noise impacts of the proposed Project. The assessment was prepared in accordance with the following NSW guidance documents:

- the Noise Policy for Industry (EPA 2017);
- the NSW Road Noise Policy (DECCW 2011); and
- the Interim Construction Noise Guideline (DECC 2009).

The noise assessment for the Project is provided in Appendix 9, Noise impact assessment.

A blasting impact assessment was also undertaken for the proposed Project by AARC Environmental Solutions Pty Ltd. This assessment was prepared taking into account the Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC 1990). The blasting assessment for the Project is provided in Appendix 6 Blasting impact assessment.

6.9.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) for the Project includes requirements relating to assessing impacts from noise and blasting. These requirements are provided in Table 6-41.

Table 6-41: Noise and blasting vibration assessment requirements

Assessment matter	Report locations
Assess likely noise impacts of the development in accordance with the Noise Policy for Industry and the Voluntary Land Acquisition and Mitigation Policy (2018).	Section 6.9.6 Section 6.9.6.5
Detail specific construction noise criteria for certain activities if a claim is made; the claim must be justified and accompanied by an assessment of the likely construction noise impacts on the activities in accordance with the Interim Construction Noise Guideline.	Section 6.9.4.2 Appendix 9, Noise impact assessment, Section 4
Assess likely road noise impacts of the development in accordance with the NSW Road Noise Policy.	Sections 6.9.4.3 and 6.9.6.1.2 Appendix 9, Noise impact assessment, Sections 4.2 and 7
Assess likely blasting impacts of the development on people, animals, buildings and infrastructure and significant natural features, having regard to the relevant ANZECC guidelines.	Sections 6.9.4.4 and 6.9.6.4 Appendix 6, Blasting impact assessment, Section 3

6.9.3 Existing environment

The Project site is characterised as rural, with scattered residential dwellings. The topography is relatively flat with undulating hills to the west of the Project (refer to Section 6.1.4.2).

Land use within the Project site is primarily agriculture (grazing and cropping activity), with some mining, as well as urban settlements (refer to Section 6.1.4.3). The existing noise environment of the Project is, therefore, currently influenced by:

- agriculture;
- mining;
- anthropogenic activities, such as:
    - motor vehicles; and
    - urban settlements.

6.9.3.1 Local meteorological conditions

Long-term climatic data from the closest Bureau of Meteorology weather station (Cobar Airport Automatic Weather Station, Site No. 048237) has been analysed to characterise the local climate of the Project site (refer to Appendix 8, Noise impact assessment, Section 5.1).

Most relevant to noise, it is noted that wind direction can increase the source noise levels experienced by a sensitive receptor. As such, annual and seasonal wind roses have been developed for the Project (from CALMET data) as per Figure 6-30.

Annual local winds at the Project site typically occur along a south-west to north-east axis, with the highest portion of winds from the west-southwest and south-west.

In summer, winds are typically from the south, south-southwest and south-west. The autumn distribution is similar to the annual distribution, with dominant winds from the south-west quadrant. In winter, winds predominately occur from the north and north-west quadrant, while in spring, the distribution is varied, with a high proportion of winds originating from the south-west and north-east quadrant.

Analysis of winds for the Project indicates that significant winds are characterised to occur in the evening period from the east during summer and south-west during autumn and in the night-time period from the east-northeast during summer and south during autumn (Appendix 8 Noise impact assessment, Section 5.1).

The potential impact of temperature inversions has been considered in respect to potential noise impacts from the Project. A temperature inversion is a meteorological phenomenon when the air temperature profile increases vertically through the atmosphere. As sound moves faster in warmer air, this phenomenon causes sound waves to bend towards the ground, increasing the received noise levels from a source, often some distance away.

For temperature inversions to be a significant characteristic of the area, they need to occur for approximately 30% of the total night-time periods during winter. An analysis of the CALMET data for the Project indicates that the frequency of temperature inversions occurring at night during the winter months is approximately 5%, with inversions, therefore, not considered a significant feature of the Project area.

6.9.3.2 Voluntary land acquisition and mitigation policy

The NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments (NSW Government 2018) describes the NSW Government's policy for voluntary mitigation and land acquisition to address noise impacts from state significant mining, petroleum and extractive industry developments. The NSW VLAMP is introduced in Chapter 2, Strategic context, Section 2.7.2.

Note: Voluntary noise mitigation rights should only apply (even with the implementation of best practice management measures) when:

- the noise generated by the development would be equal to or greater than 3dB(A) above the NSW Noise Policy for Industry (EPA 2017) project specific noise level at any residence on privately-owned land; or
- the development would increase the total industrial noise level at any residence on privately-owned land by more than 1db(A) and noise levels at the residence are already above the recommended amenity criteria in Table 2.1 of the NSW Noise Policy for Industry (EPA 2017); or
- the development includes a private rail line (which is not applicable to the Project).

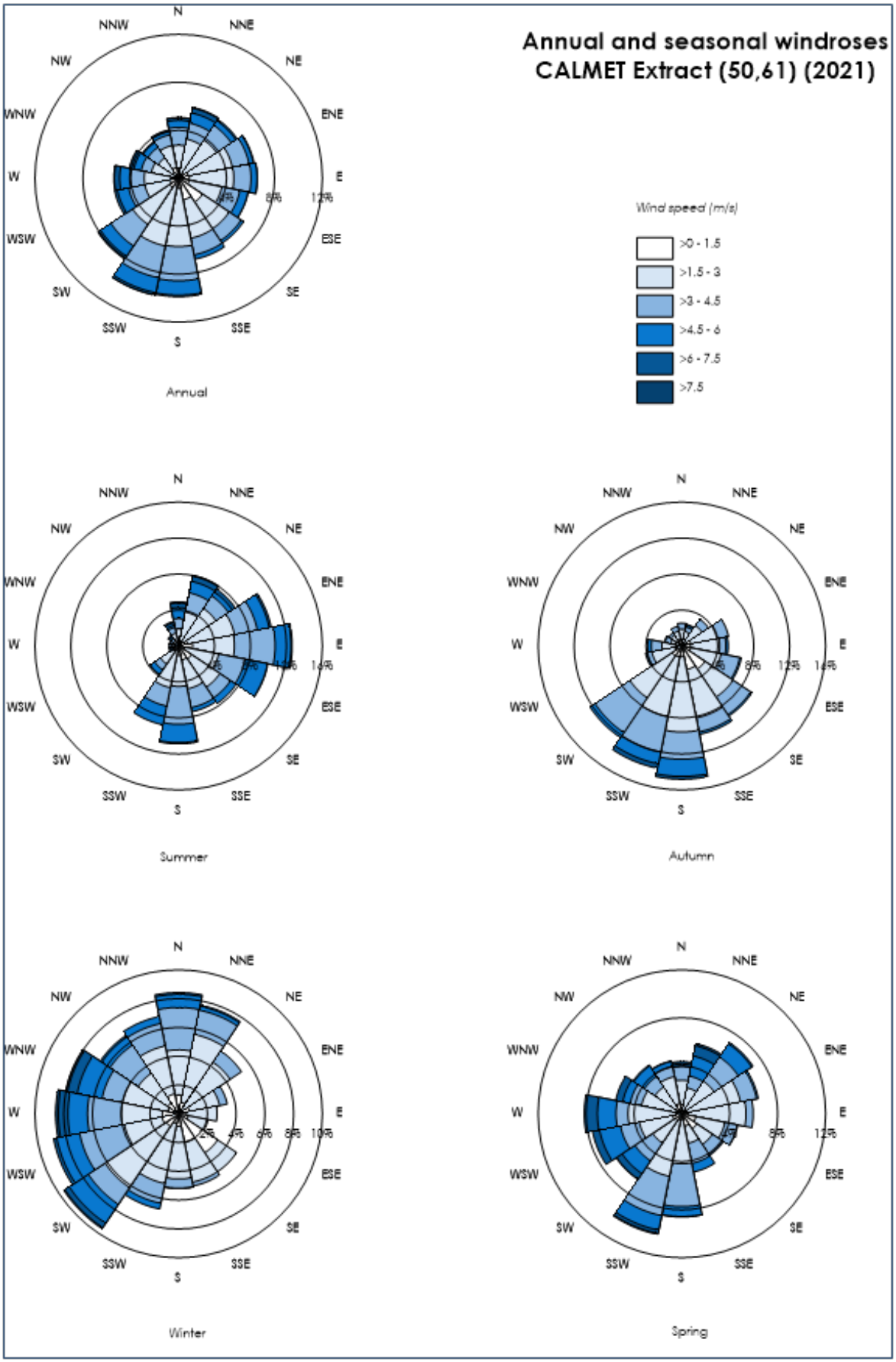


Figure 6-30: Annual and seasonal windroses for the Project

Note: Voluntary noise acquisition rights should only apply (even with the implementation of best practice management measures) when:

- the noise generated by the development would be equal to or greater than 5dB(A) above the project specific noise level at any residence on privately-owned land; or
- the noise generated by the development would contribute to exceedances of the recommended maximum noise levels in Table 2.1 of the NSW Noise Policy for Industry (EPA 2017) on more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls; or
- the development includes a private rail line (which is not applicable to the Project).

An assessment of VLAMP criteria for the Project is provided in Section 6.9.6.5.

6.9.4 Relevant noise and vibration criteria

6.9.4.1 Operational noise

In accordance with the Noise Policy for Industry (EPA 2017) a 'project noise trigger level' should be defined to provide a benchmark for assessing a proposal. A project noise trigger level, if exceeded, would trigger the need for a management response to address noise impacts.

The project noise trigger level is determined as the lower (more stringent) value of the:

- 'project intrusiveness noise level', which aims to protect receivers against a significant increase in noise levels from just the project noise relative to the existing acoustic environment; and
- 'project amenity noise level', which seeks to protect noise-sensitive receivers against cumulative noise impacts from many noise sources and thus maintain a predefined, suitable level of amenity within an area.

6.9.4.1.1. Project intrusiveness noise level

The intrusiveness of an industrial noise source is generally considered acceptable if the L_{Aeq} from the noise source does not exceed the background noise level by more than 5 dB. The minimum rating background levels presented in the Noise Policy for Industry (EPA 2017) have been adopted to represent the background noise levels for the Project, as set out in Table 6-42. The minimum rating background levels are to be applied even when actual background noise levels are likely to be lower—such as those of the Project. These are considered to be the most stringent background noise levels that can be applied per the Noise Policy for Industry (EPA 2017).

Table 6-42: Intrusiveness noise levels

Period	Rating background levels	Intrusive noise criteria ($L_{Aeq,\ 15min}$ dBA)
Day	35	(35 + 5) 40
Evening	30	(30 + 5) 35
Night	30	(30 + 5) 35

6.9.4.1.2. Project amenity noise level

To limit continuing increases in noise levels from the application of the intrusiveness level alone, the ambient noise level within an area (from all noise sources combined) should remain below the recommended amenity noise levels for the specific land use (as per Table 6-43).

Table 6-43: Amenity noise levels

Receiver	Noise amenity area	Time of day	Recommended amenity noise level ($L_{Aeq,\ 15min}$ dBA)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Commercial premises	All	When in use	65
Industrial premises	All	All	70
School classroom (internal)	All	Nosiest 1hr period when in use	35

Extracted (in part) from Appendix 9, Noise impact assessment

The recommended amenity noise levels represent the objective for total industrial noise at a noise-sensitive receiver. For the Project, the rural noise amenity area is considered to apply to the majority of surrounding receivers.

6.9.4.1.3. Project trigger noise levels

Project noise trigger levels are determined as the lower (more stringent) value of the intrusiveness noise level and amenity noise level. The noise trigger levels are shown in Table 6-44.

Table 6-44: Noise trigger levels ($L_{Aeq,\ 15min}$ dB(A))

Receiver	Period	Project intrusiveness noise levels	Project amenity noise levels	Trigger levels
Residential receivers	Day	40	50	40
	Evening	35	45	35
	Night	35	40	35

6.9.4.2 Construction noise

Construction noise management levels (derived from the Interim Construction Noise Guideline) and how they are to be applied (DECC 2009) are presented in Table 6-45.

Table 6-45: Construction noise management level

Time of day	Management level L_{Aeq}, (15 min.)	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm	Noise-affected RBL + 10dB	The noise-affected level represents the point above which there may be some community reaction to noise: • When the predicted or measured L_{Aeq}, (15-min.) is greater than the noise-affected level, the proponent should apply all feasible and reasonable work practices to meet the noise-affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
No work on Sundays or public holidays	Highly noise-affected 75 dB(A)	The highly noise-affected level represents the point above which there may be a strong community reaction to noise: • When noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: o times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); o if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise-affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • Aeris should apply all feasible and reasonable work practices to meet the noise-affected level. • When all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise-affected level, Aeris should negotiate with the community.

6.9.4.3 Road traffic noise

Modelled noise emissions from Project haulage were assessed against the applicable road traffic noise criteria, as presented in the NSW Road Noise Policy (DECCW 2011).

The haul road from the Project site to the Mitchell Highway and along Yarrandale Road to the Tritton Copper Mine is considered under the local roads category. The section of haulage route along the state-controlled Mitchell Highway is considered under the freeway/arterial/sub-arterial roads category. Haul trucks from the Project would only travel along the Mitchell Highway adjacent to the township of Girilambone for a short duration. The noise criteria for local roads and freeway/arterial/sub-arterial roads categories are shown in Table 6-46.

Note: One sensitive receptor in Girilambone is a public school (R28) for which the non-residential land use noise criteria will apply (refer to Table 6-47).

Table 6-46: Road traffic noise criteria for residential land use

Road category	**Land use**	**Assessment criteria (dB(A))**	
		Day (7:00 am – 10:00 pm)	**Night (10:00 pm – 7:00 am)**
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L_{Aeq}, (1 hour) 60 (external)	L_{Aeq}, (1 hour) 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	L_{Aeq}, (1 hour) 55 (external)	L_{Aeq}, (1 hour) 50 (external)

Table 6-47: Road traffic noise criteria for non-residential land use

Existing sensitive land use	**Assessment criteria (dBA)**	
	Day **(7:00 am-10:00 pm)**	**Night** **(10:00 pm-7:00 am)**
School classrooms	L_{Aeq}, (1 hour) 40 (internal) when in use	-

6.9.4.4 Blasting and vibration

The recommended criteria for vibration airblast are summarised in Table 6-48. The criteria include consideration of human comfort and are well below levels at which damage to typical residential type buildings is known to occur. Vibration can be felt at a much lower level than those that could result in damage to structures and at lower levels than are included in the relevant criteria.

Table 6-48: Airblast and ground vibration criteria

Aspect	**Limits**
Airblast overpressure	Level of 115 dB (Linear peak) may be exceeded on up to 5% of the total number of blasts over a period of 12 months Level of 120 dB (Linear peak) should not be exceeded at any time
Ground vibration	Level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months Level of 10 mm/s should not be exceeded at any time
Time and frequency	Blasting should generally only be permitted during the hours of 9:00 am–5:00 pm Monday to Saturday. Blasting should not take place on Sundays or Public Holidays. Blasting should generally take place no more than once per day. (This requirement would not apply to minor blasts, such as for clearing crushers or feed chutes.) Restrictions on times and frequency of blasting do not apply to (i) those premises where the effects of the blasting are not perceived at noise-sensitive sites; and (ii) major underground metalliferous mining operations.

6.9.5 Sensitive receptors

A total of 35 sensitive receptors were identified to exist in proximity to the Project and proposed haul route. The identification and location of sensitive receptors are shown in Section 6.8, Air quality and greenhouse gas (Table 6-37 and Figure 6-29). Sensitive receptor identification/numbering for this EIS is noted as being consistent across the air quality, noise and visual amenity assessments for the Project. As such, this information has not been duplicated here.

It is noted that the nearest residential dwelling to the Project site is approximately 4.6 km to the west (identified as R2). The nearest dwelling to the haul route is approximately 55 m to the west (identified as R15), noting that the haul road at this location is the existing Mitchell Highway.

6.9.6 Noise and vibration impact assessment

6.9.6.1 Assessment methods

6.9.6.1.1. Project mine site area noise

The construction and operational Project mine site noise assessment considered a potential worst-case scenario based on the maximum number of plant and equipment operating simultaneously at the site during the open cut and underground mining operations. Equipment types, numbers and corresponding sound power levels are provided in Appendix 9, Noise impact assessment, Section 6.2. This assumed worst-case noise scenario is considered a conservative approach, with overlap in open cut and underground operations expected to occur for approximately two years (refer to Chapter 3, Project description), with simultaneous peak operations anticipated for an even shorter period.

Noise impacts were modelled using the environmental noise model. The model calculated noise propagated from the Project to receivers and considered factors such as:

- distance;
- barrier effects from existing buildings;
- ground attenuation;
- air absorption; and
- wind enhancement.

The noise model also utilised digital terrain data. Potential worst-case (noise-enhancing) meteorological conditions were adopted for the model to provide for worst-case noise propagation.

6.9.6.1.2. Road traffic noise

An assessment of off-site haulage of Project mined ore along the proposed haul road was undertaken, which included back haulage of dewatered tailings material from the Tritton Copper Mine to the Project mine site (Chapter 1, Introduction, Figure 1-2). Project haulage will occur along the proposed haul road, which traverses a section of Okeh Road and Railway Road before joining the Mitchell Highway near Girilambone township. The haul road route will then follow Yarrandale Road to the Tritton Copper Mine (consistent with the existing, approved haulage route from the Murrawombie Copper Mine to the Tritton Copper Mine). Refer to Chapter 3, Project description, Section 3.4.3.

The operational phase of the Project is estimated to generate 82 truck movements per day (based on peak production volumes) over 348 days, with truck payloads of 70 t. This is equivalent to a maximum of four truck movements per hour (where 82/24 = 3.4). Further, during operations, two semi-trailer deliveries per week are anticipated (providing fuel, materials and consumables). Operational personnel will commute to the Project via a shuttle bus, with light vehicles also to be used by some mine personnel (i.e. up to 60 light vehicle movements during a peak shift change period).

Two scenarios were developed for the modelling of Project road noise, being the expected worst-case daytime traffic movements of 66 movements per hour (6 heavy vehicles + 60 light vehicles); and the expected worst-case night-time traffic of four movements per hour (4 heavy vehicles). The scenarios were assessed for noise experienced at three key sensitive receptors (R1, R15, R28), being the closest receivers to the haul road and most likely impacted by noise from Project traffic activities. The results of the assessment are provided in section 6.9.6.3.

6.9.6.1.3. Blasting and vibration

The blasting assessment for the Project considered potential airblast pressure levels and ground vibration levels against the recommended Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC 1990) at the locations of sensitive receptors.

In addition to the residences and commercial locations that were identified as sensitive receptors for the Project, other types of potential sensitive receptors were considered, including:

- Aboriginal cultural heritage sites identified in Chapter 6, Environmental assessment, Section 6.12, Cultural Heritage; and
- potential biodiversity values identified in Chapter 6, Environmental assessment, Section 6.7, Biodiversity.

The blasting assessment determined that other potential receptor types did not represent receptors that could be impacted by the blasting activities of the Project (refer to Appendix 6, Blasting impact assessment).

Potential noise and vibration impacts for the Project are discussed in the following sections, which have considered each Project phase and the associated activities.

6.9.6.2 Project mine site area noise impacts

The predicted operational noise level for each sensitive receptor was identified to be less than 25 dB(A) and therefore below the relevant trigger level of 35 dB(A). For the large majority of receptors, Project activities were predicted to be inaudible. Predicted operational noise levels are shown in Figure 6-31.

Regarding cumulative noise impacts, it is acknowledged that noise would be generated by nearby mining operations (including the Tritton Copper Mine, the Murrawombie Copper Mine and the Avoca Tank Copper Mine). However, based on the predicted noise levels of the Project and the separation distance between other projects, the assessment has determined that the potential for cumulative noise impacts is unlikely.

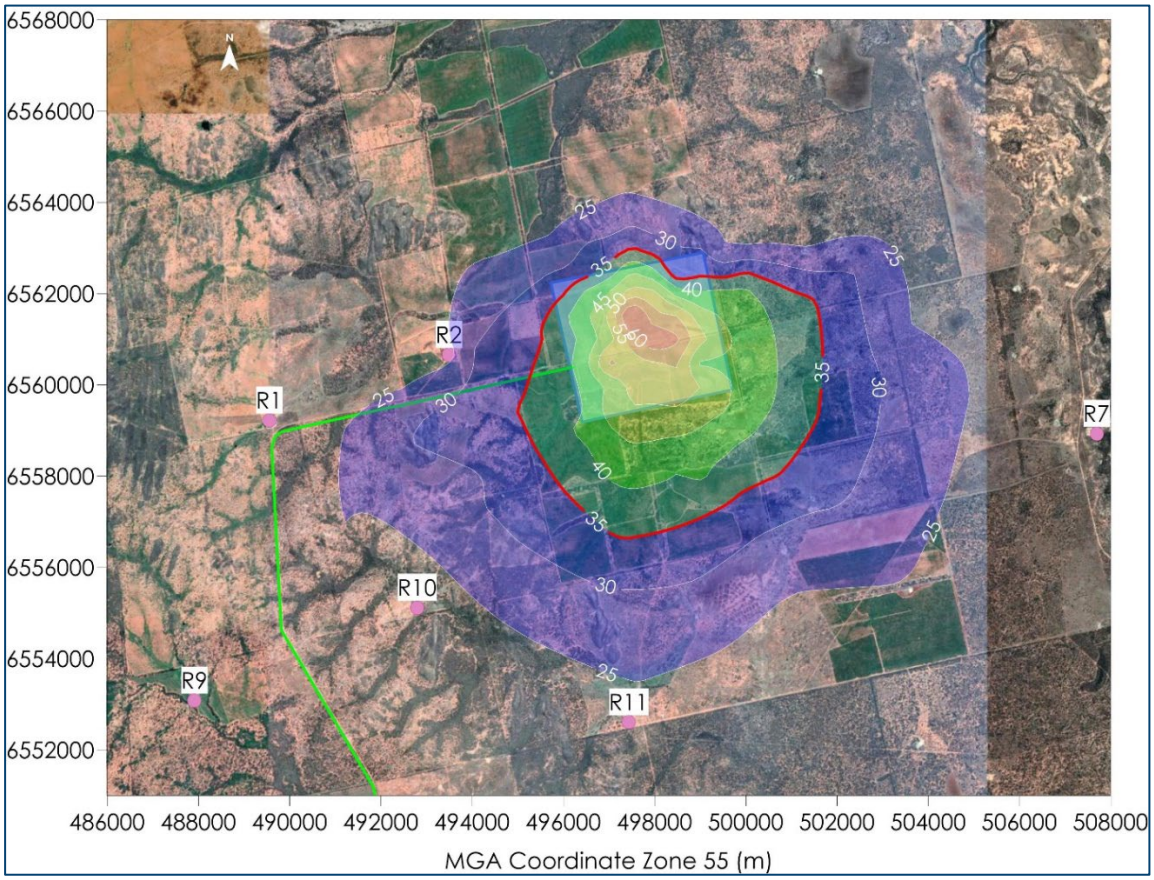


Figure 6-31: Predicted operational noise levels (dBA)

6.9.6.2.1. Construction Project mine site area noise impacts

The proposed construction activity for the Project mine site would occur between 6:00 am and 10:00 pm. The significant sources of construction noise may include trucks, cranes and power tools.

Given that the proposed plant and equipment modelled would generate similar noise levels as operational plant and equipment (arguably less, resultant of less equipment), it is reasonably asserted that construction noise emissions would comply with both intrusive and amenity criteria. Noise from construction activities would be below the applicable noise criteria for the Project. Overall, the modelling, therefore, indicates no significant risk of construction noise impacts arising.

6.9.6.3 Road traffic noise impacts

Traffic noise levels predicted for the Project at sensitive receptors are presented in Table 6-49 and Figure 6-31. All other receivers are further away from the haul road and, as such, would experience lower noise levels. The predicted noise levels for Project traffic are based on worst-case scenarios for trucks and light vehicle movements during the day and up to four trucks per hour at night for Project traffic that are not constant.

The three key sensitive receptors along the haulage route for road traffic noise are:

1) R1—a residence located approximately 320 m from the haul road (being a section of the existing Okeh Road);
2) R15—a residence located approximately 55 m from the haul road (being a section of the existing Mitchell Highway); and
3) R28—being the Girilambone Public School.

Table 6-49: Road traffic noise levels

Receiver	Road section	Distance to residence	Traffic movements (per hour)	Project related traffic noise (dB(A))	Criteria (dB(A))
R1	Haul road	320	66	44	55 (daytime)
	Haul road	320	4	39	50 (night-time)
R15	Mitchell Highway	55	66	54	60 (daytime)
	Mitchell Highway	55	4	49	55 (night-time)
R28	Mitchell Highway	600	66	40	40 (internal)

Based on predicted worst-case noise levels, no receptor is expected to experience traffic noise levels beyond their relevant criteria. However, sensitive receptors on some sections of the haul route (with low existing traffic noise) may still experience a noticeable increase in traffic noise, albeit without exceedance of the relevant criteria.

6.9.6.4 Blasting and vibration impacts

Airblast levels are predicted to be compliant at all sensitive receptors, with the modelled distance from the blast source to the 115 dB (Lin Peak) sound pressure level calculated as a maximum of 4.3 km. Further, the modelled distance from the blast source to the 120 dB (Lin Peak) sound pressure level is calculated as a maximum of 3.0 km, therefore complying with the applicable criteria.

Given the nearest receptor is approximately 4.6 km from the open cut pit, the predicted vibration levels are expected to be below 0.2 mm/s, therefore complying with the applicable criteria.

6.9.6.5 Assessment of VLAMP criteria

An assessment of VLAMP criteria (as outlined in Section 6.9.3.2) was undertaken for the Project, with no predicted exceedances of mitigation or acquisition criteria anticipated. Exceedances of the NSW Noise Policy for Industry (EPA 2017) are not predicted to occur as a result of Project construction or operations phases. Further, no private rail line is relevant to the proposed Project.

6.9.7 Commitments and management measures

6.9.7.1 Noise

While exceedances of noise criteria are not anticipated as a result of the proposed Project, a number of commitments have still been made in the interest of minimising potential noise impacts regarding:

- plant and equipment:
  - engines switched off when not in use for extended periods;
  - broadband reversing and low nuisance start-up alarms used on mobile equipment;
  - attenuation of significant noise-generating mobile equipment investigated;
- incident and complaint management:
  - noise complaints logged and investigated; and
- unusually noisy activity:
  - consultation with potentially affected receivers undertaken regarding any proposed activities that may generate higher than usual noise output prior to the undertaking of that activity.

6.9.7.2 Blasting and vibration

While proposed blasting activities are anticipated to meet applicable criteria, a number of commitments have still been made in the interest of minimising potential impacts as follows:

- Surface blasting will be limited to daylight hours.
- Relevant safety protocols (such as the establishment of exclusion zones) during blasting will be defined.
- Meteorological conditions will be considered within the blast design process (as a mechanism to prevent exacerbation of impacts).
- A process to ensure adequate notification of upcoming blasts to relevant receptors will be established and adopted.
- A complaints register will be maintained to record any blasting or vibration-related complaints.
- A process for investigating and managing complaints will be established (including reporting to external stakeholders).

6.9.8 Conclusion

Project activities will generate noise emissions, with a noise impact assessment undertaken for the Project in accordance with the Noise Policy for Industry (EPA 2017), the Interim Construction Noise Guideline (DECC 2009), and the NSW Road Noise Policy (DECCW 2011).

Noise modelling was developed for the Project to assess potential construction and operational noise impacts and potential road haulage noise.

As an outcome of this assessment, the Project was determined to comply with all relevant noise criteria across all Project phases at all sensitive receptors. Relevant VLAMP criteria for noise were also assessed and considered not to be triggered by the proposed Project. Given that the modelling assumed worst-case conditions, this assessment is considered conservative.

A blasting and vibration assessment has also been undertaken for the Project against the ANZECC guideline criteria (ANZECC 1990). As an outcome of this assessment, airblast levels were predicted to be compliant at all sensitive receptors, with predicted vibration levels also modelled to comply with applicable criteria.

Notwithstanding the predicted compliance with all relevant noise and blasting criteria, it is acknowledged that commitments to manage potential impacts have still been made. This will position the Project to have minimal impact on the existing noise environment.

6.10 Non-mining waste

6.10.1 Introduction

Non-mining waste is defined as waste generated from non-mining activities associated with the Project. This section identifies the non-mining waste that will be generated by the Project and provides management strategies to mitigate the adverse impacts of the non-mining waste on human health and the environment.

6.10.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires a waste management strategy to be developed for all waste that may be generated by the Project (i.e. non-mining waste). The specific requirements relating to waste are shown in Table 6-50. The management of other Project waste types (i.e. mineral waste, water, and air emissions) is described in other chapters and sections of this EIS:

- Mineral waste management:
  - Chapter 3, Project description;
  - Chapter 6, Environmental assessment, Section 6.3, Geochemistry; and
  - Chapter 8, Rehabilitation and closure;
- Management of water, including sewage:
  - Chapter 6, Environmental assessment, Section 6.5, Surface water; and
- Air emissions:
  - Chapter 6, Environmental assessment, Section 6.8, Air quality.

Table 6-50: Assessment requirements

Assessment requirements	**Report locations**
A waste (overburden, tailing, leach pad) management strategy	Section 6.10.6. Chapter 3, Project description, Section 3.9.2.5 Chapter 6, Environmental assessment, Section 6.3, Geochemistry Chapter 8, Rehabilitation and closure Chapter 6, Environmental assessment, Section 6.5, Surface water Chapter 6, Environmental assessment, Section 6.8, Air quality.

6.10.3 Methodology

Non-mining waste was identified and will be managed in accordance with the following guidelines:

- Waste classification guidelines (EPA 2014);
- Protection of the Environment Operations (Waste) Regulation 2014; and
- Environmental guidelines: solid waste landfills (EPA 2016).

Non-mining waste for each Project phase (i.e. construction, operation, and decommissioning) was identified by reviewing the mine design and non-mining activities in conjunction with existing documentation on the waste generation of similar projects. A total of six waste classes were identified as potentially relevant for the Project, according to the Waste classification guidelines:

1) special waste;
2) liquid waste;
3) hazardous waste;
4) restricted solid waste;
5) general solid waste (putrescible); and
6) general solid waste (non-putrescible).

The potential impacts of the non-mining waste were assessed, and waste management strategies for the identified wastes are proposed to be adopted into the applicable Waste Management Plan. The Tritton Copper Mine has a Waste Management Plan that will be revised to incorporate strategies for the Project. The Waste Management Plan will apply industry best practices and the underlying principles of avoidance: reducing, reusing and recycling.

6.10.4 Waste generation

The non-mining waste generated by the Project is described and classified in Table 6-51. Five classes of non-mining waste (Section 6.10.3) have been identified from all the phases to be generated by the Project. No restricted class waste was identified for the Project. Quantities of waste were estimated based on information from other copper mine sites. The identified wastes are expected to be comparable to the waste produced and managed at associated Aeris projects in the region.

Table 6-51: Waste identification, classification handling and disposal

Source	Project phase	Waste generated	Classification	Estimated quantity
Land clearing	Construction	Vegetation cleared from the land for infrastructure construction preparation	General solid waste (non-putrescible)	Vegetation associated with clearing, 97.3 ha [1]
Site and infrastructure construction	Construction	Scrap metal	General solid waste (non-putrescible)	To be determined following confirmation of detailed design
		Concrete		
		General packaging waste		
		Timber waste (pallets)		
	Construction, operation	Waste tyres	Special waste	400 pa[2]
		Batteries	Hazardous waste	5 tpa[2]

Source	Project phase	Waste generated	Classification	Estimated quantity
Maintenance of machinery and vehicles		Waste fuel, degreasing fluids, other petroleum fluids		Currently unknown
		Oily rags and filters		17 tpa[2]
Activities at the Project site	Construction, operation	Office wastes: plastics, paper, cardboard, glass, metal, and other office waste	General solid waste (non-putrescible)	8 tpa[2]
		Site general putrescible: scrap food, household waste that contains putrescible organics	General solid waste (putrescible)	10.4 tpa[2]
		Wastewater, sewage, and grey water	Liquid waste	31,000 Lpa[2]
Underground mining	Construction, operation	Pipe work (including vent bags)	General solid waste (non-putrescible)	Currently unknown
Infrastructure demolition, such as roads, drainage structures, and on-site offices.	Decommissioning	Waste generated during the infrastructure demolition, such as scrap metals, bricks, concrete, tiles, and cables.	General solid waste (non-putrescible)	Currently unknown

Note: [1] quantity estimated for the life of the mine; [2] quantity estimated for an annual basis (pa: per annum).

6.10.5 Potential impacts

The potential impacts of the non-mining wastes without adequate management measures may include:

- visual and odour amenity due to improper storage of waste;
- human health via direct contact with the waste or indirect contact with the polluted water, air or soil;
- human health via increased vermin and potential spread of disease due to inappropriate storage of waste;
- risks to workplace health and safety from unsafe or inadequate storage, containment and/or handling of hazardous wastes;
- pollution caused by the release of chemicals directly or indirectly into the receiving environment (e.g. water, air, and soil);
- land contamination caused by spills or inappropriate waste disposal to soil;
- littering due to unsuitable storage and containment measures for general waste;
- consumption of landfill space;
- increased risk of fire incidents due to inappropriate storage of waste; and
- release of greenhouse gases from putrescible wastes when decomposing.

6.10.6 Waste management strategies

Mineral waste, including waste rock, mineralised waste and the heap leach pad, are discussed in Chapter 8, Rehabilitation and closure, Section 8.4.1.2 and 8.4.1.4.

Non-mining waste management strategies that will be adopted by the Project will include:

- avoidance of products and practices that can generate waste;
- adopting practices to reduce waste generation;
- re-use of material when practicable;
- recycling and recovery of suitable materials;
- treatment of waste to reduce potential impacts; and
- disposal via licensed facilities.

Waste management strategies for each waste class can be found in Table 6-52. Non-mining waste will be sorted into categories, such as recyclable and non-recyclable, before being transported off site by a licensed contractor and disposed of at either a licensed facility (i.e. Bogan Shire landfill) or the Tritton Copper Mine landfill site (if required).

The Bogan Shire landfill facility will be preferentially utilised for the disposal of general waste (putrescible and non-putrescible) and special waste (i.e. tyres). Liquid waste and hazardous waste will be transported, recycled and disposed of by licensed contractors. Non-recyclables will be transported via the site access and haulage route.

The Waste Management Plan for the Tritton Copper Mine and its associated projects will be updated to include the proposed management of the Project waste. Due to the limited capacity of the Tritton Copper Mine waste facilities, hook bins will be used on the Project site to remove vent bags to a licensed disposal facility.

Monthly inspections will be undertaken to ensure the proper operations of waste management facilities:

- recycling containers—capacity and presence of non-recyclables;
- landfill—recyclables or any hydrocarbon/chemical non-compatibles;
- waste oil and grease bunded areas—water presence and bund capacity; and
- oily rags and filters—acceptable containment.

All the inspection records will be kept, and management actions may be taken when needed. The waste management strategies were adopted from the existing Tritton Copper Operations Waste Management Plan, which will be reviewed biennially and revised when necessary to meet the specific situation of the Project.

Table 6-52: Waste management strategies

Waste Class	Storage/Management	Removal/Disposal
General solid waste (putrescible and non-putrescible)	• General solid waste will be stored in covered bins or skips in lunchrooms, offices, outside workshops and elsewhere as required. • Recyclables will be collected in segregated bins. • Bins located in open areas will be fitted with animal proof lids. • Scrap metal will be stored in a specified area or elsewhere as required. • Pallets will be stored within a workshop area (or similar) and reused on-site as appropriate. • Vegetation from clearing will be stockpiled or mulched on-site.	• General solid waste will be collected on a regular basis by a licensed contractor and transported to an appropriately licensed facility for disposal or recycling. • Scrap metal will be collected on a regular basis by a scrap metal recycler. • Any excess pallets will be collected on a regular basis by a licensed contractor and transported to an appropriate facility for recycling or disposal. • Stockpiled and mulched green waste will be used on-site for progressive rehabilitation.

Waste Class	Storage/Management	Removal/Disposal
Hazardous waste (such as waste fuel and batteries)	• Waste oils and greases will be stored in IBC's and 205L waste drums placed within the bunded hydrocarbon waste storage area. When required, smaller, temporary storage containers may be positioned close to work areas, and the contents of the containers will be transferred to a larger storage tank prior to collection. • Oily rags and filters will be segregated and stored on-site in bunded areas. • Batteries will be placed within a covered and labelled battery storage area until removed from the site.	• Waste oils, greases, oily rags and filters will be collected on a regular basis by a licensed contractor and transported to an appropriately licensed facility for recycling. • Batteries will be collected, when necessary, by a licensed disposal contractor and recycled.
Tyres	Tyres will be placed within a demarcated used tyre storage area until removed from site or used for another purpose.	Tyres will be disposed of at a licensed waste management facility or removed by a third party approved to recycle tyres.
Liquid waste	Wastewater will be treated in the on-site sewage treatment plant.	Sewage sludge will be removed by a licensed waste contractor as needed. Treated effluent sub-surface water will be irrigated in accordance with the Bogan Shire Council requirements and approval.

6.10.7 Conclusion

This section identifies the non-mining waste that may be generated from the construction, operation and decommissioning phases of the Project. According to the Waste classification guidelines, identified waste was categorised into five classes:

1) general solid waste (putrescible);
2) general solid waste (non-putrescible);
3) hazardous waste; special waste; and
4) liquid waste.

The potential impacts of the non-mining waste on people and the environment were assessed, and storage, handling, transport and disposal management strategies are proposed for each waste class. All the non-mining waste will be sorted into hazardous and non-hazardous, recyclable and non-recyclable waste before being transported and disposed of by licensed contractors.

The management strategies were adopted from the existing Tritton Copper Operations Waste Management Plan to avoid or minimise the identified potential impacts.

6.11 Hazards and safety

6.11.1 Introduction

A Preliminary Hazard Analysis (PHA) was prepared by AARC Environmental Solutions Pty Ltd to assess the key hazards relating to the off-site risks and their treatment measures. The assessment is provided in full in Appendix 13, Preliminary hazard analysis.

6.11.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires a detailed description of the following:

- management of hazards (such as chemicals, concentrate and waste material);
- assessment of the potential risks related to hazardous materials used on-site with regard to public safety; and
- a PHA.

The specific assessment requirements relating to hazards are provided in Table 6-53.

Table 6-53: Hazards and safety assessment requirements

Assessment requirements	Report reference
Hazards, including: 1. a detailed description of the management of chemicals, concentrate and waste material and an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks during storage, handling, transport and use of any dangerous goods; and	Section 6.11.5. Appendix 13, Section 2.1 Management of non-mining waste—Section 6.10.6. Management of mining waste—Section 6.3 Geochemistry.
2. a Preliminary Hazard Analysis (PHA) prepared in accordance with the Hazardous Industry Planning Advisory Paper No.6, 'Hazard Analysis' and Multi-Level Risk Assessment.	Section 6.11.5. Appendix 13, Section 3.

6.11.3 Methodology

The methods used in the assessment are briefly introduced in this section. The full description of the methodologies is provided in Appendix 13, Preliminary hazard analysis.

6.11.3.1 Standards and guidelines

The assessment was prepared using the following standards and guidelines:

- AS/NZ International Organisation for Standardisation (ISO) 31000:2018 Risk Management–Guidelines (ISO 2018);
- The Hazardous Industry Planning Advisory Paper No. 4 Risk Criteria for Land Use Safety Planning (DoP 2011a);
- The Hazardous Industry Planning Advisory Paper No. 6 Guidelines for Hazard Analysis (DoP 2011b);
- Assessment Guideline Multi-Level Risk Assessment (DP&I 2011);
- New South Wales State Environmental Planning Policy Resilience and Hazards 2021 (NSW); and

- The Australian Code for the Transport of Dangerous Goods by Road & Rail (NTC 2022).

6.11.3.2 Assessment framework

The risk assessment framework followed the process provided by the assessment guideline Multi-Level Risk Assessment (DP&I 2011), as depicted in Figure 6-32.

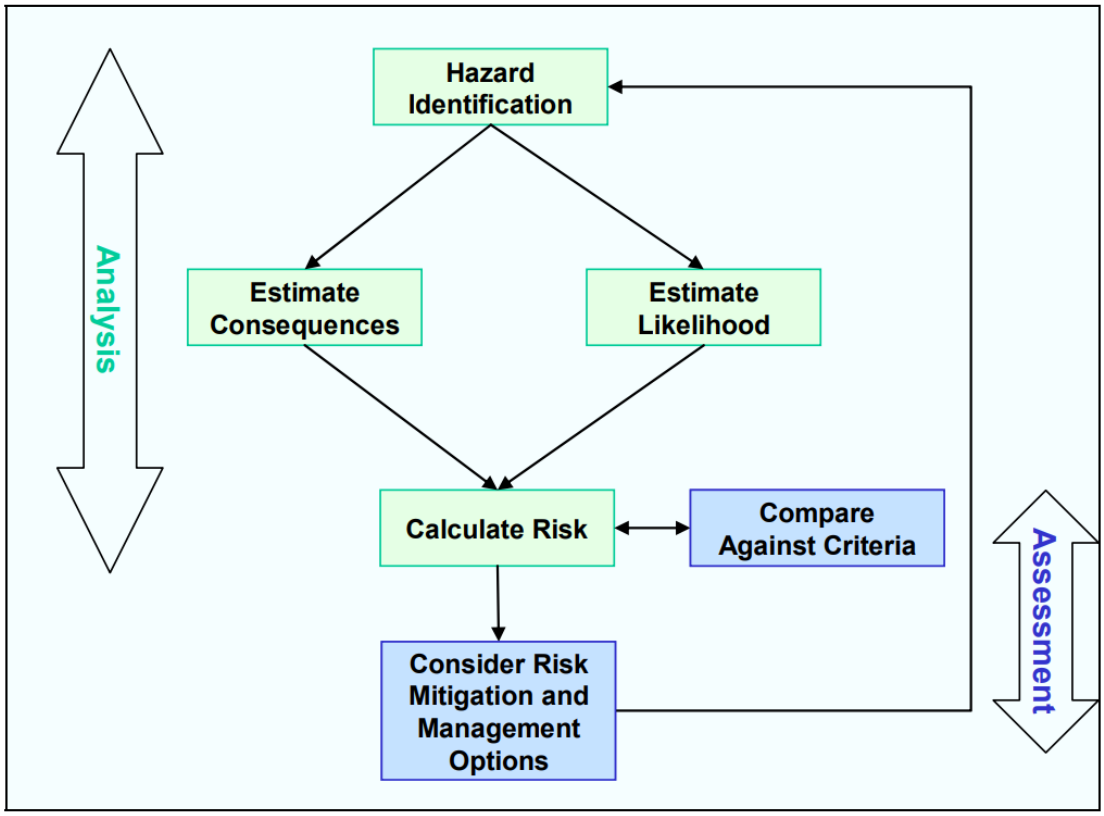


Figure 6-32: Schematic of risk management process

Assessed risks were compared to qualitative risk assessment criteria developed in accordance with the ISO 31000:2018 Risk Management–Guidelines (ISO 2018), and Hazardous Industry Planning Advisory Paper No. 4 Risk Criteria for Land Use Safety Planning (DoP 2011b).

The risk level classifications used in the risk assessment are shown in Table 6-54.

Table 6-54: Risk level classification matrix

Likelihood	Consequence				
	Very Low	**Low**	**Moderate**	**High**	**Very High**
A. Almost Certain	Class II	Class III	Class IV	Class IV	Class IV
B. Likely	Class II	Class III	Class III	Class IV	Class IV
C. Possible	Class I	Class II	Class III	Class IV	Class IV
D. Unlikely	Class I	Class I	Class II	Class II	Class IV
E. Rare	Class I	Class I	Class II	Class II	Class II

6.11.4 Identified hazards

The hazards identified for the Project are described in Sections 6.11.4.1 and 6.11.4.2.

6.11.4.1 Hazardous materials

Four types of hazardous materials were identified for the Project:

1) hydrocarbons;
2) chemicals;
3) explosives; and
4) liquid and non-liquid waste.

For each hazardous material, the hazard class, dangerous goods storage method and quantity were collated. The types of hazardous materials are shown in Table 6-55 (hydrocarbons), Table 6-56 (chemicals), and Table 6-57 (explosives). The details of storage and disposal of liquid and non-liquid waste is detailed in Chapter 6.10, Non-mining waste.

Table 6-55: Classes, storage and quantities of hydrocarbons

Material	Australian Dangerous Goods (ADG) class	United Nation number (UN no.)	Storage type	Maximum storage capacity (Litre)
Diesel	3	1202	• Self-bunded tank. • Storage and refuelling facilities in accordance with AS 1940:2017 The storage and handling of flammable and combustible liquids.	2 x 100,000
Lubricant oils, grease, degreasers and coolant.	9	3082	• Bulk Storage at stores area and workshop. • Storage and handling facilities in accordance with AS 1940:2017.	20,000

Table 6-56: Classes, storage and quantities of chemicals

Material	ADG class	UN No.	Storage type	Maximum storage capacity (Kilogram)
Sulphuric acid with more than 51% acid	8	1830	• Covered storage facility adjacent to the stores building. • Proprietary steel frame and clad sheds on concrete bunded floor suitable for forklift loading and with wire mesh gates to secure access.	80,000
Organic solvent	3	1266		20,000
Quicklime	8	1910		20,000
Potassium amyl xanthate	4.2	3342		4,000
Methyl isobutyl carbinol	3	2053		4,000

Table 6-57: Classes, storage and quantities of explosives

Material	ADG class	UN no.	Storage type	Maximum storage capacity (Kilogram)
Detonators, electric for blasting	1.1B	0030	• External magazine located at an appropriate distance from operation activities in accordance with AS2187.1-1998 Explosives – Storage, Transport and Use (refer to Appendix 13, Preliminary hazard analysis). • Explosives will be stored accordance with the *Explosives Act 2003* (NSW) and the Explosives Regulation 2013 (NSW).	10,000 (no unit)
Boosters without detonator	1.1D	0042		3,000
Charges, shaped without detonator	1.1D	0059		3,000
Cord, detonating, flexible	1.1D	0065		3,000
Econotrim butt buster 398	1.1D	0082		3,000
Explosive, blasting, type E	1.1D	0241		3,000
Cartridges, power device	1.4S	0323		3,000
Detonator assembles, non-electric for blasting	1.1B	0360		10,000 (no unit)
Ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives	5.1	3375	Underground tank	5,000
Ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives	5.1	3375	Mobile processing unit	3,300
Ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives	5.1	3375	Above ground tank	2 x 30,000

6.11.4.2 Hazardous incidents

The incidents identified, that may occur during the life of the Project, are:

- spills/leaks;
- fire;
- explosion;
- excessive vibration or overpressure;
- flyrock;
- excessive blast fume;
- geotechnical structural failure;
- unauthorised movement;
- theft;
- malfunction of equipment/mine infrastructure; and
- malicious acts.

These types of incidents were applied to the components of the Project to identify scenarios, for which treatment measures were developed.

6.11.5 Risk analysis and evaluation

A qualitative assessment of risks associated with the Project was undertaken, and is provided in Appendix 13, Preliminary hazard analysis. The qualitative assessment identified 28 off-site risks, including;

- 15 class I risks;
- 12 class II risks that all pose a class I risk, after considering proposed mitigation; and
- one class III risk associated with the heap leach facility, which poses a class II risk after considering proposed mitigation.

The analysis of the identified mitigated class II risk from the heap leach facility is presented in Table 6-58. A detailed assessment of heap leach stability is provided in Section 6.2, Subsidence and geotechnical, and the proposed rehabilitation strategy for the heap leach is provided in Chapter 8, Rehabilitation and closure.

The SEARs requires an assessment of risks relating to bushfire, which is summarised in Section 6.11.5.1.

Table 6-58: Identified pre-mitigation class III risk scenario

Project component	Incident type	Scenario	L	C	Risk	Existing and proposed treatment measures	L	C	Residual risk
Construction and operation of the heap leach facility	Spill or leak	Spill or leak of contaminated water from the heap leach facility leading to off-site impact on water quality or soils.	C	3	Class III	• Design and construction of heap leach facility in accordance with relevant standards, legislative requirements and industry best practices. • Location of heap leach facility to be upgradient from the open cut pit. • Water management system designed and constructed to capture any contaminated water from the heap leach facility. • Operations of the heap leach facility in accordance with a heap leach operating manual. • Regular inspection of the heap leach facility. • Groundwater and surface water monitoring program. • Implementation of operational procedures and operator training. • Emergency Response Systems. • Pollution Incident Response Management Plan.	D	3	Class II

6.11.5.1 Bushfire

Bushfires may impact human health, property safety and the environment on a large scale. The PHA identified seven hazards that may potentially lead to off-site fires, including bushfires. All potential bushfire-related risks were assessed to be class I risks after considering proposed mitigation. Proposed mitigation will include, but is not limited to:

- regular inspection and maintenance of facilities
- implementing operational procedures; and
- development and implementation of a Bushfire Management Plan.

6.11.6 Risk treatment

The treatment measures for each identified risk are provided in the risk assessment (Appendix 13, Preliminary hazard analysis, Appendix A1). In addition to these specific treatment measures, general hazard controls will be applied during all Project phases. The controls will include:

- **Maintenance:** Ongoing and timely maintenance of all mobile and fixed plant equipment will be undertaken according to the recommended maintenance schedule of the original equipment manufacturer and to ensure consistency with required by relevant legislation.
- **Training:** Equipment operators and drivers will be trained and licensed (when appropriate) for their operations. Only personnel who are appropriately licensed will undertake work when such licensing is required.
- **Engineered structures:** Mining and civil engineered structures will be constructed according to applicable Australian Standards, codes and guidelines. When applicable, Aeris will obtain the necessary licence and permits to construct engineered structures.
- **Contractor management:** All contractors employed on-site will be required to operate according to the relevant Australian Standards and NSW Legislation.
- **Water management:** Water management structures will be constructed to separate runoff from disturbed and non-disturbed areas. Runoff from disturbed areas will be captured in the site's water management system, while runoff from undisturbed areas will be directed around the mine site.
- **ROM ore management:** The site will be kept clean and tidy and fire hazards removed where practical. Firefighting and dust suppression equipment will be maintained in appropriate locations. Regular inspections will be conducted.
- **Storage facilities:** Storage and usage procedures for potentially hazardous materials (e.g. hydrocarbons) will be developed and implemented. Storage and usage procedures will be consistent with Australian Standards and requirements of relevant legislation. A dangerous goods register will be developed and kept up-to-date with chemicals and dangerous goods stored on-site.
- **Emergency response:** Emergency response procedures will be documented, and procedures and systems will be implemented.
- **Waste management system:** Waste management will consider general waste management principles (reduce, reuse, recycle). Waste disposal measures and waste monitoring will be described in the Waste Management Plan.

A series of management plans will be used by Aeris Resources to provide a comprehensive safety management system for Tritton Copper Operations, including the Constellation Project. The safety management system will manage risks to health and safety in accordance with the requirements of the *Work health and Safety (Mines and Petroleum Sites) Act 2013* and the Work health and Safety (Mines and Petroleum Sites) Regulation 2014.

The safety management system incorporates environmental management plans designed to minimise and mitigate environmental impacts. The existing Tritton Copper Operations environmental management plans will be revised to address the Project requirements, or new plans will be developed. The plans will include, but not be limited to:

- Bushfire Management Plan;
- Code of conduct (transport of waste rock or tailings);
- Contaminated Land Management Plan;
- Cultural Heritage Management Plan;
- Disposal Management Plan;
- Dust Management Plan;
- Environmental Management Plan;
- Emergency Plan;
- Flora and Fauna Management Plan (Biodiversity Management Plan);
- Historic Heritage Management Plan;
- Hydrocarbon and Chemical Management Plan;
- Land Management Plan;
- Noise and Vibration Management Plan;
- Operating Manual (Processing department);
- Pollution Incident Response Plan;
- Rehabilitation Management Plan;
- Sediment and Erosion Plan;
- Tailings Extraction Management Plan;
- Traffic Management Strategy;
- Visual Amenity and Landscape Management Plan;
- Waste Management Plan;
- Waste Rock Characterisation and Management Plan;
- Water Management Plan (EPL 11245); and
- Weed Management Plan

6.11.7 Conclusion

An assessment was undertaken in accordance with the SEARs, industry standards and guidelines to identify and assess the potential off-site risks posed by hazardous materials and potential hazardous incidents to people, property, and the environment.

Four hazardous material categories (hydrocarbons, chemicals, explosives, and waste) were assessed. Assessment of potential hazardous incidents was conducted using a qualitative method.

By implementing the proposed treatment measures for all risks, the assessment identified that a spill or leak from the heap leach facility would pose the highest risk (class II); and all other hazardous incidents are considered a low risk (class I). The proposed heap leach facility design and rehabilitation management plan will be subject to improvement, based on the observed performance of the similar facility at the Murrawombie Copper Mine site. Therefore, future assessment of risks associated with the facility will be made and cognisant of the outcomes at the Murrawombie site.

6.12 Cultural heritage

6.12.1 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) includes assessment of impacts to heritage, addressing Aboriginal heritage and historical heritage. The cultural heritage assessment requirements are provided in Table 6-59, and this Section has been prepared to address those requirements.

Table 6-59: Heritage assessment requirements

Assessment matter	Report locations
Assess the potential impacts of the development on Aboriginal heritage (cultural values and archaeological).	Section 6.12.2.4 Appendix 3, Aboriginal cultural heritage assessment
Include adequate consultation with relevant Aboriginal stakeholders, having regard for the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010), and document in an Aboriginal Cultural Heritage Assessment Report, including the significance of cultural heritage values for Aboriginal people who have a cultural association with the land.	Section 6.12.2.2.1 Appendix 3, Aboriginal cultural heritage assessment, Section 3
Include results of a surface survey (and test excavations, if required) undertaken by a qualified archaeologist to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record.	Section 6.12.2.3 Appendix 3, Aboriginal cultural heritage assessment, Section 7
Avoid and mitigate impacts on cultural heritage values, and identify any conservation outcomes, including mitigation measures and procedures for accidental finds at any stage of the development; and	Section 6.12.2.4 Appendix 3, Aboriginal cultural heritage assessment, Section 11 Appendix 4, Historical heritage assessment, Section 7
Assess the potential impacts on historic heritage in accordance with the NSW Heritage Manual, including any heritage conservation areas and state and local historic heritage items within and near the site.	Section 6.12.3.1 to 6.12.3.7 Appendix 4, Historical heritage assessment, Section 5

6.12.2 Aboriginal heritage

An Aboriginal Cultural Heritage Assessment (ACHA) was completed by Niche Environment and Heritage Pty Ltd (Niche) and representatives of Registered Aboriginal Parties (RAPs). The ACHA was prepared in accordance with the DECCW's Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010a) and the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW 2010b). The ACHA is provided in Appendix 3, Aboriginal cultural heritage assessment.

6.12.2.1 Existing environment

Understanding the past and present environmental context is a requisite for Aboriginal archaeological and cultural heritage investigations (DECCW 2010a). Landscape context may provide insight into areas of land that may have been used by Aboriginal people more intensively in the past due to the presence of resources, such

as water, stone, plants, animals, raw materials or landscape features that are associated with sustenance, shelter, tool manufacture and cultural activities.

The Project lies within the Cobar Downs Mitchell landscape (DECC 2002). The geomorphology of the Cobar Downs Mitchell landscape is undulating rounded ridges, low plateaus, higher areas of Ordovician and Silurian sedimentary and metamorphic rocks, sandstone ridges, siliceous and ferruginous stones and the occasional overlying sand dunes (DECC 2002). The undulating landscape with higher peaks and ridges creates vantage points providing an overview of the surrounding landscape. The presence of drainage lines creates an easily traversed landscape.

The mix of sedimentary and metamorphic rocks that make up the Girilambone Group provides material with utilitarian characteristics. Material such as chert, quartz and metamorphic rocks may be utilised in stone tool production, and materials, such as sandstone, may be utilised for grinding grooves or grinding stones. Non-utilitarian uses of sandstone may be included for art and engraving.

The soils in the region are typically uniform, and within the Project area, the predominant soil landscape is red earths and lithosols. The dominance of brown and grey clays is common within drainage lines. The increased likelihood of in situ artefacts is due to the dominance of clays that provide a stable subsurface stratigraphy (DECC 2002).

Flora and fauna within the Project area would have provided valuable sources of food, medicines, tools and ceremonial objects. The primary factor for predicting the presence of Aboriginal cultural sites is water. The Project is approximately 9 km west of the Bogan River and 20 km east of Turners Creek.

The wider landscapes have been affected by previous disturbances, including:

- mining activities;
- the settlement of Girilambone;
- construction of the Mitchell Highway;
- allocation of the Girilambone State Forest; and
- intensive agricultural and pastoral land use.

6.12.2.1.1. Ethno-historical context

The Project area falls within the traditional lands of the Wongaibon groups or Wangaaypuwan (Tindale 1974). The Ngemba, Ngiuampaa, Wangaaypuwan, Wayilwan People are the recent native title applicants for the region. The local Aboriginal language groups are the Ngiyampaa or Ngempa, extending from Nyngan to Bourke and Ivanhoe. The Ngiyampass people may refer to themselves by one of the following three names, which indicates their home country more specifically (Donaldson 1980, NPWS 2003):

- Pilaarrkiyalu—Belah Tree People;
- Nhiilyikiyalu—Nelia Tree People; and
- Karulkiyalu—Stone Country People.

Small family groups were at the core of Aboriginal society, making up the basis of the hunting and gathering lifestyles of the Wongaibon people. Archaeological remains of the activities of these family groups are typically scattered across hearths throughout the landscape where the groups would camp, source food, shelter and perform daily rituals.

The local township of Girilambone south-west of the Project is significant to the Aboriginal people of north-west NSW. The township is the setting of a dreamtime story describing a tale of local spirits causing an astronomical event, described as a meteorite impact resulting in the local mineral deposits. The story is considered an example of European influence on Aboriginal mythological stories (McQueen 2018).

6.12.2.1.2. Archaeological context

Previously, there have been no archaeological investigations within the Project site. However, several heritage assessments have been undertaken in the vicinity of the Project. These assessments mostly focused on the presence and absence of Aboriginal objects within a limited area of work.

Three extensive searches of the Aboriginal Heritage Information Management System (AHIMS) were undertaken for the Project and surrounds on 24 September 2021, 3 March 2023 and 13 May 2024. A total of 140 Aboriginal cultural heritage sites were recorded (Table 6-60); the closest AHIMS site is 1.5 km east of the Project and no sites are within the Project site.

Past archaeological work in the region indicates that archaeological features are typically modified scarred trees (41%) and hearth sites (22%) (Table 6-60). Proximity to water usually resulted in a higher occurrence of artefact scatters and isolated finds. As the Project is 9 km from the nearest reliable water source, it is more likely that terrestrial fauna comprised the main protein source for Aboriginal people of the area. Settlement in the Bogan Shire for agriculture, including management of natural resources for agriculture, ended traditional lifestyles for Aboriginal people in the area. Land clearing for timber production and grazing was later replaced by mining that greatly reduced the available landscape features available to Aboriginal people.

Table 6-60: Summary of AHIMS sites with the search area

Site features	Total	Percentage of total (%)
Modified tree (carved or scarred)	58	41.43
Hearth	31	22.14
Earth mound and hearth	30	21.43
Artefact/s	18	12.86
Artefact/s and earth mound and hearth	2	1.43
Artefact and modified tree (carved or scarred)	1	0.71
Total	**140**	**100%**

6.12.2.2 Methodology

The ACHA was prepared in accordance with the relevant government regulatory instruments, guidelines and policies, including:

- Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010b);
- Guide to investigating, assessing and reporting Aboriginal cultural heritage in NSW (OEH 2011);
- Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010a);
- Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010c); and
- The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Australia ICOMOS 2013).

Aboriginal cultural assessments were carried out by an experienced heritage consultant from Niche and the RAPs between August 2022 and February 2023.

The assessments involved linear parallel transects aligned in the east–west direction undertaken by the field team walking and by vehicle survey when highway construction did not safely allow walking.

All areas proposed to be disturbed by the Project were assessed, and a description of the methodology can be found in the ACHA (Appendix 3, Aboriginal cultural heritage assessment, Section 7.1 and 9.1).

Further, a significant impact assessment was undertaken using standard criteria from the Guide to investigating, assessing and reporting Aboriginal cultural heritage in NSW (OEH 2011).

All Aboriginal objects in New South Wales are protected under the *National Parks and Wildlife Act 1974* (NPW Act). The act recognises that destruction of sites may be necessary to allow other activities or developments to occur.

Heritage significance was assessed by considering each cultural and archaeological site against the significance criteria set out in the Guide to investigating, assessing and reporting Aboriginal cultural heritage in NSW (OEH 2011). The assessment of significance was informed by the Aboriginal community, which is documented in Appendix 3, Aboriginal cultural heritage assessment.

6.12.2.2.1. Aboriginal consultation

The ACHA followed the processes outlined in the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010b) to consult with Aboriginal people about the Aboriginal cultural heritage values and cultural significance of Aboriginal objects and/or places within the Project area. The consultation process initially identified seven Aboriginal stakeholder organisations that may have an interest in the Project. Following notification, four organisations and/or individuals chose to become RAPs for this Project (Table 6-61). All correspondence with potential Aboriginal stakeholders and RAPs is presented in Appendix 3, Aboriginal cultural heritage assessment. One organisation registered for the Project requested that their contact details be kept confidential.

Table 6-61: RAP Organisations and contacts

Organisation	Contact name
Nyngan Local Aboriginal Land Council	Veneta Dutton
Ngemba, Ngiuampaa, Wangaaypuwan, Wayilwan	Connor Wakefield and Matilda Vaughn
Bogan Aboriginal Corporation	Lesly Ryan
Organisation requested confidentiality	Contact details confidential

The Aboriginal cultural survey was conducted over 19 days by representatives from the following organisations:

- Ngemba, Ngiuampaa, Wangaaypuwan, Wayilwan; and
- Nyngan Local Aboriginal Land Council.

A draft of the ACHA report was issued to all RAPs on 29 May 2023, and a request was made for comments to be provided within a statutory time frame of 28 days.

Correspondence with potential Aboriginal stakeholders, consultation with RAPs, the consultation process and findings and feedback are provided in Appendix 3, Aboriginal cultural heritage assessment.

6.12.2.3 Aboriginal cultural heritage sites in the Project area

The archaeological field survey recorded 45 new Aboriginal cultural heritage sites (Table 6-62). These sites demonstrate tangible cultural heritage in the Project area, as depicted in Figure 6-33, along with the existing recorded sites in the AHIMS search described in Section 6.12.2.1.2. A description of each new site can be found in Appendix 3, Aboriginal cultural heritage assessment, Section 7.4.

Table 6-62: Summary of newly identified sites

Site type	Number of sites
Artefact scatter	3
Hearth	7
Hearth with artefact	1
Isolated artefact	3
Scarred tree	30
Midden	1
Total	**45**

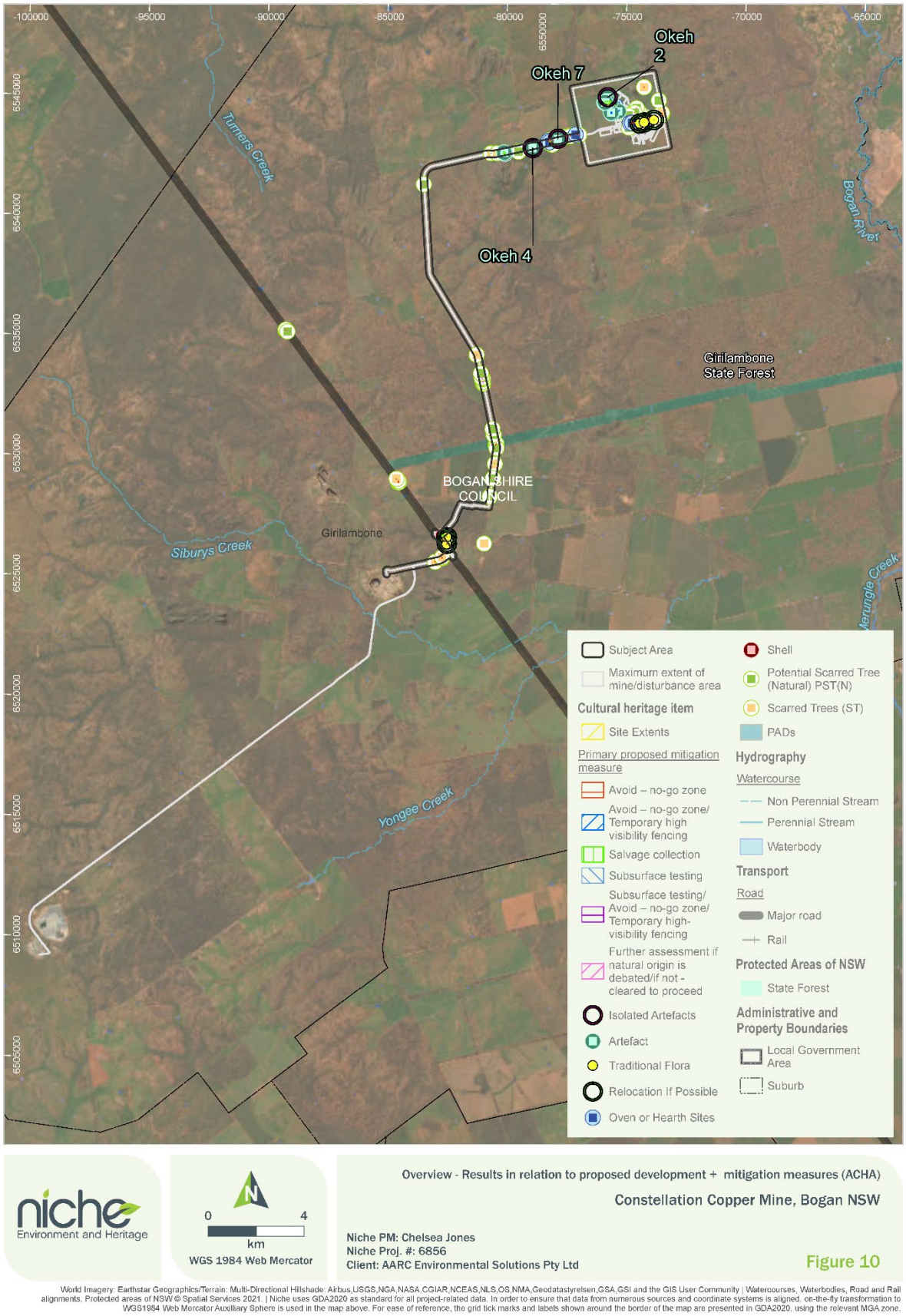


Figure 6-33: New survey sites and previously identified cultural heritage sites

6.12.2.4 Impact assessment

In the Project area, 45 sites or objects were identified to have some cultural heritage value (Section 6.12.2.3). The significance value for each Aboriginal object and/or site identified is provided in Appendix 3, Aboriginal cultural heritage assessment.

Direct and indirect harm to Aboriginal objects and places, as specified by the OEH (2011), have been considered in the impact assessment:

- Direct harm refers to occasions when an activity physically impacts a site or object, thus affecting the heritage values of the site or objects.
- Indirect harm refers to harm from secondary consequences of an activity that may affect sites or objects indirectly, such as increased erosion from an activity.

The Project has the potential to directly and indirectly harm cultural sites from activities required for:

- infrastructure works;
- road upgrades;
- the open cut mining pit;
- processing facilities; and
- waste rock emplacements.

Eleven Aboriginal heritage sites are predicted to be impacted by the Project (Table 6-63). This includes five Aboriginal heritage sites assessed to be lost from Project disturbance and six assessed to undergo partial loss from Project disturbance.

All sites predicted to undergo total or partial loss are described to have low or moderate scientific significance, low aesthetic significance and low historical significance.

Sites identified as potential archaeological deposits (PADs) are subject to a degree of unknown impact consequence, and supplementary test excavation is identified as an approach to describe with certainty the consequence of impacts on these sites.

Table 6-63: Aboriginal cultural heritage impact assessment summary

AMIS ID	Site name	Features	Type of harm	Degree of harm	Consequence (without mitigation)
26-3-0206	Okeh 1	Artefact scatter, hearth and PAD	Indirect	Partial	Partial loss of value/ unknown
26-3-0208	Okeh 3	Artefact scatter and PAD	Direct	Partial	Partial loss of value/ unknown
26-3-0196	Okeh 5	Artefact scatter and PAD	Direct	Partial	Partial loss of value/ unknown
26-3-0197	Okeh 6	Artefact scatter and PAD	Indirect	Partial	Partial loss of value/ unknown
26-3-0199	Oven 1	Hearth and PAD	Direct	Total	Total loss of value/ unknown
26-3-0200	Oven 2	Hearth and PAD	Direct	Partial	Partial loss of value/ unknown
26-3-0226	Okeh midden 1	Midden (shell) and PAD	Partial	Partial	Partial loss of value

AMIS ID	Site name	Features	Type of harm	Degree of harm	Consequence (without mitigation)
26-3-0227	Okeh scar tree 4	Scarred tree	Direct	Total	Total loss of value
26-3-0190	Okeh scar tree 8	Scarred tree	Direct	Total	Total loss of value
26-3-0193	Okeh scar tree 15	Scarred tree	Direct	Total	Total loss of value
26-3-0222	Okeh scar tree 27	Scarred tree	Direct	Total	Total loss of value

Table 6-63 lists only sites exposed to direct, partial and indirect harm. To see the full list, including sites declared as no-impact sites, refer to Appendix 3, Aboriginal cultural heritage assessment, Section 10.4.

6.12.2.5 Mitigation and management measures

Ecologically sustainable development and intergenerational equity are the founding principles for conservation under guidelines provided by the NSW Government (OEH 2011). These principles align with that of the Burra Charter (Australia ICOMOS 2013). The management hierarchy for the conservation principles is:

- avoidance and in situ conservation;
- partial avoidance and partial in situ conservation (including partial harm);
- the harm cause with mitigating circumstance such as collection or salvage; and
- unmitigated harm.

The management hierarchy was used to refine the Project layout. The Project will avoid impacting 35 Aboriginal cultural heritage sites and partially avoid a further four sites. The results of the archaeological investigations and the comments received from the RAPs were incorporated into developing the management and mitigation measures for the Project. (Refer to Appendix 3, Aboriginal cultural heritage assessment, Section 10.4 for the list of no-impact sites).

An Aboriginal Heritage Management Plan (AHMP) will be implemented to meet the Aboriginal heritage requirements for the Project. The plan outlines specific mitigation measures to ensure continued compliance with the NPW Act (Appendix 3, Aboriginal cultural heritage assessment, Section 11).

6.12.2.5.1. Commitments

The following commitments to protect Aboriginal cultural heritage sites will be undertaken for the Project:

- 'No-go zones' will be established during construction, and management plans for identified Aboriginal cultural heritage sites out of the Project impact area will be developed and implemented.
- The Aboriginal community will be consulted in accordance with consultation guidelines.
- Site cards for Aboriginal cultural heritage sites will be submitted to the AHIMS.
- An AHMP will be implemented for the Project including:
  - a protocol for consulting with RAPs to develop the AHMP;
  - an induction for Project staff of obligations in the AHMP; and
  - an action plan if previously unknown Aboriginal cultural heritage objects are discovered.
- Subsurface testing in areas for PADs will be carried out to identify the areas to be impacted including:
  - Okeh 3 PAD;
  - Okeh 5 PAD;
  - Oven 1 PAD;

- Oven 2 PAD; and
- Okeh midden 1.

- Temporary high visibility fencing will be installed to demarcate sites Okeh 1 and Okeh 6.
- Salvage surface collecting and storage will be undertaken in consultation with RAPs for part of Okeh midden 1, Okeh 3, Okeh 5, Oven 1, and Oven 2.
- Salvage collecting and storage will be undertaken in consultation with RAPs for Okeh scar trees 4, 8, 15 and 27.

6.12.2.6 Conclusion

The ACHA assessment adopted the following processes and methods to address likely heritage impacts of the project:

- Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales;
- Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010a, DECCW 2010b); and
- SEARs requirements.

An archaeological field survey was undertaken by Niche archaeologists and representatives of the RAPs. The Project is predicted to impact 11 Aboriginal heritage sites (loss of five sites and partial loss of six sites) with:

- low aesthetic and historical significance; and
- low or moderate scientific significance.

Managing the impacts is proposed, including salvaging sites identified as within or partially in the impact footprint.

6.12.3 Historical Heritage

The Historical Heritage Assessment (HHA) was undertaken by Niche in accordance with the relevant legislation and associated planning guidelines, including the NSW Heritage Manual (DUAP 1996). The HHA is provided in Appendix 4, Historical heritage assessment.

6.12.3.1 Existing environment

The historical context and heritage listings provide the existing heritage environment for the Project.

6.12.3.1.1. Heritage listings

An extensive search of national, state and local heritage registers was conducted on 8 August 2022. The search results concluded that there were no listed heritage sites within or near the Project. The search used the following databases:

- Commonwealth Heritage List;
- National Heritage List;
- NSW State Heritage Register;
- State Heritage and Conservation (Section 170) registers; and
- Bogan Local Government Area Local Environmental Plan.

Further information can be found in Appendix 4, Historical heritage assessment, Section 2.

6.12.3.1.2. Historical context

An overview of the Aboriginal history of the local area is provided in Section 6.12.2.1.1 and Section 6.12.2.1.2.

Initial European occupation occurred in western NSW by the mid-1800s, with widespread settlement throughout the area occurring by the 1850s (NPWS 2003). The growing number of European settlements throughout the area disrupted the Aboriginal populations, including introducing diseases, such as smallpox and influenza, and destroying their traditional way of life (NPWS 2003). Violent interactions between European settlers and local Aboriginal populations occurred, and vital resources within the area were soon occupied by Europeans.

The earliest settlements within the vicinity of the Project were within the township of Girilambone, approximately 20 km from the proposed Project.

Discovery of copper in the township occurred in 1875 by Thomas Harman (McQueen 2018). The NSW Geological Surveyors investigated the land for mineral deposits, leading to mining industries being developed in the region. Mining began from 1881 to 1885, when a mine site in the Girilambone area was set up by William Richardson. The Girilambone Copper Mining Company Ltd was formed on 24 March 1881 (Kass 2011).

The township of Girilambone was booming by early 1882 with a population of approximately 500 and 90 employed by the mine. The railway reached the township in 1883, and a temporary worker's camp added to the population. A railway station was opened in 1884, and a new government village was gazetted near the railway station.

A disastrous fire occurred on 7 January 1885, resulting in the loss of one of the banks, the post and telegraph offices and some stores. Coupled with the mining settlement relocating from the town to the new village, the population declined in Girilambone to 160 in 1890 (McQueen 2018).

At the start of the twentieth century, primary industries surrounding Girilambone consisted of copper mining and farming, with demand for copper increasing due to rapid worldwide development. Activity at the Girilambone mine between 1900 and 1901 focused on exploring and developing the existing mine shafts. Existing technology, however, was unable to profit from the type and grade of ore. The world copper price declined in 1901, and the Girilambone Mining Company was liquidated and reconstructed as the Girilambone Mining Company NL in 1902. In late 1907, operation at the Girilambone mine ceased (McQueen 2018).

In 1920, the NSW Copper Recovery Co. NL selected the site for a new copper leaching plant, before becoming derelict after 38 years (McQueen 2018).

In 1991, the Girilambone Copper Company was formed as a joint venture between Nord (40%) and Straits Resources Ltd (60%) to develop and operate a new mine at the resource site. Mining began in 1992 with open pits and the construction of heap leach pads over the area of the original Girilambone town site.

The Girilambone–Tritton operation became fully owned by Straits Resources in 2005, before being passed to Aeris Resources Ltd through a corporate restructure.

Today, several mining ventures operate out of Girilambone and surrounding areas, including the proposed Constellation Project approximately 16 km north-east of the original Girilambone mine (Appendix 4, Historical heritage assessment, Section 3).

6.12.3.2 Methodology

The HHA report and survey were prepared in accordance with the principles and methodology of the Burra Charter (Australia ICOMOS 2013) and in accordance with the best practice standards set out by the NSW Heritage Division, which forms the NSW Heritage Manual, including:

- assessing Heritage Significance (Heritage Office 2001);
- assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Council NSW 2009); and
- Historical Archaeology Code of Practice (Heritage NSW 2006).

The methods are described in Appendix 4, Historical heritage assessment, Section 1.6.

A site inspection was carried out concurrently with the ACHA (Appendix 4) by an experienced heritage consultant from Niche across three surveys between August 2022 and February 2023.

For the inspection, the Project was divided into two survey areas:

1) the proposed haul route option from the Tritton Copper Mine site immediately north-west of the Girilambone township, along Railway Road and Bourke Street, through a rural land block (Aeris Block) and Okeh Road to the proposed Project site; and
2) the proposed Project site on two agricultural and grazing properties, known as Okeh and Windella.

Further details, photographs from the inspection and artefacts found on the Project site are contained in Appendix 4, Historical heritage assessment, Section 4.

The NSW Heritage Office Manual guideline, 'Assessing Heritage Significance' (Heritage Office 2001) was the framework used for the significance assessment and statement of significance. The guidelines incorporate the seven aspects of cultural heritage value identified in the Burra Charter into a framework currently accepted by the NSW Heritage Council (Australia ICOMOS 2013).

6.12.3.3 Haul route survey area (Railway Road, Aeris Block and Okeh Road) findings

Most of the survey area consists of heavily modified plains and undulating plain landforms, with lower-lying areas to the far north-west extent of Okeh Road.

The Tritton Copper Mine site is the predominant feature at the western extent of the survey area (Figure 6-34). The haul route passes over the Mitchell Highway and rail line immediately north of the Girilambone township. Girilambone station and associated rail infrastructure are south of the haul route (Figure 6-35).

Properties adjacent to Okeh Road are currently being used as agricultural farmland and for livestock grazing. The land assessed during the field inspection had been heavily impacted by agricultural practices (e.g. clearing and grazing) and road construction (extensive grading and addition of imported materials for vehicle access and drainage). Several modern telegraph or electrical power poles associated with the Okeh agricultural property and other rural residences were identified in the area (Figure 6-36).



Figure 6-34: Western extent of Project area, looking southeast



Figure 6-35: Girilambone Station, south of proposed haul road, looking south-east



Figure 6-36: Landscape adjacent to north-west extent of the works area containing telegraph poles/power lines, looking north

6.12.3.4 Okeh and Windella survey area findings

'Okeh' and 'Windella', the location of the proposed mine, are working farms. The landscape of both properties is a series of gently undulating plains and simple slopes utilised for crops and grazing.

The landscape of the properties has been modified by land clearing and levelling and installing fences, dams and vehicle access for crop production and grazing purposes.

The south and south-eastern sections of the survey area contained ploughed, levelled and recently harvested cropped areas on the low, stony, simple slopes. A large dam was in the north-eastern section of the Okeh property, overlooking the proposed open cut mine area.

Sections of the properties have been revegetated. There was a 20 m wide corridor immediately south of Okeh Road, extending from the entrance to the Okeh property in the west to the Windella property on the eastern boundary of the Project. While other sections remain cleared for cattle and goat grazing, no structures or features associated with the early use of the land within or immediately adjacent to the Project site were identified.

6.12.3.5 Identified potential heritage sites

From the two survey areas (Section 6.12.3.3 and 6.12.3.4), there were six potential historical heritage items identified, as shown in Figure 6-37:

1) telegraph line 1;
2) telegraph line 2;
3) Girilambone Cemetery;
4) water tower;
5) Aeris block dump site; and
6) Girilambone Railway Station and goods loading platform.

6.12.3.6 Heritage significance assessment

There are no listed heritage items within or in the immediate proximity of the Project (Table 6-64). Using the significance criteria and gradings applied to assess the significance of the six potential heritage sites in the survey area, two sites were assessed to hold moderate local heritage significance, fulfilling the criteria for local listing:

1) Girilambone Cemetery; and
2) Girilambone railway and goods loading platform.

Statements of significance for these heritage sites are provided in Sections 6.12.3.6.1 and 6.12.3.6.2.

Table 6-64: Significance of sites recorded during the survey

Item	Historical significance	Associative significance	Aesthetic significance	Social significance	Research potential	Rarity	Representative-ness
Telegraph line 1	None	Negligible	Negligible	None	None	None	None
Telegraph line 2	None	Negligible	Negligible	None	None	None	None
Girilambone Cemetery	Moderate	Moderate	Low-Moderate	Moderate	Moderate	Low-Moderate	Low
Water Tower	None	Negligible	Low	Negligible	None	None	None
Aeris block dump site	None	Negligible	None	None	Negligible	None	None
Girilambone railway and goods loading platform	Moderate	Low-Moderate	Moderate	Low-Moderate	Low	Low-Moderate	Low

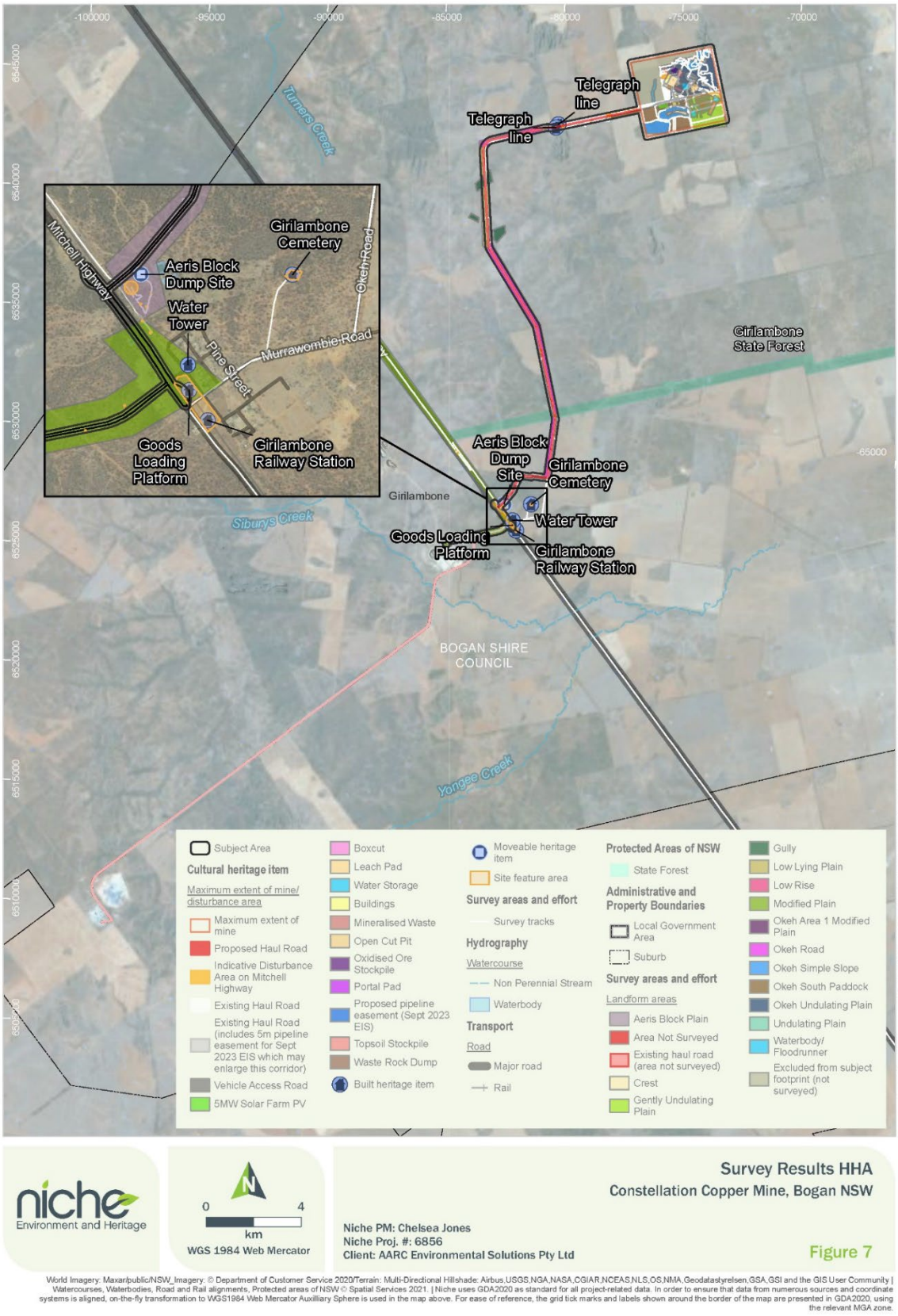


Figure 6-37: Identified potential heritage sites

6.12.3.6.1. Statement of significance—Girilambone Cemetery

Girilambone Cemetery has been in continuous use since the late nineteenth century, and it is of local heritage significance (historically and socially) to the Girilambone township and local region for its evidence of local residents recorded on gravestones.

The aesthetic significance of Girilambone Cemetery is derived from mature trees and shrubs, and there is a sense of enclosure because of the considerable remnant bush retained within its boundaries. The cemetery has retained its earliest burials with gravestones and monuments that are representative of early to mid-twentieth century graveyard features.

6.12.3.6.2. Statement of significance—Girilambone Railway Station and goods loading platform

The Girilambone Railway Station, goods loading platform and associated structures are of local heritage significance (historically, socially and associative), as the arrival of the railway in 1897 consolidated the Girilambone township and was integral to developing the region.

The railway station and loading platform are aesthetically representative of architectural design and construction methods utilised for rural railway stations in NSW during the late nineteenth and early twentieth centuries.

The Girilambone Railway Station buildings are currently under restoration, with planned use including an art gallery and café. The station buildings have previously been recommended for heritage listing and inclusion on the Bogan Local Environmental Plan (SHI # 11800700). They do not currently appear in any state or local statutory listing.

6.12.3.7 Impact assessment

The results of the impact assessment of potential heritage sites are shown in Table 6-65. Potential heritage sites that did not meet the significance criteria are assessed to pose no risk of impact. Further, no impacts are predicted for the Girilambone Cemetery, as it is not in the potential impact area. Negligible impacts on the Girilambone Railway Station are predicted during the construction period.

The site inspection in the study area incorporating the Project area identified potential sites indicating past activities, primarily from the late twentieth century historical phases and current land use. The rural use of the land in the Project area is not unique or significant within its regional context. No physical evidence suggested significance through association with historical events in the region.

Table 6-65: Site impact assessment

Item	Distance from proposed works	Impact to historical values
Telegraph line 1	Immediately adjacent	No impact—does not meet significance criteria.
Telegraph line 2	73 m from the haul route	No impact—does not meet significance criteria.
Girilambone Cemetery	1 km east of haul route	No impact—outside the Project area and will not be impacted.
Water tower	65 m east of haul route	No impact—does not meet significance criteria.
Aeris block dump site	50 m east of haul route option	No impact—does not meet significance criteria.
Girilambone Railway Station and goods loading platform	135 m south of haul route option	Negligible Impact – proposed woks may be visible from item; however, this would be limited and not continue once works are complete.

6.12.3.8 Mitigations and management measures

Historic heritage impact management measures have been developed for the Project in response to recommendations detailed in Appendix 4, Historical heritage assessment. The proposed measures aim to preserve historic values within and near the Project. The proposed management measures include the following:

- Ground-disturbing activities:
  - All ground-disturbing activity will be confined within the proposed works area.
  - Additional assessment may be required if the project layout changes and areas outside the assessed study area are to be impacted.
  - A statement of heritage impact will be prepared if the project layout changes and proposes works within 50 m of the Girilambone railway station and platform.
- Inductions:
  - All site staff and subcontractors will be advised of their obligations under the *Heritage Act 1977* prior to the commencement of works.
  - During the induction process and highlighted on all construction management plans, potential historic heritage items recognised as part of the HHA (Section 6.12.3.5) will be identified as 'no-go zones'.
- Works in proximity to heritage items:
  - Further assessment will be considered should future works be required within 50 m of identified historic heritage items, Girilambone Cemetery or Girilambone Railway and loading platform.
- Unexpected finds:
  - If unexpected non-Aboriginal heritage, including archaeological relics, is discovered during proposed works, all work in the immediate area will cease. A qualified archaeologist and, if necessary, Heritage NSW will be contacted to assess the significance and advise on further requirements prior to recommencing works.

6.12.3.9 Conclusion

The historic heritage value of the Project has been assessed by undertaking searches of heritage registers, a physical inspection of the site and analysing the cultural heritage values of the site. The assessment meets the requirements of the SEARs to assess likely heritage impacts of the Project.

The archaeological assessment determined that the Project will not impact any significant historical heritage sites, and there is a low potential for unrecorded non-Aboriginal sites in the Project area. Management strategies have been provided in Section 6.12.3.8 to preserve historic sites identified in the impact assessment.

6.13 Social

6.13.1 Introduction

The Social Impact Assessment (SIA) was prepared for the Project after holding stakeholder engagements between November 2022 and February 2023. As part of the assessment, stakeholder consultation was undertaken, and potential social impacts were identified and evaluated. It was prepared in accordance with requirements of the:

- Environmental Planning and Assessment (EP&A) Regulation 2021;
- Projects Secretary's Environmental Assessment Requirements (SEARs);
- Undertaking Engagement Guidelines for State Significant Projects (DPIE 2022d);
- State Significant Development Guidelines - preparing an environmental impact statement: Appendix B to the state significant development guidelines (DPIE 2022a);
- Social Impact Assessment Guideline (DPIE 2023a); and
- Social Impact Assessment Guideline for State Significant Projects: Technical Supplement (DPIE 2023b).

Several regional and local plans are relevant to the Project, and they identify opportunities for Project mitigation measures that could be implemented to support the community. Details of relevant regional and local planning is provided in Chapter 2, Strategic context, Section 2.3 and 2.4.

The SIA is provided in Appendix 10, Social impact assessment.

6.13.2 Assessment requirements

The Project SEARs includes requirements related to assessing social impacts. These requirements are provided in Table 6-66. Cumulative impacts relating to social impacts are in Chapter 6, Environmental assessment, Section 6.17, Cumulative impacts.

Table 6-66: Assessment requirements

Assessment matter	Report locations
An assessment of the social impacts of the development prepared in accordance with the Department's Social Impact Assessment Guideline for State Significant Projects (2021), including the likely impacts of:	Section 6.13.5 Appendix 10, Social impact assessment, Sections 6 and 7
the development on the local community;	Section 6.13.5 Appendix 10, Social impact assessment, Sections 6 and 7
cumulative impacts (considering other mining developments in the locality); and	Chapter 6, Environmental assessment, Section 6.17, Cumulative impacts Appendix 10, Social impact assessment, Section 6.9
consideration of workforce accommodation.	Section 6.13.6 Appendix 10, Social impact assessment, Sections 6 and 7

Assessment matter	Report locations
Subsidence—including an assessment of the likely subsidence effects, and the potential consequences of these effects and impacts on the natural and built environment, paying particular attention to features that are considered to have significant economic, social, cultural or environmental value.	Chapter 6, Environmental assessment, Section 6.2, Subsidence

6.13.3 Methodology

The SIA methodology was prepared in accordance with the DPIE Social Impact Assessment Guideline (2023a) and conducted by a suitably qualified social scientist. The assessment and methodology incorporated knowledge and insight from the SIA project team to develop and implement best practice impact assessment methods that were consistent with the Social Impact Assessment Guideline, including:

1) undertaking an initial scoping phase;

2) preparing a social baseline;

3) conducting community and stakeholder engagement;

4) undertaking an impact assessment;

5) undertaking a sensitivity analysis; and

6) developing recommended mitigation measures.

A Consultation and Engagement Plan was developed at the outset of the assessment to guide effective, inclusive and meaningful consultation. The community and stakeholder engagement included consultations with 37 stakeholders through:

- scoping interviews;
- a community survey; and
- semi-structured interviews, including in-person meetings and phone meetings.

The engagement conducted for the SIA is complemented by the broader community and stakeholder engagement program described in Chapter 4, Engagement.

6.13.4 Existing environment

The baseline social environment and key social conditions were described for the social locality of the Project. For the purposes of the assessment, the primary social locality was defined as the town of Girilambone (the nearest populated town). The secondary social locality was defined as the Bogan Shire. The social localities are described in Sections 6.13.4.1 and 6.13.4.2 and Figure 6-38.

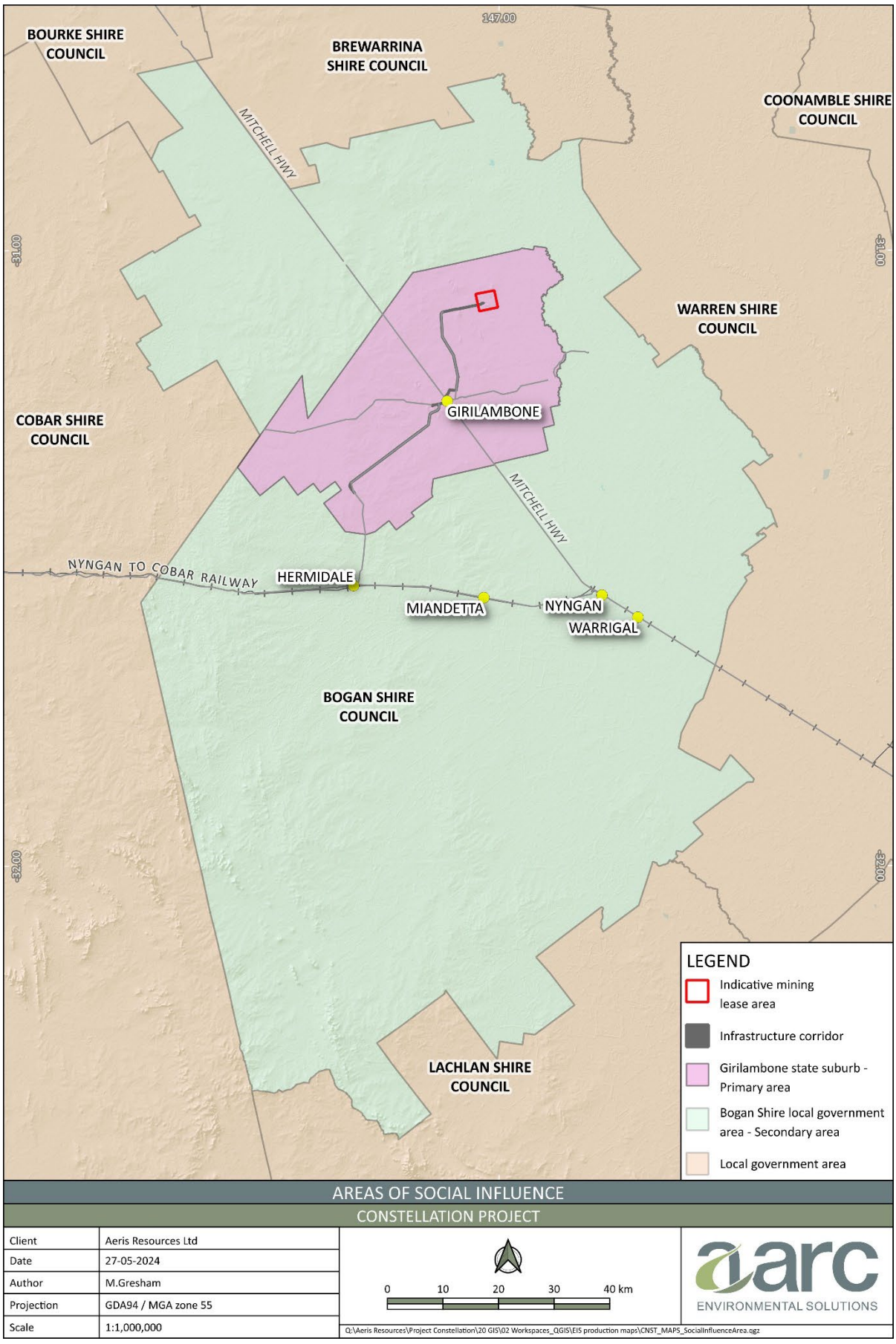


Figure 6-38: Areas of social influence

6.13.4.1 Girilambone (primary social locality)

The primary social locality is defined as the community closest to the Project; thereby likely to be most impacted. Girilambone is the closest community to the Project, approximately 20 km south-east of the Project and has been identified as the primary area of social influence inclusive of the Girilambone state suburb (Figure 6-38). Established in 1884, Girilambone serviced the construction of the Main Western Railway connecting Nyngan and Bourke townships. The Girilambone population has declined since its establishment and, according to the 2021 ABS census data, has an approximate population of 86.

6.13.4.2 Bogan Shire (secondary social locality)

The secondary social locality for the purpose of the assessment is the Bogan Shire local government area. The Project is within the Bogan Shire that has an area of 14,610 km^2. It adjoins:

- Cobar to the west;
- Bourke to the north-west;
- Brewarrina to the north;
- Warren to the east; and
- Lachlan Shire to the south.

Nyngan is the main service centre of the Bogan Shire, and it is at the junction of the Mitchell and Barrier Highways. Nyngan supports the smaller settlements of Girilambone, Coolabah and Hermidale. The majority of the population in the Bogan Shire reside in Nyngan.

6.13.4.3 Social baseline description for social locality

Baseline descriptions for the social localities are described in Sections 6.13.4.3.1 to 6.13.4.3.7. They are categorised by:

- surrounds and property;
- communities;
- housing;
- community values;
- employment and industry;
- social infrastructure; and
- health and wellbeing.

The baseline descriptions were developed from quantitative information derived through census data, other secondary sources of information (e.g. existing data from similar projects) and primary information obtained through engagement.

6.13.4.3.1. Surroundings and property

The Project is within the boundaries of the Nyngan Local Aboriginal Land Council in the Wongaibon Nation. The land use surrounding the Project is primarily agricultural, and the Project is on two agricultural properties (Okeh and Windella). The visual character is predominantly rural, with agricultural activities dominating the landscape.

The communities near the Project include the townships of:

- Girilambone (20 km from Project);
- Coolabah (27 km from Project); and
- Nyngan (55 km from Project).

The Bogan Shire is generally supported by agricultural production, grazing sheep and cattle, cropping (primarily wheat) and mining activities.

The Mitchell Highway is the major state and federal road servicing the region and will be a main access road for the Project. There are existing operating mining projects in the vicinity of the Project, including the Avoca Tank underground mine, the Tritton underground mine and the Murrawombie open cut and underground mines.

6.13.4.3.2. Communities

The Bogan Shire had a population of 2,647 in 2021, which was a decrease of 45 people since 2016. The largest populated town in the Bogan Shire is Nyngan, and the closest town to the Project is Girilambone.

Girilambone had a population of 86 people within the state suburb in 2021, which represented a significant decrease of 21% from the 2016 population. Despite these declines, the population of the shire is predicted to increase by approximately 0.27% annually over the next 25 years.

The Indigenous population in Bogan was 440 in 2021, which accounted for 16.6% of the Bogan Shire population. The Bogan Shire has a substantially higher percentage of Indigenous Australians compared to the NSW average of 3.5%.

Bogan Shire had a high proportion of couples in 2021—41.1% with no children and 42.3% with children. Proportionally this was similar to 2016 households. Couples with children (63.2%) and couples without children (36.9%) comprised the whole family and household composition for Girilambone in 2016 and 2021. For Girilambone, the proportion of couples with children increased by 13.2% and the proportion of couples without children decreased by 13.1% from 2016 to 2021.

The projection for Bogan Shire household types is that lone person and couple only households are projected to steadily increase, and couples with children, other family and group households are predicted to remain at similar figures.

The Bogan Shire recorded a similar gender ratio to the NSW average in the 2021 Census, with males at 50.3% and females and 49.7%.

Girilambone has slightly more males (55.8%) than females (39.6%)—the female proportion is 11% lower than the NSW average.

Bogan Shire has 111 people that need disability-related assistance, amounting to 4.5% of the population; this is slightly lower than the NSW average.

The percentage of Bogan residents who completed Year 12 (or equivalent) was 35.6% in 2021, which is significantly lower than the NSW average (58.9%). Approximately 32.5% of Bogan residents achieved an education until Year 10 (or equivalent), which was 12.8% higher than the NSW average. Girilambone had a smaller proportion of people who completed Year 12 (24.1%), which was 34.8% below the state average.

The median personal income of Bogan Shire residents is $774 per week, which is $39 below the state median, and the Bogan median household income is $1,444, which is considerably lower than the state median of $1,829.

Notably, the median mortgage repayment is significantly lower in Bogan Shire compared to the NSW median, with $1,083 and $2,167 a month respectively.

The median rent in Girilambone is significantly lower than the NSW median, with $200 and $420 a week respectively in 2021.

For socio-economic status, Bogan Shire ranks within the bottom fiftieth percentile of Australia, which indicates a higher potential of socio-economic disadvantage compared to other local government areas in Australia.

Bogan had 59.8 % of dwellings with two or more vehicles, which was higher than the NSW average. Girilambone had an even higher ratio of ownership of two or more vehicles at 76.9%.

6.13.4.3.3. Housing and accommodation

The majority of occupied private dwellings in Bogan Shire in 2021 were separate houses (91%). Semi-detached and townhouses formed 5.1% and 0.7% respectively, which were significantly lower than the state average in 2021.

Girilambone only had separate houses being occupied in 2016 (80.8 %). Occupancy of private dwellings in Bogan Shire and Girilambone were 78% and 86.7% occupancy respectively. This was lower than the state average of 90.6%.

Bogan Shire had a higher proportion of property outright ownership in 2021 than the NSW average. There was a significant change in tenure in Girilambone from 2016 to 2021, with rental properties rising from 0% to 23.1%. Outright ownership in Girilambone was at 42.3% in 2021, which was 10.8% higher than the state average.

In 2016, there were a total 51 social houses in the Bogan Shire or 3.9%, which was less compared to the state average. However, the estimated rate of homelessness in Bogan Shire appears to have increased between the 2016 and 2021 census period.

Online searches have indicated that there are nine short-term accommodation establishments in the Bogan Shire, although it is noted that not all have availability. Most of the establishments are in Nyngan (six), with one in Girilambone and two in Hermidale. The accommodation type is a mixture of motels and hotels, with one caravan park and a workers' village accommodation.

6.13.4.3.4. Community values

Residential amenity in the social locality is characterised by the following:

- low population density and low-density urban form, enabling privacy and a greater share of amenities and open space per resident;
- rural land uses, including productive agricultural land for sheep and cattle and large-scale cropping; and
- access to a range of local services and facilities, supporting rural living and lifestyle.

When compared to the NSW average, Bogan Shire and Girilambone have a much lower percentage of people born overseas and who speak a language other than English at home.

6.13.4.3.5. Employment and industry

The primary industry for employment in Bogan Shire was agriculture, forestry and fishing in 2021, accounting for 22.6%. Mining was the second highest employer at 15.7%, which was an increase from 2016. The next highest employment industries in Bogan were education and training (11.3%), health care and social assistance (9.5%) and public administration and safety (7.6%).

Agriculture, forestry and fishing were the primary industries for Girilambone residents in 2021, accounting for 52.8% of employment. Mining employment decreased from 23.1% to 8.3% from 2016 and 2021 to become the secondary employment industry in Girilambone. A number of industries that provided employment in 2016, such as transport, postal and warehousing and health care and social assistance, dropped to 0% in 2021.

In Bogan Shire, the unemployment rate decreased from 3.0% to 1.7% (1.3%) between 2019 and 2020. In June 2020, the unemployment rate in Bogan Shire was 3.3% below the NSW average.

6.13.4.3.6. Social infrastructure

The majority of social infrastructure facilities and services for the social locality are in the main rural township of Nyngan and include:

- five health facilities;
- nine education and early learning facilities, including the Girilambone Public School;
- six cultural and civic facilities, including Australia Post Girilambone;
- five religious facilities;
- four aged-care facilities;
- six community support facilities;
- six sport and recreation facilities; and
- two emergency and safety facilities.

6.13.4.3.7. Health and wellbeing

The review of health indicators shows that, in general, residents in Bogan Shire are not as healthy when compared to the state. For example, health indicators show that:

- Bogan Shire had more people 15 years or above self-assess their health as fair and poor compared with residents living in NSW (Age Standardised Rate 17.4 in Bogan Shire compared with 14.1 in NSW).
- The median age of death for males is 77 for Bogan Shire and 79 for NSW.
- More people 0 to 74 years of age in Bogan Shire die from cancer (at a rate of 13.4 per 10,000 persons per year), circulatory systems disease (9.5 per 10,000 persons per year) and respiratory disease (5.6 per 10,000 persons per year) compared to NSW.
- People aged 0 to 14 years who reported they had a mental health condition (including depression or anxiety) is higher in Bogan (at a rate of 2.5 per 100 persons) than NSW (1.9 per 100 persons).

The social locality lies within the Western NSW Local Health District, which covers an area of 247,000 km^2. The nearest major rural referral hospital is in Dubbo, which is approximately two-hour's drive away.

In the 12 months between January 2022 and December 2022, there were 408 reported crime offences in the Bogan Shire. The top three most common offences include:

- malicious damage to property (48);
- theft—break and enter non-dwelling (34); and
- assault—domestic violence related assault (32).

The Bogan Shire is within the West Region for Transport NSW. Data available from Transport NSW Centre for Road Safety for the social locality for the last five years (2017 to 2021) shows the following:

- There has been a total of 52 crashes, with four (or 8%) reported as fatal, and when compared to the West Region (3%) and NSW (1.5%), the percentages of fatalities in the social locality are significantly higher. The most recent reported fatality was in 2021 on the Mitchell Highway between Girilambone and Nyngan.
- Crashes involving light trucks were 27 (with two fatalities) and four involved heavy trucks.
- 71% of crashes were on state highways compared to West Region (37%) and NSW (18%).

6.13.4.4 Stakeholder consultation feedback on the social community

Feedback on the social community was obtained from the community survey (Section 6.13.3). The response rate was approximately 5% of the Girilambone community. In response to why the respondents like living in their community, responses included the statements: its small, sense of identity, the peace and the close social relationships. The other key findings of the survey relating to the social locality included:

- In relation to social fabric of the community:
  - 80% agree that their community is family-oriented;
  - 60% agreed that their community has the ability to adapt to change;
  - 50% agreed that their community is harmonious;
  - 80% agreed that their community is safe;
  - 80% agreed that their community has a strong sense of identity;
  - 40% agreed that their community is accepting of different cultures and lifestyles.
- In relation to key aspects of the community:
  - 60% disagreed that access to housing is affordable, with comments that there is not enough housing;
  - 80% disagreed that there is enough housing supply to meet demand, with comments that there is a need for more housing;
  - 100% agreed that local businesses are doing well;
  - 60% disagreed or strongly disagreed that the community has access to adequate medical and health services, with comments that there is a need for more doctors and medical staff;
  - 80% agreed that there are adequate jobs;
  - 80% agreed that the environment is healthy and clean, and 20% disagreed with comments about the current rubbish facility and village water supply;
  - 100% agreed that the quality of life is good; and
  - 80% disagreed that the roads connecting communities are safe and in good condition.

In addition to the community survey, a broad range of stakeholders were directly engaged via 31 semi-structured interviews—resulting in a considerable amount of primary data to inform the impact assessment. Feedback from the semi-structured interviews is provided in Attachment 3, Stakeholder engagement table, and summarised in Chapter 4, Engagement, Section 4.4.2.

6.13.5 Impact assessment and mitigation

The potential social issues and impacts of the Project were identified from the concurrent processes of direct engagement with stakeholders, community consultation strategy and the SIA stakeholder engagement program. The potential Project effects against the attributes of the existing social environment were assessed. The assessment drew on the knowledge and insight held by members of the Project team, applying best practice impact assessment methodology to identify and evaluate social impacts associated with the Project.

Social impacts, positive and negative, are discussed according to the social factors categories described in the SIA Guideline for State Significant Projects (DPIE 2023a) and include the following:

- way of life;
- community;
- accessibility;
- culture;
- health and wellbeing;
- surroundings;
- livelihood; and
- decision-making systems.

The pre-mitigation negative impacts ranged from high to medium significance while the pre-mitigation positive impacts ranged from medium to very high. A summary of the number of pre-mitigation impacts is shown in Table 6-67; the detail for each identified impact, proposed mitigation and post-mitigation residual impact is provided in Section 6.13.7.

Table 6-67: Summary of pre-mitigation potential impacts

Social factor category	Negative impacts	Positive impacts
Way of life	• High significance (4)	• None
Community	• High significance (1); and • Medium significance (2)	• Medium significance (2)
Accessibility	• High significance (1); and • Medium significance (3)	• None
Culture	• High significance (1)	• None
Health and wellbeing	• High significance (3); and • Medium significance (1)	• High significance (1)
Surroundings	• Medium significance (2)	• None
Livelihood	• High significance (1)	• Very high significance (1)
Decision-making systems	• Medium significance (1)	• High significance (1)

Note: Numbers in brackets are the number of impacts in each category.

6.13.6 Workforce accommodation

There will be an impact from the construction workforce resulting in increased demand for housing.

The Project will provide continued employment to existing Tritton Copper Operations personnel and will provide an average of approximately 178 full-time equivalent (FTE) jobs for employees and contractors during operations. Approximately 95 FTE contractors will be required during the 12-month construction phase of the Project.

The workforce accommodation arrangements are described in Chapter 3, Project description, Section 3.13.3. It is anticipated that approximately 51% of the workforce will reside in the surrounding local communities of Cobar, Nyngan, Hermidale, and Girilambone and may reside in the Tritton Copper Mine accommodation village while rostered on.

Approximately 49% of the workforce will be DIDO/FIFO primarily from the central coast regions and reside in the accommodation village. The accommodation village and the Outback Motel can provide a total of 79 rooms for single occupancy.

The accommodation requirements for temporary workers are identified as a source of potential impact on the way of life for the local community. The Social Impact Assessment (Appendix 10) recommends mitigation measures that it predicts will reasonably lessen the significance of the impacts on accommodating the Project workforce, as provided in Table 6-68, including:

1) developing a workforce accommodation strategy;

2) working with Bogan Shire Council to identify and respond to housing and workforce impacts;

3) requiring construction contractors to contact accommodation operators in advance of construction commencing to schedule accommodation bookings and enable accommodation providers to plan for maximum capacity;

4) advising council and real estate agents of workforce ramp-up and providing information on housing availability to workers; and

5) continuing to promote residency in the local area by providing a residential allowance and subsidised housing for certain personnel.

6.13.7 Mitigation and residual impacts

All negative impacts assessed can be reasonably mitigated with a coordinated approach involving the company and key local stakeholders. The positive impacts identified can all be enhanced using a similarly collaborative approach to realise the opportunities that the Project offers.

Table 6-68 shows:

- the proposed mitigation strategies for negative impacts and enhancement strategies for positive impacts; and
- the post-mitigation residual impact significance assessment.

The residual impacts are limited to:

- medium or low significance negative impacts; and
- high or very high significance positive impacts.

A social impact management plan will be prepared and implemented to manage Project social impacts and benefits. The plan will include a program to monitor potential social impacts over the life of the Project and identify unanticipated Project impacts.

Table 6-68: Summary of impacts mitigation and residual impacts

Project activity	Impact	Impact Significance Pre-mitigation (nature)	Recommended mitigation or enhancement strategy	Residual impact significance
Way of life				
Road works, road network and local traffic	Changes to the existing road network that may cause delays and interruption to traffic flow, as well as potentially impacting access to private property, stock movement activities and increasing road traffic volumes.	High (Negative)	1. Coordinate vehicle movements for delivery of materials and equipment on access roads. 2. Install permanent traffic control measures and signage for safe movement of vehicles. 3. Notify stakeholders of any material Project traffic-related activities (such as road closures due to road works). 4. Establish a road maintenance agreement with the Bogan Shire Council to ensure that the road is maintained in a trafficable condition. 5. Consider sealing sections of the haul route when it will mitigate material dust or noise impacts on sensitive receptors. In addition, watering of sections of unsealed road to minimise dust will be carried out. 6. Review speed limits for the haul road, particularly around sensitive uses to minimise safety risks. 7. Implement a complaints mechanism to identify, track and remediate community complaints associated with traffic generating activities from the Project's construction and operation phases.	Medium (Negative)
Rural and agricultural lifestyle	The haul road is expected to traverse private property, which will limit current operations (agriculture/farming) due to the presence of truck movement.	High (Negative)	1. Work with affected landowners to address concerns in relation to property impacts (e.g. fencing requirements, livestock safety through property specific agreements).	Medium (Negative)
	Acquisition of freehold land is required to accommodate the Project affecting landowners' use of properties.	High (Negative)	1. Landowner compensation mechanism through existing legal frameworks.	Medium (Negative)

Project activity	Impact	Impact Significance Pre-mitigation (nature)	Recommended mitigation or enhancement strategy	Residual impact significance
Accommodation requirements for temporary workers	There will be an impact from the construction workforce resulting in increased demand for housing.	High (Negative)	1. Develop a workforce accommodation strategy. 2. Work with the Bogan Shire Council to identify and respond to housing and workforce impacts. 3. Require construction contractors to contact accommodation operators in advance of construction commencing to schedule accommodation bookings and enable accommodation providers to plan for maximum capacity. 4. Advise Council and real estate agents of workforce ramp-up, and provide information on housing availability to workers. 5. Continue to promote residency in the local area through the provision of a residential allowance and subsidised housing for certain personnel.	Medium (Negative)
Community				
Community cohesion and social capital	Increasing permanent population through operations workforce will have positive effect on community life.	Medium (Positive)	1. Develop a strong workforce settlement campaign, including support for local liveability initiatives, family-oriented events and child and family health programs. 2. Work with local community associations to prepare a town welcome pack that encourages settlement and involvement in local towns. 3. Continue sponsorships and donations program, which focuses on projects that support community cohesion, promotion of local values, environmental projects, family-oriented initiatives and health-related initiatives.	High (Positive)
Community cohesion and social capital	Increasing population due to temporary construction workforce (FIFO/DIDO) may decrease the levels of community safety.	High (Negative)	1. Establish a workforce conduct policy that sets clear workforce behaviour expectations.	Medium (Negative)
	Enhancing the contribution of the Constellation Project to build social capital and community resilience.	Medium (Positive)	1. Work with the Girilambone Community Association and other groups to identify local community development projects and initiatives for sponsorship and in-kind donations.	High (Positive)

Project activity	Impact	Impact Significance Pre-mitigation (nature)	Recommended mitigation or enhancement strategy	Residual impact significance
Amenity and Lifestyle	The amenity of residents living near the Project (including the haul road) may be impacted by noise, vibration and dust, which may affect their lifestyles (e.g. willingness to use outdoor areas.)	Medium (Negative)	1. Community engagement and liaison will be undertaken to provide information on potential impacts resultant of Project activities. 2. Sealing of sections of the haul route will be considered when it will mitigate material dust or noise impacts on sensitive receptors. In addition, watering of sections of unsealed road to minimise dust will be carried out. 3. Apply reasonable and practicable dust mitigation measures, as detailed in the Air Quality Impact Assessment Report. 4. Apply reasonable and practicable noise mitigation measures, as detailed in the Noise Impact Assessment Report.	Low (Negative)
Community identity	Constellation may compromise emerging community identity around tourism due to increase mining activity.	Medium (Negative)	1. Work with community and the Girilambone Community Association to explore opportunities to partner/assist with initiative around tourism (e.g. signage project, community arts project, the restored railway station and carriages, camping in the park opposite the pub).	Low (Negative)
Accessibility				
Social Infrastructure—health	Construction workforce may generate a small increase in demand for health services in the social locality.	Medium (Negative)	1. Reduce additional demands on local health services through the provision of on-site first aid facilities for workers with appropriately trained personnel available who can assist with minor workforce health issues, as well as provide first response services for emergency situations and site accidents. 2. Continue to use online physiotherapy consultant support for workplace injuries.	Low (Negative)
Safety and Emergency Services	Increase in traffic accidents associated with increased workforce commuter traffic, heavy haulage and construction vehicles may increase demand on emergency services.	Medium (Negative)	1. Maintain regular communication with emergency services. 2. Attend local emergency management committee meetings.	Low (Negative)

Project activity	Impact	Impact Significance Pre-mitigation (nature)	Recommended mitigation or enhancement strategy	Residual impact significance
	Non-resident workers during construction creating issues around anti-social behaviour and placing pressure on police services.	Medium (Negative)	1. Engage with local police to develop emergency response plans and relationships between Aeris and the police to enable proactive responses to any project-related community safety issue. 2. Continue site meet and greet days with local emergency services.	Low (Negative)
Road Network	Increase in traffic volume on road network may deteriorate road condition and affect usability.	High (Negative)	1. Coordinate vehicle movements for delivery of materials and equipment on access roads. 2. Install temporary traffic control measures and signs for safe movement of vehicles. 3. Notify stakeholders of any Project traffic-related activities (such as road closures due to road works). 4. Establish a road maintenance agreement with the Bogan Shire Council to ensure that the road is maintained in a trafficable condition. 5. Review speed limits of haul road, particularly around sensitive uses to minimise safety risks. 6. Implement a complaints mechanism to identify, track and remediate community complaints associated with traffic-generating activities from the Project's construction and operation phases.	Medium (Negative)
Culture				
Aboriginal culture	Some loss of identified heritage items/sites is proposed to occur, including scarred trees, cultural trees and hearth sites.	High (Negative)	1. Avoidance of heritage sites has been undertaken as far as practicable, through Project design. 2. Consultation will be undertaken with traditional owners to determine opportunities for salvaging and/or recording heritage sites prior to impact. 3. Identified sites from the Project studies will be registered on relevant NSW databases to support improved understanding and protection.	Medium (Negative)

Project activity	Impact	Impact Significance Pre-mitigation (nature)	Recommended mitigation or enhancement strategy	Residual impact significance
Health and Wellbeing				
Physical Health	Noise, vibration and dust impacts for residence close to the Project and haul road may cause irritation and decrease personal health.	Medium (Negative)	1. Community engagement and liaison will be undertaken to provide information on potential impacts resultant of Project activities. 2. Sealing of sections of the haul route will be considered when it will mitigate material dust or noise impacts on sensitive receptors. In addition, watering of sections of unsealed road to minimise dust will be carried out. 3. Apply reasonable and practicable dust mitigation measures, as detailed in the Air Quality Impact Assessment Report. 4. Apply reasonable and practicable noise mitigation measures, as detailed in the Noise Impact Assessment Report.	Low (Negative)
Mental Health	Contribution to the community by providing employment certainty for existing workers and increasing employment opportunities and, therefore, reducing levels of stress.	High (Positive)	1. Develop a workforce recruitment and management strategy. 2. Provide career progression pathways for the workforce through provision of an upskilling and employment development program. 3. Prepare Workforce Health and Wellbeing Strategy.	High (Positive)
	Landowners experiencing stress and anxiety in relation to the perceived potential for impacts on their property's amenity, property value and re-sale, as well as livelihood.	High (Negative)	1. Work with affected landowners to address concerns in relation to property impacts. 2. Landowner compensation mechanism through existing legal frameworks.	Medium (Negative)
	Health impacts associated with the workforce, particularly the non-resident workforce (FIFO/DIDO) in relation to family isolation.	High (Negative)	1. Prepare a workforce health and wellbeing strategy. 2. Implement Health and Safety Management Systems, including in relation to fatigue management, management of risks associated with drugs and alcohol and workforce hygiene. 3. Continue to make the employee assistance program available to provide staff and their immediate families with free and confidential wellbeing and support services.	Medium (Negative)

Project activity	Impact	Impact Significance Pre-mitigation (nature)	Recommended mitigation or enhancement strategy	Residual impact significance
	Mine closure will also have a negative impact on the mental health of workers due to uncertainty around employment.	High (Negative)	1. Prepare and implement a people and community strategy to form part of a Rehabilitation Strategy for the Closure Phase prior to closure. 2. Engage the workforce in mine closure planning. 3. When possible, redeploy workers to other Aeris-operated projects.	Medium (Negative)
Surroundings				
Landscape and Natural Values	Some impact will occur to local environmental values to construct the proposed Project (e.g. vegetation loss, water use).	Medium (Negative)	1. Impacts to biodiversity values will be offset under NSW regulation, while water access licences will also meet water sharing requirements of regional water sharing plans.	Low (Negative)
Visual Amenity	Some visual amenity (and lighting) impacts will occur to Sensitive Receptors located along the haul road.	Medium (Negative)	1. In consultation with affected landholders and when practicable, implement screening along the haul road to minimise visual amenity impacts.	Low (Negative)
Livelihood				
Employment	The Project will provide new and ongoing employment opportunities, opportunities for local procurement (supporting local and regional business) and tax revenue for the NSW economy.	Very High (Positive)	1. Develop a workforce recruitment and management strategy. 2. Promote available employment opportunities via online job boards, local newspapers and other avenues. 3. Continue working with Nyngan High School and other local educational facilities to provide career pathway opportunities for local students. 4. Work with the Nyngan Local Aboriginal Land Council to explore opportunities for employment and training of Ngemba, Ngiyampaa, Wangaaypuwan, and Wayilwan people. 5. Encourage contractors and suppliers to provide training and recruitment opportunities for Ngemba, Ngiyampaa, Wangaaypuwan, and Wayilwan people. 6. Engage with the Nyngan Local Aboriginal Land Council to identify opportunities for Aboriginal-owned businesses to work with Tritton Resources and its contractors.	Very High (Positive)

Project activity	Impact	Impact Significance Pre-mitigation (nature)	Recommended mitigation or enhancement strategy	Residual impact significance
	Competition for labour between mining and agriculture leading to more attractive wages from mining and, therefore, a shortage of workers available for local agriculture businesses.	High (Negative)	1. Continue to provide career progression pathways for the workforce through the provision of upskilling and employee development programs.	Medium (Negative)
Decision-Making System				
Ongoing Engagement with Stakeholders	Lack of project information, such as progress and updates provided on a regular basis, leading to distrust in the community towards the project and decrease levels of social acceptance.	Medium (Negative)	1. Conduct annual resident community information sessions commencing prior to construction and continuing during at least the first two years of the Project's commencement to provide a Project update and address potential issues or concerns. 2. Provide stakeholders direct access to Project representatives who can answer their questions about the Project and its potential impacts. 3. Through the community consultative committee, build relationships that support communication, information sharing and feedback to assist decision-making regarding construction and operational impacts. 4. Ensure community aspects of the Constellation Project are part of the agenda for ongoing community consultation community forum meetings.	Low (Negative)
	Aeris will work closely with the Girilambone Community Association to continue to engage on matters impacting the town.	High (Positive)	1. Offer to meet regularly with representatives of the Girilambone Community Association. 2. Facilitate opportunities for interaction between Constellation employees and local residents to contribute positively to community cohesion and development.	Very High (Positive)

6.13.8 Conclusion

The SIA, including stakeholder engagement, was undertaken in accordance with the DPIE Social Impact Assessment Guideline. The baseline of the social locality was described, and the potential impacts were identified from stakeholder consultation and the expert opinion of the assessors.

Positive and negative social impacts were predicted, and mitigation and enhancement measures were proposed for negative and positive impacts. After implementing the recommended mitigation and enhancement measures, the residual impacts are limited to medium or low significance negative impacts and high or very high significance positive impacts.

6.14 Economic

6.14.1 Introduction

An economic impact assessment has been undertaken for the proposed Project by AEC Group Limited in accordance with the NSW Secretary's Environmental Assessment Requirements (SEARs) and relevant guidelines. The economic impact assessment has utilised a local effects analysis, literature reviews and relevant information on the existing environment to assess impacts.

This section summarises the beneficial and adverse economic impacts of the proposed Project and the management strategies to mitigate the adverse impacts and maximise the benefits on the local, regional state and national economies. The complete technical report is provided in Appendix 11, Economic impact assessment.

6.14.2 Assessment requirements

The Project SEARs requires an economic impact assessment to be undertaken. The specific requirements relating to the assessment and where each requirement has been addressed is provided in Table 6-69.

Table 6-69: Assessment requirements

Assessment matter	**Report locations**
Include an assessment of the likely economic impacts of the development, paying particular attention to the:	
• significance of the resource;	Section 6.14.4.1
• costs and benefits of the development for the state and region;	Section 6.14.5 (benefits) Section 6.14.6 (costs)
• the demand for the provision of local infrastructure and services; and	Section 6.14.6
• consideration of the need for a Voluntary Planning Agreement in relation to the demand for the provision of local infrastructure and services.	Section 6.14.8

6.14.3 Methodology

The economic impact assessment has defined the Bogan Shire Local Government area as the 'local catchment' for the purposes of this assessment.

The 'regional catchment' was defined as the area that comprises:

- Bogan;
- Cabonne;
- Dubbo;
- Gilgandra;
- Lachlan;
- Narromine;
- Orange;
- Parkes; and
- Warren Local Government areas.

The baseline scenario and the economic model developed for the Project were based on regional economic data.

The results from the economic modelling estimated the monetary contribution from direct and indirect impacts on the regional catchment and state economies:

- The direct impacts originate from the initial stimulus from the Project (i.e. construction and operational activities).
- Indirect impacts come from the additional demand for goods and services and household consumption as a result of additional wages and salaries.

Impacts from the Project at the local catchment and nationally were also examined when relevant and appropriate.

In addition to monetised economic impacts, the economic impact assessment also addresses non-monetised benefits, such as the benefits to:

- businesses;
- local infrastructure and services; and the
- local property market.

Adverse impacts and costs from developing the Project have been estimated through monetary and non-monetary methods. Monetised adverse impacts include:

- loss of agricultural productivity;
- cost of greenhouse gas emissions;
- traffic generation; and
- ecosystem services.

Non-monetised adverse impacts include impacts on:

- local businesses;
- Property;
- local infrastructure; and
- service provisions.

More details on the methodology can be found in Appendix 11, Economic impact assessment.

6.14.4 Existing environment

The local catchment's population decreased from 2,980 to 2,460 between 2012 to 2022, representing an average annual decrease of 1.9%. This local population decrease was in contrast to the regional catchment population, which increased from 141,400 to 149,800 (over the same period), representing an average annual growth of 0.6%.

Note: The regional catchment population is largely concentrated in the local government areas of Dubbo and Orange, which comprised two-thirds of the regional catchment population in 2022. These centres have largely driven population growth in the regional catchment over the last decade.

The gross regional product for the local catchment in 2021/22 was reported as approximately $563.8 million, which was heavily influenced by agricultural and mining activity, contributing a combined 73.2% of total gross value add (GVA) in 2021/22.

Mining was also the largest employing industry in the local catchment in 2021/22, employing 20.5 % of the local catchment's total workforce, while agriculture comprised 19.2% of the total workforce.

The unemployment rate in the local and regional catchments has predominantly been lower than in New South Wales over the last decade.

A decade-low unemployment rate of 1.6% in September 2020 was recorded in the local catchment, despite a reduction in the labour force in the 12 months prior to the onset of the COVID-19 pandemic, compared to an unemployment peak of 6.8% in New South Wales.

The labour market has since supported a recovery in the local catchment labour force, but there was also a rise in unemployment, registering an unemployment rate of 5% (December 2022) compared to 3% for the state.

The local catchment has observed a low level of property market development activity over the last decade due to sustained population decline.

While subdued growth in property prices and rental costs have been observed, the relative gap in prices over the last decade (within the regional catchment and state) has widened considerably. Local catchment vacancy rates have subsequently experienced minimal volatility over this period.

6.14.4.1 Significance of the resource

The Project deposit bears marked similarities with other copper sulphide deposits discovered in the Tritton Copper Operations tenement package, including the Tritton and Murrawombie deposits. The geology of the Project resource is detailed in Chapter 3, Project description, Section 3.3.2.

The copper resource targeted by the Project is identified to have significance in terms of being:

- A critical mineral for NSW, as established under the Critical Minerals and High-Tech Metals Strategy (DRNSW 2021). Investments in critical minerals are vital to enabling NSWs growth industries, including renewables. The future global economy and the pathway to lower emissions will be founded on minerals that NSW is rich in, such as cobalt, rare earth elements and copper (DRNSW 2021). Refer to Chapter 2, Strategic context, Section 2.3.2.5.
- A resource to support the continuity of the existing Tritton Copper Operations. The Project proposes to mine an average of 500,000 tonnes of copper ore per annum (across approximately 10 years of mining) to replace depleting production and maintain feed to the Tritton processing plant. This continuation will support the maintenance of significant economic and social benefits to local, regional and state communities. Social impacts of the Project are discussed in more detail in Chapter 6, Environmental assessment, Section 6.13, Social environment.

A series of formal assessment processes have been undertaken with the NSW Government (Department of Regional NSW) to support the communication of financial elements and ensure efficiency of resource extraction. This has included conducting a Resource Economic Assessment (REA) for the Project, which has reasonably satisfied that development of the targeted resource will be economically sound. The REA process is discussed further in Chapter 9, Evaluation and justification, Section 9.2.

6.14.5 Beneficial economic impacts

The potential beneficial economic impacts of the Project on economies, assessed based on the economic modelling and literature review, are summarised in Table 6-70. More detailed information on beneficial economic impacts is discussed in the following sub-sections.

Table 6-70: Potential beneficial economic impacts from the Project

Impact	Description
Economic Output	The Project will contribute to increased levels of industry output and gross regional product/gross state product in the regional catchment and NSW economies during construction and operations, flowing from both direct and flow-on impacts: • Construction activity is expected to generate a total of $144.7 million in output for businesses in the regional catchment and an additional $136.6 million in direct and flow-on output for businesses in NSW outside of the regional catchment. • Business activity attributable to construction is estimated to support $62.4 million in gross regional product for the regional catchment and an additional $69.8 million in gross regional product for the rest of NSW, totalling $132.1 million in gross state product in NSW. • Operational activity is expected to generate an average output of $179.5 million per annum in the regional catchment and an additional average output of $122.1 million per annum in direct and flow-on impacts for businesses in NSW (outside of the regional catchment). • Business activity attributable to operations is estimated to generate an annual average of $111.4 million in gross regional product in the regional catchment and an additional $60.0 million in average annual gross regional product for the rest of NSW, totalling $171.4 million in gross state product per annum in NSW.
Employment	The Project will support jobs in the regional catchment and NSW economies during construction and operations, flowing from both direct and flow-on impacts: • Construction activity is expected to support 315 FTE jobs in the regional catchment and an additional 429 FTE jobs in NSW outside of the regional catchment, totalling 744 FTE job years in NSW. • Operational activity is expected to support 256 FTE jobs in the regional catchment and an additional 362 FTE jobs for the rest of NSW, totalling 618 FTE jobs in NSW.
Household Incomes	The increase in employment will also support increased incomes in the regional catchment and NSW, flowing from both direct and flow-on impacts: • Construction activity is expected to support $40.4 million in wages and salaries in the regional catchment and an additional $40.5 million in wages and salaries in NSW outside of the regional catchment, totalling $80.9 million in wages and salaries in NSW. • Operational activity is expected to support $28.9 million in wages and salaries in the regional catchment and an additional $35.2 million in wages and salaries for the rest of NSW, totalling $64.1 million in wages and salaries in NSW.
Support for Local Businesses	Aeris has existing supply contracts and supply chains in place for Tritton Copper Operations, supporting local and NSW businesses. The Project will extend the mining and processing activities of the operation, thereby enabling continued support and opportunities for suppliers in the regional catchment and NSW that otherwise would be lost. This will provide additional security and longevity of business incomes (and employment). The Project will also present opportunities to secure new contracts to supply and service the needs of the Project during all phases of the Project. These supply contracts would not be able to be supported without the Project.
Government Revenue	The Project will provide a lift in State and Australian Government taxation revenues through a variety of taxes and duties. The NSW Government is expected to receive approximately $1.3 million in net additional revenue during construction (through payroll tax) and $6.3 million on average per annum during peak operations (primarily through royalty payments). The Australian Government is estimated to receive approximately $28.5 million during construction and $32.8 million annually during peak operations from various taxes. These additional revenues can be used by the Government to provide additional infrastructure and services to support business and households throughout Australia and NSW.

6.14.5.1 Benefits to local, regional, state and national catchments

The Project is expected to contribute to economies at local, regional and national catchment scales—refer to Table 6-71, Table 6-72 and Table 6-73 for the breakdowns of the monetised contributions to these catchments.

Table 6-71: Economic contribution to the regional catchment

Project phase	Impacts	Output ($M)	Gross Regional Product ($M)	Income ($M)	Employment (FTE)
Construction	Initial Stimulus in Local Economy	88.9	35.6	23.2	125
	Direct Requirements (First Round Type I) Impacts	26.1	10.9	8.1	83
	Industry Support (Subsequent Round Type I) Impacts	8.7	3.8	2.7	27
	Household Consumption (Type II) Impacts	20.9	12.0	6.3	80
	Total impacts	**144.7**	**62.4**	**40.4**	**315**
Operation (per annum)	Initial Stimulus in Local Economy	151.7	98	21.7	178
	Direct Requirements (First Round Type I) Impacts	13.0	5.5	2.8	27
	Industry Support (Subsequent Round Type I) Impacts	4.3	1.9	1.1	11
	Household Consumption (Type II) Impacts	10.6	6.1	3.2	40
	Total impacts	**179.5**	**111.4**	**28.9**	**256**

Notes:

- First Round Type I describes direct expenditure on goods and services by the industry experiencing the stimulus (direct suppliers to the industry).
- Subsequent Round Type I describes the second and subsequent round effects of increased purchases by suppliers in response to increased sales, known as the industry support effects.
- Type II represents the consumption-induced activity from additional household expenditure on goods and services resulting from additional wages and salaries being paid within the economic system.

Table 6-72: Economic contribution to NSW

Project phase	Revenue source	Output ($M)	Gross State Product ($M)	Income ($M)	Employment (FTE)
Construction	Initial Stimulus in Local Economy	100.5	39.9	26.3	157
	Direct Requirements (First Round Type I) Impacts	50.0	21.5	16.0	160
	Industry Support (Subsequent Round Type I) Impacts	32.3	15.3	10.5	102
	Household Consumption (Type II) Impacts	98.4	55.4	28.1	325
	Total impacts	**281.2**	**132.1**	**80.9**	**744**

Project phase	Revenue source	Output ($M)	Gross State Product ($M)	Income ($M)	Employment (FTE)
Operation (per annum)	Initial Stimulus in Local Economy	151.7	98	21.7	178
	Direct Requirements (First Round Type I) Impacts	48.1	19.7	12.2	115
	Industry Support (Subsequent Round Type I) Impacts	40.2	19.1	12.7	122
	Household Consumption (Type II) Impacts	61.5	34.6	17.6	203
	Total impacts	**301.6**	**171.4**	**64.1**	**618**

Note: All values under the operations phase are annualised.

In addition to these contributions to the NSW economy, it is noted that the Project will generate an estimated $1.3 million in tax revenue (payroll tax) during construction. A further $6.3 million per annum is also expected to be contributed to state revenue during operations (comprised of payroll tax and royalties).

Table 6-73: Economic contribution to the Australian Government

Project phase	Revenue source	Government revenue ($M)
Construction	Personal income tax	19.5
	Fringe benefits tax	0.4
	Company income tax	4.1
	GST	4.5
	Total impacts	**28.5**
Operation (per annum)	Personal income tax	15.5
	Fringe benefits tax	0.4
	Company income tax	10.4
	GST	6.6
	Total impacts	**32.8**

Note: All values under the operations phase are annualised.

In addition to monetary contributions to economies, the Project is expected to provide a range of social benefits to local, regional and state catchments. Social benefits of the proposed Project are discussed in Chapter 6, Environmental assessment, Section 6.13.

6.14.6 Adverse economic impacts

Potential adverse economic impacts of the Project are summarised in Table 6-74.

Table 6-74: Potential adverse economic impacts from the Project

Impact	Description
Impacts on Local Businesses from Competition for Resources	There will be increased competition for labour and resources as a result of the Project, leading to inflationary pressure and increased costs to businesses, as well as potential difficulties for local businesses in attracting and retaining staff. As a result, some industries (e.g. manufacturing) may observe a small decline in activity and employment relative to what would otherwise be expected to occur without the Project. Despite this, the impacts of the Project on industry output are estimated to be relatively small, and the Project's impacts primarily reflect the retention and ongoing support of economic activity already delivered by existing Tritton Copper Operations activity into the longer term.
Impacts on Agricultural Productivity	The Project is expected to result in the disturbance of approximately 170 ha of land currently used for agricultural activities. As a result, this area will be temporarily removed from production during the life of the Project but returned to agricultural use following Project completion and site rehabilitation (with the exception of the final mine void area). This is estimated to temporarily result in a potential value loss of approximately $11,100 per annum in grazing activity and approximately $22,000 per annum in cropping activity over the life of the Project.
Impacts on Local Property Market	As the Project workforce will largely comprise existing Aeris personnel and primarily reflect a maintenance of existing workforce levels, the local workforce is not anticipated to place any additional demand on the local property market beyond these existing levels. While it is acknowledged that some additional workers (beyond existing Aeris personnel) may be required during construction, the number of additional workers is expected to be small. The impact of the Project on the local property market will, therefore, likely be more positive in nature, supporting retention of the local population against a backdrop of rural decline. Without the Project, it is likely many workers living locally could leave to seek employment elsewhere. This could lead to high levels of vacancy rates and potential declines in local property values, adversely impacting property owners.
Impacts on Local Infrastructure and Service Provision	As the Project will reflect an extension of existing mining activities in the local area, thereby retaining the existing workforce and levels of activity, the Project is not expected to result in any tangible changes in demand and/or requirements for local infrastructure and service provision beyond what is currently available. It is anticipated that any Voluntary Planning Agreement would be based around the proposed infrastructure to be developed during construction and continuing any existing levels of contributions and community support by Aeris over the life of the Project.
Greenhouse Gas Emissions	The Project is estimated to produce approximately 253,300 tonnes of scope 1 and scope 2 CO_2-e emissions over the life of the Project. Applying the spot price for Australian Carbon Credit Units, the cost of these additional greenhouse gas emissions generated by the Project was estimated at approximately $7.9 million over the life of the Project.
Traffic Generation	The Project will generate additional transport movements that would otherwise not occur. This will result in increased vehicle fuel and maintenance costs, road damage costs and increased risk of accidents due to increased travel. The cost of additional traffic generation due to the Project has been estimated at approximately $3.1 million during construction and approximately $2.1 million per annum during peak operations.
Ecosystem Service Impacts	The Project is expected to result in the removal of approximately 97.2 ha of native vegetation from the subject land on which Project construction and operations will occur. This will result in direct impacts to a number of plant community types that will require environmental offsets. A total of 259 ecosystem credits are estimated to be required to offset Project development activity, with the cost of these credits currently estimated at approximately $851,500 (including oncosts).

6.14.7 Potential cumulative impacts

To assess the cumulative economic impacts of the proposed Project, the following major projects were considered during the assessment:

- Nyngan to Cobar pipeline;
- Nyngan Scandium mine;
- Nyngan solar farm;
- Bogan River solar farm; and
- Yarren Hut solar farm.

The Project has the potential to:

- reduce the availability of labour for local businesses;
- increase labour costs for businesses;
- increase reliance on non-local labour forces to support the delivery of projects; and potentially
- cause delays in projects.

Given that the Project is largely an extension of existing mining activities to supplement and replace production of other mines reaching their end of life, cumulative labour demand impacts can be expected to be limited to construction activity, with minimal impact during operations.

Employment of non-local workforces has the potential to exacerbate short-term accommodation availability and availability of rental properties. However, the Project proposes to extend mining activities and transition the workforce. Therefore, despite multiple solar farm projects awaiting commencement, the Project's contribution to short-term accommodation and rental property demand is expected to be relatively small and limited to peak construction periods (expected primarily to be undertaken over a 12-month period).

The influx of workers and population has the potential to exacerbate the accessibility of services and infrastructure in the local catchment. However, the Project's construction workforce is relatively small, and the Project's ongoing impacts, once operational, will place minimal additional demand on local services. As such, cumulative impacts are not expected to result in significant changes in demand or requirements for local infrastructure or service provision beyond what is currently available.

6.14.8 Consideration of the need for a Voluntary Planning Agreement

While discussions with the Bogan Shire Council are ongoing, it is anticipated that Aeris will adopt a Voluntary Planning Agreement with the Council to effect agreement on road maintenance and upgrade contributions associated with the Project's proposed haulage activity. These processes will continue to play out in parallel to this EIS.

6.14.9 Mitigation and management measures

Mitigation and management measures have been considered as a means to enable potential adverse economic impacts to be minimised while also maximising beneficial impacts. Measures proposed to be adopted for the Project include:

- Aeris (and contractors directly engaged by them) will source labour locally when possible and practical. Training opportunities will also be provided locally when possible. (This is consistent with existing policies implemented by Tritton Copper Operations.)
- Aeris has longstanding relationships with local businesses and an established supply chain to support existing activities. To maximise local benefits derived from the Project, Aeris will continue to support local

businesses by utilising these established supply networks and providing sufficient opportunities and information for local businesses to secure new supply contracts.

Given the Project risk of generating additional demand for accommodation/housing in the local catchment during the construction phase, Aeris is also committed to:

- developing a Workforce Accommodation Strategy;
- working with the Bogan Shire Council to identify and respond to housing and workforce impacts;
- requiring construction contractors to contact accommodation operators in advance of construction commencing to schedule accommodation bookings and enable accommodation providers to plan for the demand;
- advising the Bogan Shire Council and real estate agents of workforce ramp-up periods and providing information on housing availability to workers;
- providing genuine housing and accommodation choices to the workforce through subsidised housing costs for those who choose to live locally; and
- providing high-quality workforce accommodation to non-resident personnel.

Aeris will continue to employ existing mitigation measures and strategies for the Tritton Copper Operations, as well as progressive rehabilitation of the site to ensure the long-term impacts of the Project on agriculture are minimised.

6.14.10 Conclusion

While adverse economic impacts may arise as a result of the proposed Project, it is important to acknowledge that these impacts are assessed to be of low consequence, with the relative economic impacts of the Project anticipated to be overwhelmingly positive. Notwithstanding this, monitoring and mitigation strategies have been proposed by the Project to ensure potential adverse impacts are minimised while the opportunity to derive benefits are maximised.

6.15 Transport

6.15.1 Introduction

An assessment of potential transport impacts associated with the proposed Project was undertaken by Stantec Australia Pty Ltd. This assessment is provided as Appendix 7, Transport impact assessment.

6.15.2 Assessment requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) for the Project requires a detailed description of the following:

- management of hazards (such as chemicals, concentrate and waste material);
- assessment of the potential risks related to hazardous materials used on-site with regard to public safety; and
- a PHA.

Project SEARs requires a transport impact assessment to be completed to evaluate the potential transport impacts of the Project. The Project-specific SEARs requirements relating to transport are detailed in Table 6-75.

Table 6-75: Assessment requirements

Assessment matter	Report locations
In particular, the EIS must include, but not necessarily be limited to, the following: • an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the road and rail networks and any cumulative impacts of other developments in the locality in accordance with the *Roads Act 1993*, including: o site access routes; o site access points and road closures; and	Section 6.15.5
• a description of the measures that would be implemented to mitigate and/or manage potential traffic impacts, including schedules of the following: o road upgrades; o road maintenance contributions; o management of oversized and over-mass traffic and other traffic control measures, and o road closures developed in consultation with the relevant road authority.	Section 6.10.6

In addition to the Project SEARs requirements, the transport impact assessment for the Project has been prepared in accordance with the following:

- Guide to Traffic Management Part 12 – Integrated Transport Assessments for Developments (Austroads 2020a);
- Consolidated Supplement to Austroads Guide to Road Design (Transport for NSW 2023); and
- Guide to Traffic Generating Developments (RTA 2002).

6.15.3 Existing road networks

Transport for NSW identifies four levels of roadways in a typical road hierarchy. These levels are ranked from high mobility and low accessibility to high accessibility and low mobility. These road classes are identified as:

- Arterial Roads—controlled by Transport for NSW, typically with no limit in flow and designed to carry vehicles long distances between regional centres.
- Sub-Arterial Roads—managed by either Council or Transport for NSW under a joint agreement. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day and their aim is to carry through traffic between specific areas in a sub-region or provide connectivity from arterial road routes (regional links).
- Collector Roads—providing connectivity between local sites and the sub-arterial road network, and typically carrying between 2,000 and 10,000 vehicles per day.
- Local Roads—providing direct access to properties and the collector road system, and typically carrying between 500 and 4,000 vehicles per day.

The proposed Project has some reliance on existing road networks to support haulage activity to and from the Tritton Copper Mine (where processing of mined ore will occur). Roads proposed to be utilised for Project haulage are primarily local roads, with a crossing of a sub-arterial road (the Mitchell Highway) also proposed (refer to Figure 6-39).

6.15.3.1 Surrounding road network

During the construction and operational phases of the Project, the following (existing) roads will be utilised (as shown in Figure 6-39):

- Mitchell Highway—a two-way State Road (No. 7) aligned in a north–south direction, with one lane in each direction, set within an approximately 8-metre-wide carriageway. The general posted speed limit near Girilambone is 70 km/h, which changes to 100 km/h approximately 200 m north and 180 m south of the Mitchell Highway/Railway Road intersection.
- Yarrandale Road—a council-controlled local road that is currently utilised for haulage between Aeris' Murrawombie and Tritton Copper Mines. This is a two-way road with one lane in each direction, set within a carriageway of around 6 metres.
- Railway Road—a two-way, council-controlled local road aligned in an east–west direction, with one lane in each direction, set within a carriageway of around 6 metres.
- Okeh Road—a two-way, council-controlled local road aligned in a north–south direction, with one lane in each direction, set within a carriageway of around 6 metres.

In addition to the Mitchell Highway being considered a sub-arterial road, it is considered a 'classified road', as per classifications provided in the State Environmental Planning Policy (Resources and Energy) 2021. Under this policy, development with frontage to a classified road must not be granted, unless the road's safety, efficiency and ongoing operation are not adversely affected.

While the proposed Project does not have frontage to the Mitchell Highway, it will utilise a small section of this road as part of the proposed road haulage activity.

A new section of road that intersects with the Mitchell Highway is also proposed as part of the Project (refer to Figure 6-39) in conjunction with an upgrade of an existing intersection (at the junction of the Mitchell Highway and Railway Road). While these activities to support the proposed Project may be considered to represent development with frontage to a classified road, it is stressed that these works are subsidiary to support the proposed development, as opposed to representing a development that fronts a classified road. Indeed, no industrial development will be visible from the Mitchell Highway.

Notwithstanding this, Transport for NSW has been consulted in regard to the intersection designs proposed for the haulage interfaces with the Mitchell Highway to ensure that safety, efficiency and the ongoing operation of the Mitchell Highway are not adversely affected.

Impact assessment has also been undertaken in the areas of noise and air quality to ensure relevant criteria can be met at the location of sensitive receptors. Indeed, the location of the proposed new section of road has been proposed to avoid haulage vehicles traversing through Girilambone township (thereby reducing potential noise, air quality, visual amenity and traffic impacts).

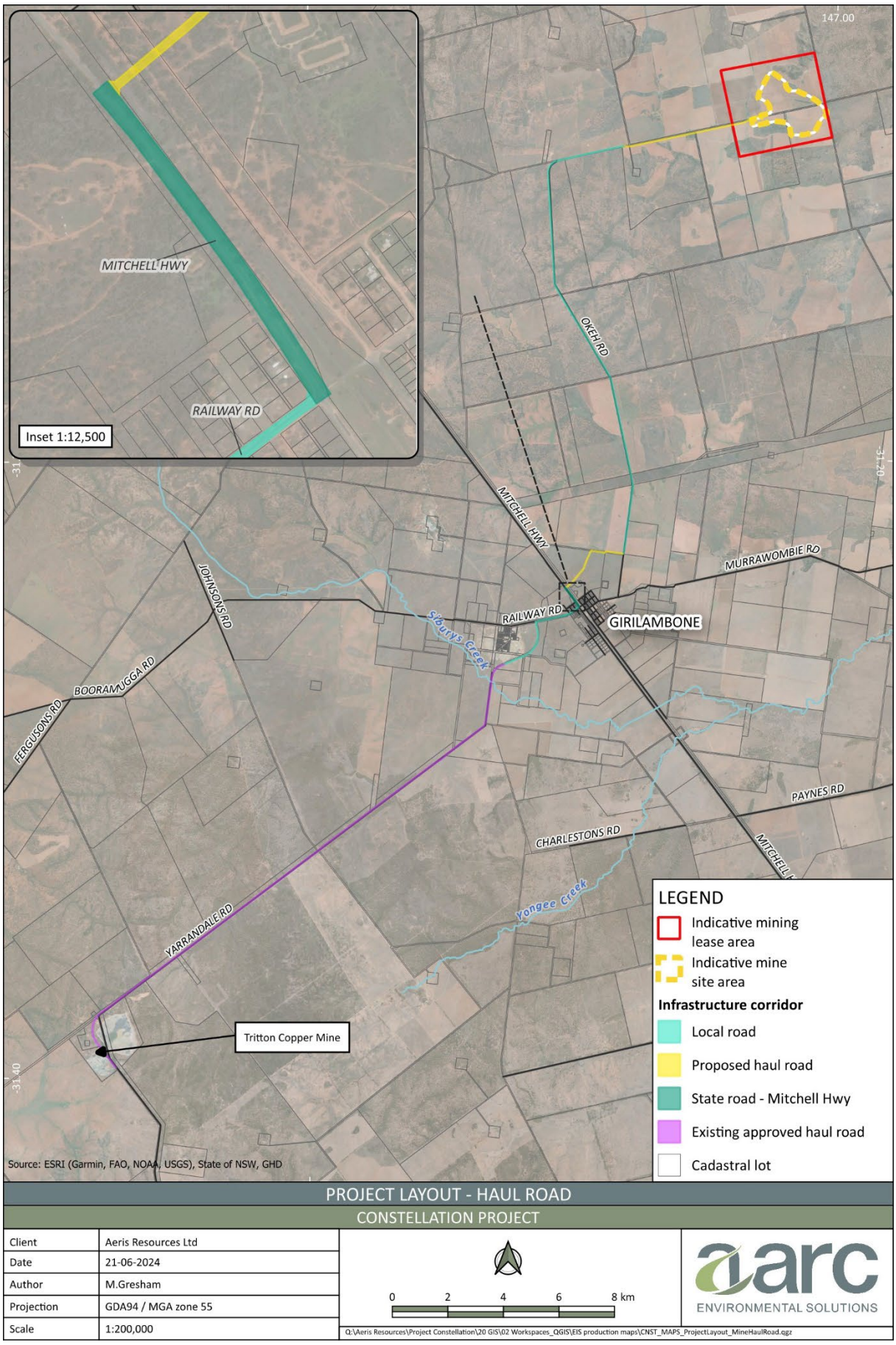


Figure 6-39: Proposed haulage route for the Project

6.15.3.2 Existing freight network

Transport for NSW imposes limitations on heavy vehicle routes throughout the state. According to the Transport for NSW restricted vehicle access map, the Mitchell Highway, Yarrandale Road, Railway Road and Okeh Road are permitted for 25/26 m B-Double travel.

6.15.3.3 Public and active transport

Based on desktop review, there is no public transport or any dedicated facility for cycling or pedestrian movement in the vicinity of the Project. Further, there is no school bus service operating within the surrounding road network. It is acknowledged, however, that NSW TrainLink runs coach services along the Mitchell Highway between Dubbo and Bourke.

6.15.3.4 Traffic volumes

Classified turning movement counts and automatic tube count surveys were undertaken as part of the transport impact assessment for the Project.

Turning movement counts were undertaken on Tuesday, 26 July 2022 between 7 am and 10 am and again between 3 pm and 7 pm. Intersections targeted were the Mitchell Highway/Railway Road (and Sirius Street) intersection and the Railway Road/Yarrandale Road intersection.

Classified turning movement counts undertaken, found that peak movements occur between 8 am and 9 am at the Mitchell Highway/Railway Road intersection while the Railway Road/Yarrandale Road intersection peaks between 3 pm and 4 pm.

Results of these intersection counts are provided in Figure 6-40 and Figure 6-41.

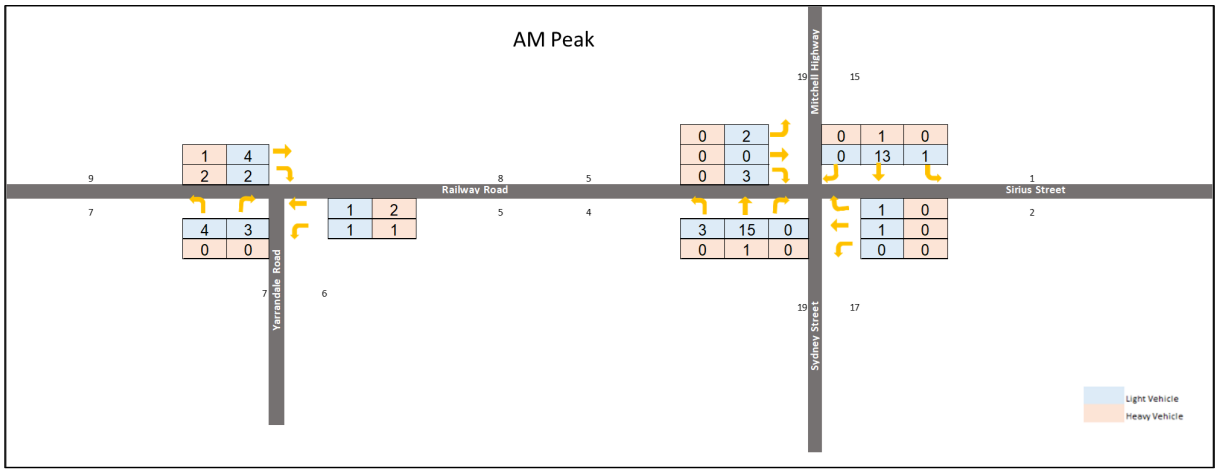


Figure 6-40: Existing peak hour traffic volumes between 8 am and 9 am

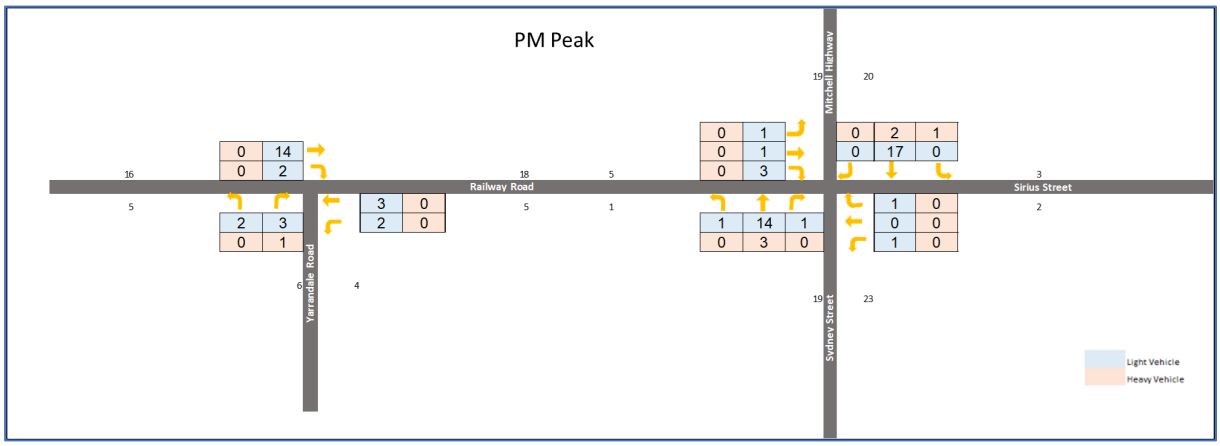


Figure 6-41: Existing peak hour traffic volumes between 3 pm and 4 pm

Automatic tube counts undertaken for the Project were undertaken on the Mitchell Highway and Railway Road between Monday, 26 July 2022 and Tuesday, 1 August 2022. These tube counts were designed to capture the typical weekday and weekend traffic volumes to develop an average daily traffic profile.

The outcome of tube counts identified that, on average, the Mitchell Highway carries 426 vehicles per weekday and 342 vehicles per day on a weekend. Similarly, Railway Road was also identified to carry slightly more vehicles on a weekday (averaging 241 vehicles per day) than on a weekend (averaging 183 vehicles per day). Results from the tube count survey are shown in Table 6-76 and Figure 6-42.

Table 6-76: Average daily traffic volumes

ATC Location	Average 7 days	Average Weekday	Average Weekend	Traffic Change Weekday vs Weekend
Mitchell Highway	402 (26%)	426 (26%)	342 (27%)	-20%
Railway Road	224 (22%)	241 (22%)	183 (23%)	-24%

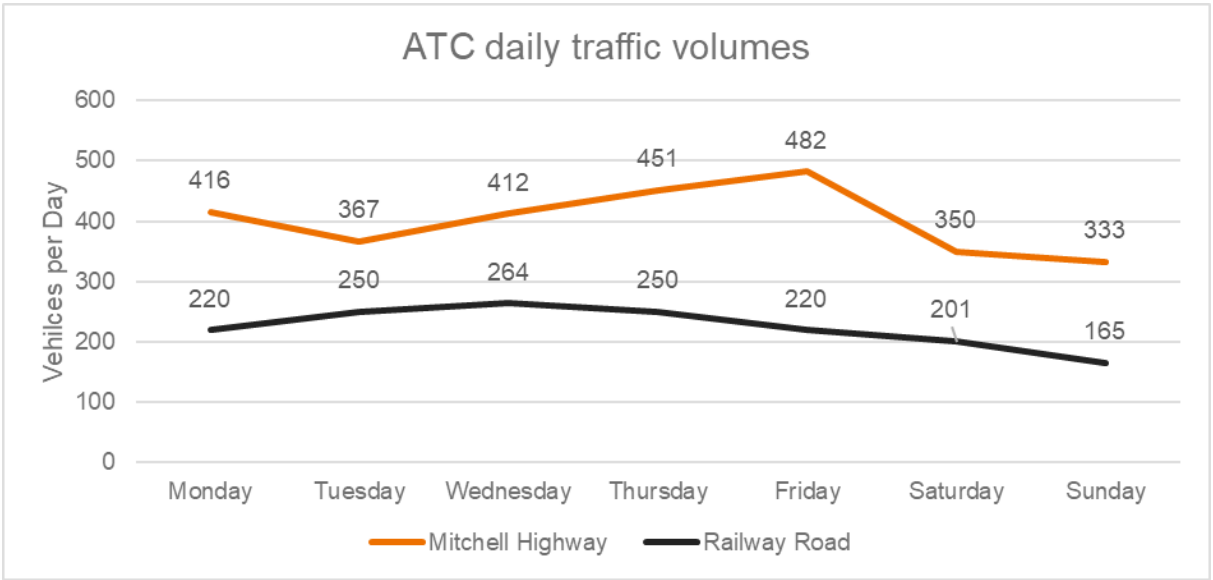


Figure 6-42: Automatic tube count daily traffic volumes

6.15.3.5 Intersection and network performance

SIDRA INTERSECTION modelling was utilised to assess the current operational performance at the two existing intersections. Results indicate that the assessed intersections operate satisfactorily, with minimal queues and delays on all approaches.

To determine mid-block road capacity, traffic performance was assessed using the Guide to Traffic Management Part 3: Transport Studies and Analysis Methods (Austroads 2020b). This assessment considered traffic performance at a midblock section of the Mitchell Highway (just north of the intersection with Railway Road/Sirius Street) and a midblock section of Railway Road (between the intersection with the Mitchell Highway and the intersection with Yarrandale Road).

Results were measured against the SIDRA intersection 'Level of Service' criteria, as presented in Figure 6-41.

Data collected for the Project identifies that road operation meets acceptable performance criteria (i.e. a Class A Level of Service) during both AM and PM peak periods (refer to Figure 6-42).

Table 6-77: SIDRA intersection Level of Service criteria

Level of Service	Average delay per vehicle (secs/vehicle)	Traffic signals, roundabout	Give Way and Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control modes
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Table 6-78: Existing midblock assessment

Location	Direction	AM peak hourly volume	Level of Service	PM peak hourly volume	Level of Service
Mitchell Highway	Northbound	19	A	19	A
	Southbound	15	A	20	A
Railway Road	Eastbound	8	A	18	A
	Westbound	5	A	5	A

6.15.3.6 Crash history

Only one crash was recorded along the proposed haulage route between 2017 and 2021 (being the most recent period of data available). This crash was related to a vehicle striking an animal during daylight hours. This does not indicate a safety deficiency or crash cluster that would need addressing.

6.15.3.7 Railway network

No operational railway or active level crossing has been identified near the Project or along the haulage route. However, a disused railway line does exist, running parallel to the Mitchell Highway between Nyngan and Bourke (identified as the former 'Main Western Railway'), and the Project haul road is proposed to cross this easement approximately 800 metres north-west of Girilambone (refer to Figure 6-43).

UGL Regional Linx, which manages all operations and maintenance on the Country Regional Network within NSW, is the relevant body that administers the Main Western Railway. Accordingly, UGL Regional Linx has been engaged in the proposed Project, with discussions ongoing at the time this EIS is being submitted. Aeris recognises that this rail infrastructure may be reopened at any stage and is committed to working with UGL Regional Linx to manage this scenario if/as required.

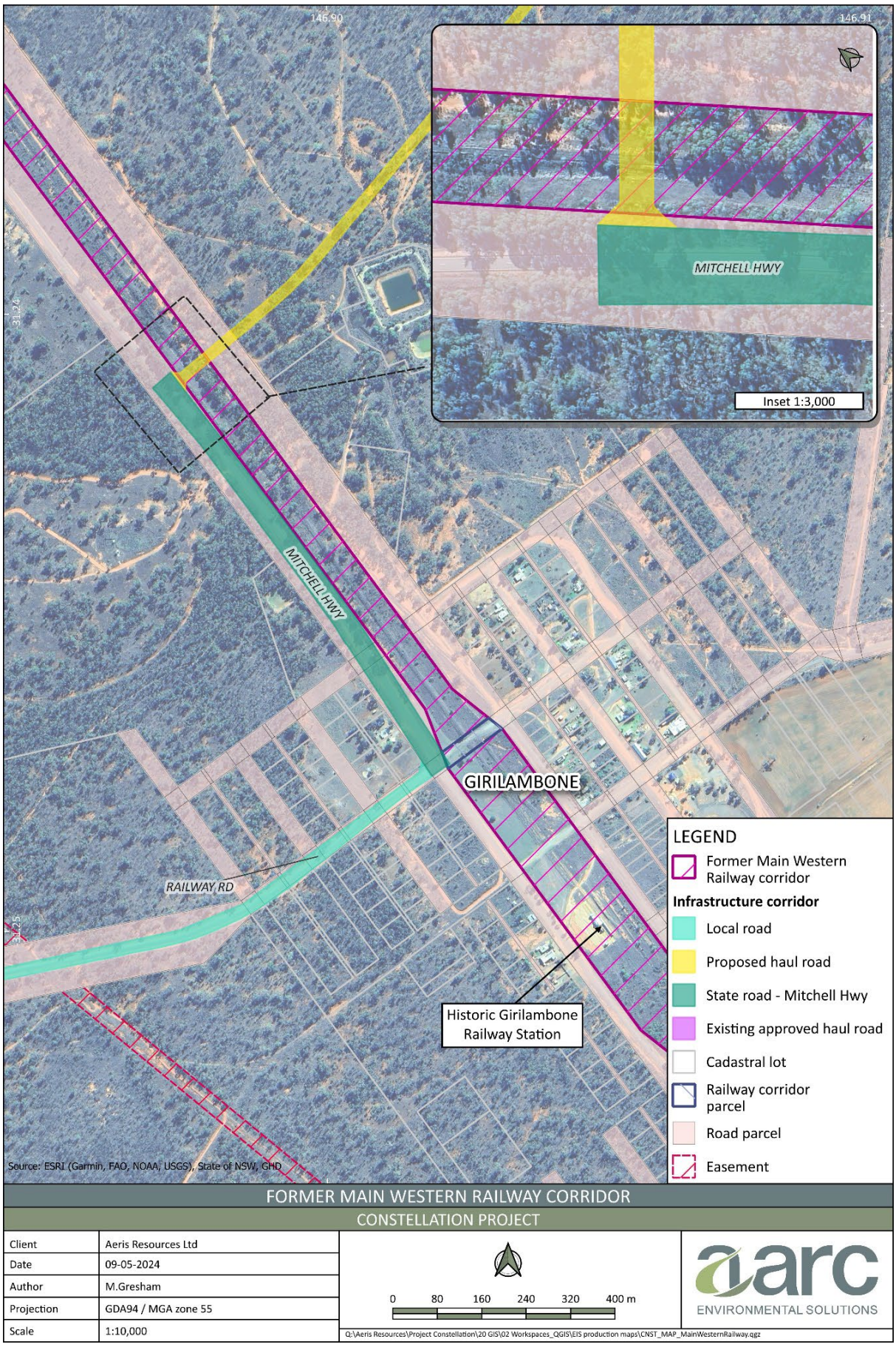


Figure 6-43: Disused rail infrastructure relevant to the proposed Project

6.15.4 Project traffic

The proposed haulage route for the Project has been designed to utilise existing road networks as far as practical. This approach significantly reduces the potential impact on environmental values (through new land disturbance) and minimises impacts on sensitive receptors.

A new section of haul road is proposed for the Project to enable the avoidance of haulage activity through the Girilambone township. Although the development of a new section of road is a higher cost option than hauling through Girilambone, it has been adopted in response to community engagement that has occurred for the Project.

The proposed new section of road will link Okeh Road and the Mitchell Highway (as per Figure 6-39) and will be constructed through land owned by Aeris. A new intersection with the Mitchell Highway is also proposed to be constructed (as per Figure 6-44). This intersection is approximately 800 metres north-west of Girilambone. The intersection includes a short channelised, right-turn treatment on the Mitchell Highway.

Note: The design of this proposed new intersection has been resultant of consultation undertaken with Transport for NSW.

While a turning lane was initially proposed to be constructed adjacent to the Highway to enable south bound haul trucks to develop speed prior to merging onto the Highway, the preference of Transport for NSW was to adopt a T intersection at this location, supported by a short, channelised right-turn treatment on the Mitchell Highway (when heading north). Detailed intersection designs are provided in Attachment 4, Road intersections.

Works are proposed to be undertaken to upgrade the safety and functionality of the existing Mitchell Highway/Railway Road intersection. The design of this intersection has been developed through consultation with Transport for NSW. Detailed intersection designs are provided in Attachment 4, Road intersections.

6.15.4.1 Traffic generation

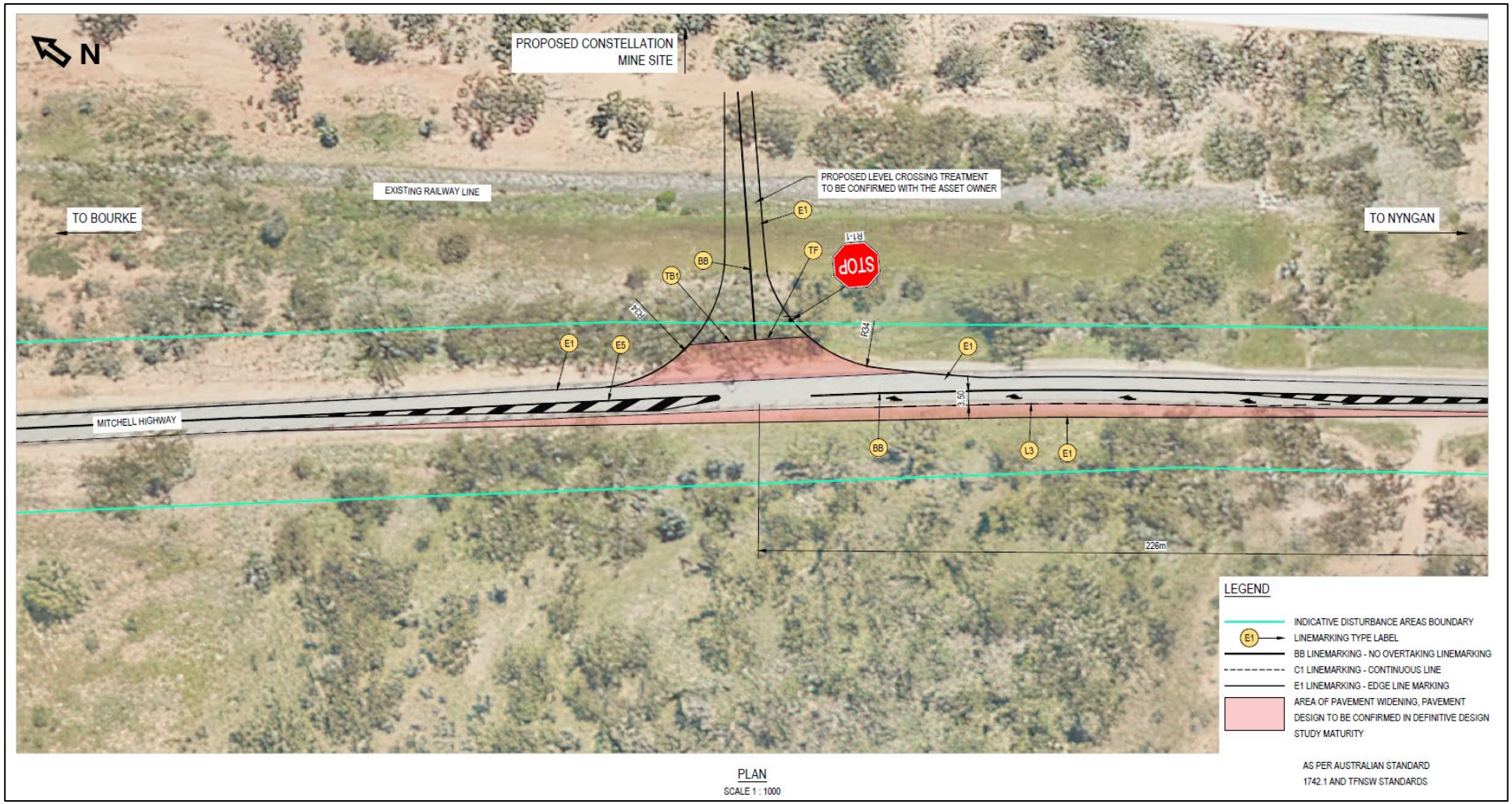
Traffic generated during the construction and operational phases was modelled as part of the transport impact assessment. Specifically, the following scenarios were modelled to assess impacts:

- existing baseline conditions;
- the Project construction phase (Project Year 0);
- the opening year of mining operations (Project Year 1); and
- a 10-year design horizon of mine operation (Project Year 10).

The modelling also assumes a conservative (high) background growth in daily traffic volumes of 2% per annum. This is in reference to the 2016–2021 Census data released by the Australian Bureau of Statistics and is consistent with the approach taken in the Nyngan Scandium Mine Traffic Assessment (Constructive Solutions Pty Ltd, 2016).

6.15.4.2 Construction traffic

The transport impact assessment predominantly focused on peak hours, such that all the workforce traffic movements are assumed to overlap with the AM and PM peak periods, and all the traffic for machinery and material deliveries is assumed to overlap with the AM peak period. Therefore, as shown in Table 6-79, during the peak period of the construction phase, 25 vehicles (23 light vehicles and two buses) per day will be inbound in the morning and outbound in the afternoon. Further, one heavy vehicle and 35 light vehicles per day are estimated to be inbound and outbound during the AM period as part of the delivery of machinery and materials.



Source: GHD, 11 August 2023

Figure 6-44: Proposed intersection design for Mitchell Highway/proposed haul road

Table 6-79: Construction peak hour traffic movements

	AM Peak Hour				PM Peak Hour			
	Inbound		Outbound		Inbound		Outbound	
	Light Veh	Heavy Veh	Light Veh	Heavy Veh	Light Veh	Heavy Veh	Light Veh	Heavy Veh
Construction Workforce	23	2	—	—	—	—	23	2
Construction Delivery	35	1	35	1	—	—	—	—
Total	58	3	35	1	—	—	23	2

During the Project construction phase, oversized and over-mass vehicles are anticipated to be required, however, these vehicles will be operated outside peak hours. As such, these vehicles are not considered within the transport impact assessment. Oversized vehicle movements will, however, be addressed as part of the Traffic Management Plan developed for the Project to ensure the potential for traffic impacts are adequately managed.

6.15.4.3 Operational traffic

During the Project operational phase, mined materials (e.g. ore and tailings) will be hauled between the Project and Tritton Copper Mine via the proposed haulage route. Haulage has been estimated based on a 70-tonne payload truck with AB Triple as the largest vehicle. Accordingly, proposed haulage movements averaged over the peak operation hours of the mine equates to four vehicles per hour (refer to Table 6-80).

Table 6-80: Regular operational traffic

Quantity	Hours of operation	No of hours	Largest vehicle	Truckload	Truck movement	No of trips per hour
1 Mpta	24 Hours	24	AB Triple	41	82	4

As part of modelling staff-generated traffic movements during mine operations, 100% of workers were assumed to attend the site every day—this assumption ensures that potential impacts are not understated. It is also assumed that 65% of the staff will use the staff shuttle buses, which include:

- a 12-seat shuttle running return from Nyngan;
- a 9-seat shuttle running return from Cobar (via the Tritton Copper Mine); and
- two 48-seat coaches running return from Nyngan (via the Tritton Copper Mine).

Other workers are assumed to travel by private vehicles, with some car-pooling resulting in an average vehicle occupancy of 1.2 people per vehicle.

It is proposed that there will be two staff changeover shifts per day (morning and evening). For the purposes of this assessment, changeover shifts are assumed to overlap with the AM and PM peak periods. On this basis, the operational workforce is expected to generate the following traffic:

- Project Year 1 operation:
  - 72 private vehicles per day or (144 daily trips);
  - 4 buses per day or (8 daily trips);

- Project Year 10 operation:
  - 34 private vehicles per day or (68 daily trips); and
  - 2 buses per day or (4 daily trips).

In terms of the traffic generated for the delivery of consumables (i.e. fuel, cement, mining consumables and reagents), it is forecast that this will require up to one heavy vehicle per day (or two vehicle movements). This traffic movement is conservatively assumed to overlap the AM peak period.

Table 6-81 and Table 6-82 shows the expected traffic generated during the operational phase in Project Year 1 and Project Year 10, respectively.

Table 6-81: Project Year 1 mine operation peak hour traffic movements

	AM Peak Hour				**PM Peak Hour**			
	Inbound		**Outbound**		**Inbound**		**Outbound**	
	Light Veh	**Heavy Veh**	**Light Veh**	**Heavy Veh**	**Light Veh**	**Heavy Veh**	**Light Veh**	**Heavy Veh**
Operation		2		2		2		2
Operational staff	36	2	36	2	36	2	36	2
Operation consumables and deliverables		1		1		1		1
Total	**36**	**5**	**36**	**5**	**36**	**5**	**36**	**5**

Table 6-82: Project Year 10 mine operation peak hour traffic movements

	AM Peak Hour				**PM Peak Hour**			
	Inbound		**Outbound**		**Inbound**		**Outbound**	
	Light Veh	**Heavy Veh**	**Light Veh**	**Heavy Veh**	**Light Veh**	**Heavy Veh**	**Light Veh**	**Heavy Veh**
Operation		2		2		2		2
Operational Staff	17	1	17	1	17	1	17	1
Operation consumables and deliverables		1		1				
Total	**17**	**4**	**17**	**4**	**17**	**3**	**17**	**3**

6.15.5 Impact assessment

The following sections summarise the potential transport impacts anticipated to arise due to the Project.

6.15.5.1 Intersection assessment

Key intersections proposed to be utilised by the Project are recapped as follows:

- Mitchell Highway/proposed haulage road (new proposed intersection);
- Mitchell Highway/Railway Road/Sirius Street (existing intersection); and
- Railway Road/Yarrandale Road (existing intersection).

The performance of these intersections has been modelled for the Project during:

- construction (Table 6-83);
- Year 1 operations (Table 6-84); and
- Year 10 operations (Table 6-85).

Table 6-83: Project Year 0 (Construction) intersection operating conditions

Intersection	Peak	Leg	Degree of Saturation	Average Delay (sec.)	95th Percentile Queue (m)	Level of Service
Mitchell Highway/ Proposed Haulage Road	AM	South	0.037	6.2	1.2	A
		East	0.028	8.7	0.8	A
		North	0.010	6.4	0	A
		Overall	0.037	8.7	1.2	A
	PM	South	0.012	6.2	0	A
		East	0.020	8.9	0.6	A
		North	0.013	6.4	0	A
		Overall	0.019	9.2	0.6	A
Mitchell Highway/ Railway Road/ Sirius Street	AM	South	0.034	6.4	0.1	A
		East	0.003	8.7	0.1	A
		North	0.029	6.4	0.1	A
		West	0.022	9.1	0.6	A
		Overall	0.034	9.1	0.6	A
	PM	South	0.012	6.4	0.1	A
		East	0.003	8.6	0.1	A
		North	0.027	6.4	0.8	A
		West	0.005	8.5	0.1	A
		Overall	0.027	8.6	0.8	A

Intersection	Peak	Leg	Degree of Saturation	Average Delay (sec.)	95th Percentile Queue (m)	Level of Service
Railway Road/ Yarrandale Road	AM	South	0.023	6.4	0.6	A
		East	0.004	7.1	0	A
		West	0.006	6.9	0.2	A
		Overall	0.023	7.1	0.6	A
	PM	South	0.005	6.6	0.1	A
		East	0.015	6.5	0	A
		West	0.009	6.2	0.1	A
		Overall	0.015	6.6	0.1	A

Table 6-84: Project Year 1 intersection operating conditions

Intersection	Peak	Leg	Degree of Saturation	Average Delay (sec.)	95th Percentile Queue (m)	Level of Service
Mitchell Highway/ Proposed Haulage Road	AM	South	0.026	6.3	1	A
		East	0.032	9	1	A
		North	0.010	6.4	0	A
		Overall	0.032	9	1	A
	PM	South	0.026	6.4	0.9	A
		East	0.034	9.1	1	A
		North	0.013	6.4	0	A
		Overall	0.034	9.1	1	A
Mitchell Highway/ Railway Road/ Sirius Street	AM	South	0.016	6.4	0.1	A
		East	0.003	8.6	0.1	A
		North	0.034	6.4	1.1	A
		West	0.032	9.1	1	A
		Overall	0.034	9.1	1.1	A
	PM	South	0.017	6.4	0.1	A
		East	0.003	8.6	0.1	A
		North	0.038	6.5	1.3	A
		West	0.031	9.1	0.9	A
		Overall	0.038	9.1	1.3	A
	AM	South	0.035	6.4	0.9	A

Intersection	Peak	Leg	Degree of Saturation	Average Delay (sec.)	95th Percentile Queue (m)	Level of Service
Railway Road/ Yarrandale Road		East	0.023	6.5	0	A
		West	0.006	7.1	0.2	A
		Overall	0.035	7.1	0.9	A
	PM	South	0.035	6.5	0.9	A
		East	0.023	6.5	0	A
		West	0.009	6.2	0.1	A
		Overall	0.035	6.5	0.9	A

Table 6-85: Project Year 10 intersection operating conditions

Intersection	Peak	Leg	Degree of Saturation	Average Delay (sec.)	95th Percentile Queue (m)	Level of Service
Mitchell Highway/ Proposed Haulage Road	AM	South	0.014	6.5	0.5	A
		East	0.022	9.9	0.7	A
		North	0.011	6.4	0	A
		Overall	0.022	9.9	0.7	A
	PM	South	0.015	6.4	0.5	A
		East	0.017	9.3	0.5	A
		North	0.016	6.4	0	A
		Overall	0.017	9.3	0.5	A
Mitchell Highway/ Railway Road/ Sirius Street	AM	South	0.017	6.4	0.1	A
		East	0.003	8.6	0.1	A
		North	0.024	6.5	0.7	A
		West	0.021	9.3	0.6	A
		Overall	0.024	9.3	0.7	A
	PM	South	0.016	6.4	0.1	A
		East	0.003	8.6	0.12	A
		North	0.028	6.5	0.7	A
		West	0.020	9.4	0.6	A
		Overall	0.028	9.4	0.7	A
	AM	South	0.021	6.4	0.5	A
		East	0.016	6.7	0	A

Intersection	Peak	Leg	Degree of Saturation	Average Delay (sec.)	95th Percentile Queue (m)	Level of Service
Railway Road/ Yarrandale Road		West	0.009	7	0.3	A
		Overall	0.021	7	0.5	A
	PM	South	0.021	6.5	0.6	A
		East	0.014	6.6	0	A
		West	0.012	6.2	0.1	A
		Overall	0.021	6.6	0.6	A

These results indicate that all intersection performance (with assumed Project traffic) has been modelled to be satisfactory. Indeed, the intersection 'level of service' is predicted to be Class A at all intersections across all Project phases.

6.15.5.2 Midblock assessment

Road network performance (through mid-block traffic assessments) has been assessed for peak hour traffic for the Mitchell Highway and Railway Road. This assessment considered Project construction and operational phases, with results provided in Table 6-86 to Table 6-88.

Table 6-86: Project Year 0 (construction) midblock assessment

Location	Direction	AM peak hourly volume	Level of service	PM peak hourly volume	Level of service
Mitchell Highway	Northbound	81	A	20	A
	Southbound	52	A	46	A
Railway Road	Eastbound	25	A	5	A
	Westbound	4	A	21	A

Table 6-87: Project Year 1 midblock assessment

Location	Direction	AM peak hourly volume	Level of service	PM peak hourly volume	Level of service
Mitchell Highway	Northbound	61	A	61	A
	Southbound	56	A	62	A
Railway Road	Eastbound	38	A	38	A
	Westbound	36	A	34	A

Table 6-88: Project Year 10 midblock assessment

Location	Direction	AM peak hourly volume	Level of service	PM peak hourly volume	Level of service
	Northbound	45	A	44	A

Location	Direction	AM peak hourly volume	Level of service	PM peak hourly volume	Level of service
Mitchell Highway	Southbound	40	A	46	A
Railway Road	Eastbound	23	A	23	A
	Westbound	22	A	18	A

These results indicate that road network performance has been modelled to be satisfactory. Indeed, the 'level of service' is predicted to be Class A on both roadways across all Project phases.

6.15.5.3 Road safety

The review of the reported crash history did not highlight any particular crash causation factors on the proposed haulage route. There were no fatalities recorded. The additional traffic assessed under the proposal is unlikely to have any material impact on the crash rate along the proposed route.

6.15.5.4 Speed limit impacts

As introduced in Section 6.15.3.1, the posted speed limit approaching the Mitchell Highway/Railway Road intersection is 70 km/h, with this increasing to 100 km/h approximately 200 m north of the intersection. This would currently place the proposed new intersection in a 100 km/h section of road. As such, the transport impact assessment has recommended an extension of the existing 70 km/h zone further north (approximately 800 m north of Railway Road) to include the proposed new intersection.

The proposed extension of the 70 km/h speed limit was argued to reduce the hazard of haulage vehicles to existing traffic along the Mitchell Highway. Further, it was noted that haulage vehicles would likely be unable to reach a speed of 100 km/h over the short distance of the Mitchell Highway that will be traversed during haulage. In addition to potentially improving safety, the impact of this lower speed limit is also expected to present a negligible impact on journey times, given the typical travel distances in this area of the state.

Notwithstanding this, following consultation with Transport for NSW, it is understood that a speed zone modification is unlikely to be supported for the Project. Accordingly, the proposed intersection has been designed on the basis of the existing speed zoning, with consideration for the operating speed of vehicles for the Project. Transport for NSW has indicated a preference to adopt a channelised right turning lane (to support haul trucks exiting the Mitchell Highway via the proposed new intersection). This design has, therefore, been adopted for the Project.

6.15.5.5 Intersection geometry

The transport impact assessment for the Project undertook a range of analyses on intersection geometry to assess the suitability of the intersections for the predicted Project traffic. This included:

- a swept path analysis;
- an intersection sight distance assessment; and
- a turn warrant assessment.

Swept path analysis—calculations and analyses of the movement (path) of different parts of a vehicle when navigating turns or intersections was undertaken. The assessment seeks to ensure that sufficient access exists for the proposed haul vehicles (in this case, AB Triple trucks) to safely pass through the proposed (or existing) intersection dimensions. Swept path diagrams are provided for intersections relevant to the Project haul route in Appendix 7, Transport impact assessment (per Appendix C).

Intersection sight distance assessment—safe sight distances were assessed based on the Austroads Guidelines: Guide to Road Design Part 4A – Unsignalised and Signalised Intersections (2023). This guideline

provides a means for determining safe intersection sight distance (for intersections on a major road), considering factors such as the speed limit and the type of vehicle travelling on the road. The assessment for the Project (for the two intersections with the Mitchell Highway) found that:

- the suitable safe intersection sight distance for the Mitchell Highway/Proposed Haulage Road intersection is 300 m (for a design speed of 110 km/h and a 2.5-second reaction time); and
- the suitable safe intersection sight distance for the Mitchell Highway/Railway Road intersection is 181 m (for a design speed of 80 km/h and a 2.5-second reaction time).

A longitudinal section of the existing Mitchell Highway was prepared for the Project to support an analysis of intersection sight distances (per Appendix 7, Transport impact assessment, Appendix D). This longitudinal section shows that an intersection sight distance of 350 m is achieved for the Mitchell Highway/Proposed Haulage Road intersection, and 200 m is achieved for the Mitchell Highway/Railway Road intersection. As such, both intersections meet (exceed) the requirements of the Austroads Guidelines: Guide to Road Design Part 4A – Unsignalised and Signalised Interactions (2023).

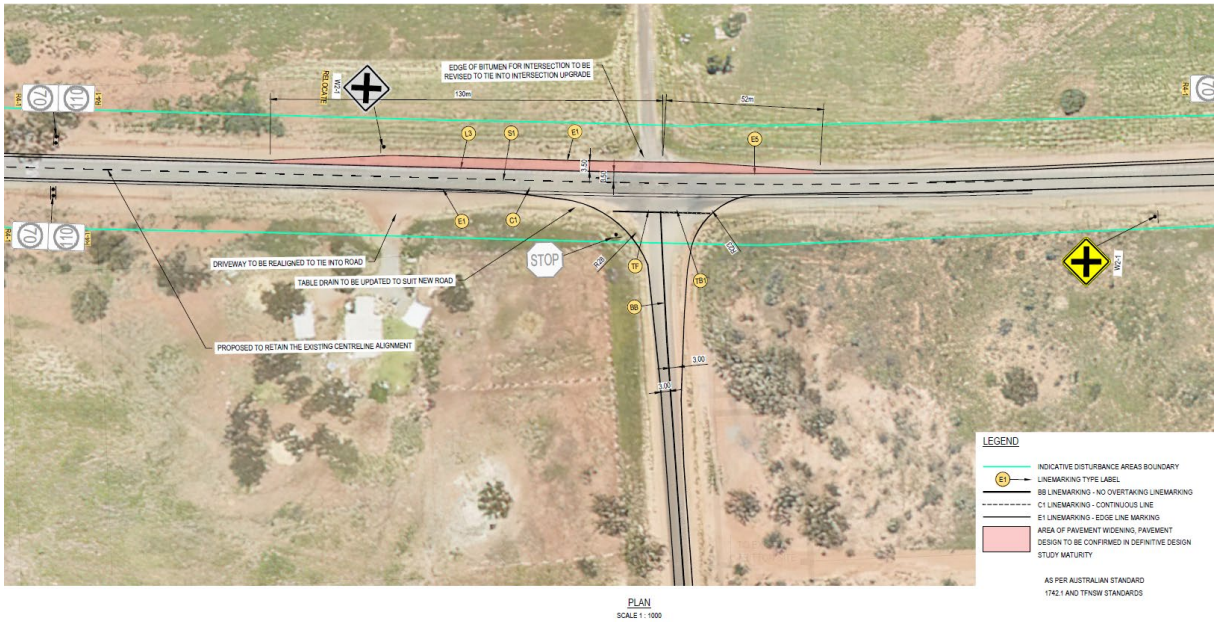
Turn warrant assessment—the Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements (Austroads 2020c) has been referenced to determine the appropriate turning traffic treatments for:

- Project Year 0 (construction traffic);
- Project Year 1 (operational traffic); and
- Project Year 10 (the final year of operational traffic).

The turn warrant assessments concluded that a 'Basic Right-turn' treatment was sufficient for the Mitchell Highway/Proposed Haulage Road intersection, and a 'Basic Left turn' treatment was sufficient for the Mitchell Highway/Railway Road intersection.

However, through engagement with Transport for NSW on the proposed Project, it is acknowledged that a short channelised right-turn treatment is preferred for the Mitchell Highway/Proposed Haulage Road intersection. Transport for NSW acknowledged that a channelised turn treatment at this location best supports northbound traffic accelerating out of the reduced 70 km/h speed zone (and further supports the avoidance of extending the reduced speed zone). As such, the final transport impact assessment has adopted this design, notably exceeding the findings of the turn warrant assessment undertaken.

Works will be undertaken to upgrade the existing Mitchell Highway/Railway Road intersection. The design of this intersection is a 'Basic Left turn' treatment developed through consultation with Transport for NSW (as per Figure 6-45). Detailed design drawings of intersections are provided in Attachment 4, Road intersections.



Source: GHD, 11 August 2023

Figure 6-45: Proposed intersection design for Mitchell Highway/Railway Road

6.15.6 Management and mitigation strategies

A number of decisions have been made during the design of the Project to support the avoidance and minimisation of potential transport impacts. These design decisions have included the following:

- Assessment of three potential haulage routes for the Project has ultimately informed a decision to utilise existing road networks as far as practicable, significantly reducing potential impacts on environmental values and local landholders (that would arise with new road developments).
- The Project haul route (initially to be 50 m wide) has been reduced to a maximum width of 18 m to work within existing road disturbance footprints. This will work to reduce environmental impacts by limiting clearing of trees within the existing road reserve.
- A new section of road has been proposed to avoid the need for haulage trucks to traverse through Girilambone. This strategy supports the minimisation of noise, dust, traffic and visual amenity impacts on Girilambone township.
- A new intersection will be developed to manage traffic interactions at the Mitchell Highway/proposed haul road. The design of this intersection has adopted Transport for NSW's recommendation for a channelised right-turn treatment, exceeding the requirements of the turn warrant assessment undertaken.
- Works will be undertaken to upgrade the safety and functionality of the existing Mitchell Highway/Railway Road intersection. The design of this intersection has been developed through consultation with Transport for NSW (being a 'Basic Left turn' treatment).

Negotiations are progressing with the Bogan Shire Council regarding the use and maintenance of council-controlled road infrastructure to support the proposed Project. It is currently anticipated that a Voluntary Planning Agreement will be adopted to effect Aeris' commitments in this space.

Further, a Traffic Management Plan will be prepared prior to construction activity to ensure sound road infrastructure and minimise potential road safety impacts.

6.15.7 Conclusion

Additional traffic generated by the proposed Project is anticipated to have a very minor impact on the surrounding transport environment. As per the findings of the transport impact assessment:

- Increases to traffic volumes (resultant of the Project) will be minor, with predicted peak traffic volumes (during the AM and PM peak periods) not expected to exceed a total of 36 vehicle movements.
- Impacts on intersection performance are expected to be indiscernible, with modelling demonstrating a Class A level of service across all intersections and Project phases.
- Impacts on road network performance are expected to be minor, with the modelled level of service predicted to be Class A across all Project phases.
- There are no specific safety concerns with the existing road transport environment that would be exacerbated by the proposed mine.
- Safe intersection sight distances are achievable at both intersections of the Mitchell Highway.
- The turn warrant assessment undertaken indicates basic turn treatments are required for the two Mitchell Highway intersections.
    - Notwithstanding this, a channelised right-turn treatment has been adopted for Mitchell Highway/proposed haulage road intersection (exceeding assessment requirements).
    - A basic left turn treatment has been adopted for the Mitchell Highway/Railway Road intersection.

A Traffic Management Plan will be prepared prior to Project construction to minimise potential road safety impacts and ensure sound road infrastructure performance.

6.16 Visual amenity

6.16.1 Introduction and assessment requirements

This section summarises the potential visual impacts of the Project from the findings of the Visual Amenity Impact Assessment (Appendix 16).

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) requires an assessment of the impacts associated with visual amenity from the Project. The specific requirements and where they have been addressed are shown in Table 6-89.

Table 6-89: Assessment requirements

Assessment matter	Report locations
Visual—an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, paying particular attention to any temporary and permanent modification of the landscape (e.g. overburden dumps and bunds) and minimising the lighting impacts of the development.	Section 6.16.4 Appendix 16, Visual amenity impact assessment

6.16.2 Existing built and visual environment

The topography of the visual impact assessment area is largely subdued, undulating plains interspersed with low hills of around 30–40 m relief. The Project area, including the haul road, has low topographic relief. The Project mine site is approximately 15 m below the average height of the surrounding region (165 m AHD) (Figure 6-46).

The Project mine site and infrastructure corridor are primarily in cleared agricultural land, with unsealed roads providing access to scattered buildings and residences. The area surrounding the mine site is largely composed of land capable of low-impact land uses, such as grazing and nature conservation. The areas surrounding the haulage route have cropping, native vegetation grazing and modified pastures grazing land uses, with non-agricultural land uses identified for the Girilambone township and the Murrawombie and Tritton Copper Mines.

The region in which the Project is located is sparsely populated. The visual environment for the sensitive receptors surrounding the Girilambone township can generally be categorised as a rural township with low-density property development and minimal industrial buildings.

The Girilambone township primarily consists of residential dwellings; there is also one industrial building and a local school.

Many properties have a view of the Mitchell Highway that passes through the township and the Murrawombie Copper Mine at the end of Railway Road.

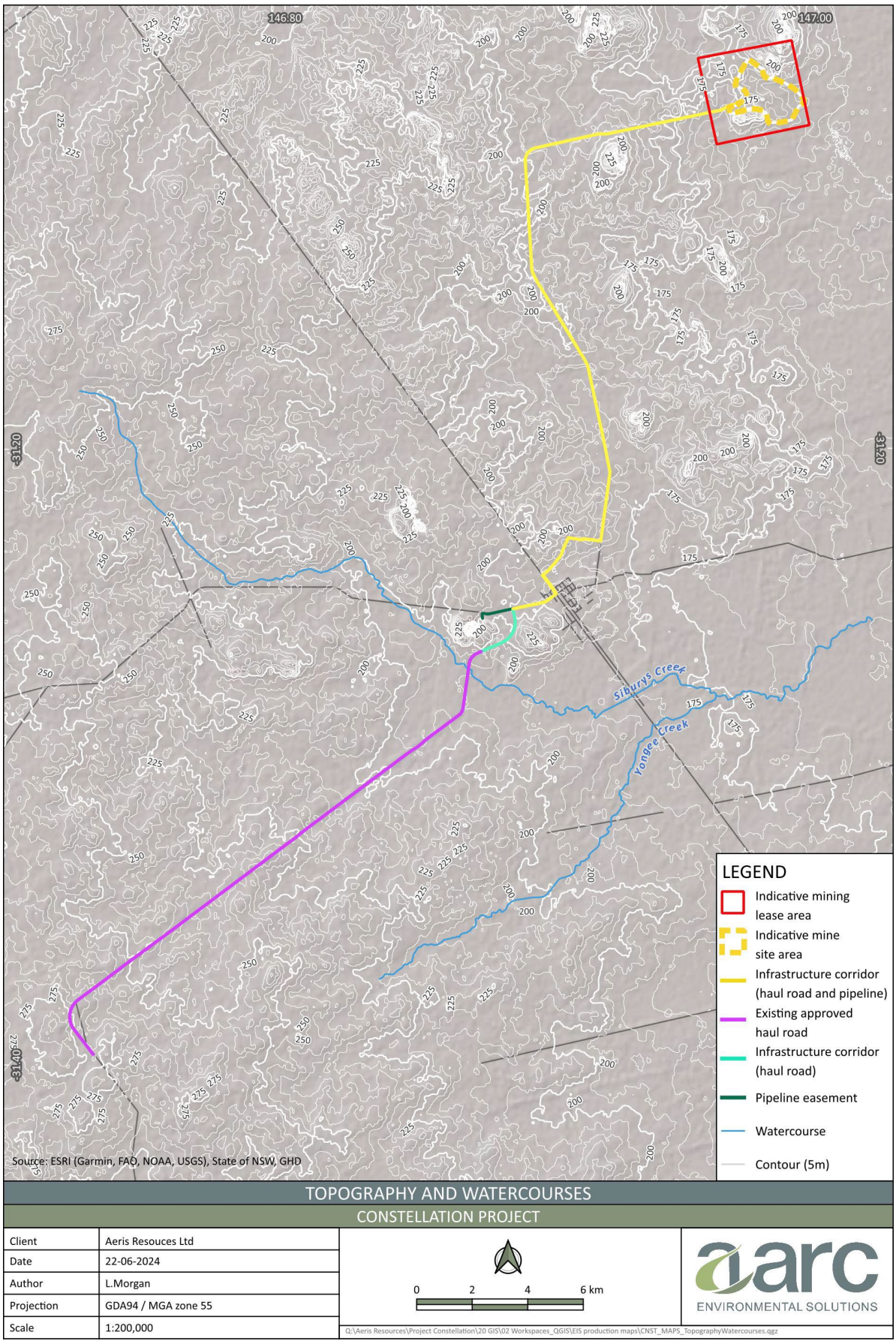


Figure 6-46: Topography and watercourses for the Project area

6.16.3 Methodology

6.16.3.1 General methodology

The visual impact assessment utilised modelling and field validation to evaluate:

1) Project site impacts; and

2) infrastructure corridor impacts.

The assessment followed the methods described in the Guideline for Landscape Character and Visual Impact Assessment (Urban Design Roads and Waterways 2023), with key methodologies and assessment frameworks taken from the Guidelines for Landscape and Visual Impact Assessment, Third Edition (2013).

These guidelines identify two key impacts to be considered for a visual amenity assessment: landscape and visual impact.

Landscape impact is considered to be topographic quality, ecological characteristics, natural drainage paths and the existence and characteristics of the built environment, such as roads and buildings.

Visual impact is defined as the day-to-day visual effects of a project on people's views. They were assessed using the maximum visual impact (i.e. when all visible features are present at their maximum extent and size).

Consideration was given to the Dark Sky Planning Guideline (DPIE 2023) as the Project is within the Dark Sky Region, 200 km east of the Siding Spring Observatory. As such, when considering visual impacts at night, consideration was given not only to sensitive receptors in the area, but also to the potential effects of the Project on the Siding Spring Observatory.

To determine the visibility extent, zones of theoretical visibility (ZTVs) were prepared by constructing representative viewsheds for the Project and receptors to accurately assess the visibility of the Project impacts.

The Viewsheds were constructed at 5 km and 15 km radii to assess impacts across day and night operations, respectively.

The use of a 15 km radius to simulate night operations is based on potential lighting impacts, which are expected to be visible further than 5 km from the site. Receptor ZTV intersecting the haul road were identified to determine if vegetation screening would effectively eliminate visibility.

The Project mine area's features pertinent to the assessment included permanent and temporary infrastructure, as shown in Table 6-90.

Table 6-90: Permanent and temporary infrastructure within the Project mine area

Permanent infrastructure	Temporary infrastructure
WRE	Low grade ore stockpile
HLP	Topsoil stockpile
MWS	Administration and workshop buildings
Open pit cut	Paste fill plant
	Infrastructure corridor (primarily the haul road).

The impact's magnitude for each viewpoint was assessed, based on its form (scale, size and character) relative to nearby receptors. Once these variables were established, the visual impact on each receptor was assessed, taking into account visibility, magnitude and receptor sensitivity.

The magnitude of the impact on the visual amenity for each receptor was assessed to determine the total significance of the proposed haulage route. The method for assessing magnitude in relation to the proposed haulage route was based on the planar area to consider the visual impacts hauling activities may pose to sensitive receptors. The proposed haulage route was categorised into three sections:

1) the infrastructure corridor from the Project mine area to the Mitchell Highway;

2) the modified section of the Mitchell Highway and existing haul road, starting at the intersection of the Mitchell Highway and infrastructure corridor and ending at the intersection between Railway Road and Yarrandale Road; and

3) the existing haul road from Yarrandale Road (Murrawombie Copper Mine) to the Tritton Copper Mine.

6.16.3.2 Sensitive receptors

Thirty-four receptors were identified as potentially being impacted by the Project. Sensitive receptor (R4) was recently destroyed by fire and omitted from the assessment. Sensitive receptors whose visual amenity may be impacted during the daylight and nighttime by Project activities were identified using the limit of visual impact determined for each scenario (refer to Section 6.16.3.1).

For daylight, the limit of visual impact from the Project includes:

- one potential sensitive receptor within 5 km of the Project mine site (Figure 6-47); the residential dwelling, sensitive receptor R2, is approximately 4.6 km west of the site; and
- twenty-one sensitive receptors within 5 km of the haulage road; the closest residential dwelling to the infrastructure corridor is approximately 50 m from the road (being a sealed section of the existing Mitchell Highway at that location).

For nighttime, the limit of visual impact (buffered 15 km) from the Project mine site includes 14 potential sensitive receptors.

No key public vantage points were identified within 15 km of the Project or 5 km from the haulage route.

All sensitive receptors were categorised as either township or rural receptors, based on classifications of the pre-mining landscape character. Township receptors are within Girilambone village in close proximity to the Mitchell Highway. All other receptors were classed as rural receptors.

6.16.3.2.1. Rural receptors

Nineteen rural receptors were single residences or farm properties, with several potential residences identified (Table 6-91). Seven rural receptors were identified within 5 km of the infrastructure corridor. The potential impact of elevated lighting on overburden emplacements and stockpiles during the first year of operation was assessed at a range of 15 km, including earth curvature. Fourteen receptors were identified within 15 km of the elevated lighting (Figure 6-47).

Table 6-91: Potential rural sensitive receptors

Receiver ID	X-coordinates (m)	Y-coordinates (m)	Approximate distance from Project site (km)	Approximate distance from infrastructure corridor (km)	Receiver classification
R1	489555	6559218	8.7	0.3	Homestead
R2	493490	6560660	4.6	0.9	Homestead

Receiver ID	X-coordinates (m)	Y-coordinates (m)	Approximate distance from Project site (km)	Approximate distance from infrastructure corridor (km)	Receiver classification
R3	489251	6545304	18	1.8	Homestead
R6	501245	6545711	15.6	8.8	Homestead
R7	507687	6558927	9.8	11.8	Homestead
R8	505215	6570886	12.2	14.0	Homestead
R9	487912	6553080	12.9	2.5	Homestead
R10	492797	6555115	7.9	3.0	Residence
R11	497434	6552606	8.4	5.8	Homestead
R12	492536	6543686	18.2	1.2	Industrial
R13	485483	6550982	16.1	5.8	Homestead
R14	487446	6537784	25.5	0.8	Homestead
R16	485231	6528933	34.6	6.6	Homestead
R29	496389	6544522	15.0	5.9	Homestead
R30	492258	6568137	6.9	8.5	Residence
R31	487654	6566080	9.0	7.5	Residence
R32	486012	6567161	10.9	9.1	Residence
R33	482275	6561731	13.5	7.9	Residence
R34	503675	6551890	9.4	11.7	Residence
R35	508109	6554886	10.0	16.7	Residence

6.16.3.2.2. Township sensitive receptors

Girilambone township is located alongside the Mitchell Highway, with township receptors as close as 55 m from the infrastructure corridor (the sealed section of the existing Mitchell Highway). Field photo locations were established at the boundaries of sensitive receptor properties on the side near the infrastructure corridor disturbance to assess the expected visual impact of the proposed haul route. As the township is more than 15 km from the proposed haul route, which is the buffer distance used to determine lighting effects from the Project, only haul route impacts have been considered. The residential receptors (Table 6-92) are illustrated in Figure 6-50.

Table 6-92: Potential township sensitive receptors

Receiver ID	X-coordinates (m)	Y-coordinates (m)	Approximate distance from Project site (km)	Approximate distance from infrastructure corridor (km)	Receiver classification
R5	491032	6543023	19.3	0.7	Residence
R15	490582	6543036	19.5	0.05	Residence

Receiver ID	X-coordinates (m)	Y-coordinates (m)	Approximate distance from Project site (km)	Approximate distance from infrastructure corridor (km)	Receiver classification
R17	490785	6543253	19.2	0.2	Residence
R18	490821	6543321	19.1	0.3	Residence
R19	490929	6543306	19.1	0.4	Residence
R20	490867	6543266	19.1	0.3	Residence
R21	490913	6543196	19.2	0.3	Residence
R22	490897	6543068	19.3	0.2	Residence
R23	490914	6543045	19.3	0.2	Residence
R24	491008	6543070	19.3	0.3	Residence
R25	490993	6543168	19.2	0.4	Residence
R26	490847	6542706	19.7	0.3	Residence
R27	490938	6542916	19.4	0.3	Residence
R28	491246	6542779	19.5	0.6	School

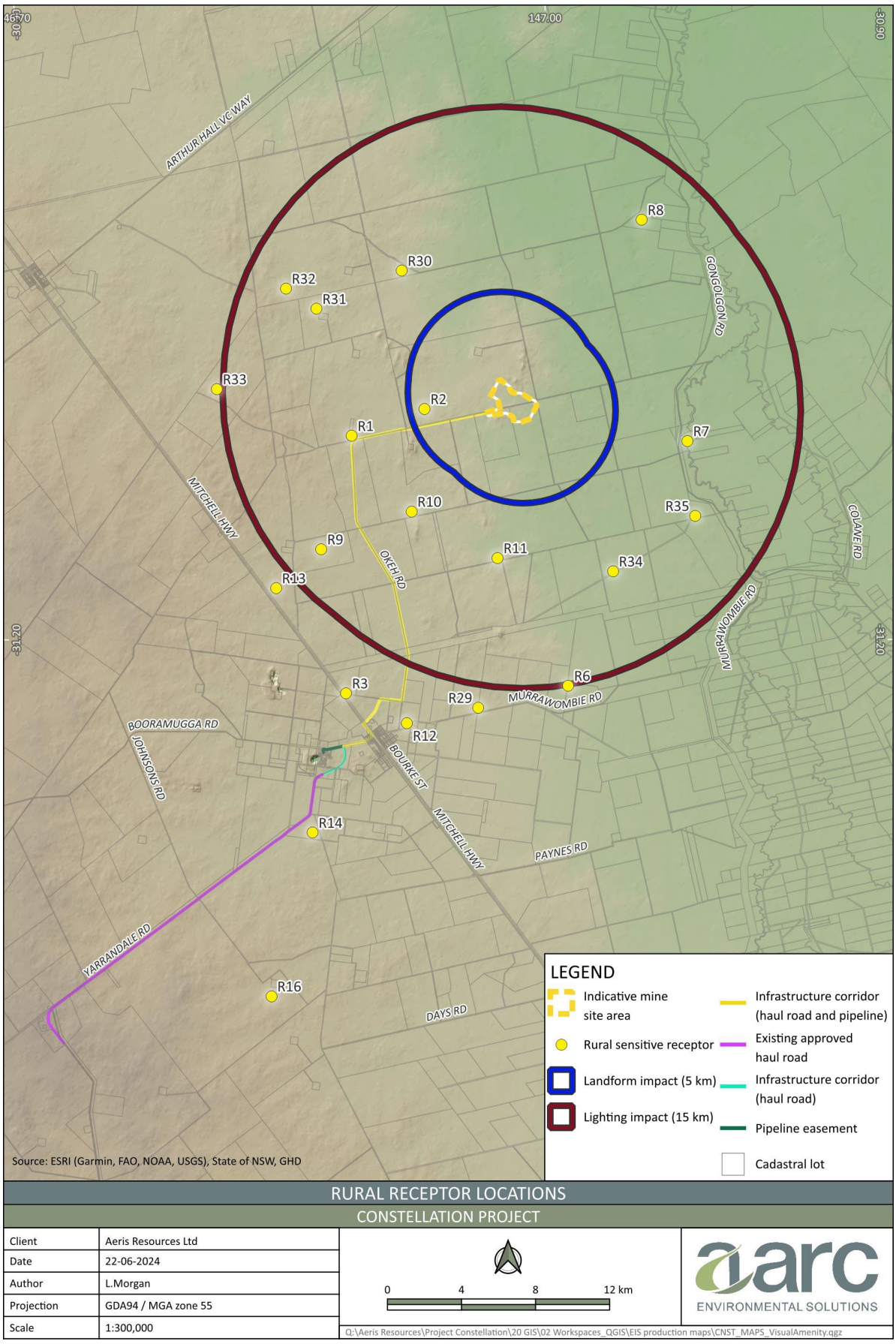


Figure 6-47: Identified Project mine area sensitive receptors (rural and residential/township)

6.16.4 Predicted site impacts

6.16.4.1 Landscape impacts

Four features of the Project site layout may impact the visual amenity of surrounding sensitive receptors, namely:

1) the oxidised ore stockpile;

2) the MWS;

3) the HLP; and

4) the WRE.

Of these four features, three will remain after mining, with the oxidised ore stockpile expected to be processed entirely during mining activities. The design specifications of these features will be consistent with the characteristics of the surrounding landforms (low hills).

The WRE will be constructed to a similar scale as the immediately surrounding low hills, and the HLP, oxidised ore stockpile and MWS will more closely match the heights of taller trees in the surrounding landscape. However, the total footprints of these features are greater than that of the natural features (of a similar height) within the surrounding environment, increasing the impact on the landscape.

As mining progresses, underground operations will be effectively screened by the retained border of native vegetation where canopy height consistently exceeds 12 m to the west towards the nearest sensitive receptors of R1 and R2.

During day operations, the magnitude of the impact is expected to be low in the primary production landscape, given that constructed landforms will be of a similar scale to the surrounding environment and activities will align with the objectives of a primary production land use zone.

Similarly, the nighttime operations of the Project are expected to result in a minor impact on the overall landscape character, as lighting fixtures are not expected to cause significant amounts of light spillage or skyglow, which will be further mitigated by adherence to the Dark Sky Planning Guideline, as proposed in Section 6.16.6.1 (DPIE 2023) and the Australian Standard AS 4282 – Control of Obtrusive Effects of Outdoor Lighting.

At closure, only three of the impacting features are expected to remain, with the oxidised ore stockpile being depleted before the site's closure. The remaining structures (MWS, HLP and WRE) will be rehabilitated to a final land use domain consistent with the surrounding environment, restoring the value of the impacted landscape. Based on these considerations, the overall impact of the proposed Project layout on the surrounding environment is expected to be negligible, with minimal permanent impact on the landscape after completing rehabilitation and closure.

6.16.4.2 Visual impacts

The maximum visual impacts of the proposed Project are expected to occur during the life of the mine, with all permanent structures to be rehabilitated at the completion of mining (closure) and integrated into the surrounding landscape.

Visual impacts over the life of mining will vary during daylight and nighttime operations due to the use of lighting equipment during night operations. As such, two ZTV have been defined for each feature, namely for daylight (5 km) and night (15 km), as shown in Figure 6-48 for each landform.

Given the ZTV, the only receptor impacted during daylight operations is R2, with the following 10 mining landform-sensitive receptors impacted during night operations:

1) R1
2) R2
3) R7
4) R8
5) R10
6) R11
7) R30
8) R32
9) R34
10) R35

The assessment considered sensitive receptor interest in the visual environment, distance from the Project and vegetation or topographic screening. Given these considerations, the receptor R2 was classed as a moderate-sensitivity receptor, with all other receptors classed as low-sensitivity receptors.

The assessment predicted a negligible visual impact from the Project site at all receptors with the exception of a moderate-low rated impact at receptor R2.

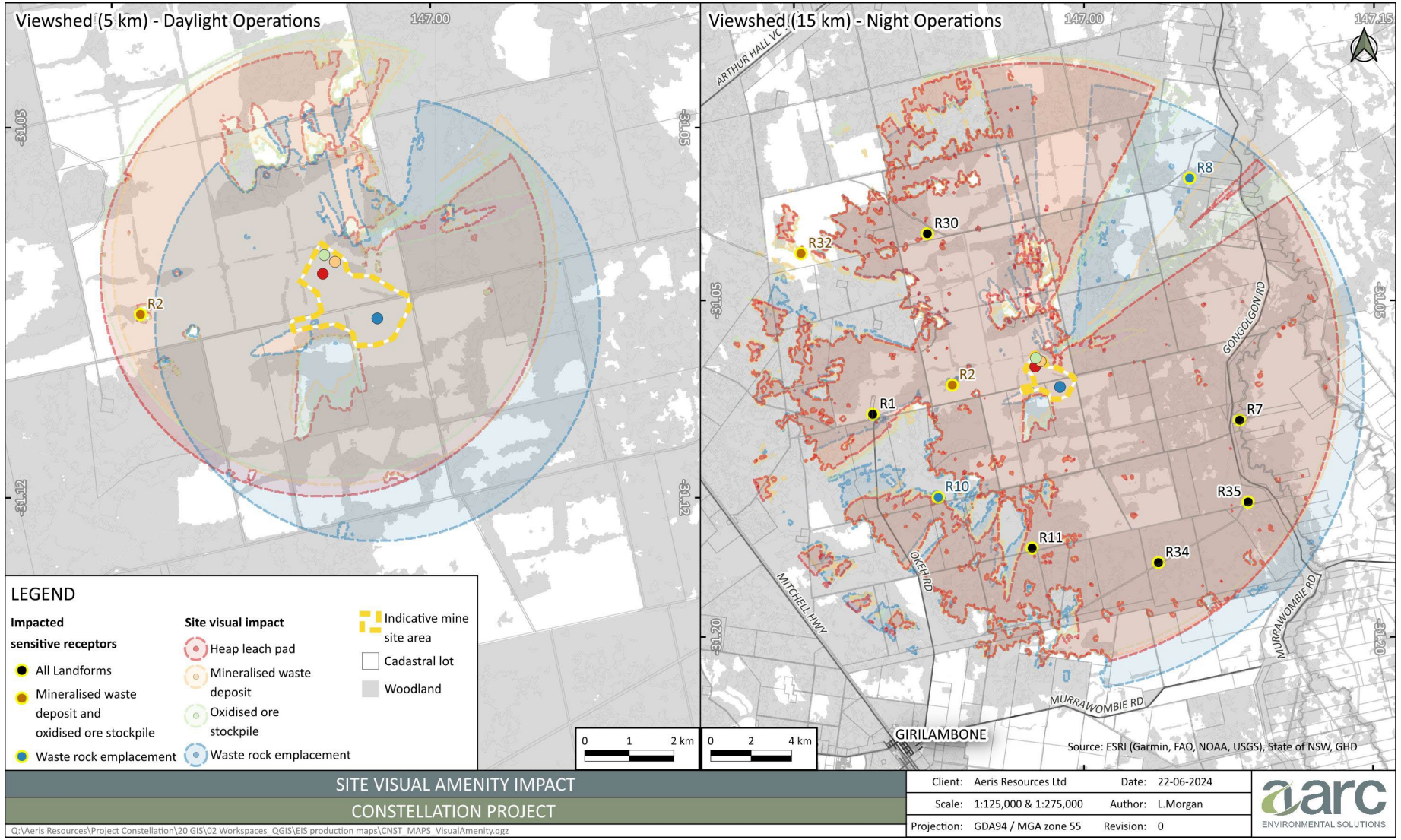


Figure 6-48: Project site ZTVs

6.16.5 Predicted infrastructure corridor impacts

6.16.5.1 Landscape impacts

The overall landscape impact of the proposed infrastructure corridor on the surrounding environment is expected to be minimal, as most of the route is proposed to follow existing road infrastructure, namely:

- Okeh Road;
- the Mitchell Highway;
- Railway Road; and
- Yarrandale Road.

Where the haulage road diverges from the existing road network, it does so in a primary production land use zone.

At closure, all impacts associated with the proposed haulage route will be negligible, given the absence of additional mining traffic and the land use zones of the affected properties and surrounding area.

6.16.5.2 Visual impacts

The proposed haul route may impact the visual amenity of 22 receptors, each assessed for their visual sensitivity. The receptors, as shown in Figure 6-49 and Figure 6-50, include:

- residential buildings;
- homesteads;
- industrial buildings; and a
- school.

Most haul route-identified sensitive receptors were considered to have a high visual sensitivity (Table 6-93). The sensitivity of each receptor was assessed with respect to the following factors:

- receptor's interest in the visual environment (high, medium or low interest in their everyday visual environment and the duration of the effect);
- receptor's viewing opportunity (prolonged, regular); and
- number of viewers and their distance/angle of view from the source of the effect, extent of screening/ filtering of view.

Table 6-93: Visual sensitivity of infrastructure corridor sensitive receptors

Sensitivity of view	Sensitive receptors	Notes
High visual sensitivity	R1, R2, R5, R14, R15, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27.	Most identified haul route sensitive receptors are considered high-sensitivity receptors, given their high interest in the visual environment, regular viewing opportunities of the surrounding landscape and proximity to the proposed haul route.
Moderate visual sensitivity	R3, R9, R10.	R3, R9, and R10 are considered moderate-sensitivity receptors. The receptors are not within the immediate vicinity of the proposed haulage route; however, they are all within the intermediate vicinity (5 km) of the proposed haulage route.

Sensitivity of view	Sensitive receptors	Notes
Low visual sensitivity	R12(industrial area), R28(school), R29.	R12 and R28 are considered low-sensitivity receptors, given that both locations are places of education and work where the setting and view are not significant with respect to the quality of the working environment. R29 is considered a low-sensitivity receptor, given that the receptor is beyond the immediate vicinity of the proposed haulage route.

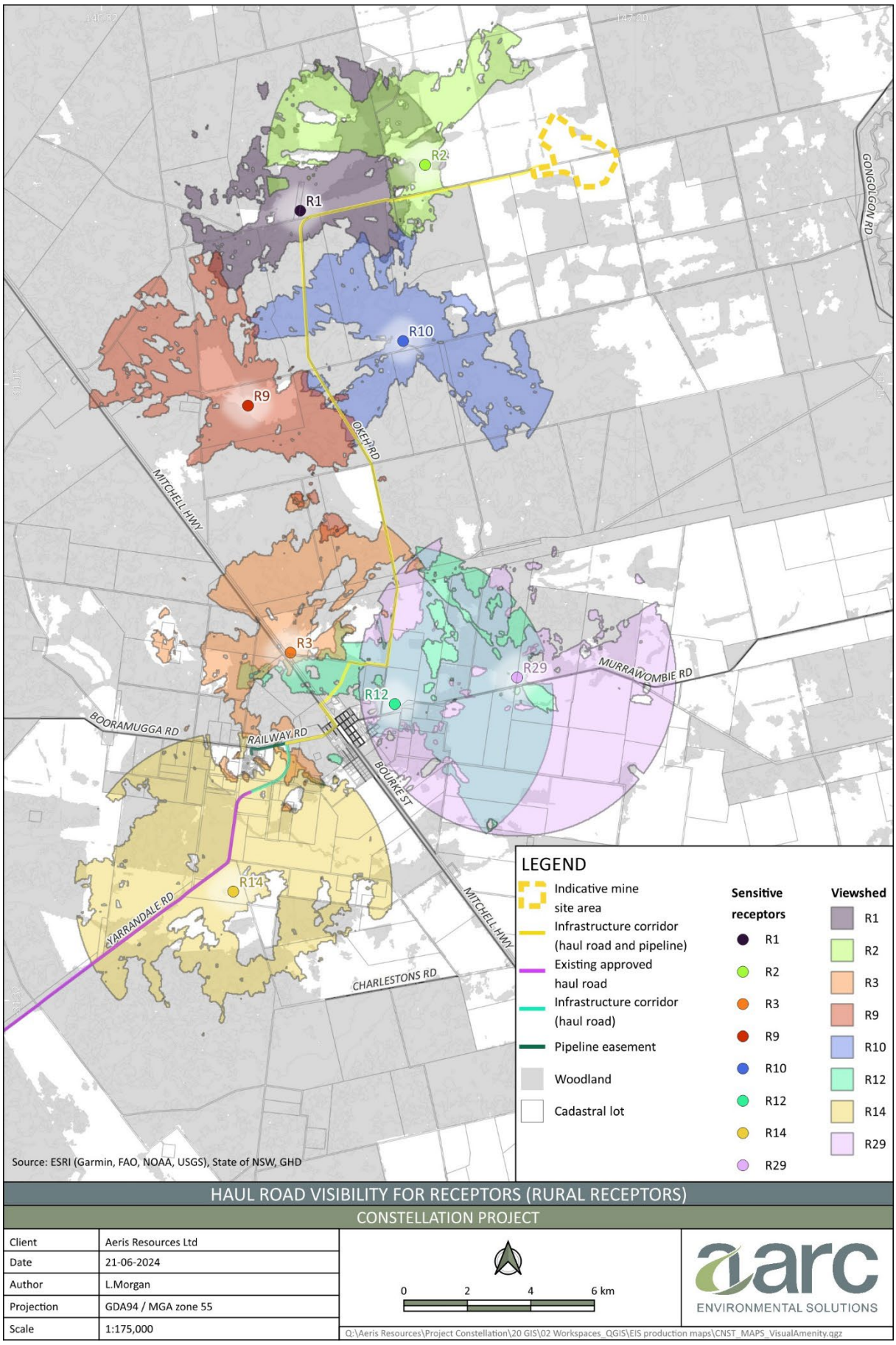


Figure 6-49: Infrastructure corridor (haulage road) visibility for rural receptors

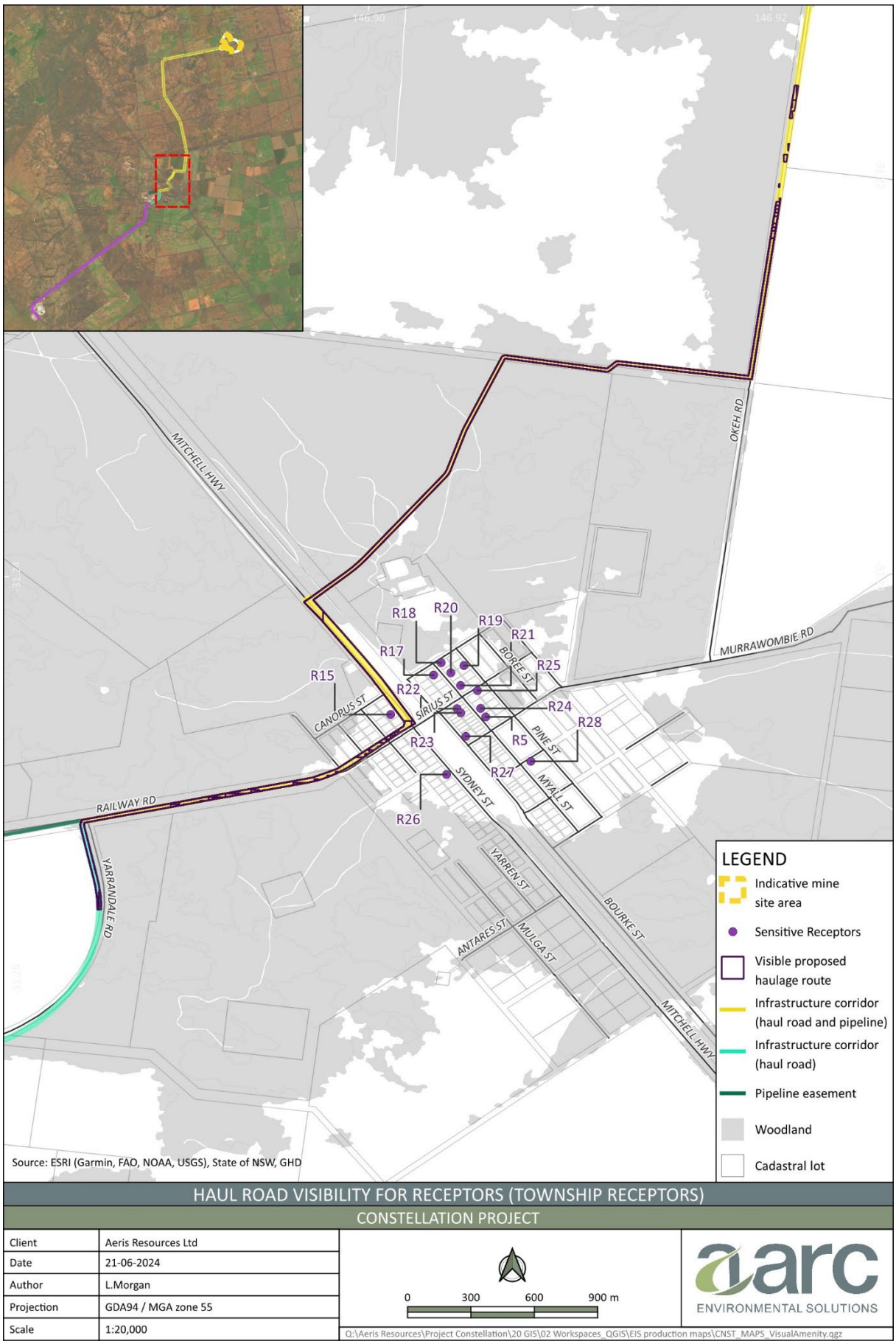


Figure 6-50: Haul road visibility for township receptors

The infrastructure corridor is within the ZTV of all haul road receptors. The proposed infrastructure corridor will utilise existing roads as far as practicable, generating minimal new disturbance. However, there are two sections where the infrastructure corridor will result in land use changes within the existing landscape:

1) the extension of Okeh Road to reach the Project site to the north; and

2) the additional road section constructed on Aeris-owned land connecting Okeh Road to the Mitchell Highway, reducing the impact on Girilambone township.

These two developments fall within the ZTV for R1 (north), R2 (north), R12 (south) and all sensitive receptors within Girilambone township (south).

Overall, the significance of the proposed haulage route impact on the visual amenity of the haul road receptors is negligible across the majority of receptors, with the impact on receptor R1 determined to be high–moderate. High–moderate indicates significant impacts on the visual environment that must be mitigated. The proposed extension of Okeh Road is approximately 2.8 km from the receptor R1, with partial screening from vegetation.

In addition to any developments associated with the proposed haulage route, visual impacts associated with traffic arising from haulage activities must be assessed. It is expected that the baseline magnitude of traffic impacts on sensitive receptors will be determined as low, given that hauling activities will likely consistently impact the visual amenity of receptors but will only be a temporary impact with a small period of exposure. However, there will be increased traffic along Okeh Road compared to the existing traffic impacts. The maximum number of single truck movements along this part of the road is estimated to be 82, or 4 per hour. This baseline will vary based on the change in current traffic conditions, proximity to the proposed haul route and any mitigating circumstances, such as vegetation or topographic features. Overall, the magnitude of impact arising from the proposed haul route is expected to be negligible across all receptors, excluding R1.

It is expected that R1 will have increased traffic impacts compared to surrounding receptors due to minimal vegetation screening along the proposed haulage route, with impacts expected to occur during day and night operations. During daylight hours, increased traffic movements will result in low-magnitude impacts consisting of temporary sightings of haulage trucks over a small period of exposure. However, light spillage resulting from truck movements is expected to increase traffic impacts to a moderate magnitude during night operations, given the frequency of truck movements, proximity of R1 to the proposed haulage route and the illuminance produced by lighting instruments. This combination of factors suggests that light spillage at R1 may increase above 0 lux, noting that the recommended maximum value of light in dark surrounds is 1 lux between the hours of 11 pm to 6 am per Australian Standard 4282 (Standards Australia 2023).

Traffic impacts at R1 are proposed to be mitigated by providing a visual barrier, such as planting semi-mature trees along the roadside and property boundary. The mitigation measures are expected to reduce the magnitude of these impacts to negligible, obscuring the visibility of passing trucks and screening light spillage during night operations.

6.16.6 Mitigation measures

Traffic impacts at R1 are proposed to be mitigated by providing a visual barrier, such as planting semi-mature trees along the roadside and property boundary.

General mitigation and management measures will be adopted to reduce visual amenity impacts at sensitive receptors during the construction, operation and rehabilitation phases of the proposed Project. These measures will include:

- using neutral tones for Project building exteriors to reduce potential contrast with the surrounding visual landscape;
- constructing a proposed new section of haul road for the infrastructure corridor to the north-west of Girilambone to avoid haulage through the township;
- considering placement, configuration and direction of lighting to reduce light emissions during the operational phase of the Project;

- rehabilitating mining disturbance and landforms as soon as land becomes available;
- creating additional visual screening along the roadside and property boundary of R1, consisting of planting semi-mature trees to act as a visual barrier;
- designing permanent landform features (WRE, HLP, and MWS) to have a final landform that does not contrast significantly with the existing topography; and
- rehabilitating the MWS, HLP and WRE in line with the surrounding environment, restoring the value of the landscape impacted.

6.16.6.1 Dark Sky Planning Guideline mitigation measures

To minimise potential Project impacts on the Siding Spring Observatory, the following lighting design principles of the Dark Sky Planning Guideline (DPIE 2023) will be adopted:

1) Light must have a clear purpose.
2) Eliminate upward spill light.
3) Direct light downward and avoid light trespass.
4) Use shielded fittings.
5) Avoid excess lighting.
6) Switch lights off when not needed.
7) Use energy-efficient bulbs.
8) Use asymmetric beams.
9) Direct light away from reflective surfaces.
10) Use warm white colours.

6.16.7 Overall visual impact conclusion

The overall visual impact of the Project has been assessed, based on the individual impacts of the Project mine area and haulage road impacts on visual amenity. In determining the overall impact, the greatest impact significance between the Project site and haulage road was used, noting that both assessments of visual impact were conservative in nature.

After assessing the Project mine area and haulage road sensitivity for the 34 sensitive receptors, the overall impact sensitivity is negligible to none for most sensitive receptors, as outlined in Table 6-94. There is predicted to be a moderate–low impact sensitivity at R2, relating to the Project site and a high–moderate impact sensitivity for R1 from the haulage route.

Table 6-94: Overall visual amenity impacts for sensitive receptors

Receiver ID	Project site impact sensitivity	Haulage route impact sensitivity	Overall impact sensitivity
R1 (Rural)	Negligible	Moderate	Moderate
R2 (Rural)	Moderate–low	Negligible	Moderate–low
R3 (Rural)	None	Negligible	Negligible
R5 (Township)	None	Negligible	Negligible

Receiver ID	Project site impact sensitivity	Haulage route impact sensitivity	Overall impact sensitivity
R6 (Rural)	None	None	None
R7 (Rural)	Negligible	None	Negligible
R8 (Rural)	Negligible	None	Negligible
R9 (Rural)	None	Negligible	Negligible
R10 (Rural)	Negligible	Negligible	Negligible
R11 (Rural)	Negligible	None	Negligible
R12 (Rural)	None	Negligible	Negligible
R13 (Rural)	None	None	None
R14 (Rural)	None	Negligible	Negligible
R15 (Township)	None	Negligible	Negligible
R16 (Rural)	None	None	None
R17 (Township)	None	Negligible	Negligible
R18 (Township)	None	Negligible	Negligible
R19 (Township)	None	Negligible	Negligible
R20 (Township)	None	Negligible	Negligible
R21 (Township)	None	Negligible	Negligible
R22 (Township)	None	Negligible	Negligible
R23 (Township)	None	Negligible	Negligible
R24 (Township)	None	Negligible	Negligible
R25 (Township)	None	Negligible	Negligible
R26 (Township)	None	Negligible	Negligible
R27 (Township)	None	Negligible	Negligible
R28 (Township)	None	Negligible	Negligible
R29 (Rural)	None	Negligible	Negligible
R30 (Rural)	Negligible	None	Negligible
R31 (Rural)	None	None	None
R32 (Rural)	Negligible	None	Negligible
R33 (Rural)	None	None	None
R34 (Rural)	Negligible	None	Negligible
R35 (Rural)	Negligible	None	Negligible

Note: Receptor R4 was a residence that was recently destroyed by fire.

6.17 Cumulative impacts

6.17.1 Introduction

This section has been prepared to provide a summary of the potential cumulative impacts of the Project.

As defined in the Cumulative Impact Assessment Guidelines for State Significant Projects (Cumulative Impact Guidelines) (DPIE 2022c):

> *Cumulative impacts are a result of incremental, sustained and combined effects of human action and natural variations over time and can be both positive and negative.*
>
> *A cumulative impact assessment is the assessment of environmental, social, economic and other impacts which result from a project when added to other past, present and reasonably foreseeable future projects.*

The Cumulative Impact Guidelines identify four approaches that may be used for cumulative impact assessment:

1) **incremental assessment**—which involves adding the incremental impacts of the Project to the baseline conditions that exist for each relevant matter;
2) **combined incremental assessment**—which involves analysing the combined effect of the different impacts of the project, normally on a sensitive area or receiver (e.g. the combined effect of dust, noise, visual and social impacts of the project on people or communities living close to the site);
3) **issue-specific cumulative impact assessment**—which involves considering the impacts of the project together with the impacts of other relevant future projects on specific issues (key matters) within an identified area (e.g. the regional airshed, water sources, ambient noise levels in certain locations, threatened species and communities, regional housing availability and affordability);
4) **combined cumulative impact assessment**—which involves considering the combined effect of the different cumulative impacts of the project with other relevant future projects on key matters in an identified area; this may involve integrating the findings of issue-specific cumulative impact assessments on each relevant matter or extending the combined incremental assessment approach to include the additional impacts of other relevant future projects.

Incremental assessment and combined incremental assessment are the most commonly adopted approaches within environmental impact assessments. The NSW Cumulative Impact Assessment Guidelines, however, seek to promote issue-specific cumulative impact assessments and combined cumulative impact assessments for SSD projects. Yet, as noted within the guidelines, not every SSD will require issue-specific cumulative impact assessments or combined cumulative impact assessments. Indeed, in some cases, incremental assessments will be sufficient (such as when the project is located in an area with no other relevant future projects). This is the case for the proposed Project.

6.17.2 Cumulative impact potential

To support the cumulative impact assessment for the proposed Project, existing and future projects were sought within the region. While existing projects are generally easy to identify, future projects can be a challenge. For the proposed Project, however, Aeris is in the unique position of being a significant holder of resource tenements within the region. As such, good visibility of potential cumulative impacts associated with other resource developments exists. Local knowledge (from Tritton personnel) and searches of the NSW Planning Portal were also relied on to identify other potential future projects within 100 km of the proposed Project (Table 6-95).

Table 6-95: Existing and future projects

Identified project	Distance to the proposed Project	Description
Existing or approved		
Avoca Tank Copper Mine (Aeris)	19 km	This operating site includes underground mining and transporting ore to the Tritton Copper Mine, with limited on-site infrastructure.
North East Copper Mine (Aeris)	20 km	The North East Copper Mine is currently in care and maintenance with some further development potential existing. Site infrastructure includes open pit and underground mining (noting mined ore was transported to the Tritton Copper Mine).
Murrawombie Copper Mine (Aeris)	22 km	This operating site includes open pit and underground mining, heap leach pads and transporting ore to the Tritton Copper Mine. Mining at Murrawombie is currently anticipated to cease in 2026.
Budgerygar (Aeris)	40 km	Budgerygar is a deposit adjacent to the Tritton Copper Mine. Mining in Budgerygar commenced in 2024, targeting the extraction of approximately 2.6 Mt of copper ore, which will be processed at the Tritton Copper Mine.
Tritton Copper Mine (Aeris)	41 km	The Tritton Copper Mine and processing plant forms the hub for the Aeris operations in the area (Tritton Copper Operations). A conventional processing plant operates at the Tritton Copper Mine, with copper concentrate railed to local end customers as well as the port of Newcastle for broader distribution.
Bogan River Solar Farm (PARF)	50 km	The Bogan River Solar Farm (also known as the Nyngan Solar Farm and Nyngan Solar Plant) is owned by the Powering Australian Renewables Fund. The project commenced operations in 2015 and is currently operated by AGL Energy.
Yarren Hut Solar Farm (BayWa r.e. Australia)	57 km	This is a 2021-approved development of a solar farm and associated infrastructure, owned by BayWa r.e Projects Australia Pty Ltd. The project is understood to have never commenced construction. The project anticipates up to 40 construction jobs would be created across a 10-month construction period, with on-site facilities proposed to accommodate the construction workforce.
Nyngan Scandium Project (EMC Metals)	59 km	This 2016-approved mining project (located on ML 1792) targets scandium and associated rare earth elements. The asset is owned by EMC Metals Australia Pty Ltd. The project is understood to have commenced development in late 2023.
Nyngan to Cobar Pipeline (NSW Govt)	>60 km	This is a project to upgrade the existing water supply pipeline and pumping infrastructure between Nyngan and Cobar. No environmental impacts will overlap the proposed Project due to the distance between the projects. Social impacts from the project are not anticipated due to the small scale and limited resourcing required. The project is not identified as an SSD and no social impact assessment is available.
Mt Boppy Gold Project (Manuka Resources)	83 km	This existing mining project (located on ML 1681) mines gold, lead and silver. The asset is owned by Manuka Resources.
Potential future projects (exploration targets)		
Kurrajong	30 km	

Identified project	Distance to the proposed Project	Description
Budgery	58 km	These are exploration targets and future potential developments to support the continuity of Tritton Copper Operations.

Environmental impacts from existing projects are considered within baseline assessments undertaken for the Project (consistent with incremental assessment methodology). Future potential projects, however, were identified to have limited opportunity to present cumulative impacts with the proposed Project due to both distance and timing considerations.

The Kurrajong deposit (approximately 30 km south of the proposed Project) and the Budgery deposit (approximately 58 km to the south-west) are considered significantly distant geographically from the Project, so environmental impacts would not overlap. Further, any future development of Kurrajong and Budgery is not expected to occur until after the downscaling of existing mining activities at Tritton Copper Operations (including the Tritton Copper Mine, Avoca Tank Copper Mine, North East Copper Mine, Bugerygar Mine and Murrawombie Copper Mine). As such, issue-specific cumulative impact assessments or combined cumulative impact assessments have not been considered necessary for the proposed Project. In this regard, it is noted that cumulative impact assessments should be proportionate to the scale and potential significance of the cumulative impacts of the Project, combined with the impacts of other relevant future projects (DPIE 2022c).

6.17.3 Assessment requirements

The Project SEARs requires an assessment of the cumulative impacts associated with the development and operation of the proposed Project, specifically identifying the areas of air quality, traffic and transport, and social aspects. A compilation of these SEARs is provided in Table 6-96, with reference to where each of these matters is addressed within the EIS.

Table 6-96: Assessment requirements

Assessment requirements	Report locations
General requirements: • an assessment of the likely impacts of all stages of the development, including interactions between the development and any other existing, approved or proposed developments in the vicinity, including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice.	Section 6.17.2 Section 6.17.4
Air Quality, including: • an assessment of the likely air quality impacts of the development, including cumulative impacts from nearby developments in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW (2016) (or its latest version), having regard for the NSW Government's Voluntary Land Acquisition and Mitigation Policy.	Section 6.17.4.1
Traffic and Transport, including: • an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the road and rail networks and any cumulative impacts of other developments in the locality.	Section 6.17.4.2
Social, including: • an assessment of the social impacts of the development prepared in accordance with the Department's Social Impact Assessment Guideline for State Significant Projects (2021), including the likely impacts of the development on the local community, cumulative impacts (considering other mining developments in the locality) and consideration of workforce accommodation.	Section 6.17.4.3

The following section provides a summary of how each of these matters has been considered in regard to cumulative impact potential, with potential cumulative impacts to water, noise and economic values also discussed.

6.17.4 Cumulative impact summaries

6.17.4.1 Air quality

Air emissions from nearby mining operations (including those listed in Table 6-95) are included within background dust levels used for the air quality impact assessment (refer to Appendix 8A. Air quality impact assessment, Section 5.3). As such, applying the incremental contribution from the Project to these background levels adequately represents the cumulative contribution.

Adoption of this methodology has identified that relevant air quality criteria will not be exceeded by the proposed Project. With air quality criteria not anticipated to be exceeded, air quality is considered to present limited opportunity to contribute to combined incremental impacts.

6.17.4.2 Transport and traffic

The transport impact assessment undertaken for the proposed Project (Appendix 7. Transport impact assessment) has considered potential Project impacts on top of the existing traffic baseline (which includes the projects identified in Table 6-95). Modelled traffic impacts have also assumed a conservative level of traffic growth within future projections. This is considered to reasonably represent potential cumulative impacts resultant of the Project.

The Project transport impact assessment has concluded that increases in traffic volumes (resultant of the Project) will be minor, with predicted peak traffic volumes (during the AM and PM peak periods) not expected to exceed a total of 36 vehicle movements.

Impacts on intersection performance are also predicted to be indiscernible, with modelling demonstrating a Class A level of service across all intersections across all Project phases. Impacts on road safety and network performance are also expected to be minor, with the modelled level of service predicted to be Class A across all Project phases (Appendix 7, Transport impact assessment).

As a result of these assessment outcomes, a cumulative impact on the existing traffic environment is not anticipated. Further, due to the minor increase in traffic as a result of the proposed Project, transport impacts are considered to present limited opportunity to contribute to combined incremental impacts.

6.17.4.3 Social

The social impact assessment undertaken for the proposed Project (Appendix 10, Social impact assessment) has considered potential social impacts on top of the existing social baseline. The assessment has found that a range of positive and negative impacts are anticipated to arise. Following the application of recommended mitigations, however, all identified negative impacts would be reduced to a significance of medium or low (Chapter 6, Environmental assessment, Section 6.13).

As the Project will primarily rely on the existing workforce, and there are no other identified future projects that will overlap the social locality or Project timeframe, the cumulative social impact of the Project is expected to be negligible. Should the approved (but yet to be developed) Yarren Hut Solar Farm ultimately commence construction concurrent with the Project, social impacts are still expected to be minimal, as that project has proposed on-site accommodation for its construction workforce. Further, the Yarren Hut Solar Farm is approximately 57 km from the proposed Project.

Due to the mitigations proposed and the scale and significance of social impacts expected, the Project is considered to present limited opportunity to contribute to combined incremental impacts.

6.17.4.4 Water

The water impact assessment undertaken for the proposed Project has considered potential impacts on water resources on top of the existing water environment. Cumulative water impacts are discussed in Appendix 5, Water impact assessment, Section 7.

The water impact assessment undertaken for the proposed Project has determined that it is unlikely the Project will have a significant impact on flooding, surface water or groundwater values. Impacts on flooding and surface water values will be localised and are not expected to give rise to cumulative impacts on other existing or future projects.

Cumulative impacts on groundwater have also been considered; however, these are not expected to arise due to the localised nature of impacts and the small scale of the mining area.

Predicted drawdown impacts are expected to extend only 1.7 km by the end of mining, reaching a maximum extent of 6.5 km approximately 600 years after mining. It is, therefore, considered unlikely that there will be any cumulative impact on groundwater drawdown as a result of the Project (with either existing or future operations). Water impacts are also considered unlikely to contribute to combined incremental impacts.

6.17.4.5 Noise

Noise emissions from nearby mining operations (including those projects listed in Table 6-95) are included within background levels used for the noise impact assessment (refer to Appendix 9, Noise impact assessment). As such, applying the incremental contribution from the Project to these background levels, adequately represents the cumulative contribution.

Based on predicted noise levels for the Project and the distance between other existing operations, there is limited potential for cumulative noise impacts to arise because of the Project. As such, noise impacts are considered to present limited opportunities to contribute to combined incremental impacts.

6.17.4.6 Economic

The economic impact assessment undertaken for the proposed Project has considered existing projects within the economic baseline. Future potential cumulative impacts have also been considered in respect of future projects (Appendix 11, Economic impact assessment, Section 5.6).

Cumulative economic impacts were considered to have the potential to create or exacerbate impacts on the labour market, housing affordability, infrastructure and service provision. Consideration of these matters is provided as follows:

- **Impacts on the labour market:** Given the Project largely reflects a continuation of existing mining activities to supplement and replace production of other mines reaching their end of life, cumulative labour demand impacts can be expected to be limited to construction activity, with minimal impacts during operations.
- **Impacts on housing affordability:** Non-local construction workforces engaged across multiple projects being developed concurrently has the potential to impact housing availability and affordability. The Project's contribution to short-term accommodation and rental property demand, however, is expected to be relatively small and limited to the peak construction period (with construction activity limited to a period of 12 months). Construction of the Project is not anticipated to overlap with other future projects; however, the approved (but yet to be developed) Yarren Hut Solar Farm may ultimately overlap. Should this occur, cumulative impacts are not expected to arise, as the Yarren Hut Solar Farm has proposed on-site accommodation for its construction workforce.
- **Impacts on infrastructure and service provision:** Cumulative impacts are not expected to result in significant changes in demand or requirements for local infrastructure and service provision beyond what is currently available.

6.17.5 Conclusion

Cumulative impact assessments should be proportionate to the scale and significance of the potential cumulative impacts of the proposed Project, combined with the impacts of other relevant future projects (DPIE 2022c).

All impact assessments undertaken for the proposed Project have considered existing projects within baseline conditions. Aeris has also committed to mitigate many impacts where possible, resulting in impacts on all environmental values being assessed to meet relevant regulatory requirements. Further, it is considered that there is limited potential for combined incremental impacts to arise on a background of compliance with regulatory requirements.

Future projects were identified to have limited opportunity to present cumulative impacts on the proposed Project due to distance and timing considerations. As such, issue-specific cumulative impact assessments or combined cumulative impact assessments were not considered necessary for the proposed Project.

Constellation Project

Environmental Impact Statement



Chapter 7 – Mitigation and Management

7 Mitigation and management measures

7.1 Introduction

This chapter describes the management commitments made by Aeris to manage, mitigate and/or monitor Project impacts during the life of the Project. Management of impacts will involve:

- measuring and tracking the status of the impact through ongoing monitoring activities; or
- undertaking actions to mitigate or repair the impact, or
- a combination of measuring and mitigating.

These commitments are outlined in the following sections.

7.2 Assessment requirements

This chapter addresses the NSW Planning Secretary's Environmental Assessment Requirements (SEARs) for "a consolidated summary of all the proposed environmental management and monitoring measures, identifying all commitments made in the EIS". A summary of the proposed measures for the Project is presented in Table 7-1.

Table 7-1: Project management and mitigation measures

No.	Commitment
General	
G1	A Construction Environmental Management Plan will be prepared for the construction phase of the Project to mitigate impacts on soil and water.
G2	The management of spills will include measures to manage and contain accidental spills, including maintaining materials such as spill kits.
G3	Where possible, potential sources of contamination will be removed, and actual contamination will be cleaned up in accordance with industry guidelines.
G4	Incident management procedures for spills and leak management will be developed in accordance with the • NSW Department of Environment and Climate Change, Storing and Handling Liquids: Environmental protection guide to managing environmental risks associated with the storage and handling of liquid substances; and • Victoria's EPA guidelines section, Bunding and Spill Management.
G5	Preventative controls for spills will be implemented, including: • bunding and containment • alarm systems • regular training and routine inspection of potential contamination sources.
Land management, soil management, erosion and sediment control	
LM1	Soil management strategies will be applied, including the development of soil management practices in accordance with the Australian Standard AS 1289 Methods of testing soils for engineering purposes (as required by Capelin 2008) and Landcom (2004) for managing urban stormwater–soils and construction.

No.	Commitment
LM2	A detailed Erosion and Sediment Control Plan will be developed in accordance with the • Best Practice Erosion and Sediment Control Guideline (IECA 2008), • Australian Standards AS 1289 Methods of testing soils for engineering purposes (as required by Capelin 2008) and Landcom (2004) for managing urban stormwater–soils and construction, and • Managing Urban Stormwater Soils and Construction Volume 2E (DECC 2008), including the consideration of soil binders, revegetation (reseeding), light mulching, heavy mulching and rock mulching. Where appropriate, the Erosion and Sediment Control Plan for the Project will include the following criteria: • Limit land clearing to the minimum amount of land required for the safe operation of the Project. • When possible, carry out rehabilitation as mining operations are completed and land becomes available. • Place soil stockpiles away from drainage areas, roads, machinery, transport corridors, stock grazing areas and areas where they may be susceptible to wind erosion. • Divert overland flow/runoff around disturbed areas. • Identify activities that could cause erosion and generate sediment. • Identify location, function and capacity of erosion and sediment control structures to minimise soil erosion and the potential for transport of sediment downstream. • Manage impacts of construction on identified areas (such as existing erosion, erodible soil types, saline soils or acid sulphate risk). • Ensure erosion and sediment control structures are appropriately maintained. • Deposit soil material directly on to areas to be rehabilitated to facilitate revegetation and maximise the use of the available seed bank. • Seed soil material as soon as possible after depositing on to rehabilitated areas if required.
LM3	Topsoil stripping will be timed, when practicable, to avoid periods of excessive rain or prolonged dry periods.
LM4	Stockpile management measures will be developed that are site-specific for the Project; specifically: • Stockpiles will be managed, taking in account locations, separation of waste types, sediment controls and stabilisation. • Stockpiles will be stabilised, establishing appropriate sediment controls and suppressing dust as required. • Stockpiles will be located away from drainage lines, waterways and areas where they may be susceptible to wind erosion.
LM5	When possible, the soil material should be stripped with its existing ground cover vegetation.
LM6	Topsoil stockpiles generally will be less than 3 m high and positioned in a manner to encourage controlled water drainage and discourage erosion.
LM7	Suitable stockpile material will be delineated and separated, such as the separation of soil types (i.e. topsoil and subsoil stockpiles).
LM8	Measures for controlling sediment and soil erosion in stockpiles will include the following where appropriate: • Suitable non-erosive drainage conditions will be established during stockpile construction (e.g. diversion of up-slope stormwater runoff); • A vegetation and/or mulch cover (e.g. hydro-mulching, rock mulching) will be laid on established stockpiles; • Erosion control blankets, mats and mesh (e.g. geofabric, jute matting, coir blanket) may be used where necessary; and • Chemical stabilisers, such as soil binders (e.g. lime, polymer soil stabilisation solutions), may be used where necessary.

No.	Commitment
LM9	Testing of soil properties prior to use in rehabilitation will be carried out. Key parameters that may be tested include: • pH; • exchangeable sodium percentage; • cation exchange capacity (major cations); • organic matter content; and • other essential nutrients, such as nitrate, phosphorus and sulphate (sulphur).
LM10	Based on soil testing results, soil ameliorants will be applied to assist rehabilitation outcomes. Ameliorants will be based on advice from a qualified agronomist/soil scientist.
LM11	Stockpiles will be monitored for erosion and weeds, with control measures implemented as appropriate.
LM12	To enhance revegetation success for rehabilitation, appropriate soil types will be laid (e.g. subsoils will be placed underneath topsoils).
LM13	Fertilisers, soil ameliorants and an appropriate seed mix may be applied to increase the likelihood of rehabilitation success.
LM14	Where possible, a minimum thickness of 0.2 m topsoil will be laid to encourage a growth medium of sufficient depth to hold water and support vegetation.
LM15	As mining operations cease, progressive rehabilitation will be completed as soon as land becomes available to reduce the risk of erosion.
LM16	Sediment control structures will be used to minimise the release of water with elevated suspended sediments into the receiving environment.
LM17	The Tritton Copper Operations Land Management Plan will be updated to incorporate topsoil recommendations (including stripping and stockpiling).
Maintaining vegetation cover for PMLU	
LM18	To achieve 60% cover and the stabilising soil for intended post-mining land use, soil binders (chemical surface stabilisers, such as gypsum) may be applied for short-term soil stabilisation to support vegetation establishment.
LM19	Re-seeding will be undertaken to establish a temporary or permanent vegetation cover over exposed soil surfaces.
LM20	To control raindrop impact erosion on slopes and assist in seed germination, light mulching may be applied using a protective blanket of straw or other plant residues.
LM21	Where appropriate, rock mulching will be installed as a thick blanket of rocks, aggregate or gravel on the soil surface in areas of high risk of erosion, such as drainage lines or non-vegetated banks.
Visual amenity	
VA1	Neutral tones will be used for the Project building exteriors to reduce potential contrast with the surrounding visual landscape.
VA2	The proposed new section of haul road will be constructed to the north-west of Girilambone to avoid the haulage through the township.
VA3	Lighting will be placed, configured and directed to reduce light emissions during the operational phase of the Project as per Australian Standard AS 4282 – Control of Obtrusive Effects of Outdoor Lighting.
VA4	Rehabilitation of mining disturbance and landforms will begin as soon as land becomes available to lessen visual impacts on sensitive receptors.
VA5	Additional visual screening will be created along roadsides and property boundaries of sensitive receptor R1 by planting semi-mature trees to act as visual barriers.

No.	Commitment
VA6	The waste rock emplacement (WRE) will be designed to have a final landform that does not significantly contrast with the existing topography.
Water and surface water management	
W1	Site water management storages will be dewatered to the pit sump prior to forecast rainfall events.
W2	A baseline and operational water quality monitoring program will be implemented. The program will be event-based and compliant with the relevant water monitoring plan for the Project, specifically: • Transfers to and from the Project will be via the off-site water supply pipeline. • Transfers in and out of the open cut pit and underground mine will be compliant with groundwater licensing. • Internal site transfers and individual storage inventory will be monitored for an annual review of the site water balance. • Surface water quality will be monitored quarterly at the monitoring locations and parameters identified in the Water Impact Assessment. When proposed monitoring locations are inaccessible due to landholder access agreements, suitable alternative monitoring locations will be investigated. Baseline surface water quality data will be used to derive site-specific trigger values. Construction and operational surface water quality monitoring will be conducted on a discharge event basis.
W3	Treated effluent disposal will be monitored in accordance with the: • Managing Urban Stormwater: Treatment techniques guideline (EPA 2004), and • Australian Guidelines for Sewerage Systems: Effluent Management ARMCANZ (1997).
W4	A Water Management Plan will be prepared that includes site-specific requirements for the Project to demonstrate compliance with water related, regulatory requirements.
W5	The water balance model will be run annually with recent site data and revised every three years. The average predicted water balance for the Project will be included in the Water Management Plan and the results for each year will be reported in the annual review for the Project.
Groundwater	
W6	Tailings transported to site from the Tritton Copper Mine will be processed into a paste on a lined pad as soon as practicable and emplaced underground to minimise oxidation.
W7	The existing groundwater monitoring network will continue to be monitored during mining operations including: • annual review of the monitoring program, including assessing whether additional monitoring bores are required; • installing meters to transfer water into and out of the mine workings during operations to allow modelled and actual inflow to be compared; • quarterly monitoring of groundwater levels at the existing monitoring bore network; • quarterly monitoring of groundwater quality for the parameters used for the baseline monitoring program (with the exception of total suspended solids and turbidity) at the existing monitoring bore network.
W8	Climate will be monitored by an automated on-site weather station to support site water management and implement the site water balance.
W9	The predictions of the groundwater model will be reviewed after two years of mining. The groundwater model review will include a comparison between the modelling results and groundwater monitoring data and mine dewatering volumes. Data collected during monitoring programs may be incorporated to improve the model, and if required, the model will be revised to improve the fit between observed and modelled dewatering volumes and groundwater levels.

No.	Commitment
Biodiversity	
B1	Preclearance protocols will be put in place during vegetation clearing. Preclearance surveys will confirm the absence of any nesting fauna in trees to be removed. The clearing protocols will include soft-felling techniques and clearing supervision when habitat trees (where nests or other habitat features are identified) are to be removed. Soft-felling techniques will typically include: • marking of all habitat trees to be cleared and demarcate the clearing boundary to avoid removing or impacting trees to be retained; • removal of ground-layer and mid-storey vegetation (under-scrubbing) around habitat trees; • tapping/nudging habitat trees by heavy machinery prior to their removal; • soft felling controlled by machinery to keep hollows intact and limit potential impacts to nesting fauna; soft felling involves the use of machinery (blade, claw or bucket) positioned at the base of the tree trunk over the structural roots; the position of the machinery on the roots controls the slow drop of the tree; and • inspection of lowered habitat trees and capture and release of any fauna species present; injured wildlife will be taken to an appropriately qualified wildlife carer or the nearest veterinary clinic. Clearing of habitat trees by bulldozing with or without linked chains will not be permitted to prevent increased likelihood of injury or death to fauna;
B2	The Tritton Copper Operations Weed Management Plan will be updated to include management of the Project area and implemented during all Project phases. The performance outcomes of the Weed Management Plan will include: • all existing weed locations to be controlled; • no new noxious weed infestations established; and • rehabilitation areas free of noxious weeds.
B3	When clearing within the Aeris block results in removal of hollow bearing trees with potential as Major Mitchell's Cockatoo habitat trees, the hollow bearing tree will be reused and/or replaced. Salvage and reuse options for hollow bearing trees will be assessed based on the characteristics of trees cleared for the Project. When suitable, hollow bearing trees can be cut and capped, then erected as tree hollows or ground habitat. Nest boxes could also compensate for the hollow bearing trees removed. A minimum replacement strategy of 1:1 for every hollow removed will be targeted and should include at least ten hollows or nest boxes suitable for Major Mitchell's Cockatoo.
B4	A Construction Environmental Management Plan will be prepared prior to clearing native vegetation. The plan will include the following: • identification of necessary hold points to ensure all biodiversity management actions are met (i.e. pre-clearing surveys followed by stage clearing of vegetation); • clearing of hollow bearing trees to be supervised by a suitably qualified ecologist following the removal of non-habitat vegetation; • a stop work order if a Major Mitchells Cockatoo is identified in a hollow bearing tree during clearance works.
B5	A Flora and Fauna Management Plan will be prepared and approved prior to clearing native vegetation and threatened species habitat within the development site. The plan will include provision for the maintenance of habitat for native species, in particular the Major Mitchell's Cockatoo. Habitat maintenance will include assurance that clearing is restricted to approved disturbance areas; specifically: • provision for the maintenance of habitat for native species, in particular the Major Mitchell's Cockatoo; • identification of hold points for clearing stages; • maps to identify construction limits and environmentally sensitive areas; • measures to avoid and minimise indirect impacts to biodiversity values adjacent to the Project site; and • updates required for the site induction procedure. The Flora and Fauna Management Plan will include provision for dealing with injured fauna. When injured animals are identified, the relevant local wildlife rescue agency (e.g. WIRES) and/or veterinary surgery will be contacted as soon as practical and immediate care will be provided to the animal.

No.	Commitment
B6	Aeris will update the Tritton Copper Operations Bushfire Management Plan to include the Project areas, including the Aeris block where the new road is proposed and the locations of the majority of impacts on conservation significant species. The plan will provide for the management and control of fire hazards by: • monitoring and maintaining areas for bushfire hazards; • identifying the response to control outbreaks of fires; • protecting the biodiversity habitat within the Aeris block from fire damage.
B7	Impacts to biodiversity values will be offset under NSW regulation.
Air quality and dust management	
AQ1	During adverse weather conditions, the Project activities' impacts on air quality will be assessed and modified as required (e.g. activity will cease when reasonable levels of dust cannot be maintained using the available means).
AQ2	Weather forecasts will be checked prior to undertaking any material handling or processing that poses a high risk of generating dust.
AQ3	On-site vehicles and plant engines will be switched off when not in use for extended periods.
AQ4	Vehicles will be maintained and serviced to minimise emissions.
AQ5	Vehicles and plant will be fitted with pollution reduction devices, such as diesel particulate filters when practicable to limit the generation of particulates.
AQ6	Activities will be visually monitored to identify potential sources of dust generation.
AQ7	The extent of exposed surfaces and stockpiles will be kept to a minimum to limit the generation of particulates.
AQ8	Exposed areas and stockpiles will be watered or covered to reduce dust emissions when practicable.
AQ9	Rehabilitation earthworks will be undertaken when practicable (i.e. when topsoil and subsoil stockpiles are moist and/or wind speed is below 10 m/s to minimise dust generation).
AQ10	Drop heights will be reduced from loading and handling equipment when practicable to lower dust generation.
AQ11	During handling, material will be dampened when excessive dust is likely to be generated.
AQ12	Unsealed haul roads, including the haul route from the Project site to the Mitchell Highway, will be watered using water carts. Roads are to be sufficiently moist to minimise on-road dust generation but not cause track washout.
AQ13	Haul roads will be inspected on a regular basis to ensure they remain in good operational condition.
AQ14	Driveways and hardstand areas will be swept or cleaned to minimise particulate generation.
AQ15	Vehicle traffic will be restricted to designated routes and speed limits will be enforced.
AQ16	Vehicle loads will be covered when travelling off-site.
AQ17	A site Air Quality Management Plan will be developed with procedures that require dust levels to remain below the relevant criteria for incremental and cumulative dust metrics at sensitive receptor locations.
Greenhouse gas management	
GG1	Energy efficiency will be considered as a criterion when selecting mining tools, heavy mining equipment, diesel and electric-powered motors and other equipment for purchase.
GG2	Options will be identified for multi-functional mining tools and heavy mining equipment for day-to-day operations that can be used to lower fuel consumption.

No.	Commitment
GG3	Energy-efficient lighting and controls will be installed where practicable.
GG4	Mine planning management measures will include minimising the vegetation clearing.
GG5	Progressive rehabilitation will be undertaken to rehabilitate the land as soon as practicable.
GG6	Fuel products that promote and deliver efficiency in consumption (i.e. premium fuels, additives etc.) will be used when practicable for mining and associated processes.
GG7	Production monitoring systems will be utilised to minimise fuel consumption and reduce idle time.
GG8	Heavy mining equipment will be maintained and used to design criteria and maximise efficiency.
GG9	Electrical equipment will be maintained to retain energy efficiency.
GG10	Haul roads will be constructed and maintained to minimise rolling resistance.
GG11	Blasting design practices and technology will ensure blasting energies are optimised and can be best utilised for material movement.
GG12	Rainwater capture and reuse, along with recycling and reuse of mine-affected water for mining operations, will minimise water requirements.
GG13	Recycled water will be utilised for processing operations to reduce off-site pumping requirements.
GG14	Operator training will be provided on techniques to minimising fuel or energy consumption. This will include minimising unnecessary idle time and dumping techniques.
GG15	Effective stock holding, management and logistic processes for 'critical insurance' stock, freight consolidation and minimising ad hoc freight transport will be undertaken to reduce energy consumption.
GG16	When suitable, local personnel will be engaged to operate the mine to reduce fuel consumption associated with extended worker commutes.
GG17	Current and future technologies will be reviewed to improve efficiencies and reduce greenhouse gas contributions from heavy mining equipment and ancillary equipment.
GG18	Solar energy and other clean energy sources will be used to extend battery life at workshops, diesel lighting plants and remote monitoring and control stations.
GG19	Internal energy audits and annual reporting of energy mass balances will be reviewed to identify where greenhouse gas emissions can be reduced.
Noise and vibration	
NV1	Engines will be switched off when not in use for extended periods.
NV2	Broadband reversing and low nuisance start-up alarms will be used on mobile equipment to maintain low noise levels.
NV3	Assessments will be performed on significant noise-generating mobile equipment to investigate attenuation options.
NV4	Operational activities will be modified during periods of meteorological enhancement. Potential worst-case (noise-enhancing) meteorological conditions will be assessed and, where practicable, operational activities will be modified to minimise noise; for example, during significant wind events.
NV5	Noise complaints and incidents will be logged and investigated, including any corrective actions.
NV6	Prior to the undertaking of an activity that may generate higher than usual noise output, consultation with those who will be potentially affected will be undertaken.

No.	Commitment
NV7	Surface blasting will be limited to daylight hours.
NV8	Relevant safety protocols (such as establishing exclusion zones) will be determined prior to blasting.
NV9	Meteorological conditions will be considered within the blast design process as a mechanism to prevent exacerbation of impacts.
NV10	A process to ensure adequate notification of upcoming blasts to relevant receptors will be established and adopted.
NV11	A complaints register will be maintained to record any blasting or vibration related complaints.
Non-mineralised and general waste management	
WM1	Waste management for the Project and any site-specific plans will be aligned to the waste hierarchy and objectives of the NSW *Waste Avoidance and Resource Recovery Act 2001*. Management strategies will be adopted that apply the hierarchy to avoid, reduce, reuse, recycle, recover, treat or dispose of waste.
WM2	General solid waste will be stored in covered bins or skips within lunchrooms, offices, outside workshops and elsewhere as required. Bins will be placed in open areas will be fitted with animal-proof lids.
WM3	Scrap metal will be stored in a specified area (or elsewhere as required) and be collected on a regular basis by a scrap metal recycler.
WM4	Pallets will be stored and reused on-site as appropriate.
WM5	Vegetation from clearing will be stockpiled or mulched on-site to be reused for progressive rehabilitation.
WM6	For waste disposal, general solid waste and pallets will be collected by licensed contractors and transported to an appropriately licensed facility for disposal.
WM7	Waste oils and greases will be stored in IBC's and 205 L waste drums placed in bunded hydrocarbon waste storage areas.
WM8	Oily rags and filters will be segregated and stored on-site in bunded areas.
WM9	Batteries will be placed in a covered and labelled battery storage area until removed from the site by licensed contractors.
WM10	Waste oils, greases, oily rags and filters will be collected for disposal, and batteries will be collected by a licensed contractor and transported to an appropriately licensed facility.
WM11	Tyres will be placed in a demarcated used tyre storage area until removed from the mine site or used for another purpose.
WM12	Tyres will be transported to a licensed waste management facility for disposal or removed by a third party holding an approved recycling permit.
WM13	Wastewater will be treated in the on-site sewage treatment plant.
WM14	A sewage treatment plant of appropriate scale to cater for the size of the peak workforce will be established on the Project site to treat effluent. The treated effluent will be used for sub-surface irrigation.
WM15	Sewage sludge will be removed by a licensed waste contractor as needed, with treated effluent sub-surface irrigated in accordance with the Bogan Shire Council requirements and approval.
WM16	The Tritton Copper Operations Waste Management Plan will be reviewed biennially and revised when necessary to meet the specific situation of this Project.
WM17	All inspection records will be kept, and appropriate management actions will be taken when required.

No.	Commitment
WM18	The waste management strategies from the existing Tritton Waste Management Plan and will be adopted and reviewed biennially and revised, when necessary, to meet the specific Project situation.
WM19	Non-mineral non-hazardous waste will be categorised into recyclable and non-recyclable waste.
WM20	Recyclables will be transported off site by a licensed contractor for recycling.
Mineralised waste	
MW1	During the operational phase, geochemical sampling and analysis will be completed for representative samples from exploration, resource drilling and drill and blast holes in any areas (such as the proposed decline and final pit wall when additional information is required to verify acid and metalliferous drainage (AMD) potential).
MW2	The geochemical data from this waste rock will be added to the resource/mine waste block model to increase the understanding of the mine waste breakdown for each mine waste class.
MW3	Development waste and mine waste from the open pit and underground deposit will be analysed and classified before this material is placed into the WRE.
MW4	The WRE will be designed to enable all potentially acid forming (PAF) waste to be emplaced in PAF cells within the WRE to minimise the potential for sulphide bearing mine waste to be exposed to oxygen and water. This will minimise long-term AMD issues to the extent possible.
MW5	Surface water, groundwater and process water sources will be monitored over the mine life to track changes in water chemistry. If changes occur this will trigger additional monitoring to verify the cause of the AMD so mitigation measures can be implemented.
MW6	At mine closure, any seepage from the heap leach pad (HLP) and the WRE will be directed to the final void, unless the surface water testing indicates the water is suitable for release into the receiving environment.
Hazards and safety	
HS1	To manage the fire/explosion related risks, site access will be restricted to trained and authorised site staff and operators.
HS2	Regular inspections will be conducted to identify and manage hazards.
HS3	Bushfire risk controls will be developed and implemented, including the construction of fire breaks and/or undertaking hazard reduction burns.
HS4	Access to critical infrastructure and emergency response equipment will be included in the Project design.
HS5	Early fire detection and water sprinkler systems for critical areas will be installed.
HS6	A Bushfire Management Plan for the Project will be prepared and implemented for preventing fire during construction and operational activities.
HS7	Ongoing and timely maintenance of all mobile and fixed plant equipment will be undertaken in accordance with the recommended maintenance schedule and be consistent with maintenance schemes required by relevant legislation.
HS8	Equipment operators and drivers will be trained and licensed, as appropriate, for their operations. Only personnel who are appropriately licensed and authorised will undertake work when such licensing is required.
HS9	Mining and civil-engineered structures will be constructed in accordance with the applicable Australian Standards, codes and guidelines. When applicable, Aeris will obtain the necessary licence and permits to design and construct engineered structures.

No.	Commitment
HS10	All contractors employed on-site will be operating in accordance with the relevant Australian Standards and NSW Legislation.
HS11	Water management structures will be constructed to separate clean and mine-affected water. Runoff from disturbed areas will be captured in the site's water management system, while runoff from undisturbed areas will be directed around the mine site.
HS12	Fire hazards will be removed from run-of-mine ore management areas. Firefighting and dust suppression equipment will be maintained in appropriate locations. Regular inspections will be conducted.
HS13	Storage facilities will be developed, and procedures will be implemented for using any potentially hazardous materials (e.g. hydrocarbons, sulphuric acid, raffinate). The procedures will comply with Australian Standards and requirements of relevant legislation.
HS14	A dangerous goods register will be developed and kept up to date with chemicals and dangerous goods stored on-site.
HS15	Emergency response procedures will be documented, and procedures and systems will be implemented.
HS16	The safety management system will incorporate Environmental Management Plans designed to minimise and mitigate environmental impacts. The existing Aeris Environmental Management Plans will be updated to address the Project, or new plans will be developed.
Heritage historical	
HH1	All ground-disturbing activity will be confined within the area of the proposed works. Additional assessment may be required if the Project layout change and area outside the assessed study area are to be impacted.
HH2	If unexpected non-Aboriginal heritage, including archaeological relics, are discovered during proposed works, all work in the immediate area will cease. In accordance with s146 of the Heritage Act, a qualified archaeologist and, if necessary, Heritage NSW, will be contacted to assess the significance and advise on further requirements prior to the recommencement of works.
Cultural heritage	
CH1	An Aboriginal Cultural Heritage Management Plan will be developed after consulting with the registered Aboriginal parties (RAPs), relevant regulatory authorities and the Aboriginal community as per the guidelines. The Plan will be regularly reviewed, and copies of the final report will be made available to each RAP, the Department of Planning and Environment and Heritage NSW. It will include: • consultation with RAPs to develop the Aboriginal Cultural Heritage Management Plan; • inductions conducted to communicate and inform site staff regarding obligations of the Aboriginal Heritage Management Plan for Project staff; and • an implemented action plan for the discovery of previously unknown Aboriginal cultural heritage objects.
CH2	Aeris will avoid impacts to 38 Aboriginal Cultural Heritage sites as identified in the Aboriginal and Cultural Heritage Assessment Report (Appendix 3).
CH3	'No go zones' with a minimum 5-metre buffer will be established on the construction site.
CH4	Management plans will be implemented for identified Aboriginal Cultural Heritage sites out of the Project impact area.
CH5	Temporary high-visibility fencing will be installed to demarcate sites Okeh 1 and Okeh 6 and avoid disturbance.
CH6	Salvage surface collection and storage in consultation with RAPs, as identified in the Aboriginal and Cultural Heritage Assessment Report (Appendix 3), will be undertaken.

No.	Commitment
CH7	Traditional flora at location 5 and 6 will be relocated in consultation with RAPs to an undisturbed area.
CH8	Subsurface testing will be undertaken in areas of potential archaeological deposits identified to be impacted.
CH9	Additional archaeological surveys will be undertaken if the parameters of the proposed works extend beyond the area assessed.
Social	
S1	To limit the traffic volumes, materials and equipment deliveries will be coordinated to minimise vehicle movements on access roads.
S2	Traffic control measures and signage for safe movement of vehicles will be installed permanently or temporarily.
S3	Stakeholders will be notified of any material Project traffic-related activities (such as road closures due to road works) as soon as practicable and prior to the activities.
S4	A road maintenance program will be implemented to ensure the haul road is kept in a trafficable condition.
S5	The haul road will be sealed where possible to mitigate noise and dust from vehicles. Watering of sections of unsealed road will be carried out to minimise dust impacts.
S6	To minimise safety risks, speed limits will be reviewed for the haul road, particularly around sensitive users.
S7	Aeris will work with affected landowners to address concerns in relation to property impacts.
S8	Impacts resulting from acquiring freehold land and increased truck movements to rural and agricultural lifestyle will be negated by consulting with landowners and addressing their concerns related to property impacts (e.g. fencing requirements, livestock safety) through property specific agreements.
S9	A landowner compensation mechanism will be implemented through existing legal frameworks to address impacts on rural residents.
S10	A workforce accommodation strategy will be developed to address the increased housing demand of construction workforce.
S11	Bogan Shire Council will be consulted to identify and respond to housing and workforce impacts.
S12	Construction operators will contact the accommodation operators before commencing construction to plan for maximum capacity and schedule bookings.
S13	Council and real estate agents will be advised of workforce ramp-up.
S14	Residency in the local area will be continuously promoted through the provision of a residential allowance and subsidised housing for certain personnel.
S15	Community engagement and liaison will be undertaken to provide information on potential impacts resultant of Project activities.
S16	To mitigate impacts of the increased temporary construction workforce (FIFO/ DIDO) on community safety, Aeris will establish a Workforce Conduct Policy that sets clear workforce behaviour expectations.
S17	Social capital and resilience will be enhanced by: • identifying local projects; • encouraging settlements in towns; • developing settlement campaigns and initiatives for sponsorships and donations to support community cohesion; • promoting local values, environmental projects, family-oriented initiatives and health-related initiatives.

No.	Commitment
S18	Aeris will work with the community and the Girilambone Community Association to explore opportunities to partner/assist with tourism initiatives—for example, a signage project; community arts project; the restored railway station and carriages and camping in the park opposite the pub.
S19	Aeris will work with the Girilambone Community Association and other groups to identify local community development projects and initiatives for sponsorship and in-kind donations.
S20	To inform, consult, involve and collaborate, Aeris will hold regular community meetings with representatives of the Girilambone Community Association.
S21	To best manage the increased demand for health services, Aeris will reduce additional demands on local health services by providing on-site first aid facilities for workers to address minor health issues.
S22	First response services will be provided on-site during emergency situations and site accidents.
S23	Aeris will continue to use the Aeris-supported online support system for workforce injuries at the Project.
S24	To reduce traffic accidents owing to heavy haulage and an increased commuting workforce, regular communication with emergency services will be maintained, and the local emergency management meeting will be attended.
S25	To manage the anti-social behaviour of non-resident workers, Aeris will engage with the Police to develop an emergency response plan and relationships to proactively ensure Project-related community safety.
S26	Meet and greet days with local emergency services will be continued.
S27	A complaints system will be implemented to identify, track and remediate (when possible) community complaints associated with traffic activities from the Project's construction and operation phases.
S28	Aeris is committing to improving the mental health of the workforce and residents by preparing a workforce health and wellbeing strategy to manage mental stress issues.
S29	A health and safety management system will be implemented to manage fatigue and risks associated with drugs and alcohol and workforce hygiene.
S30	The employee assistance program will be available to provide staff and immediate families with free and confidential support services.
S31	Prior to the mine closure, Aeris will engage with the workforce to prepare a people and community strategy and engage the workforce in mine closure planning. When possible, workers will be deployed to other Aeris-operated projects following closure of the Constellation mine.
S32	Career progression pathways will be provided to the workforce through provision of an upskilling and employment development program.
S33	Traditional owners will be consulted to determine opportunities for salvaging and/or recording heritage sites prior to impact.
S34	Identified sites from the Project studies will be registered on relevant NSW databases to support improved understanding and protection.
S35	In consultation with affected landholders, when practicable, screening along the haul road will be installed to minimise the visual amenity impacts.
S36	Water access licences will meet water sharing requirements of regional water sharing plans.
S37	A Workforce Recruitment and Management Strategy will be developed to provide employment certainty, and maximise local, disability and Indigenous employment.
S38	Training, apprenticeship, cadetship and/or intern programs will be offered to Nyngan High School that can provide pathways for local students.

No.	Commitment
S39	Aeris will promote available employment opportunities via online job boards, local newspapers and other avenues.
S40	To promote employment and training opportunities for Ngemba, Ngiyampaa, Wanagaaypuwan and Wayilwan people, Aeris will work with Nyngan Local Aboriginal Land Council to explore opportunities and encourage contractors and suppliers to provide training and recruitment opportunities.
S41	Aeris will engage with Nyngan Local Aboriginal Land Council to identify opportunities for Aboriginal-owned businesses to work with Tritton Resources and its contractors.
S42	Positive community cohesion and development will be facilitated by providing opportunities for interactions between Constellation employees and local residents.
S43	An annual resident community information session will be conducted prior to any construction, and they will continue for at least the first two years of the Project's commencement, with the purpose of providing a Project update and addressing any potential issues or concerns.
S44	Stakeholders will be provided direct access to Project representatives to seek answers to their questions about the Project and its potential impacts.
S45	Through the Community Consultative Committee, relationships will be built to support communication, information sharing and feedback to assist decision making relating to construction and operational impacts.
S46	Aeris will ensure community aspects of the Constellation Project are part of the agenda for ongoing Community Consultation Community forum meetings.
Economics	
E1	Consistent with existing policies implemented for the Tritton Copper Operations, contractors will be encouraged to source local labour when possible. Training opportunities will be provided to the locally engaged labour personnel when practical to maximise local benefits derived from the Project.
E2	Aeris has a longstanding relationship with local businesses and is an established supply chain for its existing activities in the local catchment, regional catchment and NSW. To maximise their localised benefits, Aeris will continue to support local businesses by utilising their established supply networks and providing sufficient opportunities and information for local businesses to secure new supply contracts.
E3	Aeris will seek to mitigate additional demand for accommodation in the local catchment to minimise the impact on housing availability and affordability by monitoring the accommodation market during construction and operational phases.
E4	Existing mitigation measures and strategies for the Tritton Copper Operations, as well as progressive rehabilitation of the site, will be continued to ensure long-term impacts on agriculture are minimised.
Transport	
T1	A Traffic Management Plan will be prepared to address heavy vehicle traffic and vehicle types operating outside the mining leases during the life of the Project (construction, maintenance, operation and decommissioning).
T2	To minimising the traffic safety impacts of the development and disruptions to local road users during the construction and decommissioning of the development, Aeris will install temporary traffic controls, including detours and signage
T3	During the construction and decommissioning phase, the local community will be notified about development-related traffic impacts.
T4	Potential conflicts will be minimised between development-related traffic and: • stock movements; • domestic animals; and • school buses in consultation with local schools.

No.	Commitment
T5	Measures will be implemented to minimise development-related traffic on the public road network out of standard construction hours.
T6	Procedures and systems will be implemented to ensure that development-related traffic does not track dirt onto the public road network.
T7	Loaded vehicles entering or leaving the site will have their loads covered or contained.
T8	Sufficient parking will be provided on-site for all development-related traffic.
T9	Any emergency road repair requirements and maintenance will be responded to as soon as practicable during construction, operations and decommissioning.
T10	A traffic management system will be implemented for managing over-dimensional vehicles.
T11	Fatigue Management Plans will be prepared.
T12	A driver's code of conduct will be implemented, addressing: • travelling speeds; • procedures to ensure that drivers to and from the development adhere to the designated over-dimensional and heavy vehicle routes; and • procedures to ensure that drivers implement safe driving practices when driving to and leaving the Project-related activities.
Rehabilitation	
R1	Rehabilitation of the Project mine site will be undertaken to create a safe, stable and non-polluting post-mining landform with agreed post-mining land uses.
R2	Progressive rehabilitation of mining landforms will be undertaken during the operational phase of the Project when practical.
R3	All infrastructure that is not to be used as part of the final land use will be removed.
R4	A Rehabilitation Management Plan, rehabilitation objectives and a forward program will be prepared to conform to the requirements of the *NSW Mining Act 1992* and relevant guidelines and polices, including Form and Way – Rehabilitation Management Plan for Large Mines (NSW Resource Regulator 2021b). Interim completion criteria will be further refined during preparation of the Rehabilitation Management Plan.
R5	Rehabilitation monitoring will be undertaken using analogue sites and landscape function analysis to assess rehabilitation progress and success in accordance with the rehabilitation strategy.
R6	The vegetation used for rehabilitation will include one or more species within the surrounding plant community types (i.e. PCT 180 and PCT 176).
R7	Frequent inspections of rehabilitation areas, nominally on a quarterly basis, will be undertaken to allow for early identification and correction of issues affecting the success of rehabilitation works. An inspection schedule will be developed and implemented. Corrective actions will be implemented following the identification of any required measures.
R8	Landform evolution modelling will be completed on final landform designs to verify acceptable erosion rates prior to commencing final landform construction.
R9	Underground stopes will be backfilled in accordance with the methodologies recommended in Appendix 1, Geotechnical assessment, Section 9.7.1.
R10	A final geotechnical assessment of long-term slope stability at the completion of open cut mining will confirm the location of an effective safety barrier to restrict access to areas of long-term instability around the pit (void). The safety barrier (bund) will be constructed with regolith/non-acid forming (NAF) rock to be retained around the pit shell (void) and/or a safety fence (and signs) installed to prevent unauthorised access.

No.	Commitment
R11	The WRE and HLP final landforms will be designed in accordance with good construction practices for water management, including: • limiting water ponding; • avoiding the creation of perched water tables; and • surface water management with reverse-graded berms, drains and drop structures.
R12	Rehabilitation of the WRE will occur progressively throughout the operational phase of the Project. During its construction, the WRE will be built to the final profile, including the progressive encapsulation of PAF material. As batters are completed, they will be shaped, covered with topsoil and seeded in accordance with the rehabilitation strategy: • A 5 m layer of NAF material will be placed at the base of the WRE before placing PAF-HC and PAF material. • The PAF cells will be covered with a 0.5 m thick low permeability seal and trafficked. • The PAF waste will be covered with a minimum of 3 m of NAF mine waste to be placed vertically above the encapsulated PAF cell. • Outer surfaces, including the top tier of the WRE, will have a 2 m store and release soil cover system (achieving a total cover of > 5m).
R13	A rehabilitation materials balance and projection will be established and maintained over the life of the operations to ensure sufficient materials are available for rehabilitation. The materials balance will include topsoil, subsoil and regolith/NAF waste rock.
R14	Waste material will be handled according to its classification: • Operational procedures will be developed to assess and identify waste materials as either NAF or PAF. • Operational procedures will be developed to ensure PAF and NAF materials are segregated and selectively handled to ensure there is no cross contamination or misplacement of materials.
R15	Competent NAF rock will be retained in a separate stockpile for rehabilitation and ancillary purposes and not placed within the WRE.
R16	A final surface water design for the WRE will be undertaken to ensure berms, drains and drop structures are appropriately sized and constructed.
R17	The clean water diversions, process runoff dam, waste dump catch dam and the mine infrastructure area runoff dam may be retained in the post-closure landscape. Dams will be assessed by a civil engineer to ensure their suitability for final land uses.
R18	The HLP will be covered with a store and release cover system comprising NAF material of suitable thickness (~ 0.9 m) and 0.1 m topsoil to minimise seepage.
R19	A post-closure Surface Water Management Plan will be developed that defines water containment and flow paths (and controls) for the final land uses.
R20	At the completion of underground mining, an engineered concrete plug will be constructed in the portal, and the box cut filled with NAF, subsoil and topsoil. The engineered plug will be designed, inspected and signed off by a qualified and experienced engineer.
R21	At the completion of underground mining, any surface ventilation infrastructure will be removed, and an engineered concrete cap will be constructed over the ventilation shafts.
R22	Seepage waters from the HLP, WRE and mineralised waste stockpile will be contained in the open pit void. Formal drains will be designed and established to passively direct seepage waters to the void.
R23	Regular inspections of the heap leach facility will be conducted, including regular monitoring of piezometers installed to monitor the performance the HLP underliner.
Geotechnical mitigations	
GT1	Active monitoring will be undertaken of pit walls using applicable industry methods, with a minimum of prism monitoring. Should significant instability develop, additional slope stability monitoring methods will be considered.

No.	Commitment
GT2	Geotechnical mapping of open cut pit structures will be conducted to identify possible instability mechanisms.
GT3	Pit slope performance will be reviewed during mining to confirm the appropriateness of the design and identify any potential instabilities.
GT4	The long-term groundwater level immediately behind the pit slope will be monitored using applicable industry methods. Horizontal drain holes may be required if pore pressures build up to unacceptable levels, particularly around major structures.
GT5	Measures will be taken to control rock open cut pit fall risks, including appropriate blasting methods, thorough scaling of walls post-blasting and cleaning berms to maximise catch capacity.
GT6	Internal reporting of adopted open pit stability controls will be conducted quarterly.
GT7	A Void Management Plan will be prepared to address the interaction between simultaneous open pit and underground mining operations.
GT8	A Ground Control Management Plan will be developed, which will include void management procedures and monitoring requirements.
GT9	Underground stopes will be non-personnel entry, with all equipment remotely operated from outside the stope, in accordance with normal underground mining processes.
GT10	Surface prism monitoring for underground stability on sensitive receptors will be undertaken in combination with open pit prism monitoring. The prism monitoring will be effective in measuring subsidence and consistent with industry best practices.
GT11	Ongoing underground stope monitoring (including stope over break) will be undertaken and designs reviewed in accordance with monitoring results.
GT12	Geotechnical reviews will be conducted quarterly to annually.
GT13	The WRE and HLP landforms will be designed in accordance with good construction practices for water management, including limiting water ponding, avoiding the creation of perched water tables and surface water management with reverse-graded berms, drains and drop structures.

Constellation Project

Environmental Impact Statement



Chapter 8 – Rehabilitation and Closure

8 Rehabilitation and closure

8.1 Introduction

This chapter provides a rehabilitation and closure strategy for the Constellation Project. The complete content for rehabilitation and closure is in Appendix 18 Rehabilitation and closure strategy. The objectives of the rehabilitation strategy are to:

- describe the proposed post-mining land use, landform and rehabilitation objectives;
- identify potential risks and impacts that may impact on rehabilitation and rehabilitation success;
- describe methods for establishing stable post-mining landforms; and
- propose rehabilitation completion criteria and outline the monitoring requirements that assess whether these criteria are being accomplished.

The rehabilitation concepts presented in the strategy should be regarded as provisional to allow for outcomes from future rehabilitation trials, research and unforeseeable changes that may come about to be considered. Rehabilitation will occur progressively when possible, noting that disturbance associated with the Project will be of a small scale, comprising an area of approximately 170 ha.

8.2 SEARs requirements

The NSW Planning Secretary's Environmental Assessment Requirements (SEARs) that relate to the rehabilitation and closure of the proposed mine site are presented in Table 8-1.

This chapter will also consider ML condition requirements and agency project-specific environmental assessment recommendations, which are detailed in Appendix 18, Rehabilitation and closure strategy.

Table 8-1: SEARs assessment requirements

Key issues identified from SEARS	**Assessment matter**	**Report locations**
General requirements	A Rehabilitation Strategy, including details of the progressive site rehabilitation during and following construction and decommissioning.	Section 8.4 and Section 8.4.6 Appendix 18, Rehabilitation and closure strategy, Sections 4 and 5
	A consolidated summary of all the proposed environmental management and monitoring measures.	Section 8.4.8 Appendix 18, Rehabilitation and closure strategy, Section 7
Key issues	Land and soils—the likely impact of the development on landforms (topography), including the long-term stability of any new landforms on site.	Section 8.4.4 Appendix 18, Rehabilitation and closure strategy, Section 4
	Closure, rehabilitation and final landform–including a Rehabilitation Strategy providing:	
	a detailed overview of the final land use and final landform; rehabilitation objectives and closure criteria for the development, including the conceptual final landform design;	Section 8.4.5 Appendix 18, Rehabilitation and closure strategy, Section 4

Key issues identified from SEARS	Assessment matter	Report locations
	identification and discussion of opportunities for progressive rehabilitation throughout the mine life; improve environmental outcomes for existing disturbed areas within the development site;	Section 8.4.6 Appendix 18, Rehabilitation and closure strategy, Section 5
	rehabilitation objectives, performance standards and completion criteria;	Section 8.4.3 and 8.4.7 Appendix 18, Rehabilitation and closure strategy, Section 4.3 and Section 6
	decommissioning of surface infrastructure.	Section 8.4.4 Appendix 18, Rehabilitation and closure strategy, Section 4

8.3 Relevant legislation, guidelines and policies

As per Chapter 5, Statutory context, Section 5.4.1.1, an ML under the NSW *Mining Act 1992* (Mining Act) will be required as part of the approvals for the Project. The Mining Act defines rehabilitation as:

> [T]he treatment or management of disturbed land or water for the purpose of establishing a safe and stable environment.

It is anticipated that the new ML and development consent will require rehabilitation outcome documents to be prepared and approved, including a rehabilitation management plan, following the granting of the development consent.

The objectives of the *Protection of the Environment Operations Act 1997* (POEO Act) that relate to decommissioning and rehabilitation, include:

- protecting the environment;
- restoring and enhancing the environment;
- reducing risks to human health; and
- preventing degradation of the environment.

The Bogan Shire Council Local Environmental Plan (2011) (BSC LEP) outlines objectives for each land use zone in the shire. The Project is in land zoned RU1, primary production.

Further information relating to specific rehabilitation requirements under the Mining Act, POEO Act and BSC LEP are provided in Appendix 18, Rehabilitation and closure strategy, Section 2.4.

The rehabilitation strategy prepared for Project has been prepared in accordance with legislative requirements, policies and industry requirements. The guidelines and policies used to prepare the rehabilitation strategy include:

- The Strategic Framework for Mine Closure provided by Australian and New Zealand Minerals and Energy Council Minerals Council of Australia;
- Leading Practice Sustainable Development Program for the Mining Industry handbooks provided by the Commonwealth of Australia, Department of Industry, Science and Resources, including:
    - Mine Rehabilitation Handbook; and
    - Mine Closure and Completion Handbook;

- NSW Resource Regulator guideline material including:
  - Form and Way – Rehabilitation management plan for large mines;
  - Guideline: Form and way for rehabilitation objectives statement, rehabilitation completion criteria statement and final landform and rehabilitation plan for large mines; and
  - Guideline: Rehabilitation objectives and rehabilitation completion criteria.

8.4 Rehabilitation strategy

This section summarises the relevant sections of the rehabilitation strategy in Appendix 18, Rehabilitation and closure strategy, as required by the SEARs in Section 8.2.

8.4.1 Final land use statement

The overarching rehabilitation objective of the Project is to create safe, stable and non-polluting post-mining landforms that are consistent with agreed post-mining land uses.

Aeris proposes to restore the land as much as possible to its pre-mining land use at the end of its operational life—primarily an agricultural land use comprising grazing on native/introduced (mixed) pastures. While restoring the land, Aeris aims to improve the biodiversity values of the area by re-establishing local indigenous woodland communities as part of the rehabilitation program. Specifically, rehabilitation goals include the following:

- remove all Project-related infrastructure not required by the final land use;
- restore a safe, stable and non-polluting landform;
- reinstate the soil profile and function, creating landforms that are compatible with the surrounding topography and pre-mining land uses; and
- establish a landscape that permits livestock grazing on native/mixed pastures while enhancing biodiversity values lost due to past agricultural clearing.

8.4.2 Mining and final land use domains

Mining domains are based on land management units in the Project mine site area, which generally have a unique operational purpose.

The final land use domains for the Project are the proposed post-mining land use for each mining domain on the Project mine site. A final land use domain is identified for each mining domain and summarised in Table 8-2, and further described in Sections 8.4.4 and 8.4.5. The mining domains are shown in Figure 8-1 and the proposed final land use domains are shown in Figure 8-2.

Table 8-2: Proposed mining and final land use domains

Mining domain	Project infrastructure in the domain	Final land use domain	Final land use domain description
1. Infrastructure (54 ha)	• Administration buildings • Ablution facilities • Workshops • SX crystal plant and pad	A. Agriculture grazing	The purpose of this domain is to reinstate the dominant pre-mining land use of the Project, which is grazing native/introduced (mixed) pastures. This final land use would be applied to the general mining disturbance area, except for the areas described in the Final land use domain (B. Infrastructure Areas).

Mining domain	Project infrastructure in the domain	Final land use domain	Final land use domain description
	• Solar farm/site-based generation • Core shed • Concrete batch plant • Paste plant • Underground mine ventilation infrastructure • Temporary oxide ore stockpile • Temporary agglomeration pad • Ancillary infrastructure (pumps, pipes, site-based electricity distribution etc.) • ROM pad • Roads • Carparks	B. Infrastructure areas	The Infrastructure area domain includes items that will be retained for post-mining land uses, including items such as sheds, roads, a solar farm and other infrastructures.
2. Waste rock emplacement (WRE) (40 ha)	• WRE • Mineralised Waste Stockpile (MWS)	C. Native ecosystem (woodland)	The purpose of this domain is to establish a similar woodland community that exists in the pre-mining landscape. Woodland communities remain present on small hills and outcrops in the immediate vicinity of the Project and are subject to occasional grazing. This final land use will be applied to the WRE; however, the land will be fenced and grazing excluded to ensure stability of the landform.
3. Water management areas (30 ha)	• Clean water diversions • Process runoff dam • Waste dump catch dam • Mine Infrastructure Area (MIA) runoff dam • Mine turkey nest dam • Sediment dams	D. Water management areas	The water management areas domain applies to water management structures that will be retained post-closure, including clean water diversion drains, waste dump catch dam, MIA runoff dam and sediment dams. Water storage for post-mining use would require desilting, contamination assessment and water quality testing. Post-mining, heap leach pad (HLP) and pad liquor ponds would initially be retained until rehabilitation of the HLP has been completed, following which they will be removed. Surface drains will be constructed that direct leachate from the WRE and HLP to the open pit for containment and will be retained in the post-mining landscape.

Mining domain	Project infrastructure in the domain	Final land use domain	Final land use domain description
4. HLP (18 ha)	• HLP • Associated liquor ponds	E. Native ecosystem (grassland)	The proposed vegetation community for this domain is similar to that proposed for the agriculture grazing domain and will consist of a native/introduced (mixed) grassland. The native ecosystem (grassland) domain, however, will not be grazed, allowing the grassland to dominate and stabilise the landform.
5. Underground mine (3 ha)	• Underground mine • Boxcut • Ventilation shafts	A. Agriculture grazing	The purpose of this domain is to reinstate the dominant pre-mining land use of the Project, which is grazing native/introduced (mixed) pastures. This final land use would be applied to surface disturbance associated with the underground mine, including the box cut.
6. Open cut pit (12 ha)	• Open cut pit • Safety bund	F. Final void	The final void (open pit/pit lake) will be retained in the landscape.
7. Soil stockpiles (topsoil, subsoil, regolith) (17 ha)	• Topsoil stockpiles • Subsoil stockpiles • Regolith stockpiles	A. Agriculture grazing	The purpose of this domain is to reinstate the dominant pre-mining land use of the Project which is grazing native/introduced (mixed) pastures.

8.4.3 Rehabilitation objectives

The rehabilitation objectives for the Project are set out in Table 8-3, and they are aligned with the proposed completion criteria when applicable.

Table 8-3: Rehabilitation objectives

Final land use domain	Mining domain	Rehabilitation objectives
All	All	• Prevent or minimise harm to the environment. • Rehabilitate land and water as soon as reasonably practicable after disturbance occurs. • Construct landforms that maximise surface water drainage to the natural environment (excluding final void and drains from the HLP and WRE to the final void). • Soils / growth medium is suitable (quality and quantity) to establish the post-mining land uses. • The risk of bushfire and impacts to the community, environment and infrastructure has been addressed as part of rehabilitation. • All infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials. • There is no residual soil contamination on site that is incompatible with the final land use or that poses a threat to human health or the environment. • The revegetation species composition contains species that are commensurate with the native / introduced (mixed) plant communities of the surrounding area as identified by analogue monitoring sites.
Native ecosystem (woodland)	WRE	• Residual waste materials stored on site (e.g. coarse rejects and other wastes) will be appropriately contained / encapsulated so it does not pose any hazards or constraints for intended land use. • The final landform is stable for the long term and does not present a risk of environmental harm to the surrounding environment or a safety risk to the public / stock / native fauna. • Residual leachate is directed to, and contained in the open pit void. • The revegetation species composition includes native species commensurate with one or more of the surrounding Plant Community Types (PCTs) (PCT 180, PCT 176) (Appendix 2 Biodiversity development assessment report) and deemed suitable to establish over the WRE and MWS without impacting the integrity of the cover / cap. • Levels of ecosystem function have been established that demonstrate the vegetation is self-sustainable. •

Final land use domain	Mining domain	Rehabilitation objectives
Native ecosystem (grassland)	HLP	• Residual waste materials stored on site (e.g. tailings, coarse rejects and other wastes) will be appropriately contained / encapsulated so they do not pose any hazards or constraints for intended land use. • The final landform is stable for the long term and does not present a risk of environmental harm to the surrounding environment or a safety risk to the public / stock / native fauna. • Residual leachate is directed to, and contained in the open pit void. • The revegetation species composition contains species that are commensurate with the native / introduced (mixed) plant communities of the surrounding area as identified by analogue monitoring sites. • Levels of ecosystem function have been established that demonstrate the vegetation is self-sustainable.
Agriculture (grazing)	Infrastructure Underground mine	• All infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials. • The final landform is stable for the long term and does not present a risk of environmental harm to the surrounding environment or a safety risk to the public / stock / native fauna. • Residual waste materials stored on site (e.g. tailings, coarse rejects and other wastes) will be appropriately contained / encapsulated so they do not pose any hazards or constraints for intended land use. • The revegetation species composition contains species that are commensurate with the native / introduced (mixed) plant communities of the surrounding area and identified by analogue monitoring sites. • Land capability similar to pre-mining capability (Class VI). • Levels of ecosystem function have been established that demonstrate the vegetation is self-sustainable.
Infrastructure	Infrastructure Underground mine	• All infrastructure that is to remain as part of the final land use is safe, and does not pose any hazard to the community.
Water management areas	Water management areas	• Structures that take or divert water such as final voids, dams, levees etc. are appropriately licensed and where required ensure sufficient licence shares are held in the water sources(s) to account for water take. • Clean water diversions, HLP leachate drain and WRE leachate drains are engineered to be safe, stable and non-polluting.

Final land use domain	Mining domain	Rehabilitation objectives
Final void	Open cut pit	• The final landform is stable for the long term and does not present a risk of environmental harm to the surrounding environment or a safety risk to the publicstock native fauna. • Impacts to the groundwater regime are within range as per the development consents or as predicted by groundwater assessments. • Constructed landforms that maximise surface water drainage to the natural environment (excluding final void and drains from the HLP and WRE to the final void).

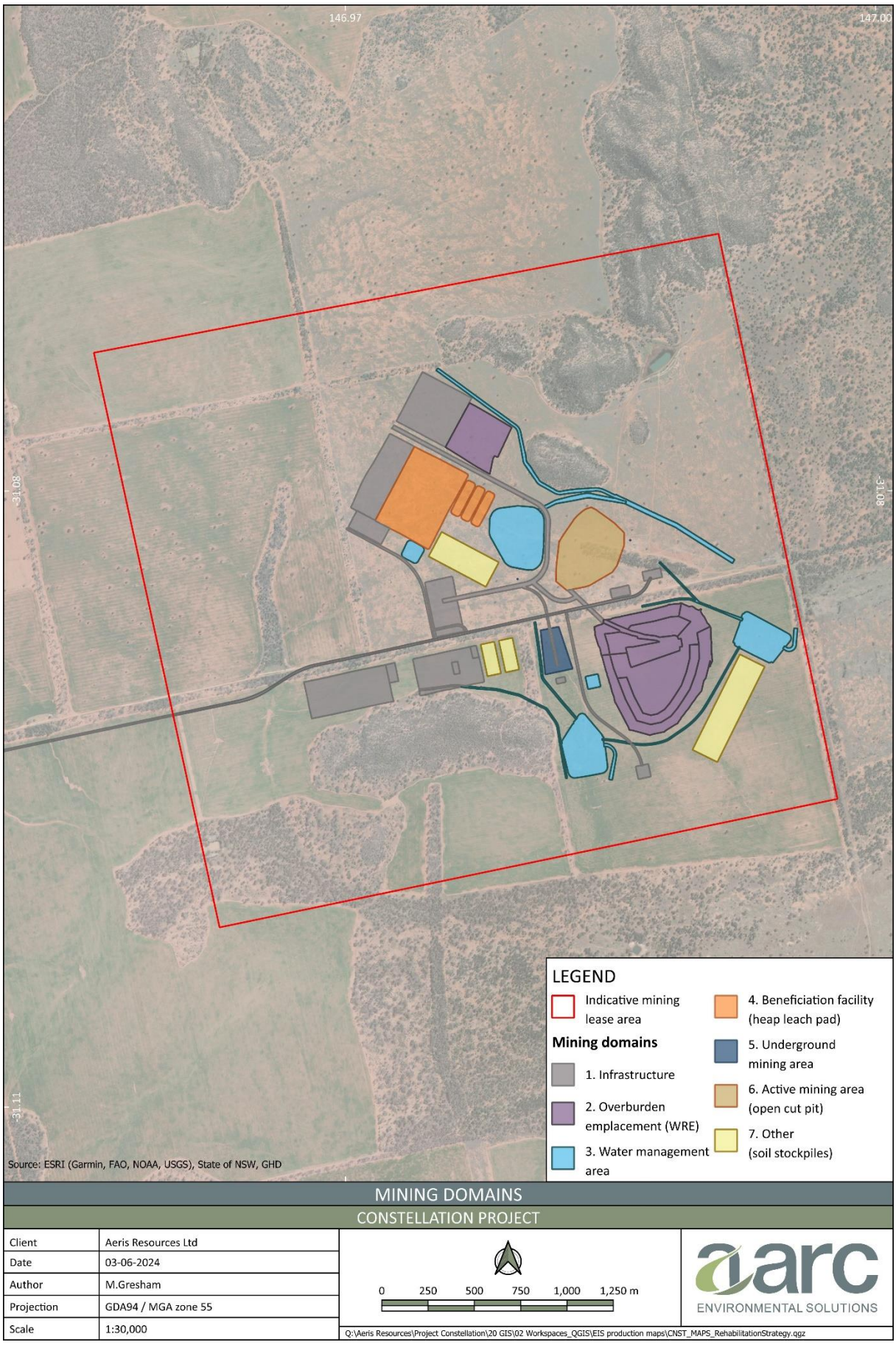


Figure 8-1: Mining domains

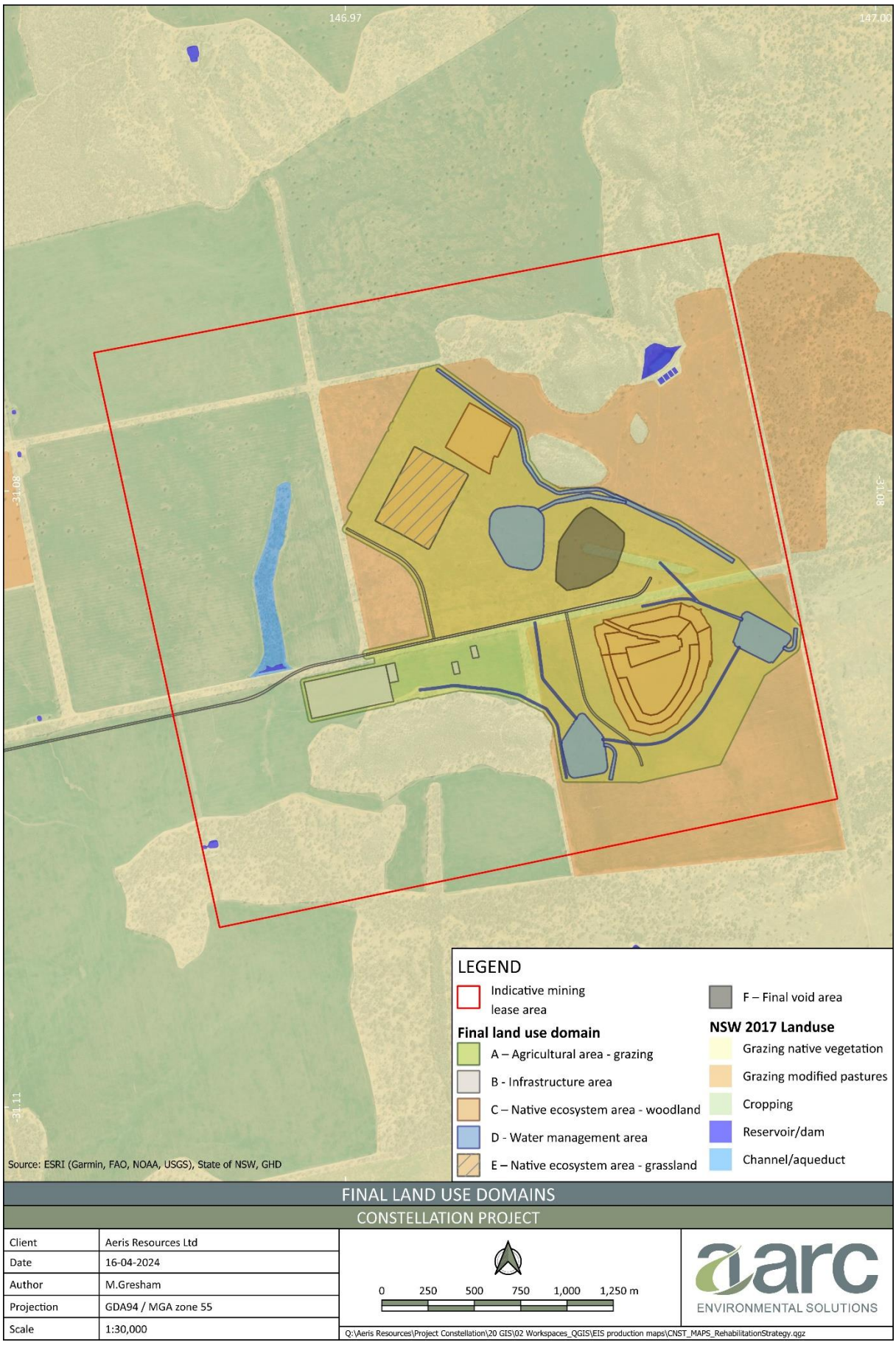


Figure 8-2: Final land use domains

8.4.4 Rehabilitation methods for closure – mining domains

8.4.4.1 Mining domain 1, infrastructure

At the completion of mining activities, all surface-based built infrastructure that is not required for future land uses will be demolished. Inert and non-polluting wastes may be disposed within the underground workings or within the WRE. Other wastes will be removed from the site and disposed of at a licensed landfill facility. Residual chemicals, contaminated materials and contaminated water will be removed from the site and disposed of in accordance with industry requirements. Contaminated soils will be assessed, removed/ remediated when required, and validation sampling will be undertaken to ensure no residual contamination liabilities remain at the site.

The general area will be shaped and backfilled where required (with non-acid forming [NAF] rock, regolith or subsoils) to blend in with the surrounding landforms.

8.4.4.1.1. Hydrocarbons and chemicals

Management practices developed during construction and operation of the Project mine will continue to be implemented during rehabilitation and closure activities. Any identified contaminated soils will be assessed, removed/remediated when required, and validation sampling will be undertaken to meet NSW NEPM requirements (DCCEEW 1999) to ensure no residual contamination liabilities remain at the site.

8.4.4.1.2. Infrastructre outside the mine development area

Infrastructure associated with the Project but outside the Project mine area and within the infrastructure corridor includes:

- **The upgraded section of Okeh Road:** The upgraded section of Okeh Road is proposed to follow the pre-existing road alignment. Bogan Shire Council will continue to have management authority for Okeh Road after closure.
- **New section of road, linking Okeh Road to the Mitchell Highway (on land owned by Aeris):** During the pre- and post-approval stages of the Project, Aeris will consult with Bogan Shire Council regarding the future management of this section of road and whether Bogan Shire Council may wish to resume management of the road post-closure. Pending the outcomes of the consultation, Aeris will either work with Bogan Shire Council to establish relevant easements or ownership of the road or decommission and rehabilitate the road.
- **Buried water supply pipeline and fibre optic line in the road easement areas (upgraded section of Okeh Road and new section of road linking Okeh Road to the Mitchell Highway):** The proposed buried pipeline between the existing Murrawombie mine and the Constellation mine will be left in situ and may be considered as part of post-closure land use options. If no future use of the pipeline is proposed, the pipeline will be disconnected and capped at both ends. Built survey plans will be provided to Bogan Shire Council for future reference.

8.4.4.2 Mining domain 2, waste rock emplacement/mineralised waste stockpile

8.4.4.2.1. Waste rock emplacement

The Geotechnical Assessment (Appendix 1) has determined the proposed WRE landform design is to be geotechnically stable in the long-term. The assessment was based on the shallow slopes, limited dump height and advantageous geotechnical conditions.

Operational procedures will be developed to ensure potentially acid forming (PAF) and NAF materials generated from the open pit and underground mines are segregated and selectively handled. The WRE may generate seepage, with elevated metal concentrations unsuitable for release to the wider environment. Therefore, any seepage from the rehabilitated WRE will be passively directed via drains to the open pit void.

Drains will be lined using high-density polyethylene or similar, with rock covering where seepage water quality poses risks to receiving environment water quality. Drain areas will be fenced to prevent access by livestock in the post-closure landscape, as required.

8.4.4.2.2. Mineralised waste stockpile

The conceptual final profile of the MWS is a domed plateau and concave slope that is analogous to the natural topography of the Project mine area. During closure, passive drainage systems will be designed and installed to allow any leachate from the MWS to flow towards and be captured by the open pit void. Drains will be lined using high-density polyethylene or similar, with rock covering where seepage water quality poses risks to receiving environment water quality. Drain areas will be fenced to prevent access by livestock in the post-closure landscape, as required.

8.4.4.3 Mining domain 3, water management areas

All dams will be rehabilitated as per the following general process, with the exception of the clean water diversions, waste dump catch dam, sediment dams and the MIA runoff dam (that will be retained for future land uses):

- Contaminated water will be removed from dams, with water either removed from the site, or placed within the open pit (depending on the nature/degree of contamination).
- Liners (or equivalent) will be removed and disposed of.
- Contaminated soils will be assessed, removed/remediated where required, and validation sampling will be undertaken to meet NSW NEPM requirements (DCCEEW 1999) to ensure no residual contamination liabilities remain at the site.
- Embankments will be removed, and dams will be backfilled with NAF rock, regolith or subsoils and shaped to blend in with the surrounding landforms.

Sediment dams, the MIA runoff dam and the waste dump catch dam will be retained and maintained during rehabilitation and closure phases to ensure any turbid waters are not released to the wider environment.

Dams identified for retention post-closure will be assessed by a civil engineer (or equivalent) to ensure the dam is suitable for post-mining land uses (namely for watering of livestock). Desilting, contamination assessment and water quality testing will be conducted to ensure suitability for post-mining land uses.

8.4.4.4 Mining domain 4 - heap leach pad

At the completion of the formal leaching stage, the HLP will be leached with raw water to flush residual acid leachate and metals for final recovery and to provide less acidic conditions that will reduce the ongoing (post-closure) release of metals.

Where required, the HLP will be shaped to the approximate final landform profile and remain contained within the under-liner catchment. Appendix 1, Geotechnical assessment, has determined that the proposed HLP landform design will be geotechnically stable in the long-term, based on the shallow slopes, limited dump height and advantageous geotechnical conditions.

Surface compression of the spent and shaped material will be undertaken by a smooth roller or 'trafficked' to a hydraulic conductivity between 10^{-6} to 10^{-7} cm/sec. This low conductivity will be achievable, given the clayey nature of the oxide ore (Appendix 15, Geochemical assessment).

The conceptual landform design for the HLP is comparable to natural landforms in the vicinity of the Project mine site area, being a domed plateau with a concave slope. A conceptual design has been provided in Appendix 18, Rehabilitation and closure strategy, which includes:

- staged (decreasing batter angle) slopes on each tier from top to bottom to provide an overall concave slope to maximise long-term stability;

- plateau and batters covered with 0.9 m regolith (option 1) and/or NAF material to sustain plant growth;
- between 100 and 200 mm of topsoil applied to the plateau and outer profile of the HLP;
- final HLP profile 'smoothed' to provide macro and micro relief to the landform to further align the HLP with the natural topography, reducing the 'engineered' outer profile of the HLP;
- key drainage controls remaining in place to ensure the stability of the landform.

The rehabilitated HLP design will be evaluated and refined on the basis of the performance of rehabilitated HLP at the Murrawombie Copper Mine site.

8.4.4.5 Mining domain 5, underground mine

At the completion of mining, services to the underground mine, such as water supply, electricity supply and dewatering pumps etc., will be disconnected. Any re-usable items will be decommissioned and removed from the underground workings. Underground workings will be used for disposing any inert waste materials, such as pond liners and broken concrete. Following the cessation of any required access to the underground workings, ventilation services will be turned off and decommissioned. Underground workings will be allowed to gradually fill with groundwater.

The box cut will have a road and excavation at the end of operations. An engineered concrete plug will be constructed in the portal. The box cut will be filled with NAF and/or regolith material to a level 0.5 m lower than the surrounding land surface. The earthen safety bund will be pushed/spread over the backfilled area and supplemented by subsoil to a level approximately 150 mm below the natural topography. Topsoil would then be applied to a depth of 100–200 mm to be level with the surrounding topography.

The two ventilation shafts will be capped with engineered concrete. Fences and signs will be installed to prevent unauthorised access.

8.4.4.6 Mining domain 6, open cut pit

At the completion of mining, the final depth of the pit will be 120 m, and it will occupy approximately 12 ha. The open pit shell will remain an open void that will form a terminal sink pit lake. Retaining the pit as a void is critical to the closure of the mine site as:

- PAF material from underground mine and operations may be placed at the base of the pit as a lower-risk storage option (than placement in the WRE).
- Ongoing seepage from the WRE, mineralised waste storage and the HLP will be passively directed to the pit for long-term containment.

According to the final void water balance model (Appendix 15, Geochemical assessment), the pit void will act as a 'terminal sink' where groundwater will, under hydraulic pressure, continue to flow into the void and not into the surrounding environment. The geotechnical assessment identified that the formation of the pit lake is beneficial for the long-term stability of the open pit landform (Appendix 1, Geotechnical assessment).

A regolith/NAF rock safety bund will be retained around the open pit shell, and a safety fence with signs will be installed to prevent unauthored access to the pit rim. The safety bund will be placed with a suitable offset from the pit rim (beyond the potential extent of failure), based on the final pit geotechnical assessment.

8.4.4.7 Mining domain 7, soil stockpiles

Topsoils and subsoils from the proposed mining domains will be stripped and stored for reuse for site rehabilitation in accordance with the recommendations in Appendix 17, Land and soil capability assessment. The topsoil stockpiles will generally be less than 2 m high, with a maximum height of approximately 3 m. They will be shaped to a maximum slope of 1:4 to allow vegetation to establish.

Sediment and erosion control measures will be installed around stockpiles and may include sediment fencing, containment berms or other measures. Subsoil stockpiles will be constructed to a maximum height of approximately 5 m and shaped to allow vegetation establishment. As there is no pre-existing seed resource, subsoil stockpiles will be required to be seeded or hydromulched to achieve a stable and persistent cover. Alternatively, erosion control blankets, mats and mesh (e.g. geofabric, jute matting and coir blankets) may be used.

The Land and soil capability assessment (Appendix 17) has estimated that the total volume of topsoil to be stripped (allowing for a 0.5 m stripping depth) will be approximately 1,520,000 m^3. The estimated required topsoil for the Project disturbance area is up to 200 mm applied to 500,000 m^3, resulting in a surplus of topsoil and subsoil resources for the Project.

8.4.5 Rehabilitation methods for closure – final land use domains

The rehabilitation methods for final land use domains, the interim revegetation species lists and other proposed measures to mitigate potential risks are discussed in Appendix 18, Rehabilitation and closure strategy.

A summary of rehabilitation methods for each final land use domain post-closure is described in Sections 8.4.5.1 to 8.4.5.6, and the rehabilitated landform, including post-rehabilitation contours, is provided in Figure 8-3.

8.4.5.1 Final land use domain A, Agriculture grazing

The purpose of this domain is to reinstate the dominant grazing native/introduced (mixed) pasture pre-mining land use of the Project mine site. The majority of the mine disturbance area, with the exception of the WRE, MWS and HLP, will be rehabilitated to achieve an agriculture (grazing) final land use, consistent with the pre-mining land use of the majority of the area.

The following methods are proposed to re-establish the agriculture grazing final land use:

- Following the removal of all required infrastructure (i.e. infrastructure not identified for post-mining land uses), the areas would be shaped (if required) to blend in with the surrounding topography.
- Roads and hardstand areas will be ripped to break up compacted layers and shaped.
- Any areas that require fill material to blend with the natural topography would be filled with regolith, NAF material and/or subsoils.
- Any areas where subsoils may have been compacted will be deep ripped.
- Topsoil would be spread to a depth of between 100 and 200 mm.
- Any required ameliorants (identified from soil stockpile sampling and analysis) would be applied and incorporated (as advised by an agronomist or suitably qualified person).
- Areas would be sacrificed to encourage infiltration of water and establishment of vegetation.
- Similar to the pre-mining land uses, access tracks (for management purposes) and fire breaks would be maintained in the post-closure landscape.
- Residual seed would be contained with topsoil stockpiles to allow revegetation. However, a seed collection program will be implemented and maintained to allow any supplementary seeding where topsoil seed is inadequate.

8.4.5.2 Final land use domain B,Infrastructure areas

Infrastructure to be retained post-mining will be subject to future discussions with adjacent landholders and other stakeholders, such as the Bogan Shire Council. Items that could potentially be retained include site sheds, solar farm/site-based electricity supply and water infrastructure (further described in Section 8.4.5.4) and

roads. The infrastructure to be retained will undergo an engineering assessment to validate suitability for post-mining land use.

8.4.5.3 Final land use domain C, Native ecosystem (woodland)

The purpose of this domain is to establish a woodland community similar to that existing in the pre-mined landscape, predominantly on small hills and outcrops close to the Project mine site. The target vegetation community for this final land use aligns with hills and outcrop areas that surround the proposed mine site (nominally aligning with PCT 98, PCT 180 and PCT 176), consisting of woodland canopies, mid-storey and understorey species.

Following installation of the proposed covers and shaping (refer to Section 8.4.4.2), the following methods are proposed to establish the native ecosystem (woodland) final land use:

- Topsoil would be spread to a depth of between 100 and 200 mm.
- Any required ameliorants (identified from soil stockpile sampling and analysis) would be applied and incorporated (as advised by an agronomist or suitably qualified person).
- Areas would be ripped parallel with the contour to encourage infiltration of water and establishment of vegetation. Deep ripping will also bring some rock to the surface to assist in creating microclimates for seed germination and a degree of erosion/scour protection.
- Aeris will implement and maintain a seed collection program to allow the seeding of this landform as required.
- After seeding, the WRE and MWS will be fenced to exclude domestic livestock and pest species, such as goats, from accessing the area and damaging establishing vegetation. Long-term grazing will not be permitted.

8.4.5.4 Final land use domain D, Water management areas

Retained water management structures, such as diversion drains, bunds and dam embankments, would be inspected by a suitably qualified civil engineer to validate that the infrastructure is suitable for post-mining land uses and that there are no health, safety or environmental risks associated with retaining them and their future use.

Several new drains are proposed to be constructed as part of the post-mining landform, including drains to (passively) direct any leachate waters from the HLP, WRE and MWS to the final void. Drains will be designed by an engineer to ensure they are capable of controlling a 1% AEP (100-year ARI rainfall event). Subject to engineering design, drains may be designed with the following features:

- wide drains with gently sloping banks (to retain cover materials and allow fauna escape);
- HDPE linings (or linings of other suitable materials) to prevent soil or groundwater contamination;
- fine material coverings, such as regolith/NAF rock, to protect the lining from damage (including UV damage);
- rock-lined to provide stability, scour protection and allow the escape of fauna; and
- fencing to exclude domestic stock and pest species, such as goats.

8.4.5.5 Final land use domain E, Native ecosystem (grassland)

The proposed vegetation community for this domain is similar to that proposed for the agriculture grazing domain and will consist of a native/introduced (mixed) grassland. The native ecosystem (grassland) domain, however, will not be grazed, allowing the grassland to dominate and stabilise the landform.

Following the installation of the proposed covers (or neutralisation) and shaping, as described in Section 8.4.4.4, the method proposed to establish this final land use is similar to that proposed for the native woodland

ecosystem (Section 8.4.5.3). The target vegetation community for this final land use aligns with the pre-mining land use for the majority of the proposed mine site, described as a grassland consisting of a mixed sward of predominantly native grasses and groundcover species mixed to varying extents with introduced grasses and broadleaf weeds. Revegetation species lists suitable for the site are provided in Appendix 18, Rehabilitation and closure strategy.

After seeding, the HLP will be fenced to exclude domestic livestock and pest species, such as goats, from accessing the area and damaging establishing vegetation. Long-term grazing will not be permitted.

8.4.5.6 Final land use domain F, Final void

The final void (open pit) will be retained in the landscape. As described in Section 8.4.4.6, the final void will form a pit lake that is a groundwater terminal sink. A regolith/NAF rock safety bund will be retained around the pit shell and a safety fence (and signs) installed to prevent unauthorised access to the pit rim. Based on the final pit geotechnical assessment, the safety bund will be placed with a suitable offset from the pit rim (beyond the potential extent of failure).

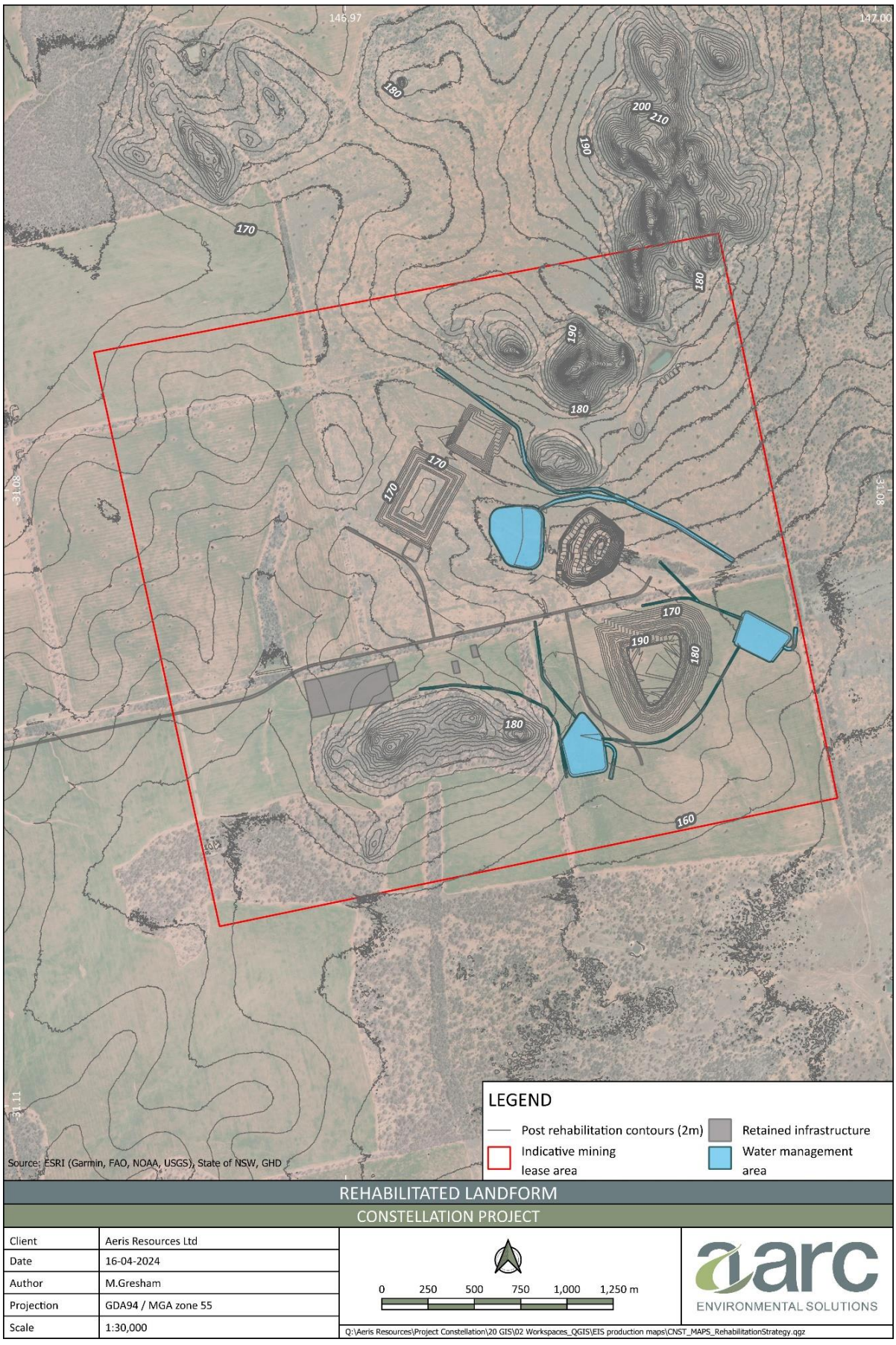


Figure 8-3: Rehabilitated landform

8.4.6 Progressive rehabilitation

Progressive rehabilitation of mining landforms will be undertaken during the operational phase of the Project to:

- stabilise landforms and reduce the amount of exposed soils and stockpiles;
- reduce closure liabilities and business risk during operational phases of the Project;
- reduce risks associated with the deferral of rehabilitation until mine closure;
- allow the refinement of rehabilitation methodologies, following the monitoring of rehabilitation results; and
- allow for earlier relinquishment of mining leases.

Rehabilitation of the WRE will occur progressively throughout the operational phase of the Project. During its construction, the WRE will be built to the final profile, including the progressive encapsulation of PAF material. As batters are completed, they will be shaped, covered with topsoil and seeded, as described in Section 8.4.4.2.

Progressive rehabilitation of the WRE will generally occur from the lower batters as it is built and from the western and southeastern sides of the landform in a northerly direction. Areas in the upper/northern portion of the WRE will remain open to place waste rock and benign/inert waste materials that may be generated from decommissioning and closure activities, such as broken concrete footings. The remaining surface infrastructure will be required for the active mine life and be decommissioned and rehabilitated following the cessation of mining.

The plan for progressive rehabilitation of the mine disturbance areas at years 2, 4, 8 and the end of mining is illustrated in Figure 8-4 to Figure 8-7.

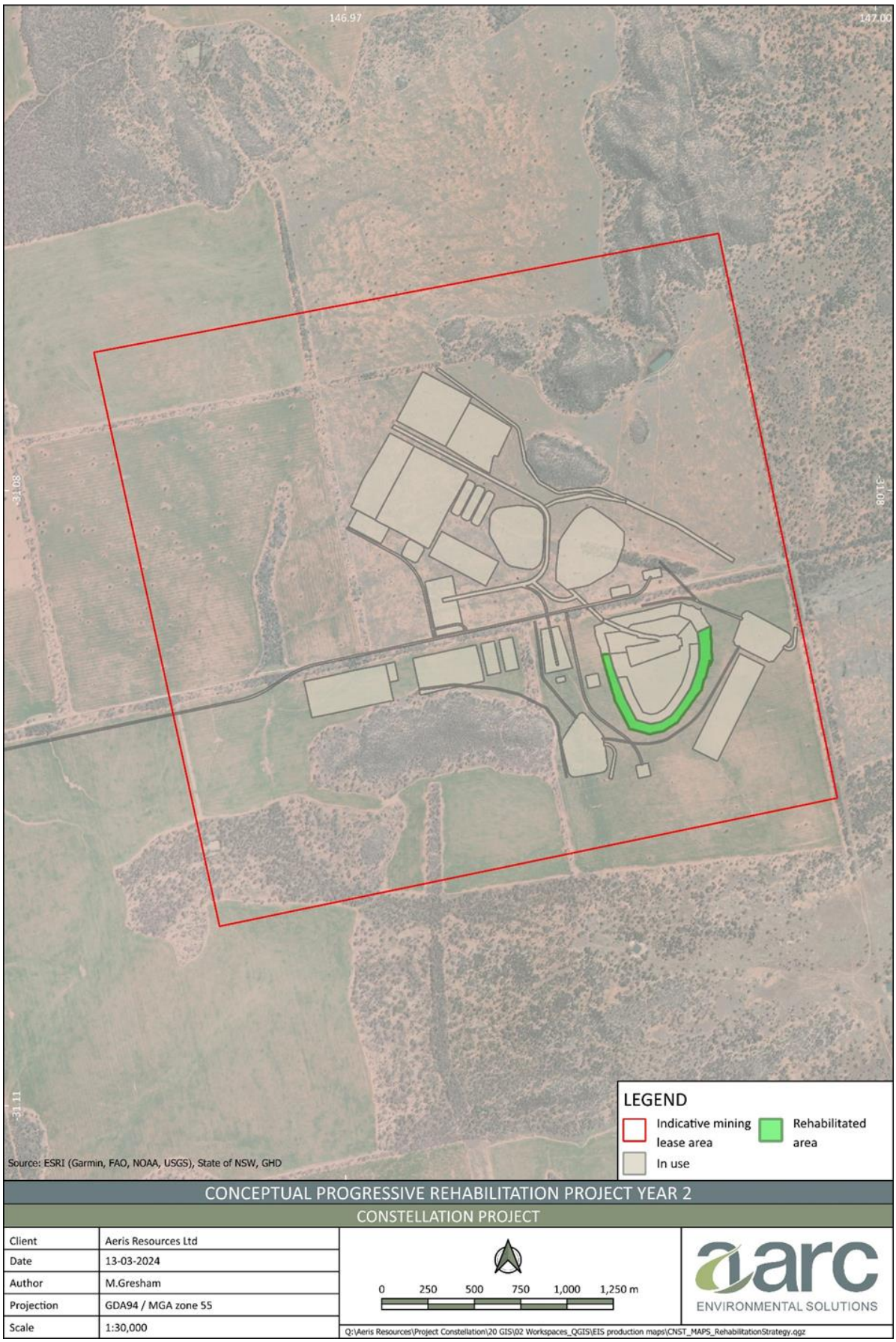


Figure 8-4: Progressive rehabilitation year 2

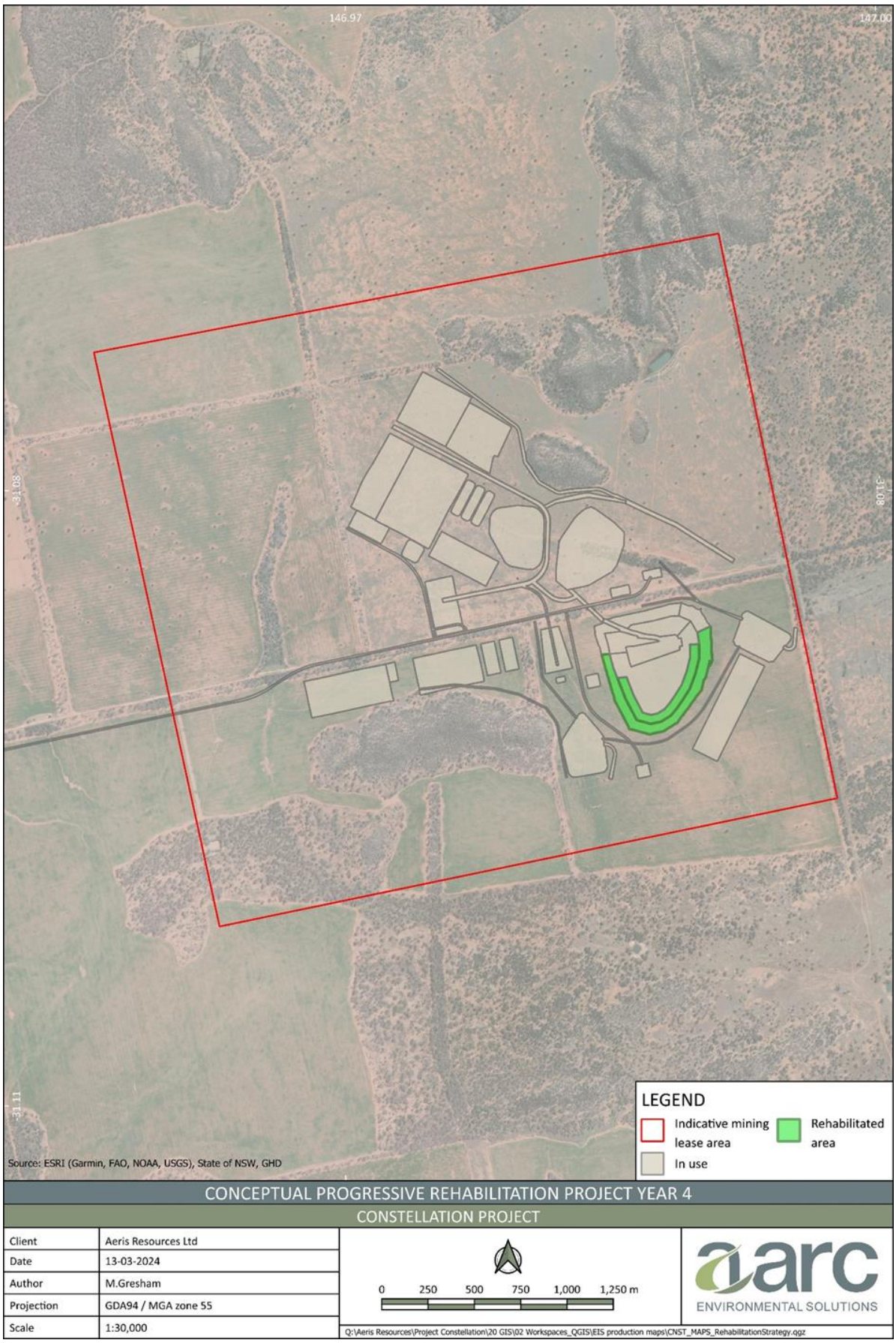


Figure 8-5: Progressive rehabilitation year 4

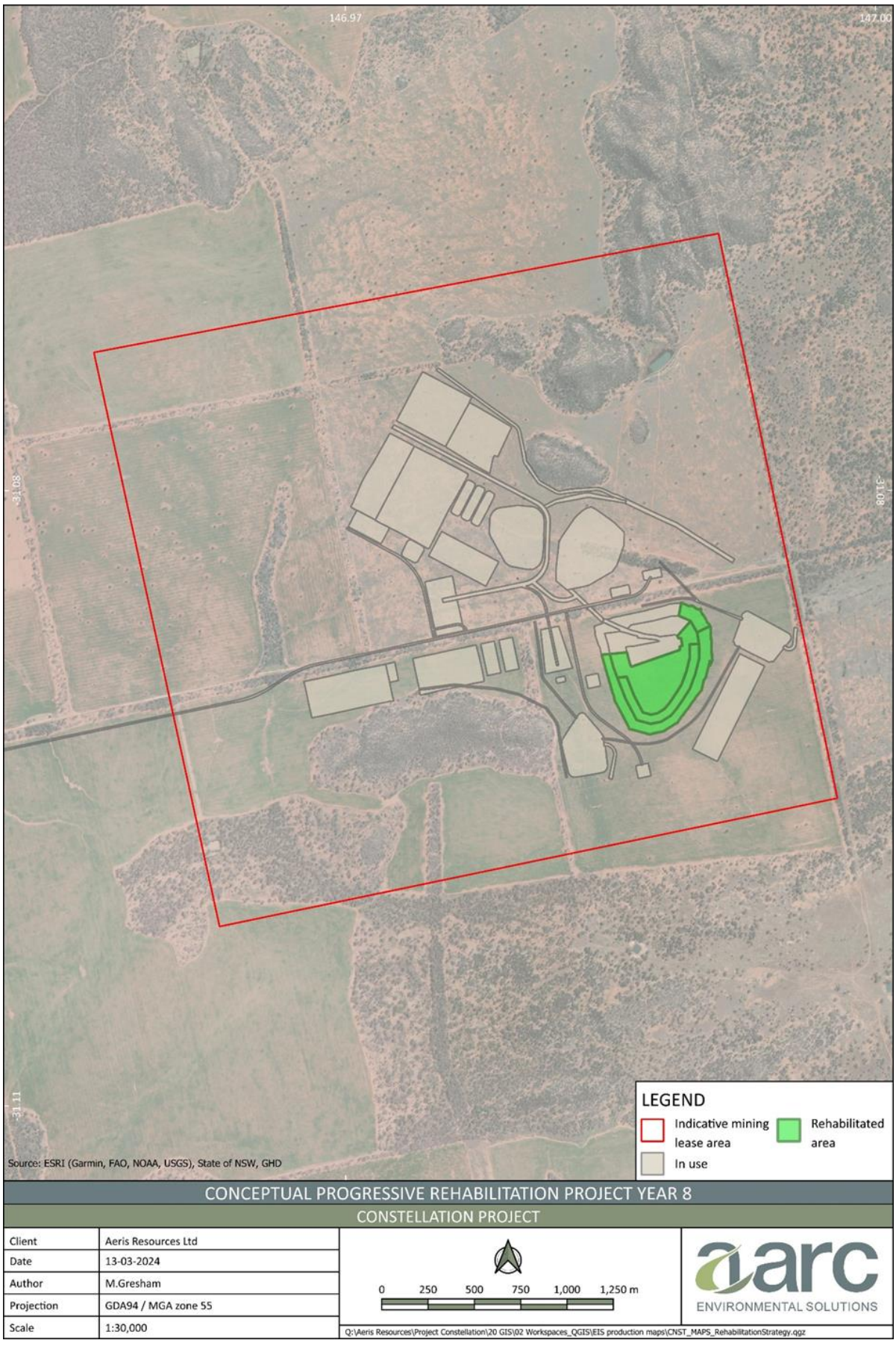


Figure 8-6: Progressive rehabilitation year 8

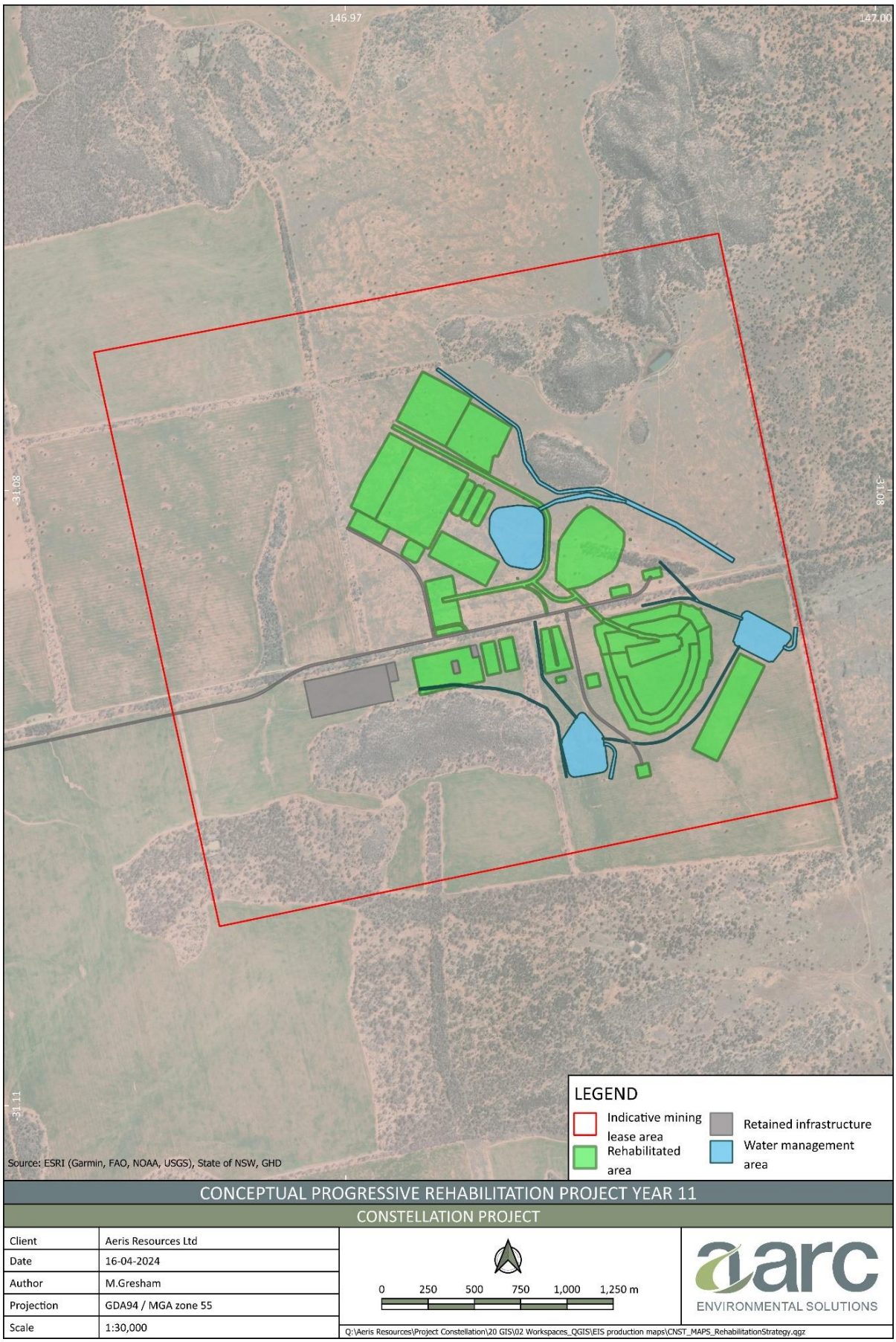


Figure 8-7: Progressive rehabilitation year 11

8.4.7 Proposed completion criteria

Interim completion criteria for the Project were developed with the current knowledge of rehabilitation practices and successes in similar project environments (Appendix 18, Rehabilitation and closure strategy, Section 6). Proposed completion criteria will be refined to prepare the post-approval rehabilitation management plan and rehabilitation outcome documents (refer to Section 8.3), which will be required as part of the standard mining lease conditions.

8.4.8 Rehabilitation monitoring

8.4.8.1 Analogue sites

Rehabilitation monitoring will be undertaken using analogue sites and landscape function analysis to assess rehabilitation progress and success. An annual rehabilitation report will be prepared, and a summary of this report will be included in the annual review.

Rehabilitated areas will be assessed against performance indicators on an annual, biannual or other frequency basis, depending on the performance of rehabilitation works. Assessment will continue for five years following the cessation of mining or earlier if completion criteria have been achieved.

Selection of suitable analogue sites will be undertaken by a suitably qualified ecologist at the commencement of rehabilitation monitoring. Indicative analogue sites and proposed monitoring methods are provided in Appendix 18, Rehabilitation and closure strategy.

8.4.8.2 Rehabilitation inspections

Frequent inspections of rehabilitation areas, nominally on a quarterly basis, will be undertaken to allow for early identification and correction of issues affecting the success of rehabilitation works. An inspection schedule will be developed and implemented. Corrective actions will be implemented following the identification of any required measures (refer to Section 8.4.8.3).

8.4.8.3 Corrective measures

Inspections and formal rehabilitation monitoring will be used to identify corrective measures to ultimately address the established and agreed completion criteria.

Corrective measures will be tracked using internal formal processes and systems, including software systems to record risk, compliance and reporting obligations.

Constellation Project

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Chapter 9 – Evaluation and Justification

9 Evaluation and Justification

9.1 Introduction

The Project is proposed as an extension to the existing Tritton Copper Operations. Tritton Copper Operations operates as a hub and spoke model, with Tritton Copper Mine serving as the centralised hub (where the processing facility is located) with other surrounding deposits (spokes) such as the proposed Project, supplying ore for processing.

Multiple Project alternatives have been considered during the Project design phase, and as part of selecting the final Project design, Aeris has considered feedback received through:

- stakeholder engagement processes;
- findings from field studies;
- efficiency of infrastructure placement; and
- design and operation.

In accordance with the Department of Planning and Environment's State significant development guideline – preparing an environmental impact statement (DPIE 2022a), a justification and evaluation should be undertaken for the Project as a whole, having regard to the economic, environmental and social impacts of the Project. This Chapter addresses this requirement.

9.2 Project evaluation

A series of formal processes have been undertaken with the NSW Government (through the Department of Regional NSW) to:

- support the communication of financial elements;
- ensure efficiency of resource extraction; and
- demonstrate a sound plan for rehabilitation and closure.

Specifically, processes have included:

- conducting a Mine Development Panel (MDP) session;
- undertaking a Resource Economic Assessment (REA) review; and
- participating in a Rehabilitation and Securities Panel (RASP) session.

9.2.1 Mine Development Panel and Resource Economic Assessment

The Mining Engineering and Geoscience (MEG) unit within the Department of Regional NSW has administered the MDP and REA sessions. These sessions were undertaken concurrently (on 20 March 2024) and included representatives from MEGs:

- Industry Advisory and Mining Concierge;
- Investment Attraction team;
- Industry Development team;
- Resource Economics team; and
- Resource Assessment team.

No significant concerns or deficiencies were identified through the MDP and REA processes from the information that was presented. The session covered:

- Project considerations and constraints;
- resource and mining methods;
- economics;
- target markets; and
- rehabilitation.

Feedback received from these sessions was integrated into EIS updates prior to finalisation and submission.

Note: An economic impact assessment has been undertaken for the proposed Project, as per Appendix 11, Economic impact assessment.

9.2.2 Rehabilitation and Securities Assessment Panel

In addition to the MDP and REA processes, a session was undertaken with MEGs 'Rehabilitation and Securities Panel' to discuss the rehabilitation and closure elements of the proposed Project. The scope of the RASP engagement was to demonstrate that the Project has:

- addressed the relevant Project SEARs;
- considered post-mining land uses to minimise land sterilisation;
- considered potential barriers or limitations to achieving successful rehabilitation;
- identified suitable post-mining land uses (taking into account local and regional planning controls); and
- justified the proposed mine design, rehabilitation schedule and final landform.

While no written response has been provided by MEG following a RASP process, no significant concerns or deficiencies were identified through the discussions. Topics discussed included:

- **The topsoil balance for the Project:** It was raised by the regulator that excess competent material could be considered to be relocated to Murrawombie Copper Mine, and similarly, competent material for construction purposes may be available at Murrawombie Copper Mine for use at the Constellation Project.
- **Geotechnical assessment of the pit walls required:** Pit wall slope stability is discussed in Appendix 1, Geotechnical assessment. Operational risk management controls will be implemented for the Project, including a ground control development plan. Prior to the completion of mining operations, a further geotechnical assessment will be undertaken to inform the bund location and any modifications to pit walls (Appendix 18, Rehabilitation and closure strategy).
- **The final groundwater level in the pit:** This is discussed in Chapter 6, Environmental assessment, Section 6.4.
- **Partial backfilling of the pit:** Potential acid forming material may be placed at the base of the pit as a lower-risk storage option. Total backfilling was an option that was not considered financially feasible for the Project (Appendix 18, Rehabilitation and closure strategy).
- **Relevant Plant Community Types and revegetation species**: These are outlined in Appendix 18, Rehabilitation and closure strategy, Section 4.6.7.
- **Consideration of geomorphic design for the rehabilitated landforms and undertaking landscape evolution modelling:** The design of the landforms aims to mimic the domed plateau and concave slope consistent with natural topography (Appendix 18, Rehabilitation and closure strategy). Aeris has committed to undertaking the desired modelling (refer to Chapter 7, Mitigation and management).

Feedback received from these sessions has been integrated into EIS updates prior to finalisation and submission. Full details of the proposed mine rehabilitation for the Project are provided in Appendix 18, Rehabilitation and closure strategy.

9.3 Economic justification

Global demand for copper is forecast to increase in coming years, primarily driven by infrastructure development (particularly from the energy sector) and demand for electric vehicles (DISR 2023). Copper is, therefore, an important resource in promoting improved living standards and transitioning towards renewable energy.

Copper is considered a 'critical mineral and tech mineral' under the NSW Government's Critical Minerals and High-Tech Metals Strategy 2021.

Justification of the need for copper development (in support of the proposed Project) has been provided in Chapter 2, Strategic context, Section 2.2.

In addition to a global demand for copper resources, the proposed Project will provide significant economic benefits for our domestic economies. The Project is expected to contribute economic growth to local, regional, state and national economies through:

- Gross Regional Product (GRP);
- Gross State Product (GSP);
- tax revenues; and royalties.

A summary of economic benefits of the proposed Project is provided through the following sections.

9.3.1 Economic output

The Project will generate significant economic output during the life of mine through direct and indirect contributions (i.e. production-induced and household consumption). Modelled economic growth during construction and operational phases is summarised as follows:

- During the 12-month construction phase:
    - Economic output is expected to be $144.7 million within the region, with an additional $136.6 million generated in flow-on effects within NSW.
    - Business activity is expected to generate $62.4 million in GRP within the region, with an estimated total of $132.1 million in GSP within NSW.
- During the operational phase:
    - Economic output is expected to be $203.2 million per annum within the region, with an additional $122.1 million per annum generated in direct and flow-on impacts for businesses in broader NSW (outside of the Project region).
    - Business activity is expected to generate $111.4 million in GRP per annum in the region, with an estimated total of $171.4 million per annum for NSW (inclusive of the regional contribution).

These economic outputs represent significant opportunities for the Project region and the State of NSW. Methodologies to derive economic outputs are detailed in Appendix 11, Economic impact assessment.

9.3.2 Employment and incomes

The Project will generate employment and increase incomes within the regional catchment other NSW regions during construction and operational phases.

During construction, the Project is expected to support 315 full-time equivalent (FTE) jobs in the region, with an additional 429 FTE jobs expected to be generated in other parts of the state.

Approximately $40.4 million in wages and salaries is estimated to be paid annually to the workforce sourced from the region, with an additional $40.5 million estimated in broader NSW.

During each year of operation, the Project is expected to maintain around 256 FTE jobs in the region while supporting an additional 362 FTE jobs in other parts of the state.

Approximately $28.9 million in wages and salaries is estimated to be paid annually within the region, with an additional $35.2 million estimated in broader NSW (outside of the Project region).

The Project is, therefore, expected to provide significant employment and income generation opportunities for the region, with significant benefits also to be realised across the state.

9.3.3 Support for local businesses

The Project will enable the continuation of existing supply contracts and supply chains for Tritton Copper Operations. There will also be potential to provide additional opportunities for local businesses. These opportunities would be lost if the Project did not proceed.

9.3.4 Strategic context at a local level

The Project is within the Bogan Shire Local Government area. Mining is the predominant economic contributor to the Bogan Shire, with Tritton Copper Operations one of the major employers in the area.

The development of the proposed Project will ensure the continuity of employment for existing Tritton employees while also supporting local population to be maintained. Maintaining local employment will support increased incomes in the region, providing direct and flow-on financial impacts.

The proposed Project is, therefore, consistent with the objectives of the Bogan Shire Council's Local Strategic Planning Statement 2019 (as detailed in Chapter 2, Strategic context, Section 2.4.4), which seeks to attract and retain business and industry.

The Project also complies with Commonwealth, State and other regional statutory requirements and strategies, are discussed in detail in Chapter 2, Strategic context, and Chapter 5, Statutory context.

9.3.5 Government revenue generation

The Project is expected to contribute to NSW and Federal Government revenue through the following taxes and royalties:

- a total of $1.3 million in tax revenues to the NSW Government during construction phase and an annual $6.3 million (in royalties and taxes) during operations; and
- a total of $28.5 million in tax revenues to the Federal Government during construction phase and an annual $32.8 million during operations (through personal income tax, fringe benefits tax, company income tax, and GST).

In addition to the above monetary benefits, the Project will also contribute to the development of local infrastructure and services during the life of the Project. This represents a significant financial opportunity for the NSW and Federal governments. These opportunities would be lost if the Project did not proceed.

9.3.6 Adverse economic impacts

The potential for adverse economic impacts resultant of the Project have been considered within the Project economic impact assessment, as summarised and discussed below:

- **Competition for labour resources**: The Project, in conjunction with other existing or planned projects, may lead to an increase in labour demand or competition, which has the potential to drive up labour costs for local businesses. Given the Project represents a continuation of existing mining operations (replacing other deposits reaching the end of their life), the impact on the labour market is expected to be limited to the construction phase, with minimal impacts anticipated during the operational phase of the Project.
- **Loss of agricultural land**: The Project site is expected to disturb approximately 170 ha of land, which is currently used for agricultural activities. This area will be temporarily removed from agricultural production during the life of the Project, however, it will be returned to agricultural use following Project completion and site rehabilitation (with the exception of the final mine void). This is estimated to temporarily result in a potential value loss of approximately $11,100 per annum in grazing activity and approximately $22,000 per annum in cropping activity over the life of the Project.
- **Impacts on the local property market**: Non-local workforces can lead to an increased demand on accommodation and housing, driving increased pricing. Notwithstanding this, it is anticipated that the increased demand resultant of the Project will be relatively small, with potential impacts expected to be limited to peak construction periods.
- **Impacts on local infrastructure and service provision**: An influx of workers and increased population has the potential to increase pressure on access to local infrastructure and services. However, given that the construction workforce is relatively small and ongoing impacts during operations will be minimal, significant impacts on local infrastructure or services are not expected.
- **Greenhouse gas emissions**: The Project is estimated to produce approximately 253,300 tonnes of scope 1 and scope 2 CO_2-e emissions over the life of the Project. Applying the current spot price for Australian Carbon Credit Units (as at 03 May 2024), the total cost of additional greenhouse gas emissions generated by the Project has been estimated at approximately $7.9 million (over the life of the Project).
- **Traffic impacts**: The Project will generate additional transport movements that would otherwise not occur, which will result in:
    - increased vehicle fuel and maintenance costs;
    - road damage costs; and
    - increased risk of accidents due to increased travel.

  The total cost of additional traffic generation due to the Project has been estimated at approximately $3.1 million during construction and approximately $2.1 million per annum during peak operations.
- **Ecosystem service impacts**: The Project is expected to result in the removal of approximately 97.2 ha of native vegetation on which Project construction and operations will occur. This will result in direct impacts on a number of plant community types that will require environmental offsets. A total of 259 ecosystem credits are currently estimated to be required to offset Project development impacts on biodiversity, with the total cost of these credits estimated at approximately $850,000 (as at 14 May 2024).

While adverse economic impacts are expected to arise as a result of the Project, it is important to acknowledge that these impacts are assessed to be of low consequence, with the relative economic impacts of the Project anticipated to be overwhelmingly positive. Notwithstanding this, monitoring and mitigation strategies have been proposed by the Project to ensure potential adverse impacts are minimised while the opportunity to derive benefits is maximised.

Mitigation and monitoring of economic impacts are discussed in more detail in Chapter 6, Environmental assessment, Section 6.14. A compilation of commitments is also provided in Chapter 7, Mitigation and management.

9.4 Social justification

A social impact assessment was undertaken for the proposed Project. This assessment was prepared in consultation with a range of identified stakeholders who were engaged through:

- surveys
- semi-structured interviews
- online information sharing
- community meetings; and
- information briefings.

The social impact assessment for the Project is detailed in Appendix 10, Social impact assessment.

The social impact assessment undertaken for the proposed Project has found that a range of positive and negative impacts are anticipated to arise.

The most significant negative impacts are identified to relate to:

- acquisition of freehold land required to execute the Project;
- increased demand for housing in the social locality;
- increased traffic (haul trucks); and
- health and wellbeing (including mental health) impacts on the workforce and landowners (Appendix 10, Social impact assessment).

Following the application of recommended mitigations, however, all identified negative impacts would be reduced to a significance of medium or low.

The most significant positive impacts are identified to relate to:

- increased permanent population through the operations workforce, which will have a positive effect on community life;
- enhanced contribution of the Project in building social capital and community resilience;
- contribution to the community by providing employment certainty for existing workers and employment opportunities for others, which will reduce levels of stress;
- new and ongoing employment opportunities, supporting local and regional business and providing tax revenue for the NSW economy.

As the Project will primarily rely on the existing workforce and there are no other state significant projects in the social locality (evidenced by searches of the NSW major projects portal), the cumulative social impact of the Project is expected to be negligible.

Community engagement and consultation has been, and will continue to be, conducted throughout the EIS process and Project operations. Ongoing engagement is seen as central to enabling negative impacts to be minimised while also enhancing or maximising positive impacts.

9.5 Environmental justification

Potential impacts of the proposed Project on environmental aspects, such as land and soil, water and biodiversity, have been assessed in detail throughout this EIS. Impact assessments are attached as Appendices to this EIS, with summaries provided in Chapter 6, Environmental assessment.

Significant commitments have been made by Aeris throughout the design of this Project to avoid, minimise and/or offset environmental impacts. These commitments are discussed in detail in Chapter 1, Introduction, Section 1.5.3.

Results from all individual environmental assessments indicate that the Project presents an acceptable level of impact on the environment. There are also no residual uncertainties identified that may result in future, unexpected environmental impacts. In part, this conclusion is derived as a result of significant mitigation and management measures proposed throughout this EIS, which formalise commitments that will guide future Project operations (refer to Chapter 7, Mitigation and management).

Future environmental compliance will also be monitored and reported on, consistent with NSW statutory processes. These processes are introduced and discussed in Chapter 5, Statutory context.

In accordance with NSW statutory processes, when impacts on biodiversity values are unable to be sufficiently managed or mitigated, offsets may be required. Impacts on environmental values that require offsets have been minimised by adopting an iterative Project design process, which has enabled impact avoidance/ minimisation decisions to be made during the design of the Project.

The proposed disturbance to execute the Project has been kept to a minimum area of approximately 170 ha. Of this disturbance, offset requirements are arising as a result of the proposed clearing of 'Plant Community Type 103'. Offset credits are, therefore, proposed to be purchased for the Project to offset this impact on biodiversity values. Offsets are discussed in more detail in Chapter 6, Environmental assessment, Section 6.7.

Aeris has committed to reducing the Project's greenhouse gas emissions by building a solar-powered generation plant.

While the Project is acknowledged to generate some negative impacts to localised environmental values (as assessed in detail throughout this EIS), many potential impacts have been avoided through the Project design process, with residual impacts proposed to be mitigated and managed through Project execution. When necessary, offsets have also been proposed to ensure the development is representative of ecological and sustainable development.

9.5.1 Ecologically sustainable development

Ecologically sustainable development (ESD) emphasises the integrated consideration of social, environmental and economic elements when making development decisions. The concept of ESD underpins both Commonwealth and NSW environmental legislation.

A primary objective of the NSW *Environment Planning and Assessment Act* 1979 is to 'facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment'. In the NSW Environmental Planning and Assessment Regulation, Part 8, Division 3, Clause 193 identifies the principles of ESD, which includes:

- the precautionary principle;
- inter-generational equity;
- conservation of biological diversity and maintenance of ecological integrity; and
- improved valuation and pricing of environmental resources.

The following sections demonstrate how these four principles have been incorporated into Project assessments.

9.5.2 The precautionary principle

The precautionary principle states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This principle has underpinned Project impact assessment, with all supporting technical studies having been undertaken by suitably qualified and experienced technical specialists (in each relevant area) to enable robust assessment of impacts.

Completed assessments have also been subject to an extensive review process, which has included reviews by:

- the Project's Registered Environmental Assessment Practitioner;
- AARC technical personnel;
- Aeris technical personnel; and
- in some cases, independent peer review (e.g. groundwater model).

Further to this, the EIS process provides opportunities for public and governmental scrutiny of the assessments. This level of rigour is considered to present a limited risk of propagating scientific uncertainty.

9.5.3 Inter-generational equity

The principle of inter-generational equity provides that the present generation should ensure that the health, diversity and productivity of the environment are maintained, or enhanced for the benefit of future generations. This includes the principle of intra-generational equity, which considers the equity within the present generation. Both the current and future generations should have equal rights to benefit from the use of natural resources.

The Project is expected to benefit the current generation through providing positive economic and social impacts, as overviewed in Section 9.3 and Section 9.4. While the Project is acknowledged to generate some negative impacts to localised environmental values (as assessed in detail throughout this EIS), the Project has a comprehensive plan for rehabilitation and closure so that the environment is returned to an agricultural land use (with the exception of the final mine void area).

Copper resources from the proposed Project are considered critical to support the development of renewable energy and sustainable development, thereby providing the opportunity for benefits to future generations. As such, the Project facilitates benefits for current and future generations, meeting obligations for both inter-generational and intra-generational equity.

9.5.4 Conservation of biological diversity and maintenance of ecological integrity

The conservation of biological diversity and ecological integrity has been considered in detail within the impact assessment undertaken for the proposed Project. Impacts on biodiversity are considered in Appendix 2, Biodiversity development assessment report and Chapter 6, Environmental assessment, Section 6.7.

Significant commitments have been made by Aeris throughout the design of this Project to avoid, minimise and/or offset impacts on biodiversity values. These commitments are provided in Chapter 1, Introduction, Section 1.5.4.

9.5.5 Improved valuation and pricing of environmental resources

In accordance with the principle of improved valuation and pricing of environmental resources, consideration of impacts should be included in the valuation of assets and services. Users of goods and services should then pay the full costs of producing such goods and services, including consideration of the use of natural resources and the ultimate disposal of any waste that is generated by those goods or services.

A common mechanism adopted to effect improved valuation and pricing of environmental resources is a 'polluter pays' scheme. A polluter pays approach establishes a methodology whereby those who generate the pollution or waste, bear the costs of containment, avoidance or abatement.

Statutory processes effecting polluter pays schemes will be adhered to for the proposed Project when relevant under NSW legislation. Biodiversity offsets will also be provided to support the proposed Project, offsetting the cost of impacts on biodiversity resources.

Non-mining waste generation and disposal that would arise as a result of the proposed Project is considered in Chapter 6, Environmental assessment, Section 6.10. Mining waste is assessed in Appendix 15, Geochemical and pit lake modelling assessment, which includes consideration of tailings material and waste rock. To minimise mineral waste generated by the Project, tailings are proposed to be hauled back to the Project site and processed as backfilling materials. For non-mining waste, a Waste Management Plan will be adopted, based on the existing Tritton Copper Mine plan.

9.6 Conclusion

The proposed Project is considered to embody a commitment to ESD. While the Project is acknowledged to generate some negative impacts to economic, social and environmental values (as assessed in detail throughout this EIS), many impacts have been avoided through the Project design processes adopted. Residual impacts have also been proposed to be mitigated and managed (through significant commitments) with offsets proposed when necessary.

Significant positive impacts will be derived from the proposed Project, including economic benefits to local, regional and state economies. Investment within regional NSW is also a key strategic outcome for NSW, promoting many social advantages and opportunities (locally and regionally). Copper produced by the Project is also considered a critical mineral for NSW, supporting an ongoing transition towards renewable energy. The proposed Project, therefore, supports a significant opportunity for NSW while embodying the objectives of ESD.

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Chapter 10 – References

10 References

Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000, *Guidelines for Sewerage Systems: Use of Reclaimed Water,* National Water Quality Management Strategy, Agriculture and Resource Management Council of Australia and New Zealand & Australian and New Zealand Environment and Conservation Council & National Health and Medical Research Council.

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Chapter 11 – Acronyms and Units

11 Acronyms and Units

11.1 Acronyms

AARC	AARC Environmental Solutions Pty Ltd
AC	Acid consuming
ACHA	Aboriginal Cultural Heritage Assessment
ADG	Australian Dangerous Goods
AEC	AEC Group Pty Ltd
AEP	Annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
AHMP	Aboriginal Heritage Management Plan
AIP	Aquifer Interference Policy
AMD	Acid and metalliferous drainage
BAL	Basic left-turn
BAM	Biodiversity Assessment Method
BC Act	Biodiversity Conservation Act
BC Regulation	Biodiversity Conservation Regulation 2017
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BSC LEP	Bogan Shire Council Local Environmental Plan 2011
BSCSP	Bogan Shire Community Strategic Plan 2032
CCNZF	NSW Climate Change (Net Zero Future) Act 2023
CHR	Channelised right-turn
Climate Change Act	Climate Change Act 2022
DA	Development application
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DNG	Derived native grassland
DoR	Department of Regional NSW
DPE	Department of Planning and Environment
DPHI	Department of Planning, Housing and Infrastructure
DPIE	Department of Planning, Industry and Environment
Ecoplanning	Ecoplanning Pty Ltd
EIS	Environmental Impact Statement
EP&A Act	Environment Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act
EPI	Environmental planning instrument
EPLs	Environmental protection licences
ESCP	Erosion and Sedimentation Control Plan
ESD	Ecologically sustainable development
FTE	Full-time equivalent
GDE	Groundwater dependent ecosystem
GHD	GHD Pty Ltd
GHG	Greenhouse gas

GRP	Gross regional product
GSP	Gross state product
GVA	Gross value add
HBTs	Hollow-bearing trees
HHA	Historical Heritage Assessment
HLP	Heap leach pad
IBRA	Interim Biogeographic Regionalisation for Australia
IECA	International Erosion Control Association
IPC	Independent Planning Commission
ISO	International Organisation for Standardisation
KLC	Kinetic leach column
LEP	Local Environmental Plan
LGA	Local government area
LSC	Land and soil capability
LSCA	Land and Soil Capability Assessment
MDP	Mine Development Panel
MEG	Mining, Exploration and Geoscience
MIA	Mine infrastructure area
Mining Act	Mining Act 1992
ML	Mining lease
MNES	Matters of National Environmental Significance
MWS	Mineralised waste stockpile
NAF	Non-acid forming
NAF_{HC}	Non-acid forming high capacity
Niche	Niche Environment and Heritage Pty Ltd
NPW Act	National Parks and Wildlife Act 1974
NSW	New South Wales
NT Act	Native Title Act
PADs	Potential archaeological deposits
PAF	Potentially acid forming
PAF_{HC}	Potentially acid forming high capacity
PAF_{LC}	Potentially acid forming low capacity
PCTs	Plant community types
PHA	Preliminary Hazard Analysis
Pipelines Act	Pipelines Act 1976
POEO Act	Protection of the Environment Operations Act 1997
PSM	Pells Sullivan Meynink Pty Ltd
RAPs	Registered Aboriginal parties
RASP	Rehabilitation and Securities Panel
RDA	Regional Development Australia
REA	Resource and Economic Assessment
REAP	Registered Environmental Assessment Practitioner
RGS	RGS Environmental Consultants Pty Ltd
Roads Act	Roads Act 1993
RUSLE	Revised universal soil loss equation
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SIA	Social Impact Assessment
SIMP	Stakeholder Impact Management Plan
SMU	Soil management units
SSD	State Significant Development

Stantec	Stantec Australia Pty Ltd
TAP	TAP Consulting
TECs	Threatened ecological communities
Todoroski	Todoroski Air Sciences Pty Ltd
TSP	Total suspended particulates
UN No.	United Nation number
UNFCCC	United Nations Framework Convention on Climate Change
VLAMP	Voluntary Land Acquisition and Mitigation Policy
WALs	Water access licences
WM Act	Water Management Act
WRD	Waste rock dump
WRE	Waste rock emplacement
WSP	Water sharing plan
ZTV	Zone of theoretical visibility

11.2 Units

AHD	Australian Height Datum
CO_2-e	Carbon dioxide equivalence
dB	Decibel, unit used to express sound intensity.
Db(A)	Decibels; A-weighted scale; unit used for most measurements of environmental noise; the scale is based upon typical responses of the human ear to sounds of different frequencies.
DC	Direct current
g/t	Grams per tonnes
GL	Gigalitre
Ha	Hectares
Koz	Thousand ounces
kVA	Kilovolt apparent
kW	Kilowatt
LAEq	The equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.
Leq,adj,1hr	A-weighted sound pressure level of a continuous, steady sound adjusted for tonal character that, within a one-hour period, has the same mean square sound. pressure of a sound that varies with time.
mbgl	Metres below ground level
ML	Megalitre
ML/yr	Megalitres per year
mm	Millimetre
mm/s	Millimetre per second
Mm^3	Million cubic metres
mRL	Metres Relative level
Mt	Million tonnes
Mtpa	Million tonnes per annum
MW	Megawatts
PM_{10}	Particulate matter less than 10 µm in aerodynamic equivalent diameter.
$PM_{2.5}$	Particulate matter less than 2.5 µm in aerodynamic equivalent diameter.
V	Volt